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

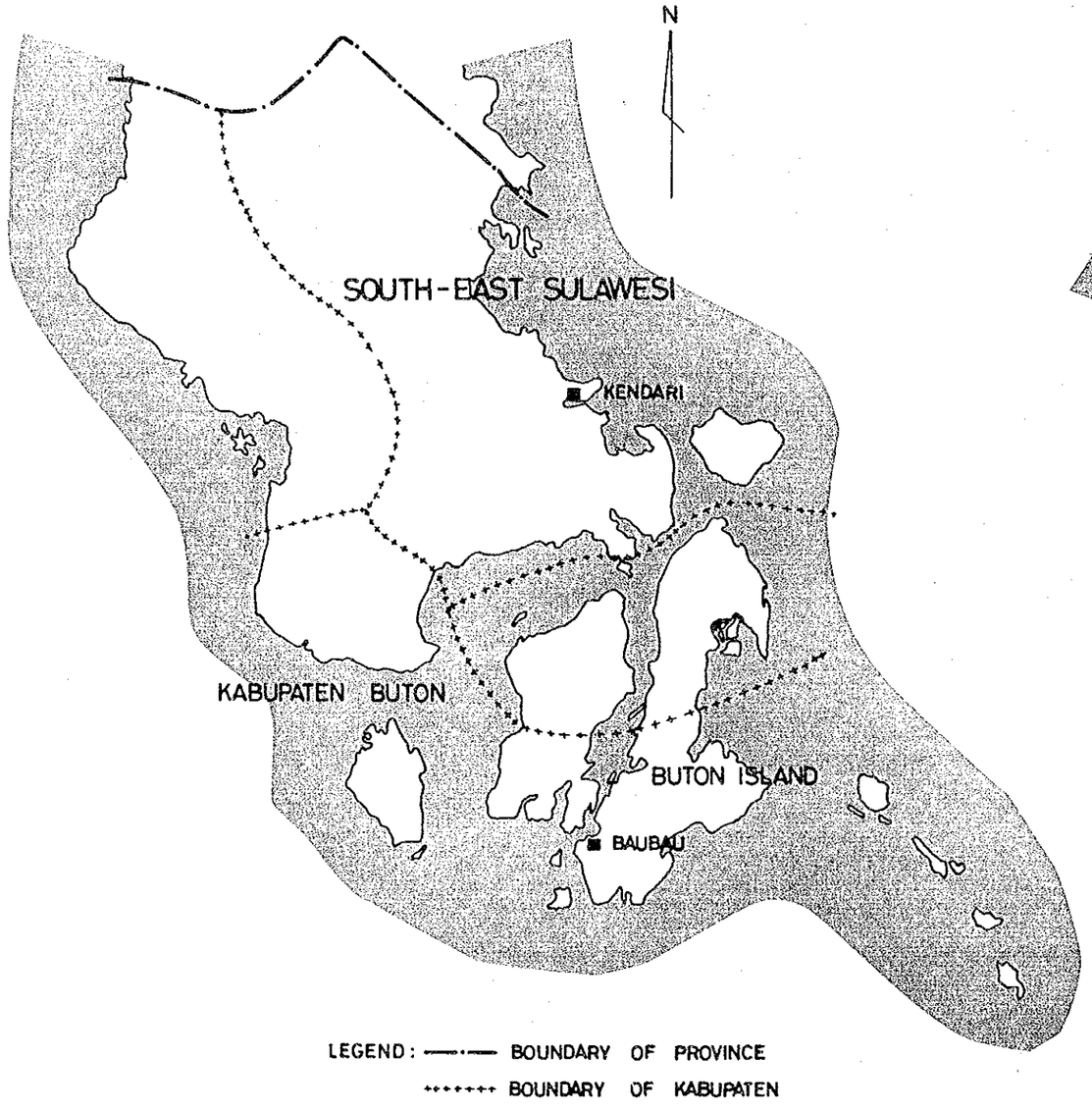
Baubau is the name of a built-up area of which a half belongs to Wolio Sub-regency and another half to Betoambari Sub-regency, and the two Sub-regencies belong to Buton Regency, Province of Southeast Sulawesi, as shown in Fig 1-4-1. The area which is termed Baubau is the present study area.

The geographical location of Baubau is 122°59' east longitude and 5°48' south latitude. The twon is at the river mouth of Baubau and on the seacoast of Buton island south east of the main island of Sulawesi. The Baubau river, which flows through the town, divides the built-up area into the above said two Sub- regencies. A main topographical feature of Baubau is that all the area consists of gently undulating hills with little flat land, the built-up area spreads in the range of elevation 0 to 100 m above sea level.

Baubau has a seaport and an airport having convenient connection with other cities in the main island and other islands of the country. Thanks to the good sea transportation, the twon has developed since very olden times, and even today there are old remains of temple and palace. Besides the town has a good command of scenic beauty of the thickly forested hills and the calm sea dotted with green islands. These will have a beneficial effect on the future development of the town.

1-4-2 Socioeconomic Aspects

Baubau consists of 14 districts as shown in Table 1-4-1 compiled from the Report and covers an area of 3,381 ha. Half of the districts have a rather high population density and others include hilly areas not fit for dwelling. According to the same table, the total population was 35,498 and the number of households 5,433 in 1977.



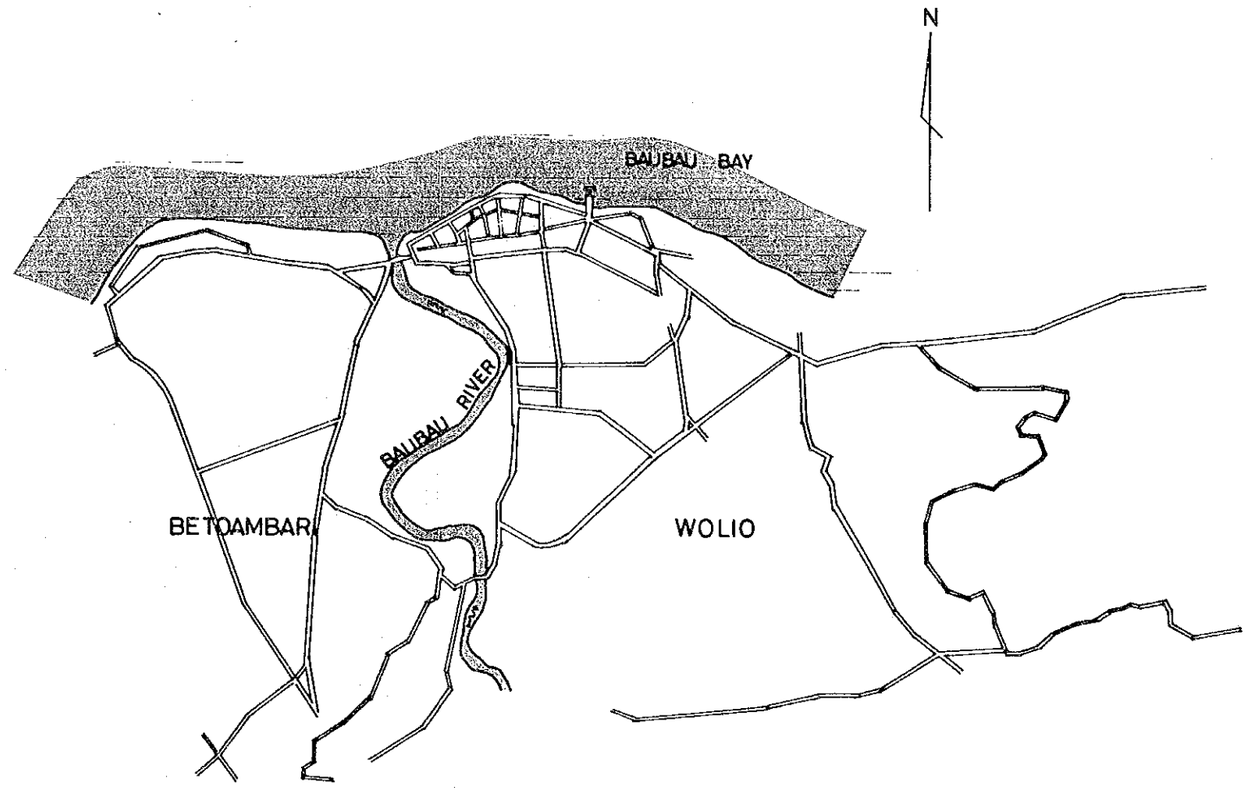


FIG. 1-4-1 MAP OF BAUBAU 1:2.000.000 1:20.000

Table 1-4-1 Districtwise Population

(quoted from the Report)

Districts	Area (ha)	Population	No. of Households
1. Wale	32.50	2,737	363
2. Tomba	48.50	3,972	594
3. Wangkanapi	263.75	2,523	269
4. Batulo	52.50	2,598	368
5. Kadolomoko	288.75	2,166	357
6. Ngangana Umala	64.00	3,230	476
7. Kaobula	35.00	1,160	199
8. Meo Meo	63.75	3,429	607
9. Bone-Bone	42.50	1,813	361
10. Katobengke	1,243.75	3,932	805
11. Wajo	228.75	3,430	604
12. Melai	306.30	1,166	250
13. Baadia	451.25	929	201
14. Liwuto	260.00	2,413	494
Total	3,381.30	35,498	5,433

Source: Office of Population Statistic Bureau of Buton Regency in 1977, and that of Walio Sub-Regency in 1977.

As the distribution of occupations and the number of facilities vizualize fairly well the character of the town, Table 1-4-2 and 1-4-3 are reproduced from the existing Report. As seen in the tables, the percentage of farmers and fishers is high compared with others, and on the other hand there are many establishments, such as schools, offices, shops, hotels, etc. These two features say that the town is a typical rural city which has two different elements combined, rural and urban. Further, the number of craftsmen accounts for more than 20%, a high percentage. This is because there are a number of home industries for artifact.

As for the average income of the people, the Report says that the estimated average income per month per household for 1980 is Rp. 36,000. This estimated value was claculated based on an assumed annual increase rate of income, 12.81%, with the 1973 income as basis for calculation.

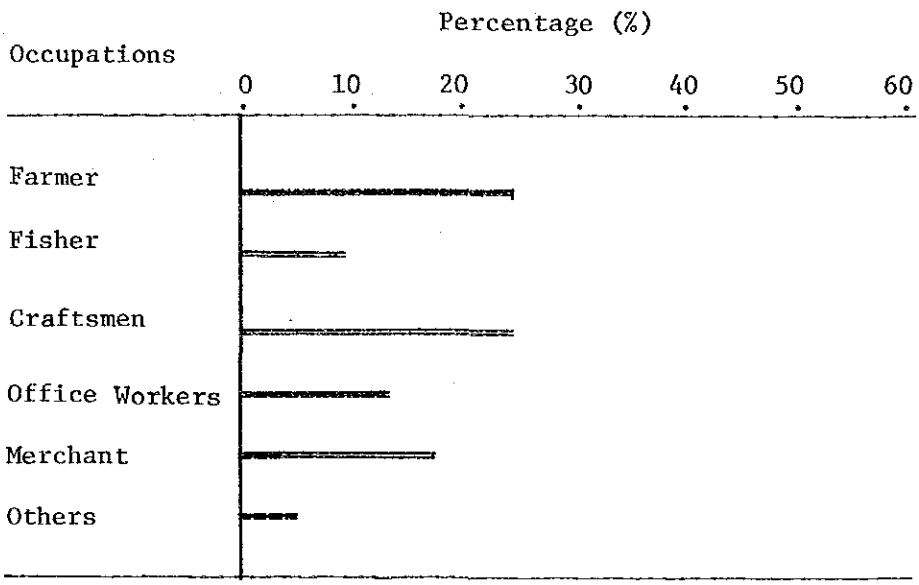
In the newly developing area on the left bank of the Baubau river, a housing scheme is now actively under way. All the roads and ditches have already been completed, and new dwellers are moving in to this area.

The most important trasnportation means for Baubau is marine transportation. Therefore, the port has regular shipping service with other major ports in the country, as well as an oil supply facility is now under construction to facilitate the marine activities.

The overall living environment of the area is in good conditions, with most roads paved, gutters provided, greens along the roads well maintained, and so forth.

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	6
	Elementary School	29
	High School	20
	College	1
Economic	Store	51
	Factory	74
	Hotel	5
Sanitary	Hospital	3
Religion	Church	2
	Mosque	22

Source : the existing Report

II. REVIEW OF PROPOSED WATER SUPPLY PLANNING

2-1 General

This chapter describes first the existing water supply of Baubau, and proceeds then with review mainly the basic factors for water supply planning of the existing Report. As the presently used water sources have still some room for more utilization, emphasis is placed on maximum use of those water sources. Another emphasis is placed on inclusion of urgently water requiring areas into the present project with an aim of making the plan as realistic as possible not distorting the intention of the existing Report.

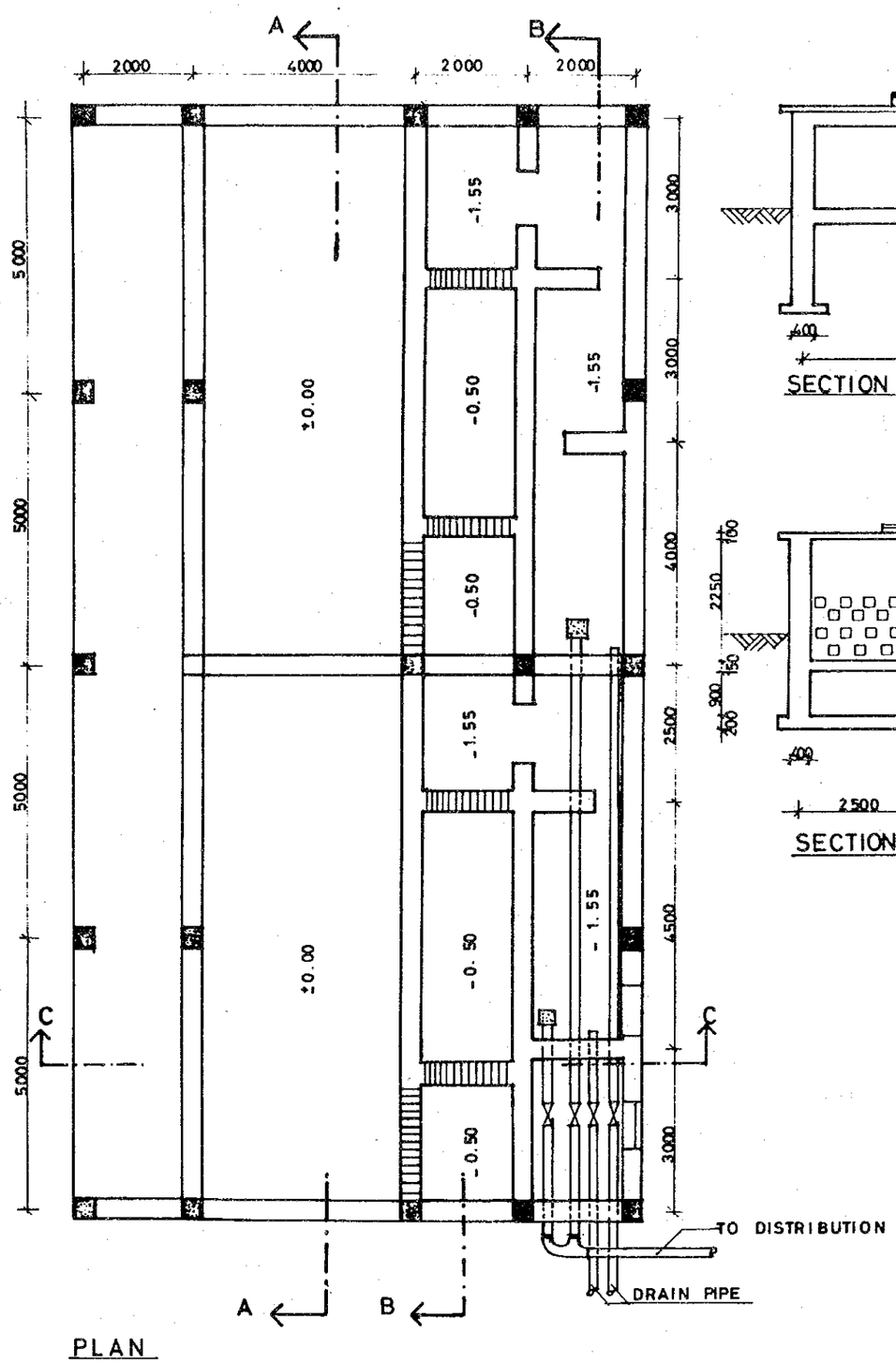
2-2 Existing Water Supply

2-2-1 Existing Water Supply Facilities

As details are described in the existing Report, the public water supply system of Baubau came into operation in 1928. The system is composed of three water sources, Wamembe, Wakonti and Matapu springs (Refer to Fig 3-3-1). Pipe systems of the former two is interconnected, but the last one has its own independent system because of its geographical location. Major features thereof are as follows.

1) Wamembe Spring

The spring is located 6 km east away from the city at an elevation of 100 m above sea level. Its yield is said to be 35 l/sec, but actually there is plenty of overflow from the intake facility, therefore the yield is believed to be about 45 l/sec. The existing intake facility of Wamembe spring is shown in Fig 2-2-1 taken from the Report. The water is transmitted by a transmission main, 125 mm in diameter and 3,000 m in length, to a service reservoir with a capacity of 600 cu m. At the reservoir there is a large amount of overflow due to insufficiency of distribution system. The distribution networks consist of pipelines, 125 mm and below,



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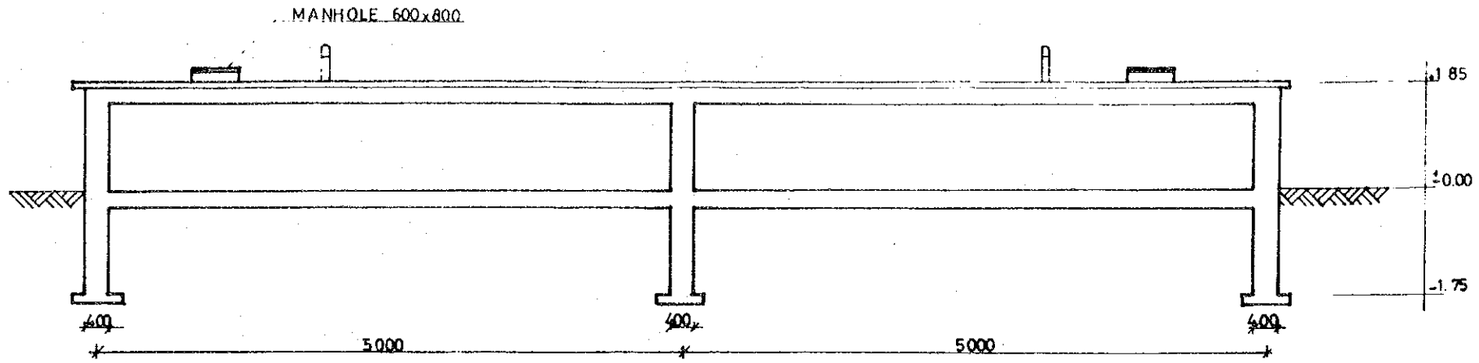
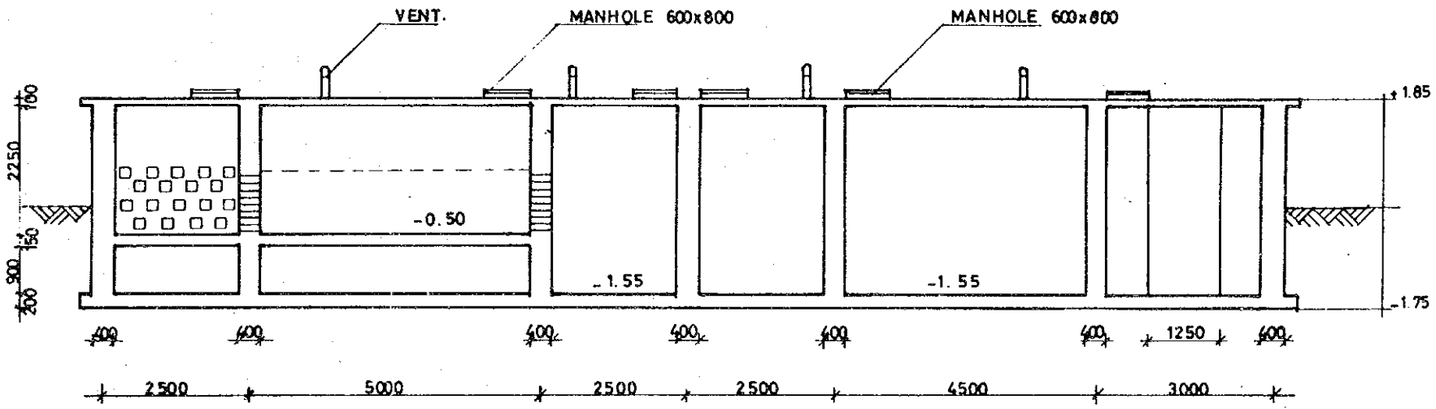
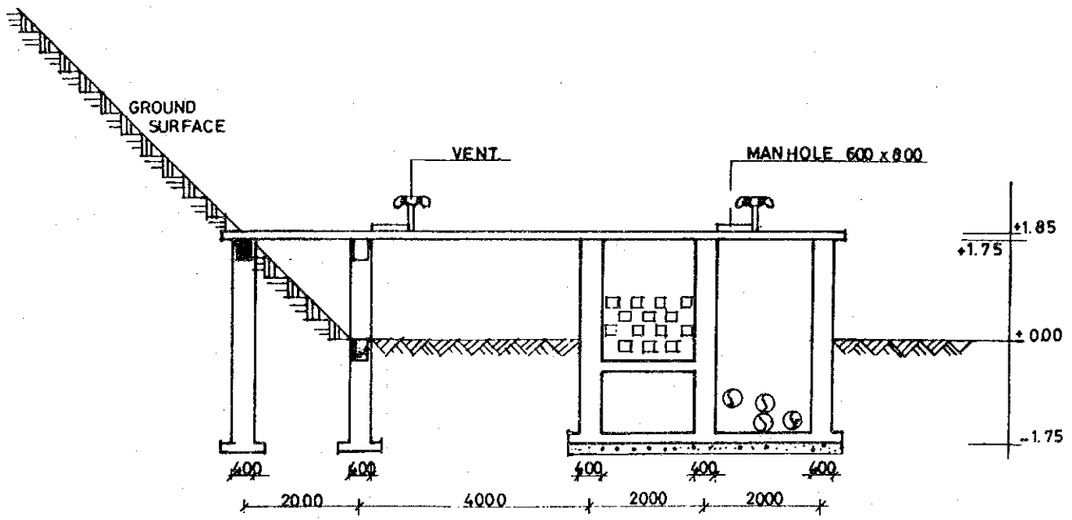


SECTION A-A



SECTION B-B



SECTION C-C

FIG. 2-2-1 EXISTING INTAKE FACILITY OF WAMEMBE SPRING 1 : 100

(TAKEN FROM THE EXISTING REPORT)

and are connected with that of Wakonti system as briefed below. A special feature of this system is that house connections are in principle equipped with water meter, presently 500 metered connections, and are charged by meter reading.

2) Wakonti Spring

It is located 5 km east away from the center of the city, at an elevation of 165 m above sea level. Its yield varies 5 to 7 l/sec according to the season; the transmission pipeline cannot accomodate all the yield leaving plenty of overflow at the intake. The water is conducted by a transmission pipeline 125 mm in diameter and 4,400 m in length to a service reservoir with a capacity of 300 cu m. The distribution pipelines of this system are connected with that of Wamembe system but are operated independently from Wamembe system by valves. It supplies intermitently, only twice a day due to insufficiency in water source. House connections of this system are not metered and charged on a flat rate because of this poor supply condition.

3) Matapu Spring

The spring is located 5 km south away from the city. As its yield is not more than 4 l/sec in the wet season, served population is quite limited. Deteriorated pipe must be repaired, but there is no possibility of increasing the supply from this source.

2-2-2 Operation of Water Supply

The city has an established organization for operation of the existing water supply system, staffed with 17 staff and personnel in total. The activities cover all operation and maintenance of the water supply facilities, and further meter reading once a month and issuing and collecting the water bills. When a bill is delinquent for two months even with claiming, the connection would be cut.

The budget of the organization is not at present separated from the general budget of the city. The statements for the past three years revealed that there have been some profits in the water supply business.

In connection with the water supply in the city, a newly developed area, situated on the left side of the Baubau river, has no public water supply. All the inhabitants in this area are obliged to buy their domestic use water from the water vendors. The vendors take water from a shallow well located near the river, which produces good quality water. As the price of the water from the vendor is excessively high and quantity is limited, the desire of the inhabitants to have a public water supply is especially keen.

2-3 Population

2-3-1 Population Data

The existing Report has some population data. Among the data, most necessary for the water supply planning are statistics of the total population, so the statistics are reproduced from the Report below in Table 2-3-1 Population Data. Regarding this table, it must be mentioned here that the total population of the table has a small difference from the actual figure, because division of Sub-regencies has been changed for administrative reason since the preparation of the Report. But it was found by the present field survey that such difference in population or redivision of sub-regencies does not affect the population in the present study area.

Table 2-3-1 Population Data

(quoted from the Report)

Year	Population
1973	31,134
1974	32,027
1975	33,117
1976	34,752
1977	35,498

Source : Office of Kabupaten Buton

As is observed in the table, the past growth of population in Baubau is constant and stable, showing arithmetic character of growth. Growth of each year is around 1,000. It will be kept in mind in review of the population projection of the Report.

2-3-2 Population Projection

The Report has used three different methods for population projection, namely 1) arithmetic method, 2) geometric method (1), and geometric method (2). And it has adopted the result of calculation by the arithmetic method. Regarding selection of one method from the three, whichever method may be taken, there will not be much difference as far as the projection is for a short-term future. But for this case the arithmetic method is preferable and appropriate, because the population growth has been rather constant, as stated in the foregoing section.

Further, the Report has assumed 5,500 persons for every five-year growth and prepared Table 2-3-2 as shown below. This figure is appropriate from the past trend .

Table 2-3-2 Projected Population

(quoted from the Report)

Year	Population
1985	44,200
1990	49,800
1995	55,300
2000	60,800
2005	66,300

2-4 Population Served and Water Demand

2-4-1 Present Water Use

In order to review the appropriateness of the projection of population served and water demand prepared by the Report, present water use will firstly be reveiwed which is one of the bases for the above projection.

Previously, the section 2-2 Existing Water Supply stated that the existing water supply system covers only the eastern part of Baubau, and the water sources of the existing system are Wamembe, Wakonti and Matapu springs.

Further, from the present field survey and the Report, the following information has been obtained, namely, 1) population served by this system is 2,522, 7% of the total population, and 2) average daily distribution is estimated as about 3,000 cu m/day. Whereas the distributed water is a fairly large quantity, the real consumption is only a part of that quantity, because most portion thereof is being wasted as overflow.

On the other hand there are great many people who have no access to the water supply, especially on the left bank of the Baubau river. They are obliged to buy high priced water from the water vendor, so they eagerly desire to have a public water system installed.

2-4-2 Population Served

The existing Report has made an estimation of population served in the coming years, as shown in Table 2-4-1 Estimated Population Served, quoted from the Report. The Report, considering the urgency of public water supply and willingness of the people as described in the above paragraph, has assumed rather high percentages of population served as are shown in the same table. For the target year of the present project 1985, a percentage 70 % is assumed. The Study Team, to ascertain the appropriateness of such proposal, made a field reconnaissance, and realized that the proposal is adequate because in addition to the urgency and willingness the congested built-up area makes it possible for most households to take the public water supply.

Table 2-4-1 Estimated Population Served

(quoted from the Report)

Year	Population	Percentage	Population Served
1985	44,200	70	31,000
1990	49,800	80	39,800
1995	55,300	90	49,800
2000	60,800	90	54,700
2005	66,300	95	63,000

2-4-3 Water Requirements

The Report, based on the projection of population served and considering the conditions of water supply, has made an estimation of water requirement. As for the process of the estimation, the usually practiced method was utilized, namely, to multiply the unit consumption by the population, or the number of beds, or the like. The results of the estimation by the Report are shown in Table 2-4-2 Water Requirements. (Refer to Appendix A).

The unit consumptions employed by the Report are tabulated below.

1)	Domestic use by house taps	served population	x	100	l/c/d
2)	Domestic use by public hydrants	served population	x	30	l/c/d
3)	Institutions	office workers	x	20	l/c/d
4)	Industrial facilities	number of factories	x	1.8	cu m/d
5)	Hotels	number of beds	x	75	l/bed/d
6)	Shops & Markets	number of units	x	0.6	cu m/d
7)	Medical facilities	number of beds	x	280	l/bed/d
8)	Schools	pupils	x	16	l/c/d
9)	Religious institutions	number of units	x	1.75	cu m/d
10)	Harbor	number of ships per day	x	4	cu m/d

All the figures in the above table are considered acceptable, with some comments. Domestic uses by house tap and by public hydrant are adequate considering the figures which are being used for similar projects in Indonesia and the results of the study by the Study Team. The unit consumption per bed for medical facilities is rather high. It should be checked in the future. All others are considered appropriate at this stage.

In the meantime, the Report has also estimated the water requirements after the present target year 1985, as shown in Table 2-4-2. For this estimation, the Report has allowed a gradual increase in both the numbers such as population, beds, etc. and the unit consumptions. This method is proper, but the actual development of these figures should be reviewed when the project is put into normal operation.

Table 2-4-2 Water Requirements

	Item and Unit		1985	1990	1995	2000	2005
	Domestic						
	Domestic Use	a	100	125	125	150	150
		b	1,990	3,421	4,492	6,385	7,463
	Public Hydrant	a	30	30	30	30	30
		b	332	373	415	365	398
	Sub-total	b	2,322	3,794	4,907	6,750	7,861
	Non-domestic						
	Institution	b	19	24	29	35	39
	Hotel	b	8	10	11	15	17
	Shop and Market	b	45	60	69	78	93
	Factory	b	153	195	242	294	348
	Medical Facility	b	67	79	109	135	157
	School	b	198	271	338	404	464
	Religious Institution	b	54	64	76	92	113
	Others	b	18	21	25	44	51
	Sub-total	b	562	724	899	1,097	1,282
(1)	Total Water Consumption	a	93	114	117	143	145
		b	2,884	4,518	5,806	7,847	9,143
		c	33	52	67	91	106
(2)	Unaccounted-for Water (2) =(1) x 0.30	b	865	1,355	1,742	2,354	2,743
(3)	Average Day (3) =(1) + (2)	a	121	148	152	186	189
		b	3,749	5,873	7,548	10,201	11,886
		c	43	68	87	118	138
(4)	Maximum Day (4) = (3) x 1.25	a	151	184	189	233	236
		b	4,670	7,321	9,414	12,751	14,858
		c	54	85	109	147	172

Note : a =per capita per day (l/c/d)
b =cubic meters per day (cu m/d)
c =liter per second (l/sec)

2-5 Water Source

The recommended water sources by the existing Report are Wamembe and Wakonti springs, which are presently utilized for the existing water supply system. To make certain their suitability, the Study Team made a field survey of these water sources in late April 1980.

The yield of the Wamembe spring is estimated at 45 l/sec as stated in the preceding section. As for quality of the spring, the analytical results of our investigation show that it is suitable for drinking as shown in Table 2-5-1. In addition Table 2-5-2 Water Quality Standard is attached for reference. There is no need for water treatment.

The yield of the Wakonti spring is comparatively small, but it has still room for expansion, and it will be utilized for the present project. About the water quality, there is no problem like that of Wamembe, as shown in Table 2-5-1. It has a slightly higher contents of total hardness and alkalinity, though not requiring any treatment.

From the above, these two water sources should be made full use of for the present project with the target year 1985, despite any minor difference between the estimated water demand and the total yield of the springs. Only if the spring water should be justified as not enough for 1985 target, then the next project could be advanced as required.

2-6 Water Tratment

As is clear in the preceding section, there is no need for treatment for the spring water of Wamembe and Wakonti, and no treatment facilities are proposed.

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

Item	Unit	Sources		
		Wamembe Spring	Wakonti Spring	Matapu Spring
Date, Time		30-4-80 10:00	30-4-80 12:00	30-4-80 14:00
Weather		fine	fine	fine
Atmospheric Temperature	^{o}C	27.5	28	28.5
Water Temperature	^{o}C	25.5	25.5	27.5
Color as Pt.Co	Unit	0	0	0
Turbidity	FTU	2	2	3
pH		7.1	6.9	7.1
Alkalinity as CaCO3	mg/l	160	180	190
Total Hardness as CaCO3	mg/l	120	115	120
Chloride as Cl2	mg/l	18	18	17
Total Iron as Fe	mg/l	less than 0.1	less than 0.1	less than 0.1
Coliform Groups	/100 ml	negative	negative	negative
Total Bacteria	/ml	40	15	90
Ammonia-N as NH4	mg/l	less than 0.2	less than 0.2	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.

As regards disinfection, it has a different purpose from treatment, namely, it is used for preventive purpose of epidemic diseases. For example, when some epidemic water borne disease is prevalent, and contamination of the water is feared, it is most advisable to dose chlorine in the drinking water. It is to kill germ which may enter in the water and keep the drinking water safe.

2-7 Future Water Supply System

By the present project all spring water sources that are located rather close to the central part of the city and can be developed with moderate construction costs are to be exhaustively utilized, leaving no more undeveloped spring water sources nearby. Therefore, new water sources have to be developed for future water supply extension projects. In this connection the existing Report mentioned two water sources, Kosombu spring and Baubau river. Consideration on the two candidate water sources are as follows.

1) Kosombu spring

According to the existing Report it has a yield of 40 l/sec, a sizable quantity, the only demerit of this water sources is its distance from the city; it is about 22 km. As the spring is located in the mountains, construction of the transmission pipeline will be rather expensive. Utilization of this water source requires careful engineering and economic study.

2) Baubau river

So far no detail investigation of the river has been made, although its name was mentioned by the existing Report. As the river is conveniently located in the center of the city, it should be exploited for the use of the water supply of the city. To take water from the river, the following investigation should be undertaken:

a. Discharge of the river at least for one year.
b. Water quality of the river once a month for a year.
c. The farthest limit from the estuary where sea water comes up.
d. A place where a treatment plant can be constructed.
e. A place where a service reservoir can be constructed, the elevation of which is desirable to be about 50 m above sea level.

III. REVIEW OF DESIGN CRITERIA AND PRELIMINARY DESIGN

3-1 General

The existing Report contains all necessary design criteria and preliminary designs. The proposed design criteria were prepared based on the current water supply engineering practice in Indonesia. Some of them may not necessarily be perfect, because reliable data are unavailable in the country due to lack of similar water supply systems. However, the proposed design criteria are, as a whole, acceptable with minor modifications for the present project, only except for the water source development. It must be noted that the Study Team proposes a full utilization of the present water sources, without depending on a new water source of the Baubau river as proposed by the existing Report, which certainly has a vital influence on the construction cost.

In the following sections, major items of design criteria and preliminary designs are presented.

3-2 Design Criteria

The existing Report has the following design criteria, which are considered in general appropriate and acceptable for the present project. These criteria have all been practiced in water supply engineering design in the country.

1) Factor for maximum daily consumption 1.25 and that for peak hourly consumption 1.75.
2) Capacity of service reservoir to be calculated from the daily consumption curve.
3) Flow velocity in pipe 0.8 to 3.0 m/sec.
4) Pressure at the pipe end 15 m.

In addition to the above, the Study Team proposed the following criteria after due consideration of the local conditions such as the water sources to be utilized, the topography of the served area, etc. based on the findings in the field.

1) Intake facility, transmission pipeline, storage capacity of the service reservoir and trunk distribution pipeline shall be designed to full utilize the yield of each of two water sources, Wamembe and Wakonti.
2) Secondary distribution pipelines shall be installed to meet the requirement in 1985.
3) Pressure at the pipe end 15 m can be decreased as required by the topographycal condition.
4) Calcium hypochlorite shall be used.
5) Fire hydrant will not be provided in the present project.

In connection with the above item 1), the existing service reservoirs have enough capacity for 1985 consumption.

3-3 Preliminary Design

The existing Report provided a preliminary design based on the following principle:

a. Target year of the first stage project, 1995.
b. Water sources to be used, Wamembe, Wakonti and Matapu.
c. Development of the Baubau river for water supply in 1982.

Against the above, the present report proposes as follows:

a. Target year of the present project, 1985.
b. Water sources to be used, Wamembe and Wakonti, full yield of which will be utilized.
c. The Baubau river will not be developed for water supply in this stage.

Preliminary design prepared based on the above principle is shown in Fig 3-3-1 Proposed Water Supply System, and an outline of the facilities is described below. Regarding distribution of water, the two water sources are designed to have separate distribution systems, taking into consideration the elevations of the existing service reservoir.

1) Transmission Pipeline

- From the Wamembe spring to the Wamembe reservoir.

  Capacity : 45 l/sec
  Material : DCIP or GSP
  Length : Ø 250 x 3,000 m

- From the Wakonti spring to the reservoir.

  Capacity : 15 l/sec
  Material : DCIP or GSP
  Length : Ø 150 x 4,400 m

2) Solution Tank of Calcium Hypochlorite

  Material : Fiberglass
  Number of sets : 2 sets, one for Wamembe and one for Wakonti
  Component of set : 2 solution tanks with capacity of 300 liter each together with a feeding device.

3) Distribution Pipeline

  Material : DCIP/ACP/PVC
  Length : Ø 300 x 1,600 m
  Ø 250 x 1,300 m
  Ø 200 x 1,550 m
  Ø 150 x 4,150 m
  Ø 175 x 6,350 m

4) House Connection and Public Hydrant

  Number of house connection : 3,200 units
  Number of public hydrant : 55 units

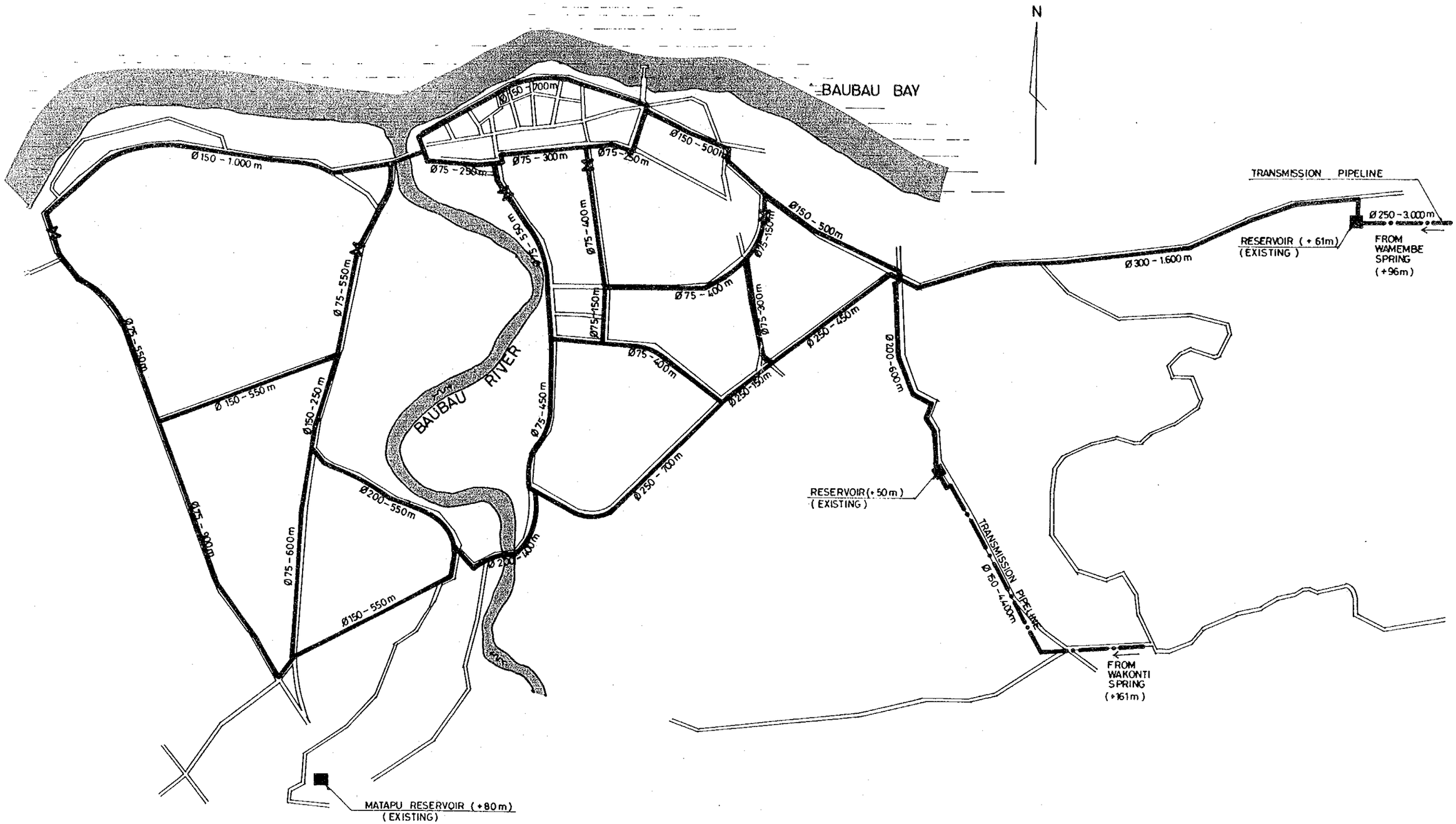


FIG. 3-3-1 PROPOSED WATER SUPPLY SYSTEM 1 : 10.000

IV. REVIEW OF COST ESTIMATE AND IMPLEMENTATION SCHEDULE

4-1 General

The existing Report estimated all the construction costs of the project. But as some revisions in work have been proposed as described in the preceding chapter III Review of Design Criteria and Preliminary Design, the construction costs for the present project are again estimated hereinafter, and in connection with the estimation some factors which have to do with the costs are also considered as presented below. The implementation schedule for the project is prepared which intends the start of operation within 1982.

4-2 Consideration on Labor, Materials, etc.

Baubau is geographically isolated from the main island of Sulawesi by the sea, but with respect to transporation it is very conveniently located being connected with major cities of the country, such as Ujung Pandang, Jakarta, Surabaya, etc. by sea transport. Because of this advantageous location, Baubau has been a center of transportation since olden times. And it also is beneficial for all construction works in Baubau.

1) Contractors and Labor

Regarding contractors and labor, there is no problem to hinder the construction works. The central government and local government in Sulawesi keep a list of contractors and suppliers available for any type of work and classified according to their ability. Unskilled labor is locally available and skilled labor is usually provided by the contractor from other cities.

2) Materials

Aggregates for concrete work are available at the site and cement is transported from Ujung Pandang. Piping materials, both domestic and imported, are available from Jawa. Their costs are about 15 % higher than in Jawa because of the transportation charges.

4-3 Construction Cost

Table 4-3-1 shows the estimated construction costs. (The breakdown of estimated construction costs is attached in Appendix B). All the unit costs are those as of May 1980, which are obtained from on-going projects in Indonesia similar to the present project. For 1982 costs, in which 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 some supplemental surveys, construction supervision, etc. are provided with an allowance 8% of the construction cost plus escalation and contingency. Table 4-3-2 shows the estimated project cost including all the above.

4-4 Implementation Schedule

The target of project completion set by Cipta Karya being considered, an implementation schedule of the project is prepared as shown in Fig 4-4-1. Cipta Karya desires the project to be completed and commissioned within 1982. In preparing the schedule with this time limit, all the requirements for time and procedures in financing, tendering, construction, etc. are duly considered.

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 Cost

Rupiahs 1,000

Item	Foreign Exchange	Local Currency	Total
1. Transmission Pipeline (Wamembe)			
Ø 250 x 3,000 m	Rp 27.5/m 82,500	Rp 10.9/m 32,700	115,200
2. Transmission Pipeline (Wakonti)			
Ø 150 x 4,400 m	Rp 15.8/m 69,520	Rp 7.5/m 33,000	102,520
3. Distribution Pipeline			
Ø 300 x 1,600 m	Rp 37.8/m 60,480	Rp 10.7/m 17,120	77,600
Ø 250 x 1,300 m	Rp 27.6/m 35,880	Rp 9.9/m 12,870	48,750
Ø 200 x 1,550 m	Rp 23.7/m 36,735	Rp 10.9/m 16,895	53,630
Ø 150 x 4,150 m	Rp 12.4/m 51,460	Rp 6.9/m 28,635	80,095
Ø 75 x 6,350 m	Rp 3.9/m 24,765	Rp 4.7/m 29,845	54,610
4. Bulk meter			
Ø 300 x 1 piece Ø 200 x 1 piece	lump sum 5,610	lump sum 1,830	7,440
5. Water Meter			
Ø 13 x 3,200 pieces	Rp 17.0/piece 54,400	Rp 1.7/piece 5,440	59,840
6. Public Hydrant			
Ø 18 x 55 pieces	Rp 30.0/piece 1,650	Rp 303.0/piece 16,665	18,315
Total Cost	423,000	195,000	618,000

Table 4-3-2 Estimated Project Costs

(1)

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

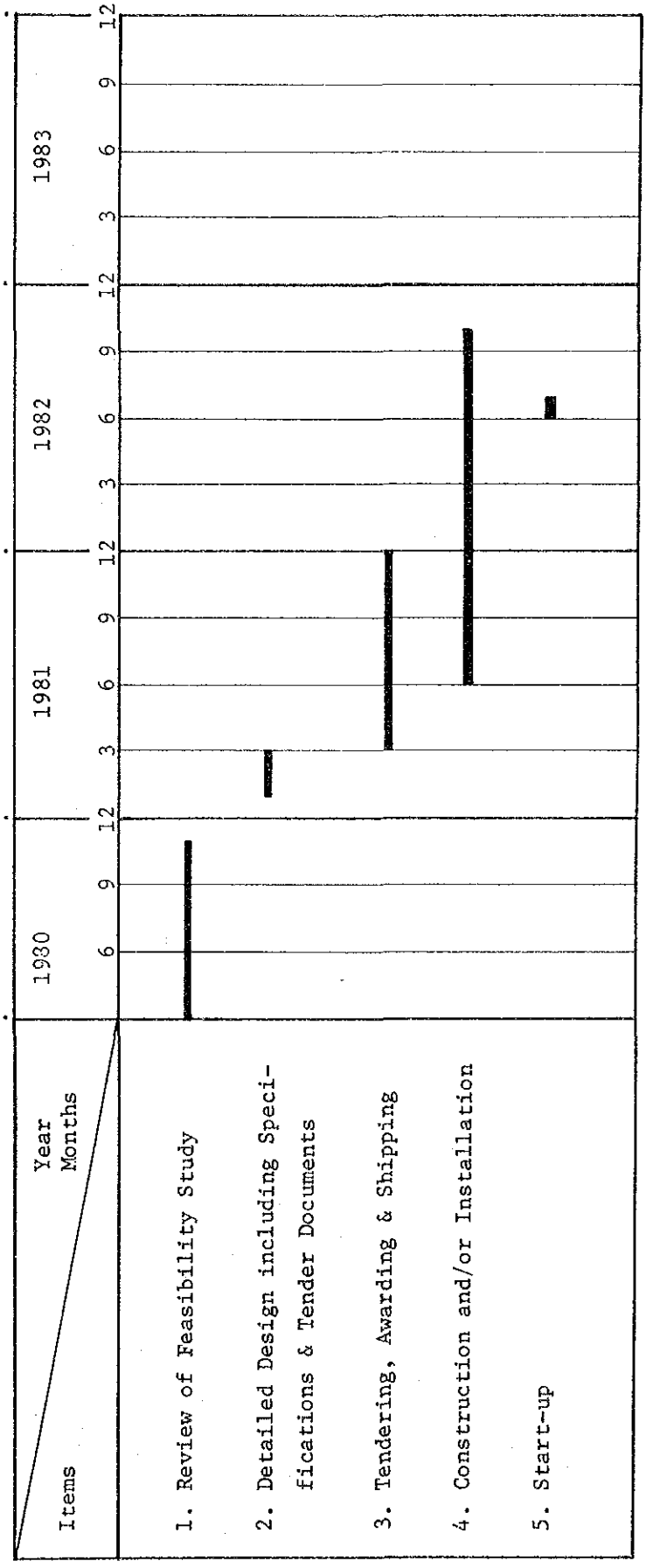
Item	Foreign Exchange	Local Currency	Total Cost
a. Construction Cost(2)	423 672	195 310	618 982
b. Escalation(3) (a x 32.25 %)	136 217	63 100	199 317
c. Sub-total	559 889	258 410	817 1,299
d. Contigencies (c x 20%)	112 178	51 82	163 260
e. Sub-total	671 1,067	309 492	980 1,559
f. Engineering Services (e x 8%)	11 17	68 108	79 125
Total Cost of Project	682 1,084	377 600	1,059 1,684

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 a detailed financial study in compliance with its engineering planning. However, as the planning by the Report has been revised in the present study, the financial feasibility will be studied over again hereinafter in line with the presently proposed works and the funding conditions as described in the following sections.

The study will be conducted in the following manner, that is, firstly the fund requirements and fund sources will be described, secondly financial feasibility will be examined under the conditions that the government is to provide a full grant to the project, and finally the water tariff system to be set up will be studied together with the checking of the paying ability of the consumers.

5-2 Funding Requirement

Funds required for construction of water supply facilities in Baubau are summarized in Table 4-3-2 Estimated Project Costs. Total cost necessary to implement the project is Rp. 1,059 million or US $ 1,684,000 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 in determining the units costs of goods and materials to be employed for calculation of the capital cost, local conditions of Baubau are 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 Cash Flow of Water Enterprise. The revenue of water sales is obtained by water sales time proposed water rate. The operation cost includes such costs as personnel salary, maintenance and operation, and office operation. Depreciation of the constructed facilities is considered in operation cost. Detail description of assumptions for financial projections is given in Appendix C in the present report. As can be seen in Table 5-4-1, Water Enterprise can generate revenue from 1986, although first three years the Enterprise has a deficit, which amounts to Rp. 10.7 million in 1985.

Table 5-4-1 Income Statement

(Rp 1 million)

	1983	1984	1985	1986	1987	1988
Water Production (m^3/year)	1,058,281	1,213,333	1,368,385	1,523,437	1,678,489	1,833,541
Water Sales (m^3/year)	814,096	933,378	1,052,666	1,171,442	1,291,224	1,410,506
Percentage Sales to Production (%)	77	77	77	77	77	77
Revenue Water Sales (1)	41.1	46.7	52.3	57.9	63.5	69.1
Other Fees	8.6	0.5	0.5	0.5	0.5	0.5
Total Billing	49.8	47.2	52.8	58.4	64.0	69.6
Less Provision for Bad Debt	0.9	0.9	1.0	1.2	1.3	1.4
Total Revenue	48.8	46.3	51.8	57.2	62.7	68.2
Operation Cost	51.1	52.5	54.0	55.5	57.0	58.8
Net Income (Deficit)	(2.3)	(6.2)	(2.2)	1.7	5.7	9.4

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	(2.3)	(6.2)	(2.2)	1.7	5.7	9.4
Depreciation	23.7	23.7	23.7	23.7	23.7	23.7
Government grant	1,059					
Total	1,080.4	17.5	21.5	25.4	29.4	33.1
Application of cash						
Capital expenditure	1,059	-	-	-	-	-
Total	1,059	-	-	-	-	-
Net cash inflow (outflow)	21.4	17.5	21.5	25.4	29.4	33.1
Cash at beginning	-	21.4	38.9	60.4	85.8	115.2
Cash at end	21.4	38.9	60.4	85.8	115.2	148.3

5-5 Water Rate

The proposed water rate for Baubau 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. Design of proposed water rate is given in Attachment I) of Appendix C.

Table 5-5-1 Water Rate

	Residential Rp	Commercial RP	Industrial Rp	Social Rp	Public Hydrant Rp
0 - 15 cu m/m	40	80	120	32	32
15 - 30 cu m/m	60	80	120	48	32
30 - cu m/m	120	160	200	64	32

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. 36,000.

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 Baubau, the average monthly income of consumers is found to be about Rp. 36,000, so it will be appropriate if the monthly payment is below Rp.1,440. In accordance with the proposed water rate, the average monthly water charge to be paid by consumers will be Rp. 600, in case they use 15 cu m of water in one month, which is far less than Rp. 1,440, and falls within 4 %.

VI. REVIEW OF ORGANIZATION

6-1 General

The existing Report proposed a new organization and operation of the water enterprise to be set up in Baubau in the long range of master plan, recommending to be a self-sustained basis in accordance with the guidelines of Cipta Karya. Although there exists an organization now operating water supply business, the Report did not mention the present system whether it will be extended or it will be reformed. The study, in that sense, did not necessarily reflect the present practices. The Study Team reviewed the existing study with emphasis on the utilization of the existing organization as much as possible in the immediate future of 1985, and recommends an organization to be set up after modification of the existing one so as to maintain a sound water supply business.

6-2 Present Organization and Operation

The present organization was established not long time ago to operate water supply in the town. The organization remains as one of the branch units of Public Works in the Municipal Office, far from self-sustained basis, providing, water supply services to about 500 houses.

The present organization is shown in Fig 6-2-1 Organization Chart of Water Supply Section. There are 17 staff in the organization at present. The organization is largely divided into two sections under the head, namely, Administration and Finance, and Operation and Technic. Among 16 staff under the head, five staff are assigned to Administration and Finance and the remaining 11 staff are under Operation and Technic. Five staff in Administration and Finance are in charge of general administration, accounting and bookkeeping, meter reading, and billing and collection, while 11 staff in Operation and Technic are in charge of maintenance of reservoirs and distribution pipelines.

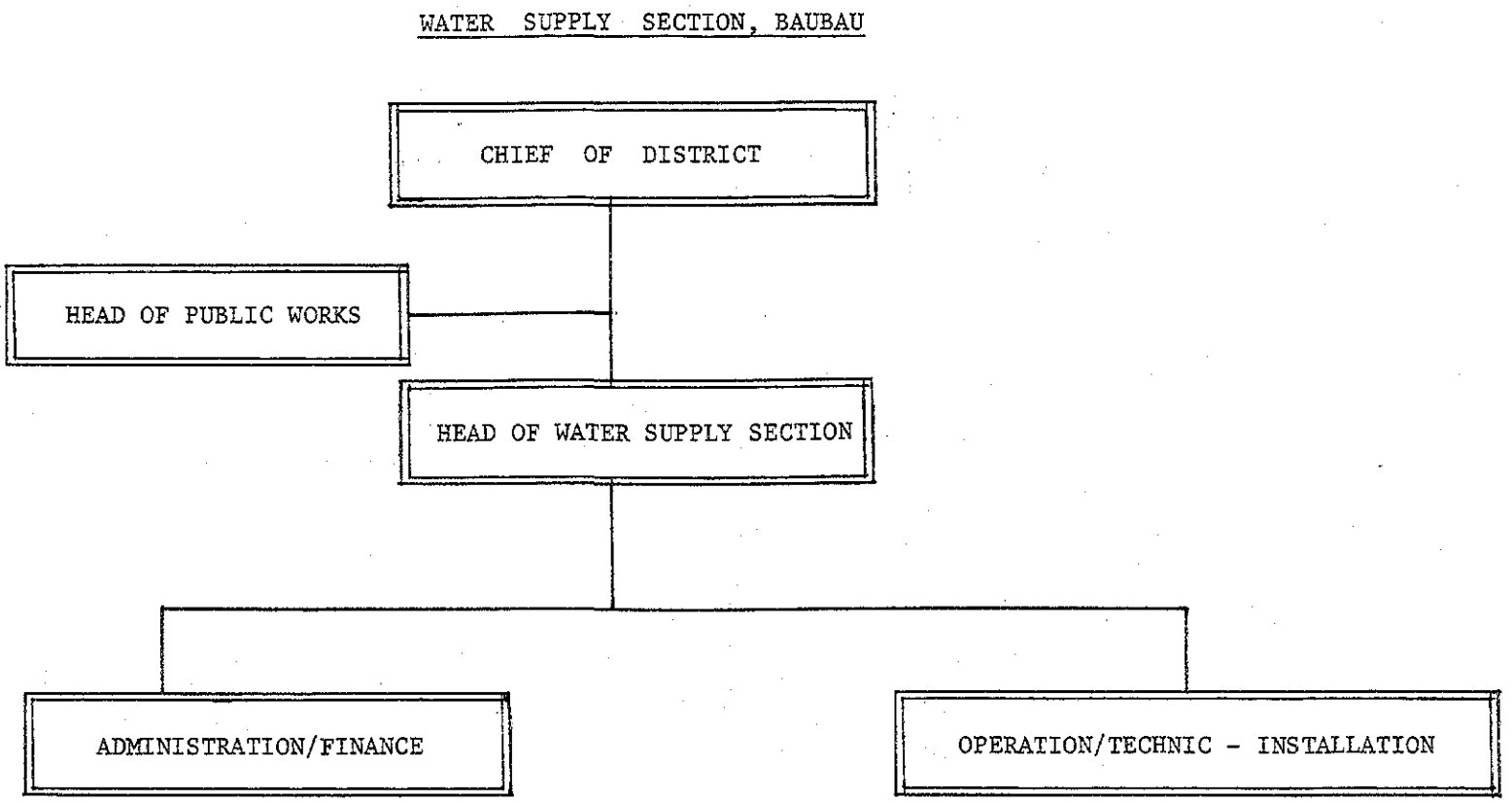


Fig. 6-2-1 Organization Chart of Water Supply Section

It is the intent of the Central Government to expand the existing water supply system in order to increase served population of the town, by the year 1985. In order to meet this expansion program, the present organization, which has still room to be improved, should be modified, so that it can provide people with proper service based on financial and technical soundness.

6-3 Recommended Organization

The existing Report has proposed the organization for the body of water supply enterprise for the target year of 1995 based on the principle directed by Cipta Karya as shown in Fig 6-3-1. This proposed organization is reviewed considering the present capacity thereof and the recommended organization for the Baubau Water Enterprise is presented in Fig 6-3-2. In preparing this organization following factors were considered :

1) To utilize the current organization as fully as possible.
2) To give capability of providing increased services to customers due to planned growth of water services.
3) To maintain financially self-supporting.

Besides, the recommended structure of organization is prepared along with the guidelines of Cipta Karya, however, modifying it to be more realistic and practicable in Baubau.

The Baubau Water Enterprise will be supervised and controlled by a Board of Management, which should be composed of Indonesian citizens appointed by the Head of Province. The enterprise should be managed by a full time manager experienced with waterworks operations. As shown in the Fig, the organization is structured into two major groups. One group will be responsible for financial and administrative matter and the other for technical operations and system maintenance.

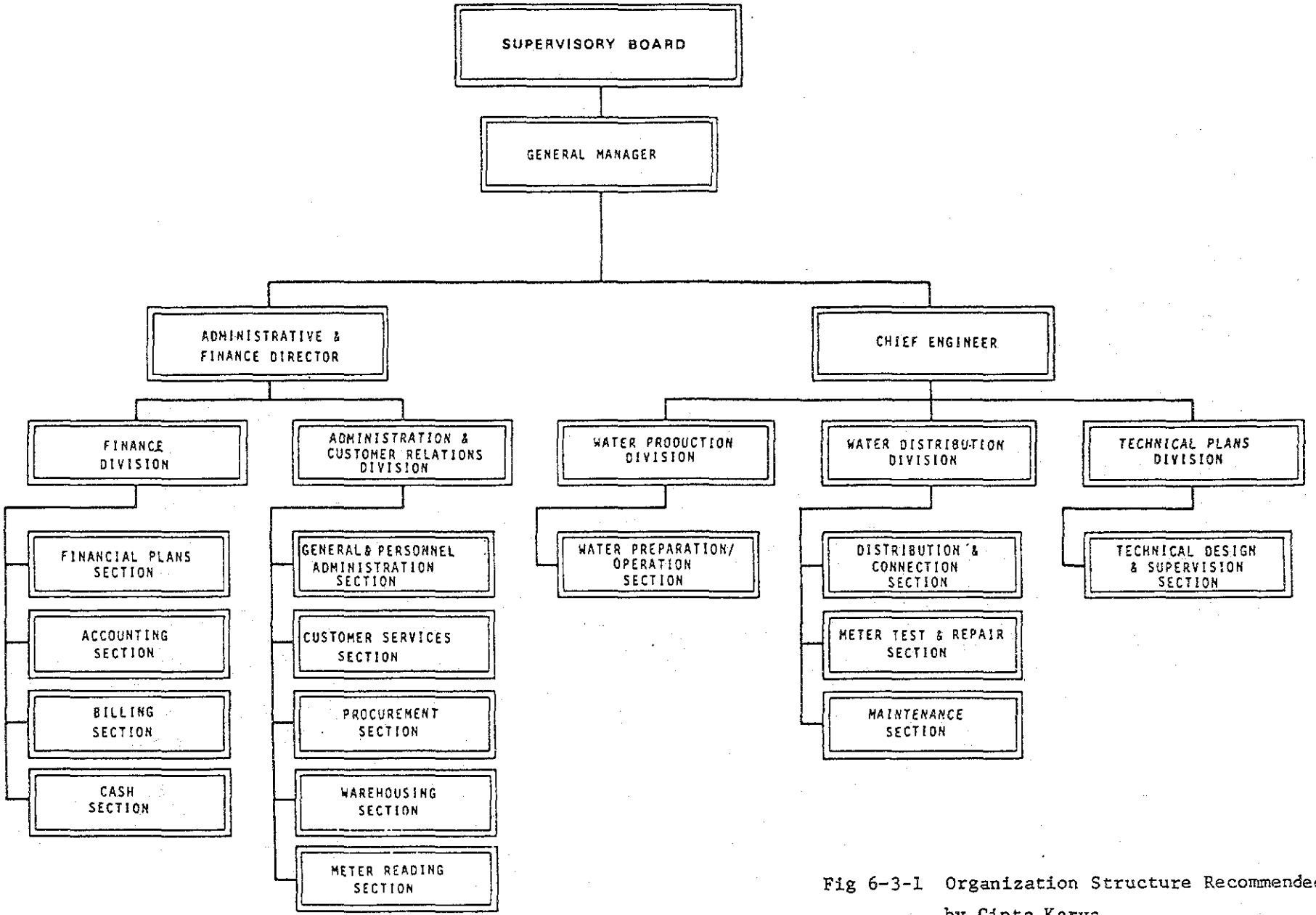


Fig 6-3-1 Organization Structure Recommended by Cipta Karya

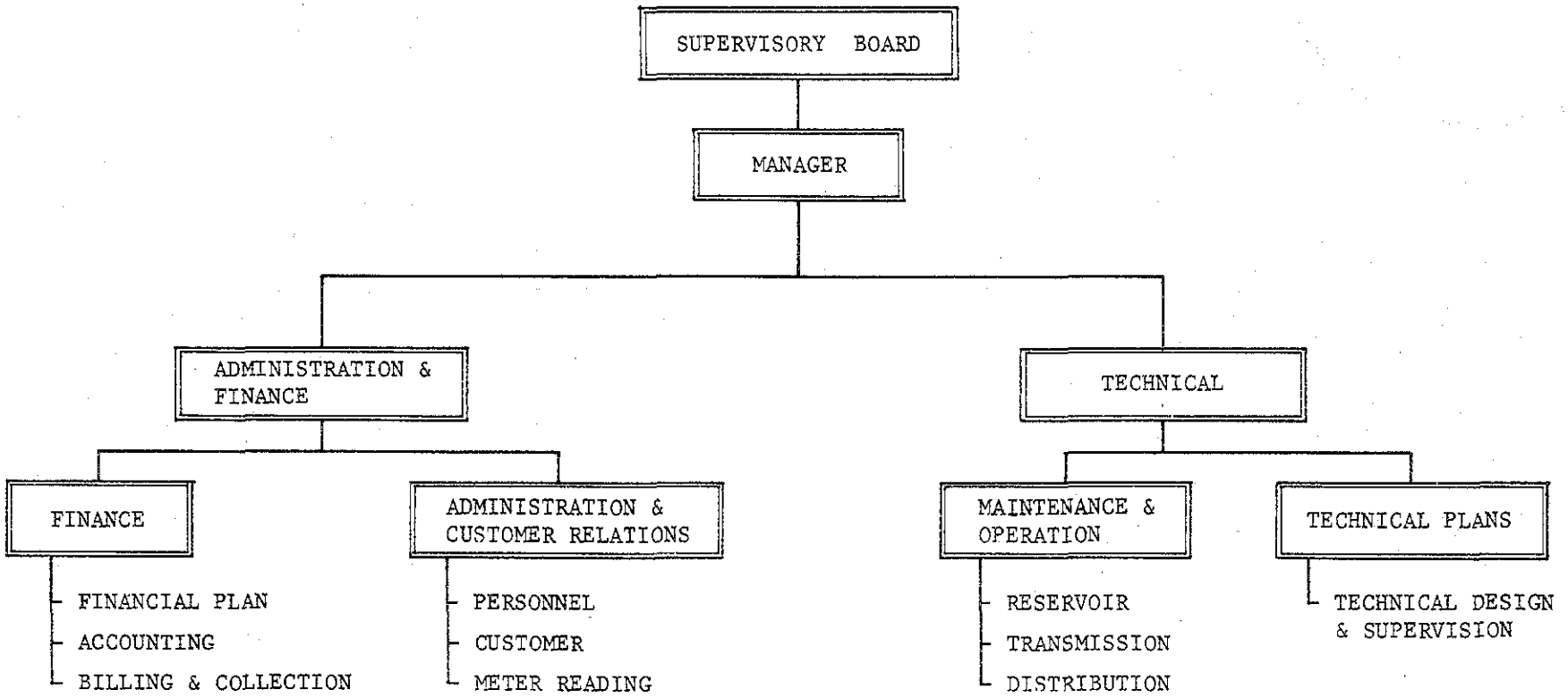


Fig 6-3-2 Proposed Organization Chart for Baubau Water Enterprise

The administration and finance should play an important role in the organization since the system is intended to expand and great many customers are expected to enjoy the services of the enterprise. The finance section should be responsible for overall financial plan including budget preparation and annual expenditure program so as to maintain self-sustained financial operations. The administration and customers relations is responsible for personnel policies and administration, office procedures and customer relation policies. This section is also in charge of personnel training in the water enterprise required from time to time along the programmes arranged by Cipta Karya.

The technical operations is responsible for system operations and maintenance, and technical design and supervision for the expected extension project.

Regarding the function of organization and its activities it is recommended that a set of guidelines prepared by Cipta Karya should better be applied.

6-4 Staffing Schedule

The proposed staffing for Baubau water enterprise is shown in Table 6-4-1. The total number required in the year 1985 is 30, 13 staff is intended to increase from the present figure of 17.

The total numbers of staff required for conducting water supply activities are studied considering the existing and proposed facilities of Baubau water supply and also target year of the present project. The number of personnel is kept minimum to the extent possible. This schedule can be utilized as a guideline for recruiting the staff.

Table 6-4-1 Staffing Schedule

Description	Year					
	1980	1981	1982	1983	1984	1985
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	7	7	7	7	7	7
Technical Plan	1	2	2	3	3	3
Sub-total	9	10	10	11	11	11
Administration & Finance						
Head	1	1	1	1	1	1
Financial Plan	2	2	2	2	2	2
Accounting	2	2	2	2	2	2
Bookkeeping	2	2	2	2	2	2
Billing & Collection	1	1	2	3	3	3
Meter Reading	2	2	3	3	3	3
Personnel	1	1	2	2	2	2
Customer	1	1	2	2	2	2
Sub-total	12	12	16	17	17	17
Total	23	24	28	30	30	30

VII. EVALUATION OF THE PROJECT AND RECOMMENDATIONS

7-1 Evaluation of the Benefits of the Project

The present project can increase the number of consumers and also water sales to a great extent. In addition there are a number of benefits which cannot be expressed in terms of money or figures. They are described in the following in a descriptive manner.

1) Elimination of Water Shortage in the New Town
Presently all the inhabitants in the newly developed area on the left bank of the Baubau river are buying from the water vendor their daily use water at a very high price. Their expenditure for water is far higher than those who live in the old town. By the present project, all this disadvantage can be corrected to the satisfaction of the public.

2) Fire Fighting Water
By the construction of the project, fire fighting water becomes available throughout the built-up area of the city. As there are no streams and ponds usable for emergency except the Baubau river, water of the water supply system is a very important water source for fire fighting.

3) Improvement of Health Condition and Living Environment
Because of lack of running water, most of the population are inevitably leading unsanitary life with the unhygienic storage of drinking water in the house and the not-much attended kitchen. When the running water is introduced into the house or the yard, all these conditions can be rectified. And this will further promote the improvement activities of the living environment.

4) Rise of Earning by Promotion of Commercial Activities
The city is a local center for transportation, air, sea and land, and has been developing in various fields of commerce and industry. But the insufficiency of water supply has been retarding the development.

The present implementation of the water supply project will solve this problem and contribute greatly to a rise of earning of the public.

5) Promotion of Industries

An oil supply facility is now under construction with its completion within the near future. The facility is intended to supply fuel and water to the ships as well as fuel to the consumers in the city. When the present project is executed, the facility can start its full operation, contributing to promotion of overall industrial and commercial activities and a rise of earning in the whole community.

7-2 Recommendations

In order to realize sound management of the water supply enterprise and to develop a better water supply system, the following is recommended.

1) Engineers and technicians should be recruited as early as possible, so as to operate the expanded water supply system properly and efficiently. Required staff is shown earlier in the text.

2) Budget for the water supply enterprise should be separated from the general budget so as to make clear the financial conditions of the enterprise, and enable profits, if any, to be spent for improvement or expansion of the water supply facilities.

3) As to the Wamembe system, the transmission pipeline route should be made usuable as a road for regular inspection and access in emergency to the intake.

4) As for the Wakonti spring, the collection area should be fenced to prevent people from entering this area, and further the area should be covered with concrete to prevent contamination by drain water and trash thrown by passers-by.

5) Water sources to be developed by the present project will sooner or later be outgrown by the ever increasing water demand. Therefore, detailed investigation of the Baubau river for another water source should be started at an earliest possible opportunity.

6) After completion of the project, it will be possible to get reliable data for consumption and production, which due to be used for the following extension planning. All the readings of both bulk and house meters should be kept and analyzed for this purpose.

APPENDIX A

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) House Tap

Table VII-17
Water Demand for Domestic Use
by House Tap

Year	Population	Population Served		Average Nos. of Resident	Consumption per Capita per Day (l/c/d)	Total Consumption	
		Percentage	Population Served			(m^3/d)	(l/sec)
1979	37,680	30	11,340	6.62	100	1.134	13.1
1980	38,771	35	13,570	6.55	100	1.357	15.7
1982	40,953	35	14,334	6.43	100	1.434	16.6
1983	42,044	40	18,920	6.56	100	1.472	21.9
1985	44,226	45	19,902	6.24	100	1.990	23
1990	49,754	55	27,365	5.93	125	3.421	39.6
1995	55,283	65	35,934	5.62	125	4.492	52
2000	60,811	70	42,568	5.34	150	6.385	74
2005	66,340	75	49,755	5	150	7.463	86.4

(2) Public Hydrant

Table VII-18

Water Demand for Domestic Use by Public Hydrant

Year	Population	Population Served		Population Served per public Hydrant	Consumption per Capita per Day (l/c/d)	Total Consumption	
		Percentage (%)	Population Served			(m^3/d)	(l/sec)
1979	37,680	30	11,304	250	30	340	3.9
1980	38,771	30	11,631	250	30	349	4.0
1982	40,953	30	12,286	250	30	372	4.3
1983	42,044	30	12,613	250	30	378	4.4
1985	44,226	25	11,057	200	30	332	3.8
1990	49,754	25	12,439	200	30	373	4.3
1995	55,283	25	13,821	200	30	415	4.8
2000	60,811	20	12,162	150	30	365	4.2
2005	66,340	20	13,268	150	30	398	4.6

ii) Non-domestic Use

(1) Institutions

Table VII-19

Year	Nos. of Office Workers	Consumption per Capita (l/c/d)	Total Consumption (m^3/d)	(l/sec)
1979	354	20	7.08	0.08
1980	363	20	7.26	0.08
1982	384	20	7.68	0.09
1985	413	20	8.26	0.09
1990	463	20	9.26	0.11
1995	523	25	13.07	0.15
2000	576	25	14.4	0.17
2005	628	25	15.7	0.18

(2) Dormitory

Table VII-20

Year	Nos. of Beds	Consumption per Bed per Day (l/bed/d)	Total Consumption (m^3/d)	(l/sec)
1979	54	100	5.4	0.06
1980	58	100	5.8	0.07
1982	60	100	6.0	0.07
1985	65	100	6.5	0.08
1990	72	125	9.0	0.10
1995	79	125	9.8	0.11
2000	84	150	12.6	0.14
2005	93	150	13.9	0.16

(3) Mess

Table VII-21

Year	Nos. of Beds	Consumption per Bed per Day (l/bed/d)	Total Consumption (m^3/d)	(l/sec)
1979	35	100	3.5	0.04
1980	40	100	4.0	0.05
1982	42	100	4.2	0.05
1985	44	100	4.4	0.05
1990	48	125	6.0	0.07
1995	52	125	6.5	0.07
2000	56	150	8.4	0.10
2005	60	150	9.0	0.10

(4) Hotel

Toble VII-22

Water Demand for Hotel

Year	Nos. of Beds	Consumption per Bed per Day (l/bed/d)	Total Consumption (m^3/d)	(l/sec)
1979	60	100	6.0	0.07
1980	65	100	6.5	0.08
1982	69	100	6.9	0.08
1985	75	100	7.5	0.09
1990	80	125	10.0	0.12
1995	90	125	11.25	0.13
2000	100	150	15.00	0.17
2005	115	150	17.25	0.20

(5) Shop & Market

Table VII-24

Water Demand for Shop & Market

Year	Nos. of Units	Consumption per Unit per Day (m^3/unit/d)	Total Consumption (m^3/d)	(l/sec)
1979	53	0.55	29	0.34
1980	54	0.55	30	0.35
1982	56	0.60	34	0.39
1985	61	0.60	37	0.43
1990	69	0.70	48	0.56
1995	76	0.75	57	0.66
2000	83	0.80	66	0.76
2005	90	0.85	77	0.89

(6) Theater

Table VII-25

Water Demand for Theater

Year	Nos. of Unit	Consumption per Unit per Day (m^3/unit/d)	Total Consumption (m^3/d)	(l/sec)
1979	2	4	8	0.09
1980	2	4	8	0.09
1982	2	4	8	0.09
1985	2	4	8	0.09
1990	3	4	12	0.14
1995	3	4	12	0.14
2000	3	4	12	0.14
2005	4	4	16	0.19

(7) Factory

Table VII-26

Water Demand for Factory

Year	Nos. of Unit	Consumption per Unit per Day (m^3/unit/d)	Total Consumption (m^3/d)	(l/sec)
1979	76	1.5	114	1.3
1980	77	1.5	116	1.3
1982	79	1.75	138	1.6
1985	85	1.8	153	1.8
1990	93	2.1	195	2.3
1995	101	2.4	242	2.8
2000	109	2.7	294	3.4
2005	116	3	348	4.0

(8) Medical Facilities

(a) Hospital

Table VII-27

Water Demand for Hospital

Year	Nos. of Beds	Consumption per Bed per Day (l/bed/d)	Total Consumption (m^3/d)	(l/sec)
1979	60	250	15	0.17
1980	60	250	15	0.17
1982	100	250	25	0.29
1985	176	280	49	0.57
1990	179	310	55	0.64
1995	221	340	75	0.87
2000	243	370	90	1.04
2005	265	400	106	1.23

(b) Health Center

Table VII-27

Water Demand for Health Center

Year	Nos. of Unit	Consumption per Unit per Day (m^3/unit/d)	Total Consumption (m^3/d)	(l/sec)
1979	1	1.5	1.5	0.02
1980	3	2.0	6	0.07
1982	4	2.2	8.8	0.10
1985	4	2.2	8.8	0.10
1990	4	2.4	9.6	0.11
1995	5	2.6	13	0.15
2000	6	2.8	17	0.20
2005	6	3	18	0.20

(c) Maternity

Table VII-28

Water Demand for Maternity

Year	Nos. of Unit	Consumption per Unit per Day (m^3/unit/d)	Total Consumption (m^3/d)	(l/sec)
1979	1	1.5	1.5	0.02
1980	2	2	4	0.05
1982	3	2.2	6.6	0.08
1985	4	2.2	8.8	0.10
1990	6	2.4	14.4	0.17
1995	8	2.6	20.8	0.24
2000	10	2.8	28	0.32
2005	11	3	33	0.38

(9) School

Table VII-29

Water Demand for School

Year	Nos. of Pupils	Percentage (Pupils/ population)	Consumption per Pupil per Day (l/pupil/d)	Total Consumption (m^3/d)	(l/sec)
1979	9,420	25	15	141.3	1.6
1980	9,693	25	15	145.4	1.7
1981	10,364	26	15	155.5	1.8
1982	10,648	26	15	159.7	1.8
1983	11,352	27	15	170.3	1.9
1984	11,646	27	15	174.7	2.0
1985	12,383	28	16	198.1	2.3
1986	12,693	28	16	203.1	2.4
1987	13,467	29	16	215.5	2.5
1988	13,787	29	16	220.5	2.6
1989	14,595	30	16	233.5	2.7
1990	15,921	32	17	270.6	3.1
1995	18,796	34	18	338.3	3.9
2000	21,284	35	19	404.4	4.7
2005	23,219	35	20	464.2	5.3

(10) Religious Institution

Table VII-31

Water Demand for Religious Institution

Year	Nos. of Units	Consumption per Unit per Day (m^3/unit/d)	Total Consumption (m^3/d)	(l/sec)
1979	24	1.75	42	0.49
1980	26	1.75	45.5	0.53
1982	28.0	1.75	49	0.57
1985	31	1.75	54.25	0.63
1990	34	2.00	64	0.74
1995	38	2.00	76	0.88
2000	41	2.25	92.25	1.08
2005	45	2.5	112.5	1.30

(11) Public Park

Table VII-32

Water Demand for Public Park

Year	Nos. of Unit	Consumption per Unit per Day (m^3/unit/d)	Total Consumption (m^3/d)	(l/sec)
1980	7	0.5	3.5	0.04
1982	7	0.5	3.5	0.04
1985	7	0.5	3.5	0.04
1990	8	0.5	4.0	0.05
1995	9	0.5	4.5	0.05
2000	10	0.5	5	0.06
2005	11	0.5	5.5	0.06

(12) Harbor

Table VII-33

Water Demand for Harbor

Year	Nos. of Ships	Consumption per Ship (m^3/ship)	Consumption per Ship per Day (m^3/ship/d)	Consumption at Harbor (m^3/d)	Total Consumption (m^3/d)
1980	684	3	5.6	2	7.6
1982	760	3	6.25	3	9.25
1985	874	4	9.58	3	12.58
1990	1,064	4	11.66	3	14.66
1995	1,254	6	13.74	4	17.74
2000	1,444	8	32	4	36
2005	1,634	8	36	5	41

(13) Airport

Table VII-34

Water Demand for Airport

Year	Nos. of Unit	Daily Consumption (m^3/d)	Total Consumption (m^3/d)	(l/sec)
1980	1	1.5	1.5	0.02
1982	1	1.6	1.6	0.02
1985	1	1.7	1.7	0.02
1990	1	2.1	2.1	0.02
1995	1	2.6	2.6	0.03
2000	1	3.25	3.25	0.04
2005	1	4.00	4.00	0.05

APPENDIX B

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 BAUBAU (in Rp.)

Items	Foreign Exchange	Local Currency	Remarks
1. Transmission Pipeline (Wamembe) Ø 250 x 3,000 m DCIP	1) pipe @ 22,338/m x 3,000 m = 67,014,000 2) fitting 67,014,000 x 20 % = 13,402,800 3) valve 490,000/pcs x 4 pcs = 1,960,000 Total 82,376,800 @ 27,500/m	1) pipe @ 6,000/m x 3,000 m = 18,000,000 2) protection 4,500,000 3) valve box @ 500,000/pcs x 4 pcs = 2,000,000 4)* local transportation 8,200,000 Total 32,700,000 @ 10,900/m	4)* In case of Baubau, costs of materials x 10 %
2. Transmission Pipeline (Wakonti) Ø 150 x 4,400 m DCIP	1) pipe @ 12,958/m x 4,400 m = 57,015,000 2) fitting 57,015,000 x 20 % = 11,403,040 3) valve 217,525/pcs x 5 pcs = 1,087,625 Total 69,505,665 @15,800/m	1) pipe @ 4,000/m x 4,400 m = 17,600,000 2) protection 6,000,000 3) valve box @ 500,000/pcs x 5 pcs = 2,500,000 4) local transportation 7,000,000 Total 33,100,000 @ 7,500/m	

Items	Foreign Exchange	Local Currency	Remarks
3. Distribution Pipeline			
- Ø 300 x 1,600 m DCIP	1) pipe @ 30,781/m x 1,600 m = 49,249,600 2) fitting 49,249,600 x 20 % = 9,849,920 3) valve @ 656,000/pcs x 2 pcs = 1,312,000 Total 60,411,520 @ 37,800/m	1) pipe @ 6,000/m x 1,600 m = 9,600,000 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 6,000,000 Total 17,100,000 @ 10,700/m	
- Ø 250 x 1,300 m DCIP	1) pipe @ 22,338/m x 1,300 m = 29,039,400 2) fitting 29,039,400 x 20 % = 5,807,880 3) valve @ 490,000/pcs x 2 pcs = 980,000 Total 35,827,280 @ 37,600/m	1) pipe @ 6,000/m x 1,300 m = 7,800,000 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 3,600,000 Total 12,900,000 @ 9,900/m	

Items	Foreign Exchange	Local Currency	Remarks
- Ø 200 x 1,550 m DCIP	1) pipe @ 17,395/m x 1,550 m = 26,962,250 2) fitting 26,962,250 x 20 % = 5,392,450 3) valve 327,148/pcs x 5 pcs = 1,635,740 4) river crossing @ 90,000/m x 30 m = 2,700,000 Total 36,690,440 @ 23,700/m	1) pipe @ 6,000/m x 1,550 m = 9,300,000 2) valve box @ 500,000/pcs x 5 pcs = 2,500,000 3) thrust block @ 50,000 pcs x 10 pcs = 500,000 4) river crossing @ 35,000/m x 30 m = 1,050,000 5) local transportation 3,600,000 Total 16,950,000 @ 10,900/m	
- Ø 150 x 4,150 m PVC	1) pipe @ 9,340/m x 4,150 m = 38,761,000 2) fitting 38,761,000 x 20 % = 7,752,200 3) valve 217,525/pcs x 10 pcs = 2,175,250 4) river crossing @ 90,000/m x 30 m = 2,700,000 Total 51,388,450 @ 12,400/m	1) pipe @ 4,000/m x 4,150 m = 16,600,000 2) valve box @ 500,000/pcs x 10 pcs = 5,000,000 3) thrust block @ 50,000/pcs x 20 pcs = 1,000,000 4) river crossing @ 35,000/m x 30 m = 1,050,000 5) local transportation 5,140,000 Total 28,790,000 @ 6,900/m	

Items	Foreign Exchange	Local Currency	Remarks
- Ø 75 x 6,350 m PVC	1) pipe @ 3,130/m x 6,350 m = 19,875,500 2) fitting 19,875,500 x 20 % = 3,975,100 3) valve @ 92,750/pcs x 13 pcs = 1,205,750 Total 25,056,350 @ 3,900/m	1) pipe @ 3,500/m x 6,350 m = 22,225,000 2) valve box @ 300,000/pcs x 13 pcs = 3,900,000 3) thrust block @ 40,000/pcs x 25 pcs = 1,000,000 4) local transportation 2,500,000 Total 29,625,000 @ 4,700/m	
4. Bulk Meter	1) Ø 300 - 1 piece 4,000,000 2) Ø 200 - 1 piece 1,610,000 Total 5,610,000	1) meter box @ 500,000/pcs x 2 pcs = 1,000,000 2) local transportation 830,000 Total 1,830,000	
5. Water Meter ø13	1) water meter @ 17,000/pcs x 3,200 pcs = 54,400,000	1) local transportation 5,440,000 @ 1,700/pcs	
6. Public Hydrant	1) meter - Ø 18 @ 30,000/pcs x 55 pcs = 1,650,000	1) concrete @ 400,000/pcs x 55 pcs = 16,500,000 2) local transportation 170,000 Total 16,670,000 @ 303,000/pcs	

APPENDIX C

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 considered in the item of operation and maintenance cost. Water rates, therefore, are arranged to generate return of depreciation in addition to operation and maintenance cost. 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 for 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.

11. The straight line method of calculating depreciation is used based on the estimated useful lives of the individual assets and a composite rate of 2.24% is developed. Calculation is shown in VI Attachment V) Calculation of Depreciation 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

Baubau

1985

m^3/day	Residential					Social		
Class of Water Consumption	Domestic	Institutional	Medical	Commercial	Industrial	Religious	Public	Harbor
	1,990	19	67	8	153	252	322	-
0 - 15 m^3/m	1,745	9	37	6	-	91	120	-
15 - 30 m^3/m	245	10	3	2	-	154	203	-
more than 30 m^3/m	-	-	27	-	153	7	9	-

1990

m^3/day	Residential					Social		
Class of Water Consumption	Domestic	Institutional	Medical	Commercial	Industrial	Religious	Public	Harbor
	3,421	24	79	10	195	335	373	-
0 - 15 m^3/m	3,000	11	43	8	-	121	137	-
15 - 30 m^3/m	420	12	32	2	-	205	229	-
more than 30 m^3/m	1	1	4	-	195	9	7	-

C. Water Sales

Item \ Year	1985	1990
Residential	2,178A	3,750A
Commercial	16A	20A
Industrial	765A	975A
Social	622.8A	752.8A
Harbor	-	-
Total	3,581.8A	5,497.8A

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
	1,027,621A		1,307,357A		1,587,093A		1,866,829A	
		1,167,489A		1,447,225A		1,726,961A		2,006,697A

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

E. "A" Factor based on Water Sales

	1983	1984	1985	1986	1987	1988	1989	1990
"A" factor	49.73	44.96	41.29	38.35	35.97	34.05	32.45	31.11

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

"A" factor is determined to be Rp.40.

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

BAUBAU

Operation and Maintenance Cost

(Rp. 1,000)

	I t e m	1983	1984	1985	1986	1987	1988
I.	Personnel Cost	18,648	19,582	20,609	21,643	22,726	23,894
II.	Operation & Maintenance Cost						
	1. Maintenance	5,634	5,917	6,215	6,526	6,852	7,195
	2. Office Operator	577	614	615	688	725	762
	3. Chemical	1,875	1,969	2,067	2,170	2,279	2,393
	Total (I & II 1,2,3)	26,734	28,082	29,542	31,027	32,582	34,244
	4. Other Expenses	652	685	720	756	794	835
	5. Depreciation	23,722	23,722	23,722	23,722	23,722	23,722
	Total	51,108	52,489	53,984	55,505	57,098	58,801
	Water Consumption (m^3/year)	814,096	933,378	1,052,666	1,171,942	1,291,224	1,410,506
	Production Cost (Rp./m^3)	62.78	56.23	51.28	47.36	44.22	41.69

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

BAUBAU

Personnel Cost

(Rp. 1,000)

Description	1980	1981	1982	1983	1984	1985	1986	1987	1988
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	3,780	3,969	4,167	4,376	4,595	4,824	5,065	5,319	5,585
Technical Plan	600	1,230	1,291	1,956	2,054	2,156	2,264	2,378	2,496
Administration & Finance									
Head	780	819	860	903	948	995	1,045	1,097	1,152
Financial Plan	1,200	1,260	1,323	1,389	1,459	1,531	1,608	1,688	1,773
Accounting	1,200	1,260	1,323	1,389	1,459	1,531	1,608	1,688	1,773
Bookkeeping	1,080	1,134	1,191	1,250	1,313	1,378	1,447	1,520	1,596
Billing & Collection	480	504	1,009	1,540	1,617	1,697	1,782	1,871	1,997
Meter reading	480	504	769	808	848	890	935	982	1,031
Personnel	480	504	1,009	1,060	1,113	1,196	1,256	1,319	1,384
Customer	480	504	1,009	1,060	1,113	1,196	1,256	1,319	1,384
Total	13,080	14,334	16,729	18,648	19,582	20,609	21,643	22,726	23,894

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	Baubau
Water Production (Average day 1/sec)	43
Dosage of Chlorite (ppm)	0.8
Period of Dosage	Daily
Usage of Chlorite per Year (kg/y)	1,180

Attachment V)

Calculation of Depreciation

V. Calculation of Depreciation

Asset Composition

Civil Structure

Composing ratio in the assets	85%
Average service life	45 years
Salvage at the end of life	10%

Pipeline

Composing ratio	15%
Average service life	25 years
Salvage at the end of life	10%

Composite rate of depreciation

$$\frac{1 - 0.1}{45} \times 85 + \frac{1 - 0.1}{15} \times 15 = \underline{2.24\% \text{ (per annum)}}$$

JICA

REPUBLIC OF INDONESIA

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

FINAL REPORT

Vol. 6 : ENREKANG

NOVEMBER 1980

JAPAN INTERNATIONAL COOPERATION AGENCY

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

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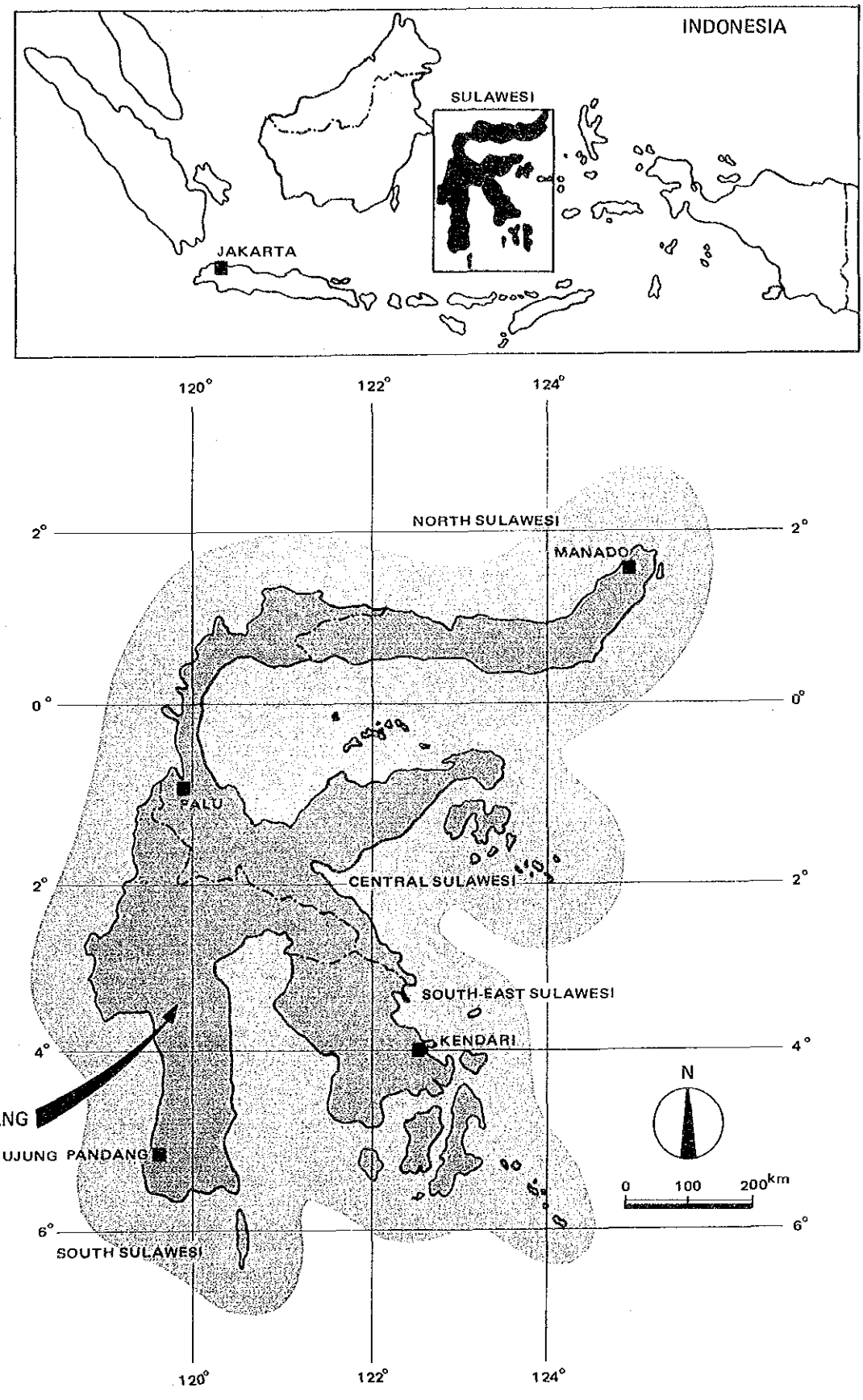
LIST OF ABBREVIATIONS

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" prepared 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 Enrekang Water Supply System, has been prepared based on a review of the existing Feasibility Study Report (the existing Report) 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

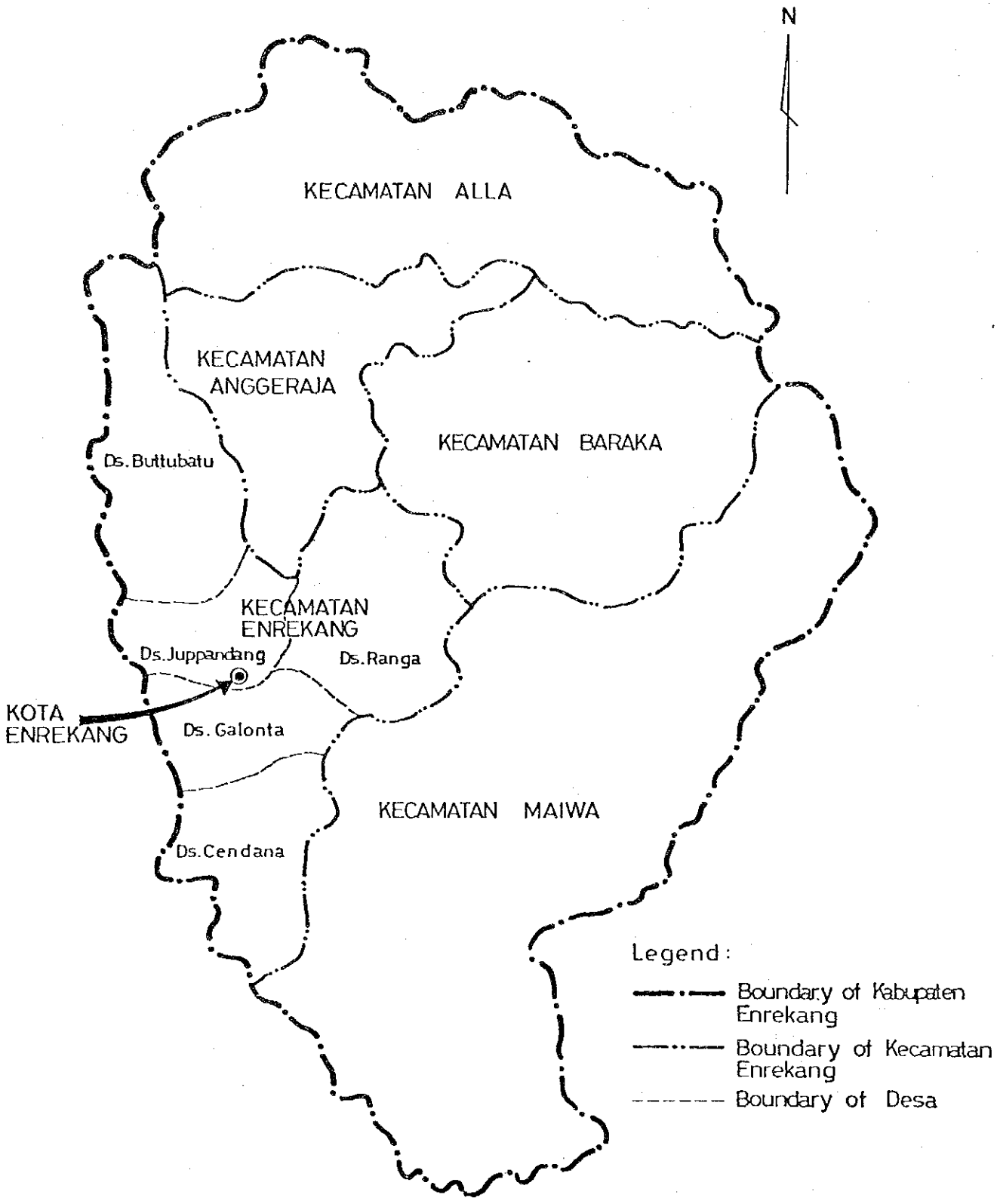
Enrekang belongs to Enrekang Sub-regency, Enrekang Regency, Province of South Sulawesi. Its geographical location is 119°42' east longitude and 4°36' south latitude. The town is 230 km north of Ujung pandang, the capital of the Province, and 75 - 200 m above sea level. Topographically, Enrekang is located in the southern part of the central mountainous area of Sulawesi island, and characterized by undulatory hills and steep mountains. The local climate is cool and pleasant, typical of the mountainous district.

The town is an entrance to Tana Toraja, a well known district for its cultural traits, where many tourists visit by car usually via Ujung Pandang from east and west. The road from Ujung Pandang to Enrekang is well paved and maintained. This makes the local transportation convenient to reach the town, although the town is located at a remote and hilly place surrounded by mountains.

1-4-2 Socioeconomic Conditions

Enrekang Sub-regency consists of five districts, i.e., Galonta, Juppandang, Ranga, Buttubatu and Cendana, covering a vast area of 38,220 ha. Out of the total population of the Sub-regency, 31,223 in 1978, about half thereof concentrates on a small alluvial plain which has been formed at the confluence of the two rivers, Sa'dan and Mata Allo, as shown in Fig 1-4-1 and Table 1-4-1. This populated area is called Kota Enrekang, the study area.

People living in the hilly area outside of the kota are engaged in farming, some in cattle breeding, and people in the kota are engaged in various tertial production activities, as is the case in the urbanized area. There are governmental offices, restaurants, hotels, clinics, etc. All of them are of small scale. On the other hand, there are not yet remarkable secondary productions, except home industries, in the area.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KECAMATAN ANGGERAJA
KECAMATAN BARAKA
Ds. Buttubatu
KECAMATAN ENREKANG
Ds. Juppandang
Ds. Ranga
KOTA ENREKANG
Ds. Galonta
KECAMATAN MAIWA
Ds. Cendana
Legend :
Boundary of Kabupaten Enrekang
Boundary of Kecamatan Enrekang
Boundary of Desa

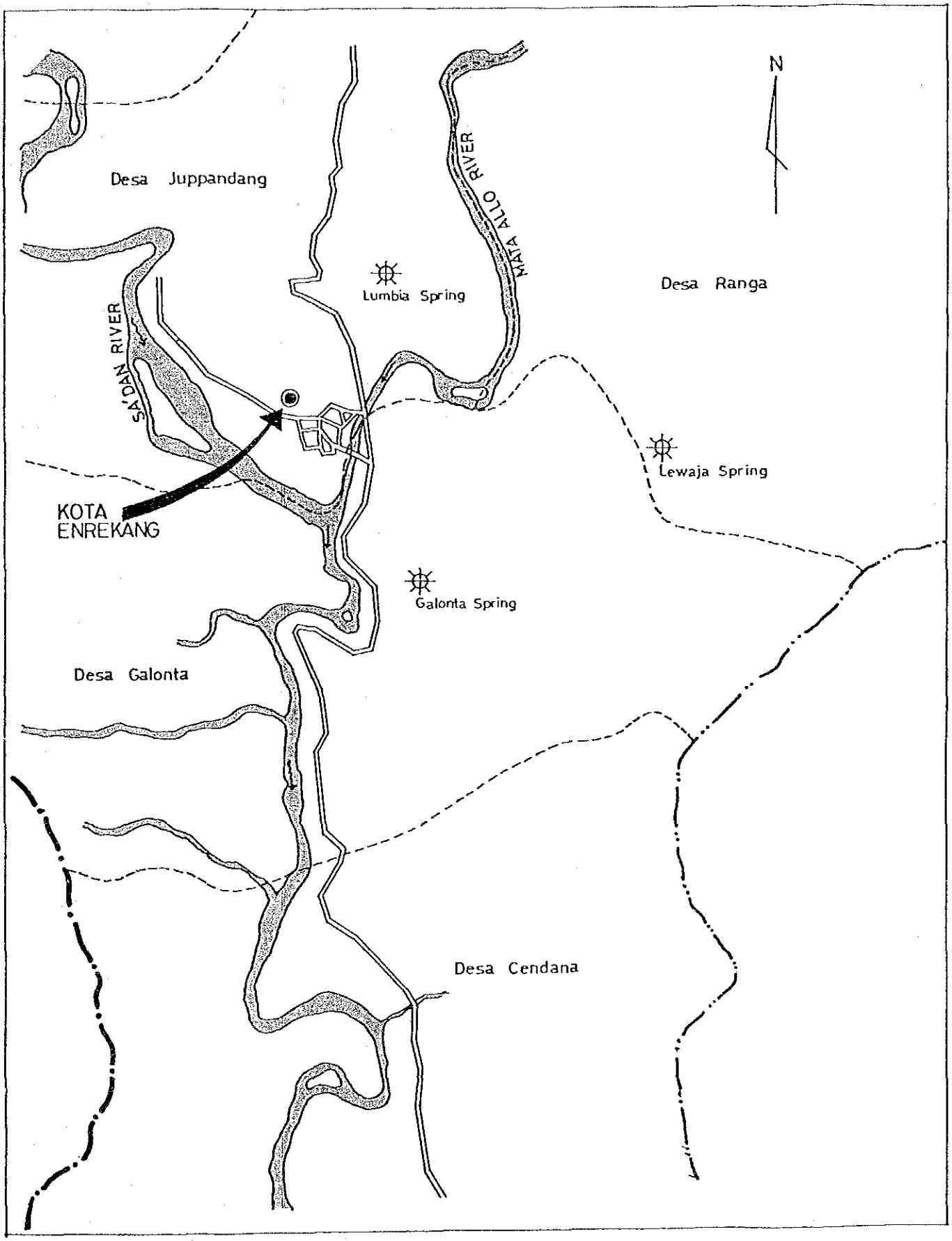


FIG. I-4-1 MAP OF KOTA ENREKANG 1: 300,000
1: 50,000

Table 1-4-1 Population of Kecamatan Enrekang

District	Population	Area (ha)
Juppandang*	7,742	4,350
Galonta*	5,023	4,385
Ranga*	5,388	10,269
Buttubatu	6,381	11,966
Cendana	6,689	7,250
Total	31,223	38,220

* These three districts constitute Kota Enrekang.

Source: Office of Kabupaten Enrekang, in 1978.

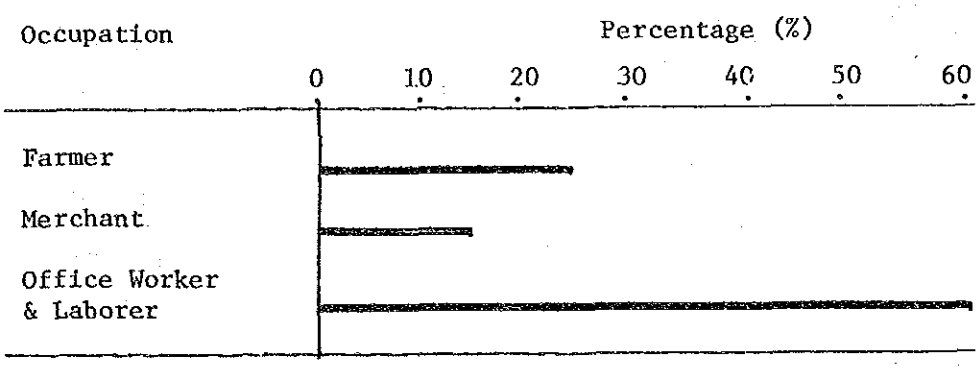
The kota spreads mostly on both banks of the Mata Allo river. On the left bank of the river, there is a small water supply system serving a minor part of the people, but the right bank where most of the people live lacks water supply. The present study area, therefore, covers this populated Kota Enrekang where water is urgently required, as dealt with by the existing Report.

The population of the study area was 13,804 in 1977 according to the existing Report. The Report, further, carries the following two informative Tables 1-4-2 and 1-4-3. As for the former table, the occupations are not necessarily properly classified, but it will be known that the number of office workers and laborers is rather high, showing the character of the town.

In the meantime, the average income of inhabitants who are supposed to receive water from the present project is obtained from interviews with people and also data which described the economy of Enrekang. The average income is found to be Rp. 33,000 per month. All these data and information will be used as based for further study hereinafter.

Table 1-4-2 Distribution of Occupations

in 1977



Source : the existing Report

Table 1-4-3 Number of Facilities

in 1977

Catagory	Facility	Number
Education	Elementary School	8
	High School	8
	University	1
Economic	Shop & Restaurant	20
	Market	2
	Office	27
	Hotel	2
Sanitary	Hospital	2
Religion	Church	1
	Mosque	1

Source : the existing Report

II. REVIEW OF PROPOSED WATER SUPPLY PLANNING

2-1 General

This chapter describes an outline of the existing water supply facilities, and then reviews basic elements for water supply system planning dealt with in the existing Report. As the Report is found very incomplete without including necessary descriptions of the engineering planning essential for financial analysis or projection, this chapter and the succeeding will supplement all the insufficiencies of the Report and complete feasibility study of the present project.

2-2 Existing Water Supply

In Enrekang there is an existing water supply system, or more precisely a group of water supply facilities, taking water from the Galonta spring, as mentioned in the existing Report. The existing system is such an old-fashioned water supply system that it cannot be termed a water supply system in the present-day engineering practice. As the open channel flow is widely used in the existing facilities, no water pressure, a most important factor in the modern water supply system, cannot be maintained. On the basis of the present field survey and the review of the Report, major features of the existing system are described below, together with some comments on the use of the spring.

1) Water Source and Quality

The water source, Galonta spring, is located 3 km from the center of Kota Enrekang and in the hills south east of the populated area, and has an elevation about 150 m above kota Enrekang. The yield is 4 l/sec according to the Report. Hence, the spring has advantages of

proximity to the served area and a sufficient elevation for gravity distribution. As for the water quality, it is found good for drinking from the result of the present analysis. The water, therefore, can be distributed directly to the consumers without treatment, as has been practiced in the area.

2) Water Supply Facilities

The existing facilities have been built piecemeal. From the water collection structure at the spring, a plural number of transmission and distribution lines have been installed. One of them is a 2 1/2" steel pipeline and others are halved bamboo pipes. The steel pipeline, about 1 km in length, goes straight down to the existing reservoir with a capacity 100 cu m, located near the built-up area. On the other thand, the halved bamboo lines go from the spring to the consumers. From the reservoir, distribution lines go out in a similar manner to the transmission lines. Presently, about 2 % of the population is served with this water supply system.

According to the Report, the water quantity distributed is 1 l/sec out of the yield 4 l/sec of the spring. The reliability of these figures could not be verified due to the irregularity of the construction of the water supply system, in the present field reconnaissance. It was, however, observed that the present yield, in the wet season, is more than 4 l/sec and by improving all the pipe system, the supply capacity can be substantially increased.

2-3 Population

In the following paragraphs, population, which is a most basic factor for water supply planning, will be reviewed. Firstly, the data concerning population in the Report will be handled. Then the projected population by the Report will be treated, taking into consideration the above population data and the results of the present field investigation.

2-3-1 Population Data

There is only table in connection with population data in the existing Report, which is reproduced below as Table 2-3-1. On the other hand, the figure of the total population of Enrekang Sub-regency was obtained from the year book of Enrekang, as 31,223, as already stated in 1-4 Study Area. Data needed for water supply planning are the population in the area to be served and its growth rate. The population statistics in the table cover the populated Kota Enrekang, the present study area. There, the three districts, Galonta, Juppandang and Ranga join forming the study area. The Table 2-3-1 contains all necessary information, so it will suffice the present requirement.

Regarding the quoted table, the average growth rate of population in the past five years is calculated as 2.21%, and further the annual growth rates are almost constant through the five years. This rate, compared with that of the whole country of Indonesia, is almost same. Duly considering all the above, this growth rate will be employed as a basis for the review of the population projection made in the Report.

Table 2-3-1 Population Data

Year	Population	Growth Rate (%)
1973	12,648	-
1974	12,928	2.214
1975	13,214	2.212
1976	13,506	2.210
1977	13,804	2.206

Source: the existing Report

2-3-2 Population Projection

The existing Report has projected the future population of Enrekang up to the year of 2005. The method used for the projection is the geometric