2-3 Population

2-3-1 Statistics of Population

Tentena consists of 6 districts, i.e., Sangele, Tentena, Pamona, Petirodongi, Tendeadongi and Sawidago. The existing Report considered the population of only 3 districts. This results in a difference between the data of population in the said Report and the actual population count presently available. From now on in the following sections, population, population served, etc. are recalculated based on the latest data.

The latest data available of districtwise population of Tentena in the past 6 years (1974 - 1979) are shown in Table 2-3-1.

Table 2-3-1 Population Data

District		1974	1975	1976	1977	1978	1979
1. Sangele	a	1,870	1,930	2,015	2,030	2,060	2,223
	b	238	240	247	273	282	297
2. Tentena	a	1,070	1,084	1,092	1,112	1,033	1,112
	b	117	124	126	133	149	169
3. Pamona	a	768	784	801	814	824	838
	b	80	84	92	98	103	123
4. Petirodongi	a	487	496	503	512	539	549
	b	65	68	72	84	101	105
5. Tendeadongi	a	420	469	475	487	497	502
	b	48	51	56	61	65	70
6. Sawidago	a	1,153	1,167	1,172	1,198	1,224	1,251
	b	166	178	187	209	216	221
T o t a l	a	5,768	5,930	6,058	6,153	6,177	6,475
	b	714	745	780	858	916	985

Note : a = Population
b = Number of households

Source : Office of Kecamatan Pamona Utara

2-3-3 Population Projection

The existing Report made population projection, but due to the change in the study area as mentioned in the preceding section the projection has had to be made once again. Therefore, the Study Team has projected the future population based on the latest data and considering the local features, as detailed in Appendix A Population Projection. The method used for the calculation is the geometric method based on the average annual growth rate and the results of the calculation are shown in Table 2-3-2, below.

Table 2-3-2 Projected Population

Year	Population	Population Increase (/ 5 years)
1980	6,630	-
1985	7,440	810
1990	8,350	910
1995	9,380	1,030
2000	10,520	1,140
2005	11,820	1,300

2-4 Population Served and Water Demand

2-4-1 Present Water Use

As has already been dexcribed in the section 2-2 Existing Water Supply Facilities, there are some water supply facilities, but they can not be termed a public system. Most of the inhabitants get water for domestic use from rivers, springs and shallow wells. The river water in particular is in wide use.

Regarding quantity of consumption, the Study Team conducted a field survey visiting about 70 households. As a result of this survey, it has been known that the consumption for domestic purposes varies from a low of 8 l/c/d, to a high of 50 l/c/d, with an average of 20 l/c/d. This figure will be utilized later for estimation of water demand.

2-4-2 Population Served

The existing Report has employed the usual method for estimation of population served, namely, to multiply the total population by some assumed percentage. By this method, however, the local conditions can not necessarily be reflected in the estimation. Considering this, the Study Team has used a more realistic approach for the estimation as explained in Appendix A Population Served and Water Demand. The results thus obtained is presented in Table 2-4-1.

Table 2-4-1 Estimated Population Served

Year	Population	Population Served	Percentage (%)
1980	6,630	-	-
1985	7,440	4,791	64.4
1990	8,350	5,695	68.2
1995	9,380	6,785	72.3
2000	10,520	8,082	76.8
2005	11,820	9,648	81.6

2-4-3 Water Requirement

As already stated in 2-3-1, recalculation of the population was necessitated as detailed in Appendix A, and further water requirements as well had to be newly estimated because of 1) the revised population pro-

jection and 2) lack of estimation of water requirements for the years after 1985, which is detailed in Appendix B. Major points of the review of the Report and also the present additional study are outlined below.

The Report calculated the water requirement as a product of the unit consumption and the number of population served, or beds, or others. This method, as considered appropriate, is employed for the present study. As for the categories of use, those used in the Report are also used for the present study, because they are considered appropriate. These are shown in Table 2-4-2 Water Requirements.

Regarding the unit consumptions, all the values which were employed by the Report, shown below, have been used for the present study, only except the unit consumption for domestic use. As the domestic use water accounts for most portion of the total water requirement and requires as realistic estimation as possible, it has been estimated after being classified into two categories, namely house connection use and public hydrant use, as detailed in Appendix B. All the use categories and their unit consumptions are shown below.

1)	Domestic use by house taps	Population served	x 100 l/c/d
2)	Domestic use by public hydrants	Population served	x 30 l/c/d
3)	Institutions	Office workers	x 30 l/d
4)	Hotels	Number of hotels	x 30 rooms x 200 l/d
5)	Markets & Shops	Domestic consumption	x 3%
6)	Medical facilities	Number of hospitals	x 30 rooms x 200 l/d
7)	Schools	Pupils	x 20 l/d
8)	Dormitories	Number of dormitories	x 30 beds x 150 l/d
9)	Religious institutions	Domestic consumption	x 5%

Table 2-4-2 Water Requirements

Item and Unit		1980	1985	1990	1995	2000	2005
Domestic							
Domestic Use	(1)	-	100(4)	108	115	123	130
	(2)	-	226	422	567	758	999
Public Hydrant	(1)	-	30(4)	30	30	30	30
	(2)	-	76	54	56	57	59
Sub-total	(2)		302	476	623	815	1,058
Non-domestic							
Institutions	(2)	-	6	6	7	8	9
Hotels, Shops & Markets	(2)	-	33	48	64	74	86
Medical Facilities	(2)	-	24	26	42	45	60
Schools	(2)	-	36	43	52	61	72
Dormitories	(2)	-	18	23	27	32	36
Religious Institutions	(2)	-	15	24	31	41	53
Sub-total	(2)		132	170	223	261	316
a. Total Water Consumption	(1)	-	91	113	125	133	142
	(2)	-	434	646	846	1,076	1,374
	(3)	-	5	7	10	12	16
b. Unaccounted-for Water b = a x 0.15	(2)	-	65	97	127	161	206
c. Average Day c = a + b	(1)	-	104	130	143	153	164
	(2)	-	499	743	973	1,237	1,580
	(3)	-	6	9	11	14	18
d. Maximum Day d = c x 1.25	(1)	-	130	163	179	191	205
	(2)	-	624	929	1,216	1,546	1,975
	(3)	-	7	11	14	18	23

Note : (1) = liter per capita per day
(2) = cubic meter per day
(3) = liter per second
(4) = The figure is based on the results of the present study

2-5 Water Source

2-5-1 Latea River

The recommended water source in the existing Report is the Latea river. In order to ascertain its suitability from standpoints of environment, discharge, water quality, and construction work, the Study Team conducted a field reconnaissance in April, 1980 as described in the following paragraphs.

1) Environment of the Proposed Site
The proposed site for the intake is located extremely upstream of the Latea river, near the source of the river in the virgin forest. At the proposed site, there is a diversion for the water supply system which was earlier described in the section 2-2 Existing Water Supply Facilities. It was selected obviously because the stream is clear without any contamination at this point. This place is 3 km away from the town and there is no access to here except the small ditch for the above said diversion. All the watershed upstream of, and around this proposed intake site, is thickly covered with tropical forests.

2) Discharge of the River
The measured discharge was 90 l/sec at this place, when the present field reconnaissance was undertaken. According to the inhabitants of the town, the discharge of the river is almost constant all the year round, despite the season; this may be true, as it is rather apparent from the conditions in the watershed.

3) Water Quality
The stream water was very clear as it was apparent from the conditions of the environment. The results of the analysis of the sampled water from the stream, by the Study Team, revealed the water quality as being excellent and suitable for drinking, as shown in Table 2-5-1 and 2-5-2. The only thing that has to be cared for, however, is foreign matters to be contained in the water, such as leaves, twigs, and sometimes a little turbidity in the heavy rains.

Table 2-5-1 Analytical Results of Water Quality in Tentena

Item	Unit	Sources			
		Latea River	Tentena River	Poso Lake	Spring near Hospital
Date, Time		7-4-80 09:00	8-4-80 10:00	8-4-80 12:00	9-4-80 14:00
Weather		fine	fine	fine	fine
Atmospheric Temperature	^{o}C	22	28	30	28
Water Temperature	^{o}C	21	25	28	24.5
Color as Pt.Co.	unit	0	0	0	0
Turbidity	FTU	0	3	3	0
pH		8.1	7.5	8.0	7.1
Alkalinity as CaC03	mg/l	30	10	35	90
Total Hardness as CaC03	mg/l	80	30	50	240
Chloride as C12	mg/l	6	6	3	3
Total Iron as Fe	mg/l	less than 0.1	less than 0.1	less than 0.1	less than 0.1
Coliform Groups	/100 ml	negative	3,000	1,000	2,500
Total Bacteria	/ml	120	120	10	200
Ammonia-N as NH4	mg/l	less than 0.2	less than 0.2	0.3	less than 0.2

Table 2-5-2 Water Quality Standard
(WHO and Indonesian Standards for Drinking Water)

Item	Unit	WHO Standards		Indonesian Standards	
		Recommended Limit	Acceptable Limit	Permissible Value	Maximum Permissible Value
Color as Pt.Co.	unit	5	50	5	50
Turbidity	FTU	5	25	5	25
Total Solids	mg/l	500	1500	500	1500
pH		7 - 8.5	6.5 - 9.2	-	6.5 - 9.2
Detergents	mg/l	0.2	1.0	-	-
Mineral Oil	mg/l	0.01	0.3	-	-
Phenol	mg/l	0.001	0.002	-	-
Total Hardness (as CaCO3)	mg/l	100	500	-	5 - 10 (1)
Calcium as Ca	mg/l	75	200	75	200
Magnesium as Mg	mg/l	30	150	30	150
Chloride as Cl2	mg/l	200	600	200	600
Copper as Cu	mg/l	0.05	1.5	0.05	1.5
Total Iron as Fe	mg/l	0.1	1.0	0.1	1.0
Manganese as Mn	mg/l	0.05	0.5	0.05	0.5
Sulfates as SO4	mg/l	200	400	250	-
Zinc as Zn	mg/l	5	15	5	15
Coliform Groups	/100 ml	negative	-	negative	-
Total Bacteria	/100 ml	10	-	100,000	-

Note : (1) German System of Degrees of Hardness (^{o}D)

Source : Indonesian Standard from Departemen Kesehatan R.I.

4) Construction Work

Civil work required for taking water from this stream is to construct a small diversion weir and a transmission pipeline. As there is no access road, transporting of necessary materials may require a somewhat larger labor force than usual, and some allowance must be provided for the construction costs.

From all the above findings and considerations, it has been concluded that the recommended water source should be employed for the present project.

2-5-2 Other Potential Water Sources

In order to locate a water source for the future water supply extension and, if possible, to find a better water source than the Latea river, the Study Team investigated other water sources in the area.

One of the possible future sources is the Tentena river, which has almost the same conditions as the Latea river. Nevertheless, the water transmission from the river was found less convenient than the Latea river, so this river was considered not advisable for the present project.

Poso Lake, located south of the town, is a strong potential water source for the future water supply. It has a surface area of 400 sq km and a depth of 400 m in the deepest point. Presently, fishing and tourism are not active, so that the pollution of the lake water is very low. The only problem with Poso Lake as a water source for Tentena water supply, is that the water has to be lifted by pump. As power supply is not necessarily sufficient and procurement of spare parts is inconvenient, such pumping facilities are not recommended for the present project. It, however, will be utilized for water supply in the future, when such inconveniences have been removed.

2-6 Water Treatment

The existing Report mentioned the capacity of the water supply system to be constructed and the location of the treatment plant. But the Report did not indicate how to treat the water. As it has already been detailed in the preceding section 2-5 Water Source, foreign matters that may be contained in the water must be removed, for domestic use. The Study Team, therefore, proposes the following facilities for water treatment.

1) Rough Filtration

Rough filtration should be made for the purpose of removing foreign matters in the water. Coarse screening, of course, must precede the rough filtration. As the purpose is no more than the removing of foreign matters, the filtration rate to be employed would be similar to that of rapid sand filter, and the grain size of the filter media would be coarser than that of the same with a lesser depth of filter media. Cleaning of the filter media would be made manually together with a backwash.

2) Disinfection

Disinfection should be made by feeding calcium hypochlorite. As already described, the upstream of the proposed intake is not contaminated and may not be contaminated even in the future, but disinfection in emergency cases, such as the occurrence of epidemic diseases, or high turbidity of the stream water due to a storm, should be made. Such emergencies cannot be predicated, so disinfection all the time is recommendable. The feeding of calcium hypochlorite is simple, and does not require special equipment for feeding.

2-7 Future Water Supply System

The existing Report made a projection of population up to the year 2005, and only mentioned ordinary methods of water treatment without

any description in detail and without investigating potential water sources in the study area. Therefore, some brief considerations of the Study Team will be given, hereunder, regarding the future water supply system.

According to the present study as described in the previous sections, water demand in the long-term future, the year 2005, will nearly triple, i.e., over 20 l/sec. To meet such water demands, two alternative plans for water sources can be mentioned, namely, the Latea river and Poso Lake. Merits and demerits have already been described in the previous section 2-5 Water Source. It is premature to make a final decision, and preparation of the water supply master plan should be made, after completion of the present project, considering the tendency of the actual development in the districts.

In the meantime, the proposed water supply facilities in the present study have some surplus capacity, as far as transmission and trunk distribution pipelines are concerned. These pipelines, therefore, can accomodate the incremental water demand, to a certain extent, after 1985.

III. REVIEW OF DESIGN CRITERIA AND PRELIMINARY DESIGNS

3-1 General

The design of the proposed water supply system in the existing Report is not supported by detailed technical information, such as design criteria, calculation, etc., although the Report mentioned that the water supply system should be constructed with a capacity of 20 l/sec, in accordance with the standards made by Cipta Karya. The Study Team, after discreet consideration regarding water treatment and distribution, has reached a conclusion that the standard capacity system is not necessarily appropriate in the case of Tentena, because the quality of raw water does not require ordinary treatment facilities, such as found in standard type plants. The Study Team, therefore, proposes, as described hereunder, design criteria and preliminary design for major water supply facilities, based on the results of study in the preceding chapter.

3-2 Design Criteria

1) Design of all the facilities shall be made for the requirements in 1985, 7.2 l/sec. However, facilities from the intake down to the transmission main shall be capacitated for 20 l/sec despite the above criterion to facilitate the future expansion of the system.

2) Pipelines shall be designed to meet the peak hour demand.

3) A rough filtration device shall be provided to remove foreign matters from the raw water.

4) As described in the preceding section 2-6, disinfection is not required all the time, but it shall be practical as a preventive measure against water-borne diseases.

5) Standard pressure at the end of distribution pipeline shall be 1.5 kg/sq cm. However, it will not be applied to Petidorongi village, furtherest area from the proposed break pressure chamber, because the elevation there is exceptionally high, compared with other areas, and house connections are not expected.

3-3 Preliminary Designs

Preliminary designs of major facilities prepared based on the above design criteria are presented below. Figs 3-3-1 and 3-3-2 show the proposed water supply system to be constructed for the year 1985 and the profile of the system.

1) Intake Weir
   Made of reinforced concrete, across the stream, at the point where presently there is a diversion, as shown in Fig 3-3-3.

2) Transmission Pipeline A
   From the intake to the receiving well.
   Material : DCIP or GSP
   Length : Ø 150 x 1,550 m

3) Grit Chamber
   Made of reinforced concrete as shown in Fig 3-3-4.
   Dimension : B 2.5 m x L 3.5 m x D 3.0 m - 1 basin
   Retention time 1 hour. A weir shall be attached to measure the inflow.

4) Rough Filters
   Made of reinforced concrete as shown in Fig 3-3-4.
   Dimension : B 2.0 m x L 5.0 m - 2 basins
   Filtration rate will be about 90 cu m/sq m/day.

5) Transmission Pipeline B
   From the rough filters to the break pressure chamber.
   Material : DCIP or ACP
   Length : Ø 150 x 600 m

6) Break Pressure Chamber

Made of reinforced concrete as shown in Fig 3-3-5.

Dimension : B 2.0 m x L 2.0 m x D 2.0 m - 1 basin

7) Calcium Hypochlorite Solution Tank and Stirrer

Material : Fiberglass

Number of Set : 1 set

Component of Set : 2 solution tanks with capacity of 100 l together with a feeding device.

8) Distribution Pipelines

Material : PVC/ACP

Length : ϕ 150 x 3,400 m
ϕ 100 x 3,200 m
ϕ 75 x 4,750 m
ϕ 50 x 600 m

9) House Connection and Public Hydrant

Fig 3-3-6 shows a sketch of typical public hydrant.

Number of house connection : 370 units

Number of public hydrant : 10 units

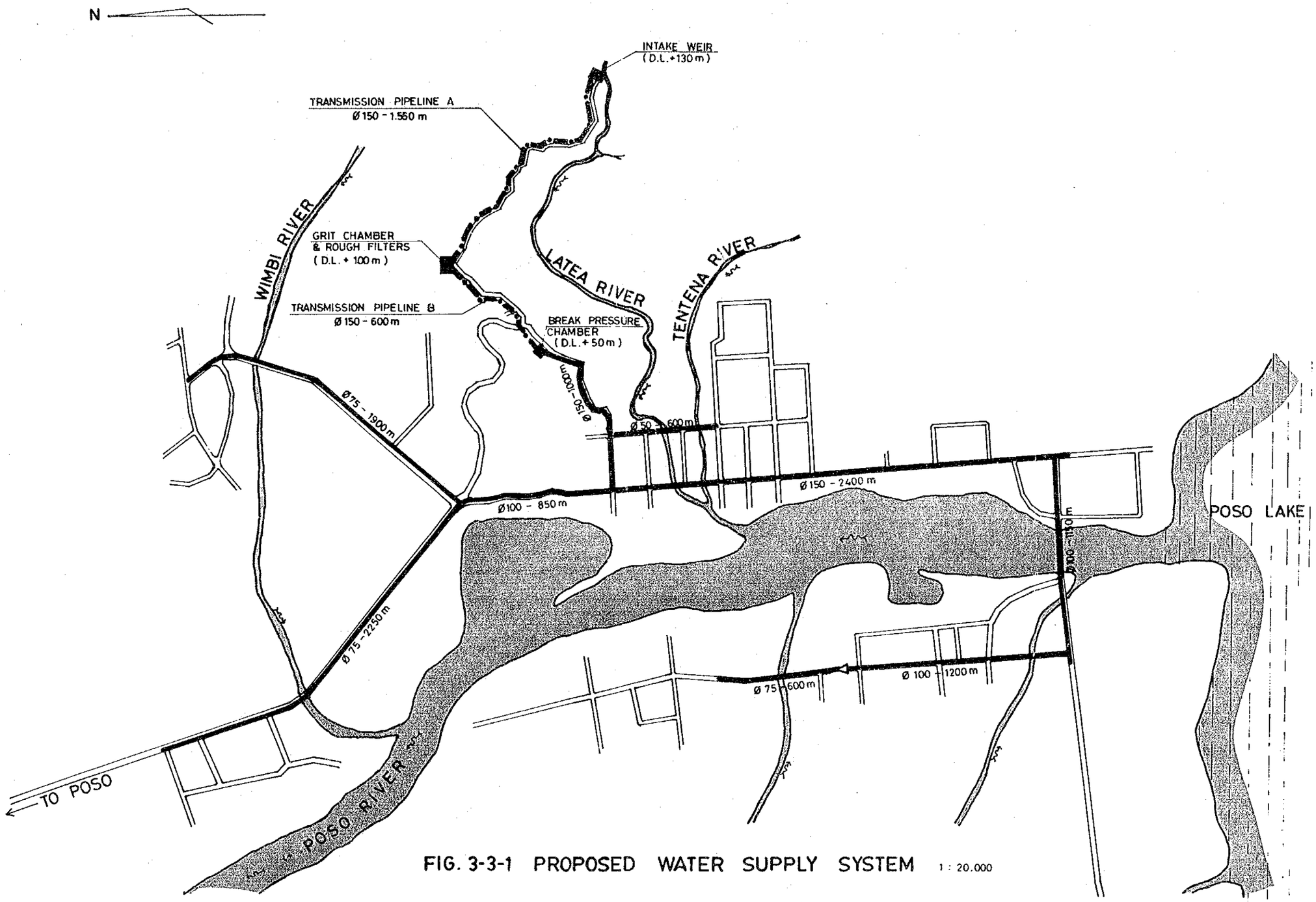


FIG. 3-3-1 PROPOSED WATER SUPPLY SYSTEM 1 : 20.000

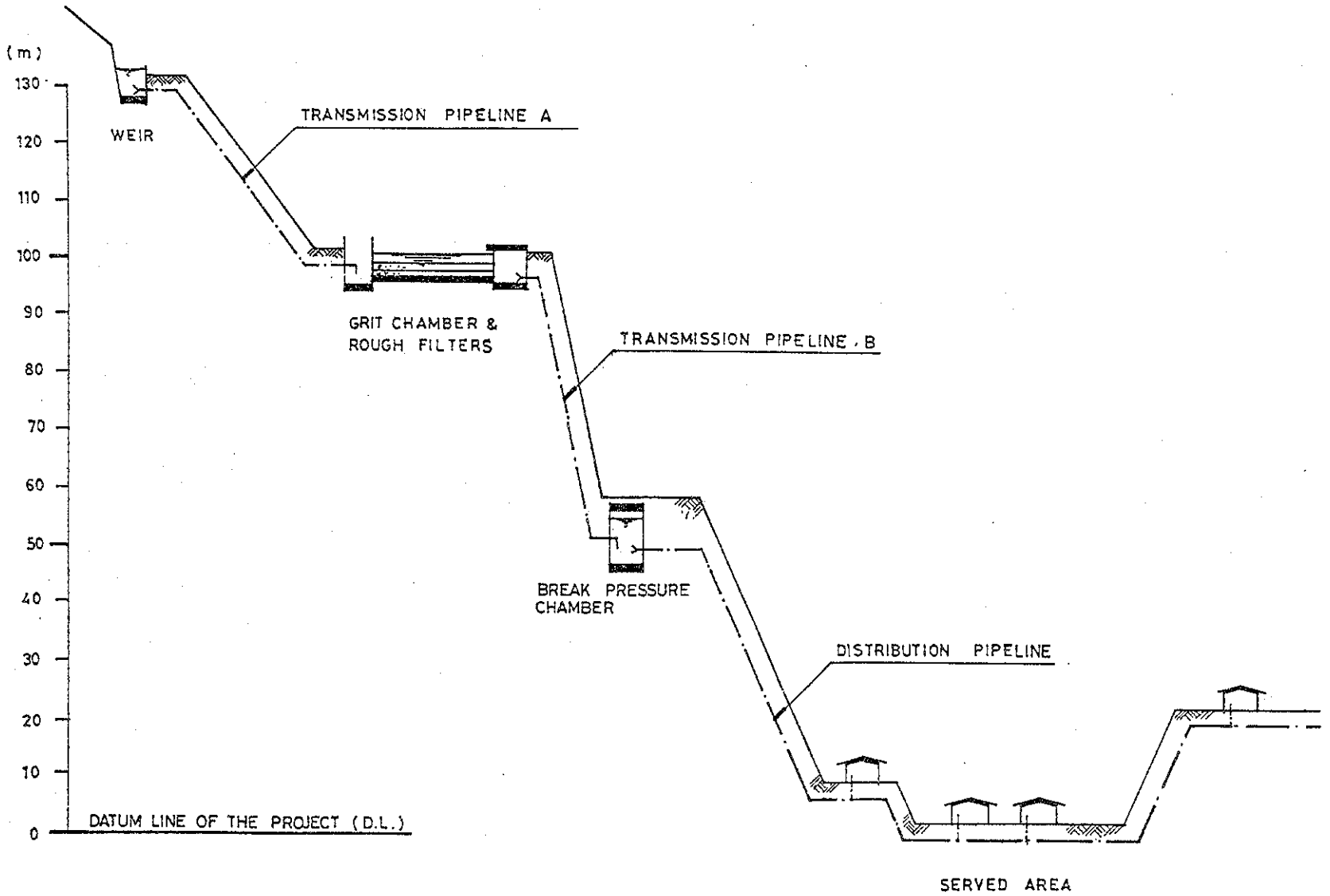
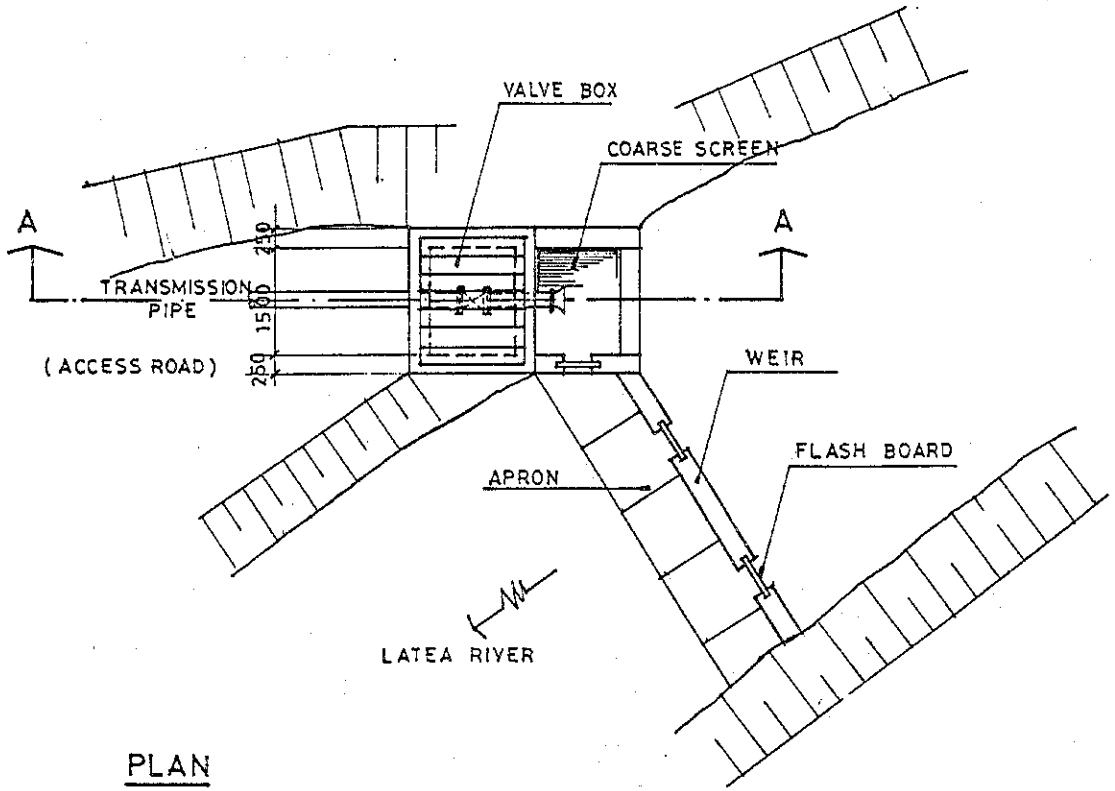
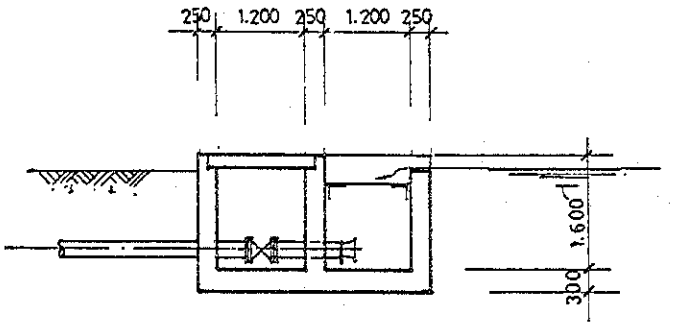


FIG. 3-3-2 PROPOSED PROFILE OF WATER SUPPLY SYSTEM H = NO SCALE V = 1 : 1000



PLAN



SECTION A-A

FIG. 3-3-3 INTAKE WEIR 1 : 100

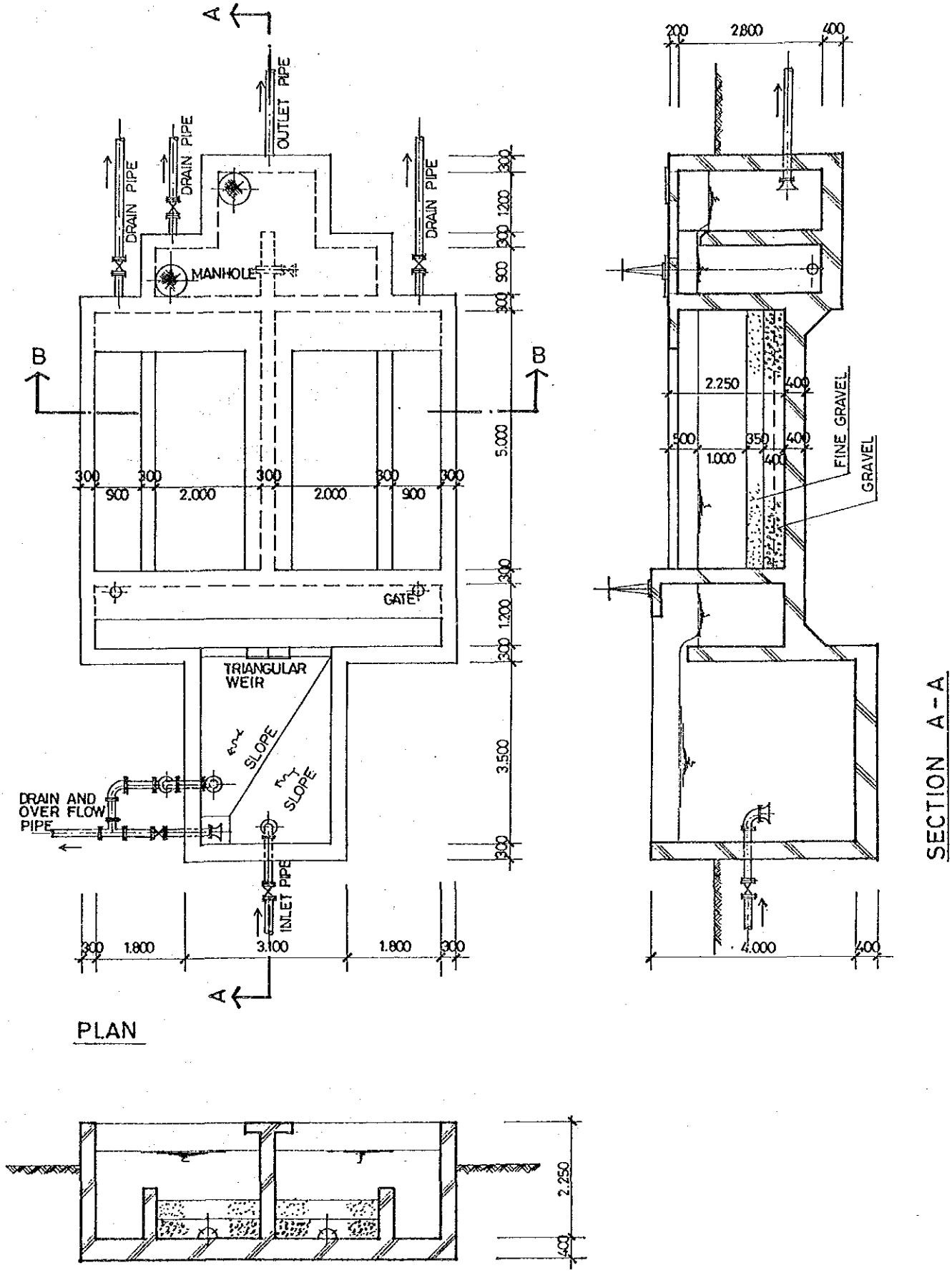
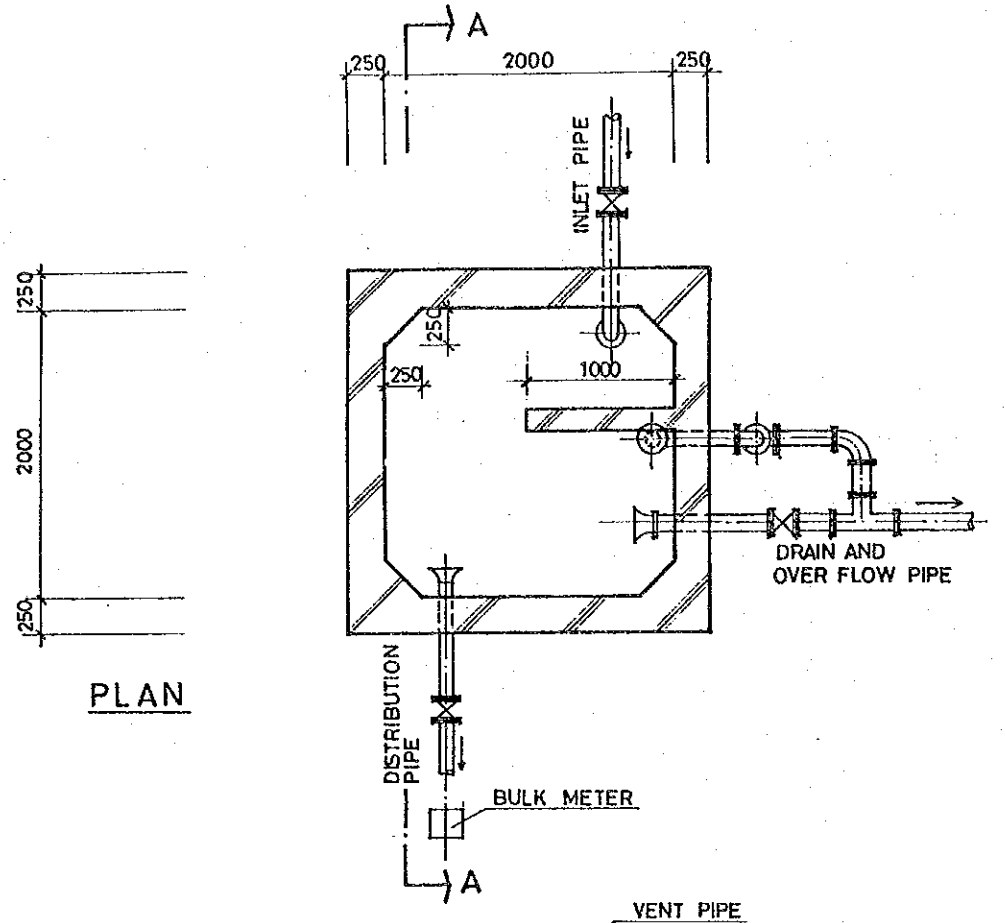
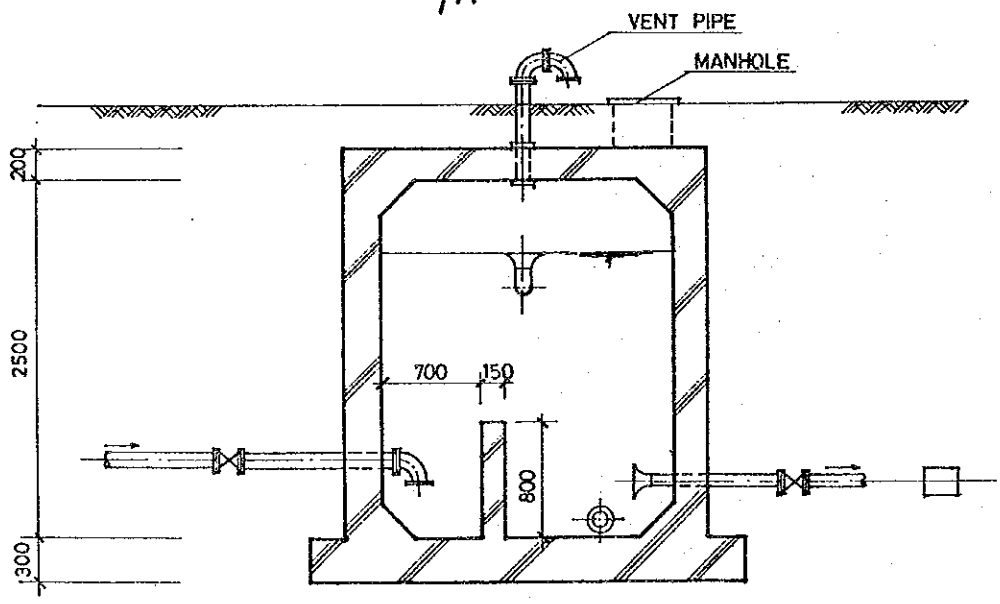


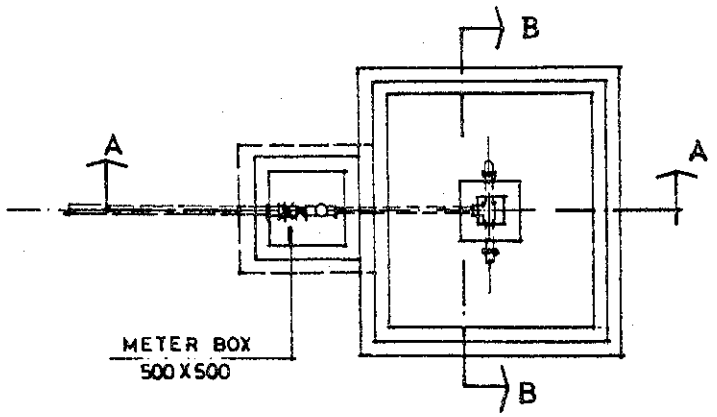
FIG. 3-3-4 GRIT CHAMBER & ROUGH FILTERS 1:100





SECTION A-A

FIG. 3-3-5 BREAK PRESSURE CHAMBER 1 : 50



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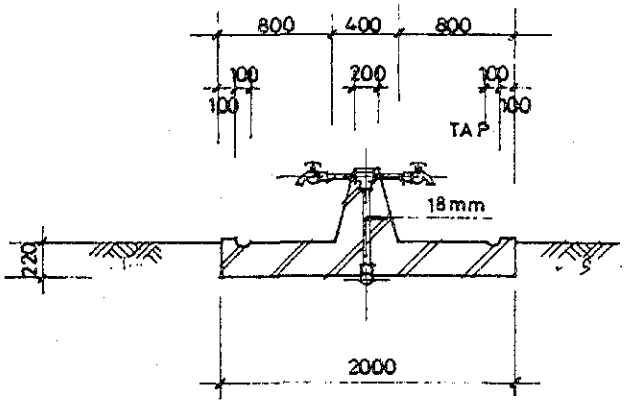
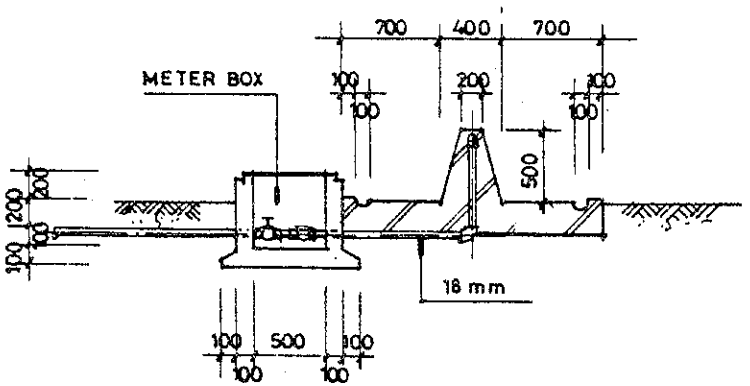


SECTION B-B



SECTION A-A

FIG. 3-3-6 TYPICAL PUBLIC HYDRANT 1 : 50

IV. REVIEW OF COST ESTIMATE AND IMPLEMENTATION SCHEDULE

4-1 General

The existing Report does not have a cost estimate nor contains a definite implementation schedule for the project. Therefore, the Study Team has estimated all the construction costs of the project, and prepared an implementation schedule, as described below, based on 4-2 Considerations on Construction-related Matters. The costs include construction costs broken down into foreign and local portions, escalation and contingency costs, and engineering cost, required for implementing the project.

4-2 Considerations on Construction-related Matters

From the standpoint of executing the project with success, matters related with construction have been studied in the field. Sulawesi is a region which has not progressed as rapidly as others, on the whole, although in such places as Ujung Pandang and Manado, construction of various government installations has given a rise to much needed experience.

In this region, land transportation facilities have not yet been developed, however good seaports are available, and in fact are being used to link Sulawesi with the major cities of neighboring islands. In addition, air transportation has also added to the progress of linking Sulawesi to its neighbors.

1) Contractors and Suppliers

There are a great many contractors and suppliers, small and large in this region. The provincial government prepares and keeps a list of contractors and suppliers, to make selection and nomination of contractors and suppliers more convenient. The local governments below the provincial government utilize this list for construction and procurement.

In the list, not only local contractors, but leading contractors of Jakarta, are also listed with their capabilities being classified according to the experience of their staff, equipment, work experience and capital of their companies.

As for water supply construction, most contractors are not well experienced, the reason being a scarcity of water supply projects, but it does not matter for the present project. The present project is composed of rather simple civil engineering and small size pipe laying work. Therefore, most contractors will be able to carry out the work without any difficulties.

2) Materials

Materials required for the present project are mainly pipe materials, together with some concrete work. Pipe and fittings are mostly imported in Indonesia, with the exception of some smaller size pipe made locally. There is no difficulty in procuring such materials. As to concrete, the aggregate along with sand is available in the district, and cement is produced in the island while steel bar comes from Jawa. But it is said that all materials in Sulawesi are a little costlier than in Jawa, due to transportation expenses.

3) Labor

Unskilled labor is abundantly available locally, and skilled labor is always provided by the contractor from major cities in Jawa. As the present project does not require much skilled labor, no problem is anticipated in construction work.

4-3 Construction Costs

Table 4-3-1 represents the estimated construction costs (The breakdown of estimated construction costs is attached in Appendix C). All unit costs are valid as of May 1980, and were obtained from on-going projects in Indonesia, similar to the present project. For 1982 costs, in which

Table 4-3-1 Estimated Construction Cost

Rupiahs 1,000

Item	Foreign Exchange	Local Curency	Total
1. Intake Weir	-	lump sum 2,450	2,450
2. Transmission Pipeline A			
Ø 150 x 1,550 m	Rp 15.8/m 24,490	Rp 8.6/m 13,330	37,820
3. Grit Chamber & Rough Filter	lump sum 2,710	lump sum 20,158	22,868
4. Transmission Pipeline B			
Ø 150 x 600 m	Rp 16.3/m 9,780	Rp 9.0/m 5,400	15,180
5. Break Pressure Chamber	lump sum 700	lump sump 2,200	2,900
6. Distribution Pipeline			
Ø 150 x 3,200 m	Rp 12.6/m 42,840	Rp 7.3/m 24,820	67,660
Ø 100 x 3,200 m	Rp 12.3/m 39,360	Rp 9.3/m 29,760	69,120
Ø 75 x 4,750 m	Rp 5.0/m 23,750	Rp 5.2/m 24,700	48,450
Ø 50 x 600 m	Rp 7.8/m 4,680	Rp 7.5/m 4,500	9,180
7. Bulk Meter			
Ø 150 x 1 piece	1,100	670	1,770
8. Water Meter			
Ø 13 x 370 pieces	Rp 17.0/piece 6,290	Rp 2.6/piece 962	7,252
9. Public Hydrant			
Ø 18 x 10 pieces	Rp 30.0/piece 300	Rp 305.0/piece 3,050	3,350
Total Cost	156,000	132,000	288,000

year the project is to be implemented, an escalation of 15% per annum and a contingency of 20% are provided. In addition to the above, engineering costs for detailed design, including supplemental surveys, supervision, etc. are provided, with an allowance of 8% of the construction cost plus escalation and contingencies. Table 4-3-2 shows the estimated project costs, including all above items.

4-4 Implementation Schedule

The time frame set by Cipta Karya, being considered in an implementation schedule of the project, is prepared as shown in Fig 4-4-1. Cipta Karya desires the project to be completed in 1982, and put in operation in 1983. To meet this target, the schedule is prepared, taking into consideration all the requirements for time and procedures. It must be mentioned here that provision of expert service for the on-the-job training of operators is made for the initial period of operation of the facilities.

It should, however, be noted that the implementation schedule has been prepared assuming that the financing for the project would be decided within this calendar year. Therefore, if not, the implementation schedule is subject to change, at a later date, according to the decision of financing by the agencies concerned.

Table 4-3-2 Estimated Project Costs

Rupiahs 1,000,000(1)
U.S. Dollars 1,000

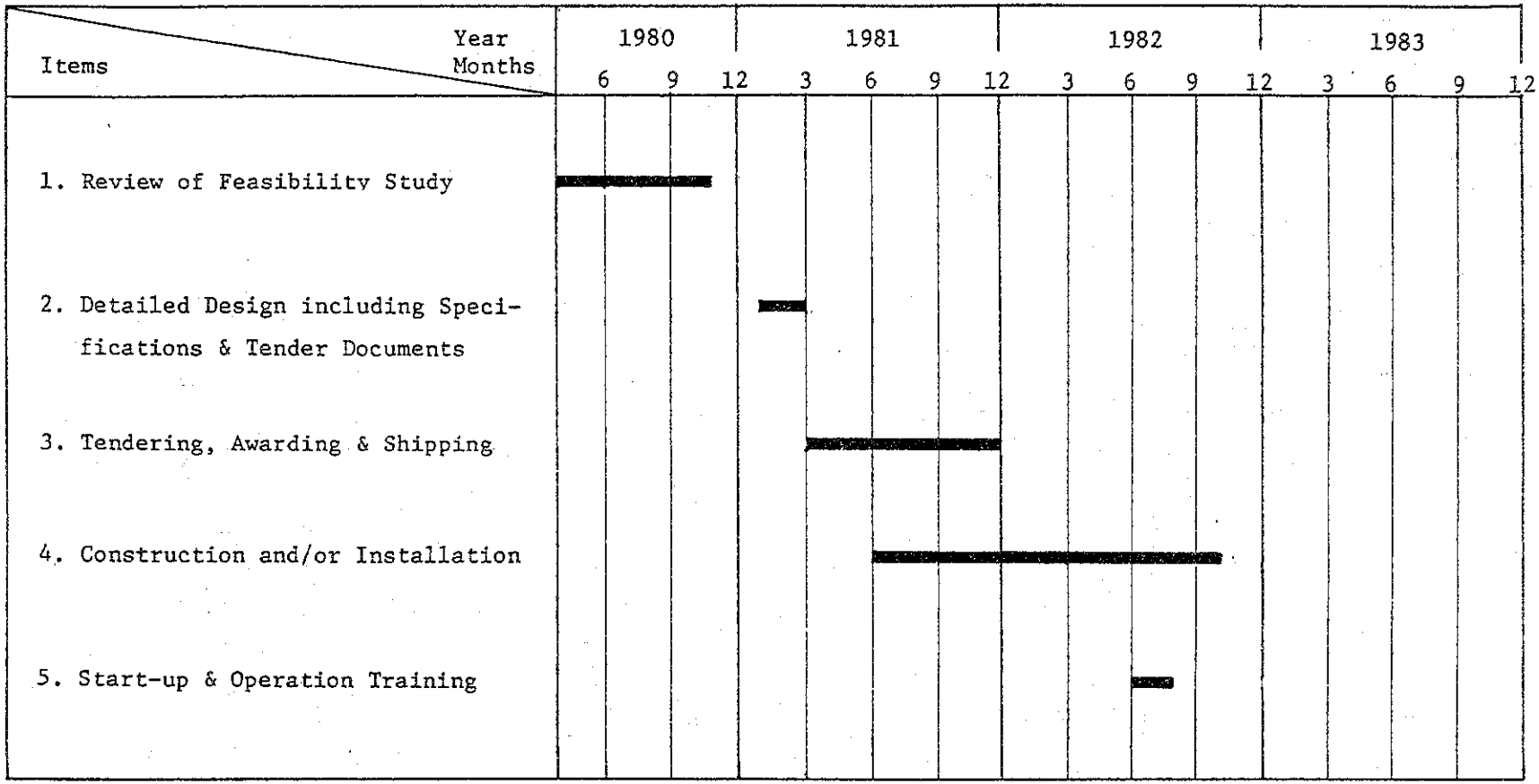
Item	Foreign Exchange	Local Currency	Total Cost
a. Construction Cost (2)	156 248	132 210	288 458
b. Escalation (3) (a x 32.25%)	50 80	43 68	93 148
c. Sub-total	206 328	175 278	381 606
d. Contingencies (c x 20%)	41 66	35 55	76 121
e. Sub-total	247 394	210 333	457 727
f. Engineering Services (e x 8%)	11 17	26 41	37 58
Total Cost of Project	258 411	236 374	494 785

Note: (1) Currency equivalent : US.$ 1 = Rp. 629

(2) Construction cost is calculated based on the prices as of May 1980.

(3) The escalation is considered as 15 % annually each for years of 1981 and 1982.

Fig 4-4-1 Implementation Schedule



V. REVIEW OF FINANCIAL STUDY

5-1 General

The existing Report has not made any financial study. The Study Team, therefore, will study the financial feasibility of the present project based on the engineering plan and the cost estimate so far prepared and described in preceding sections.

With regard to the financial feasibility of the project, it should be noted that the capital cost required is to be provided by the central government in the form of grant. Therefore, the examination of the feasibility of the project must be made from a standpoint a little different from the usual public enterprise.

Since the capital cost needed to construct the facilities of the present project is borne by the central government, the water enterprise of the local government can concentrate its effort to cover the cost of maintenance and operation. To check the financial condition of the water enterprise, the projection of revenue and expenditure is made with the assumptions that the enterprise is to pay cost of maintenance and operation.

In the meantime, the government of Indonesia is now carrying out PELITA III, in which the construction of small and medium sized towns water supply systems throughout the country is one of the most important social welfare policies, and the government has the intention of providing all the capital cost for such construction in grant in consideration of the financial weakness of such small scale water supply enterprises.

5-2 Funding Requirement

Funds required for construction of water supply facilities in Tentena, are summarized in Table 4-3-2 Estimated Project Costs. Total cost, necessary to implement the project, is Rp. 494 million of US.$ 0.8 million, based on prices as of May, 1980. As construction of the facilities is proposed to be initiated in 1981, escalation of 15% is assumed for the years of 1981 and 1982. For contingencies, 20% is assumed. It should be noted that unit costs provided with allowances for local transaction are employed for calculation of capital cost, taking Tentena local conditions into consideration.

5-3 Sources of Financing

As a source of financing for the present project, the Government of the Republic of Indonesia is considering to be financed with a loan from external sources to cover the foreign components of the capital cost. The Government, however, intends to construct the facilities, on a full grant basis, in accordance with the policies envisaged in PELITA III. This means, that all construction costs will be borne by the Government, and after construction, the facilities will be turned over to the local government.

For operation and maintenance, the costs will also be met by the grant from the Government, for the first 2-year operation of the facilities, in case the enterprise can not afford to pay.

5-4 Financial Feasibility

The financial projections were worked out to check business conditions of the enterprise, i.e., whether the enterprise can pay costs of operation and maintenance by their own generated fund or not, and for that purpose, comparison of costs and revenues was made.

Table 5-4-1 Income Statement

(Rp 1,000)

	1983	1984	1985	1986	1987	1988
Water Production (m^3/year)	146,503	164,292	182,080	199,869	217,657	235,446
Water Sales (m^3/year)	127,458	142,934	158,410	173,886	189,362	204,818
Percentage Sales to Production (%)	87	87	87	87	87	87
Revenue Water Sales (1)	9,735	10,908	12,081	13,254	14,427	15,600
Other Fees	1,053	42	42	42	42	42
Total Billing	10,788	10,950	12,123	13,296	14,469	15,642
Less Provision for Bed Debt	216	219	242	266	289	313
Total Revenue	10,572	10,731	11,881	13,030	13,180	14,329
Operating Cost	10,489	12,018	12,618	13,249	13,909	14,604
Net Income (Deficit)	83	(1,287)	(737)	(219)	(729)	725

Note : (1) Revenue water sales are based on water rate structure

Table 5-4-2 Cash Flow

(Rp 1,000)

	1983	1984	1985	1986	1987	1988
Sources of Cash						
Net Income	83	(1,287)	(737)	(219)	(729)	725
Government grant	494,000					
Total	494,000	(1,287)	(737)	(219)	(729)	725
Application of cash						
Capital expenditure ,	494,000					
Total	494,000					
Net cash inflow (outflow)	83	(1,287)	(737)	(219)	(729)	725
Cash at beginning		83	(1,204)	(1,941)	(2,160)	(2,889)
Cash at end	83	(1,204)	(1,941)	(2,160)	(2,889)	(2,164)

Table 5-4-1 shows projected Income Statement and Table 5-4-2 shows projected Cash Flow. The statements indicate the financial condition of the water enterprise from the year of the expected operation of the facilities in 1983, and six years thereafter. In the income statement the revenue of water sales is projected from the yearly water quantity of water sales times the proposed water rate. The cost of operation covers costs of personnel salary, maintenance and operation, chemical and office operation. In the case of Tentena, depreciation is not considered to be included in the expenditure items, due to the financial weakness of the water enterprise.

The income statement shows that the enterprise will have deficits from 1984 to 1987 which amounts to Rp. 3.0 million during four years. However, the revenue will be bigger than the expenditure from 1988, and the enterprise can generate income thereafter. It can be said that the business is still operational. Detail description of assumptions for financial projection is given in Appendix D, in the present report.

5-5 Water Rates

The proposed water rate for Tentena water enterprise has been worked out, considering costs of production and also paying ability of consumer. Table 5-5-1 shows the water rates for different consumers in accordance with uses of water. Detail description about design of proposed water rate is given in Attachment I) of Appendix D.

Table 5-5-1 Water Rate

Block	Residential	Commercial	Industrial	Social	Public Hydrant
0 - 15 cu m/m	65	130	195	52	52
15 - 30 cu m/m	97.50	130	195	70	52
In excess of 30 cu m/m	195	260	325	104	52

5-6 Ability of the Consumers to Pay for Water

The income survey mentioned in 2-4-1, was conducted in order to know the ability and willingness to pay for water by consumers who are to be served with water from the proposed system. For income survey, about 70 houses were selected on the basis of random selection and answers were obtained by means of visiting of each house distributed at areas to be served by the proposed system.

Table 5-6-1 summarizes the result of survey. As is shown in table, willingness of consumers for water supply regardless of their house type income is considerably high in spite of abundance of natural water around them. The reason is attributable to the fact that the existing water sources are located in general rather far from their houses which makes them difficult to obtain potable water for their living, and moreover that water quality is not always clean enough for drinking.

Concerning consumers' ability to pay for water supply, the result of survey shows that the average monthly income in the community is about Rp. 36,000, and monthly income of about 50 % of the inhabitants is as low as less than Rp. 20,000. This means water supply with high tariff may make consumers reluctant or unable for connection. Careful attention, therefore, was exercised for establishing a proper water charge.

According to the policy of the Central Government, water rate is recommended to be arranged under 4 % of the average monthly income of consumers which is agreeable. In the case of Tentena, the average monthly income of consumers were found to be about Rp. 36,000, so it will be appropriate if the monthly payment is determined below Rp. 1,500 per month.

For low income group with their monthly income of, say, less than Rp. 10,000, which means more difficulty to pay for water it is recommended to supply them by public hydrants with nominal water charge. On the other hand, for high income group, it is recommended to supply them by house tap or tap installed in their garden with water meter furnished at connection.

Table 5-6-1 Household Economic Survey

Income (Rp/Month)	Total	Number of Household Selected by House Type			Average Water Charge within Willingness to Pay
		A	B	C	
Less than 5,000	-	-	-	-	
5,000 - 10,000	16	13	3	-	600
10,000 - 15,000	6	4	-	2	760
15,000 - 20,000	11	5	5	1	660
20,000 - 50,000	25	6	8	11	790
More than 50,000	11	-	7	4	1,550
Total	60	28	23	18	
Average Income(Rp)	36,000	15,000	50,000	48,000	
Average Nos. of Residents	7.4	6.8	8.2	7.6	
Average Water Charge within Willingness to Pay		721	611	1,305	840
Existing Water System		Not Provided	Not Provided	Not Provided	
Existing Water Source Used		river	river, well	well, river	

Note: House type A Temporary
House type B Semi-permanent
House Type C Permanent

VI. REVIEW OF ORGANIZATION

6-1 General

Presently, Tentena has no established organization for water supply, because the existing water supply facilities, described in 2-2 Existing Water Supply Facilities, are not owned by a public administrative body. Therefore, to implement and operate successfully the present project, a new organization has to be established, specially designed for water supply operation and management.

6-2 Recommended Organization and Operations

Guidelines, together with a schematic organization, have been prepared by Cipta Karya, Ministry of Public Works, to be applied to all water supply enterprises in the country. Some of the water supply enterprises have already been reshaped, in accordance with the guidelines, and are in operation. The recommended structure of organization is presented in Fig 6-2-1, which is to be adjusted according to size and other local features of each enterprise.

In the case of Tentena, the scale of the enterprise is rather small, with served population less than 5,000 with connections amounting to about 600. Therefore, the standard organization, by Cipta Karya, should be modified to one shown in Fig 6-2-2, so as to be more realistic and practicable.

As shown in Fig 6-2-2, the water enterprise is under the supervision and control of a Board of Managers, which should be composed of Indonesian citizens, appointed by the head of the Regency. The term of appointment for Board members should be for a period of 4 years. Under the Board, Tentena Water Enterprise should be headed by a Manager, who is responsible for the overall activities of water management.

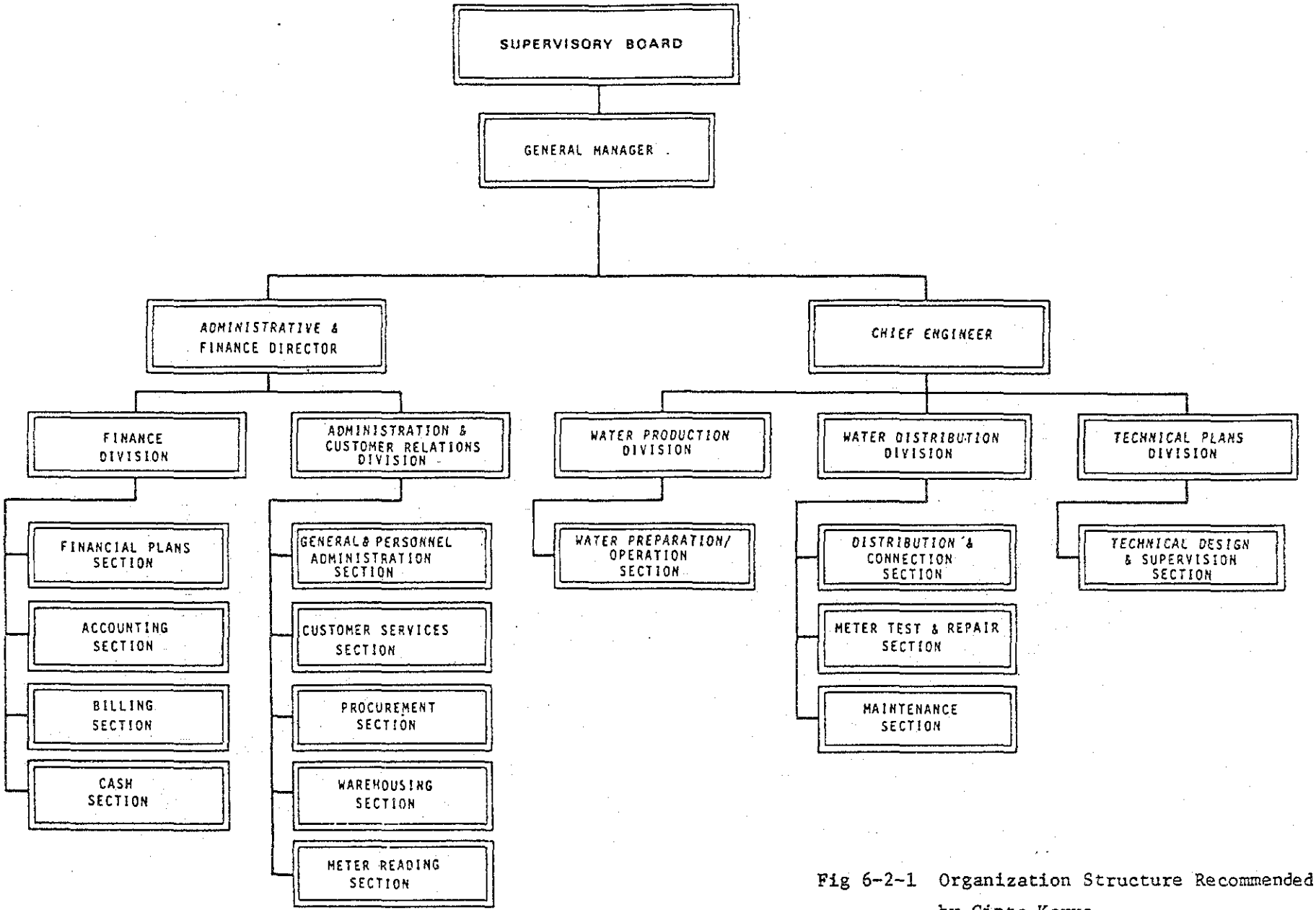


Fig 6-2-1 Organization Structure Recommended by Cipta Karya

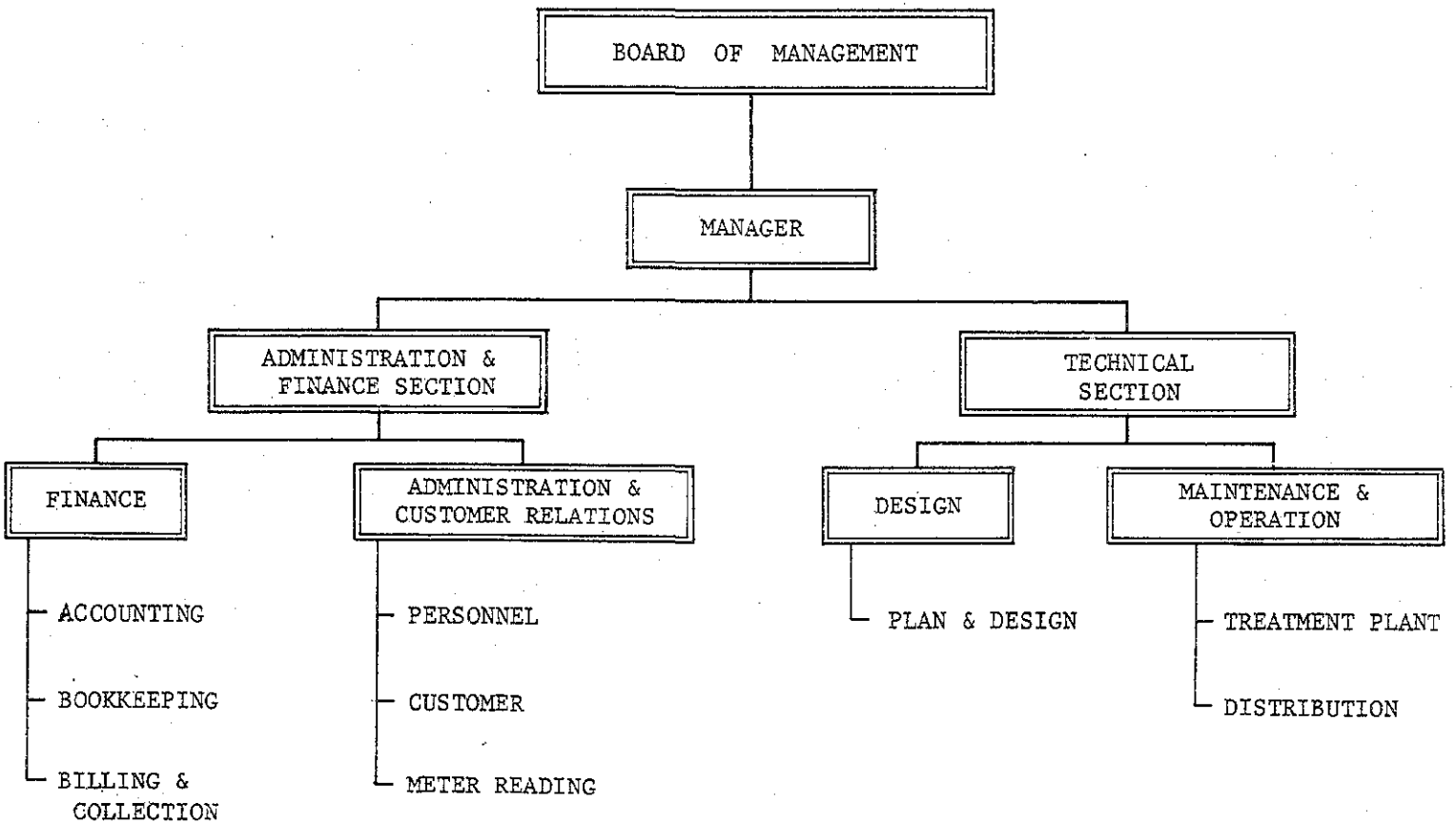


Fig 6-2-2 Proposed Organization Structure for Tentena Water Enterprise

Under the Manager, there are two Sections 1) Finance & Administration, and 2) Technical. The Finance & Administration Section will be responsible for routine bookkeeping, billing, and collection, including meter reading.

The Technical Section will be responsible for maintenance and operation of water supply facilities including the treatment plant and distribution pipelines. Although a design division is provided in the chart, actual activities of this division will start after completion of the present project.

6-3 Staffing Schedule

Necessary number of personnel required for conducting water supply activities is studied considering the scale of Tentena water supply and the target year of the present project. The staffing schedule is shown in Table 6-3-1. The number of personnel is kept minimum to the extent possible. This staffing schedule is to be utilized by the water enterprise as a guideline for recruiting the staff.

As can be seen in the Table, there are only 3 staff members in the Technical Section, who look after the maintenance and operation of facilities from the time of start-up of the system, until 1985, the target year of the present project. There are 8 staff members in Finance & Administration Section, one each for accounting and bookkeeping, four for billing and collection, and one for meter reading, at the target year of 1985. Therefore, the total number of staff personnel will be 13 in 1985.

6-4 Transient Measures in the Initial Stage of Operation

In the initial period of the project operation, it will be advisable for Cipta Karya to provide some experienced personnel, under an appropriate organization, for the purpose of breaking-in all the staff personnel of the new organization. Along with this, it is also recommended to Cipta Karya, to assist in employing, if possible, experienced persons for the new organization.

Table 6-3-1 Staffing Schedule

Description	1980	1981	1982	1983	1984	1985
Manager	-	-	1	1	1	1
Secretary & Typist	-	-	1	1	1	1
Sub-total	-	-	2	2	2	2
Technical						
Head	-	-	1	1	1	1
Maintenance & Operation	-	-	-	2	2	2
Sub-Total	-	-	1	3	3	3
Administration & Finance						
Head	-	-	1	1	1	1
Accounting	-	-	-	1	1	1
Bookkeeping	-	-	-	1	1	1
Billing & Collection	-	-	-	2	4	4
Meter reader	-	-	-	1	1	1
Sub-Total	-	-	1	6	8	8
Total	-	-	4	11	13	13

VII. EVALUATION OF THE PROJECT AND RECOMMENDATIONS

7-1 Evaluation of the Benefits of the Project

Most benefits, to accrue from the present project, can not necessarily be evaluated in the monetary terms, or in figures. Rather, for this case, descriptive explanations will be more useful and appropriate.

1) Release of women and children from the difficult labor of water carrying.
A majority of the inhabitants use the river water of Poso, and water carrying is almost always done by women and children, several times a day. When the construction of the water supply system is realized, such a hard work of women and children will be eliminated.

2) Improvement of health conditions
Daily use of unsanitary water for drinking and other domestic purposes brings about enteric diseases together with other various diseases. In Tentena, incidences of such diseases are high, including a special endemic disease of throat. These diseases can be decreased by everyday use of clean and safe water from the water supply system well designed and constructed.

3) Betterment of living environment
Construction of the water supply system will surely be a good chance for improving the living environment. At present, most of the public are not much concerned about their drinking water, as well as disposal of waste water, and their environment of living. When the tap of running water is installed in their house or in the yard, their attention will be directed to the cleanliness of the kitchen and further to their surrounding environment of living, and this should be encouraged by the local authority to enhance the effect of the water supply.

4) Utilization of unemployed labor

The construction of the water supply system requires a sizable amount of labor for civil works. As construction works in Tentena are currently rather inactive, there are numerous people who are half-idle. These people will be mobilized as a work force for the present project.

5) Attraction of tourists and expansion of earning

The district located on the plateau, in the center of which Tentena lies, abounds in scenic beauty of the mountain clad with tropical forests and the lake of clear water, further together with fresh cool air. Despite of all these, tourism in this district is still low, mainly because of poor health conditions. The construction of the water supply system will contribute to an increase of tourists leading to a rise in earning in the community as a whole.

7-2 *Recommendations*

To successfully operate and manage the completed facilities, giving satisfaction to the consumers, and to ensure the safety of the supplied water, the following must be practiced.

1) The recommended enterprise organization should be established as soon as possible, with all necessary staff personnel employed.

2) With respect to the budget of the enterprise, it should be independent from the general budget of the municipality. Such financial independence should be prepared as early as possible.

3) As is planned in this report, and required by Cipta Karya, metering should be practiced by all means. Success of the enterprise depends on fair and rational charging for consumption, and unfailing collection of the bills.

4) Per capita consumption, accordingly the total water demand, in the report has been taken from the guidelines of Cipta Karya, because there is no data obtained from actual consumption in this town. Therefore, it is indispensable to review the actual figure, after commissioning the completed facilities.

5) The water supply system of the hospital is to remain as it is and be used for the hospital and houses nearby until the present project is completed. The existing facilities should be improved, so as not to be contaminated by waste water, and access of people.

6) A fence should be constructed around the intake facilities, to prevent people and animals from entering into the intake area, and contaminating the source water.

7) If any environmental destruction should be feared in the watershed of the river, upstream of the intake, some measures should be taken to prevent it. In case of any environmental destruction, necessary water treatment facilities should be added.

A P P E N D I X A

POPULATION PROJECTION

1. General

The existing Report dealt with the population of 3 districts, but presently Tentena consists of 6 districts, Sangele, Tentena, Pamona, Petirodongi, Tendeadongi and Sawidago. The latest data of population, which is now available about the six districts, is somewhat different from that used in the existing Report. Therefore, the population of Tentena will be recalculated up to the year of 2005 based on the data.

2. Population Data

Latest data of districtwise population of Tentena, and ratio of district population to the total population, are shown in Table A-1.

As shown in Table A-1, each district has a small fluctuation in the ratio in the past 6 years, which is not very significant. It may, therefore, be assumed that the population of the districts has grown at nearly the same rate, and this trend will continue in the short term future as well.

3. Population Projection

Generally, the following three methods (formula) are employed for population projection.

1) An arithmetic method, formulated by the least mean square method,
2) A geometric method,
3) Logistic curve, by the least mean square method.

The arithmetic method is useful to project population of cities that have a rather low growth rate of population. The second method is appropriate, in the case of small sized towns which are developing, and supposed to develop rather rapidly. The last method, originally formulated for the projection of biological propagation, under some limit for growth, is applicable to population projection for communities which have some limits to the development.

Table A-1 Population Data

	District		1974	1975	1976	1977	1978	1979
1.	Sangele	a	1,870	1,930	2,015	2,030	2,060	2,223
		b	0.324	0.325	0.333	0.330	0.334	0.343
2.	Tentena	a	1,070	1,084	1,092	1,112	1,033	1,112
		b	0.186	0.183	0.180	0.181	0.167	0.172
3.	Pamona	a	768	784	801	814	824	838
		b	0.133	0.132	0.132	0.132	0.133	0.129
4.	Petirodongi	a	487	496	503	512	539	549
		b	0.084	0.084	0.083	0.083	0.087	0.085
5.	Tendeadongi	a	420	469	475	487	497	502
		b	0.073	0.079	0.078	0.079	0.081	0.078
6.	Sawidago	a	1,153	1,167	1,172	1,198	1,224	1,251
		b	0.200	0.197	0.194	0.195	0.198	0.193
	T o t a l	a	5,768	5,930	6,058	6,153	6,177	6,475
		b	1.000	1.000	1.000	1.000	1.000	1.000

Note : a = population

b = district population/total population

For comparison and reference, population projections by all three methods are shown in Table A-2 and Fig A-1, and the preference of formula will further be described.

As seen Fig A-1, there are remarkable differences among the projected populations. In the case of Tentena, though, 2) geometric method is preferable, because the characteristics of the town, as enumerated below, correspond with the specific character of the method.

1) The town is small in size.
2) It has potential to develop as a tourist resort in the future.
3) It, being a center Christian missionary development in Central Sulawesi, may attract visitors.
4) It is situated at a strategic point along Poso Lake and on the main road.

4. Notes for Future Approach

In preparing the present paper, in order to acquire a most realistic result, the newest population data was employed, and a method considered most adequate was adopted for projection. Even though, it may not be assured that the future development would certainly take a course in the projected line. Hence, to attain a more appropriate projection in the future, it is advisable to take the following into consideration.

1) To project the future population as accurately as possible, some more detail data, in addition to that used for the present study, should be utilized, if any available, such as birth rate, population by age and others. Therefore, it is advisable to collect regularly such necessary data for use in the future population projection.

2) There are a number of methods for population projection. An appropriate one must be selected, taking into consideration the stage of actual development of the area.

3) The methods mentioned in the text, are all characterised by the use of 'trend'. That is the assumption that the trend of population growth in the past will continue in the future. Therefore, those methods are effective, only for a short-term projection, and not necessarily applicable for a long-term projection.

4) The result of population projection, conducted for the present project, should be reviewed in the future, after the project is completed.

Table A-2 Estimation of Future Population

Method	1980	1985	1990	1995	2000	2005
1	6,530	7,160	7,780	8,410	9,030	9,660
2	6,630	7,440	8,350	9,380	10,520	11,820
3	6,530	7,170	7,820	8,460	9,090	9,700

Note: 1. Arithmetic method formulated by the least mean square method,

$Y = 125X - 240,970$

2. Geometric method

$Y = 6475\ (1.0 + 0.0234)^{x-1979}$

3. Logistic curve by the least mean square method

$Y = 15,000/(1.0 + e^{0.0345T-0.363})$

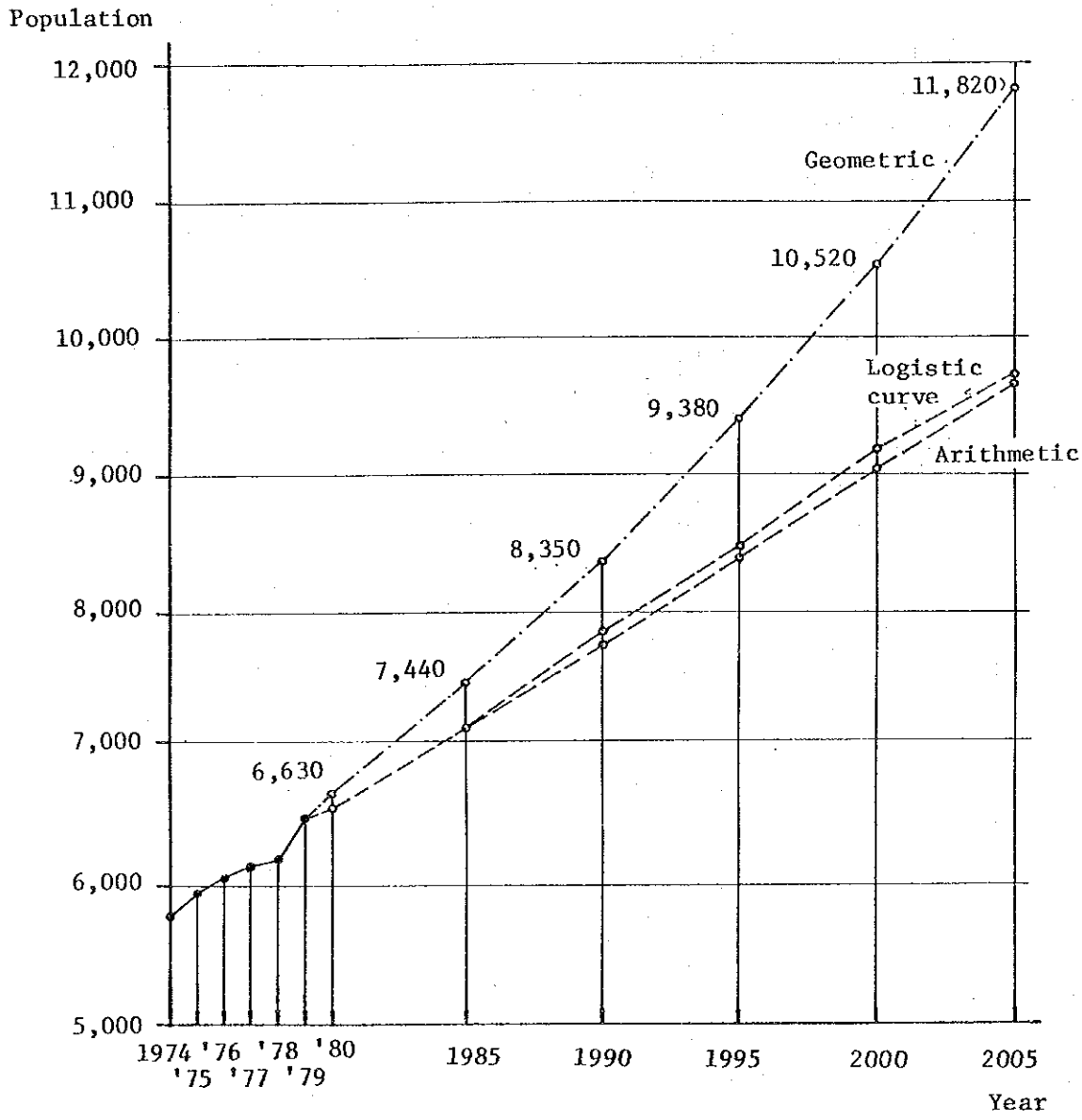
where,

Y : population

X : year to estimate population

T : term between standard year and year to estimate population, in years (i.e., T = X - 1977)

e : the base of natural logarithm



Legend :

●——● : Population data in the past.

o—·—·—o : Estimated population by means of geometric method.

o— — —o : Estimated population by means of arithmetic method and logistic curve method.

Fig A-1 Future Population

APPENDIX B

POPULATION SERVED

AND

WATER DEMAND

1. General

The projection of population served and water demand made by the existing Report is only for the year of 1985, whereas the projection of the total population has been made up to the year of 2005. This paper, therefore, will estimate the population served and water demand up to the year of 2005, based on the projected population in Appendix A. Further, for the estimation of water demand, the method adopted by the Report and the results of the survey by the Study Team will be utilized.

2. Present Water Use

In Tentena, there are some water supply facilities, but the people served by these facilities are very limited. Most of the inhabitants get water for domestic use from rivers, springs and shallow wells. The river water is, particularly, in wide use.

A field survey was conducted for quantity of consumption, and it was found that the consumption for domestic purposes varies from a low of 8 l/c/d to a high of 50 l/c/d, with an average of 20 l/c/d. Estimation of water demand will be made, based on these figures.

3. Population Served

Estimation of population served is usually made, multiplying total population by some assumed percentage, as made in the existing Report. It is acceptable, but to make further estimation as realistic as possible, local conditions, such as described below, will be reflected in the following calculation.

1) People who have an easy access to springs, wells, or rivers are rather reluctant to have the public water.

2) Average income of dwellers in temporary type houses is lower than that of dwellers in permanent or semi-permanent type houses, and dwellers of the temporary type houses will generally get water from public hydrants.

3) Ratio of population of each district to total population of the whole town is fairly constant over a short-term planning period.

4) Percentage of temporary type houses may gradually decrease, along with living standards, and it is assumed that the percentage in each district may become similar to that of Sangele, which has the lowest percentage in Tentena.

To calculate population served, the following steps will be taken :

(1) to allot the total population to each district.
(2) to project population districtwise and house type wise.
(3) to project population served in each district.

Results of calculation made according to the steps are presented hereinafter, together with some notes.

(1) to allot the total population to each district

Alloted population to each district is shown in Table B-1 below, for which a ratio calculated using the data in 1979 was employed. In this step, factor 3) described in the beginning of this section was considered.

Table B-1 Projected Population
(by District)

District	1980	1985	1990	1995	2000	2005	Population Ratio
1. Sangele	2,274	2,552	2,864	3,217	3,608	4,054	0.343
2. Tentena	1,140	1,280	1,436	1,614	1,810	2,033	0.172
3. Pamona	855	960	1,077	1,210	1,357	1,525	0.129
4. Petirodongi	564	632	710	797	894	1,005	0.085
5. Tendeadongi	517	580	651	732	821	922	0.078
6. Sawidago	1,280	1,436	1,612	1,810	2,030	2,281	0.193
Total	6,630	7,440	8,350	9,380	10,520	11,820	1,000

(2) to project population districtwise and house type wise

Projected population, districtwise and house type wise, is shown in the following Table B-2. As will be seen in the table, factor 4) was considered in the projection.

(3) to project population served in each district

Based on results of steps (1) and (2), the following tables are prepared with factors 1) and 2) considered.

Table B-2 Projected Population
(by District and House Type)

	District		1980	1985	1990	1995	2000	2005
1.	Sangele	a	1,478	1,659	1,862	2,091	2,345	2,635
		b	796	893	1,002	1,126	1,263	1,419
2.	Tentena	a	681	778	887	1,015	1,157	1,321
		b	459	502	549	599	653	712
3.	Pamona	a	291	386	500	636	798	991
		b	564	574	577	574	559	534
4,	Petirodongi	a	84	157	248	359	492	653
		b	480	475	462	438	402	352
5.	Tendeadongi	a	215	269	331	407	495	599
		b	302	311	320	325	326	323
6.	Sawidago	a	465	603	771	968	1,204	1,483
		b	815	833	841	842	826	798
	Total	a	3,214	3,852	4,599	5,476	6,491	7,682
		b	3,416	3,588	3,751	3,904	4,029	4,138

Note : a = permanent and semi-permanent house type population
b = temporary house type population

Table B-3 Estimated Served Population
(by District and Consumer)

District		1980	1985	1990	1995	2000	2005
1. Sangele	a	-	1,327	1,583	1,882	2,228	2,635
	b	-	416	466	524	588	661
2. Tentena	a	-	622	754	914	1,099	1,321
	b	-	250	273	298	325	354
3. Pamona	a	-	309	425	572	758	991
	b	-	296	298	296	288	275
4. Petirodongi	a	-	-	211	323	467	653
	b	-	370	237	225	207	181
5. Tendeadongi	a	-	-	281	366	470	599
	b	-	364	154	156	156	155
6. Sawidago	a	-	-	655	871	1,144	1,483
	b	-	837	358	358	352	340
Total	a	-	2,258	3,909	4,928	6,166	7,682
	b	-	2,533	1,786	1,857	1,916	1,966

Note : a = Number of direct consumers
b = Number of indirect consumers

Table B-4 Percentage of Population Served

Year	Population Served	Percentage
1980	-	-
1985	4,791	64.4
1990	5,695	68.2
1995	6,785	72.3
2000	8,082	76.8
2005	9,648	81.6

4. Water Requirement

Water requirements consist of domestic consumption, and other uses. Domestic consumption can be computed, as a product of population and per capita consumption, and other uses in a similar way. For the present estimation of domestic consumption, the following are referred to, and taken into consideration.

1) Population served, discussed in the preceding section,

2) Per capita consumption by domestic use, based on other study reports for towns of similar nature in size and economic development,

3) Per capita consumption by public hydrants, based on the present field survey on water demand.

Regarding other uses, the existing Report calculated the requirements only for 1985, so the requirements for following years will be calculated in the same way as shown in Table B-5.

Table B-5 Water Requirements

Item and Unit		1980	1985	1990	1995	2000	2005
Domestic							
Domestic Use	(1)	-	100(4)	108	115	123	130
	(2)	-	226	422	567	758	999
Public Hydrant	(1)	-	30(4)	30	30	30	30
	(2)	-	76	54	56	57	59
Sub-total	(2)		302	476	623	815	1,058
Non-domestic							
Institutions	(2)	-	6	6	7	8	9
Hotels, Shops & Markets	(2)	-	33	48	64	74	86
Medical Facilities	(2)	-	24	26	42	45	60
Schools	(2)	-	36	43	52	61	72
Dormitories	(2)	-	18	23	27	32	36
Religious Institutions	(2)	-	15	24	31	41	53
Sub-total	(2)		132	170	223	261	316
a. Total Water Consumption	(1)	-	91	113	125	133	142
	(2)	-	434	646	846	1,076	1,374
	(3)	-	5	7	10	12	16
b. Unaccounted-for Water b = a x 0.15	(2)	-	65	97	127	161	206
c. Average Day c = a + b	(1)	-	104	130	143	153	164
	(2)	-	499	743	973	1,237	1,580
	(3)	-	6	9	11	14	18
d. Maximum Day d = c x 1.25	(1)	-	130	163	179	191	205
	(2)	-	624	929	1,216	1,546	1,975
	(3)	-	7	11	14	18	23

Note : (1) = liter per capita per day
(2) = cubic meter per day
(3) = liter per second
(4) = The figure is based on the results of the present study

5. Notes for Future Approach

So far the estimation of population served and water demand has been made based on the projected population in Appendix A, especially taking into consideration the local characteristics which are considered to have effect on the estimation. For reference, the results of this estimation are compared with the values set forth in the guidelines of Cipta Karya, as shown below. Some differences between the two are seen, but they are very small and almost negligible. From this, the values of the guidelines are considered to be practically applicable to the planning for cities/towns with similar features, in size and character.

	Item	Guidelines of Cipta Karya	Result of the Estimation in 1985
a	Percentage of Served Population (%)	60	64
b	Ratio of Served Population by Public Hydrants	0.50	0.52
c	Water Consumption by Public Hydrants (l/c/d)	30	30

In the present estimation, some assumptions were inevitably employed due to insufficiency of data. When such data becomes available from water supply projects in the future, the following steps will be advised to be taken, for a more accurate and reliable estimation of population served and water requirements.

1) To review the assumption used for the present estimation, at a later stage, when the project is in operation.

2) To take all data of population served and water consumption, broken down into use categories, after the commissioning of the present project, and to use results of their analyses for the next expansion planning.

APPENDIX C

BREAKDOWN OF

ESTIMATED CONSTRUCTION COST

Note:

Foreign Portion : CIF of pipe and fitting, meter, valve and pump. PVC and ACP, although locally available, are included in Foreign Portion, considering that the manufacturing capacity and experience in use are still not sufficient.

Local Portion : Cement, steel bar, gravel, sand, civil work and local transportation.

ESTIMATED CONSTRUCTION COST FOR TENTENA (in Rp.)

Items	Foreign Exchange		Local Currency		Remarks
1. Intake Weir	———		1) earthwork	150,000	
			2) concrete @ 200,000/cu m x 11 cu m =	2,200,000	
			3) coarse screen	100,000	
			Total	2,450,000	
2. Transmission Pipeline A Ø 150 x 1,550 m DCIP	1) pipe @12,958/m x 1,550 m =	20,084,900	1) pipe @ 4,000/m x 1,550 m =	6,200,000	
	2) fitting 20,084,900 x 20 % =	4,016,980	2) protection	2,500,000	
	3) valve @ 217,525/pcs x 2/pcs=	435,050	3) valve box @ 500,000/pcs x 2/pcs =	1,000,000	
	Total	24,536,930 @ 15,800/m	4)* local transportation	3,700,000	4)* In case of Tentena, costs of Materials x 15 %
			Total	13,400,000 @ 8,600/m	
3. Grit Chamber & Rough Filter	1)* yard pipe - Ø 100 @8,891/m x 100 m =	889,100	1) earthwork (500 cu m)	1,000,000	1)* Includes all drain and overflow pipes
	2) fitting @ 889,100 x 20 % =	177,820	2) concrete @ 200,000/cu m x 90 cu m =	18,000,000	
	3) valve @ 120,074/pcs x 4 pcs=	480,296	3) manhole, etc.	458,000	
	4) gate, weir	1,162,784	4) gravel @ 20,000/cu m x 15 cu m =	300,000	
	Total	2,710,000	5) local transportation	400,000	
			Total	20,158,000	

Items	Foreign Exchange	Local Currency	Remarks
4. Transmission Pipeline B Ø 150 x 600 m DCIP	1) pipe @ 12,958/m x 600 m = 7,774,800 2) fitting 7,774,800 x 20 % = 1,554,960 3) valve @ 217,525/pcs x 2 pcs = 435,050 Total 9,764,810 @ 16,300/m	1) pipe @ 4,000/m x 600 m = 2,400,000 2) protection 500,000 3) valve box @ 500,000/pcs x 2 pcs = 1,000,000 4) local transportation 1,500,000 Total 5,400,000 @ 9,000/m	
5. Break Pressure Chamber	1)* yard pipe - Ø 100 @ 8,891/m x 50 m = 444,550 2) fitting @ 444,550 x 20 % = 88,910 3) valve 120,074 Total 653,534 ≒ 700,000	1) earthwork (20 cu m) 400,000 2) concrete @ 200,000/cu m x 8.5 cu m = 1,700,000 3) local transportation 100,000 Total 2,200,000	1)* Includes all drain and overflow pipes
6. Distribution Pipeline			
- Ø 150 x 3,400 m PVC	1) pipe @ 9,340/m x 3,400 m = 31,756,000 2) fitting 31,756,000 x 20 % = 6,351,200	1) pipe @ 4,000/m x 3,400 m = 13,600,000 2) valve box @ 500,000/pcs x 5 pcs = 2,500,000	

Items	Foreign Exchange	Local Currency	Remarks
	3) valve @ 217,525/pcs x 5 pcs = 1,087,625 4) river crossing @ 90,000/m x 40 m = 3,600,000 Total 42,794,825 @ 12,600/m	3) thrust block @ 50,000/pcs x 20 pcs = 1,000,000 4) river crossing @ 35,000/m x 40 m = 1,400,000 5) local transportation 6,400,000 Total 24,900,000 @ 7,300/m	
- Ø 100 x 3,200 m PVC	1) pipe @ 4,913/m x 3,200 m = 15,721,600 2) fitting 15,721,600 x 20 % = 3,144,320 3) valve @ 120,074/pcs x 5 pcs = 600,370 4) river crossing @ 90,000/m x 220 m = 19,800,000 Total 39,266,290 @ 12,300/m	1) pipe @ 4,000/m x 3,200 m = 12,800,000 2) valve box @ 500,000/pcs x 5 pcs = 2,500,000 3) thrust block @ 50,000/pcs x 20 pcs = 1,000,000 4) river crossing @ 35,000/m x 220 m = 7,700,000 5) local transportation 5,900,000 Total 29,900,000 @ 9,300/m	
- Ø 75 x 4,750 m PVC	1) pipe @ 3,130/m x 4,750 m = 14,867,500 2) fitting 14,867,500 x 20 % = 2,973,500 3) valve @ 92,750/pcs x 6 pcs = 556,500	1) pipe @ 3,500/m x 4,750 m = 16,625,000 2) valve box @ 300,000/pcs x 6 pcs = 1,800,000 3) thrust block @ 40,000/pcs x 20 pcs = 800,000	

Items	Foreign Exchange		Local Currency		Remarks
	4) river crossing @ 90,000/m x 60 m =	5,400,000	4) river crossing @ 35,000/m x 60 m =	2,100,000	
			5) local transportation	3,600,000	
	Total	23,797,500 @ 5,000/m	Total	24,925,000 @ 5,200/m	
- Ø 50 x 600 m PVC	1) pipe @ 1,563/m x 600 m =	937,800	1) pipe @ 3,000/m x 600 m =	1,800,000	
	2) fitting 937,800 x 20 % =	187,560	2) valve box @ 300,000/pcs x 2 pcs =	600,000	
	3) valve @ 76,393/pcs x 2 pcs =	152,786	3) river crossing @ 35,000/m x 40 m =	1,400,000	
	4) river crossing @ 85,000/m x 40 m =	3,400,000	4) local transportation	700,000	
	Total	4,678,146 @ 7,800/m	Total	4,500,000 @ 7,500/m	
7. Bulk Meter Ø 150	1) bulk meter	1,100,000	1) meter box	500,000	
			2) local transportation	170,000	
			Total	670,000	
8. Water Meter Ø 13	1) water meter @ 17,000/pcs x 370 pcs =	6,290,000	1) local transportation	940,000 @ 2,600/pcs	

Items	Foreign Exchange	Local Currency	Remarks
9. Public Hydrant	1) meter - Ø 18 @ 30,000/pcs x 10 pcs = 300,000	1) concrete @ 300,000 x 10 = 3,000,000 2) local transportation 50,000 Total 3,050,000 @ 305,000/pcs	

APPENDIX D

ASSUMPTIONS FOR FINANCIAL PROJECTIONS

Financial projections are prepared on the basis of following assumptions.

1. The accounts in the financial statements conform with the generally accepted chart of accounts for water utilities. The financial statement and projections are based on an accrual system of accounting.

2. Revenues are expected from water sales and other income for installing and reconnecting service connections. Volumes of water sold are consistent with the engineering estimates of total water consumption. Other income for installing and reconnecting service connections is a service payment. Other income consists of revenues from reconnection fees and labor costs billed for installing new connections. Customers are assumed to pay for the meters, pipes and other materials used in installing the service connections.

3. The water rate, payable by the consumers, are determined, employing guidelines for setting water rates prepared by Cipta Karya, on the basis of production cost. Water rates are assumed to be minimum to generate return of the operation and maintenance cost. Depreciation for assets newly constructed is not considered in the item of operation and maintenance cost, since the provision of such expense will affect the water rate to be high. Details of water rates calculation are shown in Attachment I) Assumption for Calculation of Water Rate.

4. Two per cent of annual billings are written off as bad debts in line with assumptions of increasing water rates and number of customers.

5. Operating expense are assumed at substantially increasing levels considered necessary to operate and maintain the water supply system adequately and to provide for expanding operations. Details are given in Attachment II) Projection of Operation and Maintenance Cost.

6. Personnel costs are based on staffing requirements for the implementation of the project and on equitable salaries, and 5% increase annually. Details are given in Attachment III) Projection of Personnel Cost.

7. Annual costs of materials for repairs and maintenance cost is estimated at 0.6% of the gross value of fixed assets (project cost) in the service at 1983 and will increase 5% annually.

8. Annual office supplies expense is assumed to amount to about Rp.200 for every customer.

9. Chemical expenses are based on the chemical requirements for the volume of water to be treated and increase 5% annually. Chemical price is assumed to be Rp.1,170/kg in 1980. Details are given in Attachment IV) Projection of Chemical Cost.

10. Other operating expenses include expenditures for communications, reproduction, personnel training, board meeting, and miscellaneous items. This is estimated at 5% of total of other cash operating expenses such as personnel cost, office operating cost, and chemical cost.

Attachment I)

Assumption for Calculation of Water Rate

A. Percentage of Water Structure Classification*

Item	Percentage of Usage of Water		
	0 - 15 m^3/m	15 - 30 m^3/m	more than 30 m^3/m
Domestic Use	87.70	12.30	-
Office	47.00	51.81	1.19
Commercial	80.51	19.49	-
Industrial	-	-	100
Social	36.09	61.29	2.62
Hospital	54.7	4.01	41.29

Note: Residential/Government tariff includes domestic use, office, and medical facilities.
Commercial tariff includes hotel, markets.
Industrial tariff includes industrial.
Social tariff includes religious, school and domitories.
Public tariff includes public taps and public parks.
Port tariff includes harbor.

* .... Water structure classification is based on the data of monthly water consumption in Donggala.

B. Classification of Water Consumption

Tentena

1985

m^3/day	Residential					Social		
Class of Water Consumption	Domestic	Institutional	Medical	Commercial	Industrial	Religious	Public	Harbor
	226	6	24	33	-	69	76	-
0 - 15 m^3/m	198	2	13	26	-	25	27	-
15 - 30 m^3/m	28	3	1	6	-	42	46	-
more than 30 m^3/m	-	1	10	1	-	2	3	-

1990

m^3/day	Residential					Social		
Class of Water Consumption	Domestic	Institutional	Medical	Commercial	Industrial	Religious	Public	Harbor
	422	6	26	48	-	90	54	-
0 - 15 m^3/m	370	2	14	39	-	32	19	-
15 - 30 m^3/m	52	3	1	9	-	55	33	-
more than 30 m^3/m	-	1	11	-	-	3	2	-

C. Water Sales

Item \ Year	1985	1990
Residential	294A	506A
Commercial	68A	96A
Industrial	-	-
Social	147.2A	154.4A
Harbor	-	-
Total	509.2A	756.4A

Note: Figures in each classification show sales of water in Rupiah per cubic meter per day x "A" factor.

D. Water Sales

Water Sales \ Year	1983	1984	1985	1986	1987	1988	1989	1990
	149,767A		185,858A		221,949A		258,040A	
		167,812A		203,904A		239,995A		276,086A

Note: Figures show sales of water in Rupiah per year x "A" factor.

E. "A" Factor based on Water Sales (Rp/m^3)

	1983	1984	1985	1986	1987	1988	1989	1990
"A" factor Rp/m^3	70.0	71.61	67.89	64.98	62.67	60.85	59.41	55.55

Note: "A" Factor = $\frac{\text{Total Cost of Operation and Maintenance}}{\text{Water Sales}}$

"A" factor is determined to be Rp.65.

F. Proposed National Standard Water Rate Structure

Blocks	Residential/ Government	Commercial	Industrial	Social	Public Bath-house & Standpipes	Ports
0 - 15 m^3	1.0A	2.0A	3.0A	0.8A	0.8A	5.0A
15 - 30 m^3	1.5A	2.0A	3.0A	1.2A	0.8A	5.0A
more than 30 m^3	3.0A	4.0A	5.0A	1.6A	0.8A	5.0A

Attachment II)

Projection of Operation and Maintenance Cost

TENTENA

Operation and Maintenance Cost

(Ro. 1,000)

	I t e m	1983	1984	1985	1986	1987	1988
I.	Personnel	6,885	8,189	8,598	9,028	9,478	9,953
II.	Operation/Maintenance						
	1. Maintenance	2,964	3,112	3,268	3,431	3,603	3,783
	2. Office Operation	70	73	76	79	82	85
	3. Chemical Cost	253	265	279	293	307	323
	Total (I & II 1,2,3)	10,172	11,639	12,221	12,831	13,470	14,144
	4. Other Expenses	317	379	397	418	439	460
	TOTAL	10,489	12,018	12,618	13,249	13,909	14,604
	Water Consumption (m^3/year)	127,458	142,934	158,410	173,886	189,362	204,838
	Production Cost (Rp./m^3)	82.27	84.08	79.65	76.19	73.45	71.29

Attachment III)

Projection of Personnel Cost

Monthly salary of personnel according to the qualification is assumed based on information obtained from D.S.E., Cipta Karya:

	Position	Rp./month
i.	Manager	100,000.-
ii.	Head	65,000.-
iii.	Accounting Staff	50,000.-
iv.	Maintenance & Operation Staff	45,000.-
v.	Bookkeeping Staff	45,000.-
vi.	Staff of Billing & Collection	40,000.-
vii.	Meter reader	20,000.-
viii.	Secretary cum Typist	45,000.-
ix.	Foreman	15,000.-

Note :	Position	Qualification
	Manager	Technical I
	Head	Technical II
	Technical Plan	Technical III
	Maintenance & Operation Staff	Technical IV
	Accounting Staff	Administration II
	Staff of Billing & Collection	Administration III
	Meter reader	Administration IV
	Secretary cum Typist	Administration II

TENTENA

Personnel Cost

(Rp. 1,000)

Description	1982	1983	1984	1985	1986	1987	1988
Manager	1,200	1,260	1,323	1,389	1,459	1,531	1,608
Secretary/Typist	540	567	595	625	656	689	724
Technical							
Head	780	819	860	903	948	995	1,045
Maintenance & Operation	-	1,080	1,134	1,191	1,250	1,313	1,378
Administration & Finance							
Head	780	819	860	903	948	995	1,045
Accounting	-	600	630	661	694	729	766
Bookkeeping	-	540	567	595	625	656	689
Billing & Collection	-	960	1,968	2,066	2,170	2,278	2,392
Meter reader	-	240	252	265	278	292	306
TOTAL	3,300	6,885	8,189	8,598	9,028	9,478	9,953

Attachment IV)

Projection of Chemical Cost

A. Projection of Chemical Cost

i. Unit Price : Rp. 1,170/kg as of 1980
(annual escalation of 5% considered)

ii. Amount of calcium hypochlorite to be used.

Items	Tentena
Water Production (Average day l/sec)	5.8
Dosage of Chlorite (ppm)	0.8
Period of Dosage	Daily
Use of Chlorite per Year (kg/y)	240

REPUBLIC OF INDONESIA

FEASIBILITY STUDY FOR SMALL AND MEDIUM SIZED TOWNS WATER SUPPLY PROJECTS IN SULAWESI

FINAL REPORT

Vol. 4 : LUWUK

NOVEMBER 1980

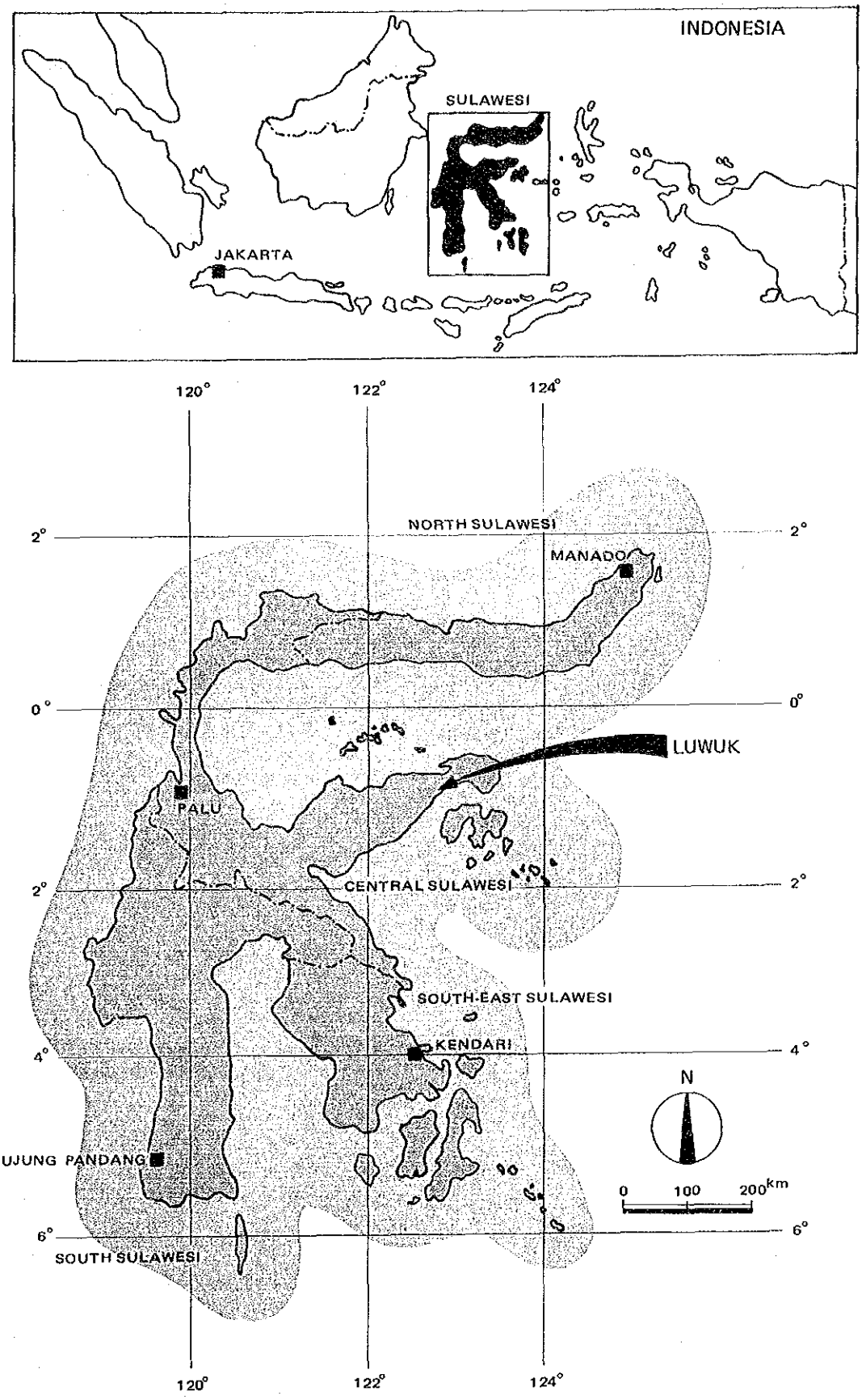
JAPAN INTERNATIONAL COOPERATION AGENCY

FEASIBILITY STUDY FOR
SMALL AND MEDIUM SIZED TOWNS WATER SUPPLY PROJECT
IN SULAWESI
THE REPUBLIC OF INDONESIA

TABLE OF CONTENTS

LIST OF ABBREVIATIONS

CIPTA KARYA	- the Directorate General of Housing, Building, Planning and Urban Development
DSE	- the Directorate of Sanitary Engineering, CIPTA KARYA
JICA	- the Japan International Cooperation Agency
The existing Report or the Report	- "Feasibility Study dan Master Plan Sistim Penyediaan Air Minum for Luwuk" prepared by P.T. Ciriajasa Total Design
sq km	- square kilometer
kg/sq cm	- kilogram per square centimeter
ha	- hectare
%	- percentage
°C	- degree centigrade
l/sec	- liter per second
l/c/d	- liter per capita per day
cu m/d	- cubic meter per day
cu m/m	- cubic meter per month
ppm	- parts per million by weight
mg/l	- miligram per liter
pH	- potential of Hydrogen
FTU	- function turbidity unit
ACP	- asbestos cement pipe
PVC	- polyvinyl chloride pipe
CIP	- cast iron pipe
DCIP	- ductile cast iron pipe
GSP	- galvanized steel pipe
SP	- steel pipe



LOCATION MAP OF STUDY AREA

I. GENERAL

1-1 Introduction

The Government of the Republic of Indonesia intends to implement the Small and Medium Sized Towns Water Supply Projects in the frame of PELITA III, and has requested the Government of Japan to carry out a Feasibility Study for five towns in Sulawesi. In response to the request, the Government of Japan has decided to conduct the Feasibility Study for the projects, and the Study Team has been dispatched to carry out the study, covering a period from March to August 1980, by the Japan International Cooperation Agency (JICA), the official agency responsible for implementation of the Technical Cooperation Program of the Government of Japan.

This report, the Feasibility Study for the Luwuk Water Supply System, has been prepared based on a review of the existing Feasibility Study Report prepared by the Directorate of Sanitary Engineering, Cipta Karya, Ministry of Public Works, and on the Team's own surveys conducted during the study period for the above mentioned project. The report describes the result of review and presents a recommended system to be constructed with a target year of 1985, together with an estimated cost of the project and an implementation schedule thereof, all based on the said review.

The report also deals with necessary funds required for the construction of the proposed system, with potential sources of financing, and the financial feasibility of the project. Considerations are given to establishing a suitable organization, which will perform the operation and maintenance of the system after completion. This organization is to be established along the basic policy lines of Cipta Karya.

It is to be noted that this report does not contradict the above mentioned existing Report, but replenishes it with additional studies and analyses, on the basis of supplemental data and information. In compiling the report, quotations or reproductions from the existing Report have been

minimized in so far as the context of the present report is not obscured. In case, however, any necessary data of the previous study happens not to be quoted in this report, it is wished the original Report be referred to.

1-2 Objective of the Study

The objective of this study is conduct a Feasibility Study Report based on the review of the existing Report including preliminary engineering designs prepared by Cipta Karya. To attain the above purpose, the study also covers some supplemental studies on the engineering and financial requirements.

1-3 Scope of Work

The Operation Program signed between Cipta Karya and the Study Team, defines the scope of work for the Small and Medium Sized Towns Water Supply Projects in Sulawesi.

The scope of work is as follows :

1) To review the existing feasibility reports and data;
2) To undertake field survey and investigation based on the existing reports;
3) To carry out supplemental studies on each of cities/towns;
4) To carry out analysis of data and information;
5) To study construction materials, labor force, and construction ability of local contractor;
6) To study a water supply organization;
7) To prepare financial planning;
8) To study benefits of the Project;
9) To prepare an implementation schedule.

1-4 Study Area

1-4-1 Geography

Luwuk, administratively, belongs to Luwuk Sub-regency, Banggai Regency, Province of Central Sulawesi, as shown in Fig 1-4-1.

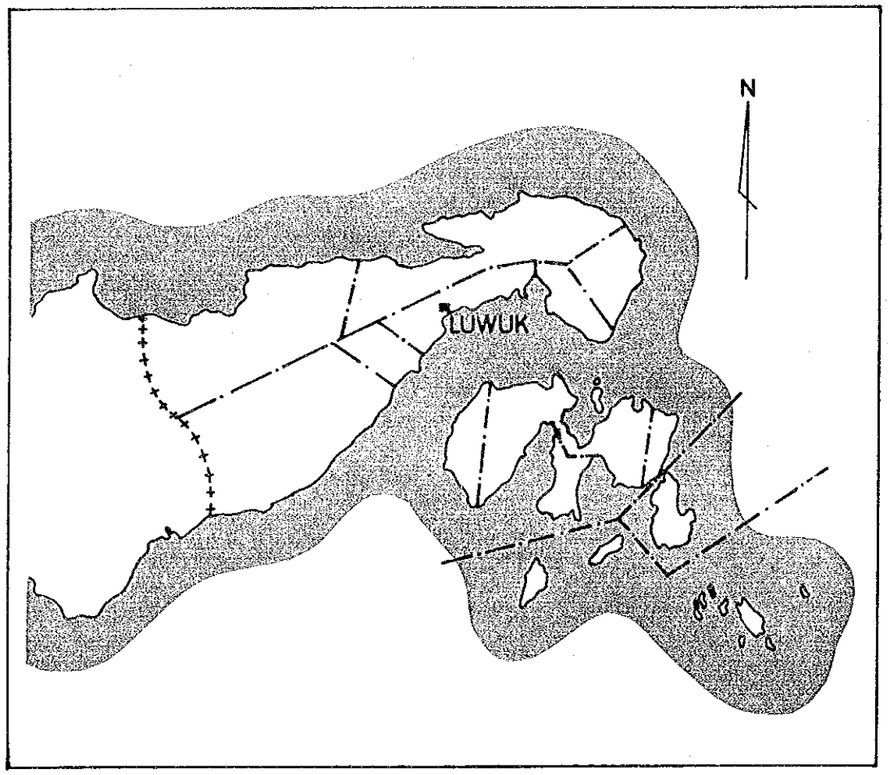
The town is located near the tip of one of the four large peninsulas of Sulawesi island. The peninsula is the second from the northern-most one. Luwuk is, so to speak, an isolated town in the undeveloped virgin forest, because the town has few roads linking with other cities/towns on the peninsula. As for marine and air transportation, however, it has a civil airport and a seaport, and is conveniently connected with other major cities in the island, such as Ujung Pandang, Manado, etc.

Its geographical location is 122°38' east longitude and 0°52' south latitude. Topographical features of Luwuk are that the town has grown on a slope of the mountain facing south to the sea, with almost no flat land. The built-up area spreads between elevations 0 to 50 m above sea level. And both ends of the twon, east and west, are bounded by forests. Geologically, formations of the area are mainly of lime stone, and abound in groundwater.

The climate of the area is of the nature of tropics and ocean due to its location, having temperature ranging from 22°C to 28°C, annual rainfalls 1,000 to 1,500 mm.

1-4-2 Socioeconomic Conditions

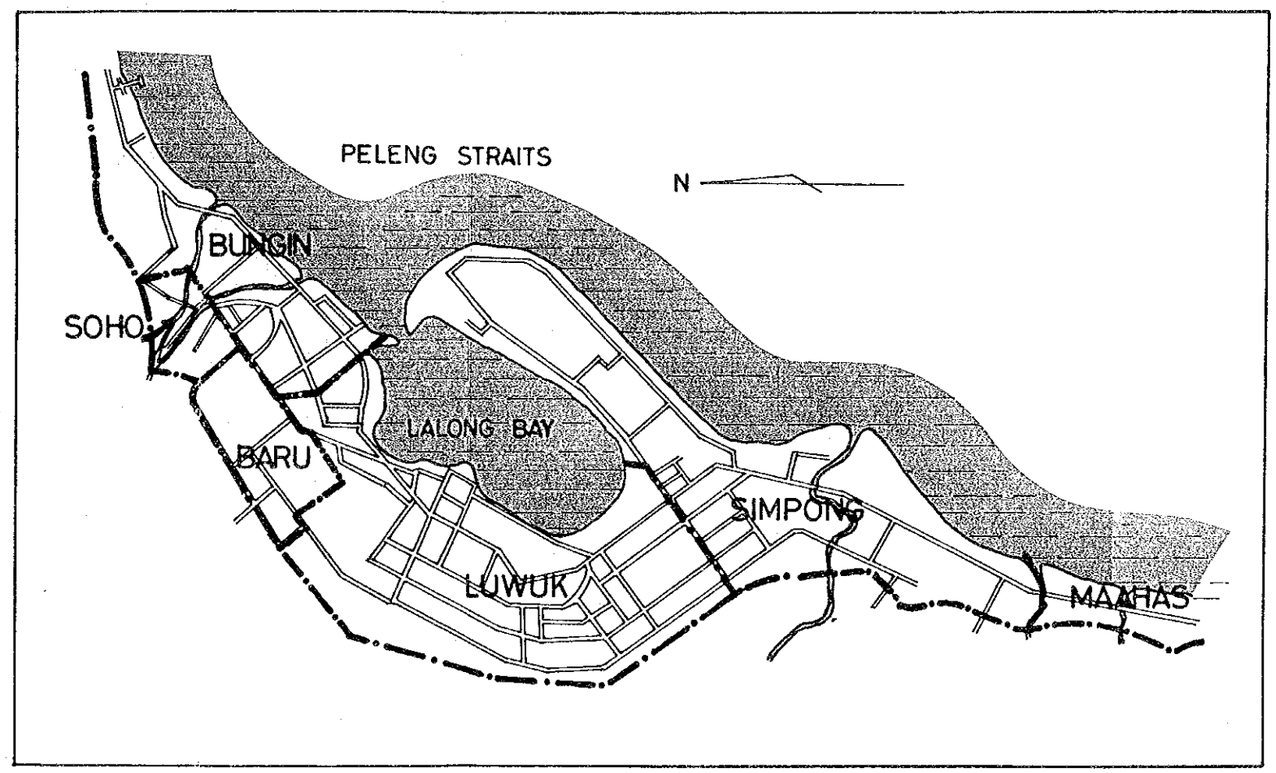
The total population of Luwuk was 18,019 according to the record of 1979, as shown in Table 1-4-1. And the area to cover this population is 178 ha, as studied by the existing Report. This area is intended to be developed as an orderly built-up area, and is the present study area.



LEGEND :

+++++++ KABUPATEN BOUNDARY OF LUWUK

—·—·— KECAMATAN BOUNDARY OF LUWUK



LEGEND :

—·—·— DISTRICTS OF KOTA LUWUK

FIG. 1-4-1 MAP OF LUWUK 1 : 2.000.000 / 1 : 20. 000

There are another two tables contained in the Report, which are reformed as Tables 1-4-2 Distribution of Occupations and 1-4-3 Number of Facilities. As is clear in the tables, Luwuk has three characteristics as a community, namely, a town of agriculture, home industry and an urbanized center. The agriculture is self-supporting farming of people, the home industry consists of lumbering including manufacturing and stone masonry, and as an urbanized center in the regency the town has various urban facilities, such as educational facilities, commercial establishments, hotels, hospitals, etc.

Table 1-4-1 Districtwise Population

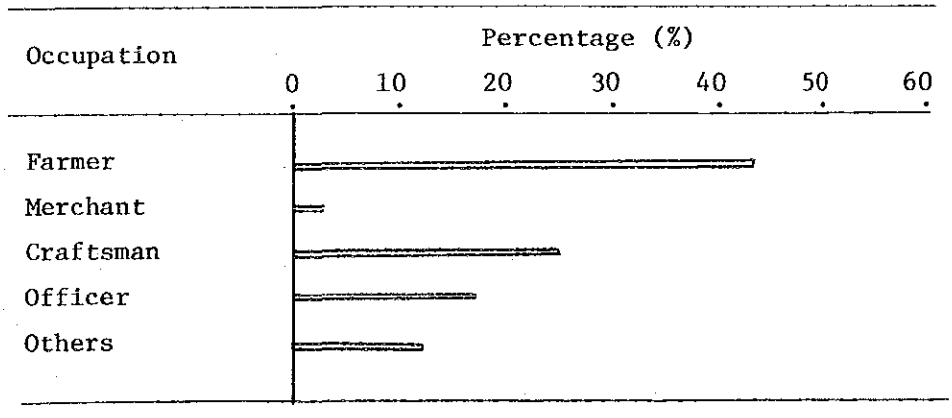
(quoted from the Report)

District	Population
1. Luwuk	4,321
2. Maachas	1,189
3. Simpong	2,818
4. Kampung Baru	3,202
5. Soho	2,530
6. Bungin	3,959
Total	18,019

Source : Office of Kecamatan Kota Luwuk

Table 1-4-2 Distribution of Occupations

in 1977



Source : the existing Report

Table 1-4-3 Number of Facilities

in 1977

Category	Facility	Number
Education	Kindergarten	3
	Elementary School	16
	High School	22
	College	3
Economic	Store & Market	53
	Factory	84
	Office	66
	Hotel	4
Sanitary	Hospital	5
Religion	Church	6
	Mosque	7

Source : the existing Report

As for the earning of the people in Luwuk, the report says that the average monthly income per household might read Rp. 73,000. This value was estimated from the census of 1976 in Central Sulawesi, and it was calculated assuming the income increase rate at 15.86 % annually and making the 1976 income as basis for calculation. On the other hand, information obtained in the present field study is that the present average income is supposed to be around Rp. 38,000.

1-4-3 Environmental Condition

Luwuk is not necessarily in a hygienic condition, which is reflected in the incidence of diseases, as shown in the following Table 1-4-4 Various

Diseases in Kota Luwuk, 1977 quoted from the existing Report.

In Luwuk excellent water sources are available rather close to the inhabited area, but nevertheless many people are still using unsafe water for their daily use and their living environment is not clean. Such conditions must be rectified as early as possible, and in view of this the local governments concerned have already established a comprehensive regional development plan, including the present water supply project and other public utilities. The water supply project, among others, has been taken up by the central government for the first realization of the plan, and this will, it is expected, motivate all other construction activities of environmental facilities.

Table 1-4-4 Various Disease in Kota Luwuk, 1977

(quoted from the Report)

Kind of Diseases	No of Patients	%
1. Malaria	3,256	29.12
2. Respiratory Disease	2,532	22.65
3. Gastroenteritis	2,100	18.78
4. Influenza	1,775	15.87
5. Skin Disease	950	8.50
6. Parasitic Disease	360	3.22
7. Others	208	1.86

II. REVIEW OF PROPOSED WATER SUPPLY PLANNING

2-1 General

Luwuk is blessed with plentiful spring water, as it is called Kota Air. Half century ago there was already a water supply system which tapped water from the spring Mangkio. Due to abundance of water, water supply facilities have been constructed one after another from the same water source without any orderly plan to construct a complete water supply system. To make the situation worse, all the once-constructed facilities have not been attended to for maintenance and management. In view of the above mentioned prevailing condition, the present review of the water supply planning proposed by the existing Report has been placing an emphasis on establishing an efficient and operation-easy water supply system. This chapter will firstly describe the existing water supply system, and then proceed to review the fundamental factors proposed by the existing Report for the present project, taking the above into due consideration.

2-2 Existing Water Supply

2-2-1 Existing Water Supply Facilities

As details are described in the existing Report, the public water supply system in Luwuk came into operation with water from the spring Mangkio in 1926, and still is operating. Aside from this system, as the Report says, there is another water supply system which takes water from the spring Supak and supplies only limited establishments. Major features of the two water supply systems are as follows.

1) Water Supply System of Mangkio Spring

The spring Mangkio is located at the north end of the populated area of Luwuk at an elevation of 50 m above sea level. It has a very convenient location and elevation for water supply of Luwuk.

The yield of the spring is 250 - 300 l/sec, according to the measurement of the local government and another measurement by the local consultant who prepared the existing Report. The yield does not vary much through the year.

The existing intake facility was first constructed in the colonial days. It is a box-type collection chamber as shown in Fig 2-2-1 and later another similar chamber was added to increase intake quantity. The environment is generally safe from contamination, but the existing fence is not sufficient to protect the spring area.

The water is distributed directly from the intake chamber to the distribution mains with diameters 150 to 75 mm, without a reservoir. Surplus water about 100 to 150 l/sec is overflowing at the intake. The existing distribution pipelines are quite insufficient to distribute the available water at the spring, because all the existing pipelines are deteriorated with years of use, with some clogged and others leaking.

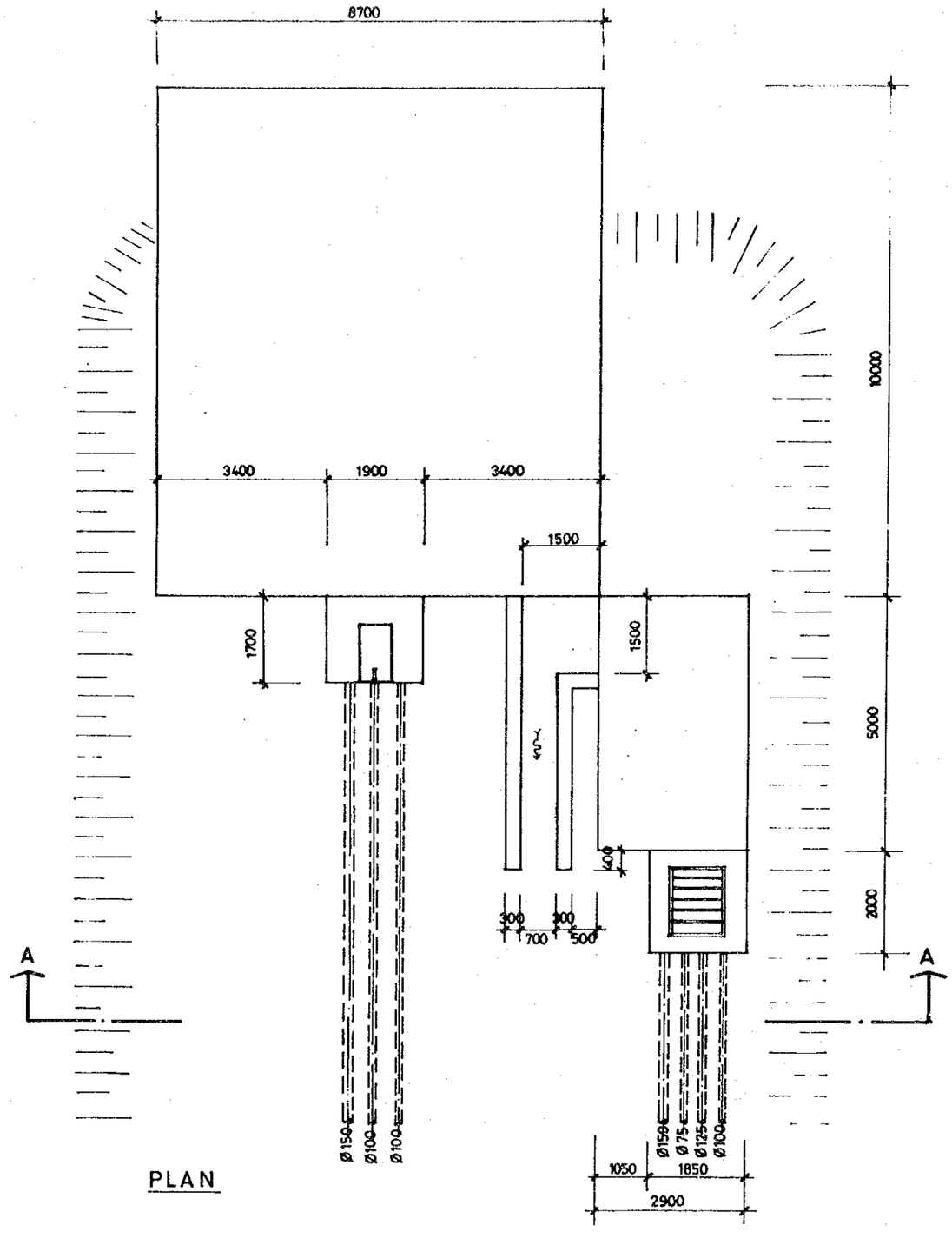
2) Water Supply System of Supak Spring

The spring is also located at the north end of Luwuk at an elevation of 40 m above sea level, and has a yield of 20 to 25 l/sec. Part of the yield is presently used exclusively by a military establishment and Copra Cooperative Center.

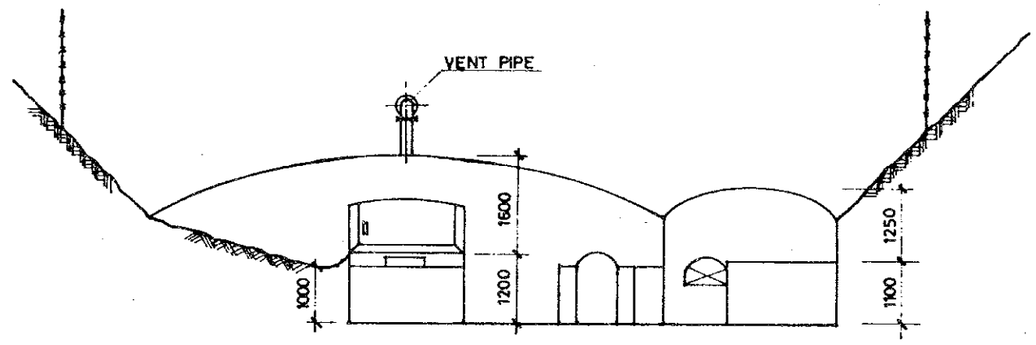
2-2-2 Present Water Supply Conditions

According to the existing Report, and as observed by the Study Team, present conditions of the existing water supply system are as follows.

Population served is very limited, 426 customers, that is about 2,500 persons. The reason for that the population served is rather few despite the abundant supply source is that the supply capacity of the pipelines has extremely decreased due to deterioration. There are some areas where pipelines are existent but no water is available. From this condition, no new connections can be made.



PLAN



SECTION A-A

FIG. 2-2-1 EXISTING BOX-TYPE COLLECTION CHAMBER 1:100

So far no house meters have been installed, and charge has been made according to the number of taps of each connection. In Table 2-2-1 quoted from the Report, the number of customers and water tariff are shown.

Luwuk has no independent organization for water supply, so the management of the water supply system is now made by the local government itself.

Table 2-2-1 Number of Customers and Water Tariff, 1977

a. Number of customers

Customers	Number
Domestic use	250
Government office	25
Private office	25
Shop	100
Enterprise	10
Hospital	5
Religious institution	6
Dormitory	5
Total	426

b. Water tariff for each customer

Customers	Unit price per tap per month
Government personnel	Rp 250
General public	400
Enterprise	1,000
Shop	500
Ship	250/cu m
Hospital	Bills not collected
Religious institution	-do-
School	-do-
Dormitory	-do-
Tap for parks	-do-

Note : quoted from the existing Report