II. REVIEW OF PROPOSED WATER SUPPLY PLANNING

2-1 General

This chapter deals with planning of the present stage project, proposed by the existing Report and together with revisions proposed by the Study Team, after briefly describing the present conditions of the existing water supply systems in Donggala.

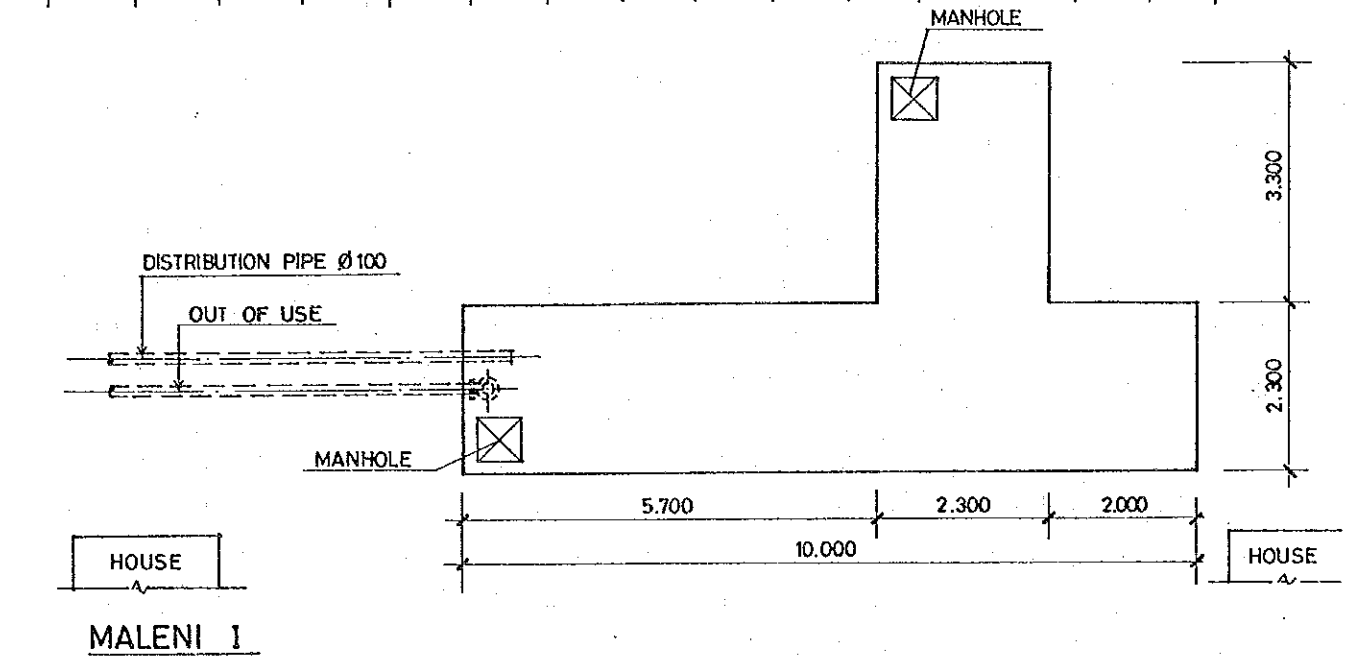
What to be specially noted in this introduction is that the water sources mentioned in the existing Report were found in the present study not suitable because of their geographical location and water quality. Hence, another water source has had to be looked for by the Study Team. Needless to say, what is most desirable in the case of small water supply systems is that the source water does not require any treatment and besides the water can be distributed by gravity. It is obvious that from this standpoint every effort has been made by those engineers who engaged in the previous feasibility study. Even though, the proposed water sources were found to be intolerable for the present project. Therefore the Study Team is presenting another alternative water source, as described in the following sections, for the project.

2-2 Existing Water Supply

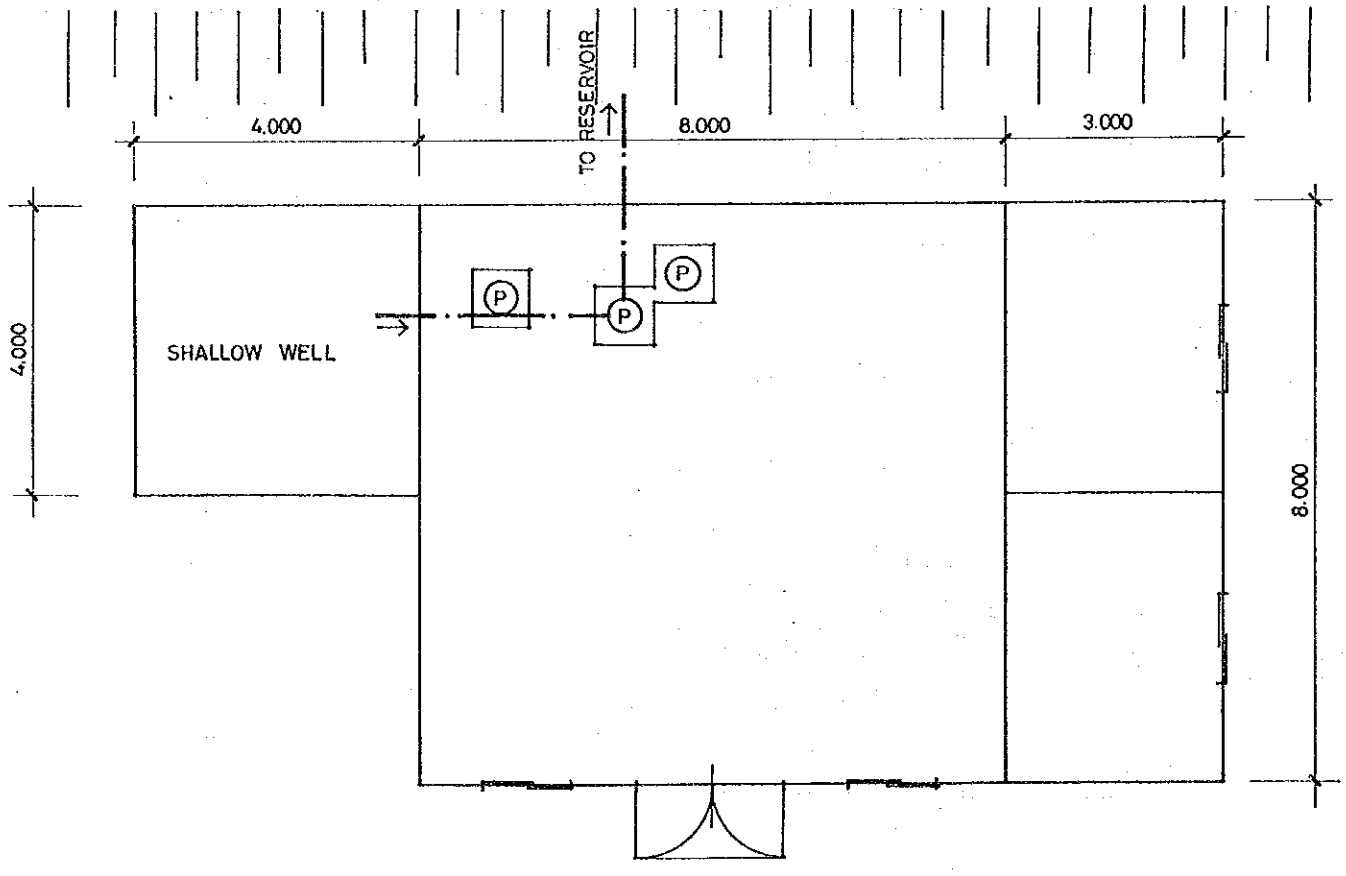
2-2-1 Existing Water Supply Systems

The public water supply in Donggala started in 1920 initiated by the Dutch government, as is described in the existing Report. It was the spring Maleni I that the initial water supply system utilized as its water source. Later another water supply system was added taking water from the spring Maleni II. Currently these two systems are supplying Donggala with drinking water as shown in Fig 2-2-1.

Maleni I has a yield of 1.5 l/sec, and is located at the south end of the populated area of Donggala with an elevation 13.5 m above sea level.



MALENI I



ROAD

MALENI II

FIG. 2-2-1 EXISTING WATER SOURCES 1 : 100

At the spring, a structure which combines two functions of collecting and storing spring water (10 cu m) is constructed, from which direct distribution is being made taking advantage of its elevation.

On the other hand, Maleni II has an yield of 1.0 l/sec, is located 200 m away from Maleni I and has as low an elevation as 4 m above sea level. The water is lifted by two pumps into a reservoir with a capacity of 6 cu m, and part of the stored water is directly distributed from the reservoir and another part is led into a small reservoir (2.25 cu m) and then distributed.

The distribution networks consist of 4" to 3/4" galvanized steel pipelines with total length about 5,000 m. As mentioned in the above paragraph, the distribution is made by gravity.

2-2-2 Present Water Supply Conditions

The water supply of Donggala is presently operated by Palu Water Enterprise which covers water supply of not only Donggala but also other cities. In this sense, Donggala does not have an independent water supply organization of its own.

Population served is 4 % of the total population, that is, in terms of household 120 out of the total 2,991 by the statistics of the year 1978. Location of the households served with water is confined within the central commercial area of the town. Water often does not reach the consumers due to the insufficiency of the supply capacity.

Present water tariff is shown in Table 2-2-1, quoted from the existing Report. Water charge is billed by meter reading, but the billed charge does not always correspond to the real consumption, because the minimum charge would be applied even when the consumption is below the basic consumption.

Table 2-2-1 Water Tariff of Kota Donggala, 1978

(quoted from the Report)

Group	Water Price (Rp./cu m)
Social :	
a) Religious institution/Reformatory	25
b) Hospital/School	50
Non-commercial :	
a) Dwelling	75
b) Office	50
Commerical :	
a) Shop	100
b) Factory	87

Source : Perusahaan Daerah Air Minum Kab. D.T. II, Donggala

2-3 Population

The existing Report has collected all available data of population and analyzed them. The text being reviewed, together with a field observation and interviews with related officials, the study by the Report is considered generally appropriate. Therefore, major results thereof necessary for the present review work will be summarized in the succeeding sections.

2-3-1 Population Data

Out of several data concerning population in the Report, statistics of population are presented in Table 2-3-1, reproduced from the Report. In the table, unusual high increases are observed since 1976. By the field reconnaissance it is known that this phenomenon is of transient nature, brought about by transmigration. The population projection by the Report,

which has taken into consideration the above fact, is therefore considered adequate. In the succeeding sections, review of the Report will be made based on the above findings.

Table 2-3-1 Population Data

(quoted from the Report)

Year	Population
1974	10,286
1975	10,606
1976	14,284
1977	16,081
1978	17,556

Source : Office of Kecamatan Banawa, DATI II Donggala

2-3-2 Population Projection

For population projection, the existing Report has employed methods devised on the basis of annual growth, annual growth rate and so forth, and adopted in the planning the projected population calculated by the geometric method, which is shown in the following Table 2-3-2 Projected Population. With respect to the method employed by the Report, its selection is adequate, because the method is fit for population projection of such a community as Donggala which is characterized by high density of population, small size of the community and the present stage of development. Processes employed are also adequate, and the results of estimation are considered appropriate (Refer to Appendix A). Therefore, the projected results will be used as a basis for review of the succeeding part of the Report.

Table 2-3-2 Projected Population

(quoted from the Report)

Year	Population
1980	18,713
1985	20,813
1990	23,149
1995	25,746
2000	28,636
2005	31,849

2-4 Population Served and Water Demand

2-4-1 Present Water Use

As has been described in the preceding section, population served by the existing water supply systems is limited to 120 households in 1978, that is, 4 % of the total. Water sources of the systems are Maleni I and II with yields, 1.0 and 1.5 l/sec respectively. They are not sufficient to serve increasing water demands in Donggala. Due to the above limited population served, a greater part of the people are obliged to use water from the Donggala river and a few springs located at the foot of the hills for daily domestic use.

Regarding the water consumption by the existing water supply system, gross daily consumption per capita is calculated as 81 l/c/d from the records of water consumption in 1979 as shown in Appendix A. And per capita per day consumption solely for domestic use is calculated as 62 l/c/d in the same Appendix.

2-4-2 Population Served

Table 2-4-1 Population Served, the figures shown in parentheses, is the projection of population served proposed by the existing Report.

The population served was calculated as a product of the total population and a percentage. This method is widely used for water supply planning, and is considered acceptable. The percentage assumed in the said projection is 40 % for 1980, 45 % for 1985, and then gradually increasing rises up to 63 % for 2005 (Refer to Appendix C).

Regarding this percentage of population served, however, the Study Team has given further considerations by reviewing the Report and observing all the conditions of Kota Donggala, especially the area where the water supply service is to be provided. Considerations are as follows : 1) about the distribution of the population, the statistics tell that a little over 60 % of the population now concentrate in the Kota area, 2) regarding the density of houses in the built up area, the laying of pipelines in the major streets suffices to serve 60 % of the population, and 3) from the above, almost all the population now living in the area, i.e., 60 %, should more realistically be supposed to be served with water by the present installation of the water supply system.

After all the above duly considered, a revision of the percentage is proposed here, that is, the percentage for 1985 to be revised from 45 % to 60 %, similarly to be increased afterwards. Population served thus calculated is presented in Table 2-4-1.

Table 2-4-1 Population Served

Year	Population	Percentage	Population Served
1985	20,813	60 (45)	12,490 (9,283)
1990	23,149	63 (50)	14,590 (11,389)
1995	25,746	66 (54)	16,990 (13,852)
2000	28,636	69 (58)	19,760 (16,723)
2005	31,849	72 (63)	22,930 (20,065)

Note : The figures in parentheses denote the values taken from the existing Report.

2-4-3 Water Requirements

Following the proposed revision of the percentage of population served in the preceding section, the future water requirements are recalculated as shown in Table 2-4-2 Water Requirements.

For the calculation, firstly the method used is same as that used by the Report,namely to multiply the unit consumption by the population served or the number of beds, etc. This method is practical and is considered appropriate.

Secondly as to the unit consumptions employed, 106 l/c/d for domestic use, 66 l/c/d for joint use tap in the yard, and 30 l/c/d for public hydrant are all acceptable. The former two units are seemingly slightly higher than usual, but when the highly concentrated built-up area and lack of other good water sources are considered, these employed units are adequate. As for the unit consumptions employed for non-domestic use, 16 l/c/d for institutions, 1 cu m/d/unit for religious institutions and so on are also all acceptable, considering from data in similar cities in Indonesia and foreign countries.

The unit consumptions of non-domestic use for the target year employed in this report are summarized below, based on the existing Report.

1)	Institutions	employees	x	16 l/d
2)	Industrial facilities	number of unit	x	3 cu m/d
3)	Shops & Markets	number of unit	x	11 cu m/d
4)	Medical Facilities	number of bed	x	250 l/d
5)	Schools	pupils	x	6 l/d
6)	Religious institutions	number of unit	x	1 cu m/d
7)	Public parks	domestic consumption	x	2.5 %
8)	Harbor	number of ships per day	x	4 cu m

Table 2-4-2 Water Requirements

Item and Unit		1985	1990	1995	2000	2005
Domestic						
Domestic Use(1)	(a)	106	112	118	124	130
	(b)	662	907	1,215	1,598	2,070
Domestic Use(2)	(a)	66	72	78	84	90
	(b)	82	100	121	144	172
Public Hydrant	(a)	30	30	30	30	30
	(b)	150	153	154	155	153
Sub-total	(b)	894	1,160	1,490	1,897	2,395
Non-domestic						
Institutions	(b)	28	34	41	49	58
Industrial Facilities	(b)	29	45	58	78	95
Hotels, Shops & Markets	(b)	22	36	39	42	60
Medical Facilities	(b)	13	15	16	18	20
Schools	(b)	32	44	57	75	95
Religious Institutions	(b)	28	31	34	38	42
Public Parks	(b)	13	18	24	32	41
Harbour	(b)	4	4	8	8	8
Sub-total	(b)	169	227	277	340	419
A. Total Water Consumption	(a)	85	95	104	113	123
	(b)	1,063	1,387	1,767	1,237	2,814
	(c)	12	16	20	26	33
B. Unaccounted-for Water B = A x 0.15	(b)	160	208	265	336	422
C. Average Day C = A + B	(a)	98	109	120	130	142
	(b)	1,223	1,595	2,032	2,573	3,236
	(c)	14	18	24	30	37
D. Maximum Day D =C x 1.25	(a)	122	137	149	163	176
	(b)	1,529	1,993	2,540	3,216	4,045
	(c)	18	23	29	37	47

Note : (1) = Domestic use for direct connections
(2) = Domestic use for joint house taps
(a) = liter per capita per day (l/c/d)
(b) = cubic meter per day (cu m/d)
(c) = liter per second

2-5 Water Source

The existing Report has proposed two water sources, namely, Lohu and Wusu springs, for the first stage project with the target year 1995. By reviewing the said Report, it has been found that the water sources and transmission line are not sufficiently detailed. To ascertain the above, the Study Team reconnoitered the sites concerned in late March and once again in mid-june 1980 to investigate the alternative water source.

2-5-1 Proposed Two Water Sources

The general plan attached to the existing Report, as reproduced and attached here as Fig 2-5-1, indicates clearly the location of Wusu spring but the indication of Lohu spring is very ambiguous with only an arrow mark put on the plan.

a. Wusu Spring
By the reconnaissance, Wusu spring was found to have been misrepresented by the Report on the plan. On the spot indicated on the plan, actually, there is no spring. Despite every means to find the spring, its location was not verified.

b. Lohu Spring
The Team ascertained that the spring Lohu is not a single spring but a group of very small springs scattered on the mountain slope. Each small spring, after flowing some distance, collects into one stream, which was termed Lohu spring in the existing Report. At the point of collection, the flow was measured by the Team as about 10 l/sec, and analytical results of the water by the Study Team is shown in Table 2-5-1. In addition Table 2-5-2 Water Quality Standard is attached for reference.

c. Consideration and Conclusions of Proposed Water Sources
Yield : The total yield of the two springs (although Wusu spring itself could not be located, the discharge was ascertained by the small stream) is insufficient for the present project.

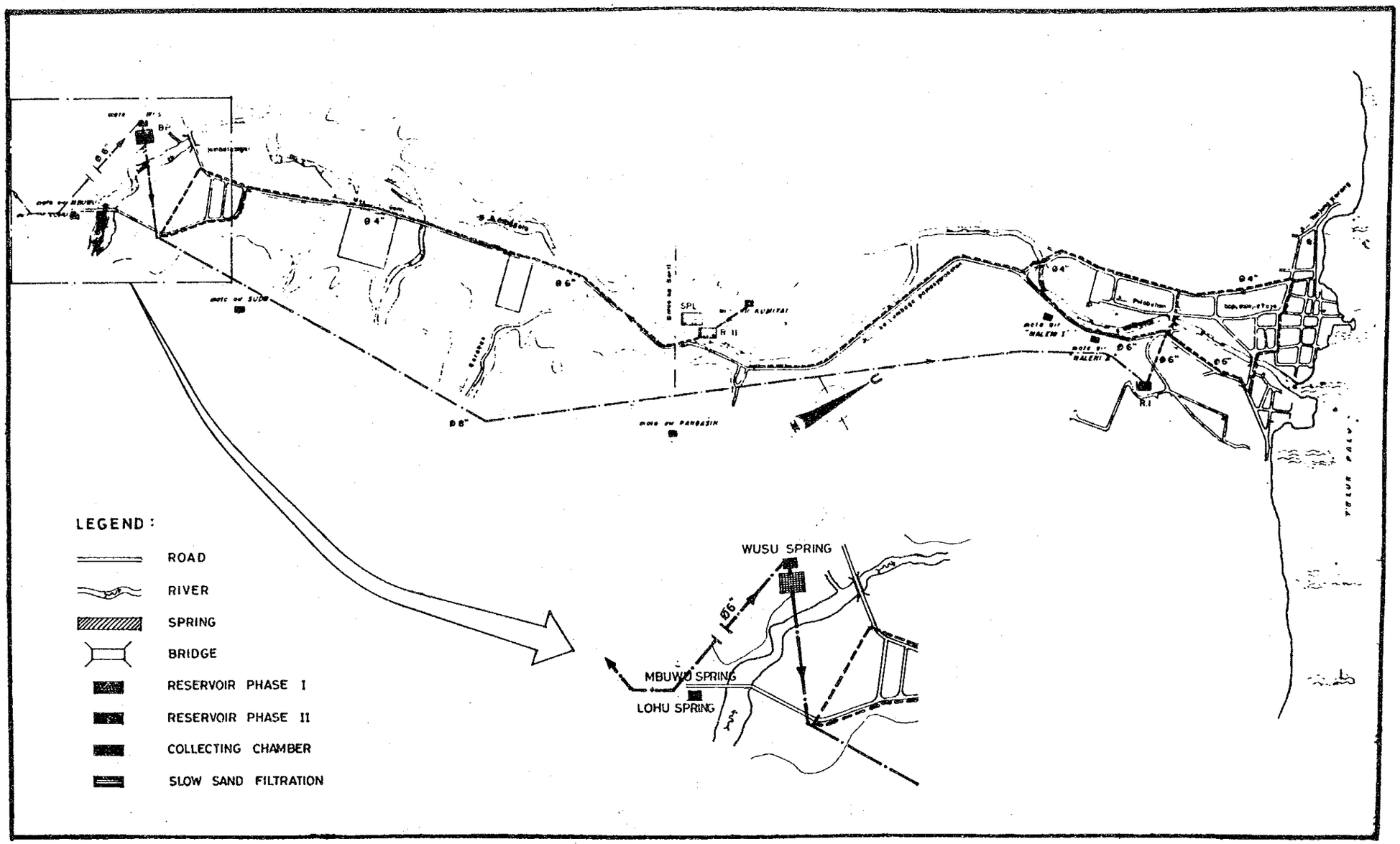


FIG. 2-5-1 GENERAL PLAN (TAKEN FROM THE EXISTING REPORT)

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

Item	Unit	Sources			
		Spring Maleni I	Spring Maleni II	Spring Lohu	Donggala river *
Date, Time		26-3-80 14:00	26-3-80 15:00	28-3-80 11:00	28-3-80 15:00
Weather		fine	fine	fine	fine
Atmospheric Temperature	^{o}C	30	30	27	33
Water Temperature	^{o}C	29	28	25	32
Color as Pt.Co.	Unit	0	0	0	6
Turbidity	FTU	3	1	1	4
pH		7.4	7.2	8.2	8.3
Alkalinity as CaCO3	mg/l	200	190	220	150
Total Hardness as CaCO3	mg/l	100	170	270	180
Chloride as Cl2	mg/l	10	12	10	10
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	20,000	15,000	negative	30,000
Total Bacteria	/ml	280	600	120	800
Ammonia-N	mg/l	0.3	0.4	less than 0.2	0.5

* Sampled 3 km upstream from the Donggala river mouth.

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.

Quality of water : The two sources can not be tapped at the origin of spring, and intake must be made at a point after the spring water flowing down some distance. Therefore, the water has a chance of deterioration in quality and so the merits of spring water will be totally lost.

Construction work : The distance of the water sources from the served area is too far from the standpoint of economy. Besides due to the topographical conditions the constructions of the intake and transmission line may cost unusually high.

From the above considerations, the Study Team has reached a conclusion that if an alternative source is available, the proposed water sources in the existing Report should not be adopted.

2-5-2 Alternative Water Sources

There are a few springs in Donggala including Maleni I and II, but all of them have poor yields, insufficient for the present project.

On the other hand, about surface water there is a river with perennial flow, the Donggala river, flowing through the study area. It originates in the mountains south of Donggala and flows down through the populated area of Donggala emptying into Palu Bay. The river has different characteristic flows at downstream and upstream, namely, at the most downstream span of about 2.5 km the least flow is over 100 l/sec, but at the upperstream span the flow almost disappears in the dry season submerging into riverbed. Therefore, there are two possible intake methods: 1) to take surface water at downstream and 2) to take riverbed water at upstream. The two alternative methods are, in general, compared as follows:

Comparison of Intake Methods

	1. Surface Water	2. Riverbed Water
a.	Structures Required Barrage across the river, intake gate and grit chamber	Shallow well (and collection pipe) in the riverbed
b.	Water Treatment Complete treatment needed	Simple treatment suffices
c.	Maintenance Removal of deposits and debris frequently needed	Almost maintenance-free
d.	Cost for Construction and Maintenance Expensive	Reasonable

From the above comparison, the alternative 2. is preferable in every respect. Therefore, the present study proposes the intake of riverbed water for the project. Detailed design, however, should be made based on further detailed investigation of the riverbed concerned.

2-6 Water Treatment

At the present stage of study, exact data of the riverbed water is not available. However, to complete the present study which is meant to direct necessary works to follow, to prepare preliminary designs and to estimate costs for financial feasibility study of the project, a water treatment method is presented as described below after due considerations on the riverbed water.

1) Assumption of the Riverbed Water Quality

From the observation of the river flow along the stream where withdrawal of river water is planned and also the information that the Study Team obtained in the field, the river flow apparently infiltrates under the riverbed around a point 6 km upstream from the river mouth and finds its way again on the riverbed around a

point 2.5 km from the river mouth. Therefore, it may safely be supposed that there is riverbed water and the water undergoes purification action to some extent by filtration through the riverbed. During filtration, as is observed elsewhere, most of turbidity will be removed. Apart from the turbidity, some dissolved organic matters may possibly be contained in the riverbed water, for there are some sparsely inhabited areas upstream of the proposed intake discharging domestic waste water into the basin. For reference, analytical results of the surface water, sampled at the proposed intake, of the river is shown in Table 2-5-1.

2) Water Treatment

Treatment of the riverbed water generally does not require sedimentation, because the water is clear free from most of suspended solids which are removed while its passage through the riverbed. Even though, the riverbed water may happen to be lightly turbid when the surface flow water is burdened with heavy turbidity, therefore slow sand filtration is usually required. It will also remove dissolved organic matters. Considering all the above, the present study proposes slow sand filters for treatment of the riverbed water.

3) Investigation to be Made

Investigation of the riverbed by boring and test pumping must be undertaken so as to make sure the above assumption and find out potentiality of yield, water quality, location and construction of the intake facilities. Further the investigation must be carried out in time for detailed design.

2-7 Future Water Supply System

According to data, information and investigation which are available or so far made, the most promising water source is the Donggala river. Water quantity required for the present project is 17.7 l/sec,which is not excessively large compared with the river discharge. But as long-term data

of the river discharge is not available, it is unpredictable at the moment how much quantity of water over the present plan is available in the future. Therefore, the discharge of the river should be observed over a long period to determine usable quantity. And on the results of the above observation, the future water supply plan should be established.

In addition to the above, a comprehensive development plan of all springs in and around Donggala should be prepared, considering that the Donggala river may not be able to meet all the future water requirement of Donggala. All the currently used water sources should, without saying, be checked thoroughly about their yields, water quality and the structures and facilities for maximum possible utilization.

The future water supply system after the present project will be worked out based on the results of all the above mentioned investigations and projection of water demand calculated from consumption data to be obtained after the completion of the present project.

III. REVIEW OF DESIGN CRITERIA AND PRELIMINARY DESIGNS

3-1 General

The existing Report contains design criteria and preliminary designs required for the water supply facilities up to the year of 2005. The present project, though, is intended for the target year 1985. Therefore, the design criteria and the preliminary designs will be prepared to meet this target year. Further the preliminary designs will be made for the water source of the Donggala river, as proposed earlier in this report.

3-2 Design Criteria

The design criteria proposed in the existing Report are summarized as follows :

1)	Water source	: springs for Stage I
2)	Water treatment	: not necessary
3)	Factors	: 1.15 for maximum daily consumption 1.55 for peak hourly consumption
4)	Capacity of production	: 28 l/sec for Stage I
5)	Capacity of reservoir	: 450 cu m for Stage I
6)	Size of pipe	: for demand in Stage II
7)	Calculation of pipe	: primary distribution mains by peak hourly flow secondary pipe by Hardy Cross method
8)	Number of connection	: 1,010 for direct house connection 30 for connection in the yard 8 for public hydrant.

Out of the above items, revisions proposed by the present study are as follows :

1) As the water source for the target year 1985, the riverbed water of the Donggala river is to be taken, together with necessary treatment.

2) For maximum daily consumption, 1.25 x average daily demand will be employed and for peak hourly consumption, 1.75 x average daily demand.
3) The capacity of production is to be for the maximum daily consumption 17.7 l/sec, say, 20 l/sec.
It shall be applied to the facilities from the intake to the service reservoir.
4) The capacity of the reservoir is to be equivalent to 5 hour maximum daily consumption.
5) Designs of all pipelines are to be made for the requirements in 1985.
6) The transmission pipeline is to be for maximum daily consumption.
7) Yard connections proposed by the Report will be designed in the similar way to public hydrants.

3-3 Preliminary Designs

Dimensions, structural features, etc. of the major facilities are proposed in accordance with the above design criteria. Fig 3-3-1 and Fig 3-3-2 show the plan and profile of proposed water supply system.

1) Infiltration Pipe and Pump-well
Fig 3-3-3 shows an exemplary drawing for the infiltration pipe and well for the intake of riverbed water.
Raw water intake pump : Horizontal centrifugal pump
1.2 cu m/min x 30 m x 11 kw
2 units (1 standby)
Diesel generator : 15 ps, 2 units (1 standby)

2) Transmission Pipeline
From the pump-well to the receiving well.
Material : DCIP or GSP
Length : Ø 150 x 200 m

3) Receiving Well and Slow Sand Filters
Made of reinforced concrete as shown in Fig 3-3-4.
Dimension : B 12.0 m x L 15.0 m - 2 basins
Filtration rate will be about 5 cu m/sq m/day.

4) Service Reservoir

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

Total capacity	:	350 cu m
Number of basin	:	2 basins
Dimension	:	B 5.0 m x L 10.0 m x D 3.5 m

5) Solution Tank of Calcium Hypochlorite

Material	:	fibreglass
Number of set	:	1 set
Component of set	:	2 solution tanks with capacity 50 liter together with a feeding device.

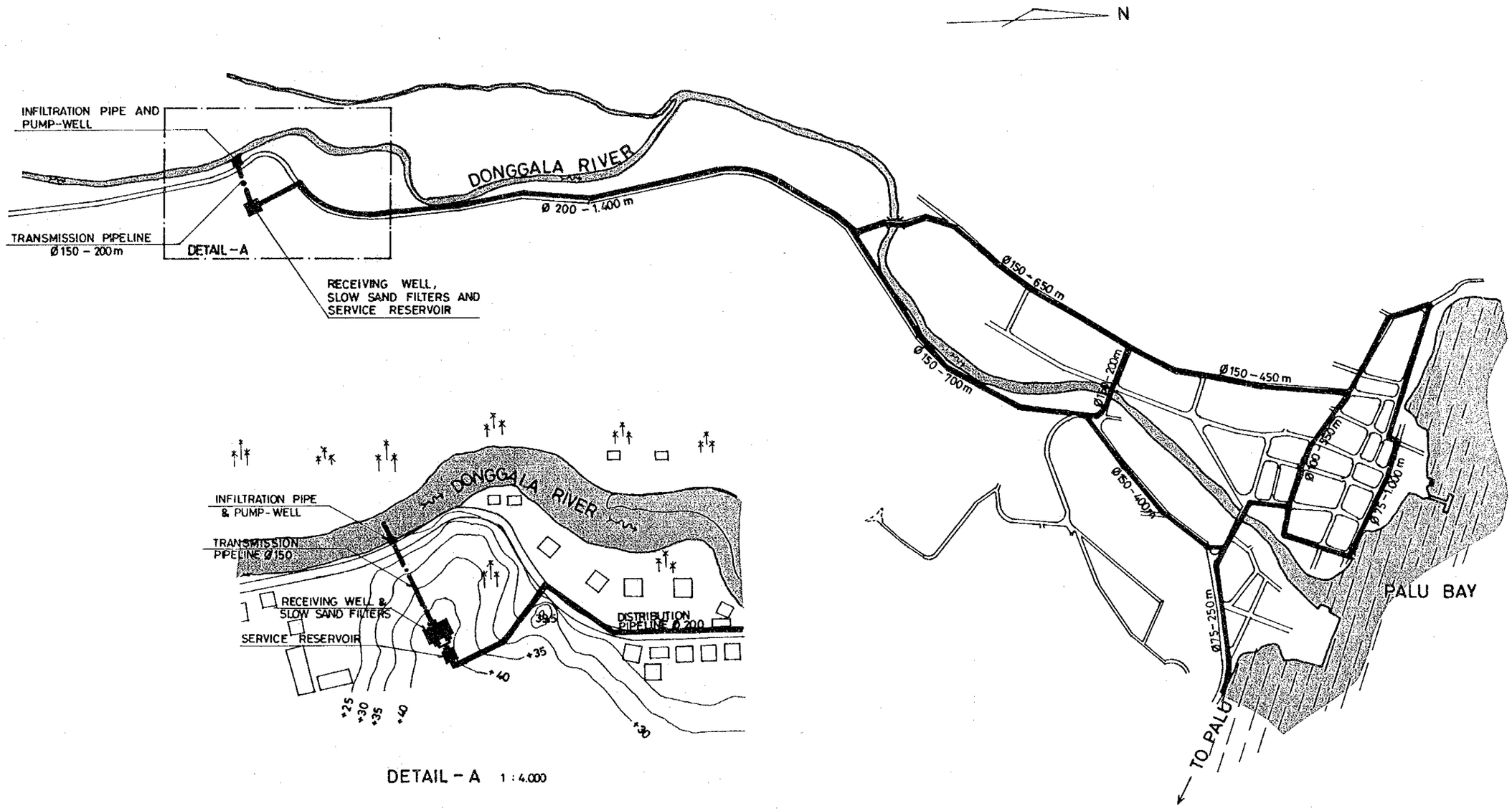
6) Distribution Pipeline

Material	:	DCIP/PVC/ACP
Length	:	Ø 200 x 1,400 m
		Ø 150 x 2,400 m
		Ø 100 x 550 m
		Ø 75 x 1,250 m

7) House Connection and Public Hydrant

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

Number of house connection	:	1,010
Number of public hydrant	:	38



DETAIL - A 1 : 4.000

FIG. 3-3-1 PROPOSED WATER SUPPLY SYSTEM 1 : 8.000

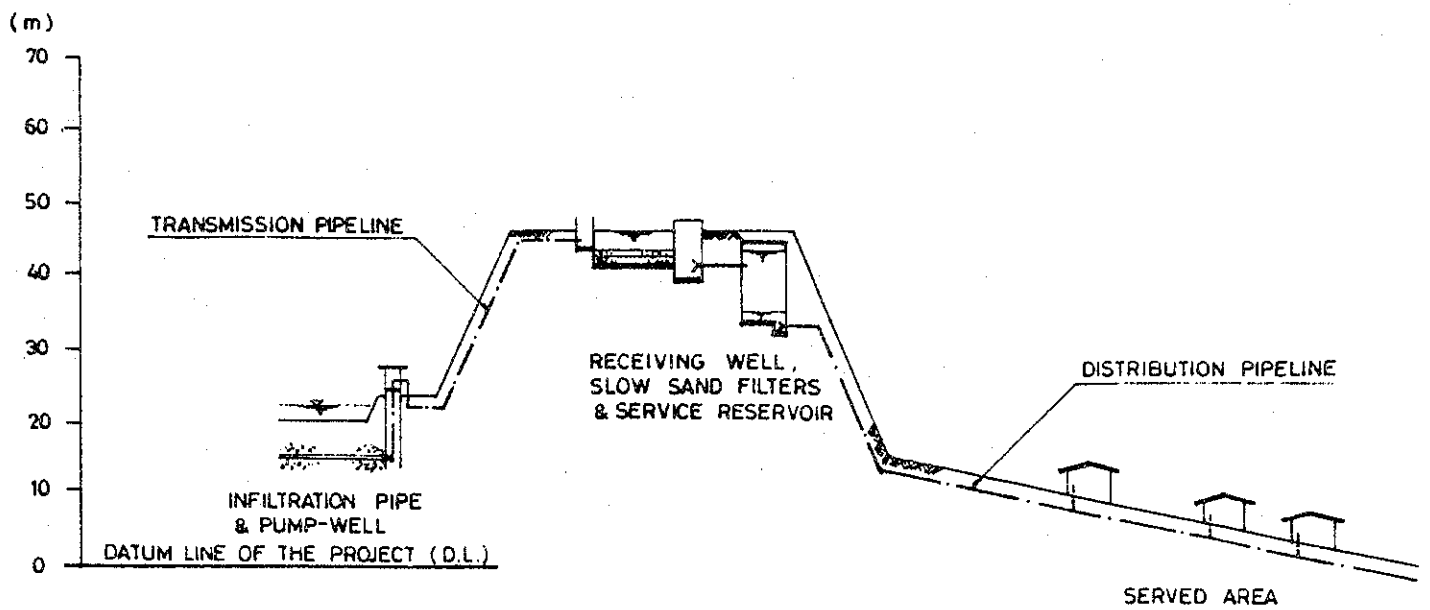
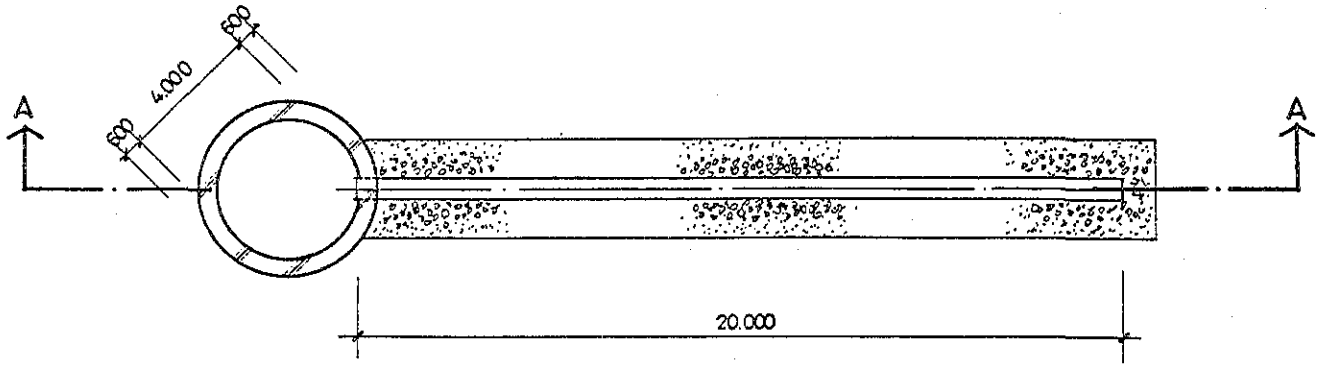


FIG. 3-3-2 PROPOSED PROFILE OF WATER SUPPLY SYSTEM H = NO SCALE V = 1 : 1000



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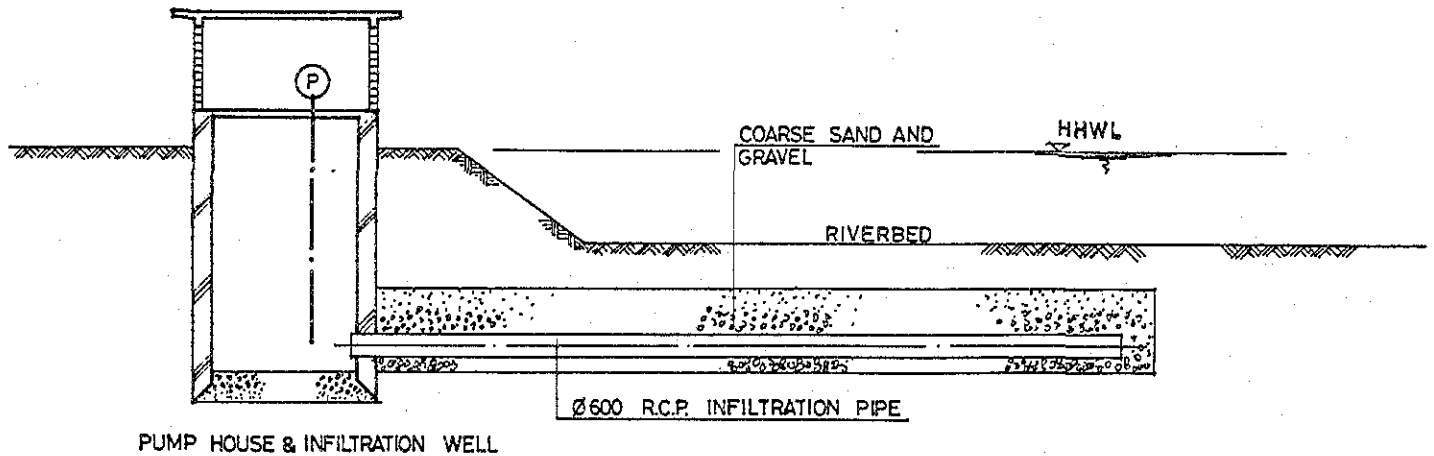
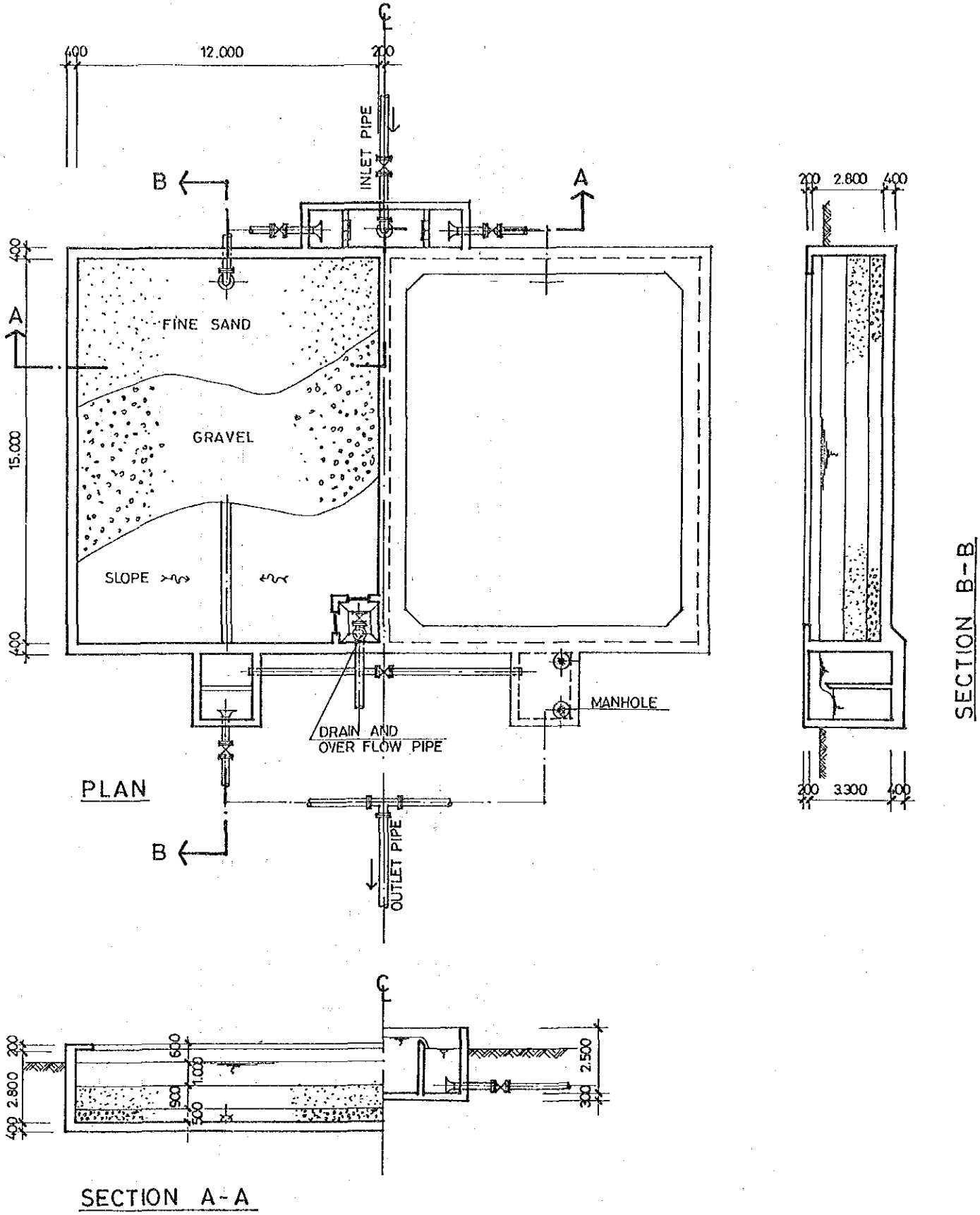


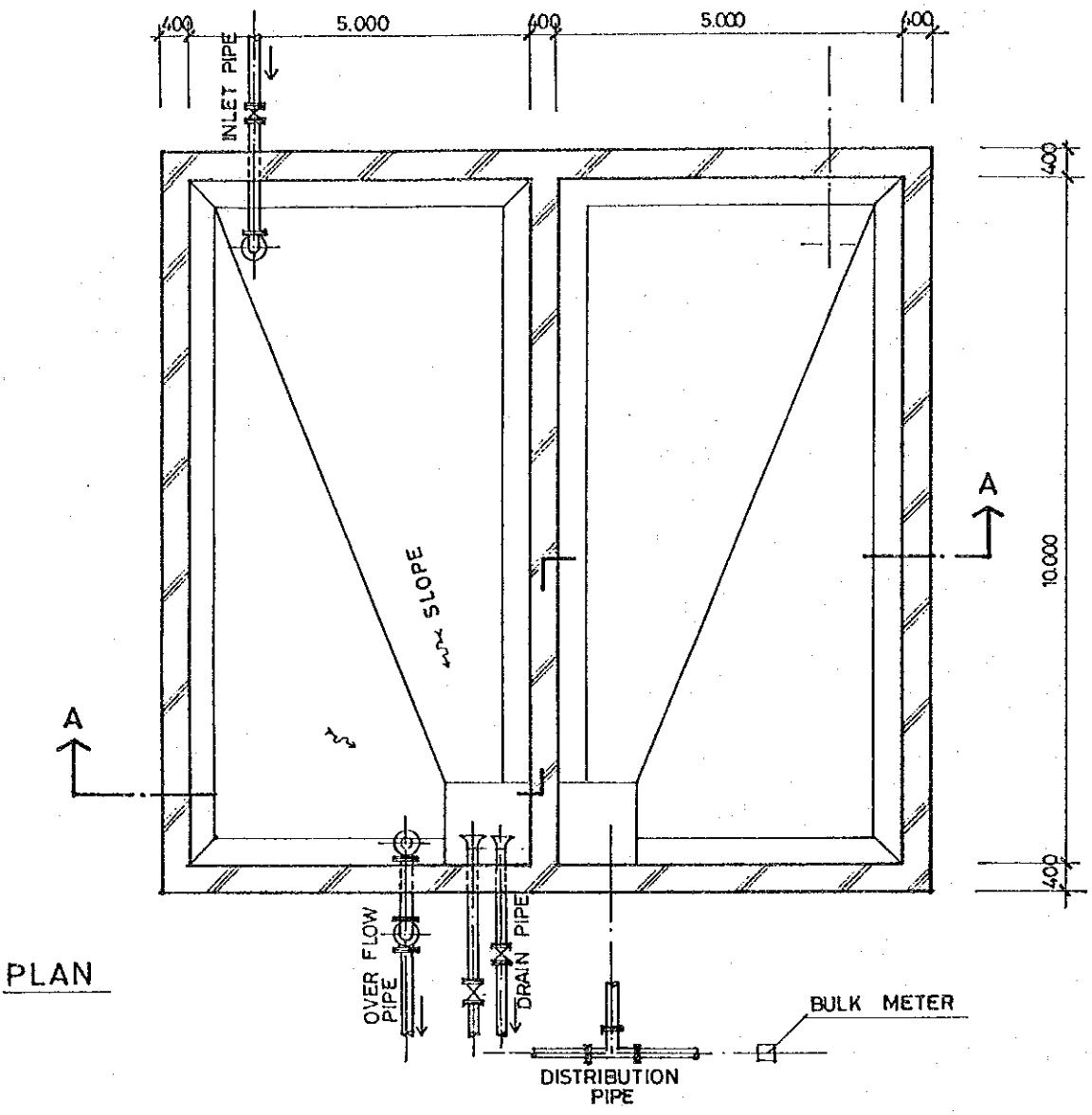
SECTION A-A

FIG. 3-3-3 INFILTRATION PIPE AND PUMP-WELL TYPICAL DRAWING 1 : 200



SECTION A-A

FIG. 3-3-4 RECEIVING WELL & SLOW SAND FILTERS 1 : 200



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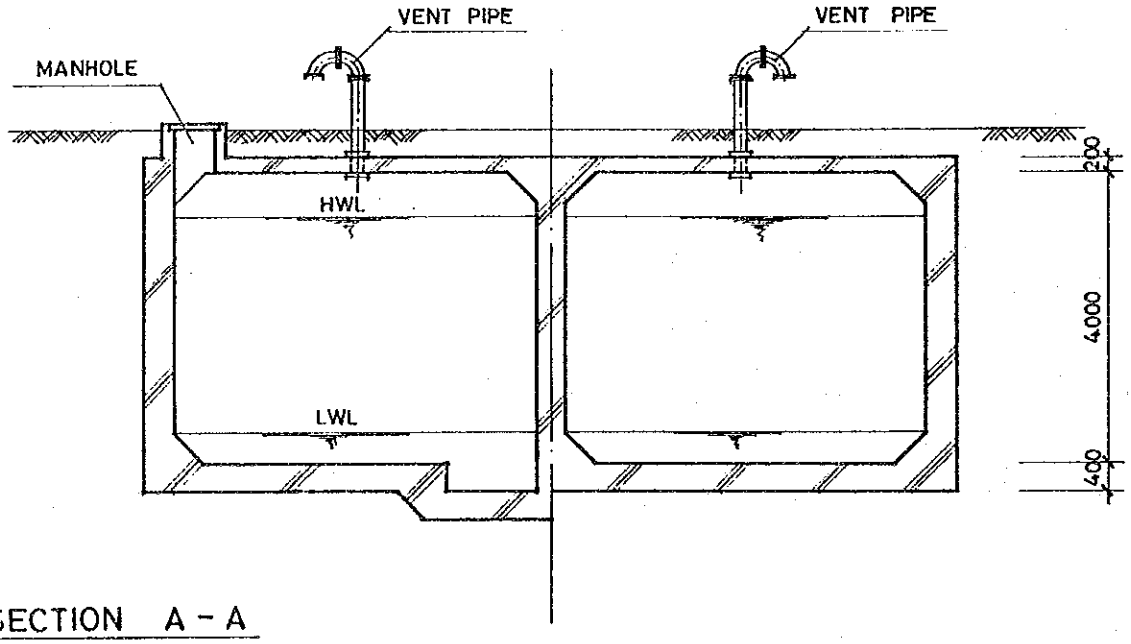
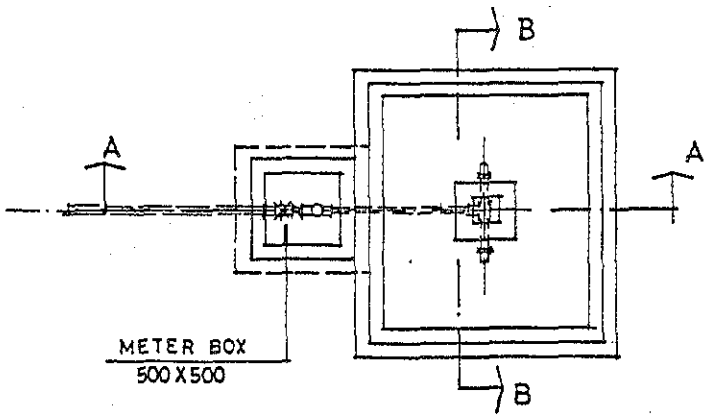


SECTION A - A

FIG. 3-3-5 SERVICE RESERVOIR 1 : 100



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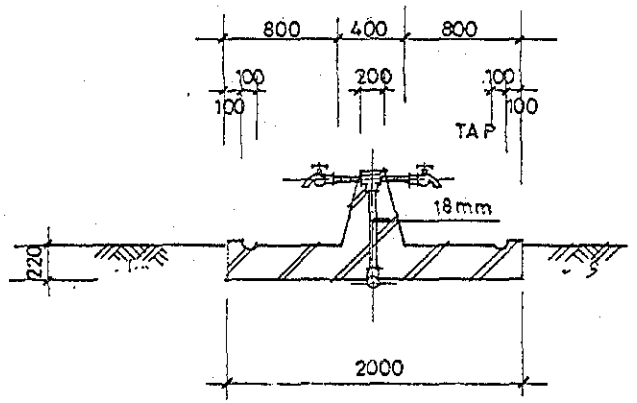
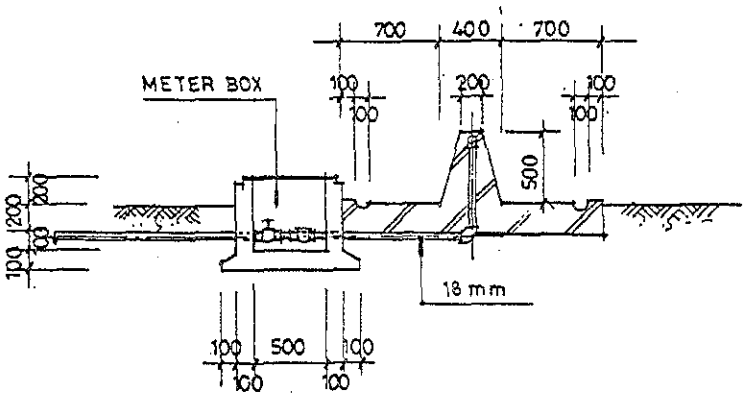


SECTION B-B



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 carries a cost estimate for the construction work of the project. As the present study has proposed an alternative water source reviewing the existing Report as detailed in the preceding chapter III Review of Design Criteria and Pleminary Designs, a cost estimate subsequently required is made as presented in the following paragraphs. In estimating the cost, considerations are given to some factors which influence the cost, as described below. Further the implementation schedule of the project is prepared with the target of commissioning the project within 1982.

4-2 Considerations on Labor, Materials, etc.

A study has been made in the field regarding all matters related to the execution of construction works, such as contractors, labor and materials. As Donggala is situated on the sea coast in the central part of Sulawesi, it has an advantageous position for sea transportation, from which the present project will benefit.

1) Contractors and Labor

A complete list of contractors and suppliers has been prepared by the central and local governments to facilitate a proper selection of necessary contractors and suppliers. The list covers not only their names and addresses, but also their specialities and capabilities. Skilled labor is generally supplied by the contractor recruited from other cities, and unskilled labor is locally available.

2) Materials

Gravel and sand for concrete work are locally available, and cement can be purchased from the local cement manufacturer at Ujung Pandang. Pipe materials, both domestic and imported, are available from Jawa.

Such materials are usually 15% higher than in Jawa owing to the transportation charges.

4-3 Construction Costs

Table 4-3-1 shows the estimated construction costs (Its breakdown is attached in Appendix A). All the unit costs employed for the estimation are those as of May 1980, which are obtained from projects similar to the present project and now under way in the country. For the cost in 1982 when the project is envisaged to be executed, an escalation 15% per annum and a contingency 20% are allowed. In addition to the above, an engineering cost for detailed design including some incidental surveys, construction supervision, etc. is provided with an allowance 8% of the construction costs, escalation and contingency. Table 4-3-2 shows the estimated project costs including all the above.

4-4 Implementation Schedule

Fig 4-4-1 indicates the implementation schedule of the project prepared taking into consideration the target of project completion set by Cipta Karya, whose desire is to commission the project within 1982. In preparing the schedule, all the requirements for time and procedures in financing, tendering, construction, etc. are carefully considered. Further, a period necessary for training the operators to be involved in the plant operation is allowed in the schedule.

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 4-3-1 Estimated Construction Costs

Rupiahs 1,000

Item	Foreign Exchange	Local Currency	Total
1. Infiltration Pipe and Pump-well	lump sum 28,860	lump sum 27,400	56,260
2. Transmission Pipeline			
Ø 150 x 200 m	Rp 16.6/m 3,320	Rp 8.2/m 1,640	4,960
3. Receiving Well and Slow Sand Filter	lump sum 2,700	lump sum 101,249	103,949
4. Service Reservoir	lump sum 1,150	lump sum 31,000	32,150
5. Distribution Pipeline			
Ø 200 x 1,400 m	Rp 21.3/m 29,820	Rp 9.2/m 12,880	42,700
Ø 150 x 2,400 m	Rp 15.1/m 36,240	Rp 8.5/m 20,400	56,640
Ø 100 x 550 m	Rp 14.5/m 7,975	Rp 11.0/m 6,050	14,025
Ø 75 x 1,250 m	Rp 4.1/m 5,125	Rp 5.2/m 6,500	11,625
6. Bulk Meter			
Ø 200 x 1 piece	1,500	650	2,150
7. Water Meter			
Ø 13 x 1,010 pieces	Rp 17.0/piece 17,170	Rp 1.7/piece 1,717	18,887
8. Public Hydrant			
Ø 18 x 38 pieces	Rp 30.0/piece 1,140	Rp 303.0/piece 11,514	12,654
Total Cost	135,000	221,000	356,000

Table 4-3-2 Estimated Project Costs

Rupiahs 1,000,000 (1)
US. Dollars 1,000

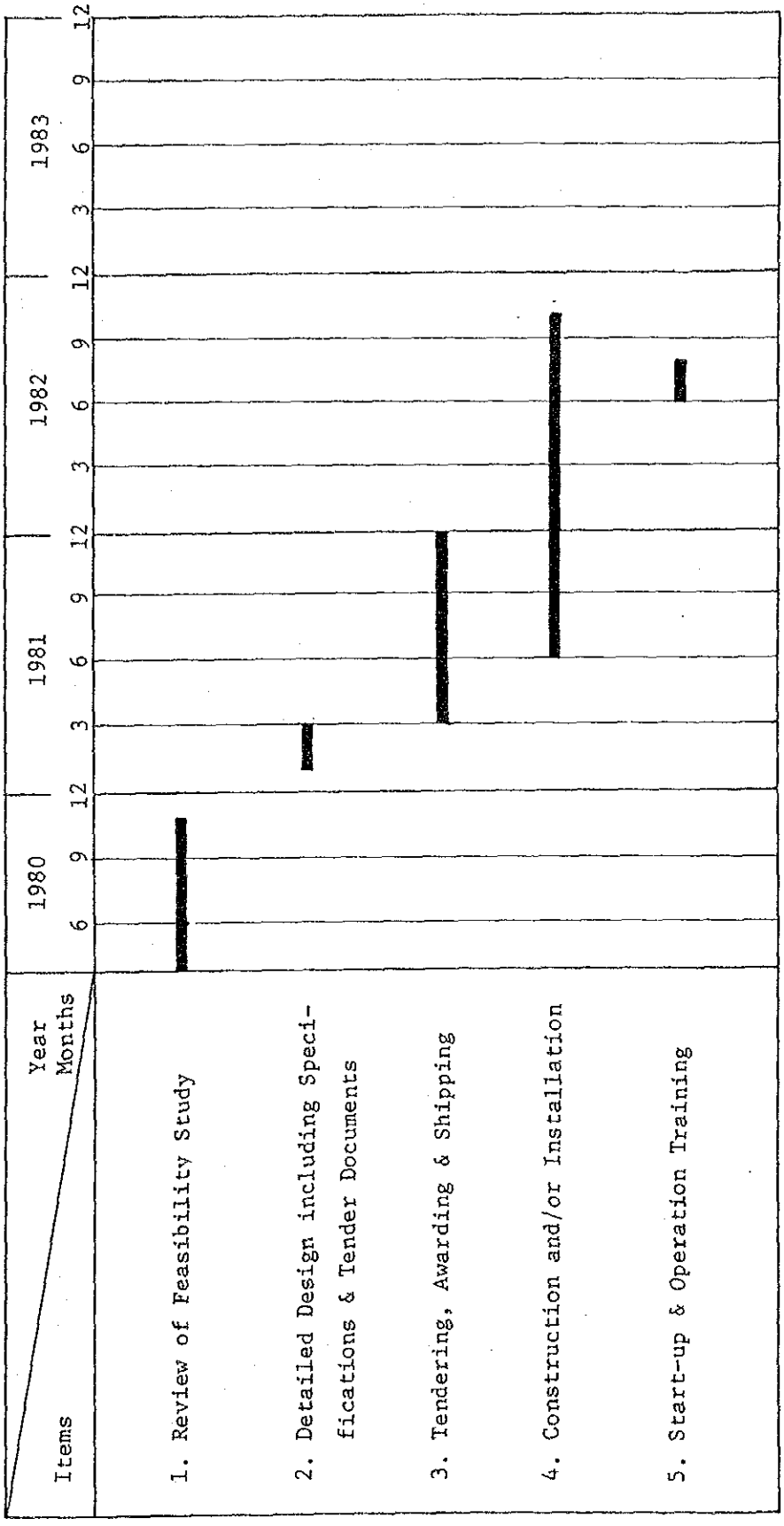
Item	Foreign Exchange	Local Currency	Total Cost
a. Construction Cost (2)	135 215	221 351	356 566
b. Escalation (3) (a x 32.25 %)	43 68	71 113	114 181
c. Sub-total	178 283	292 464	470 747
d. Contingencies (c x 20 %)	36 57	58 93	94 150
e. Sub-total	214 340	350 557	564 897
f. Engineering Services (e x 8 %)	11 17	34 54	45 71
Total Cost of Porject	225 357	384 611	609 968

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

(2) Construction cost is calculated based on the price 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 a financial study based on rough cost estimates on each item of facility. The target year of the plan is set in 1995. As the planning by the Report has been revised in the present study, the Study Team will study the financial feasibility of the present project based on the engineering plan proposed 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 assumption 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 Donggala are summarised in Table 4-3-2 Estimated Project Cost. Total cost necessary to implement the project is Rp. 609 million or US.$ 968,000 based on the prices as of May 1980. As the construction of the facilities is considered to initiate in 1981, escalation of 15 % is assumed for the years of 1981 and 1982. For contingencies, 20 % is also assumed. It should be noted that unit costs provided with allowances for local transportation are employed for calculation of the capital cost, local conditions of Donggala being duly taken into consideration.

5-3 Sources of Financing

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

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

5-4 Financial Feasibility

The financial projection is worked out to check business condition of the enterprise, i.e., whether the Enterprise can pay costs of operation and maintenance by their own generated fund or not, and for the purpose,

comparison of cost and revenue is made. Table 5-4-1 shows projected Income Statement and Table 5-4-2 shows projected Cash Flow of the Water Enterprise from 1983, the year of expected operation of the facilities, and six years thereafter. In project income statement, the revenue of water sales is projected from the yearly water quantity of water sales times the proposed water rate which is worked out considering the costs of production and consumers ability as well, as described in section 5-6, while the cost of operation covers costs of personnel salary, maintenance and operation, chemicals and office operation. In the case of Donggala, due to the financial weakness of the Water Enterprise, depreciation is not considered as expenditure items.

As can be seen in the table, the revenue is bigger than the cost and the Water Enterprise can generate income. Total accumulated net income for six years amounts to Rp. 7.8 million. From this it can be said that the Enterprise can pay the costs of operation by running business with self-sustained basis. Detail description of assumptions for financial projections is given in Appendix E, in the present report.

Table 5-4-1 Income Statement

(Rp 1 million)

	1983	1984	1985	1986	1987	1988
Water Production (m^3/year)	391,599	418,785	445,971	507,640	500,263	527,530
Water Sales (m^3/year)	340,691	364,343	387,995	441,647	435,229	458,951
Percentage Sales to Production (%)	87	87	87	87	87	87
Revenue Water Sales (1)	21.4	23.1	24.8	26.4	28.0	29.7
Other Fees	2.9	0.1	0.1	0.1	0.1	0.1
Total Billing	24.3	23.2	24.9	26.5	28.1	29.8
Less : Provision for Bad Debt	0.5	0.5	0.5	0.5	0.5	0.6
Total Revenue	23.8	22.7	24.4	26.0	27.6	29.2
Operation Cost	21.4	22.5	23.7	24.8	26.1	27.4
Net Income	2.4	0.2	0.7	1.2	1.5	1.8

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

Table 5-4-2 Cash Flow

(Rp 1 million)

	1983	1984	1985	1986	1987	1988
Sources of cash						
Net income	2.4	0.2	0.7	1.2	1.5	1.8
Depreciation	-	-	-	-	-	-
Government grant	609					
Total	611.4	0.2	0.7	1.2	1.5	1.8
Application of cash						
Capital expenditures	609	-	-	-	-	-
Total	609	-	-	-	-	-
Net cash inflow (out flow)	2.4	0.2	0.7	1.2	1.5	1.8
Cash at beginning	-	2.4	2.6	3.3	4.5	6.0
Cash at end	2.4	2.6	3.3	4.5	6.0	7.8

5-5 Water Rates

The proposed water rate for Donggala Water Enterprise has been worked out, considering costs of production and also paying ability of consumers. Table 5-5-1 shows the 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 E.

Table 5-5-1 Water Rate

	Residential Rp	Commercial Rp	Industrial Rp	Social Rp	Public Hydrant Rp	Port Rp
0 - 15 cu m/m	55	110	165	44	44	275
15 - 30 cu m/m	82.50	110	165	66	44	275
30 cu m/m	165	220	275	88	44	275

5-6 Ability of the Consumer to Pay for Water

The average income of consumers who are expected to receive water by the present project is checked to know the ability of consumers to pay for water. According to the survey, the average monthly income of consumers is about Rp. 32,000.

According to the policy of the Central Government, water rate is recommended to be arranged under 4 % of the average monthly income of consumers. In the case of Donggala, the average monthly income of consumers were found to be about Rp. 32,000, so it will be appropriate if the monthly payment is determined below Rp. 1,280 per month. Since tariff for residential customers is fixed to be Rp. 55, if a customer uses water 15 cu m per month, the charge he has to bear is Rp. 825, which is far less than Rp. 1,280.

VI. REVIEW OF ORGANIZATION

6-1 General

The existing Report, although it shows the chart of the existing organization, does not discuss anything about an organization which will cope with the proposed water supply system to be established in Donggala. To review the current operation of the existing water supply together with the organization therefor, a survey was carried out by the Study Team and on the basis of such review an organization most adequate to the town was studied.

The present water supply system is operated and maintained by the branch office of Palu Water Enterprise (Perusahaan Air Minum Daerah, Palu). Although Donggala water supply system is isolated from that of Palu and is supplying water solely to inhabitants in kota Donggala, the responsibility to manage the water enterprise is all rested with Palu Water Enterprise. This present arrangement is acceptable, considering from the small scale of towns. However, the number of staff in branch office is quite insufficient and besides present function is not clear. Along the implementation of the present project, it is recommended to strengthen the present organization so as to suit the operation of water business in Donggala.

6-2 Recommended Organization

The existing organization, either in Palu or branch office in Donggala, is not clear. Fig 6-2-1 is the organization structure presented in the existing Report. According to the field survey, however, in the branch office of Donggala, there are only three staff who engaged in operation and maintenance of the existing system. To cope with future expansion of the system, the present organization should be strengthened.

Fig 6-2-2 is the organization structure recommended by Cipta Karya, which, in the opinion of the Study Team, is necessary to be adjusted according to the local features of kota Donggala modifying it to be more simple and

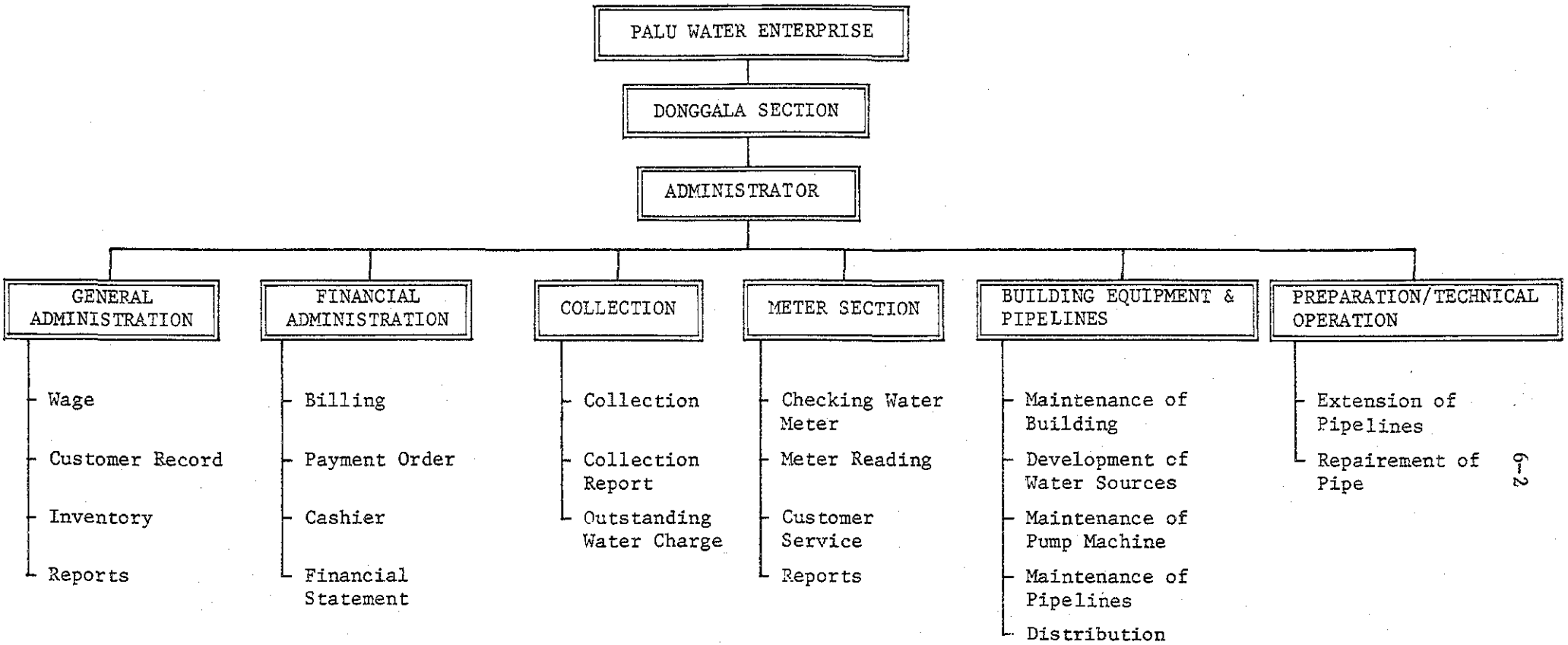


Fig 6-2-1 Organization Structure of Donggala Section, Palu Water Enterprise
(Taken from the Existing Report)

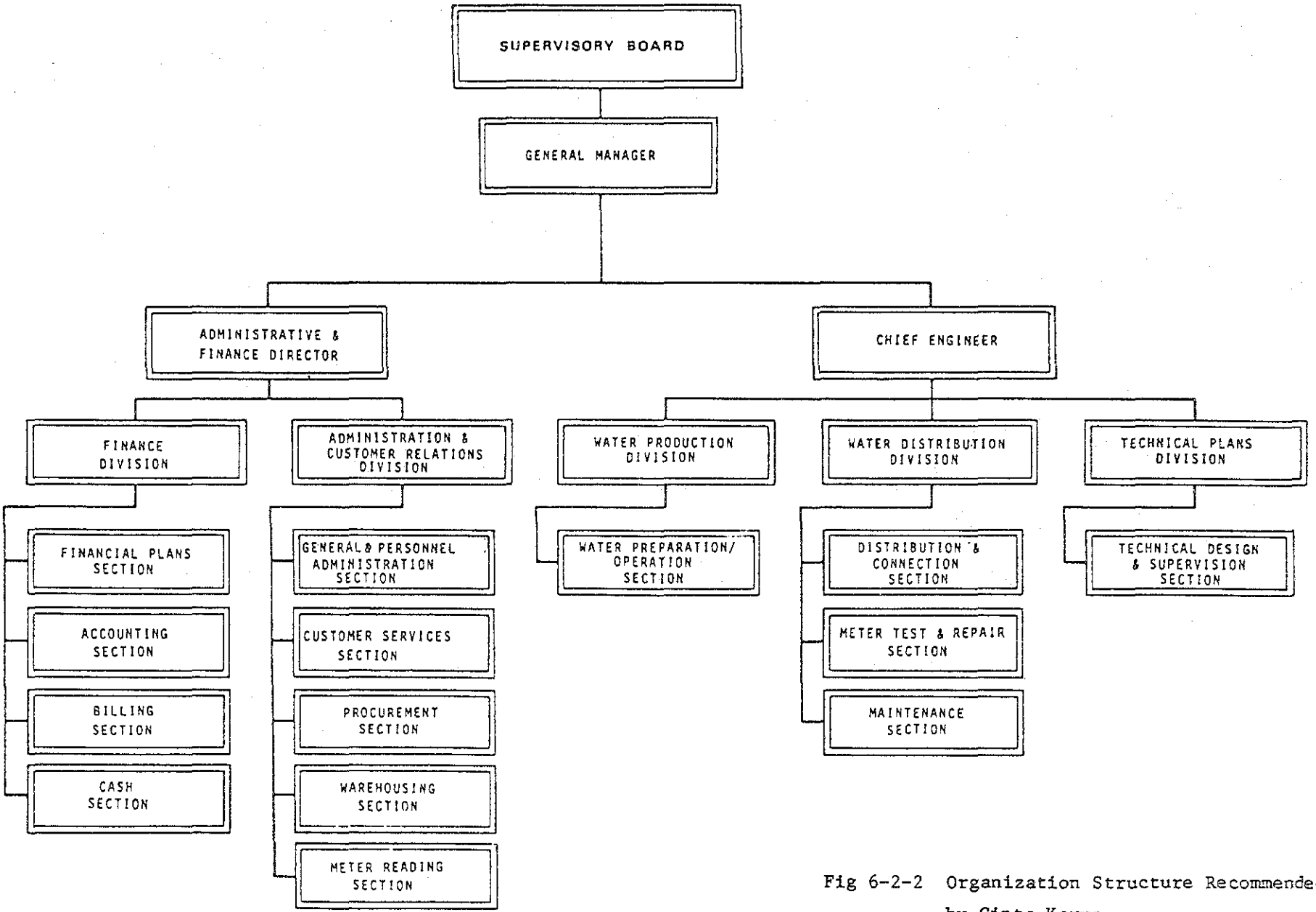


Fig 6-2-2 Organization Structure Recommended by Cipta Karya

compact considering the fact that Donggala water system is the branch office of Palu Water Enterprise.

The recommended structure of organization is shown in Fig 6-2-3, which is prepared based on the guidelines of Cipta Karya, adjusting, however, to be more realistic and practicable according to size and other local features in Donggala. As shown in Fig 6-2-3, branch office is under the supervision and control of a Board of Management, Palu Water Enterprise. Donggala Branch Office is headed by a Manager, a member of the Board, and is responsible for overall activities of water management in Donggala. Under the Manager there are two Sections for 1) Finance and Administration, and 2) Technical. Finance and Administration Section will be responsible for routine bookkeeping and billing and collection including meter reading.

Technical Section will be responsible for maintenance and operation of water supply facilities including treatment plant and distribution.

6-3 Staffing Schedule

Necesssary number of personnel required for conducting water supply activities is studied considering the scale of Donggala water supply and the target year of the present project. The staffing schedule is shown in Table 6-3-1.

In preparing the staffing schedule, it is intended to keep minimum number of staff considering the scale of water enterprise. However, the water enterprise can attain full function of the enterprise as efficiently as possible.

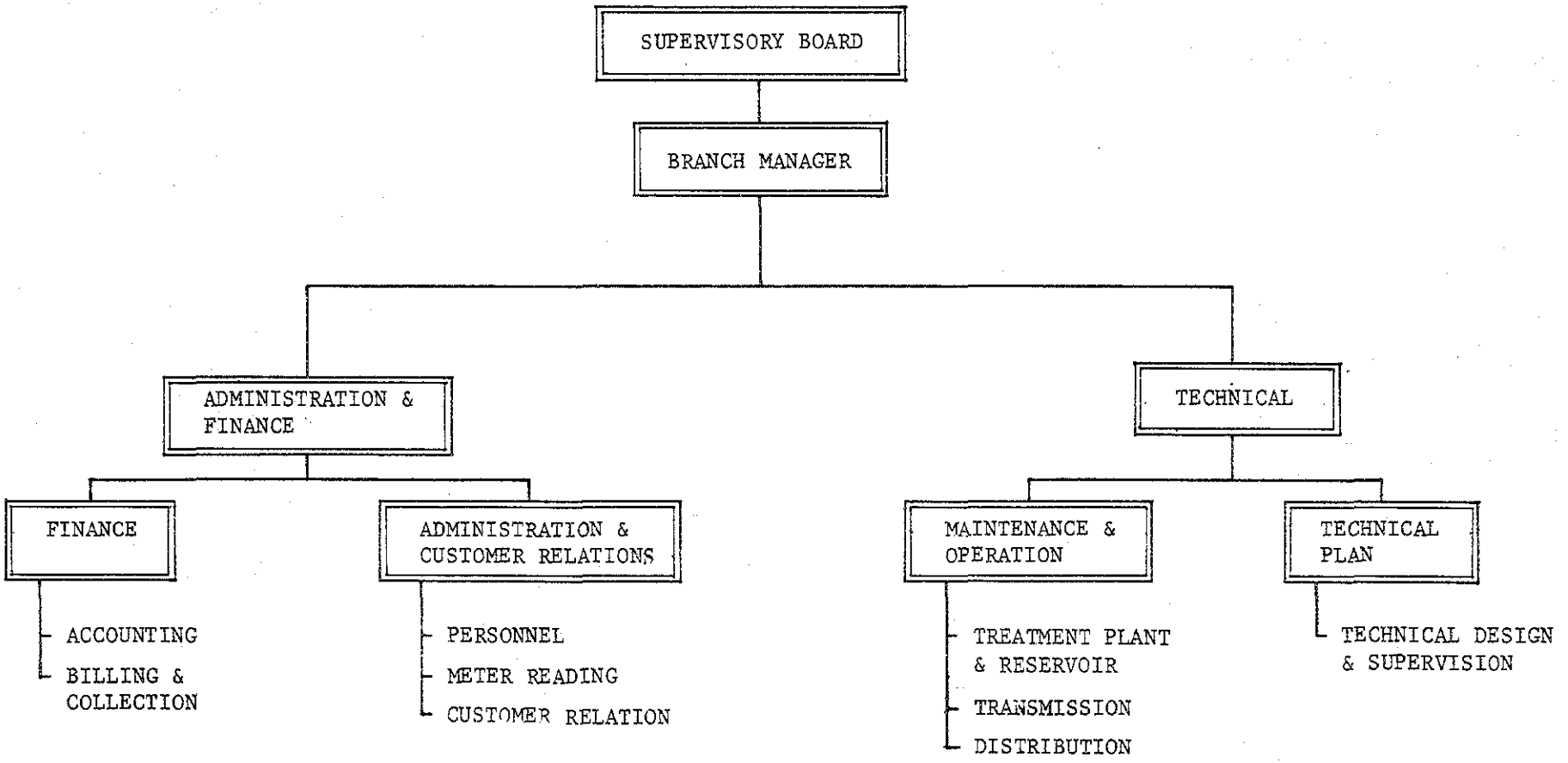


Fig 6-2-3 Proposed Organization Chart for Palu Water Enterprises, Donggala Branch Office

Table 6-3-1 Staffing Schedule

Description	1980	1981	1982	1983	1984	1985
Branch Manager	1	1	1	1	1	1
Secretary/Typist	1	1	1	1	1	1
Sub-total	2	2	2	2	2	2
Technical						
Head	1	1	1	1	1	1
Maintenance & Operation	2	2	2	3	3	3
Technical Planning	1	1	1	1	1	1
Foreman	-	-	4	4	4	4
Sub-total	4	4	8	9	9	9
Administration & Finance						
Head	1	1	1	1	1	1
Accounting	1	1	1	1	1	1
Bookkeeping	1	1	1	1	1	1
Billing & Collection	1	1	1	1	1	1
Meter reader	1	1	1	1	1	1
Sub-total	5	5	5	5	5	5
Total	11	11	15	16	16	16

6-4 Transient Measures in the Initial Stage of Operation

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

VII. EVALUATION OF THE PROJECT AND RECOMMENDATIONS

7-1 Evaluation of Benefits of the Project

Because of its geographycal location at the tip of a peninsula, Donggala is not gifted with abundant water sources. From sea transportation, it is located on a strategic point but due to insufficiency of drinking water its development has been hindered, and besides the life of the inhabitants has been adversely affected. The construction of the water supply system will bring the following merits to the inhabitants' life and development of the district.

1) Safe Drinking Water to be Secured
The existing water sources do not always ensure safe water and in addition the quantity is far less than enough. By the present project all the citizens will be able to enjoy safe as well as plentiful drinking water. Further, health of the people can be promoted by the construction of the water supply system.

2) Release of Women and Children from Water Carrying
Women and children have been obliged to carry water from a distant place all the year round. Once the water supply system is completed, they will be released from such a hard labor.

3) Realization of Healthy Environment
Water supply is a basic condition for good public health. The present project will reduce enteric diseases, and other diseases as a secondary effect, and further give a motivation for overall improvement of the living environment in the kota area.

4) Water for Ships and Increase of Earning
The existing water supply system has not been able to supply the incoming ships with water, whereas it is an essential condition of the port town mainly on which the citizens earn their livehood. When the present project is executed, this long-pending problem will be immediately solved, and the gross income of the people will rise up.

5) Construction Work and Employment

Construction work of the present project has a fairly large share of civil work. For this civil work, both skilled and unskilled labors have to be mobilized. It will contribute to an expansion of the earning of the public in Donggala.

7-2 Recommendations

1) Investigation of the Riverbed Water

While the present study being performed, it was found imperative that an investigation of the riverbed water be carried out before the detail design started. Therefore, the necessary cost for the investigation is allowed in the cost estimate, and necessary time in the implementation schedule.

2) Securing of Skilled Operators

Treatment facilities, however well designed and constructed, will not function well, unless they are operated properly. Production of safe drinking water depends on operation of the facilities. It is, therefore, most important to give the operators concerned skill and knowledge needed for appropriate operation of the facilities. If possible, experienced operators should be recruited; if not, operators should be trained during the initial period of operation of the completed facilities.

3) Exploration of Other Water Sources

The Donggala river is not necessarily a big water, and in a prolonged dry period the riverbed water may become short. On the other hand, the water requirement of Donggala will incessantly increase along with its development, therefore all possible water sources must be explored.

4) Measurement of Production and Consumption

All production and consumption must be measured and recorded. By analyzing these records the future water demand can be estimated, and

further based on such estimates an adequate future extension plan can be worked out.

5) Improvement of the Existing Water Supply Systems

In Donggala, Maleni I and II springs are valuable water sources, which are located close to the served area. As far as there is yield and the quality is tolerable for drinking, these two water supply systems should be fully used, and all defects should be repaired and improved.

The existence of coliform groups and ammonia-N in the spring water (Ref. Table 2-5-1) is an indication of possible contamination by domestic waste water. To prevent occurrence of epidemic water borne diseases by this water supply, it is strongly recommended to practice disinfection by hypochlorite.

APPENDIX A

CONSIDERATION ON

POPUALTION PROJECTION IN THE REPORT

1. General

In this text, firstly, the method employed in the existing Report will be introduced. Secondly, several kinds of equations which are all widely used for water supply planning will be presented. Each equation has parameters. These parameters will be determined employing the least mean square method. From these equations future population will be calculated so as to know the range of distribution of the projected population. Finally, some comments by the Team on the projected population in the said Report will be given.

2. Population Projection in the Existing Report

For population projection, the Report employed some common methods. Hereunder, the methods employed as well as processes and results of projection are introduced quoted wholly from the Report.

Section VII. Projection of Water Demand

1. General

For projection of future water demand in Kota/Daerah, it will be necessary to know about future development in Kota. This development covers the population growth and increase of many kinds of buildings, and the possibility of expansion of Kota itself. Especially, the projected population is related with projection of domestic water demand, and the activities in Kota concerned.

2. Population Projection

For making population projection of Kota Donggala, population statistics from 1973 to 1977 are shown in Table III-1. As shown in this table, population growth between 1975 and 1978 is remarkably high. This matter was brought about by the transmigration of people into Kota Donggala during the said period. The population growth rate in the past, which is very high, will not be able to be employed for population projection in Kota Donggala. Because such transmigration will no longer happen in the future. For the population projection of Kota Donggala, 2.77%, which is the average growth rate recorded in the period between 1963 and 1975 when the effects of transmigration were less remarkable, will be employed.

a) Arithmetic Method

Future population will be estimated by the following equation.

$$P_n = P_o (1 + Rn)$$

where : P_n = population in n years later of the standard year

P_o = population in the standard year

R = average population growth rate per year

n = term between year to estimate and the standard year, in years

Using this equation, future population up to 2005 will be calculated. (Refer to Table III-2 and Fig III-1.)

b) Least Square Method

Future population will be estimated as follows:

$$Y = K (1 + r)^t$$

where : Y = population in the future
K = constant
$(1 + r)$ = constant
t = term between year to estimate and the standard year, in years

From the calculation, the equation to be used in the population projection for Kota Donggala will be given as follows, using the least square method.

$$Y = 16,218 \times (1.023)^t$$

And future population by this method in the period between 1978 and 2005 is shown in Table VII-2 and Fig VII-1.

c) Geometric Method

Future population growth will be calculated by the following equation.

$$P_n = P_o (1 + R)^n$$

where : P_n = population in n years later of the standard year
P_o = population in the standard year
n = term between year to estimate and the standard year, in years
R = average population growth rate per year
= 2.77%

Table III-1

Luas Wilayah & Jumlah Penduduk Kota Donggala

No.	Nama Desa	Luas Desa (Ha)	Jumlah Penduduk (orang)					
			1963	1974	1975	1976	1977	1978
01	Boya	262,5	-	-	-	3408	3874	4353
02	Labuan	600	-	1474	1535	1571	1674	1678
03	Maleni	200	1072	1277	1407	1509	1730	1750
04	Bone oge	900	1495	1495	1509	1520	1583	1590
05	Ganti	3500	-	-	-	-	852	1736
06	Kabonga kecil	1050	1261	1511	1531	1551	1587	1595
07	Gunung Bale	500	1025	1037	1040	1050	1060	1080
08	Kabonga besar	300	1515	1620	1635	1645	1650	1660
09	Tg. Batu	450	1745	1872	1949	2030	2071	2114
	Jumlah	7762,5	8113	10286	10606	14284	16081	17556

Sumber data: PEMDA Kecamatan Banawa, daerah tingkat 11 Donggala

Table VII-1

Proyeksi jumlah penduduk Donggala

Tahun	A	B	C
1978	17556	17556	17556
1980	18529	17764	18542
1985	20966	19901	21256
1990	23392	22298	24368
1995	25823	24983	27935
2000	28255	27991	32025
2005	30686	31361	36713

A = Metoda "Arithmetik"

B = Metoda "Least Square"

C = Metoda "Geometric"

Population up to the year of 2005 is shown in Table VII-2.

Projected population for the present project

After comparing the results of population projections by the three methods (Table VII-2), future population by geometric method will be used for the Water Supply Master Plan.

In employing the geometric method here, the followings are taken into consideration.

- Kota Donggala is planned to be Ibukota Kabupaten, and so the population growth would occur relatively fast, comparing with the adjacent small cities.
- Facilities in Kota will be gradually increasing.
- Development potentiality of daerah is quite large.

The population growth rate is 2.15 % per annum. This figure is employed after consideration of the following:

- Population growth rate, 2.77 % per annum is a figure which has been affected by the plan of transmigration.
- Indonesian average growth rate ia only 2.3 % per year at present.
- Average growth rate in Kabupaten Donggala is only 2.15 % per year.

Projected population in each of five years between 1980 and 2005 is presented in Table VII-3 and Fig VII-1.

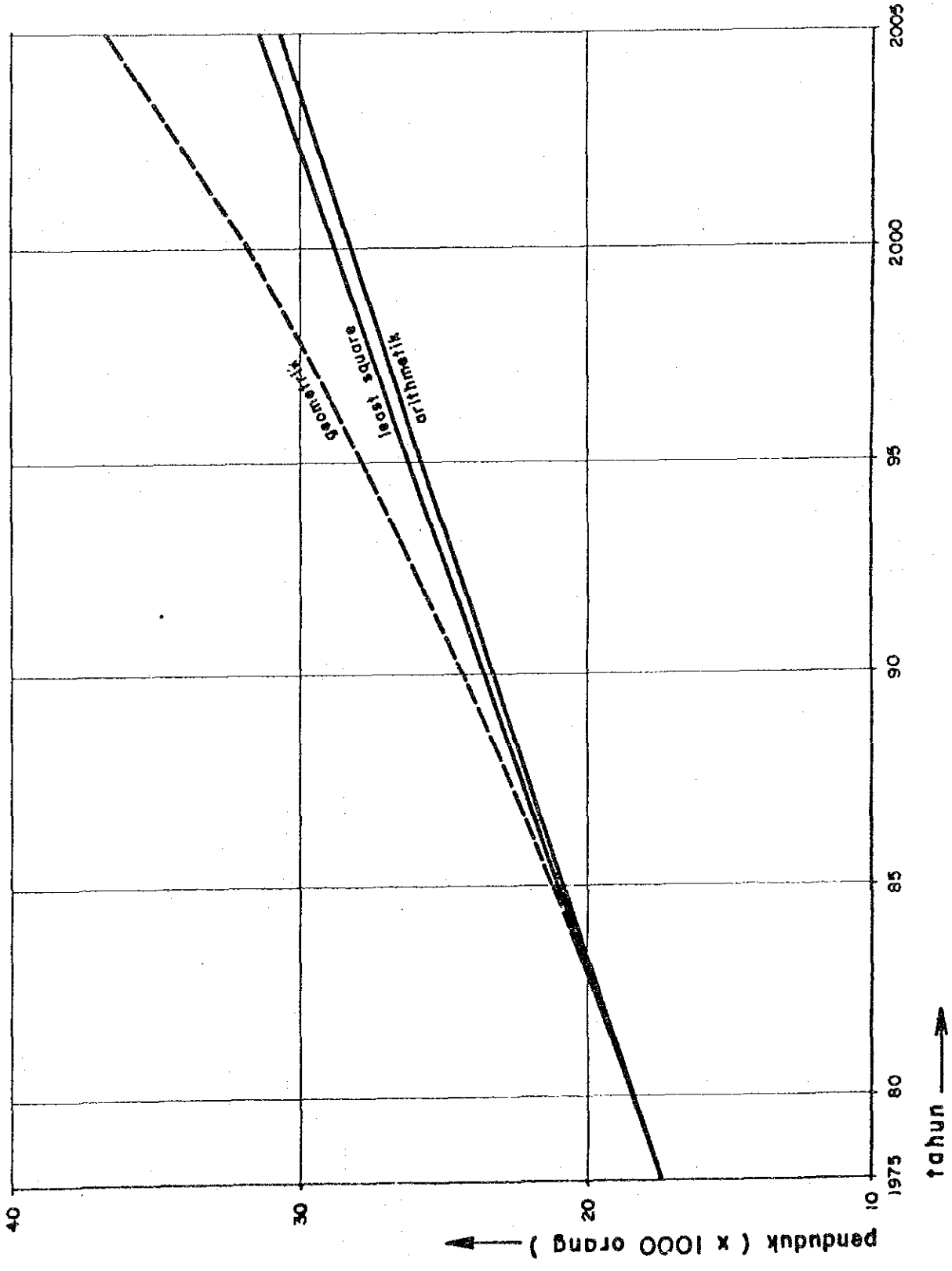
Table VII-2

Proyeksi Jumlah penduduk kota Donggala yang dipakai dalam Master Plan (1980 - 2005)

Tahun	Jumlah penduduk (orang)
1980	18713
1985	20813
1990	23149
1995	25746
2000	28636
2005	31849

Grafik VII – 1

Proyeksi penduduk kota Donggala
tahun 1978_2005

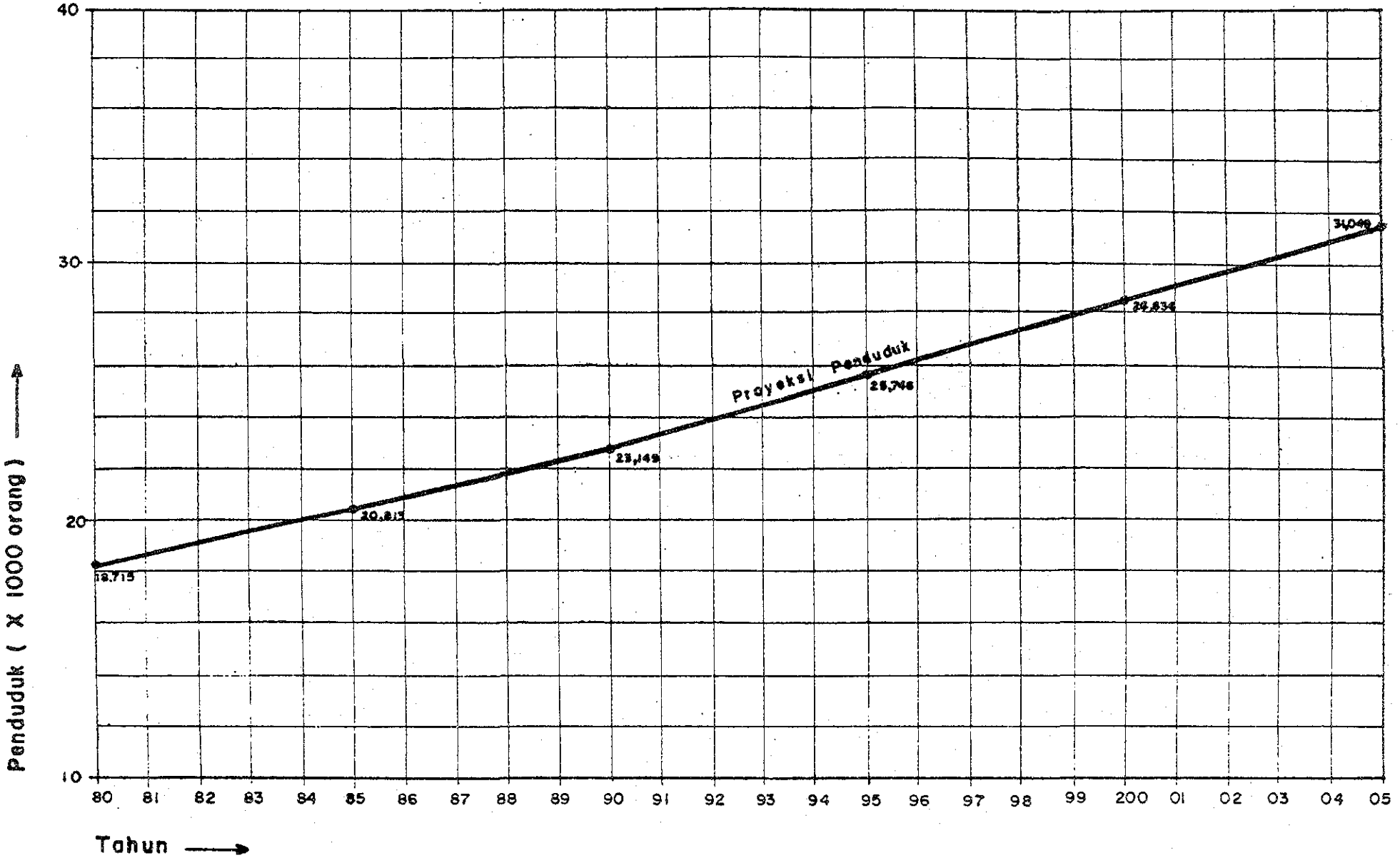


GRAFIK VII – 2

PROJEKSI PENDUDUK KOTA DONGGALA DENGAN METODA GEOMETRIK

TAHUN 1980 – 2005

YANG DIPAKAI PADA MASTER PLAN AIR MINUM



3. Future Population

The preceding section concerning the population projection was quoted from the existing Report. In this section, population projection furthermore, employing several kinds of equations, will be made to know the range of distribution of future population. For the population projection, the following fundamental equations are employed, which are all commonly employed for population projection.

i) $y = ax + b$

ii) $y = K/ (1 + e^{aT+b})$

iii) $y = p_o (1 + r)$

iv) $y = ax^{0.5} + b$

v) $y = ax^2 + b$

where, y : population
x : term between the first year of utilized data and year to estimate population, in years
T : term between standard year to estimate population, in years
a,b : parameters
p_o : the latest population
e : the base of natural logarithm

Population projection by iii) and v) equations would usually give higher side results than the others when growth rate in the past is relatively high.

The future population will be calculated in the following steps. Firstly, the parameters in each equation are determined by means of the least mean square method. And then population up to the year of 2005 will be estimated based on these equations. The results of estimation using the above equations are presented in Table A - 1 and Fig A - 1. As seen in Fig A - 1, the projected population by the Report is the lowest one among these projections although geometric method has been employed in the Report. This is because of the application of relatively low growth rate of Kabupaten Donggala to projection.

Fig A-1 Future Population

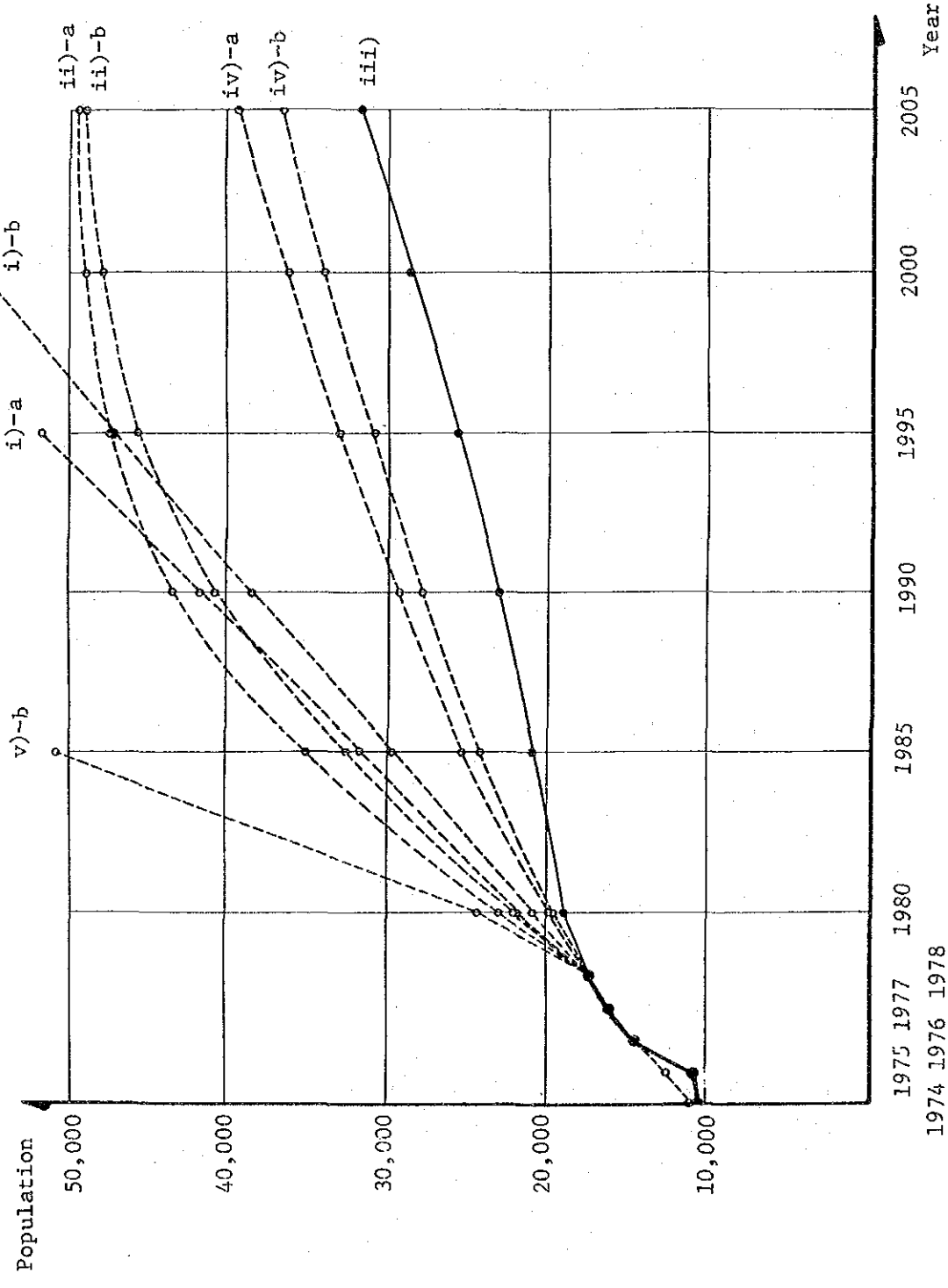


Table A-1 Future Population

	equation	1985	2005	Remarks
i)-a	$y = 7,758 + 2,002\ X$	21,770	71,810	
-b	$y = 9,022 + 1,733\ X$	21,195	64,460	
ii)-a	$y = 50,000/\ (1 + e^{0.9880-0.2039T})$	22,850	49,640	
-b	$y = 50,000/\ (1 + e^{0.9358-0.1730T})$	21,970	49,170	
iii)	——*	20.813	31,849	Taken from the Report
iv)-a	$y = 3,000 + 6,420\ X^{0.5}$	19,990	39,320	
-b	$y = 4,814 + 5,611\ X^{0.5}$	19,660	36,550	
v)-b	$y = 11,181 + 276\ X^{2}$	24,720	294,050	

Note: a = equation based on the population statistic in the past 5 years.

b = equation based on the modified statistics considering unusual increase between in 1975 and 1976.

* ---- Refer to section 2 Population Projection in the Existing Report.

4. Considerations on the Results of Projection

The foregoing section estimated future population by several kinds of equation. Comparing the results of the above projections with the projection in the existing Report, some comments are briefly described. (Refer to Fig A - 1.)

i) Donggala would probably have 20,000 to 30,000 population in the year of 1985, whichever equations might be employed in projection.

ii) Since an extraordinarily high growth of population in the past mainly came from the transmigration, application of such past trend to the projection of future population will result in an excessively high side result. Even the linear equation gives a high side result. Taking duly into consideration the above matter, the existing Report projected the future population, using the present average growth rate of Kabupaten Donggala, a little lower than that of Kota Donggala.

iii) The process and result of population projection is to be reviewed in the frame of future plan of transmigration and city planning after the system is constructed and put into operation. In the future review of this population projection, further collection and analysis of data concerned will be in need and should be done so as to obtain more reliable results of population projection.

iv) In the existing Report, some defects were found. They did not give serious results to the feasibility study but they are all very important for any study or planning. For reference, therefore, such defects are categorized as below.

- Simple miscalculation of future population,
- Insufficient understanding of the real meaning of each adopted method,
- Lack of logical description despite redundant explanation in the Report.

APPENDIX B

RECORDS OF WATER CONSUMPTION

Records of Water Consumption

This Table B-1 Records of Water Consumption is obtained from the local governmental office concerned. This contains valuable data of water consumption, such as the number of connections and monthly water consumption over a certain long period which is broken down into several categories of use.

From this data, the unit consumption can be calculated. Firstly, the unit consumption per capita per day for domestic use is calculated as 62 l/c/d. For this calculation, the Item 1 Domestic in the table is employed, and further it is assumed that one connection supplies 6 persons. Secondly, gross unit consumption per capita for all uses included is calculated as 81 l/c/d. As from the records the number of population served is not available, an assumed population, namely, 6 persons multiplied by the number of all connections, is employed instead of the population served. For the practical purpose, this method is not necessarily way off the mark, because almost all the establishments are of small scale.

Table B-1 Water Consumption Data

in 1979

	Item		Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1.	Domestic	(1)	25	24	26	28	28	30	30	30	31	31	31	31	-
		(2)	385	338	443	334	383	383	341	346	303	305	292	349	4,202
2.	Hospital	(1)	3	3	3	2	3	3	3	3	3	3	3	3	-
		(2)	136	117	107	65	66	65	68	71	54	79	80	87	989
3.	Church & Mosque	(1)	1	1	1	1	1	1	1	1	1	1	1	1	-
		(2)	30	20	22	10	10	10	15	29	16	14	10	15	201
4.	Office	(1)	5	5	5	5	5	5	5	6	6	5	5	5	-
		(2)	103	108	166	63	58	59	59	70	57	48	59	59	209
5.	Commerce - Small	(1)	22	20	20	23	24	26	28	28	28	29	29	29	-
		(2)	401	307	338	330	316	327	290	341	273	250	266	285	3,724
	- Large	(1)	65	65	61	65	65	62	62	62	61	62	61	61	-
		(2)	1,559	1,354	1,368	1,372	1,298	1,166	1,129	974	893	709	722	692	13,236
	Total	(1)	121	114	116	124	126	127	129	130	130	132	130	131	-
		(2)	2,614	2,244	2,438	2,174	2,131	2,010	1,902	1,831	1,596	1,405	1,429	1,487	23,261

Note : (1) = Number of connections
(2) = Water consumption (cubic meter)

Source : Office of PDAM Kabupaten DATI II Donggala, in 1979

APPENDIX C

WATER DEMAND

BY THE EXISTING REPORT

The Report has estimated the future water demand broken down into use categories. For reference, the process of the estimation in each category will be introduced as below in the form of tables.

i) Domestic Use

(1) Domestic Use by House Taps

Table VII-05
Water Demand for Domestic Use
by House Taps

Year	Population	Percentage (%)	Population Served	Consumption per capita per day (l/c/d)	Consumption (m^3/d)
1980	18,713	25	4,678	100	468
1985	20,813	29	6,036	106	640
1990	23,149	33	7,639	112	856
1995	25,746	37	9,526	118	1,124
2000	28,636	41	11,741	124	1,456
2005	31,849	45	14,332	130	1,863

(2) Domestic Use by Joint House Taps

Table VII-06
Water Demand for Domestic Use
by Joint House Taps

Year	Population	Percentage (%)	Population Served	Consumption per capita per day (l/c/d)	Consumption (m^3/d)
1980	18,713	5	936	60	56
1985	20,813	6	1,249	66	82
1990	23,149	7	1,620	72	117
1995	25,746	8	2,060	78	161
2000	28,636	9	2,577	84	217
2005	31,849	10	3,185	90	287

(3) Domestic Use by Public Hydrants

Table VII-07
Water Demand for Domestic Use
by Public Hydrants

Year	Population	Percentage (%)	Population Served	Consumption per capita per day (l/c/d)	Consumption (m^3/d)
1980	18,713	10	1,871	30	56
1985	20,813	9.6	1,998	30	60
1990	23,149	9.2	2,130	30	64
1995	25,746	8.8	2,266	30	68
2000	28,636	8.4	2,405	30	72
2005	31,849	8.0	2,548	30	76

ii) Non-domestic Use

(1) Industrial

Table VII-08

Water Demand for Industrial

Year	Industry			Home Industry			Total Industrial Consumption (m^3/d)
	Nos. of Unit	Consumption per Unit (m^3/d/unit)	Total Consumption (m^3/d)	Nos. of Unit	Consumption per Unit (m^3/d/unit)	Total Consumption (m^3/d)	
1980	5	2	10	10	1	10	20
1985	6	3	18	11	1	11	29
1990	7	3	21	12	2	24	45
1995	8	4	32	13	2	26	58
2000	9	4	36	14	3	42	78
2005	10	5	50	15	3	45	95

(2) Commercial

Table VII-09

Water Demand for Commercial

Year	Nos. of Unit	Consumption per Unit (m^3/unit/d)	Consumption (m^3/d)
1980	2	10	20
1985	2	11	22
1990	3	12	36
1995	3	13	39
2000	3	14	42
2005	4	15	60

(3) Institutions

Table VII-10

Water Demand for Institutions

Year	Population	Nos. of Employees	Consumption per capita per day (l/c/d)	Total Consumption (m^3/d)
1980	18,713	1,815	15	27
1985	20,813	2,018	16	32
1990	23,149	2,245	17	38
1995	25,746	2,498	18	45
2000	28,636	2,778	19	53
2005	31,849	3,089	20	62

(4) Medical Facilities

Table VII-11

Water Demand for Medical Facilities

Year	Population	Nos. of Beds	Consumption per Bed (l/bed)	Consumption (m^3/d)
1980	18,713	47	250	12
1985	20,813	52	250	13
1990	23,149	58	250	15
1995	25,746	64	250	16
2000	28,636	72	250	18
2005	31,849	80	250	20

(5) Religious Institutions

Table VII-12

Water Demand for Religious Institutions

Year	Population	Nos. of Unit	Consumption per Unit (m^3/unit/d)	Total Consumption (m^3/d)
1980	18,713	25	2	50
1985	20,813	28	2	56
1990	23,149	31	2	62
1995	25,746	34	2	68
2000	28,636	38	2	76
2005	31,849	42	2	84

(6) Schools

Table VII-13

Water Demand for Schools

Year	Population	Percentage (%)	Nos. of pupils and teachers	Consumption per capita per day (l/c/d)	Total Consumption (m^3/d)
1980	18,713	25.5	4,772	10	48
1985	20,813	28.4	5,911	11	65
1990	23,149	31.3	7,246	12	87
1995	25,746	34.2	8,805	13	114
2000	28,636	37.1	10,624	14	149
2005	31,849	40	12,740	15	191

(7) Public Parks

Table VII-14

Water Demand for Public Parks

Year	Domestic Use (m^3/d)	Percentage (%)	Consumption (m^3/d)
1980	454	2.5	11
1985	645	2.5	16
1990	894	2.5	22
1995	1,215	2.5	30
2000	1,622	2.5	41
2005	2,134	2.5	53

(8) Harbor

Table VII-15

Water Demand for Harbor

Year	Nos. of Ships per day	Consumption per Ship (m^3/ship/d)	Total Consumption (m^3/d)
1980	1	4	4
1985	1	4	4
1990	1	4	4
1995	2	4	8
2000	2	4	8
2005	2	4	8

iii) Total Consumption

Item	Year					
	1980	1985	1990	1995	2000	2005
1. Domestic Use by House Taps	468	640	856	1,124	1,456	1,863
2. Domestic Use by Joint House Taps	56	82	117	161	217	287
3. Domestic Use by Public Hydrants	56	60	64	68	72	76
4. Industrial	20	29	45	58	78	95
5. Commercial	20	22	36	39	42	60
6. Institutions	27	32	38	45	53	62
7. Medical Facilities	12	13	15	16	18	20
8. Religious Institutions	50	56	62	68	76	84
9. Schools	46	65	87	114	149	191
10. Public Parks	11	16	22	30	41	53
11. Harbor	4	4	4	8	8	8
Sub total	770	1,019	1,346	1,731	2,210	2,799
Unaccounted-for Water (15% - 20%)	115	163	229	312	420	560
Total (m^3/d)	885	1,182	1,575	2,043	2,630	3,359
(l/sec)	10.2	13.7	18.2	23.7	30.5	38.9

APPENDIX D

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 DONGGALA (in Rp.)

Items	Foreign Exchange	Local Currency	Remarks
1. Infiltration Pipe and Pump-well	1) pump @ 1,080,000/units x 2 units = 2,160,000 2) deasel generator @ 13,000/units x 2 units = 26,000,000 3) panel @ 350,000/units x 2 units = 700,000 Total 28,860,000	1) earthwork (1,000 cu m) 2,000,000 2) concrete (75 cu m) @ 200,000 cu m x 75 cu m = 15,000,000 3) shed @ 150,000/sq m x 30 sq m = 4,500,000 4) coase sand and gravel @ 20,000 cu m x 120 cu m = 2,400,000 5) infiltration pipe @ 30,000/m x 20 m = 600,000 6)* local transportation 2,900,000 Total 27,400,000	6)* In case of Donggala costs of materials x 10 %
2. Transmission Pipeline Ø 150 x 200 m DCIP	1) pipe @ 12,958/m x 200 m = 2,591,600 2) fitting 2,591,600 x 20 % = 518,320 3) valve @ 217,525/pcs x 1 pce= 217,525 Total 3,327,445 @ 16,600/m	1) pipe @ 4,000/m x 200 m = 800,000 2) valve box @ 500,000/pcs x 1 pce. = 500,000 3) local transportation 330,000 Total 1,630,000 @ 8,200/m	

Items	Foreign Exchange		Local Currency		Remarks
3. Receiving Well & Slow Sand Filter	1)* yard pipe - Ø 100 @ 8,891/m x 100 m =	889,100	1) earthworks (1,900 cu m)	3,800,000	1)* Includes all drain and overflow pipes.
	2) fitting 889,100 x 20 % =	177,820	2) concrete (340 cu m) @ 200,000/cu m x 340 cu m =	68,000,000	
	3) valve @ 120,074/pcs x 5 pcs =	600,370	3) sand (350 cu m) @ 71,940/cu m x 350 cu m =	25,179,000	
	4) water	1,000,000	4) gravel (180 cu m) @ 20,000/cu m x 180 cu m =	3,600,000	
	Total	2,667,290≒	5) manhole etc.	400,000	
		2,700,000	6) local transportation	270,000	
			Total	101,249,000	
4. Service Reservoir	1)* yard pipe - Ø 100 @ 8,891/m x 50 m =	444,550	1) earthworks (1,900 cu m)	3,800,000	1)* Includes all drain and overflow pipes.
	2) fitting 444,550 x 20 % =	88,910	2) concrete (135 cu m) 200,000 x 135 cu m =	27,000,000	
	3) valve @ 120,074/pcs x 5 pcs =	600,370	3) manhole etc.	200,000	
	Total	1,133,830≒	4) local transportation	110,000	
		1,150,000	Total	31,110,000≒	
				31,000,000	

Items	Foreign Exchange	Local Currency	Remarks
5. Distribution Pipeline			
- Ø 200 x 1,400 m DCIP	1) pipe @ 17,395/m x 1,400 m = 24,353,000 2) fitting 24,353,000 x 20 % = 4,870,600 3) valve @ 327,148/pcs x 2 pcs = 654,296 Total 29,877,896 @ 21,300/m	1) pipe @ 6,000/m x 1,400 m = 8,400,000 2) valve box @ 500,000/pcs x 2 pcs = 1,000,000 3) thrust block @ 50,000/pcs x 10 pcs = 500,000 4) local transportation 3,000,000 Total 12,900,000 @ 9,200/m	
- Ø 150 x 2,400 m PVC	1) pipe @ 9,340/m x 2,400 m = 22,416,000 2) fitting 22,416,000 x 20 % = 4,483,200 3) valve @ 217,525/pcs x 6 pcs = 1,305,150 4) river crossing @ 90,000/m x 90 m = 8,100,000 Total 36,304,350 @ 15,100/m	1) pipe @ 4,000/m x 2,400 m = 9,600,000 2) valve box @ 500,000/pcs x 6 pcs = 3,000,000 3) thrust block @ 50,000/pcs x 20 pcs = 1,000,000 4) river crossing @ 35,000/m x 90 m = 3,150,000 5) local transportation 3,600,000 Total 20,350,000 @ 8,500/m	

Items	Foreign Exchange		Local Currency		Remarks
- Ø 100 x 550 m PVC	1) pipe @ 4,913/m x 550 m	= 2,702,150	1) pipe @ 4,000/m x 550 m	= 2,200,000	
	2) fitting 2,702,150 x 20 %	= 540,430	2) valve box @ 500,000/pcs x 2 pcs	= 1,000,000	
	3) valve @ 120,074/pcs x 2 pcs	= 240,148	3) thrust block @ 50,000/pcs x 5 pcs	= 250,000	
	4) river crossing @ 90,000/m x 50 m	= 4,500,000	4) river crossing @ 35,000/m x 50 m	= 1,750,000	
	Total	7,982,728 @ 14,500/m	5) local transportation	800,000	
			Total	6,000,000 @ 11,000/m	
- Ø 75 x 1,250 m PVC	1) pipe @ 3,130/m x 1,250 m	= 3,912,500	1) pipe @ 3,500/m x 1,250 m	= 4,375,000	
	2) fitting 3,912,500 x 20 %	= 782,500	2) valve box @ 300,000/pcs x 4 pcs	= 1,200,000	
	3) valve @ 92,750/pcs x 4 pcs	= 371,000	3) thrust block @ 40,000/pcs x 10 pcs	= 400,000	
	Total	5,066,000 @ 4,100/m	4) local transportation	500,000	
			Total	6,475,000 @ 5,200/m	

Items	Foreign Exchange	Local Currency	Remarks
6. Bulk Meter Ø 200	1) bulk meter 1,500,000	1) meter box 500,000 2) local transportation 150,000 Total 650,000	
7. Water Meter Ø 13	1) water meter @ 17,000/pcs x 1,010 pcs = 17,170,000	1) local transportation 1,700,000 @ 1,700/pcs	
8. Public Hydrant	1) meter - Ø 18 @ 30,000/pcs x 38 pcs = 1,140,000	1) concrete @ 300,000/pcs x 38 pcs = 11,400,000 2) local transportation 110,000 Total 11,510,000 @ 303,000/pcs	

APPENDIX E

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. For fuel cost, Rp.15,000 per day is calculated with assumption that 100 liter of light oil per day is used. Details are given in Attachment IV) Projection of Chemical and Fuel Costs.

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

Donggala

1985

Class of Water Consumption (m^3/day)	Residential			Commercial	Industrial	Social		Harbor
	Domestic	Institutional	Medical			Religious	Public	
	744	28	-	22	29	60	163	4
0 - 15 m^3/m	652	13	-	17	-	22	59	-
15 - 30 m^3/m	91	14	-	4	-	37	100	-
more than 30 m^3/m	1	1	-	1	29	1	4	4

1990

Class of Water Consumption (m^3/day)	Residential			Commercial	Industrial	Social		Harbor
	Domestic	Institutional	Medical			Religious	Public	
	1,007	34	-	36	45	75	171	4
0 - 15 m^3/d	883	16	-	29	-	27	62	-
15 - 30 m^3/d	124	18	-	7	-	46	105	-
more than 30 m^3/d	0	-	-	-	45	2	4	4

C. Water Sales

Item \ Year	1985	1990
Residential	825.5A	1,112A
Commercial	46.0A	72A
Industrial	145.0A	225A
Social	194.0A	216.8A
Harbor	20.0A	20.0A
Total	1,233.5A	1,645.8A

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
	390.032A		450.227A		510.423A		570.619A	
		420.130A		480.325A		540.520A		600.717A

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	55.04	53.64	52.55	51.72	51.09	50.65	50.37	50.23

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

"A" factor is determined to be Rp.55

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

DONGGALA

Operation and Maintenance Cost

(Rp. 1,000)

Item	1983	1984	1985	1986	1987	1988
I. Personnel Cost	9,213	9,674	10,157	10,666	11,198	11,758
II. Operation/Maintenance						
1. Maintenance	3,654	3,834	4,028	4,230	4,441	4,663
2. Office Operation Cost	195	203	210	217	224	231
3. Chemical Cost	1,016	1,067	1,120	1,176	1,235	1,296
4. Fuel	6,367	6,685	7,019	7,370	7,739	8,126
(Total I & II $_{1,2,3,4}$)	20,445	21,463	22,534	23,661	24,837	26,074
5. Other Expenses	1,022	1,073	1,127	1,183	1,242	1,304
TOTAL	21,467	22,536	23,661	24,844	26,079	27,378
Water Consumption m^3/year	340,691	364,343	387,995	441,647	435,229	458,951
Production Cost Rp./m^3	63.36	61.85	60.98	60.35	59.92	59.65

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

DONGGALA

Personnel Cost

(Rp. 1,000)

Description	1980	1981	1982	1983	1984	1985	1986	1987	1988
Branch Manager	1,200	1,260	1,323	1,389	1,459	1,531	1,608	1,688	1,773
Secretary/Typist	540	567	595	625	656	689	724	760	798
Technical									
Head	780	819	860	903	948	995	1,045	1,097	1,152
Maintenance & Operation	1,080	1,134	1,786	1,790	1,880	1,974	2,072	2,176	2,285
Technical Plan	600	630	661	694	729	766	804	844	886
Foreman	-	-	720	756	794	833	875	919	965
Administration & Finance									
Head	780	819	860	903	948	995	1,045	1,097	1,152
Accounting	600	630	661	694	729	766	804	844	886
Bookkeeping	540	567	595	625	656	689	724	760	798
Billing & Collection	480	504	529	556	583	613	643	675	709
Meter reader	240	252	265	278	292	306	322	338	354
Total	6,840	7,182	8,855	9,213	9,674	10,157	10,666	11,198	11,758

Attachment IV)

Projection of Chemical and Fuel 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.

Item	Donggala
Water Production (Average day 1/sec)	14.2
Dosage of Chlorite (ppm)	1.0
Period of Dosage	Daily
Use of Chlorite per Year (kg/y)	750

B. Projection of Fuel Cost for Donggala

Fuels for generators
Light oil = Kerosene

100 1/day

100 1 x Rp. 150 = Rp. 15,000/day
Rp. 15,000 x 365 days = Rp. 5,475,000
Rp. 5,500,000
==========

REPUBLIC OF INDONESIA

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

FINAL REPORT

Vol. 3 : TENTENA

NOVEMBER 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

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

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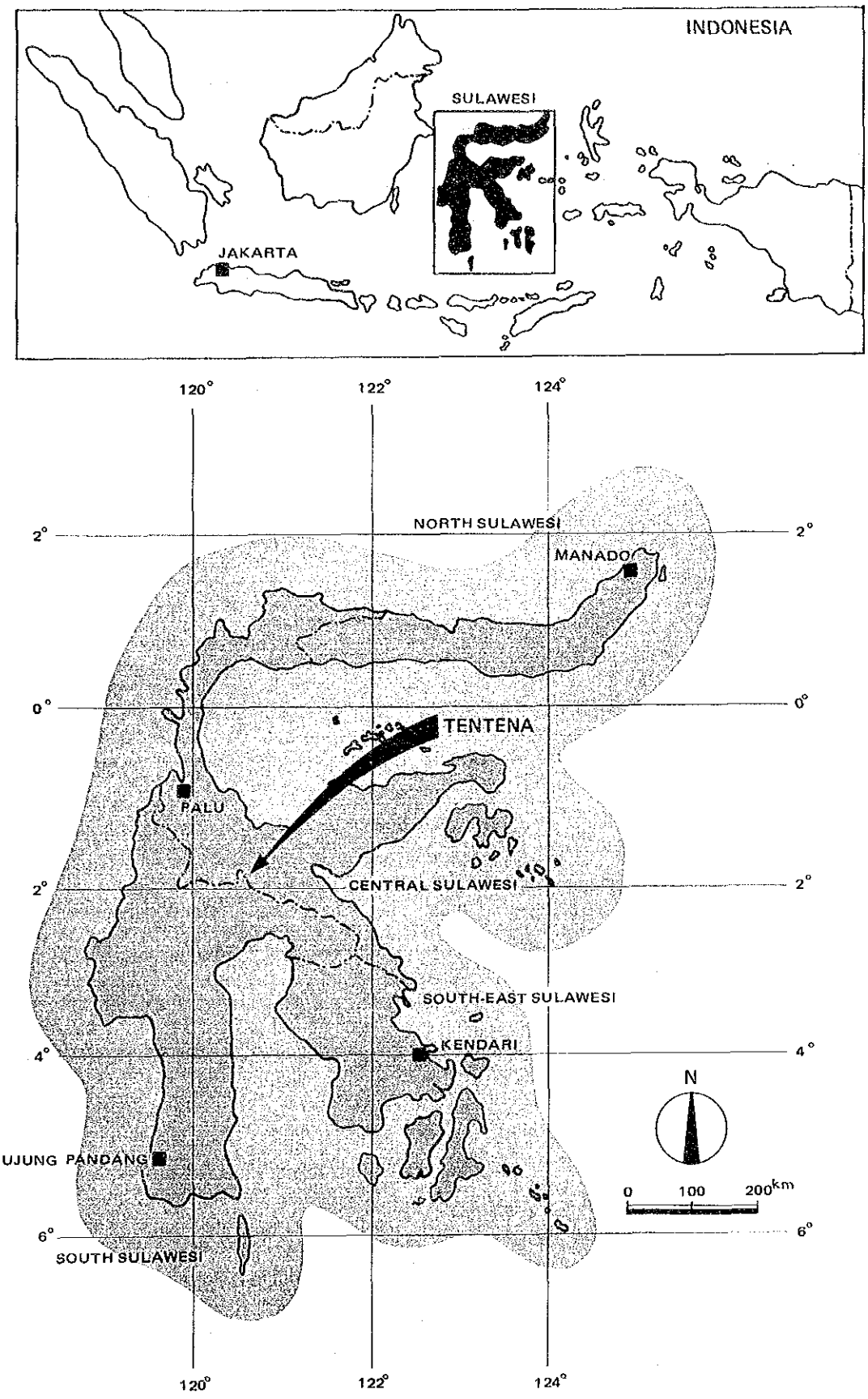
LIST OF ABBREVIATIONS

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	- "Pekerjaan Supervisi Design Konstruksi untuk Study Regional Air Minum 10 (sepuluh) Kota Di Daerah Kalimantan dan Sulawesi" by P.T. Bumi Prasidi
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 Tentena Water Supply System, has been prepared based on a review of the existing Feasibility Study Report (the existing 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 the 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

Tentena is on the shore of Lake Poso, which is a well-known beautiful and large lake surrounded by high mountains in the middle of central Sulawesi. The geographical location of Tentena is 120°36' east longitude and 1°48' south latitude, and 500 - 550 m above sea level. The town is 56 km inland away from the nearest seaport, Poso city. Administratively, it belongs to North Pamona Sub-regency, Poso Regency, Province of Central Sulawesi.

The local climate is mild with an average temperature of 22°C, varying from a low of 18.0°C to a high of 27.0°C. Although it is located close to the equator, the temperature is rather cool because the town stands on a plateau of high altitude. The area has an abundant annual precipitation, about 1,800 mm in average.

A feature to be noted about Tentena is that this area has been a center of Christianity since the olden times. 90% of the population in this area are Christians, while the country as a whole is Islamic.

Whereas the town is at present a small community developed in the mountainous area, it has a high potential to develop as a center of Christian religion as well as a tourist resort thanks to its historical background, its pleasant climate and especially its excellent scenic beauty of the serene lake and verdurous mountains.

1-4-2 Socioeconomic Conditions

Tentena is divided into six districts as shown in Table 1-4-1. The approximate study area covering these districts is 1,000 ha. As also shown in the same table, Tentena had a population of 6,457 with 985 households in 1979. From these figures it is clear that Tentena has a small population compared with its wide area, resulting in a very low population density.

As for the built-up area of Tentena, churches, stores, hospitals and offices are situated almost exclusively in the two districts of Sangele and Tentena, where urban activities are concentrated. These districts have a higher ratio of permanent and semi-permanent type to temporary type houses than in other districts, suggesting a higher income level as a whole.

Regarding income of the people, a field survey conducted by the Study Team in this built-up area revealed that the average monthly income of the sampled households was Rp. 36,000, although that of 60% of the households was less than Rp. 25,000, as will later be stated in 5-6 Ability of the Consumers to Pay for Water.

Distribution of Occupations and Number of Facilities are shown in Tables 1-4-2 and 1-4-3 respectively reformed from the Report, where farmers account for 60%, more than half, of the population. It tells that Tentena is characterized predominantly by the nature of farming district, with few other industries or occupations.

Table 1-4-1 Districtwise Population

		Area (ha)	Population	No. of Households
1.	Sangele	150	2,223	297
2.	Tentena	100	1,112	169
3.	Pamona	250	838	123
4.	Petirodongi	200	549	105
5.	Tendeadongi	100	502	70
6.	Sawidago	200	1,251	221
	Total	1,000	6,475	985

Source: Office of Kecamatan Tentena, in 1979

Table 1-4-2 Distribution of Occupations

in 1977

Occupations	Percentage (%) 0 10 20 30 40 50 60
Farmer	==========
Merchant	====
Office Worker	==
Others	==========

Source : the existing Report

Table 1-4-3 Number of Facilities

in 1977

Category	Facility	Number
Education	Kindergarten	4
	Elementary School	9
	High School	9
	College	1
Economic	Store	32
	Office	14
	Hotel	1
Sanitary	Hospital	1
Religion	Church	5
	Mosque	1

Source : the existing Report

II. REVIEW OF PROPOSED WATER SUPPLY PLANNING

2-1 General

In this chapter, firstly the existing water supply facilities are briefly described, and secondly the results of review of the basic factors for the planning of the present project proposed by the existing Report are set forth, supplemented by the Study Team's field reconnaissance and additional study.

2-2 Existing Water Supply Facilities

In Tentena there is no public water supply system, except for a few water supply facilities, which supply water to a plural number of consumers. One is a water supply system for the use of a hotel and several houses. It takes water from the Latea river at a point about 3 km upstream from the town, and conducts the water by a small ditch, dug specially for this purpose, up to a distribution box, from which each house receives water by a pipe.

A second water supply system, which supplies a hospital with drinking water, consists of an intake from a spring, a pump, and an elevated tank, together with certain related piping. Some households in the neighbourhood are also supplied by this water supply system. As the yield of the spring is quite limited, only 2.6 l/sec, there is no possibility of expanding this system for the general public water supply.

Except for the above two water supply systems, there is no significant water supply system in the town. Most of the inhabitants rely on the surface water of the Poso river and other streams for their domestic uses.