BASIC DESIGN STUDY REPORT
ON
THE PROJECT FOR RURAL/IKKS WATER SUPPLY
IN
SULAWESI ISLAND
IN
THE REPUBLIC OF INDONESIA

VOL. I
MAIN REPORT

NOVEMBER 1990

JAPAN INTERNATIONAL COOPERATION AGENCY

ERRATA

CHAPTER	PAGE	LINE	ORIGINAL REPORT	CORRECTION
4	4-8	Total	74, 959	71,350
4	4-13	15	+ 24	x 24
4	4-18	2	Appendix 5-1	Appendix 5-2
4	4-28	3-2	Reservior G	Reservoir E
4	4-36	3-2	Concrete Pit	Gabion Pit
4	4-36	3-3	Concrete Pit	Gabion Pit
4	4-36	3-5	Concrete Pit	Gabion Pit
4	4-44	1-1~1-4	Grevity	Gravity
4	4-44	2-1~2-3	Grevity	Gravity
4	4-44	2-7	SALANTAK	SALAKAN
4	4-44	2-8	Grevity	Gravity
4	4-44	3-2~3-4	Feading	Feeding
4	4-44	3-5	Feading Pump	Gravity
4	4-44	3-6	Grevity	Feeding Pump
4	4-44	3-7	Feading Pump	Gravity
4	4-44	3-8	Feading	Feeding
4	4-46	3-2	Surface	Elevated
4	4-64	Type of pipe	Cost Iron	Cast Iron
4	4-65	Cost Evaluation	Screw Type	
			100-1.6	100-1
			150-1	150-1.6
5	5-2	2	Central Sulawesi:	
			17,620,000	29,060,000
APPENDIX	20	Total	75,518	71,350
APPENDIX	21	1-2 SALU		
		Sub total	19.7	19.4

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PREFACE

In response to a request from the Government of the Republic of Indonesia, the Government of Japan has decided to conduct a Basic Design Study on the Project for Rural/IKKS Water Supply in Sulawesi Island and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Indonesia a survey team headed by Mr. Tsunao Usami, Head of Planning Division of Kanagawa Water Supply Authority from May 7 to June 20, 1990.

The team exchanged views with the officials concerned of the Government of Indonesia and conducted a field survey. After the team returned to Japan, further studies were made. Then, a mission was sent to Indonesia in order to discuss the draft report and the present report was prepared.

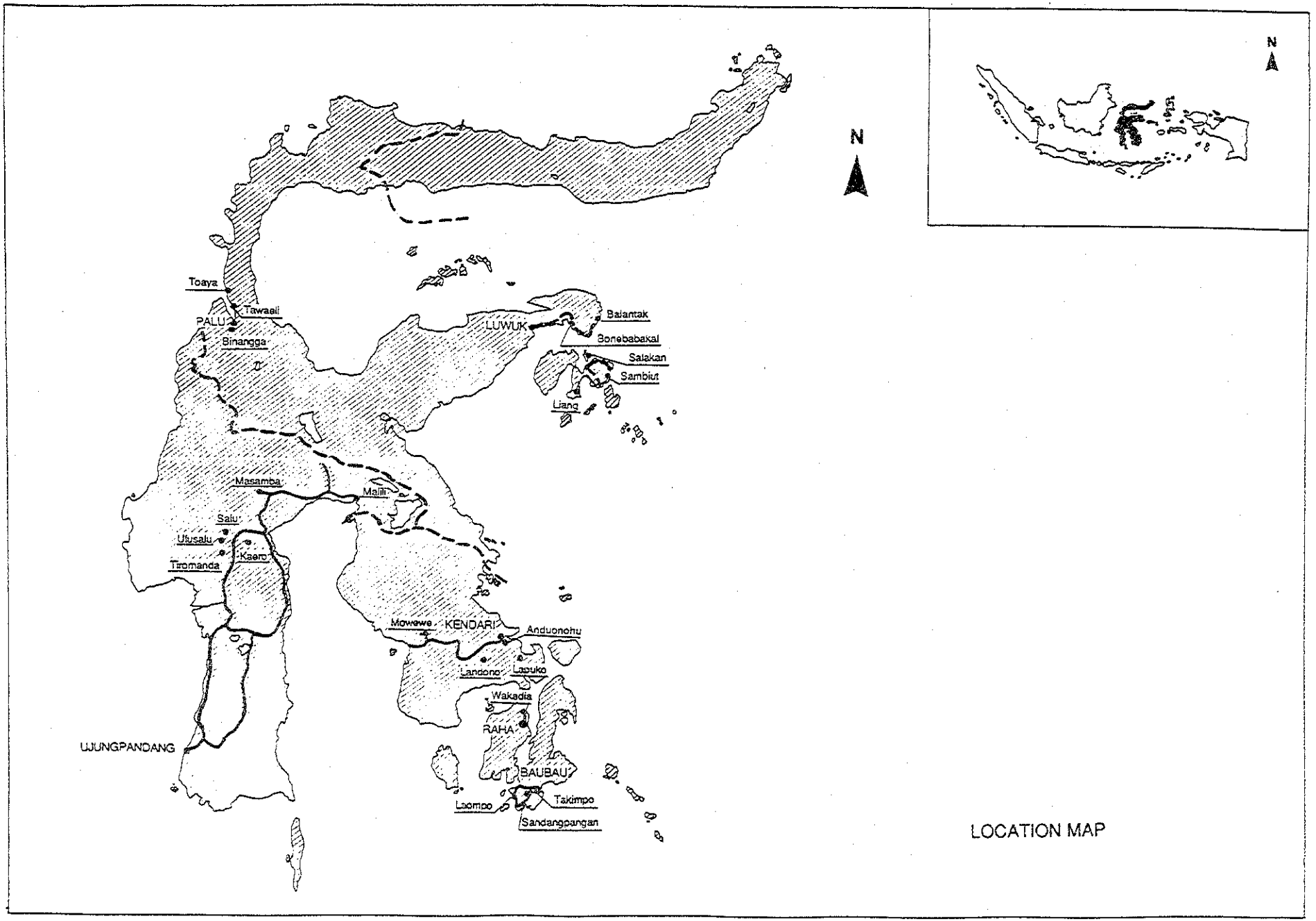
I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Indonesia for their close cooperation extended to the teams.

November 1990

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency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Mowewe
KENDARI
Anduonohu
Landono
Lapuko
Wakadia
RAHA
BAUBAU
Takimpo
Laompo
Sandangpangan
UJUNGPANDANG
N
LOCATION MAP

CONTENTS

LIST OF TABLES

LIST OF FIGURE

ABBREVIATION

ADB	Asian Development Bank
BAPPEDA	Provincial Government of Development Planning
BAPPENAS	National Development Planning Agency
BPAM	Transitional Water Supply Management Unit
CARE	Public Welfare Working Group
CIPTA KARYA	Directorate General of human Settlements
DAB	Directorate of Water Supply
GDB	Gross Domestic Product
IBRD	World Bank
IEC	International Electrotechnical Committee
IKK	Sub-District Capitals
IUIDP	Integrated Infrastructure Development Plan
JEC	Standard of Japan Electrotechnical Committee
JEM	Standards of the Japan Electrical Manufacture's Association
JICA	Japan International Cooperation Agency
JIS	Japan Industrial Standard
l/c/d	liter/capita/day
l/bed/d	liter/bed/day
PAB	Regional Water Supply Department
PDAM	Regional Water Supply Enterprise
PLN	National Electronic Supply Cooperation
PMDU	Provincial Monitoring Development Unit
PPSAB	Provincial Project Water Supply
PU	Ministry of Public Works
REPELTA	National Development Plan
UNICEF	United Nations International Children's Emergency Fund

SUMMARY

SUMMARY

The water supply development program in the Republic of Indonesia has been the highest priority in the Five-year National Development Plan (REPELITA). However, the program achievement is far below its objective. The percentage of population served in rural areas is 55.5% of the objective which should be achieved up to REPELITA IV. As of the end of Fourth Five-year National Development Plan (1984-1989, REPELITA IV), the water supply development program of the Sub-District Capitals called Ibu Kata Kecamatan (IKK) had completed water systems in only 1100 IKKs of the total of 3500 IKKs.

Presently, there are no piped water system in rural areas (other than the about 1100 IKKs) and these people get water for drinking from shallow wells, springs and rivers without treatment. As a result of this situation, there are many water-borne diseases in the area. The infant mortality rate is 58 of 1000 births. It is said that this high mortality rate is related to this situation in which the people can not obtain safe drinking water.

In the PEPELITA V, the Government of Indonesia intends to promote rural water supply programs to serve up to 60% of the rural population, but the funds will be not increased very much for this program. However, it is intended to promote assistance from organizations such as ADB, IBRD and CARE, and bilateral aid from certain countries, in accordance with proposal of International Drinking Water Supply and Sanitation Decade(1981-1990).

To date the Government of Indonesia has promoted the development of water supply systems mainly in western and northern Indonesia, the Government intends to promote the program in South, Central and South-East Sulawesi where conditions are very prefaced for the construction for water supply (such as roads and water sources). As a result of this background, the Government of Indonesia requested the project for rural/IKKs water supply in Sulawesi island through Japan's grant aid program in accordance with a request of the Ministry of Public Works, Directorate General of Human Settlements (Cipta Karya). According to this request, Japan International Cooperation Agency (JICA) carried out a fact finding study and then, in 1990, the Government of Japan decided to implement the basic design study by the JICA study team.

In accordance with statistik Indonesia, 1988, the total area of the three provinces (South, central and South-East Sulawesi) are 170193 km^2 and the total population and population density are 10 million and 60 people/km^2 respectively.
The main products are rice, coffee, cacao and pepper and there are underground resources such as nonferrous metals produced by South Sulawesi and natural asphalt produced by South-East Sulawesi. The ranking with regard to GDP (combining both monetary and traditional economic units) of these provinces, in the total of 27 Sulawesi provinces is:

South Sulawesi.....20th
Central Sulawesi.....21 st
South-East Sulawesi.....22nd

Presently, the population served with clean water supply in the 3 provinces of Sulawesi is estimated at 11% (270 thousand house-holds) of the total and the remaining 89% obtain their drinking water from rivers, springs and shallow wells. The conditions of these water source are very poor with respect to water quantity and quality. The existing shallow wells dry up in dry seasons and are contaminated by dirty water from sanitary systems. River water are very turbid in rainy seasons. The rural people in these areas are badly in need of clean water.

As result of the present conditions, the projects are designed to consider the following:

(1) The systems are to supply as many people as possible.
(2) The systems should be designed to minimize maintenance and operation in consideration of the socioeconomic and technical conditions in the project area.
(3) The Projects are to be managed as public utility associations.
(4) the projects are to conform to the system of Japan's Grant Aid program.

The project is outlined as follow:

Project Outline

Description	Project Outline
1. Agency	Ministry of Public Works, Directorate General of Human Settlements (Cipta Karya) Provincial Project Water Supply (PPSAB)
Operation and maintenance	Transitional Water Supply Management Unit (BPAM) Water Supply Enterprise (PDAM)
2. Project area	22 sites (Excepting Pendolo in Central Sulawesi) South Sulawesi Project area.....6 sites Total population in area.....27,629 peoples Central Sulawesi Project area.....8 sites Total population in area.....32,038 peoples South-East Sulawesi Project area.....8 sites Total population in area.....28,002 peoples
3. Design period	10 years
4. Object of water supply	Drinking water (Resident, School, Hospital)
5. Level of service	To be supplied by public taps, but design will also consider house connections to serve 50% of the population)
6. Water source	Deep well..... 3 sites Spring.....18 sites Mountain stream..... 1 sites
7. Flow system	by gravity.....12 sites by booster pumps.....10 sites The water flow system consists with intake facility, reservoir tank, transmission and distribution pipe and public tap. The booster pump system is applied to pump unit and the gravity system means to utilize head of water in intake area.

The government of Indonesia will bear the expense of land acquisition for the equipment site and the expense of installing electrical power cable for the equipment and lighting works. They will also bear the expense of rehabilitation of pavement after laying pipelines administration office for construction and be responsible for project equipment customs and clearance costs.

The major portion of the project costs will be borne by the Government of Japan. The construction cost to be borne by the Government of Indonesia is estimated to be Rp. 1,278 million.

Annual operation and maintenance expenses are estimated as follow,

South Slawesi	:	Rp. 22,640,000
Central Slawesi	:	Rp. 17,620,000
South East Slawesi	:	Rp. 76,660,000

The project implementation is scheduled to be completed within 24 months after the signing of the Exchange of Notes. Project implementation will be divided into 2 phases, because there are a total of 22 sites in 3 provinces.

The percentage of the population served in the protect area will increase to 82 percent (90,000 people) from the 3.8% of existing population served, as a result of the implementation of the project. The project, by supplying clean water to the area, will contribute not only to achieving the objective of the water supply program. but will result in a considerable improvement in the standard of living in the project area.

CHAPTER 1 INTRODUCTION

CHAPTER 1 INTRODUCTION

At the 1990 Annual Consulting Meeting, the Government of Indonesia requested implementing the water supply development programme in the South, Central and Southeast Sulawesi provinces.

Based on the request of the Government of Indonesia, the Japanese Government directed the Japan International Cooperation Agency (JICA) to conduct the fact-finding study as the first step for Project implementation. The study report was submitted in September, 1989. In the report, 30 IKK sites were placed in priority order depending upon their basic conditions for Project implementation.

The Government of Japan decided to implement the Basic Design Study for 23 IKKs according to their order of priority. JICA then sent to The Republic of Indonesia the Basic Design Study Team headed by Mr. Tsunao Usami, Head of Planning Division of Kanagawa Water Supply Authority from May 7 to June 20, 1990. The Study Team conducted the following field surveys:

① A study of the existing IKK water supply systems that were included in the Five-year National Development Plan and Rural Development Plan

② A study to determine the willingness of the residents in the 23 IKKs of the Project area to have water supply systems

③ Confirmation of the propriety of the Government of Indonesia's request (the study was based on socioeconomic and technical conditions)

④ The field survey work to be finalized for the cost estimation and design criteria such as water source, water intake capacity, water quality, hydraulics and equipment arrangement

⑤ A study of the operation and maintenance of the existing water supply systems

After discussions pertaining to the Project were held with the concerned officials of the Government of Indonesia, the field survey results and the basic agreements were written up as the Minutes of Discussions and were signed by both parties (See Appendix-4).

The Government of Japan dispatched a mission headed by Mr. Tsunao Usami, the Head of the Basic Study Team, to Indonesia for the explanation of the Draft Final Report from September 23 to October 12, 1990. The mission held discussions with the Government of Indonesia's officials concerned. The results of the discussions were adopted as the Minutes of Discussions (See Appendix-4).

Upon returning to Japan, further studies relevant to the Project were made. As a result, this report "BASIC DESIGN STUDY REPORT ON THE PROJECT FOR THE PROJECT FOR RURAL/IKKs WATER SUPPLY IN SULAWESI ISLAND, THE REPUBLIC OF INDONESIA" was prepared.

CHAPTER 2 BACKGROUND OF THE PROJECT

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1. Outline of Water Supply Sectors

(1) Administration of Water Supply

It is a centralized nation under the president as the top ruler from the view point of its structure. The central government is organized with the ministries under the president as shown in Fig. 2-1.

There are four (4) ministries at the national level which are concerned to water supply.

The ministries are:

Ministry of Public Works (PU)

Ministry of Home Affairs (Dalam Negeri)

Ministry of Health

Ministry of Finance

The Jurisdiction of the each ministry is as follows.

a. Ministry of Public Works

The ministry is a executing authority of public works.

It has three (3) directorate generals, namely, Housing and Human Settlements, Highways and Water Resources Development.

The Housing and Human Settlements is called the Directorate General Cipta Karya. Cipta Karya has the directorates, namely. Planning and Programming, City and Regional Planning, Housing, Public Building, Sanitary and Human Settlements and Water Supply.

The Directorate of Water Supply (DAB) is in charge of water supply administration. Cipta Karya has a Provincial Project Water Supply (PPSAB) in each province, which implements water supply system to be operated and managed in future by Semi-autonomous Regional

Water Supply Enterprises (PDAM) and Transitional Water Supply Management Unit (BPAM).

The systems to be implemented are limited to urban water supply systems for cities and towns ranged from large cities to IKKS.

PPSABs and DAB conduct site selection, fund allocation, basic design, detailed design, construction supervision, test operation, in another word everything up to the completion of implementation, and furthermore authorization of BPAM establishment, Personnel, technical and financial aid for BPAMs, authorization of transformation of BPAM to BPAMs, authorization of transformation of BPAM to PDAM, technical and management assistance for promotion of PDAMs.

The organization chart of the Ministry of Public Works is shown in Fig. 2-2.

b. Ministry of Home Affairs (Dalam Negeri)

This ministry is a supervising authority of local autonomy.

It has five (5) directorate generals, namely, Rural, Village Development, Regional Development, Public Administration and Regional Autonomy, and Social Politics. The ministry appoints, supervises and advises the personnels of the local governments. At the local level, water supply administration is in charge of regional governments and municipal governments, which conduct the program whose fund and materials are mostly supplied from the provincial government, the Armed Force (ABRI MASUK DESA), Ministry of Health, Foreign Aid, etc.

The Executing agencies are PABs under the regional governments and municipal governments, which implement rural water supply systems and water facilities of villages (Desa, Kulurahan).

The planning, adjustment, budget allocation for the projects is in charge of BAPPEDA in the provincial governments.

Being based on the plan of BAPPEDA, the governor requests project implementation of large systems to Cipta Karya for the PPSAB to execute. Besides, there is a supervising agency for PDAMs in each provincial government called Provincial Monitoring Development Unit (PMDU). The systems and facilities implemented by PAB are not always operated and maintained by PDAM/BPAM. Most of them are operated and maintained by the local communities.

The ministry has the authority of appointing mayors and regional governors, and the mayors and regional governors appoint the heads of PDAM/BPAM. Therefore, the ministry is indirectly responsible to the management of PDAM/BPAM.

The organization chart of the Ministry of Home Affairs is shown in Fig. 2-3.

c. Ministry of Health

Within the ministry, Directorate General for Communicable Disease Control and Environmental Health gives information and guidance on improvement of sanitation and water supply according to the survey of water quality. The Directorate General is also in charge of distribution of water supply materials aided by UNICEF, and technical assistance to rural water supply systems and facilities. The organization chart of Ministry of Health is shown in Fig. 2-4.

d. Ministry of Finance

The ministry has the authority of government budget allocation, tax collection, issue of government bond, etc.

The Directorate General of Budget is responsible for sectoral development projects through funds which are provided in the national, provincial and regional/municipal development budget. BAPPENAS makes overall sector programming and planning both at the national level and local level.

PDAMs can apply for loans of the Ministry through the local government (PMDU) and the Ministry of State Wealth.

c. Other Central Government Agencies

The Ministry of Mines and Energy is in charge of groundwater exploration and relevant data collection.

The Ministry of Population and Environment is responsible for establishing policies on water pollution control and environmental issues. The Ministry of Education and Culture is responsible for guidance to schools or sanitation and environmental health education/training.

Fig. 2.1 **ORGANIZATIONAL STRUCTURE OF THE INDONESIAN GOVERNMENT**

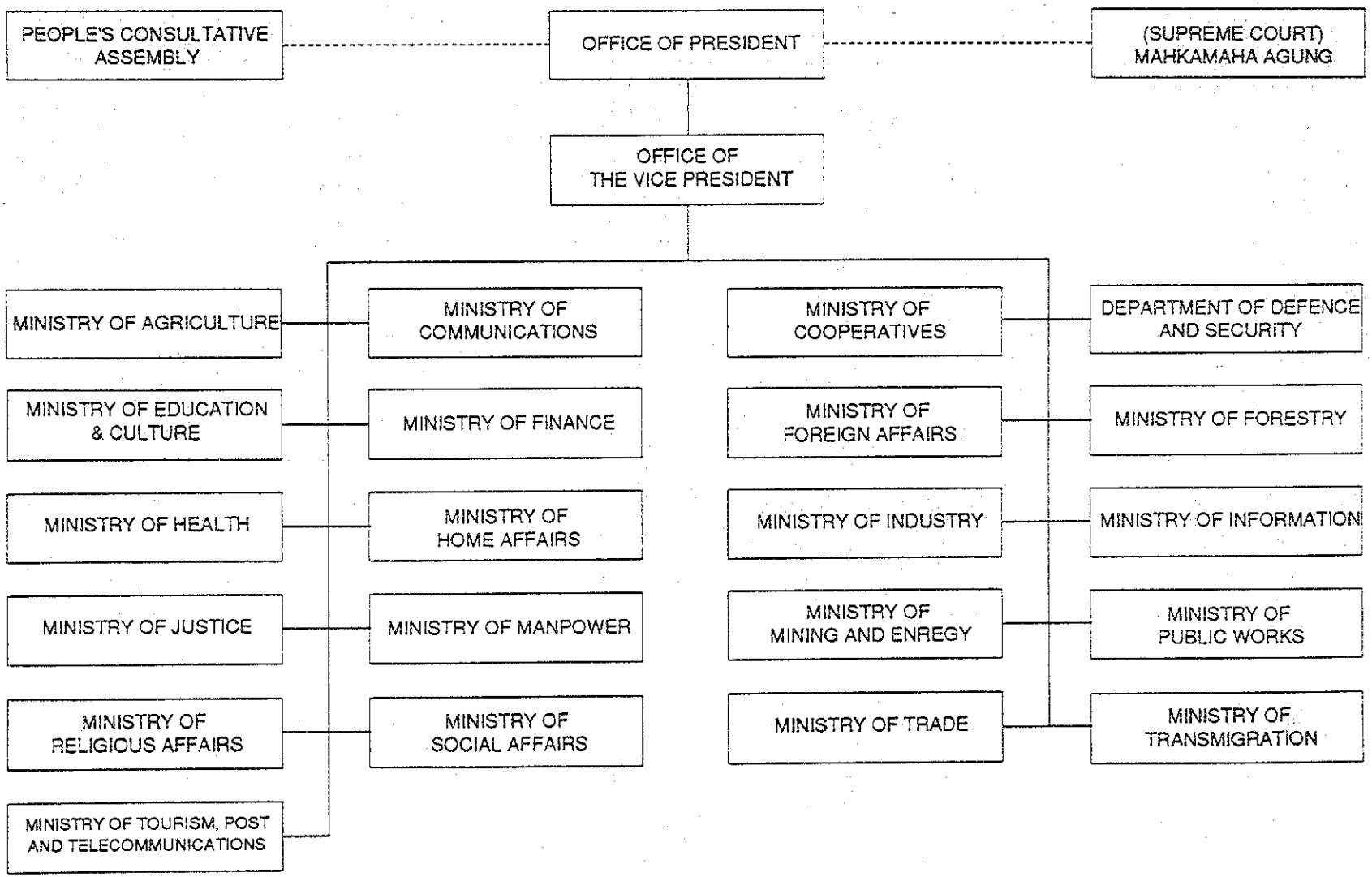


Fig. 2.2 MINISTRY OF PUBLIC WORKS ORGANIZATION STRUCTURE

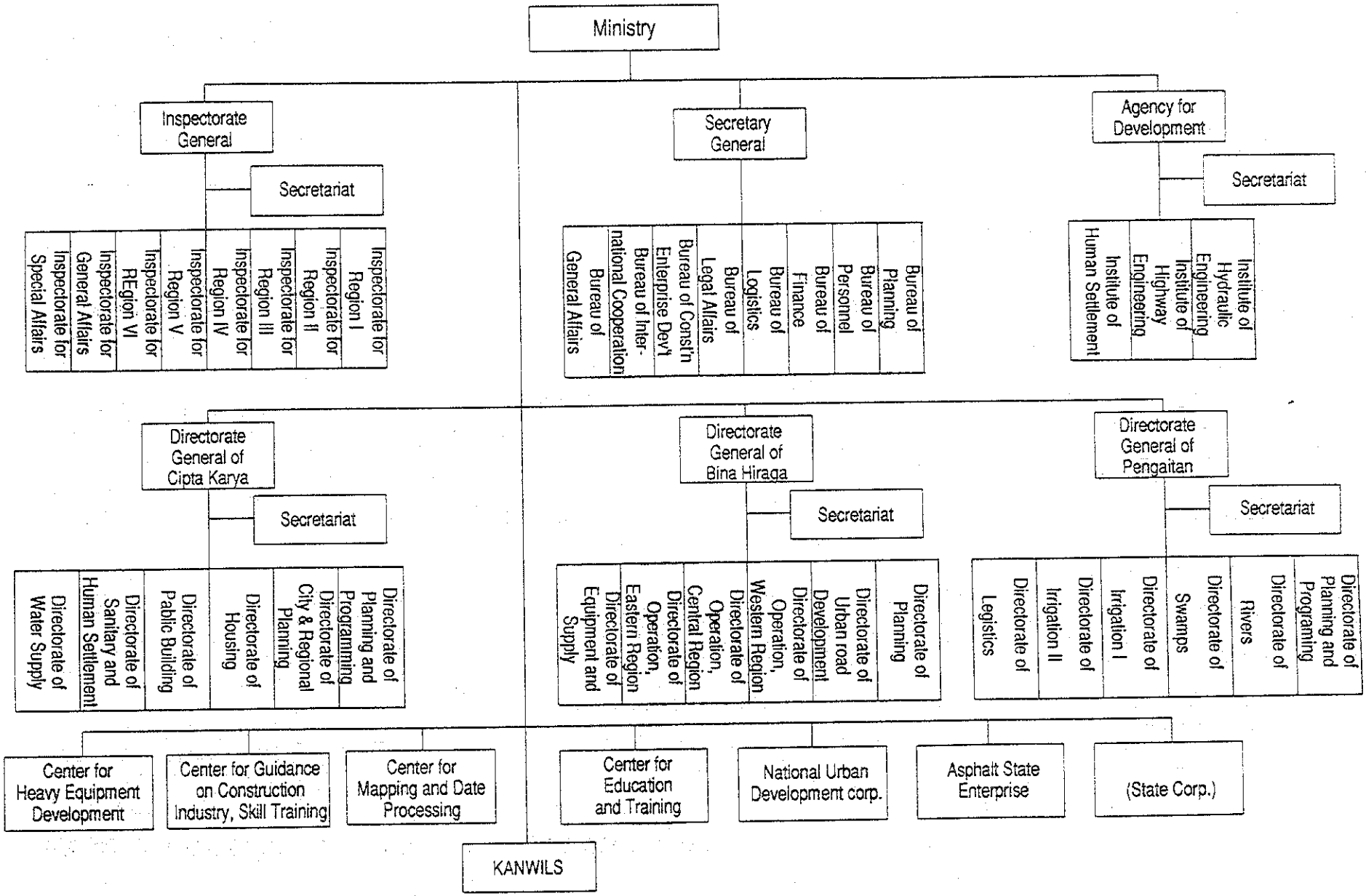


Fig. 2.3 **ORGANIZATION CHART : MINISTRY OF HOME AFFAIRS (DALAM NEGERI)**

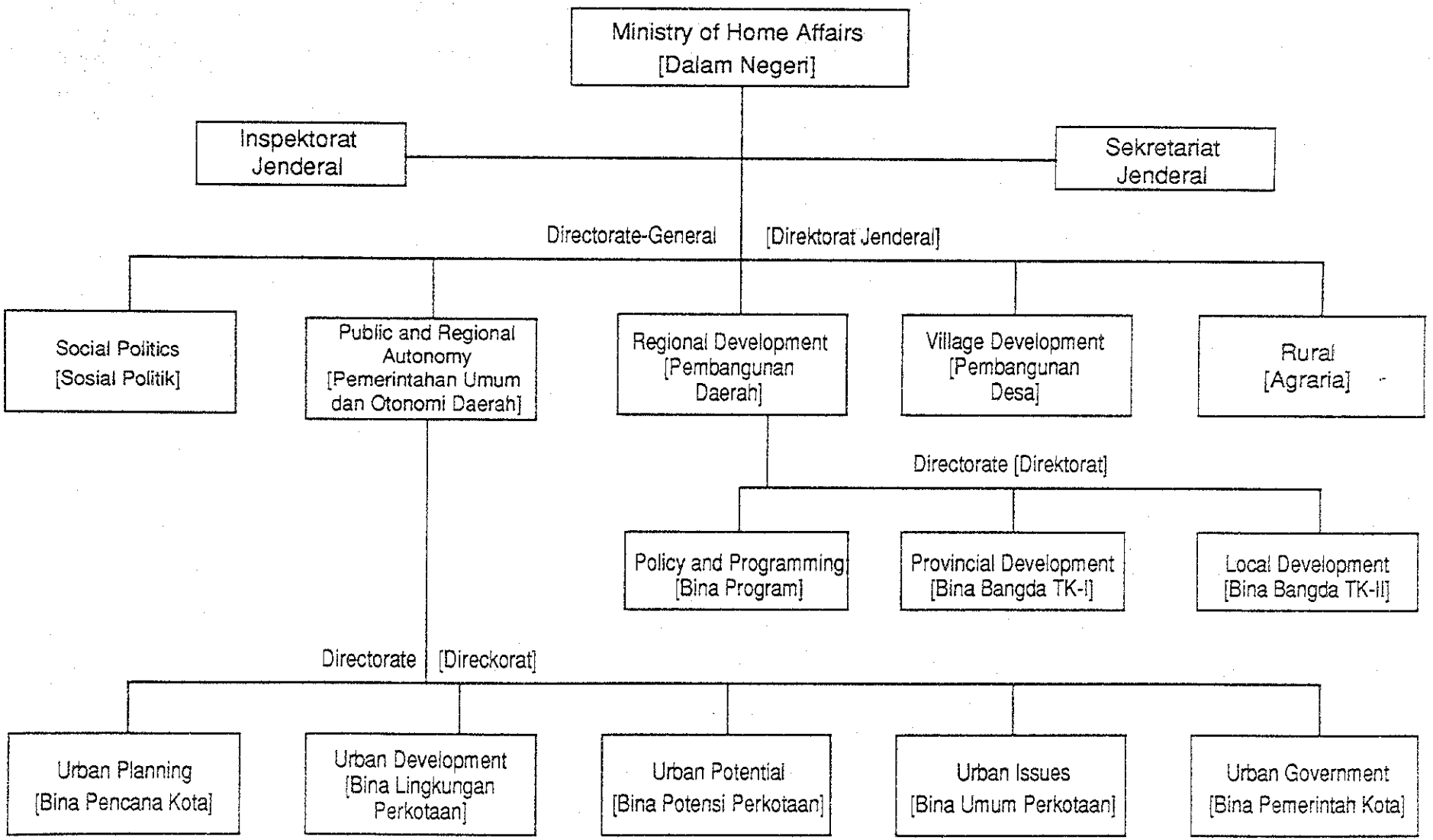
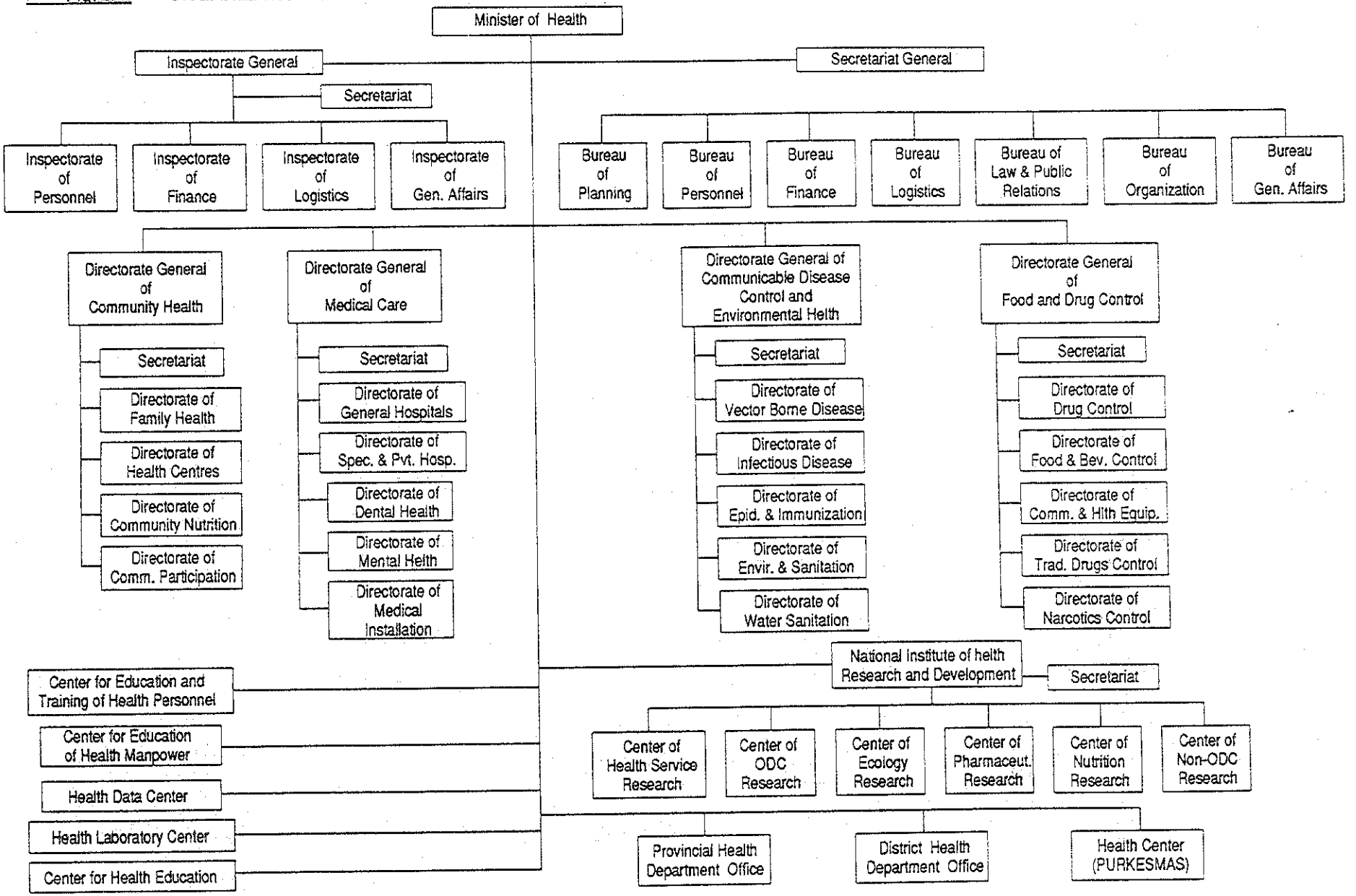


Fig. 2.4. ORGANIZATION CHART: MINISTRY OF HEALTH



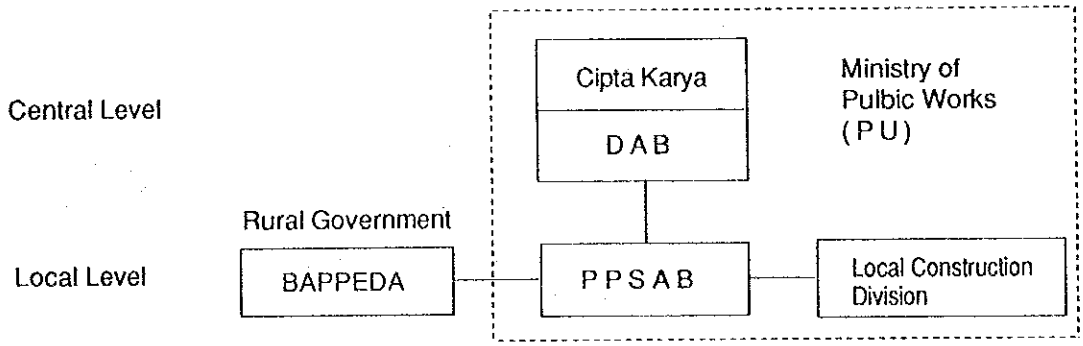
(2) Organizational Set-up for Implementation

Water supply projects are implemented by two sectors.

One is the ministry of Public Works and the other is local governments (Regional/Municipal). In the ministry, the Directorate of Water Supply (DAB) is in charge in Cipta Karya. Cipta Karya locates water supply projects (PPSAB) in each province, which conducts site selection, study and planning of the project having close relation with BAPPEDA of the provincial government, and carries out design, costing, tender and construction supervision.

Each PPSAB works closely with KANWILS (local office of PU) all the way through the planning and implementation.

Fig. 2.5 Organizational Set-up of the Ministry of Public Works for Water Supply Project



Source: Water Supply and Sanitation Sector, Final Report Vol. II - Appendices, 1990

The systems being transferred to BPAM/PDAM after test operation of the facilities, operation and maintenance of the systems are done by BPAM/PDAM. BPAM/PDAM are established in each region and municipality. In the nation, there are 148 bodies of BPAM and 137 enterprises of PDAM IN 1989.

BPAMs are subsidized by Cipta Karya in terms of finance, engineering and management, and supervised by PPSABs.until self-supporting management is possible. When Cipta Karya judges that the BPAM became self-supported, the BPAM is handed over to the provincial government, and become PDAM.

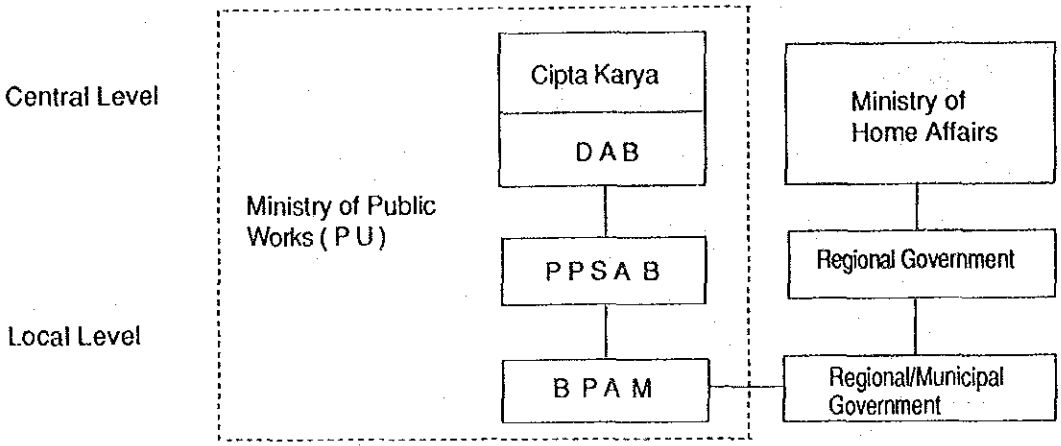
PDAMs will be supervised by PMDU of the provincial government.

Cipta Karya subsidizes the PDAMs transformed from BPAMs in kind, which is limited to materials (chemicals), until they diminish the deficit of its BPAM age. The central government plans to transform all the BPAMs to PDAMs by the end of 1993, handing over them to the local governments.

The organization set-up for administration differs depending on which territory the system is located in BPAM or PDAM.

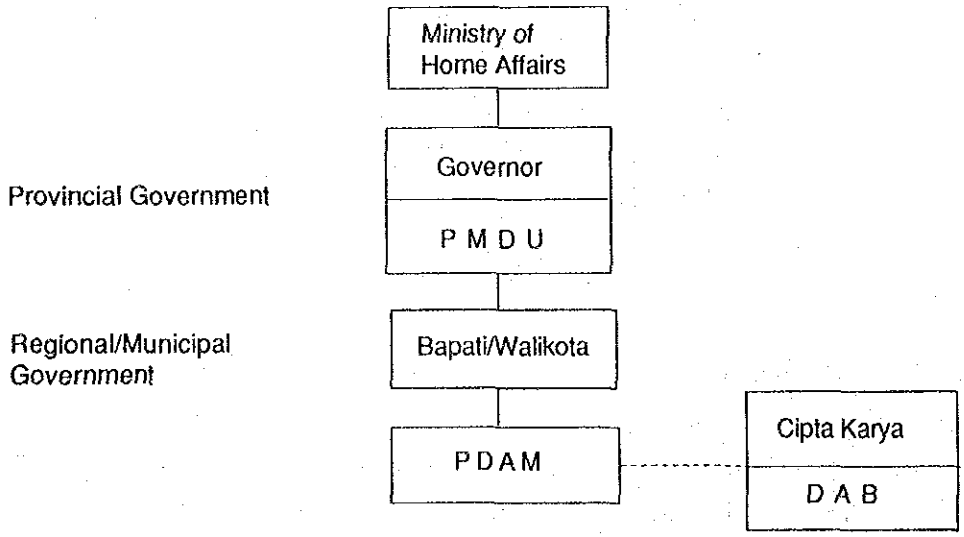
For the systems handed over to BPAMs, the organization set-up is as shown in Fig. 2.6. For the systems handed over to PDAMs is as of Fig. 2.7.

Fig. 2.6 Organizational Set-up for the Administration to BPAM



Source: Water Supply and Sanitation Sector Study, Final Report Vol. II - Appendices, 1990

Fig. 2.7 Organization Set--up for the Administration to PDAM



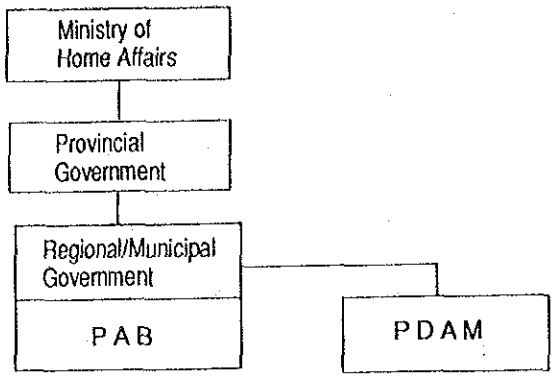
Source: Water Supply and Sanitation Sector Study, Final Report Vol. II - Appendices, 1990

The local governments (Regional/Municipal) are involved in the projects of rural water supply program implemented by PABs and the provision and expansion projects of PDAMs.

The rural water supply program as stated before is composed of piped water supply projects for villages, which is called Desa water supply systems and water source development projects for point sources of dwellings.

These facilities are upon the completion operated and maintained by LKMD (Village Development Institution), PKK (family Welfare Association), cooperative society or any other NGO. There are some cases that Desa systems were handed over to PDAM. PDAMs conducts the provision and expansion of their systems financing by their own funds and/or loans from the Ministry of Finance. In the Integrated Urban Infrastructures Development program (IUIDP), their roles are important in water supply sector. The water supply projects under this program are implemented by the joint-venture of PDAMs and Cipta Karya in many cases. Here, organizational set-up of the local governments for the implementation of water supply projects is shown in Fig. 2.8.

Fig. 2.8 Organizational Set-up of the Local Governments for the Implementation of Water Supply Projects



Source: Water Supply and Sanitation Sector Study, Final Report Vol. II - Appendices, 1990

BPAM/PDAM collect water fee from the beneficiaries.

They apply the following tariff to BNA water supply systems. This tariff divides the beneficiaries into 9 categories, and applies monthly basic fee as well as quantity dependent fee.

The unit price being more expensive for larger consumption, big customers are more loaded.

2. Outline of Relevant Development Plans

(1) Outline of the National Development Plan

The government of Indonesia has carried out four (4) national development plans (Repelita) since 1969. The fifth national development plan (Repelita-V) is now being carried out. The Repelita-V is the last plan of the first 25 year long term development plan as well as the basis of the second long term plan.

These five (5) year development plans have been drawn up with these major policies i.e.

1) even distribution of development gains,
2) sufficient economic growth,
3) Healthy and active stability of the society,

in which economic growth is most weighed, particularly.

1) agriculture development to aim at self sufficiency of food and manifold agricultural products, and

2) industrial development to aim at promotion of exportation, absorption of labor force, process of agricultural products and promotion of machine industry.

The Repelita-V calls for an economic growth rate with an annual average of 5% which is expected to create sufficient additional work opportunities to adsorb the rapid increment of labor force, anticipating the growth of industrial sector.

The source of fund in order to attain such economic growth relays on the increase of non-oil/gas export (double in 5 years at least) and the increase of domestic revenue (about three times in 5 years) in view of the future condition that is not favorable to the income from oil/gas production. The shortage of investment is anticipated to be covered by investment of private sector.

Thus, it must activate private enterprises, strengthening the neutralization policy to the investment regulation, which has been continuing since 1985. The shortage, which is not covered by the government investment and private sector investment, will be depended on ODAs and other foreign aid.

The total investment is planned to be 239,100 billion Rps for the five years. It is estimated that the average annual investment is 26.4% of the GDP. the government development budget is planned to be 107.5 billion Rps. in total for the five years including foreign aid. The planned development budget is shown in Table 2.1.

Table 2.1 Planned Development Budget for Repelita-V

Unit: 10 Billion Rp.

	1980/90	1990/91	1991/92	1992/93	1993/94	Total
I. Government saving	1,804.8	4,602.9	8,264.9	13,492.0	18,949.6	47,114.2
II. Foreign Aid	11,325.1	11,566.0	22,644.8	12,195.0	12,687.0	60,417.9
Total	13,129.9	16,168.9`	20,909.7	25,687.0	31,636.6	107,532.1

Source: Fifth Five - year Development plan 1989/90 - 1993/94
The Republic of Indonesia

The development budget is allocated weighting on the following sectors, Agriculture & Irrigation, Education, Mining & Energy, Road & Communication, Regional/City Development more than 10% of the total budget for each of these sections.

(2) Water Supply Program

Since water supply is an important element to stable the society and to improve health condition of the people, Repelita has provided water supply programs as well as strengthen water enterprises in terms of management, operation and maintenance of the facilities and technical level.

However, the progress of the water supply programs is far behind the target in general because of shortage of funds and staffs with the governments. The target of the programs was 70% coverage of water supply in urban areas and 55% coverage in rural areas at the end of Repelita IV, that is 1989, whereas it is reported that achievement was 60% in urban areas and 30.5% in rural areas.

In the Repelita IV, it was rather concentrated on the urban water supply program for the cities ranging from the population of 20,000 to 500,000. This program is called BNA water supply program, which was conducted by the DAB of Cipta Karya. This program is still on going in the Repelita IV.

Looking at the situation, the government drew a plan in which target is 80% coverage of water supply in urban areas and 60% coverage in rural areas within Repelita V.

The total budget for the five (5) years is estimated at 3,878.8 billion Rps for the five (5) years, which implements 820 urban water supply systems, 1,000 rural water supply systems and 2,000 water source facilities for villages (point sources such as well, rain collector). The budget of the first year for the water supply programs was 365.9 billion Rps.

The achievement of water supply programs throughout Repelita I-IV is shown in Fig. 2.9. The application of funds and the sources of funds are shown in Table 2.2

Table 2.2 Application and Sources of Funds-Water supply Subsector (1983-1989)

	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89	1983/84	1984/85	1985/86	1986/87	1987/88	1988/89
	(Rp Billion)						(%)					
Application of Funds												
Development Expenditures	60.8	81.7	106.5	90.2	242.7	195.1	48.6	49.7	52.6	45.5	68.9	60.1
DKI	12.4	7.1	16.6	11.9	54.0	25.9	9.9	4.3	8.2	6.0	15.3	8.0
Large cities	8.9	15.0	15.3	12.4	46.4	48.6	7.1	9.1	7.6	6.2	13.2	15.0
BHA	14.3	26.4	27.1	19.5	76.7	79.5	11.4	16.1	13.4	9.8	21.8	24.5
IKK	14.5	14.9	16.0	20.9	29.1	21.0	11.6	9.1	7.9	10.5	8.2	6.5
Overhead. training etc.	10.7	18.3	31.5	25.6	36.6	20.1	8.5	11.1	15.6	12.9	10.4	6.2
Local Projects	18.5	24.8	52.2	30.9	22.5	31.3	14.8	15.1	12.5	15.6	6.4	9.6
Operation and Maintenance	45.8	57.9	70.7	77.0	87.0	98.3	36.6	35.2	34.9	38.9	24.7	30.3
Total	125.1	164.4	202.4	198.1	352.2	326.7	100.0	100.0	100.0	100.0	100.0	100.0
Sources of Funds												
DIP	46.9	50.3	62.9	31.2	61.8	57.7	37.5	30.6	31.1	15.8	17.6	17.8
Cipta Karya	45.2	48.5	58.7	29.8	55.3	53.0	36.1	29.5	29.0	15.0	15.7	16.3
Pengatran	1.7	1.8	4.2	1.4	6.5	4.7	1.4	1.1	2.1	0.7	1.8	1.5
Foreign Aid	10.4	23.7	32.6	46.9	145.5	103.2	8.3	14.4	16.1	23.7	41.3	31.8
Cipta Karya	10.4	23.7	32.5	44.6	138.0	98.3	8.3	14.4	16.1	22.5	39.2	30.3
Pengatran	0.0	0.0	0.1	2.3	7.5	5.0	0.0	0.0	0.0	1.1	2.1	1.5
Subtotal DIP + Foreign	57.3	54.0	75.5	78.1	207.4	161.0	45.8	45.0	47.2	39.4	58.9	49.6
Domestic Loans	3.5	7.7	11.0	12.1	35.3	36.7	2.8	4.7	5.4	6.1	10.0	11.3
APBD I & II (Incl. INPRES)	64.2	82.7	95.9	107.9	109.5	127.0	51.4	50.3	47.4	54.5	31.1	39.1
Level I	3.8	4.5	3.5	5.1	8.5	9.4	3.0	2.7	1.7	2.6	2.4	2.9
Level II	1.5	1.7	1.3	4.3	2.1	2.4	1.2	1.0	0.6	2.2	0.6	0.7
PDAM	58.9	76.5	91.1	98.5	98.9	115.2	47.1	46.5	45.0	49.7	28.1	35.5
Subtotal local expenditures	67.7	90.4	106.9	120.0	144.8	163.7	54.2	55.0	52.8	60.5	41.1	50.4
Total	12.51	164.4	202.4	198.1	352.2	324.7	100.0	100.0	100.0	100.0	100.0	100.0

Source : Water Supply and Sanitation Sector Study Final Report vol. II Appendices. 1990

Considering low cost benefit aspect with water supply projects in rural area and necessity of drinking water with the people, Repelita V allocates funds weighting on the IKK water supply program.

This program is also conducted by the DAB of Cipta Karya, which aims implementation of piped water supply systems for rural towns ranging from the population of 3,000 to 20,000.

Repelita V also plans the Integrated Infrastructure Development Plan (IUIDP), and intends to develop various components of cities by means of cooperation of agencies concerned, fully utilizing limited funds and resources. The fund will be born by loans and return by means of tax, fare and fee paid by the users and beneficiaries. This program is applied for the cities having population of more than 20,000.

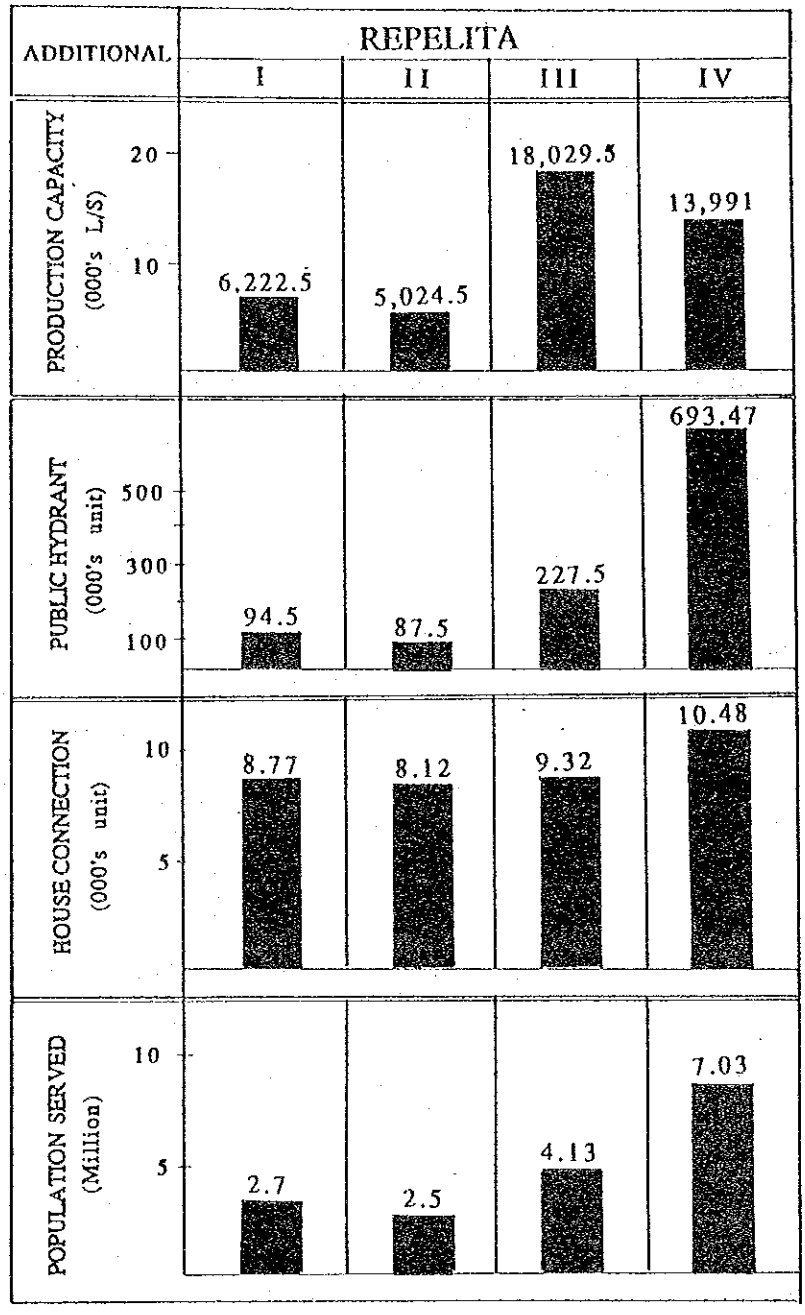
Here, the city classification of Cipta Karya is shown in Table 2.3.

Table 2.3 Cipta Karya's City Classification and Application of Development Programs

City Classification	Population	Program	Urban Water Program
1. Metropolitan	More than 1,000,000		
2. Large	500,000 - 1,000,000		
3. Medium	100,000 - 500,000	BNA	IUIDP
4. Small -1	50,000 - 100,000		
" -2	20,000 - 50,000		
" -3	10,000 - 20,000	IKK	
" -4	3,000 - 10,000		

Source: Housing and Human Settlements Development in Repelita V, 1989

TABLE 2.9 Achievements in Piped Water Supply Provision



Source: Overall Review of The Water Supply and Sanitation Sector, 1989

Local governments conduct a rural water supply program other than the programs stated before. This program is composed of piped water supply projects for villages and water source development projects for dwellings. The former aims to implement piped water supply systems for the villages having population of less than 3,000. The latter provides point sources (wells, rain collectors and sprig development) for dwellings.

It is because regional/municipal governments do not have sufficient funds to implement these projects, they conduct the program, receiving funds and materials from the provincial governments, Abri Mask Desa, Ministry of Health, Foreign Aid Groups and so on.

The target of Repelita V for the urban water supply programs is higher than that of Repelita IV, which plans to increase 13 million of people to be served by the water supply systems.
The target of the plan is shown in Table 2.4.

Table 2.4 The Target of Urban Water Supply Systems in The Repelita V

Fiscal Year	Production Capacity (l/s)	House Connection (unit)	Public Tap (unit)	Population Served (person)
1989/90	1,400	140,000	1,500	1,130,000
1990/91	2,000	250,000	2,200	1980,000
1991/92	2,800	350,000	3,800	2,830,000
1992/93	3,800	400,000	4,900	3,290,000
1993/94	4,000	460,000	5,500	3,770,000

Source: Housing and Human Settlements Development in Repelita V, 1989

3. Background of the Request and its contents

The fourth five (5) year national development plan (Repelita IV) ended in 1989 resulted in 30.5% of water supply in rural area, which was however lower than the target. The IKK water supply program achieved the provision of about 1,100 systems among 3,500 IKKs by the end of Repelita IV.

However, many IKKs still do not have water supply systems, and therefore the people cannot but directly drink water from rivers, springs, shallow wells, etc. In Indonesia, mortality caused by water related diseases in still high, and particularly infant mortality rate is as high as 58 per 1,000 life birth in 1989. It is said that one of the reasons is unsafe drinking water in rural areas.

In this situation, the government of Indonesia put more weight on the IKK water supply program than before in Repelita V, which plans to invest not only government funds but also funds of foreign aid in the program.

The government of Indonesia having put efforts on the provision of water supply mainly in the western and northern Jawa, he drew a new policy to give precedence to developing areas such as eastern Indonesia. Based on this background, Cipta Karya planned a water supply project covering South Sulawesi, Central Sulawesi and South-east Sulawesi, where access and water source conditions are favorable for the project. The government of Indonesia requested grant to implement the project to the government of Japan in the annual meeting of 1989 for economic and technical cooperation.

In order to put priorities among the candidate IKKs requested by the government of Indonesia, Japan International Cooperation Agency (JICA) ordered the fact finding study to a local consultant firm and JICA experts, and made the study report in September 1989. This study put priorities on 30 IKKs among 61 candidates based on the site selection criteria that willingness of the inhabitants is high, quantity and quality of the source is sufficient, access to the site is favorable, system without treatment plant and easy to maintain is feasible, gravity transmission is possible.

Based on the study report, the government of Japan decided to conduct a basic design study for 23 IKKs out of the 30 IKKs.

Major contents of the request is as follows.

(1) Design Criteria for the IKK Water Supply systems

Population to be served : More than 50% of the total population in the service area

Service Level	:	Ratio of population served by public taps is 50%.
		Ratio of population served by house connection is 50%.
Supply Level	:	30 l/cap/d for public taps
		90 l/cap/d for house connection
Water Allocation for Non-Domestic Demand	:	20%

(2) Facilities for the request

Intake facility

Transmission main (Including in pump set, if necessory)

Reservoir tank

Chlorination (If necessary)

Water treatment plant (If necessories)

Distribution system

Public taps with accessories

(3) Candidate IKK

The candidates IKKs are shown in Table 2.5.

Table 2.5 List of Candidate IKK

South Sulawesi

No.	Kabupaten	IKK Town	Population (est.1989/1990)
1.	Tana Toraja	Ulusalu	3,125
2.	〃	Salu	3,128
3.	〃	Kaero	2,839
4.	〃	Tiromanda	1,832
5.	Luwu	Malili	7,034
6.	〃	Masamba	9,671

Central Sulawesi

No.	Kabupaten	IKK Town	Population (est.1989/1990)
1.	Donggala	Toaya	3,710
2.	〃	Binangga	5,859
3.	〃	Tawaeli	11,199
4.	Banggai	Bone Bobakal	1,130
5.	〃	Sumbiut	3,105
6.	〃	Balantak	2,860
7.	〃	Salakan	2,158
8.	〃	Liang	2,017
9.	Poso	Pendolo	2,068

South East Sulawesi

No.	Kabupaten	IKK Town	Population (est.1989/1990)
1.	Kendari	Landono	3,635
2.	〃	Anduonohu	3,845
3.	〃	Lapuko	2,367
4.	Kolaka	Mowewe	3,218
5.	Muna	Wakadia	1,956
6.	Buton	Laompo	3,191
7.	〃	Sandangpangan	2,408
8.	〃	Takimpo	7,382

CHAPTER 3 OUTLINE OF THE PROJECT

CHAPTER 3 OUTLINE OF THE PROJECT

1. Objective of the Project

Water supply projects have been conducted as a part of the Five-year National Development Plan. Thus far, the targeted progress rate has not been achieved. In particular, only 30.5% of the water service ratio has been achieved in the rural areas due to the lack of funds.

The Fourth Five-year National Development Plan ended in 1988. Less than 5% of the initially planned water supply systems were completed in the IKKs under this Plan. It was reported that the main reason for the low accomplishment rate was the lack of project funds. But, in reality, it was attributed to insufficient project management and the lack of manpower.

To prevent the delay of the rural water supply plan, the Government of Indonesia decided to increase the water supply rate in the rural areas to 60% by the end of the Fifth Five-year National Development Plan that got underway in 1989 and established a plan to install 1,000 water supply systems in IKKs throughout the country by allocating grant aid from foreign countries mainly to the rural water supply projects.

The objective of the Project is to construct water supply systems for IKKs in the South, Central, and Southeast Provinces of the Sulawesi Island in order to provide sufficient, safe water to the residents and to improve their living standards.

2. Study and Examination on the Request

(1) Necessity and Appropriateness of the Project

Water supplies for the IKKs included in the Government of Indonesia's request are demanded by the farmers and by some public facilities such as public offices, schools, and hospitals. There are practically no private industries in the IKKs; thus, no demand for industrial water use exists. The water to be supplied will be used mainly for domestic purposes, such as for drinking, bathing, and flushing toilets.

Present water sources include springs, streams and shallow wells. Presently, the springs are mostly located a great distance away from the villages. To fetch water from these springs is an arduous task. To compound the problem, some springs have become contaminated by domestic animals and farming activities.

Normally, streams dry up during dry seasons and become turbid during rainy seasons and it is impossible to use them as domestic water sources throughout the year.

The turbidity of river water increases during the rainy season. Shallow wells are located close to houses. Unfortunately, most of them are located in the vicinity of a toilet and/or place for bathing, as has been the custom of the residents, and the water is contaminated. The water in some shallow wells becomes turbid during dry seasons. In some areas located close to the sea, shallow well water is saline.

Only, a small number of IKKs have water supply systems, but only few of them receive water supplies because of the insufficient amount of source water or because the systems have developed leaks.

As described above, there are a number of water supply related problems preventing the provision of safe, clean drinking water to the IKKs. These problems can be overcome by constructing the Project's water supply systems which will provide the IKKs with a convenient, sufficient, safe and stable water supply.

In view of the above, construction of the Project's water supply systems for the IKKs will meet the objectives of the Fifth Five-year National Development Plan and will contribute to improving the living standards of the residents of the IKKs, and the improvement of the technical level of IKK's water supply.

For these reasons, the implementation of the project with grant aid from the Government of Japan is thought to be appropriate.

(2) Management, Operation, and Maintenance Plan

The management, operation, and maintenance system of the existing water supply facilities was described in the previous Section.

Rural water supply systems to be constructed for the IKKs under the Project will be managed either by PDAM or BPAM, management organizations of the existing water supply systems.

Presently, each rural area has water supply facilities that are either under the BNA system or IKK system. These facilities will be integrated and come under the management of either PDAM or BPAM.

The organizational structures, including the number of personnel of PDAM and BPAM, are thought to be sufficient to undertake the management and operation of the Project's water supply systems. However, the number of PDAM and BPAM engineers must be increased in the future to correspond to the increase of water supply facilities.

The management of the Project's water supply systems should be basically supported by an autonomous accounting system. The systems' management, operation, and maintenance cost is planned to be paid for by water use fees and subscription fees.

The costs for IKKs' existing water supply systems are managed by an independent accounting system financially supported by the government. The expenses and revenues of the water supply systems are maintained in balance with the government covering approximately 10% of the expenses. It is, however, impossible to recover the construction costs of the water supply systems.

As a result of the hearing survey of area residents, it was confirmed that they have a willingness to pay water tariff within the limits of approximately Rp 1,000 to Rp 2,000/month/household.

Due to the inadequacies of the existing water supply facilities, the collection of water fees is not fully enforced. The establishment of a new water tariff collecting method is a future subject.

(3) Similar Projects

Foreign aid for water supply projects in Indonesia are provided by the World Bank (IBRD), the Asian Development Bank (ADB), and the governments of Australia, France, West Germany, Netherlands, Switzerland, the United States of America, Japan, etc.

Aid from IBRD is mainly used in the water supply field for problem solving, planning, and the strengthening of administrative and management organizations.

Aid from ADB is in the form of technical cooperation for conducting water supply project surveys for IKK and small city water supply systems. Also, the establishment of water supply rules and water supply organizations, and the preparation of the standards for water supply facility operation and maintenance systems are supported by ADB aid.

Aid from foreign countries is used to implement water supply projects.

The water supply projects mentioned here do not include IKK's which are to be covered by the Project.

(4) Selection of IKKs for the Project

The Study Team confirmed with CIPTA KARYA to conduct the field surveys of the 23 locations included in the Government of Indonesia's request.

The selection of IKKs to be included in the Project was made based on the following conditions:

1) Degree of domestic water need

2) Area having a suitable water source and favorable topographic conditions to install a simple water supply system requiring low cost and easy operations and maintenance work

3) Area having an improved road network which allows the access of construction equipment.

4) Several areas needing a water supply system located close by thereby allowing easy construction management.

Pendalo does not satisfy Condition 3 above. Construction equipment is not accessible. There are two roads that reach Pendolo. One road is from South Sulawesi. Plans were made to improve the road to make it an artery of the Trans-Sulawesi Highway by the end of 1990. However, the road improvement project has been delayed and its completion date is unknown. This road near the provincial border is no more than a foot

path. The road reaching Pendolo from the north comes around Lake Poso, however large vehicles cannot use this road

With such road conditions, it is impossible to conduct large scale construction work in Pendolo.

For the above reason Pendolo was deleted from the Project and 22 areas were included in the Project.

(5) Basic Principle for Project Implementation

As described in the previous Section, the appropriateness and necessity of the Project and the Indonesian side's capability to implement it were confirmed.

Further, since the effects of the Project meet the rules of the Japanese Government's grant aid programme, Project implementation with grant aid from Japan is thought to be appropriate. Thus, the Basic Design for the Project was prepared based on the premise that the Project would be implemented with Japanese grant aid. A part of the Indonesian Government's request was modified for the Basic Design as described above.

3. Outline of the Project

(1) Project Implementation and Its Organization

After completing Project construction, the Project facilities will be managed and operated either by PDAM or BPAM under the direction of CIPTA KARYA. PDAM and BPAM were organized to manage and operate rural water supply systems.

The organization chart of PDAM and BPAM is shown in Fig. 3-1.

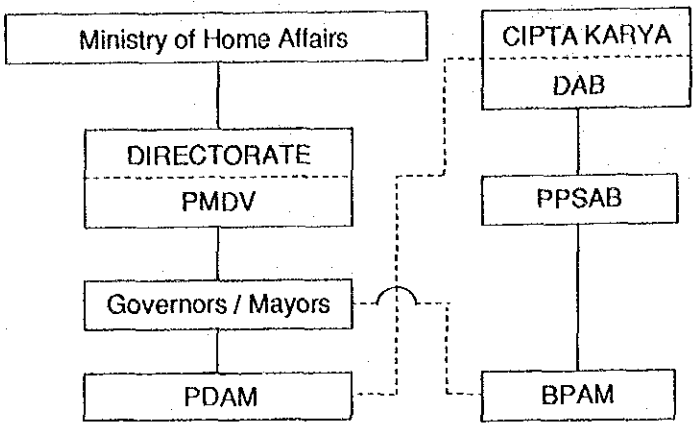


Fig. 3-1 Organization Chart of PDAM and BPAM

PDAM is under the jurisdiction of the provincial governments. BPAM is under the jurisdiction of the Directorate of Water Supply of the Ministry of Public Works. PDAM and BPAM have strong ties in managing water supply systems. Only for financial reasons are they under different jurisdiction.

The internal organization of PDAM and BPAM is shown in Fig. 3-2.

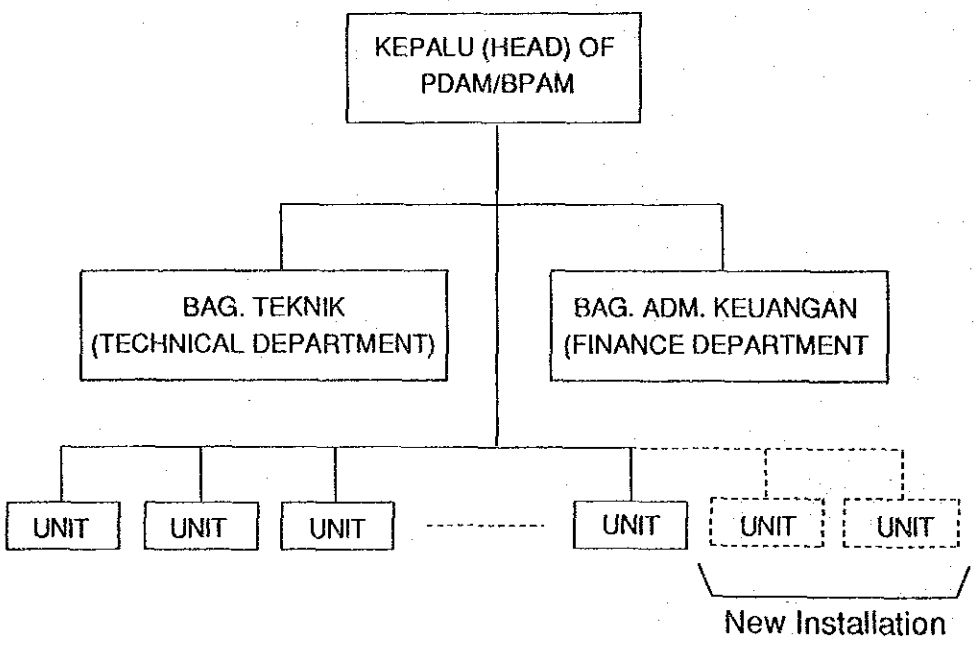


Fig. 3-2 Organization Chart of PDAM/BPAM

The technical and finance department of PDAM/BPAM are located in their headquarters.

For the operation and maintenance of each water supply system, PDAM/BPAM establishes an independent "Unit." If there is an increase in the number of IKK water supply systems, the number of Units must be increased.

For the management, operation, and maintenance of the Project's water supply systems, it is planned to assign a manager, an operator, and a water tariff collector for each IKK water supply system Unit. If a system has a pumping facility, an additional operator will be provided. PDAM/BPAM will increase the number of personnel and strengthen their organizations based on the increase in the number of new Units.

(2) Project Plan

As a result of a series of examinations, it was decided upon to construct water supply systems for eight IKKs in Central Sulawesi, six IKKs in South Sulawesi, and eight IKKs in Southeast Sulawesi (a total of twenty-two IKKs).

Each IKK's water supply system will differ depending upon its water source, water quality, and the topographic conditions in the area.

It would be necessary to construct an intake facility where the water source is a spring. Well construction would be necessary where groundwater is to be used as the water source. If there is fear of water source contamination, the construction of a water treatment facility would be required. If water service areas or water distribution pipes are located higher than the water source, the installation of a pumping facility would be necessary.

Table 3-1 lists the planned water supply facilities for each IKK.

(3) Locations and Conditions of Project Sites

Each IKK's topographic, area, and infrastructure conditions are tabulated in Table 3-2. The detailed conditions of each IKK is described thereafter.

Table 3.1 Design Water Supply Facilities for Each IKK

NAME OF IKK	INTAKE FACILITY	INTAKE PUMP	WELL	TRANSMI-SSON FACILITY	RESERVIOR TANK	DISTRIBU-TION FACILITY	PUBLIC TAPS	CHLORINA-TION FACILITY
1. South Sulawesi								
1-1 ULUSALU	○			○	○	○	○	○
1-2 SALU	○			○	○	○	○	○
1-3 KAERO	○			○	○	○	○	○
1-4 TIROMANDA	○			○	○	○	○	○
1-5 MALILI	○			○	○	○	○	
1-6 MASAMBA		○	○	○	○	○	○	○
2. Central Sulawesi								
2-1 TOAYA	○			○	○	○	○	○
2-2 BINANGGA	○			○	○	○	○	○
2-3 TAWAELI	○			○	○	○	○	○
2-4 BONEBOBAKAL	○	○		○	○	○	○	
2-5 SAMBIUT	○			○	○	○	○	
2-6 BALANTAK	○			○	○	○	○	
2-7 SALAKAN		○	○	○	○	○	○	
2-8 LIANG	○			○	○	○	○	○
3. Sutheast Sulawesi								
3-1 LANDONO		○	○	○	○	○	○	
3-2 ANDUONOHU	○	○		○	○	○	○	○
3-3 MOWEWE	○	○		○	○	○	○	○
3-4 WAKADIA	○	○		○	○	○	○	○
3-5 LAOMPO	○	○		○	○	○	○	○
3-6 LAPUKO	○			○	○	○	○	○
3-7 SANDANGPANGAN	○	○		○	○	○	○	○
3-8 TAKIMPO	○	○		○	○	○	○	○

Table 3.2 Basic Data for IKKS

IKK NAME	LOCATION			POPULATION	ECONOCICAL & FINANCIAL SITUATION			SANITATION (%)		DISEASES RELATED WATER		INFRASTRUCTURE	
	KABUPATEN	KECAMATAN	DISTANCE		INCOME	EXPENDITURE	LIVELI HOOD	TOILET	NO TOILET	MORBIDITY	MORTALITY	ELECTRICITY BYPU	WATER SUPPLY
SOUTH SULAWESI			*1		×1000Rp	×1000Rp	*2			(%)	(‰)		
ULUSALU	Tana Toraja	Saluputti	22	3.125	110	100	A	100	0	25	4	○	○(MOH)
SALU	〃	Sanggalangi	18	3.128	120	100	A	90	10	25	7	×	×
KAERO-	〃	Sangalla	20	2.839	100	90	A、F	100	0	25	2	○	○(CANADA)
TIROMANDA	〃	Makale	10	1.832	125	100	A	57	43	20	4	×	×
MALILI	Luwu	Malili	120	7.034	75	60	A、F、M	100	0	10	4.3	○	○(HOLLAND)
MASAMBA	〃	Bone	50	9.671	90	75	A、F	100	0	40	3	○	×
CENTRAL SULAWESI													
TOAYA	Donggala	Sindue	37	3.710	75	70	A、F	20	80	37	0	○	○
BINANGGA	〃	Marawola	7	5.859	70	70	A、O	25	75	34	0	○	○
TAWAELI	〃	Tawaeli	19	11.199	80	75	A	51	49	26	0	○	○
BONEBOBAKAL	Banggai	Lamala	663	2.168	80	50	F	56	44	54	6.3	×	×
SUMBIUT	〃	Tatikum	883	1.130	60	60	A	42	58	89	0.3	○	×
BALANTAK	〃	Balantak	746	3.105	90	80	W、O	57	43	87	0.7	○	×
SALAKAN	〃	Tinangkung	795	2.860	70	60	F、O	100	0	44	1	○	×
LIANG	〃	Liang	850	2.017						56		○	○
SOUTHEAST SULAWESI													
LANDONO	Kendari	Landono	32	3.635	50	40	A	77	23	37	3	×	×
ANDUONOHU	〃	Poasia	8	3.845	75	60	A	98	2	47	2	○	×
MOWEWE	Kolaka	Mowewe	145	3.218	75	75	A	95	5	30	2	△*3	×
WAKADIA	Muna	Kosambi	18	1.956	75	60	A	50	50	80	5	○	×
LAOMPO	Buton	Batanga	25	3.191	75	60	A	82	18	45	2	×	×
LAPUKO	Kendari	Moramo	54	2.367	50	40	A	60	40	39	2	△	○ (MOH)
SANDANGPANGAN	Buton	Sampolawa	32	2.408	60	40	A	70	30	4	1	×	×
TAKIMPO	〃	Pasar Wajo	50	7.382	65	55	A	75	25	16	2	△	×

NOTES : *1 : Km from kabupaten
*2 : A : Agriculture 、 F : Fishing 、 M : Mining、 W : Wood Work 、 O : Others *3 : By Engine Generator

South Sulawesi

- **Ulusalu**

Ulusalu is located in a valley of a mountainous area. The people here are mainly engaged in rice farming. Some farmers grow coffee.

Residents in the central area and Tomban receive their water supply through an existing water supply system. However, due to the system's severe leakage problem and, as there are an insufficient number of spring water sources, the residents are strongly demanding the construction of a new water supply system.

- **Salu**

The people of Salu are mainly engaged in agriculture and forestry. In the areas along the middle through downstream course of the Salu River rice farming is conducted. Some of Salu's residents commute to work in Makale.

In Salu there is no existing water supply system. Most of the residents obtain their domestic water from nearby springs. Many of these springs dry up during dry seasons and the residents desire the construction of a water supply system.

- **Kaero**

Kaero is mostly flatland where rice farming is predominant.

Some of Kaero's residents receive their water supply through the public taps of an existing water supply system that has two water distribution lines. One of these lines is not functioning at all.

The people of Kaero are strongly demanding the construction of a new water supply system.

- **Tiromanda**

In Tiromanda, most of the people are rice farmers. They conduct farming in the valleys of a mountainous area. There are some farms where coffee is

There is no existing water supply system in the area. The residents obtain their domestic use water from nearby springs, most of which only have a small water yield. Some of the springs dry up during dry seasons.

Since there are no existing roads near the mountainside, it will be very difficult to deliver construction materials to the area.

- **Malili**

Malili is located on an alluvial plain and in a hilly area. Farming and mining are mainly conducted in the area.

There is a drain coming from an ore processing plant that has been polluting the mountain stream.

A Dutch build water supply system is providing water to 98 households. However, due to the insufficient amount of water, water hours have been imposed. Residents not served by this water supply system must use the river water which is of low quality.

- **Masamba**

Masamba is the province's farm product trading center. There are many stores selling daily necessities. Masamba has a police headquarters, hospitals, schools, and an administrative service office. When Luwa prefecture is divided into two separate prefectures in the future, Masamba is planned to be the capital of the eastern prefecture.
No water supply system exists in Masamba. Many households have their own shallow wells. Households not having wells obtain their domestic water from neighbors' wells. Some of Balebo's residents use river water for domestic purposes.

Central Sulawesi

- **Toaya**

Copra farming is conducted in Toaya. Fishing is also conducted along the sea. In the central area, school construction is planned. The existing water supply system is old and does not function. Many households rely on their own shallow wells for their domestic water.

- **Binanga**

In Binanga there is an irrigation system that utilizes the water of the Sonbe River. Using the irrigation system, rice farming is mainly conducted in the area.

In Desa, there are a few small stores selling daily necessities.

A water supply system was constructed in 1951, but due to poor operations and maintenance and the pilfering of water from the conveyance line, water does not reach the end of the line in Binanga.

Residents in Pamela and Boyabarinaze in Desa are receiving water from the existing system. The residents desire the construction of a new water supply system where connections are made to each household.

- **Tawaeli**

Coconut and copra farming and farm product processing are conducted in Tawaeli. The only port in Tawaeli is in Pantaluan. Goods from Balu are unloaded at this port.

The existing water supply system is old and deteriorated. It serves only the area close to its water source.. Most of the residents rely on their own shallow wells or public use springs for their domestic water. In Pantaluan there is a water supply system that is only for port use.

- **Bonebobakal**

Bonebobakal is a deep-sea fishery base -- bonita is the main fish catch. Bonebobakal is a natural port where large fishing boats can enter.

There is no water supply system in the area and the residents must rely on their own or public owned shallow wells for their domestic water. Since the area is located on a cape, the water is saline. The salinity increases during dry seasons when some of the well water becomes undrinkable.

The residents have been requesting the construction of a water supply system.

- **Sumbiut**

Copra forming is Sumbiut's main industry.

There is a port in Sumbiut, but only small boats are able to use it.

There is no water supply system in the area. Many households obtain water from springs through bamboo pipes connected to the houses.

In Sumbiut and Bolonan, there are ten shallow wells. During dry seasons these wells yield only a small amount of water.
The residents of Sumbiut desire the construction of a water supply system.

- **Balantak**

Balantak is located in the middle part of the region. It is distribution center of goods. Balantak has schools, PLN, and an administrative service office. The residents are engaged in commerce, woodworking, and public service.

Only Padun has a water supply system. It serves about twenty households. Water is received through house connections. In other areas, residents obtain domestic water from their own wells.

- **Salakan**

Salakan is the gateway to Peleng Island. There is ferry service between Salakan and Luwuku, the center of the region. A new ferry service port will open next year.
The road networks in Peleng Island start from Salakan. Salakan is a distribution center of goods. There are warehouses and large stores. Many residents are engaged in the transportation business, and in commerce, fishery, and public service.

No water supply system exists in the area. Many household own private shallow wells. The water in these wells is saline. The salinity increases during dry seasons. In Ponganang (located on a cape) the residents have been suffering from the effects of drinking saline water. These people are demanding the construction of a water supply system.

There is no spring water in the vicinity of the area.

- **Liang**

The people of Liang are mainly engaged in farming and fishing. Liang has a market that is the distribution center of the area. There are three Desa in the area. One of them, Bajo, is a fishing village. Farming is dominant in the other two. There are plans to build a cacao distribution center in Liang.

The existing water supply system serves 200 to 300 residents in the central area. The system is subjected to leakages and water pilferage.

Many households obtain their domestic water from springs through house connected bamboo pipes.

There is an extreme water shortage in Bajo. Residents here obtain their drinking water from the existing water supply system, place it in bamboo tubes, and transport it by boat.

Southeast Sulawesi

- **Landono**

Landono is located on a hill. Farming is mainly conducted in the area. Landono is the center of Kubupaten and is the commerce center of the nearby settlement areas.

Electricity is supplied to the area, but no water supply system is installed. Area residents use spring water, river water, and well water. The river water is very turbid. The spring water and well water have high iron contents.

The residents strongly desire having a water supply system.

- **Andounohu**

Andounohu is located on a flat coastal terrace and part of a hill. People here are engaged mainly in rice farming. There is a freight port nearby.

No water supply system exists in the area and the residents must use river water or well water. About 80% of the residents rely on shallow wells, but the wells yield only a small amount of water during dry seasons.

- **Mowewe**

Mowewe is situated in a trough basin where rice farming is predominant. It is the basin's transportation center. People bring goods in from the surrounding mountainous areas.

No water supply system exists in the area and the residents rely on rivers and shallow wells for their domestic water. However, the quality of the river water and shallow well water is poor.

- **Wakadia**

Wakadia is located on a hilly terrace. Farming is predominant in the area. It is planned to build a vegetable distribution center here.

There is no water supply system in the area and the residents use river water or shallow well water for their domestic use. During rainy seasons river water turbidity becomes high and the residents are obliged to rely soley on the shallow wells. Unfortunately, the quality of the well water is extremely poor.

- **Lapuko**

Lapuko is located on a hilly coastal terrace and in a relatively low mountainous area. The flat land in the area is used for stock farming.

In 1985 the Ministry of Health constructed a water supply system in Lapuko, but, as the pipe connection at the intake point was poor, the system remains unused. Area residents resort to using river water and shallow well water even though the water quality is poor.

- **Sandapangan**

Sandapangan is located on mountainsides. The people of Sandapangan mainly engage in the growing of coffee and pepper.

No water supply system is installed in the area and residents must rely on rivers and springs for their domestic water. The people have to fetch water from great distances. A medical clinic closed two years ago because of the inconvenience of obtaining water.

- **Takimpo**

Takimpo is located on a flat coastal terrace. The main industry here is farming. There is an asphalt shipping port nearby. Takimpo is a suburb of Bauban, the prefecture's capital, and is the capital's source of farm products.

There is no water supply system in the area and residents must obtain domestic water from rivers and shallow wells. The river water is heavily polluted and some of the wells yield saline water.

(4) Outline of the Design Water Supply Facilities

Necessary facilities for the water supply systems to be constructed at twnety-two IKKs are outlined below:

1) Intake Facilities

For water supply systems using water from springs and streams it will be necessary to construct intake facilities to protect the water sources and intake water. An intake facility will consist of an intake weir or pit, a sand removal facility (if necessary), and a drain pipe.

2) Intake Pump Facilities

For water supply systems where the water source is located at an elevation lower than the water served area or whose transmission pipes traverse a higher elevation area than the water served area, it will be necessary to install an intake pump facility in order distribute the water by gravity flow. The facility will consist of a pump suction well, pumps, and a generator unit.

3) Well Facilities

Well facilities will have to be provided to the three IKKs that cannot obtain water from streams or springs. Well facility construction includes well drilling, well casing installation, well finishing work, and pump installation.

4) Transmission System

Transmission system must be constructed to convey water from the water sources to reservoir tank. A transmission system consists of a pipeline, valves, sand flushing units, and air relief valves.

5) Distribution Reservoir

A reservoir tank stores water for use during peak water demand times, intake pump shutdown periods (for pump maintenance work), or for well repair periods in order to distribute water without interruption. The facility consists of either a reinforced concrete-made tank or FRP elevated tank and its incidental equipment.

6) Distribution System

Water is distributed from the distribution reservoir to each service point through the distribution system. The system consists of a pipeline, drainage units, and air relief valves.

7) Public Tap

Public taps will be installed serve water to IKK residents. The facility consists of a concrete made sink and water taps.

8) Chlorination Facility

A chlorination facility is installed to disinfect in order to provide safe water. Calcium hypochlorites in powdered form will be used. A chlorinator feeder is to be installed at the fore bay of the reservoir tank.

(5) Operation and Maintenance Plan

The water supply systems to be constructed for the Project can be classified into two types; the gravity flow type, and the pump type.

For a gravity flow type water supply system, two men will be required to operate and maintain its intake facility, pipeline, reservoir tank, chlorination facility, and other associated facilities.
For a pump type water supply system, at least four men will be needed: two men to operate and maintain the pump facility and two men to operate and

maintain the intake facility, pipeline, reservoir tank, chlorination facility, and other associated facilities.

The technical skills required for Project facility operations and maintenance personnel has already been acquired through experience gained in operating and maintaining the existing water supply facilities (Project facilities, such as pumps and generators are similar to those used for the existing water supply systems). It is expected that the experienced personnel will train the new personnel to perform Project related work.

Table 3-3 shows the estimated operation and maintenance costs for Project water supply systems.

Each Project water supply system will require a different amount of operation and maintenance cost. By referencing the operation and maintenance costs of existing water supply systems in each Sulawesi province, the rate of the operation and maintenance cost of the Projects water supply systems to the average income in the water serving area of each province was calculated. Southeastern Sulawesi has the highest rate of 2.7%. This figure is thought to be within the range each area resident can afford.

Table 3-3 Operation and Maintenance Cost Estimates of Water Supply Systems

Project Area		Number of Households to Receive Water Supply (x 10)	Average Annual Income in Area Rp 65.000 x 12 x No. of Households	Estimated Oprcation and Maintenance Costs (OPC)					Burden Rate (OPC/Average Annual Income) (%)
				Generator/ Pump 10 hr/day Operation Fuel: rp 145/PNL: Rp 150/kwh	Employees' Salaries Rp 25.000/ person/ month	Office Experiences: Rp 10.000/ 2 persons Rp 20.000/ 4 persons	Chlorine Cost: Rp 4.000/kg	TOTAL	
			x Rp 1.000	x Rp 1.000	x Rp 1.000	x Rp 1.000	x Rp 1.000	x Rp 1.000	
1. SOUTH SULAWESI									
1.1 ULUSALU	A	230	179.400	—	900	180	1.360	2.440	1.4
1.2 SALU	A	190	148.200	—	900	180	1.090	2.170	1.5
1.3 KAERO	A	240	187.200	—	900	180	1.390	2.470	1.3
1.4 TIROMANDA	A	170	132.600	—	900	180	960	2.040	1.5
1.5 MALILI	A	640	499.200	—	900	180	0	1.080	0.2
1.6 MASAMBA	F	1.060	826.800	4.100	1.200	240	6.900	12.440	1.5
SUB TOTAL			1.973.400	4.100	5.700	1.140	11.700	22.640	1.1
2. CENTRAL SULAWESI									
2.1 TOAYA	A	300	234.000	—	900	180	1.810	2.890	1.2
2.2 BONHANGA	A	600	514.800	—	900	180	3.840	4.920	1.0
2.3 TAWAELI	A	1.060	826.800	—	900	180	6.180	7.260	0.9
2.4 BONEBOBAKAL	C	120	93.600	4.700	1.200	240	0	6.140	6.6
2.5 SUMBIUT	A	370	288.600	—	900	180	0	1.080	0.4
2.6 BALANTAK	A	350	273.000	—	900	180	0	1.080	0.4
2.7 SALAKAN	D	260	202.800	1.700	1.200	240	0	3.140	1.5
2.8 LIANG	A	240	187.200	—	900	180	1.470	2.550	1.4
SUB TOTAL			2.620.800	6.400	7.800	1.560	13.300	17.620	0.7
3. SUTHEAST SULAWESI									
3.1 LANDONO	E	420	327.600	3.100	1.200	240	0	4.540	1.4
3.2 ANDUONOHU	D	490	382.200	4.100	1.200	240	2.850	8.390	2.2
3.3 MOWEWE	D	540	421.200	9.200	1.200	240	3.170	13.810	3.3
3.4 WAKADIA	D	450	351.000	9.200	1.200	240	2.630	13.270	3.9
3.5 LAOMPO	C	380	296.400	4.700	1.200	240	2.260	8.400	2.8
3.6 LAPUKO	B	320	249.600	—	900	180	1.890	2.970	1.2
3.7 SAMDANGP.	C	310	241.800	14.300	1.200	240	1.810	17.550	7.3
3.8 TAKIMPO	C	670	522.600	4.700	1.200	240	3.890	10.030	1.9
SUB TOTAL			2.792.400	49.300	9.300	1.860	18.500	76.660	2.7

4. Technical Cooperation

In 1987, rural water supply systems that are on the same level as the Project's were installed in 46 areas in Sulawesi. The management, operation, and maintenance of the existing systems are conducted either by PDAM or BPAM. Thus, it is considered that the management, operation, and maintenance of the Project's water supply systems can be taken care of by strengthening the PDAM and BPAM organizations without providing any technical cooperation.

Since the rural water supply systems for the IKKs are designed by the Directorate of the Water Supply of the central government, and that the management, operation, and maintenance of the systems are carried out by the provincial PDAM or BPAM, proper construction is sometimes not conducted because of inadequate design study. Furthermore, the design concepts of the systems are sometimes not fully reflected in the operation and maintenance of the systems after their construction completion.

For the sound development of the rural water supply systems, it will be necessary to educate the technicians who will be assigned the task of operating and maintaining the systems. The education/training must take place during the planning and design stages. For this reason, it will be essential to conduct the technical transfer during the Project implementation period. Also, it will be necessary to educate the concerned personnel at the recently completed water supply and environmental sanitation training center or send them to Japan where they can receive appropriate training, mainly in the field of rural water supply projects.

CHAPTER 4 BASIC DESIGN

CHAPTER 4 BASIC DESIGN

4-1 Design Policy

This Basic Design Follows Rural/IKK* Water Supply Guidelines that are based on the Five-year National Development Plan of Indonesia (REPELITA 5). In addition, the Design Guidance for Rural Water Supplies issued by Japan' Ministry of Public Welfare was referred to.

Based on the Rural/IKK Water Supply Guidelines, the design was made to meet the water requirements up to the year 2000 AD.

The objective of the Project is to provide water for domestic use. This does not include the provision of water supplies for industry, livestock, or irrigation.

Based on Rural/IKK Water Supply Guidelines, the minimum water supply rate is set at 50%.

The design water service level extends to the public taps even though the hydraulic calculation takes into consideration the water supply to house connections.

In area where there are existing water supply facilities, the repair and reuse of those facilities are not taken into consideration because of their state of disrepair and small size.

To simplify the water supply system, the hand operation method is adopted.

Water sources needing no other water treatment facility than chlorination were selected.

There are some intake, transmission and reservoir sites where it would be inconvenient to transport construction materials. Therefore, construction methods and material needs must be decided upon by taking into consideration transportation convenience.

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* IKK: Ibu Kota Kecamatan (Sub-District Capital)

4-2 Study and Examination on Design Criteria

Based on the Rural/IKK Water Supply Guidance issued by CIPTA KARYA and the Design Guidance of Rural Water Supply issued by Japan's Ministry of Health and Welfare, the design criteria for this Project is determined as follows:

Design Criteria		Examination
(1) Population increase rate		
To be applied to each population growth rate of Kabupaten.		Population Increase rates vary in each Kabupaten, also they are different from the average of the country. The increase rate of population adopted is based on the data of the past 5 years and calculated by each Kabupaten.
(2) Water supply service level		
house connections : public taps = 50% : 50%		Recommended water supply service level of CIPTA KARYA is the range of house connections: public taps = 50% : 50% to 80% : 20%. Considering the present water supply service level and water supply development conditions in Sulawesi, 50% : 50% water supply service level is adequate.
(3) Rates of water usage		
Domestic use		
- house connection	90l/c/d	To be based on the Rural/IKK Water Supply Guidance. This rate is suitable for present living conditions in the IKKs.
- public tap	30l/c/d	
Hospital used		
- patient	40l/bed/d	To be based on the actual water use of existing hospital. Water usage rate of house connection is adopted for quarters.
- attendant	40l/c/d	
- employee	10l/c/d	
- quarters	90l/c/d	
School use		
- School	2000l/School/2 hrs	To be based on the 2 hours' water quantity of a 13mm tap.

Design Criteria	Examination
(4) Factor of daily maximum water demand = 1.1	To be based on the recommended value is the Rural/IKK Water Supply Guidance. Because of small annual change of atmospheric temperature, the annual change of water demand is small. Therefore, the coefficient 1.1 is adequate.
(5) Coefficient of hourly maximum water demand = 2.1 - 3.1	The recommended value of the Rural/IKK Water Supply Guidance is 1.5. However the capacities of facilities are small scale. Therefore the water quantity for all taps fully opened is adopted.
(6) Diameter of pipe end : over 30mm	To be based on the water quantity when all taps are fully opened.
(7) Water allocation for non-drinking demand = 5%	To be based on the Rural/IKK Water Supply Guidance.
(8) Water allocation for leakage and losses in the system = 15%	To be based on the Rural/IKK Water Supply Guidance.
(9) Number of water served persons per public tap = 100 persons/tap	To be based on the Rural/IKK Water Supply Guidance. The water supply area of one tap is about 250m radius, depends on the population density.
(10) Number of persons per house = 10 persons/house	To be based on the Rural/IKK Water Supply Guidance.

4-3 Basic Design

(1) Water Supply Plan

1) Water Served Area

Design water served areas and each populations are listed as follows;

Table 4.1 Design Water Served Areas and Population

1. South Sulawesi:		
1-1	ULUSALU	3,125
1-2	SALU	3,128*
1-3	KAERO	2,839
1-4	TIROMANDA	1,832
1-5	MALILI	7,034
1-6	MASAMBA	9,671
2. Central Sulawesi:		
2-1	TOAYA	3,710
2-2	BINANGGA	5,859*
3-3	TAWAELI	11,199*
2-4	BONEBOBAKAL	1,130
2-5	SAMBAIT	3,105
2-6	BALANTAK	2,860
2-7	SALAKAN	2,158
2-8	LIANG	2,017
3. Southeast Sulawesi:		
3-1	LANDONO	3,635
3-2	ANDUONOHU	3,845
3-3	NOWEWE	3,218
3-4	WAKADIA	3,956
3-5	LAOMPO	3,191
3-6	LAPUKO	2,367
3-7	SANDAN PANGAN	2,408
3-8	TAKIMPO	7,382

* The populations are shown in 1990 excepting mark * (1989)

2) Design Population Served

The Population Served (Appendix 6-1) is determined as against the present total population of the water served area, Considering the topography and socio-economy of the area. (Table 4.3 refers)

The available population data on a district (Kabupatan) basis in all the concerned Provinces of Sulawesi, for each year from 1984 to 1988 is shown in Table 5.2. It is evident from the above table that the population in each Kabupatan has undergone an yearly increase.

Hence the average population growth rate in 1984 - 1988 was computed using the following relationship.

$$\left(\frac{\text{Population in 1988}}{\text{Population in 1984}}\right)^{1/4} - 1$$

The results are also shown in Table 5.2. Accordingly, the population growth rate varried widely from 0.5% in Kabupatan Tana Toraja to 5.36% in Kabupatan Kolaka, whereas the average population growth rate of whole Indonesia is 2.1%.

Hence, applicability of this existing population growth rate in extrapolating the design water service population in the year 2000 as well, for each Kabupatan, is studied for the above two (2) Kabupatans with extreme growth rate variations.

In general, population growth rate of an area in governed by landuse, climate, social and econimic considerations. In this regard, the Kabupatan Tana Traja, where the population growth rate is the lowest of 0.5%, is situated in mountainous terrain with very limited arable land and the available transportation means in also very limited. On the contrary, the Kabupatan Kolaka, having the highest growth rate of 5.36%, is a coastal plain with well developed road networks and is a centre of commerce, fishing and other economic activities. Hence it is reasonable to have such extreme population growth rate variation.

Accordingly, the design water service population in the year 2000 is determined assuming the population growth rate would remain the same as that of Table 5.2. Also it is assumed that all IKKs of a particular

Kabupatan will have that same average population growth rate as the Kabupatan.

After calculating the average population increase rate by each Kabupaten based on the data obtained between the years 1984 and 1988, the design population served is then calculated as follows:

$$Pn = Po \quad (1 + \gamma)^n$$

Pn	:	Estimated population after n years
Po	:	Present population served (Table 5.3)
n	:	Years between year of data and design year
γ	:	Average population increase rate (Table 5.2)

Table 4.3 shows calculation results of design population served.

Table 4.2 Change of Population in Project Areas and the Population Increase Rate

area \ population	1984 population	1985 population	1986 population	1987 population	1988 population	Average Rate
1. South Sulawesi						
Luwu district	559,875	570,681	594,182	600,214	614,525	2.35
Tana Toraja district	340,015	342,279	344,886	346,113	346,538	0.50
total	899,890	912,960	939,068	946,327	961,063	1.70
2. Central Sulawesi						
Banggai district	311,044	329,362	326,979	331,641	334,851	1.9
Donggala district	638,031	667,681	681,429	686,302	722,480	3.16
total	1,239,135	1,305,064	1,320,123	1,334,853	1,389,916	2.74
3. Sutheast Sulawesi						
Buton district	344,268	349,531	367,504	373,794	379,731	2.48
Muna district	188,053	190,933	202,765	205,155	206,367	2.35
Kendari district	380,053	399,597	423,542	429,118	435,731	3.46
Kolaka district	174,972	179,665	197,084	203,744	215,638	5.36
total	1,087,611	1,119,726	1,190,895	1,211,811	1,237,467	3.33

Source : Sulawesi Salatan Dalam Augka, 1988
Sulawesi Tengah Dalam Augka, 1988
Sulawesi Tenggara Dalam Augka,1988

Table 4.3 Estimation of Population Served in Year 2000

Project area	Present Population (Po)	Service years (n)	Average Annual Population Increase Rate (γ)	Population Served in 2000 (Pn)
1. South Sulawesi:				
1-1 ULUSALU	2,199	10	0.5	2,311
1-2 SALU	1,765	11	0.5	1,865
1-3 KAERO	2,272	10	0.5	2,388
1-4 TIROMANDA	1,572	10	0.5	1,652
1-5 MALILI	5,050	10	2.35	6,370
1-6 MASAMBA	8,381	10	2.35	10,572
2. Central Sulawesi:				
2-1 TOAYA	2,217	10	3.16	3,026
2-2 BINANGGA	4,687	11	3.16	6,600
3-3 TAWAELI	7,517	11	3.16	10,584
2-4 BONE BOBAKAL	968	10	1.9	1,168
2-5 SAMBAIT	3,105	10	1.9	3,748
2-6 BALANTAK	2,860	10	1.9	3,452
2-7 SALAKAN	2,158	10	1.9	2,605
2-8 LIANG	2,017	10	1.9	2,435
3. Southeast Sulawesi:				
3-1 LANDONO	2,994	10	3.46	4,207
3-2 ANDUONOHU	3,460	10	3.46	4,862
3-3 NOWEWE	3,218	10	5.36	5,424
3-4 WAKADIA	1,956	10	2.35	* 4,467
3-5 LAOMPO	3,013	10	2.48	3,849
3-6 LAPUKO	2,300	10	2.46	3,232
3-7 SANDAN PANGAN	2,408	10	2.48	3,076
3-8 TAKIMPO	5,233	10	2.48	6,686
Total	74,959			94,579

* : Considering the new town development plan, the design population served in Wakadia was calculated as follows; $Pn = Po \times (1 + \gamma)^n + 2,000$

3) Design Water Demand

a. Design Daily Average Water Demand

Considering the following items from i to x, the design daily average water demand is determined:

i. Domestic Water

Service level	Rate of water using	Rate of service level
House connection	90 l/c/d	50%
Public taps	30 l/c/d	50%

Table 4.4 shows the design daily average water demand for domestic water, based on the design population served (Table 4.3) and the above rates.

Table 4.4 Design Daily Average Water Demand (domestic water)

Project area	A. Population served in design year (2000)	B. House connection A x 0.5 x90l/day	C. Public taps A x 0.5 x 30l/day (m^3/day)	D. Summation B+C (m^3/day)
1. South Sulawesi:				
1-1 ULUSALU	2,311	104	35	139
1-2 SALU	1,865	84	28	112
1-3 KAERO	2,388	107	36	143
1-4 TIROMANDA	1,652	74	25	99
1-5 MALILI	6,370	287	96	383
1-6 MASAMBA	10,572	476	156	635
2. Central Sulawesi:				
2-1 TOAYA	3,026	136	45	181
2-2 BINANGGA	6,600	297	99	396
3-3 TAWAELI	10,584	476	159	635
2-4 BONE BOBAKAL	1,168	53	18	71
2-5 SAMBAIT	3,748	169	56	225
2-6 BALANTAK	3,452	155	52	207
2-7 SALAKAN	2,605	117	39	156
2-8 LIANG	2,435	110	37	147
3. Southeast Sulawesi:				
3-1 LANDONO	4,207	189	63	252
3-2 ANDUONOHU	4,862	219	73	292
3-3 NOWEWE	5,424	244	81	325
3-4 WAKADIA	4,467	201	67	268
3-5 LAOMPO	3,849	173	58	231
3-6 LAPUKO	3,232	145	48	193
3-7 SANDAN PANGAN	3,076	138	46	184
3-8 TAKIMPO	6,686	301	100	401
Summation	94,579	4,255	1,420	5,675

ii. Hospital

Among the Project areas only Nasamba has a hospital. No additional hospitals are planned for Project areas. Therefore, this design treats only the water demand for the Masamba Hospital

Table 4.5 Calculation of Population Served at the Hospital

Classification	*1 Design Water Usage rate	1990	2000
Patients	40 *l*/c/d	100 beds	300 beds *2
Attendants	40	300 persons	900 persons
Employees (live out)	10	152 persons	456 persons
Employees (live in)	90	70 persons	210 persons

*1: Based on the actual figures of 1989.

*2: Estimated based on long range plans of the Masamba Hospital Other estimated persons are assumed to be those in the year 2000 (3 times as many as in 1990).

Table 4.6 Design Water Demand of Masamba Hospital

Classification	Year 1990	Year 2000
Patients	4 m^3/day	12 m^3/day
Attendants	12	36
Employees (live in)	1.6	4.6
Employees (live out)	6.3	18.9
Total	23.9 m^3/day	71.5 m^3/day

iii. Schools

Most of the schools in the Project areas are dither junior or junior high schools. Daily school hours are short. Hence, assuming a water serving period for school is 2 hours per day, the design water demand per school is determined as follows:

-: Conditions :-

Diameter of tap: 13 mm

Water quantity: 17 l/min/tap

Water served period: 2 hours/day

Table 4.7 Design Water Demand for School

Project area	Number of Schools	Water Usage Rate m^3/school/day	Design Water Demand m^3/day
ULUSALU	2	2	4
SALU	1	"	2
KAERO	2	"	4
TIRO MANDA	1	"	2
MALILI	3	"	6
MASAMBA	8	"	16
TOAYA	4	"	8
BINANGGA	3	"	6
TAWAELI	5	"	10
BONE BOBAKAL	1	"	2
SAMBIUT	5	"	10
BALAKAN	2	"	4
SALAKAN	4	"	8
LIANG	3	"	6
LANDANO	3	"	6
ANDUONOIIU	3	"	6
MOWEWE	3	"	6
WAKADIA	3	"	6
LAOMPO	3	"	6
LAPUKO	3	"	6
SANDANG PANGAN	3	"	6
TAKIMPO	3	"	6
Total	68		136

iv. Shops and Hotels

Shops and Hotels are very small scale. They are mostly combined with house. Therefore, the water demand for shops and hotels is considered to be a part of the domestic water.

v. Public Organizations

Because of short work hours and the small number of workers, and no workers' houses the water demand for public organizations is considered to be a part of domestic water.

vi. Water Demand for Other Development Project

An industrial park has been built in Wakadia and houses of 200 employees are planned to be construct in it. Therefore, the

population served in Wakadia is considered to be 2000 persons more than the population based on present conditions.

vii. Water allocation for non-domestic water is 5%.

viii. Water allocation for leakage and losses is 15%.

ix. The water demand for livestock and industrial facilities is not taken into consideration.

x. The design water service rate is 50 - 100%. Water served persons per tap is 100.

b. Design Daily Maximum Water Demand

The design daily maximum water demand is 110% of daily average water demand. This is based on the Rural IKKs Water Supply Guidance. Table 4.8 shows the design daily maximum water demand.

c. Water Demand Design Hourly Maximum

The recommended hourly maximum rate (C x (hourly maximum water demand/daily maximum water demand) ÷ 24) is 1.5 in the Rural/IKKs Water Supply Guidance. However, the hourly maximum rate is changed to 2.4 for the following reasons:

The water quantity when all taps are fully opened greatly exceeds the hourly maximum water demand. In this case, water may not reach the taps at the pipe end.

Table 4.8 shows the hourly maximum water demand based on the Rural/IKKs Water Supply Guidance and the hourly maximum rate of the time when all taps are fully opened. In Table 5.8 the average of hourly maximum rate when all taps are fully opened is from 2.1 to 3.1. Therefore, the design hourly maximum rate is based on these factor.

Table 4.9 shows the design hourly maximum water demand. Detail of the design hourly maximum water demand is attached in Appendix 6-2.

Table 4.8 Design Hourly Maximum Water Demand

Project Area	Daity Average Water Demand (m^3/day)	Daity Maximum Water Demand (m^3/day)	Hourly Maximum Water Demand per CIPTA KARYA Guidance	Tap Disharge		
				number of taps	Discharge (m^3/hr) *1	ratio of hourly Maximum
1. South Sulawesi						
1-1 ULUSALU	173	190	11.9	23	23.5	3.0
1-2 SALU	138	152	9.5	19	19.4	3.1
1-3 KAERO	177	195	12.2	19 *2	19.4	2.4
1-4 TIROMANDA	122	134	8.4	17	17.3	3.1
1-5 MALILI	469	516	32.3	49 *2	50.0	2.3
1-6 MASAMBA	873	960	60.0	91 *2	92.8	2.3
2. Central Sulawesi						
2-1 TOAYA	228	251	15.7	25 *2	25.5	2.4
2-2 BINANGGA	485	534	33.4	46 *2	46.9	2.1
2-3 TAWAELI	779	857	53.6	91 *2	92.8	2.6
2-4 BONE BOBAKAL	89	98	6.1	12	12.2	3.0
2-5 SAMBIUT	284	312	19.5	32 *2	32.6	2.5
2-6 BALANTAK	255	281	17.6	30	30.6	2.6
2-7 SAMBIUT	198	218	13.6	21 *2	21.4	2.4
2-8 LIANG	185	204	12.8	24	24.5	2.9
3. Southeast Sulawesi						
3-1 LANDONO	312	343	21.4	37 *2	37.7	2.6
3-2 ANDUONOHU	360	396	24.8	39 *2	39.8	2.4
3-3 MOWEWE	400	440	27.5	39 *2	39.8	2.2
3-4 WAKADIA	331	364	22.8	35	35.7	2.4
3-5 LAOMPO	286	315	19.7	33 *2	33.7	2.6
3-6 LAPUKO	240	264	16.5	27 *2	27.5	2.5
3-7 SANDANGPANGAN	230	253	15.8	31	31.6	3.0
3-8 TAKIMPO	491	540	33.8	62 *2	63.2	2.8

*1 Discharge : (number of taps)×17ℓ /min×60min

Discharge when all taps are fully opened : 17ℓ /min

*2 Five Taps System is not including in the number.

Table 4.9 Design Water Demand

Project Area	A. Domestic Water		B. Hospital		C. School		D. Non domestic Water (A+B+B) × 0.05	E. Leakage and Losses (A+B+C+D) × 0.15	F. Daily Average Water Demand (m³/day)	G. Daily Maximum Water Demand F × 1.1 (m³/day)	H. Hourl Maximum Water Demand G/24x2.4 (m³/hr)
	Population Served	Water Demand (m³/hr)	Number of facilities	Water Demand (m³/hr)	Number of facilities	Water Demand (m³/hr)					
1. South Sulawesi											
1-1 ULUSALU	2.311	139	0	0	2	4	7	23	173	190	23.5
1-2 SALU	1.865	112	0	0	1	2	6	18	138	152	19.4
1-3 KAERO	2.388	143	0	0	2	4	7	23	177	195	19.4
1-4 TIROMANDA	1.625	99	0	0	1	2	5	16	122	134	17.3
1-5 MALILI	6.370	383	0	0	3	6	19	61	469	516	50.0
1-6 MASAMBA	10.572	635	1	72	8	16	36	114	873	960	92.8
2. Central Sulawesi											
2-1 TOAYA	3.026	181	0	0	4	8	9	30	228	251	25.5
2-2 BINANGGA	6.600	396	0	0	3	6	20	63	485	534	46.9
2-3 TAWAELI	10.584	635	0	0	5	10	32	102	779	857	92.8
2-4 BONE BOBAKAL	1.168	71	0	0	1	2	4	12	89	98	12.2
2-5 SAMBIUT	3.748	225	0	0	5	10	12	37	284	312	32.6
2-6 BALANTAK	3.452	207	0	0	2	4	11	33	255	281	30.6
2-7 SALAKAN	2.605	156	0	0	4	8	8	26	198	218	21.4
2-8 LIANG	2.435	147	0	0	3	6	8	24	185	204	24.5
3. Southeast Sulawesi											
3-1 LANDONO	4.207	252	0	0	3	6	13	41	312	343	37.7
3-2 ANDUONOHU	4.862	292	0	0	3	6	15	47	360	396	39.8
3-3 MOWEWE	5.424	325	0	0	3	6	17	52	400	440	39.8
3-4 WAKADIA	4.467	268	0	0	3	6	14	43	331	364	35.7
3-5 LAOMPO	3.849	231	0	0	3	6	12	37	286	315	33.7
3-6 LAPUKO	3.232	193	0	0	3	6	10	31	240	264	27.5
3-7 SANDANGPANGAN	3.076	184	0	0	3	6	10	30	230	253	31.6
3-8 TAKIMPO	6.686	401	0	0	3	6	20	64	491	540	63.2
Total		5.675	1	72	68	136	295	927	7.105	7.817	817.9

3) Planned Water Sources

For the selection of water sources, the following items were mainly considered:

i. Hydrogeological study results (table 4.11)

ii. Topographic conditions between water sources and water served areas. (elevation and distance)

iii. Condition of access to water source for facility construction and operation and maintenance purposes.

iv. Existing water rights.

Table 4.10 shows the results of the selection of water sources.

Design Water Source

Project Area	Water Source	Eype	Capacity (m³/day)	Reliability	Exisiting Water Right	Relative Height to Distribution Pund (m)	Distance to to Distribution Pund (m)	Distance from Existing Road (km)
1. South Sulawesi								
1-1 ULUSALU	Kondongan	Spring	259	good	Domestic Water	144.5	1.344.8	0.3
1-2 SALU	Lemo	Spring	276	inferior	irrigation	117.8	771.1	0.3
1-3 KAERO	Salambu	Spring	5.184	good		37.2	1.863.0	0.5
1-4 TIROMANDA	Parino	Spring	2.506	inferior	irrigation	80.7	2.800.1	6.2
1-5 MALILI	Karebbe	Spring	3.456	good		12.0	50.0	0.1
1-6 MASAMBA	–	Well	864	good		-35.1	217.3	0
2. Central Sulawesi								
2-1 TOAYA	Kayudango	Spring	1.037	good		7.9	718.0	0.5
2-2 BINANGGA	Kurondo	Spring	1.037	good	irrigation			0.9
2-3 TAWAELI	Rubo	Spring	1.728	good	Domestic Water	5.3	648.0	0.2
2-4 BONE BOBAKAL	Lomba	Spring	2.851	good		-34.3	2.678.4	0.2
2-5 SAMBIUT	Moang	Spring	2.592	good		10.7	625.9	0.7
2-6 BALANTAK	Di Matana	Spring	1.728	good		97.1	504.3	1.2
2-7 SALAKAN	–	Well	280	good		-29.8	77.0	0
2-8 LIANG	Koili	Mountain Stieam	12.960	inferior	Domestic Water	27.7	450.1	Steep road
3. Southeast Sulawesi								
3-1 LANDONO	–	Well	864	good		-55.5	75.5	0
3-2 ANDUONOHU	Matanggonawa	Spring	5.184	good		-28.0	2.000.0	0.5
3-3 MOWEWE	Matioka	Spring	864	good		-25.8	2.150.0	0.1
3-4 WAKADIA	Rawa	Spring	4.320	good		-66.3	2.137.2	0.4
3-5 LAOMPO	Kalangona	Spring	43.200	good		-24.4	1.372.0	0.8
3-6 LAPUKO	Langgayaropa	Mountain Stieam	4.320	inferior	irrigation	6.7	1.427.7	marsh
3-7 SANDAGPANGAN	Rano	Spring	4.320	good		-277.5	868.1	1.0
3-8 TAKIMPO	Labcanpangule	Spring	5.000	good		-28.8	469.1	0.7

4) Water Quality of Planned Water Source

Results of water quality analysis are attached to Appendix 6-2 and the Indonesian Water Quality Standard for Dringking Water by CIPTA KARYA is shown in table 4.12.

Among the water quality criteria shown in Table 4.12, the maximum value of the water quality standard for treated water (item B) is adopted as the standard value for determining the necessity of a treatment facility. In addition, for design purposes, the following consideration is given to the following:

a. Pollution of Water Source

Detection of either colon bacillus or anmonian nitrogen indicates that the water source is polluted. In such case, sterilization is necessary. In Indonesia, chlorine gas is used for water treatment in urban areas and hypo-chloride is used for water treatment in local cities. Considering the method of procurement, custody and handling of treatment chemicals, is believed that Hypo-chlorite is suitable for the Project areas.

b. Turbidity

Among the available water quality data, no turbidity figure exceeds 5 degrees (the figure for kaoline) which is the upper level of the Indonesian water quality standards for turbidity. However, sedimentation by clay and sand particles during the rainy seasons may possibly cause turbidity to increase to a higher level than shown in the data available. Therefore, sand removal facilities are to be installed depending upon water source situations.

c. Hardness

From a geological viewpoint, there are many water sources in the Project areas that exists in limestone formations. Although the total hardness and concentration of calcium of such water are relatively high, the total hardness is less than 300 mg/l, the Indonesian water quality

standard. In case of a spring that

Table 4.11 Hydrogeology of Design Water Source

Project areas	Water Source	Hydrogeology
1. South Sulawesi		
1-1 ULUSALU	Kondongan	Spring exists in gravel bed
1-2 SALU 3	Lemo	Spring exists in block joints of andesite formation
1-3 KAERO 3	Salambu	Spring exists in reef limestone
1-4 TIROMANDA	Parlno	Spring exists in block joints of andesite formation
1-5 MALILI	Karebbe	Spring exists in pyrocrastic material and lava
1-6 MASAMBA 1	-	Confined water in gravel aquifer
2. Central Sulawesi		
2-1 TOAYA	Kayudango	Spring exists in gravel bed of alluvial fan of Toaya river
2-2 BINANGGA	Kurondo	Spring exists in shale of river-side of Somba river
2-3 TAWAELI	Rubo	Spring exists in gravel bed of alluvian fan of Pontaloan river
2-4 BONE BOBAKAL	Lomba	Spring exists in reef limestone
2-5 SUMBIUT	Moang	Spring exists in errosion cave of reef limestone
2-6 BALANTAK	Di Matana	Spring exists in gravel bed of the mid-slope of Mt. Talima
2-7 SALAKAN	-	Groundwater in reef limestone
2-8 LIANG	Koill	Spring exists in corrosion cave in reef limestone
3. Southeast Sulawesi		
3-1 LANDONO	-	Unconfined water in gravel bed
3-2 ANDOUNOHU	Mataggonawa	Spring exists in talns gravel in river terrace and limestone
3-3 MOWEWE	Maiioka	Spring exists in Quaternary deposit of techtonic basin
3-4 WAKADIA	Rawa	Spring exists in reef limestone
3-5 LAOMPO	Kalangona	Spring exists in reef limestone
3-6 LAPUKO	Langgayaropa	Spring exists in talus gravel in river terrace
3-7 SANDANPANGAN	Rano	Spring exists in cracks of limestone
3-8 TAKIMPO	Labeanpangule	Spring exists in reef limestone

discharges free carbonation into the air, the raw water becomes cloudy by separated calcarious matter. In order to remove the calcarious matter sedimented in the intake facility and/or reservoir, a sediment flushing facility must be iunstalled.

d. Chloride ion

Although several water sources in the Project areas contain chloride ion, the concentrtion is far below Indonesian water quality standads and presents no problem.

e. Groundwater Quality

The quality of groundwater will be determined after test drilling during the detail design stage.

Except for Masamba, there is no particular need for treatment facilities because, judging from the topography, geology, and the previous basic study results, it appears that the quality of groundwater is the same as the quality of spring water. A treatment facility is needed in Masamba because of the large population to be served.

Table 4.13 indicates whether or not a Project area requires a water treatment facility.

Table 4.12 Indonesian Water Quality Standard for Drinking Water

No.	Items (Unsur-Unsur)	Unit (Satuan)	Water Quality Standard Syarat-Syarat Air Minum		
			Standard for treated Water (Min.) (Min. yang diperolehkan)	Standard for treated Water (Max.) (Maks.yang dianjurkan))	Standard for treated Water (Allowable value) (Maks.yang diperbolehkan)
	I. Fisika				
1.	Suhu udara/air	℃			Suhu udara
2.	Warna	Unit (Skala Pt Co)		5	50
3.	Bau				
4.	Rasa				
5.	Kekeruhan	Unit(Skala silika)		5	25
	II. Kimia				
6.	Derajat Keasaman (pH)		6.5		9.2
7.	Zat padat/jumlah	mg/l		500	1500
8.	Zat organik(sebagai KMnO4)	〃			10
9.	Karbondioksida Agresif(sebagai CO2)	〃			0.0
10.	Kesadahan jumlah	OD	5		10
11.	Kalsium (sebagai Ca)	mg/l		75	200
12.	Magnesium (〃 Mg)	〃		30	150
13.	Besi/jumlah (〃 Fe)	〃		0.1	1.0
14.	Mangan (〃 Mn)	〃		0.05	0.5
15.	Tembaga (〃 Cu)	〃		0.05	1.5
16.	Seng (〃 Zn)	〃		1.0	15
17.	Klorida (〃 Cl)	〃		200	600
18.	Sulfat (〃 SO4)	〃		200	400
19.	Sulfida (〃 H2S)	〃			0.0
20.	Fluorida (〃 F)	〃			2.0
21.	Amonia (〃 NH4)	〃			0.0
22.	Nitrat (〃 NO3)	〃			20.0
23.	Nitrit (〃 NO2)	〃			0.0
24.	Phenolik (〃 Phenol)	〃		0.001	0.002
25.	Arsen (〃 As)	〃			0.05
26.	Timbal (〃 Pb)	〃			0.10
27.	Selenium (〃 Se)	〃			0.01
28	Kromium (〃 Cr)	〃			0.05
29.	Sianida (〃 CN)	〃			0.05
30.	Kadmium (〃 Cd)	〃			0.01
31.	Air Raksa (〃 Hg)	〃			0.001

Table 4.13 Necessity of Water Treatment Facility

Project area	Colon bacillus and NH4-N	Turbidity	Hardness	Chlorine ion	Ground Water
1. South Sulawesi					
1-1 ULUSALU	○	○	×	×	
1-2 SALU	○	×	×	×	
1-3 KAERO	○	×	×	×	
1-4 TIROMANDA	○	×	×	×	
1-5 MALILI	×	×	×	×	
1-6 MASAMBA					–
2. Central Sulawesi					
2-1 TOAYA	○	×	×	×	
2-2 BINANGGA	○	×	×	×	
2-3 TAWAELI	○	×	×	×	
2-4 BONE BOBAKAL	×	×	×	×	
2-5 SAMBIUT	×	×	×	×	
2-6 BALANTAK	×	×	×	×	
2-7 SALAKAN					–
2-8 LIANG	○	○	×	×	
3. Southeast Sulawesi					
3-1 LANDONO					–
3-2 ANDUONOHU	○	○	×	×	
3-3 MOWEWE	○	○	×	×	
3-4 WAKADIA	○	×	×	×	
3-5 LAOMPO	○	○	×	×	
3-6 LAPUKO	○	×	×	×	
3-7 SANDANGPANGAN	○	×	×	×	
3-8 TAKIMPO	○	×	×	×	

Legond ○ : Water treatment is reguired

× : Water treatment is not reguired