

## *Attachments*

- 1. Water Quality Analysis**
- 2. Survey on Community Water Supply**
- 3. El-Nino Infrastructure Rehabilitation Project**
- 4. Review for Water Demands and Facility Plan in Feasibility Study**
- 5. Study on New Management Body**
- 6. Basic Design Drawings**

*Attachment-1*  
*Water Quality Analysis*

## Water Quality Analysis

Table 1 Location of Water Sampling and Test Items

(1) Location of Water Sampling			Test Items for Laboratory Test	Tested by Portable Equipment
1.	Intake (Alternative 1)	Kathita River	○	3 May, 2000
2.	Intake (Alternative 2)	Kathita River	○	3 May, 2000
3.	Intake (Alternative 3)	Kathita River	○	4 May, 2000
4.	Existing Kathita Intake	Kathita River	○	2 May, 2000
5.	ASK Spring		○	2 May, 2000
6.	Gatabora Spring		○	2 May, 2000
7.	Gatabora Stream Intake			2 May, 2000
8.	Treatment Plant (Inlet)		○	2 May, 2000
9.	Treatment Plant (Reservoir)		○	2 May, 2000
10.	Existing Reservoir for High Level Zone			2 May, 2000
11.	Community Water 1 (Tap Water)	Muwiteria	○	4 May, 2000
12.	Community Water 2 (Tap Water)	Thura-Giaki	○	4 May, 2000
13.	Community Water 3 (Tap Water)	Nudruma Gakundo		4 May, 2000
14.	Community Water 4 (Tap Water)	Katheri High School		4 May, 2000
15.	Community Water 5 (Tap Water)	Nkugwa		5 May, 2000
16.	Community Water 6 (Tap Water)	Milimani		5 May, 2000
17.	Community Water 7 (Tap Water)	Majengo		5 May, 2000
18.	Water Kiosk (Tap Water)	Shauri Yako		5 May, 2000

(2) Test Items	Laboratory Test	Portable Equipment
1. Water temperature		
2. Colour		-
3. pH		
4. Electric conductivity		
5. Fluoride		
6. Nitrate (NO <sub>3</sub> )		
7. Nitrite (NO <sub>2</sub> )		
8. Turbidity		
9. Total Solid		-
10. Total Dissolved Solid		-
11. Chloride		-
12. Sulphates		-
13. Total Hardness (CaCO <sub>3</sub> )		-
14. Total Alkalinity (CaCO <sub>3</sub> )		
15. Cadmium		-
16. Zinc		-
17. Lead		-
18. Copper		-
19. Iron		
20. Manganese		
21. Arsenic		-
22. Selenium		-
23. Mercury		-
24. TTHM (CHCl <sub>3</sub> )		-
25. Standard Plate Count		
26. Total Coliform		
27. Ammonium Nitrogen	-	
28. COD	-	
29. Residual Chlorine	-	

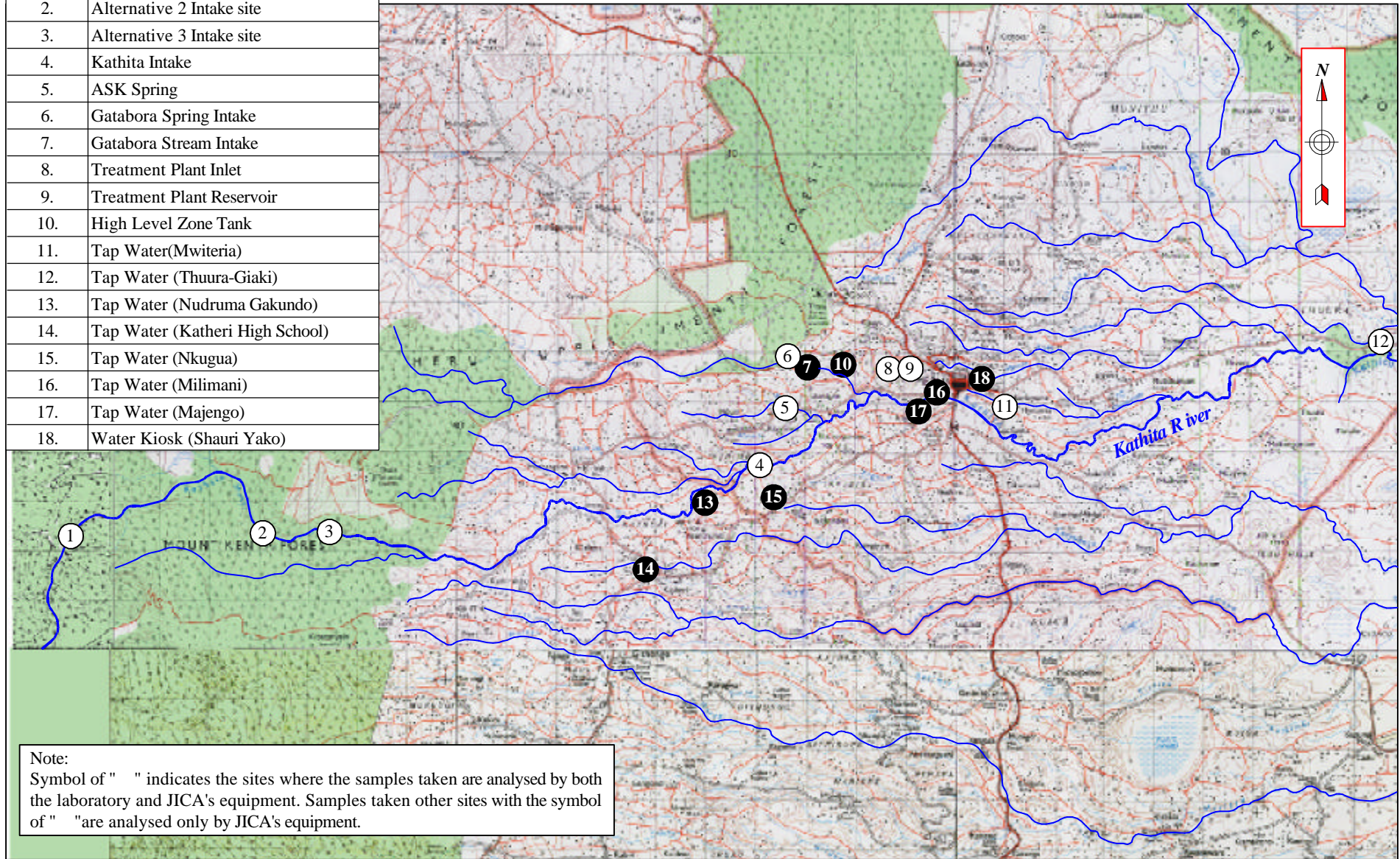
Table 2 Testing Result of Water Quality Analysis Made by Portable Equipment

1. Sample No.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	Ranges for measurements
2. Sampling Site	Alternative 1 Intake site	Alternative 2 Intake site	Alternative 3 Intake site	Kathita Intake	ASK Spring	Gatabora Spring Intake	Gatabora Stream Intake	Treatment Plant Inlet	Treatment Plant Reservoir	High Level Zone Tank	Tap Water(Mwiteria)	Tap Water (Thuura-Giaki)	Tap Water (Nudruma Gakundo)	Tap Water (Katheri High School)	Tap Water (Nkugua)	Tap Water (Milimani)	Tap Water (Majengo)	Water KIOSK (Shauri Yako)	
3. Date	03/05	03/05	04/05	02/05	02/05	02/05	02/05	02/05	02/05	02/05	04/05	04/05	04/05	04/05	05/05	05/05	05/05	05/05	
4. Weather	Cl.	Cl.	Cl.	Fine	Cl.	Fine	Fine	Fine	Fine	Fine	Cl.	Fine	Fine	Fine	Fine	Fine	Fine	Fine	
5. Temperature	19.0	18.5	16.5	28.0	26.0	24.0	25.0	28.0	30.0	31.0	24.0	32.0	26.0	16.0	27.0	28.0	27.0	29.0	
6. Water temperature	12.5	12.4	12.0	20.0	20.3	18.8	19.1	18.1	18.5	19.4	23.2	23.8	19.2	21.6	22.4	20.0	22.2	20.5	0 ~ 60
7. Electric conductivity	145	71	95	5	29	31	19	17	19	101	35	42	46	31	24	122	14	114	0 ~ 1999 $\mu$ s
8. Standard plate count bacteria	M	S	S	S	L	L	L	M	0	M	S	M	S	M	S	L	S	S	numbers/100ml
9. Coliforms	M	S	L	M	S	M	S	L	0	L	M	S	S	S	S	L	S	M	numbers/100ml
10. Fluoride	0.5	1.0	1.0	1.0	0.5	0.5	0.5	2.0	0.5	0.5	0.5	0.5	1.0	0.5	1.0	1.0	1.0	1.0	0.5 ~ 5 mg F/ l
11. Nitrate nitrogen	0	0	0	0	2	2	1	1	1	2	0	1	0	5	1	1	1	0	1 ~ 45mgNO <sub>3</sub> <sup>-</sup> / l 0.2 ~ 10mgNO <sub>3</sub> <sup>-</sup> -N/ l
12. Nitrite nitrogen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02 ~ 1mgNO <sub>2</sub> <sup>-</sup> / l 0.006 ~ 3mgNO <sub>2</sub> <sup>-</sup> -N/ l
13. Turbidity	1.0	1.0	2.0	3.0	1.0	0.5	2.0	3.0	0.5	0.5	5.0	5.0	2.0	5.0	3.0	5.0	5.0	5.0	0.5 ~ 20 unit JIS
14. Iron	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2 ~ 10 mg Fe/ l
15. Manganese	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.5 ~ 20 mg Mn/ l
16. pH	8.3	8.3	8.5	8.3	7.0	6.9	8.0	8.2	8.2	6.9	8.1	8.1	8.0	7.3	8.0	8.2	8.1	8.2	0.0 ~ 14.0 pH
17. Alkalinity	55	60	60	55	80	110	130	55	55	125	60	60	60	30	55	70	70	70	ppm
18. Ammonium nitrogen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.1 ~ 5mg NH <sub>4</sub> <sup>+</sup> / l 0.08 ~ 4mg NH <sub>4</sub> <sup>+</sup> -N/ l
19. COD	5	5	5	5	30	5	2	20	2	2	5	5	5	10	5	5	5	5	0 ~ 100 mg O/ l
20. Residual chlorine	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	0.1	0.1	0.1	0.1 ~ 5mg Cl/ l
	-	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	0.1	0.1	0.1	

Table 3 Result of Water Quality Analysis Made by Laboratory Test

1. Sample No.	Unit	(1)			(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	Maximum Allowable WHO 1984
2. Sampling Site	-	Alternative 1 Intake site			Alternative 2 Intake site		Alternative 3 Intake site	Kathita Intake	Gatabora Spring Intake	ASK Spring	Treatment Plant Inlet	Treatment Plant Reservoir	Tap Water (Mwiteria)	Tap Water (Tsuura Giaki)	
		B/D	F/S		B/D	F/S									
			Dry Season	Wet Season											
3. Date	-	5/3	-	-	5/3	-	5/4	5/5	5/5	5/5	5/4	5/4	5/4	5/4	-
4. Water temperature		13	-	-	11	-	10.5	16	17	17	17	16	21	22	-
5. Colour		6	15	< 5	< 5	< 5	< 5	< 5	< 5	7	< 5	< 5	< 5	5	-
6. pH		8	7.9	8.3	7.4	7.89	6.95	7.93	7.45	6.53	7.01	7.25	6.78	7.05	6.5-8.5
7. Electric conductivity	µ S/cm	90	145	98	79	104	86	83	163	127	83	81	82	90	-
8. Fluoride	mg/l	1.0	0.38	0.32	1.10	0.45	1.15	1.2	0.7	0.5	0.95	1.0	0.9	0.8	1.5
9. Nitrate (NO <sub>3</sub> )	mg/l	0.242	0.01	0.00	0.299	0.06	0.57	0.528	1.19	0.748	0.19	0.44	0.092	0.063	40
10. Nitrite (NO <sub>2</sub> )	mg/l	0.023	-	-	0.01	-	0.01	0.00	0.013	0.00	0.00	0.031	0.01	0.00	-
11. Turbidity	NTU	1	1.6	0.8	3	0.3	2	-	3	2	8	3	3	12	5
12. Total Solid	mg/l	110	70	158	110	182	80	150	180	110	133	110	140	130	1,000
13. Total Dissolved Solid	mg/l	90	65	140	100	182	75	110	130	100	100	80	90	100	-
14. Chloride	mg/l	8	16	14	4	25	8	8	2	4	6	4	15	2	250
15. Sulphates	mg/l	76	33	38	33	44	64	95	79	36	74	74	41	69	400
16. Total Hardness (CaCO <sub>3</sub> )	mg/l	20	76	18	26	6	12	16	19.2	60	32	22	16	24	500
17. Total Alkalinity (CaCO <sub>3</sub> )	mg/l	189.5	53	92	184	50	189	167.5	65	271	167.5	184	178	187	-
18. Cadmium	mg/l	N/T	-	-	N/T	-	N/T	N/T	N/T	N/T	N/T	N/T	N/T	N/T	0.005
19. Zinc	mg/l	N/T	-	-	N/T	-	N/T	0.02	0.27	0.02	N/T	N/T	N/T	N/T	5.0
20. Lead	mg/l	N/T	-	-	N/T	-	N/T	N/T	N/T	N/T	0.23	N/T	N/T	N/T	0.05
21. Copper	mg/l	N/T	0.00	0.01	N/T	0.02	N/T	N/T	N/T	N/T	0.02	N/T	N/T	N/T	1.0
22. Iron	mg/l	0.05	0.02	0.02	0.14	0.04	0.14	N/T	0.09	0.19	0.23	0.19	0.23	0.33	0.3
23. Manganese	mg/l	0.01	0.00	0.00	0.01	0.00	0.02	N/T	0.02	0.02	0.02	0.02	0.01	N/T	0.1
24. Arsenic	mg/l	N/T	-	-	N/T	-	N/T	N/T	N/T	N/T	N/T	N/T	N/T	N/T	0.05
25. Selenium	mg/l	N/T	-	-	N/T	-	N/T	N/T	N/T	N/T	N/T	N/T	N/T	N/T	0.01
26. Mercury	µ g/l	0.150	-	-	0.180	-	0.160	0.27	0.03	0.05	NT	N/T	0.06	N/T	1.0
27. TTHM (CHCl <sub>3</sub> )	µ g/l	2.95			3.78		2.50	3.06	3.16	1.18	4.27	3.74	3.40	3.51	30 (CHCl <sub>3</sub> only)
28. Standard Plate Count	/ml	< 100	-	-	< 100	-	150	700	< 100	300	< 100	< 100	200	150	-
33. Total Coliform	CFU/100ml	4	350	210	4	60	Nil	35	10	20	Nil	Nil	35	30	-

Numbers in Figure	Location
1.	Alternative 1 Intake site
2.	Alternative 2 Intake site
3.	Alternative 3 Intake site
4.	Kathita Intake
5.	ASK Spring
6.	Gatabora Spring Intake
7.	Gatabora Stream Intake
8.	Treatment Plant Inlet
9.	Treatment Plant Reservoir
10.	High Level Zone Tank
11.	Tap Water(Mwiteria)
12.	Tap Water (Thuura-Giaki)
13.	Tap Water (Nudruma Gakundo)
14.	Tap Water (Katheri High School)
15.	Tap Water (Nkugua)
16.	Tap Water (Milimani)
17.	Tap Water (Majengo)
18.	Water Kiosk (Shauri Yako)



Note:  
 Symbol of " " indicates the sites where the samples taken are analysed by both the laboratory and JICA's equipment. Samples taken other sites with the symbol of " "are analysed only by JICA's equipment.

Figure 1 Location of Water Sampling

*Attachment-2*  
*Survey on Community Water Supply*

## **Survey on Community Water Supply Schemes**

### **1. Purpose of Hearing Survey**

The community water scheme survey was conducted to obtain necessary information to estimate the demand for potable water to be provided by the Project in the study area. Questionnaire for the survey was prepared in collaboration with staff of Ministry of Environment and Natural Resources, taking into account the social condition in Meru.

### **2. Methodology**

Prior to the survey, precise inventories of community water schemes in Locations included in the study area were not available due to recent fragmentations in administrative boundaries and existence of unregistered small-scale schemes. Therefore, the survey team started visiting District Officers and Location Chiefs included in the study area to obtain provisional lists of community schemes in each location and to ask them to summon representatives of each community water schemes to each Location Chief's office.

The explanation of survey and distribution of questionnaires were carried out on the meetings held at Location Chief's places. To visits all possible water schemes was not realistic because the number of water schemes in the study area was expected to reach as many as 200, which considered unapproachable by staff and time then available.

After the meetings at each Location, the participants went back to their communities to discuss on the questionnaire and to get collective answers. And then, the questionnaires filled in were either asked to be submitted to corresponding Location Chief's office or were directly collected by surveyors. In both cases, surveyors were present at collection spots to assist the representatives of water schemes to fill in missing questions of questionnaire.

The major input for the survey was human resources. From April 28 through May 10, one of the Study Team members, 8 of Meru Central DWO staffs, one official from WDD, one official from Meru Central DSDO participated in the survey. 8 vehicles with drivers were mobilized on busiest days to transport the survey staff to each location. Over 400 sets of questionnaires were distributed

### **3. Findings**

During the course of survey, the name and locations of 233 community water schemes possibly included in the study area were identified. Out of those sample candidates, 188 water schemes replied to the questionnaire. As a result of cross-check of served area indicated in the map in questionnaire, 158 water schemes were turned out to be inside the study area and the remaining 30 were outside as shown in Tables 1 to 3. 45 water schemes were unreachable by various reasons including refusal to questionnaire. Reportedly some people misunderstood the objective of survey. They considered it a kind of Government's intervention to interfere with their current water abstraction capacity and to jeopardize the existence of their water schemes. Repeated explanations by survey staff later dispelled this misunderstanding.

The principal findings from the results of the 158 schemes inside the Study Area are:



- (1) Community water scheme users are unsatisfied with quality (93 %) and quantity (96 %) of their community water;
- (2) Community water scheme users want to use the clean water of the Project by individual connection (94 %) and water kiosk (6 %); and
- (3) Those probable users are willing to pay initial connection fee (Ksh 1,634 per family on average) and monthly water charge (Ksh 229).

The other findings and the elaboration of the above are enumerated below:

- 1) The average size of a community water schemes is 88 in terms of the number of members, 325 in terms of the number of households<sup>1</sup>, and 1301 in terms of population<sup>2</sup>; The average ratio of household to member is 3.7 to 1;
- 2) Average size of intake pipe diameter is 4.1 inches;
- 3) As a possible result of the above dissatisfaction, considerable number of households join plural community water schemes to secure adequate quantity of water. This is the reason why the total number of population covered by 158 schemes reaches as many as 200,288 which by far exceeds the actual population in the study area;
- 4) Sixty percent of community water supply schemes are taking river water as a water source, others are using spring water.
- 5) Most of communities started and operate by themselves. The 8 percent of schemes received assistance from outside organizations at initial stage, only the 3 percent are currently receiving outside assistance;
- 6) Community water supply schemes were initiated in 1970s, and increases at a rate of 4 schemes per year;
- 7) Currently no meter is installed;
- 8) Initial cash contribution to become a member and to use the community water is Ksh 7,037 on average and Ksh 40,000 in maximum;
- 9) Average monthly maintenance fee is Ksh 52, although monthly operation and maintenance fee are collected only at 40 % of the schemes;
- 10) Individual connection is already most popular. The 84 percent of members have individual connection;
- 11) As a possible result of the above high penetration of individual connection, most of community water schemes prefer individual connection to water kiosk if they use the Project's water. As many as 85 percent of community water schemes opted for individual connection, and the 14 percent opted for combination of individual connection and water

kiosk. Only 1 percent of community showed no interest in the Project's water, preferring their water.

- 12) On the weighted average basis, the 94 percent of community water schemes want to use the Project's water by individual connection. The remaining 6 percent prefer to be supplied by kiosk;
- 13) Monthly fuel cost of household who boil water for drinking is averagely Ksh 441, out of which roughly 20 percent is estimatedly used for water boiling purpose;
- 14) Affordable initial contribution fee of those who prefer individual connection is averagely Ksh 1,634 per household, which, if multiplied by 3.7 (=the average household to member ratio), turns out to be Ksh 6,045. This amount is comparable to Ksh 7,032 which is the average initial contribution per member of surveyed water schemes;
- 15) Affordable monthly fee per household of those who prefer individual connection is averagely Ksh 229, while that of kiosk is Ksh 126.

## Questionnaire Sheet on Community Water Scheme

This survey is carried out by the Japan International Cooperation Agency, in cooperation with the Ministry of Environment and Natural Resources in order to materialize a project of new Meru Water Supply.

The new Meru Water Supply Project aims to realize constant supply of potable water to people in Meru by rehabilitation and augmentation of the facilities and organizational restructuring. Such potable water has tremendous advantages:

- **First you do not need to boil the water for drinking so that you can save time and money for fuel.**
- **Second it is hygienically clean so that your chance of contracting water borne diseases becomes much lower.** Thus, you can save your time and medical cost for recuperation from the diseases.

Those time and costs you can save will lead you to better life. However it should be noted that such potable water has a price. You cannot get the water for free, which is applied everywhere in the world.

The area where your community water supply scheme covers is included in the project study area. We would like to know a general opinion of your community as to whether your member families want to be connected to the new Meru water supply system and get potable water. When the new Meru Water Supply Project starts, it is assured that you can get stable and clean water.

1) Name of community water scheme

2) Name & title of the person interviewed

- a. Name \_\_\_\_\_  
b. Title \_\_\_\_\_

3) Area served (specify in the map)

4) Name(s) of village, sub-location, and location in which the served area is included.

- a. Village name(s) \_\_\_\_\_  
b. Sub-location name(s) \_\_\_\_\_  
c. Location name(s) \_\_\_\_\_

5) Number of members and households served by your water scheme

- a. Member \_\_\_\_\_  
b. Household \_\_\_\_\_

6) Water source

- a. River \_\_\_\_\_ (name)  
b. Spring \_\_\_\_\_ (name)  
c. Well  
d. Others (specify)

7) Original intake capacity, current abstraction, and pipe diameter of intake

- a. Original intake capacity \_\_\_\_\_ (m<sup>3</sup>/day, litter/sec, gallon/day, etc)  
b. Current abstraction \_\_\_\_\_ (m<sup>3</sup>/day, litter/sec, gallon/day, etc)  
c. Pipe diameter of intake \_\_\_\_\_ (mm, inch)

8) Did any Kenyan administration, NGO, or international organization assist your water scheme at the beginning? If so, please specify the name.

- a. Yes \_\_\_\_\_  
b. No

9) Is any Kenyan administration, NGO, or international organization currently assisting your water scheme? If so, please specify the name.

- a. Yes \_\_\_\_\_
- b. No \_\_\_\_\_

10) When did (will) the scheme start operation? (Year)

11) Contribution per member (Ksh)

12) Monthly maintenance fee per member (Ksh/month)

13) Monthly revenue of water scheme (Ksh/month)

14) Monthly operation & maintenance cost of water scheme (Ksh/month)

15) Current balance of deposit from water scheme (Ksh)

16) How many of the members have individual connection?

17) Is the water scheme metered? (Yes / No)

18) If water is usually boiled for drinking, how much does the fuel cost on average? (Ksh/month/household)

19) Are you satisfied with your community water scheme in terms of quality and quantity?

- a. Quality (Yes / No)
- b. Quantity (Yes / No)

In the new Meru Water Supply Project, water pipes will be laid along main and secondary roads. You will be able to get clean water either by individual connection or by roadside water kiosk.

20) Which supply system does your community prefer, individual connection or water kiosk?

- a. Individual connection (Go to Q22 & Q23. Skip Q21, Q24 & Q25)
- b. Water kiosk (Go to Q24 & Q25. Skip Q21, Q22 & Q23)
- c. Neither individual connection nor kiosk. Present scheme is preferable (End interview)
- d. Combination of individual connection and water kiosk (Go through all questions)

21) How many of the members prefer individual connection and water kiosk respectively?

- a. Individual connection \_\_\_\_\_
- b. Water kiosk \_\_\_\_\_

22) **At the maximum**, how much can you pay for initial cash contribution per household? Please note such initial contribution is to fully cover connection cost from main pipe to individual household. Those connection cost is uncertain at this moment. When the connection cost is estimated and your cash contribution cannot reach the cost, you may not be able to have individual connection.

- a. Ksh 4000
- b. Ksh 3500

- c. Ksh 3000
- d. Ksh 2500
- e. Ksh 2000
- f. Ksh 1500
- g. Ksh 1000

23) **At the maximum**, how much can you pay as monthly water fee per household for individual connection?

- a. Ksh 600
- b. Ksh 550
- c. Ksh 500
- d. Ksh 450
- e. Ksh 400
- f. Ksh 350
- g. Ksh 300
- h. Ksh 250
- i. Ksh 200

24) **At the maximum**, how much can you pay as monthly water fee per household for water kiosk?

- a. Ksh 500
- b. Ksh 450
- c. Ksh 400
- d. Ksh 350
- e. Ksh 300
- f. Ksh 250
- g. Ksh 200
- h. Ksh 150
- i. Ksh 100

25) Please specify in the map your desirable point(s) of water kiosk or communal water tap.

**Asante sana.**

Table 1 List of Community Water Supply Schemes in the Study Area

No.	Name of Scheme	Location	Sub-location	Name of Village	Population	Start of Service	Water Source
1	Chugu Factory	Chugu	Chungari	Kamutune, Kabii, Rubwene, Kabutii	412	1976	Tonu River
2	Kanthingu Utuuro Group	Chugu	Chungari	Kanthingu	720	1980	M'Itharia Spring
3	Kirwiro	Chugu	Chungari	Matooro	236	1972	M'Itharia Spring
4	Lower Chugu	Chugu	Chungari	na	2,400	1972	Karumanthi Spring
5	Omone	Chugu	Chungari	Gantukene, Gikindune, Omone	456	2002	Kiogo River
6	Mukera	Chugu	Runogone	Kanthiga, Kiandiw	1,812	1986	Karumumo Spring
7	Kanyira	Chugu/ Mulathankari	Runogone/Kaaga	Kamyira	600	2001	Ngaciuma River
8	Kaaga	Chugu/Ntima/ Municipality	Chungari/Upper Igoki/ Kaaga	Kaaga, Mpakone, Kathinga, Chugu	2,800	1991	Ngaciuma Spring
9	Kathima	Igoki	Gachanka	Kathima	680	1996	Kamuthara Spring
10	Muguna Igoki	Igoki	Gachanka	Kiringa	4,000	1970	Kathita River
11	Tabiru	Igoki	Gachanka	Tabiru, Mukuru	1,680	1978	Kanywabgo River
12	Upper Tabiru	Igoki	Gachanka	Taribu	528	1997	Kinyagia Spring
13	Wendo Kiringa Women	Igoki	Gachanka	Kiringa	6,000	1980	Kathita River
14	Gatambune	Igoki	Kanyuango/Kathita	Abombugi, Amira, Abweriri, Gakuthari	6,400	2000	Kathita River
15	Kirige High School	Igoki	Lower Igoki	Murinsombugi, Karimene		1997	Kanyuango Spring
16	Njukinjiru	Igoki	Lower Igoki	Njukinjiru	7,200	2000	Kathita River
17	Wendo	Igoki	Lower Igoki	Njukinjiru	1,600	1976	Groundwater Well
18	Kibari	Igoki	Muringa-Ombugi	Kiroari	360	1994	Kathita River
19	Kigwii	Igoki	Muringa-Ombugi	Murinsombugi	200	1984	Kanyuango River
20	Kiriungi	Igoki	Muringa-Ombugi	Kiriungi	2,000	1988	Riiji River
21	Mwitethia	Igoki	Muringa-Ombugi	Murinsombugi	920	2000	Gacieae Spring
22	Nchaore Kaongo	Igoki	Muringa-Ombugi	Kiringa, Kithiu, Kiithuene, and other 4 villages	600	1996	Gachiege Spring
23	Familys	Katheri Central	Kathita	Majene, Kathii and Sirimu	48	1974	Kathitamunyi River
24	Kamiura	Katheri Central	Kathita	Kaathi	400	1999	Kathitamunyi River
25	Kathita Munyi	Katheri Central	Kathita	Mwanika	760	1965	Kathitamunyi Spring
26	Kiigene Cirimu	Katheri Central	Kathita	Muchicha, Kaathi, Cirimu	2,640	1999	Kathita River
27	Muchicha Muthangene	Katheri Central	Kathita	Muchicha, Muthangene	800	1978	Spring
28	Mutuaro	Katheri Central	Kathita	Mwithu, Mwiru	120	1996	Kathitamunyi River
29	Mwinda Mpara	Katheri Central	Kathita	Muchicha, Mwithu, Mwiru	60	1996	Kirungamango Spring
30	Muthangene Rubiri	Katheri Central	Kathita/Nkiriri North	Muthangene, Rubiri	476	1978	Kathitamunyi River
31	Katheri Nthimbiri	Katheri Central	Mwirangombe	Villages in the related sub-locations	15,600	1964	Kathitamunyi River
32	Muguna Katheri	Katheri Central	Mwirangombe	Mwirangombe	5,140	1990	Kathita River
33	Bahati	Katheri Central	Nkiriri South	Kionyo, Nkumbo	100	1986	Katheri Spring
34	Gatuntune	Katheri Central	Nkiriri South	Nkiriri	6,000	1992	Kathita River
35	Karene	Katheri Central	Nkiriri South	Kaarene	1,600	1978	Nkadone Spring Mbuthu
36	Karene Kirima	Katheri Central	Nkiriri South	Kaarene	1,440	1981	Kanyuango Spring
37	Karimene	Katheri Central	Nkiriri South	Kaarene	28	1999	Nkure Spring

Table 1 List of Community Water Supply Schemes in the Study Area

No.	Name of Scheme	Location	Sub-location	Name of Village	Population	Start of Service	Water Source
38	Katheri Kionyo	Katheri Central	Nkiriri South	Kionyo	240	1980	Rwairi River
39	Kieni Kia Ruguru	Katheri Central	Nkiriri South	Kieni, Kiaruguru	640	1988	Njaria Spring
40	Kionyo	Katheri Central	Nkiriri South	Kionyo	640	1972	Rwairi River
41	Kithamburu	Katheri Central	Nkiriri South	Kithamburu	96	2000	Kanyuango Spring
42	Mwiriene	Katheri Central	Nkiriri South	Nkiriri	840	1992	Kathita River
43	Mwiriene I	Katheri Central	Nkiriri South	Nkiriri	4,000	1984	Kathitamunyi River
44	New Kirungurune	Katheri Central	Nkiriri South	Kionyo	136	1984	Mbira Mburi Spring
45	Nkiriri	Katheri Central	Nkiriri South	Mwiriene	80	2000	Kanyoo Spring
46	Wendo	Katheri Central	Nkiriri South	Kaarene	336	1995	Nkandone Mbuthu Spring
47	Mworoga Mpuri	Katheri Central/Katheri East	Nkiriri North/Kirimakiathi	Mworoga (Kithaku)	920	1964	Ruuji Rwamgombe River
48	Kionyo Kithigachio	Katheri Central/Katheri East	Nkiriri South/Kinjo North	Kionyo, Kithigachio	1,448	2002	Kathita River
49	Kimuri	Katheri Central/Katheri East/Nthimbiri	Kathita/Nkiriri North/Kirimakiathi/Mpuri	Muchicha, Mworoga, Mwanika, Kithaku	1,800	2001	Kathita River
50	Kanja Gantuku	Katheri East	Kianthumbi South	Gantukene	480	1996	Kathita River
51	Kanyuango	Katheri East	Kianthumbi South	Kianthumbi	320	1971	Kanyuango River
52	Mukungu	Katheri East	Kianthumbi South	Kianthumbi	440	2000	Ntugu River
53	Ruchunga	Katheri East	Kianthumbi South	Kianthumbi	800	1971	Ruchunga Spring
54	Kabirithiru	Katheri East	Kinjo North	na	160	1980	Rwairi River
55	Karemba	Katheri East	Kinjo North	Gitimdi	72	1985	Rwairi River
56	Kithigachu	Katheri East	Kinjo North	Kithigachiu, Mpingene	600	1980	Riiji River
57	Mpingene	Katheri East	Kinjo North	Mpingene	160	2000	Riiji River
58	Mathigiune	Katheri East	Kinjo North/Kinjo South	na	600	1976	Rwairi River
59	Kijijone	Katheri East	Kinjo South	Kijijone, Mukiki	1,080	1980	Rwairi River
60	Kinjo South	Katheri East	Kinjo South	Kinjo	1,080	1999	Mariara River
61	Mukiki	Katheri East	Kinjo South	Mukiki	500	2003	Ruati
62	Kibarine Women	Katheri East	Kirimakiathi	Mwanika	752	1999	Kathitamunyi River
63	Nduruma Gakumbo	Katheri East	Kirimakiathi	Kiriwalkathi, Kianginyo	680	1985	Rwaire River
64	Karene Riiji	Katheri East/Katheri Central	Kianthumbi South/Nkiriri South	Kianthumbi, Kareene	184	1985	Kanyuango R. & Spring
65	Kirima Kia Athi	Katheri East/Katheri Central	Kianthumbi South/Nkiriri South	Kianthumbi	1,200	1988	Kathita River
66	Kangombe	Katheri East/Nthimbiri	Kianthumbi South/Nthimbiri	Nthgimbiri, Kianthumbi	1,188	1965	Kanyuango River
67	Mishiiri	Katheri East/Nthimbiri	Kirimakiathi/Mpuri	Mwanika, Nkurune	128	1998	Kathitamunyi River
68	Mikurwene	Katheri West	Kathiranga Central	Mwereru	1,400	1998	Kathita River
69	Mwereru	Katheri West	Kathiranga Central	Mwereru	2,000	2003	Kathita River
70	Karia	Katheri West	Kathiranga East	Kitharene	188	1990	Rwaire River
71	Kariiji motego	Katheri West	Kathiranga East	Kitharene	380	1993	Riiji Spring
72	Kitharene Rwairi	Katheri West	Kathiranga East	Kitharene	1,200	1971	Rwaire Spring
73	Mutethia	Katheri West	Kathiranga East	Kitharene	64	1989	Rwaire River

Table 1 List of Community Water Supply Schemes in the Study Area

No.	Name of Scheme	Location	Sub-location	Name of Village	Population	Start of Service	Water Source
74	Njaria Rwairi	Katheri West	Kathiranga East	Kitharene	240	1972	Njaria Spring
75	Karumanthi	Katheri West	Kathiranga North	Kanthuni	100	1976	Karumanthi Spring
76	Karunkua	Katheri West	Kathiranga North	Nchebene	420	2000	Karunkua Spring
77	Kimenwa	Katheri West	Kathiranga North	Kiruanyi	160	1987	Karugi Ka Ngombe River
78	Majeene	Katheri West	Kathiranga North	Kagere	120	1984	Kanthanga Spring
79	Nondone	Katheri West	Kathiranga North	Kanthuni	192	1986	Kathitamunyi River
80	Kaimenyi	Katheri West	Kathiranga West	Kaiwenyi		not operational	Kathita River
81	Kagoji	Katheri West/Githongo	Kathiranga East/Githongo	Kitharene, Kijijone	320	1993	Kiriji Spring
82	Kirima Kiarago	Katheri West/Katheri Central	Kathiranga West/Mwirangombe	Kirima, Kiarago	1,600	1999	Kathita River
83	Kathita Mpuri	Katheri West/Katheri Central/Katheri East	Kathita/Nkiri North/Kianthubi North	Mpri, Mworoga, Mwanika, Muthangene, Gakando, Rubiri	800	2000	Kathita River
84	Gikiriiri	Mulathankari	Kaaga	Gikiriiri	360	1989	Kathambia Nyoto Spring
85	Kanthiga	Mulathankari	Kaaga	Kanthiga		1991	Ngaguma River
86	Kariuri	Mulathankari	Kaaga	Kaaga	180	not operational	Nganciuma Spring
87	Kongoacheke Ngwataniro	Mulathankari	Kaaga	Kangoacheke	400	1987	Kagwankungura Spring
88	Muguna Mutethia	Mulathankari	Kaaga	Kaaga, Mpakone, Kauthuga, Kangoacheke, Karumonhi, Nthunguri	2,400	1983	Ngachiuma River
89	Kathita	Mulathankari	Mukua	Kathita	504	1999	Karinaa River
90	Kibachia	Mulathankari	Mukua	Kibachia	304	1980	Thongoma River
91	Kieni Kia Ngonda	Mulathankari	Mukua	Kibachia, Kanje	820	2003	Kuronyu River
92	Mukua	Mulathankari	Mukua	Kibachia	1,600	2000	Kaburi Spring
93	Mulathankari	Mulathankari	Mukua	Kanje, Kathita, Anlibanjoka, Kaninariga	3,200	1967	M'Itaga Spring
94	Mwonyone	Mulathankari	Mukua	Kanje	800	1978	Kathita River
95	Kaguoro	Mulathankari	Njoka	Kathita, Antu-ba-Njoka	1,200	1984	Kaguoro Spring
96	Karimaga Young Generation	Mulathankari	Njoka	Kanimaba	396	2000	Karurimu River and Spring
97	Karimaiga Kirimene	Mulathankari	Njoka	Karimaiga, Kirimene	1,400	1987	M'kiogo Spring
98	Kithoa	Mulathankari	Njoka	Karimaiga	800	1990	Karumathi Spring
99	Muriuki	Municipality	Gakoromone/Kaaga	Nkoune, Mwirine	636	1993	Kunyungu Spring
100	Nkoune Mwirine	Municipality	Gakoromone/Kaaga	Nkoune, Mwirine	432	1978	Kiogo Spring
101	Barabi	Municipality	Kaaga	Kaaga, Rurai, Gakurine	600	1999	Tributary of Ngaciuma River
102	Kagwankunguru	Municipality	Township	Kambaika	400	1980	Kauwanku River
103	Mjini	Municipality	Township	Mjiri	1,800	-	River/Spring/Well
104	Muguna Kithiu	Municipality/Mulathankari	Gakoromone/Mukua	Kooje, Gantunkuwa, Mwirine, Mulathankari, Kirambune, Shauriyako, Kasimga	3,660	1989	Kiongo River
105	Gakurumbi	Municipality/Ntima	Township/Kaaga/Upper Igoki	Kambakia	640	1985	Gatabora Spring
106	Muguna Mutethia	Municipality/Ntima/Mulathankari	Kaaga/Upper Igoki/Mukua	Kaaga, Mpakone, Karumanthi, Nthunguri	4,800	1981	Ngaciuma River & Spring
107	Ngaciuma	Municipality/Ntima/Mulathankari	Township/Upper Igoki/Kaaga	Mpakone, Kaaga	320	1973	Ngaciuma River
108	Kairichi	Ntakira	Gitugu	Gitugu	2,000	2001	Kanyuango



Table 1 List of Community Water Supply Schemes in the Study Area

No.	Name of Scheme	Location	Sub-location	Name of Village	Population	Start of Service	Water Source
109	Koorone	Ntakira	Gitugu	Gitugu	800	1988	Gachiege River
110	Weru	Ntakira	Gitugu/Ngonyi	Gitugu, Nkairire	2,400	plan	Kanyuango River
111	Karingene	Ntakira	Kirugua	Kiringene	1,440	1972	Ruini Spring
112	Mukikimwe	Ntakira	Kirugua	Ngati	520	1987	Karinda Ngurne River
113	Kirugua Kathumbi	Ntakira	Kirugua/Magundu	Kirugua, Kathumbi, Magundu, Mugaine	2,000	1996	Karimaiga River
114	Karoro	Ntakira	Nchaure	Ntara Kagwi, Ntura Nkia, Kiruiro	2,000	1971	Kinyagia
115	Kirwiro	Ntakira	Nchaure	Kirwiro, Menga	1,400	1998	Kinyagia Spring
116	Ntokangu	Ntakira	Nchaure	Menga	400	1974	Gachiege River
117	Gachiege Tiaru	Ntakira	Nchaure/Kirugua	Tiaru, Menga	1,000	1972	Gachiege Spring
118	Gatamana	Ntakira	Ngonyi	Ngonyierwara	6,168	1979	Rwaire River
119	Mugambone Kariene	Ntakira	Ngonyi	Mugambone, Kithangarine, Kariene	3,200	2000	Mariara River
120	Riiji 'B'	Ntakira	Ngonyi	Kiera, Muruine, Kongo-ka-Mbirwa, Kaongo	800	1976	Riiji River
121	Magundu	Ntakira/Igoki	Magundu/Kirugua/Nchaure/Ngonyi/Gachanka	Magundu, Kirogine, Irinda, Kirugua, Kaguru, Gikumene, Nchaure	16,800	1976	Kathita River
122	Maigene	Ntakira/Igoki	Nchaure/Muringa-Ombugi	Ntura, Gituma	320	1997	Gachiege River
123	Nthungu	Ntakira/Nthimbiri	Ngonyi/Kainginyo	Kithima, Karungu	2,000	1981	Riiji River
124	Gachiege Kimanya	Nthimbiri	Kainginyo	Gachiege, Kimanya	168	1997	Kiine Spring
125	Kamunyoki	Nthimbiri	Kainginyo	Kienine	376	1974	Karumo Spring
126	Karikambwii	Nthimbiri	Kainginyo	Kithima, Gitebe, Mpigene	1,980	1983	Ruairi River
127	Kithioroka	Nthimbiri	Kainginyo	Riiji		2000	Riiji River
128	Mkandone	Nthimbiri	Kainginyo	Nthungu	216	1982	Ntutumi Spring
129	Abonyaine	Nthimbiri	Mpuri	Mwirigootibu, Kiamiriru	352	1991	Abonyaine Mutunguro Spring
130	Buurindaja	Nthimbiri	Mpuri	Mpuri	88	1999	Tributary of Kathita River and Gatakene Spring
131	Gatakene	Nthimbiri	Mpuri	Mpuri	68	1997	Gatakene River
132	Giantune	Nthimbiri	Mpuri	Giantune	972	1973	Kathita River and Karimaiga Spring
133	Giantune Kithima	Nthimbiri	Mpuri	Matuntukine	1,200	1994	Kithima Mukindia
134	Giantune Matangi	Nthimbiri	Mpuri	Giantune, Kuage	468	1987	Mpuri Spring
135	Kanondone	Nthimbiri	Mpuri	Murirene	360	1968	Kanondone River
136	Kiandiu	Nthimbiri	Mpuri	Kiandiu	160	1985	Kawampungu
137	Kithima Inono	Nthimbiri	Mpuri	Kithima, Inono	264	1995	Gatakene River and Spring
138	Kongo Agaceke Giantune	Nthimbiri	Mpuri	Giantune	264	1985	Mpuri River
139	Manduru	Nthimbiri	Mpuri	Nkubune	68	1990	Kathitamunyi River
140	Matuntukine	Nthimbiri	Mpuri	Giantune B	936	1995	Mpuri River
141	Miguru	Nthimbiri	Mpuri	Mpuri	668	1972	Gatakene River
142	Mwicheuri	Nthimbiri	Mpuri	Murirene	84	2001	Kathitamunyi River
143	Mworoga	Nthimbiri	Mpuri	Mworoga	600	1983	Ngare Naro Spring
144	Ngithiria	Nthimbiri	Mpuri	Kiamiriru, Mpuri	288	1970	Karimaiga River

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No.	Name of Scheme	Location	Sub-location	Name of Village	Population	Start of Service	Water Source
145	Nkurune	Nthimbiri	Mpuri	Nkurune	68	1972	Gatakene River
146	Gaciunju	Nthimbiri	Nthimbiri	Mukuruti, Muringene	800	1974	Kanyuango River
147	Gakumbo	Nthimbiri	Nthimbiri	Rutiti, Kirimene, Ngurumo, Magundu	2,840	1976	Kathita River
148	Karimba	Nthimbiri	Nthimbiri	Nkumbo	192	1999	Ntongoro Spring
149	Kiine	Nthimbiri	Nthimbiri	Kiine, Kainginyo	400	1993	Kiine Spring
150	Kirimene	Nthimbiri	Nthimbiri	Kirimene	280	1990	Kiine River and Nga'u Spring
151	Nkumbo	Nthimbiri	Nthimbiri	Nkumbo	1,680	1974	Ntongoro Spring
152	Ntongoro	Nthimbiri	Nthimbiri	Ntongoro, Nkumbo	360	1961	Kanyuango River
153	Kithangene	Nthimbiri	Nthimbiri/ Kainginyo	Gachiunju, Kinugu	272	1973	Gachiunyo Spring
154	kiutha	Nthimbiri/Ntakira	Kainginyo/ Ngonyi	Makirone, Muruine	628	1976	Karurumo Spring and Well
155	Kiguru Wendani	Nthimbiri/Ntakira	Nthimbiri/ Kirugua	Ngaurumo, Kirugua	496	2000	Kathita River
156	Tangiri	Ntima	Upper Igoki	Kinoru, Kaithe, Kigure, Gitooro	1,800	1989	Mpuri River
157	Muturai Karimaga Ntwiko	Ntima/Chugu/ Mulathankari	Upper Igoki/ Chungari/Kaaga	Karima-ga-Ntwiko	1,072	not completed	Muturai River and Spring
158	Kongo Acheke Kirogonyo	Ntima/ Municipality	Upper Igoki/Kaaga	Rianyambo, Kiwani	1,320	1979	Gakinyange Spring

Table 2 Result of Survey on Community Water Supply Schemes ( 1/2)

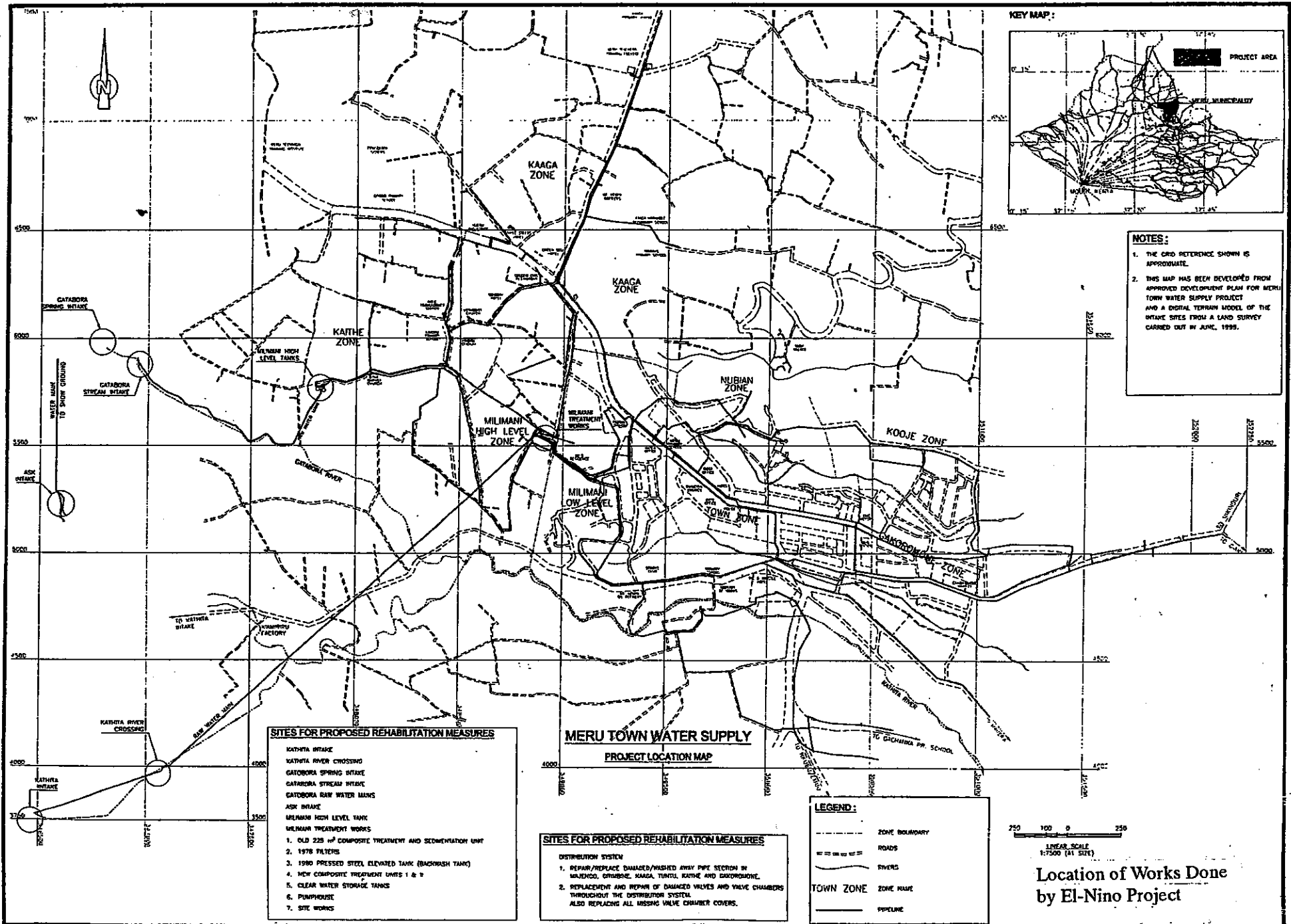
No.	Question No.	5a	5b	Household / member ratio	6	7a	7b	7c	8	Donor name	9	10	11	12	13	14	15	16	17	18	19a	19b	20	21			22	23	24
																								Name of community water scheme	No. of members	No. of households			
1	Chugu Factory		103		river			4	no		no	1976	20,000	2,900	0	2,900	0	100%	no	200	no	no	individual	100%			1,500	200	
2	Kanhungu Uturo Group	75	180	2.4	spring			2	no		no	1980	610	20	350	600	3,000	48%	no		no	no	indiv./kiosk	60%	40%		1,500	200	
3	Kirwiro	59	59	1.0	spring			4	no		no	1972	1,200	0	0	300	1,500	61%	no	50	no	no	individual	100%			2,000	200	
4	Lower Chugu	250	600	2.4	spring			6	no		no	1972	2,200	20	5,000	2,000	8,000	100%	no	250	no	no	individual	100%			2,000	250	
5	Omone	23	114	5.0	river	9.54	9.54	4	no		no	2002	15,000					100%	no	300	no	no	individual	100%			2,500	200	
6	Mukera	150	453	3.0	spring			6	no		no	1986	10,000	20	0	3,000	12,000	57%	no	150	no	no	indiv./kiosk	57%	43%		1,000	200	100
7	Kanyira	100	150	1.5	river			6	yes	National Council of Churches of Kenya (NCCK)	no	2001	3,300				85,000	0%		100	no	no	individual	100%			3,000	200	
8	Kaaga	200	700	3.5	spring			6	no	Methodist Church of Kenya	yes	1991	150	20	2,000	200	15,000	50%	no	50	no	no	individual	100%			3,000	250	
9	Kathima	33	170	5.2	spring			4	no		no	1996	1,200	0	0	800		100%	no	500	no	no	individual	100%			2,000	200	
10	Muguna Igoki	346	1,000	2.9	river			8	no		no	1970	1,200				15,000			300	no	no	individual	100%			2,000	200	
11	Tabiru	70	420	6.0	river			4	yes	GoK	no	1978	2,200	30		500	7,560	71%	no	500	no	no	individual	100%			1,500	400	
12	Upper Tabiru	22	132	6.0	spring			2	no		no	1997	1,000	100			1,500	64%	no	400	no	no	individual	100%			1,500	250	
13	Wendo Kiringa Women	100	1,500	15.0	river			4	no		no	1980		0	0	500	500	100%	no	200	no	no	individual	100%			2,000	200	
14	Gatambune	400	1,600	4.0	river			8	no		no	2000	5,000	50	20,000		300,000		no	200	no	no	individual	100%			4,000	400	
15	Kirige High School				spring			3	no		no	1997							no		no	yes	individual	100%			4,000	600	
16	Njukinjiru	450	1,800	4.0	river				no		no	2000	10,000	25		10,000	36,000		no		no	yes	individual	100%			2,500	200	
17	Wendo	100	400	4.0	well			4	no		no	1976	10,000	10			5,000	90%	no	200	yes	no	individual	100%			2,500	200	
18	Kibari	31	90	2.9	river			1	no		no	1994	7,000				1,000	100%	no	500	no	no	individual	100%			1,000	200	
19	Kigwii	35	50	1.4	river			3	no		no	1984	5,000	10		350	1,000	100%	no	30	no	no	individual	100%			1,500	200	
20	Kiriungji	50	500	10.0	river			6	no		no	1988	5,400	50		2,000	1,000	100%	no	300	yes	no	individual	100%			2,000	200	
21	Mwilethia	80	230	2.9	spring				no		no	2000	10,000	100									individual	100%			2,000	200	
22	Nchaore Kaongo	45	150	3.3	river	100	91	4	no		yes	Water Management Services	1996	11,600	6		247	1,500	45%	no		no	individual	100%			2,500	600	
23	Familys	12	12	1.0	river/spring			4	no		no	1974	20,000	0	0	300	0	100%	no	500	no	no	individual	100%			1,000	200	
24	Kamlura	25	100	4.0	river			4	no		no	1999	26,000	50	1,250	0	0	100%	no	500	no	no	individual	100%			3,000	200	
25	Kathita Munyi	38	190	5.0	spring			7	no		no	1965	20,000	10	380		3,000	100%	no	600	no	no	individual	100%			3,000	200	
26	Kiigene Cirimu	110	660	6.0	river			6	no		no	1999	34,000	50	0	2,000	20,000	86%	no	600	no	no	individual	100%			1,000	200	
27	Muchicha Muthangene	47	200	4.3	spring			4	no		no	1978		20	940	0	0	100%	no	600	no	no	individual	100%			1,000	200	
28	Muturo	14	30	2.1	river			2	yes	Kenya National Farmer's Union	no	1996	30,000	0	0	500	0	100%	no	1,000	no	no	individual	100%			1,000	200	
29	Mwinga Mpara	15	15	1.0	spring			3	no		no	1996	15,000	40	600			100%	no	600	no	no	individual	100%			1,000	200	
30	Muthangene Rubiri	104	119	1.1	river			4	no		no	1978	2,400	0	0		10,000	100%	no	500	no	no	individual	100%			1,000	200	
31	Katheri Nthimbiri	1,301	3,900	3.0	river			18	yes	GoK	no	1964	3,850	0	0	0	0	55%	no	1,000	no	no	individual	100%			2,000	200	
32	Muguna Katheri	133	1,285	9.7	river	173	173	4	yes	CARE	yes	1990	2,000	100		1,200	0	65%	no	700	no	no	individual	100%			2,000	300	
33	Bahati	12	25	2.1	river			3	no		no	1986						100%	no	50	yes	no	individual	100%			1,000	200	
34	Gatuntune	300	1,500	5.0	river			3	no		no	1992	1,500				2,500	100%	no	500	no	no	individual	100%			1,000	200	
35	Karene	25	400	16.0	spring			2	no		no	1978	1,800	10			5,000	84%	no	30	no	no	individual	100%			1,000	200	
36	Karene Kirima	52	360	6.9	spring			3	no		no	1981	300	10	520	0	5,000	92%	no	500	no	no	individual	100%			1,000	200	
37	Karimene	7	7	1.0	spring			3	no		no	1999	1,100				0	100%	no	600	no	no	individual	100%			1,000	200	
38	Katheri Kionyo	60	60	1.0	river			3	no		no	1980	500	0	0	0	0	100%	no	800	no	no	individual	100%			1,000	200	
39	Kieni Kia Ruguru	40	160	4.0	spring			2	no		no	1988	3,500	20	800	600	0	88%	no	800	no	no	individual	100%			1,000	350	
40	Kionyo	39	160	4.1	river			4	no		no	1972	5,000	200	1,000	2,000	8,000		no		no	no	individual	100%			4,000	400	
41	Kithamburu	17	24	1.4	spring			4	no		no	2000	8,000						no	1,200	no	no	individual	100%			1,500	200	
42	Mwiriene	70	210	3.0	river			4	yes	USAID	no	1992	5,000	30	2,100		0	86%	no	500	no	no	individual	100%			1,000	200	
43	Mwiriene I	96	1,000	10.4	river			2	no		no	1984	2,310	15	1,440		0	83%	no	1,000	no	no	individual	100%			1,000	200	
44	New Kirungurune	34	34	1.0	spring	30	25	3	no		no	1984	10,000	50	1,000	0	2,000	59%	no	500	no	no	individual	100%			1,000	200	
45	Nkiri	8	20	2.5	spring			2	no		no	2000	5,000				20,000		no	1,000	no	no	individual	100%			2,000	200	
46	Wendo	21	84	4.0	spring			2	no		no	1995	2,500	20	420	240	1,500	100%	no	600	no	no	individual	100%			1,000	200	
47	Mworoga Mpuri	120	230	1.9	river			3	no		no	1964	1,900	0	0	0	19,000	100%	no	600	no	no	indiv./kiosk	60%	40%		3,000	200	100
48	Kionyo Kithigachio	130	362	2.8	river			4	no		no	2002	15,000				276,000		no	600	no	no	individual	100%			1,000	200	
49	Kimuri	200	450	2.3	river			8	no		no	2001	14,000				150,000	100%	no	600	no	no	individual	100%			2,000	200	
50	Kanja Gantuku	75	120	1.6	river			4	no		no	1996	10,000	50	4,500	3,000	0	53%	no	1,200	no	no	indiv./kiosk	53%	47%		1,000	200	100
51	Kanyuango	16	80	5.0	river	7		3	no		no	1971	1,000	0	0	0	2,700	100%	no	unboiled	no	no	individual	100%			1,000	200	
52	Mukungu	25	110	4.4	river			2	no		no	2000	1,000						no		no	no	individual	100%			1,000	200	
53	Ruchunga	61	200	3.3	spring	7		3	no		no	1971	1,000					100%	no	1,000	no	no	individual	100%			1,000	200	
54	Kabirithru	20	40	2.0	river			5	no		no	1980	12,000	100			45,000	100%	no		no	no	individual	100%			2,000	300	
55	Karemba	16	18	1.1	river			3	no		no	1985	2,500				500	100%	no		no	no	individual	100%			2,000	250	
56	Kithigachu	50	150	3.0	river	30.9		3	no		no	1980	3,000				3,500	80%	no	150	no	no	indiv./kiosk	70%	30%		2,000	200	100
57	Mpingene	30	40	1.3	river				no		no	2000	2,500	100				100%	no		no	no	individual	100%			1,000	200	
58	Mathigijune	97	150	1.5	river			6	no		no	1976	6,878	25			30,000	85%</											

Table 3 Result of Survey on Community Water Supply Schemes ( 2/2)

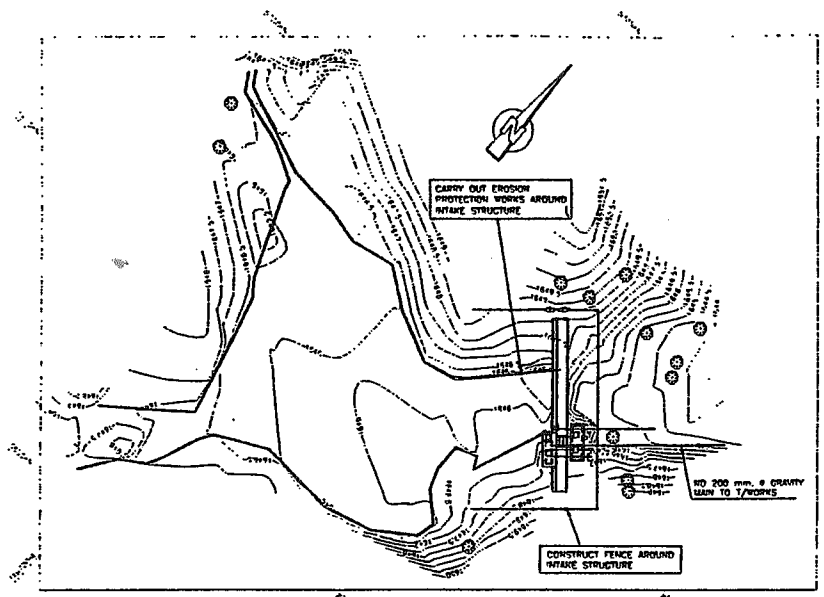
No.	Question No.	5a	5b	6	7a	7b	7c	8	9	10	11	12	13	14	15	16	17	18	19a	19b	20	21			22	23	24	
																						Name of community water scheme	No. of members	No. of households				Household / member ratio
85		80		river			4	no		1991	4,000	20	1,600	2,000	10,000	100%	no	100	no	no	individual	100%				1,000	200	
86		25	45	1.8	spring			no		future	500	0	0	0	12,500			100	no	no	individual	100%				2,000	600	
87		55	100	1.8	spring			4	no	1987	30,000	20	1,100	2,200	0	100%	no	1,000	no	no	individual	100%				1,500	200	
88		288	600	2.1	river			4	yes	1983	12,000	0	0	2,000	21,000	52%	no	1,000	no	no	individual	100%				1,000	200	
89		42	126	3.0	river			5	no	1999	6,000	0	0	0	0	100%	no	300	no	no	individual	100%				1,500	200	
90		38	76	2.0	spring			3	no	1980	10,000	0	0	0	2,000		no	300	no	no	individual	100%				1,000	200	
91		35	205	5.9	river/spring			3	no	2003	6,000	0	0	0		40%	no	300	no	no	individual	100%				2,000	200	
92		100	400	4.0	spring			3	no	2000	7,000	50	5,000	0	0		no	300	no	no	individual	100%				1,000	200	
93		200	800	4.0	spring			5	yes	1967	5,000	0	0	0	0	58%	no	300	no	no	individual	100%				1,000	200	
94		64	200	3.1	river			4	no	1978	2,000	0	0	0	0	33%	no	200	no	no	individual	100%				1,000	200	
95		82	300	3.7	spring			3	no	1984	5,000	20	1,640	600	15,000	100%	no	300	no	no	individual	100%				1,000	50	
96		33	99	3.0	river/spring			6	no	2000	5,000						no	300	no	no	individual	100%				2,000	200	
97		200	350	1.8	spring			3	no	1987	5,000	30	6,000	4,000	20,000	100%	no	300	no	no	individual	100%				2,000	200	
98		54	200	3.7	spring			3	no	1990	5,000	20	1,080	1,000	10,000	37%	no	200	no	no	individual	100%				1,000	200	
99		53	159	3.0	spring	5	5	3	no	1993	3,000	0	0	0	2,000	100%	no	100	no	no	individual	100%				3,500	350	
100		36	108	3.0	spring	5	1	5	no	1978	3,000	0	0	0	14,000	100%	no	100	no	no	individual	100%				4,000	400	
101		30	150	5.0	river			4	no	1999	10,000	50	1,500	300	15,000	100%	no	50	no	no	individual	100%				1,000	200	
102		30	100	3.3	river			3	no	1980	200	20		500		100%	no	500	no	no	individual	100%				1,500	250	
103			450	spring						future							4%	no	unboiled	no	no	indiv./kiosk	40%	60%		2,500	300	100
104		183	915	5.0	spring			4	no	1989	965		0	500	10,000	96%	no	200	no	no	individual	100%				1,000	200	
105		71	160	2.3	spring			2	yes	1985	8,000	0	0	4,000	21,000	100%	no	300	yes	no	individual	100%				1,000	200	
106		200	1,200	6.0	river/spring/well			8	no	1981	100				21,000	100%	no		no	no	individual	100%				1,000	250	
107		20	80	4.0	river			4	no	1973	3,000			600	15,000	100%	no	300	no	no	individual	100%				1,000	100	
108		60	500	8.3	river			4	no	2001	3,000				2,000		no	100			individual	100%				1,000	200	
109		38	200	5.3	river	43	43	3	no	1988	2,000	100			500	63%	no	100	no	no	individual	100%				1,000	200	
110		70	600	8.6	river			4	no	future											individual	100%				1,000	200	
111		24	360	15.0	spring	23	23	2	no	1972	5,000	0			1,000	46%	no	200	no	no	indiv./kiosk	63%	38%		1,000	200	100	
112		29	130	4.5	river			2	no	1987	5,000	50	0	200	2,000	100%	no	150	no	no	individual	100%				1,000	200	
113		100	500	5.0	river			6	no	1996	10,500	20	2,000	1,000	3,000	79%	no	150	no	no	individual	100%				2,000	200	
114		100	500	5.0	spring			4	no	1971	1,000	0	0	1,200	5,000	20%	no	470	no	no	indiv./kiosk	50%	50%		1,000	200	100	
115		63	350	5.6	spring			6	no	1998	1,000				2,968	71%	no		yes	no	individual	100%				1,000	200	
116		25	100	4.0	river			2	no	1974	300					44%	no	100	no	no	individual	100%				1,000	200	
117		75	250	3.3	spring	23	14	3	no	1972	600	0	0	0	600	80%	no		yes	no	individual	100%				1,000	200	
118		206	1,542	7.5	river			4	no	1979	3,500	0	0	4,000	21,000	88%	no	231	no	no	individual	100%				1,000	200	
119		250	800	3.2	river			12	no	2000	3,000	60	200				no		no	no	individual	100%				1,500	200	
120		60	200	3.3	river			4	no	1976	2,000	10	600	500	12,000	75%	no	300	no	no	indiv./kiosk	58%	42%		2,000	200	100	
121		400	4,200	10.5	river	182	45	6	yes	1976	3,600	0	0	500	21,000	88%	no	400	no	no	indiv./kiosk	75%	25%		1,000	200	100	
122		18	80	4.4	river			3	no	1997	7,000	100		200		100%	no	50	no	no	indiv./kiosk	67%	33%		1,500	200	100	
123		100	500	5.0	river			4	no	1981	2,000				2,500	30%	no	150	no	no	individual	100%				1,000	200	
124		28	42	1.5	spring			3	no	1997	5,000	30	680	0	0	64%	no	unboiled	no	no	indiv./kiosk	55%	45%		3,000	300	150	
125		40	94	2.4	spring			4	no	1974	6,200	0	0	0	39,000	100%	no	500	no	no	individual	100%				2,000	250	
126		165	495	3.0	river			4	no	1983	10,000	0	0	0	10,000	100%	no	unboiled	no	no	individual	100%				1,000	200	
127		30		river				4	no	2000	5,000	0	0	0	0		no	600			individual	100%				1,000	200	
128		24	54	2.3	spring			3	no	1982	4,000	20	480	200	6,800	63%	no	500	yes	no	individual	100%				1,000	200	
129		44	88	2.0	spring			3	no	1991	3,000	20	880	0	500	100%	no	unboiled	no	no	individual	100%				1,000	200	
130		15	22	1.5	river/spring			4	no	1999	20,000	100	1,500	200	5,000	100%	no	800	no	no	individual	100%				2,000	250	
131		8	17	2.1	river			4	no	1997	16,000	200	1,600	400	0	75%	no	700	no	no	individual	100%				2,500	300	
132		72	243	3.4	river			4	no	1973	120				18,000	100%	no	600	no	no	indiv./kiosk	72%	28%		1,000	200	100	
133		90	300	3.3	spring	23	23	4	no	1994	7,500				15,000	100%	no	600	no	no	indiv./kiosk	30%	70%		2,000	200	100	
134		39	117	3.0	spring			3	no	1987	15,000	120	4,680	3,000		100%	no		no	no	individual	100%				2,000	300	
135		30	90	3.0	river			3	no	1968	2,000	0	0	0	0	100%	no	unboiled	no	no	individual	100%				1,500	200	
136		40	40	1.0	spring			2	no	1985	6,780	0	0		12,000	83%	no	unboiled	no	no	individual	100%				1,000	200	
137		22	66	3.0	river/spring			3	no	1995	9,000	15	320	300	8,500	100%	no	unboiled	no	no	indiv./kiosk	88%	13%		2,500	200	100	
138		22	66	3.0	river			3	no	1985	2,000	0	0	0	0	100%	no	unboiled	no	no	individual	100%				1,000	250	
139		11	17	1.5	river			6	no	1990	1,500				0	45%	no	unboiled	no	no	individual	100%				1,000	200	
140		78	234	3.0	river			4	no	1995	7,000					56%	no	unboiled	yes	no	individual	100%				1,000	200	
141		82	167	2.0	river			3	no	1972	4,000	0	0	500	6,000	100%	no	700	no	no	individual	100%				2,000	200	
142		20	21	1.1	river			4	no	2001	5,000				1,000	35%	no	unboiled	no	no	individual	100%				1,500	200	
143		116	150	1.3	spring	114		6	yes	1983	3,000				0	0%	no	600	no	no	individual	100%				2,500	250	
144		72	72	1.0	river			4	no	1978	6,000	0	0		1,800	100%	no		no	no	individual	100%				1,000	250	
145		12	17	1.4	river			3	no	1972	1,600	0	0	400	0													

*Attachment-3*

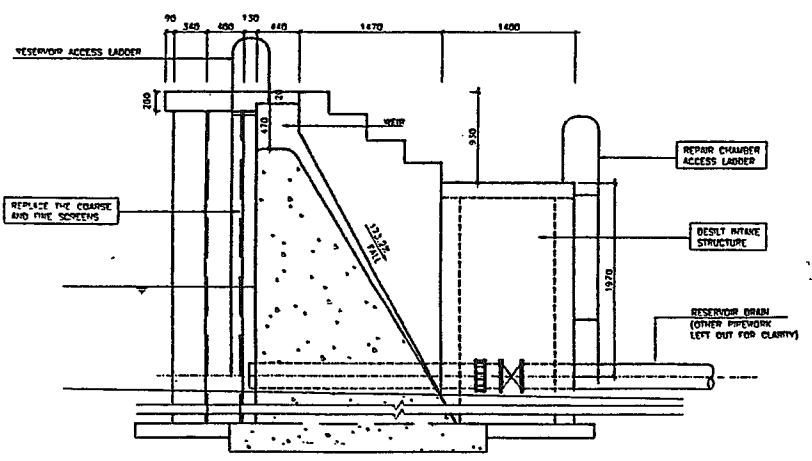
*El-Nino Infrastructure Rehabilitation Project*



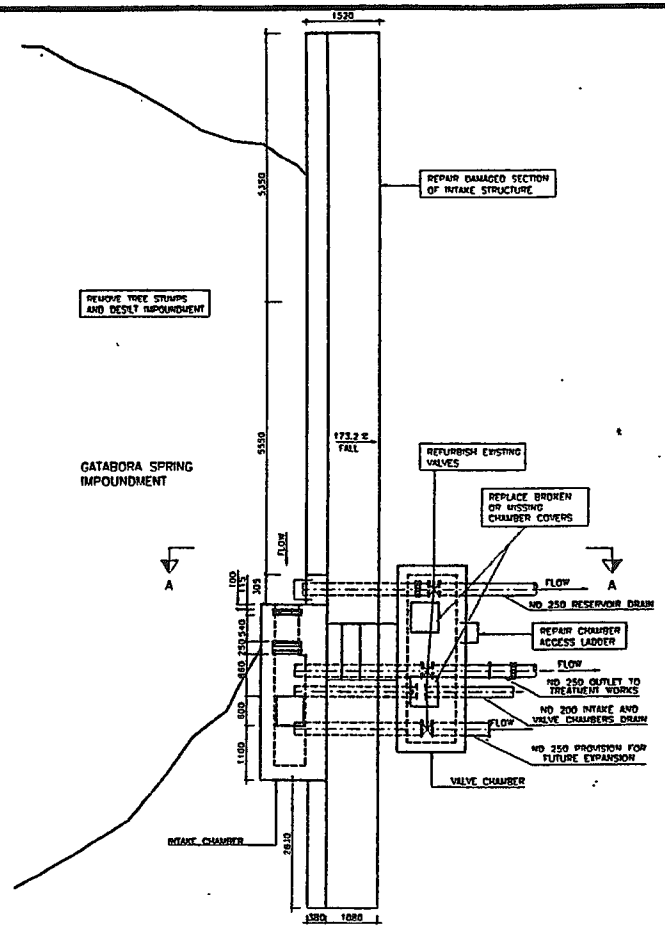
Location of Works Done by El-Nino Project



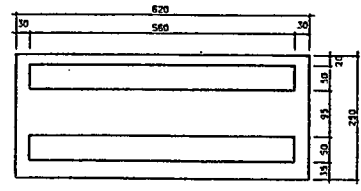
LAYOUT PLAN  
SCALE 1:250



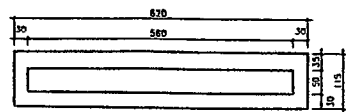
SECTION A-A  
SCALE 1:25



PLAN  
SCALE 1:50



FINE SCREEN SLOTS DETAILS  
SCALE 1:5

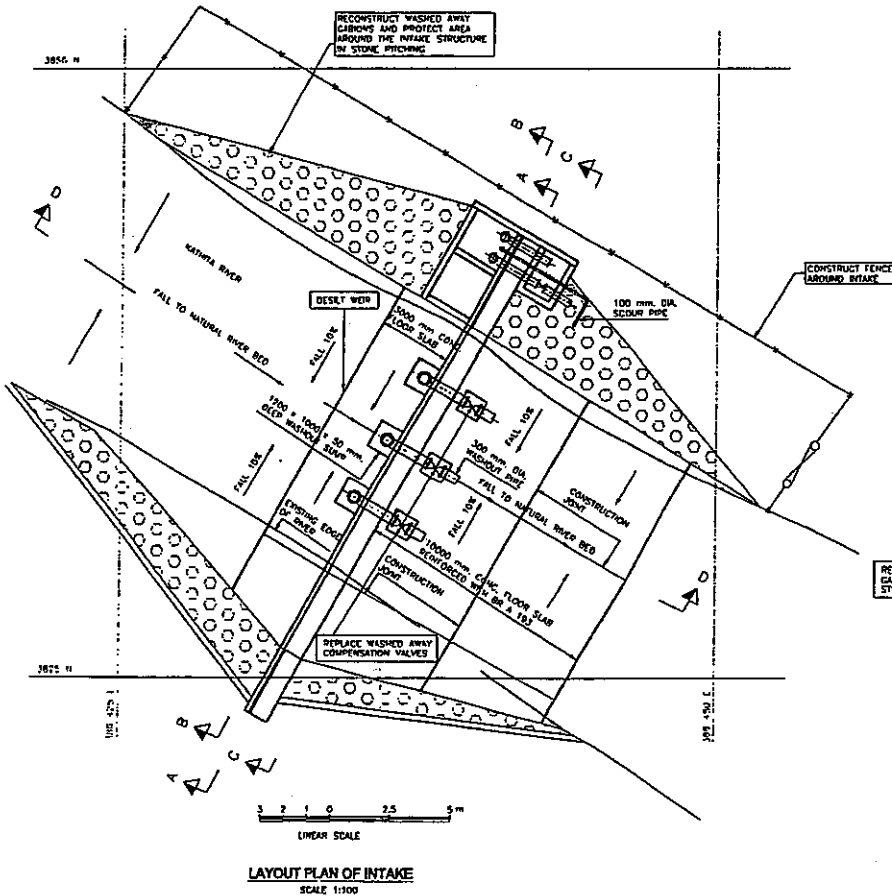


COARSE SCREEN SLOT DETAILS  
SCALE 1:5

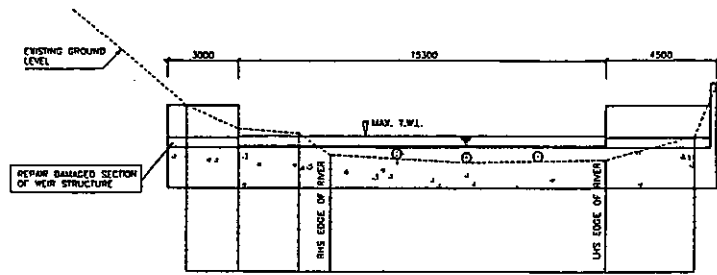
- NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
  2. ALL LEVELS ARE IN METRES ABOVE SEA LEVEL. (m.a.s.l.)
  3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DWG. Nos. EMP/NC/P/CD/1.6, 1.7 & 1.8.

- LEGEND:**
- PIPELINE
  - (REFURBISH) PROPOSED REHABILITATION MEASURES
  - ⊕ TREES
  - FENCE

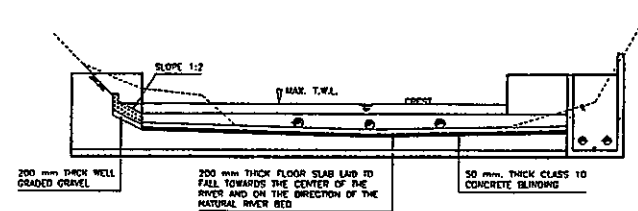
Source : Tender Drawings of El-Nino Project



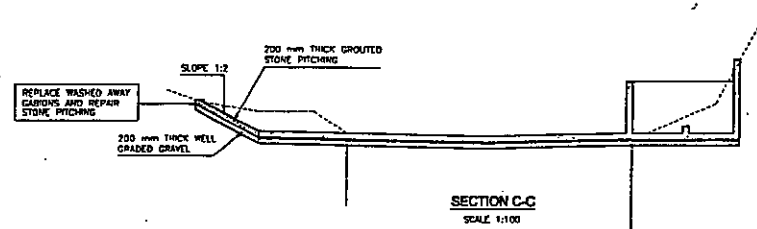
LAYOUT PLAN OF INTAKE  
SCALE 1:1000



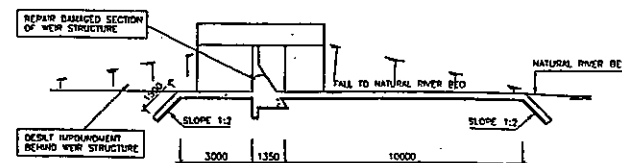
SECTION A-A  
SCALE 1:100



SECTION B-B  
SCALE 1:100



SECTION C-C  
SCALE 1:100



SECTION D-D  
SCALE 1:100

NOTES:

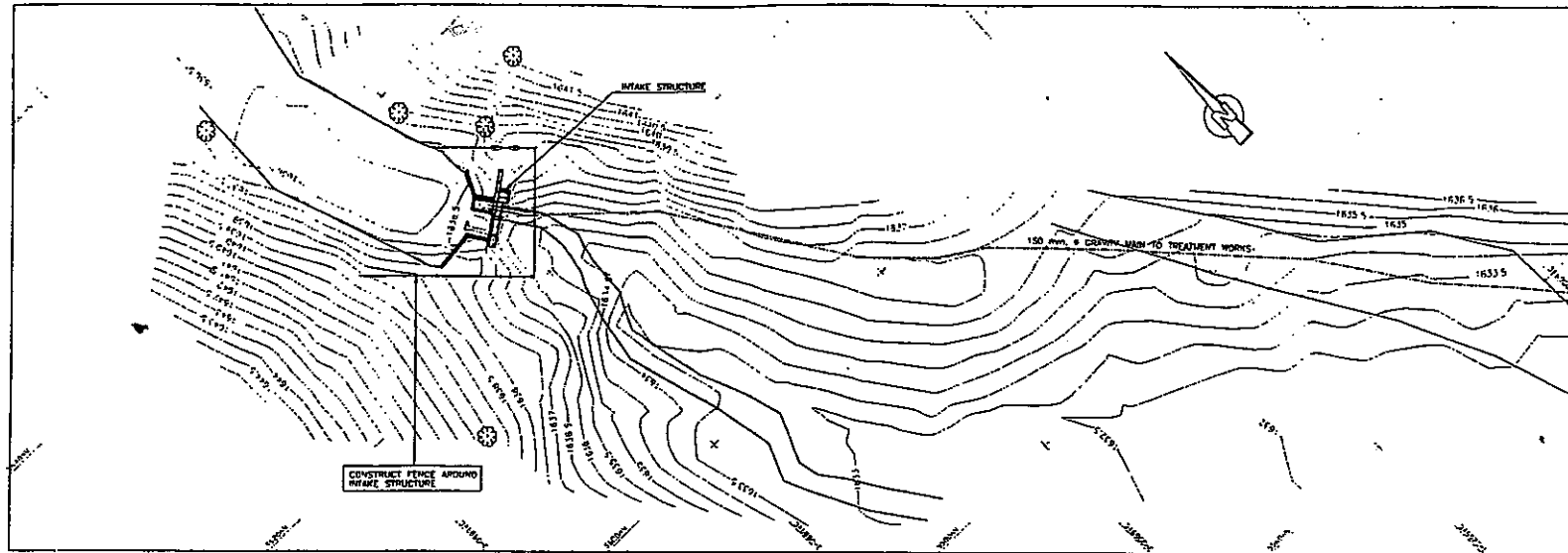
1. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE.
2. THIS DRAWING HAS BEEN REPRODUCED FROM M.S.W.D. DRG. No. CWS2/70/5 AND MODIFIED AS PER THE SITE VISIT CARRIED OUT IN JUNE 1999.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRG. No. ENP/UC/W/MT/2.1.1
4. FOR FENCING DETAILS SEE DRG. No. ENP/UC/W/CO/1.7.

LEGEND:

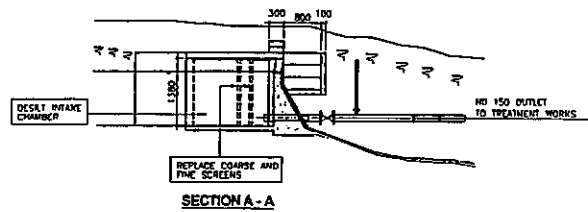
- REPAIR PROPOSED REMEDIATION MEASURES



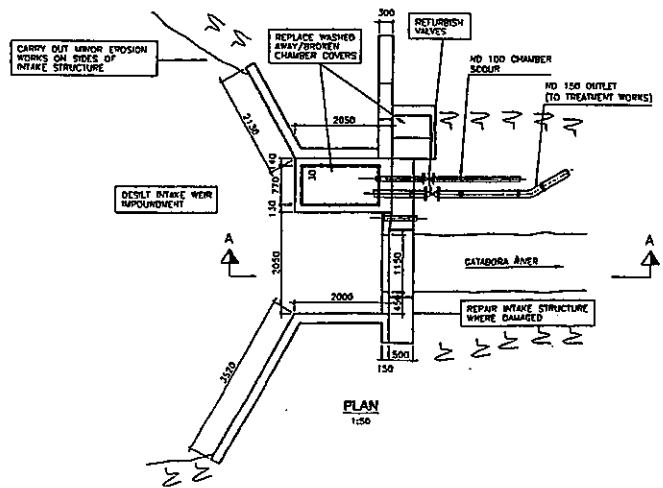




6 4 2 0 5 10m  
**LAYOUT PLAN OF GATABORA STREAM INTAKE**  
 1:200



**SECTION A - A**  
 1:50



**PLAN**  
 1:50

- NOTES:**
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
  2. ALL LEVELS ARE IN METRES ABOVE SEA LEVEL ( m.a.s.l. )
  3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DWG. NO. ERP/AC/W/CO/1.6, 1.7 & 1.8.

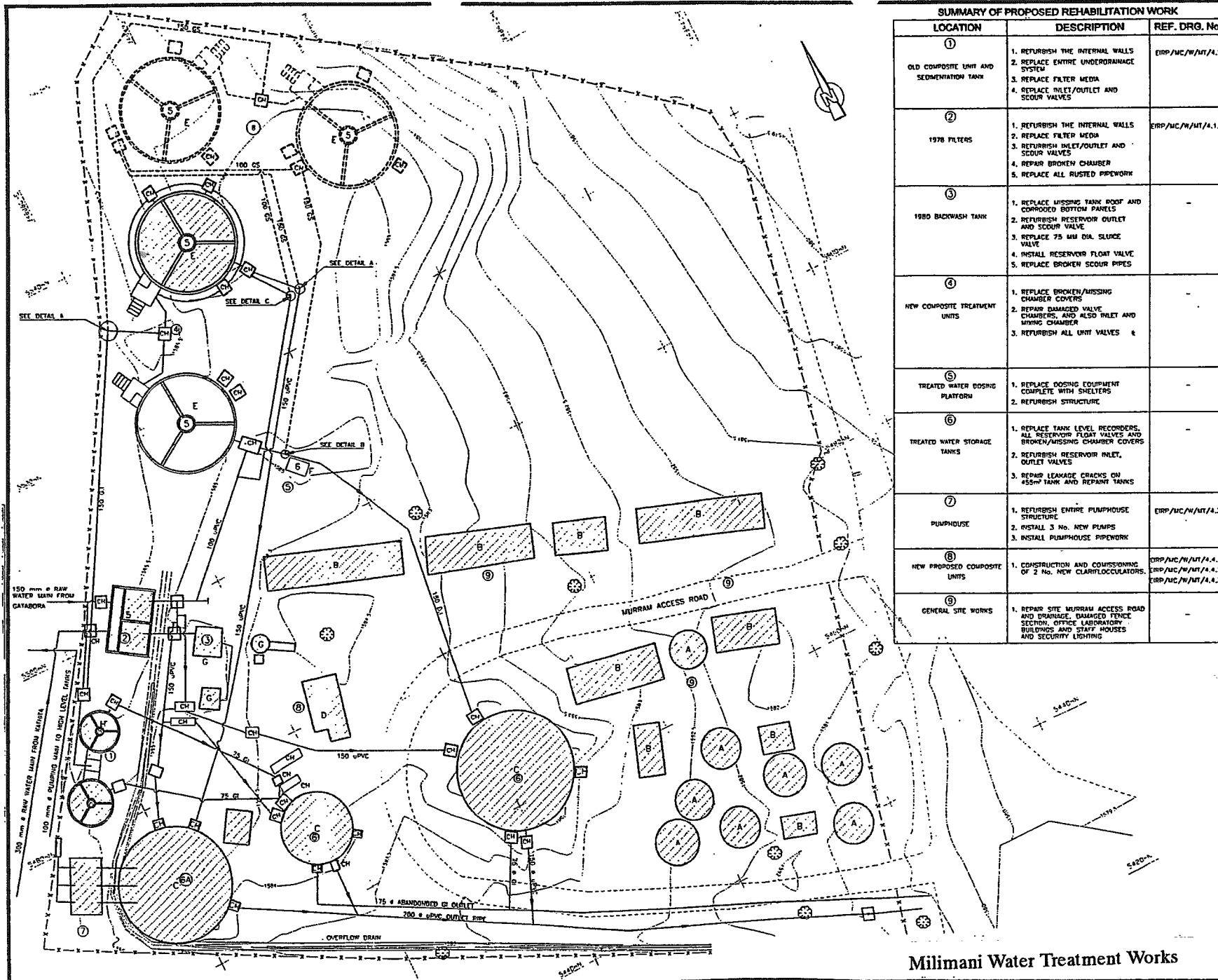
**LEGEND:**

	PIPELINE
	PROPOSED REHABILITATION MEASURE
	TREES
	FENCE

A3-5

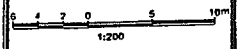
Source : Tender Drawings of El-Nino Project

Gatabora Stream Intake



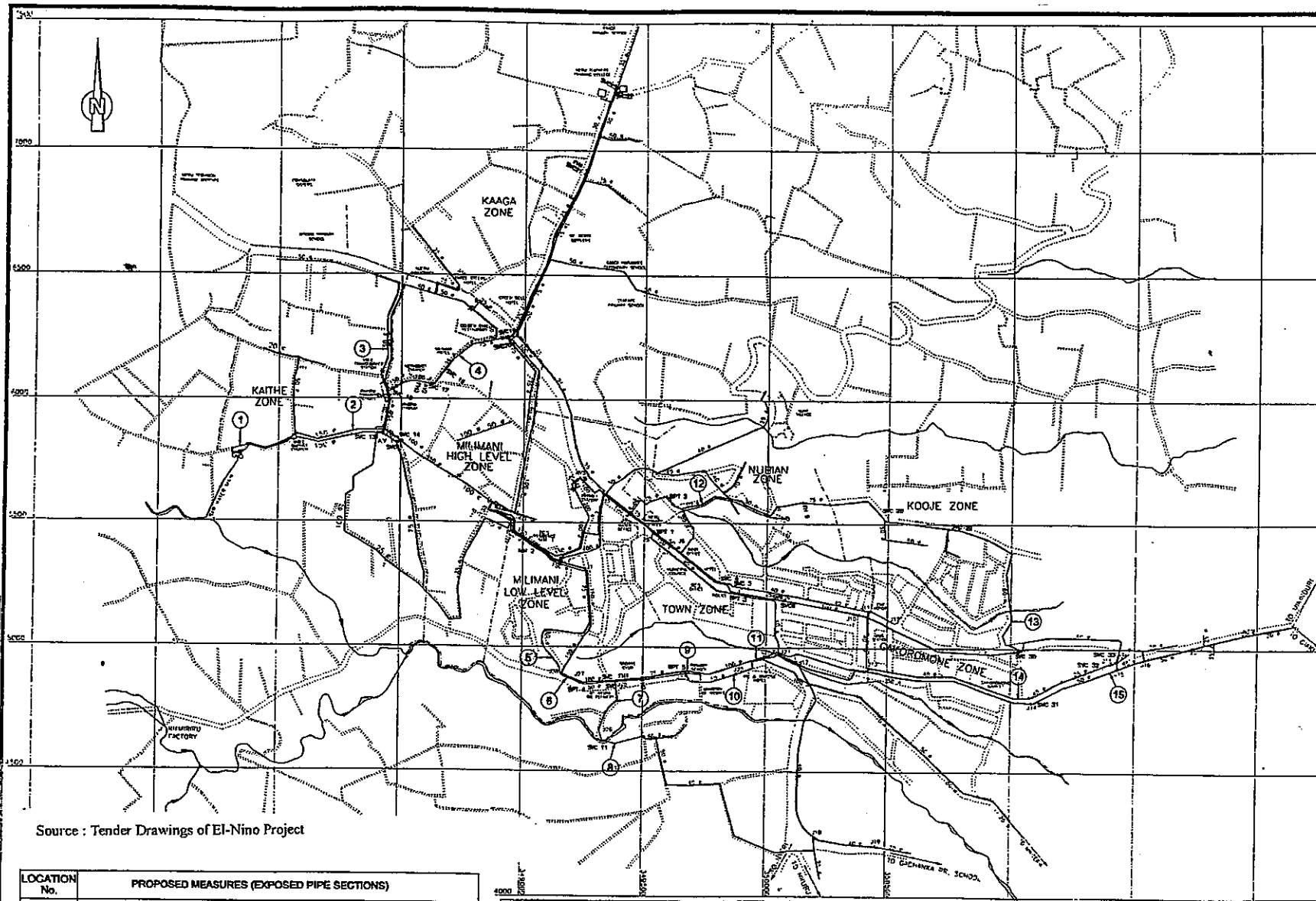
SUMMARY OF PROPOSED REHABILITATION WORK		
LOCATION	DESCRIPTION	REF. DRG. No.
①	OLD COMPOSITE UNIT AND SEDIMENTATION TANK	ERP/UC/W/MT/4.1.2
②	1978 FILTERS	ERP/UC/W/MT/4.1.2
③	1980 BACKWASH TANK	-
④	NEW COMPOSITE TREATMENT UNITS	-
⑤	TREATED WATER DOSING PLATFORM	-
⑥	TREATED WATER STORAGE TANKS	-
⑦	PUMPHOUSE	ERP/UC/W/MT/4.3
⑧	NEW PROPOSED COMPOSITE UNITS	ERP/UC/W/MT/4.4.1 ERP/UC/W/MT/4.4.2 ERP/UC/W/MT/4.4.3
⑨	GENERAL SITE WORKS	-

- NOTES :**
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
  2. ALL LEVELS ARE IN METRES ABOVE SEA LEVEL ( m.s.a.l )
  3. FOR DETAILS A, B & C SEE DRG. No. ERP/UC/W/MT/4.4.4.



- LEGEND :**
- ① PROPOSED REHABILITATION MEASURE
  - EXISTING PIPEWORK
  - - - PROPOSED NEW PIPEWORK
  - A TIN HUTS
  - B STAFF HOUSES
  - C CLEAR WATER STORAGE TANKS
  - D OFFICES
  - E NEW UNITS
  - F DOSER
  - G ELEVATED TANKS
  - H OLD UNITS
  - I FILTERS
  - CH CHAMBERS
  - PROPOSED NEW STRUCTURES

Milimani Water Treatment Works



**NOTES:**

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS STATED OTHERWISE.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRG. Nos. ERP/UC/M/1/7.1, 7.2, 7.3, 7.4, 7.5, 7.6 & 7.7.

**LEGEND:**

--- ZONE BOUNDARY  
 --- ROADS  
 --- RIVERS

**TOWN ZONE** ZONE NAME

--- PIPELINE  
 BPT BREAK PRESSURE TAP  
 JT JUNCTION  
 40 Ø PIPE DIAMETER  
 SVC SLUICE VALVE CHAMBER  
 AV AIR VALVE  
 FH 1 FIRE HYDRANT  
 UM 1 METER CHAMBER  
 ① REFRESHMENT LOCATION NUMBER

0 100 200 300 m  
 --- LINEAR SCALE

Source : Tender Drawings of El-Nino Project

LOCATION No.	PROPOSED MEASURES (EXPOSED PIPE SECTIONS)
1.	VERTICALLY AND HORIZONTALLY REALIGN 150 mm DIA. PIPES EXPOSED ALONG DIRT ROAD.
2.	RELOCATE 150 mm DIA. uPVC PIPES OFF DIRT ROAD.
3.	RELOCATE 50 mm DIA. uPVC PIPES OFF DIRT ROAD.
4.	REPLACE DAMAGED 75 mm DIA. uPVC PIPES AND VERTICALLY AND HORIZONTALLY REALIGN PIPE SECTION.
5.	VERTICALLY AND HORIZONTALLY REALIGN EXPOSED 50 & 50 mm DIA. uPVC PIPE ALONG DIRT ROAD AND A FURTHER 50 m AT CORNER OF THE DIRT ROAD.
6.	VERTICALLY AND HORIZONTALLY REALIGN EXPOSED SECTIONS OF 100 mm DIA. AND 50 mm DIA. PIPES.
7.	VERTICALLY AND HORIZONTALLY REALIGN 75 mm DIA. uPVC AND 50 mm DIA. CI PIPES. REPLACE RUSTED 50 mm DIA. CI PIPES.
8.	REINSTATE PIPE STREAM OVERCROSS AND REPAIR DAMAGED PIPES.

LOCATION No.	PROPOSED MEASURES (EXPOSED PIPE SECTIONS)
9.	VERTICALLY AND HORIZONTALLY REALIGN 100 mm DIA. EXPOSED PIPE SECTION ALONG DIRT ROAD.
10.	REPLACE 50 mm DIA. uPVC DAMAGED PIPE SECTION AND VERTICALLY AND HORIZONTALLY ALIGN THE EXPOSED PIPE SECTION.
11.	VERTICALLY AND HORIZONTALLY REALIGN 100 mm DIA. EXPOSED PIPE SECTION.
12.	RELOCATE 16 m LENGTH 50 mm DIA. uPVC PIPE SECTION OFF LANDSLIDE AREA.
13.	REPLACE WASHED AWAY 50 mm DIA. CI PIPES AT RIVER CROSSING AND REWSTATE CROSSING.
14.	RELOCATE/REALIGN 40 mm DIA. AND 50 mm DIA. CI PIPES AT LANDSLIDE PRONE AREA ALONG DIRT ROAD.
15.	VERTICALLY AND HORIZONTALLY REALIGN 50 mm DIA. CI PIPE AT ROAD CROSSING/SIDE DRAIN.

**Distribution Pipeline Network**

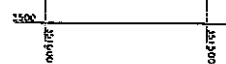


Table 1 Main Works of El-Nino Infrastructure Rehabilitation Project for Meru Water Supply

Location	Work Items	Main Features/Work Quantity
1. Kathita Intake	1) Removal of silting material in the reservoir and intake chamber	<ul style="list-style-type: none"> <li>• 150 m<sup>3</sup> in the river stretch with a length of 30 m upstream</li> <li>• 10 m<sup>3</sup> in the chamber</li> </ul>
	2) Repair of damaged part of weir body	<ul style="list-style-type: none"> <li>• Minor concrete works</li> </ul>
	3) Replacement of screen	<ul style="list-style-type: none"> <li>• Coarse (5 m<sup>2</sup>) and fine (5 m<sup>2</sup>) screens</li> </ul>
	4) Replacement of trash racks	<ul style="list-style-type: none"> <li>• 5 m<sup>2</sup></li> </ul>
	5) Replacement of washed-away compensation valves	<ul style="list-style-type: none"> <li>• 2 nos. with a diameter of 300 mm</li> </ul>
	6) Refurbishing existing valves	<ul style="list-style-type: none"> <li>• 3 nos. with a diameter of 300 mm</li> </ul>
	7) Erosion protection and river training	<ul style="list-style-type: none"> <li>• 40 gabion mattress with a dimension of 2m x 1m x 0.5m</li> </ul>
	8) Electing a fence around intake facilities	<ul style="list-style-type: none"> <li>• A length of 40 m with height of 2.5 m to 3.0 m</li> </ul>
	9) Improvement of access road	<ul style="list-style-type: none"> <li>• 7.2 km</li> </ul>
2. Gatabora Stream Intake	1) Removal of silting material in the reservoir and intake chamber	<ul style="list-style-type: none"> <li>• 100 m<sup>3</sup> in the river stretch with a length of 20 m upstream</li> <li>• 2 m<sup>3</sup> in the chamber</li> </ul>
	2) Repair of the chamber	<ul style="list-style-type: none"> <li>• Minor concrete work</li> </ul>
	3) Replacement of screen	<ul style="list-style-type: none"> <li>• Coarse (2 m<sup>2</sup>) and fine (2 m<sup>2</sup>) screens</li> </ul>
	4) Repair of damaged chamber cover	<ul style="list-style-type: none"> <li>• 2 nos. with a size of 1 m<sup>2</sup> to 5 m<sup>2</sup></li> </ul>
	5) Refurbishing existing valves	<ul style="list-style-type: none"> <li>• 2 nos. with a diameter of 150 mm</li> </ul>
	6) Erosion protection around the intake	<ul style="list-style-type: none"> <li>• Stone pitching around the intake</li> </ul>
	7) Electing a fence around intake facilities	<ul style="list-style-type: none"> <li>• A length of 30 m with height of 2.5 m to 3.0 m</li> </ul>
3. Gatabora Spring Intake	1) Removal of silting material in the reservoir including tree stumps	<ul style="list-style-type: none"> <li>• 50 m<sup>3</sup> in the river stretch with a length of 20 m upstream</li> <li>• 10 nos. of tree stumps</li> </ul>
	2) Repair of damaged chamber cover	<ul style="list-style-type: none"> <li>• Minor concrete work</li> </ul>
	3) Replacement of screen	<ul style="list-style-type: none"> <li>• Coarse (2 m<sup>2</sup>) and fine (2 m<sup>2</sup>) screens</li> </ul>
	4) Refurbishing existing valves	<ul style="list-style-type: none"> <li>• 3 nos. with a diameter of 200 mm</li> </ul>
	5) Repair of damaged part of weir body and access ladders	<ul style="list-style-type: none"> <li>• Minor concrete work</li> </ul>
	6) Erosion protection around the intake	<ul style="list-style-type: none"> <li>• Stone pitching around the intake</li> </ul>
	7) Electing a fence around intake facilities	<ul style="list-style-type: none"> <li>• A length of 40 m with height of 2.5 m to 3.0 m</li> </ul>
4. ASK Spring Intake	1) Removal of silting material in the reservoir including tree stumps	<ul style="list-style-type: none"> <li>• 10 m<sup>3</sup> at intake and chamber</li> <li>• 5 nos. of tree to be removed</li> <li>• 5 nos. of tree stumps with a diameter of 500mm to 1000 mm</li> </ul>
	2) Replacement of screen	<ul style="list-style-type: none"> <li>• Coarse (1 m<sup>2</sup>) and fine (1 m<sup>2</sup>) screens</li> </ul>
	3) Replacement of missing valves	<ul style="list-style-type: none"> <li>• 2 nos. with a diameter of 100 mm</li> </ul>
	4) Replacement of damaged/washed-away chamber covers	<ul style="list-style-type: none"> <li>• 2 nos. with precast concrete of 3m<sup>3</sup> to 4 m<sup>3</sup></li> </ul>
	5) Repair of damaged sections of intake structure	<ul style="list-style-type: none"> <li>• Minor concrete work</li> </ul>
	6) Electing a fence around intake facilities	<ul style="list-style-type: none"> <li>• A length of 40 m with height of 2.5 m to 3.0 m</li> </ul>

Table 1 Main Works of El-Nino Infrastructure Rehabilitation Project for Meru Water Supply

Location	Work Items	Main Features/Work Quantity
	7) Erosion protection around the intake	<ul style="list-style-type: none"> <li>• Stone pitching around the intake</li> </ul>
5. Kathita Raw Water Main	1) Reconstruction of the existing damaged pipe crossing the river channel	<ul style="list-style-type: none"> <li>• Double flanged pipes with a diameter of 300 mm and length of 80 m</li> <li>• Concrete piers and anchor blocks with a volume less than 50 m<sup>3</sup></li> </ul>
	2) River training and minor erosion protection measures at river crossing	<ul style="list-style-type: none"> <li>• 20 nos. of gabion mattress with a size of 2 m x 1m x 0.5m</li> <li>• Stone pitching with a volume of 100 m<sup>3</sup></li> </ul>
	3) Refurbishing of all valves	<ul style="list-style-type: none"> <li>• Not described in the B/Q</li> </ul>
	4) Rehabilitation of chambers along the pipeline	<ul style="list-style-type: none"> <li>• Not described in the B/Q</li> </ul>
6. Gatabora Raw Water Main	1) Replacement of the existing damaged and/or washed-away sections of pipe	<ul style="list-style-type: none"> <li>• Double flanged standard pipes with a total length of 100 m and diameter of 200 mm from Gatabora spring</li> <li>• Double flanged non-standard pipes with a total length of 36 m and diameter of 150 mm from Gatabora stream</li> </ul>
	2) Protection of pipes at landslide and exposed sections	<ul style="list-style-type: none"> <li>• Type of protection work is not described in B/Q</li> </ul>
	3) Construction of valve chambers for replacing the existing ones	<ul style="list-style-type: none"> <li>• 2 nos. of valve chambers</li> <li>• 5 nos. of sluice valve chambers</li> <li>• 2 nos. of single air valve chambers</li> </ul>
	4) Replacement of 2 nos. of air valves, 2 nos. of sluice valves, and 2 nos. of washed-out	<ul style="list-style-type: none"> <li>• Air valves with a diameter of 50 mm</li> <li>• Sluice valves with a diameter of 150 mm and 200 mm</li> </ul>
7. Milimani Water Treatment Plant		
7.1 Treatment Units with a capacity of 225 m <sup>3</sup> /d	<ol style="list-style-type: none"> <li>1) Refurbishing the internal walls and water proof</li> <li>2) Replacement of under-drainage system and pipe works/fitments</li> <li>3) Replacement of filter media</li> <li>4) Replacement of inlet, outlet and scour valves</li> </ol>	<ul style="list-style-type: none"> <li>• Concrete works: 60 m<sup>3</sup></li> <li>• Sand material: 5 m<sup>3</sup>, gravel: 2 m<sup>3</sup> for filter media</li> <li>• Replacement of old valves (5 nos.) with a diameter of about 150 mm</li> </ul>
7.2 1978 Filter	<ol style="list-style-type: none"> <li>1) Refurbishing the internal walls</li> <li>2) Replacement of blocked and damaged under-drainage system</li> <li>3) Replacement of filter media</li> <li>4) Replacement of inlet, outlet and scour valves</li> <li>5) Repair of broken chamber</li> <li>6) Replacement of rusted pipe works</li> </ol>	<ul style="list-style-type: none"> <li>• 2 nos. of precast concrete manhole covers with a volume of 2 m<sup>3</sup></li> <li>• Provision of filter sand with a size of 0.55 mm</li> <li>• Replacement of 12 valves with a diameter of 150 mm</li> </ul>
7.3 1980 Back-wash Tank	<ol style="list-style-type: none"> <li>1) Replacement of tank proof and corroded bottom panels</li> <li>2) Refurbishing of reservoir outlet and scour valve</li> <li>3) Replacement of sluice valve with a diameter of 75 mm</li> <li>4) Installation of float valve</li> <li>5) Replacement of broken scour valve</li> </ol>	<ul style="list-style-type: none"> <li>• 1 no. of flanged gate valve with non-rising spindle with a diameter of 80 mm</li> <li>• 1 no. of ball float valve (150 mm) with necessary accessories</li> <li>• Replacement of 2 reservoir valves on outlet and scour pipes with a diameter of 300 mm</li> </ul>

Table 1 Main Works of El-Nino Infrastructure Rehabilitation Project for Meru Water Supply

Location	Work Items	Main Features/Work Quantity
7.4 Treatment Units constructed in 1993	<ol style="list-style-type: none"> <li>1) Replacement of broken and missing chamber covers</li> <li>2) Repair of damaged valve chamber, inlet and mizing chamber</li> <li>3) Refurbishing of all unit valves</li> <li>4) Replacement of filter media</li> </ol>	<ul style="list-style-type: none"> <li>• 10 nos. of concrete manhole covers</li> <li>• Sand material: 20 m<sup>3</sup>, gravel: 7 m<sup>3</sup> for filter media</li> <li>• Replacement of 10 leaking and rusty sluice valves</li> </ul>
7.5 Treated Water dosing Platform	<ol style="list-style-type: none"> <li>1) Replacement of dosing equipment complete with lightweight shelters</li> </ol>	<ul style="list-style-type: none"> <li>• 3 nos. of FRN gravity dosers</li> </ul>
7.6 Treated Water Storage Tanks	<ol style="list-style-type: none"> <li>1) Replacement of float valves installed at all the reservoirs</li> <li>2) Replacement of broken and missing chamber covers</li> <li>3) Refurbishing of all the reservoir valves</li> <li>4) Repair of leakage cracks on tanks with a capacity of 455 m<sup>3</sup>/d</li> <li>5) Repair of tanks</li> </ol>	<ul style="list-style-type: none"> <li>• 5 nos. of precast concrete manhole covers</li> <li>• 3 nos. of reservoir ball float valves with a diameter of 150 mm</li> <li>• 5 nos. of bulk water meters with a diameter of 80 mm, 150 mm and 200 mm</li> <li>• Repair of leakage clacks at the tank of 455 m<sup>3</sup></li> <li>• Provision of 3 tank level recorders</li> </ul>
7.7 Pump-house	<ol style="list-style-type: none"> <li>1) Refurbishing of pump-house structure</li> <li>2) Provision and installation of 3 nos. of new pumps together with cabling, switchgear and other accessories</li> <li>3) Provision of pipe works for pump-house</li> </ol>	<ul style="list-style-type: none"> <li>• 3 nos. of centrifugal water pumps with flow of 10 l/s and hydraulic head of 90 m</li> </ul>
7.8 New Treatment Units	<ol style="list-style-type: none"> <li>1) Construction of 2 nos. of additional composite units</li> </ol>	<ul style="list-style-type: none"> <li>• Excavation work of 75 m<sup>3</sup></li> <li>• Filling and compaction with a volume of 270 m<sup>3</sup></li> <li>• Concrete works with a volume of 240 m<sup>3</sup></li> <li>• Steel pipes of 100 m with a diameter 150 mm</li> <li>• UPVC with a total length of 106 m and a diameter of 50 mm</li> <li>• Galvanised threaded pipes at 8 places with a diameter of 100 mm and 150 mm</li> <li>• 12 nos. of double flanged gate valves with a diameter of 150 mm</li> <li>• 8 nos. of flanged flap valves with a diameter of 150 mm</li> <li>• Sand material: 20 m<sup>3</sup>, gravel: 7 m<sup>3</sup> for filter media</li> <li>• Installation of 370 underdrain filter nozzles</li> </ul>
7.9 General Site Works	<ol style="list-style-type: none"> <li>1) Re-arrangement of inlet pipe works</li> <li>2) Installation of master meters</li> <li>3) Repair and refurbishing of management offices and laboratory buildings</li> <li>4) Improvement of internal roads and drainage</li> <li>5) Repair of damaged fence surrounding WTP</li> <li>6) Repair of security lighting</li> </ol>	<ul style="list-style-type: none"> <li>• As instructed by the Project Manager</li> </ul>

Table 1 Main Works of El-Nino Infrastructure Rehabilitation Project for Meru Water Supply

Location	Work Items	Main Features/Work Quantity
8. Milimani High Level Tank	<ol style="list-style-type: none"> <li>1) Flushing and cleaning of tank</li> <li>2) Provision of new FRN Doser including shelter</li> <li>3) Replacement of missing chamber cover</li> <li>4) Reconstruction of damaged chamber</li> <li>5) Refurbishing of attendants pump-house</li> <li>6) Refurbishing of valves and meters</li> <li>7) Provision of float valves</li> <li>8) Refurbishing of tank level recorder</li> <li>9) Provision of overflow pipe works</li> </ol>	<ul style="list-style-type: none"> <li>• Replacement of 2 reservoir float valves with a diameter of 150 mm</li> <li>• Replacement of 4 concrete manhole covers</li> <li>• Replacement of 2 tank level indicators</li> <li>• Replacement of FRN gravity doser</li> <li>• Replacement of 5 valves at the reservoir</li> <li>• Replacement of 1 master meter with a diameter of 150 mm</li> </ul>
9. Distribution System	1) Exposition and inspection of the pumping main to Milimani tanks and rehabilitation as required	
	2) Repair and replacement of damaged and washed-out pipe section in Majengo, Gitimbine, Kaaga, Tuntu, Kaithe and Gakoromone	<ul style="list-style-type: none"> <li>• PVC pipes with a diameter of 150 mm and a length of 400 m</li> <li>• PVC pipes with a diameter of 100 mm and a length of 100 m</li> <li>• PVC pipes with a diameter of 50 mm and a length of 770 m</li> <li>• PVC pipes with a diameter of 40 mm and a length of 300 m</li> <li>• PVC pipes with a diameter of 75 mm and a length of 50 m</li> <li>• GI pipes with a diameter of 50 mm and a length of 60 m</li> </ul>
	3) Replacement and repair of damaged valves and valve chambers, including missing valve chamber cover	<ul style="list-style-type: none"> <li>• Rehabilitation of air valve chamber with 6 flanged tees and 6 air valves</li> <li>• Replacement of 4 chamber covers</li> </ul>
	4) Replacement of damaged float valve in the break pressure tanks	<ul style="list-style-type: none"> <li>• 8 nos. of float valves with a diameter of 50 mm and 80 mm</li> <li>• 7 nos. of gate valves with a diameter of 50 mm and 80 mm</li> </ul>

出典 : Tender Document, November 1999



***Attachment-4***  
***Review for Water Demands and Facility Plan in***  
***Feasibility Study***

## **Review for Water Demands and Facility Plan in Feasibility Study**

### **1. Proposed Facilities by the Feasibility Study**

The feasibility study in 1997 recommended construction of water supply facilities consisting of the following main components:

- (1) Intake weir with design discharge of 22,000 m<sup>3</sup>/day on the Kathita River,
- (2) Raw water conveyance pipeline with a diameter of 500 mm and total length of 5,825 m,
- (3) Water treatment plant with a treatment capacity of 10,000 m<sup>3</sup>/day,
- (4) Transmission and distribution mains with a total length of 61,200 m,
- (5) Storage tanks at six locations and with a total volume of 7,050 m<sup>3</sup> for transmission and distribution, and
- (6) Other facilities and equipment related to the above facilities

### **2. Necessity of the Review of the Request by the Government of Kenya**

The field survey was carried out in order to identify any changes on social and economic conditions and issues related to Meru water supply, after the feasibility study in 1997. As a result of the survey, it has been found after the initial review of the feasibility study that further study should be required for the following issues in order to formulate a definitive plan comprising more concrete features of the Project:

#### **2.1 Administrative Division and Population Growth Rate**

At the time of the feasibility study in 1997, the population census in 1989 was available in terms of the official population statistics. The result of the latest population census conducted in August 1999 is made available and reveals the following issues:

- (1) The population statistics in census are indicated by sub-location. The Study Area covers 6 sub-locations on the basis of the administrative division in 1989. These sub-locations have been further subdivided during the last decade. The number of sub-locations in the Study Area has increase to 34 on the basis of the administrative division in 1999. Water demand projection for the Project should be modified on the basis of the increased sub-locations in order to prepare a more accurate plan of water distribution network in the Study Area.
- (2) The feasibility study applied a population growth rate of 3.0% per annum in the Study Area according to the 1989 census. The 1999 census result indicates that the population growth rate has declined at 2.2% in the Study Area. Water demand projection for the Project should be updated on the basis of the latest population growth rate.

#### **2.2 Involvement of Community Water Supplies to the Project**

Many residents in the Study Area rely on community water supplies. For successful implementation of the Project, it is a key issue whether these residents have willingness to use water to be supplied by the Project or not.

The number of community water supplies in the Study Area is found to be more than 200. The questionnaire survey is carried out for all the community in the Study Area in order to confirm their willingness to use water to be supplied by the Project.

The results of the questionnaire survey reveals that most of residents relying on community water supplies do not satisfy their present water supplies in terms of quality and quantity of water. They show willingness to obtain clean and stable water from the Project. It is suggested that they have awareness of sanitary conditions and necessity of payment for water supply service.

During the feasibility study, a similar questionnaire survey was carried out for 20 selected samples of community water supplies. However, necessity to take all the community water in the Project could not be identified clearly. The feasibility study proposed that coexistent of the public water supply by the Project and community water supplies was considered most likely option to the year 2005, although full integration of community water supplies should be the ultimate goal of the public water supply in the Study Area.

The questionnaire survey by the present Study clarifies that the residents using community water supplies expect to have clean and stable water from the Project. The plan of water distribution network should be re-organized with water demand projection on the condition that the resident using community water supplies would be taken in the public water supply by the Project. It is also necessary to study on measures to encourage the residents using community water supplies to connect with the public water supply by the Project.

### **2.3 Viability of Facility Plan**

The requested facilities were planned under the concept of easy operation and maintenance based on gravity flow throughout the planned system and good quality of raw water to be maintained to the future. In the initial review of the feasibility study, it is pointed out that technical and economic viability for this facility plan should be examined carefully in view of a suitable scale of construction cost under a Grant Aid Scheme.

The site investigation has been carried out for the proposed sites of intake, route of raw water main and water treatment plant. As a result, technically possible alternatives for saving construction cost have been identified. Comparative study is therefore conducted between the requested facility plan and such alternatives to select an optimum facility plan for a Grant Aid Scheme.

### **2.4 Need of Full-scale Rehabilitation of Existing Distribution Facilities**

Part of the rehabilitation of existing water supply facilities is being implemented by the El Nino rehabilitation project. The El Nino rehabilitation project also intends an expansion of water treatment facility. However, it seems that the rehabilitation of existing distribution facilities is limited replacement of damaged valves and pipeline sections and is not sufficient for effective use of an expanded water treatment capacity.

The existing distribution facilities serving water to the central part of Meru has a quite important role in Meru Water Supply. It is proposed that full-scale rehabilitation is necessary for the existing distribution facilities together with some expansion for effective use of the water

treatment capacity.

### **3. Water Demand Projection based on the Latest Census in 1999**

#### **3.1 Population in 2005**

The request of the Government of Kenya has been based on the feasibility study, which recommended implementing the Phase-1 of the Meru water supply project with the target year of 2005. Therefore, the water demand in 2005 is reviewed in this Study, based on the latest census data and information in 1999.

Projection has been made on the basis of the population census data for the sub-locations in 1989 and 1999. According to these population census data, the annual mean growth rate is ranging from 1.6 % in the rural area and 2 to 5 % in the peri-urban and urban areas. Especially, the locations of Igoki and Mulathankari has higher growth rate than that in the Municipality. Comparing these growth rate with that during the previous decade before 1989, increase of population with a high rate of 3 %, which was applied in the feasibility study, has been declined between 1989 and 1999 due to the effort of the Government of Kenya for education on family planning.

Under these situation, population projection is made on the basis of the lower growth rate of each sub-location in the Study Area, assuming that population in the Study Area will increase at these rates for five years towards 2005.

Result of projection is given in Table 1.

#### **3.2 Schools, Commercial and Industrial Establishments, and Health Facilities**

Baseline figures for numbers of pupils, institutional staff and commercial and industrial establishments, were collected from the District Education Office, District Trade Office, and District Medical Office.

##### **a) Schools**

The numbers of schools, and pupils and students in the Study area is available in the division basis, and show the figures of 108 and 36,638 in 1999, respectively.

Description	Miriga Mieru East	Abothuguchi West	Miriga Mieru West	Total
1) No. of Schools	30	52	26	108
2) Pupils and Students	10,212	17,209	9,217	36,638

Source : District Education Office

Note : Figures are those in the Study Area

These figures in the sub-location in 1999 are estimated by multiplying the rate of total population in the division to the sub-location with the above-mentioned figures.

##### **b) Commercial and Industrial Establishments**

The District Trade Office provides an inventory containing only name, address and type of commercial and industrial establishments in the related administrative divisions, without number

of workers, production amount, water consumption, and so on. Table 2 shows the type and numbers of commercial and industrial establishments in the related administration divisions.

Based on this Table, the following figures are estimated in the Study Area, in order to apply the design manual of the MENR issued in 1986:

Descriptions	Municipality	Miriga Mieru West	Miriga Mieru East	Abotchuguchi West
No. of Beds in Hotel				
•High class (40 beds)	200	0	0	0
•Medium class (20 beds)	180	0	11	0
•Low class (10 beds)	100	0	0	0
Bars	71	8	2	7
Shops	661	65	31	70
Total Area of Industrial Factories (ha)	16	2	0	2

Source : JICA Study Team

Projection of these figures for hotels, bars, shops and area of industrial factories in 2005 are made on the basis of the population growth rate, since there is no scenario and target in District Trade Office towards 2005 and current economic growth rate of Kenya is similar with the population growth rate.

#### c) Health Facilities

The following table indicates numbers of health facilities, beds, out-patients and staff in the Study Area as of 1999:

Description	Miriga Mieru East	Abotchuguchi West	Miriga Mieru West	Total
No. of Health Facilities	1	0	12	13
No. of Beds	0	0	404	404
No. of Out-patient per day	33	0	1,195	1,228
No. of Staff	6	0	611	617

Source : District Medical Office

As indicated in the Table, most of facilities such as district hospitals, clinics and dispensaries are concentrating into Municipality in the Division of Miriga Mieru West.

#### d) Others

There are no statistical data on numbers of employment of other public organizations. The feasibility study estimated numbers of employment at 1000 persons in 1997, and this estimate also applied for the Study.

### 3.3 Livestock

Existing livestock ownership levels have been estimated using the results of the livestock census conducted in Meru Central District during 1997. Livestock units per 1000 population are as follows:

Livestock	Miriga Mieru East	Miriga Mieru West	Abothuguchi West
Total of Livestock Units	22,261	5,143	9,938
Population in 1999	57,073	68,205	59,829
Number of Livestock per 1000 population in 1999	406	78	173

Source : District Agricultural Office

### 3.4 Unit Water Consumption

The per capita consumption rates recommended in the 1986 MOWD Design Manual were reviewed by the consumer survey undertaken by the feasibility study, and considered that it is reasonable for metered connections. In this study, the design manual consumption rates are applied for design as follows:

Category		unit	Consumption	
Domestic water	Rural	Individual connection	1/c/d	60
		Water kiosk	1/c/d	20
	Urban	High class housing	1/c/d	250
		Medium class housing	1/c/d	150
		Low class housing	1/c/d	75
	Water kiosk	1/c/d	20	
Institutions	Schools	Boarding	1/c/d	50
		Day school	1/c/d	5
	Administration staff		1/c/d	25
Health facilities	Hospitals	District	1/bed/d	200
		Other	1/bed/d	100
		Out patients	1/patient/d	20
	Dispensary/ Health centre		m <sup>3</sup> /day	5
Commercial use	Hotels	High class	1/bed/d	600
		Medium class	1/bed/d	300
		Low class	1/bed/d	50
	Bars		1/day	500
	Shops		1/day	100
Industrial factory			m <sup>3</sup> /ha/d	20
Livestock			1/c/d	50

Source: MOWD Design Manual, 1986

### 3.5 Distribution Rate of Population to Urban and Rural Areas

The spatial distribution of the population is estimated on the basis of different household categories was taken from the WRAP report and applied for the feasibility study as follows:

Location	Classification of House in Urban Area (%)			Rural Area Ratio (%)
	High	Medium	Low	
1) Mulathankari	2	7	6	77
2) Chugu	0	0	0	100
3) Katheri Central	0	0	0	100
4) Katheri East	0	0	0	100
5) Katheri West	0	0	0	100
6) Nthimbiri	0	0	0	100
7) Ntakira	0	0	0	100
8) Igoki	0	0	0	100
9) Municipality	10	30	60	0
10) Ntima	10	30	60	0

Note: Classification of urban houses is based on the F/S and WRAP studies.

### 3.6 Type of Connection based on the Survey for Community Water Schemes

Survey on community water schemes, undertaken by this Study, reveals that the community needs clean and drinkable tap water with stable and reliable supply for maintaining their health conditions. Also, the result of survey identified that most of communities require individual connection to their houses similar to the current water use condition, and that it is preferable for several percent of communities to provide water kiosk, as follows:

Type of Connection

Location	Type of Connection for Proposed System (%)		
	Individual	Water kiosk	No Requirement
1) Mulathankari	100	0	0
2) Chugu	90	10	0
3) Katheri Central	99	1	0
4) Katheri East	87	13	0
5) Katheri West	99	1	0
6) Nthimbiri	93	7	0
7) Ntakira	86	14	0
8) Igoki	91	9	0
9) Municipality	96	4	0
10) Ntima	96	4	0

Source: Community survey result of JICA Study Team

### 3.7 Service Level

The design manual stated the service level for different household categories as follows:

Categories		Initial	Intermediate	Design Horizon
Rural	High	20 %	40 %	80 %
	Medium	10 %	20 %	40 %
	Low	5 %	10 %	20 %
Urban	High	100 %	100 %	100 %
	Medium	100 %	100 %	100 %
	Low	10 %	30 %	50 %

Source: MOWD Design Manual, 1986

The master plan and feasibility study for Meru water supply set up the target of service level at 60 % in rural area, 100 % in high and medium class houses in urban area and 40 % in low class houses in urban area in the year of 2005. It is recognized through the survey on community schemes that the same target level is necessary to be applied for the Study, taking into account desire of communities for clean and stable water.

Service level for other water use are set up at; 1) 100 % for schools, commercial and industrial customers, and 2) 100 % for health facilities, and 3) 15 % for breeding livestock.

Regarding water use for livestock in the rural areas, it is considered that the communities have own water supply system and that they will use it for water supply to livestock. However, the Kathita River has deep gorges in the study area, which does not allow to access to the river channel at part of the river course, and the tributaries of the Kathita River sometimes are dried up during the dry season. Therefore, 15 % of water demand is included into the water demand in the rural areas, where the community water schemes are developed.

### 3.8 Water Demand in 2005

Based on the mentioned design parameters, the water demands in 2005 are estimated as shown in Table 3, and summarized as follows:

Categories	Net Water Demand (m <sup>3</sup> /day)		
	1999	2005	2005 (F/S)
Domestic	4,670	6,920	7,260
Livestock	110	130	101
Industry	400	450	2,377
Institutions	280	320	324
Health	170	190	116
Commercial	310	350	259
Total	5,940	8,360	10,437

Source: JICA Study Team

Note : Water demands above include those in sub-locations outside of the Study Area, where the existing system covers.

Comparing the water demands estimated by the feasibility study, about 2,000 m<sup>3</sup>/day is decreased in this projection. This is caused by lower population growth than feasibility study and failure of industrialization in Meru Town, expected in the feasibility study.

The District Development Plan 1997-2001 expected that Meru Central District has a potential for development of agro-industries such as food processing, milling and so on, by provision of sufficient infrastructures including road network and water supplies. However, there have been many kinds of constraints during the period and industrialization results in failure for the time being. Taking into account the current economic situation, the estimated industrial water demands are judged to be applicable for planning of the water supply system.

## 4. Assumptions and Conditions for Water Supply Plan

### 4.1 Water Supply Areas and Zones

The water demand projection discussed in the section 2.2 covers both existing distribution zones and other zones in the Study Area. The existing water supply facilities are to be rehabilitation by the El Nino rehabilitation project. The capacity of the Milimani water treatment plant will be expanded to 5,000 m<sup>3</sup>/day after the completion of the El Nino rehabilitation project. Taking this treatment capacity into consideration, distribution zones in the Study Area are demarcated.

In the present distribution zones by the existing water supply facilities, the high level zones are not supplied by the Milimani water treatment plant located at lower elevation. The high level zones rely on the Gatabora Spring but are suffering from rationing due to the shortage of supply capacity.

The El Nino rehabilitation project intends to install pumping equipment in the Milimani water treatment plant. This installation envisages that supplemental water is to be sent to the high level zones by pumping as temporary solution for the water shortage. After commencement of the present Project, the high level zones will be supplied by the proposed facilities. The pumping equipment in the Milimani water treatment plant will be utilized to supply



back-washing water for the rapid sand filters.

The basic concept of the water transmission and distribution plan at the feasibility study is not changed with the implementation of the El Nino rehabilitation project. Water transmission and distribution will be performed by gravity throughout the Study Area. According to this concept, distribution zones in the Study Area are demarcated as follows (see Figure 1):

- **Distribution Zones by Existing System:**

Present distribution zones and neighboring zones to the east and south where expansion of distribution network is possible by gravity. Also, the new system will provide treated water for high level zones in order to reduce operation and maintenance costs for pumping-up of treated water from Milimani treatment works to High Level Tank.

- **Distribution Zone by Proposed System:**

Remaining zones in the Study Area. Supplemental water will be provided for the high level zones.

## **4.2 Intake and Raw Water Main Alternatives**

The feasibility study in 1997 proposed the new intake site from the following viewpoints:

- (1) Water conveyance, transmission and distribution are entirely performed by gravity.
- (2) For simple treatment process, water is abstracted in the Mt. Kenya Forest to maintain good quality of raw water to the future.
- (3) The intake site is accessible by existing road.

In addition to the above, the intake site is reviewed the following viewpoints in this Study:

- (1) Difficulty and scale of construction works for raw water main.
- (2) Environmental impacts in the Mt. Kenya Forest.
- (3) Affects to the existing water users by new abstraction.

Taking the viewpoints into consideration, the site investigation along the Kathita river is carried out. Through the site investigation, the following three alternatives are identified. These alternative sites are set up taking into account; 1) water quality of the Kathita River in the forest area, 2) possibility of application of gravity supply in the Study Area, 3) less land acquisition of private lands, 4) less construction cost, especially for raw water main, 5) environmental aspect due to the implementation of the Project.

- (1) **Alternative-1** : The same as the proposed plan by the feasibility study.
- (2) **Alternative-2** : The intake site is located at downstream of a waterfall where the Kathita river joins the Luguso river. The riverbed elevation at this site is about EL. 2,225 m. It is therefore necessary to move the site of water treatment plant to lower location to convey raw water by gravity.
- (3) **Alternative-3** : The intake site is located at 1 km downstream from the alternative-2. The riverbed elevation is about EL. 2,210 m. This is the most downstream

site to allow the water treatment plant sited within the government land.

Intake site, route of raw water main and water treatment plant site for each alternative is shown in Figure 2. Comparison of the alternatives is shown as follows

Descriptions	Alternative 1	Alternative 2	Alternative 3
1. Features			
a) Intake elevation	2,460 m	2,225 m	2,210 m
b) Inlet elevation of treatment plant	2,240 m	2,150 m	2,150 m
c) Hydraulic head	220 m	75 m	60 m
d) Length of raw water main	6 km	4 km	3 km
2. Necessity of construction of new access road along the raw water main	3 km	-	-
3. Condition of the slope for pipeline construction	Very steep slope with 3 km length	Steep slope with 1.5 km length	Steep slope with 1 km length, but better than alternative 2
4. Water resources			
a) Catchment area	122 km <sup>2</sup>	178 km <sup>2</sup>	179 km <sup>2</sup>
b) Water resources	46,200 m <sup>3</sup> /day	62,700 m <sup>3</sup> /day	63,100 m <sup>3</sup> /day
c) Water amount taken in the forest area	100 m <sup>3</sup> /day	4,800 m <sup>3</sup> /day	5,100 m <sup>3</sup> /day
5. Water Quality	Good water quality and less opportunity in future water pollution	same as the alt. 1	same as the alt. 1
6. Environmental Impact			
a) Natural environment	<ul style="list-style-type: none"> <li>Felling of forest for construction of access road 3 km length</li> <li>Clearing of slopes may affect the nature there, but minor</li> </ul>	<ul style="list-style-type: none"> <li>Clearing of slopes may affect the nature there, but minor</li> </ul>	<ul style="list-style-type: none"> <li>Clearing of slopes may affect the nature there, but minor</li> </ul>
b) Social environment	<ul style="list-style-type: none"> <li>Less possibility for lack of water at the site</li> <li>Impact on the down-stream water balance is not large.</li> </ul>	same as the alt. 1	same as the alt. 1

This Table obviously indicates that the Alternative-3 has a large advantage on length of raw water main and less hardness for construction works of raw water main on the slope of the river channel, and that other issues are similar among the alternatives.

From the result of the mentioned comparison for the three sites, the Alternative-3 is selected for the proposed intake site.

The proposed raw water main is planned to be laid out on the partly steep slope of the river channel of the Kathita River, where the PVC pipelines for two community water supplies exist and pass through the proposed water treatment site.

Hydraulic head between the proposed intake site and water treatment plant is estimated at about 60 m based on the available topographic map and levelling survey carried out by the DWO and JICA Study Team. The length of the pipeline is worked out at 3 km and steel pipe is recommended to be utilised taking into account the importance of this pipeline.

There is a footpath with a width of 2 to 3 m on the top of the hill along the route of the proposed pipeline beside the Kathita River, which connects the intake weir with the treatment plant. This footpath is available for construction works of the pipeline.

### **4.3 Water Treatment Plant**

The location of the water treatment plant has been studied together with intake weir and raw water main in the alternative studies. As a result, the site for construction of water treatment plant is proposed to be in the forest area, where it is possible to apply the gravity water treatment method and distribution system to the supply area.

The land use at the proposed site is covered with 40 % of grassland, 30 % of low bush, and 30 % of trees. Therefore, it is considered that there is no impact on social environment, though the suggested land by the feasibility study is cultivated by the farmers.

It is possible that sedimentation and chlorination would make the water potable, since the Kathita River has sufficient water quality as a water source for water supply. However, cultivation activities are gradually expanded in the surrounding areas of the proposed intake site and it is considered that the turbidities of the river water would be worsened by these activities. Therefore, proper treatment has to be decided taking into account these issues.

### **4.4 Distribution Pipelines**

The feasibility study recommended to supply treated water priority areas in the Study Area under the assumption that both the public and community water supply systems are available for residents until 2005, after completion of the Project, the users for community water supply schemes are sifted to the public water supply system.

The survey on community water supply schemes in this Study identified that water users of the community system needed potable water with good quality and sufficient quantity from the public water supply system. Also, the feasibility study could not clarify provision of service pipes connecting with water users.

The distribution system was reviewed from the following points, taking into above-mentioned:

- (1) Pipeline plan, including route, diameter, location and storage volume of distribution tanks, required break pressure tanks, is preliminary reviewed based on the up-dated water demands in sub-locations.
- (2) Pipeline facilities in the feasibility study are designed on the basis of topographic maps with a scale of 1 to 50,000 prepared in 1976. The road network and conditions are investigated in detail to update road and housing information along the existing roads.
- (3) Site for storage tanks required has been identified at the existing school ground to reduce the land acquisition of private land.
- (4) The survey on the community water schemes indicates that they are able to pay about Ksh 6,000 for initial connection fee, corresponding to length of PVC pipe of 500 m. Therefore, the supply grid with 1 km is judged to be applicable.

- (5) Based on the population distribution and topography in the Study Area, the supply area is divided into the four areas; 1) existing supply area of Meru system; 2) populated area surrounding Meru Town; 3) northern rural area of the Kathita River; and 4) southern rural area of Kathita River.

## 5. Water Supply Plan

- Intake weir : Intake discharge of 6,700 m<sup>3</sup>/day, to be constructed at 6 km upstream from Kathiranga Village
- Raw water main : Total length of 3 km with a diameter of 350 mm
- Treatment works : Treatment capacity of 6,700 m<sup>3</sup>/day
- Transmission and distribution : Steel pipeline of 10 km with a diameter of 200 to 250 mm, uPVC pipeline of 130 km with a diameter of 50 to 225 mm, total storage volume of distribution tanks of 5,350 m<sup>3</sup>, and break pressure tanks at 72 locations.

The proposed general layout plan of the water supply facilities is shown in Figure 2.

### (1) Intake

The river width at the proposed site is about 10 m and there exists an intake of the community water scheme. Boulders and rock riverbed are found out at the riverbed with a gradient of about 1 to 50 and elevation of about 2,210 m. The river channel with steep slopes forms V-shaped gorge with a height of 40 m to 50 m.

The feasibility study proposed the common fixed weir type of intake. Similar type of weir with intake structures will be designed based on the topographic map to be prepared in the basic design stage.

### (2) Raw Water Main

The proposed raw water main is located at 2.6 km downstream along the river channel from the intake site. Pipeline route runs along the existing footpath provided between intake and treatment plant sites. This footpath is crossing two small streams. The altitude of intake and treatment works is 2,210 m and 2,150 m, respectively.

Taking into account importance of the raw water main, steel pipe with proper strength is applied for this part.

### (3) Water Treatment Plant

The proposed water treatment plant of 6,700 m<sup>3</sup>/day in production capacity will be constructed. The area, which is about 2 km east of the proposed intake site on the Kathita river, is presently governmental properties, and its elevation approximately ranges from 2,140 m to 2,160 m. The area has a gentle slope from west to east. Raw water from the proposed intake comes to the plant by gravity.

Quality of the raw water is revealed suitable for the water supply, so that the raw water is treated at this plant simply by plain sedimentation and chlorination. Major facilities to be constructed

at the plant will be as follows:

• Inlet Chamber	RC made	1 unit
• Sedimentation Tank	RC made	4 units
• Clear Water Storage	RC made	2 units
• Chlorination Building	Masonry made	1 unit
• Administration Building	Masonry made	1 unit
• Staff Residence	Masonry made	2 units

Area required for the treatment plant will be  $50 \text{ m} \times 140 \text{ m}$ , or  $7000 \text{ m}^2$ , including the area for future expansion of the additional facilities. Layout of the facilities of the plant is shown on Figure 3. Future potential facilities to be considered are; 1) flocculation basin, 2) rapid sand filters, 3) sludge concentrators, 4) sludge drying beds, 5) pumping facilities, 6) elevated tank for backwashing, 7) chemical building, and their appurtenances. These facilities are not required for the time being, however, enough future space for construction of such facilities are taken into account inside the premises. Such facilities should be added in case deterioration of the raw water quality occurs in the future.

The treated water of the plant will also be supplied to the existing High Level Tanks and the backwashing tank of the Milimani Water Treatment Plant for auxiliary or emergency purposes.

#### (4) Water Transmission and Distribution

##### a. Pipe materials

The steel pipes are proposed for all along the northern pipeline route of treated water transmission main, some part of the southern pipeline route of treated water transmission main, part of inlet or outlet of storage tanks or break pressure tanks, and some sections such as road and river crossings.

Un-plasticised polyvinyl chloride (uPVC) pipes which comply with Kenyan Standard, KS 06-149, 1981, are proposed for the transmission and distribution mains

##### b. Treated water transmission main

The transmission mains are comprised of the northern and southern routes. The transmission main on northern route consists of steel pipe for reason that this pipe is so important to supply Meru urban area, and there are many river crossings, up and down. The part of transmission main on southern route is constructed by steel pipe since there will be constructed long length water pipe bridge.

The main features of transmission mains are tabulated in Table 4.

##### c. Water distribution main

Based on the result of survey on community water supply schemes, the main pipes are planned to be provided by the distance of 500 m from individual connections. Diameters of pipes are 25 mm in minimum and 200 mm in maximum, taking into account magnitude of water demands and road and topographic conditions.

The uPVC pipes are basically used for distribution mains, but steel pipes are applied for pipe bridge, river crossing sites, and so on.

The main features of distribution mains are tabulated in Table 4.

#### (5) Implementation Scenario

The first priority for implementation of the Project is given to improvement of the existing water supply facilities and strengthening of the new management body. Following to this first priority project, expansion of water supply areas to other areas together with provision of new water supply facilities such as an intake, raw water mains, treatment plant, transmission and distribution mains.

##### 1) First Stage: Improvement of Existing Water Supply Facilities

Following to El-Nino Rehabilitation Project, the proposed improvement works are planned to be implemented under the Grant Aid. Water supply area of the Project comprises existing supply area of 26 km<sup>2</sup> and expansion areas of 5 km<sup>2</sup>.

The Project aims to provide treated water distribution network and improve treated water quality in the proposed supply area.

##### 2) Second Stage: Expansion to Densely Populated Area Surrounding Meru Town

When the First Stage is successfully completed, the planned water demands reach the treatment capacity of the Milimani waterworks. Therefore, to cope with incremental demands, the water supply area needs the additional treatment facilities, but there is no space in Milimani waterworks for construction of additional treatment facilities, even in Meru Town.

While, there is no public water supply system with good quality and sufficient water quantity in the densely populated areas surrounding Meru Town. As a Second Stage, it is proposed to execute construction of a new system consisting of an intake, north raw water main, treatment plant, and transmission and distribution mains, in order to supply water to the mentioned area including Meru Town, especially to High Level Zone for reducing operation cost of pumps and fulfill water demands there, and to this populated area of 13 km<sup>2</sup>.

The northern rural area with area of 18 km<sup>2</sup> may have higher priority than that of the southern area, since the transmission main to the above-mentioned areas is laid out through edge of forest area and it is possible to develop gravity distribution system from this transmission line. However, it is required for the new management body to educate residents for shifting them to customers in this area.

Development of distribution network needs the implementation after the northern rural area with the area of 30 km<sup>2</sup>.

The implementation of the second stages requires further review of this study, focusing on design horizon and water demands as well as scale of facilities.

Table 1 Result of Population Projection

No.	Sub-location	Location	Annual Growth Rate (%)	Population		Total (Location)	
				1999	2005	1999	2005
1	Kaaga	Mulathankari	2.3%	3,546	4,075	8,144	9,359
2	Mukua			2,273	2,612		
3	Njoka			2,325	2,672		
4	Kiri mene	Munithu	1.6%	3,281	3,770	9,444	10,852
5	Gankere			2,630	3,022		
6	Kambiti			3,533	4,060		
7	Kithoka	Chugu	2.1%	5,587	6,420	12,759	14,661
8	Chungari			4,019	4,618		
9	Runogone			3,153	3,623		
10	Nkiriri North	Katheri Central	1.6%	1,676	1,926	16,530	18,996
11	Nkiriri South			3,205	3,683		
12	Kathita			1,788	2,055		
13	Mwirangombe			937	1,077		
14	Kinjo South	Katheri East	1.6%	890	1,023	4,624	5,314
15	Kinjo North			922	1,059		
16	Kirima Kiathi			1,587	1,824		
17	Kianthumbi			1,225	1,408		
18	Kathiranga North	Katheri West	1.6%	1,257	1,444	4,300	4,941
19	Kathiranga East			1,006	1,156		
20	Kathiranga Central			996	1,145		
21	Kathiranga West			1,041	1,196		
22	Nthimbiri	Nthimbiri	2.0%	3,198	3,675	11,159	12,823
23	Mpuri			5,340	6,136		
24	Kainginyo			2,621	3,012		
25	Ngonyi	Ntakira	2.2%	3,632	4,174	17,432	20,031
26	Gitugu			1,760	2,022		
27	Nchaure			3,140	3,608		
28	Kirugua			3,174	3,647		
29	Magundu			5,726	6,580		
30	Lower Igoki	Igoki	4.8%	2,010	2,310	14,442	16,595
31	Gachanka			4,059	4,664		
32	Muringa-Ombugi			4,059	4,664		
33	Kanyuango			4,314	4,957		
34	Township	Municipality	2.1%	4,314	4,957	22,887	26,300
35	Gakoromone			8,865	10,187		
36	Kaaga			9,708	11,156		
37	Tuntu	Ntima	2.1%	1,085	1,247	9,153	10,518
38	Upper Igoki			8,068	9,271		
Total			2.2%	121,950	142,140		

Table 2 Numbers of Commercial and Industrial Connections

	Descriptions	Municipality	Miriga Mieru West, excluding Municipality	Miriga Mieru East	Abotchuguchi West
1.	Boarding/Lodging/Hotel	24		1	
2.	Caterers (Bars)	71	8	4	26
3.	Barber	7	1		2
4.	Bicycle repair	1			1
5.	Book shop	10			
6.	Boutique	51			
7.	Butchery	22	1	4	14
8.	Charcoal distributor	1			
9.	Chemist	6			1
10.	Cosmetic shop/Pharmacy	2			
11.	Driving school	2			
12.	Dry cleaner/Laundry	5			1
13.	Electrical/Electronics shop/repair	20			
14.	Farm Input	1	1		5
15.	Furniture	3			2
16.	Hand craft	1			
17.	Hardware	8			
18.	Heberlist	3		2	
19.	Knitting	4			
20.	Music store	2			
21.	Photographic/Photocopy	5			1
22.	Produce store	20	1	4	15
23.	Wholesales/Retail	331	58	47	183
24.	Saloon	46			3
25.	Shoe dealer	7			1
26.	Spare parts	7			
27.	Stationanery shop	5			
28.	Supermarket	6			
29.	Tailoring/Clothing	72	2	1	21
30.	Transportation (incl. garage)	8			2
31.	Video library/shop	4	1	1	1
32.	Wines and spirits	1			
	Total (Commercial)	756	73	64	279
33.	Agro-chemicals	3			
34.	Animal feeding	1			1
35.	Blacksmith	3			
36.	Carpentry	7	1		9
37.	Contractor	1			
38.	Duplicating	4			1
39.	Engineering appliances	1			
40.	Hides and skins	2			
41.	Machines repair	2			
42.	Manufacturers (large scale factories)	9	1		4
43.	Metal work/Steel work	4			3
44.	Po sho milling	4	2	3	16
45.	Motor vehicle repair/Workshop	26	1		
46.	Petrol Station	8		1	4
47.	Printing	3			2
48.	Pump (kerosin or paraffin)	5			
49.	Timberyard/sales	2			
50.	Tyres	8			
51.	Welding	7			2
52.	Bakery	1			
	Total (Industry)	101	5	4	42
	Total Area of Factories	16.00	2.00	0.09	6.60



Table 3 Result of Water Demands Projection

Sub-locations		Water Demands in 1999 (m3/day)						Water Demands in 2005 (m3/day)							
		Domestic	Livestock	Industry	Institutional	Health	Commercial	Total	Domestic	Livestock	Industry	Institutional	Health	Commercial	Total
1	Kaaga	57	11	0	4	0	0	72	119	12	0	4	0	1	136
2	Mukua	36	7	0	2	0	0	45	75	8	0	2	0	0	85
3	Njoka	37	7	0	2	0	0	46	77	8	0	2	0	0	87
4	Kiri mene	0	0	0	0	0	0	0	166	0	0	0	0	0	166
5	Gankere	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Kambiti	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	Kithoka	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8	Chungari	147	12	0	4	0	0	163	199	14	0	4	0	0	217
9	Runogone	50	10	0	2	0	0	62	94	11	0	3	0	0	108
10	Nkiriri North	63	2	4	9	0	2	80	80	3	4	10	0	2	99
11	Nkiriri South	115	4	8	17	0	2	146	162	5	9	19	0	3	198
12	Kathita	64	2	4	9	0	2	81	90	3	5	10	0	2	110
13	Mwirangombe	34	1	2	5	0	0	42	48	1	2	6	0	0	57
14	Kinjo South	37	1	2	4	0	0	44	36	1	2	5	0	0	44
15	Kinjo North	34	1	2	5	0	0	42	44	1	2	6	0	0	53
16	Kirima Kiathi	57	2	4	8	0	2	73	80	2	4	9	0	2	97
17	Kianthubi	48	2	3	6	0	2	61	63	2	3	7	0	2	77
18	Kathiranga North	45	2	3	7	0	2	59	64	2	3	7	0	2	78
19	Kathiranga East	36	1	2	6	0	0	45	51	2	3	6	0	0	62
20	Kathiranga Central	36	1	2	5	0	0	44	51	2	3	6	0	0	62
21	Kathiranga West	37	1	3	6	0	0	47	53	2	3	6	0	0	64
22	Nthimbiri	116	2	3	8	0	1	130	159	2	3	8	0	2	174
23	Mpuri	203	3	4	13	0	2	225	249	4	5	13	0	2	273
24	Kainginyo	19	0	0	1	0	0	21	103	0	0	1	0	0	105
25	Ngonyi	138	2	3	9	0	2	154	169	2	3	10	0	2	186
26	Gitugu	6	0	0	0	0	0	7	18	0	0	1	0	0	19
27	Nchaure	118	2	3	8	0	1	131	138	2	3	9	0	2	153
28	Kirugua	123	2	3	8	0	1	137	142	2	3	9	0	2	158
29	Magundu	227	3	5	13	0	2	250	250	4	5	15	0	2	276
30	Lower Igoki	73	1	2	5	0	0	81	102	1	2	6	0	0	111
31	Gachanka	153	2	3	10	21	2	191	190	3	4	13	24	2	236
32	Muringa-Ombugi	148	2	1	4	0	0	155	77	3	2	5	0	0	87
33	Kanyuango (Nkabune)	31	3	2	2	18	0	56	150	3	3	4	22	1	183
34	Township	312	3	60	36	6	54	471	435	3	69	40	6	61	614
35	Gakoromone	661	5	124	21	5	109	925	970	6	141	24	5	123	1,269
36	Kaaga	724	6	136	23	23	119	1,031	1,062	7	154	27	24	135	1,409
37	Tuntu	81	1	1	2	1	0	86	117	1	1	3	1	0	123
38	Upper Igoki	601	5	7	19	99	2	733	874	5	8	22	110	2	1,021
Total		4,667	109	396	283	171	307	5,935	6,757	127	449	321	192	350	8,197

Table 4 Main Feature of Pipelines

Diameter (mm)	Pipe Material	Length of Pipeline (m)																	Total (m)			
		Raw Water Main	Transmission Mains		Water Supply Areas																	
					Northern Rural Area			Meru Town and Surrounding Area					Southern Rural Area									
			North	South	1	2	3	Existing	4	5	6	7	8	9	10	11	12	13		14		
50	uPVC				3,100				1,500						7,600		2,350		4,200		4,050	22,800
63	uPVC				4,350	3,600	7,500	200							2,400		2,200	4,700	3,250	2,350	900	31,450
75	uPVC				1,600				7,600			4,950								1,800		15,950
90	uPVC				500	3,850	1,750	2,600	2,300			1,150	5,400	1,500	850		1,650	3,250				24,800
110	uPVC						1,100	11,150	3,250			1,400		3,050					950			20,900
140	uPVC							4,300	2,250	6,200		800	1,400									14,950
160	uPVC							1,700	1,150	1,150	3,700											7,700
200	uPVC							3,250	4,700		1,200											9,150
225	uPVC							300														300
90	Steel Pipe			200																		200
110	Steel Pipe		400	200																		600
140	Steel Pipe			3,200																		3,200
160	Steel Pipe																					0
200	Steel Pipe			3,650																		3,650
225	Steel Pipe																					0
250	Steel Pipe			2,250																		2,250
300	Steel Pipe		8,000																			8,000
400	Steel Pipe	3,000																				3,000
Length		3,000	8,400	9,500	9,550	7,450	10,350	32,600	13,650	7,350	9,850	3,350	16,800	4,550	5,400	4,700	9,100	8,350	4,950			168,900
Break Pressure Tank		0	2	3	6	2	4	24	6	2	6	0	9	3	3	4	6	5	3			88
Total	Length	3,000	8,400	9,500	27,350			66,800					53,850						168,900			
	Nos of BPT	0	2	3	12			38					33						88			

A4-17

A4-18

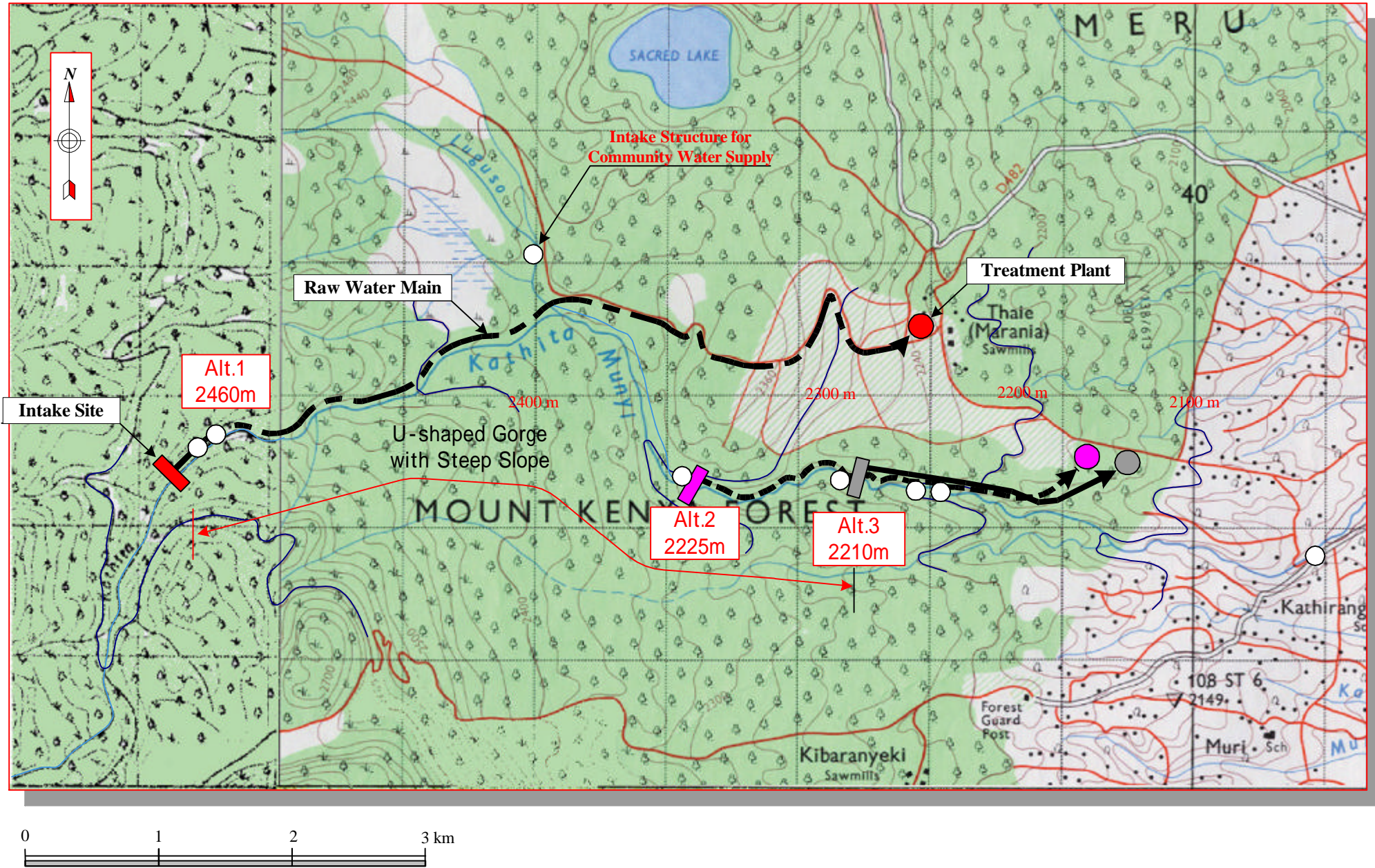


Figure 1 Alternatives on Intake and Route of Raw Water Mains

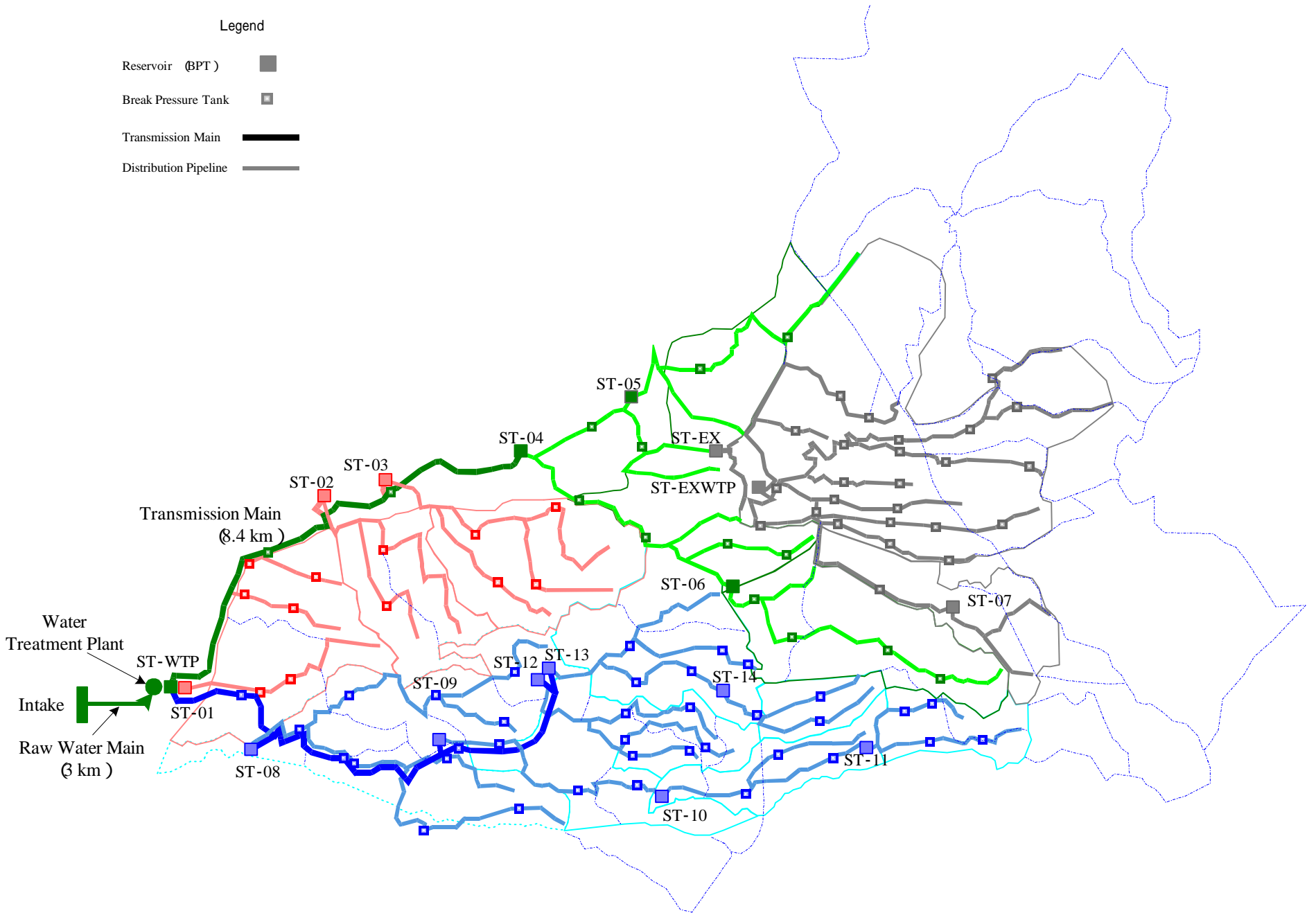


Figure 2 General Layout Plan of Water Supply Facilities

*Attachment-5*  
*Study on New Management Body*

## **Study on New Management Body**

### **1. Staff Structuring of New Organization**

Judging from the staff information, if the new managing body takes over the Meru urban water supply operation, it seems quite possible to recruit most of the staff from the current Meru Central DWO. However top management staff who are qualified and experienced may have to be found outside.

There is no accepted standard as to the number of staff for a water supply organization of particular served area and population. The appropriate number of staff should be determined, not by simply following the present status but by considering the situation after completion of El Nino Project and rehabilitation by this Project. Applying the same assumptions used in financial planning (Chapter 2), and taking into account the production capacity, capacity utilization, and water demand in 2005, the proposed number of staff in 2005 is estimated to be 56. The organizational and staff structure is shown in Figure 1.

Out of the 56, staff like security guard and cleaner can be contracted out easily. The new managing body is supposed to take over the Meru water supply operation in the latter half of 2001. The staff of Meru Central DWO as of October 2000 numbers 161. The 56 new staff will be selected from them, probable except top management staff. In Table 1 a referential salary structure of those 56 staff is presented. Some of them may be not yet assigned proper job in 2001 because the full-scale operation is scheduled in 2005. They will either have necessary training or assist other section's job so that idling can be minimized.

The new managing body is steered by the core management team composed of General Manager, Technical Manager, and Commercial Manager. General Manager is charged with reporting to the Board of Trustees or Board of Directors for overall planning, control, operations and maintenance of the operation. Technical Manager is responsible for all technical aspects of water production such as O&M, UFW levels and targets, block-mapping, connections, and disconnections. Commercial Manager is responsible for commercial and financial aspects such as meter reading, billing, revenue collection, and financial planning, customer relations. Administrative Section is directly under General Manager's responsibility. Functions of each section under each member of the core management team are summarized in Table 2.

Those sections are defined to cover the smallest number of dissimilar functions into which Meru urban water supply operation may be divided. However, depending on the actual situation such as size of section and availability of staff, some sections may be combined or derivative functional units may be established.

### **2. Financial Planning**

#### **2.1 Present Status**

Precise financial data collection and disclosure are not performed at Meru Central DWO. For example, only financial data available in the Annual Report 1999 is billing and collection amount during the year. Financial data should be organized and utilized as part of Management

Information System (MIS), which entails assistance of computer. Although the Meru Central DWO is equipped with only one computer, its maximum use is required to improve the financial data management.

Financial situations of a water supply undertaking are generally judged on the basis of various indicators of profitability, liquidity and productivity. In the case of the Meru Central DWO however, the operational costs do not necessarily reflect the real costs. Instead they are dependent on receipts of Appropriation in Aid (AIA), which is the subsidy from MENR. Therefore it is not really meaningful to analyze indicators based on operational costs. The book values of fixed assets are uncertain, thus "return on assets" type indicator is not available either. That unavailability of essential information limited financial analysis to time-series comparison of certain indicators. If data of other water supply undertakings in Kenya are available as shown in Table 3, the comparisons by city were performed.

#### (1) Composition of Operational Costs

The costs of water supplies incurred at the Meru Central DWO are shown in Table 4. As regards the Meru Urban Water Supply, the amount and the composition vary year by year. Although as previously said, the operational costs do not necessarily reflect the real costs, it is possible to grasp the general tendency. The total annual amount is approximately Ksh 7 million. The personnel cost accounts for about 70 percent and the rest are material, chemical, electricity, and fuel cost.

#### (2) Personnel Cost

The personnel cost is the biggest cost item in Meru Central DWO, accounting for more than 70 percent of all operational costs. The number of staff in Meru Central DWO is about 160 as of September 2000, which becomes 19 if converted into the number of staff per 1000 connections. This 19 is not so bad when compared with most of other cities. However there is still much room for improvement, if compared with Nairobi, whose figure is 12 or with the future target of the Nyeri Water and Sewerage Company, which has about 15 staff per 1000 connections, or with an international rule of thumb by which less than 10 is considered desirable.

The current salary levels at Meru Central DWO are shown in Table 5. Those levels are subject to standard emolument base of government employees. On the average basis, the staff of the Meru Central DWO receives Ksh 8,026 per month, which is roughly 30 percent less than that of the Nyeri Water and Sewerage Company (Table 6).

#### (3) Collection Efficiency

Table 7 shows the revenue and collection data. The collection efficiencies of the Meru urban water supply system was as low as 59 percent in 1999, and a little recovery is expected in 2000. Although Nairobi city has an even lower rate of 39 percent, the rate of Meru urban water supply system, around 60 percent is considered low enough. As a result of such a low collection efficiency, the arrears have been accumulated and becomes astronomically high. At the end of September 2000, arrears exceed Ksh 41 million, which amounts to four years' billing revenue and 7 years' collection revenue of the year 1999. Although it is difficult to obtain precise defaulters information under the current accounting data management system, some of delinquent defaulters are listed in Table 8. Meru Municipal Council is the biggest defaulter by

far. Other big defaulters are also governmental or public institutions. Those defaulters are often reminded by MENR to clear the arrears, however, the payments are only made sporadically, and as a result, the arrears keep rising.

## **2.2 Financial Projection**

Financial projection through the year 2005 is made assuming that the Project is implemented and the new managing body takes over the Meru urban water supply operation. Needless to say, the biggest assumption is that the Government of Japan injects capital grants to the Project so as for the facilities to be rehabilitated. In addition, the soft component grants will be allocated to strengthen the management capacity of the new managing body. The soft component grant will cover for example, training costs, and sensitization of new customers.

Financial projection is in other words, financial planning. Estimated income statements (Table 9) starts from confirmation of current situation of 1999 and 2000. The year 2000 and onwards are mostly target figures. Estimated statements of cash flow (Table 10) shows the cash movement related to the Project on the assumption that the new managing body takes over operation from the latter half of 2001. Those assumptions, forecasts, and rationales are presented in Tables 11 and 12.

Table 13 is a summary of financial planning, in which principal items are selected. The facility capacity and the capacity utilization are based on demand forecast and achievable leakage rate. The production capacity will increase due to rehabilitated facility by the Project. On the other hand however, replaced pipeline network can reduce leakage, therefore the water distributable to customers increase. As the result, in order to prevent excess supply, the treatment facility should be operated considerably below the capacity from 2001 to 2004.

Financial viability of the Project can be judged by analyzing the cash flow. If the Meru urban water supply will be operated as scheduled, the operating cash flows in 2002 and 2003 are negative, which entail borrowings of operating capital. However the operating cash flow gets into the black in 2004 and the operating capital borrowings can be repaid in 2005. To sum up, the Project seems financially viable.

## **3. Water Tariff**

### **3.1 Present Water Tariff**

The current water tariff consists of 2 per-purpose systems, namely general-purpose and boarding school-purpose. The general-purpose system has a 6-step progressive structure with minimum charge requirement, thus it is imperfectly volumetric. The boarding school purpose system is a 3-step progressive with no minimum charge requirement, which means the perfect volumetric system. There exists cross subsidy between those two types of customers. General users pay higher bill than boarding school users. At 20 m<sup>3</sup>/month consumption, the former pay 1.125 times the bill of the latter, 1.8 times at 100 m<sup>3</sup>/month and 4.05 times at 600 m<sup>3</sup>/month.

The current tariff became effective since December 1999 and the same tariff is applied to all urban water supply systems run by MENR. Compared with the previous tariff, the current tariff increased by 50 to 60



percent, reflecting the cost recovery policy. The monthly meter rent also increased from Ksh 5 to Ksh 50.

The volumetric tariff has become merely a name in Meru. Under the volumetric tariff system, each consumer is supposed to have a meter, and water rate are calculated by the volume of water consumed indicated by the meter. In Meru urban water supply however, as there are not many functional meters, the volumetric tariff is barely applied. In Meru urban water supply, the number of metered connection is 2,118 and accounts for 75 percent of the total 2,842 connections. However functional meters are 269, which accounts for 13 percent of metered connections. Even those functional meters are mostly more than 10 years old. The performance of old meters in general tends to deteriorate, and as a result for example, under-measurement may occur. As Meru Central DWO is not equipped with a meter test and repair facility, those functional but old meters are regarded as precise, and based on which the volumetric tariff is charged.

Those connections that are not installed meters or whose meters are not functional, are subject to flat rate or estimated rate computed on the historic usage basis. According to experiences, those flat or estimated rates tend to end up with lower billing than what should be really charged.

There is no established rationality why all users are classified either into general user or boarding school. Not to mention the cross-subsidy. Having only one category for all customers except boarding schools also lacks rationality. This oversimplified categorization neglects the fact that supply cost and degree of benefit vary depending on customers. Per-diameter tariff system is an alternative way of reflecting such factors. However its introduction has not been discussed in the past mainly because 1/2-inch meters are predominant. The 1/2 inch meters account for more than 98 percent of 2,118 total metered connections and the rest is over 3/4 inch meters.

### **3.2 Advice on New Tariff System**

If the new managing body takes over the Meru urban water supply, it is recommended that they establish a new water tariff system based on characteristics of served area. As a preparation it will be necessary to inventory existing customers on the per-use basis such as institution, commercial, industry, individual, apartment house, institution, and needy family. As a result of analysis on existing tariff system, the following points are found advisable in setting a new tariff system. However, their appropriateness should be further discussed during the preparation period.

- (1) Customer grouping should have more variation, at least three, which are individual, institution, and commerce/industry;
- (2) Basic rate portion should be created in the tariff system in order to cover a part of fixed costs such as meter installation and meter reading;
- (3) Bigger size meters may increase in future. The per-diameter tariff system could be applied to those who have bigger size meters;
- (4) Reduced tariff should be applied to joint connections in rural area or low-income area where new connections are to be promoted;

- (5) If the strict application of metered volumetric tariff would result in irrational rates for apartment houses and buildings with apartments and stores in town area, corrective tariff should be applied;
- (6) Instead of individual or joint connection, water kiosk may be preferred in certain area in poverty. Reduced tariff should be applied to such water kiosks. Also some technical assistance in O&M of kiosk should be provided.

## **4. Billing and Collection**

### **4.1 Present System**

The billing and collection flow is depicted in Figure 2. In fact, the current flow includes various steps that allow delays and oversights, which is far from efficient.

Meru urban water system is supposed to have 19 staff as meter readers. However many of them are actually plumbers. Some staff whose original job is inactive for example telephone operator, are also included as meter reader. The served area is divided into 9 zones, each of which is assigned 2 meter readers. These 2 meter readers patrol their territory in pairs. Other than line patrol, they are reading meters, locating illegal connections, reminding defaulters of payment. Meter readers from plumbers are also charged with new connection and disconnection. Although meter readings are carried out every month, the number of meters which are functional and readable is limited. Most of the customers are unmetered or their meters are not functional. In that case, flat rates or estimated rates are applied.

Bills are supposed to be issued monthly and delivered manually by meter readers. However delay in issuance is frequent and it is not unusual for the amount of bill to be accumulated for three months. Some customers, who have not been delivered their bills for a long period, even pre-emptively come to the District Water Office and ask the bill issuance.

Payment of bill is also cumbersome from customer's side. When customers receive a bill, they go to District Commission Office for the payment, and receive the receipt upon payment. After that they have to go to the District Water Office to present the receipt and get their accounts debited in the customer ledger.

To sum up, the following aspects in billing and collection stand out as problematic points:

- (1) Nominal number of meter readers is sufficient however, most of them are plumbers or work concurrently in other sections. Thus it is difficult to schedule routine meter reading work;
- (2) Interval of bill issuance tend to be more than a month, which leads to increase of arrears;
- (3) The customer ledgers are still manually maintained. Monitoring of major defaulters and arrears are not always routinely and subject to uncertain factors such as memories of staff and sporadic reports from meter readers;
- (4) Efficiency is lacking in all processes of meter reading and patrol, bill issuance, bill delivery, and collection. And there is no incentive for staff to perform their task efficiently;

- (5) Bill collection and presentation of receipt take place in different venues. Customer's convenience is neglected.

## **4.2 Advice on Billing and Collection**

As a result of analysis on the present system, when the new managing body takes over Meru urban water supply operation, the following corrective measures should be taken:

- (1) In line with the overall meter installation policy, meter readers should also be specialized and given appropriate training;
- (2) As meter readers are required to treat customers in a fair manner, proper territory setting and efficiency-linked incentive should be introduced;
- (3) Customer data input and maintenance, and bill issuance should be computerized or computer-aided at the earliest convenience. The customer data should be also utilized for management decision making purpose as part of Management Information System;
- (4) Data of arrears and abnormal consumption should be detected and maintained, which lead to effective performance of disconnection and increase of arrear recovery;
- (5) Rule of bill issuance should be established. Big consumers and usual consumers may have different rules. Bills should be issued monthly or at longest bimonthly;
- (6) Bill delivery can be made by post. However, considering cost and security in the meantime, meter readers should deliver them together with meter readings;
- (7) Firstly, point of bill collection should be the head office of new company. Furthermore, to enhance customers' convenience, local banks and large-scale shops should be considered as additional collection points;

## **5. Initial Connection**

### **5.1 Present System**

After customers submit their application, the Officer in Charge of Water Supply sends a plumber to their house for site investigation. The plumber confirms the nearest distribution line to be connected to service pipe of the customers and informs the customer of bill of quantity to construct service installation. Meru Central DWO is originally supposed to install water meters and charge meter rent to customers, however in Meru, customers themselves procure their water meter since the DWO does not have a stock of water meters. It is customers who are under obligation of construction work of service installation except connection between distribution pipe and service pipe. Since there are no particular construction companies designated by the DWO as water supply work agent, customers can contract with any construction companies or individual plumbers and entrust the construction. Even customers themselves can construct. Average construction cost in case of Meru town, is Ksh 2,000 for construction plus Ksh 3,000 for

a water meter. When the customer almost completes the construction, the plumber of the DWO comes to the customer and connects the service pipe to distribution line. After that the customer is registered at the DWO. New customers also pay a deposit to the DWO.

The number of new connection is not so many. Including reconnections in which customers use existing dormant service lines by reconnection, about 200 applications are submitted annually.

In activities related to initial connection, there are following problems:

- (1) Quality of service installation works are not standardized, therefore some low quality works and materials are causing leakage;
- (2) As the DWO cannot provide water meters, customers are forced to procure expensive new meters or inexpensive used meters. Used meter's quality is not guaranteed
- (3) Plumbers perform meter reading and line patrol other than connection, disconnection, and leak repair. Thus visits to customer's premise for new connection cannot be swiftly done;
- (4) Lack of vehicles and gasoline budget deprives mobility of plumbers who visit customers.

## **5.2 Advice on Initial Connection**

Under the new company, the initial connection activities should be improved as follows:

- (1) To maintain satisfactory quality of service installation works, the new company itself could conduct service installation works for big consumers. Or after strict selection, some construction companies could be designated as authorized agent;
- (2) The new company should at least, strengthen final check before connecting service line with distribution line;
- (3) To promote new connections in rural or poverty area, the new company should prepare the standard or manual of construction work to be done by residents. Sensitization and technical assistance to those new customers should be done with assistance of NGOs;
- (4) Water meters should be provided by the new company, which can charge meter rent afterwards. Procuring new meters and repair of old meters should be done by the new company;
- (5) Several plumbing teams should be formed with about 3 persons in each team. Those teams should be provided vehicle to guarantee their mobility to connect, disconnect, and repair leakage.

## **6. Customer Relation**

### **6.1 Present System**

The Customer Services Desk was created in 1999 and one staff is assigned to handle speedily complaints from customers. That staff is supposed to be full-time, however, he is also asked to

assist other O&M tasks from time to time. Customer complaints are received when customers come to the Desk. Complaints received are manually recorded in a logbook. The staff informs related section of the complaints and monitors until they are solved. The number and type of complaints received are summarized in Tables 14 and 15.

There are climatic factor and human factor that affect the number of complaints. The climatic factor includes the complaints when dry weather causes reduction or interruption of water supply. The human factor includes the complaints when disconnection program is reinforced and many delinquent customers or illegal users are disconnected. All complaints received are reportedly solved.

Summing up, the following major problems are detected in the present system:

- (1) Customer's complaints are received only at the Customer Services Desk;
- (2) Although one staff is in charge of the Desk, he is not really a full-time. Thus when his is absent, no claims can be received;
- (3) Complaints are just solved and there is no feedback for management purpose.

## **6.2 Advice on Customer Relation**

Supposing that the new company takes over the operation, following corrective measures should be taken:

- (1) The Customer Service Section should have plural staff. All the staff should be full-time;
- (2) Statistical data of complaints should be maintained such as the number of complaints, the contents, the caused, the ways of solving claims and the sections of handling. Those data should be utilized for management purposes;
- (3) Data handling and maintenance should be computerized or computer-aided at the earliest convenience;
- (4) The Customer Services Section should not only handle complaints but also take charge of receiving various application from customers such as new connection, and developing new customers in newly served area;
- (5) Complaints should not be received only through customer's visit. Telephone, fax, and E-mail should be included.

Table 1 Sample of Salary System for Staff of New Management Body

(Unit: Ksh/month)

Job Title	No. of staff	Base Salary		House allowance	Leave allowance	Medical cover	Retirement benefit	Total cost per staff	Total cost per job
		Min.	Max.						
General Manager	1							120,000	120,000
Commercial Manager	1							80,000	80,000
Technical Manager	1							70,000	70,000
Water Supply Inspector	2	14,919	21,632	4,290	373	1,000	1,790	25,729	51,457
Accountant /Information Officer	1	14,919	21,632	4,290	373	1,000	1,790	25,729	25,729
Executive Secretary	1	12,471	18,083	4,290	312	1,000	1,497	22,376	22,376
Workshop Inspector	1	12,471	18,083	4,290	312	1,000	1,497	22,376	22,376
Revenue Officer	1	12,471	18,083	4,290	312	1,000	1,497	22,376	22,376
Customer Relations Officer	1	10,425	15,116	3,380	261	1,000	1,251	18,663	18,663
Logistic Officer	1	10,425	15,116	3,380	261	1,000	1,251	18,663	18,663
Laboratory Technologist	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Mechanic	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Electrician	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Information Clerk	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Accounts Clerk	2	8,715	12,637	3,380	261	750	1,046	16,113	32,226
Meter Reading Supervisor	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Assistant Technician	2	5,724	8,300	2,860	172	750	687	11,481	22,962
Meter Repairman	1	5,724	8,300	2,860	172	750	687	11,481	11,481
Plumber	3	5,724	8,300	2,860	172	750	687	11,481	34,443
Secretary	2	5,724	8,300	2,860	172	750	687	11,481	22,962
Storekeeper	1	5,724	8,300	2,860	172	750	687	11,481	11,481
Clerical Officer	3	5,724	8,300	2,860	172	750	687	11,481	34,443
Cashier	2	5,724	8,300	2,860	172	750	687	11,481	22,962
Billing Clerk	2	5,724	8,300	2,860	172	750	687	11,481	22,962
Meter Reader	4	5,724	8,300	2,860	172	750	687	11,481	45,924
Water Operator	4	5,724	8,300	2,860	172	750	687	11,481	45,924
Assistant Plumber	6	4,785	6,938	2,080	144	500	574	9,160	54,957
Intake Attendent	1	4,785	6,938	2,080	144	500	574	9,160	9,160
Driver	1	4,785	6,938	2,080	144	500	574	9,160	9,160
Messenger / Cleaner	2	4,000	5,800	1,560	120	500	480	7,560	15,120
Security Guard	4	4,000	5,800	1,560	120	500	480	7,560	30,240
Total	56								958,610
							Average salary	12,993	

Note:

Year 2000 data in Corporate Plan of Nyeri Water and Sewerage Company is used as reference.

Average salary does not include General Manager, Technical Manager, and Commercial Manager.

Table2 Tasks of Divisions in New Management Body

Section	Principal functions
Production O&M	<ul style="list-style-type: none"> <li>• To perform routine operations of WTP</li> <li>• To perform preventive maintenance and corrective maintenance</li> <li>• To patrol and maintain intake facilities</li> <li>• To carry out water quality tests</li> </ul>
Distribution O&M	<ul style="list-style-type: none"> <li>• To take charge of O&amp;M of distribution facilities</li> <li>• To carry out routine inspection of distribution facilities</li> <li>• To conduct works of new connection, disconnection and leak repair</li> </ul>
Workshop	<ul style="list-style-type: none"> <li>• To repair tools and facilities</li> <li>• To repair and test water meters</li> <li>• To maintain and repair vehicles</li> </ul>
Accounting	<ul style="list-style-type: none"> <li>• To prepare financial and accounting information</li> <li>• To maintain accounting system</li> <li>• To prepare O&amp;M budget</li> <li>• To maintain management information system</li> <li>• To establish computer system</li> </ul>
Billing and Collection	<ul style="list-style-type: none"> <li>• To process billings</li> <li>• To collect billings and keep cash in safe</li> </ul>
Meter Reading	<ul style="list-style-type: none"> <li>• To read meters</li> <li>• To deliver bills</li> <li>• To patrol served area to detect leakage and illegal use</li> <li>• To receive customer complaints</li> </ul>
Supplies and Stores	<ul style="list-style-type: none"> <li>• To check in materials and record receipts</li> <li>• To handle and store materials</li> <li>• To issue materials and transfer them</li> <li>• To perform physical inventories</li> </ul>
Customer Relations	<ul style="list-style-type: none"> <li>• To handle customer complaints</li> <li>• To develop new customer</li> <li>• To coordinate public relation activities</li> </ul>
Administration	<ul style="list-style-type: none"> <li>• To recruit personnel</li> <li>• To coordinate staff training</li> <li>• To maintain personnel records</li> <li>• To take charge of various administrative works at Head Office</li> </ul>

Table 3 Comparison of Water Utilities

Indicator	Served area	Meru Urban	Meru Central DWO	Nyeri Y1999 est.	Nyeri Y2004 plan	Nairobi	Eldoret	Kericho	Kisumu	Kitale	Naivasha	Nakuru	Nanyuki	Nyahururu	Thika	NWCPC	MENR, WDD
1) Urban Centers Served		1	6**	1	1	1	1	1	1	1	1	1	1	1	1	32	89
2) Urban Population		22,887	500,000	109,543	n/a	2,100,000	300,000	58,723	400,000	90,400	50,000	500,000	53,100	150,000	149,448	1,170,000	3,400,000
3) Urban Population Served		11,200	25,084	43,817	n/a	1,853,000	175,000	58,723	224,000	58,065	20,000	300,000	43,500	50,000	120,000	950,000	1,340,000
4) Service Ratio (% population served)		49%	5%	40%	n/a	88%	58%	100%	56%	64%	40%	60%	82%	33%	80%	81%	39%
5) Number of Connections		2,800	6,271	5,310	9,020	158,000	8,776	4,757	13,653	1,920	n/a	17,317	6,320	2,250	4,260	53,500	124,000
6) Staff Employed		53 *	161	152	139	1,870	202	181	302	94	n/a	599	134	56	146	1,617	7,600
7) Staff per 1000 connections		19	26	29	15	12	23	38	22	49	n/a	35	21	25	34	30	61
8) Water production (m3 / day)		4,000	5,207	8,073	12,650	347,000	11,358	5,394	12,500	7,000	860	28,164	10,000	3,000	24,000	79,452	1,700,000
9) Water sold (m3 / day)		1,400	1,900	4,674	9,488	170,000	4,203	3,344	3,875	1,400	611	15,490	7,100	1,890	12,720	50,685	436,000
10) Unaccounted for Water (%)		65%	64%	42%	25%	51%	63%	38%	69%	80%	29%	45%	29%	37%	47%	36%	74%
11) Revenue billed (000 Ksh / month)		836	1,119	5,917	18,228	127,500	11,975	3,010	8,437	n/a	250	17,650	n/a	771	4,228	41,158	235,440
12) Revenue collected (000 Ksh / month)		491	624	n/a	n/a	50,000	10,900	1,053	3,289	n/a	180	10,981	n/a	684	3,229	20,579	97,000
13) Collection Efficiency (%)		59%	56%	n/a	90%	39%	91%	35%	39%	n/a	72%	62%	n/a	89%	76%	50%	41%
14) Days of Accounts Receivable		1,359	1,442	244	40	770	131	255	n/a	n/a	80	360	n/a	490	260	570	876
15) Average Tariff per cubic meter (Ksh.)		18	10	25	32	25	32	30	n/a	n/a	30	36	n/a	29	31	n/a	18
16) Cost of connection (Ksh.)		n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	3,000	4,000	200
17) Metering (%)		9%	22%	n/a	n/a	25%	90%	100%	n/a	91%	n/a	85%	n/a	99%	84%	65%	28%

Source: Nyeri Water and Sewerage Company Five-Year Corporate Plan 2000-2004, Draft report of "Study on Commercialization and Private Sector Participation Options for the Urban and Peri-urban Water and Sanitation Sector",

Meru Central District Water Office, 1999 National Census, Study Team Estimate

\* 41 out of 161 Meru Central District Water Office staff are deployed within Meru urban water supply. Common staff in Meru Central District Water Office number in 16 (1 DWO, 1 Executive Officer, 2 Account Clerks, 2 Storeman, 3 Electro mechanical staff, 4 Drivers, 2 Copy typist, 1 Messenger). Those staff are allocable to Meru Urban Water Supply proportionary to billing amount of 1999. Thus,  $53 = 41 + 16 * 10029628 / 13427044$

\*\* Meru Central District Water Office is in charge of 6 water supply systems, one of which is Meru urban water supply.



Table 4 Operating Expenses of Meru Urban Water System

Item	1998 (Ksh)		1999 (Ksh)		2000 * (Ksh)		1998-2000 average (Ksh)	
Personnel	4,575,586	69.4%	4,726,442	64.8%	4,856,201	77.3%	4,719,410	70.2%
Chemicals	473,904	7.2%	418,516	5.7%	171,168	2.7%	354,529	5.3%
T.C.L.	348,153		178,850		87,360		204,788	
Alum	106,111		152,826		51,408		103,448	
Soda ash	9,800		78,320		0		29,373	
D.P.D. tablets	9,840		8,520		32,400		16,920	
Transport & Electricity	421,581	6.4%	1,071,998	14.7%	514,591	8.2%	669,390	10.0%
Service	36,700		62,100		28,800		42,533	
Lubricants	54,455		61,139		89,148		68,247	
Fuel	242,924		618,499		181,675		347,699	
Parts	68,926		310,110		144,119		174,385	
Electricity	18,576		20,150		70,849		36,525	
Materials	1,117,729	17.0%	1,076,272	14.8%	741,020	11.8%	978,340	14.6%
<b>Total</b>	<b>6,588,799</b>	<b>100.0%</b>	<b>7,293,228</b>	<b>100.0%</b>	<b>6,282,981</b>	<b>100.0%</b>	<b>6,721,669</b>	<b>100.0%</b>

\* Estimated by Meru Central DWO

Table 5 Salary Table of Meru Central District Water Office

Salary Grade	No. of staff	Basic salary		House allowance	Medical cover	Total cost per staff	Total cost per grade
		min	max				
B	15	2,660	3,300	294	375	3,649	54,735
C	16	2,830	3,980	840	375	4,620	73,920
D	22	3,110	4,500	840	375	5,020	110,440
E	28	3,720	5,340	1,110	495	6,135	171,780
F	8	4,240	6,250	1,110	495	6,850	54,800
G	45	5,340	9,640	1,482	750	9,722	437,490
H	26	7,090	10,595	2,058	990	11,891	309,153
J	6	8,500	12,450	2,058	990	13,523	81,138
K	2	9,225	14,650	2,445	990	15,373	30,745
L	1	11,690	16,750	3,018	1,500	18,738	18,738
M	1	14,210	19,865	3,018	1,500	21,556	21,556
<b>Total</b>	<b>170</b>						<b>1,364,495</b>
Average salary							<b>8,026</b>

Estimation by JICA Study Team

Table 6 Salary Table of Nyeri Water and Sewerage Company

(Unit: Ksh/month)

Job Title	No. of staff	Basic salary		House allowance	Leave allowance	Medical cover	Retirement benefit	Total cost per staff	Total cost per job
		min	max						
Managing Director	1							120,000	120,000
Commercial Manager	1							80,000	80,000
Technical Manager	1							70,000	70,000
Financial Accountant	1	14,919	21,632	4,290	373	1,000	1,790	25,729	25,729
Sewerage Superintendent	1	14,919	21,632	4,290	373	1,000	1,790	25,729	25,729
Water Superintendent	1	14,919	21,632	4,290	373	1,000	1,790	25,729	25,729
Executive Secretary	1	12,471	18,083	4,290	312	1,000	1,497	22,376	22,376
Water Technician	2	12,471	18,083	4,290	312	1,000	1,497	22,376	44,752
Maintenance Technician	1	12,471	18,083	4,290	312	1,000	1,497	22,376	22,376
Internal Auditor	1	12,471	18,083	4,290	312	1,000	1,497	22,376	22,376
Sewerage Inspector	1	12,471	18,083	4,290	312	1,000	1,497	22,376	22,376
Customer Relations Officer	1	10,425	15,116	3,380	261	1,000	1,251	18,663	18,663
Laboratory Technologist	1	10,425	15,116	3,380	261	1,000	1,251	18,663	18,663
Secretary	1	10,425	15,116	3,380	261	1,000	1,251	18,663	18,663
Senior Water Operator	6	8,715	12,637	3,380	261	750	1,046	16,113	96,678
Water Foreman	2	8,715	12,637	3,380	261	750	1,046	16,113	32,226
Bills Control Officer	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Electrician	2	8,715	12,637	3,380	261	750	1,046	16,113	32,226
Plant Mechanic	3	8,715	12,637	3,380	261	750	1,046	16,113	48,339
Stores and Supplies Officer	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Computer Operations Supervisor	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Accounts Officer (Revenue)	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Payroll and Administrative Officer	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Reconnection & Disconnection Supervisor	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Meter Reading Supervisor	1	8,715	12,637	3,380	261	750	1,046	16,113	16,113
Plumber/Mason	1	5,724	8,300	2,860	172	750	687	11,481	11,481
Plumber	18	5,724	8,300	2,860	172	750	687	11,481	206,658
Telephone Operator/Receptionist	1	5,724	8,300	2,860	172	750	687	11,481	11,481
Laboratory Assistant	1	5,724	8,300	2,860	172	750	687	11,481	11,481
Computer Operator	2	5,724	8,300	2,860	172	750	687	11,481	22,962
Store Clerk	3	5,724	8,300	2,860	172	750	687	11,481	34,443
Accounts Clerk	4	5,724	8,300	2,860	172	750	687	11,481	45,924
Cashier	2	5,724	8,300	2,860	172	750	687	11,481	22,962
Meter Reader	5	5,724	8,300	2,860	172	750	687	11,481	57,405
Sewerage Headman	2	4,785	6,938	2,080	144	500	574	9,160	18,319
Water Operator	11	4,785	6,938	2,080	144	500	574	9,160	100,755
Driver	5	4,785	6,938	2,080	144	500	574	9,160	45,798
Pump Attendant	10	4,785	6,938	2,080	144	500	574	9,160	91,595
Messenger/Cleaner/T-Lady	2	4,000	5,800	1,560	120	500	480	7,560	15,120
Security Guard	13	4,000	5,800	1,560	120	500	480	7,560	98,280
Water Attendant	15	4,000	5,800	1,560	120	500	480	7,560	113,400
Sewerage Attendant	20	4,000	5,800	1,560	120	500	480	7,560	151,200
Total	150								1,918,952
								Average salary	11,217

Salary information is extracted from Year 2000 data of Corporate plan of Nyeri Water and Sewerage Company.

Average salary does not include Managing Director, Technical Manager, and Commercial Manager.

Table 7 Revenue of Meru Central District Office

Year / Month	Meru Urban Water System				Other 5 Water Systems *				Total of 6 Water Systems			
	Billing (Ksh)	Collection (Ksh)	Collection efficiency (%)	Arrears at monthly end (Ksh)	Billing (Ksh)	Collection (Ksh)	Collection efficiency (%)	Arrears at monthly end (Ksh)	Billing (Ksh)	Collection (Ksh)	Collection efficiency (%)	Arrears at monthly end (Ksh)
1997 Total	9,657,380	4,600,408	48%		3,300,182	1,357,485	41%		12,957,562	5,957,893	46%	
1998 January	801,400	268,315	33%		316,866	50,081	16%		1,118,266	318,396	28%	
1998 February	802,400	261,287	33%		311,937	15,508	5%		1,114,337	276,795	25%	
1998 March	811,900	527,380	65%		314,452	207,611	66%		1,126,352	734,991	65%	
1998 April	807,500	958,352	119%		309,062	102,877	33%		1,116,562	1,061,229	95%	
1998 May	797,220	310,703	39%		323,777	32,790	10%		1,120,997	343,493	31%	
1998 June	797,450	530,219	66%		334,305	58,029	17%		1,131,755	588,248	52%	
1998 July	813,607	450,412	55%		328,374	83,962	26%		1,141,981	534,374	47%	
1998 August	814,232	442,909	54%		330,133	139,231	42%		1,144,365	582,140	51%	
1998 September	814,240	577,139	71%		327,737	391,789	120%		1,141,977	968,928	85%	
1998 October	814,220	645,661	79%		320,212	153,339	48%		1,134,432	799,000	70%	
1998 November	813,970	529,322	65%		322,951	145,107	45%		1,136,921	674,429	59%	
1998 December	813,970	764,429	94%		320,928	70,881	22%		1,134,898	835,310	74%	
1998 Total	9,702,109	6,266,127	65%		3,860,734	1,451,205	38%		13,562,843	7,717,332	57%	
1999 January	878,763	846,366	96%		318,038	232,671	73%		1,196,801	1,079,037	90%	
1999 February	873,965	459,550	53%		276,930	192,900	70%		1,150,895	652,450	57%	
1999 March	827,659	850,333	103%		276,294	118,486	43%		1,103,953	968,819	88%	
1999 April	827,548	301,082	36%		279,657	116,829	42%		1,107,205	417,911	38%	
1999 May	827,748	222,899	27%		273,547	78,435	29%		1,101,295	301,334	27%	
1999 June	828,048	337,647	41%		278,895	140,875	51%		1,106,943	478,522	43%	
1999 July	829,236	812,734	98%		283,040	87,121	31%		1,112,276	899,855	81%	
1999 August	828,116	456,235	55%		281,910	96,626	34%		1,110,026	552,861	50%	
1999 September	827,067	422,130	51%		300,490	194,318	65%		1,127,557	616,448	55%	
1999 October	826,134	348,265	42%		294,591	86,320	29%		1,120,725	434,585	39%	
1999 November	824,379	518,096	63%		267,300	162,097	61%		1,091,679	680,193	62%	
1999 December	830,965	319,775	38%		266,724	86,881	33%		1,097,689	406,656	37%	
1999 Total	10,029,628	5,895,112	59%		3,397,416	1,593,559	47%		13,427,044	7,488,671	56%	
2000 January	1,271,614	553,149	43%	37,347,588	335,486	262,182	78%	15,689,229	1,607,100	815,331	51%	53,036,816
2000 February	1,274,338	750,162	59%		342,316	160,133	47%		1,616,654	910,295	56%	
2000 March	1,270,987	728,260	57%									
2000 April	1,201,217	500,073	42%									
2000 May	1,205,004	944,783	78%									
2000 June	1,203,181	428,315	36%									
2000 July	1,292,575	1,427,797	110%									
2000 August	1,248,888	802,170	64%									
2000 September	1,201,184	744,327	62%	41,637,540								
2000 October *	1,201,184	744,327	62%									
2000 November *	1,201,184	744,327	62%									
2000 December *	1,201,184	744,327	62%									
2000 Total *	14,772,540	9,112,017	62%									

\* Forecast by JICA Study Team

Table 8 List of Major Defaulters

Name	Amount (Ksh)	Share
Meru Municipal Council	10,196,725	24%
District Commissioner	2,694,839	6%
Meru District Hospital	4,922,230	12%
ASK Meru Branch	227,370	1%
Kaaga Girl's High school	106,694	0%
Other defaulters	23,489,682	56%
Total	41,637,540	100%

Note:

- 1) The above data show balance as of Sep. 2000.
- 2) Only identified institutional and industrial users who have more than Ksh 100,000 arrears are listed.
- 3) Individual and commercial users are not routinely identified by DWO.
- 4) DWO should reconcile total amount of arrears with actual customer ledgers. Because:
  - Average arrear per connection other than listed above becomes Ksh8,280 (= 23489682 / 2837), which seems unusually high.
  - Those practically identified as a big defaulter are only 3 customers (M.C. Meru, D.C., and Meru Hospital).
- 5) Customer data should be computerized at earliest convenience, to easily obtain for example, following data:
  - List of major defaulters by customer category
  - Distribution of arrears by zone
  - Age analysis of arrears
  - Tariff applied to defaulters

Table 9 Estimated Income Statement

Year	1999	2000	2001	2002	2003	2004	2005
1 Income							
2 Water sales (water + fee)	5,895,112	9,112,017	17,576,227	19,153,477	22,096,285	25,240,886	28,723,625
3 Meter rent			48,000	576,000	1,230,474	1,575,370	1,767,730
4 Total income	5,895,112	9,112,017	17,624,227	19,729,477	23,326,759	26,816,256	30,491,355
5 Expenses							
6 Personnel	4,719,410	4,719,410	8,111,365	11,503,320	11,848,420	12,203,872	12,569,988
7 Power	36,525	36,525	1,475,815	2,915,105	3,002,558	3,092,635	3,400,645
8 Chemicals	354,529	354,529	2,063,410	3,772,292	3,885,461	4,002,024	4,400,604
9 Vehicles	632,865	632,865	416,433	200,000	206,000	212,180	218,545
10 Materials	978,340	978,340	1,089,170	1,200,000	1,236,000	1,273,080	1,311,272
11 Meters					6,190,403	1,379,468	1,379,468
12 Other operating expense			489,768	979,536	1,318,442	1,108,163	1,164,026
13 Interest expense			0	0	483,000	724,500	241,500
14 Total expenses	6,721,669	6,721,669	13,645,961	20,570,253	28,170,284	23,995,922	24,686,049
15 Net income (loss)	-826,557	2,390,348	3,978,266	-840,776	-4,843,525	2,820,333	5,805,306

Source: Meru Central DWO, Estimation of JICA Study Team

- 1) For sake of simplicity and understandability, the cash basis is employed for revenue recognition.
- 6) Costs in 1999 and 2000 are average of actual costs of 1998 and 1999, and estimated cost of 2000 (See operating expenses table).  
Salaries paid by the new company in 2002 is estimated at Ksh 958,610 per month (See personnel cost proposal table), which will be annually increased by 3% through 2005.  
Cost in 2001 is estimated at intermediate value of those of 2000 and 2002.
- 7) Unit price of electricity in 2000 is Ksh 6.7/kWh, which will be annually increased by 3% through 2005.  
Electricity usage in 2005 is estimated at 600kWh/day (= 3 pumps x 16.66kW x 24 hours). Usages in 2002, 2003, and 2004 are proportionate to water production of same years.  
Cost in 1999 is estimated figure, which is similarly applied in 2000. Cost in 2001 is estimated at intermediate value of those of 2000 and 2002.
- 8) Unit price of alum in 2000 is Ksh 34/kg, which will be annually increased by 3% through 2005.  
Usage of alum in 2005 is estimated at 100kg/day. Usages in 2002, 2003, and 2004 are proportional to water production of same years.  
Unit price of chlorine in 2000 is Ksh 70/kg, which will be annually increased by 3% through 2005.  
Usage of chlorine in 2005 is estimated at 100kg/day. Usages in 2002, 2003, and 2004 are proportional to water production of same years.  
Cost in 1999 is estimated figure, which is similarly applied in 2000. Cost in 2001 is estimated at intermediate value of those of 2000 and 2002.
- 9) Cost in 2002 is estimated at (1 car x 10000km drive x Ksh 10 per km) + (5 motorbikes x 10000km drive x Ksh 2 per km), which will be annually increased by 3% through 2005.  
Cost in 1999 is estimated figure, which is similarly applied in 2000. Cost in 2001 is estimated at intermediate value of those of 2000 and 2002.
- 10) Cost in 1999 is estimated figure, which is similarly applied in 2000. Cost in 2002 is estimated at Ksh 1,200,000, which will be annually increased by 3% through 2005.  
Cost in 2001 is estimated at intermediate value of those of 2000 and 2002.
- 11) Unit price of water meter and box is estimated at Ksh 6000. From 2003, meters have to be procured by the new company.
- 12) Other operating expenses of 2002 through 2005 are estimated at 5% of personnel, power, chemical, vehicle, material and meter costs.  
Cost in 2001 is estimated at intermediate value of those of 2000 and 2002.
- 13) General lending rate of Kenyan commercial banks as of Sept. 2000 is used.
- 15) It is assumed that no depreciation expense is incurred due to uncertainty of asset transfer; revenue is recognized on the cash basis; the new company is tax exempted.

Table 10 Estimated Statement of Cash Flow

Year	2001	2002	2003	2004	2005	Total
1 Cash flows from operating activities						
2 Net income (loss)	1,989,133	-840,776	-4,843,525	2,820,333	5,805,306	4,930,472
3 Net cash provided by the activities	1,989,133	-840,776	-4,843,525	2,820,333	5,805,306	4,930,472
4 Cash flows from noncapital financing activities						
5 Net borrowings (repayments) for working capital financing	0	0	4,200,000	-2,100,000	-2,100,000	0
7 Interest paid on working capital financing	0	0	-483,000	-724,500	-241,500	-1,449,000
8 Net cash provided by the activities	0	0	3,717,000	-2,824,500	-2,341,500	-1,449,000
9 Cash flows from capital and related financing activities						
10 Rehabilitation of capital assets	-200,000,000	-600,000,000	-200,000,000			-1,000,000,000
11 Formation of intangible assets (soft component)	-13,400,000	-40,200,000	-13,400,000			-67,000,000
12 Capital grants contributed by foreign agency	194,000,000	582,000,000	194,000,000			970,000,000
13 Capital grants contributed by GoK	6,000,000	18,000,000	6,000,000			30,000,000
14 Soft component grants contributed by foreign agency	13,400,000	40,200,000	13,400,000			67,000,000
Net cash provided by the activities	0	0	0			0
15 Net increase (decrease) in cash	1,989,133	-840,776	-1,126,525	-4,167	3,463,806	3,481,472
16 Cash balances at beginning of year	0	1,989,133	1,148,357	21,833	17,666	3,176,989
17 Cash balances at end of year	1,989,133	1,148,357	21,833	17,666	3,481,472	6,658,462

Source: Meru Central DWO, Estimation of JICA Study Team

- 2) 50% of yearly operating income (loss) is shown in 2001, assuming that the new company takes over the operation from July 2001.
- 9) Those cash flows are prepared to show the magnitude of the Project, assuming for convenience's sake that the new company owns the assets.
- 10,11,12,13,14) Wild guess is applied.

Table 11 Principal Assumptions in Financial Planning

	Year	1999	2000	2001	2002	2003	2004	2005	Total
1	Production capacity (m3/day)	5,000	5,000	6,000	6,730	6,730	6,730	6,730	42,920
2	Process loss + capacity disutilization (% of capacity)	10%	10%	20%	26%	26%	26%	21%	1
3	Actual production (m3/day)	4,500	4,500	4,800	4,980	4,980	4,980	5,317	34,057
4	Unit cost of water produced (Ksh/m3)	4.1	4.1	7.8	11.3	15.5	13.2	12.7	69
5	Water loss by leakage (% of production)	55%	55%	30%	25%	20%	15%	15%	2
6	Water loss by unbilled use (% of production)	10%	10%	9%	8%	7%	6%	5%	1
7	Water loss by unbilled use (m3/day)	450	450	432	398	349	299	266	2,644
8	Water billed (m3/day)	1,575	1,575	2,928	3,337	3,636	3,934	4,253	21,238
9	Collection efficiency	59%	62%	64%	68%	72%	76%	80%	5
10	Water billed and collected (m3/day)	926	971	1,874	2,269	2,618	2,990	3,403	15,051
11	Unit price of water billed (Ksh/m3)	17.4	25.7	25.7	23.1	23.1	23.1	23.1	161
12	Water collection (water + fee) (Ksh/year)	5,895,112	9,112,017	17,576,227	19,153,477	22,096,285	25,240,886	28,723,625	127,797,630
13	Water billing (Ksh/year)	10,029,628	14,772,540	27,462,855	28,166,878	30,689,285	33,211,692	35,904,532	180,237,410
14	DWO water supply (billed + unbilled) (m3/day)	2,025	2,025	3,360	3,735	3,984	4,233	4,519	23,882
15	Demand for DWO water (m3/day)	2,935	3,193	3,452	3,710	3,968	4,227	4,485	25,970
16	Excess supply (m3/day)	-910	-1,168	-92	25	16	7	34	-2,088
17	Number of legal connections	2,800	2,842	3,072	3,302	3,532	3,762	3,992	23,301
18	Water meter installment or replacement (piece/year)			500	2,000	1,032	230	230	3,992
19	Water meter rent (Ksh/month/piece)			50	50	50	50	50	250
20	Water usage per legal connection (m3/month)	17.1	16.9	29.0	30.7	31.3	31.8	32.4	189
21	Interest rate of working capital financing	23%	23%	23%	23%	23%	23%	23%	2
22	Inflation		3%	3%	3%	3%	3%	3%	
23	Operating ratio	1.1	0.7	0.8	1.0	1.2	0.9	0.8	7
24	Staff per 1000 connections (person)	18.9	18.9	18.2	17.0	15.9	14.9	14.0	118

Source: Meru Central DWO, Estimation of JICA Study Team

2) Capacity utilization has to be limited considerably from 2001 through 2003 to reconcile upscaled production capacity with decrease of leakage due to new pipe installation.

11) Average tariff will be lowered by tariff cut in 2002 when meter installation is at peak period. Without this tariff cut, which is assumed here at 10%, ambitious meter installation and stricter bill collection program would boost average billing amount per connection and result in increase of customer complaints and decrease of demand.

12) DWO estimates that water sales account for 99% of billed amounts and the remaining 1% is fee revenue.

17) Number of legal connections will increase proportionately to demand for DWO water.

18) 2500 water meters are expectedly granted. The remaining meters will be purchased anew or cannibalized from old meters.

21) General lending rate of Kenyan commercial banks as of Sept. 2000 is used.

23) Operating ratio is to indicate the level of total operating expenditures which generate total operating revenues.

Total operating expenditures include depreciation and non cash charges and exclude interest. This indicator is expressed as: Total Operating expenses ÷ Total operating revenues.

24) This is a commonly used indicator to measure the staff productivity. Efficient organizations usually have less than 10 staff per 1000 connections.

Table 12 Demand Assumptions in Financial Planning

	Year	1999	2000	2001	2002	2003	2004	2005	Total
Water Demand (m3/day)		2,935	3,193	3,452	3,710	3,968	4,227	4,485	25,970

Table 13 Summary of Financial Planning

	Year	1999	2000	2001	2002	2003	2004	2005	Total
Actual production (m3/day)		4,500	4,500	4,800	4,980	4,980	4,980	5,317	34,057
Water loss (% of production)		65%	65%	39%	33%	27%	21%	20%	3
Demand for DWO water (m3/day)		2,935	3,193	3,452	3,710	3,968	4,227	4,485	25,970
Unit cost of water produced (Ksh/m3)		4.1	4.1	7.8	11.3	15.5	13.2	12.7	
Unit price of water billed (Ksh/m3)		17.4	25.7	25.7	23.1	23.1	23.1	23.1	161
Total income (Ksh)		5,895,112	9,112,017	17,624,227	19,729,477	23,326,759	26,816,256	30,491,355	132,995,203
Operating ratio		1.1	0.7	0.8	1.0	1.2	0.9	0.8	7
Cash flows from operating activities (Ksh)		n.a.	n.a.	1,989,133	-840,776	-4,843,525	2,820,333	5,805,306	4,930,472
Collection efficiency		59%	62%	64%	68%	72%	76%	80%	5
Staff per 1000 connections (person)		18.9	18.9	18.2	17.0	15.9	14.9	14.0	118

Table 14 Customer Complains Received

	No. of complaints	No. per month
Nov. 1998 through Feb. 1999	60	15
Nov. 1999 through Feb. 2000	358	90
June 2000 through Aug. 2000	101	34

Table 15 Type of Customer Complains

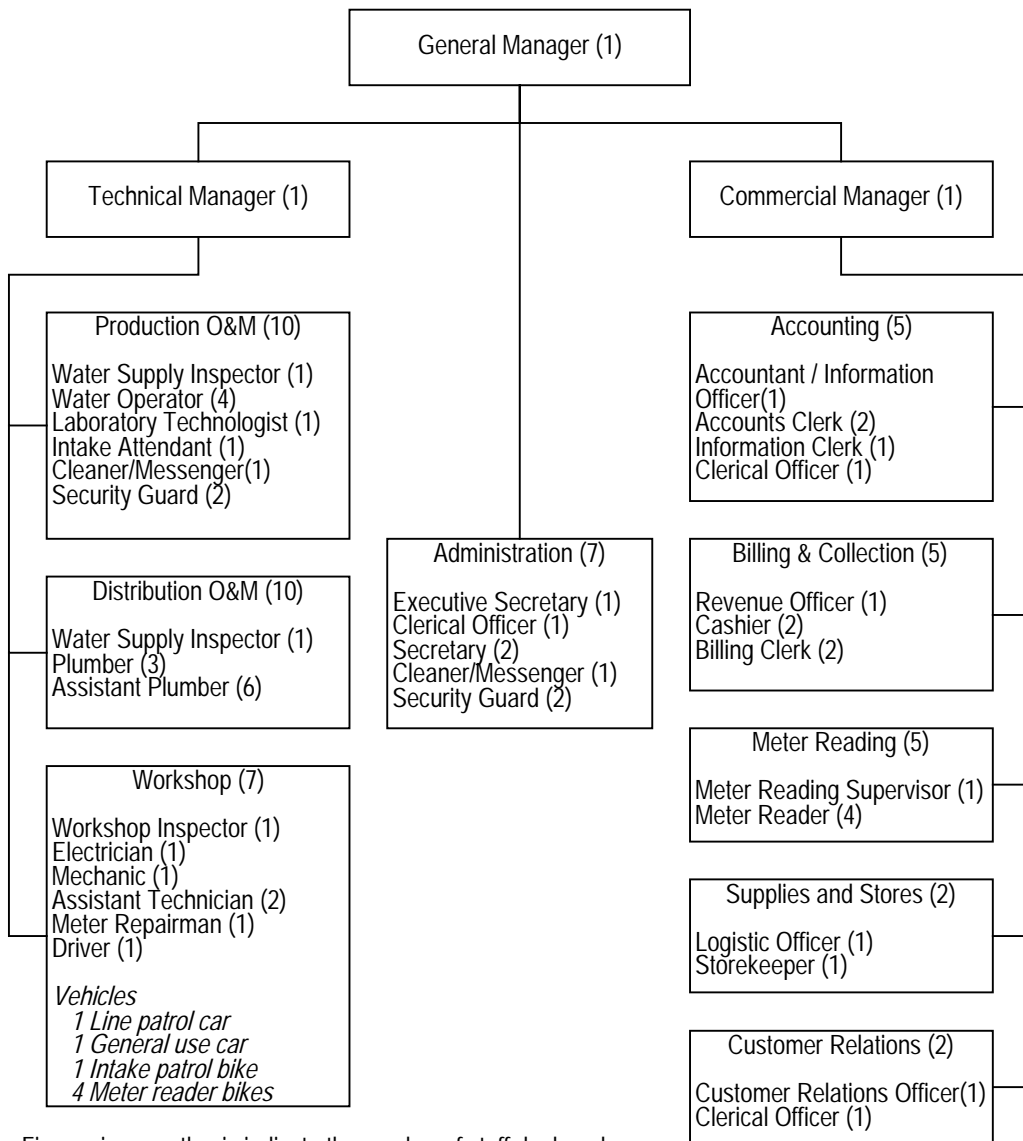
Nature of complaints	No. of complaints
Lack or interruption of water supply	69
Pipe bust	8
Blockage	4
Leakage	12
Overcharge	3
Pipe damage	5
Total	101

Note: Complaints received for the month of June through August 2000.  
All complaints were reportedly solved.

Source: Customer Relation Desk, Meru Central DWO

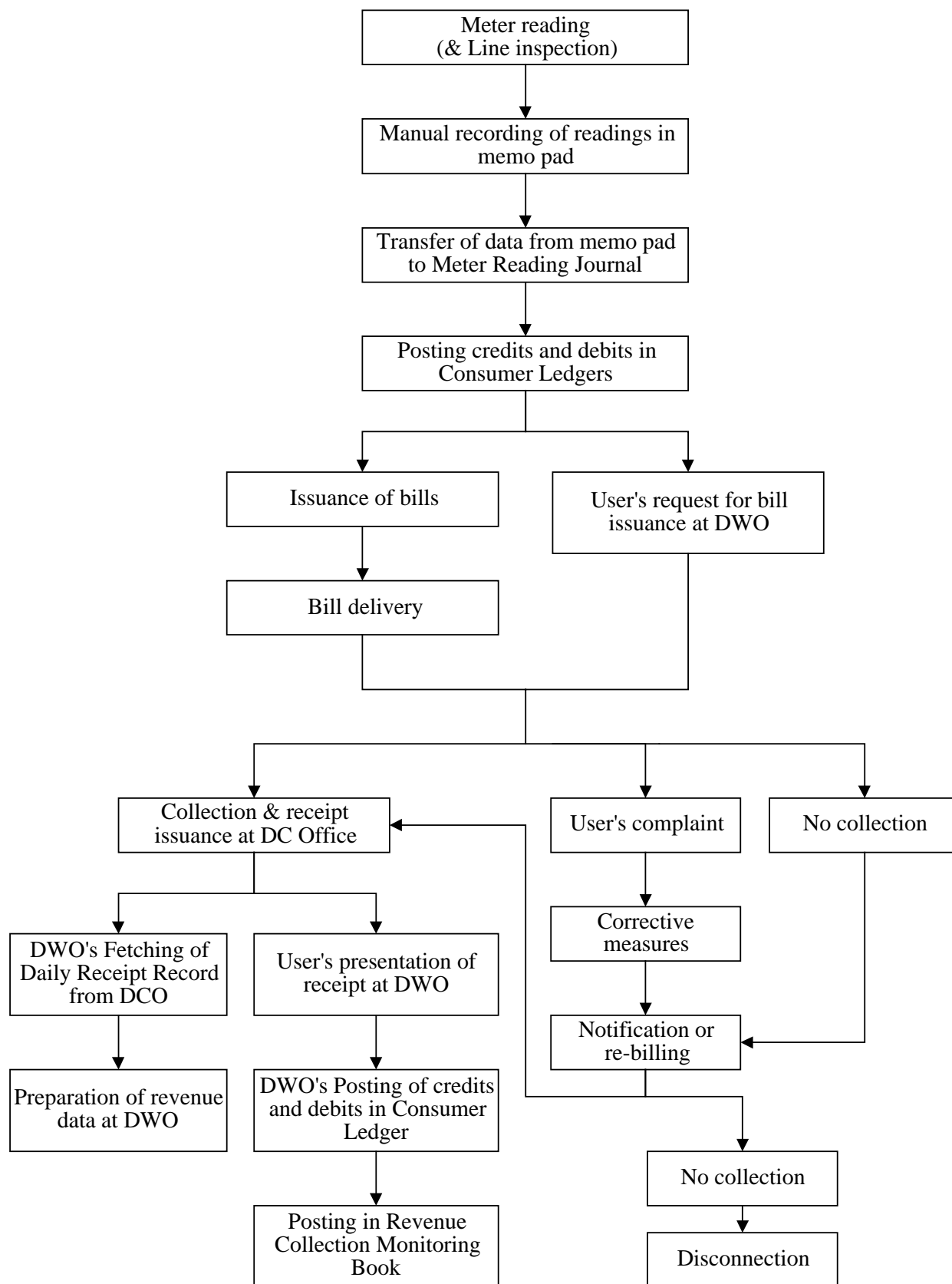


Figure 1 Functional Organization Structure and Staff Structure of New Management Body



-Figures in parenthesis indicate the number of staff deployed.  
 -Total number of staff is 56.

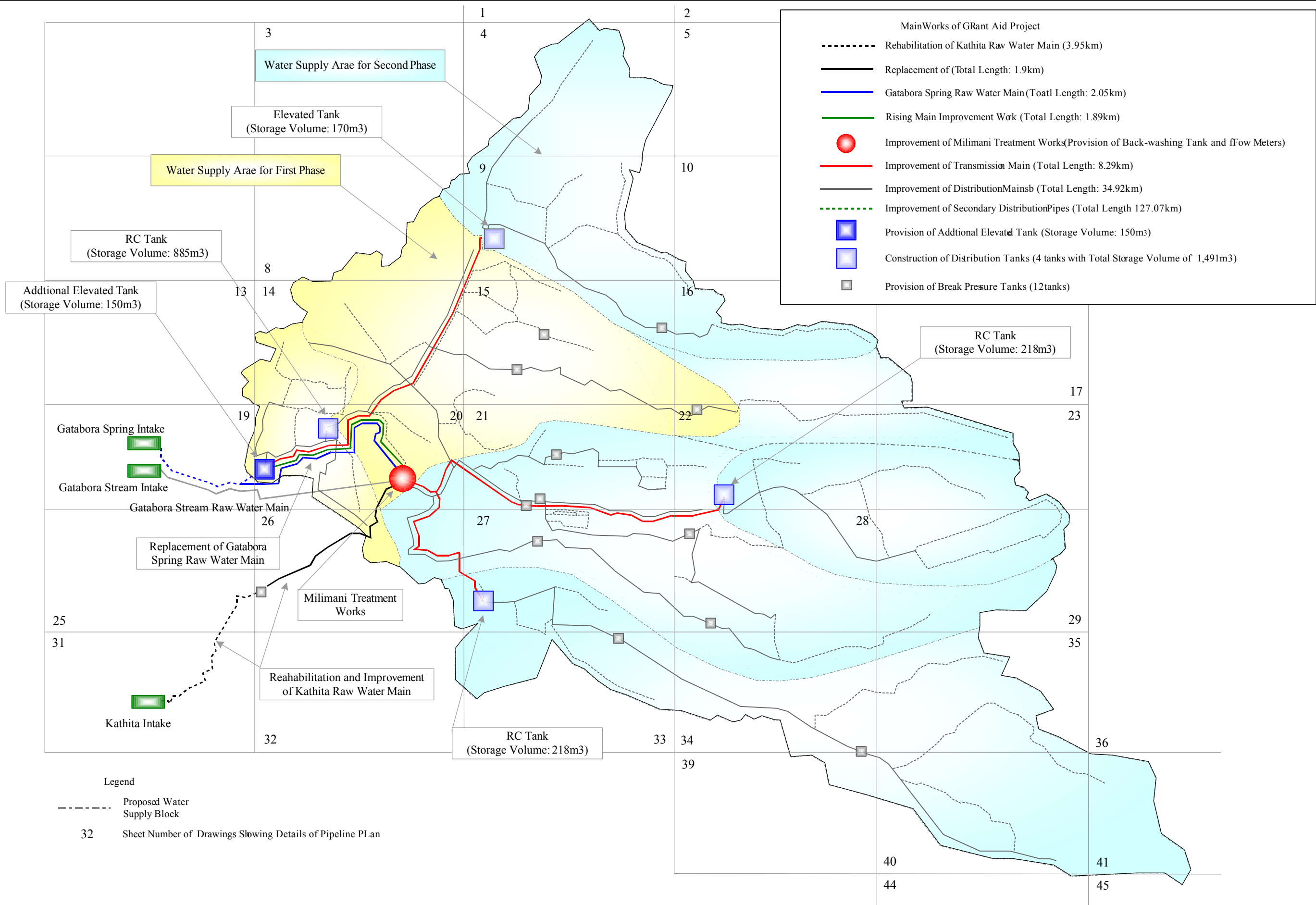
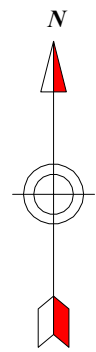
Figure 2 Billing and Collection Process

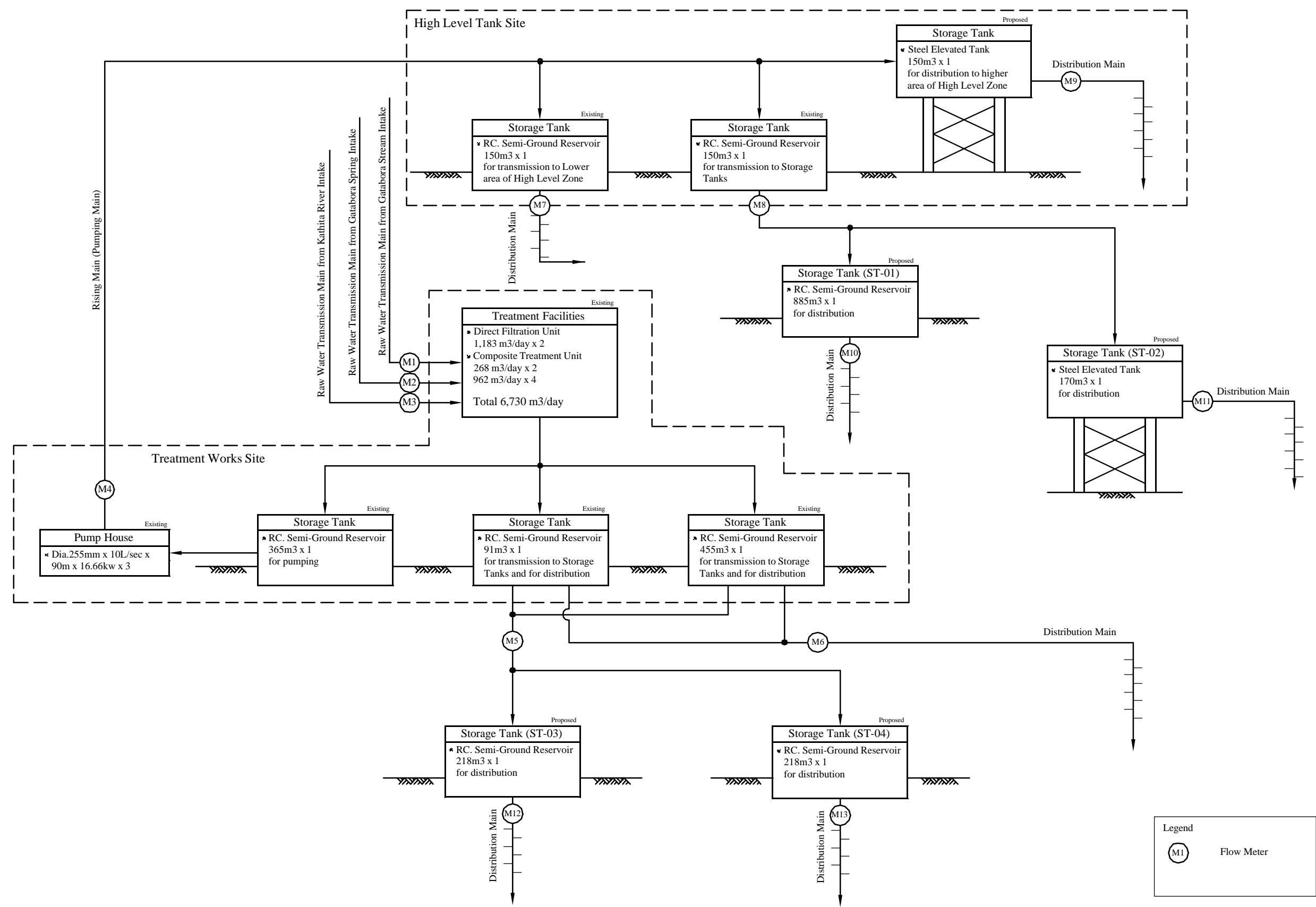


***Attachment-6***  
***Basic Design Drawings***

# DRAWING LIST

DRAWING NO.	TITLE		
	<b>GENERAL</b>		
MWS-001		LOCATION MAP LF MAIN FACILITIES IN MERU WATER SUPPLY	
MWS-002		DESIGNED FLOW DIAGRAM OF MERU WATER SUPPLY	
	<b>RAW WATER MAIN</b>		
MWS-003		GENERAL PLAN	
MWS-004		KATHITA REHABILITATION WORKS(1/2)	(1/2)
MWS-005		KATHITA REHABILITATION WORKS	(2/2)
MWS-006		PIPE BRIDGE WALK WAY	
MWS-007		PIPE BRIDGE REHABILITATION	
	<b>WATER TREATMENT PLANT</b>		
MWS-008		IMPROVEMENT PLAN	
MWS-009		PROCESS FLOW	
MWS-010		DETAILS	(1/3)
MWS-011		DETAILS	(2/3)
MWS-012		DETAILS	(3/3)
MWS-013		IMPROVEMENT PLAN	
MWS-014		PUMPING CONTROL SYSTEM	
	<b>TRANSMISSION MAIN</b>		
MWS-015		GENERAL PLAN	
MWS-016		PIPE BRIDGE	
	<b>DISTRIBUTION MAIN</b>		
MWS-017		GENERAL PLAN	
MWS-018		SECONDARY PIPE PLAN	
MWS-019		HIGH LEVEL TANK SITE	
MWS-020		HIGH LEVEL TANK	(1/2)
MWS-021		HIGH LEVEL TANK	(2/2)
MWS-022		STORAGE TANK 885M3	(1/5)
MWS-023		STORAGE TANK 885M3	(2/5)
MWS-024		STORAGE TANK 885M3	(3/5)
MWS-025		STORAGE TANK 885M3	(4/5)
MWS-026		STORAGE TANK 885M3	(5/5)
MWS-027		STORAGE TANK 218M3	(1/5)
MWS-028		STORAGE TANK 218M3	(2/5)
MWS-029		STORAGE TANK 218M3	(3/5)
MWS-030		STORAGE TANK 218M3	(4/5)
MWS-031		STORAGE TANK 218M3	(5/5)
	<b>STANDARD DRAWINGS</b>		
MWS-032		PIPE INSTALLATION	
MWS-033		TYPICAL CROSSING	
MWS-034		BREAK PRESSURE TANK	
MWS-035		VALVE WORKS	
MWS-036		THRUST BLOCK	
MWS-037		THRUST BLOCK	(1/2)
MWS-038		PIPE BRANCH	(2/2)







Legend  
 (M1) Flow Meter





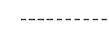
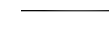


THE MINISTRY OF ENVIRONMENT  
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THE STUDY ON MERU WATER SUPPLY PROJECT  
 JAPAN INTERNATIONAL COOPERATION AGENCY


 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: GENERAL DESIGNED FLOW DIAGRAM OF MERU WATER SUPPLY		
SCALE	DATE	DRAWING NO.
NONE	30 / 01 / 2001	MWS-002

-Legend-


-  Boundary of Supply Area
-  Existing Raw Water Transmission Main (from Gatabora Spring Intake, Gatabora Stream Intake and Kathita River Intake)
-  Replacement Raw Water Transmission Main (from Kathita River Intake)
-  Existing Raw Water Transmission Main (Stop using)
-  Proposed Raw Water Transmission Main (from Gatabora Spring Intake and Kathita River Intake)
-  Existing Rising Main (Pumping Main)
-  Proposed Rising Main (Pumping Main)
-  Treated Water Transmission Main


 Water Treatment Works (Q=6730m<sup>3</sup>/day, V=911m<sup>3</sup>)


 High Level Tank (V=450m<sup>3</sup>)


 Gatabora Spring Intake


 Gatabora Stream Intake


 Kathita River Intake


 Storage Tank (V=885m<sup>3</sup> Kinoro Primary School)

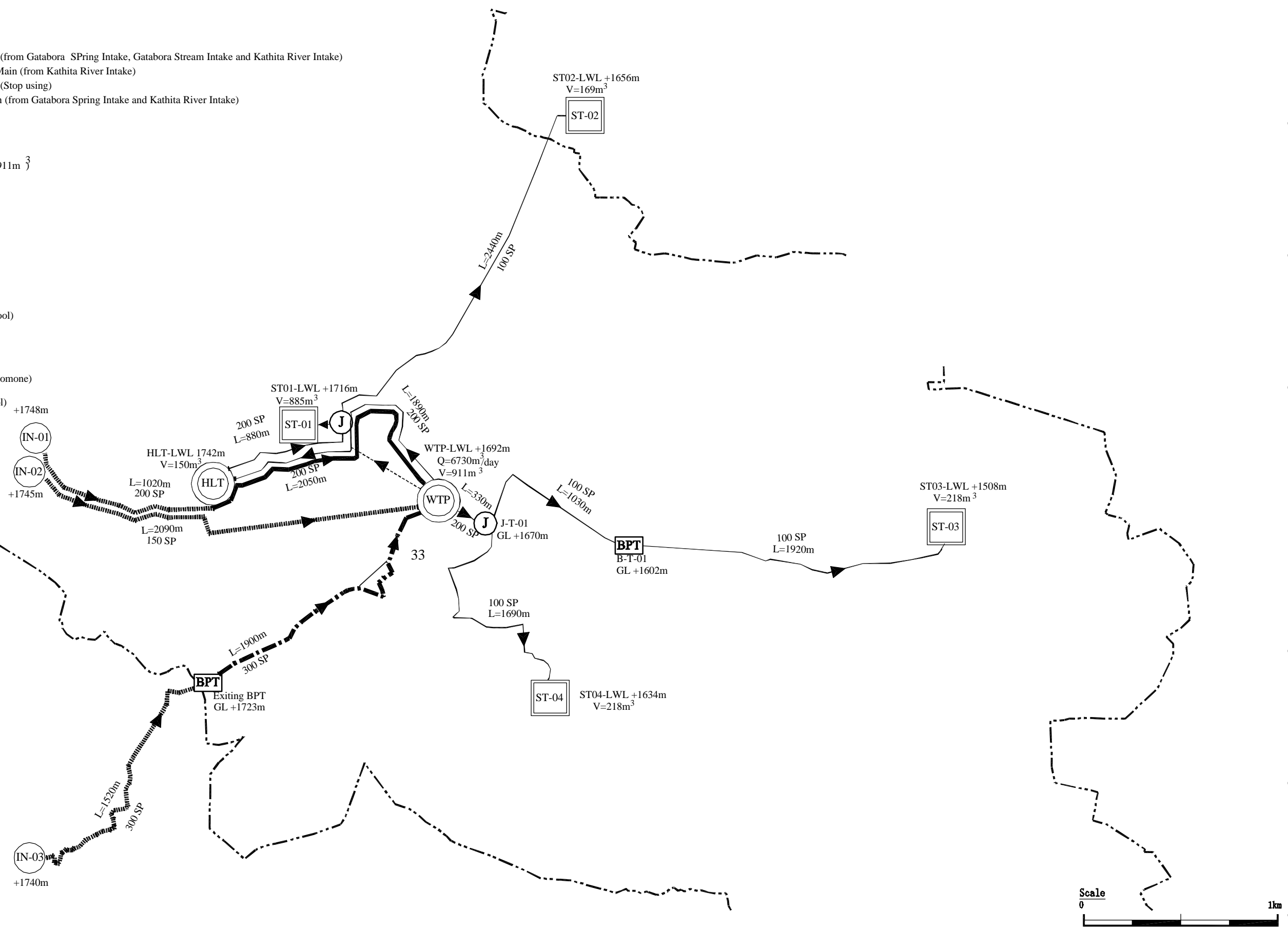
 Storage Tank (V=170m<sup>3</sup> Meru High School)

 Storage Tank (V=218m<sup>3</sup> Public works Road Maintenance Camp, Gakoromone)

 Storage Tank (V=218m<sup>3</sup> Irinda Primary School)



 Junction

 Break Pressure Tank

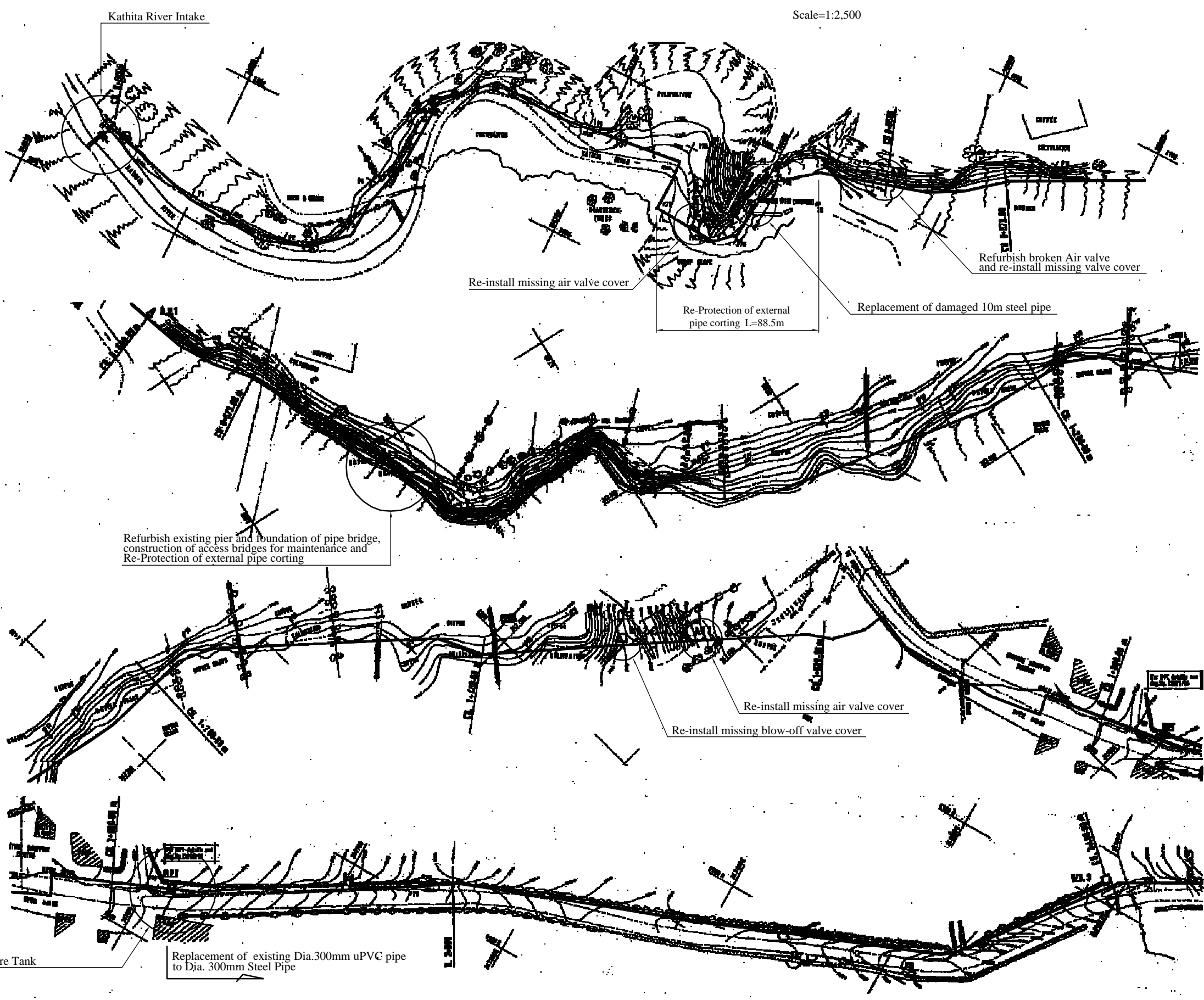


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 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: RAW WATER MAIN GENERAL PLAN		
SCALE: 1 : 20,000	DATE: 30 / 01 / 2001	DRAWING NO.: MWS-003



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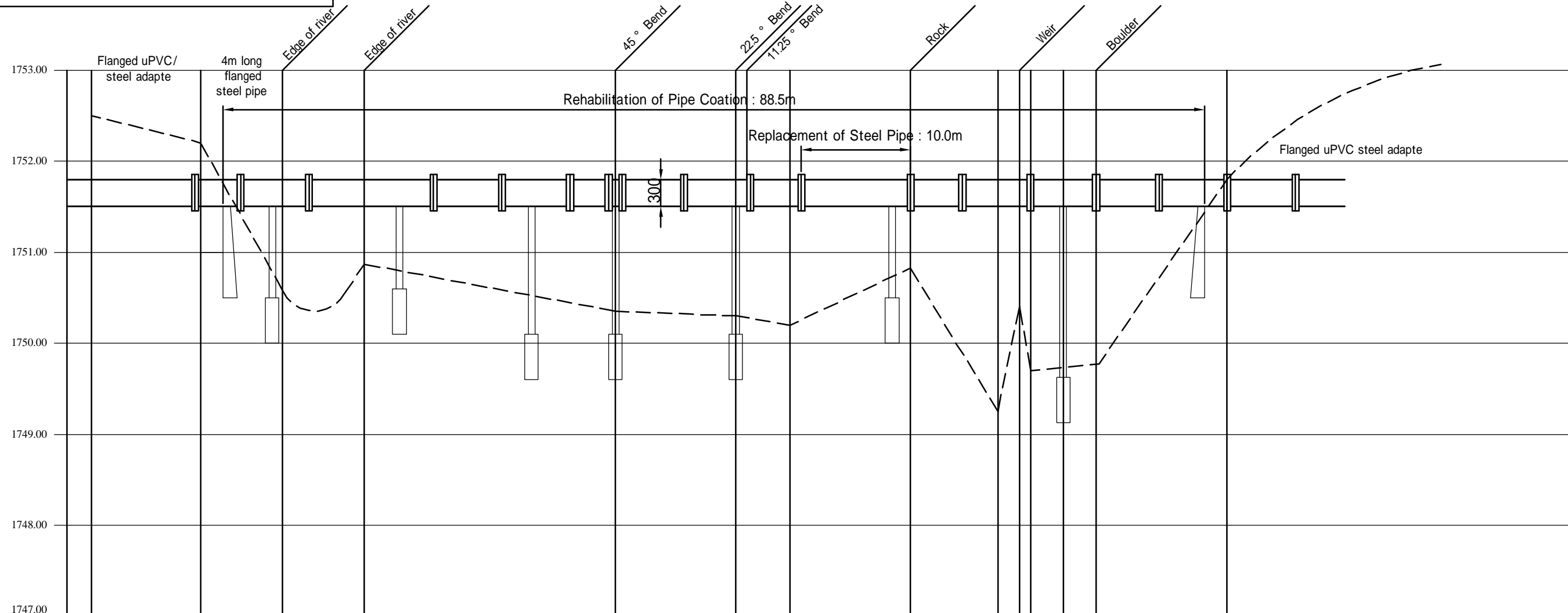
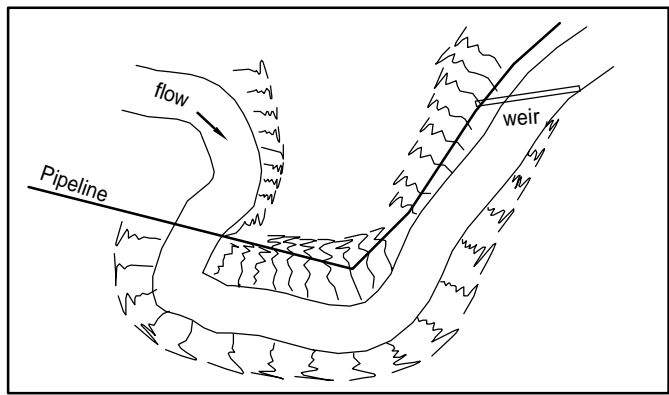
THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: RAW WATER MAIN KATHITA REHABILITATION WORKS (1/2)		
SCALE	DATE	DRAWING NO.
1 : 2,500	30 / 01 / 2001	MWS-004





A  
B  
C  
D  
E  
F  
G  
H



CHAINAGE (M)	0	10.0	17.5	25.0	48.0	59.0	64.0	75.0	83.0	85.0	86.0	89.0	92.0	104.0
GROUND LEVEL (M)	1752	1752	1751	1751	1750	1750	1751	1749	1750	1750	1750	1750	1750	1752
INVERT LEVEL (M)														
HYDRAULIC LEVEL (M)														
HYDRAULIC GRADIENT (%)														
PIPE SIZE & MATERIAL	300mm uPVC		300mm steel										300mm uPVC	
SOIL TYPE SURVEY REMARKS														

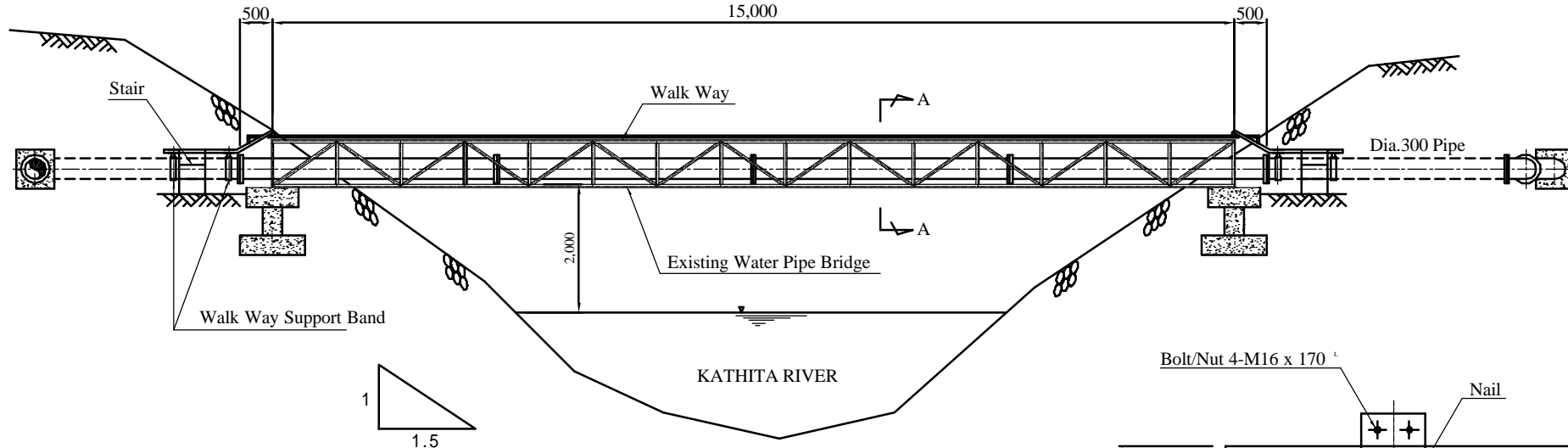
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THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

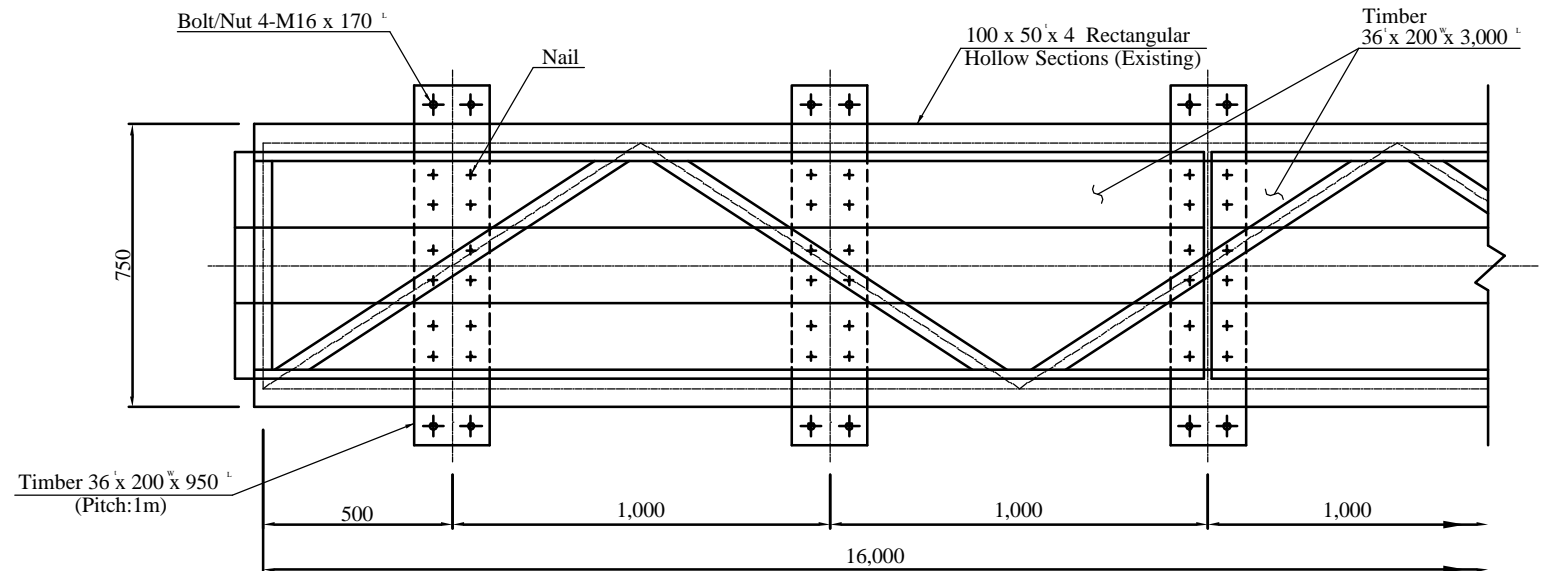
 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: RAW WATER MAIN KATHITA REHABILITATION WORKS (2/2)		
SCALE 1:400, 1:40	DATE 30 / 01 / 2001	DRAWING NO. MWS-005

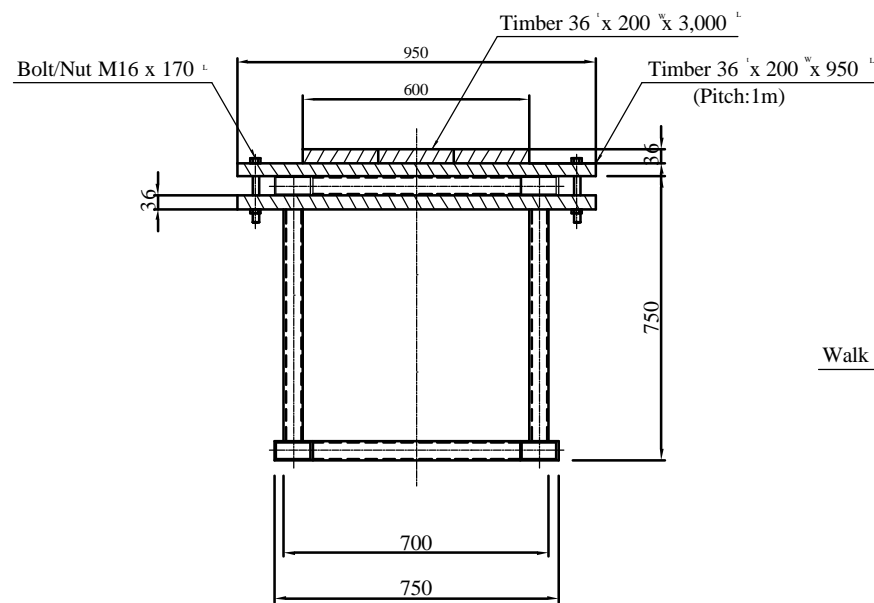
Longitudinal Section  
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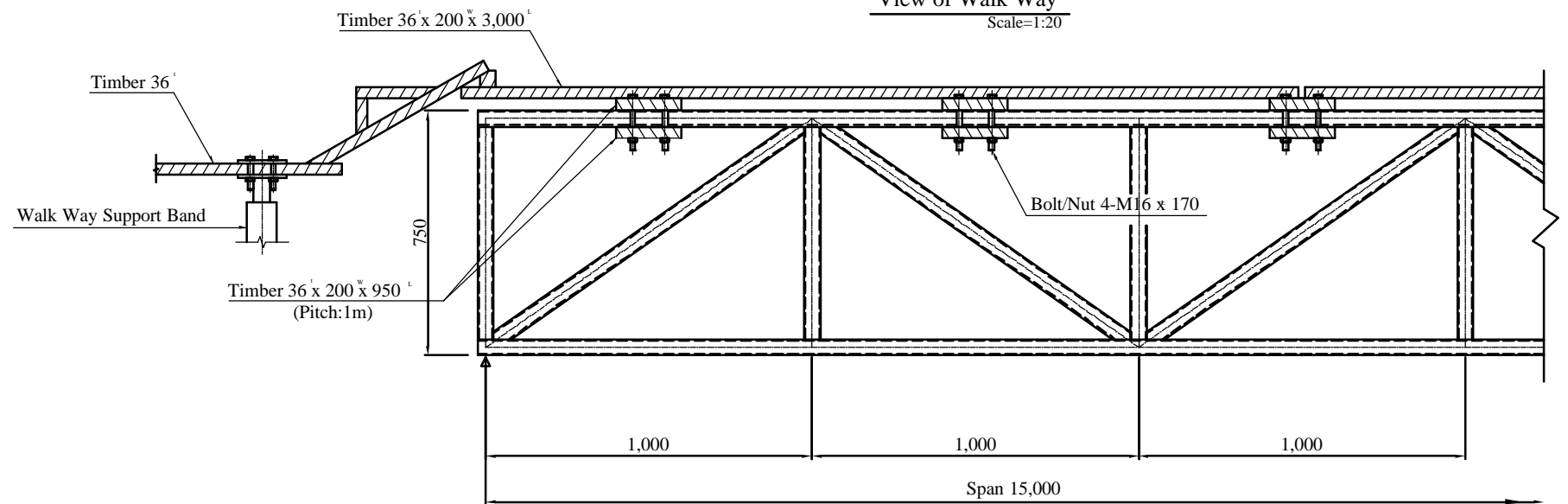
Plan of Walk Way  
Scale=1:20



Section A-A  
Scale=1:20





View of Walk Way  
Scale=1:20



Walk Way (Type-B)  
歩廊 (タイプ-B)

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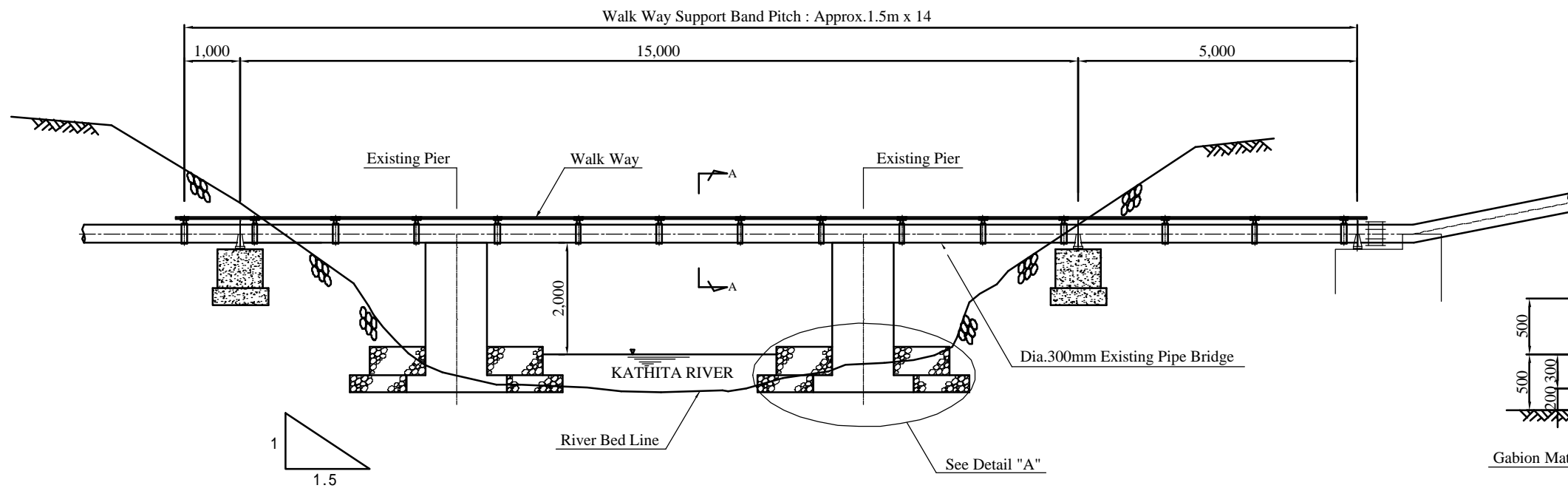
TITLE:  
RAW WATER MAIN  
PIPE BRIDGE WALKWAY

SCALE  
1:20  
1:100

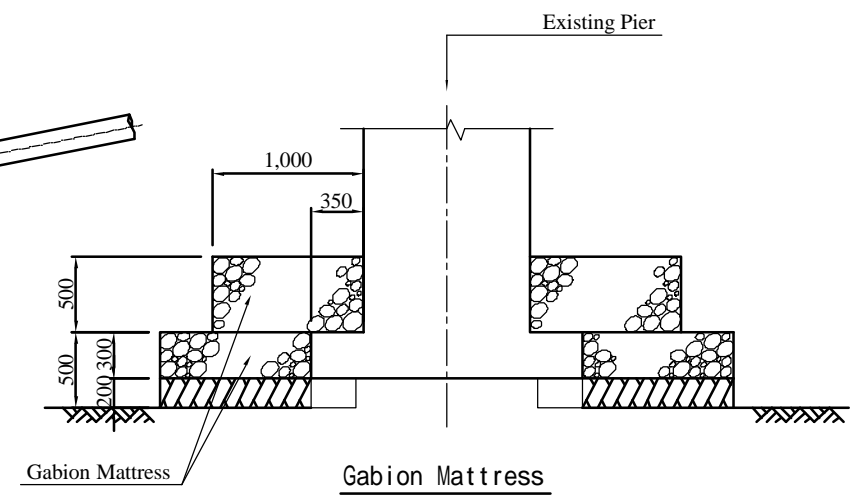
DATE  
30/01/2001

DRAWING NO.  
MWS-006

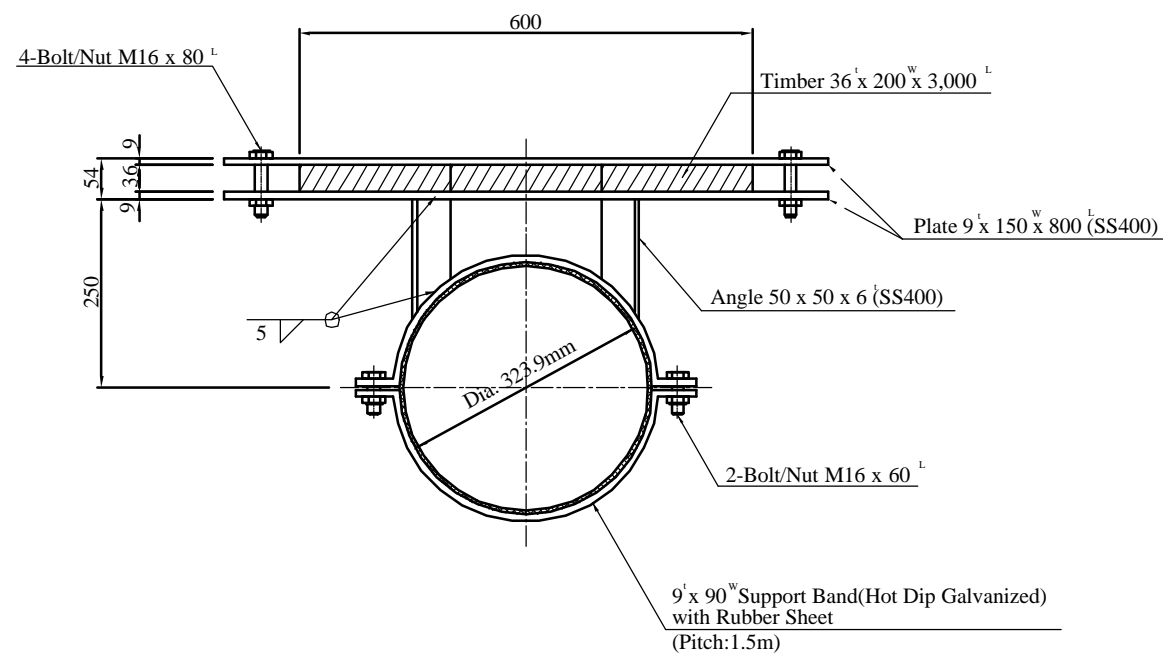
Longitudinal Section  
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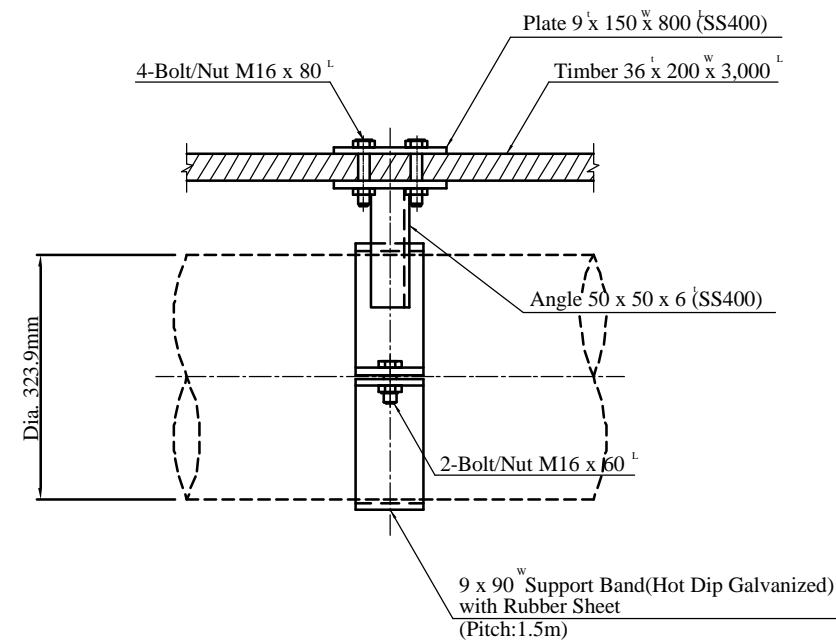
Detail "A"  
Scale=1:50



Section A-A  
Scale=1:10





Side View  
Scale=1:10



Walk Way (Type-A)  
歩廊 (タイプ-A)

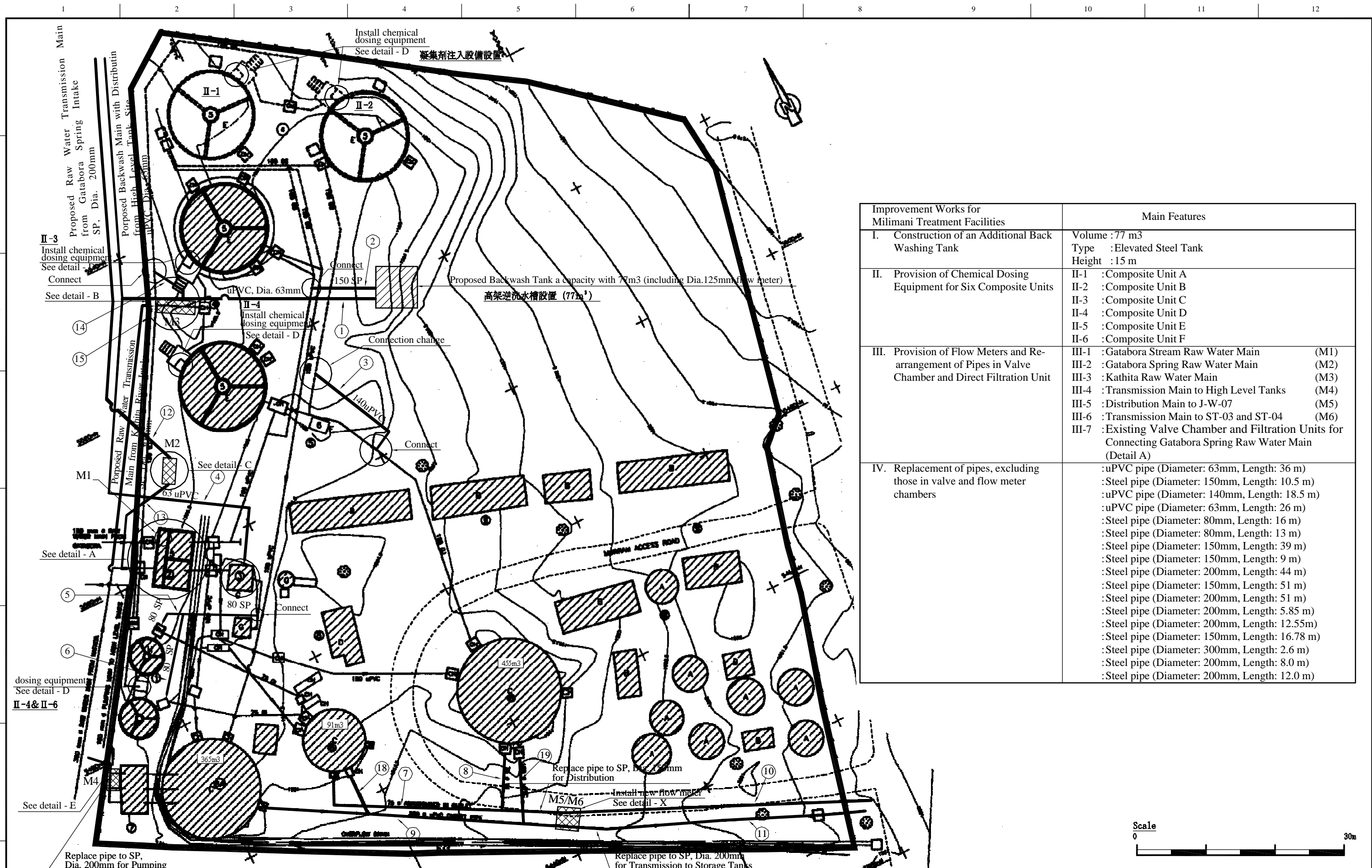
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THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE:  
RAW WATER MAIN  
PIPE BRIDGE REHABILITATION

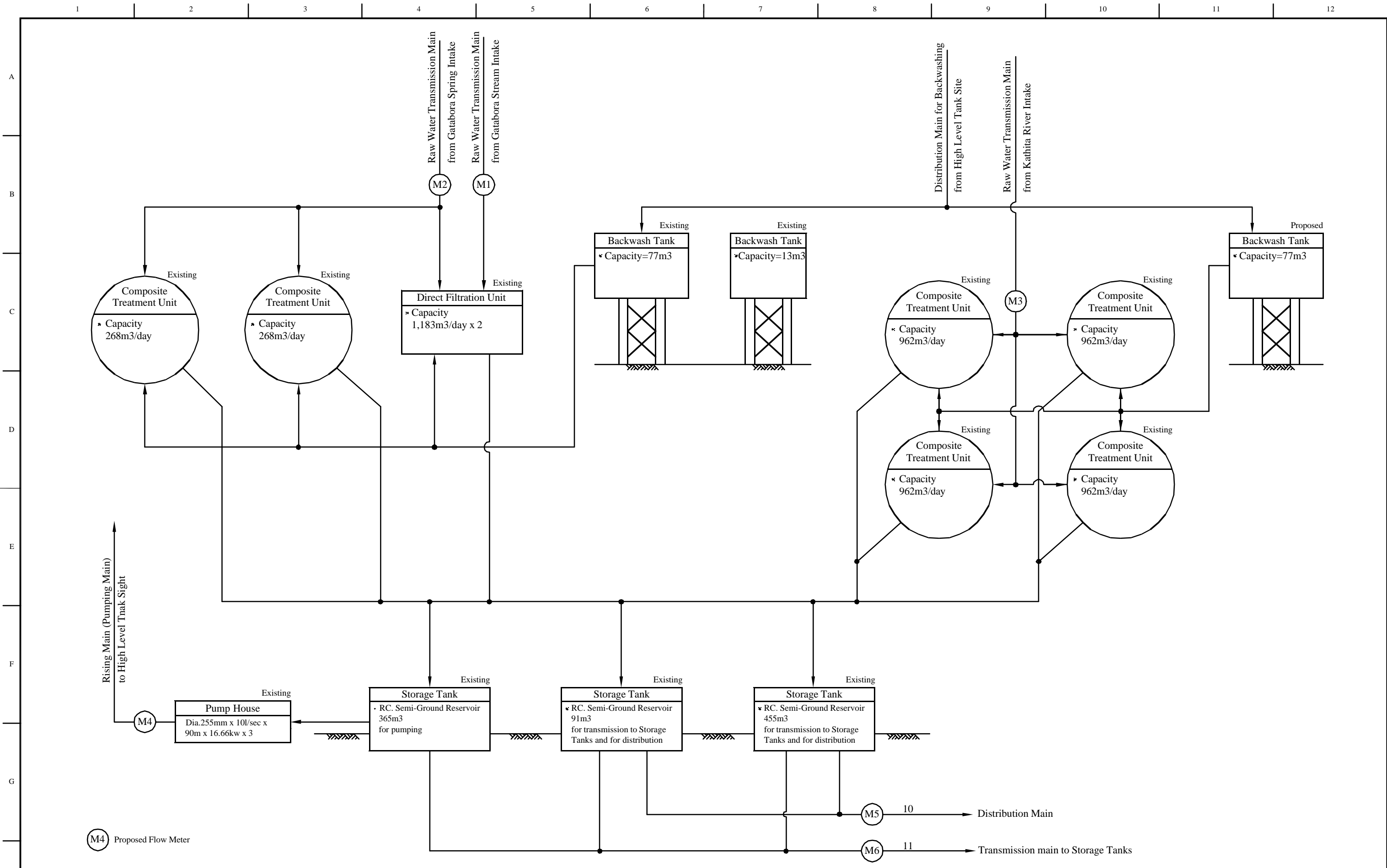
SCALE	DATE	DRAWING NO.
1 : 10 1 : 50 1 : 100	30 / 01 / 2001	MWS-007



Improvement Works for Milimani Treatment Facilities	Main Features
I. Construction of an Additional Back Washing Tank	Volume : 77 m <sup>3</sup> Type : Elevated Steel Tank Height : 15 m
II. Provision of Chemical Dosing Equipment for Six Composite Units	II-1 : Composite Unit A II-2 : Composite Unit B II-3 : Composite Unit C II-4 : Composite Unit D II-5 : Composite Unit E II-6 : Composite Unit F
III. Provision of Flow Meters and Re-arrangement of Pipes in Valve Chamber and Direct Filtration Unit	III-1 : Gatabora Stream Raw Water Main (M1) III-2 : Gatabora Spring Raw Water Main (M2) III-3 : Kathita Raw Water Main (M3) III-4 : Transmission Main to High Level Tanks (M4) III-5 : Distribution Main to J-W-07 (M5) III-6 : Transmission Main to ST-03 and ST-04 (M6) III-7 : Existing Valve Chamber and Filtration Units for Connecting Gatabora Spring Raw Water Main (Detail A)
IV. Replacement of pipes, excluding those in valve and flow meter chambers	: uPVC pipe (Diameter: 63mm, Length: 36 m) : Steel pipe (Diameter: 150mm, Length: 10.5 m) : uPVC pipe (Diameter: 140mm, Length: 18.5 m) : uPVC pipe (Diameter: 63mm, Length: 26 m) : Steel pipe (Diameter: 80mm, Length: 16 m) : Steel pipe (Diameter: 80mm, Length: 13 m) : Steel pipe (Diameter: 150mm, Length: 39 m) : Steel pipe (Diameter: 150mm, Length: 9 m) : Steel pipe (Diameter: 200mm, Length: 44 m) : Steel pipe (Diameter: 150mm, Length: 51 m) : Steel pipe (Diameter: 200mm, Length: 51 m) : Steel pipe (Diameter: 200mm, Length: 5.85 m) : Steel pipe (Diameter: 200mm, Length: 12.55m) : Steel pipe (Diameter: 150mm, Length: 16.78 m) : Steel pipe (Diameter: 300mm, Length: 2.6 m) : Steel pipe (Diameter: 200mm, Length: 8.0 m) : Steel pipe (Diameter: 200mm, Length: 12.0 m)





THE MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES THE REPUBLIC OF KENYA	THE STUDY ON MERU WATER SUPPLY PROJECT	NIPPON KOEI CO., LTD. NIHON SUIDO CONSULTANTS CO., LTD.	TITLE: WATER TREATMENT PLANT IMPROVEMENT PLAN		
	JAPAN INTERNATIONAL COOPERATION AGENCY		SCALE: 1 : 500	DATE: 30 / 01 / 2001	DRAWING NO.: MWS-008



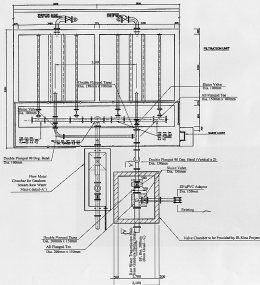
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THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

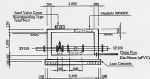
 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: WATER TREATMENT PLANT PROCESS FLOW		
SCALE	DATE	DRAWING NO.
NONE	30 / 01 / 2001	MWS-009

Detail - A

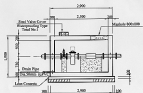
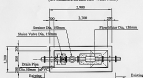


Section A - A



Detail A'

(At Gaskets Smooth Raw Water Side)



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THE STUDY ON MURU WATER BURY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY



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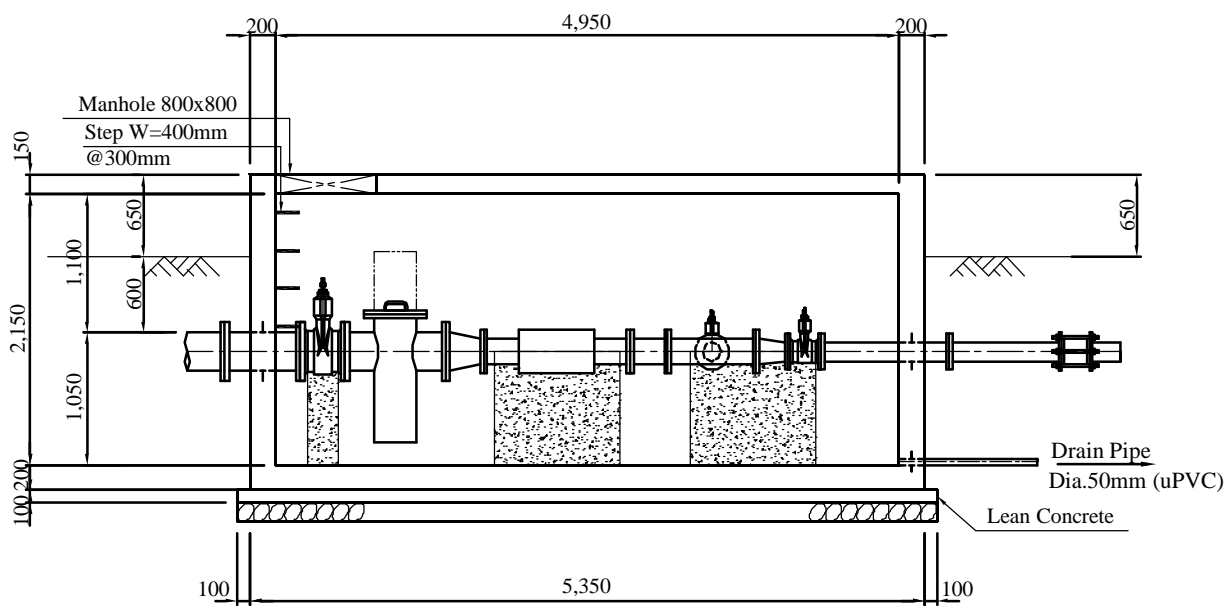
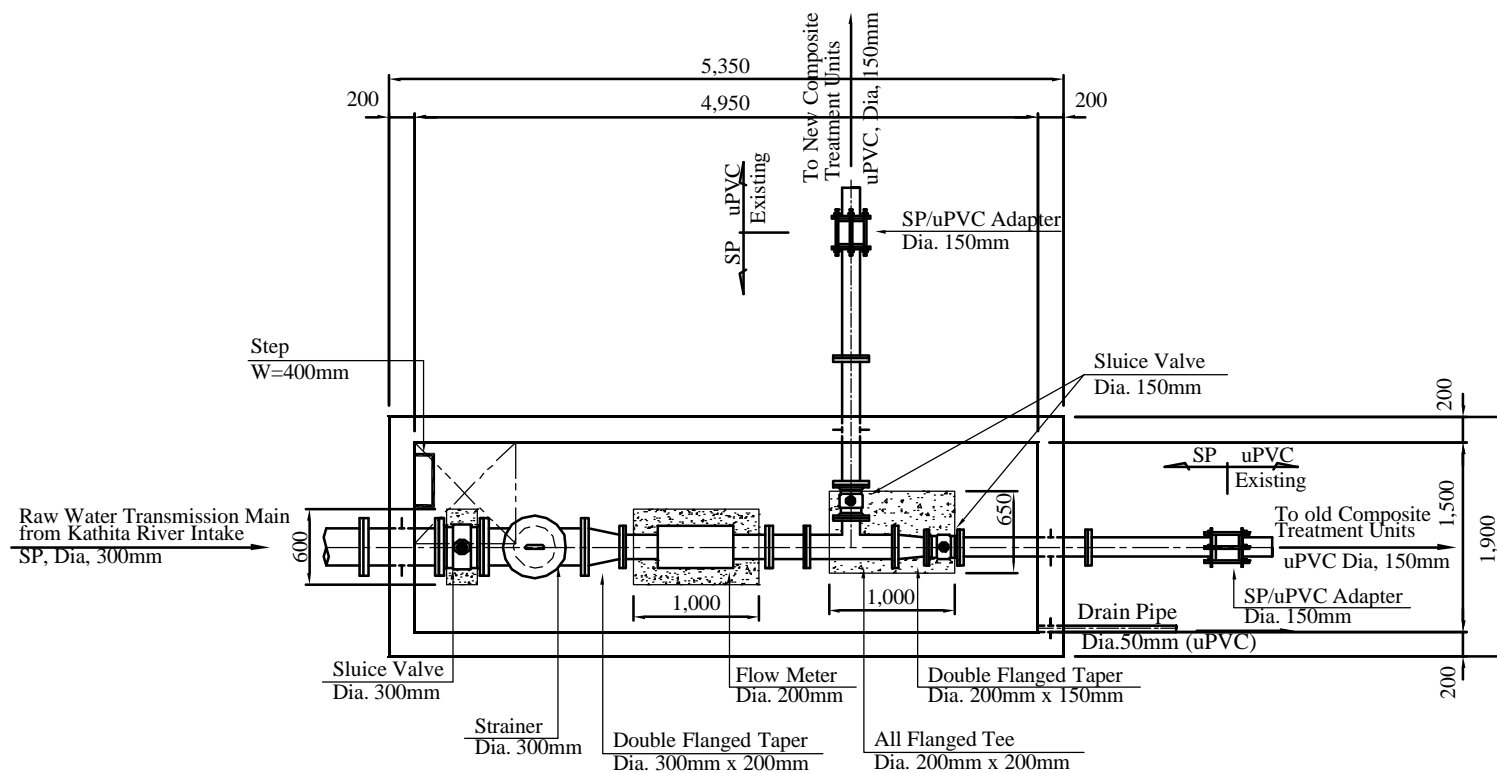
PROJECT: WATER TREATMENT PLANT  
DETAILS (3/3)

SCALE: 1:40

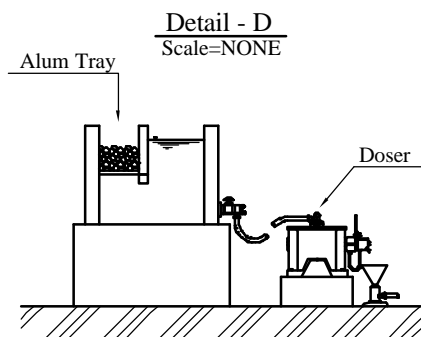
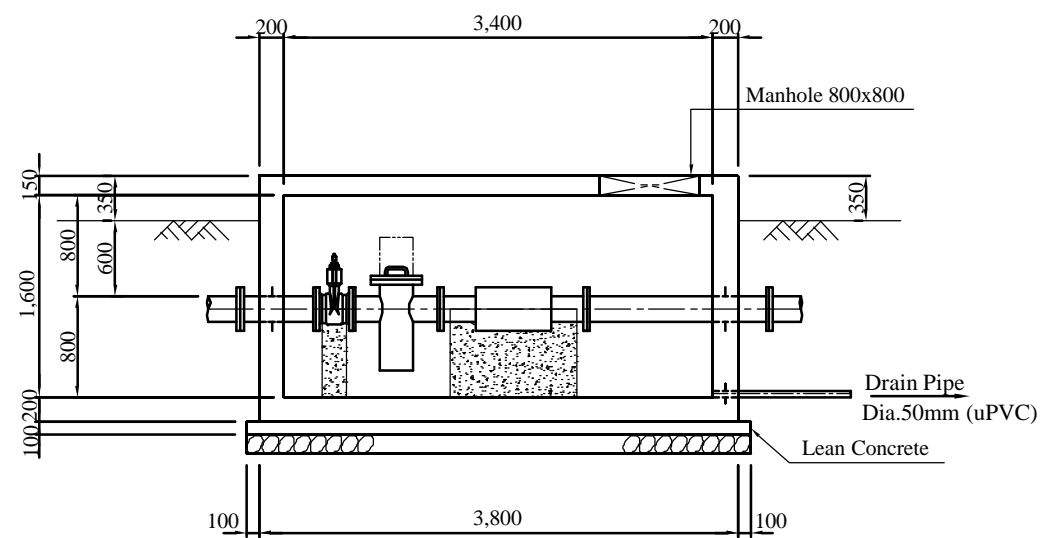
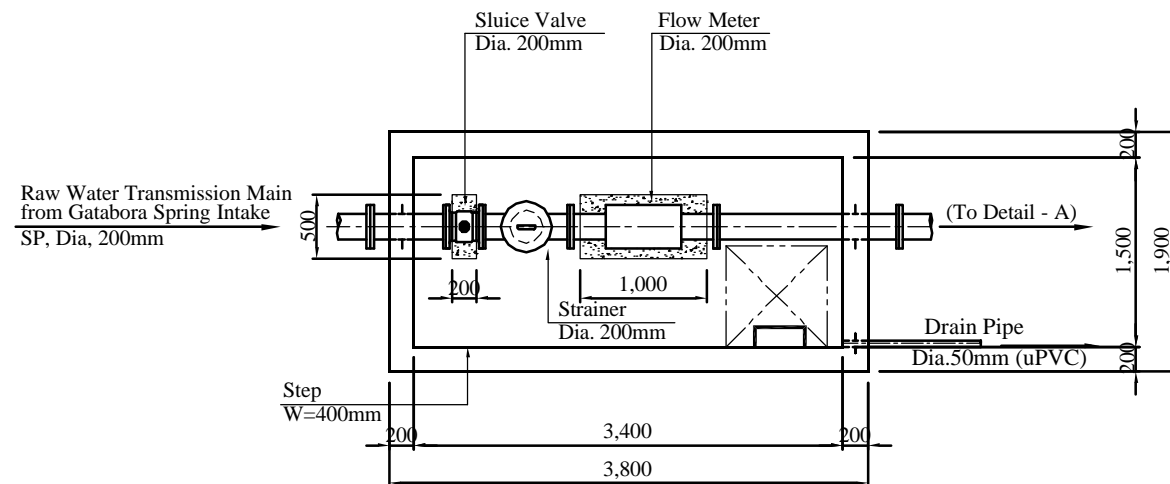
DATE: 30 / 01 / 2006

WORKING NO.  
MRG-030

Detail - B  
(Kathita Raw Water Main : M3)





Detail - C  
(Gatabora Spring Raw Water Main : M2)



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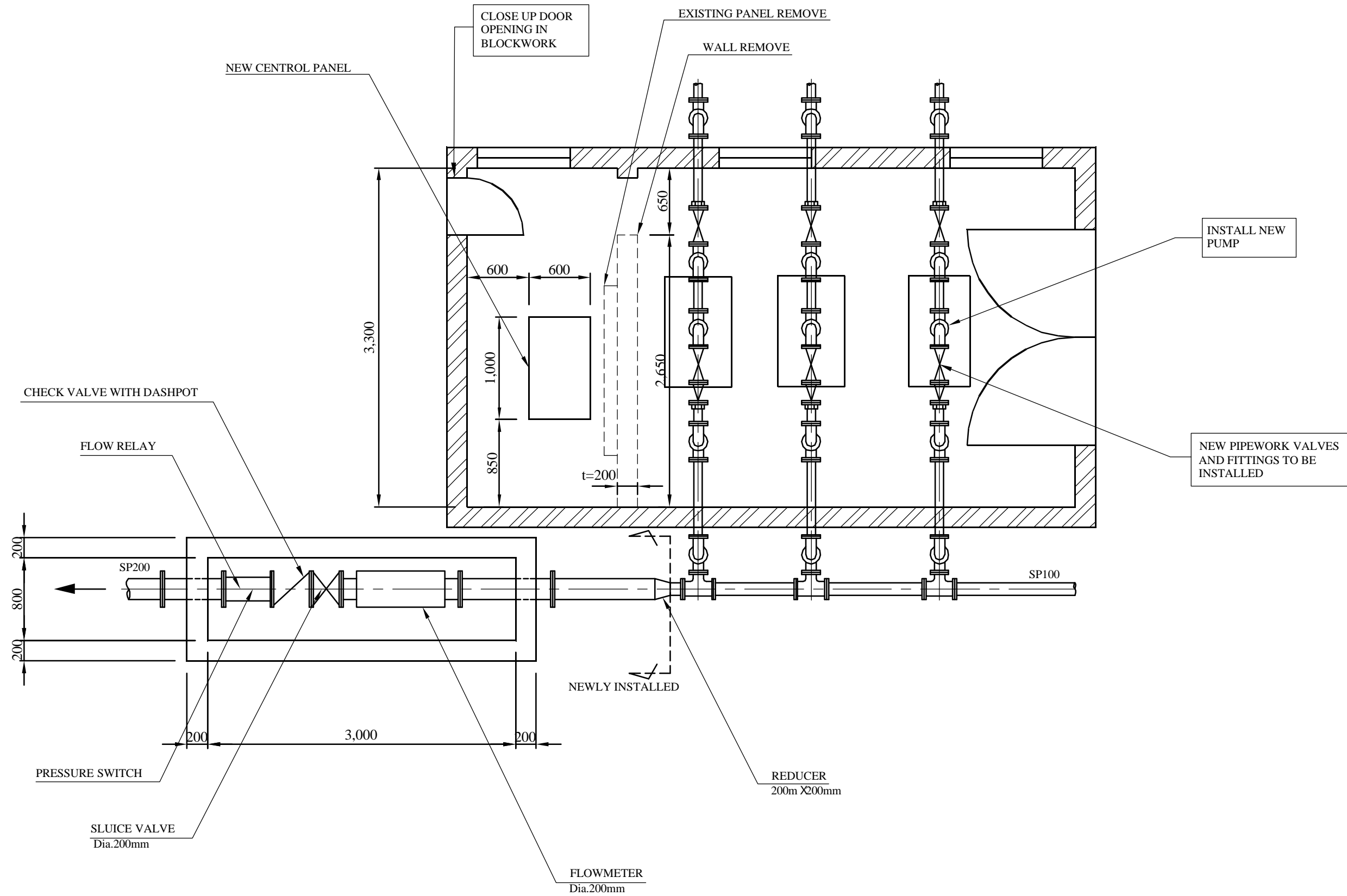
THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: WATER TREATMENT PLANT  
DETAILS (2/3)

SCALE	DATE	DRAWING NO.
1 : 60	30 / 01 / 2001	MWS-011

Detail - E



THE MINISTRY OF ENVIRONMENT  
AND NATURAL RESOURCES  
THE REPUBLIC OF KENYA

THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY



NIPPON KOEI CO., LTD.  
NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: WATER TREATMENT PLANT  
DETAILS (3/3)

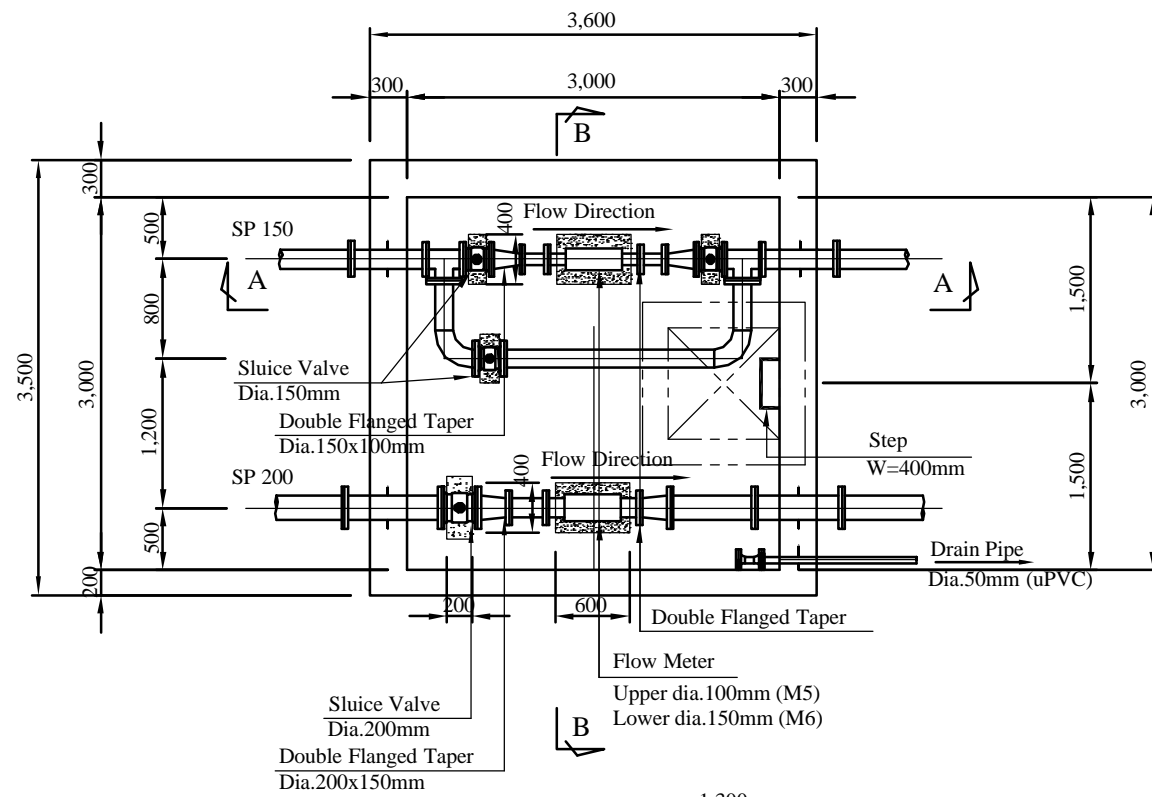
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DATE  
30 / 01 / 2001

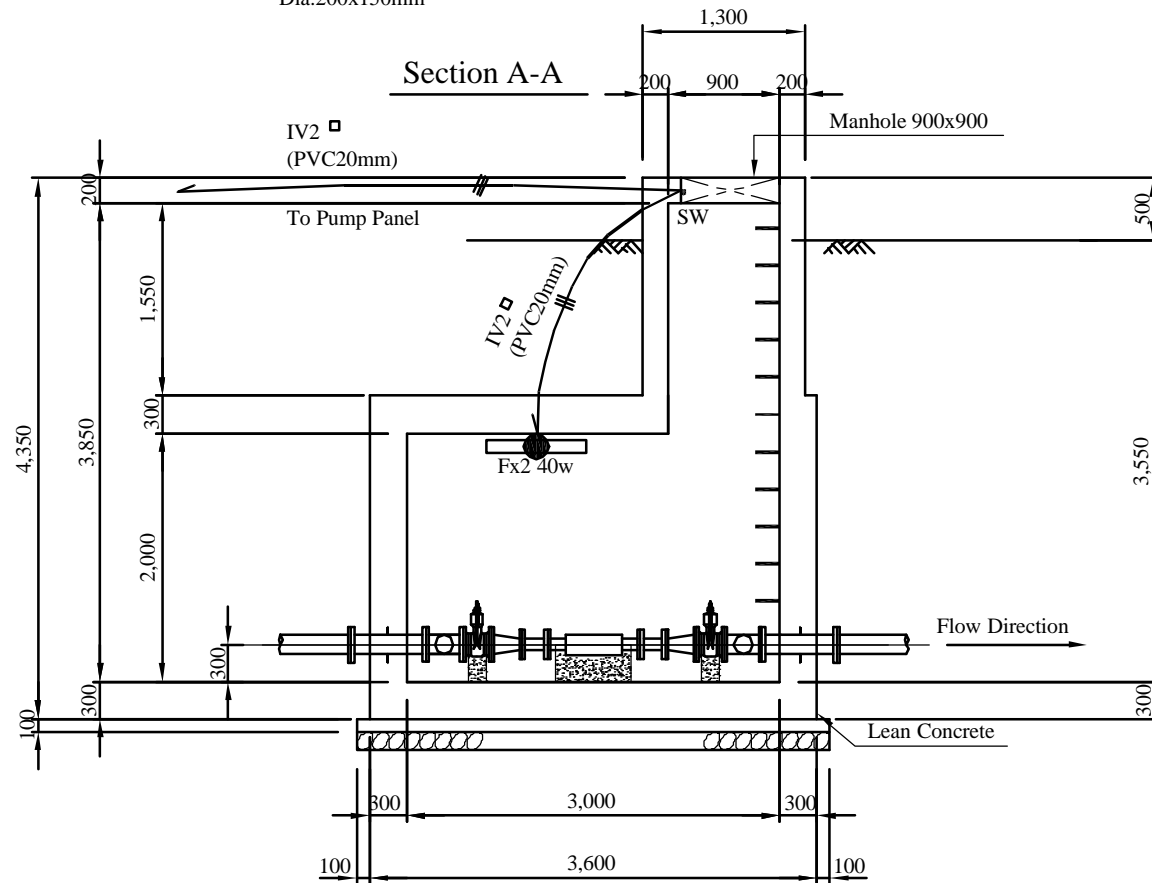
DRAWING NO.  
MWS-012



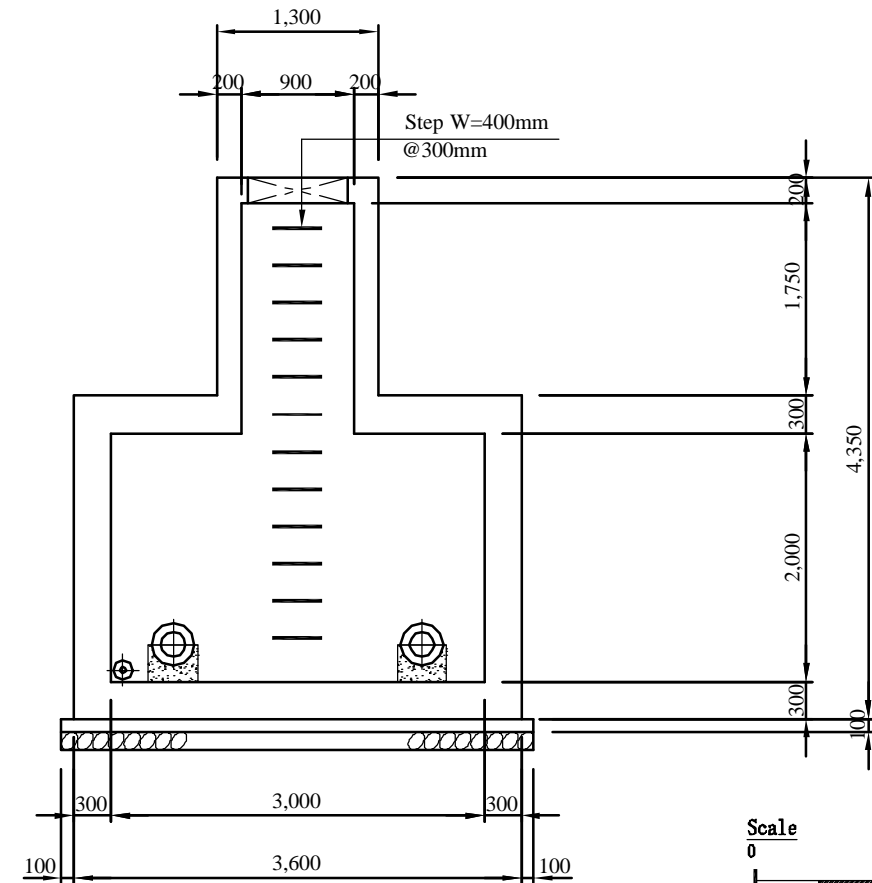
Detail - X (M5/M6)



Section A-A





Section B-B



THE MINISTRY OF ENVIRONMENT  
AND NATURAL RESOURCES  
THE REPUBLIC OF KENYA

THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

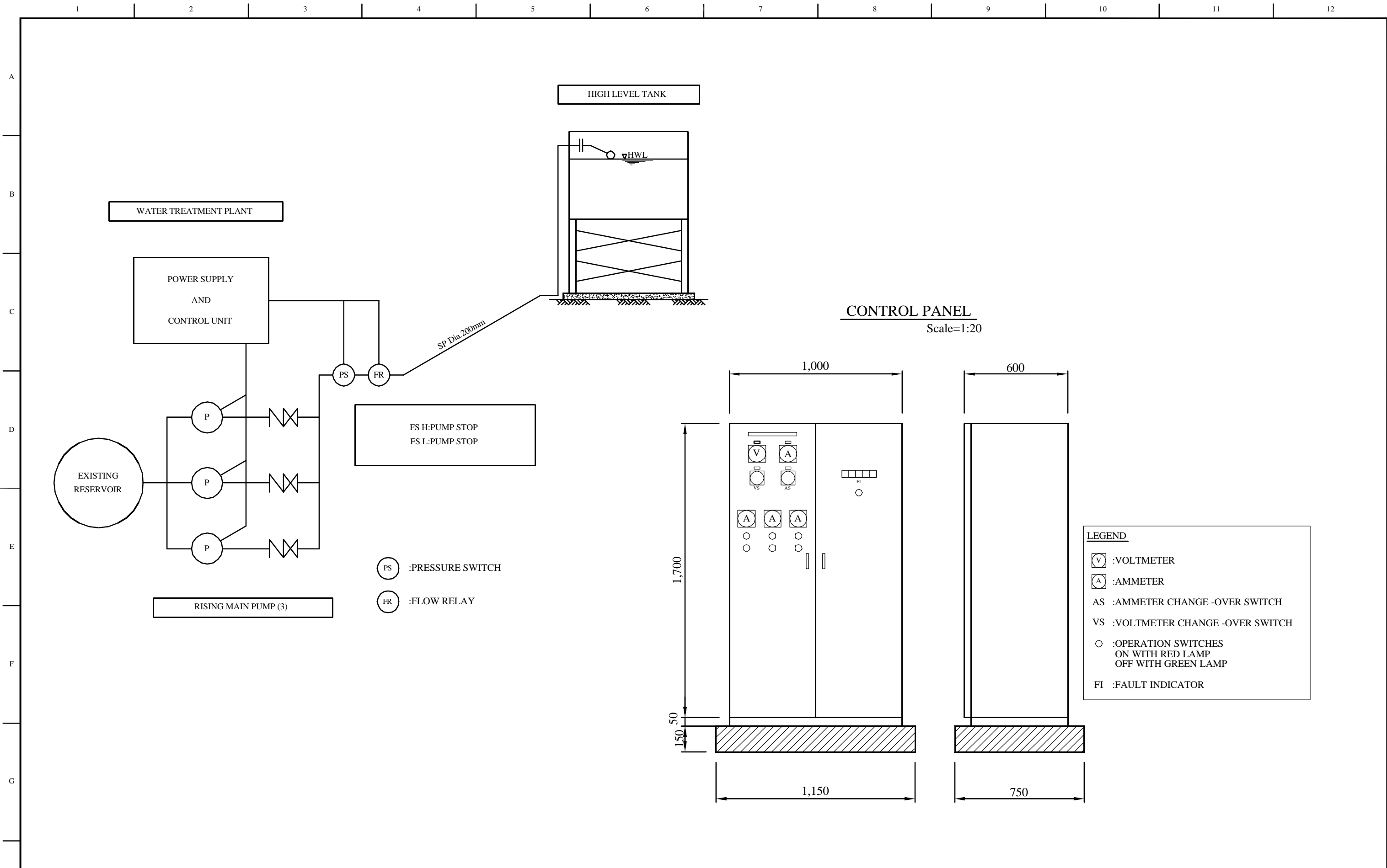
 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: WATER TREATMENT PLANT  
IMPROVEMENT PLAN

SCALE  
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DATE  
30 / 01 / 2001

DRAWING NO.  
MWS-013





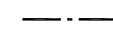





THE MINISTRY OF ENVIRONMENT  
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THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY


 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: WATER TREATMENT PLANT PUMPING CONTROL SYSTEM		
SCALE NONE	DATE 30 / 01 / 2001	DRAWING NO. MWS-014


**-Legend-**


-  Boundary of Supply Area
-  Existing Raw Water Transmission Main (from Gatabora Spring Intake, Gatabora Stream Intake and Kathita River Intake)
-  Replacement Raw Water Transmission Main (from Kathita River Intake)
-  Existing Raw Water Transmission Main (Stop using)
-  Proposed Raw Water Transmission Main (from Gatabora Spring Intake and Kathita River Intake)
-  Existing Rising Main (Pumping Main)
-  Proposed Rising Main (Pumping Main)
-  Treated Water Transmission Main


 Water Treatment Works (Q=6730m<sup>3</sup>/day, V=911m<sup>3</sup>)


 High Level Tank (V=450m<sup>3</sup>)


 Gatabora Spring Intake


 Gatabora Stream Intake


 Kathita River Intake


 Storage Tank (V=885m<sup>3</sup> Kinoro Primary School)

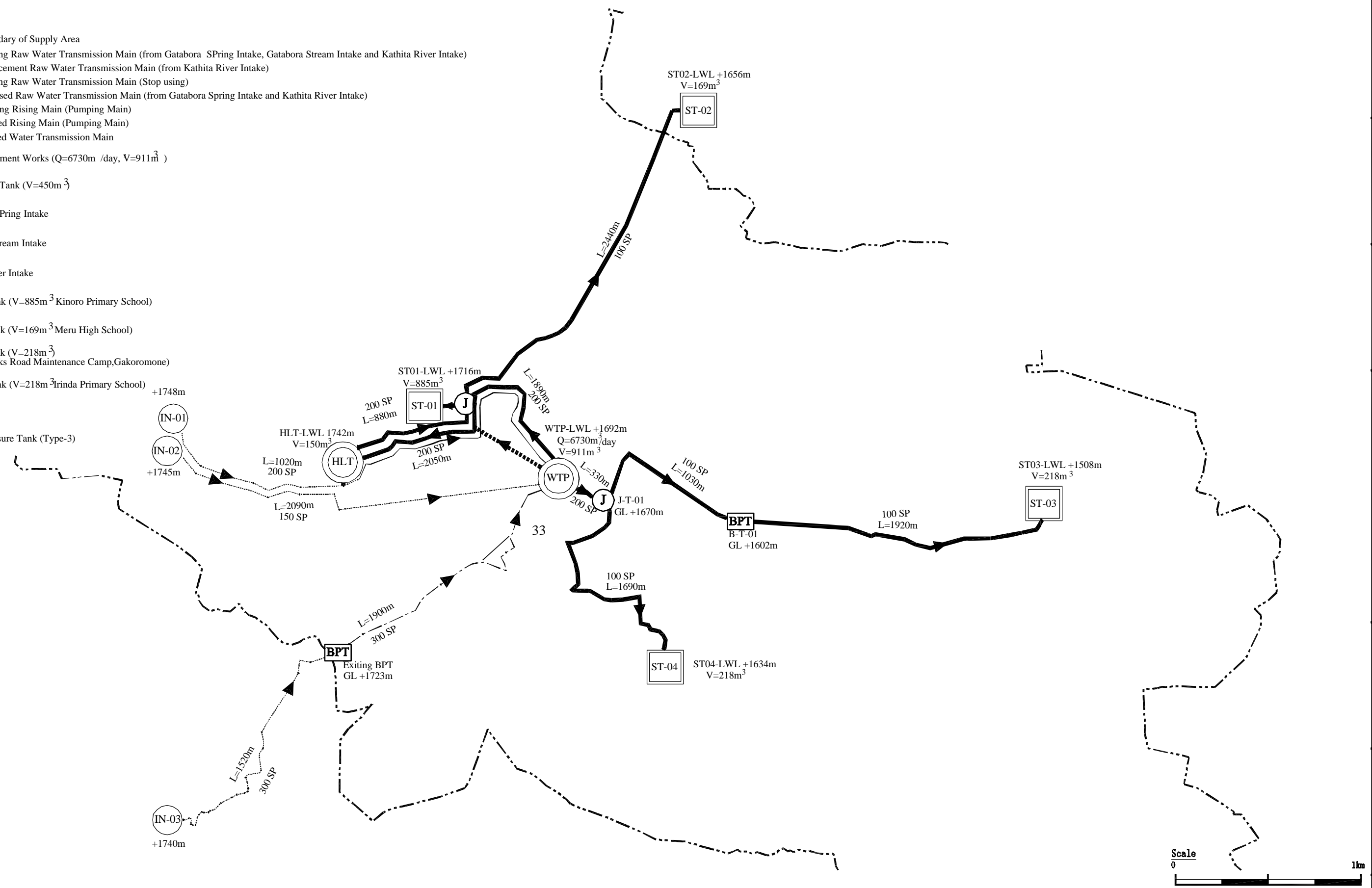
 Storage Tank (V=169m<sup>3</sup> Meru High School)

 Storage Tank (V=218m<sup>3</sup> Public works Road Maintenance Camp, Gakoromone)

 Storage Tank (V=218m<sup>3</sup> Irinda Primary School)

 Junction

 Break Pressure Tank (Type-3)



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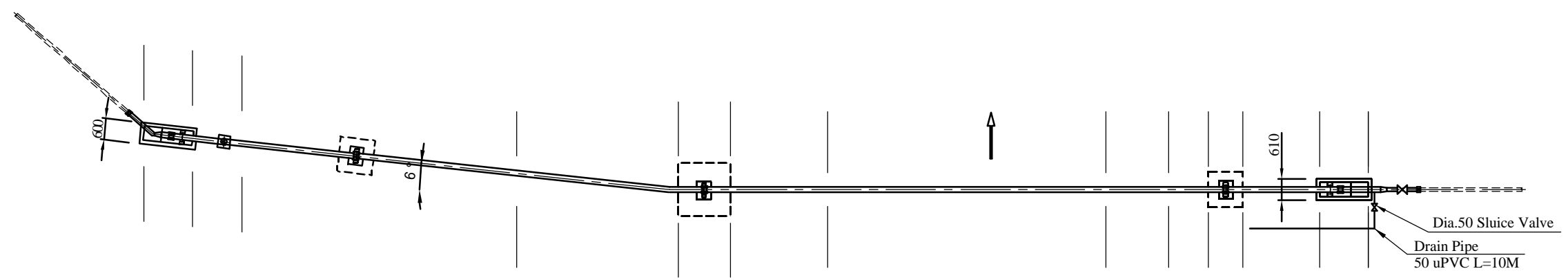
TITLE:  
TRANSMISSION MAIN  
GENERAL PLAN

SCALE  
1 : 20,000

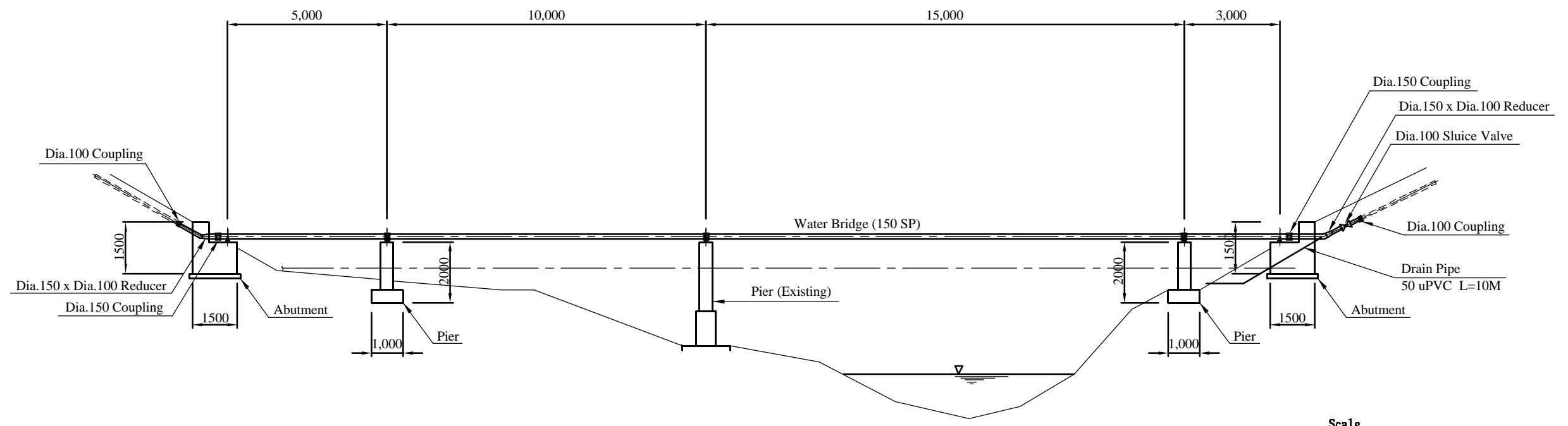
DATE  
30 / 01 / 2001

DRAWING NO.  
MWS-015

Plan





Longitudinal Section



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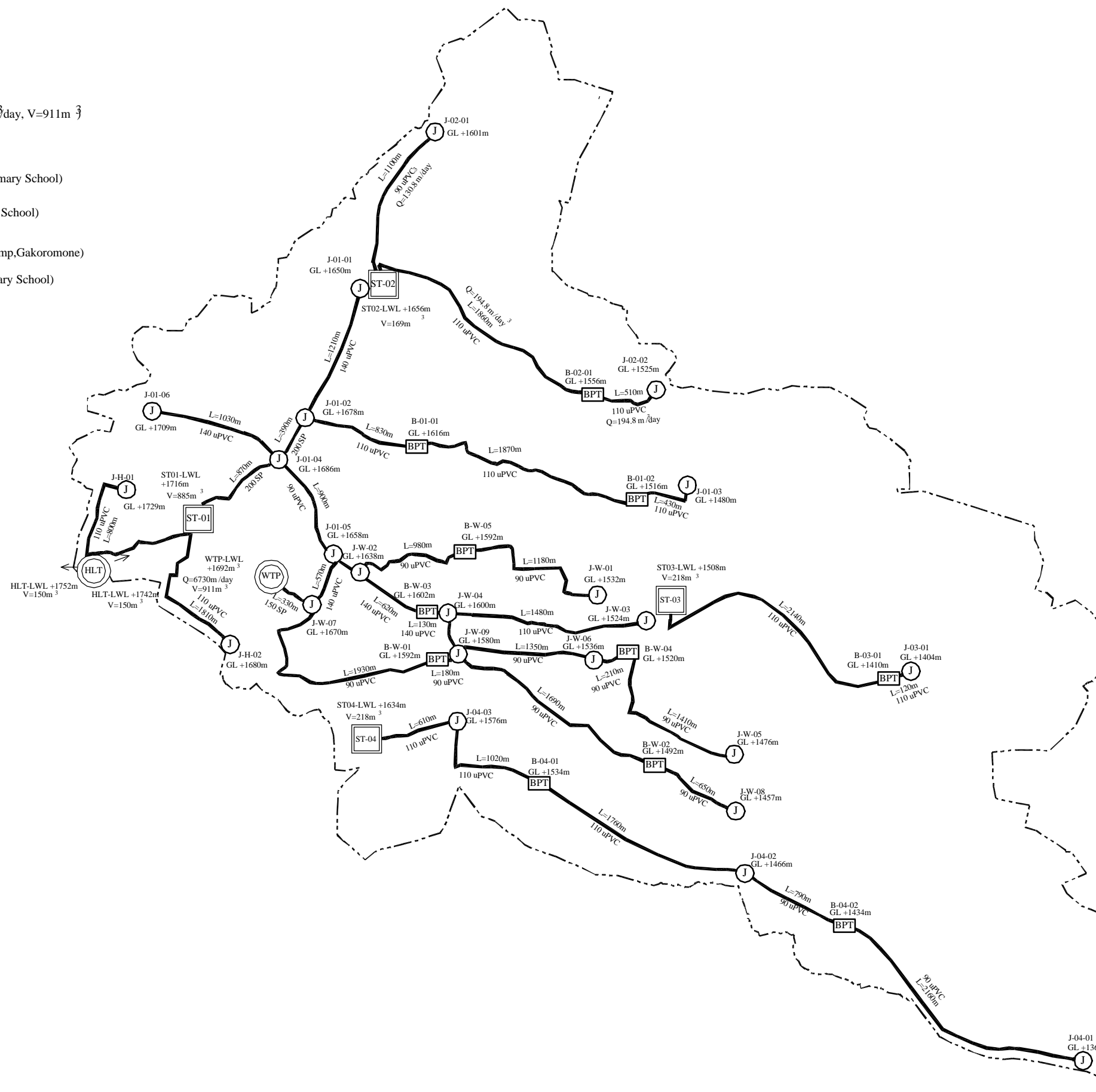
THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: <u>TRANSMISSION MAIN PIPE BRIDGE</u>		
SCALE 1 : 150	DATE 30 / 01 / 2001	DRAWING NO. MWS-016

**-Legend-**

- Boundary of Supply Area
- Distribution Main
- Water Treatment Works (Q=6730m<sup>3</sup>/day, V=911m<sup>3</sup>)
- High Level Tank (V=450m<sup>3</sup>)
- Storage Tank (V=885m<sup>3</sup> Kinoro Primary School)
- Storage Tank (V=169m<sup>3</sup> Meru High School)
- Storage Tank (V=432m<sup>3</sup> (Public works Road Maintenance Camp, Gakoromone)
- Storage Tank (V=218m<sup>3</sup> Irinda Primary School)
- Junction
- Break Pressure Tank



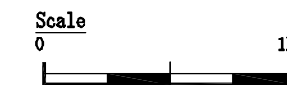
**Length of Distribution Mains**

Line Code Number	Steel Pipe(m)			uPVC (m)		
	200A	150A	100A	140A	110A	90A
HLT	0	0	0	0	800	0
HLT	0	0	0	0	1,810	0
J-01-02	0	0	0	1,210	0	0
J-01-02	0	0	0	0	3,130	0
J-01-04	390	0	0	0	0	0
J-01-04	0	0	0	0	0	900
J-01-04	0	0	0	1,030	0	0
ST-01	870	0	0	0	0	0
Sub-Total	1,260	0	0	2,240	5,740	900
J-W-02	0	0	0	0	0	2,180
J-W-04	0	0	0	0	1,480	0
J-W-04	0	0	0	0	0	2,970
J-W-02	0	0	0	750	0	0
J-W-07	0	0	0	570	0	0
J-W-07	0	0	0	0	0	4,450
WTP	0	330	0	0	0	0
ST-02	0	0	0	0	0	1,100
ST-02	0	0	0	0	2,370	0
ST-03	0	0	0	0	0	2,260
ST-04	0	0	0	0	3,390	2,950
Sub-Total	0	330	0	1,320	9,500	13,630
Total	1,260	330	0	3,560	15,240	14,530
Grand-Total				34,920		

**Break Pressure Tank for Distribution Mains**

No	Code No.	Inlet Pipe Diameter (mm)	Type
<b>First Phase</b>			
1	B-01-01	110	Type-2
2	B-01-02	110	Type-2
<b>Second Phase</b>			
3	B-02-01	110	Type-2
4	B-W-01	90	Type-1
5	B-W-02	90	Type-1
6	B-W-03	140	Type-4
7	B-W-04	90	Type-1
8	B-W-05	90	Type-1
9	B-03-01	110	Type-2
10	B-04-01	110	Type-2
11	B-04-02	90	Type-1

Note: Structures are shown in attached drawings (Drawing No. MWS-034)



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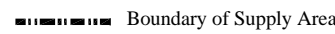
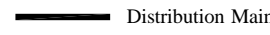
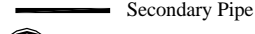
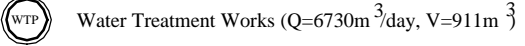

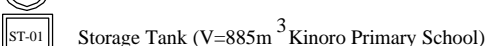
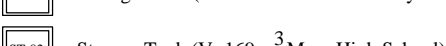
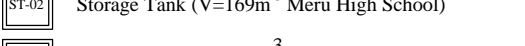
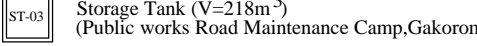

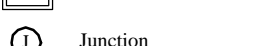
TITLE:  
DISTRIBUTION MAIN  
GENERAL PLAN

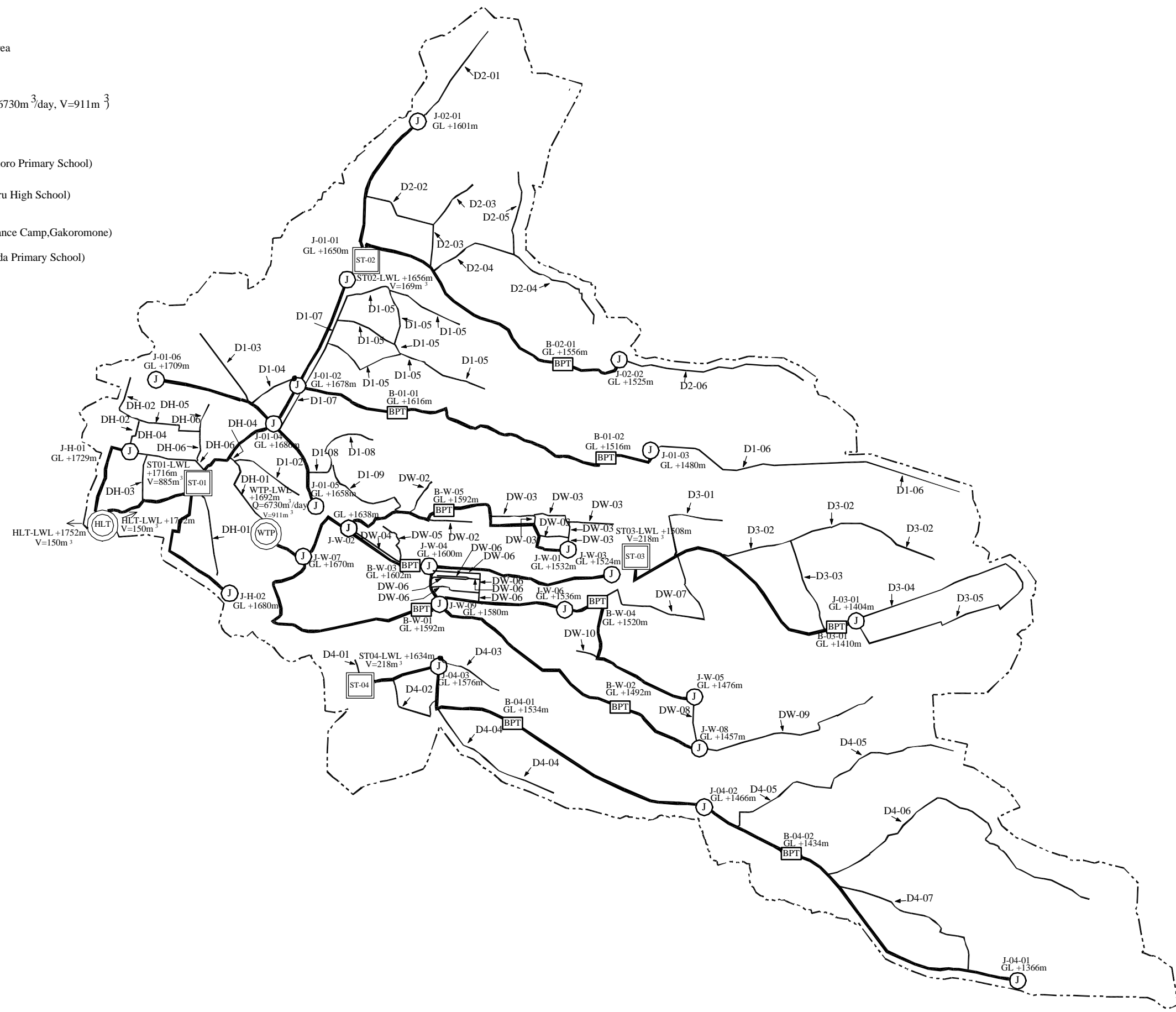
SCALE  
1 : 30,000

DATE  
30 / 01 / 2001

DRAWING NO.  
MWS-017

-Legend-

-  Boundary of Supply Area
-  Distribution Main
-  Secondary Pipe
-  Water Treatment Works (Q=6730m<sup>3</sup>/day, V=911m<sup>3</sup>)
-  High Level Tank (V=450m<sup>3</sup>)
-  Storage Tank (V=885m<sup>3</sup> Kinoro Primary School)
-  Storage Tank (V=169m<sup>3</sup> Meru High School)
-  Storage Tank (V=218m<sup>3</sup> (Public works Road Maintenance Camp,Gakoromone))
-  Storage Tank (V=218m<sup>3</sup> Irinda Primary School)
-  Junction
-  Break Pressure Tank





Distribution Block	Line Code	Length(m)
ST-HLT	DH-01	750
	DH-02	710
	DH-03	400
	DH-04	550
	DH-05	550
	DH-06	530
	Sub-Total	3,490
ST-01	DH-01	670
	DH-02	630
	DH-03	650
	DH-04	420
	DH-05	3,680
	DH-06	2,560
	DH-07	1,140
	DH-08	790
	DH-09	830
	Sub-Total	11,370
First Phase		14,860
ST-02	D2-01	950
	D2-02	620
	D2-03	790
	D2-04	1,730
	D2-05	680
	D2-06	1,500
	Sub-Total	6,270
ST-03	D3-01	750
	D3-02	1,850
	D3-03	780
	D3-04	1,270
	D3-05	1,890
	Sub-Total	6,540
ST-04	D4-01	150
	D4-02	640
	D4-03	610
	D4-04	1,180
	D4-05	2,040
	D4-06	2,680
	D4-07	1,390
	Sub-Total	8,690
ST-WTP	DW-01	320
	DW-02	390
	DW-03	1,540
	DW-04	470
	DW-05	400
	DW-06	1,730
	DW-07	1,500
	DW-08	390
	DW-09	1,530
	DW-10	180
	Sub-Total	8,450
Second Phase		29,950
Total		44,810

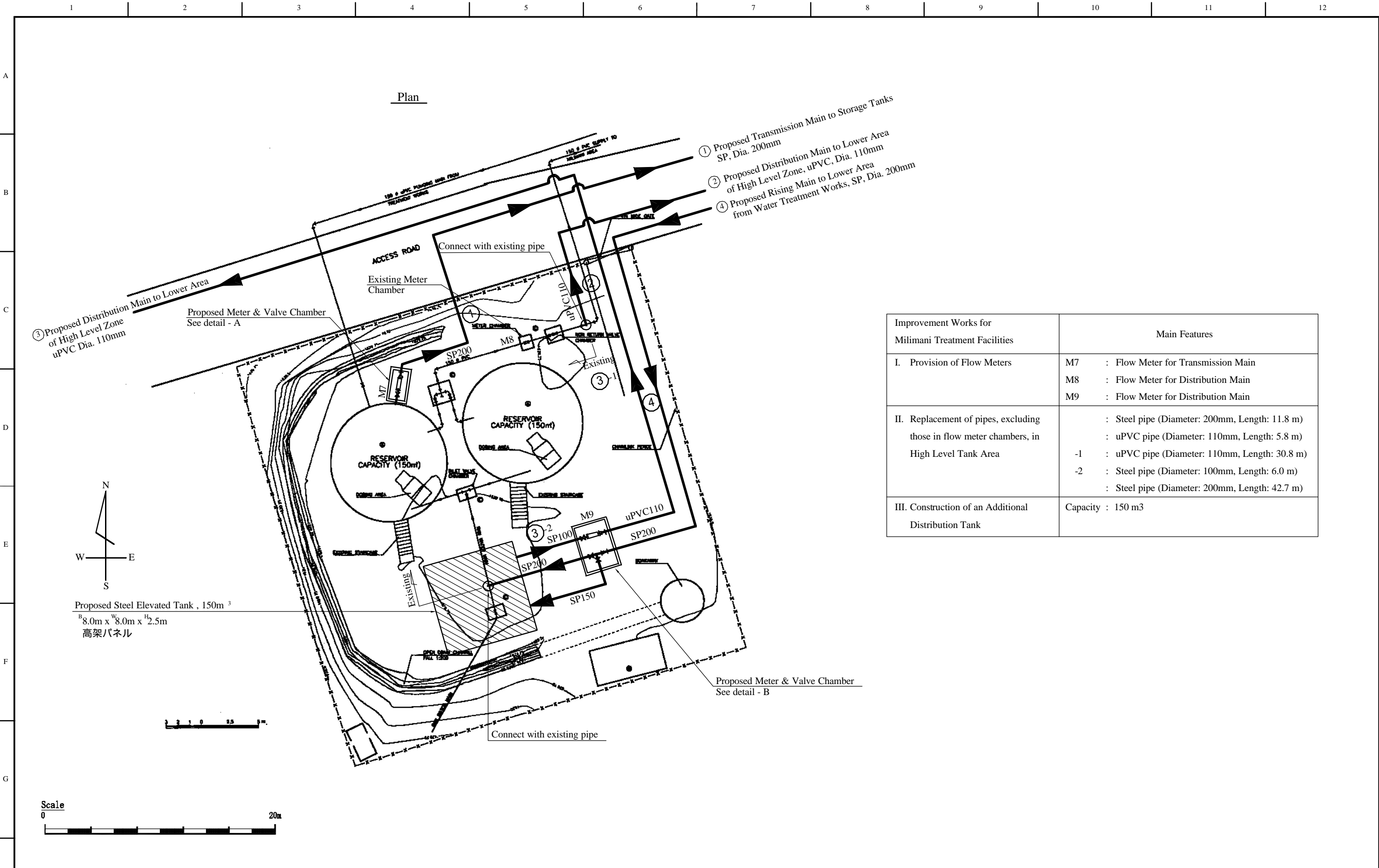


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TITLE: DISTRIBUTION MAIN SECONDARY PIPE PLAN		
SCALE 1 : 30,000	DATE 30 / 01 / 2001	DRAWING NO. MWS-018



Improvement Works for Milimani Treatment Facilities	Main Features
I. Provision of Flow Meters	M7 : Flow Meter for Transmission Main M8 : Flow Meter for Distribution Main M9 : Flow Meter for Distribution Main
II. Replacement of pipes, excluding those in flow meter chambers, in High Level Tank Area	: Steel pipe (Diameter: 200mm, Length: 11.8 m) : uPVC pipe (Diameter: 110mm, Length: 5.8 m) -1 : uPVC pipe (Diameter: 110mm, Length: 30.8 m) -2 : Steel pipe (Diameter: 100mm, Length: 6.0 m) : Steel pipe (Diameter: 200mm, Length: 42.7 m)
III. Construction of an Additional Distribution Tank	Capacity : 150 m <sup>3</sup>

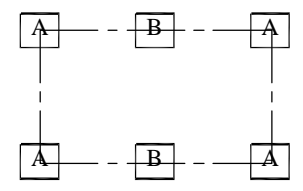
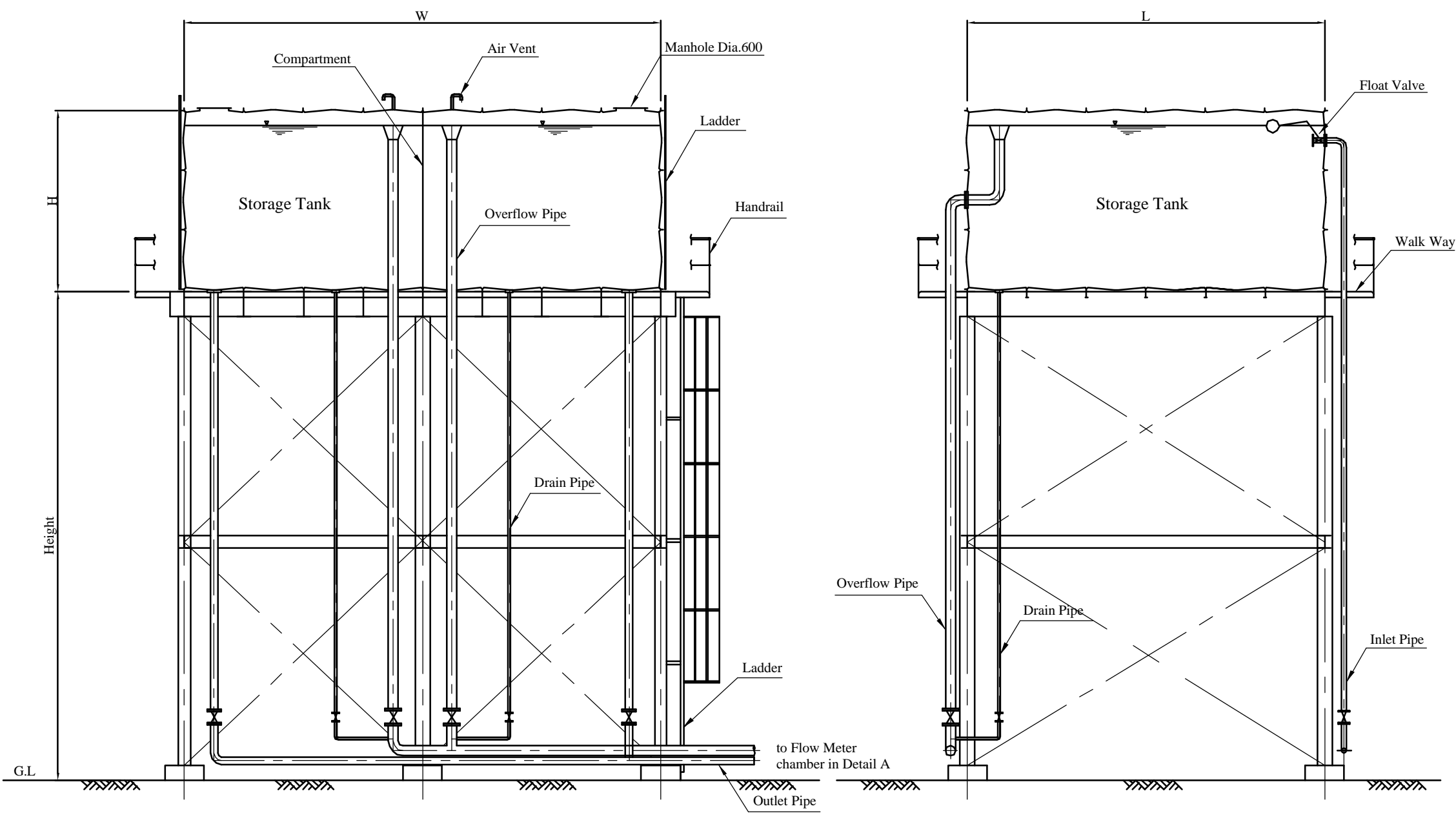
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THE STUDY ON MERU WATER SUPPLY PROJECT  
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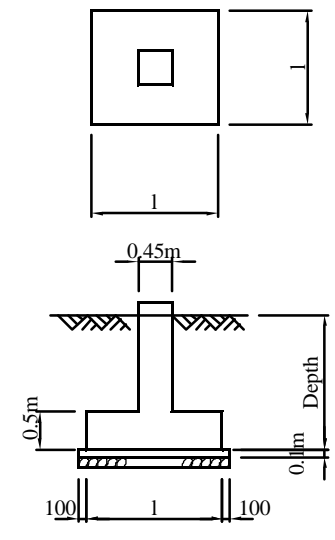
 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: DISTRIBUTION MAIN  
HIGH LEVEL TANK SITE

SCALE 1 : 300	DATE 30 / 01 / 2001	DRAWING NO. MWS-019
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Layout of Footing





Dimension of Footing

TANK ID	Design Volume of Tank V(m <sup>3</sup> )	W (m)	L (m)	H (m)
ST-02	170	7.32	7.32	3.66
ST-HLT	150	9.76	7.32	2.44
ST-WTP	77	7.32	4.88	2.44

Tank ID	Storage Volume (m <sup>3</sup> )	Dimension of Tank (m)				Basement		
		W	L	H	Height	Number of Footing	Depth (m)	Size of Basement (m)
ST-02	170	7.32	7.32	3.66	10	4	1.5	(A) l=1.6m (B) None
ST-HLT	150	9.76	7.32	2.44	10	6	1.5	(A) l=1.2m (B) l=1.7m
Back Washing Tank	77	7.32	4.88	2.44	15	4	2.0	(A) l=1.5m (B) None

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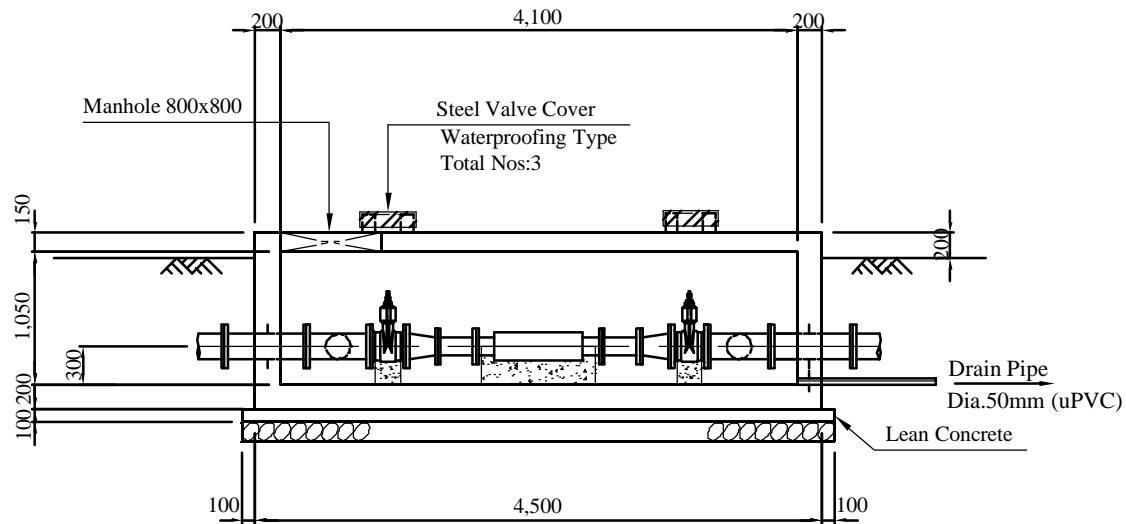
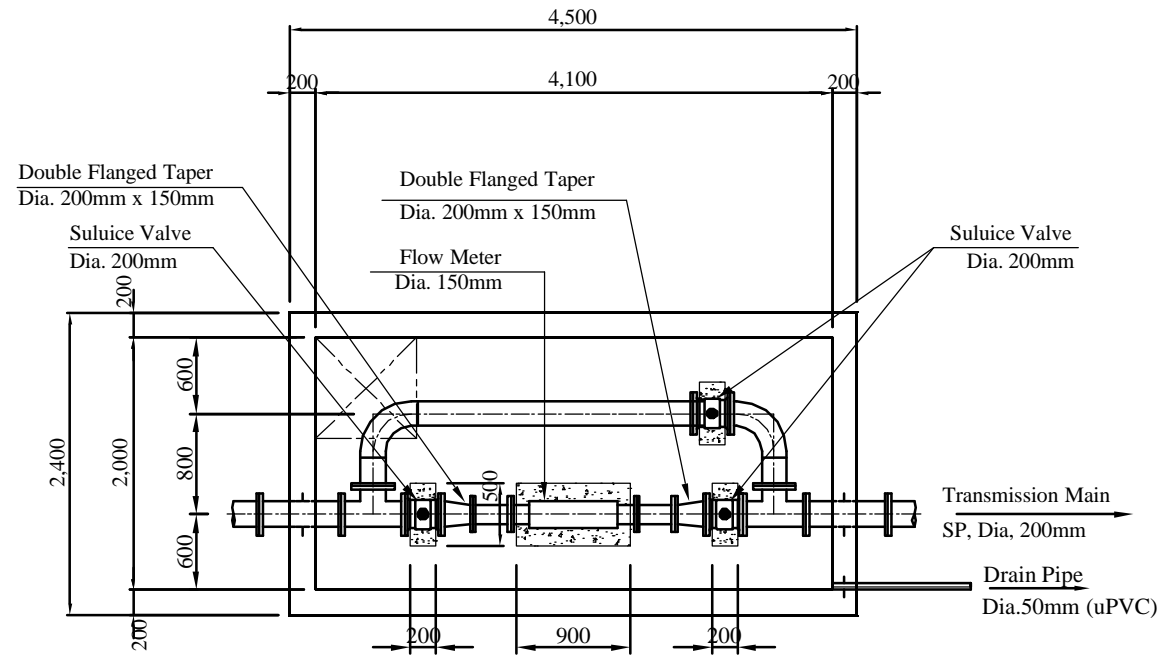
THE STUDY ON MERU WATER SUPPLY PROJECT  
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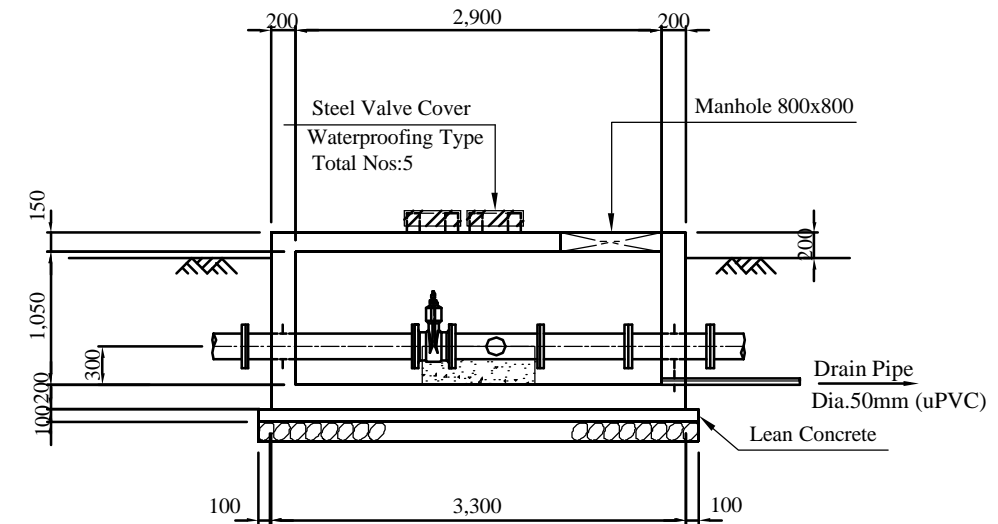
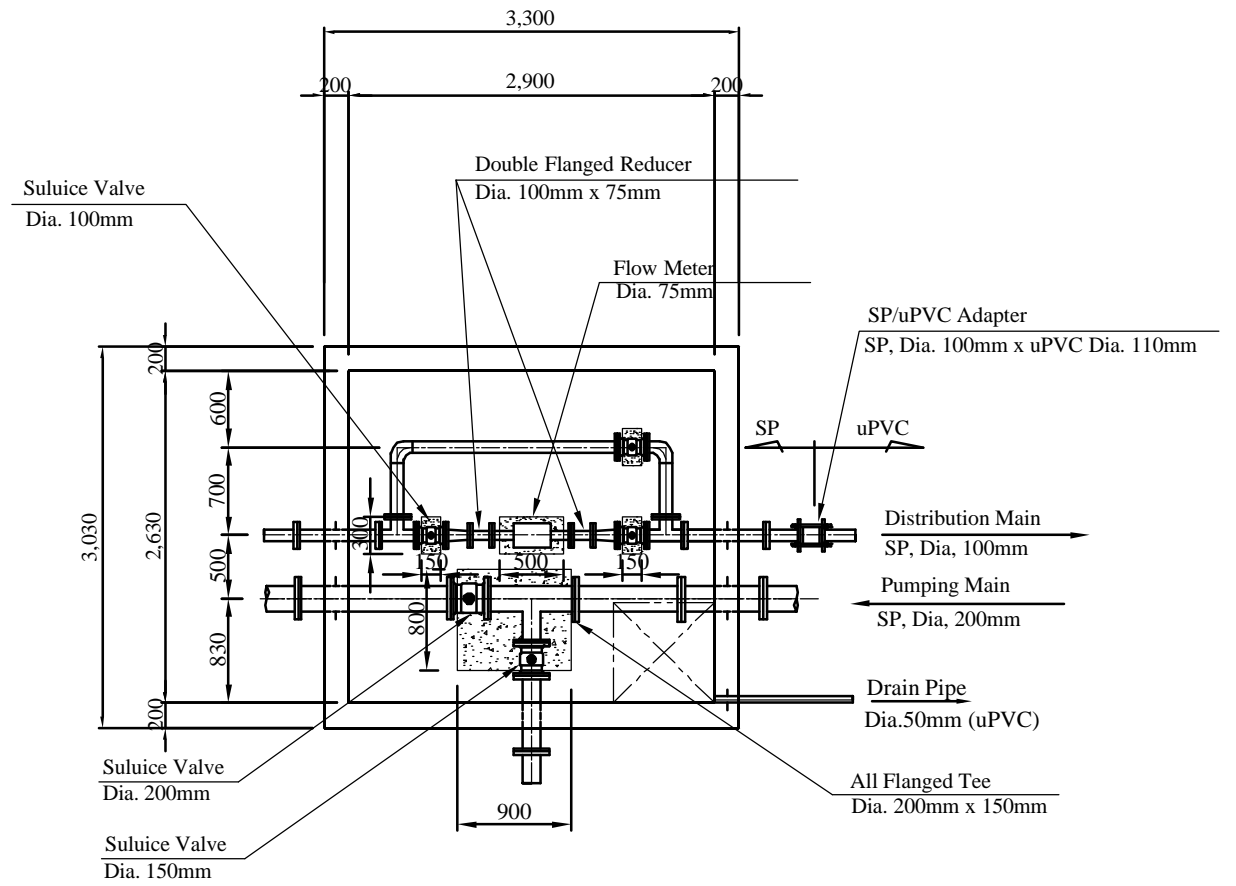
TITLE: DISTRIBUTION MAIN HIGH LEVEL TANK (1/2)		
SCALE NONE	DATE 30 / 01 / 2001	DRAWING NO. MWS-020



**Detail - A**  
M-7 (Transmission Main)





**Detail - B**  
M-9 (Transmission and Distribution Mains)



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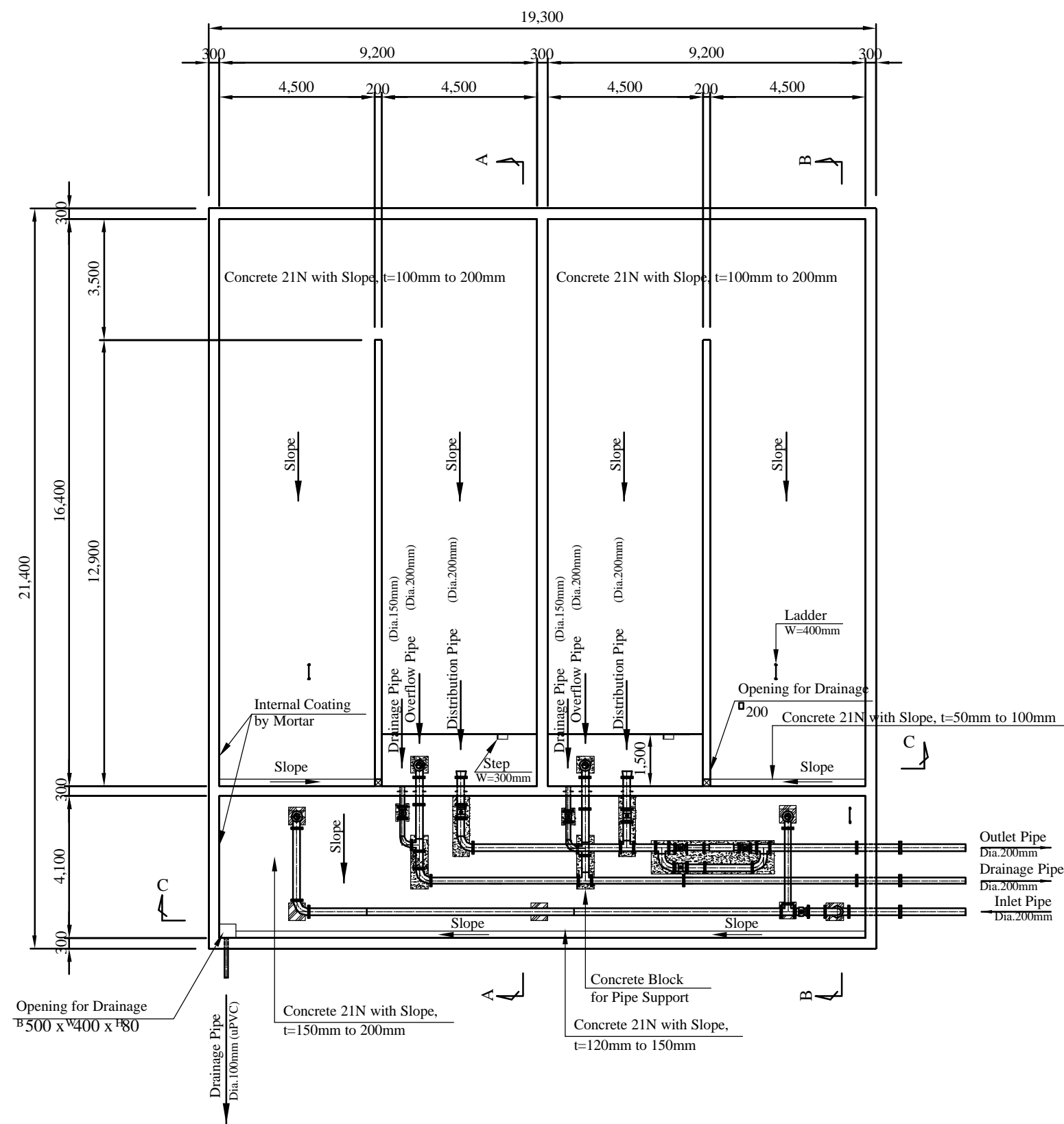
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DISTRIBUTION MAIN  
HIGH LEVEL TANK

SCALE  
1 : 60

DATE  
30 / 01 / 2001



DRAWING NO.  
MWS-021

Plan-1



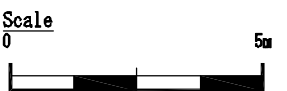
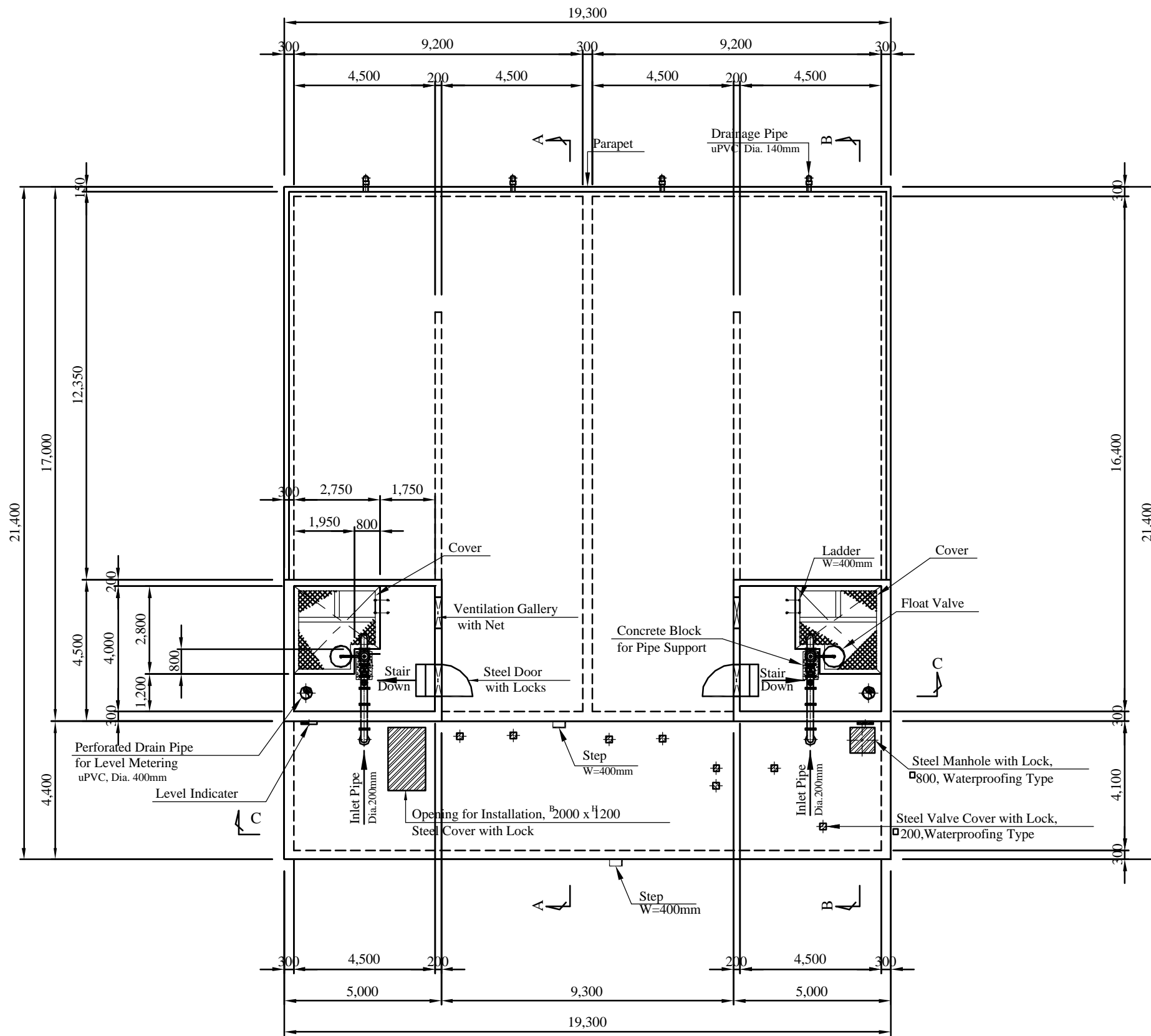
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TITLE: DISTRIBUTION MAIN STORAGE TANK 885M3 (1/5)		
SCALE 1 : 150	DATE 30 / 01 / 2001	DRAWING NO. MWS-022

Plan-2



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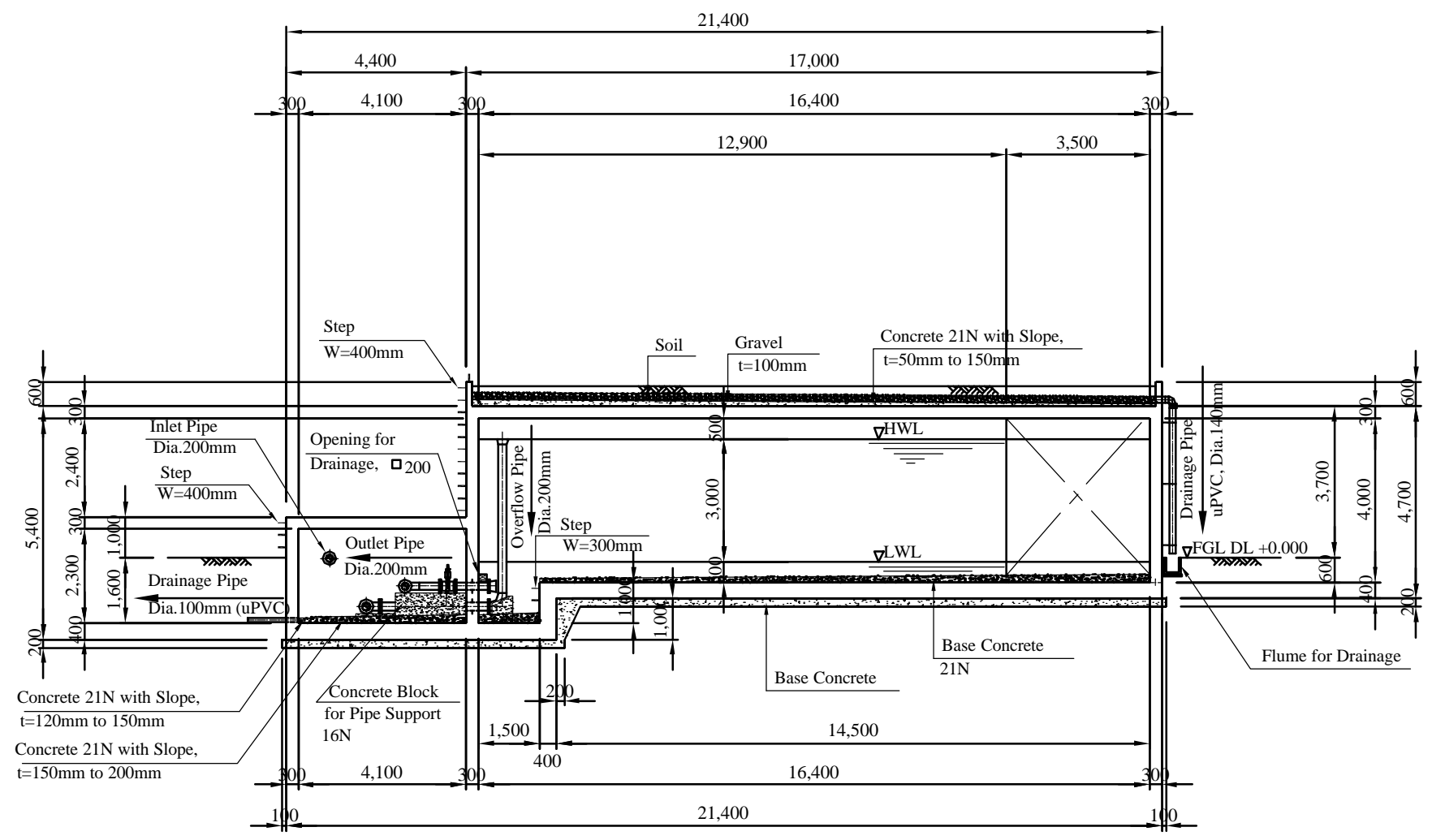
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DISTRIBUTION MAIN  
STORAGE TANK 885M3 (2/5)

SCALE  
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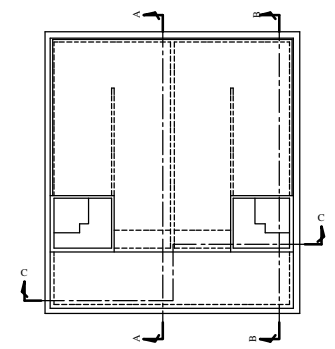
DATE  
30 / 01 / 2001

DRAWING NO.  
MWS-023

Section A-A





KEY PLAN



Note : PVC Water stop to be placed in vertical construction joint

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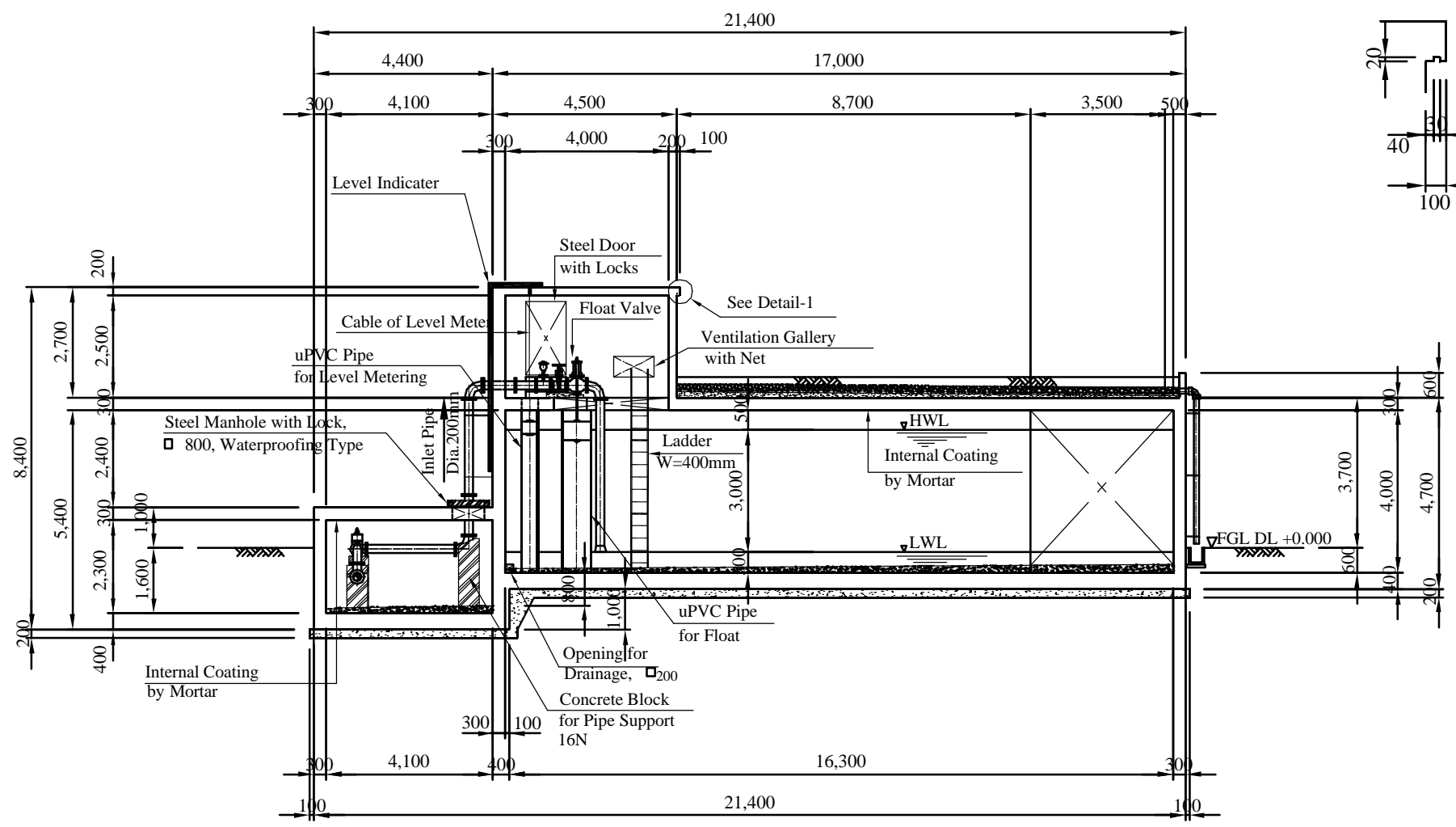
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STORAGE TANK 885M3 (3/5)

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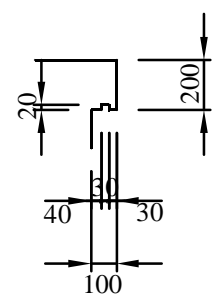
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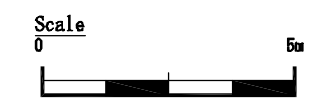
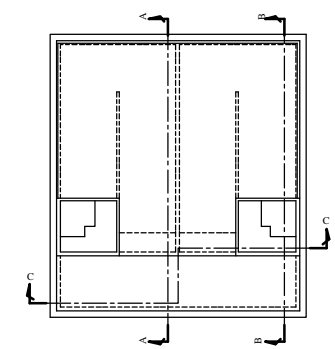
**Section B-B**



**Detail-1**  
Scale=1:30





**KEY PLAN**



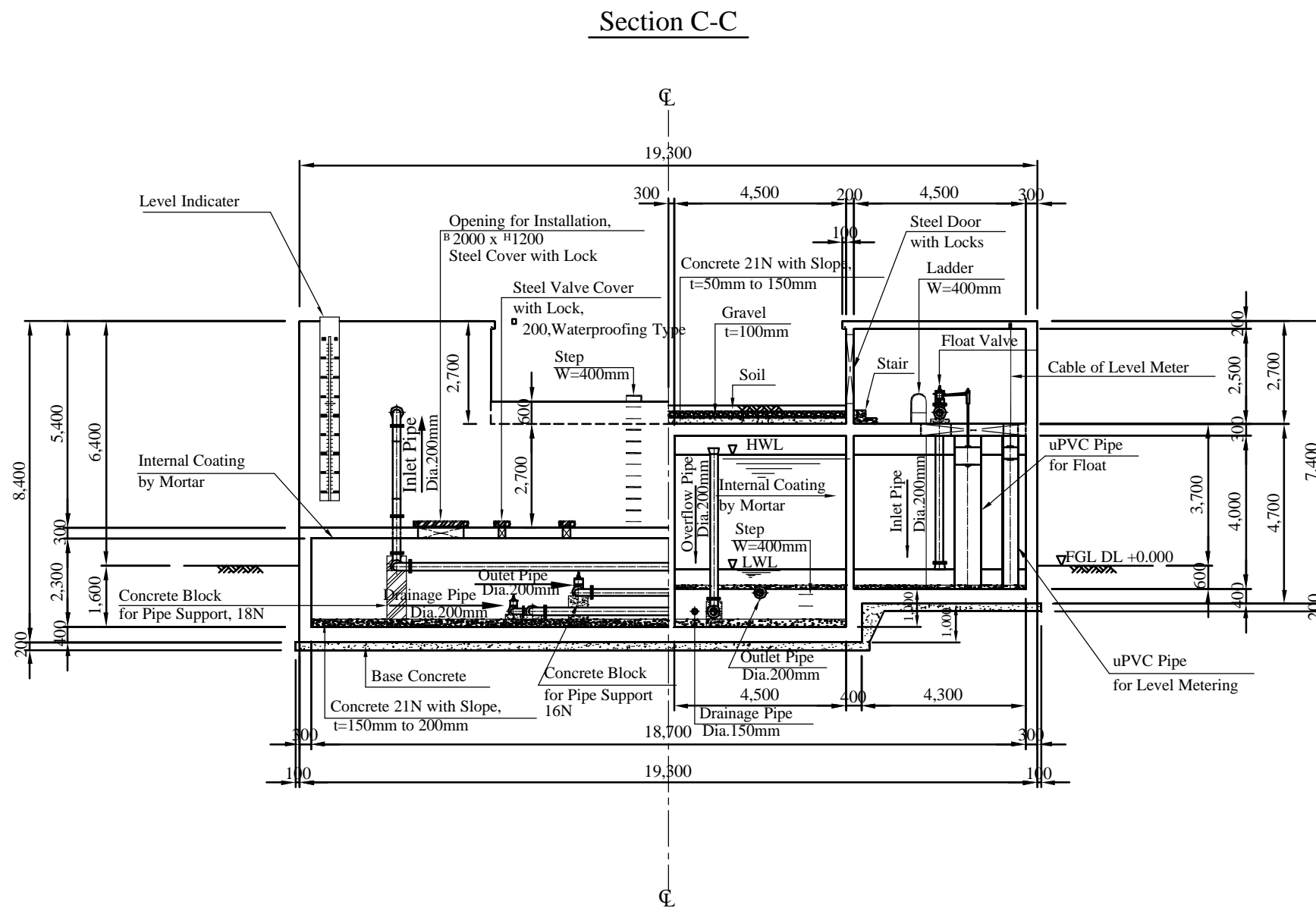
Note : PVC Water stop to be placed in vertical construction joint

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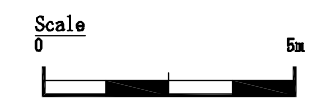
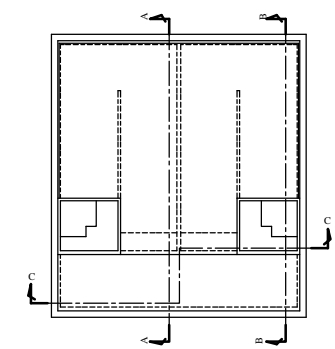
THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

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 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: DISTRIBUTION MAIN STORAGE TANK 885M3 (4/5)		
SCALE 1 : 150	DATE 30 / 01 / 2001	DRAWING NO. MWS-025



**KEY PLAN**



Note : PVC Water stop to be placed  
in vertical construction joint

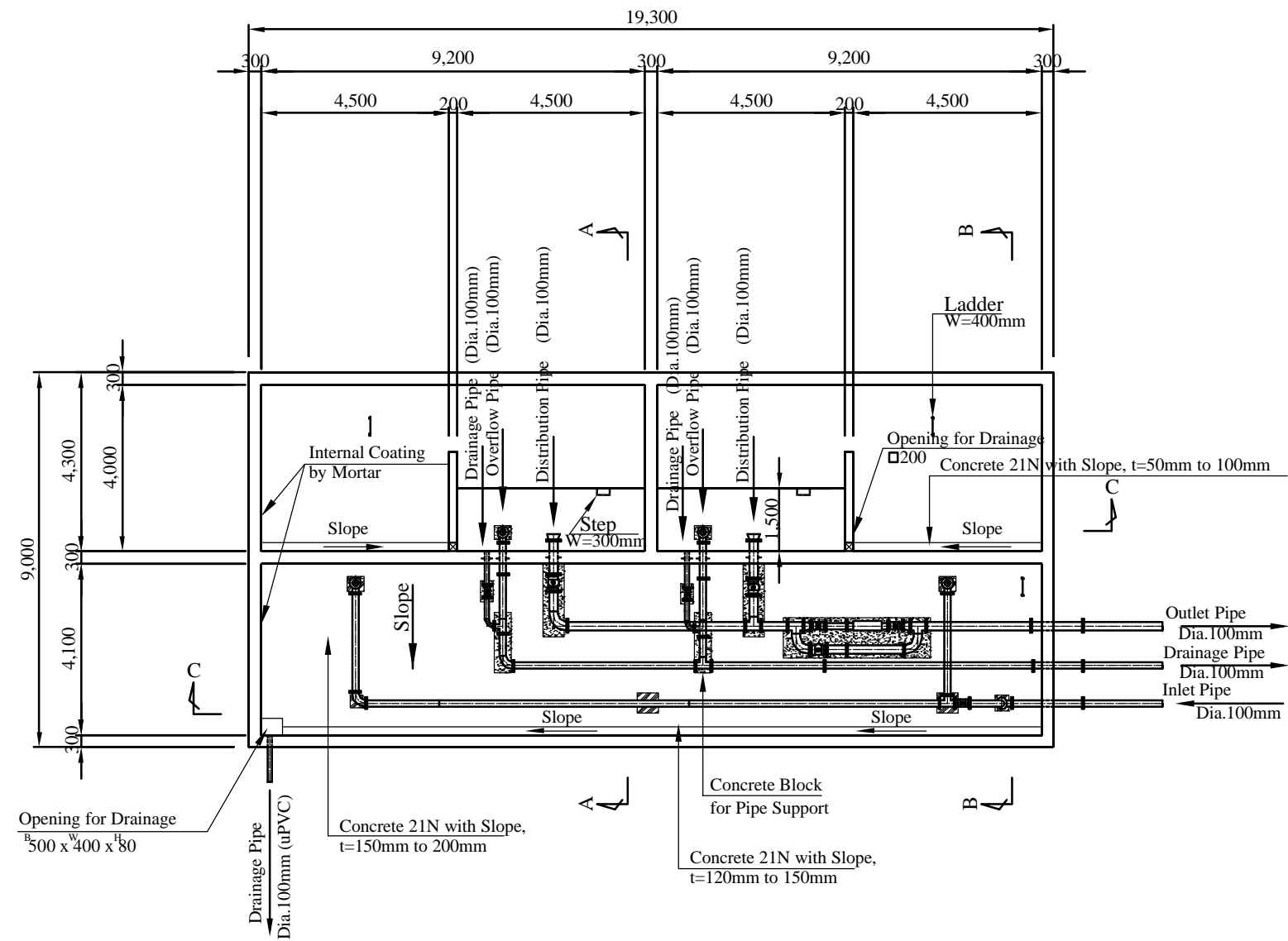
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TITLE: <b>DISTRIBUTION MAIN STORAGE TANK 885M3 (5/5)</b>		
SCALE 1 : 150	DATE 30 / 01 / 2001	DRAWING NO. MWS-026

Plan-1



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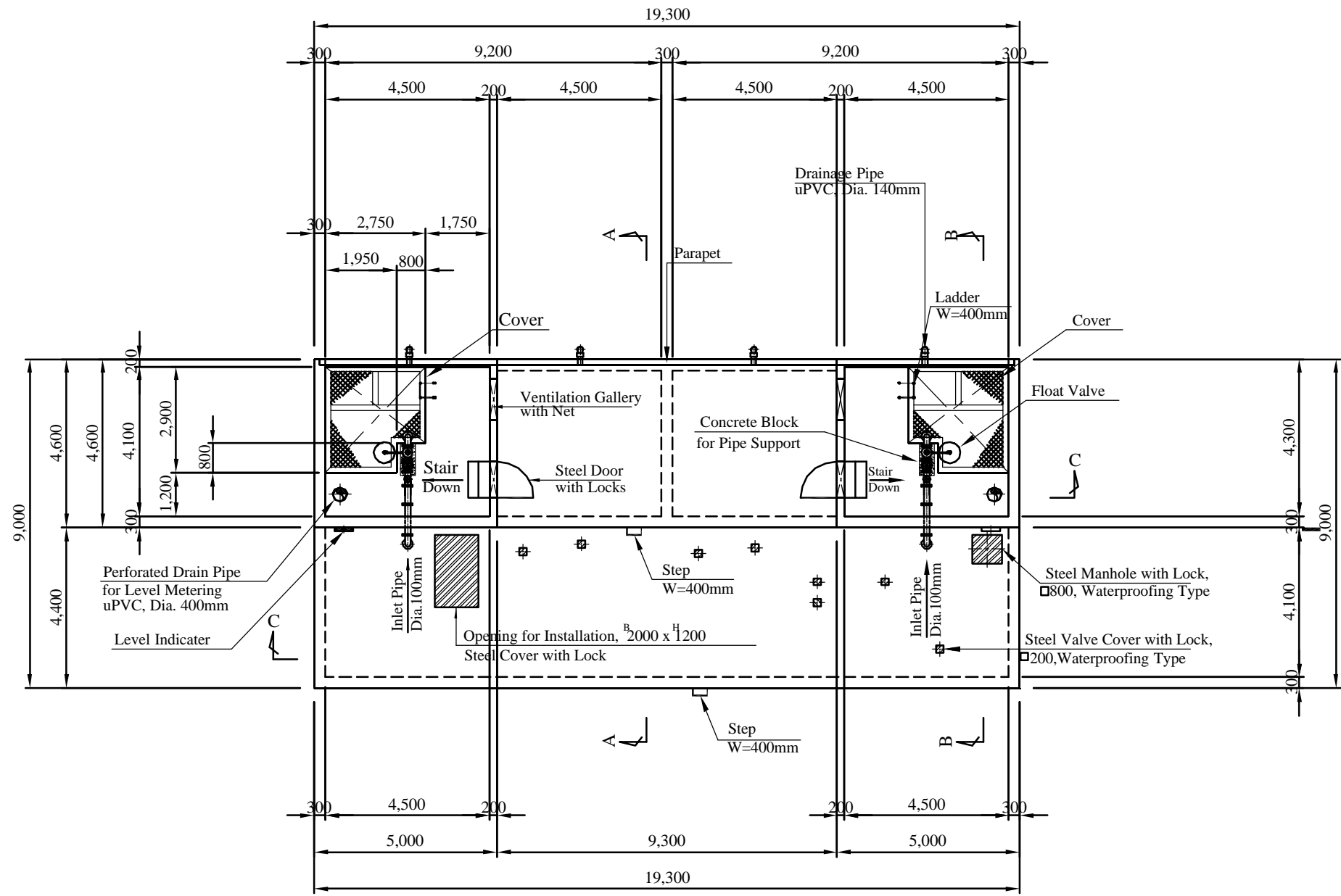
THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE:  
DISTRIBUTION MAIN  
STORAGE TANK 218M3 (1/5)



SCALE 1 : 150	DATE 30 / 01 / 2001	DRAWING NO. MWS-027
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Plan-2



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TITLE:  
DISTRIBUTION MAIN  
STORAGE TANK 218M3 (2/5)

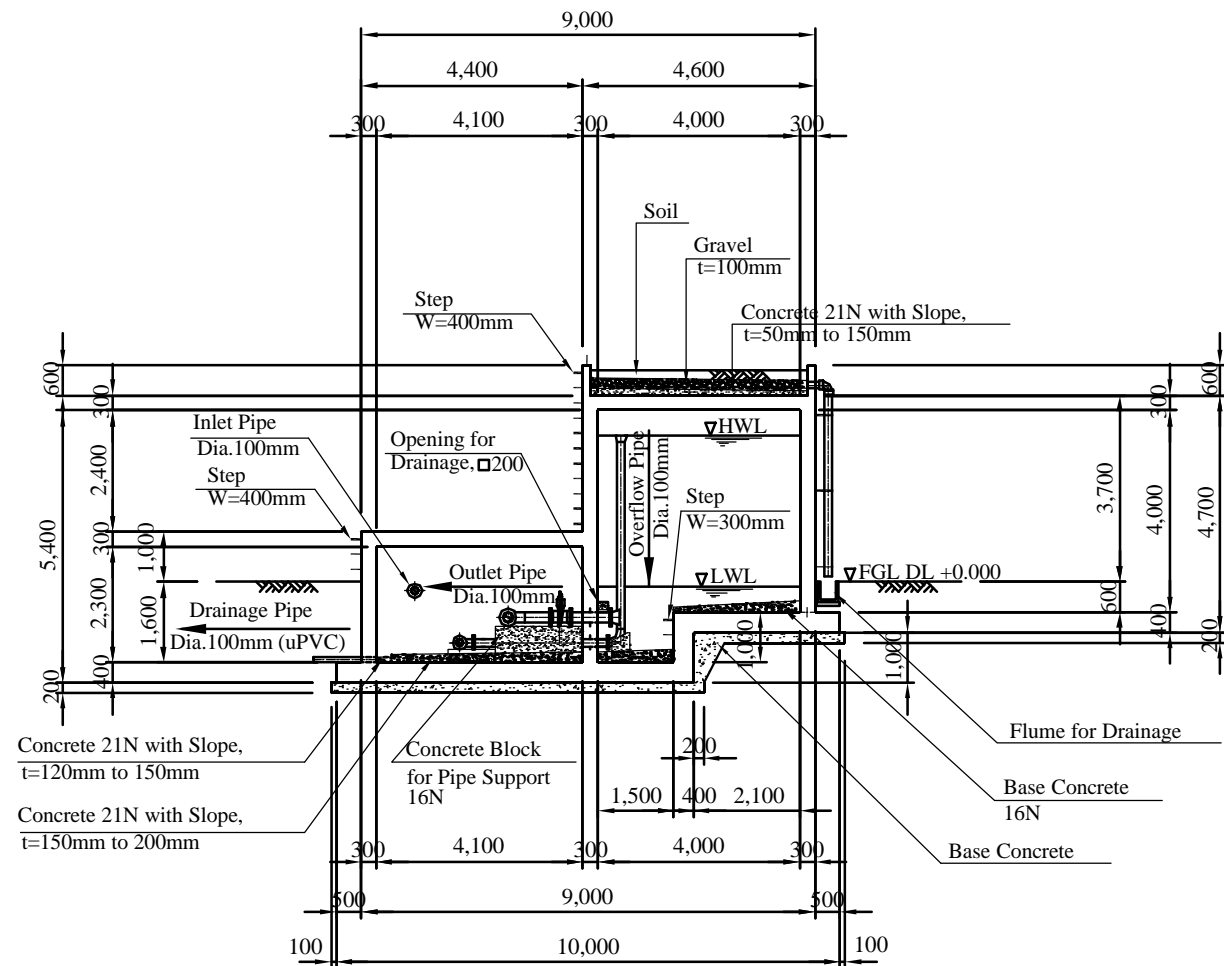
SCALE  
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DATE  
30 / 01 / 2001

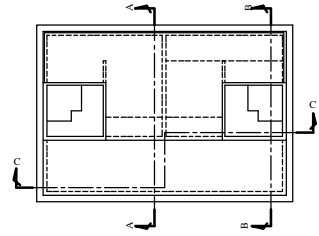
DRAWING NO.  
MWS-028



Section A-A



KEY PLAN





Note : PVC Water stop to be placed in vertical construction joint



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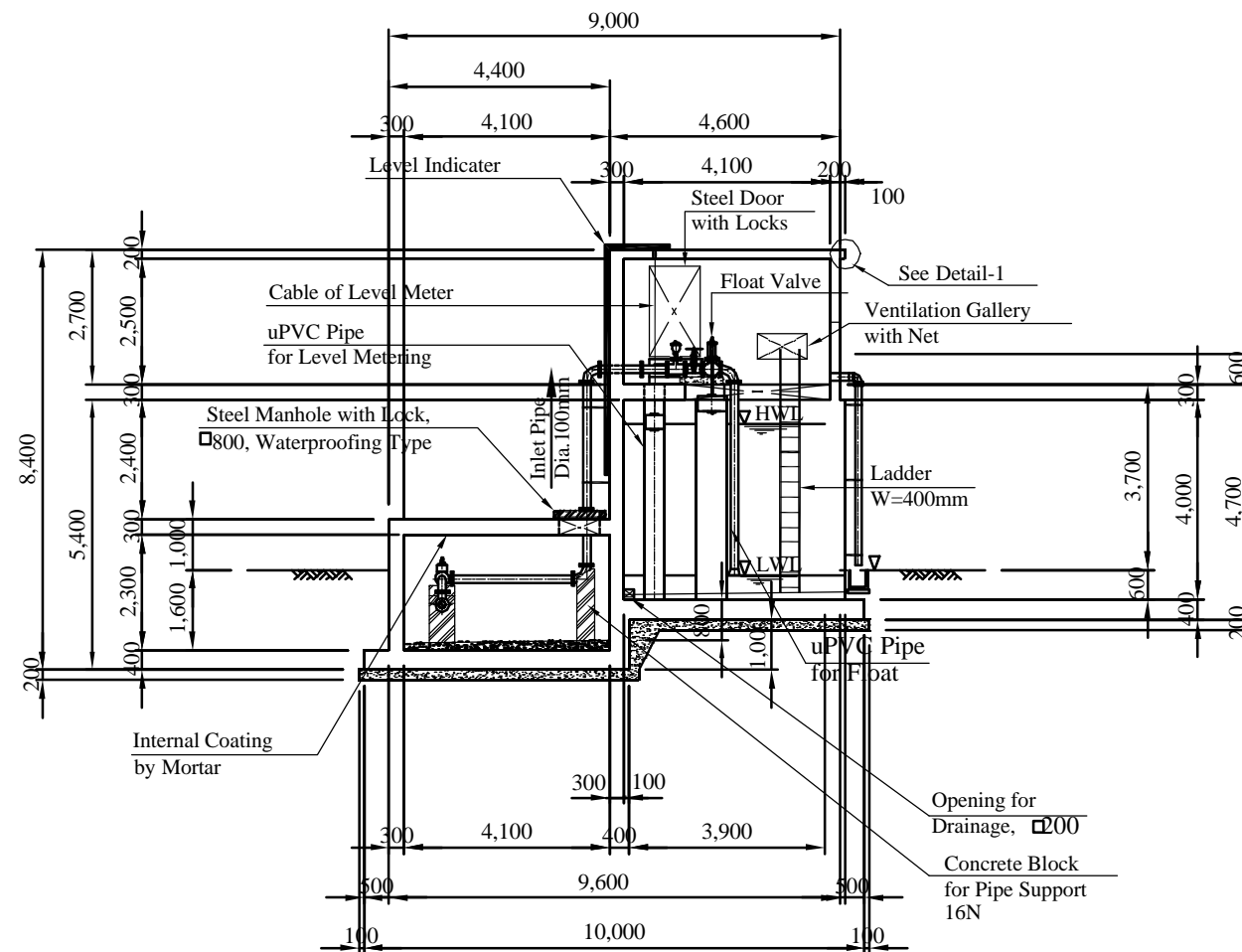
 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: DISTRIBUTION MAIN STORAGE TANK 218M3 (3/5)		
SCALE 1 : 150	DATE 30 / 01 / 2001	DRAWING NO. MWS-029

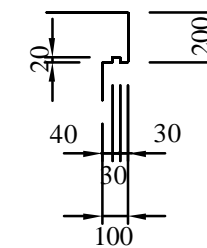
1 2 3 4 5 6 7 8 9 10 11 12

A  
B  
C  
D  
E  
F  
G  
H

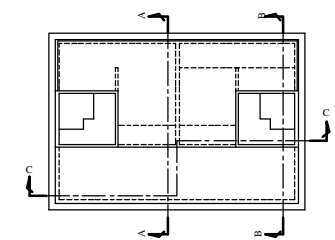
### Section B-B



Detail-1  
Scale=1:30



### KEY PLAN





Note : PVC Water stop to be placed  
in vertical construction joint



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TITLE:  
DISTRIBUTION MAIN  
STORAGE TANK 218M<sup>3</sup> (4/5)

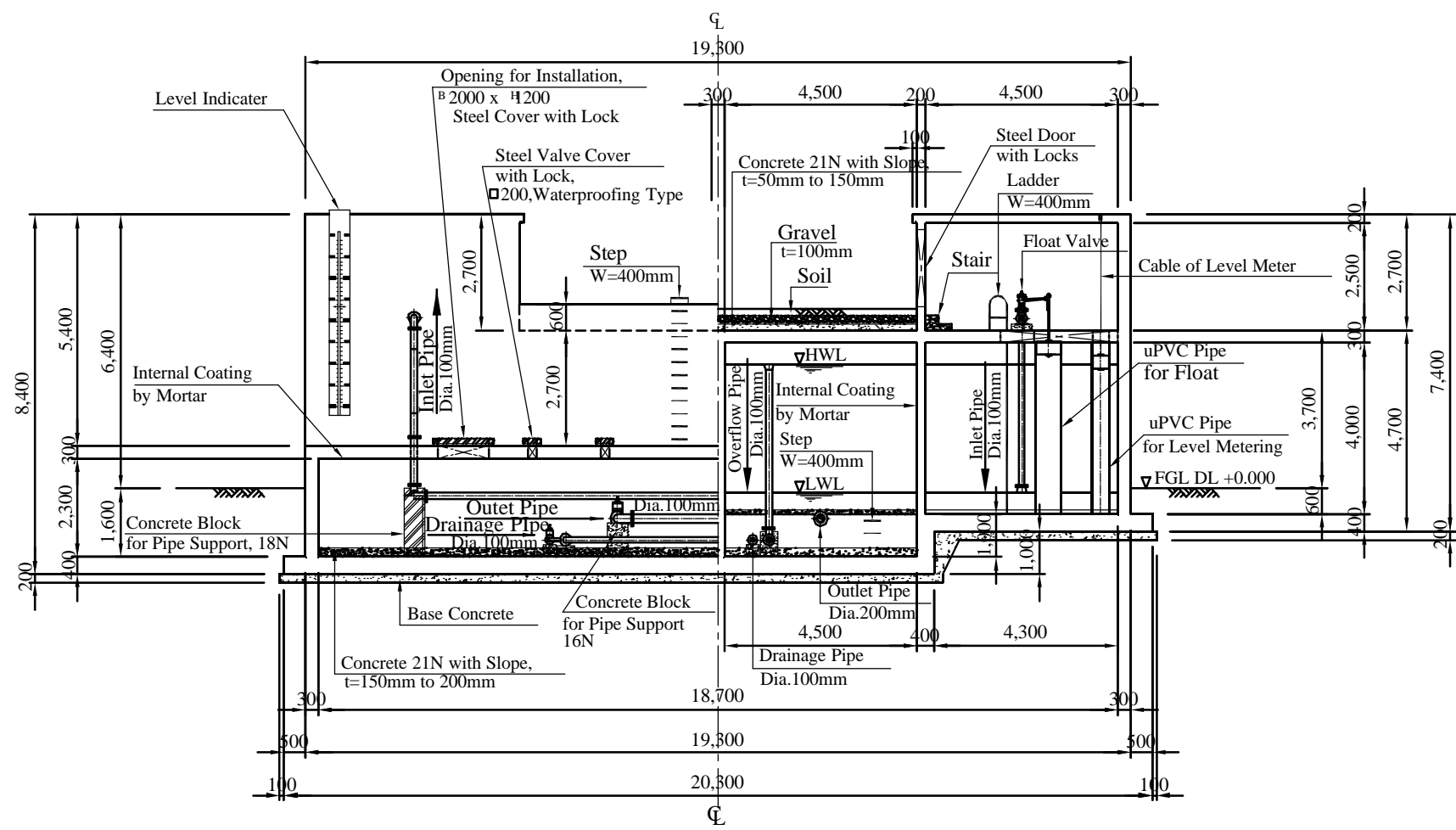
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DATE  
30 / 01 / 2001

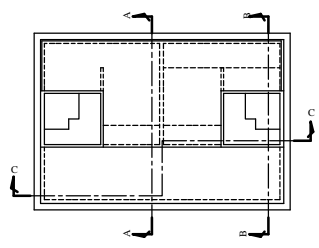
DRAWING NO.  
MWS-030

1 2 3 4 5 6 7 8 9 10 11 12

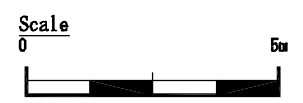
Section C-C



KEY PLAN



Note : PVC Water stop to be placed in vertical construction joint



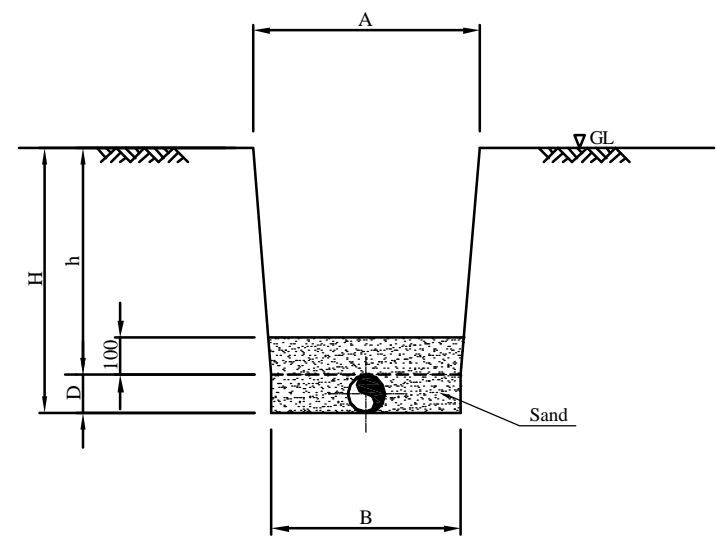
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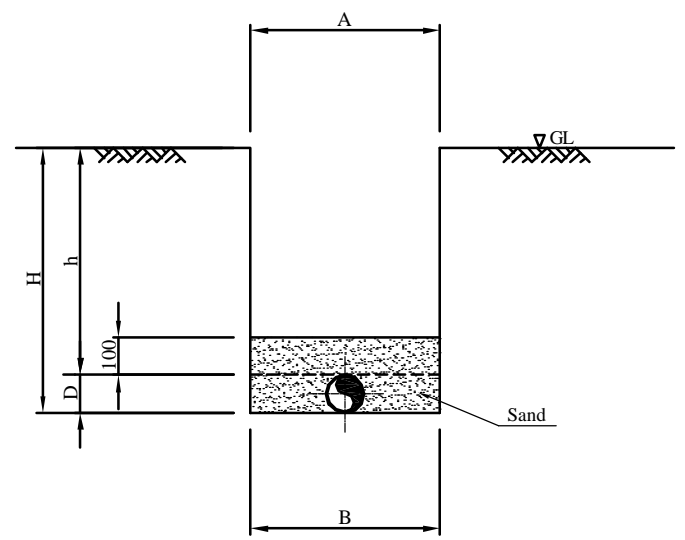
NIPPON KOEI CO., LTD.  
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TITLE: DISTRIBUTION MAIN STORAGE TANK 218M3 (5/5)		
SCALE 1 : 150	DATE 30 / 01 / 2001	DRAWING NO. MWS-031

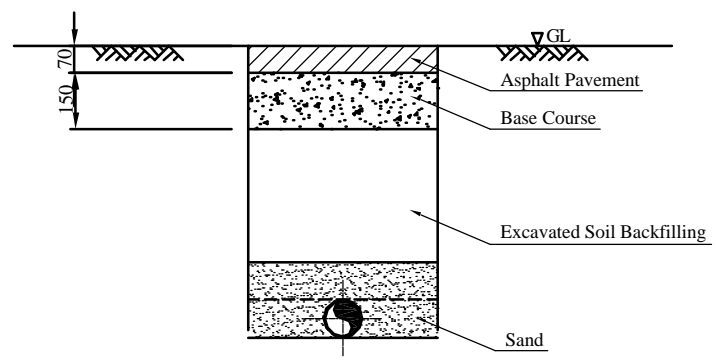
**Manual Excavation**  
(Service Pipes)



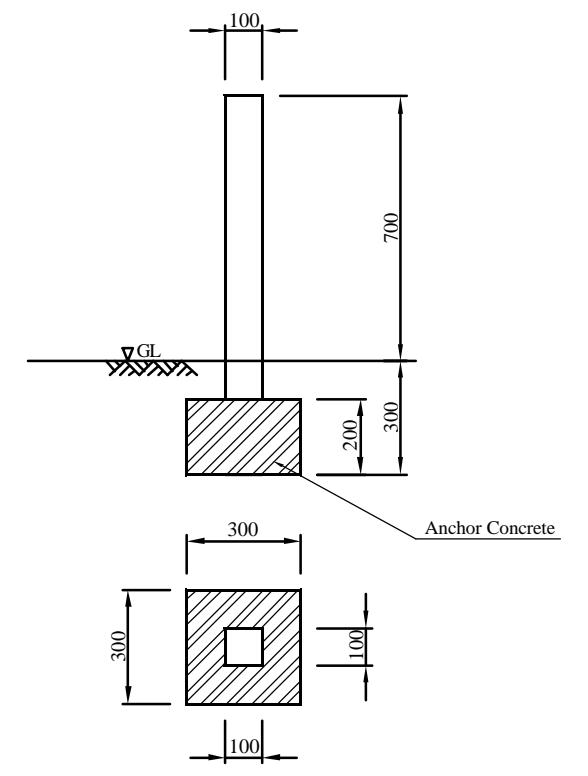
**Machine Excavation**  
(Main Pipelines including Distribution Secondary)



**Road Pavement for Main Road**



**Line Marker**



Note : Line Marker shall be installed at 200m intervals and branches for pipeline

Dimension of Manual Excavation



Pipe Diameter.D (mm)	Width: A (m)	Width: B (m)	Overburden Depth :h (m)	Excavation Depth :H (m)
50 or Less	0.60	0.50	0.60	0.65
63				0.70
90				
110				
140				
150	0.65	0.55	0.60	0.75
200				0.80
300				0.85

Dimension for Machine Excavation

Pipe Diameter.D (mm)	Width: B (m)	Overburden Depth :h (m)	Excavation Depth :H (m)
50 or Less	0.50	0.60	0.65
63	0.60		0.70
90	0.65		
110	0.70		
140			
150			
200	0.75	0.80	
300	1.00	0.90	

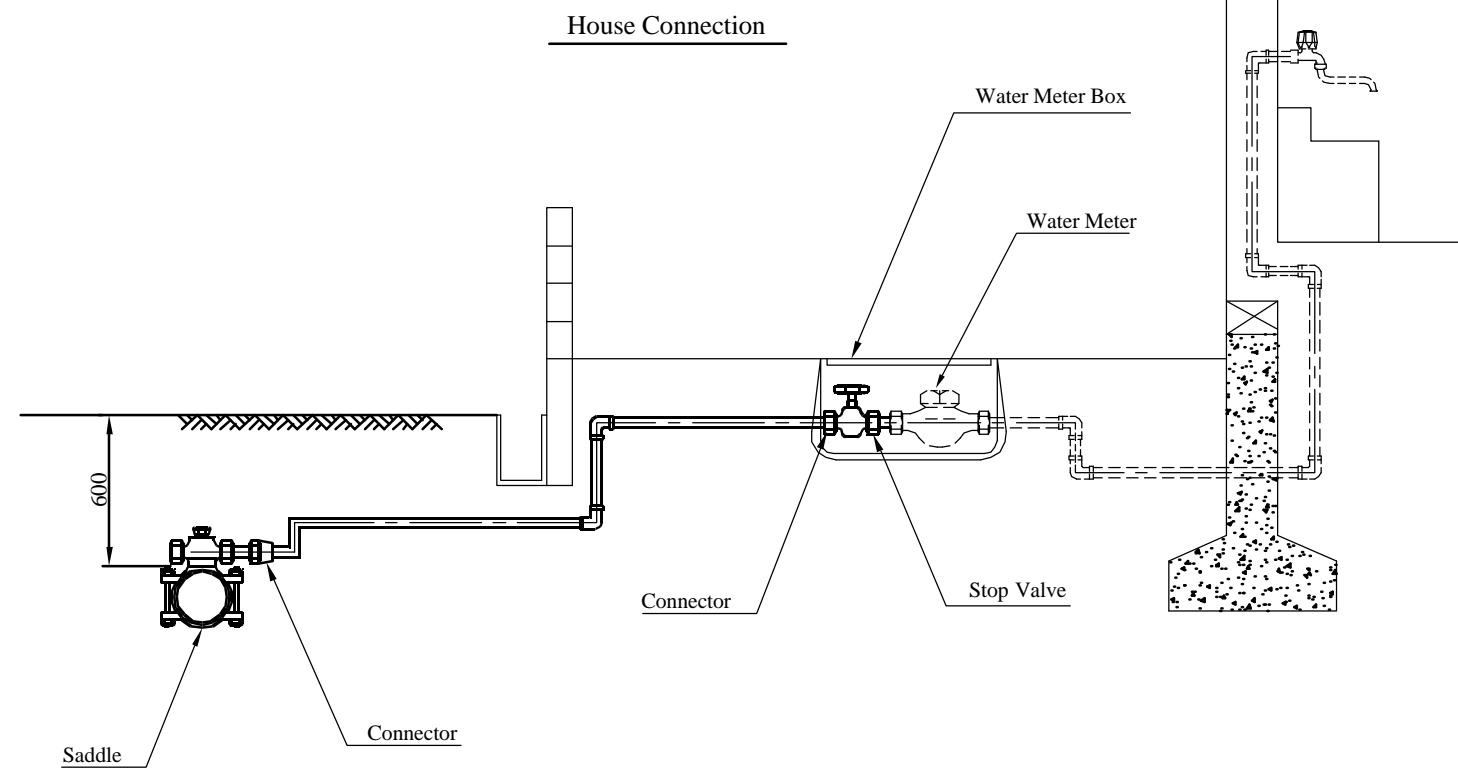
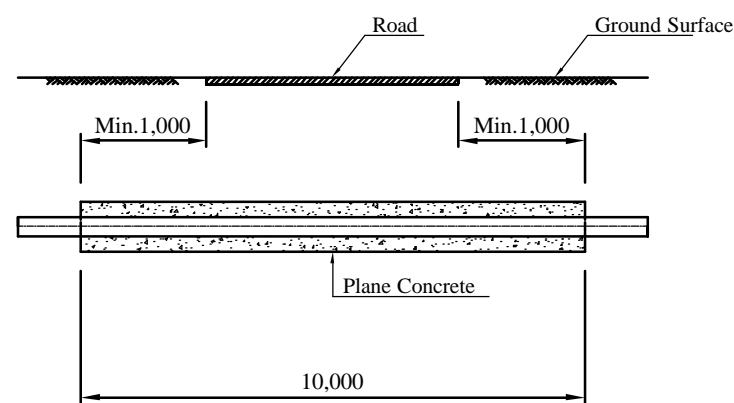
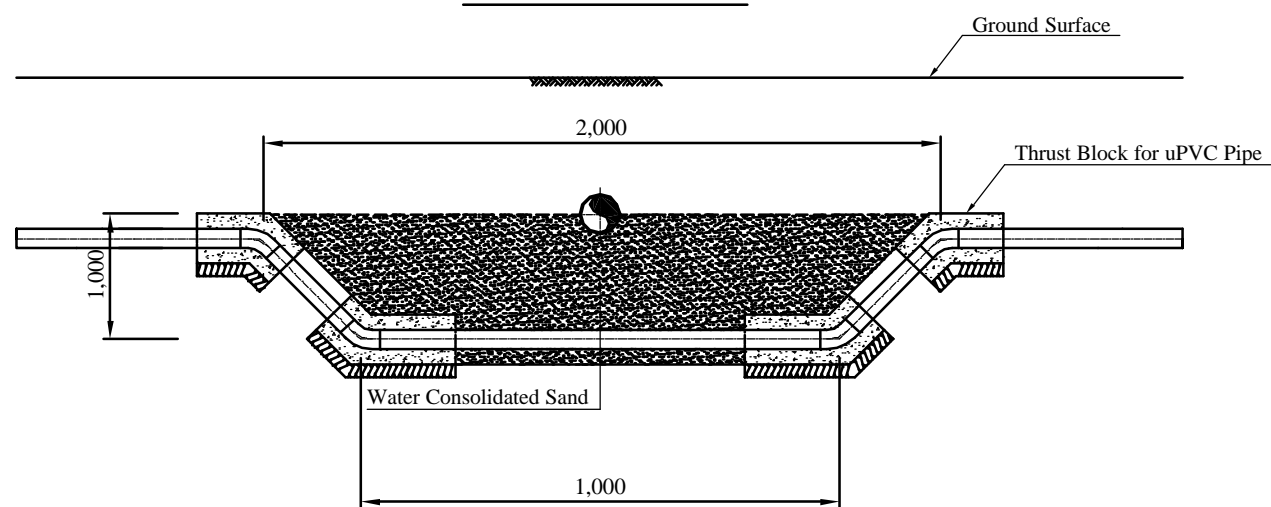
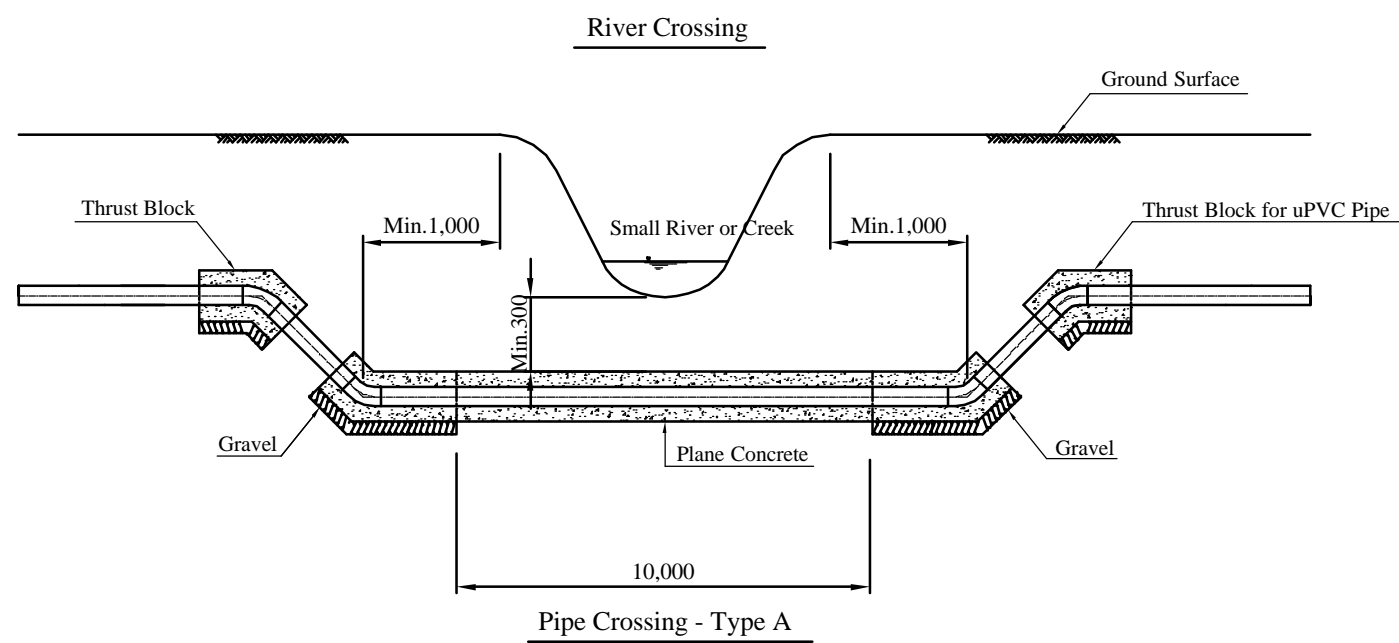
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TITLE: **STANDARD DRAWINGS**  
**PIPE INSTALLATION**

SCALE	DATE	DRAWING NO.
NONE	30 / 01 / 2001	MWS-032



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TITLE: **STANDARD DRAWINGS**  
**TYPICAL CROSSING**

SCALE

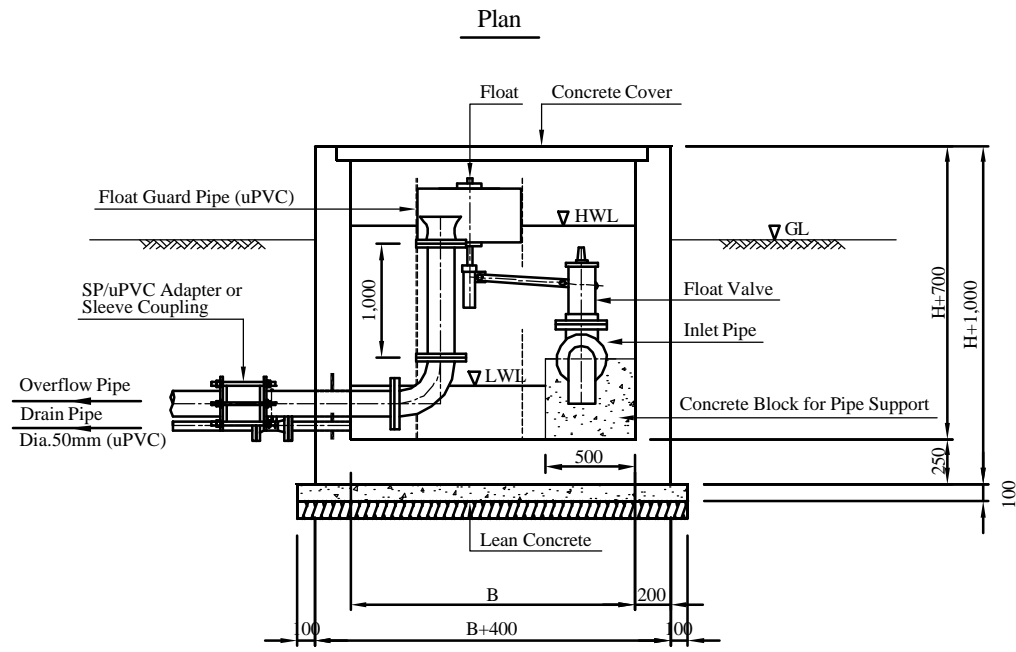
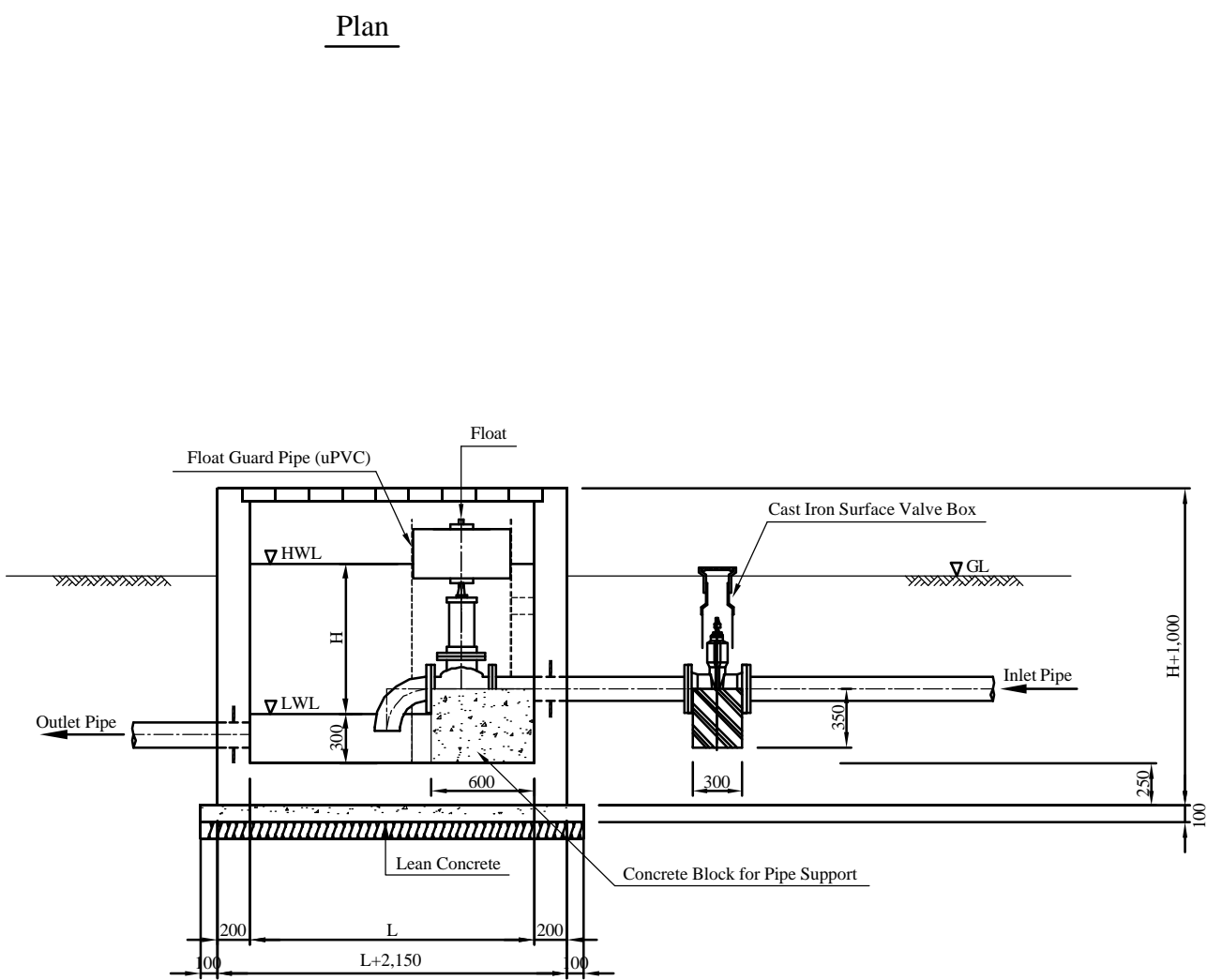
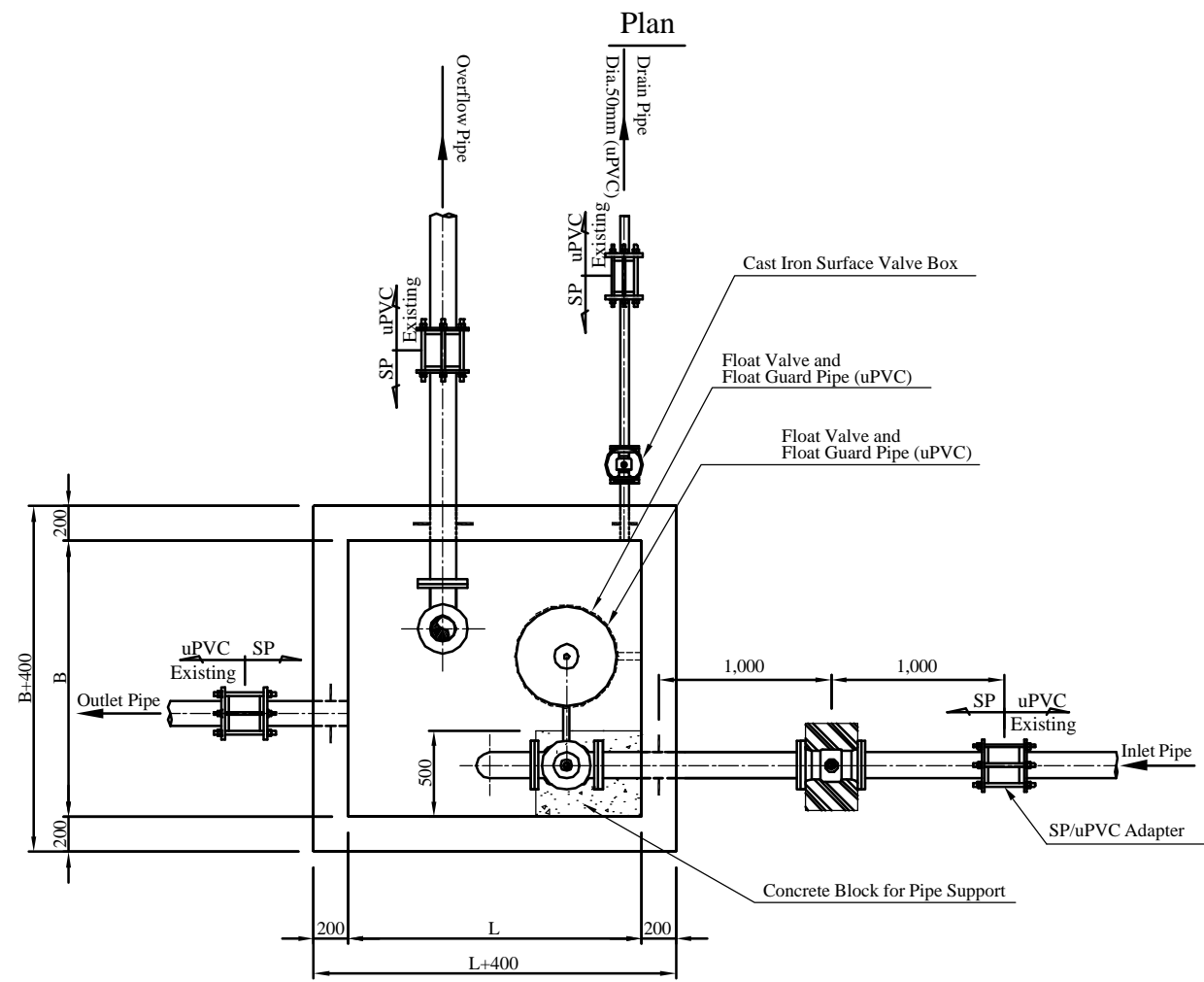
NONE

DATE

30 / 01 / 2001

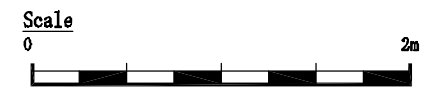
DRAWING NO.

MWS-033



Dimension of BPT

Type	Inlet pipe diameter (D1) (mm)	Inlet pipe Material	Inside pipe diameter (D2) (mm)	Inside pipe Material	Length (L) (mm)	Breadth (B) (mm)	Effective depth (H) (mm)	Overburd (h) (mm)	Tank volume (V) (mm)	pipe length (l) (mm)	Phase-1 Nos.	Phase-2 Nos.
1	90	uPVC	80	SP	1,350	1,350	650	655	1.2	950	2	5
2	110	uPVC	100	SP							0	3
3	100	SP	100	SP	1,400	1,600	800	695	1.8	1,100	0	1
4	140	uPVC	125	SP							0	1



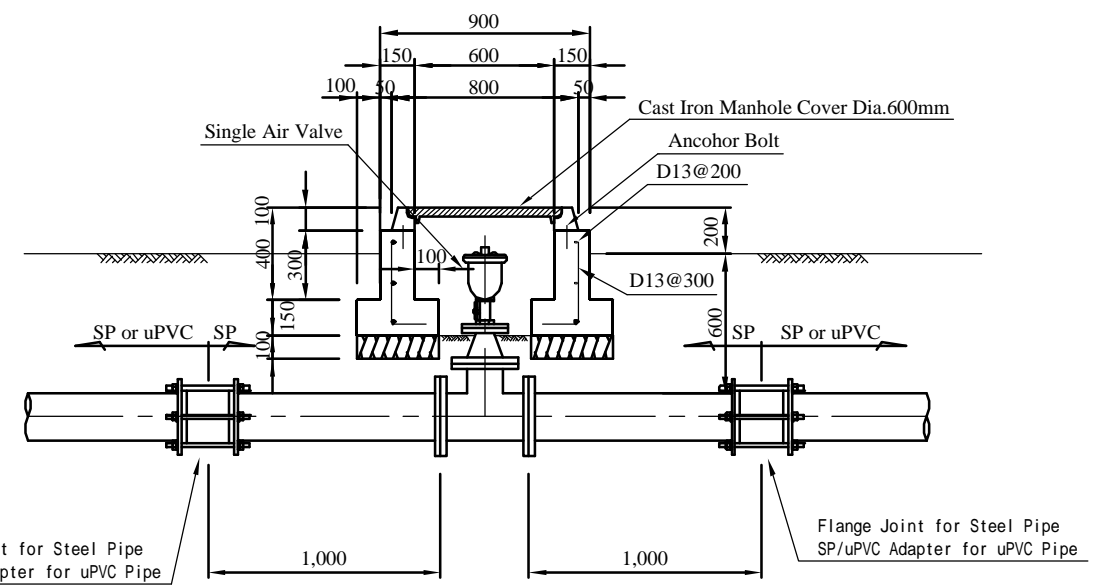
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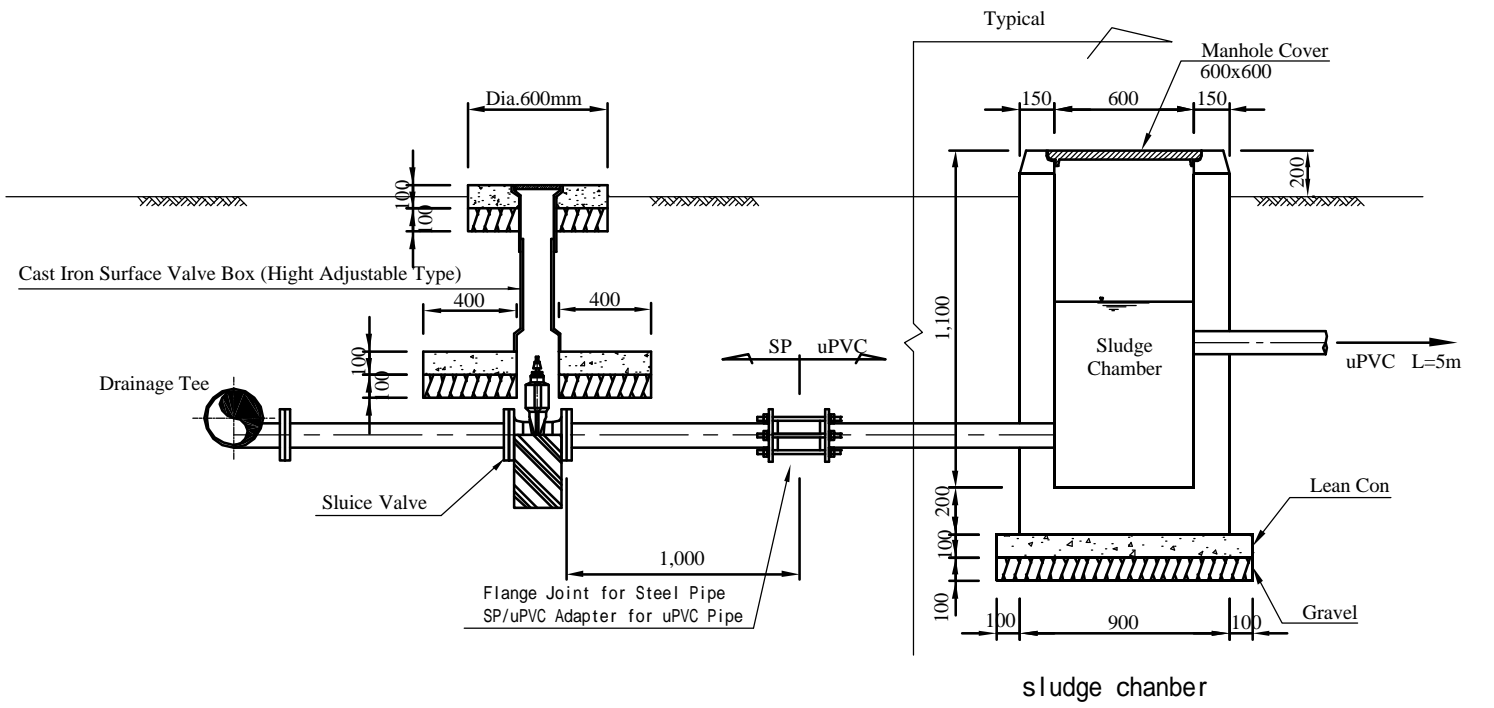
NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: STANDARD DRAWINGS  
BREAK PRESSURE TANK  
SCALE: 1 : 40  
DATE: 30 / 01 / 2001  
DRAWING NO.: MWS-034

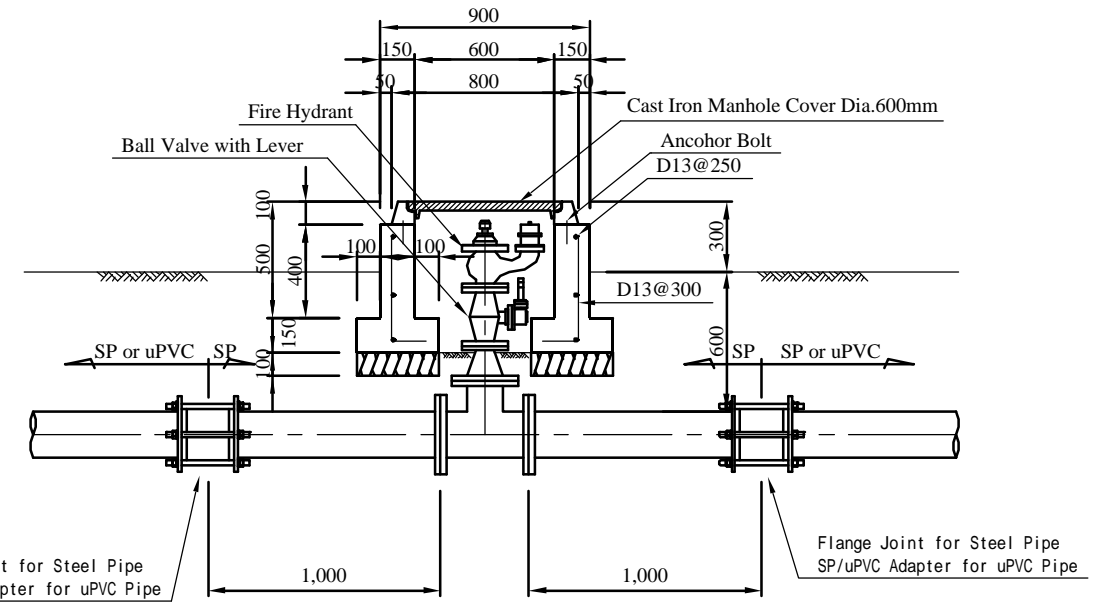
**Air Valve**



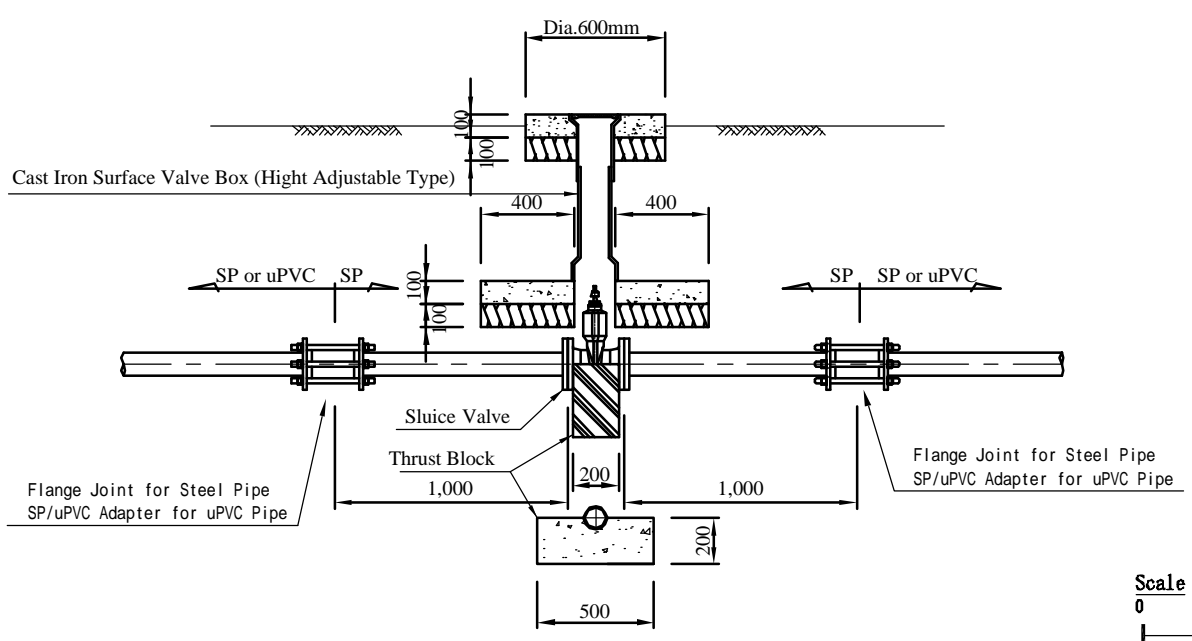
**Blow-Off**



**Fire Hydrant**





**Gate Valve**



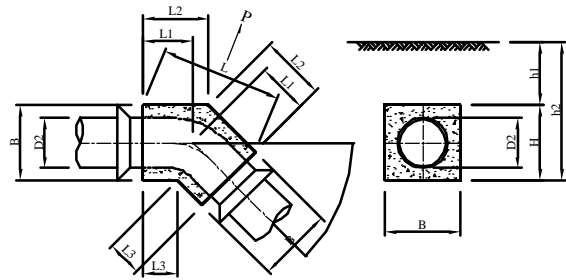
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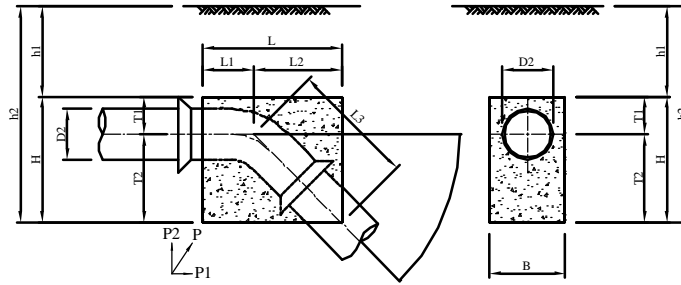
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TITLE: <b>STANDARD DRAWINGS VALVE WORKS</b>		
SCALE: 1 : 30	DATE: 30 / 01 / 2001	DRAWING NO.: MWS-035

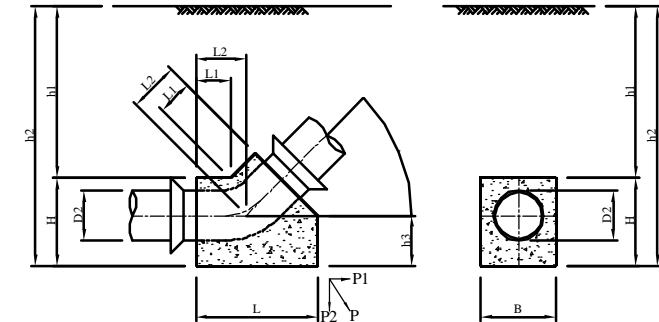
Horizontal Bend



Vertical Upward Bend



Vertical Downward Bend



Horizontal Bend

Pipe nominal outside diameter (mm)	Degree of bend (Degree)	Dimension										Weight of concrete (tf)	Volume of concrete (m3)
		B (m)	H (m)	L (m)	L1 (m)	L2 (m)	L3 (m)	h1 (m)	h2 (m)				
50	90	0.35	0.35	0.74	0.35	0.53	0.18	0.450	0.800			0.198	0.085
63	90	0.40	0.40	0.99	0.50	0.70	0.30	0.431	0.831			0.369	0.158
63	45	0.30	0.35	0.67	0.30	0.36	0.24	0.456	0.806			0.144	0.062
75	90	0.50	0.50	1.13	0.55	0.80	0.30	0.387	0.887			0.635	0.271
75	45	0.30	0.35	0.95	0.45	0.51	0.39	0.462	0.812			0.213	0.091
90	90	0.60	0.60	1.27	0.60	0.90	0.30	0.345	0.945			0.997	0.425
90	45	0.40	0.40	1.08	0.50	0.58	0.42	0.445	0.845			0.361	0.154
110	90	0.80	0.60	1.70	0.80	1.20	0.40	0.335	0.955			1.769	0.753
110	45	0.55	0.50	1.23	0.55	0.66	0.44	0.405	0.905			0.686	0.292
140	90	1.00	0.70	2.12	1.00	1.50	0.50	0.320	1.020			3.217	1.369
140	45	0.60	0.60	1.62	0.75	0.87	0.63	0.370	0.970			1.214	0.517
140	22.5	0.40	0.50	1.06	0.50	0.54	0.46	0.420	0.920			0.434	0.185
160	90	1.00	0.80	2.40	1.20	1.70	0.70	0.280	1.080			4.398	1.872
160	45	0.80	0.60	1.88	0.85	1.02	0.68	0.380	0.980			1.837	0.782
160	22.5	0.55	0.50	1.28	0.60	0.65	0.55	0.430	0.930			0.718	0.306
200	90	1.20	0.80	3.32	1.75	2.35	1.15	0.300	1.100			7.636	3.250
200	45	0.90	0.80	2.19	1.00	1.19	0.81	0.300	1.100			3.235	1.377
200	22.5	0.60	0.50	1.88	0.90	0.96	0.84	0.450	0.950			1.135	0.483

Vertical Upward Bend

Pipe nominal outside diameter (mm)	Degree of bend (Degree)	Dimension												Weight of concrete (tf)	Volume of concrete (m3)
		B (m)	H (m)	L (m)	L1 (m)	L2 (m)	T1 (m)	T2 (m)	h1 (m)	h2 (m)					
50	90	0.45	0.40	0.70	0.35	0.35	0.15	0.25	0.475	0.875			0.293	0.125	
63	90	0.55	0.50	0.75	0.35	0.40	0.15	0.35	0.481	0.981			0.480	0.205	
63	45	0.40	0.40	0.55	0.25	0.30	0.15	0.25	0.481	0.881			0.202	0.086	
75	90	0.60	0.60	0.85	0.40	0.45	0.15	0.45	0.487	1.087			0.710	0.303	
75	45	0.40	0.40	0.80	0.40	0.40	0.15	0.25	0.487	0.887			0.293	0.125	
90	90	0.80	0.60	1.00	0.50	0.15	0.45	0.50	0.495	1.095			1.114	0.475	
90	45	0.50	0.50	0.80	0.40	0.40	0.15	0.35	0.495	0.995			0.457	0.195	
110	90	1.15	0.60	1.20	0.60	0.60	0.20	0.40	0.455	1.055			1.923	0.819	
110	45	0.65	0.50	1.00	0.50	0.50	0.20	0.30	0.455	0.955			0.743	0.317	
140	90	1.40	0.60	1.95	0.95	1.00	0.20	0.40	0.470	1.070			3.800	1.618	
140	45	0.80	0.60	1.15	0.55	0.60	0.20	0.40	0.470	1.070			1.256	0.535	
140	22.5	0.55	0.50	1.00	0.50	0.50	0.20	0.30	0.470	0.970			0.608	0.259	
160	90	1.40	0.75	2.10	1.10	1.00	0.20	0.55	0.480	1.230			5.103	2.172	
160	45	0.90	0.60	1.35	0.70	0.65	0.20	0.40	0.480	1.080			1.653	0.704	
160	22.5	0.60	0.50	1.20	0.60	0.60	0.20	0.30	0.480	0.980			0.787	0.335	
200	90	1.50	1.00	2.30	1.15	1.15	0.20	0.80	0.500	1.500			7.963	3.389	
200	45	1.00	0.80	1.50	0.75	0.75	0.20	0.60	0.500	1.300			2.701	1.150	
200	22.5	0.80	0.60	1.25	0.65	0.60	0.20	0.40	0.500	1.100			1.313	0.559	



Vertical Downward Bend

Pipe nominal outside diameter (mm)	Degree of bend (Degree)	Dimension										Weight of concrete (tf)	Volume of concrete (m3)
		B (m)	H (m)	L (m)	L1 (m)	L2 (m)	h1 (m)	h2 (m)	h3 (m)				
50	90	0.25	0.50	0.65	0.15	0.30	0.375	0.875	0.350	0.234			0.100
63	90	0.40	0.50	0.65	0.15	0.30	0.381	0.881	0.350	0.374			0.160
63	45	0.25	0.30	0.24	0.04	0.10	0.481	0.781	0.150	0.035			0.015
75	90	0.50	0.50	0.70	0.20	0.35	0.387	0.887	0.350	0.525			0.224
75	45	0.30	0.30	0.36	0.09	0.15	0.487	0.787	0.150	0.070			0.030
90	90	0.50	0.50	0.85	0.35	0.50	0.395	0.895	0.350	0.699			0.298
90	45	0.30	0.30	0.36	0.09	0.15	0.495	0.795	0.150	0.069			0.030
110	90	0.80	0.50	0.80	0.30	0.50	0.405	0.905	0.300	1.025			0.437
110	45	0.35	0.35	0.48	0.12	0.20	0.480	0.830	0.150	0.123			0.053
140	90	1.10	0.50	0.90	0.40	0.60	0.420	0.920	0.300	1.662			0.708
140	45	0.40	0.40	0.60	0.17	0.25	0.470	0.870	0.200	0.212			0.091
140	22.5	0.30	0.30	0.42	0.17	0.20	0.520	0.820	0.150	0.083			0.036
160	90	1.10	0.60	1.05	0.45	0.75	0.380	0.980	0.300	2.296			0.978
160	45	0.40	0.40	0.72	0.22	0.30	0.480	0.880	0.200	0.262			0.112
160	22.5	0.30	0.30	0.42	0.17	0.20	0.530	0.830	0.150	0.081			0.035
200	90	1.10	0.70	1.30	0.60	1.00	0.350	1.050	0.300	3.375			1.437
200	45	0.40	0.40	1.09	0.37	0.45	0.500	0.900	0.200	0.427			0.182
200	22.5	0.30	0.30	0.42	0.17	0.20	0.550	0.850	0.150	0.076			0.033

\* Inpipe Pressure is 15.0kgf/cm2

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THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

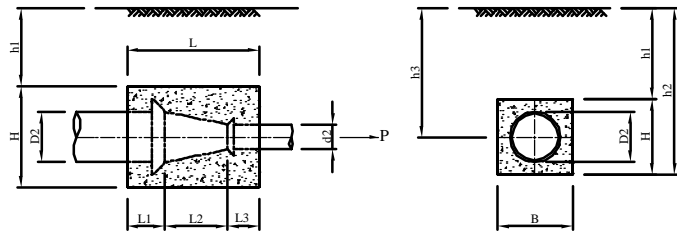
 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

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STANDARD DRAWINGS  
THRUST BLOCK (1/2)

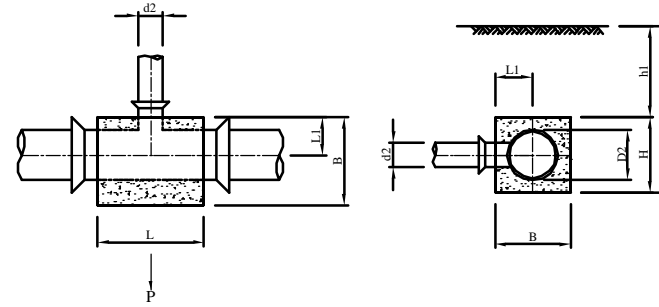
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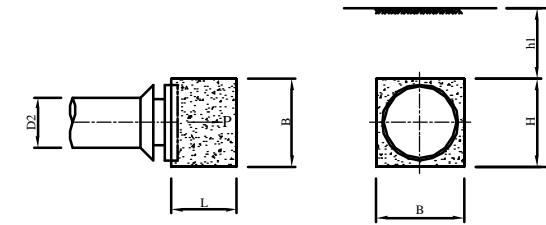
Reducer



Tee



Plug, Cap



Reducer

Pipe nominal outside diameter		Dimension								Weight of concrete (tf)	Volume of concrete (m <sup>3</sup> )
(Larger Pipe) (mm)	(Smaller Pipe) (mm)	B (m)	H (m)	L (m)	L1 (m)	L2 (m)	L3 (m)	h1 (m)	h2 (m)		
75	50	0.50	0.50	0.35	0.175	-	0.175	0.350	0.850	0.203	0.087
90	63	0.55	0.50	0.50	0.250	-	0.250	0.395	0.895	0.318	0.136
110	75	0.80	0.50	0.60	0.300	-	0.300	0.405	0.905	0.555	0.237
110	90	0.55	0.50	0.45	0.225	-	0.225	0.405	0.905	0.281	0.120
140	90	1.00	0.50	1.30	0.650	-	0.650	0.420	0.920	1.495	0.637
140	110	0.80	0.50	0.85	0.425	-	0.425	0.420	0.920	0.773	0.329
160	90	1.20	0.60	1.50	0.750	-	0.750	0.380	0.980	2.491	1.060
160	110	0.80	0.80	1.30	0.650	-	0.650	0.280	1.080	1.911	0.814
160	140	0.60	0.60	0.70	0.350	-	0.350	0.380	0.980	0.564	0.240
200	110	1.20	0.80	2.25	1.125	-	1.125	0.300	1.100	4.968	2.115
200	140	1.20	0.60	1.90	0.950	-	0.950	0.400	1.000	3.109	1.323
200	160	0.80	0.80	1.50	0.750	-	0.750	0.300	1.100	2.164	0.921

Tee

Pipe nominal outside diameter		Dimension						Weight of concrete (tf)	Volume of concrete (m <sup>3</sup> )
Main Pipe (mm)	Branch Pipe (mm)	B (m)	H (m)	L (m)	L1 (m)	h1 (m)	h2 (m)		
50	50	0.40	0.40	0.45	0.15	0.425	0.825	0.167	0.072
63	50	0.40	0.40	0.45	0.15	0.431	0.831	0.302	0.129
63	63	0.50	0.40	0.65	0.15	0.431	0.831	0.300	0.128
75	63	0.50	0.40	0.65	0.15	0.437	0.837	0.298	0.127
75	75	0.65	0.50	0.70	0.15	0.387	0.887	0.526	0.224
90	63	0.50	0.40	0.65	0.15	0.445	0.845	0.295	0.126
90	75	0.60	0.50	0.70	0.15	0.395	0.895	0.482	0.206
90	90	0.80	0.50	0.90	0.15	0.395	0.895	0.831	0.354
110	75	0.60	0.50	0.70	0.20	0.405	0.905	0.476	0.203
110	90	0.80	0.50	0.90	0.15	0.405	0.905	0.824	0.351
110	110	1.00	0.50	1.20	0.20	0.405	0.905	1.380	0.588
140	90	0.80	0.50	0.90	0.20	0.420	0.920	0.811	0.346
140	110	1.00	0.50	1.20	0.15	0.420	0.920	1.365	0.581
140	140	1.20	0.60	1.55	0.15	0.370	0.970	2.563	1.091
160	90	0.80	0.50	0.90	0.20	0.430	0.930	0.801	0.341
160	110	1.00	0.50	1.20	0.20	0.430	0.930	1.351	0.575
160	140	1.20	0.60	1.55	0.20	0.380	0.930	2.545	1.083
160	160	1.20	0.60	2.00	0.20	0.380	0.980	3.283	1.398
200	110	1.00	0.50	1.15	0.20	0.450	0.950	1.264	0.538
200	140	1.20	0.60	1.50	0.20	0.400	1.000	2.423	1.032
200	160	1.20	0.80	1.55	0.20	0.300	1.100	3.377	1.438
200	200	1.50	0.80	2.15	0.20	0.300	1.100	5.896	2.509

Plug, Cap

Pipe nominal outside diameter (mm)	Dimension					Weight of concrete (tf)	Volume of concrete (m <sup>3</sup> )
	B (m)	H (m)	L (m)	h1 (m)	h2 (m)		
50	0.50	0.35	0.40	0.450	0.800	0.165	0.071
63	0.60	0.40	0.60	0.431	0.831	0.338	0.144
75	0.75	0.40	0.80	0.437	0.837	0.564	0.240
90	0.80	0.50	1.05	0.395	0.895	0.987	0.420
110	1.05	0.60	1.05	0.355	0.955	1.555	0.662
140	1.10	0.80	1.50	0.270	1.070	3.102	1.320
160	1.20	0.80	2.00	0.280	1.080	4.512	1.920
200	1.50	0.80	2.75	0.300	1.100	7.755	3.300

\* Inpipe Pressure is 15.0kgf/cm<sup>2</sup>

THE MINISTRY OF ENVIRONMENT  
AND NATURAL RESOURCES  
THE REPUBLIC OF KENYA

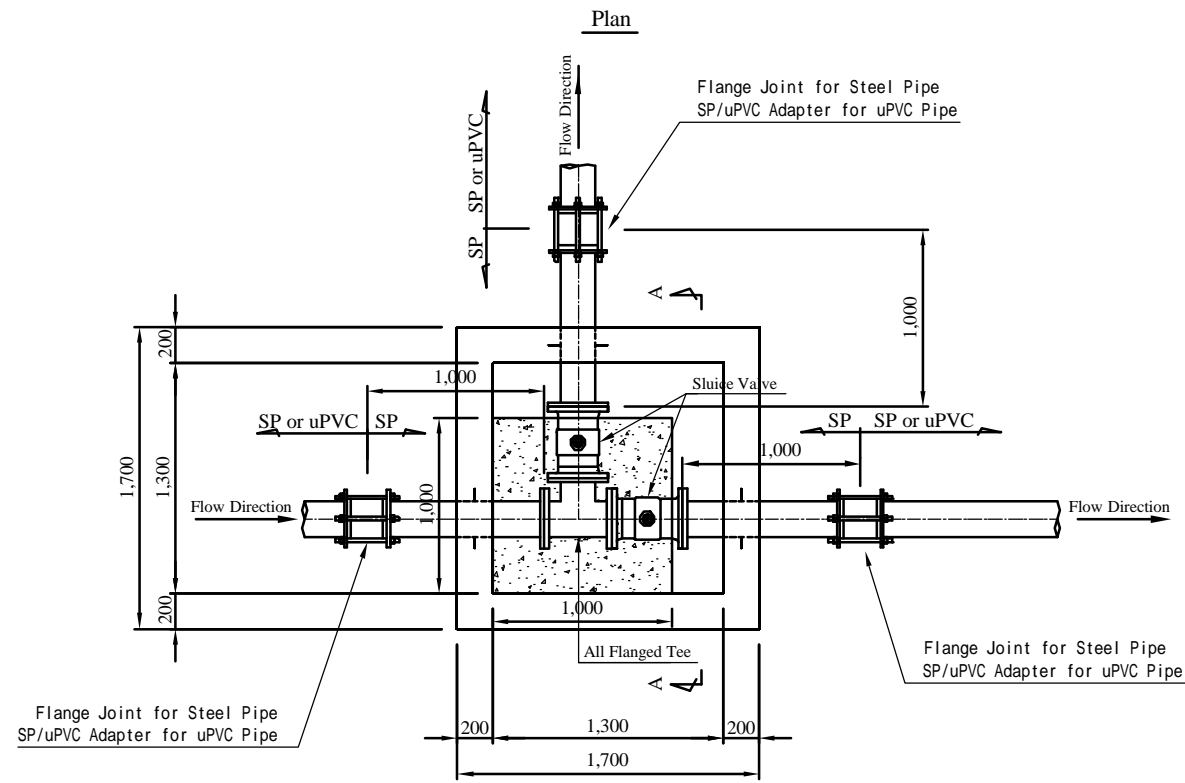
THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

NIPPON KOEI CO., LTD.  
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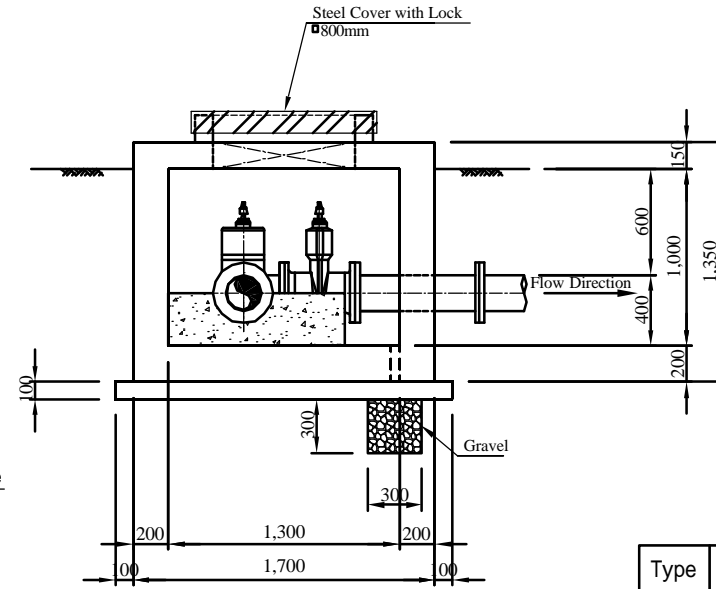
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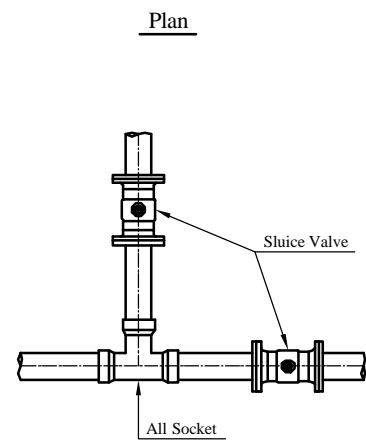
Valve Chamber for Branch



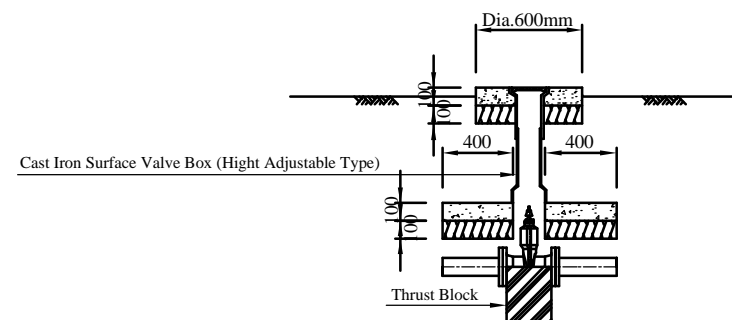
Section - A



Valve Cover for Branch (for uPVC)



Section - A





Type	Function	Main Pipe		Main Pipe	
		Material	D (mm)	Material	D (mm)
A	Washout	Steel	300	Steel	100
B	Washout	Steel	200	Steel	100
C	Washout	Steel	200	uPVC	63
D	Distribution Branch	Steel	200	Steel	200
E	Distribution Branch	Steel	200	uPVC	63
F	Washout	Steel	100	uPVC	50
G	Distribution Branch	uPVC	140	uPVC	110
H	Distribution Branch	uPVC	140	uPVC	63
I	Distribution Branch	uPVC	110	uPVC	63
J	Distribution Branch	uPVC	90	uPVC	90
K	Distribution Branch	uPVC	90	uPVC	63
L	Distribution Branch	uPVC	140	uPVC	90
M	Distribution Branch	uPVC	140	uPVC	140
N	Washout	Steel	150	uPVC	50
O	Distribution Branch	Steel	200	uPVC	200

Note: Length of Washout pipe shall be 20m.

THE MINISTRY OF ENVIRONMENT  
AND NATURAL RESOURCES  
THE REPUBLIC OF KENYA

THE STUDY ON MERU WATER SUPPLY PROJECT  
JAPAN INTERNATIONAL COOPERATION AGENCY

 NIPPON KOEI CO., LTD.  
 NIHON SUIDO CONSULTANTS CO., LTD.

TITLE: STANDARD DRAWINGS  
PIPE BRANCH

SCALE 1 : 40	DATE 30 / 01 / 2001	DRAWING NO. MWS-038
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## *Appendices*

- 1. Member List of Survey Team*
- 2. Survey Itinerary*
- 3. List of Party Concerned*
- 4. Minutes of Discussion*
- 5. Cost Estimation Borne by the Government of Kenya*

*Appendix-1*

*Member List of Survey Team*

## Member List of Survey Team

First Field Survey ( Inception Report Explanation and Field Survey : April 9 to May 28, 2000 )

Position	Name	Affiliation
Team Leader	YAMAMOTO, Keiko	Water Supply Development Specialist, Institute for International Cooperation, JICA
Coordinator	SUZUKI, Tsutomu	Staff, Project Monitoring and Coordination Division, Grant Aid Management Department, JICA
Chief Consultant/ Water Supply Planner	SAKAMOTO, Masanobu	Nippon Koei Co., Ltd.
Water Supply Management Planner	DOYA, Mitsuhiro	Nihon Suido Consultants Co., Ltd.
Facility Planner (Intake)	OGINO, Masayuki	Nippon Koei Co., Ltd.
Facility Planner(Pipeline)	OKAZAKI, Koichi	Nihon Suido Consultants Co., Ltd.
Facility Planner (Treatment Plant)	MINAMI, Seibun	Nihon Suido Consultants Co., Ltd.
Procurement and Construction Planner/ Cost Estimator	OKADA, Tokuji	Nippon Koei Co., Ltd.

Second Field Survey ( Interim Report Explanation and Field Survey : September 5 to October 30, 2000 )

Position	Name	Affiliation
Team Leader	YAMAMOTO, Keiko	Water Supply Development Specialist, Institute for International Cooperation, JICA
Coordinator	KURISU, Masanori	Staff, First Project Management Division, Grant Aid Management Department, JICA
Chief Consultant/ Water Supply Planner	SAKAMOTO, Masanobu	Nippon Koei Co., Ltd.
Water Supply Management Planner	DOYA, Mitsuhiro	Nihon Suido Consultants Co., Ltd.
Facility Planner (Intake)	OGINO, Masayuki	Nippon Koei Co., Ltd.
Facility Planner (Pipeline)	OKAZAKI, Koichi	Nihon Suido Consultants Co., Ltd.

The Mission for the Explanation of Draft Basic Design Study Report ( February 10 to February 24, 2001 )

Position	Name	Affiliation
Team Leader	WUSHIKI, Hisao	Senior Adviser, Institute for International Cooperation, JICA
Coordinator	KURISU, Masanori	Staff, First Project Management Division, Grant Aid Management Department, JICA
Chief Consultant/ Water Supply Planner	SAKAMOTO, Masanobu	Nippon Koei Co., Ltd.
Water Supply Management Planner	DOYA, Mitsuhiro	Nihon Suido Consultants Co., Ltd.
Facility Planner (Pipeline)	OKAZAKI, Koichi	Nihon Suido Consultants Co., Ltd.

*Appendix-2*  
*Survey Itinerary*

## Survey Itinerary

First Field Survey ( Inception Report Explanation and Field Survey : April 9 to May 28, 2000 )

No.	Date		Team Member	Station	Activities
1	April /9	S	Yamamoto/Suzuki/Sakamoto/Doya	On Board	Move ( Tokyo - London - Nairobi )
2	10	M	Yamamoto/Suzuki/Sakamoto/Doya	Nairobi	Arrived at Nairobi Discussion on Inception Report
3	11	T	Yamamoto/Suzuki/Sakamoto/Doya	Nairobi	Courtesy call on Japanese Embassy and JICA Discussion on Inception Report
4	12	W	Yamamoto/Suzuki/Sakamoto/Doya	Nairobi	Discussion on Inception Report
5	13	T	Yamamoto/Suzuki/Sakamoto/Doya	Meru	Move ( Nairobi - Meru ) Site Investigation
6	14	F	Yamamoto/Suzuki/Sakamoto/Doya Ogino/Okazaki/Minami	Meru On Board	Site Investigation Move ( Tokyo - London - Nairobi )
7	15	S	Yamamoto/Suzuki/Sakamoto/Doya Ogino/Okazaki/Minami	Meru Nairobi	Site Investigation Arrive at Nairobi
8	16	S	Yamamoto/Suzuki/Sakamoto/Doya Ogino/Okazaki/Minami	Nairobi Nairobi	Move ( Meru - Nairobi ) Data Arrangement
9	17	M	Yamamoto/Suzuki/Sakamoto/Doya Ogino/Okazaki/Minami	Nairobi	Discussion on Minutes
10	18	T	Yamamoto/Suzuki/Sakamoto/Doya Ogino/Okazaki/Minami	Nairobi	Discussion on Minutes
11	19	W	Yamamoto/Suzuki/Sakamoto/Doya Ogino/Okazaki/Minami	Nairobi	Signing on Minutes
12	20	T	Yamamoto/Suzuki Sakamoto/Doya/Ogino/Okazaki/ Minami	On Board Nairobi	Move ( Nairobi - Zurich ) Discussion on Questionnaire with MENR
13	21	F	Yamamoto/Suzuki Sakamoto/Doya/Ogino/Okazaki/ Minami Okada	On Board Nairobi On Board	Move ( Zurich - Tokyo ) Discussion on Questionnaire with MENR Move ( Tokyo - London - Nairobi )
14	22	S	Yamamoto/Suzuki Sakamoto/Doya/Ogino/Okazaki/ Minami Okada	Tokyo Nairobi Nairobi	Arrive at Tokyo Data collection and arrangement Arrive at Nairobi
15	23	S	Sakamoto/Doya/Ogino/Okazaki/ Minami/Okada	Nairobi	Internal Meeting
16	24	M	Sakamoto/Doya/Ogino/Okazaki/ Minami/Okada	Meru	Move ( Nairobi - Meru )
17	25	T	Sakamoto/Doya/Ogino/Okazaki/ Minami/Okada	Meru	Site Investigation, Survey on Community Water Supply, Water Quality Analysis, Data Collection and Analyses, and so on
.	.	.	.	.	Site Investigation, Survey on Community Water Supply, Water Quality Analysis, Data Collection and Analyses, and so on
.	.	.	.	.	
39	May 17	W	Sakamoto/Doya/Ogino/Okazaki/ Minami/Okada	Nairobi	Move ( Meru - Nairobi )
40	18	T	Sakamoto/Doya/Ogino/Okazaki/ Minami Okada	Nairobi On Board	Analyses and Design, Preparation of Technical Note Move ( Nairobi - London )
41	19	F	Sakamoto/Doya/Ogino/Okazaki/ Minami Okada	Nairobi On Board	Analyses and Design, Preparation of Technical Note Move ( London - Tokyo )
42	20	S	Sakamoto/Doya/Ogino/Okazaki/ Minami Okada	Nairobi Tokyo	Analyses and Design, Preparation of Technical Note Arrive at Tokyo
43	21	S	Sakamoto/Doya/Ogino/Okazaki/ Minami	Nairobi	Analyses and Design, Preparation of Technical Note
44	22	M	Sakamoto/Doya/Ogino/Okazaki/ Minami	Nairobi	Analyses and Design, Preparation of Technical Note
45	23	T	Sakamoto/Doya/Ogino/Okazaki/ Minami	Nairobi	Discussion on Technical Note with MENR

No.	Date		Team Member	Station	Activities
46	24	W	Sakamoto/Doya/Ogino/Okazaki/ Minami	Nairobi	Discussion on Technical Note with MENR
47	25	T	Sakamoto/Doya/Ogino/Okazaki/ Minami	Nairobi	Report to JICA
48	26	F	Sakamoto/Doya/Ogino/Okazaki/ Minami	On Board	Move ( Nairobi - London )
49	27	S	Sakamoto/Doya/Ogino/Okazaki/ Minami	On Board	Move ( London - Tokyo )
50	28	S	Sakamoto/Doya/Ogino/Okazaki/ Minami	Tokyo	Arrive at Tokyo

Second Field Survey ( Interim Report Explanation and Field Survey : September 5 to October 30, 2000 )

No.	Date		Team Member	Station	Activities
1	Sept. 5	T	Yamamoto/Kurusu/Sakamoto/Doya/ Okazaki	On Board	Move ( Tokyo - London - Nairobi )
2	6	W	Yamamoto/Kurusu/Sakamoto/Doya/ Okazaki	Nairobi	Arrive at Nairobi Courtesy call on Japanese Embassy, JICA and MENR
3	7	T	Yamamoto/Kurusu/Sakamoto/Doya/ Okazaki	Nairobi	Discussion on Interim Report
4	8	F	Yamamoto/Kurusu/Sakamoto/Doya/ Okazaki	Meru	Site Investigation
5	9	S	Yamamoto/Kurusu/Sakamoto/Doya/ Okazaki	Meru	Site Investigation
6	10	S	Yamamoto/Kurusu/Sakamoto/Doya/ Okazaki	Nairobi	Move ( Meru - ナイロビ )
7	11	M	Yamamoto/Kurusu/Sakamoto/Doya/ Okazaki	Nairobi	Discussion on Minutes
8	12	T	Yamamoto/Kurusu/Sakamoto/Doya/ Okazaki	Nairobi	Discussion on Minutes
9	13	W	Yamamoto/Kurusu/Sakamoto/Doya/ Okazaki	Nairobi	Discussion on Minutes
10	14	T	Yamamoto/Kurusu/Sakamoto/Doya/ Okazaki	Nairobi	Signing on Minutes
11	15	F	Yamamoto/Kurusu/Sakamoto/ Okazaki	Nairobi	Report to Japanese Embassy and JICA
			Doya	Nairobi	Core Team Meeting
12	16	S	Yamamoto/Kurusu	On Board	Move ( Nairobi - London )
			Sakamoto/Doya/Okazaki	Nairobi	Internal Meeting
13	17	S	Yamamoto/Kurusu	On Board	Move ( London - Tokyo )
			Doya/Okazaki	Meru	Move ( Nairobi - Meru )
			Sakamoto	On Board	Move ( Nairobi - London )
14	18	M	Yamamoto/Kurusu	Tokyo	Arrive at Tokyo
			Sakamoto	On Board	Move ( London - Tokyo )
			Doya/Okazaki	Meru	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
15	19	T	Sakamoto	On Board	Arrive at Tokyo
			Doya/Okazaki	Meru	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
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24	28	T	Doya/Okazaki	Nairobi	Move ( Meru - Nairobi )
25	29	F	Doya/Okazaki	Nairobi	Core Team Meeting
26	30	S	Doya	Meru	Move ( Nairobi - Meru )
			Okazaki	Nairobi	Discussion on result of study and investigation



No.	Date		Team Member	Station	Activities
27	Oct. 1	S	Doya	Meru	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
			Okazaki	Nairobi	Discussion on result of study and investigation
28	2	M	Doya	Meru	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
			Okazaki	On Board	Move ( Nairobi - London )
29	3	T	Doya	Meru	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
			Okazaki	On Board	Move ( London - Tokyo )
30	4	W	Doya	Meru	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
			Okazaki	On Board	Arrive at Tokyo
31	5	T	Doya	Meru	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
.	.	.	.	.	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
.	.	.	.	.	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
41	15	S	Doya	Nairobi	Move ( Meru - Nairobi )
42	16	M	Doya	Nairobi	Discussion on result of study and investigation
			Ogino	On Board	Move ( Tokyo - London - Nairobi )
43	17	T	Doya	On Board	Move ( Nairobi - London )
			Ogino	Nairobi	Arrive at Nairobi
44	18	W	Doya	On Board	Move ( London - Tokyo )
			Ogino	Nairobi	Meeting with local contractor
45	19	T	Doya	Tokyo	Arrive at Tokyo
			Ogino	Meru	Move ( Nairobi - Meru )
.	.	.	.	.	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
.	.	.	.	.	Site Investigation, Supervision of local contractors for topographic survey and getechnical investigation, analyses and design
51	25	M	Ogino	Nairobi	Move ( Meru - Nairobi )
52	26	T	Ogino	Nairobi	Preparation of Technical Note
53	27	W	Ogino	Nairobi	Discussion on result of study and investigation
54	28	T	Ogino	On Board	Report to JICA
					Move ( Nairobi - London )
55	29	F	Ogino	On Board	Move ( London - Tokyo )
56	30	S	Ogino	Tokyo	Arrive at Tokyo

The Mission for the Ecplanation of Draft Basic Design Study Report ( February 10 to February 24, 2001 )

No.	Date		Team Member	Station	Activities
1	Feb. 10	S	Sakamoto/Doya/Okazaki	On Board	Move ( Tokyo - London - Nairobi )
2	11	S	Sakamoto/Doya/Okazaki	Nairobi	Arrive at Nairobi Internal Meeting
3	12	M	Sakamoto/Doya/Okazaki	Nairobi	Courtesy call on JICA
4	13	T	Sakamoto/Doya/Okazaki	Nairobi	Discussion on Draft Final Report
5	14	W	Sakamoto/Doya/Okazaki	Nairobi	Discussion on Draft Final Report
6	15	T	Sakamoto/Doya/Okazaki	Meru	Move ( Nairobi - Meru )
					Site Investigation
7	16	F	Sakamoto/Doya/Okazaki	Nairobi	Site Investigation
					Move ( Meru - Nairobi )
8	17	S	Sakamoto/Doya/Okazaki	Nairobi	Internal Meeting
			Wushiki/Kurusu	機中	Move ( Tokyo - London - Nairobi )
9	18	S	Sakamoto/Doya/Okazaki	Nairobi	Internal Meeting
			Wushiki/Kurusu	Nairobi	Arrive at Nairobi
10	19	M	Wushiki/Kurusu/Sakamoto/Doya/Okazaki	Nairobi	Courtesy call on JICA
					Discussion on Minutes

No.	Date		Team Member	Station	Activities
11	20	T	Wushiki/Kurusu/Sakamoto/Doya/ Okazaki	Nairobi	Discussion on Minutes
12	21	W	Wushiki/Kurusu/Sakamoto/Doya/ Okazaki	Nairobi	Signing on Minutes
13	22	T	Wushiki/Kurusu/Sakamoto/Doya/ Okazaki	On Board	Report to Japanese Embassy and JICA Move ( Nairobi - London )
14	23	F	Wushiki/Kurusu/Sakamoto/Doya/ Okazaki	On Board	Move ( London - Tokyo )
15	24	S	Wushiki/Kurusu/Sakamoto/Doya/ Okazaki	Tokyo	Arrive at Tokyo

*Appendix-3*

*List of Party Concerned*

## List of Party Concerned

### Embassy of Japan in Kenya

Morihisa AOKI	Ambassador
Yousuke MATSUMIYA	Second Secretary

### JICA Kenya Office

Eiji HASHIMOTO	Resident Representative
Takeshi NARUSE	Deputy Resident Representative
Satoru MATSUYAMA	Assistant Resident Representative
Syouji HASEGAWA	Technical Advisor on Grant Aid Project
Heihachiro ISHIHARA	JICA Expert (Development Plan in Water Supply)
E. Kinyangi	Administration Officer

### Ministry of Environment and Natural Resources

Mohammed Isahakia	Permanent Secretary
K. G. Chesang	Director of Water Development
D. N. Stower	Senior Deputy Director, Water Development
T. W. Wambua	Deputy Director, Water Development
C. M. Mimano	Deputy Director, Water Development
T. W. Kibaki	Project Manager/KJWSP, Water Development
G. N. Karanja	Project Manager/MUWS, Water Development
Irari Wagereka	Project Manager/GDRD, Water Development
E. N. Onguti	Project Economist, Water Development
V. C. N. Njeru	Meru Central District Water Officer

### National Water Conservation and Pipeline Corporation

Yoshihiko Kobayashi	JIOCA Expert ( Management of Water Supply Organization )
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### Meru Central District

W. G. Kerario	District Commissioner, Meru Central District
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*Appendix-4*  
*Minutes of Discussion*

**MINUTES OF DISCUSSIONS  
ON THE BASIC DESIGN STUDY  
FOR THE MERU WATER SUPPLY PROJECT  
IN THE REPUBLIC OF KENYA**

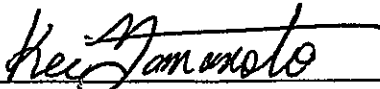
In response to a request from the Government of Republic of Kenya (hereinafter referred to as "GOK"), the Government of Japan (hereinafter referred to as "GOJ") decided to conduct a Basic Design Study for the Meru Water Supply Project in the Republic of Kenya (hereinafter referred to as "the Project") and entrusted the study the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Kenya the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mrs. Keiko Yamamoto, Senior Technical Adviser, JICA, and is scheduled to stay in the country from April 10 to April 20.

The Team held discussions with the officials concerned of the GOK and conducted a field survey in the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further work and review the project requested by the GOK for preparing the Basic Design.

Nairobi, April 19, 2000



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Mrs. Keiko Yamamoto  
Leader,  
Basic Design Study Team,  
Japan International Cooperation Agency



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Dr. Mohammed Isahakia  
Permanent Secretary  
Ministry of Environment and Natural  
Resources

## ATTACHMENT

### 1. Objective

The Objective of the Project is to improve water supply services in Meru Town through construction and rehabilitation of water supply facilities and institutional and organizational capacity building.

### 2. Study Area

The study area to be covered by the Basic Design Study is shown in Annex-1.

### 3. Responsible and Implementing Agency

(1) The Responsible Agency of the Project

Ministry of Environment and Natural Resources (hereinafter referred to as "MENR", Annex-2)

(2) The Implementing Agency of the Project

Water Development Department, Ministry of Environment and Natural Resources

### 4. Items Requested by the Government of Kenya

The items described below were requested by the Kenyan side:

- (1) Intake weir on the Kathita River,
- (2) Raw water conveyance pipeline,
- (3) Water treatment plant,
- (4) Transmission and distribution facilities,
- (5) Rehabilitation of the existing facilities,
- (6) Other facilities and equipment including water meter, relevant to the operation and maintenance, and
- (7) Technical assistance.

### 5. Changes of the Situation Concerning with the Project

The Kenyan side reported the following issues:

- (1) That the part of the existing facilities in Meru water supply system will be rehabilitated under the El-Nino Infrastructure Rehabilitation Project to be executed by the Office of the President.
- (2) That the MENR has decided to devolve the Meru water supply services to a future local

water supply managing body with full autonomy, based on the National Water Policy issued in 1999.

## **6. Water Supply to the Communities in the Study Area**

Both sides confirmed that it was necessary to supply stable and safe water to the communities in the study area. In order to achieve this objective, it is necessary to sensitize and create awareness of communities, that are relying on their inadequate own water supply system with no treatment, and strengthen public relation capacity of the District Water Office by the Kenyan side.

Therefore, the MENR is required to make a continuous effort on this issue.

## **7. Review of the Project Requested by the Government of Kenya**

The Team presented the Inception Report and held discussion with the officials of MENR.

The both sides agreed that the Team would review the following engineering and institutional issues during the first stage of the field survey on the basis of the present situation described in the items 4, 5 and 6:

- (1) Rehabilitation works of the existing facilities to be done by the Project.
- (2) Feasibility of each distribution main from the view points of needs in the communities for connection with the Meru water supply system,
- (3) Identification of alternative site of the envisaged intake weir and water treatment plant based on hydraulic studies,
- (4) Water demand taking into account needs of communities in the study area,
- (5) Water supply capacity of the facilities of the Project, and
- (6) Institution and organization for operation and maintenance of the Project

## **8. Sustainability of the Project**

The both sides recognized that sound management of the Meru water supply services is highly important as well as improvement of facilities. Accordingly the followings are confirmed by both sides:

- (1) GOK has already established a Project Preparation Unit in the MENR, in order to arrange necessary matters to establish a fully autonomous and self-sufficient water supply managing body of Meru;
- (2) The project must be designed, taking into consideration capacity of a future local water supply managing body such as reliable water supply, service area with higher bill collection and lower operation cost potential, and appropriate personnel deployment for sound management of the Meru water supply services.

*H. M.I.*



- (3) The Kenyan side also requested strongly that GOJ extend technical assistance to build the Kenyan side's institutional capacity to establish, operate, and maintain the organization required for the Project. The Team understood the necessity and announced that the request for technical assistance would be conveyed to JICA Headquarters.

## 9. Japan's Grant Aid System

- (1) The Kenyan Side understood Japan's Grant Aid Scheme and Procedures explained by the Team as shown in Annex-3 and Annex-4.
- (2) The Kenyan Side agreed that they would take the necessary measures, described in Annex-5, for smooth implementation of the project, as a condition for the Japanese Grant Aid to be implemented.

## 10. Period of the Study

The Team explained that the study period in Kenya will be divided into two stages because of substantial changes in situations which are recognized by the study team since the JICA M/P Study. The first study will be carried out for the review of the Project and the second study will be carried out for the Basic Design. The Kenyan side agreed on it. Schedule of the study is following.

First stage study : April 10 to May 26

Second stage study : The Kenyan side will be informed in June 2000 through the JICA Nairobi Office.

## 11. Other Relevant Issues

### (1) Action Plan

The Kenyan side reported to the Team their activities of action plan strongly suggested by JICA M/P Study Team in 1997, whose objectives were to improve performance of operation and maintenance described in Annex-6.

The Team appreciated the Kenyan side's efforts, albeit insufficient still, and requested the Kenyan side to continue the efforts. The Kenyan side assured of the continuation.

### (2) Forest Land Conservation Area

The Kenyan side promised to clarify the law or regulation of conservation of the forest during the first stage study. The Team will evaluate environmental impact of the Project in the national conservation area.

(3) Study of the communities

The Kenyan side confirmed to carry out the inventory study with the Team to find the water demand and willingness to pay in the study area.

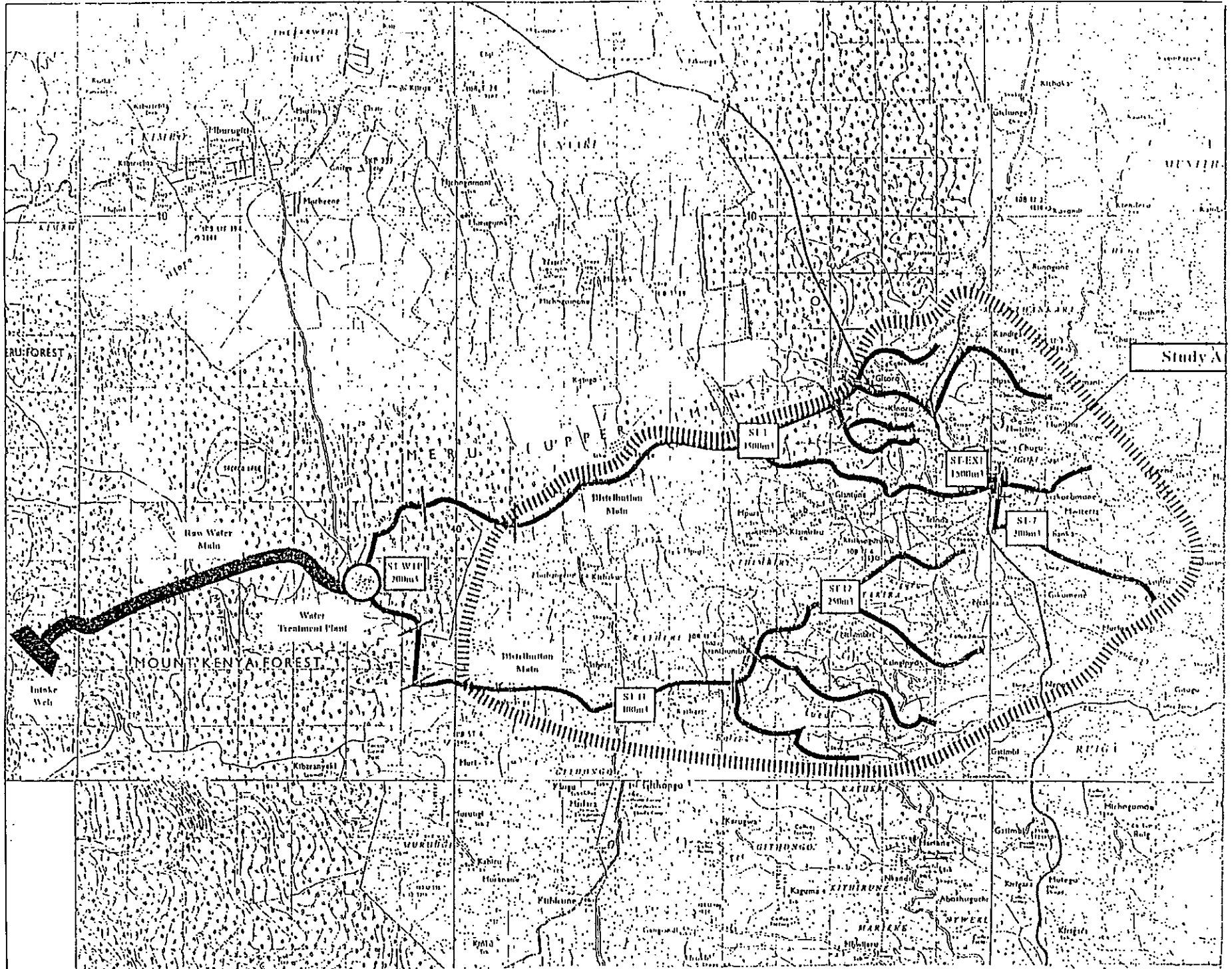
(4) Counterpart Personnel

The Kenyan side agreed to provide necessary counterpart personnel on full time basis to the Team during the period of their investigations in Nairobi and Meru.

(5) Sewerage expansion in Meru Town

The Kenyan side emphasized that expansion of sewerage system in Meru Town would be necessary to take care of increased wastewater.

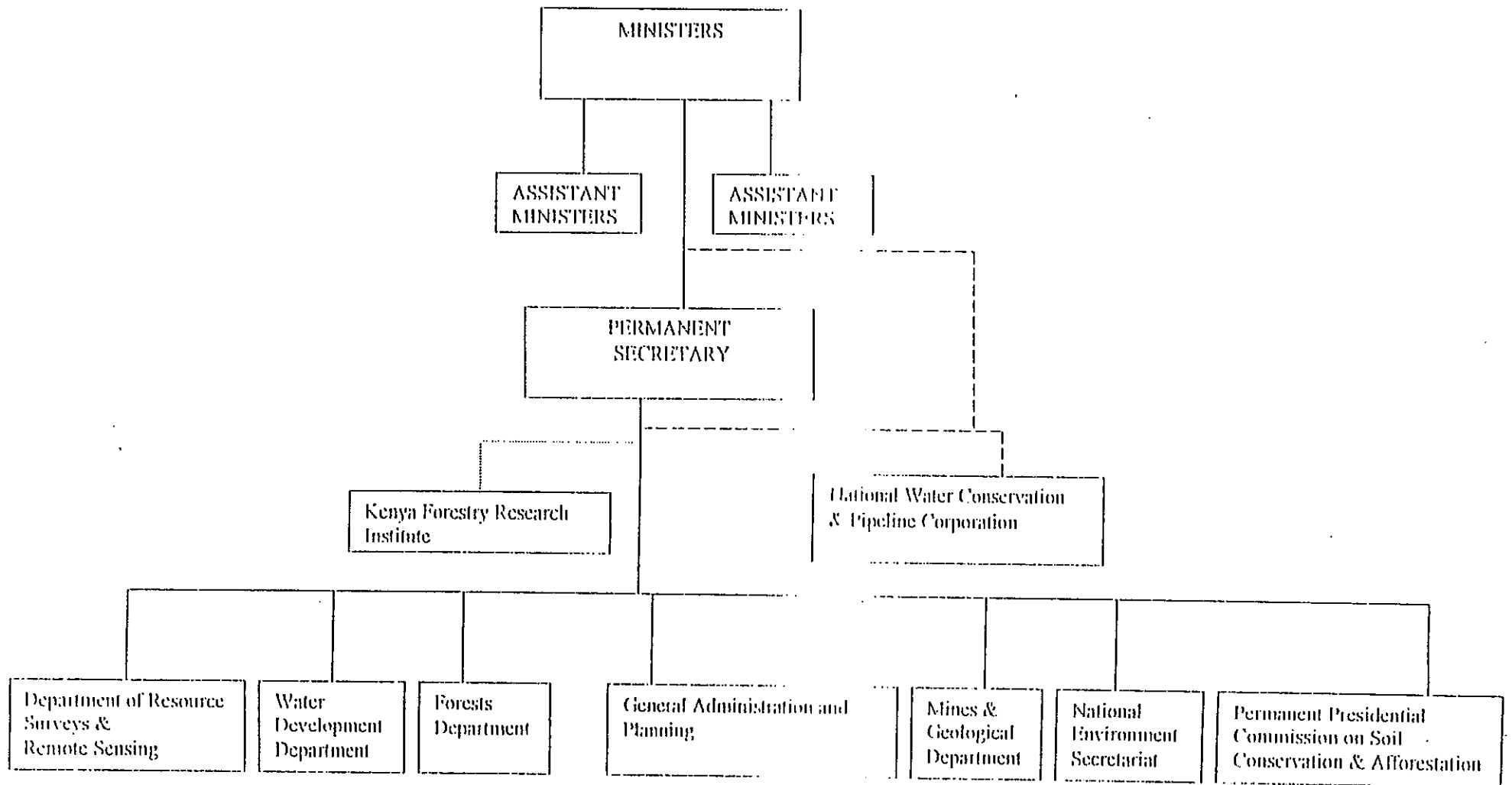
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CHART 1: MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES: CURRENT ORGANISATION STRUCTURE



KEY: - - - - - Autonomous  
 - . . . . . Semi-Autonomous

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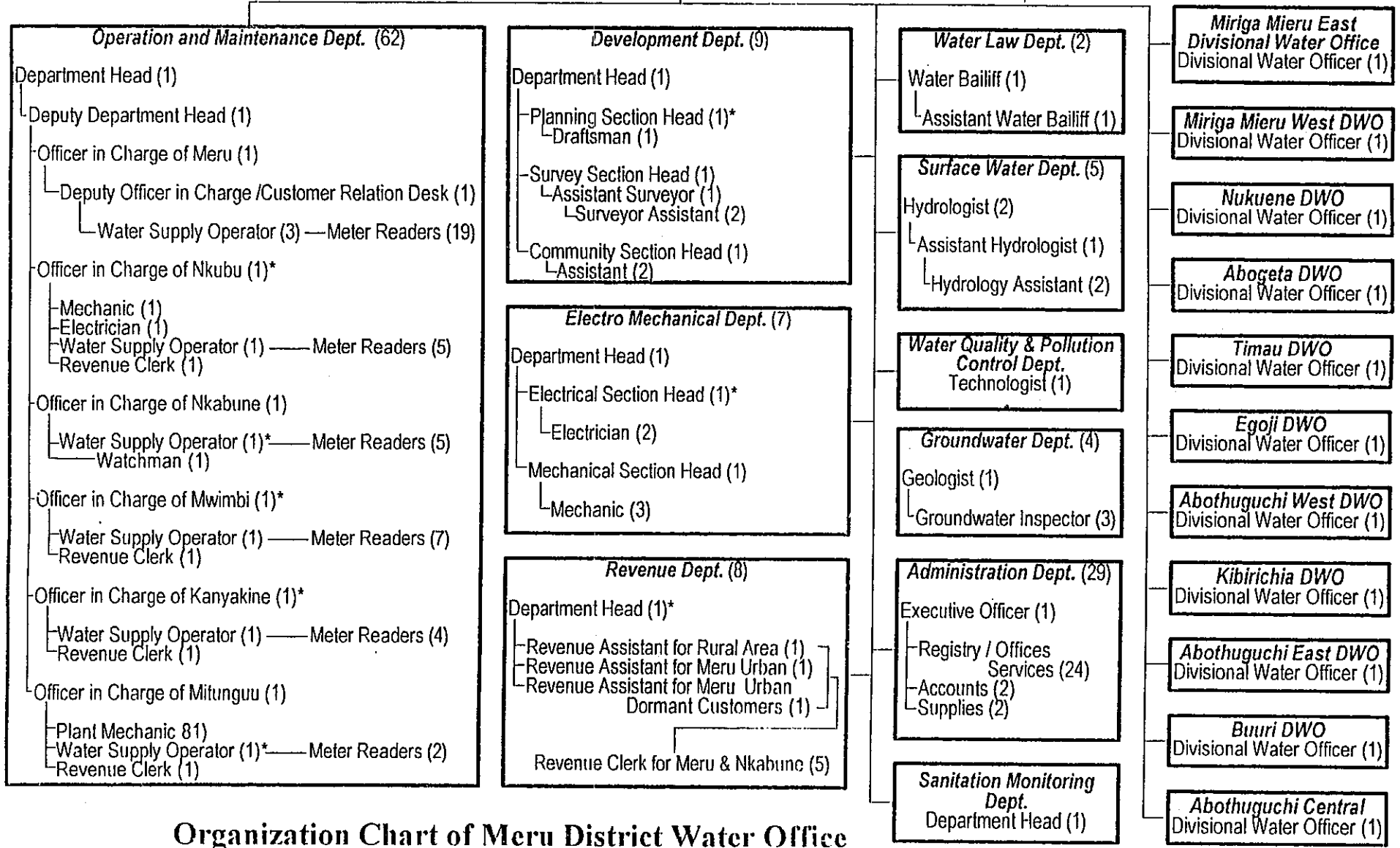
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Annex-2 (1)

**Meru District Water Office**  
District Water Officer (1)

-Numbers in parenthesis show the number of employees deployed.  
-Positions concurrently occupied are shown by \*  
-Total staff number as of April 2000 is 140.



**Organization Chart of Meru District Water Office**

B-14

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## Annex-3 JAPAN'S GRANT AID PROGRAM

### 1. Japan's Grant Aid Procedures

(1) The Japan's Grant Aid Program is executed by the following procedures.

- Application (request made by a recipient country)
- Study (Preliminary Study / Basic Design Study conducted by JICA)
- Appraisal & Approval (Appraisal by the Government of Japan and Approval by the Cabinet of Japan)
- Determination of Implementation (Exchange of Notes between both Governments)
- Implementation (Implementation of the Project)

(2) Firstly, an application or a request for a Grant Aid project submitted by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Japan's Grant Aid. If the request is deemed appropriate, the Government of Japan entrusts a study on the request to JICA (Japan International Cooperation Agency).

Secondly, JICA conducts the Study (Basic Design Study), using a Japanese consulting firm

Thirdly, the Government of Japan appraises to see whether or not the project is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the Project, once approved by the Cabinet, becomes official when pledged by the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the Project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

### 2. Contents of the Study

(1) Contents of the Study

The aim of the Study (hereinafter referred to as "the Study") conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

- a) Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary for

- project implementation,
- b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economical point of view,
  - c) Confirmation of items agreed on by both parties concerning the basic concept of the Project,
  - d) Preparation of a basic design of the Project,
  - e) Estimation of costs of the project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-Reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through to Minutes of Discussions.

#### (2) Selecting (a) Consulting Firm(s)

For smooth implementation of the study, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry (ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the study is (are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

### 3. Japan's Grant Aid Scheme

#### (1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non reimbursable funds needed to procure facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not in a form of donation of materials or such.

(2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(3) "The period of the Grant Aid" means one Japanese fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consulting firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation of construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant may be used for the purchase of products or services of a third country.

However the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality)

(5) Necessity of the "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese Yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese tax payers.

(6) Undertakings required to the Government of the recipient country

In the Implementation of the Grant Aid Project, the recipient country is required to undertake necessary measures such as the follows:

- a) To secure land necessary for the sites of the project and to clear, level and reclaim the land prior to commencement of the construction work,



- b) To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
- c) To secure buildings prior to the installation work in case the Project is providing equipment,
- d) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,
- e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,
- f) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their works.

(7) "Proper Use"

The recipient country is required to maintain and use facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for operation and maintenance of them as well as to bear all expenses other than those to be covered by the Grant Aid.

(8) Re-export

The products purchased under the Grant Aid shall not be re-exported from the recipient country.

(9) Banking Arrangement (B/A)

- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by Government of the recipient country or its designated authority under the Verified Contracts.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to pay issued by the Government of the recipient country or its designated authority.

# Annex-4 Flow Chart of Japan's Grant Aid Procedures

Stage		Flow & Works	Recipient Gov't	Japanese Gov't	JICA	Consultant	Contractor	Others
Application	(T/R: Terms of Reference)							
		<pre> graph TD     Request[Request] --&gt; Screening[Screening of Project]     Screening --&gt; Eval[Evaluation of T/R]     Eval --&gt; PID[Project Identification Survey]             </pre>						
Study (Project Formation & Preparation)	Preliminary	<pre> graph TD     PS[Preliminary Study] --&gt; FSHWR1[Field Survey Home Office Work Reporting]             </pre>						
	Basic Design	<pre> graph TD     BDS[Basic Design Survey] --&gt; SC[Selection &amp; Contracting of Consultant by Proposal]     SC --&gt; FSHWR2[Field Survey Home Office Work Reporting]     BDS --&gt; EDR[Explanation of Draft Final Report]     EDR --&gt; FR[Final Report]             </pre>						
Appraisal & Approval	<pre> graph TD     AP[Appraisal of Project] --&gt; IMC[Inter Ministerial Consultation]     IMC --&gt; PDN[Presentation of Draft Notes]     PDN --&gt; ABC[Approval by the Cabinet]             </pre>							
	Implementation	(E/N: Exchange of Notes) (A/P: Authorization to Pay)						
		<pre> graph TD     EN[E/N] --&gt; BA[Banking Arrangement]             </pre>						
		<pre> graph TD     CC[Consultant Contract] --&gt; V1[Verification]     V1 --&gt; IA[Issuance of A/P]             </pre>						
		<pre> graph TD     DTD[Detailed Design &amp; Tender Documents] --&gt; ARG[Approval by Recipient Gov't]     ARG --&gt; PT[Preparation for Tendering]             </pre>						
		<pre> graph TD     TE[Tendering &amp; Evaluation] --&gt; CC2[Construction Contract]             </pre>						
		<pre> graph TD     CC2 --&gt; V2[Verification]     V2 --&gt; AP1[A/P]             </pre>						
		<pre> graph TD     C[Construction] --&gt; CC3[Completion Certificate by Recipient Gov't]     CC3 --&gt; AP2[A/P]             </pre>						
		<pre> graph TD     O[Operation] --&gt; PES[Post Evaluation Study]             </pre>						
Evaluation & Follow up	<pre> graph TD     EPE[Ex-post Evaluation] --&gt; FU[Follow up]             </pre>							

*M.I.*

**Annex-5 Necessary measures to be taken by the Government of Kenya on condition that Japan's Grant Aid is extended.**

1. To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction work.
2. To bear commissions to the Japanese bank to execute the banking services based upon the banking arrangement.
3. To ensure prompt unloading and customs clearance at port of disembarkation in Kenya and facilitate internal transportation therein of the products purchased under the Grant.
4. To ensure the customs clearance at the port, inland transportation from the port to each site, and to bear the cost for bonded storage at the port.
5. To exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in Kenya with respect to the supply of the products and services under the verified contracts. And to take necessary measures for such tax exemption.
6. To accord Japanese nationals, whose services may be required in connection with the supply of products and services under the verified contracts, such facilities as may be necessary for their entry into Kenya and stay therein for the performance of their work.
7. To use and maintain properly and effectively all the equipment purchased and facilities constructed under the Grant.
8. To bear all the expenses other than those covered by the Grant, necessary for the execution of the Project.
9. To provide necessary data and information for the project.
10. To assign exclusive counterpart engineers and technicians for the Project.

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Annex - 6 Progress of Action Plan

Activity	Before Action Plan		After Action Plan		Comment
	Data	Period	Data	Period	
1) Metering system improvement					
1.1) Number of connection on ledger	3,002	As of Jul. 1998	3,805	As of Apr. 7, 2000	Satisfactory progress
1.2) Number of connection on field inventory *a	0	As of Jul. 1998	2,816	As of Apr. 7, 2000	Satisfactory progress
1.3) Number of meter on field inventory *a	0	As of Jul. 1998	2,092	As of Apr. 7, 2000	Satisfactory progress
1.4) Number of meter repaired	no records	As of Jul. 1998	6 per month	During Mar. 2000	Recording system established
2) Billing and collection system improvement					
2.1) Block mapping	Started	In Oct. 1998	90% progress	As of Mar. 2000	Satisfactory progress
2.2) Billing	Ksh 2,415,700 per 3 months	Jan.-Mar. 1998	Ksh 3,816,939 per 3 months	Jan.-Mar. 2000	Water tariff increased in Jan. 2000
2.3) Collection	Ksh 1,056,982 per 3 months	Jan.-Mar. 1998	Ksh 2,031,571 per 3 months	Jan.-Mar. 2000	
2.4) Collection efficiency	43.8%	Jan.-Mar. 1998	53.2%	Jan.-Mar. 2000	Improved
3) Illegal connection prevention					
3.1) Number of illegal connection identified	17 per month *b	Oct. 98 to Jan. 99	95 per month	During Mar. 2000	Productivity increased
3.2) Number of illegal connection disconnected	17 per month *b	Oct. 98 to Jan. 99	33 per month	During Mar. 2000	
4) Customer relation improvement					
4.1) Consumer Relation Desk	Inexistent	Before Oct. 1998	Established *c	Nov. 1998	Realized as scheduled
4.2) Number of complaint received	60 per 4 months	Nov. 98- Feb. 99	358 per 4 months	Nov. 99- Feb. 00	Satisfactory progress
5) Institutional capacity building					
5.1) Consumer Relation Desk	Inexistent	Before Oct. 1998	Established *c	Nov. 1998	Realized as scheduled
5.2) Leak Detection Unit	Inexistent	Before Sep. 1998	Established *d	Oct. 1998	Realized as scheduled
5.3) Meter Reading Unit	14 staff	As of Oct. 1998	19 staff	As of Mar. 2000	Staff increased

Note:

\*a Reconciliation of field data and ledgers still going on.

\*b Monthly average between Oct. 98 and Jan. 99

\*c One staff is concurrently deployed.

\*d Four staffs are concurrently deployed.

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M.T.

**MINUTES OF DISCUSSIONS  
ON THE BASIC DESIGN STUDY  
FOR THE MERU WATER SUPPLY PROJECT  
IN THE REPUBLIC OF KENYA**

In response to a request from the Government of Republic of Kenya (hereinafter referred to as "GOK"), the Government of Japan (hereinafter referred to as "GOJ") decided to conduct a Basic Design Study for the Meru Water Supply Project in the Republic of Kenya (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Kenya the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mrs. Keiko Yamamoto, Senior Technical Adviser, JICA, and is scheduled to stay in the country from September 6 to September 16.

The Team held discussions with the officials concerned of GOK and conducted a field survey in the study area.

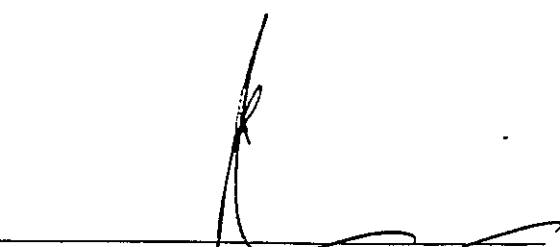
In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further work and review the project requested by GOK for preparing the Basic Design.

Nairobi, September 14, 2000



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Mrs. Keiko Yamamoto  
Leader,  
Basic Design Study Team,  
Japan International Cooperation Agency



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Dr. Mohammed Isahakia  
Permanent Secretary  
Ministry of Environment and Natural  
Resources

## ATTACHMENT

### 1. Objective

The Objective of the Project is to improve water supply services in Meru Town through construction and rehabilitation of water supply facilities and institutional and organizational capacity building.

### 2. Study Area

The study area to be covered by the Basic Design Study is shown in ANNEX-1.

### 3. Responsible and Implementing Agency

#### (1) The Responsible Agency of the Project

Ministry of Environment and Natural Resources (hereinafter referred to as "MENR", Annex-2)

#### (2) The Implementing Agency of the Project

Water Development Department, MENR

### 4. Items Requested by the Government of Kenya

After the discussion on Interim Report, GOK finally requested the following items:

#### (1) Improvement of the existing water supply system

##### a. Intake facilities and raw water transmission mains

- Installation of new valves on the Kathita and Gatabora raw water mains,
- River crossings on raw water transmission main, and
- Replacement of uPVC pipes on the Kathita and Gatabora raw water mains.

##### b. Water Treatment Plant

- Construction of new backwash tanks,
- Improvement of chemical dosing equipments,
- Installation of new control valves,
- Installation of new flow meters, and
- Construction of new tanks at the water treatment plant.

c. Pipeline network

- Replacement of the existing distribution pipes, and expansion of pipeline including construction of new break pressure tanks and reservoirs in the proposed new supply area,
- Replacement of rising main from water treatment plant to high level tanks, and
- Installation of new flow meters and valves for management of a zonal distribution system.

d. Rehabilitation of workshop building

(2) Supplies of equipment for operation and maintenance

- a. Vehicles and motor bikes for effective revenue collection, patrol and maintenance for pipe network,
- b. Workshop tools for repair of mechanical and electrical equipment including repairing and testing equipment for water meter,
- c. Laboratory instruments for water quality tests,
- d. Equipment for leakage control,
- e. Water meters for replacement of the existing meters broken or out of order,
- f. Topographic survey equipment
- g. Earthwork tools for maintenance, and
- h. Spare parts for mechanical and electrical equipment of the Meru water supply including water meter.

(3) Technical assistance for capacity building of the envisaged autonomous managing body during implementation stage of the Project

JICA will assess the appropriateness of the request and will recommend to GOJ for approval.

**5. Japan's Grant Aid Scheme**

- (1) GOK understood the Japan's Grant Aid scheme and procedures explained by Team as shown in Annex-3 and Annex-4.
- (2) GOK will take the necessary measures, described in Annex-5, for smooth implementation of the Project, as a condition for the Japanese Grant Aid to be implemented.
- (3) Both Sides recognized that GOK has a responsibility to provide the office for a new management body.

## 6. Schedule of the Study

- (1) The consultants will conduct further studies in Kenya until October 30, 2000.
- (2) JICA will prepare a draft report in English and dispatch a mission in order to explain its contents in January 2001.
- (3) In case that the contents of the draft report are accepted in principle by GOK, JICA will complete the final report and send it to GOK by the end of March 2000.

## 7. Other Relevant Issues

- (1) Action Plan for Improvement of Operation and Maintenance in Meru Water Supply

MENR reported to the Team their activities of action plan for improving performance of operation and maintenance of Meru Water Supply.

Japanese Side appreciated the MENR's efforts, albeit insufficient still, and requested the MENR to continue the efforts. The MENR assured of the continuation.

- (2) Water Supply Development Plan in the Study Area

Japanese Side explained that the Water Supply Development Plan in the Study Area has been reviewed and that this Project is formulated by focusing on the existing service area including potential supply area from the existing water supply facilities. MENR understood it.

MENR strongly requested JICA to reconsider the area marked in green and also understood necessity of another request for future expansion project.

- (3) El-Nino Project

MENR confirmed to submit the officially approved monthly progress report of construction works of the El-Nino project to JICA Kenya Office.

- (4) Final Report for Establishment of a New Managing Body for Meru Water Supply

MENR explained that the Project Preparation Unit has established the "Core Team" in September 2000. The MENR also explained the proposed action plan of the Core Team for establishing a full autonomous body for Meru Water Supply, as given in Annex-6 and 7.

MENR will submit the proposed action plan to the Core Team for discussion and adoption

The agreed plan will be submitted to JICA Kenya Office by 20<sup>th</sup> September 2000.

MENR will determine the type of new managing body by December 2000.



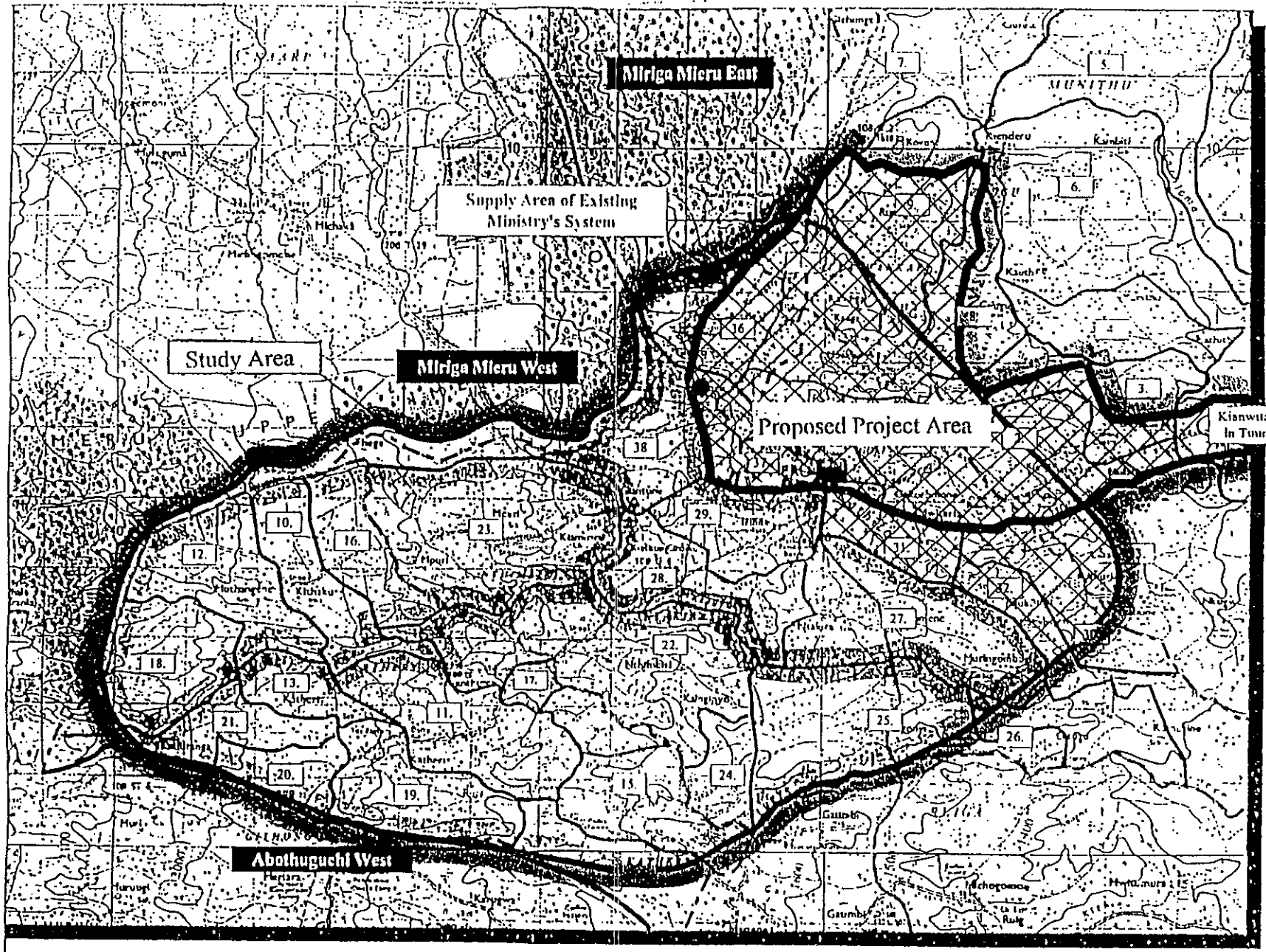
Japanese Side requested GOK to exert effort to have it registered by March 2001.

MENR confirmed to submit the report including the determination of type of new managing body approved by GOK to JICA Kenya Office by 5<sup>th</sup> January 2001.

(5) Sewerage expansion in Meru Municipality

MENR recognized the need for improvement of sewerage system in Meru Municipality, but it was clarified that this is the responsibility of GOK as it is not covered under the Project.

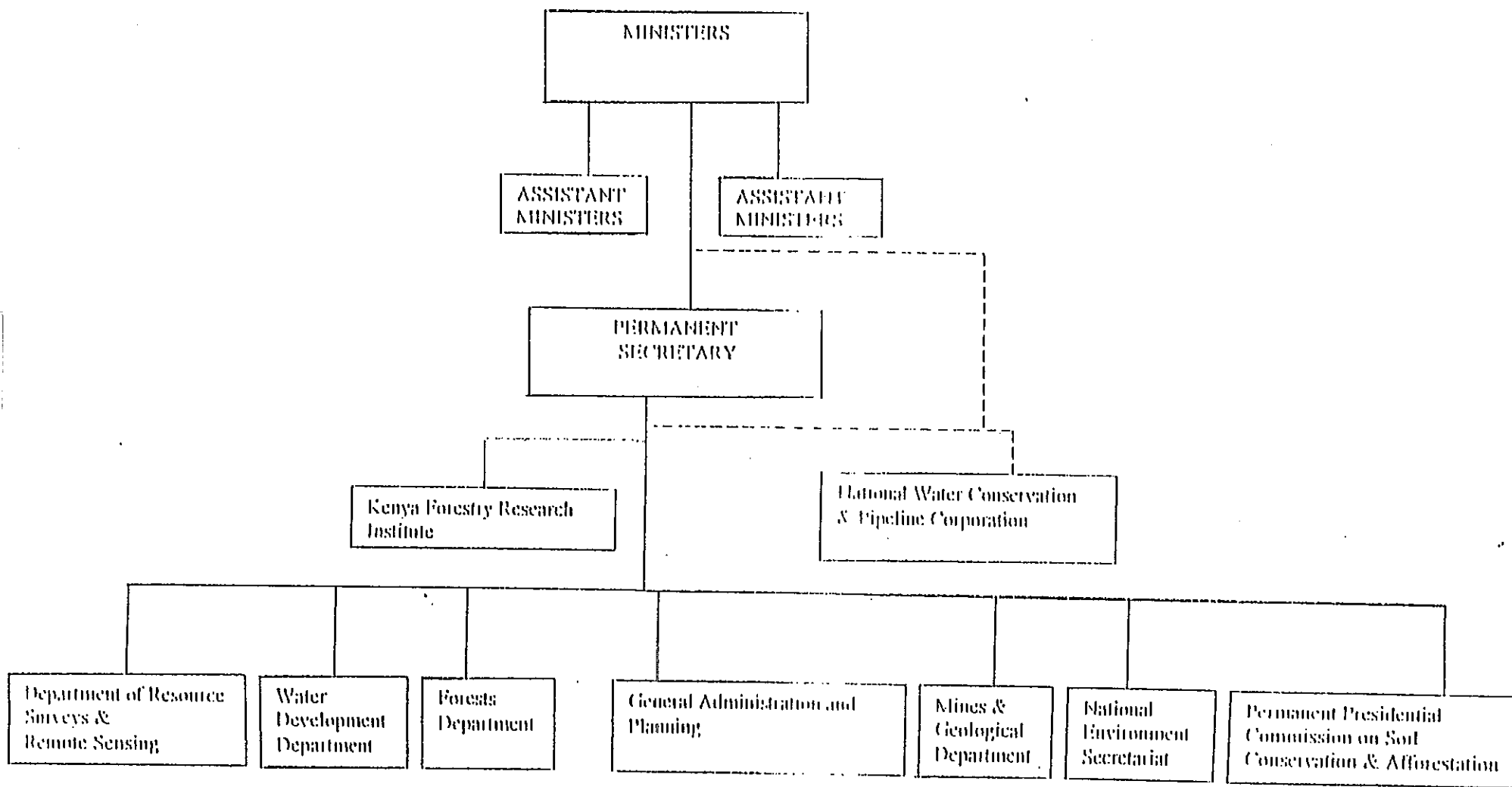
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CHART 1: MINISTRY OF ENVIRONMENT AND NATURAL RESOURCES: CURRENT ORGANISATION STRUCTURE



KEY: - - - - - Autonomous  
 \_\_\_\_\_ Semi-Autonomous

**Meru District Water Office**  
District Water Officer (1)

Numbers in parentheses show the number of employees deployed  
Positions concurrently occupied are shown by \*  
Total staff number as of April 2000 is 140

**Operation and Maintenance Dept. (62)**

- Department Head (1)
  - Deputy Department Head (1)
    - Officer in Charge of Meru (1)
      - Deputy Officer in Charge / Customer Relation Desk (1)
        - Water Supply Operator (3) — Meter Readers (19)
    - Officer in Charge of Nkubu (1)\*
      - Mechanic (1)
      - Electrician (1)
      - Water Supply Operator (1) — Meter Readers (5)
      - Revenue Clerk (1)
    - Officer in Charge of Nkabune (1)
      - Water Supply Operator (1)\* — Meter Readers (5)
      - Watchman (1)
    - Officer in Charge of Mwimbi (1)\*
      - Water Supply Operator (1) — Meter Readers (7)
      - Revenue Clerk (1)
    - Officer in Charge of Kanyakine (1)\*
      - Water Supply Operator (1) — Meter Readers (4)
      - Revenue Clerk (1)
    - Officer in Charge of Milunguu (1)
      - Plant Mechanic (81)
      - Water Supply Operator (1)\* — Meter Readers (2)
      - Revenue Clerk (1)

**Development Dept. (9)**

- Department Head (1)
  - Planning Section Head (1)\*
    - Draftsman (1)
  - Survey Section Head (1)
    - Assistant Surveyor (1)
    - Surveyor Assistant (2)
  - Community Section Head (1)
    - Assistant (2)

**Electro Mechanical Dept. (7)**

- Department Head (1)
  - Electrical Section Head (1)\*
    - Electrician (2)
  - Mechanical Section Head (1)
    - Mechanic (3)

**Revenue Dept. (6)**

- Department Head (1)\*
  - Revenue Assistant for Rural Area (1)
  - Revenue Assistant for Meru Urban (1)
  - Revenue Assistant for Meru Urban Dormant Customers (1)
- Revenue Clerk for Meru & Nkabune (4)

**Water Law Dept. (2)**

- Water Bailiff (1)
  - Assistant Water Bailiff (1)

**Surface Water Dept. (5)**

- Hydrologist (2)
  - Assistant Hydrologist (1)
  - Hydrology Assistant (2)

**Water Quality & Pollution Control Dept. Technologist (1)**

**Groundwater Dept. (4)**

- Geologist (1)
  - Groundwater Inspector (3)

**Administration Dept. (29)**

- Executive Officer (1)
  - Registry / Offices Services (24)
  - Accounts (2)
  - Supplies (2)

**Sanitation Monitoring Dept. Department Head (1)**

**Miriga Meru East Divisional Water Office**  
Divisional Water Officer (1)

**Miriga Meru West DWO**  
Divisional Water Officer (1)

**Nyakuene DWO**  
Divisional Water Officer (1)

**Ahogeta DWO**  
Divisional Water Officer (1)

**Timau DWO**  
Divisional Water Officer (1)

**Egoji DWO**  
Divisional Water Officer (1)

**Abothuguchi West DWO**  
Divisional Water Officer (1)

**Kibirichia DWO**  
Divisional Water Officer (1)

**Abothuguchi East DWO**  
Divisional Water Officer (1)

**Burui DWO**  
Divisional Water Officer (1)

**Abothuguchi Central**  
Divisional Water Officer (1)

**Organization Chart of Meru District Water Office**

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## Annex-3 JAPAN'S GRANT AID PROGRAM

### 1. Japan's Grant Aid Procedures

(1) The Japan's Grant Aid Program is executed by the following procedures.

- Application (request made by a recipient country)
- Study (Preliminary Study / Basic Design Study conducted by JICA)
- Appraisal & Approval (Appraisal by the Government of Japan and Approval by the Cabinet of Japan)
- Determination of Implementation (Exchange of Notes between both Governments)
- Implementation (Implementation of the Project)

(2) Firstly, an application or a request for a Grant Aid project submitted by the recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Japan's Grant Aid. If the request is deemed appropriate, the Government of Japan entrusts a study on the request to JICA (Japan International Cooperation Agency).

Secondly, JICA conducts the Study (Basic Design Study), using a Japanese consulting firm

Thirdly, the Government of Japan appraises to see whether or not the project is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the Project, once approved by the Cabinet, becomes official when pledged by the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the Project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

### 2. Contents of the Study

(1) Contents of the Study

The aim of the Study (hereinafter referred to as "the Study") conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

- a) Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary for

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- project implementation,
- b) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economical point of view,
  - c) Confirmation of items agreed on by both parties concerning the basic concept of the Project,
  - d) Preparation of a basic design of the Project,
  - e) Estimation of costs of the project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-Reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through to Minutes of Discussions.

#### (2) Selecting (a) Consulting Firm(s)

For smooth implementation of the study, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry (ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the study is (are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

### 3. Japan's Grant Aid Scheme

#### (1) What is Grant Aid?

The Grant Aid Program provides a recipient country with non reimbursable funds needed to procure facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. The Grant Aid is not in a form of donation of materials or such.

(2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc., are confirmed.

(3) "The period of the Grant Aid" means one Japanese fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consulting firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation of construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

(4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant may be used for the purchase of products or services of a third country.

However the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality)

(5) Necessity of the "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese Yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese tax payers.

(6) Undertakings required to the Government of the recipient country

In the Implementation of the Grant Aid Project, the recipient country is required to undertake necessary measures such as the follows:

- a) To secure land necessary for the sites of the project and to clear, level and reclaim the land prior to commencement of the construction work,

- b) To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
- c) To secure buildings prior to the installation work in case the Project is providing equipment,
- d) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,
- e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,
- f) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their works.

(7) "Proper Use"

The recipient country is required to maintain and use facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for operation and maintenance of them as well as to bear all expenses other than those to be covered by the Grant Aid.

(8) Re-export

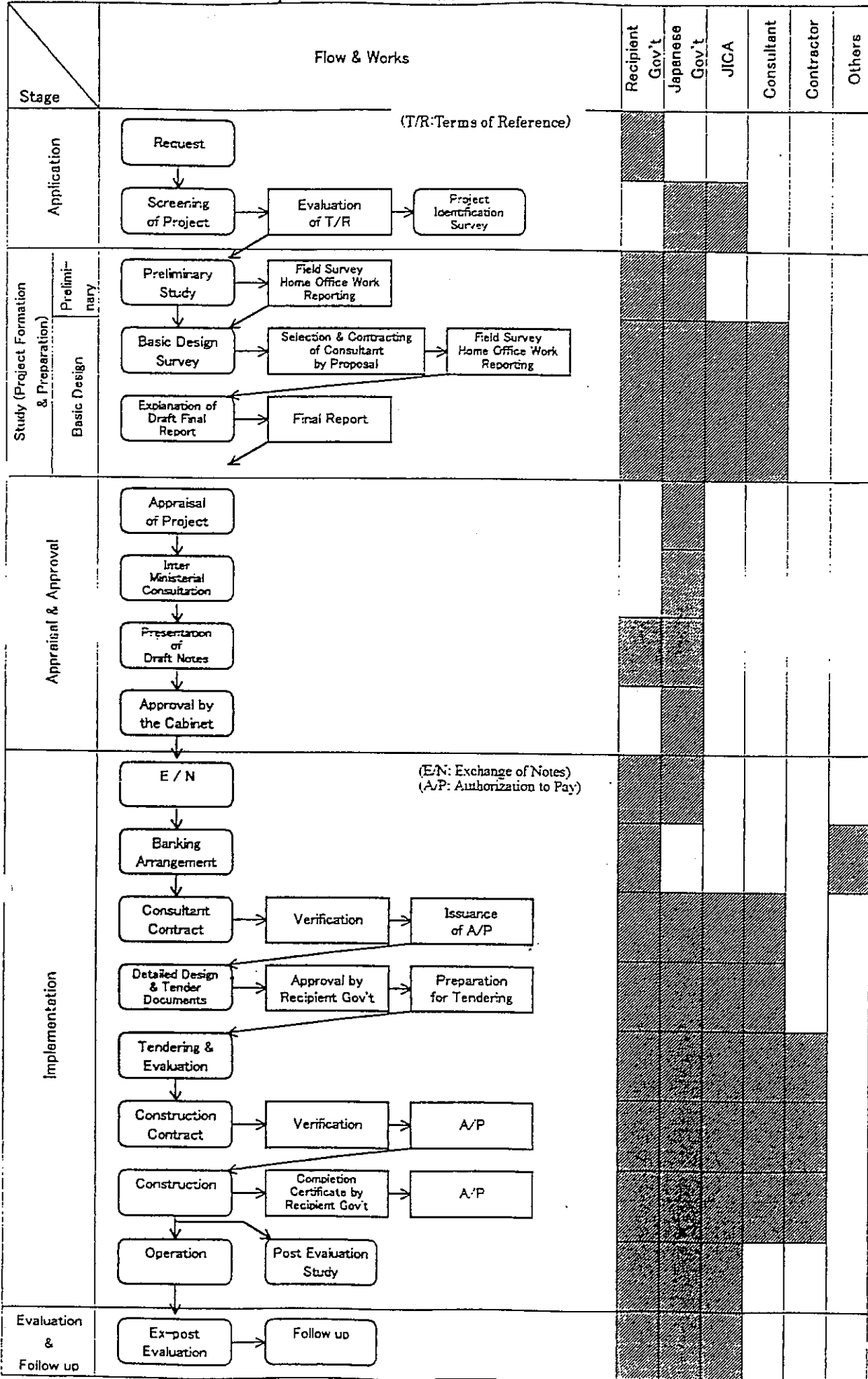
The products purchased under the Grant Aid shall not be re-exported from the recipient country.

(9) Banking Arrangement (B/A)

- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by Government of the recipient country or its designated authority under the Verified Contracts.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to pay issued by the Government of the recipient country or its designated authority.



Annex-4 Flow Chart of Japan's Grant Aid Procedures



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**Annex-5 Necessary measures to be taken by the Government of the Kenya on condition that Japan's Grant Aid is extended.**

1. To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction work.
2. To bear commissions to the Japanese foreign exchange bank to execute the banking services based upon the banking arrangement.
3. To ensure prompt unloading and customs clearance at port of disembarkation in the Kenya and facilitate internal transportation therein of the products purchased under the Grant.
4. To ensure the customs clearance at the port, inland transportation from the port to each site, and to bear the cost for bonded storage at the port.
5. To exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in the Kenya with respect to the supply of the products and services under the verified contracts. And to take necessary measures for such tax exemption.
6. To accord Japanese nationals, whose services may be required in connection with the supply of products and services under the verified contracts, such facilities as may be necessary for their entry into the Kenya and stay therein for the performance of their work.
7. To use and maintain properly and effectively all the equipment purchased and facilities constructed under the Grant.
8. To bear all the expenses other than those covered by the Grant, necessary for the execution of the Project.
9. To provide necessary data and information for the project.
10. To assign exclusive counterpart engineers and technicians for the Project.

**Annex-6 Proposed Action Plan for Establishment of an Autonomous Managing Body for Meru Water Supply**

- (1) Objective of an action plan is to establish a full autonomous body for Meru Water Supply, defined as follows:
- a. There is no external interference in affairs of "body".
  - b. All decisions regarding affairs of "body" are made by management and or board.
  - c. Management and/or board is responsible for policy of "body".
  - d. "Body" can collect tariffs and utilize them for water supply operation and sanitation operation.
  - e. Transparency and accountability have to be maintained.
  - f. "Body" can receive bilateral finance and technical assistance under guarantee of GOK.
- (2) The Core Team is composed of officials of the relevant agencies as follows:

Name of Members	Organization	Position
1. Mr. K. G. Chesang	MENR	DWD
2. Mr. D. N. Stower	MENR	SDD/WRD
3. Mr. H. Ishihara	MENR	JICA Expert
4. Mr. S. M. Wambua	MENR	DD/OM
5. Mr. T. W. Kibaki	MENR	Program Manager, KJWSP
6. Mr. S. Thuo	MENR	Japan Desk Officer
7. Mr. C. N. Mimano	MENR	DD/PD
8. Mr. E. Onguti	MENR	Principal Economist
9. Mr. G. N. Karanja	MENR	Project Manager
10. Mr. Irari Wagereka	MENR	Project Manager
11. To be nominated	Meru Municipal Council	Town Clerk
12. To be nominated	Meru County Council	County Clerk
13. To be nominated	UDD/MoLG	
14. To be nominated	A. G. Office	
15. To be nominated	Treasury	
16. To be nominated	Meru Central District Water Office	

- (3) The main subjects to be assessed by Core Team are;
- a. Determination of type of managing body,
  - b. Legal preparation for establishment,
  - c. Organization structuring and staff planning of a project management unit and supporting staff,
  - d. Financial planing, and
  - e. Registration of a new managing body.

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### Annex 7 Proposed Principal Tasks to Set Up A New Managing Body

	Year 2000				Year 2001											
	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
<b>Legal preparation</b>																
Kick off meeting of core team	▼															
Budget is allocated to Team		▼														
Decide legal scope and schedule		▼														
Recruit legal expert		▼														
Legal investigation																
Report on legal issues					▼											
Evaluate result of legal report					▼											
Determination of new managing body					▼											
Registration of new managing body										▼						
<b>Organization structuring and staff planning</b>																
Review of required staff																
Report on staff planning				▼												
Evaluate staff planning report				▼												
Finalize staff planning					▼											
Setting up of new managing body										▼						
Management transfer from DWO to new managing body												▼				
Structuring of supporting staff																
<b>Financial planning</b>																
Review of financial situation (by DWO)																
Decide financial scope and schedule		▼														
Recruit financial expert			▼													
Financial investigation																
Report financial planning				▼												
Evaluate financial planning report					▼											
Finalize financial planning						▼										
Identify financing source of initial capital							▼									

▼ Activity dead line    ||||| Activity duration

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**MINUTES OF DISCUSSIONS  
ON THE BASIC DESIGN STUDY  
FOR THE MERU WATER SUPPLY PROJECT  
IN THE REPUBLIC OF KENYA**

In response to a request from the Government of Republic of Kenya (hereinafter referred to as "GOK"), the Government of Japan (hereinafter referred to as "GOJ") decided to conduct a Basic Design Study on the Meru Water Supply Project in the Republic of Kenya (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Kenya the Basic Design Study Team (hereinafter referred to as "the Team"), which is headed by Mr. Hisao Wushiki, Senior Advisor, JICA, and is scheduled to stay in the country from February 11 to February 22, 2001

The Team held discussions with the officials concerned of the GOK and conducted a field survey in the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The Team will proceed to further work and review the project requested by the GOK for preparing the Basic Design.

Nairobi, February 21, 2001

---

Mr. Hisao Wushiki  
Leader,  
Basic Design Study Team,  
Japan International Cooperation Agency

---

Dr. Mohammed Isahakia  
Permanent Secretary  
Ministry of Environment and Natural  
Resources

---

Mr. Martin Oduor Otieno  
Permanent Secretary  
Ministry of Finance and Planning

## ATTACHMENT

### 1. Components of the Draft Final Report

The Government of Kenya agreed and accepted in principle of the components of the draft final report of the Basic Design Study on Meru Water Supply explained by the Study Team.

### 2. Japan's Grant Aid Scheme

Kenyan side understands the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Kenya as explained by the Team and described in Annexes 1 to 3 of the Minutes of Discussions signed by both parties on 21 February, 2001.

### 3. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to the Government of Kenya by the end of March 2001.

### 4. Other Relevant Issues

- (1) The Kenyan side requested the Japanese side for technical assistance including counterpart training in strengthening of New Management Body of water supply system in Meru Town, as one of the components of the Grant-Aid Scheme.

The Kenyan side agreed provision of counterpart personnel required for assistance of the Project.

- (2) The Team explained the Draft Final Report of the Basic Design Study on Meru Water Supply to the Kenyan side. Both parties agreed that this draft final report should not be duplicated or released to any outside parties without prior written consensus.
- (3) The Kenyan side explained the progress of activities of the Preparatory Unit of the MENR for implementation of New Management Body for Meru water supply. Registration of the trust corporation (New Management Body) for Meru water supply will be completed by the end of March 2001, but it will require some time to make the body operational. Therefore, schedule of setting-up of New Management Body for Meru water supply has been revised as shown in Annex 4.

The Japanese side requested the Kenyan side to send evidence of registration including full copy of application documents soon after the registration in April 2001 through JICA Kenya Office in Nairobi.

Both parties understood that operation plan would have an important role for sustaining the New Management Body. The Preparatory Unit has responsibility to conduct transitional arrangements as a part of operation plan, scheduled in Annex 4. The Kenyan side agreed to

submit the monthly progress report of the activities in this Annex 4 to the JICA Kenya Office.

- (4) Both parties agreed that the Counterpart Fund is one of the financial sources for initial operation of New Management Body.
- (5) The Kenyan side agreed to secure necessary land for implementation of the Project under the Grant-Aid Scheme.

The Kenyan side agreed to avail approval letter for use of required government lands such as sites required for distribution tanks and pipeline network along the existing roads in Meru Town.

- (6) The Government of Kenya will exempt goods and services required for the Project from all taxes including VAT.
- (7) Both parties agreed that this Project would execute the rehabilitation and improvement works of the existing facilities in Meru water supply, avoiding duplication with the works of the El-Nino Infrastructure Rehabilitation Project.

The Japanese side will assess and verify the monthly progress report of the El-Nino Infrastructure Rehabilitation Project in February 2001, attached in Annex 5, and finalize the project components of the Grant-Aid in Japan.

- (8) The Kenyan side confirmed that they are finalizing the Poverty Reduction Strategy Programme (PRSP) to include this Project, as reflected in the current Medium Term Expenditure Framework (MTEF) Budget.

## **Annex-1 JAPAN'S GRANT AID PROGRAM**

### **1. Japan's Grant Aid Procedures**

(1) The Japan's Grant Aid Program is executed by the following procedures.

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- b) Evaluation of the appropriateness of the Project to be implemented under the Grant



Aid Scheme from a technical, social and economical point of view,

- c) Confirmation of items agreed on by both parties concerning the basic concept of the Project,
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Japan's Grant Aid is extended in accordance with the Notes exchanged by the two Governments concerned, in which the objectives of the Project, period of execution,

conditions and amount of the Grant Aid, etc., are confirmed.

- (3) "The period of the Grant Aid" means one Japanese fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consulting firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation of construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Governments.

- (4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant may be used for the purchase of products or services of a third country.

However the prime contractors, namely, consulting, contractor and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality

- (5) Necessity of the "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese Yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese tax payers.

- (6) Undertakings required to the Government of the recipient country

In the Implementation of the Grant Aid Project, the recipient country is required to undertake necessary measures such as the follows:

- a) To secure land necessary for the sites of the project and to clear, level and reclaim the land prior to commencement of the construction work,
- b) To provide facilities for distribution of electricity, water supply and drainage and other incidental facilities in and around the sites,
- c) To secure buildings prior to the installation work in case the Project is providing equipment,
- d) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid,

- e) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts,
- f) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their works.

(7) "Proper Use"

The recipient country is required to maintain and use facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign the necessary staff for operation and maintenance of them as well as to bear all expenses other than those to be covered by the Grant Aid.

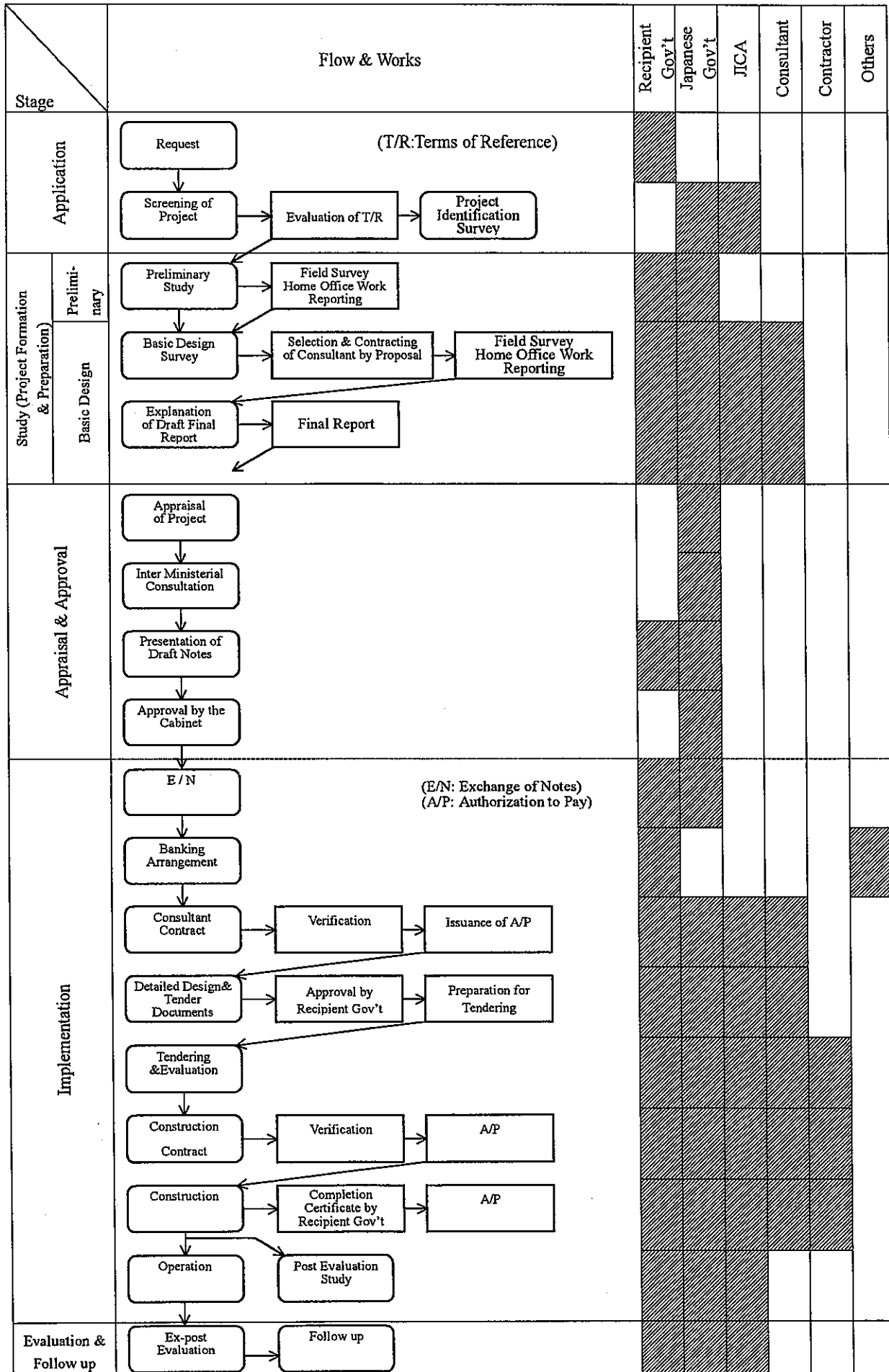
(8) Re-export

The products purchased under the Grant Aid shall not be re-exported from the recipient country.

(9) Banking Arrangement (B/A)

- a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by Government of the recipient country or its designated authority under the Verified Contracts.
- b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an Authorization to pay issued by the Government of the recipient country or its designated authority.

**Annex-2 Flow Chart of Japan's Grant Aid Procedures**



**Annex-3 Necessary measures to be taken by the Government of the Kenya on condition that Japan's Grant Aid is extended.**

1. To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction work,
2. To bear commissions to the Japanese foreign exchange bank to execute the banking services based upon the banking arrangement,
3. To ensure prompt unloading and customs clearance at port of disembarkation in the Kenya and facilitate internal transportation therein of the products purchased under the Grant,
4. To ensure the customs clearance at the port, inland transportation from the port to each site, and to bear the cost for bonded storage at the port,
5. To exempt Japanese nationals from custom duties, internal taxes and other fiscal levies which may be imposed in the Kenya with respect to the supply of the products and services under the verified contracts. And to take necessary measures for such tax exemption,
6. To accord Japanese nationals, whose services may be required in connection with the supply of products and services under the verified contracts, such facilities as may be necessary for their entry into the Kenya and stay therein for the performance of their work,
7. To use and maintain properly and effectively all the equipment purchased and facilities constructed under the Grant,
8. To bear all the expenses other than those covered by the Grant, necessary for the execution of the Project,
9. To provide necessary data and information for the project, and
10. To assign exclusive counterpart engineers and technicians for the Project.

## Annex 4 Transitional Arrangements And Time Frame

Year 2001

	3	4	5	6	7
1	<b>Registration of Trust Fund</b>				
1.1	▼				▼
2	<b>Registration of New Managing Body</b>				
2.1	▼				
2.2		▼			
3	<b>Asset / Debt transfer confirmation</b>				
3.1			▼		
3.2	▼				
3.3	▼				
4	<b>Confirmation of Initial financing</b>				
4.1	▼				
4.2		▼			
5	<b>Preparatory works to make the Body operational</b>				
5.1			▼		
5.2				▼	
5.3					
5.3.1			▼		
5.3.2			▼		
5.3.3			▼		
5.3.4			▼		
5.4					
5.4.1					▼
5.4.2					▼
5.4.3			▼		
5.4.4					▼
5.4.5				▼	
5.4.6				▼	
6				▼	

▼ Event deadline      ■ Event



**OFFICE OF THE PRESIDENT**

**EL NINO EMERGENCY PROJECT (ENEP)**  
VIEW PARK TOWERS, UTALJI LANE-OFF LEBURU HIGHWAY

Telegraphic Address: "RAIS"  
Telephones: Nairobi 255640  
Fax: (254) - 01 - 255637  
When replying please quote  
Ref. No. EIRP/WSS/PW26A/Vol.III(19)

P. O. BOX 40213  
NAIROBI

February 9, 2001

The Director  
Water Development  
Ministry of Environment and  
Natural Resources  
P.O. Box 30521  
NAIROBI

**RE: EL NINO INFRASTRUCTURE REHABILITATION PROJECT  
REHABILITATION OF WATER AND SANITATION  
FACILITIES IN MERU DISTRICT  
CONTRACT NO. EIRP/WSS/PW26  
REHABILITATION WORKS**

We are in receipt of your letter WD/3/3/156 Vol.III/(82) dated 13<sup>th</sup> November 2000 on the above subject.

Attached find a list of works which are being executed under the above contract for your records.

  
**ENG. D.K. BARASA**  
**FOR: PROJECT MANAGER**

Enc..

*EL-NIÑO EMERGENCY PROJECT*

*MERU CENTRAL DISTRICT WATER SUPPLIES*

**INTAKE WORKS**

*GATOBORA STREAM, SPRING INTAKE, ASK INTAKE*

- desilting of the intake pool
- fencing of the intake
- provision of fine and coarse intake screens
- refurbishment of the intake structure

*Works not done due to limitation of funds*

- Additional desilting of the intake pool
- Extension of the fencing at the intake.

*Summary of works carried out*

- Desilting of intake pool
- Replacement of valves, fine and coarse screens
- Protection works upstream and downstream of intake
- Repair of intake structure
- Fencing works
- Regrading of the access road to the intake.



## **RAW WATER MAINS**

### **KATHITA RAW WATER MAIN**

#### **Summary of works carried out:**

- Construction of steel bridge for the pipe support on Kathita river crossing.
- Protection work at the river crossing
- Replacement of the damaged pipes at the river crossing

#### **Works not done due to limitation of funds**

- Salvaging of old pipes at the river crossing.
- Protection of exposed steel pipes particularly at the river crossings.
- Replacement of air valves and ball float valves for EPTs.

### **GATOBORA RAW WATER MAIN**

#### **Summary of works carried out:**

- Replacement of pipes at the rope bridge section
- Construction of rope bridge pipe support at the landslide section
- Replacement of some air valves, sluice valves on the raw water main.

#### **Works not done due to limitation of funds**

- Salvaging of old uPVC pipes on the new rope bridge section
- Rehabilitation of some sections of the pipeline.

### **ASK RAW WATER MAIN**

#### **Summary of works carried out:**

- Replacement of some damaged uPVC, G.I. sections with steel pipes.

#### **Works not done due to limitation of funds**

- Replacement of some uPVC pipes with G.I. pipes and provision of pipe supports at Gatobora river crossing.
- Replacement of air valves and provision of chambers.

## MILIMANI TREATMENT WORKS

### OLD CLARIFLOCCULATORS AND SEDIMENTATION BASIN

#### Summary of works carried out:

- desilting of the units
- refurbishment of the underdrain system
- replacement of the media
- repair of leaking walls.
- Rehabilitation of the pipework including valves

#### Works not done due to limitation of funds

- Construction of a dosing tower, chemical mixing tanks and gravity dosers

### 1978 FILTER UNITS

#### Summary of works carried out:

- Desilting of the units
- Repair of the underdrainage system
- Replacement of filter media
- Refurbishment of valves and chambers

#### Works not done due to limitation of funds

- Construction of flocculators and sedimentation basin
- Modification of the inlet raw water pipework
- Chemical dosing arrangement for the raw water
- White washing of the external surfaces of the filters

### 1995 COMPOSITE TREATMENT UNITS

#### Summary of works carried out:

- Construction of a collapsed partition wall

- Desilting of the units
- Replacement of the filter media
- Refurbishment of the underdrain system
- Refurbishment of chambers and repair of valves
- Provision of chemical dosing system

Works not done due to limitation of funds

- Improvement/rehabilitation of the external surfaces

1980 PRESSED STEEL ELEVATES TANK

Summary of works carried out:

- Repair of the backwash steel tank
- Refurbishment of valves

Works not done due to limitation of funds

- Rehabilitation of the small backwash steel tank

STORAGE TANKS 91, 265 and 455 m<sup>3</sup>

Summary of works carried out:

- Refurbishment of the inlet and outlet pipework
- Replacement of ball float valves and bulk meters and tank level recorders
- Repair of leaking tank

Works not done due to limitation of funds

- Repair of the leaking underground tank by applying another layer of plaster internally
- Provision of additional storage capacity at the treatment works

## PUMPHOUSE

### Summary of works carried out

- Repair of the pumphouse
- Supply of 3 No. centrifugal pumps for transfer of water to the high level tanks including associated pipework.
- Switchgear etc. for the pumps

### Works not done due to limitation of funds

- New rising main from the pumphouse to Milimani High Level Tanks.

## SITE WORKS

### Summary of works carried out:

- Rehabilitation of staff houses.
- Repair of roads, fencing etc.

### Works not done due to limitation of funds

- Replacement of badly damaged roofs of staff houses
- Refurbishment of electrical sanitation systems for the houses.
- Chemical storage building.
- External security lighting system
- Drainage system for the treatment works site.

## NEW COMPOSITE UNITS

### Summary of works carried out:

- Construction of 2 No. composite units including the following:-
  - Inlet, outlet, backwash pipework
  - Chemical dosing system for raw water
  - Walkways and other associated works

### Works not done due to limitation of funds

- Chemical dosing arrangement for the filtered water from the units
- Drainage pipework for the new composite units.

## RESERVOIRS AND DISTRIBUTION SYSTEM

### High Level Tanks

#### Summary of works carried out:

- Rehabilitation of chambers, tanks, level recorders
- Provision of new ball float valves complete with control assemblies
- Refurbishment of pipework, valves etc.
- Provision of chemical dosing arrangement
- Site works including refurbishment of attendant's house

#### Works not done due to limitation of funds

- Provision of a bulk meter
- Pumping system and additional storage tanks at a much higher level ground for supply of water to high pressure zone.
- Electrical works at Millmani high level tanks site.

## DISTRIBUTION SYSTEM

### Summary of works carried out

- The new Gitoro – Makutano pipeline for supply of water to higher pressure zone.
- Refurbishment of pipework at junctions including replacement of valves, or construction of chambers.
- Replacement of ball float valves for BFTs
- Replacement of bulk meters

### Works not done due to limitation of funds

- Expansion of the distribution system
- Repair of some sections of the pipelines including reconstruction of the remaining valve chambers

Additional Information on the works not done due to limitation of funds

- Two units of chlorine dozers of for the composite units constructed in 1995 in Milimani Treatment Works,
- Two units of sluice valves along the Gatabora Stream Raw Water Main.



*Appendix-5*  
*Cost Estimation Borne*  
*by the Government of Kenya*

### Cost Estimation Borne by the Government Kenya

No.	Cost Items	Quantity	Unit	Unit Price	Cost (Ksh)
1	Land Acquisitin for Break Pressure Tank	310	m2	200	62,000
2	Compensation Cost Item 1.	310	m2	36	11,160
3	Cutting of Trees	100	trees	3,000	300,000
4	Construction of Fence				
	4.1 Reservoir	5	sites	198,000	990,000
	4.2 Break Pressure Tank	12	sites	55,000	660,000
5	Start up cost for autonomous Management Body	1			2,000,000
Total					4,023,160