4.3   Institutional Plan

4.3.1   Wastewater management

In the M/P, two Alternatives I and II are studied as elucidated before. Pursuant to the nation-wide trend, the Alternative II shall be selected for the F/S in the year 2005. The F/S is carried out in the framework of the M/P.

(1)   Basic conditions

   1)   Population in 2005 : 1,520 thousand

   2)   Revision of Perda, KMUP : No.6/1974 etc.

        for amalgamation of a transitional unit (BPAL) with PDAM

   3)   The present PDAM

        a.   The present number of personnel : 417 persons for 53,537 households

        b.   Future plans for a long term : Uncertain/unknown

        Though it is said that the personnel will be about 800 persons in 1990 for 100,000 households and on the other hand that the number will not increase according to increment of the capacity of water supply because of the introduction of computerization.

(2)   Required personnel

   1)   Total number of personnel in 2005 :   1,319 persons

   2)   Break-down

        i.   Presidential room (President/directors/staff) :   6 persons

        ii. Supervision council (Supervisors) :   5 persons

        iii. General and financial directorate :   263 persons

        iv. Others (Administration such as Research, Audit,

             Security, Housing service, etc) :   233 persons

> v. Water supply directorate : 600 persons
>
> vi. Wastewater directorate : 212 persons

(3) Organization chart

Reference is made to *Fig* 4.4 as attached herewith.

4.3.2 Solid waste management

As described in the Master Plan, PD Kebersihan shall be established to provide efficient service by the year 2005. It is desirable to establish PD Kebersihan together with implementation of Priority Project planned to start in 1996. Contracting out to the private sector shall be done in the six (6) old Kecamatan as explained in this report.

(1) Basic conditions

> i. Service area : All the area of KMUP. Concerning disposal of solid waste, the concept of the MINASAMAUPA is emphasized.
>
> ii. Service population : 1,520 thousand in 2005, of which those served by each type are as follows;
>
>   - Direct operation : 1,061,300 persons (69.8%)
>
>   - Contracting-out : 458,700 persons (32.2%)
>
> iii. Dinas Kebersihan will convert to PD Kebersihan by 2005. The work of septage desludging will be transferred to a wastewater management institution when it is set up, from Dinas or PD Kebersihan.
>
> iv. One head office and four branches shall be established as mentioned in the Master Plan.
>
> v. The number of the branches includes an office of joint operation with Dinas Kebersihan, Gowa for the Samata disposal site to start in 2002.
>
> vi. Workshop is located at Tamangapa.

vii. Waste collection and haulage from the six old Kecamatan to the TPA shall be contracted-out to the private sector.

(2) Transitional transaction

a. Plan for the establishment of the PD Kebersihan

A few years are considered required for setting up a plan to materialize the establishment of PD by the year 2005, even if a study on the plan commences in 1996.

b. Necessary departments/branches for PD Kebersihan

PD Kebersihan shall be managed in principle on a self-accounting basis, which is far different from the managerial method of Dinas Kebersihan.

The difference by nature between the two requires strengthening of administrative fields in addition to that of technical ones to provide beneficiaries with up-graded services.

New departments and branches necessary for PD Kebersihan shall be planned and prepared, utilizing the present duties of affairs and/or sections as widely as possible, however when this seems to be difficult it is then advisable to set up a new organization structure afresh regardless of the present structure of Dinas Kebersihan.

(3) Legal procedures

a. A new Perda shall be issued by the Mayor of KMUP and promulgated by the Governor of South Sulawesi for the change of the legal status from Dinas to PD Kebersihan, based on the regional / local autonomy, by the year 2005.

b. Perda (number, in blank) of KMUP (undated) concerning the establishment of PD Kebersihan was drafted by KMUP in February, 1995 but has not legitimately been signed and promulgated yet by the authorities concerned.

The draft stipulates in the "considering; b" that ... the existing Dinas Kebersihan is required to be changed into becoming a local enterprise and in Chapter II Article 2 that Dinas Kebersihan ..., its form is changed

into becoming a local cleansing enterprise of KMUP, then it is called as "PD Kebersihan" (local cleansing enterprise) of KMUP.

(4) Required personnel for the F/S in 2005

PD Kebersihan requires 859 in total in the year 2005, subject to the realization of the contracting-out to the private sector, roughly broken down as below.

(a) Head office (Bontoala) 139 persons	a) President room:	3 persons (President and others)
	b) supervision council:	3 persons (Council members)
	c) Internal auditing:	12 persons (general Financial & Tech-operation Auditors)
	d) Development & research:	5 persons (Research, Analysis, Monitoring)
	e) General director & departments	116 persons (general directors and personnel of 4 departments)
(b) Branches 720 persons		
a) Branch 1 (Bontoala) 56 persons	a. Administration b. Inspector c. Street sweeping	3 persons 7 persons 46 persons
b) Branch 2 (Tamangapa) 86 persons	a. Administration b. Workshop c. Depot No.1	5 persons 18 persons 63 persons
c) Branch 3 (Panakkukang) 379 persons	a. Administration b. Depot No.2 c. Collection/Ditch Cleaning d. Street sweeping	17 persons 44 persons 225 persons 93 persons
d) Branch 4 165 persons	a. Administration b. Collection/Ditch Cleaning c. Street sweeping	8 persons 117 persons 40 persons
e) Branch 5 34 persons	a. Administration b. TPA (from 2002)	5 persons 29 persons

Remarks: This is the minimal number of personnel.

Number of Personnel & PD Kebersihan in 2005 (total: 859 persons)

With 859 persons, and by contracting-out for 30.2% of the KMUP population, PD Kebersihan will be able to attain 90% of the collection ratio of solid waste from the total population (1,520,000) (providing that the contracting-out can be materialized.

(5) Organization chart

Refer to *Fig.* 4.5 as attached herewith.

(6) Joint operation of Samata disposal site

1) Land: 168 ha in total (65 ha for Phase I, 56 has for II & 47 ha for III)

Letter of instruction of Kecamatan Somba Opu to Mr. Lurah of the Kelurahan Samata dated June 26, 1995 in compliance with the direct instruction of Mr. Bupati of Gowa made on June 23, 1995.

The instruction letter provides not to recommend the right of transfer of those land owners to another party that can disturb the land acquisition plan to JICA. Lists of the land owners (242 persons) and respective square meters (73.76 ha in total) are attached to the instruction letter. The area falls on the Phase I area (65 ha) for TPA at the Samata Site of the Study.

2) Agreement on the land use and the operation of Samata disposal site between the Mayor of KMUP and Mr. Bupati of Gowa Kabupaten for the approval of the Governor of South Sulawesi province. This agreement is indispensable.

3) Commencement time of operation

The year 2002 will be desirable as a starting year of the operation in light of the life of the present TPA of KMUP at Tamangapa (inclusive of the planned extension at that site). However, the time of establishment of PD should be taken into account as an important element.

4)　Type of the office

The site shall be regarded as a branch of Dinas or PD Kebersihan of KMUP (equating a similar case of Bekasi final disposal site for DKI Jakarta), though the operation shall be jointly carried out.

5)　Required personnel

-	Manager	1 person
-	Administrative staff	4 persons
-	Engineer	2 persons
-	Weigh bridge staff	3 persons
-	Heavy equipment operator	10 persons
-	Drive	6 persons
-	Working staff	8 persons
	Total	34 persons

Discussion shall be made on the number of staff from and between KMUP and Kabupaten Gowa. It is at least expected that the manager and one administrative personnel are from KMUP, and some other administrative staff are from Gowa particularly for public relations to the citizens.

[1] Ref: John Taylor *MFEI Eligible Expenditures Monitoring System*, USAID, 1993, Chap 2

[2] Ref: MOPW *IUIDP Sulawesi Part III*, 1990, pp. 3.2.1-5

[3] INPRES had been divided into eight categories by the end of REPELITA V. Due to contractionary new budget in 1994 and development budget restructuring, total budget of INPRES was slightly declined from Rp. 5361.5 million to Rp. 5340.5 million.

[4] In principle, the residual 30% is transferred to regional governments/special law entities as grant funds. As a matter of course, this allocative figure varies depending on given factors.

[5] Source: Ministry of Finance, Asian Development Bank, 1995

[6] Ref: B. Suselo, J. L. Taylor and E. Wegelin *Indonesia's Urban Infrastructure Development Experience: Critical Lessons of Good Practice*, UNCHS, 1995, pp. 56-71

[7] Source: J. L. Taylor *MFEI Eligible Expenditures Monitoring System*, USAID, 1993, p.12

FIG. 4.1   Implementation Schedule of Feasibility Study Project for Wastewater Management
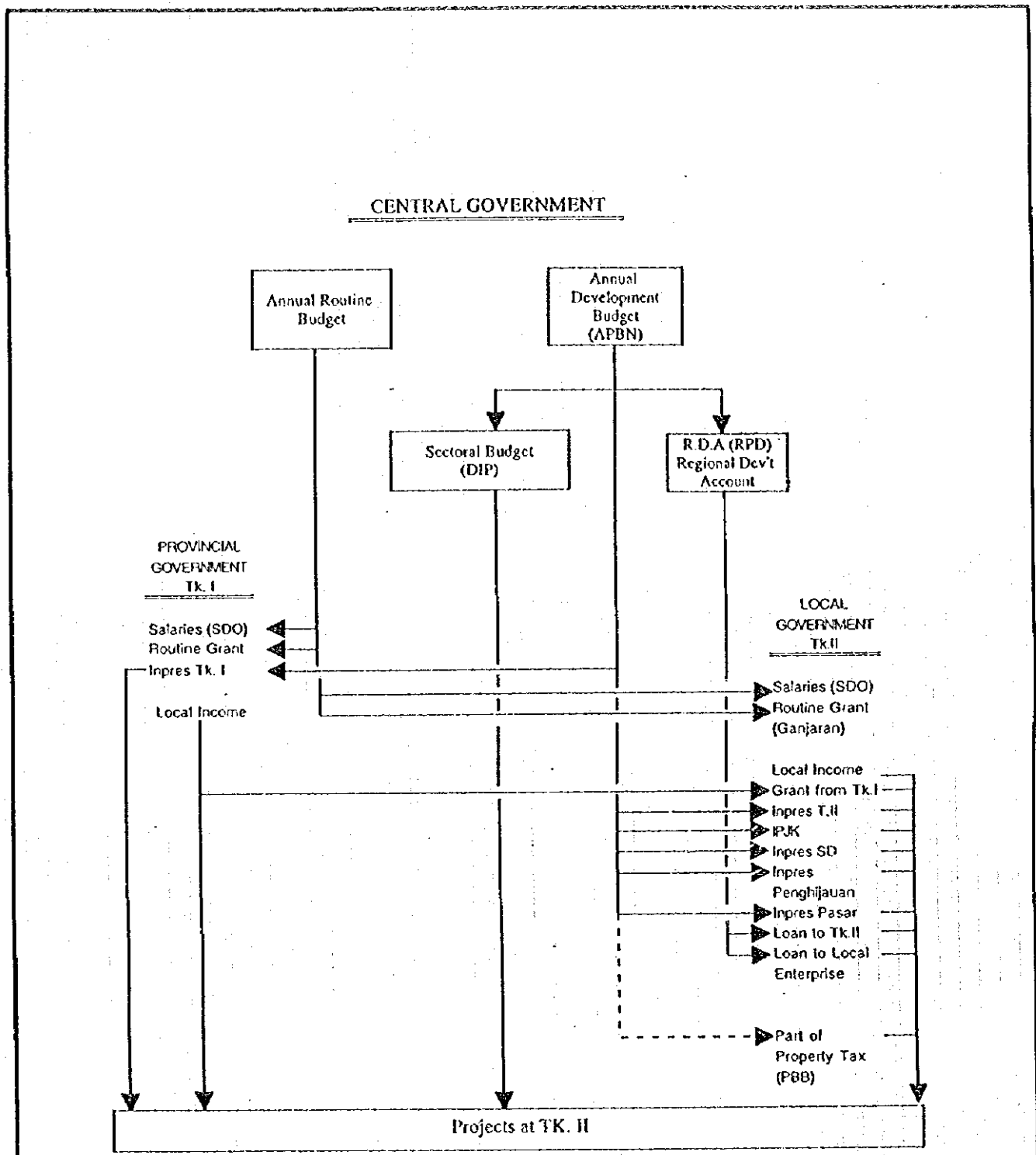
Item	1995/96	1996/97	1997/98	1998/99	1999/2000	2000/01	2001/01	2002/03
a Feasibility study								
b Application of loan								
c Commitment								
d Tender for engineering service								
e Detailed design								
f Tender								
for procurement								
for construction								
g Procurement & construction								
MCK					Rehabili59pcs, New66pcs (360 mRp)			
Vacuum trucks				20pcs (1,540 mRp)				
Antang road repair				1.8km (540 mRp)				
SMS(B/G),pilot				6pc (1pc PWTP) (1,759 mRp)				
SMS(B/G),wider						5pcs (509 mRp)		
LMS(north)					(10,454 mRp)			
CSS(central)					(49,098 mRp)			
CSS(south)					(12,086 mRp)			
Total Cost	76.346 million Rp.							

Note: Price and physical contingencies are not included.

FIG. 4.2 Implementation Schedule of Feasibility Study Project for Solid Waste Management

Item	1995/96	1996/97	1997/98	1998/99	1999/2000	2000/01	2001/02
a Feasibility study	■						
b Application of loan	■	■					
c Commitment		v					
d Tender for engineering service		■					
e Detailed design		■					
f Tender							
for procurement			■				
for construction			■				
g Procurement & construction							
Collection				■ (5,011 mRp)			
Street sweeping				■ (610 mRp)			
Ditch cleansing				■ (606 mRp)			
Tamangapa					■ (10,186 mRp)		
Samata				■ (1720 mRp)			
Heavy equipment					(390 mRp)	■ (6,562 mRp)	
Branch office						(820 mRp)	
					(3,456 mRp)	(21.082 mRp)	■
Total Cost	50,443 million Rp.						

Note: Price and physical contingencies are not included.

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CENTRAL GOVERNMENT

Annual Routine
Budget

Annual
Development
Budget
(APBN)

Sectoral Budget
(DIP)

R.D.A (RPD)
Regional Dev't
Account

PROVINCIAL
GOVERNMENT
Tk. I

Salaries (SDO)
Routine Grant
Inpres Tk. I

Local Income

LOCAL
GOVERNMENT
Tk.II

Salaries (SDO)
Routine Grant
(Ganjaran)

Local Income
Grant from Tk.I
Inpres T.II
PJK
Inpres SD
Inpres
Penghijauan
Inpres Pasar
Loan to Tk.II
Loan to Local
Enterprise

Part of
Property Tax
(PBB)

Projects at TK. II

Source : John L. Taylor MFEI Eligable Expenditures Monitoring System, 1993. P.12

| FIG. 4.3 | Overview of Funding Sources for Urban Development in Indonesia |

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE
MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA
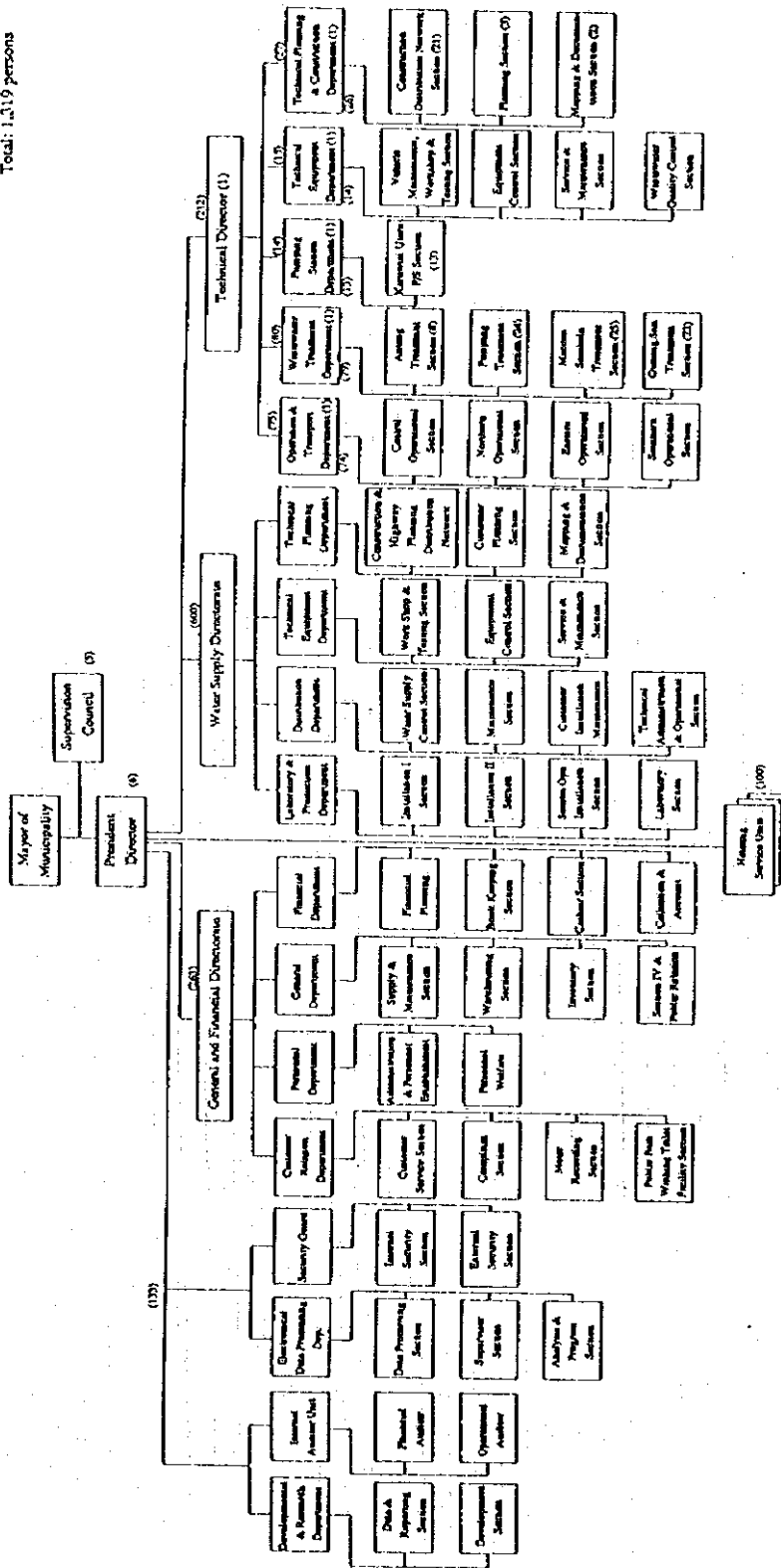
JICA   A.D.1994

Fig. 4.4 | Organization Chart of PDAM in 2005

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE
MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA

4 - 16

A.D. 1995

Organization Chart of PD Kebersihan in 2005

Alternative : 3
Total : 859 persons
Personnel : 1,079
Primary Collection : 429

Mayor

Supervision Council — 3 persons

President Director — 3 persons

Development and Research Unit — 5 persons
- Development & Research Sub-Unit
- Information Analysis & Planning Sub-Unit
- Monitoring & Evaluation Sub-Unit
- Work Procedure System Analysis Sub-Unit

Technical Director — 720 persons — 836 persons

Branch 1 (Bontoala) — 56
- Waste Collection Section
- Ditch Cleaning Section
- Street Sweeping Section

Branch 2 (Timungapa) — 86
- Work Shop Section
- Depot No. 1 Section
- TPA (up to 2005)

Branch 3 (Panakkukang) — 379
- Depot No. 2 Section
- Waste Collection Section
- Ditch Cleaning Section
- Street Sweeping Section
- Future SWM Treatment Facility (After 2015)

Branch 4 (Biringkanaya) — 163
- Waste Collection Section
- Ditch Cleaning Section
- Street Sweeping Section

Branch 5 (Gowa) — 34
- TPA (After 2005)

General Director — 116 persons

General & Material Department — 43
- Administration Sub-Dept.
- Company General Service Sub-Dept.
- Filing Sub-Dept.
- Material Abolition & Maintenance Supply Sub-Dept.

Personnel Department — 27
- Career & Training Development Plan Sub-Dept.
- Welfare & Work Safety Sub-Dept.
- Personnel Administration Sub-Dept.

Financial Department — 34
- Book-Keeping & Verification Sub-Dept.
- Cash & Payroll Sub-Dept.
- Budgeting Sub-Dept.
- Determining Collection Sub-Dept.

Law & Public Relation Dept. — 12
- Work Contract Sub-Dept.
- Complaint Claim Sub-Dept.
- Public Relation Sub-Dept.

Internal Auditing Unit — 12 persons
- General Auditing Sub-Unit
- Financial Auditing Sub-Unit
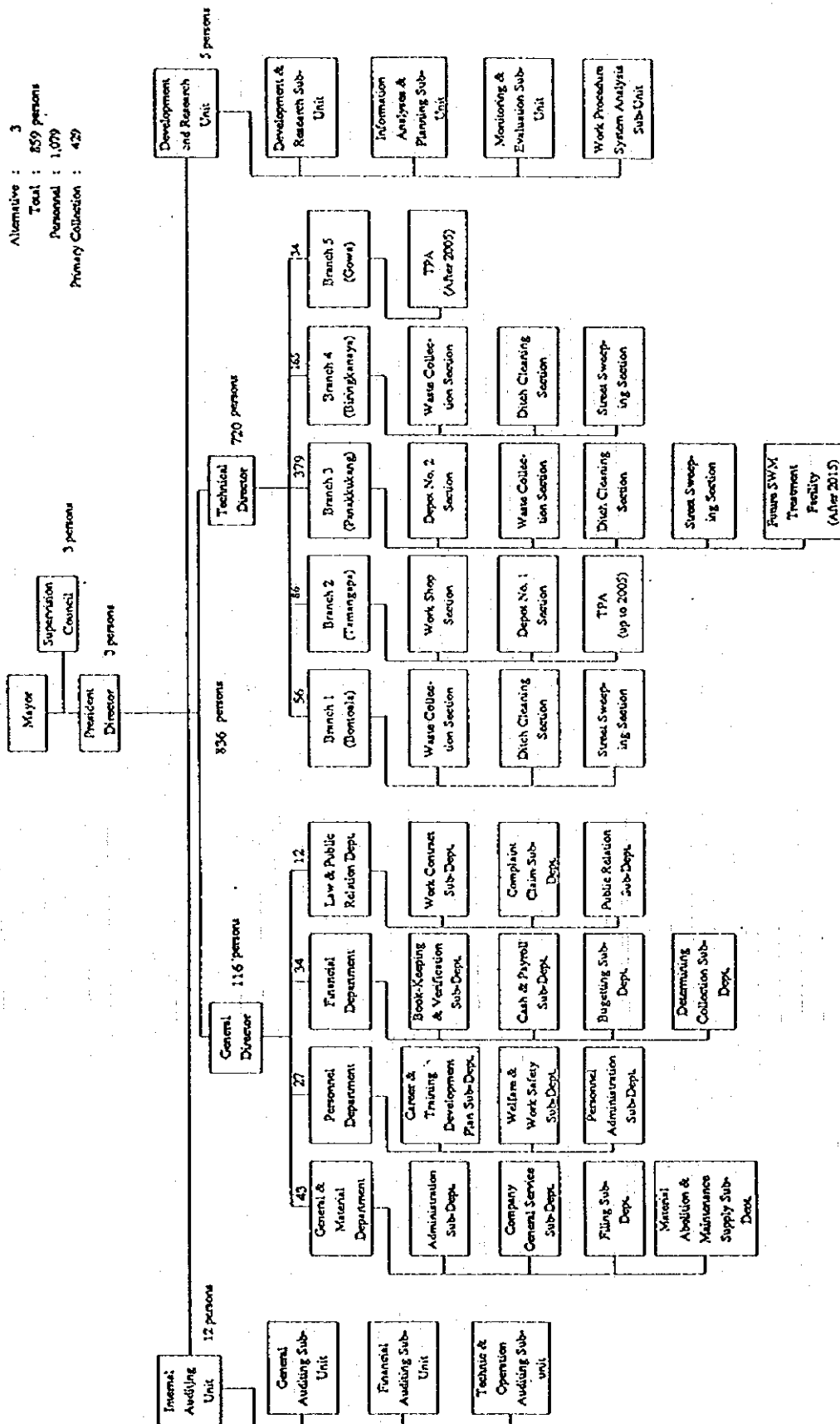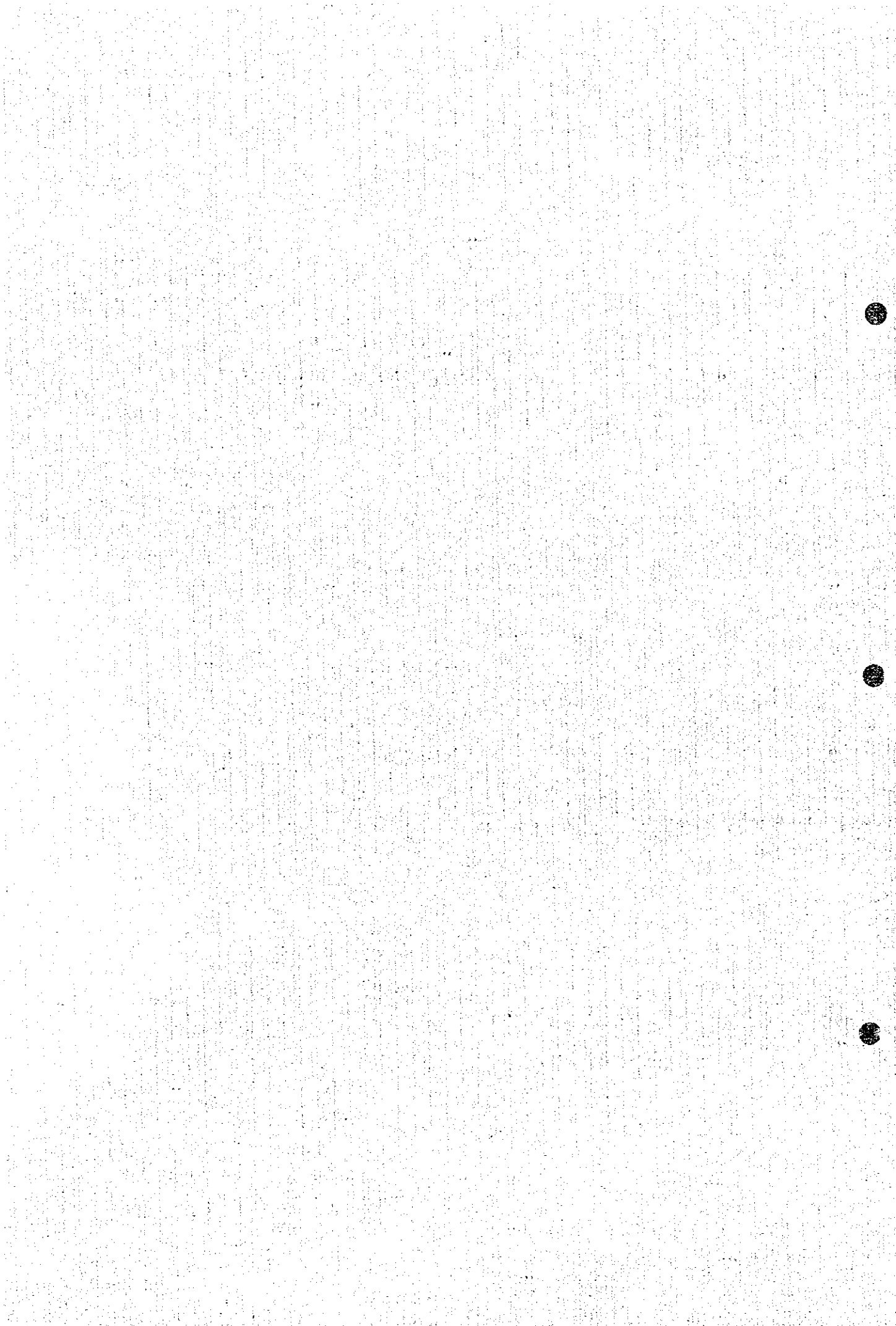- Technic & Operation Auditing Sub-unit

Fig. 4.5 Organization Chart of PD Kebersihan in 2005

MASTER PLAN AND FEASIBILITY STUDY ON WASTEWATER AND SOLID WASTE
MANAGEMENT FOR THE CITY OF UJUNG PANDANG IN THE REPUBLIC OF INDONESIA

JICA A.D.1995

CHAPTER 5
PROJECT EVALUATION

CHAPTER 5 PROJECT EVALUATION

5.1   Technical Evaluation

The proposed project components of wastewater and solid waste management are evaluated to be technically feasible for construction by the KMUP with the technical guidance from CIPTA KARYA, followed with independent management by KMUP based of the justifications given below.

1.   The on-site sanitation improvement works planned as urgent project are the extension of similar works already accomplished in Ujung Pandang.

2.   The off-site sewerage systems planned are first for Ujung Pandang as public sector projects. Still, the simple wastewater treatment technology of stabilization pond system, having insignificant mechanical and electrical installations, is considered easily amenable for construction and management. Such stabilization pond system is in operation in Bandung and Cerebon.

    In this regard, it is worth to mention that KIMA industrial estate has its own wastewater treatment plant.

3.   The improvement planned for the final smangapa followed with Samata is gradual. The controlled landfill method used in Tamangapa at present will be first improved to semi-sanitary landfill, followed with sanitary landfill at Samata. Such a gradual improvement conforming to stepwise approach is considered as technically adaptable for the responsible organization of operation and maintenance (Dinas Kebersihan/PD Kebersihan).

5.2 Environmental Impact Assessment

5.2.1 General

The anticipated environmental impacts due to the Project activities of both wastewater and solid waste management are mostly beneficial, as the project in itself is an urban environmental improvement project. Significant beneficial effects include improvements of surface water, groundwater and coastal water quality as well as living environment and public health.

A detailed environmental impact assessment (EIA/AMDAL) study for both the project components of wastewater management and solid waste management was conducted, conforming the relevant laws and regulations of the Government of Indonesia, and compiled separately.

Even though the project is an urban environmental improvement project, there are some potential adverse effects requiring proper management. Such potential adverse effects are principally confined to the wastewater treatment plant locations and final solid waste disposal locations, and their vicinity.

Potential environmental impacts and the required mitigatory measures for all relevant project components of the feasibility study selected for EIA, until the year 2005, are delineated in the subsequent section.

5.2.2 Environmental impact and mitigation

(1) Wastewater management

The environmental impacts and mitigatory measures during each of the three stages of preconstruction, construction and post construction (operation) with respect to the three (3) sewerage development projects are delineated below.

1) Preconstruction stage

Land acquisition requirement for wastewater treatment plants (3 locations) and pump station (1 location) are the significant activities with potential social impacts, especially with respect to resettlement and compensation.

Required area of land acquisition and the relevant number of housing compensation are given below.

System	Location	Land acquisition	
		Area (ha)	Housing compensation (No.)
Wastewater treatment plant	Lembo (Northern area))	6	none (0)
	Pampang (Central area)	44	7
	Maccini Sombala (Southern area)	29	6
Pump station	Karuwisi Utara (Kebun Binatang at Jl. Urip Sumoharjo)	1	none (0)
Total of wastewater management project		80	13

As the mitigatory measure for anxiety of community, the cost of land acquisition and housing compensation is recommended to be decided amicably with due consultation between the land owners and KMUP.

It is noted that housing resettlement is necessary only for the two (2) treatment plant sites of Pampang and Maccini Sombala. Still the number of houses requiring resettlement (7 houses in Pampang and 6 houses in Maccini Sombala) is not very significant, in comparison to the extent of land area acquired (44 ha in Pampang and 29 ha in Maccini Sombala).

Since all sewer pipes are installed under existing roads no land acquisition is required with respect to pipe laying work.

2)   Construction stage

All significant impacts during the construction stage are temporary ones, that would disappear with the completion of construction works.

Anticipated significant impacts and mitigatory measures, that are essentially technical in nature, are delineated below.

i)   Vibration and nose

Vibration and noise could be anticipated mainly due to the excavation works of trenches for pipe laying. However, since most excavation work would be carried out manually, with no

significant mechanical equipment, the resultant impact is assessed to be insignificant.

ii) Lowering of groundwater table

The groundwater table level in the proposed sewer pipe laying areas is rather shallow. Accordingly, temporary lowering of groundwater table level during pipe laying may occur. Since this lowering of groundwater table level would be confined to the portion of the trench being excavated, the impact is assessed to be not very significant. Moreover, most trench excavation works have to be limited to dry season, during which groundwater table level would be lower. Accordingly, the resultant lowering of groundwater table level would be further minimized.

iii) Traffic disturbance

Traffic disturbance could be anticipated both due to excavation of sewer trenches as well as due to transportation of construction materials and surplus excavated soil.

The impact due to excavation of sewer trench on traffic may be significant. Still, the impact due to transportation of construction materials and surplus excavated soils may not be that significant, in consideration to the operational flexibility of such vehicles with respect to both operational time and route.

Still the traffic disturbance due to all these project activities could be minimized with a proper work plan to avoid peak hours of daily traffic. Moreover, if necessary, length of one time excavation of sewer trench shall be limited in heavy traffic roads, in addition to confining the excavation works to night time only.

3) Operational stage

Odour and noise are the significant long term impacts anticipated due to the operation of treatment plants and the respective pump facilities.

The stabilization pond system designed consists of facultative and maturation ponds only. Accordingly, at least the surface layers of all ponds would be under aerobic condition. This would mitigate any potential emission of odour. However, proper operation and maintenance of the treatment systems need to be ensured to avoid malfunctioning of treatment system and the resultant potential emission of odour.

The significant source of potential noise with this treatment system of stabilization ponds is the inflow pumps. Other than these are no other mechanical installations in the treatment system. Accordingly, the effect due to noise within a treatment plant is considered as not significant.

There is one pump facility in the collection system of the central sewerage system, located at Kebun Binatang in Jl. Urip Sumoharjo (Kel. Karuwisi Utara). This is also a potential source of noise. If necessary, as the mitigatory measure, the pump house could be noise proofed.

(2) Solid waste management

Significant impacts will be confined to the final solid waste disposal locations and their vicinity. At a time, only one (1) final disposal site, either the existing one at Tamangapa or the planned one at Samata would be in operation. The existing Tamangapa site will be used until the year 2001, and would be closed since then. The operation of Samata site would commence from the year 2002.

Anticipated environmental impacts at each of these sites and the relevant mitigatory measures are described below.

1) Tamangapa final disposal site

This is the existing controlled landfill site for the disposal of solid waste generated in KMUP. Since this site is in operation at present, relevant project stages are only operational stage and post operational statge (with the closure of the site).

i) Operational stage

The project is aimed at improving the existing controlled landfill method of solid waste disposal to that of semi-sanitary landfill by instituting leachate collection and its primary treatment. Accordingly, the resultant adverse effect on surrounding environment could be minimized in comparison to the existing condition. This minimized environmental impact is assessed to be tolerable, since the site would be closed by the end of the year 2001.

The continued operation of this site (until 2001) would require expansion of the existing operational area of 7 ha to 32 ha. This requires additional land acquisition of 25ha. This land acquisition does not involve any resettlement. Accordingly, social impact is assessed to be not significant.

ii) Post operational stage

The proposed land use of Tamangapa site, since its closure by 2001, is creation of a public park. Such a public park would be very useful for surrounding fastly developing residential area, including housing complex developments. Moreover, creation of a park would not interfere with progressing land subsidence associated with a closed landfill site.

2) Samata final disposal site

Since this is a new site, the operation of which could continue for a long time of more than 20 years from its commencement of operation from the year 2002, the project stages considered are preconstruction, construction and operation.

i) Pre construction stage

Required area of land acquisition for the initial ten (10) year operation (2002-2011) of the landfill site is 65 ha. There is no resettlement of population since this an open land. Still, compensation for land acquisition is recommended to be decided amicably with due consultation between the owners and Gowa Regency (Kab. Gowa).

ii) Construction stage

This would be the sanitary land fill site consisting of leachate collection and treatment as well as gas venting facilities. The major construction activities are earth works of land clearing and dike construction works, and the expansion and pavement of access road.

Potential air pollution due to spread of dust related to earth work could be minimized with spraying of water. Increase in volume of traffic due to transportation of construction materials is anticipated to be not very significant in consideration to the remoteness and the relevant low existing traffic density in this Samata area.

iii) Operational stage

With the operation of this site, the traffic density along the access road and its vicinity of Kel. Samata would increase due to operation of solid waste transportation vehicles. Still, the relevant impact is considered not very significant due to the proximity of this site to that of the existing one at Tamangapa and the low traffic density in this area, under the present conditions.

Environmental impacts due to operation of the sanitary land fill is not very significant. This is due to the precautionary measures incorporated in the facilities of sanitary landfill system, particularly, gas venting and lechate collection and treatment. However, proper operation and maintenance of the landfill site is necessary to ensure effective functioning of the sanitary landfill system.

5.3 Financial Evaluation

5.3.1 Pricing and Tariff Structure

(1) Introduction

Associated with a number of government experiences of severe budget constraints, an appropriate framework for domestic urban sanitation sector pricing, tariffs and contracts is required not only to achieve an efficient allocation of scarce resources, but also to maintain the long-term financial sustainability of utilities and sanitation service undertakings, and to attract private sector, and possibly external capital, to the sector to the extent possible. In pricing, there would be two key objectives in terms of allocative efficiency: (i) tariffs should be sufficient to provide for the financial viability of the urban sanitation services and undertakings and generate a sufficient surplus to allow for their financing a significant part of their own investment programs in the years to come, and (ii) prices should be set at levels which encourage efficient use of service capacity and avoids wasteful consumption.

Besides, an equity issue would arise to cross subsidize the costs allocated among the several segments of beneficiaries. In fine, tariff will be made progressive (cascade tariff structure) with the explicit equity consideration that the poorer are cross-subsidized by the richer segment of the society. Numerical assumption for the benchmarked cross-subsidy from the economically affluent segments to the distressed ones will be that lower incomers will not to pay a higher proportion of their income on the sanitation subsector services concerned than the rich.

With the standard allocative efficiency considerations in view, it is useful to obtain an indication of the benchmark level at which the price should be set. While taking affordability of the beneficiaries associated with the Project scope, the indicative tariff structure to cover the total operation and maintenance cost and house connection cost for wastewater, and those to meet the total cost obligation inclusive of depreciation for the septage management, and solid waste management services will be shown with the concept of marginal cost pricing and the current state-of-the-art to approximate the marginal costs in view. The background microeconomics theories and concepts, inter alia, marginal cost pricing,

average cost pricing and Pareto optimality will be given in the Supporting Report as attached.

(2)   Estimates of Marginal Costs

Marginal costs have been estimated based on the major numerical assumptions as follows.

Capital Investment Costs: Of the total, Rp. 20.2 billion (US$8.96 million equivalent to cover the total recurrent cost and house connection cost), Rp.6.9 billion ($3.05 million as per the whole project scope), and Rp.69.4 billion ($30.84 million as per the whole project scope) inclusive of physical and price contingencies have been allocated to the wastewater, septage management, and solid waste sub-components, respectively. Base costs are all estimated as per 1995 price.

Capital Recovery Factor (CRF): With the discount rate of 10 percent over the 20 years of expected project life, CRF used to annuitize the capital investment costs is 0.1175.

Direct Beneficiaries: Assumptive numbers of direct beneficiaries used as a proxy to attain the cost of advancing one unit of the urban sanitation services concerned are 225,000, 1,300,000, and 1,350,000, for wastewater, septage management and solid waste management, respectively.

Unlike the case of domestic households, there has been no data available regarding the number of commercial/industrial and public facilities within the Project area. Thus, floor area of each of the establishments in the area will be applied as a proxy to estimate the direct beneficiaries, which worked out to 431,916 sq. meters (50 percent), 67,435 sq. meters (8 percent) and 366,321 sq. meters[1] in that order, respectively.

Shadow Pricing: As previously noted, value added tax (VAT) corresponding to 10 percent of the local currency cost components is being deducted, and subsequently the SCF of 0.9 is applied considered to convert the market value of the Project components to its value in shadow prices expressed in terms of border currency unit. The foreign cost components of the Project are assumed to have been expressed at border prices, inter alia, CIF for the importables and FOB for the exportables.

Although indicative, the marginal costs to supply one additional tonnage of wastewater treatment, septage management and solid waste collection and management in the forthcoming years till 2015 have been figured out to be around Rp.2.4 billion (US$ 1.07 million equivalent), Rp.0.86 billion ($0.38 million), and Rp.8.2 billion ($3.64) per year, respectively. With this and the operation and maintenance costs accrued, the levelized annuity costs to readily meet the financial obligation inclusive of debt service will reach at Rp.3.3 billion ($1.46 million), Rp.2.0 billion ($0.90 million), and Rp.11.6 billion ($5.14 million), respectively. The shadow priced annuity costs for the same sub-components are calculated to be Rp.2.7 billion (US$1.22 million), Rp.1.7 billion ($0.77 million), and Rp.9.9 billion ($4.4 million) per year for sewerage, septage management and solid waste, respectively. These costs are summarized as shown below.

Financial and Shadow Priced Annuity Costs (Rp. billion)

	Wastewater	Septage	Solid Waste
Financial Annuity Cost	3.3 ($1.46 mil)	2.0 ($0.90 mil)	11.6 (5.14 mil)
Shadow Priced Annuity C.	2.7 ($1.22 mil)	1.7 ($0.77 mil)	9.9 ($4.4 mil)

(3) Indicative Tariff Structure

1) Tariff Design Concept - "Harga Pokok"

As is in the case for the water tariff policy, "Harga Pokok" which is a cost-related benchmark being defined as the total revenue requirement divided by the volume of services produced and/or divided by the unit of beneficiaries[2]. Under the current study, Harga Pokok is equivalent to the marginal costs per domestic (household) users and per floor area with relevancy to commercial/industrial entity and public facility. Given that services are being provided for which customers will financially cover regardless of their actual disposal, ratesetting will simply consider the costs to be recovered and allocated the beneficiaries with due recognition of their affordability which is envisaged to be around 1 percent of income for sewerage and around 2 percent for solid waste, respectively.

2)   Beneficiaries Classification and Welfare Weights (Cross-Subsidy)

Direct Beneficiaries: It is reiterated that the assumptive numbers of direct beneficiaries are 225,000, 1,30000 and 1,350,000, for wastewater, septage management and solid waste management, respectively. With this, it is further assumed that there exist the beneficiary households associated with the Project scope standing at around 40,909, 236,364, and 245,455, given that each of the household comprises 5.5 family members in average. The tariff-chargeable floor areas by beneficiary categories in that order are assumed to be 431,696 sq. Meters (50 percent), 67,435 sq. Meters (8 percent), and 366,320 sq. Meters (42 percent).

Income Distribution: The income distribution of the city residents is highly deviated with the positive skewness of 1.8. With this, around 45 percent of the total population falls to the annual income of less than Rp.250,000 per month followed by 35 percent of medium incomers and 20 percent of the affluent people under Rp.450,000 per month and above, respectively. The average monthly incomes for each of the population cohorts are assumed to be Rp.180,000, Rp.380,000, and Rp.800,000 in that order. It is presumably taken into analysis that income distribution of the residents associated with the Project be identical to that for the city residents as a whole. The average revenue of business undertakings in the city is being estimated at Rp.118.7 million ($52,700), as given in the Master Plan Report section 3.3.2.

Beneficiaries Classification and Welfare Weights (Cross-Subsidy): Domestic (household) users are classified as lower (referred to as R-1), medium (R-2) and higher income (R-3) groups with each of these attributed to the 0-45th percentile, 46-80th percentile and the residual of the total population. Commercial and industrial entities are divided into two sub-categories with the small and medium sized (BE-1), and the large scale entities (BE-2). A cohort comprising public entities (PE) is treated as an unit sub-category without any decomposition.

The welfare weights associated with the full cost recovery principle are specifically allocated to each of the beneficiary groups. With this, cross-subsidization is triple-folded, that is, in the sewerage

subsector, (i) households cover 50 percent of the total financial burden while enjoying 70 percent of project benefit, thereby being subsidized by business entities, (ii) a higher income group subsidizes a lower income group with a half of the costs associated with the total household portion whereas the population share is as little as 20 percent, and (iii) large scale business entities with the floor share of 8 percent bear the financial burden of 30 percent of the costs attributed to the entity segment. As for the solid waste management subsector, the same consideration has been made with the specific cost allocation and cross-subsidization as follows. (i) households cover only 50 percent of the total financial burden while enjoying 70 percent of project benefit, thereby being subsidized by business entities, (ii) a higher income group subsidizes a lower income group with a little bit less than a half of the costs associated with the total household portion whereas the population share is as little as 20 percent, and (iii) large scale business entities with the floor share of 8 percent bear the financial burden of a quarter of the costs attributed to the entity segment.

It would be noted that the middle income group of households and public entities are to share the financial burden in proportion to each of the share of presence.

Marginal costs: As previously estimated in 5.3.1 above, the levelized annuity costs to readily meet the financial obligation inclusive of debt service will reach at Rp.3.3 billion ($1.46 million), Rp.2.0 billion ($0.90 million), and Rp.11.6 billion ($5.14 million), respectively.

Affodability: Provided that the maximum amount to pay for the tariffs accrued to the sanitation services concerned are generally accepted at 1 percent, 0.75 percent and 2 percent of disposable which accounts for 90 percent of the total income for wastewater, septic management, and solid waste management, respectively, the ")bid prices") at the highest, or ")willingness to pay") for wastewater, septage management, and solid waste management services are summarized as follows.

Willingness to Pay (Rp./month)

	R-1	R-2	R-3	BE/PE
Wastewater	1,440	3,040	6,4000	1,186,000
Septic Management	1,080	2,280	4,800	890,000
Solid Waste	2,880	6,080	12,800	2,373,000

Thus far the indicative parameters for ratesetting are sorted out, and will be summarized herewith.

	R-1	R-2	R-3	BE-1	BE-2	PE
Weights (Sewerage)	8%	18%	25%	15%	15%	20%
Weights (Solid Waste)	10%	18%	23%	18%	12%	20%
# of Household			-	-	-	
Wastewater	16,400	12,700	7,300	-	-	-
Septage	13,900	10,800	6,200	-	-	-
Solid Waste	110,450	85,910	49,100	-	-	-
Floor Area	-	-	-	431,696	67,435	366,320
Annual Cost Share (Rp.m/yr)						
Wastewater	246	575	821	493	493	657
Septage Management	152	354	506	304	304	405
Solid Waste	1,157	,1,024	2,602	2,082	1,388	21,313

3)   Indicative Tariff Structure

In view of the foregoing, the following ratesetting will be indicated. It would be noted that, in general, tariff structuring is undertaken based on the cost-of-service approach where considerable attention be given to clarify cost accounting items (operating/non-operating direct/indirect costs) incurred during daily operation of service undertakings. The Report, notwithstanding, does not present a detailed ratesetting framework which could be instantaneously replaced for the somewhat complicated tariff structure currently in use due to critical shortage of time and relevant data. It is noted that the tariff of wastewater management (sewerage service) is set for partial cost recovery of operation and maintenance (O/M) and house connection costs.

Indicative Monthly Tariff per Entity/per sq. meter

	R-1	R-2	R-3	BE-1	BE-2	PE
Indicative Tariff	per HH	per HH	per HH	per sq.m	per sq.m	per sq.m
Wastewater (Rp.)	1,115.3	3,345.8	8,364.6	95.1	608.9	149.5
Septage (Rp.)	119.0	357.0	892.4	503	375.4	92.1
Solid Waste(Rp.)	872.5	1,963.2	4,417.2	401.6	1,715.0	526.2

Now that all the tariff indicated above rest below or near the neighborhood of willingness to pay for households, it would be acceptable to access the Project scope to be affordable. As for business entities, the monthly weighted average tariff per sq. meter is Rp.172.1 with the afore-mentioned share of floor area and the tariff set forth to each of the business entities as given. Let the average willingness to pay for wastewater services provided be about Rp.100,000 per month, thus making the "}maximum average floor area per entity"} stand at 581 sq. meters. With this and all other factors as given, the average floor area of business entities in the city is most likely to be less than 580 sq. meters, thereby making it possible to appraise the proposed services to be feasible and affordable, accordingly.

5.3.2 Financial Analysis

(1) Introduction

The projects proposed under the study is subject to financial analysis that includes an assessment of financial viability (profitability) of revenue-generating components over the specified project life. The specific indicators and the indicative cut-off rate as borne out by financial internal rate of return (FIRR) will be used to measure and subsequently assess the overall financial sustainability. With a view to self-financing future investment costs while enabling the prospective sanitation service undertaking (s) to meet debt service obligations, revenue-earning undertakings will be expected to generate FIRR reasonably equivalent or close to the current opportunity cost of capital of about 8-10 percent'. In keeping with generally accepted guidelines for financial analysis, the financial costs/benefits used in the computation of FIRR will be in constant early 1995 prices. Further, the capital costs will be reconcilable

with the base costs and physical contingencies, but with the exclusion of price contingencies and interest during construction.

While it is pertinent to investigate the financial positions of the municipality level units or participating agencies with a bearing on the accounting concept of "going-concern", projected financial statements and accounting analysis thereon were not prepared largely due the following reasons: (i) the current accounting and reporting system used by Dinas Kebershihan do not fully demonstrate its financial position because of lack of generally acceptable accounting principles and an appropriate management information system, (ii) time schedule to devise the institutional framework to come should further be elucidated. Nonetheless, a bird's eye view of the past financial performance of each of Dinas Kebersihan and the Water Supply Enterprise (PDAM) of Kotamaja Ujung Pandang will be presented in the Supporting Report within the limit of the currently available information and data.

1)   Notes and Assumptions

The basic assumptions used in the analysis include the followings: (i) project life. (ii) demographic and related factors. (iii) cost estimation (base cost plus physical contingency), (vi) financial terms, (v) loan-grant mix, and (vi) tariff. While Numerical assumptions specifically used for the analysis are detailed in the Supporting Report, the most relevant data and information, among others, are as follows.

(i) Project Cost

The total cost of the Project exclusive of possible interest during construction is estimated at Rp.170.5 billion (US$ 77.9 million equivalent as per 1995 price), with a foreign exchange and a local cost components of Rp.72.5 billion ($27.1 million) and $Rp.98 billion ($50.8 million), respectively. Of the total, Rp.92.9 billion ($ 41.3 million), Rp.13.1 billion ($5.8 million), and Rp. 64.5 billion ($30.8 million) are to be allocated to the wastewater, septage management, and solid waste sub-components, with each of these accounting for 53 percent, 7 percent, and 40 percent, respectively.

(ii) House Connection

With a view to ensuring a consistent standard of construction, and to improving affordability of the sewerage service to lower-income users, provision for construction of individual household connections has been included in the Project cost.

(iii) Contingencies

Reflecting expected increases in the base cost estimates of the Project(s) due to changes in quantities and methods of implementation, physical contingency allowances have been set at 5 percent of the base cost of each of the sub-projects. Further, in anticipation of increases in the base cost estimates of a project/projects due to changes in unit prices for the various project components/parts beyond the date of the base cost estimates, price contingency allowances have been set at 7 percent in 1996 and 6 percent in 1997 and thereafter of the base cost plus physical contingencies for the local cost expenditures and 2.7 percent for the foreign expenditures, respectively[4].

(iv) Revenues

Tariff revenues based on marginal cost pricing rule are assumed to be the major source of income while capital works charge levied to newly constructed large scale, high-rise buildings in the project areas will be also taken into account. Nonetheless, other form of private sector involvement such as beneficiary's contribution (an one-shot charge to the prospective beneficiaries in the project areas on the right to connect their toilet facilities with major sewerage pipes) is set out of the revenue scope largely due to the political and social difficulties envisaged.

There hasn't been any explicit assumptions about tariff development over the Project period, thus implicitly assuming that there will be no change in real tariffs as per foreign exchange over the period concerned. In other words, the nominal tariff increase in rupiah term which would possibly take place during the Project period will be canceled out in

respect of devaluation of the rupiah against the dollar and other major foreign currencies.

(v) Capital Works Charge

Rp.10,000 per sq. meter to the year 2005 and Rp.20,000 per sq. meter onwards. Various kinds of high-rise (with more than 5 stories being assumed) commercial/public building combining to a total of 10,000 sq meters per annum will be constructed in the city;

(vi) Tariff

The following tariff will be set forth for each of the sanitation services concerned. The wastewater tariff is for the partial cost recovery of operation and maintenance and house connection costs. Accordingly, the financial analysis concerned to wastewater management is based on the above partial cost recovery.

Indicative Monthly Tariff per Entity/per sq. meter

Indicative Tariff	R-1	R-2	R-3	BE-1	BE-2	PE
	per HH	per HH	per HH	per sq.m	per sq.m	per sq.m
Wastewater (Rp.)	1,115.3	3,345.8	8,364.6	95.1	608.9	149.5
Septage (Rp.)	119.0	357.0	892.4	503	375.4	92.1
Solid Waste(Rp.)	872.5	1,963.2	4,417.2	401.6	1,715.0	526.2

(2) Financial Internal Rates of Return (FIRRs)

Financial viability of the Project has been established by calculating a financial internal rate of return (FIRR) on the basis of the costs and benefits associated with the project. The cost flows consist of (i) capital investments for the provision of the sewerage and solid waste management services at a required level over the period of 1996 through 2015, excluding costs incurred prior to the afore-mentioned years (sunk costs), and (ii) the new and incremental operation and maintenance cost of these facilities solid waste dumping sites.

The benefits comprise tariff revenues as borne out by the provision of wastewater, desludging and solid waste treatment services attributable to

the investments during the fiscal year 1997 to 2000 for the sewerage and desludging, and to 2001 for the solid waste component. In addition, Capital works charge which leads to the city revenue at Rp.10,000 per sq. meter to the year 2005 and Rp.20,000 per sq. meter onwards is taken into account.

The FIRR of the investment plan with all costs and benefits expressed as per 1995 price level, is estimated at 11.4 percent inclusive of the two sub-components, inter alia, the sewerage and the solid waste subsectors. Divided into each of the sub-projects, FIRRs worked out to 10.5 percent and 12.7 percent for the sewerage and the solid waste sub-sectors, respectively. With the current opportunity cost of capital standing at around 8 to 10 percent, the FIRRs for the Project are to exceed the real cost of Project capital, thereby making it possible to evaluate the Project as financially viable. A summarized net cash-flow table is given as attached (*Table* 5.1).

Provided that, in liue of marginal cost pricing, the Project benefits are measured by willingness to pay of the prospective beneficiaries and the tariff currently in use for solid waste, the FIRR calculation has no solutions because of the excessive cost streams over the project period.

5.3.3 Economic Analysis

(1) Economic Internal Rates of Return (EIRRs)

Economic analysis of the Projects under the study has been quantitatively carried out wherever possible while taking into account a number of economic, social and environmental benefits accrued. The economic internal rates of return (EIRR) have been expeditiously estimated with the marginal cost-based tariff and the shadow priced project costs. Besides, reduction of morbidity rates, especially for waterborne diseases and infant mortality rates has been contemplated to intuitively measure its benefit in monetary term. To date, an overall values of real estate in the city boundary have not been experienced any price-hike to the extent, thus make it unlikely to present a rationally estimated land value-hike in the future. Thus, the secondary and tertial project benefits which would possibly take place in the wake of the Project completion[5] have not been taken into account.[6] Methodology of shadow pricing applied to convert

market prices to border prices and the net cash-flow table are given in the Supporting Report.

The EIRRs were calculated on the basis of the new and the incremental cost and benefit streams associated with the proposed investment outlays over the period of maximum 6 years with the commencement in 1996. All the costs are shadow priced, being adjusted to convert market prices to shadow prices expressed in terms of border currency unit (US$). The projected level of tariffs being set as per the marginal opportunity cost of each of the sub-components of the Project are used as a proxy for benefits. No shadow pricing adjustment has been made to the project benefit attributed to capital works charge, since this portion is assumed to be well representing people's willingness to pay for the connection services provided by the authority.

In view of the foregoing, EIRR on the Project as a whole works out to 11.7 percent, with 10.8 percent and 12.9 percent for the sewerage and solid waste sub-components, respectively. Thus, the Project with those sub-projects altogether is substantially viable and acceptable, while the currently estimated opportunity cost of capital which stands at around 10 percent is taken into account. A summary net cash-flow table is attached as shown in *Table* 5.2.

It would be noteworthy that, in marginal cost pricing, internal rates of return result in little disparities between economic and financial analysis, largely due to the almost same proportion of impact of shadow pricing on the cost and benefit streams.

(2)   Health Effects of the Project

As recognized in the projects previously financed by external aid agencies and carried out in Indonesia, the sanitation subsector projects will reduce the morbidity or medical expenditures by expanding the coverage and using better ways and means for wastewater treatment and solid waste management. In particular, the proposed Project combined with the public education programs contained therein will lead to a shift in better service quality and reduced morbidity, thereby making the people in the region better off.

With the new and incremental supply of the sewerage and solid waste management services, the associated benefits of the Project will be the

positive health, institutional and social impact and an improved policy and financial environment for the urban sanitation subsectors concerned. In the field of environmental beautification, the Project will reduce health hazards to the public by eventually creating well designed and appropriately located off-site sewerage system, in lieu of the existing unsanitary and costly on-site system, for the sewerage subsector, and by reducing unauthorized dumps and unsanitary open landfills associated with better operation systems of waste collection and landfills for the solid waste subsector, thereby making it possible for the people in the city to be better-off. Provided that the full economic value of the health effect is reflected by an individual's "willingness to pay (WTP)" to avoid a mortality risk with a very small probability, say, an increment of 0.0001, it is hypothetically estimated that WTP in Indonesia would be clustered in the range of $7.5 to $17.5 per person per year. This WTP across all people would be further summed up leading up to an estimated value of a statistical life. Given the foregoing postulate is to be held, the implied economic value of an avoided statistical death would range from $75,000 to $175,000. Let the economic value of an avoided death be equivalent to the discounted present value of lifetime income, inter alia, $10,000 in Jakarta and $5,000 (note that the average household income per annum has been estimated at Rp.3 million) in Ujung Pandang, $75,000 falls about in the middle of $5,000 and $175,000, thereby making it possible to approximate the economic value of the health effect.

In view of the foregoing, it could be acceptable to consider that the economic value attributable to the Project would be about $37.5 million per annum, with the range of $5 million to $175 million, if and only if about 500 deaths annually be attributed to the sanitation causality in Ujung Pandang'.

5.4   Institutional Evaluation

5.4.1   Wastewater management

(1)   Evaluation on the study

1)   Result of the study on PDAM of KMUP

Since PDAM itself is out of the scope of work in this Study, its organizational structure is accepted as it is. It is convinced at the several times of interview that the amalgamation of a wastewater management institution will be implementable.

2)   Study on the organization, its structure and number of personnel in change of wastewater management.

The minimal number of personnel and scale of the organization are studied in detail enough to institutionally be implementable for providing 90% of the citizens with the service of on-site activities and 15% with that of off-site activities. That is, 5% of the citizens will be furnished with the dual services of on and off-sites for a certain period.

(2)   Conclusion

The Study on PDAM with a wastewater management institution of KMUP in 2005 is evaluated institutionally feasible.

5.4.2   Solid waste management

(1)   Type of institution

PD Kebersihan (Local public enterprise) shall be established by 2005 with 859 personnel.

(2)   Comparison based on the present Dinas Kebersihan KMUP, Bandung PD Kebersihan in 1994 and PD Kebersihan KMUP proposed in 2015 for the M/P.

Refer first to 7.2 (2) of the M/P regarding the comparison from such a point of views as population, collection service ratio (%) and number of personnel.

1) Dinas Kebersihan KMUP in 1994

(a) Conditions

Item	Dinas Kebersihan, 1994	PD Kebersihan, 2005
Population	1,050 thousand	1,520 thousand
Collection ratio	57%	90%
Number of personnel	836 persons	X (?)

(b) Calculation

    i. (1,520 × 836) + 1,050 = 1,210 persons only based on population

    ii. (1,210 × 90) + 57 = 1,911 persons based on ratio in addition to i.

2) Bandung PD Kebersihan in 1994

(a) Conditions

Item	Bandung PD Kebersihan, 1994	PD Kebersihan, 2005
Population	2,058 thousand	1,520 thousand
Collection ratio	88%	90%
Number of personnel	1,884 persons	X (?)

(b) Calculation

    i. (1,520 × 1,884) + 2,058 =1,392 persons only based on population

    ii. (1,392 × 90) + 80 = 1,424 persons based on ratio in addition to i.

3) PD Kebersihan KMUP in 2015 (M/P: alternative II)

(a) Conditions

Item	M/P (2015) (alternative II)	F/S (2005)
Population	2,200 thousand	1,520 thousand
Collection ratio	95%	90%
Number of personnel	2,099 persons	X (?)

(b) Calculation

    i. (1,520 × 2,099) ÷ 2,200 =1,450 persons only based on population

    ii. (1,450 × 90) ÷ 95 = 1,374 persons based on ratio in addition to I.

4) PD Kebersihan KMUP in 2015 (M/P: alternative III)

(a) Conditions

Item	M/P (2015) (alternative III)	F/S (2005)
Population	2,200 thousand	1,520 thousand
Collection ratio	95%	90%
Number of personnel	975 persons	X (?)

(b) Calculation

    i. (1,520 × 975) ÷ 2,200 = 674 persons

    ii. (674 × 90) ÷ 95 = 639 persons

(3) Organizational structure

This is the same as 7.2 (2)1)(b) of the M/P which shall be referred to.

(4) Evaluation

    1) Type of institution: Alternative II same as that for the M/P.

    2) PD Kebersihan KMUP in 2005 (with 859 personnel) can be evaluated:

        i. Good, compared to the Dinas Kebersihan KMUP in 1994. The present Dinas Kebersihan KMUP will require 1,911 persons in 2005 should it operate as it does at present.

        ii. Good, compared to Bandung PD Kebersihan in 1994. Comparing 859 to 1,424.

        iii. Good, compared to the contents of the M/P (alternative II)

        iv. No good, compared to the contents of the M/P (alternative III).

(5) Conclusion

The F/S (resulting in 859 persons as a necessary number of personnel) is acceptable because of the reasons evaluated above and subject to the realization of the contracting-out to the private sector.

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[1] The estimates are those in the year 2005, and used as the mean values over the Project period.

[2] Ref.: USAID, *Water Tariff Policy in Indonesia*, 1994, p.11

[3] The cut-off rate recommended by UNDP is 10%, which sounds too low with the current return of capital which ranges around 10-17 percent in view.

[4] ADB estimates, PAI No. 1.3, Appendices 1,2, 1994

[5] Indirect benefits accrued to the Project would be, for example, further investment of external funds to the city which will enable higher tax bases.

[6] In the World Bank operation, economic benefit of human/solid waste is not quantified. Asian Development Bank points out that sub-projects in the water supply and low-income housing sectors be often feasible for economic analysis. (Framework for the Economic and Financial Appraisal of Urban Development Sector Projects) In IUIDP, FIRR is normally used as a proxy for EIRR. The Project Appraisal Manual of UNDP (draft, 1995) supports this approach in principle.

[7] In respect of the hypothetical figures shown here, see the World Bank *Indonesia Environment and Development: Challenges for the Future*, 1994, P. 253, also see V. Lavy and J. Aquigley *Willingness to Pay for the Quality and Intensity of Medical Care, Low-Income Households in Ghana*, WB, 1993

Table 5.1   Financial Internal Rate of Return

SUMMARY FINANCIAL INTERNAL RATE OF RETURN, TOTAL
(Marginal Cost Pricing)

Year	Capital Cost ($Mil)	Incremental O-M Cost ($Mil)	Incremental Cost ($Mil)	Sewerage (Ton)	Average Price ($/ton)	Capital W-Charge ($Mil)	Incremental Desludge (Ton)	Average Price ($/ton)	Incremental Solid Waste (Ton)	Average Price ($/ton)	Incremental Benefit ($Mil)	NET CFLOW ($Mil)
1996	7.9		7.9		0.42		33,600	12.4		24.2	0.4	-7.5
1997	12.5		12.5		0.42		33,600	12.4		24.2	0.4	-12.1
1998	14.0	0.9	14.9		0.42		33,600	12.4	69,000	24.2	2.1	-12.8
1999	14.0	1.5	15.5		0.42		33,600	12.4	83,000	24.2	2.4	-13.1
2000	14.0	3.2	17.2	31,575	0.42		33,600	12.4	149,000	24.2	8.9	-8.4
2001	5.3	4.2	9.4	42,100	0.42	0.04	31,800	12.4	226,000	24.2	12.3	2.9
2002		4.2	4.2	42,100	0.42	0.04	31,800	12.4	240,000	24.2	12.6	8.4
2003		4.3	4.3	42,100	0.42	0.04	31,800	12.4	254,000	24.2	13.0	8.7
2004		4.3	4.3	42,100	0.42	0.04	31,800	12.4	268,000	24.2	13.3	9.0
2005		4.3	4.3	42,100	0.42	0.04	31,800	12.4	282,000	24.2	13.7	9.3
2006		4.3	4.3	42,100	0.42	0.08	31,800	12.4	282,000	24.2	13.7	9.3
2007		4.3	4.3	42,100	0.42	0.08	31,800	12.4	282,000	24.2	13.7	9.3
2008		4.3	4.3	42,100	0.42	0.08	31,800	12.4	282,000	24.2	13.7	9.3
2009		4.3	4.3	42,100	0.42	0.08	31,800	12.4	282,000	24.2	13.7	9.3
2010		4.3	4.3	42,100	0.42	0.08	31,800	12.4	282,000	24.2	13.7	9.3
2011		4.3	4.3	42,100	0.42	0.08	31,800	12.4	282,000	24.2	13.7	9.3
2012		4.3	4.3	42,100	0.42	0.08	31,800	12.4	282,000	24.2	13.7	9.3
2013		4.3	4.3	42,100	0.42	0.08	31,800	12.4	282,000	24.2	13.7	9.3
2014		4.3	4.3	42,100	0.42	0.08	31,800	12.4	282,000	24.2	13.7	9.3
2015		4.3	4.3	42,100	0.42	0.08	31,800	12.4	282,000	24.2	13.7	9.3

FIRR =   11.4%

SUMMARY FINANCIAL INTERNAL RATE OF RETURN, SEWERAGE
(Marginal Cost Pricing)

Year	Capital Cost ($Mil)	Incremental O-M Cost ($Mil)	Incremental Cost ($Mil)	Sewerage (Ton)	Average Price ($/ton)	Capital W-Charge ($Mil)	Incremental Desludge (Ton)	Average Price ($/ton)	Incremental Benefit ($Mil)	NET CFLOW ($Mil)
1996	5.8		5.78		0.42		33,600	24.2	0.42	-5.4
1997	9.3		9.33		0.42		33,600	24.2	0.42	-8.9
1998	8.7		8.74		0.42		33,600	24.2	0.42	-8.3
1999	8.7		8.74		0.42		33,600	24.2	0.42	-8.3
2000	8.7	1.1	9.82	31,575	0.42		33,600	24.2	5.25	-4.6
2001		1.4	1.40	42,100	0.42	0.04	31,800	24.2	6.83	5.4
2002		1.4	1.40	42,100	0.42	0.04	31,800	24.2	6.83	5.4
2003		1.4	1.40	42,100	0.42	0.04	31,800	24.2	6.83	5.4
2004		1.4	1.40	42,100	0.42	0.04	31,800	24.2	6.83	5.4
2005		1.4	1.40	42,100	0.42	0.04	31,800	24.2	6.83	5.4
2006		1.4	1.40	42,100	0.42	0.08	31,800	24.2	6.83	5.4
2007		1.4	1.40	42,100	0.42	0.08	31,800	24.2	6.83	5.4
2008		1.4	1.40	42,100	0.42	0.08	31,800	24.2	6.83	5.4
2009		1.4	1.40	42,100	0.42	0.08	31,800	24.2	6.83	5.4
2010		1.4	1.40	42,100	0.42	0.08	31,800	24.2	6.83	5.4
2011		1.4	1.40	42,100	0.42	0.08	31,800	24.2	6.83	5.4
2012		1.4	1.40	42,100	0.42	0.08	31,800	24.2	6.83	5.4
2013		1.4	1.40	42,100	0.42	0.08	31,800	24.2	6.83	5.4
2014		1.4	1.40	42,100	0.42	0.08	31,800	24.2	6.83	5.4
2015		1.4	1.40	42,100	0.42	0.08	31,800	24.2	6.83	5.4

FIRR =   10.5%

SUMMARY FINANCIAL INTERNAL RATE OF RETURN, SOLID WASTE
(Marginal Cost Pricing)

Year	Capital Cost ($Mil)	Incremental O-M Cost ($Mil)	Incremental Cost ($Mil)	Incremental Solid Waste (Ton)	Average Price ($/ton)	Incremental Benefit ($Mil)	NET CFLOW ($Mil)
1996	2.1		2.1		24.2		-2.1
1997	3.2		3.2		24.2		-3.2
1998	5.3	0.9	6.2	69,000	24.2	1.7	-4.5
1999	5.3	1.5	6.8	83,000	24.2	2.0	-4.7
2000	5.3	2.1	7.4	149,000	24.2	3.6	-3.8
2001	5.3	2.8	8.0	226,000	24.2	5.5	-2.6
2002		2.8	2.8	240,000	24.2	5.8	3.0
2003		2.9	2.9	254,000	24.2	6.1	3.3
2004		2.9	2.9	268,000	24.2	6.5	3.6
2005		2.9	2.9	282,000	24.2	6.8	3.9
2006		2.9	2.9	282,000	24.2	6.8	3.9
2007		2.9	2.9	282,000	24.2	6.8	3.9
2008		2.9	2.9	282,000	24.2	6.8	3.9
2009		2.9	2.9	282,000	24.2	6.8	3.9
2010		2.9	2.9	282,000	24.2	6.8	3.9
2011		2.9	2.9	282,000	24.2	6.8	3.9
2012		2.9	2.9	282,000	24.2	6.8	3.9
2013		2.9	2.9	282,000	24.2	6.8	3.9
2014		2.9	2.9	282,000	24.2	6.8	3.9
2015		2.9	2.9	282,000	24.2	6.8	3.9

FIRR =   12.7%

Table 5.2 Economic Internal Rate of Return

SUMMARY ECONOMIC INTERNAL RATE OF RETURN, TOTAL

Year	Capital Cost ($ Mil)	Incremental O M Cost ($ Mil)	Incremental Cost ($ Mil)	Wastewater (Ton/yr)	Average Price ($/ton)	Capital WCharge ($ Mil)	Incremental Desludge (Ton/yr)	Average Price ($/ton)	Incremental Solid Waste (Ton)	Average Price ($/ton)	Incremental Benefit ($ Mil)	NET CFLOW ($ Mil)
1996	3.9		3.9	-	0.26		-	27.5		15.8	-	-3.9
1997	2.9		2.9	-	0.26		33,780	27.5		15.8	0.9	-1.9
1998	14.1	1.3	15.4	-	0.26		34,248	27.5	93,805	15.8	2.4	-13.0
1999	13.1	1.4	14.5	-	0.26		34,716	27.5	110,230	15.8	2.7	-11.8
2000	14.5	1.7	16.1	-	0.26		36,120	27.5	168,630	15.8	3.7	-12.5
2001	5.2	2.1	7.3	16,498,000	0.26	0.04	37,524	27.5	185,420	15.8	8.3	1.0
2002		2.0	2.0	16,498,000	0.26	0.04	38,928	27.5	239,805	15.8	9.2	7.2
2003		2.1	2.1	16,498,000	0.26	0.04	40,332	27.5	282,875	15.8	10.0	7.8
2004		2.3	2.3	16,498,000	0.26	0.04	41,736	27.5	285,430	15.8	10.0	7.8
2005		2.3	2.3	16,498,000	0.26	0.04	43,140	27.5	329,960	15.8	10.8	8.5
2006		2.3	2.3	16,498,000	0.26	0.08	43,140	27.5	329,960	15.8	10.8	8.5
2007		2.3	2.3	16,498,000	0.26	0.08	43,140	27.5	329,960	15.8	10.8	8.5
2008		2.3	2.3	16,498,000	0.26	0.08	43,140	27.5	329,960	15.8	10.8	8.5
2009		2.3	2.3	16,498,000	0.26	0.08	43,140	27.5	329,960	15.8	10.8	8.5
2010		2.3	2.3	16,498,000	0.26	0.08	43,140	27.5	329,960	15.8	10.8	8.5
2011		2.3	2.3	16,498,000	0.26	0.08	43,140	27.5	329,960	15.8	10.8	8.5
2012		2.3	2.3	16,498,000	0.26	0.08	43,140	27.5	329,960	15.8	10.8	8.5
2013		2.3	2.3	16,498,000	0.26	0.08	43,140	27.5	329,960	15.8	10.8	8.5
2014		2.3	2.3	16,498,000	0.26	0.08	43,140	27.5	329,960	15.8	10.8	8.5
2015		2.3	2.3	16,498,000	0.26	0.08	43,140	27.5	329,960	15.8	10.8	8.5

EIRR = 11.7%

SUMMARY ECONOMIC INTERNAL RATE OF RETURN, SEWERAGE

Year	Capital Cost ($ Mil)	Incremental O M Cost ($ Mil)	Incremental Cost ($ Mil)	Wastewater (Ton)	Average Price ($/ton)	Capital WCharge ($ Mil)	Incremental Desludge (Ton)	Average Price ($/ton)	Incremental Benefit ($ Mil)	NET CFLOW ($ Mil)
1996	2.92		2.92		0.26			27.50		-2.92
1997	1.42	0.27	1.69		0.26		33,780	27.50	0.93	-0.76
1998	9.34	0.37	9.71		0.26		34,248	27.50	0.94	-8.77
1999	9.13	0.38	9.52		0.26		34,716	27.50	0.95	-8.56
2000	9.09	0.40	9.49		0.26		36,120	27.50	0.99	-8.50
2001		0.80	0.80	16498000	0.26	0.04	37,524	27.50	5.39	4.58
2002		0.81	0.81	16498000	0.26	0.04	38,928	27.50	5.42	4.62
2003		0.81	0.81	16498000	0.26	0.04	40,332	27.50	5.45	4.65
2004		0.82	0.82	16498000	0.26	0.04	41,736	27.50	5.50	4.68
2005		0.83	0.83	16498000	0.26	0.04	43,140	27.50	5.54	4.71
2006		0.83	0.83	16498000	0.26	0.08	43,140	27.50	5.54	4.71
2007		0.83	0.83	16498000	0.26	0.08	43,140	27.50	5.54	4.71
2008		0.83	0.83	16498000	0.26	0.08	43,140	27.50	5.54	4.71
2009		0.83	0.83	16498000	0.26	0.08	43,140	27.50	5.54	4.71
2010		0.83	0.83	16498000	0.26	0.08	43,140	27.50	5.54	4.71
2011		0.83	0.83	16498000	0.26	0.08	43,140	27.50	5.54	4.71
2012		0.83	0.83	16498000	0.26	0.08	43,140	27.50	5.54	4.71
2013		0.83	0.83	16498000	0.26	0.08	43,140	27.50	5.54	4.71
2014		0.83	0.83	16498000	0.26	0.08	43,140	27.50	5.54	4.71
2015		0.83	0.83	16498000	0.26	0.08	43,140	27.50	5.54	4.71

EIRR = 10.8%

SUMMARY ECONOMIC INTERNAL RATE OF RETURN, SOLID WASTE

Year	Capital Cost ($ Mil)	Incremental O M Cost ($ Mil)	Incremental Cost ($ Mil)	Incremental Solid Waste (Ton)	Average Price ($/ton)	Incremental Benefit ($ Mil)	NET CFLOW ($ Mil)
1996	0.95		0.95		15.76		-0.95
1997	1.45		1.45		15.76		-1.45
1998	4.71	0.95	5.67	93,805	15.76	1.48	-4.19
1999	3.99	0.99	4.98	110,230	15.76	1.74	-3.24
2000	3.99	1.27	5.26	168,630	15.76	2.66	-2.60
2001	5.38	1.33	6.71	185,420	15.76	2.92	-3.79
2002		1.24	1.24	239,805	15.76	3.78	2.54
2003		1.30	1.30	282,875	15.76	4.46	3.16
2004		1.46	1.46	285,430	15.76	4.50	3.04
2005		1.44	1.44	329,960	15.76	5.20	3.77
2006		1.44	1.44	329,960	15.76	5.20	3.77
2007		1.44	1.44	329,960	15.76	5.20	3.77
2008		1.44	1.44	329,960	15.76	5.20	3.77
2009		1.44	1.44	329,960	15.76	5.20	3.77
2010		1.44	1.44	329,960	15.76	5.20	3.77
2011		1.44	1.44	329,960	15.76	5.20	3.77
2012		1.44	1.44	329,960	15.76	5.20	3.77
2013		1.44	1.44	329,960	15.76	5.20	3.77
2014		1.44	1.44	329,960	15.76	5.20	3.77
2015		1.44	1.44	329,960	15.76	5.20	3.77

EIRR = 12.9%

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