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COMPARATIVE STUDY

CENTRALIZED WASTEWATER TREATMENT PLANTS IN INDONESIA

SEPTEMBER 2006

This publication was produced by Development Alternatives, Inc. for the United States Agency for International Development under Contract No. 497-M-00-05-00005-00

Photo Credit: Oni Hartono/ ESP Yogyakarta.

Situation of Sewon Wastewater Treatment Plant – Bantul, Yogyakarta.
Aerated Pond with surface aerator.

COMPARATIVE STUDY

CENTRALIZED WASTEWATER TREATMENT PLANTS IN INDONESIA

Title:	**Comparative Study Centralized Wastewater Treatment Plants in Indonesia**
Program, activity, or project number:	**Environmental Services Program, DAI Project Number: 5300201.**
Strategic objective number:	**SO No. 2, Higher Quality Basic Human Services Utilized (BHS).**
Sponsoring USAID office and contract number:	**USAID/Indonesia, 497-M-00-05-00005-00.**
Contractor name:	**DAI.**
Date of publication:	**September 2006**

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LIST OF ACRONYMS

A	Area
ADB	Asian Development Bank
Adm.	Administration
APBD	Anggaran Pendapatan Belanja Daerah (local government budget)
APBN	Anggaran Pendapatan Belanja Negara (Central government budget)
AWWA	American Water Works Association
Bappenas	Badan Perencanaan Pembangunan Nasional (National Planning Agency)
BOD	Biological Oxygen Demand
BPAL	Badan Pengelola Air Limbah (Sewerage Enterprise Agency)
BPLHD	Badan Pengelola Lingkungan Hidup Daerah (Environmental Agency)
BUDP	Bandung Urban Development Project
BUMD	Badan Usaha Milik Daerah (Local government owned company)
BUMN	Badan Usaha Milik Negara (Central government owned company)
cm	Centimeter
COD	Chemical Oxygen Demand
conn	Connection
Cu	Cupper
CUDP	Cirebon Urban Development Project
Depr	Depreciation
DINAS	Local Government Department
DIPA	Daftar Isian Pelaksanaan Anggaran (Budget Plan)
DKKP	Dinas Kebersihan Keindahan dan Pemakaman (Parks and Cleaning Agency)
DO	Dissolved Oxygen
DPRD	Dewan Perwakilan Rakyat Daerah (local government)
ESP	Environmental Services Program
F	Flouride
Fe	Ferrum / Iron
FORKALIM	Forum Komunikasi Air Limbah (Wastewater communication forum)
FORKAMI	Forum Komunikasi Air Minum (Water communication forum)
GoI	Government of Indonesia
GTZ	Geselleschaft für Technische Zusammenarbeit
Ha	hectare
HB	High building
HC	House Connection
HDPE	High Density Polyethylen
HH	household
HRD	Human Resources Development
HRT	Hydraulic Retention Time
IBRD	International Bank for Reconstruction and Development
IC	Inspection chamber
IMB	Ijin Mendirikan Bangunan (building permit)
IND	Indonesia
Inv	Investment
IPAL	Instalasi Pengolahan Air Limbah (wastewater treatment plant)
IPLT	Instalasi Pengolahan Lumpur Tinja (Sludge treatment plant)
ISO	International Standard Organization
ISSDP	Indonesia Sanitation Sector Development Project
JICA	Japan International Cooperation Agency
Kabag	Kepala Bagian (Department head)
KIM	Kawasan Industri Medan (Medan Industrial Estate)
km	Kilometer
kW	Kilo Watt

l/s	Liter per second
Lab	Laboratory
LG	Local Government
LH	Lingkungan Hidup / Environmental
m	meter
M&E	Mechanical and Electrical
m^3/d	Cubic meter per day
Max	Maximum
Max.cap	Maximum capacity
mg/L or mg/l	Milligram per liter (it should be mg/l)
mill	million
MLSS	Mixed Liquor Suspended Solid
mm	Millimeter
MOF	Ministry of Finance
MoU	Memorandum of Understanding
NGO	Non Government Organization
NH_3	Ammoniak
NH_4	Ammonium
NO_2	Nitrite
NO_3	Nitrate
O&M	Operational & Maintenance
P	Phosphorus
PD	Perusahaan Daerah (local government company)
PD PAL	Perusahaan Daerah Pengelola Air Limbah (local government company for wastewater management)
PDAM	Perusahaan Daerah Air Minum (local government company for drinking water)
PEMDA	Pemerintah Daerah (local government)
Per. Selatan	Perumnas Selatan (South National Housing)
Per. Utara	Perumnas Utara (North National Housing)
PERDA	Peraturan Daerah (Local Government Regulation)
Perpamsi	Persatuan Perusahaan Air Minum Seluruh Indonesia (Indonesian associations of waterworks)
Perumnas	Perumahan Nasional (National Housing)
PKK	Program Kesejahteraan Keluarga (Welfare Family Program)
PLN	Perusahaan Listrik Negara (national electricity company)
PP	Peraturan Pemerintah (Government Regulation)
PR	Public Relation
PU	Pekerjaan Umum (public works)
PVC	Polyvinyl Chloride
Q	Quantity (capacity)
Qr	Return Sludge Flow
RBC	Rotating Biological Contactor
Rp	Rupiah
RT	Rukun Tetangga (neighborhood association)
SK	Surat Keputusan (decree)
SK GUB DKI	Surak Keputusan Gubernur Daerah Khusus Ibukota (decree of Jakarta governor)
SLA	Subsidiary Loan Agreement
SMA	Sekolah Menengah Atas (High School)
SMEs	Small and Medium Size Enterprise
SNI	Standar Nasional Indonesia (Indonesian national standard)
SOP	Standard Operational Procedure
SS	Suspended Solids
SSUDP	Semarang Surakarta Urban Development Project
SV	Sludge Volume
SVI	Sludge Volume Index
SWOT	Strength, Weaknesses, Opportunities, Threats
TA	Technical Assistance

TDS	Total Disolved Solids
THR	Tunjangan Hari Raya (holiday bonus)
Tk I	Tingkat Satu (Level 1)
Tk II	Tingkat Dua (Level 2)
TS	Total Solids
TSS	Total Suspended Solid
UASB	Up flow Anaerobic Sludge Blanket
UPT PAL	Unit Pelaksana Teknis Pengolahan Air Limbah (Technical department for wastewater treatment)
USAID	United States Agency for International Development
V	Volume
WB	World Bank
WI	Working Instruction
WW	Wastewater
WWTP	Wastewater Treatment Plant
Zn	Zink

EXECUTIVE SUMMARY OF FINDINGS AND RECOMMENDATIONS

Recommendation of Best Practices
Based on the findings in the different installations, the following are recommendations of best practices for successful decentralized wastewater treatment (in this order). These recommendations are valid for all organizational forms like PDAM, PD, and DINAS.

1. Strong support and commitment by (local) government in terms of:
    - Providing grant financing for investment cost of major installations
    - PERDA which makes it mandatory to connect, whereever sewer line is within reachable distance of the premise
    - For new houses a sewer connection must be mentioned in the building permit (Ijin Pembangunan)
    - PEMDA allows adequate tariff structure or subsidies for households and business / industry , recoverig at least all Operation and Maintenance costs
    - Pressure from Local Environmental agency (Bappedalda) to private enterprises to treat wastewater or connect to sewer (hotels, hospitals, shopping centres, factories, etc)
    - Control of operating organization through performance targets, not through influencing of daily operations

2. Strong commitment by operating organization
    - Separate accounting system for wastewater treatment (cost and revenue) from water supply
    - Clearly defined targets for the future and accountability to the owner regarding the targets, including regular reporting
    - Break down of the targets into organizational unit targets
    - Basic quality management system including SOPs, monitoring, corrective action, preventive action and maintenance
    - Adequate budgets to conduct these activities
    - Committed employees measured by regular employee satisfaction survey's

3. Institutional Set-up
    - Independent structure of the operating organization (separate PD or within an organization (PDAM)
    - In case of new installations it should be decided from the beginning which competent operator is able to run the plant
    - Business plan and financial planning should be conducted in cooperation with the selected operator
    - The selected operator should be involved in the whole process from the planning stage until handover and training
    - Billing system connected to other billing system (ideally PDAM water bill or possibly electricity bill, but this is a different sector, legal entity)

4. Tariff and Billing
- Coupling wastewater tariff to water tariff (best as % of water bill)
- Collection of wastewater bill together with water bill
- Not using flat rates which are difficult to adjust through Mayor and DPRD
- Establish sewer in areas with high PDAM coverage

5. Sufficient Budget by
- Establishing tariff which can cover, at minimum, O&M cost
- Independency from subsidies for O&M (often paid delayed)
- Establish sewer in service areas with high commercial density
- Installation should be on grant basis because people are not willing (yet) to pay for full cost recovery
- Capacity of installations should be utilized 100%

6. Socialization and communication to
- People
  - Increase of willingness to pay
  - Establish marketing strategy
- Commercial Customers
- Mayor
- DPRD
- Environmental Agency (LH)
- City planning agency (Tata kota)
- Control Board
- Media, Press

7. Adequate Sewer and Treatment System

There is a relationship between O&M costs, operation complexity, and land usage:
- More complex installations have higher O&M costs, use more energy and are more difficult to operate; but they need less land.
- Low complexity: anaerobe, facultative, and aerobe lagoons have almost no energy cost, but need large areas. Maintenance is easy, not much control needed.
- Medium complexity: aerated lagoons need electricity for aerators, but not much control necessary. Smaller area needed.
- High complexity: activated sludge, UASB, RBC, (and Trickling filter) need less space, but have high energy cost and more complex control of process
- If high complexity system is chosen, always consider RBC as an option with lower energy usage and relatively low operation complexity
- Only one example for UASB exists in Indonesia for communal wastewater (Medan). Although theoretically there are many advantages for anaerobic treatment the technology has to be proven viable for low BOD concentration of communal wastewater.
- Disadvantage of plants with high complexity and O&M costs: Problems in O&M due to inappropriate skills of operator and lack of money leads to breakdown of process
- Sludge should be considered to be used as fertilizer or for other purposes
- Flow meters should be installed
- Re-use of treated wastewater should be considered
- In design of sewer system the pumping should be minimized (where possible)

8. Good Operation Practice
   - SOPs
   - Monitoring
   - Recording
   - Evaluation
   - Corrective Action
   - Preventive Action

9. Good Maintenance
   - Preventive maintenance plan
   - Inspection and cleaning of sewer
   - Adequate budget

10. Human Resources
   - Competent staff
   - Training in accordance to need (competency analysis)
   - Adequate salary and incentives
   - Performance evaluation and consequences

Before a project is considering technical assistance it should assess the ability of each operator to implement the support sustainable. Maintenance programs can only be implemented with support of top management and sufficient funds and equipment. For process control a laboratory must exist and must be able to conduct analysis. Funds must be available for reagents and O&M costs. Or the analysis must be outsourced with sufficient funds.

Before investment measures are taken, capacity of existing plant and sewer has to be re-evaluated and compared with actual usage. The possibility for connecting new customers has to be assessed first, and tariff and billing system should be reviewed to ensure cost recovery.

Overview of visited public owned treatment installations

Description's	Unit	JAKARTA	CIREBON	BANDUNG	TANGERANG	YOGYAKARTA	SOLO	BALIKPAPAN	BANJARMASIN	MEDAN	
										Kota Medan	Kota Parapat
Operator	-	**PD PAL Jaya**	**PDAM Kota**	**PDAM Kota**	**Dinas Pemda**	**Dinas Pemda**	**PDAM Kota**	**PDAM Kota**	**PDAM Kota**	**PDAM Tirtanadi**	**PDAM Tirtanadi**
Capacity Treatment Plant	conn.	70,272	32,750	176,000	16,212	22,187	11,000	1,200	700	36,000	2,025
Number of Connections	conn.	1,269	15,397	89,139	5,620	9,960	10,728	458	528	10,149	159
Tariff System	-	based on m²	included in the water bill	30% of water bill	**	fixed monthly fee	fixed monthly fee	fixed monthly fee *	25% of water bill	based on m²	based on m²
Billing system	-	separate bill	incl in PDAM bill	incl in PDAM bill	**	separate bill	separate bill, combined with PDAM	combined with PDAM	combined with PDAM	combined with PDAM	combined with PDAM
Investment	mill. Rp	6,360	22,870	82,027	**	68,000	40,793	**	8,715	11,499	**
O&M cost	mill. Rp/year	10,814	2,133	13,428	**	872	761	**	302	2,007	355
Tariff Revenue (billed)	mill. Rp/year	14,405	**	16,346	**	89	636	**	435	1,866	6
Cost Recovery (excl. depr)		133%	na	122%	na	10%	84%	na	116%	93%	na
Cost Recovery (incl. depr)		116%	na	103%	na	na	54%	na	32%	44%	na
Collection Efficiency	%	60%-80%	**	80%	**	80%	15%	**	86%	97%	85%
Average Bill/con/month	Rp	8,200	**	15,300	**	775	4,950	**	73,090	15,700	2,550
Plant system		**Setiabudi** aerated lagoon	anaerobic, facultative, maturation	**Bojongsoang**: anaerobic, facultative, maturation	**Tanah Tinggi**: activated sludge	**Pendowohardjo Sewon**: aerated facultative, maturation	**Mojosongo**: facultative aerated	**Margasari**: activated sludge	**Lambung Mangkurat**: RBC	**Pulo Brayan Bengkel** (Cemara): UASB, aerated lagoon, facultative lagoon	**Parapat Ajibata**: aerated facultative, maturation
					Spread 8 locations: oxidation pond		Semanggi: aeration ***				

Note: * = not yet implemented ** = no data available *** = not functioning

1. INTRODUCTION AND BACKGROUND

The Environmental Services Program (ESP) is a fifty-eight month program funded by the United States Agency for International Development (USAID) and implemented under the leadership of Development Alternatives, Inc. (DAI). ESP works with government, private sector, NGOs, community groups and other stakeholders to promote better health through improved and expanded access to clean water and sanitation services. The period of the project is from December 2004 through September 2009. ESP activities are currently focused on seven High Priority Provinces: Nanggroe Aceh Darussalam, North Sumatra, West Sumatra, East Java, Central Java, Yogyakarta, West Java and DKI Jakarta. ESP also supports a limited set of activities in four Special Concern Imperative Areas: Balikpapan, Manado, Manokwari and Jayapura.

The ESP work plan for the first year has identified that in order to increase access to improved, citywide sanitation services it is important to gain more information on the nine centralized domestic sewerage + waste water treatment systems currently operating in Indonesia. Because of the low priority given by both Local Government and communities most of these systems are not operating well (high idle capacity / low willingness to connect and pay). By conducting a comprehensive comparative study of the nine existing systems and including three systems operated by private sector, it will be possible to compare the systems and recommend improvements in general management, as well as operational, institutional and financial systems.

Objective of the study
The objective of this study is the assessment of nine Centralized Wastewater Treatment Systems. Comparison is done on four major topics: financial (revenues and cost), management, technical, and institutional.

Results and recommendations of this comparative study will be used as input in subsequent policy discussions with the respected stakeholders both at local level (Local government & operators) and national level (National Government, donor institutions), to ultimately improve the operation of these facilities and to guide decision makers responsible for potential new locations.

The study focuses on public operated domestic wastewater treatment installations. But for comparison also a private owned sewerage installation (Lippo Karawang) and two industrial centralizes treatment plants (Bandung, Medan) have been visited.

The Report
The Report consists of one main report and individual reports on every plant. The main report combines the information in a comparative form of all treatment installations and provides a summary over the most important findings and recommendations in Chapter 1. At the end of the report recommendations are found for the implementation of projects. The individual reports focus on the special findings for each installation and each individual report is completed with a data sheet. Data is based on the information gathered from the

operator and is sometimes limited to the extend data monitoring and control is conducted by the operator.
It was reported during the study that another small WWTP exists in Samarinda, Kalimantan, but this is not included in the report.

The following table gives a short overview about the domestic public owned installations.

2. FINDINGS AND DISCUSSION

2.1. INSTITUTIONAL ISSUES

2.1.1. INSTITUTIONAL SET-UP

PDAM

In Surakarta (Solo), Medan, Balikpapan, Banjarmasin, Bandung and Cirebon the wastewater treatment and sewerage system falls under the responsibility of the local PDAM. An advantage of this set-up is that PDAM often possesses competence to handle a wastewater installation from the organizational and technical side. The billing system is already in place, the customer database and relationship implemented, PDAM is used to treat water, and piping systems are utilized. Billing can be combined which is far more efficient than separate billing.
On the other hand, most PDAMs are not interested to operate a wastewater installation, because they are not healthy enough to fulfill their obligation regarding drinking water and are given an additional burden to operate a wastewater system.

PD (Perusahaan Daerah)

Up until now, only in Jakarta a PD organizational form is applied, separate from the Municipal Water utility. However, Banjarmasin and Bandung are interested in going in this direction. An advantage is the independency from the government and PDAM. They have their own responsibility and can work independently. Disadvantages ares that they do not have the backing of PDAM. Billing through PDAM and fees based on water usage will not be so easy anymore.

PD PAL drives its business successful, but it cannot be compared with other areas, because it serves mostly high rise buildings in the centre of Jakarta and can apply tariffs which cross-subsidize lower tariffs of households.

Also the visited industrial treatment plants in Bandung and Medan, which are owned or partly owned by the government, do not have a convincing set-up to achieve cost recovery and good operational performance.

Dinas

In Tangerang and Yogyakarta the facilities are managed by the local government (Dinas). In some of the other visited cities it was managed by Dinas before it has been moved to PDAM (e.g. Medan, Balikpapan). Most installations operated by Dinas suffer from budget problems and insufficient billing efficiency (if any billing at all). Only in Yogyakarta commitment by the management could be found. However, budget problems at the beginning of every year and losing support in DPRD for subsidies will threaten the performance in the medium term.

Comparison of Institution Models
A rough comparison of the 10 best practices is given in the table below. 0 points are given if the practice is not easily achievable in the institution. 1 point is given for medium achievability and 2 points if the institutions provide a good environment to achieve this best practice.

	Best Practices	Dinas	PDAM	PD
1	Commitment local G'ment	2	2	2
2	Commitment operator	1	1	2
3	Institutional Set-up	0	2	2
4	Tariff and Billing	0	2	1
5	Sufficient Budget	0	2	2
6	Socialization & Communication	1	1	1
7	Adequate Sewer & Treatment System	1	1	1
8	Good Operation Practice	1	2	2
9	Good Maintenance	0	1	1
10	Human Resources	0	1	1

The most important practices are the first 5 in the table: commitment of local government until sufficient budget. A comparison of these practices demonstrates the same value of 15 for PD and PDAM compared to 6 for Dinas.

However it has to be mentioned that the results very much depend on the actual implementation in each location. From the limited number of installations in Indonesia, it cannot be concluded which operational model has been proven as the one which should be recommended to other cities.
In each city it will strongly depend on the actual environment, especially the local government and the commitment of the top management.

2.1.2. RELATION TO OWNER, LEGAL FRAMEWORK

Relation to Owner
The treatment facilities are usually owned by the municipal authority. For good performance, a good relationship to the local government is essential. At the same time, the local government must show full commitment to wastewater treatment in their area. The local government is responsible for tariff, tariff increases, local government regulations, and provision of the funds and has therefore large impact on revenue and performance of the operator. Banjarmasin is a good example of a committed local government, which also supports the operator with funds.

Legal Framework
Domestic wastewater treatment is based on Keputusan Menteri Negara Lingkungan Hidup Nomor 112 Tahun 2003 Tentang Baku Mutu Air Limbah Domestik, dated 10 Juli 2003.

According to this regulation all wastewater from real estates, restaurants (more than 1000 m^2), offices, small businesses, apartments and boarding houses (more than 100 habitants) has to be treated individually or in a centralized treatment plant to thresholds of: pH 6-9, BOD

100 mg/l, TSS 100 mg/l and Oil and Grease 10 mg/l. The values are also valid for centralized domestic treatment plant. Sewers should not be open channels but have to be closed. Bupati/Mayor is obliged to mention the thresholds in the building license (izin pembuangan) for real estates, restaurants, offices, small businesses (niaga), apartments and boarding houses. Provincial regulation can change the thresholds to lower values.

In general the operator (PDAM, Dinas, private operator) of the wastewater treatment plants were not aware of this regulation. They were often confused about the regulations in regard to industry and river water quality. There is often no law enforcement from LH regarding the regulations.

In some districts (Medan, Parapat) a PERDA (Local Government regulation) is in place which makes connecting to existing sewers mandatory. PDAM Solo is in the status of proposing this to the local government.

In all areas, it is recommended to establish local regulations which reflect the national law and make the connection to the sewer mandatory if the premise is close to the sewer.

2.1.3. RELATION WITH OTHER STAKEHOLDERS

For the operator, good relations to all relevant stakeholders are very important. A good example is demonstrated in Banjarmasin.

Good relations to the **Mayor** can assure financial grants and support for tariff adjustments and PERDAs. For the latter lobbying the **DPRD** and relevant groups of DPRD is important. With support of **LH** small businesses, hotels, restaurants can be brought to connect to the sewer. Good communication is necessary with **Tata Kota** to ensure that private houses and real estates will connect to the sewer by including it in the building permit. For communication to the people, a good relationship with the local press should be maintained.

2.2. MANAGEMENT ISSUES

2.2.1. CORPORATE STRATEGY

The evaluation has shown that generally a successful operator needs full support from the management.

The corporate strategy must be oriented towards goals that the organization wants to achieve. The management must fully support this strategy. The goals must be controlled and reviewed over the period to ensure achievement of goals.

The operator should analyze the internal and external situation and should derive the strategy and the goals from the analysis. The operator could use the best practice points of Chapter 1 of this report as a checklist for analysis and potential issues for their strategy.

2.2.2. QUALITY MANAGEMENT SYSTEM

None of the operators are using a consistent quality management system (QMS). Only in the plant of Yogyakarta and in Banjarmasin parts of a QMS could be observed. In general, no systematic monitoring and recording is carried out, leaving no possibility for corrective action. Also SOPs do not exist at all or only in very simple and incomplete forms. Even in Medan, where the water part of PDAM is ISO 9001 certified, the wastewater division has no management system in place. Consequently, the processes are often not under control. This is especially a problem if the activated sludge process is used. However, the lack of a quality management system is also relevant in all other divisions like maintenance, customer relation, and sewer system.

It is strongly recommended to implement a basic quality management system based on identified processes including at least SOPs, monitoring, recording, evaluation, corrective action and preventive action.

2.2.3. HUMAN RESOURCES DEVELOPMENT

Employee development is generally not deemed an important factor for the operators visited. Employee satisfaction, evaluation of competence and performance are not issues addressed. Therefore in some organizations the motivation of employees is not high. This problem is often connected to the issue that the staff comprises government employees or – in a public company - have a similar position as a government employee. In these organizations the rules are often the same as for government employees.
Training is often associated as incentive for an employee who shall be honored for good performance, and not with a training need to close a competence gap.

The following table provides an impression of the number of employees used for the installations. The numbers cannot be directly compared, because some are with administrative overhead and some without. A lower number of employees often lead to insufficient maintenance.

Operator	Connections	Employees Plant	Employees Sewer	Employees Total	Connections per Employee
PDAM Bandung	89,000			260	342
PDAM Banjarmasin	550			22*	25
PDAM Balikpapan	771**			12	64
PDAM Cirebon	15,400	23	12	88***	175
PD PAL Jakarta	1269			105	12
PDAM Medan	10,000			11	910
PDAM Parapat	159			8	20
PDAM Surakarta	10,728			17****	630

Operator	Connections	Employees Plant	Employees Sewer	Employees Total	Connections per Employee
Dinas Tangerang	5,620			5	1,120
Dinas Yogyakarta	9,660	31	37*****	68	140

*without hired people for sewer and without overhead in PDAM
** before fire destroyed 323 houses
*** including overhead in PDAM
**** without overhead in PDAM
***** Dinas reported that 67 people are necessary for sewer

2.2.4. CUSTOMER

Most operators do not have a special marketing plan to obtain more customers. Only Banjarmasin and PD PAL have special activities to attract new customers. Some operators conduct customer satisfaction surveys; PD PAL on a yearly basis; Medan once did a survey together with the water department.

The customer database is often neither verified nor up-to-date. In Bandung about 9,000 customers are registered, but 89,000 are assumed to be customers. Balikpapan has a complete customer database but only has 500 customers. Cirebon estimates the real number of customers 10 – 20% higher than recorded, and Yogyakarta 40% higher. Tangerang seems to have no database.

The willingness to pay is quite different. Although PD PAL and Banjarmasin do not have many problems with the payment, the willingness to pay in areas like Tangerang is quite low. In Banjarmasin and Jakarta the operators serve many commercial customers and households which need a sewer. Banjarmasin is often conducting public campaigns to raise public awareness.

In comparison, KIM Medan, which has as a captive market for wastewater in the industrial estate operator of WWTP, has connected less than 10% of the industrial plants of textile industries in Bandung.

2.3. FINANCIAL ISSUES

2.3.1. INVESTMENT

The initial investments were mostly financed by loans from donors (World Bank, ADB, Japan, etc), either on-granted or on-lended to the local government, as shown by the following table.

Area	Operator	Total Investment[1]/ (Rp 000)	Financing Source	
Bandung	PDAM	60,159,617	Loan from: ADB-SLA, PDN, RDI	Grant from: GOI, Prov. Gov't
Banjarmasin	UPT PAL	8,714,955		WB on-granted, GOI
Cirebon	PDAM	22,870,015	ADB-SLA	Grant from: GOI, Prov. Gov't
Jogja	Dinas	68,000,000		JICA Grant
Medan	PDAM	9,251,555		ADB on-granted, GOI
DKI Jakarta	PD PAL	6,360,053 [2]/		IBRD grant
Solo	PDAM	40,793,200		WB on-granted, GOI

[1]/ Initial investment
[2]/ Data of investment on plant is not available

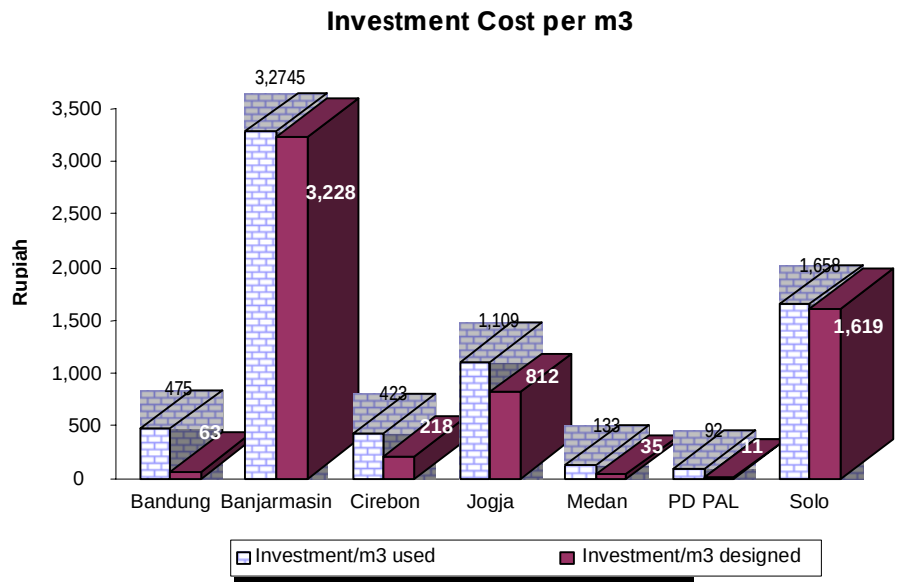
Only Cirebon and Kota Bandung bear loans while the rest received grants. However, being sourced from grant is frequently used as a reason of not having proper management of the system.

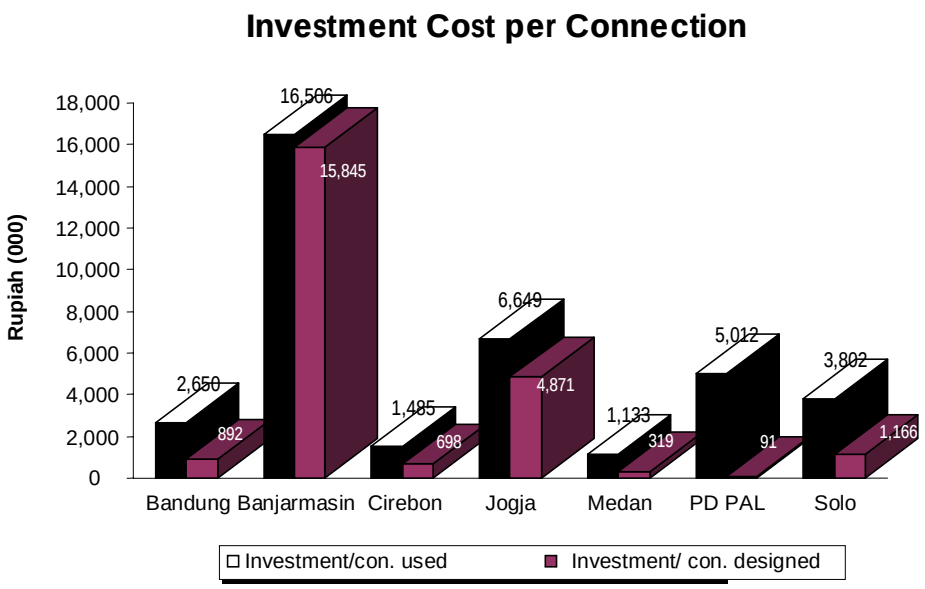
During the operation of the system, some operators have been able to carry out routine investments such as installing new connections or purchasing some equipment through their own budget. But system expansion is by no means doable unless supported by the local or central government. Borrowing from any financial institutions is almost impossible to do since the existing tariff rates are insufficient to back its borrowing capacity. Only PDAM Kota Bandung and PD PAL seem to have the capability to borrow to finance their investment needs. However, PDAM Kota Bandung is having loan arrears that will constrain them from making another loan.

The table below shows large differences between the cities regarding investment. If the investment is calculated per m^3 wastewater (assumed to be treated over 15 years) or per connection, the values vary between 35 and 3228Rp/m^3 designed and 319,000 and 15,845,000 Rp per connection (excluding PD PAL, which does not have a complete system).

The table below also attempts to show the investment cost efficiency of each system, comparing the designed capacity to the actual used capacity. Compared to the others, Banjarmasin has the most expensive system with more than Rp3,000 per m^3, or more than Rp15,000 per connection. Comparing the cost per designed capacity and usage shows that the actual use is still far behind the design, except for Solo that reaches almost full capacity of the plant. This increases the fixed cost in some cases like Bandung, Jakarta and Medan substantial.

Operator	**Investment/m^3 used (Rp)**	**Investment/ m^3 designed (Rp)**	**Investment/con. Used (Rp 000)**	**Investment/ con. Designed (Rp 000)**
Bandung	475	63	2,650	892
Banjarmasin	3,274	3,228	16,506	15,845
Cirebon	423	218	1,485	698
Jogja	1,109	812	6,649	4,871
Medan	133	35	1,133	319
PD PAL	92	11	5,012	91
Solo	1,658	1,619	3,802	1,166





However, it should be noted, that some initial investment figures are subject to revision since complete data was not available during the field survey.

2.3.2. TARIFF AND COLLECTION OF BILLS

Tariff

The tariff is determined by the local government with the approval of the local parliament DPRD.

The operators are using different tariff systems, which are described below and summarized in the following table:

Tariff System	Advantages	Disadvantages
Fixed Price Tariff	• Easy to calculate based on house type • Easy to calculate for non-PDAM user	• Tariff usually low • For hotels and other commercial organizations tariff much too low and not adequate to load discharged • Tariff difficult to increase (through mayor and DPRD) • Difficult for billing collection
Tariff based on square meter	• Easy to calculate for non-PDAM user	• Tariff difficult to increase (through mayor and DPRD) • Not easy to calculate if area of house not known • Relation between area and water usage not always clear • Difficult for billing collection
Tariff based on clean water used	• Logic, because water used becomes wastewater • Easy to bill through PDAM	• Not easy to increase tariff through mayor and DPRD • Other tariff is necessary for non-PDAM user
Percentage of water bill paid for sewerage user	• Logic, because water used becomes wastewater • Easy to bill through PDAM • Increase of tariff follows increase of water tariff	• Other tariff is necessary for non-PDAM user
Percentage of water bill to all PDAM customers	• Easy to bill through PDAM • Increase of tariff follows increase of water tariff • Very high income to operator which can cover investment	• "unfair" Difficult to argue against non-sewage user which have to pay because connected to PDAM

1. Fixed price tariff
   The tariff is based on different house types. Bigger houses generally pay more. The disadvantages are: The tariff is usually very low and cannot cover the cost. Each increase of the tariff has to be discussed with the mayor and DPRD. For hotels and other commercial organizations the tariff is generally much too low and not adequate for the volume and organic load discharged.

2. Tariff based on square meter of houses
   An advantage is that if a customer does not use PDAM water an adequate bill can be calculated. A disadvantage is that every increase of the tariff has to be agreed by the mayor and DPRD. It is also not always easy to calculate the square meter of the houses. The relation from the area of a house to wastewater discharge is not always clear. Big buildings like storehouses have almost no water consumption but large area.

3. Tariff based on clean water volume used
   An advantage is the logic behind this approach. All water used will become wastewater. Therefore it has to be paid for. A disadvantage is that it is not so easy to increase the tariff, because it has to be approved by the mayor and DPRD.

The tariff based on clean water volume used reduced by a factor (e.g. 30%) is another option discussed. But this model is exactly the same as the one discussed above. Only the amount of wastewater volume will become smaller, but this has to be compensated by a higher tariff to cover the cost.

4. A percentage of the water bill paid
   An advantage is that the wastewater bill is correlated to the water bill. As it is connected with a constant factor (e.g. 25 or 30%) to the water bill, all tariff increases for water will automatically also apply to the wastewater bill. This seems to be the model with the most advantages.

5. A percentage of the water bill paid for all PDAM customers
   This system is applied in Bandung with a wastewater bill of 30% of the water bill. The advantage is that this leads to a relatively high income for the operator. A disadvantage is that some customers pay for something they do not obtain, because all PDAM customers who are not connected to the sewer have to pay as well. The fee must therefore be declared as environmental fee. Otherwise the consumer can complain against this payment. The calculation in Bandung shows (see report Bandung) that with such a model the PDAM can come to full cost recovery and is able to pay back a loan if the installation is not too large.

Some operators have very low tariffs for commercial customers (Yogyakarta, Solo). Operators should consider tariffs based on water volume used as the basis for the tariff for commercial customers.

No operator is calculating the tariff based on the BOD load. For domestic waste this seems to not be very feasible because the BOD is not easy to determine for each household. Nevertheless, if the operator is considering treating large amounts of industrial wastewater, the BOD load can be considered as the basis for the fee.

Collection of the bills

The collection of the bills is a serious problem as almost all operators do not bill together with PDAM bills. Except PD PAL, all operators have problems in collecting the bills, when the bill is not combined with the water bill. In general, the bills are quite low (Rp 500 to 7,500 per connection). If the bills have to be collected separately, the cost for billing is often higher than the revenue per bill and billing is not enforced. Therefore the combined billing with the water bill seems to be the best solution.

Table billing systems:

Operator	Billing System	Collection Efficiency
PDAM Bandung	Together with water bill	80%
PDAM Banjarmasin	Together with water bill	86%
PDAM Balikpapan	no billing	-
PDAM Cirebon	Included in water bill	93%
PD PAL Jakarta	Separate bills	60-80%
PDAM Medan	Together with water bill	98%
PDAM Solo	Usually separate bill	15%
Dinas Tangerang	no billing	-
Dinas Yogyakarta	Separate bill	80%

The collection efficiency of each operator is quite good except for Solo (<15%).

The correlation between the collection efficiency and the billing system is not so clear. Good collection efficiency is achieved in Bandung and Banjarmasin, which combine the bill with the water bill. Solo, employing a separate billing system, only has 15% collection efficiency. Operators like PDAM Bandung, which collect mostly through the water bill, have also very low collection efficiency in cases where the customers are not water supply customers. PD PAL achieves high collection efficiency because they have committed commercial customers, while Yogyakarta is probably profiting from the very low tariff and time consuming door to door collection. The problem in Solo is mainly related to the customers that do not have piped-water connection, that represent 93% of the total wastewater customers. People do not like to travel and stand in long queues for small amounts of money; yet door to door collections are also inefficient.

It also has to be recognized that the collection through a third party can lead to problems, when the operator is not fulfilling his duties. Examples are a PD, DINAS or PT billing through PDAM or PLN. In case the customer is not satisfied with the service and holds the payment the collector is placed in a difficult position. PLN also cannot stop its services if the customer is not paying for the wastewater. With regards to billing and the collection of bills, there are many advantages if PDAM is appointed as the operator of wastewater collection and treatment.

2.3.3. FINANCIAL PERFORMANCE

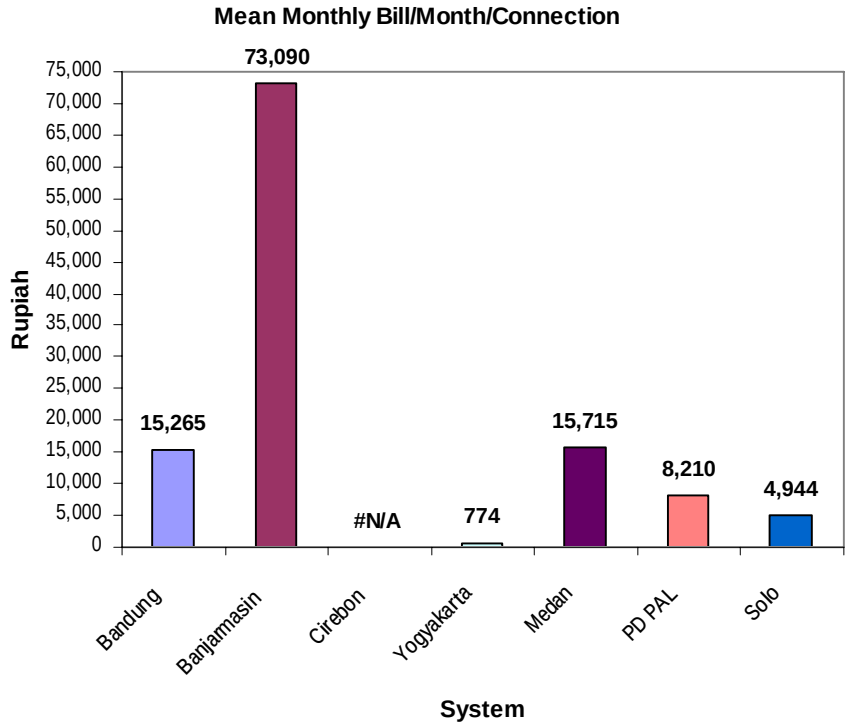
Only PDAM Kota Bandung and PD PAL Jaya are able to attain full cost recovery (including depreciation). However, there are certain conditions that should be noted from the two operators: (i) PDAM Bandung charges all water customers with 30% for wastewater bill regardless if they are connected to the system or not, (ii) PD PAL gets an advantage of having non-domestic institutions, especially high rise buildings, as their customers. These amount to only 12% of total customers but contribute 97% to the total income of the service.

Dinas seems to have less concern toward the financial performance of the wastewater system. DKPP Yogyakarta for example, has not updated the tariff in 12 years, resulting in a very low cost recovery and very inadequate funds to support its daily operation. Dinas Tangerang does not even charge their customers and does not maintain any records on its wastewater operation.

Revenue

The tariff/revenue and its collection play a crucial role in the performance of the wastewater collection and treatment.

Calculating the average monthly bill per month per connection large variations can be observed. In Banjarmasin, many commercial customers pay Rp73,000 per month, while in Yogya the bill is only Rp774. In Tangerang and Balikpapan the customers don't pay at all. Meanwhile, Bandung and Medan pay approximately Rp15,000 per month, which is paid by all PDAM customers in the case of Bandung. The lower revenues are achieved in Solo and Yogya where fixed tariffs are in place, which are quite low.



Operator	Tariff System	Mean Monthly Bill per Connection (in Rp)
PDAM Bandung	30% is added to water bill of all PDAM customers	15,265 *
PDAM Banjarmasin	25% of water bill	73,090
PDAM Balikpapan	Fixed fee, no billing	-
PDAM Cirebon	Included in water bill	-**
PD PAL Jakarta	Based on square meter	8,210 ***
PDAM Medan	Fixed fee based on square meter	15,715
PDAM Solo	Fixed fee	4,950
Dinas Tangerang	Fixed fee, no billing	0
Dinas Yogyakarta	Fixed fee	774

* in Bandung per PDAM customer

** in Cirebon the bill is included in the water bill but cannot be separated

*** for PD PAL this figure only represents the average monthly bill per connection for households to be able to compare it with other operators. Calculations on all connections including non-domestic customers will produce a very high average, incomparable to others that almost all of the revenues come from household connections.

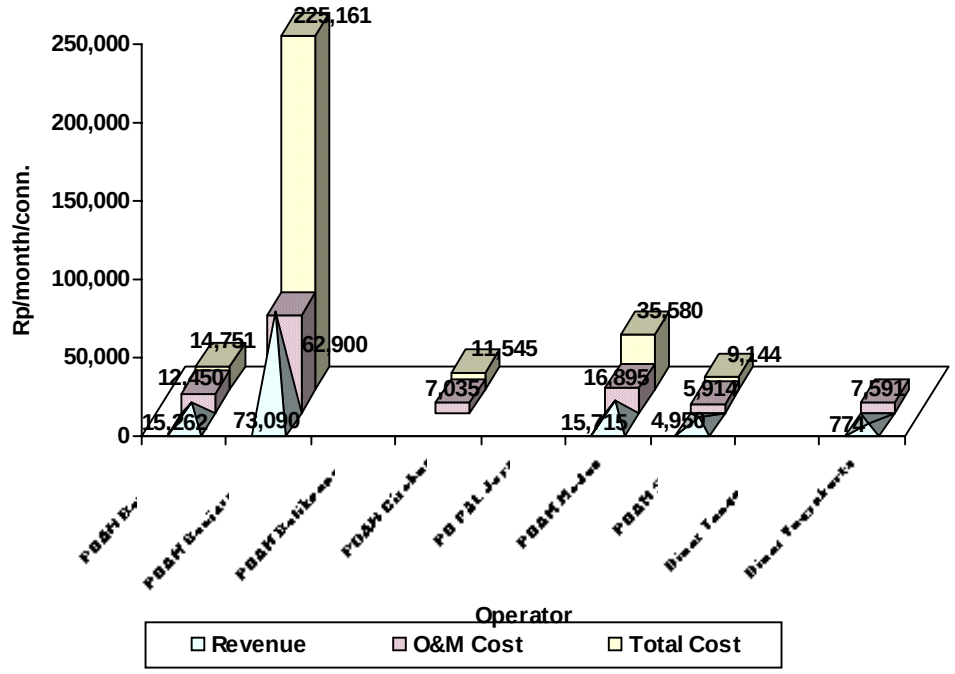
Higher income is achieved with a system based on % of water bill (Banjarmasin and Bandung).

Cost

For comparison of the different installations the cost has been calculated per month and customer. The cost can be compared to each other but also to the monthly average bill.

Operator	Total Cost Rp/month/conn.	O&M Cost Rp/month/conn.	Revenue Rp/month/conn.
PDAM Bandung	14,751	12,450	15,265
PDAM Banjarmasin	225,161	62,900	73,090
PDAM Balikpapan			
PDAM Cirebon	11,545	7,035	
PD PAL Jaya	not available	not available	not available
PDAM Medan	35,580	16,895	15,715
PDAM Solo	9,144	5,914	4,950
Dinas Tangerang			
Dinas Yogyakarta		7,591	774

(Total Cost incl. Depreciation)



The comparison regarding O&M costs shows values of approximately Rp15,000 as a mean. Banjarmasin has very high O&M costs as it also has a very high Total cost because of its relatively high investment cost. Solo and Yogyakarta seem to have too low O&M costs to cover the real costs of O&M. However, also in Medan and Bandung the impression was that for sustainable O&M, more funds should be made available. Therefore the O&M costs should probably be above Rp20,000 per month and connection.

Compared to the current water bills such an amount seems to be realistic to be billed to the customers. In Banjarmasin the average bill is even above Rp70,000. The operator should focus on high income houses (like from Real Estates) and on commercial customers, to implement cross subsidizing.

Operator	Cost Recovery (excl. depreciation)	Cost Recovery (incl. depreciation)	Average Tariff/ Connection	Collection Efficiency
PDAM Kt. Bandung	122%	103%	15,265	80%
PDAM Banjarmasin (UPT PAL)	116%	32%	73,090	85%
PDAM Balikpapan [1)]	NA	NA	NA	NA
PDAM Cirebon [2)]	NA	NA	NA	93% [3)]
PD PAL Jakarta	133%	116%	8,210 [4)]	60-80% [5)]
PDAM Medan	93%	44%	15,715	97%
PDAM Solo	84%	54%	4,944	<15%
Dinas Tangerang	NA	NA	NA	NA
Dinas Yogyakarta	10%	NA	774	80%

Note: Based on 2004 financial data

1) PDAM Balikpapan has not applied the tariff regulation and transactions are recorded only in daily cash book.
2) Revenue from waste water tariff is not separated from water bill.
3) Assumed to be similar with collection efficiency of the water bill.
4) This average tariff is only for household connections in order to compare with other operators, since major income comes from non-domestic connections that produce very high average tariff (more than Rp 900,000/con). Cost recovery is calculated to all costs and incomes.
5) 60% for households and more than 80% for high rise buildings

Regarding cost recovery including depreciation can be concluded that all tariff rates were not derived from appropriate cost calculation, taking into account all costs needed for the sustainability of the system.

Low tariff and/or not sufficient fee collection systems yield to cuts in the budget for operation and maintenance. An example is PDAM Cirebon, where the fee for wastewater treatment is included in the water fee. But it is not defined how much of the collected fee is related to wastewater. This gives the PDAM the feeling that wastewater treatment is only cost-centre and does not provide revenue and is a center for continuous losses.

2.3.4. PRICE/TARIFF CALCULATION

Some tariff simulations have been done for Banjarmasin and Yogyakarta to show the average tariff for the system and the huge gap between the present tariff rate and the ideal one (see 3.1.4 Tariff and Collection of bills). The tariff has been simulated under the condition of a 18% interest rate and 15 years of loan payment period. The calculation considered also 100% utilization of the installation.

Operator	Current Condition	100% Utilization of Installation
Banjarmasin	Rp 355,000	Rp 260,000
Yogyakarta	Rp 127,000	Rp 105,000

(More explanation see in Banjarmasin and Yogyakarta reports)

Such high wastewater bills currently seem impossible to be implemented. Therefore, for the time being, it should be considered that all investments are covered by the local or central government.

2.3.5. ACCOUNTING SYSTEM

PD PAL Jaya has set up a complete accounting system to record its day-to-day operation and any other transactions. The accounting system has been computerized and programmed to produce financial statements such as Income Statement, Balance Sheet, and Cash Flow. The O&M costs are classified into 3 (three) main groups: (1) cost for treatment, (2) marketing cost, and (3) administration cost. However, costs for the plant and sewer are not separated into different cost centres.

PDAM Kota Bandung has also implemented a computerized accounting system for the wastewater division. The costs are classified into four (4) cost centres: pumping, treatment, sewer and planning. That is very useful to evaluate the efficiency of each cost centre. However, the accounting system can only produce an Income Statement, while the Balance Sheet and Cash Flow are combined or included in the PDAM Main Financial Report.

Dinas in Yogyakarta and Tangerang have not maintained proper accounting systems. Daily operations are recorded on cash basis. There is no report of the Income Statement showing the capacity of the system to generate revenue. There is no tool to measure the adequacy of the tariff to support the operation and maintenance of the system nor its required investment.

2.4. TECHNICAL ISSUES

2.4.1. TREATMENT PLANT

Different treatment systems are used by the operators. The following table gives an overview about the technologies used.

Operator	Treatment System
PDAM Bandung	An-aerobe, facultative, maturation ponds
PDAM Banjarmasin	Rotating Biological contactor (RBC)
PDAM Balikpapan	Activated Sludge
PDAM Cirebon	Facultative, maturation ponds
PD PAL Jakarta	Aerated lagoon
PDAM Medan	UASB, aerated lagoon, facultative pond
PDAM Parapat	Aerated lagoon
PDAM Solo	Aerated lagoon
Dinas Tangerang	1. Activated sludge, 2. aerated lagoon, 3. facultative ponds
Dinas Yogyakarta	Aerated lagoon
Industrial Plant Bandung	Activated Sludge (modified)
Industrial Plant Medan	Aerated lagoon
Lippo Karawaci	Activated Sludge

Most plants are equipped with a pre-treatment such as screen for course material and grit chamber for sand removal.

Aeration ponds

Aeration ponds consist of large basins where aeration is achieved from the air by natural diffusion of oxygen into the water. If the basins are deep, an-aerobic processes reduce the BOD in the lower part of the tanks. No major equipment is necessary. Aeration Ponds are easy to maintain and do not need much operational effort except sludge removal.

Aeration ponds are often used in a sequence with an-aerobic ponds, facultative ponds and maturation ponds. The an-aerobic ponds are so deep, that the absence of oxygen provides a good climate for an-aerobic bacteria. In the facultative ponds the upper part is aerobe, while the lower part is an-aerobe. The maturation ponds are so shallow, that the aerobe processes are dominant.

Aeration ponds are used in Bandung, Cirebon and in some smaller plants in Tangerang.

Aerated Ponds / Lagoons

Aerated ponds are similar to the aeration ponds, but use mechanical aerators to get higher oxygen transfer into the wastewater. With higher oxygen transfer the ponds can be designed with smaller HRT and therefore smaller volumes. But electrical energy is necessary which increases the operational cost.

This technology is widely used in Indonesia. Yogyakarta has a very good system based on this technology. Tangerang has three smaller aerated pond systems and Cirebon, Parapat, Solo (Mojosongo), Jakarta, and Medan Industrial Park KIM use this system as well. In Medan an Upflow Anaerobic Sludge Blanket (UASB) Reactor is followed by a large lagoon with aeration in the first part. The second part of the lagoon is not aerated and serves as a facultative pond.

Activated Sludge Process

The activated sludge process is a technique to enrich the amount of bacteria in the basins by recycling them from the final clarifier to the basin. This technology needs quite some energy for aeration of the aeration tank and for the pump to recycle the sludge. The operation is much more intensive than for aerated ponds or aeration ponds. The sludge in the basin and the return sludge have to be carefully controlled. Therefore quite some monitoring and knowledge of the staff is mandatory.

This is not always the case in the plants visited. There is no monitoring in the plant of Tangerang and the knowledge is also insufficient to run such a plant. In Balikpapan PDAM has taken over the plant just some months before the visit and the staff conducts no monitoring and has also insufficient knowledge. However, both plants are well designed and should be able to achieve good organic load reduction. In the industrial treatment plant of Bandung a modified activated sludge process is used as well with a flocculation pre-treatment. Nonetheless, the treatment process is not well controlled.

Rotating Biological Contactor (RBC)

The RBC is a process which holds the bacteria in the basin to achieve better organic load reduction per volume basin. The RBC is equipped with a rotating material, which has a large surface to provide the bacteria with the possibility to grow on it. The material rotates to ensure that the bacteria on the material are provided with oxygen as long as they are out of the water. If submersed the bacteria come in contact with the wastewater and take out the organic load.

Only the plant in Banjarmasin is using the RBC. The plant was in good condition and bacteria growth could be observed on the surface of the material. The RBC does not need much operation and maintenance compared to the activated sludge process. The energy usage is probably also lower than for activated sludge process.
The RBC is also sometimes used in hotels and malls for decentralized treatment systems.

Performance of Plants
Thresholds for treatments plants are defined by central government with BOD 100mg/l, SS 100 mg/l and Oil & Grease 10mg/l and pH between 6 and 9. Usually, most important are BOD and SS. COD also gives a good indication about organic concentration (as BOD), but is easier to measure. In Indonesia BOD measurements yield often to doubtful results, because the method has many possibilities for errors. SS provides a good indication about the settling capacity of the last settler. Oil & grease is not often measured. PH is usually in the range required, because aerobic processes work in that range.

Table performance of treatment plants

Operator	Treatment System	COD Reduction	BOD in mg/l	BOD out mg/l	BOD Reduction	SS out mg/l
PDAM Bandung	An-aerobe, facultative, maturation ponds	53 %	151	63	57 %	-
PDAM Banjarmasin	Rotating Biological contactor (RBC)	66 %	38	4	89 %	48
PDAM Balikpapan	Activated Sludge	-	-	-	-	-
PDAM Cirebon Kesenden	Facultative, maturation ponds	14 %	42	28	33 %	39
PDAM Cirebon Ade Irma	Facultative, maturation ponds	57 %	22	18	18 %	50
PDAM Cirebon Per. Utara	Facultative, maturation ponds	48 %	80	24	70 %	85
PDAM Cirebon Per. Selatan	Facultative, maturation ponds	51 %	42	32	60 %	94
PD PAL Jakarta *	Aerated lagoon	45%	106	53	45 %	211
PDAM Medan	UASB, aerated lagoon, facultative pond	40 %	175	80	54 %	88
PDAM Parapat	Aerated lagoon, maturation	83 %	200	30	85 %	19
PDAM Solo	Aerated lagoon, maturation		385			
Dinas Tangerang	1. Activated sludge, 2. aerated lagoon, 3. facultative ponds	-	-	-	-	
Dinas Yogyakarta	Aerated lagoon	89 %	162	19	88 %	32

*Mean of two ponds

All data in the table has to be interpreted with the doubt of validated analytical results. BOD analysis is often conducted with large errors.

Good results are achieved in the aerated lagoons of Yogyakarta and Parapat. The plant in Yogyakarta has its own lab and is regularly monitoring the inlet and outlet. The data from Parapat are subject to some doubt because monitoring is not often carried out. But from the visual appearance the plant also made a good impression, but was quite under-loaded.
The RBC of Banjarmasin also seems to achieve very good results. It is also still under-loaded.

Not such good results have been achieved in the plants of Cirebon, Medan, Jakarta and Bandung. Although the BOD reduction is about 50%, the plants are often still under-loaded. Especially the UASB in Medan does not show good performance.

For Tangerang and Balikpapan no data was available. Both are activated sludge processes and from the design they should achieve sufficient results with good O&M.

The plant Semanggi in Solo is not mentioned in the table, because the design and operation seems to be not appropriate to achieve any significant organic load removal.

In some installations preventive maintenance of the plant is carried out regularly (e.g. Banjarmasin). But often maintenance is reduced to breakdown or repair maintenance (e.g. Cirebon). Maintenance seems to be the main saving target in case of budget problems.

For easy maintenance spare parts of equipment used should be easily available in Indonesia. This should be considered in the design and bit documents.

Monitoring and Laboratory
Some plants like Yogyakarta and Jakarta have their own laboratory, some plants like Bandung use the lab of the water unit, and some plants do not have a lab or equipment at all (e.g. Tangerang).

For regular monitoring like for the activated sludge process it is recommended to have an own lab. Otherwise the results are reported too late and the costs are also high. Installations with a lower frequency of analysis do not need to have an own lab but must have sufficient funds to outsource the analysis. For plants connected to PDAM with existing water laboratory it is recommended to use that lab. This will increase the capacity used of the lab and therefore reduce the fixed cost. On the other hand to install an own lab does not need only funds but skilled staff which is not easy to get and to train in Indonesia.

2.4.2. WASTEWATER COLLECTION SYSTEM

The sewer covers only a small part of each city. The wastewater flows with gravity. It is raised at some pump stations to a higher level from where it flows again by gravity. In some cities open channels are used to transport Waste Water to the Waste Water treatment Plant (like Bandung); during the dry season farmers sometimes use this waste water to directly irrigate their lands.

Sewer systems used are sometimes still from the Dutch period like in Bandung, Yogyakarta, Surakarta and Cirebon, but have been extended in later projects.

The customers are connected to the sewer through inspection chambers; one to three customers connect to one chamber. The main problem is the regular cleaning of the sewer

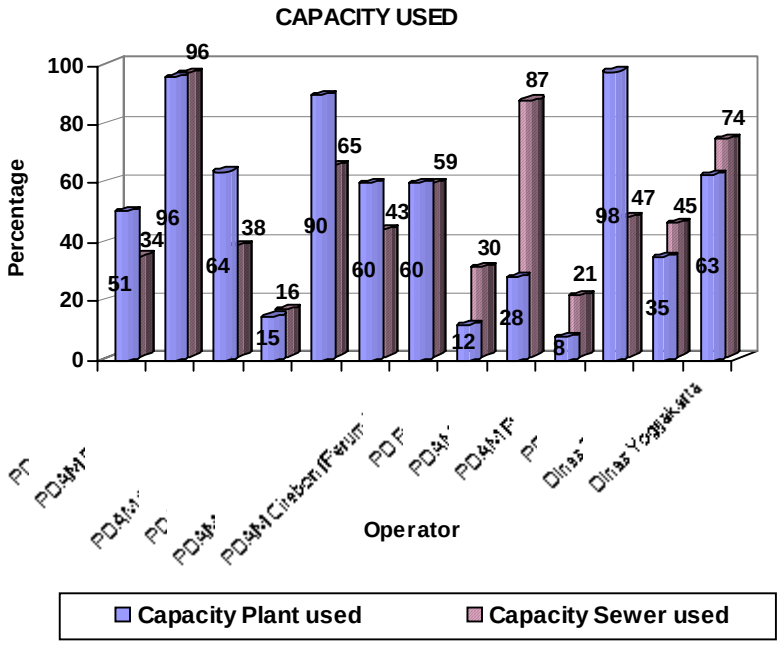
to avoid blocking. In Tangerang, for instance, no periodic cleaning is conducted. Only in case of serious blocks the sewer is cleaned, sometimes renting equipment from PD PAL Jakarta. In some cities (Yogyakarta, Cirebon, Bandung, Surakarta) the sewer is flushed by using river water. Because the river water rinses continuously through the sewer the wastewater is diluted and the hydraulic load of the plant increases. Due to low maintenance customer complaints are regular and as result some Waste Water operators, like Dinas Tangerang therefore do not invoice their service. Interestingly, in 2003 Dinas Yogyakarta increased the number of personnel for sewer maintenance form 13 to 29 and could directly measure a reduction of breakdown maintenance by 50%.

Some installations do not have adequate equipment to conduct easy cleaning of the pipes, and some have no warehouse for repair material. Thus, in case of repair the material has to be bought first, leading to delays in the repair.

In case of budget problems the installations often reduce operation and maintenance costs for sewer cleaning as they do with plant maintenance.

2.4.3. CAPACITIES UTILIZED

An overview over the capacity of plant and sewer used gives the following table.



Operator	Capacity Plant used	Capacity Sewer used
PDAM Bandung	51	34
PDAM Banjarmasin	96	96
PDAM Balikpapan	64	38
PDAM Cirebon Kesenden	15	16
PDAM Cirebon Ade Irma	90	65
PDAM Cirebon Per. Utara	60	43
PDAM Cirebon Per. Selatan	60	59
PD PAL Jakarta	12	30
PDAM Medan	28	87
PDAM Parapat	8	21
PDAM Solo	98	47
Dinas Tangerang	35	45
Dinas Yogyakarta	63	74

It is remarkable that in almost no case 100% capacity is used. The consequence of so much idle capacity is that the fixed costs are much higher (see below). In cases where the capacity of the sewer or the plant is around 90% the capacity of the correlated plant or sewer is much lower, yielding also to idle capacity. In general, the capacities of plant and sewer are seldom the same.

3. RECOMMENDED ACTIVITIES OF ESP/ ISSDP

3.1. INSTITUTIONAL ISSUES

I-1: National Workshop
Workshop on national level with Directors of interested operators about findings, best practices and possible activities. Important discussion topics are: Tariff models, possibility to charge all PDAM customers, collection of tariff, cooperation with Departments of Environment, Public works, customers. Use of campaigns, lobbying with mayor and DPRD.

Wastewater association FORKALIM (Forum Komunikasi Air Limbah) could be considered as facilitator.

I-2: Long term activities in Municipal
Facilitation of cooperation between operator and stakeholders like mayor, customers, Departments of Environment, Public works, and NGOs (see also management issues 5.2). Exchange of information of project results with regard to billing, local laws, lobbying of Mayor and DPRD. Facilitation in regards to bill collection system in Balikpapan, Yogyakarta, Cirebon. Models could be: collection with clean water bill, combine with other bills like solid waste, billing in advance for a year with discount.
Facilitation in regard to tariff between operator, mayor and DPRD in following towns: Balikpapan, Yogyakarta, Solo, Tangerang, Cirebon. This should include awareness raising programs for mayor and DPRD.

3.2. MANAGEMENT ISSUES

M-1: Quality Management in WWTP
Classroom training on quality management system for operators.
Implementation of quality management in terms of SOPs, measurements, recording, evaluation, corrective action, and preventive action should be part of operational control.

M-2: Marketing Strategies
Develop marketing, PR, lobbying strategies to get more customers connected. Models should consider the law KepMen 112/2003, implementation of PERDAs (Peraturan Daerah), pressure by LH (Lingkungan Hidup), cooperation of operator with institution responsible for IMB - Ijin Mendirikan Bangunan (building permit), real estates, high rise buildings, malls, hospitals, food industry, other industry with biodegradable waste, hotels. Output should be input to lobbying activity in 5.1, I-2.

3.3. FINANCIAL ISSUES

F-1: Accounting
Training on the accounting system and practice is highly recommended for the accounting division to be able to produce accurate accounting records and complete financial statement (Balance Sheet, Income Statement and Cash Flow) for the wastewater entity. The accounting division staff should have good understanding in the wastewater management characteristics, the financial performance indicators/ratios, analyzing the results and finding the solution.

F-2: Planning and Budgeting
The financial and accounting division should be able to prepare not only yearly forecasts but also a longer financial projection (mid or long-term). This will cover the calculation of the tariff, required tariff increases throughout the projection period in the anticipation of increase in costs or prices and any required investment to ensure good service to public.

The division should develop tariff strategies that accommodate different types of customers based on the analysis of cost for wastewater operation.

Having capability to prepare financial projection and analyze the result of the projection will help in identifying the possible financing sources to finance an investment program to be implemented in certain time frames.

Develop tariff strategy for industry and commercial organizations mentioned in KepMen LH 112/2003. This tariff should consider the costs of treatment plant operation for O&M with and without investment and should also consider the cost of treatment for industry if they treat wastewater with their own plant.

3.4. TECHNICAL ISSUES / OPERATIONAL CONTROL

T-1 Basics of wastewater treatment
Basic knowledge of technologies for treatment: sedimentation (sand, sludge), grit removal, pre-sedimentation, screening, biological processes, anaerobic process, aerobic process, bacteria grow, bacteria types, final sedimentation, parameters to be observed.

T-2 Control of wastewater treatment plant
Grit chamber, screening, an-aerobic ponds, aeration tanks, facultative ponds, facultative ponds, maturation ponds, activated sludge, RBC. Control parameters: process and product parameters. Corrective action.

T-3 Analysis, Lab Management
Support in regard to laboratory analysis and management in Balikpapan, Bandung and Yogyakarta (and in Cirebon if budget is provided by PDAM Cirebon). It should be considered to contact FORKAMI if they are able and willing to certify wastewater labs.

T-4 Maintenance WWTP
Preventive maintenance, maintenance plan, maintenance of building, engines, mechanical items. Repair maintenance, maintenance management.

T-5 Operation & Maintenance Sewer
Preventive maintenance, maintenance plan, maintenance of pipes, engines, mechanical items. Repair maintenance, maintenance management.

3.5. TRAINING IMPLEMENTATION

The training could be planned as a sequence: Classroom Training, Training on the Job, and Implementation.

Training could start with the technical parts to ensure sufficient service to the customers. *Technical training should only be conducted if the operator fully supports the implementation from the management side and is providing sufficient O&M budget for the implementation.* Best preconditions regarding this issue are in Bandung, Banjarmasin, Balikpapan, Yogyakarta and probably Surakarta.

Technical training should be combined with quality management training about process identification, SOPs, procedures, work instructions, measurements, recording, corrective action, and preventive action.

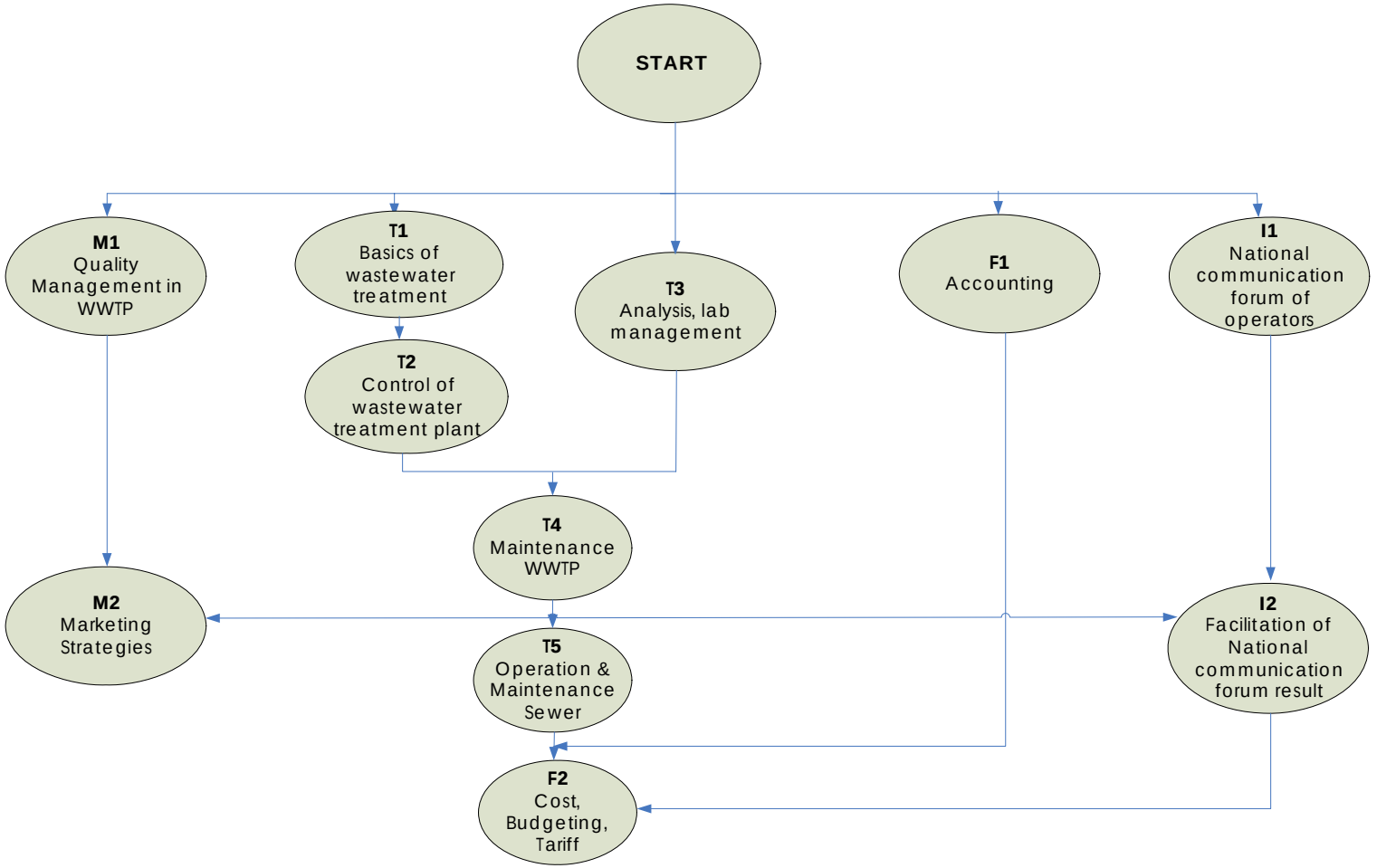
Tangerang is in need of training for the operational control of activated sludge process. Condition should be a guarantee from the side of DINAS for minimum operational budget and minimal (lab) equipment for parameters like SV, MLSS, BOD, COD, pH, flow or budget for external analysis.

Three Step Implementation of Training
1. Classroom Training
At each location a training provider could carry out theoretical classroom training to convey the basics on each subject.

2. Training on the Job
An experienced consultant will determine for each subject the O&M necessary activities (operational activities, control parameters, maintenance activities and maintenance plans) of the operator including budget and workforce estimation. Indah Water could probably contribute to this.

3. Support of the operator during implementation
Support of operator with consultancy during implementation using STTA over a mid term period. All O&M activities should be implemented in a sustainable way using basic quality management system including SOPs, monitoring, evaluation, records, corrective action and preventive action.

TRAINING FLOW DIAGRAM



cey /Training Flow Diagram /020206

Table of Training and recommended Operator

Training / Facilitation	Operator
I-1 National communication forum of operators to discuss tariff, collection, new customers strategies, stakeholder	All
I-2 Facilitation of tariff issues, collection of fee, cooperation with stakeholders, lobbying with mayor and DPRD in regions	Balikpapan, Yogyakarta, Bandung, Surakarta
M-1 Quality Management in WWTP	Balikpapan, Yogyakarta, Bandung, Surakarta, Banjarmasin
M-2 Marketing Strategies	Balikpapan, Yogyakarta, Bandung, Surakarta
T-1 Basics of wastewater treatment	Balikpapan, Yogyakarta, Bandung, Surakarta, Banjarmasin
T-2 Control of wastewater treatment plant	Balikpapan, Yogyakarta, Bandung, Surakarta, Banjarmasin
T-3 Analysis, lab management	Balikpapan, Bandung, Yogyakarta, (Cirebon if operational budget available)
T-4 Maintenance WWTP	Balikpapan, Yogyakarta, Bandung, Surakarta, Banjarmasin
T-5 Operation & Maintenance Sewer	Balikpapan, Yogyakarta, Bandung, Surakarta, Banjarmasin
F-1 Accounting	Bandung, Balikpapan, Cirebon, Tangerang
F-2 Cost, Budgeting, Tariff	Bandung, Balikpapan, Cirebon, Tangerang

4. CONTACT LIST

No.	Contact Person	Organization	Position	Phone	e-mail
1	Ir. E. Yudi Indardo, MPPM	**PD. PAL JAYA** Jl. Sultan Agung No.1 - Setiabudi-Jakarta Selatan (12980)	Head of Program Planning	(021)-8354252 / 8354253 / 8354255 Fax: (021)-8301470 hp: 0816.1102.772	e_yudi@paljaya.com / www.paljaya.com / paljaya@paljaya.com
2	Ir. Urip Adrijatno, MM	**PDAM Kota Cirebon** Jl.Tuparev No.25 - Cirebon	Head of Unit Wastewater	(0231)-204800 / 202594 / 203031 Fax: (0231)-207508 hp: 0816.642.861	-
3	Betty Wediawati	**PDAM Kota Bandung** Jl.Badaksinga No.10, Bandung 40132	Head of WWTP Bojongsoang	(022)-2509030 / 2506584 Fax: (022)-2508063 hp: 0811.248.062	pdam@bdg.centrin.net.id
4	Ir. H. Ibrahim Suriamihardja	**PT DAMBA INTRA** IPAL Terpadu Cisirung, Jl. Cisirung - Palasari - Bandung 40256	Director	(022)-5226778 / 5204873 Fax: (022)-5226780	-
5	Ayi Sukandi	**Dinas Perumahan & Permukiman – Kota Tangerang**	Head of Sub Dinas Pengelolaan Perumahan & Permukiman	(021)-55764955, ext 503 Fax: (021)-55768688 hp: 0812.932.6562	-
6	Indra Sutapa	**Dinas Kebersihan Keindahan & Pemakaman (DKKP)** Jl. Bima Sakti No.1 - Yogyakarta	Head of Section Wastewater	(0274)-515876 Fax: (0274)-515876 hp: 0274-7439377	dkkp@jogja.go.id / dkkp@intra.jogja.go.id

No.	Contact Person	Organization	Position	Phone	e-mail
7	Agus Saryono, SE	**PDAM Surakarta** Jl. LU Adi Sucipto No. 143, Solo - Surakarta	Head of Wastewater Division	(0271)-723093 Fax: (0271)-723093 hp: 081.2261.6385	-
8	Firmansyah	**PDAM Kota Balikpapan** Jl. Pandan Arum No.1, Kelurahan Margasari, Kec. Balikpapan Barat, Kota Balikpapan	Head of Unit IPAL	(0542)-424068 / 732159 Fax: (0542)-731215 hp: 0815.200.1589	-
9	Muh. Muhidin, ST	**PDAM Bandarmasih** Jl. Pramuka, Kompleks PDAM No. 5, Banjarmasin	Head of UPT-PAL (Unit Pelaksana Teknis Pengelolaan Air Limbah)	(0511)-270210 / 361206 Fax: (0511)-270210 hp: 0811.512.674	-
10	Zulkarnaen	**PDAM Tirta Nadi** Jl. Sisimangaraja No.1 - Medan 20212	Head of Section Wastewater	(061)-4571666 / 6638349 Fax: (061)-4572771 hp: 0812.605.3245	-
11	David Manurung	**PT. Kawasan Industri Medan (Limited Corporation)** Jl. Pulau Batam No.1, Kompleks KIM Tahap II, Medan - Sumatera Utara	Head of Section Wastewater	(061)-6850222 / 6871177 Fax: (061)-6871088	Kim@idola.net.id / http:www.kim-cyber.go.id
12	Cornelia Retno S	**Lippo Karawaci** 2121 Bulevard Gajah Mada #0101, Lippo Karawaci Utara, Tangerang 15811 – Banten	Deputy Head of Water & Sanitation Department	(021)-55790190 / 55790191 ext: 422	retno@lippokarawaci.co.id

APPENDICES

APPENDIX 1: SUMMARY OF WASTEWATER SYSTEM PDAM BALIKPAPAN

SUMMARY OF WASTEWATER SYSTEM PDAM BALIKPAPAN

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Strength

- Committed employees in wastewater department
- Installation technically appropriate and sufficient for operation
- Sufficient subsidy from local government for operation and maintenance
- Existing lab with competent personal for monitoring

Weaknesses

- No experiences because installation just taken over from Dinas Kebersiha, resulting in very inefficient operation
- No income through direct billing, so completely depending on subsidies
- Almost no data available of monitoring
- No data about cost available
- Sludge disposed in river rather then treated in IPLT

Opportunities

- Customer living at the seasite where the lack of wastewater treatment facilites results in pollution of the sea and shore.

Threats

- Currently no direct revenue from customers, because a surcharge applied to PDAM customers goes direct to Perda. This will yield to financial problems when subsidies are not provided anymore.

Recommendations

Short term:

With the convincing commitment of the staff in the wastewater department and good facilities in the plant (activated sludge) and lab, the wastewater department of PDAM Balikpapan could be the target for the first training. All modules could be developed and implemented on the job in this organization. The activated sludge process they have is the most complex process and the modules can then be transferred in reduced form to other treatment plants.

The amount of 300 mill Rupiah for O&M as subsidy seems to be sufficient to carry out operation and maintenance. This is very important in case Balikpapan will be pilot project area.

Long term:

Balikpapan could also be the pilot project area for the development of modules in regard to socialization of tariffs, public campaign and budget calculations.

2. GENERAL DATA

Province
Kalimantan Timur

Kabupaten
Municipal Balikpapan

Topography
Hilly, but in the sewer area flat

Area
50,331 Ha

Population (2005)
500 000

Water supply situation
PDAM supplies about 61 000 customers with clean water (about 60% of population). The raw water situation is not sufficient and especially in the dry season water shortages are observed.

3. INSTITUTIONAL ASPECTS

Ownership and Institutional Set-up
Owner of the installation is the local Government of Balikpapan. The operation is conducted by PDAM Balikpapan, which took over responsibility just 3 month before the visit (mid of 2005). PDAM Balikpapan has established a separate department for wastewater treatment.

History
The plant was built in 2001 and became operational in 2002 under provincial government. It was financed with a WB loan and was given to the provincial government as a grant. In 2004 PU TK I transferred the installation to DKPP (Dinas Kebersihan) of City Balikpapan. In 04/2005 the installation was transferred further to PDAM and became operational under PDAM in 8/2005 (SK Walikota 188,45-49/2005).

Coverage & Connections
WW had 771 customers (less than 1 % of the town). But in September 2005 some houses which are served by WW were destroyed by a fire. Currently only 458 customer remain. In the area (24 Ha) about half the population is served by the sewerage. About 85 % of the wastewater customers are also PDAM customer. The other 15 % get probably the water from their neighbors and therefore also from PDAM. People are interested to become connected to the sewer because in that area no other sanitation is possible due to the location near the sea and insufficient space for septic tanks. Interest of low and high income customers in connections are the same. The installation is only a pilot project and should be extended later in larger scale.

Collection system
There is no tariff collection until now. It is planned to bill through PDAM water invoice, because 85% of the connections are also receiving water from PDAM.

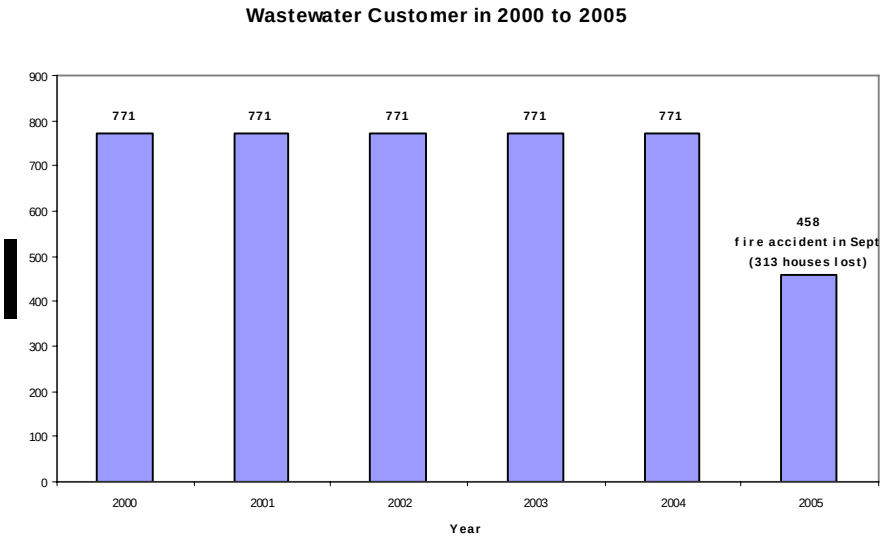
4. MANAGEMENT ASPECTS

Strategic management / Business plan
Due to the short time PDAM is responsible for the wastewater treatment no business plan or general strategy exists. Nevertheless it is planned to extend the existing connections with additional 200 connections in a government housing area (low income people, house type 21 and 36 m^2).

Quality management system
There is no quality management system in place. But PDAM is interested to implement one to control the processes.

HRD / Employees
6 employees work for the treatment plant (3 PDAM and 3 honorary employees) and 6 employees (subcontract) work for the sewer, in total 12 employees. (PDAM has totally 280 employees). The staff is without much experience and has only limited knowledge in regard to technical and tariff/collection issues. PDAM is interested in training for their staff.

Customer Relation & Marketing
PDAM has a complete database of their customers. The number of customer is stable (see graphic below), with the exception of a fire in 2005 which destroyed the houses of 313 houses.



Grafik Customer – PDAM Balikpapan

Reportedly PDAM will focus on awareness and change of attitude of the people to implement the tariff system and to collect fees for the wastewater treatment. PDAM is interested in awareness training and consultancy for this activity.

5. FINANCIAL ASPECT OF WW DIVISION

Investment and Source of Funds
PDAM Kota Balikpapan has just received the transfer of the wastewater management from the Municipal Government in April 2005. The total number of connection written in the Letter of Transfer is 778 units, however only 771 were identified before the fire. 85% of the customers are connected to water supply system..

Investment Plan
PDAM has not prepared any investment plans. PDAM staffs are not yet ready to implement the operation of the wastewater system. There were 3 PDAM personnel participating in the training program at the beginning of the project but none is involved in the operation now.

Outstanding Loans and Debt Service Coverage
PDAM has no outstanding loan. The investment was financed through a grant from Central Government to the Local Government.

Tariff, Revenue and Subsidy
Since the operation of the wastewater system started there has never been any tariff execution by the operating institution under the local government. Tariff for wastewater has actually been set at Rp 2,500/month in the Perda. PDAM plans to implement the tariff in 2006. However, this plan will not be easy to be implemented with resistance expected from the customers since a levy of 5% for wastewater has already been added to the water bill of all connected PDAM customers.

Cost Recovery
In consequence of the absence of real tariff application which can be hold by PDAM, the wastewater management has not generated any income.

Operation and Maintenance Expenditures
The expenditures so far are only for personnel in the plant (6 persons with around Rp7.5 billion/month), electricity at Rp33,950,230 per year and maintenance (flushing) of Rp33,864,000. The maintenance is done by contracting a third party. PDAM has not allocated any fund for maintenance of pumps/installation nor buildings.

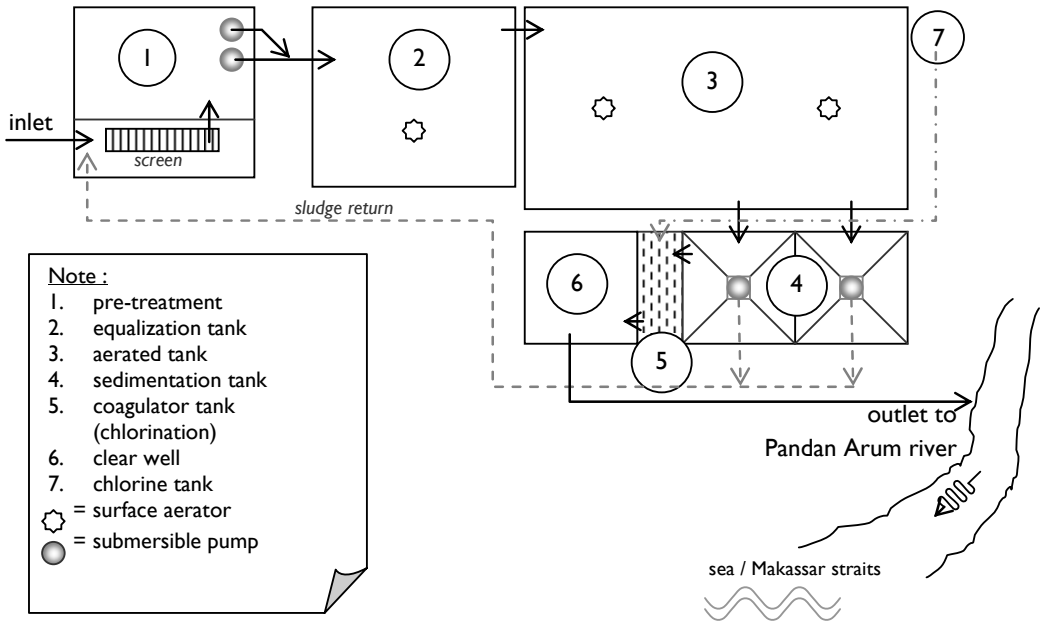
Accounting System
PDAM has not established an accounting system for waste water division. Transactions are recorded in daily cash book. The head of the accounting division is expecting to get training on that subject.

6. TECHNICAL ASPECTS

Treatment system used
The treatment is based on an activated sludge process. Before the wastewater enters the aeration tank a screen removes solid waste from the wastewater. The wastewater is pumped into an equalization tank which serves probably as well as sand trap. The bacteria mass is separated in a clarifier and recycled back to the aeration tank. The treated water flows into a control tank. A chlorination installation is not used. The sludge is pumped to a sludge tank. Up to now the sludge is then pumped direct into the river . By discharging the sludge to the river the whole treatment process becomes obsolete and the river is almost as polluted as without treatment.

No drying bed is available. An alternative solution could be to discharge the sludge to a sludge treatment plant (IPLT).

The layout of WWTP is as follows:



Performance of treatment
Almost no data are available. Some measurements have been conducted but the results are doubtful (see table attached). Therefore no exact assessment can be made. From the dark brown sludge color it can be deduced that the sludge is too old, probably due to the low load after wastewater of almost 300 customers is not treated anymore and/or not enough sludge is discharged. Reportedly the wastewater is contaminated with sea water because of sea water use by customers.

Capacity used
Currently (after the fire) only about 38% of the maximum of 1200 houses are served (before 65%). About 305 m^3 wastewater is treated per day while the plant and the sewer are designed for 800 m^3 (38%).

Quality Management system
No SOPs and no operation manual are in place. Records are available only on pump times and some other operation parameters.

Monitoring
No process parameters like MLSS, SV, SVI, DO Q_r and no water parameters are measured for control purposes. SV was measured on the spot by the consultants and the value was very low with 30ml/l, probably due to the low organic load of the wastewater.

Laboratory
A lab is available in PDAM. The lab gave a good impression, especially the knowledge of the analysts. Nevertheless the results of BOD and COD are doubtful, because PDAM is not using the standard methods. Some SOPs are available but no comprehensive management system. Original data are kept. The lab staff is very interested in training about measurements like BOD, DO, COD, etc.

Maintenance
Currently a lot of repair maintenance and restoration is conducted to bring the plant back to the original status. The plant is suffering from corrosion being located close to the sea.

Sewerage system
The wastewater is pumped by 7 pump stations, each equipped with 2 pumps.
Pumps are operated manually due to much debris in the wastewater destroying the pumps.
PVC pipes between 10 and 25 cm are used.

Capacity Sewerage system
Reportedly the capacity of the sewer system is with 1200 HC in accordance to the treatment system.

Maintenance
Maintenance of the sewer is conducted with subcontracted people. Sewer is cleaned regularly.

7. PHOTOS


Photo by: Edzard Ruehe
Date: November,13 '05
Location: WWTP Margasari - Balikpapan
Remarks: Left picture: pretreatment (fine screen)
Right picture: equalization tank with surface aerator


Photo by: Oni Hartono
Date: November,13 '05
Location: WWTP Margasari - Balikpapan
Remarks: Left picture: aeration tank with surface aerator
Right picture: sedimentation tank


Photo by: Edzard Ruehe
Date: November,13 '05
Location: WWTP Margasari - Balikpapan
Remarks: Left picture: chlorinator
Right picture: clear well


Photo by: Oni Hartono
Date: November,14 '05
Location: WWTP Margasari - Balikpapan
Remarks: Outlet from WWTP Margasari (with pipe PVC Ø 150mm), water goes to Pandan Arum river.

Photo by: Oni Hartono
Date: November,14 '05
Location: Behind of WWTP Margasari - Balikpapan
Remarks: Situation of Pandan Arum river, lot of sludge and smell.


Photo by: Edzard Ruehe
Date: November,14 '05
Location: WWTP Margasari - Balikpapan
Remarks: Left picture: genset (in WWTP Margasari)
Right picture: truck for maintenance of sewerage pipe (flushing).

8. DATA SHEETS

	Balikpapan (PDAM)		
General			
Population	499,524		
Area (Ha)	50,331		
Houses	99,905		
PDAM Customer	61,323		
Connections (wastewater)	771		
Coverage population (%)	1		
Coverage area (Ha)	24		
Coverage area (%)	0.05		
Coverage PDAM customer (%)	61		
WW customer connected to piped water (%)	90		
Capacity of WWTP (connections)	1,200		
No People per houses (person/houses)	5		
Water consumption (m³/conn./month)	25		
WWTP Capacity used (%) (based on connections)	64		
Technical			
Wastewater System	**IPAL MARGASARI**		
Sewer System			
Length of Sewerage System (km)	17		
- primer Ø 150 - 250 mm, PVC	3		
- sekunder Ø 75 - 100 mm, PVC	13		
Capacity of sewer (installed):			
- m³/day			
- for house connection	1,200		
Capacity of sewer (used):			
- m³/day			
- house connection	458		
Capacity used in %	38		
WWTP			
Q (design) m³/day	800		
Q (production or used) m³/day	305		
Capacity used %	38		
Unit Process	**Equalization**	**Aeration**	**Sedimentation**
COD in (mg/L)	no data		
COD out (mg/L)			117
Removal %			
BOD in (mg/L)	no data		
BOD out (mg/L)			6
Removal %			
SS in (mg/L)	no data		
SS out (mg/L)			74
Coliform in (MPN/100 ml)			
Total Coliform out (MPN/100ml)			
Treatment Systems	**Activated Sludge**		
V tanks (m³)	147	600	113
A tanks (m²)	49	200	25
depth (m)	3	3	5
HRT design (day)	0.2	0.8	0.1
HRT actual (day)	0.5	2.0	0.4
Financial (based on 2004)	no data *		

* = PDAM Balikpapan is not ready with the recording/ accounting systems (transfered of operation under PDAM Balikpapan in April 2005)

APPENDIX 2: SUMMARY OF WASTEWATER SYSTEM PDAM BANDUNG

SUMMARY OF WASTEWATER SYSTEM PDAM BANDUNG

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

PDAM is one of the few operators with sufficient revenue from wastewater billing because the waste water bill is collected together with clean water bill from all water customers.

Strength

- Tariff: All clean water customers have to pay 30% of the water bill
- Billing System: The wastewater bill is combined with the water bill
- The ownership of the wastewater treatment plant is seen as strength
- The plant is well maintained.
- Commitment of top management

Weaknesses

- A strategic disadvantage in this PDAM is that there is no incentive for PDAM to connect new customers. The wastewater fee is included in the water bill and has to be paid by all clean water customers anyway.
- Efficiency is going down, because of lack of funds for O&M
- Substantial investment is necessary to build a WWTP for western area of Bandung
- No billing for customers who do not receive clean water because of lack of database
- No database on existing connections

Opportunities

- For eastern side number of connections can be increased
- Number of hotels in Bandung city-centre would like to connect

Threats

- PDAM is afraid of water supply customer complaints for paying a waste water surcharge, while not received services
- No PERDA exists that makes connection to the sewer compulsory.
- No wastewater treatment for sewerage system of western part of Bandung could yield to protest from environmental agency and people

Recommendations

PDAM Bandung has the commitment of the top management and resources to carry out necessary monitoring, maintenance and operation activities. It is therefore one of the first targets for training activities and consultancy. The only disadvantage is, that the plant operation is not very demanding for the training program because of the pond system.

Short term:

- Establishment of a complete database of all WW customers;
- Development of marketing plan;
- Connect western part to the existing treatment plant or built new treatment. Develop financial plan for that;
- Development of SOPs and records for operation and maintenance. Establishment of maintenance plan for sewer and treatment plant. Increase O&M budget in accordance to need;
- Training for lab staff regarding analysis of parameters like COD, BOD, DO, SS, pH;
- Training for lab staff regarding lab management like monitoring plan, sampling, SOPs, records, interpretation of results, quality control. (PDAM has to provide sufficient funds for regular monitoring).

Long term:

- Development of strategy regarding billing (which should include mayor and DPRD):
  1. develop a fair solution for PDAM customer who pay for WW but do not get service; e.g. free cleaning of septic tanks, PERDA with polluter fee which goes to PDAM for building sewer;
  2. develop appropriate tariff and solution for non-PDAM customer which discharge to sewer;
  3. develop appropriate tariff for business customers;
- Increase cooperation with Dinas Pengawasan Bangunan and Dinas Tata Kota for new house connection and review for implementation in other cities.

2. GENERAL DATA

Province
Java Barat

Kabupaten
Kotamadya Bandung

Topography
Hilly

Area
16,730 Ha

Population
2,340,000

Water supply situation
35% of Bandung population gets clean water from PDAM.

3. INSTITUTIONAL ASPECTS

Owner
Owner of PDAM is the mayor of Bandung; he plays an important role in internal matters of PDAM.

History
The wastewater treatment system is operated by PDAM as BUMD, based on local government regulation Perda 08/1987.

The first part of the wastewater system was already built by the Dutch, including a sewer system and an Imhoff tank. Between 1979 and 1994 the system was extended with a wide sewerage system and a treatment plant in Bojongsoang under the BUDP I and II projects with ADB and Central Government loans.

Beside the sewer system PDAM also cleans septic tanks and treats the sludge in the wastewater treatment plant together with the wastewater. PDAM is also operating 26 communal septic tanks in two public real estates.

Legal Regulations and Enforcement
In Perda no. 3/2005 about Ketertiban, Cleanliness, and Keindahan penalties are established for not having wastewater facilities or septic tanks. But until now it is not compulsory for houses to connect to the sewer.

Relation with Stakeholders
The mayor as the owner of the treatment facilities is reviewing the yearly budget and reportedly influences PDAM in their daily business. The local government gets 55% of the PDAM profit.

LH, the environmental department of the city Bandung, is responsible for external control. Samples are regularly analyzed but the results are not reported to PDAM. It is not clear, which regulation apply for the effluent of the wastewater treatment plant. There is also no pressure from LH in businesses to connect to the sewer.

Overlapping responsibilities exists with Dinas Pengairan in regard to Pronghang, the open sewer channels in the back of private houses. It is not clear which organization has to clean these channels.

PDAM cooperates with Dinas Pengawasan Bangunan and Dinas Tata Kota in a team to make sure that new built houses get connected to the sewer. This seems to be a very good example to get new customers.

Coverage & Connections
The official number of existing connections is about 89,000 or 30% of the population. This number is only an estimation based on connections at the time the sewer was built. Out of them 58,000 are connected to a sewer in West Bandung, but the sewer is not connected to a treatment plant. The other 31,000 houses are connected to the plant in Bojangsoang. 63% of the clean water customers are connected to the sewer. In regard to area also about 30% of Bandung is covered with the sewer.

Tariff and Collection system
Wastewater is charged to all clean water users as a surcharge of 30%. This includes also clean water user who are not connected to the sewer. Houses, that are connected to the sewer but do not get clean water are not billed up to now. According to the government regulation they could be charged Rp 5000 per month. But the billing costs are higher as the revenue generated and billing is not conducted.

4. MANAGEMENT ASPECTS

Strategic management / Business plan
PDAM Bandung has clearly defined mission, vision and policy which include also the issue of domestic wastewater treatment. Aim of the wastewater treatment is to increase people's standard of living by establishing and improving sanitation facilities.

The importance of the wastewater section for PDAM is shown by appointing one director responsible for wastewater only. Currently PDAM is developing the new corporate plan 2006 – 2010. The strategy for the future is to connect more houses and to connect the existing sewer in the western part of the city to the existing or a new waste water treatment plant. Yearly work programs exist which are controlled in three monthly meetings. The corporate plan is broken down to department level. But the awareness of the corporate plan and the department targets is still low within PDAM.

Quality management system
There is no coherent systematic quality management system in place in terms of SOPs, records, monitoring, evaluation, corrective action and preventive action. But some elements are partly carried out like recording.

HRD / Employees
PDAM has currently 916 employees. 123 of them work directly for the wastewater section, 450 work directly for the clean water section, and 343 for both sections. If these 343 are divided in accordance to the number of connections (60% clean water, 40% wastewater), additional 137 persons have to be added to the wastewater section. This results in a total of 260 employees related to the wastewater collection and production.

Job descriptions exist for management positions down to Section Head.

All retired employees will get a pension which is smaller than the one for BUMN but higher than the pension for civil servants.

Recruitment of new personal with high qualification is required. But influences by local government do not always assure that qualified personnel needed can be also selected. 3% of the HRD budget is allocated for training and is seen as not sufficient. Promotion is based on education, experience, position, and skill.

Turn over of personal is quite low. The salary is higher than in BUMN. The employee satisfaction was evaluated in 2005 and no major complaint was recorded.

Incentive system is generally not based on performance. Only water meter readers get incentive based on targets. 10% of the profit is distributed to the employees.

Customer Relation & Marketing
The customer data base covers only about 9000 out of estimated 89,000 customers. This is a very weak point in the management of PDAM.

Strategy of PDAM is to connect new and existing real estates to the sewer. Also local heads of kampungs (kelurahan) are contacted for marketing purposes. Hotels and small businesses are another target.

Low income customers are a target if they have no space to build septic tanks.

No customer surveys are carried out to get information about customer satisfaction.

All customer complaints are recorded. A form sheet exists to record the complaints; but reportedly there are no complaints regarding wastewater.

A strategic disadvantage in this PDAM is that there is no incentive for PDAM to connect new customers. The wastewater fee is included in the water bill and has to be paid by all clean water customers whether they are connected to the sewer or not.

5. FINANCIAL ASPECTS

Investment and Source of Funds
The first investment was to build sewer in 1979 at the amount of Rp21.9 billion, financed by grant from GoI and loan from ADB. Investments followed in 1986 to build the treatment plant and sewerage at the total amount of Rp 60.16 billion, financed by loan either from ADB or GoI, grants from Central and Provincial Government and by PDAM internal cash. Subsequent investments in the last 5 years were mostly in the treatment and sewer pipes ranging between Rp42 to Rp622 million. The investments were mostly financed by PDAM internal cash except for equipment in 2002 (ADB Loan through BUDP II).

Year	Source of fund	Amount	Transfer of Assets
1979			
BUDP I	GOI	6,273,744,763.31	
	ADB Loan 400-INO	15,593,440,218.16	
	Total Investment	21,867,184,981.47	15 January 1990
1986			
BUDP II	ADB Loan 768-INO	39.327.442.514.90	
	PDN (Pinjaman Dalam Negeri)	8,617,423,900.00	
	RDI Loan (Rekening Dana Investasi)	900,000,000.00	
	Central Gov't Grant	10,236,283,095.81	
	Provincial Gov't Grant	869,031,000.00	
	PDAM Kota Bandung	209,142,462.36	
		60,159,322,973.07	
	Others	294,040.92	
		60,159,617,013.99	10 December 1996

Investment Plan

The Corporate Plan of 2006-2010 shows that PDAM plans to invest Rp 113.5 billion in waste water division to improve the coverage, quantity, quality and the treatment capacity. The financing source is expected to come from central and local government, grant or loan from donors.

Issue	Program	Cost Estimates (Rp mio)
Coverage	Survey and preparation of Sewerage System Bank Data	500
	Performance Optimization	750
	New Connections (25,000+53,500 units)	23,550
	New equipment for operation and maintenance	2,500
	Rehabilitation and addition of supporting building	1,500
Quantity	Preparation of program and implementation of private and public participation	250
Quality	Design of Integrated monitoring system and procurement of sludge truck	450
	Rehabilitation and construction of communal septic tank and water quality monitoring system	2,000
	Preparation of DED and supervision of Sewerage Treatment Plant for West Bandung	2,500
	Construction of WWTP West Bandung to be joined with WWTP South Bandung	28,500
WWTP Capacity	Expansion of sewer network area in DTBT (380 km)	50,800
	Public campaign	250
	Total	**113,550**

Source: PDAM Kota Bandung Corplan 2006-2010

Outstanding Loans and Debt Service Coverage

PDAM has outstanding loan approximately Rp 94 billion (including arrears) and has to pay for the debt service around Rp4 billion per year, resulting in a low Debt Service Coverage Ratio, less than 2.5. PDAM fails to pay its debt service at the scheduled amount leaving arrears of Rp51.8billion.

Tariff, Revenue and Subsidy

Tariff is set at 30% of total water bill for all PDAM customers, written in the water bill. The revenue comes from the wastewater retribution and sludge service (rent of sludge truck) and very little from new connection. A fixed amount of Rp5,000 per connection is charged to non-PDAM customers but connected to the sewer system. However, these customers have never been billed. No subsidy for the operation of the system has been received by PDAM.

Cost Recovery

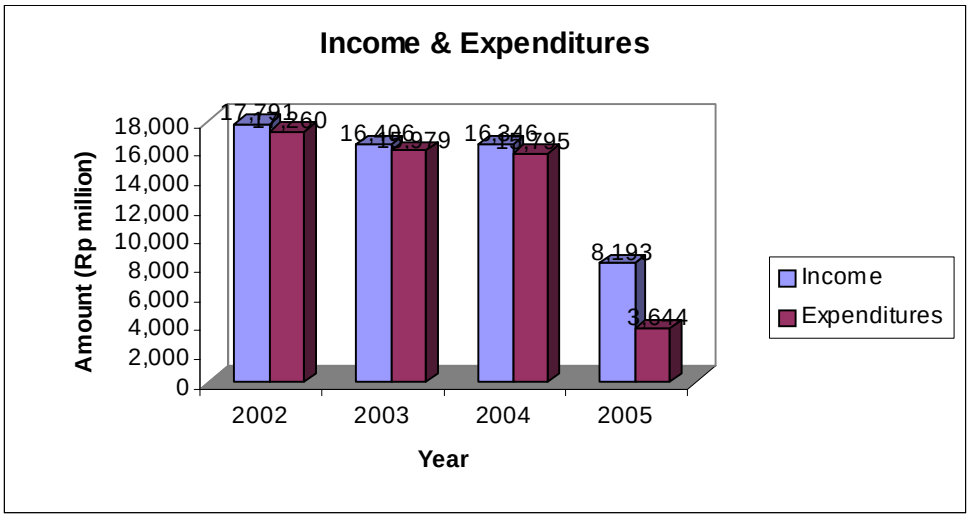
Given that PDAM Kota Bandung applied the 30% tariff to all water customers has allowed the revenue from waste water to cover all costs, as shown below. The waste water management has been able to reach full cost recovery at around 103% every year.

Description	2002	2003	2004	2005 June
Operating Income	**17,791.23**	**16,406.44**	**16,345.77**	**8,193.25**
Operating Expenditures				
Operating Expenses*)	3,907.54	4,190.52	4,549.58	1,691.42
Customer Service	257.54	369.40	306.76	301.13
Financial (incl. interest)	5,411.14	5,367.09	3,881.73	509.28
General & Admin.	1,666.37	1,844.36	2,022.92	-
Bad Debt Write-off	3,122.71	1,713.53	2,667.00	-
Depreciation	2,894.92	2,494.31	2,367.50	1,142.28
Total	**17,260.23**	**15,979.21**	**15,795.49**	**3,644.12**
Allocation of personnel cost in central office	12.72	17.76	20.87	NA
Total Operating Exp.	17,272.94	15,996.97	15,816.36	
Net Operating Income	**518.29**	**409.47**	**529.41**	**4,549.13**
Non-Op. Income (net)	347.41	548.04	187.96	-
Net Income	**865.70**	**957.51**	**717.37**	**4,549.13**
Cost Recovery	**103%**	**103%**	**103%**	**225%**
Operating Ratio	97%	97%	97%	44%
No of connections	89,139	89,179	89,236	89,267
Average tariff/con	16,632	15,331	15,264	15,300
Average cost/con	16,147	14,948	14,770	6,800

Note:

* Breakdown is shown in table of operation and maintenance expenditures (direct cost).
* The average cost/connection up to June 2005 looks low since interest, allowance for bad debt and gen.& adm. Costs have not been calculated.

The financial performance is shown in chart below.



Collection Efficiency

The collection efficiency for waste water bills is 80%, similar to water bills since the bill is combined with water bill.

Operation and Maintenance Expenditures

The division has four (4) cost centres i.e. pumping, treatment, sewer and planning. Sewer is the biggest cost centres. Taking out personnel cost and depreciation, maintenance of the sewer and manholes is the most costly component. For details, see the following table.

OPERATION AND MAINTENANCE EXPENDITURES (Direct Costs)

NO	DESCRIPTION	2002	2003	2004	2005 August
I	**Pumping**				
1	Personnel	218.52	276.01	341.23	250.22
2	Electricity for Pumps	191.84	178.40	162.87	104.90
3	Fuel	9.88	9.99	14.79	9.67
4	Equipment and Maintenance	46.87	106.18	15.34	28.16
5	Manhole	-	-	-	-
6	Miscellaneous	2.51	12.25	31.95	14.65
	Sum	**469.62**	**582.82**	**566.19**	**407.61**
II	**Treatment**				
1	Personnel	555.79	658.91	724.42	537.82
2	Electricity	154.34	157.32	181.76	130.44
3	Fuel	32.49	12.52	1.82	-
4	Chemical	-	49.15	8.81	3.51
5	Laboratory	80.52	9.88	8.62	12.05
6	Equipment and Maintenance	214.17	90.52	320.38	79.45
7	Miscellaneous	190.03	162.73	149.74	116.77
	Sum	**1,227.34**	**1,141.02**	**1,395.54**	**880.04**
III	**Sewer**				
1	Personnel	874.39	1,127.21	1,202.97	888.37
2	Maintenance of Sewer	609.81	521.17	288.66	56.62
3	Maintenance of Manhole	299.36	392.22	524.46	195.59
4	Equipment and Maintenance	20.99	6.06	21.68	9.89
5	Miscellaneous	50.32	24.91	68.32	49.86
	Sum	**1,854.88**	**2,071.56**	**2,106.10**	**1,200.32**
IV	**Planning**				
1	Personnel	337.08	377.02	471.90	376.02
2	Research and Survey	1.00	3.00	4.00	9.71
3	Miscellaneous	17.63	15.10	5.84	12.78
	Sum	**355.71**	**395.12**	**481.74**	**398.50**
	Total	**3,907.54**	**4,190.52**	**4,549.58**	**2,886.48**

Personal Cost
PDAM has currently 916 employees. 450 work exclusively for clean water, and 123 exclusively for wastewater. The rest of the employees can be distributed between clean water and wastewater in accordance to house connections. Clean water provides about 143 000 houses with water, while the wastewater department discharges wastewater from about 90 000 houses. With this 40% of the administrative cost (like personal cost) can be allocated to the wastewater treatment. (see cost recovery table)

Accounting System
PDAM has established a computerized accounting system for waste water that produces income statements. However, balance sheet and cash flow statements are consolidated with water supply.

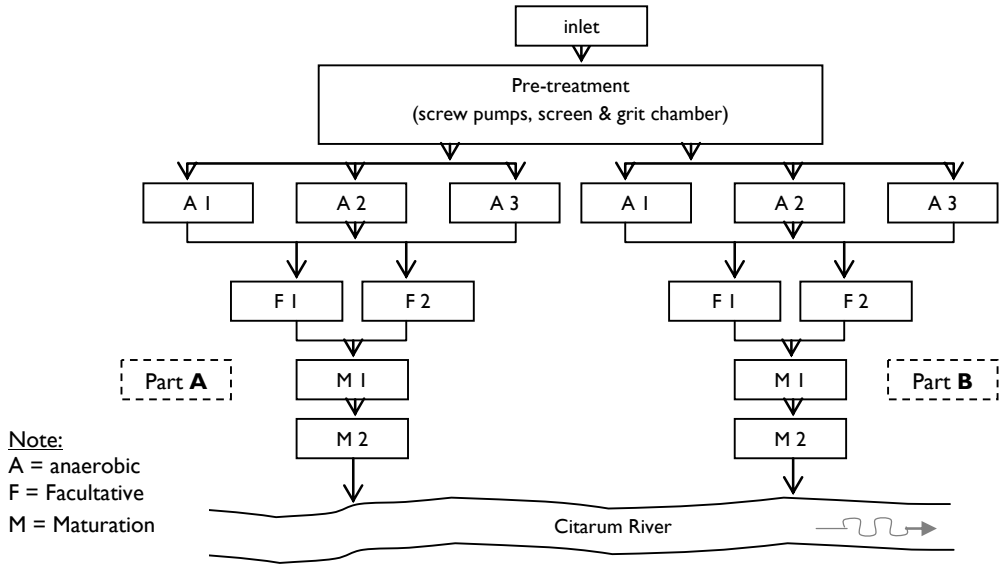
6. TECHNICAL ASPECTS

Treatment system used
In western region no more treatment exists. Previously the wastewater was treated in an Imhoff Tank from the Dutch period. But now this tank cannot be used anymore. Therefore all wastewater from the sewer in the western region is discharged direct to the river.

The wastewater collected in the eastern sewer system flows into the treatment plant Bojongsoang. The plant is designed for 80 000 m3 per day; but currently only about 50 000 m3/day is utilized. Sometimes rainwater is also collected in the sewer system.

In the treatment plant the water is raised by some meters with screw pumps, flowing through screens into grit chambers. The first basins are three parallel anaerobic tanks. The wastewater is split and goes partly into the anaerobic ponds and partly direct into the facultative ponds. After the anaerobic ponds the combined flows go into two parallel facultative ponds and then into serial maturation ponds. There are two identical parallel systems.

The treatment process in WWTP Bojongsoang is as follow:



The debris is cleaned automatically from the screen as is the sand from the grit chamber.

The plant is physically well maintained. The maintenance budget is per year 120 million for the treatment plant, 80 million for M&E (pumps, grit chamber and screen). But the ponds are not regularly cleaned. Therefore too much sludge is in the ponds reducing HRT.

The plant is suffering from people living in the environment of the plant and taking out water direct from the open sewer channel and from ponds of the installation for irrigation. Beside this also industry is discharging their wastewater to the sewer.

A very complete technical description of the system and their problems is given in the report "Technical Assessment on the operation and management of the existing wastewater treatment plant in Bandung, Jakarta and Medan by Indah Water Konsortium (Malaysia) in collaboration with ESP.

Performance of treatment
Incoming COD is about 200mg/l, probably diluted by storm water. In the anaerobic ponds the COD is reduced by 35% to about 130mg/l. The outlet of the facultative pond has still 115mg/l COD, probably because some of the raw wastewater is by-passing the anaerobic ponds. In the maturation ponds the COD is reduced by another 25% to about 85mg/l. Total reduction is about 58%. The BOD reduction is similar, total reduction is also 58% from 151mg/l to 64mg/l. The performance is not very good considering the low capacity utilized and low organic load of the plant (see below).

Much algae growth is observed and the smell is bothering the neighbors.

Capacity used (only Bojongsoang)

Capacity WWTP design used	234,000 m^3/day 32,000 m^3/day	13 %
Capacity Sewer design used	92,000 connections 31,000 connections	34 %

Based on the incoming flow (design and actual) only 13% of the WWTP capacity is used and based on the actual connections only 34% of the sewer is used. These calculations are based on data available at PDAM, which are not very reliable especially in regard to connections. In some months also the incoming flow is quite low because wastewater is taken out of the sewer system by people before WWTP. Farmers are also taking out wastewater from the various ponds of the WWTP. Therefore, in the dry season no outflow is recorded in the plant.

Quality Management system
No management system is developed and in place. Some records are available but no systematic approach in terms of process control is established.

Monitoring
Flow is monitored by measuring working hours of pumps and multiplying them with a factor representing the flow per hour of the pumps. This system has never been calibrated.

Amount of sand yielded in the grit chamber is recorded.

Analytical parameters are monitored every two weeks. More frequent measurements are advisable, probably under consideration of HRT in the basins.

Laboratory

The lab has no management system. Unqualified employees work with the assistance of pupils from SMA in the lab. Results of DO are wrong (see results of DO in the sheets above 10 mg/l, which is impossible). Original data are not recorded; SS is wrong calculated as was demonstrated to consultants during visit. Almost no calibration is carried out. Crosschecks with clean water lab are conducted but no evaluation of the results and no corrective action.

PDAM has additional lab for clean water and cooperates there with LH. PDAM should consider:

1. to select qualified employees for the lab with analytical background and train them adequate and to develop management system in the lab with quality assurance or,
2. to move the analyses to the clean water lab and use it as service lab.

Lab manager and staff are very interested in improving their performance through professional training.

Sewerage system

Two sewer systems exist, one in the west and one in the east. The sewerage system in the west is not connected to any waste water treatment facility (since the old Imhoff broke down), but disposes directly into the Cikapundung river; the sewerage system in the east transports the wastewater to the Bojongsoang treatment plant.

Totally 385 Km are installed, 67 Km in the western part and 318 in the eastern part. The system includes pipes with a diameter of 30 to 150 cm and open channels.

A pump station is in Cijawura with 3 pumps: one works and 2 stand by (the 2 are currently out of order). One problem in the pump station is that since no screens are installed before the pumps, they are easily damaged by debris.

No preventive maintenance (cleaning) has been carried out since 2003.

7. PHOTOS


Photo by: Edzard Ruehe
Date: October,10 '05
Location: WWTP 'Bojongsoang' - Bandung
Remarks:(left) Equalization tank & Pump (screw) building, still working & good conditions.
(right): Garbage machine to clean garbage from screen to container using belt conveyor. Good condition & still working.



Photo by: Edzard Ruehe
Date: October,10 '05
Location: WWTP 'Bojongsoang' - Bandung
Remarks: (left): Pre-sedimentation unit with mechanical scraper, good condition & still working.
(centre & right): Grit chamber unit with mechanical cleaner, good condition & still working.

Photo by: Oni Hartono
Date: October,10 '05
Location: WWTP 'Bojongsoang' - Bandung
Remarks: Maturation Pond (and outlet to Citarum river)

Photo by: Oni Hartono
Date: October,10 '05
Location: WWTP 'Bojongsoang' - Bandung
Remarks: Algae (green color) found in Facultative Pond. Very strong smell.

Photo by: Edzard Ruehe
Date: October,10 '05
Location: Station pump – Cijawura - Bandung
Remarks: (left picture): Pumps unit in Cijawura, pumping wastewater to WWTP Bojongsoang. Pump station still under rehabilitation.
(right picture): Outlet from pumps (see on the right) to WWTP Bojongsoang has a hole (see on the left) by-passing wastewater direct to the river (Cidurian River).

Photo by: Edzard Ruehe
Date: October,10 '05
Location: Antapani office & workshop wastewater division (PDAM) - Bandung
Remarks: (left): Equipment for sewer maintenance.
(right): Equipment for maintenance sewer facility, from top left (rotate clockwise) Blower to bring gas out from sewer, Mobile genset for energy supply, Jetting for cleaning sewer with spray water, Rodding for cleaning sewer. All in good condition and still working.

8. DATASHEETS

	Bandung (PDAM)
General	
Population	2,639,835
Area (Ha)	16,730
Houses	527,967
PDAM Customer	143,250
Connections (wastewater)	89,139
Coverage population (%)	30
Coverage area (Ha)	5,019
Coverage area (%)	30
Coverage PDAM customer (%)	35
WW customer connected to piped water (%)	30
Capacity of WWTP (connections)	176,000
No People per houses (person/houses)	5
Water consumption (m^3/conn./month)	21
WWTP Capacity used (%) (based on connections)	51

Technical															
Wastewater System	**Bdg Tmr - IPAL BOJONGSOANG (KOLAM SET A)**							**Bdg Tmr - IPAL BOJONGSOANG (KOLAM SET B)**							**BANDUNG BARAT (no IPAL)**
Sewer System															
Length of Sewerage System (km)	318														67
- primer (Ø 400 - 1500) mm, beton	51														
- sekunder (Ø 100 - 300) mm, PVC	267														
Capacity of sewer (installed):															
- m³/day															
- for house connection	92,000														84,000
Capacity of sewer (used):															
- m³/day															
- house connection	30,949														58,190
Capacity used in % (based on flow)	34														69
WWTP															**no IPAL, wastewater direct to Citepus River**
Q (design) m³/day	243,000														
Q (production or used) m³/day	31,979														
Plant capacity used (%)	13														
Unit Process	An-aerobik (1)	An-aerobik (2)	An-aerobik (3)	Fakultatif (1)	Fakultatif (2)	Maturasi (1)	Maturasi (2)	An-aerobik (1)	An-aerobik (2)	An-aerobik 3)	Fakultatif (1)	Fakultatif (2)	Maturasi (1)	Maturasi (2)	
COD in (mg/L)	199							209							
COD out (mg/L)	127	122	120	110	114	75	79	138	145	136	113	120	107	94	
Removal %							60							55	
BOD in	151							146							
BOD out	97	100	84	66	77	52	63	105	103	106	89	91	74	65	
Removal %							58							55	
SS in	-							-							
SS out	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Coliform in (MPN/100 ml)	1.1E+09							2.9E+07							
Total Coliform out (MPN/100ml)	1.1E+08	7.5E+06	2.3E+06	3.0E+04	4.0E+04	1.5E+04	2.3E+04	5.3E+06	1.2E+07	2.3E+06	4.3E+05	1.5E+05	2.1E+04	9.0E+03	
		An-aerobik		Fakultatif		Maturasi			An-aerobik		Fakultatif		Maturasi		
V tanks (m³)	28,000	28,000	28,000	148,000	148,000	121,500	121,500	28,000	28,000	28,000	148,000	148,000	121,500	121,500	
A tanks (m²)	7,000	7,000	7,000	74,000	74,000	81,000	81,000	7,000	7,000	7,000	74,000	74,000	81,000	81,000	
depth (m)	4	4	4	2	2	1.5	1.5	4	4	4	2	2	1.5	1.5	
HRT design (day)	2	2	2	7	7	3	3	2	2	2	7	7	3	3	
HRT actual (day)	5.3	5.3	5.3	18.5	18.5	15.2	15.2	5.3	5.3	5.3	18.5	18.5	15.2	15.2	
(based on assumption that parallel flows are equal distributed, no sludge in tanks reducing the real volume, and 100% flow goes into anaerobic treatment)															

Financial (based on 2004)	
Initial Investment	82,026,507,955
Investment Treatment System	NA
Investment Sewerage System	NA
Investment Pumps	NA
Financing Source (APBN/APBD Prov/APBD LG/Donor)	ADB L400-INO
Loan / Grant	Loan
Amount (Rp)	16
Debt service	(Paid off)
Interest/Commitment charge	0
Loan Period (years)	0
Grace Period (years)	0
Subsequent Investment	113,550,000,000
Investment Treatment System	79,300,000,000
Investment Sewerage System	32,500,000,000
Investment Pumps	0
Others	1,750,000,000
Financing Source (APBN/APBD Prov/APBD LG/Donor)	APBN/APBD Provincial/Donor
Loan / Grant	Grant
Debt service	-
Interest	-
Loan Period	-
Grace Period	-
Average Tariff (per conn)	15,265
Connection Fee	0
Tariff Revenue (Rp/year)	16,345,766,714
Total Revenue (Rp/year)	16,345,766,714
O&M Subsidy (Rp/year)	-
Billed (Rp/year)	16,345,766,714
Collected Bills (Rp/year)	13,076,613,371
Collection efficiency (%)	80%
O + M Cost (Rp/year)	13,427,987,284
Personnel	2,740,527,825
Energy	361,242,855
Chemicals	17,430,250
Administration (incl. Deprec. Office)	8,882,410,000
Maintenance	1,170,527,074
Depreciation (Rp/year)	2,367,499,768
Other	255,849,280
Total Cost incl. depr+interest (Rp/year)	15,795,487,052
Cost of New Connection	0
Investment/m3 used	475
Investment/m3 designed	63
Investment/connection used	2,650,405
Investment/connection designed	891,592
Total Cost/m3 used	1,372
Total Cost/conn.	510,377
O + M Cost /m3	1,166
O + M Cost /conn.	433,879
Operating Ratio %	97%
Cost Recovery % (Total)	103%
Mean monthly fee per Connection	0
O&M cost sewer	NA
O&M cost installation	NA
O&M cost sewer/connection	NA
O&M cost sewer/Km	NA
O&M cost installation/connection	NA
O&M cost installation/m^3	NA

APPENDIX 3: SUMMARY OF WASTEWATER SYSTEM BANJARMASIN

SUMMARY OF WASTEWATER SYSTEM BANJARMASIN

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

The committed management and good designed and maintained installation provides the opportunity for expansion and is an example for other operators.

The average monthly tariff is currently Rp 73,000 per connection.

Calculations under the assumption of 100% capacity utilization and full coverage of all investment cost shows that a payment per month of Rp 260,000 per connection or Rp 115,600 per private household is necessary to cover all cost including depreciation cost. This is three times the current tariff.

Strength

- Committed Top Management
- Good strategy to cover area with many commercial customers
- Tariff connected to water tariff which is regularly raised
- Functioning wastewater treatment plant with simple technology
- Back up from PDAM in case subsidies are paid late

Weaknesses

- O&M still paid by subsidies from local government
- No own revenue
- Low salaries of employees

Opportunities

- Committed Mayor supporting regularly with funds
- People accept treatment plant in their neighborhood in the center of the town

Threats

- Prefers to operate separate form PDAM, which will further increase overhead costs

Recommendations

PDAM Banjarmasin can be used as example for good communication and socialization to all stakeholders. Their communication and socialization programs should be further evaluated as input for dissemination to the other institutions with wastewater treatment plants.

PDAM should be supported in receiving funds for further investments.

2. GENERAL DATA

Province
South Kalimantan

Kabupaten
City Banjarmasin

Topography
Flat, swampy area partly below sea level

Area
Banjarmasin has an area of 72 Km^2.

Population (2005)
590 000

Water supply situation
PDAM provides water to 59 % of the population. In the sewerage target area 98% of the customers receive water from PDAM.

3. INSTITUTIONAL ASPECTS

Ownership and Institutional Set-up
Owner of the system is the city of Banjarmasin and PDAM was appointed as operator of the system by the mayor. The wastewater unit is located direct under the managing director. The revenue for the wastewater collected through the water bills goes directly to the local government. On the other hand the local government subsidizes 100% of the O&M cost of the wastewater installation cost. In addition the local government provides funds in cooperation with the central government and outside loans (WB) for investments.

Nevertheless PDAM is planning to develop the wastewater unit into a PD. Main reason is the possibility to apply for grants independently and that grants can go directly to the unit and not through PDAM. This PD can then also utilize the collected tariff directly and can control the O&M budget. It will not depend on the local government budget. This will also reduce the problems with the payments in the first months of each year when the government budget is not approved. Reportedly another advantage of a PD is that they have fully control of their employees. Now qualified people are often moved into other sections of the PDAM.

History
The local government started its activities regarding wastewater treatment in 1995/1996 through the Program Pembangunan Prasarana Kota Terpadu (P3KT) in the framework of the Kalimantan Urban Development Project IBRD No 3854 IND. The first installation (Lambung Mangkurat) and sewer was built as a pilot plant in 1998 – 2000 (200HC, 500m^3/day). The WB financed 77% of the installation by IBRD loan No. 3854 IND (central government 17% and local government 6%).

Sewerage activities in PDAM are based on SK Walikota No 173/1998 (Foundation of unit wastewater treatment) and 174/1998 (organizational structure of the unit) and SK Walikota 151/2000 to manage the wastewater unit under PDAM. In decree Walikota No 144/2001 duty and function of the unit within PDAM had been defined and in Perda 4/2001 has been determined the retribution of the users to the local government through PDAM. The retribution was implemented by Perda 98/2001.

It was found that the households do not use as much water as assumed in the design of the plant and therefore in 2002 the sewer could be extended by 300 connections. In 2004 a new installation has been built to cover the area on the other side of the river Martapura (Pekapuran Raya). The first 36 houses have been connected to this plant in 2005.

Legal Regulations and Enforcement
The plant is built to fulfill the standards for wastewater of the decree of Governor South Kalimantan No. 58 / 1994.

Relation with Stakeholders
PDAM Banjarmasin sees lobbying as very important to conduct their services. PDAM cooperates closely with the mayor, DPRD, LH, Dinas Kesehatan, and the customers. Also regular coordination is carried out with the press and the control body (badan pengawas). As result they get good feedback from their stakeholders, including fully support of the mayor. With regard to the DPRD relations, PDAM is focusing on close coordination with the relevant commission and Panitia Khusus. Meetings with the press are carried out weekly.

In the beginning of each year a workshop is conducted with all stakeholders (about 200 people). In those meetings topics like increase of the tariff are discussed.

Every three month the wastewater unit of PDAM has a meeting with LH and Dinas Kesehatan to discuss issues related to wastewater. The press interested in environmental issues is also always invited. In these meetings socialization to the people is coordinated.

PDAM Bajarmasin is very much focusing on campaigns to inform the people. Every two weeks activities are carried out in the 52 kelurahan to socialize the importance of hygiene and proper wastewater treatment.

If PDAM wants to extend its wastewater collection system, campaigns are carried out with two to five steps. In a first meeting “important institutions” (like lurah and hotels) of the new region are invited to an information meeting. This meeting is followed by a campaign with women in the region (through PKK). To convince the people often meetings are attended by the Pak Camat. Visits of the wastewater treatment plant are also part of the campaign to show openness and to reduce fear about wastewater treatment. The clear effluent of the wastewater treatment plant makes the people much more comfortable, especially if they live close to the plant. People and organizations complaining are often invited to further meetings.

Rewards to hotels and other institutions are given to appreciate their support. Often the press is invited to such events. Usually NGOs are subcontract to conduct campaigns. They also carry out customer surveys once a year. LH monitors the effluent of the WWTP. But LH is also supportive in campaigns to get new WW customers.

PDAM is also cooperating with the city planning institution (tata kota), which is responsible for planning new housing area. This is a possibility to get new houses immediately connected to the sewer. Puskesmas of Cempaka Kecamatan Banjarmsin Tengah is conducting statistics about the development of diseases. A clear trend of reduced infections exists between 2001 and 2004 for skin diseases, diarrhea, and respiratory infections.

Coverage & Connections
The sewerage system covers about 550 customers in an area of 30 Ha. This is about 0.4% of the population, 0.7% of the PDAM customers, and 0.4% of the city area. From the beginning PDAM has been focusing on areas with sufficient commercial customers to make sure that they can and will pay their bills. Also for the next extensions PDAM will cover first areas with commercial customers.

Collection system
The fees are collected through the PDAM billing system.

4. MANAGEMENT ASPECTS

Strategic management / Business plan
PDAM has defined its strategy in the business plan. The mission of the wastewater unit is to treat wastewater in a technical controlled way with consideration of the environment. The unit wants to become an independent institution to strive for service excellence and professional service in the whole area of Banjarmasin and all people.

Regarding wastewater treatment PDAM is planning to build a new system with 4500 m^3/d. An installation for 500 m^3/d is already built, and up to now 36 houses are already connected. PDAM has also divided the city into zones for a long term development of the sewerage system. In 2015 the unit shall cover 70% of the population.

Quality management system
No systematic quality management system could be observed.

HRD / Employees
22 people work direct for the wastewater treatment system. One of them is public servant, 3 PDAM employees and 18 other employees work in the wastewater unit. In addition workers are hired for work in the sewer system.

Employee satisfaction not measured but it is reported that they are not satisfied with the salary.People are leaving for other companies with higher salaries after they received training in PDAM. This gives problems in regards to quality of the staff.

The management tries to include employees in the decision process to keep them motivated. Training of employees is conduced depending on need.

Customer Relation & Marketing
For internal calculations PDAM assumes that 77% of their customers are offices and shops, 3% Hotels, and 20% private houses. The high amount of commercial customers is a strategy of PDAM to get cross-subsidies from commercials customers to private customers.

Graphic Customer

5. FINANCIAL ASPECTS

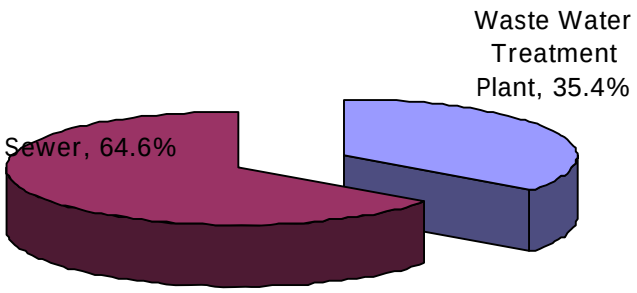
Investment and Source of Funds

At present, Kota Banjarmasin has a wastewater treatment facility in Lambung Mangkurat. This facility was built in year 1998 – 2000 funding by World Bank Loan No. 3854 through Urban Development Project Program (KUDP).
The total project investment was Rp. 8.7 billion. Investment category and the composition of source of fund is described in table below:

Investment and Source of Funds

No.	Category	Local Government	Central Government	World Bank	Total	Composition
1	Waste Water Treatment Plant	-	616,570,763	2,466,283,051	3,082,853,814	35.4%
2	Sewer	503,141,092	885,230,037	4,243,730,257	5,632,101,386	64.6%
	Total	503,141,092	1,501,800,800	6,710,013,308	8,714,955,200	100.0%
	Composition	5.8%	17.2%	77.0%	100.0%	

Investment by category



Based on composition of source of funds the biggest share with 77% is from World Bank and the rest comes from Central and Local Government. Largest part of the investment cost based on category is for sewer.

UPT PAL receives operational cost as contribution from Pemda based on the budget which has been approved in local government budget (APBD). Every year, UPT PAL proposes a budget to Pemda that consists of investment requirement, socialization cost, and support equipment. On the other hand all revenue is transferred to Pemda (see below).

Investment Plan

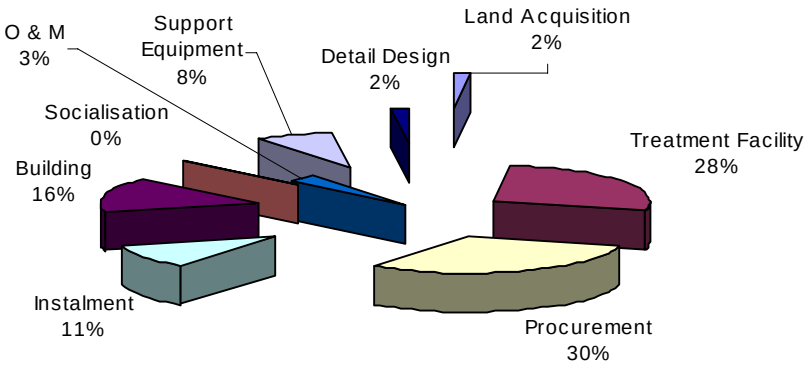
UPT PAL has new investment plan for a new service area – Pekapuran Raya. This facility is planed for 4000 m3/day and 2000 connections. The investment is planned to start in year 2004 until 2009. The figure below shows the detail of source of fund. Local government/Tk II contributes 21%, Province/TK I 5% and central government 47.6%. There is still a lack of funding of 26.4% or Rp21.5 billion. Pemda Kota Banjarmasin is trying to approach the Central Government to cover it or to find other sources/alternative.

Investment Plan

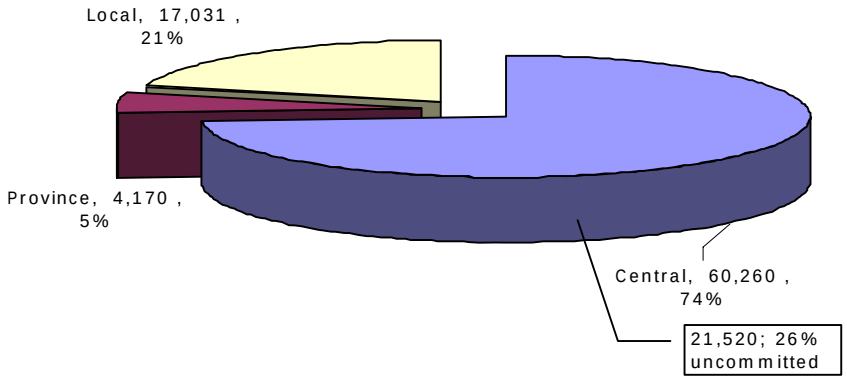
Rp. Millions

Category	Total	Tk II	Tk I	Central
Land Acquisition	1,300	1,300	-	-
Treatment Facility	22,510	1,270	-	21,240
Procurement	25,401	6,051	1,550	17,800
Instalment	8,744	1,504	620	6,620
Building	12,806	3,506	-	9,300
Socialisation	200	200	-	-
O & M	2,400	2,400	-	-
Support Equipment	6,500	-	2,000	4,500
Detail Design	1,600	800	-	800
Total	81,461	17,031	4,170	60,260

Investment Plan by Category



Investment Plan by source of fund



Outstanding Loan and Debt Service Coverage

PDAM Kota Banjarmasin has no debt related to project investment for UPT PAL because all project investment cost was funded by grant.

Tariff, Revenue and Subsidy

UPT PAL gets revenue based on customer payments PDAM Kota Banjarmasin who have registered as customers of UPT PAL. Based on Perda Kota Banjarmasin No. 4 year 2001 "Retribusi Pengolahan Air Limbah" waste water tariff is 25% from the water bill (not including fixed charge). All payment that has been collected by PDAM will be transferred directly to Pemda. There is no cash flow from customers to UPT PAL.

To finance the daily operation, UPT PAL gets cash contribution from Pemda based on their budget which has been approved before. Every 3 months disbursement will be applied (sometimes longer that that). In that case, PDAM Kota Banjarmasin helps them to cover until funds from Pemda are transferred.

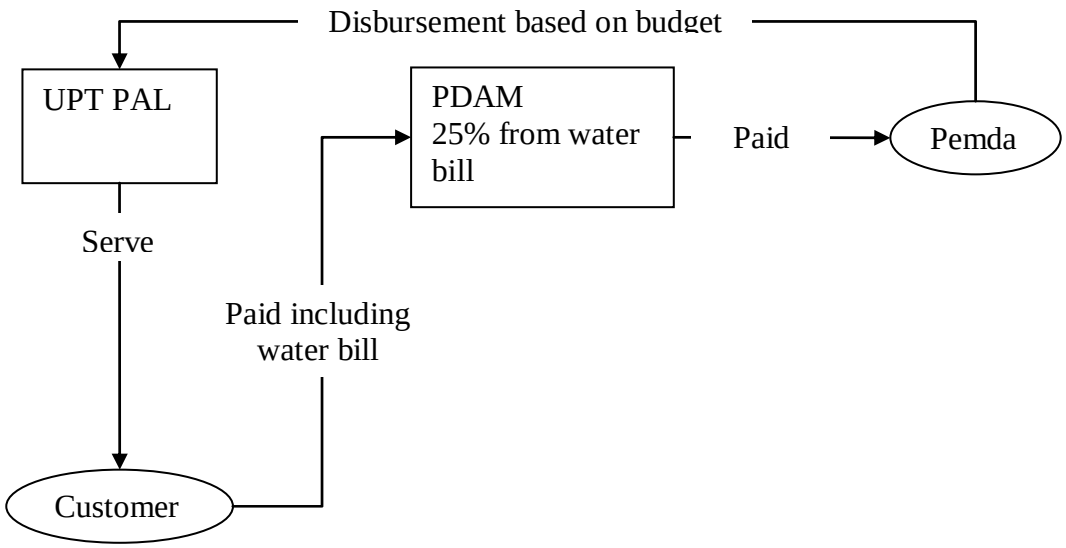
Cost Recovery

The tariff has been able to fully cover the operating cost (116%), but it is still far from covering also the depreciation (only 32%), as shown in the table below. Therefore for the investment projects and other purposes, UPT PAL receives contribution as grant from local government, province and central government.

	2004 (Rp. 000)
Operating Income	435,036
Operating Cost:	
Personnel	114,375
Electricity	120,000
Maintenance	120,000
Administration	20,000
Total	374,375
Depreciation	965,782
No of Connection	496
Average tariff/con	73,091
Average Cost/con (excl. depr)	62,899
Average Cost/con (incl. depr)	225,161
Cost Recovery (excl. depr)	116%
Cost Recovery (incl. depr)	32%

Cash Flow

Figure below shows the cash flow from customers to Pemda and from Pemda to UPT PAL.



Collection Efficiency

The collection efficiency is 85% from the total bill.

Operation and maintenance cost

The costs are not classified into cost centres, but for the whole system, from sewer to the plant.

Cost structure of UPT PAL is:

1. electricity/power
2. labour
3. maintenance
4. administration

The table below shows the operational cost year 2001 – 2004 and budget for year 2005.

Operation and Maintenance Cost

in thousand Rp.

No.	Description	2001	2002	2003	2004	% of Cost 2004	2005*
1	Electricity	60,000	60,000	120,000	120,000	39.79%	120,000
2	Labor	14,220	18,510	34,680	41,610	13.80%	114,375
3	Maintenance	90,000	90,000	120,000	120,000	39.79%	120,000
4	Administration	5,000	5,000	20,000	20,000	6.63%	20,000
	Total	169,220	173,510	294,680	301,610		374,375
	Growth		2.5%	69.8%	2.4%		24.1%

*) Budget

Electricity and maintenance costs have been the major expenditures. In year 2003, there was a big incremental operational cost related to increased number of customers at that time.

Accounting System

UPT PAL has not established a computerized accounting system. Currently, they just record all the operational cost. They can not provide financial report such as balance sheet, income statement, and cash flow.

Tariff Simulation

A tariff simulation has been conducted to calculate a tariff structure under consideration of the investments. The calculations have been done under the condition that the capacity of the plant is 100% utilized. Therefore the tariff is calculated for 700 connections.

Category	Connection	Volume	Water Bill	Bill payment 25%
Social	10	1,559	1,029,600	257,400
House hold - A1	2	38	64,520	16,130
House hold - A2	27	568	1,392,160	348,040
House hold - A3	36	845	2,632,150	658,038
House hold - A4	3	263	1,167,250	291,813
Govern, Army	14	2,602	9,383,640	2,345,910
Small Comm.	95	3,065	12,203,510	3,050,878
Midle Comm.	235	5,070	21,259,640	5,314,910
Large Comm.	69	16,681	87,499,090	21,874,773
Home Industry	2	96	403,640	100,910
Large Industry	3	883	7,976,810	1,994,203
Total	496	31,670	145,012,010	36,253,003

*including debt service

Category	Estimate - Max connection		
	m^3/connection/ month	Connection	Volume/ year
Social	155.9	14	26,191.2
House hold - A1	19.0	3	684.0
House hold - A2	21.0	38	9,592.9
House hold - A3	23.5	51	14,365.0
House hold - A4	87.7	4	4,208.0
Govern, Army	185.9	20	44,605.7
Small Comm.	32.3	134	51,879.2
Midle Comm.	21.6	332	85,952.7
Large Comm.	241.8	97	281,401.2
Home Industry	48.0	3	1,728.0
Large Industry	294.3	4	14,128.0
Total	63.66	700	534,735.9

Category	Tariff Rp/ m^3		
	Water tariff	Wastewater Tariff	Wastewater Tariff
Social	660	165	589
House hold – A1	1,698	424	1,514
House hold – A2	2,451	613	2,186
House hold – A3	3,115	779	2,778
House hold – A4	4,438	1,110	3,958
Govern, Army	3,606	902	3,216
Small Comm.	3,982	995	3,551
Middle Comm.	4,193	1,048	3,739
Large Comm.	5,245	1,311	4,678
Home Industry	4,205	1,051	3,749
Large Industry	9,034	2,258	8,056
Total	4,579	1,145	4,076

*) Tariff existing

Operational Cost/ year	Rp. 468,000,000
Debt Service/ year	Rp. 1,711,641,451
Total Cost/ year	Rp. 2,179,641,451

Cost investment (in million Rp)	8,714.96
Estimate volume (m^3/year)	534,736
Assumption for repayment	
* rate of interest (annually)	18.0 %
* period (year)	15
* repayment (Rp. Million/ year)	1,711.64

Table above shows that if all investment cost is funded by loan (with the assumption term of loan as mentioned above) every year funds of Rp1.7 billion should be allocated for repayment of the loan. So the total cost is Rp2.2 billion (including operational cost) per month. Compared with the existing condition, to achieve cost recovery, the tariff should be in average Rp4,076/m^3. It means that the existing tariff should be increased by around 257%.

Similar calculation under current conditions with 496 connections gives an average water tariff of about 5,560 Rp/m^3. From this calculation can be seen how important 100% utilization of an installation is.

With a mean water volume of 64m^3/month the monthly bill per customer would be Rp 355,000 under current conditions and Rp 260,000 under condition 100% capacity usage. For a normal house connection (Tariff A3 3,853Rp/m^3 with 30m^3/m) the bill would be Rp115,600/month.

5. TECHNICAL FINANCIAL

Treatment system used
The treatment is a Rotating Biological Contactor (RBC), which consists in general of a pre-settling device followed by four chambers with rotors. The rotors have a surface with large surface area to ensure that bacteria can grow on them. The rotors are submersed in the wastewater to about 40%. Through the rotation the bacteria come in contact with the wastewater (BOD) if submersed and with the air for aeration if outside of the basin. This treatment step is followed by another settling tank. Disinfection is usually not used. An installed sand filter is by-passed.

Performance of treatment
Not much data is available about plant performance. Mean COD is 92mg/l for the inlet and 31mg/l for the outlet, a reduction of 66%. Also the BOD values are quite low with 38mg/l for the inlet and 4mg/l for the outlet, a reduction of 89%. The RBC could probably still treat higher load. It is recommended to evaluate this by projects interested in providing assistance to Banjarmasin.

Capacity used
Accordance to the design the capacity of the installation is almost 100%. But from the performance results can be seen that probably still more customers can be connected.

Monitoring
PDAM is analyzing once a month T, COD, BOD, pH, TSS, DO, and NH_3-N. pH is measured every day. This is done more to verify compliance with government regulations than for process control. COD influent is relative low with values between 70 and 100 mg/l. After the treatment a COD of about 30mg/l is left, which is a reduction of 70%. BOD influent is between 26 and 50mg/l. After the treatment a BOD of about 4mg/l is left, which is a reduction of 90%. SS with values between 43 and 56mg/l in the effluent is quite high compared with the low COD and BOD. (The data could not be verified).

Laboratory
Until now all analysis is outsourced. But it is planned to install an own laboratory in the new plant.

Maintenance
A preventive maintenance plan exists and maintenance is carried out.
No warehouse available. All spare parts have to be ordered.

Sewerage system
Bajarmasin sewer system is 15 Km for the existing treatment plant in with 353 IC, 113 manhole, 19 washout chambers and 8 pumping stations (each two pumps) for 528 HC. Because the treatment facilities can still receive some organic load it is planned to extend the sewer system for 200 HC.

Maintenance
Maintenance is performed regularly. Inspection chambers, pumping stations, manholes are inspected. A maintenance plan is in place and records are available.

7. PHOTOS


Photo by: Edzard Ruehe
Date: November,16 '05
Location: WWTP Lambung Mangkurat - Banjarmasin
Remarks: (Left picture) pretreatment (fine screen)
(Right picture) equalization tank (with submersible pump)


Photo by: Edzrad Ruehe
Date: November,16 '05
Location: WWTP Lambung Mangkurat - Banjarmasin
Remarks: (Left picture) RBC (Rotating Biological Contactor), with motor to rotate media.
(Right picture) bacteria media and outlet to final clarifier


Photo by: Edzard Ruehe
Date: November,16 '05
Location: WWTP Lambung Mangkurat - Banjarmasin
Remarks: (Left picture) chlorination unit
(Right picture) outlet WWTP to Martapura river


Photo by: Oni Hartono
Date: November,16 '05
Location: WWTP Lambung Mangkurat - Banjarmasin
Remarks: (Left picture) control panel (for pumps)
(Right picture) situation of WWTP Lambung Mangkurat and operational truck for maintenance of sewer


Photo by: Oni Hartono
Date: November,16 '05
Location: WWTP Lambung Mangkurat - Banjarmasin
Remarks: (Left picture) Submersible pump under repair
(Right picture) flexible pipe for maintaining sewerage pipe (flushing)


Photo by: Oni Hartono
Date: November,16 '05
Location: PDAM Banjarmasin office
Remarks: Meeting and discussion with President Director and PDAM Banjarmasin staff.

7. DATASHEETS

	Banjarmasin (PDAM-UPT-PAL)		
General			
Population	589,954		
Area (Ha)	7,264		
Houses	137,408		
PDAM Customer	81,497		
Connections (wastewater)	528		
Coverage population (%)	0.4		
Coverage area (Ha)	28		
Coverage area (%)	0.4		
Coverage PDAM customer (%)	59		
WW customer connected to piped water (%)	98		
Capacity of system (connections)	550		
No People per houses (person/houses)	4		
Water consumption (m³/conn./month)	40		
WWTP Capacity used (%) (based on connections)	96		
Technical			
Wastewater System	**IPAL Lambung Mangkurat**		
Sewer System			
Length of Sewerage System (km)	18		
- primer Ø (150 - 350) mm, PVC	8		
- sekunder Ø (100) mm, PVC	10		
Capacity of sewer (installed):			
- m³/day			
- for house connection	550		
Capacity of sewer (used):			
- m³/day			
- house connection	528		
Capacity used in %	96		
WWTP			
Q (design) m³/day	800		
Q (production or used) m³/day	493		
Capacity used %	62		
Unit Process	**Pre-Treatment**	**Rotating Biological Contactor**	**Final Clarifier**
COD in (mg/L)	92		
COD out (mg/L)			31
Removal %			**66**
BOD in (mg/L)	38		
BOD out (mg/L)			4
Removal %			**89**
SS in (mg/L)	117		
SS out (mg/L)			48
Coliform in (MPN/100 ml)			
Total Coliform out (MPN/100ml)			
Treatment Systems	**Aerobic Systems**		
V tanks (m³)		306	
A tanks (m²)		85	
depth (m)		4	
HRT design (day)		0.4	
HRT actual (day)		0.6	

Financial (based on 2004)	
Initial Investment	8,714,955,200
Investment Treatment System	3,082,853,814
Investment Sewerage System	5,632,101,386
Investment Pumps	0
Financing Source (APBN/APBD Prov/APBD LG/Donor)	APBN / APBD / World Bank Loan
Loan / Grant	6,710,013,308
Amount (Rp)	NA
Debt service	0
Interest/Commitment charge	0
Loan Period (years)	0
Grace Period (years)	0
Subsequent Investment	NA
Investment Treatment System	NA
Investment Sewerage System	NA
Investment Pumps	NA
Others	NA
Financing Source (APBN/APBD Prov/APBD LG/Donor)	NA
Loan / Grant	NA
Debt service	NA
Interest	NA
Loan Period	NA
Grace Period	NA
Average Tariff (per conn per month)	73,091
Connection Fee (Rp/year)	NA
Tariff Revenue (Rp/year)	435,036,030
Total Revenue (Rp/year)	435,036,030
O%M Subsidy (Rp/year)	NA
Billed (Rp/year)	435,036,030
Collected Bills (Rp/year)	375,669,505
Collection efficiency (%)	86%
O + M Cost (Rp/year)	**301,610,000**
Personnel	41,610,000
Energy	120,000,000
Chemicals	NA
Administration (incl. Deprec. Office)	20,000,000
Maintenance	120,000,000
Depreciation (Rp/year)	0
Other	NA
Total Cost incl. depr+interest (Rp/year)	301,610,000
Cost of New Connection	2,000,000
Investment/m^3 used	3,275
Investment/m^3 designed	2,017
Investment/connection used	16,505,597
Investment/connection designed	15,845,373
Total Cost/m^3 used	1,700
Total Cost/conn.	571,231
O + M Cost /m^3	1,700
O + M Cost /conn.	571,231
Operating Ratio % (to O & M)	125%
Cost Recovery % (Total)	125%
Mean monthly fee per Connection	NA
O&M cost sewer	NA
O&M cost installation	NA
O&M cost sewer/connection	NA
O&M cost sewer/Km	NA
O&M cost installation/connection	NA
O&M cost installation/m^3	NA

APPENDIX 4: SUMMARY OF WASTEWATER TREATMENT PLANT PDAM CIREBON

SUMMARY OF WASTEWATER TREATMENT PLANT PDAM CIREBON

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Sanitation has only low priority within PDAM and local government.

Strength

- Environmental fee for WW treatment is implemented for WW operation and maintenance
- Qualified laboratory

Weaknesses

- In the combined bill for clean water and wastewater PDAM can not identify the revenue for the wastewater. This yield to the impression in the PDAM that wastewater generates only cost but no revenue.
- No incentive for PDAM to connect new customer because no additional income will be achieved
- Budget for process control too small
- No analytical control of processes.
- PDAM responsible for drainage system, but Dinas PU is responsible for the cleaning.
- Almost no preventive maintenance; only repair maintenance because of limited budget.

Opportunities

- In three installations still enough capacity of sewer and plant available for new connections
- Flat topography

Threats

- Limited support by local government
- No enforcement by government institutions to connect
- Customer do not like to connect to sewer

Recommendations

Support to calculate realistic O&M budget with relation to tariff. Implementation of accounting system for WW inclusive revenue. Technical assistance if sufficient budget is available for O&M and commitment of management for improvement.

2. GENERAL DATA

Province
West Java

Kabupaten
Municipal Cirebon

Topography
Flat

Area
3,736 Ha

Population
270,000

Water supply situation
90% of population covered by PDAM

3. INSTITUTIONAL ASPECTS

Owner and Operator
The owner of the installation is PDAM. The wastewater treatment plants are operated by PDAM.

History
A sewerage system has been built in the centre of the town in 1925 during the Dutch colonialism and operated by PU after the independence of Indonesia. Another system was built in 1987 by the Perumnas (State Housing Company) in southern part of Cirebon. These two systems were revitalized under CUDP II and III between the period of 1987-1992 and the assets were then transferred to PDAM Cirebon in 1994. In 1998 a new system was built in the northern part of Cirebon under CUDP III. The systems ware financed through several program and sources, e.g. 100% grant from Switzerland, DIP from central and provincial government, or shared financing: 19% local government and 81% grant from central government.

Coverage
The sewer system covers 27% of the population and 15% of the area of Cirebon.

Connections
The (recorded) existing number of connections is 15.397 units. PDAM expects a higher number of actual connections higher, but a complete survey for households, connected since 1925, has never been done. The number of additional connection per year is quite small with less than 50 units.

Transfer of assets or ownership to PDAM I 1994 was done under Perda (local government regulation) No 9/1994. Perda no. 13 Year 1994 stipulates PDAM to operate and manage water supply and wastewater services.

Government Back up
According to Perda 13/1994 all houses have to be connected to the sewer. But there is not sufficient coordination with LH or other institutions to enforce implementation of the regulation.
The Governor of West Java issued a decree regarding wastewater with very low thresholds.

Billing system
The bills for wastewater are combined with the monthly bills for water. The amount for wastewater is not mentioned in the bill.

4. MANAGEMENT ASPECTS

Strategic management / Business plan
A master plan feasibility study has been developed in 2005 funded by World Bank. PDAM Cirebon has developed a written mission in regard to wastewater treatment to show its commitment to wastewater treatment.

The local government of Cirebon has the target to become a 'healthy city '(kota sehat) by 2010. It is not obvious how this target is reflected in the PDAM strategy.

Quality management system
Reportedly there are SOPs and records implemented. But this could not be verified in the field because of time constrains.

HRD / Employees
In the organisation chart of PDAM Kota Cirebon the wastewater department is one of operation departments of the company. The department is led by Kepala Bagian Air Limbah and total number of staff without Kepala Bagian is currently 34 persons. Beside the head 12 people work in the sewer sub-department and 22 people in the treatment sub-department. Three more PDAM staff work exclusively for wastewater planning. From the administrative employees additional 50 people should be assumed as the proportion working for the wastewater department.

Training is only conducted based on offers from third parties like PU or Perpamsi, but not because of training needs. It is used as appreciation for good performance.

In 2002 employee satisfaction was measured. The result was mixed, some employees were satisfied, some not. To avoid too much routine work employees are rotated in their positions.

Employees get additional income for family, attendance and food. If staff is coming late punishment is conducted by reducing incentives. Every two years the salary is increased. But this increase depends on the evaluation of the performance.

Customers
15,397 connections are recorded as customers. But according to PDAM some more thousand are probably connected which are not in the database.

In the last some years almost no increase in the number of customer could be achieved. Currently about 27% of the population and 15% of the area of Cirebon is covered.

Marketing
Currently no campaigns are conducted to get new customers although reportedly some good results have been achieved in the past with campaigns.

5. FINANCIAL ASPECTS

Investment and Source of Funds
PDAM records indicate that the sanitation systems was mostly financed by government grant either from central or provincial government meanwhile the total loan has been withdrawn for these systems is totally Rp2.9 Billion which is used to finance Perumnas sanitation system. As of 31 August 2005 PDAM has a recorded entire asset of sanitation system of Rp22.8 Billion which is divided into 7 asset categories as follows:

Sanitation – Fixed Assets, PDAM Kota Cirebon, as of 31 August 2005 (Rp-000)

No	Description	Acquisition Value	Remarks
1	Land	2,839,000	Total Funded by Loan: Rp. 2,946,499 – CUDP 2 – SLA loan program.
2.	Pump	3,192,872	
3.	Treatment Plant	3,625,725	
4.	Distribution / Sewerage	11,757,905	
5.	Building – Office	299,300	
6.	Equipment		
	- Laboratory	66,917	
	- Vehicles	128,692	
	- Other Equipment	863,168	
7.	Furniture and Fixtures	96,436	
	Total	**22,870,015**	

Investment Plan
For year 2006 due to lack of demand PDAM has no specific plan to enlarge the sanitation service in the city of Cirebon. The regular investment for the coming years has been budgeted in the amount of approximately Rp2 Billion for small replacement of the assets.

Outstanding Loans and Debt Service Coverage
A loan for a sanitation development program has been withdrawn in 1988 under the CUDP 2 project to develop the system in Perumnas housing complex. Total loan withdrawn is Rp2.9 Billion regarded as the SLA of MOF program with the repayment period of 25 years and the interest rate of 9%. PDAM has settled its entire repayment obligation properly; current outstanding loan is Rp1.5 Billion. The annual interest expense for the last 3 years (2002-2004) is around Rp150 Million and the annual repayment is Rp123 Million.

Tariff, Revenue and Subsidy
The tariff of the sanitation service in Kota Cirebon is not specified clearly in the tariff system of PDAM. The sanitation expenditures, which include O&M, depreciation and interest expenses, have been included into the water tariff calculation. Thus, the non-customer of wastewater has been charged as the other customers who connect to the wastewater service. This system has caused that the PDAM has never recorded the wastewater income specifically in their books. In this tariff system subsidy for the wastewater operation has been provided directly by the non-customer of wastewater.

Two other items which are charged by PDAM to the customer are regarded as waste water income, i.e. new connection income and water test income. The new connection charge has been determined as stipulated in local government regulation no. 13 between Rp750,000 and Rp1 Million per connection. In the implementation of the regulation, PDAM considers this amount as relatively high and could burden the customer and marketing effort of the service provided by PDAM. To enable PDAM to expand the service smoothly, the new connection charge then was decreased to Rp150.000 per connection. Total income from wastewater for the last three years has been recorded as follows:

Sanitation – Other Income PDAM Kota Cirebon (Rp-Million)

Description/Year	2002	2003	2004
New Connection Income	398.4	482.3	0
Water test income	3.9	0.4	0
Total	**402.3**	**482.7**	**0**

Cost Recovery

Cost recovery of wastewater can not be calculated properly due to the tariff system which does not record specifically the wastewater tariff component. Currently total number of customers are served is approximately 15.397 connections. Total annual operating expenditures to serve these customers are around Rp2 Billion. The table below describes detailed the cost of operation and maintenance of the wastewater for the last three years.

Sanitation – Operating Expenditures, PDAM Kota Cirebon, (Rp-000)

Personnel	705,171	851,746	889,370
Office costs	14,168	12,675	9,237
Fuel/Electricity	288,633	193,244	231,279
Maintenance	131,222	91,859	169,991
Depreciation	849,446	823,717	833,209
Total	1,988,641	1,973,240	2,133,085

Collection Efficiency

Since PDAM Kota Cirebon has never charged explicitly the wastewater service, the collection efficiency can not be described properly. But collection efficiency for clean water is with 93% very high.

Operation and Maintenance Expenditures

The wastewater operating expenditures accounts record only transactions within the wastewater department which are directly related to wastewater. Expenses of other departments which relate to wastewater operation are not recorded as wastewater expenses in the wastewater account. For example the salary of accounting staff of water business which support the wastewater system is not recorded to the waste water-salary expenses account, but it is included to the salary expenses of the water business. The same happens with other department expenses such as customer and personnel.

Accounting System

PDAM has not established a separate accounting system for the wastewater. The current accounting system records all transaction which includes water and wastewater in one accounting system. However, in recording transactions in its financial report (PDAM report) the cost centre and revenue centre accounts of wastewater have been set in that one report. This is that each transaction can be presented properly in PDAM financial report.

6. TECHNICAL ASPECTS

Treatment system used

PDAM is operating four treatment plants with four sewerage systems: Kesenden, Ade Irma, Perumnas Utara, and Perumnas Selatan. Each treatment plant is connected to an own sewer system. Ade Irma is located in the center of the town and is in fact overloaded. The wastewater is mixed with stormwater and 4000m³ of the mixture is pumped every day to the plant (equivalent to 50l/s). The remaining flows direct to the sea. In terms of connections the capacity of the sewer is only used by 65%.

The other three plants are only used 15-60% of their capacity, which is also in the range of the used capacity of the sewer (16-65%). Thus, at these three plants quite some capacity is still idle.

The plants are all systems with grit chambers, screens, an-aerobic, facultative and maturation ponds. The performance of these systems in terms of COD reduction is not satisfying, especially considering idle capacities in the plants.

Plant	COD in	COD out	Reduction
Kesenden	70	60	14 %
ADE IRMA	46	20	57 %
Perumnas Utara	180	93	48 %
Perumnas Selatan	183	90	52 %

The treatment plant Kesenden treats also sludge from septic tanks.

Sludge from the ponds is removed every 10 years and is used for land reclamation; the last time this was done was in 2003.

Capacity used

Table capacity treatment plant and sewer

Plant	Capacity Plant used	Capacity Sewer used
Kesenden	15 %	16 %
Ade Irrma	90 %	65 %
Perumnas Utara	60 %	43 %
Perumnas Selatan	60 %	59 %

(Ade Irma plant is in fact overloaded because some wastewater is discharged direct to sea)

Monitoring
Until 2003 PDAM monitored some parameters regularly. Until 2000 the reduction of main parameters has been controlled at each step. But all controlling was stopped for cost reasons.

Laboratory
The laboratory uses SOPs of HACH and the AWWA standard methods. Good housekeeping is weak in the lab.

Maintenance
The effort for maintenance is very poor, especially maintenance of the sewer. Maintenance focuses also only on breakdown maintenance. Every year pump coils have to be repaired 3 to 4 times because they are burnt. Water level controllers (WLC) become often entangled with rubbish, but are not cleaned regularly. Nevertheless, bearings of submersible pumps are inspected once a month.

In general maintenance is hampered by limited budget. For maintenance Rp1.3 billion is spent. The largest positions are personnel with about Rp900 million and electricity with Rp 230 million.

7. PHOTOS


Photo by: Edzard Ruehe
Date: October,06 '05
Location: WWTP Kesenden – Cirebon
Remarks: (Centre) equalization tank and submersible pumps.
(Right) bar screen with gate water.

Photo by: Edzard Ruehe
Date: October,06 '05
Location: WWTP Kesenden – Cirebon
Remarks: Aerated pond (without aerator)


Photo by: Oni Hartono
Date: October,06 '05
Location: WWTP Kesenden – Cirebon
Remarks: (Left) Facultative pond (people fishing).
(Right) Outlet from WWTP Kesenden goes to river /sea.


Photo by: Oni Hartono
Date: October,06 '05
Location: Pump station Wastewater Ade Irma - Cirebon
Remarks: Equalization tank and pump station.


Photo by: Edzard Ruehe
Date: October,06 '05
Location: WWTP Ade Irma - Cirebon
Remarks: (from left) inlet unit ; aerated pond (with ecenk gondok plants).





Photo by: Oni Hartono
Date: October,06 '05
Location: PDAM Cirebon office (workshop)
Remarks: Top (left to right): Sludge truck 'maxlife' 8 m³ (bad condition) ; Sludge tank 'maxlife' 1 m³ for small street (bad condition)
Bottom (left to right): Sludge truck 'maxlife' 3 m³ (good condition) ; jetting machine for flashing sewerage (bad condition) ; bucket machine for cleaning sewerage between manhole and manhole (good condition).

8. DATASHEETS

	Cirebon
General	
Population	269,186
Area (Ha)	3,736
Houses	66,824
PDAM Customer	52,989
Connections (wastewater)	15,397
Coverage population (%)	27
Coverage area (Ha)	561
Coverage area (%)	15
Coverage PDAM customer (%)	90
WW customer connected to piped water (%)	50
Capacity of WWTP (connections)	32,750
No People per houses (person/houses)	5
Water consumption (m^3/conn./month)	31
WWTP Capacity used (%) (based on connections)	47

Technical																
Wastewater System	**Kesenden (Utara Kota)**			**ADE IRMA (Pusat Kota)**				**Perumnas Utara (selatan Kota)**				**Perumnas Selatan (selatan Kota)**			
Sewer System															
Length of Sewerage System (Km)	11			21				9				28			
- primary (m); Ø (900 - 1100)mm	2			2				0				0			
- secondary (m); Ø (250 - 800)mm	2			19				0.5				4			
- tertiery (m); Ø (150 - 200)mm	8			0				9				24			
Capacity of sewer (installed):															
- m³/day															
- for house connection	8,750			12,000				6,000				6,000			
Capacity of sewer (used):															
- m³/day															
- house connection	1,418			7,822				2,600				3,557			
Capacity used in %	16			65				43				59			
WWTP															
Q (design) m³/day	6,480			4,320				4,320				4,320			
Q (production or used) m³/day	950			3,888				2,592				2,592			
Plant capacity used (%)	15			90				60				60			
Unit Process	**An-aerob**	**Fakultatif**	**Maturasi**	**An-aerob**	**Fakultatif**	**Maturasi I**	**Maturasi II**	**An-aerob**	**Fakultatif**	**Maturasi I**	**Maturasi II**	**An-aerob**	**Fakultatif**	**Maturasi I**	**Maturasi II**
COD in (mg/L)	70			46				180				183			
COD out (mg/L)			60				20				93				90
Removal %			**14**				**57**				**48**				**51**
BOD in (mg/L)	42			22				80				80			
BOD out (mg/L)			28				18				24				32
Removal %			**33**				**18**				**70**				**60**
SS in (mg/L)	64			76				126				168			
SS out (mg/L)			39				50				85				94
Coliform in (MPN/100 ml)															
Total Coliform out (MPN/100ml)															
Treatment Systems	An-aerob	Fakultatif	Maturasi	An-aerob	Fakultatif	Maturasi I	Maturasi II	An-aerob	Fakultatif	Maturasi I	Maturasi II	An-aerob	Fakultatif	Maturasi I	Maturasi II
V tanks (m³)	5,625	36,000	28,575	155	24,800	15,500	15,500	2,450	3,150	5,250	8,750	6,125	13,125	12,250	10,500
A tanks (m²)	2,500	16,000	12,700	100	16,000	10,000	10,000	1,400	1,800	3,000	5,000	3,500	7,500	7,000	6,000
depth (m)	(1.5 - 3.0)			(1.35 - 1.75)				(1.5 - 2.0)				(1.5 - 2.0)			
HRT design (day)	1	6	4	0	6	4	4	1	1	1	2	1	3	3	2
HRT actual (day)	6	38	30	0	6	4	4	1	1	2	3	2	5	5	4

Financial (based on 2004)	
Initial Investment	22,870,015,000
Investment Treatment System	0
Investment Sewerage System	0
Investment Pumps	0
Financing Source (APBN/APBD Prov/APBD LG/Donor)	APBN / APBD / MOF
Loan /Grant	2,946,499,181
Amount (Rp)	
Debt service / Loan Repayment per year	122,700,000
Interest	9%
Loan Period	25
Grace Period	6
Subsequent Investment	NA
Investment Treatment System	NA
Investment Sewerage System	NA
Investment Pumps	NA
Others	NA
Financing Source (APBN/APBD Prov/APBD LG/Donor)	NA
Loan / Grant	NA
Debt service	NA
Interest	NA
Loan Period	NA
Grace Period	NA
Average Tariff (per conn per month)	-
Connection Fee (Rp/year)	0
Tariff Revenue (Rp/year)	-
Total Revenue (Rp/year)	0
O&M Subsidy (Rp/year)	0
Billed (Rp/year)	0
Collected Bills (Rp/year)	0
Collection efficiency (%)	0
O + M Cost (Rp/year)	**2,133,086,000**
Personnel	889,370,000
Energy	231,279,000
Chemicals	0
Administration (Excl. Deprec. Office)	9,237,000
Maintenance	169,991,000
Depreciation (Rp/year)	833,209,000
Other	0
Total Cost incl. depr+interest (Rp/year)	2,966,295,000
Cost of New Connection	150,000
Investment/m^3 used	423
Investment/m^3 designed	218
Investment/connection used	1,485,355
Investment/connection designed	698,321
Total Cost/m^3 used	822
Total Cost/conn.	192,654
O + M Cost /m^3	591
O + M Cost /conn.	138,539
Operating Ratio % (to O & M)	0
Cost Recovery % (Total)	0
Mean monthly fee per Connection	NA
O&M cost sewer	NA
O&M cost installation	NA
O&M cost sewer/connection	NA
O&M cost sewer/Km	NA
O&M cost installation/connection	NA
O&M cost installation/m^3	NA

APPENDIX 5: SUMMARY OF WASTEWATER TREATMENT PLANT PD PAL DKI JAKARTA

SUMMARY OF WASTEWATER TREATMETN PLANT PD PAL DKI JAKARTA

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

PD PAL focuses on central business district in Jakarta with many high rise buildings. With this business model PD PAL can cover their operational cost and their depreciation cost (which are currently quite low). But the plant cannot be operated independently because PU in controlling the plant.

Strength

- Customer are willing to get connected and paying their bills.
- O&M does not have to be subsidized
- (relative) high proportion business customers
- Cost recovery including investment

Weaknesses

- Wastewater cannot be treated in accordance to required standards because lagoons are used by PU for flood control
- In-adequate treatment system

Opportunities

- Expanding of collection system to malls and other commercial buildings in the central district
- PD PAL sees a good market for decentralized small treatment plants
- Existing market for operation of wastewater treatment plants of commercial buildings

Threats

- PD PAL depends on support by PEMDA for investments

Recommendations
Support PD PAL in its effort to separate wastewater and flood control. As long as this problem is not solved no improvement in the treatment can be achieved.

2. GENERAL DATA

Province
DKI Jakarta

Topography
Flat

Area
560 Ha

Population (2000)
8,350,000

Water supply situation
Around 650,000 connections

3. INSTITUTIONAL ASPECTS

Ownership and Institutional Set-up
The sewer is owned by PD PAL while the wastewater plant is owned by the Central Government (Ministry of Public Work). The installation is used for flood control and for wastewater treatment; but flood control has the priority. In case of approaching flood the basins are emptied and then filled during the flood with flood water yielding to severe overlapping with the function of the wastewater treatment plant. Because Dinas PU is the operator of flood control system PD PAL has only restricted control of their treatment processes. In addition PD PAL is institutional located under Dinas PU.

History
Installation was built in three stages: Jakarta Sewerage and Sanitation Project JSSP I (1982 – 1987), JSSP II (1988 – 1990), JSSP Extension (1991 – 1996) by IBRD loan. In 1987 a temporary enterprise (BPAL) was established based on decree by Department of Public Works 510/KPTS/1987. This enterprise became PDPAL Jaya in 1991 by Provincial Regulation 10/1991 for the area of Setiabudi Tebet. Since 1997 the working area has been extended to the entire area of Jakarta (14/1997).

Legal Regulations and Enforcement
A government regulation exists regarding domestic wastewater discharge and thresholds (SK GUB DKI 582/95). LH is monitoring the effluent but in case of non-compliance there is no law enforcement.

Coverage & Connections
The sewer system covers 560 Ha or 1% of the city area. The 1269 connections are about 0.05% of the population. But it be considered that the plant treats not only wastewater of households but also of many large buildings.

Collection system
All customers are directly billed. The customers have an interest in the connection to the sewer system and pay usually on-time.
PD PAL has a program in socialization of the importance of wastewater treatment for their environment and health. This information supports a change in the mind set of the people to recognize wastewater treatment as an important issue and to pay for that.

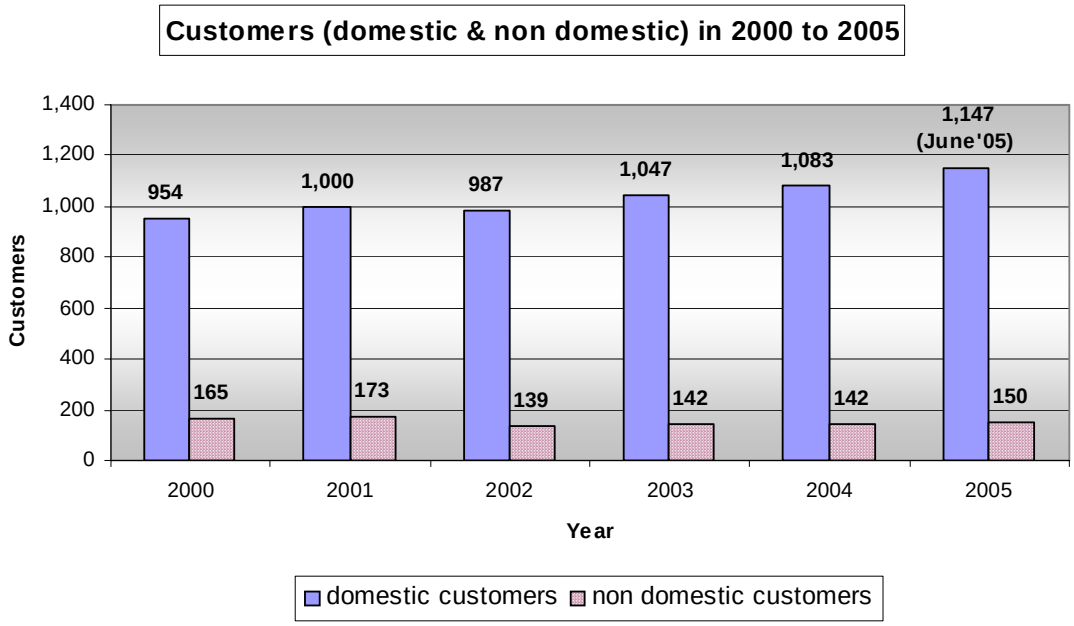
4. MANAGEMENT ASPECTS

Management is aware of existing policy, mission and vision. The strategy for the medium term is a change in the institutional set-up to separate flood control of PU and wastewater treatment of PD PAL.

Currently almost no procedures, work instructions and SOPs exist. Not much reporting is conducted, but records are available.

1100 connections are registered, 200 large buildings and 900 small houses. Customer connect to the system because their area becomes cleaner (less rats, etc). According to PD PAL low income houses would like to connect, but they lack buying power. In general it is difficult to connect houses with existing septic tanks. Willingness to pay is not high. Number of connections has increased in the last years.

Customer Gaph – PD PAL JAYA



PD PAL owns a website: www.paljaya.com and has a hotline during the day.
Customer satisfaction is analyzed every year with regard to: empathy, responsiveness and reliability. According to the survey the quality of service of PD PAL improves every year.

Community based treatment plants are seen as efficient alternative to a centralized system.

PD PAL has 105 employees. Job descriptions are available down to SubBidang. Evaluation of staff competence and performance is seen as not efficient. The training budget is 60 million (2005). The employee satisfaction is high according to the management. The employees are sharing 15% of the profit as incentive. Every year the best employee is send to Haj. Absenteeism is measured for personnel adjustment of incentive, but not generally evaluated.

5. FINANCIAL ASPECTS

Investment and Source of Funds
The first investment was done under Jakarta Sewerage and Sanitation Project financed – through grant - by IBRD in 1991, consisting of:

Land	1,016,520,473
Sewer	4,617,389,332
Office supplies	9,926,000
Administration	716,217,558
Total	**6,360,053,363**

Data on the value of the plant is not available.

Investment Plan
In average PD PAL allocates around Rp1 billion for its routine/annual investment, financed through its own budget, while for the expansion of the system, PD PAL is still dependant on Pemda DKI. Pemda is expected to support with investment until its total share of equity reaches Rp200 billion (presently total equity is Rp45.5 billion). PD PAL conducts feasibility studies prior to decision to make some investments. The indicators used to evaluate the feasibility are the FIRR, NPV and the payback period.

Following table shows PD PAL investment in year 2005.

PD PAL INVESTMENT PROGRAM		2005
A	Network Expansion - Gatot Subroto	9,460,000,000
B	New Connections - Mega Kuningan	590,339,091
C	PD PAL JAYA routine Investment	1,808,056,890
	Household Connections	132,400,764
	Network Expansion – Tarikan	272,236,250
	Procurement of Boat	35,000,000
	Procurement of Garbage Holder	45,000,000
	Construction of Intercept Connection and others	601,541,216
	Procurement of Garbage collection equipment	125,000,000
	Vehicles	
	Building renovation	78,000,000
	Office supplies	392,378,660
	Chemical	55,000,000
	Laboratory Equipments	71,500,000
	Total	11,858,395,981

Source: PD PAL Quarterly Report, July 2005

From the total investment of Rp11.8 billion, Rp9.4 billion is financed by the Local Government. PD PAL also borrows from Bank DKI at 11% interest rate.

Outstanding Loans and Debt Service Coverage

PD PAL Jaya has an outstanding loan of Rp4 billion from Bank DKI. The loan period is 3 years, with a grace period of 1 year. The first instalment is due in September 2005.

Tariff, Revenue and Subsidy

Tariff is set to each square meter of the building and the rate is different for each type of customer. Revenue comes mainly from the tariff and new connection fees. The prevailing tariff has been effective since July 2003 with a yearly average increase of 29% from 1994 base tariff (Household type A), while connection fee was reduced by 50% to attract more people to connect. Present cost of a connection is Rp300,000 in average (3m pipes and control chamber of 40x60x60).

Connection fee is Rp/unit for household and Rp/m2 for non-domestic.

PD PAL Service Tariff & Connection Fee

NO	CUSTOMER CATEGORY	WASTE WATER SERVICETARIFF (Rp/m^2)	CONNECTION FEE *)	
			Unit	Rp
I	**HOUSEHOLDS**			
1	HOUSEHOLDS TYPE A	72	unit	10,000
2	HOUSEHOLDS TYPE B	90	unit	10,000
3	HOUSEHOLDS TYPE C	108	unit	10,000
4	HOUSEHOLDS TYPE D	126	unit	10,000
II	**SMALL COMMERCIAL**			
1	SHOPS	108	per m^2	1,000
2	OFFICE (UP TO 3 FLOORS)	108	per m^2	1,000
3	HAIR DRESSER	126	per m^2	1,000
4	CATERING	144	per m^2	1,400
5	RESTAURANT	180	per m^2	1,500
6	SMALL HOTEL	180	per m^2	1,500
7	OTHER	180	per m^2	1,500
III	**LARGE COMMERCIAL**			
1	HIGH OFFICE BUILDINGS	360	per m^2	1,750
2	HIGH OFFICE BUILDINGS INCL. RESTAURANTS AND/ OR FITNESS	396	per m^2	1,925
3	SHOPPING CENTRES/MALLS/ SUPERMARKETS/ SHOWROOM	396	per m^2	1,925
4	I, II, III - STARS HOTEL	396	per m^2	1,925
5	APARTMENT/CONDOMINIUM	540	per m^2	2,625
6	IV - STARS HOTEL	540	per m^2	2,625
7	ENTERTAINMENT CENTRES/BIG RESTAURANTS/ CAFE	576	per m^2	2,800
8	PRIVATE HOSPITALS	576	per m^2	2,800
9	V - STARS HOTEL	576	per m^2	2,800
10	OTHER	576	per m^2	2,800
IV	**SOCIAL**			
1	RELIGIOUS PLACES	40	per m^2	550
2	COMMUNITY HEALTH CENTERS	85	per m^2	1,100
3	SCHOOLS	108	per m^2	850
4	GOVERNMENT INSTITUTIONS	144	per m^2	1,100
5	OTHER INSTITUTIONS	144	per m^2	1,100
6	SCHOOLS Incl. DORMITORY	144	per m^2	1,100
7	SWIMMING POOLS	180	per m^2	1,100
8	GOVERNMET HOSPITALS	216	per m^2	1,500
9	CLINIC	216	per m^2	1,500
V	**INDUSTRY**			
1	SMALL INDUSTRY	144	per m^2	1,000
2	MEDIUM INDUSTRY	432	per m^2	4,200
3	LARGE INDUSTRY	468	per m^2	4,300

Note: *) From standard pipe to control chamber

PD PAL does not receive any subsidy to operate and maintain the system. The tariff seems to be adequate to cover the needs. However, cross subsidy seems to take place between non domestic to domestic customers. Most of the connections are households, more than 85% of total customers, but total square meters served are only 4%, proving that non-domestic contributes the most to the income (up to second quarter 2005 connected households are 1,124 with 123,348m^2 and non-domestic are 154 with 3,580,946m^2).

(Rp million)

INCOME					
DESCRIPTION	2001	2002	2003	2004	2005
					Budget
A Service					
Commercial (Large)	7,300.5	7,814.7	10,417.7	13,893.4	14,164.5
Commercial (Small)	24.6	24.6	32.4	39.7	42.8
Industry	0.4	0.4	0.6	0.7	0.7
Households	36.3	38.8	66.9	106.7	112.3
Social	164.3	173.0	263.4	364.1	365.0
Income from Service	7,526.1	8,051.5	10,781.0	14,404.6	14,685.3
B New Connection					
Installation	625.8	365.9	468.5	345.1	488.4
Construction	14.6	14.5	15.1	6.2	11.6
Total Income from New Connections	640.4	380.4	483.6	351.3	500.0
C Other Income	1,039.2	1,864.3	959.1	2,625.2	741.1
TOTAL INCOME	9,205.7	10,296.2	12,223.7	17,381.1	15,926.4

Collection Efficiency

The collection efficiency is quite high, more than 80% for high rise buildings but only 60% for households. One reason of the high efficiency could be that the fees are collected door to door as wished by the customers.

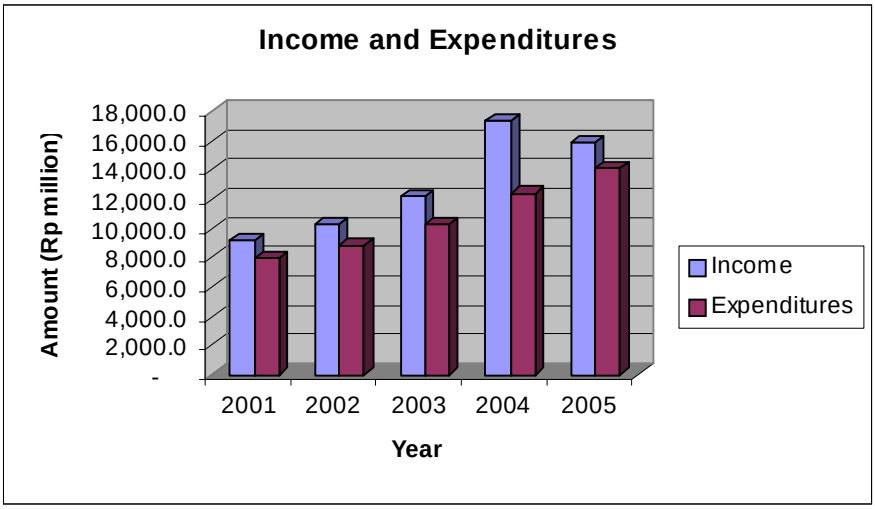
Cost Recovery

As shown in table below, the tariff started to fully cover the expenditures in 2003 when the tariff adjustments were done after 9 years.

INCOME STATEMENTS						(Rp million)
DESCRIPTION		2001	2002	2003	2004	2005 Budget
INCOME						
a	Total Income from Service	7,526.1	8,051.5	10,781.0	14,404.6	14,685.3
b	Total Income from New Connections	640.4	380.4	483.6	351.3	500.0
c	Other Income	1,039.2	1,864.3	59.1	2,625.2	41.1
TOTAL INCOME		9,205.7	10,296.2	12,223.7	17,381.1	15,926.4

INCOME STATEMENTS						(Rp million)
DESCRIPTION		2001	2002	2003	2004	2005 Budget
EXPENDITURES						
a	Cost of Treatment	4,956.0	5,394.8	6,160.9	6,090.0	6,801.5
b	Marketing Cost	236.7	208.6	240.0	427.8	473.6
c	Total Administration Costs	1,785.1	2,180.1	2,879.7	4,995.3	5,957.5
d	Other Operating Expenditures	309.0	301.1	438.0	461.9	557.2
e	Other Expenditures	719.9	776.4	529.0	436.8	285.0
TOTAL EXPENDITURES		8,006.7	8,861.0	10,247.6	12,411.8	14,074.8
INCOME BEFORE TAX		1,199.0	1,435.2	1,976.1	4,969.3	1,851.6
f	Total Taxes	414.5	250.3	784.0	1,127.4	649.1
NET INCOME AFTER TAX		784.5	1,184.9	1,192.1	3,841.9	1,202.5
TOTAL SQUARE METERS SERVED (M2)		2,757,487	2,937,315	3,057,065	3,079,196	3,210,432
	Households (HH)	106,347	107,925	114,129	117,563	125,403
	High Building (HB)	2,651,140	2,829,390	2,942,936	2,961,633	3,085,029
NO OF CUSTOMERS		1,173	1,126	1,189	1,225	1,297
	Households (HH)	1,000	987	1,047	1,083	1,147
	High Building (HB)	173	139	142	142	150
Cost Recovery		94%	94%	105%	116%	104%
Operating Ratio		87%	86%	84%	71%	88%
Average Tariff/m^2/month		227	228	294	390	381
	Households (HH)	28	30	49	76	75
	High Building (HB)	230	231	296	392	384
Average Cost/m^2/month		242	251	279	336	365
Average Tariff/connection/month		534,676	595,878	755,607	979,905	943,543
	Households (HH)	3,025	3,276	5,325	8,210	8,159
	High Building (HB)	3,528,661	4,700,060	6,133,040	8,177,113	7,893,333
Average Cost/connection/month		568,819	655,787	718,223	844,340	904,318

The bar chart below shows the financial performance of PD PAL.



Operation and Maintenance Expenditures

PD PAL divides expenditures into 3 (three) main classification: (1) cost for treatment, (2) marketing cost, and (3) administration cost. For details, see the following table.

EXPENDITURES		2001	2002	2003	2004	2005 Budget
a	Cost of Treatment					
	Wages, allowances and taxes	1,716.8	1,769.9	2,273.7	2,300.6	2,665.0
	Employee welfare	969.9	1,037.8	1,224.4	1,130.1	1,296.7
	Treatment and Maintenance	1,046.9	1,260.9	1,412.7	1,310.7	1,334.3
	Office supplies	262.5	380.3	433.4	444.8	601.1
	Depr. of Sewer	764.0	753.5	624.3	702.2	904.4
	Depr. of Production Equipment	195.9	192.4	192.4	201.6	-
	Cost of Treatment	4,956.0	5,394.8	6,160.9	6,090.0	6,801.5
b	Marketing					
	Marketing & Advertising	207.0	155.0	193.4	370.4	473.6
	Customers Counselling	29.7	53.6	46.6	57.4	-
	Marketing Cost	236.7	208.6	240.0	427.8	473.6
c	Administration					
	Wages, allowances and taxes	512.9	692.5	753.6	2,214.4	2,447.9
	Employee welfare	203.1	226.1	262.7	858.7	970.5
	Maintenance	476.3	520.5	848.2	662.2	1,133.5
	Utility, phone and office	176.3	225.2	253.7	261.2	349.5
	Travel	-	10.6	44.0	138.3	150.0
	Course and Training	43.6	23.9	110.4	78.9	-
	Office Equipment	34.1	60.1	54.3	75.2	82.6
	Research and Development	-	-	-	-	155.0
	Depreciation	338.8	421.2	552.8	694.1	668.5
	Interest	-	-	-	12.3	-

EXPENDITURES		2001	2002	2003	2004	2005 Budget
	Total Administration Costs	1,785.1	2,180.1	2,879.7	4,995.3	5,957.5
d	Other Operating Expenditures	309.0	301.1	438.0	461.9	557.2
e	Other Expenditures	719.9	776.4	529.0	436.8	285.0
TOTAL EXPENDITURES		8,006.7	8,861.0	10,247.6	12,411.8	14,074.8

Accounting System
PD PAL as a wastewater treatment company has established a complete computerized accounting system that is able to generate financial statements: Balance Sheet, Income Statement and Cash Flow.

6. TECHNICAL ASPECTS

Treatment system used
PD PAL runs different plants: an aerated lagoon in Setiabudi serving the central business district and an extended aeration in Cenkareng as operator. PD PAL owns and operates two plants in AGRO building and Marriot Hotel, using extended aeration and Bioactivator. PD PAL is renting and operating 4 other plants, one RBC and 3 bioactivators.

The visited plant in Setiabudi was actually planned as reservoir for a treatment plant in Muara Baru but until now used as the sole treatment. It is equipped with two parallel aerated lagoons (depth 4.5 m). The wastewater comes direct into the lagoons without screen and grit chamber. In addition storm water runs into the plant without screen (screen is defect) leading to severe floating of debris in the lagoon. The lagoon is aerated for only 6-8 hours per day to reduce energy cost, leading to low DO (< 0.5mg/l). The seven aerators are powered by 37 kW engines and are designed to supply 48 kg O_2/hour each.

An on-line DO meter is installed, but not interpreted well by the operators. It is also not clear if it is installed accordingly.

Parameters analyzed weekly for monitoring are: pH, T, DO, TSS, TDS, BOD, COD, NH_4, NO_3, NO_2, Cu, Zn, F, Fe, Mn, detergent. Flow rate is not measured. Analysis is carried out according to HACH procedures, or SNI. PPLHD is monitoring as well.

Data available show removal of COD is east pond by 58% (296 to 124mg/l) and west pond by 33% (167 to 124mg/l) with a similar BOD reduction in east pond 61% (138 to 53mg/l) and west pond 29% (74 to 53mg/l). The actual HRT is about 7.5 days.

Sewer used
The sewer system is 43 km long using 1.3 m concrete primarily pipes. For HC 4 inches PVC pipes are used. Most clogging problems appear in these small pipes. 3 pumps are installed in Semanggi and two in Manggarai.

Maintenance in the piping system is repeated every 3 months in the whole sewer system. In the treatment plant the most time consuming maintenance is the screening of floating debris in the ponds. Oil is exchanged every year. Sufficient equipment for sewer maintenance is available, sometimes even rented out to Tangerang installation.
There is no warehouse for spare parts. All spare parts are bought before use.

The used capacity is about 55 – 60% accordance to the management. Housekeeping could be improved.

According to the information received the sludge is discharged by PU to flood canal system. This is a inadequate final discharge because the separation of water and pollutant achieved is totally lost by this procedure. The canal system is almost as polluted as without treatment.

7. PHOTOS



Photo by: Edzard Ruehe
Date: October,3 '05
Location: PD PAL office, Jakarta
Remarks: Laboratory PD PAL Jaya


Photo by: Oni Hartono
Date: October,3 '05
Location: Jl. Setiabudi - Jakarta
Remarks: Waduk Setiabudi with surface aerator

Photo by: Edzard Ruehe
Date: October,3 '05
Location: Jl. Setiabudi - Jakarta
Remarks: Pumping house to discharge wastewater from Waduk Setiabudi to Banjir Kanal River

Photo by: Edzard Ruehe
Date: October,4 '05
Location: Jl. Setiabudi - Jakarta
Remarks: Waste cleaned in Waduk Setaibudi by PD PAL Jaya staff

Photo by: Oni Hartono
Date: October,4 '05
Location: Agro Plaza Building (jl. Kuningan) - Jakarta
Remarks: STP (300 m^3/day) in Agro Plaza Building (operational by PD PAL Jaya)

8. DATASHEETS

	Jakarta	
General		
Population	8,347,083	
Area (Ha)	66,152	
Houses	2,227,140	
PDAM Customer	No data	
Connections (wastewater)	1,269	
Coverage population (%)	0.1	
Coverage area (Ha)	560	
Coverage area (%)	1	
Coverage PDAM customer (%)	No data	
WW customer connected to piped water (%)	No data	
Capacity of system (connections)	70,272	
No People per houses (person/houses)	4	
Water consumption (m³/conn./month)		
WWTP Capacity used (%) (based on connections)	2	
Technical	**SETIABUDI POND(s)**	
Wastewater System	**EAST POND**	**WEST POND**
Sewer System		
Length of Sewerage System (km)	43	
- Tersier (Ø 100 - 250) mm	25	
- Sekunder (Ø 300 - 500) mm	9	
- Primer (Ø 600 - 1500) mm	9	
Capacity of sewer (installed):		
- m³/day	42,768	
- for house connection	No data	
Capacity of sewer (used):		
- m³/day	12,777	
- house connection	1,269	
Capacity used in % (based on connections)	30	
WWTP		
Q (design) m³/day	60,480	44,928
Q (production or used) m³/day	12,777	
Plant capacity used (%)	12	
Unit Process	**Aerated Pond**	**Aerated Pond**
COD in (mg/L)	296	167
COD out (mg/L)	124	112
Removal %	58	33
BOD in (mg/L)	138	74
BOD out (mg/L)	53	53
Removal %	61	29
SS in (mg/L)	424	73
SS out (mg/L)	381	41
Coliform in (MPN/100 ml)		
Total Coliform out (MPN/100ml)		
Treatment Systems	**Aerated Lagoon**	**Aerated Lagoon**
V tanks (m³)	41,700	54,000
A tanks (m²)	17,400	26,100
depth (m)	(2 - 2.5) m	(2 - 2.5) m
HRT design (day)	0.7	1.2
HRT actual (day)	1.4	2.4

Financial (based on 2004)	
Initial Investment	6,360,053,363
Investment Treatment System	NA
Investment Sewerage System	4,617,389,332
Investment Pumps	NA
Financing Source (APBN/APBD Prov/APBD LG/Donor)	APBN/Donor (IBRD)
Loan / Grant	Grant
Debt service	-
Interest	-
Loan Period	-
Grace Period	-
Subsequent Investment	11,858,395,981
Investment Treatment System	-
Investment Sewerage System	11,858,395,981
Investment Pumps	0
Financing Source (APBN/APBD Prov/APBD LG/Donor)	APBD Provincial
Loan / Grant	Grant
Debt service	-
Interest	-
Loan Period	-
Grace Period	-
Average Tariff (per conn)	4,678
Connection Fee	0
Tariff Revenue (Rp/year)	14,404,600,000
Total Revenue (Rp/year)	17,381,100,000
O&M Subsidy (Rp/year)	-
Billed (Rp/year)	14,404,600,000
Collected Bills (Rp/year)	11,523,680,000
Collection efficiency (%)	80%
O + M Cost (Rp/year)	11,508,000,000
Personnel	6,503,800,000
Energy	0
Chemicals	0
Administration (incl. Deprec. Office)	2,794,800,000
Maintenance	1,310,700,000
Depreciation (Rp/year)	903,800,000
Other	898,700,000
Total Cost incl. depr+interest (Rp/year)	12,411,800,000
Cost of New Connection	NA
Investment/m3 used	92
Investment/m3 designed	11
Investment/connection used	5,011,862
Investment/connection designed	90,506
Total Cost/m3 used	2,698
Total Cost/conn.	9,780,772
O + M Cost /m3	2,502
O + M Cost /conn.	9,068,558
Operating Ratio %	71%
Cost Recovery % (Total)	116%
Mean monthly fee per Connection	0
O&M cost sewer	0
O&M cost installation	0
O&M cost sewer/connection	0
O&M cost sewer/Km	0
O&M cost installation/connection	0
O&M cost installation/m³	0

APPENDIX 6: SUMMARY OF WASTEWATER SYSTEM PDAM MEDAN AND PARAPAT

SUMMARY OF WASTEWATER SYSTEM PDAM MEDAN AND PARAPAT

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Strength

- Wastewater treatment staff is committed
- Billing combined with Water Supply, making collection easy and efficient (80%)

Weaknesses

- Not fully supported by PDAM senior management, because it is considered as a burden and a cost centre compared with clean water delivery
- Not sufficient technical knowledge
- Not much initiative and incentives to connect more customers
- Tariff too low to cover required operating and maintenance cost

Opportunities

- Idle capacity both for treatment plant and sewer system.
- Treatment plant and sewer capacity in Parapat for 760 connections, but only 159 houses are connected.

Threats

- Revenue insufficient to cover investments, combined with lack of support by senior management threatens comprehensive improvement and/or expansion plans
- Insufficient support and commitment from external organizations like municipal and provincial government departments, like environment, health, etc.

Recommendations

- ESP could consider supporting PDAM to develop a new (simplified) tariff scheme, e.g. based on water bill.
- PDAM needs training on the UASB reactor and how to use it in the current situation (under-load). Training is also important regarding the control of the aerated lagoon in Medan and Parapat to optimize the process and energy usage.
- Training is required regarding occupational health and safety for working in sewer system
- If commitment of management increases ESP can support activities for new connections

2. GENERAL DATA

Province
North Sumatra

Kabupaten
Medan: Municipal Medan and Kabupaten Binjai, Kabupaten Deli Serdang
Parapat: Toba Samosir and Simalungun

Topography
Medan: Mostly flat, 3 – 38m high
Parapat: Hilly

Area
Medan: 26,510 Ha
Parapat: 500 Ha

Population
Medan: 2,210,743 (Year 2000)
Parapat: about 10,000

Water supply situation
PDAM Medan has about 308,000 customers for clean water which is equivalent to 77% of the population. 99% of the waste water customers receive water from PDAM.

Parapat has 159 connections out of 3,312 houses or 5% of the population. The sewer covers about 1% of the city area. 80% of the customers get water from PDAM.

3. INSTITUTIONAL ASPECTS

Ownership and Institutional Set-up
PDAM Tirtanadi is responsible to treat the domestic wastewater of Medan and Parapat and to discharge it in a way that it does not pollute the environment.

PDAM Tirtanadi is under the Provincial Government and not under the municipal government as in other areas, and is also responsible for installations outside of Medan.

History
The installation of Medan was handed over from Kimpraswil to PDAM Tirtanadi in 2000. Also the treatment facility in Parapat was handed over in 2000, from the central government to the Governor of North Sumatera, and subsequently to PDAM Tirtanadi

Legal Regulations and Enforcement
The fees charged are based on Governor Decree No. 539/1023/2002 dated 23.December 2002 and PDAM Tirtanadi Director Decree No SK 151/KPTS/2002 dated 25. November 2002.

In SK Walikota Medan No 660.1/227/SK/1996, Perda 42/2001 Kabupaten Simalungun (Parapat), and Perda Kabupaten Toba Samosir No 10/2003 is determined that all houses, offices, plaza, restaurants, hotels, and others which discharge wastewater have to be connected to existing sewer.

Relation with Stakeholder
The municipality does not provide adequate support PDAM with regard to their wastewater operation. Department of environment does never checks the operation and efficiency of the treatment plants and also no law enforcement is carried out. Willingness to pay by customers is considered by PDAM as sufficient, but the public awareness with regard to sanitation and hygiene improvements is still low.

Coverage & Connections
Medan
About 10,000 customers are connected to the sewer system, which is about 2% of the population of Medan. Plant and sewer are designed for 60,000m3/day or 30,000 customers. Currently 16,000m³/day wastewater is treated or 27% of the capacity. This means that only 33% of the sewer system is used and 67% is idle.

The sewer is covering an area of 520 Ha which is also about 2% of the city area. PDAM has around 300,000 customers for clean water and only 3% of these customers discharge their wastewater to the sewer.

Parapat
159 customers are connected to the system, divided into three regions. Each region is connected to a pump station.
The capacity of the sewer system is 760 customers. Therefore only about 20% of the capacity is used. The capacity of the plant is 2,000m³/day, out of which 100m³/d or 5% is used.

Collection system
The bill is included in the water bill and collected together. Only a few customers do not get water from PDAM and are billed separately and as a result of this do not pay the bills. No serious follow-up is made for non water supply customers

4. MANAGEMENT ASPECTS

Strategic management / Business plan
Wastewater treatment is not discussed in the business plan 2000 to 2005. Within the PDAM operation wastewater is only their second priority, but it is mentioned in vision and mission.

PDAM has sufficient capacity to treat wastewater based on existing sewer and treatment installation, but the current efforts of the PDAM do not reflect their overall vision to become the best wastewater treatment operator in Indonesia. Improvements are possible to connect more customers and increase efficiency.

Quality management system
Despite having implemented quality management system ISO 9001 in water production and ISO 17025 in the water supply laboratory the wastewater treatment department does not have much of a quality management system. No work instructions are used and almost no maintenance carried out in Parapat sewer. Some recording is available. The process of UASB is not controlled.

HRD / Employees
One Kabag and one assistant are responsible for the installations in Medan and Parapat. 9 operators (8 civil servants and 1 daily worker) work in three shifts in Medan installation. In

Parapat 4 people work at the pump stations and three for pipe maintenance. One is operating the treatment plant.

Job descriptions are available for management positions only.
Employee performance is evaluated on a yearly basis. The evaluation is not based on concrete targets to be achieved. The result of the evaluation has only impact on promotion, but has no relation to incentives. Employee satisfaction is not measured.

Training measures are proposed by department heads, but not always approved and implemented. For 2005 a total PDAM staff training budget of Rupiah 1 billion was approved but later reduced to Rupiah 0.6 billion. No training for the treatment plant operators was planned, but some training for the sewer system operators.

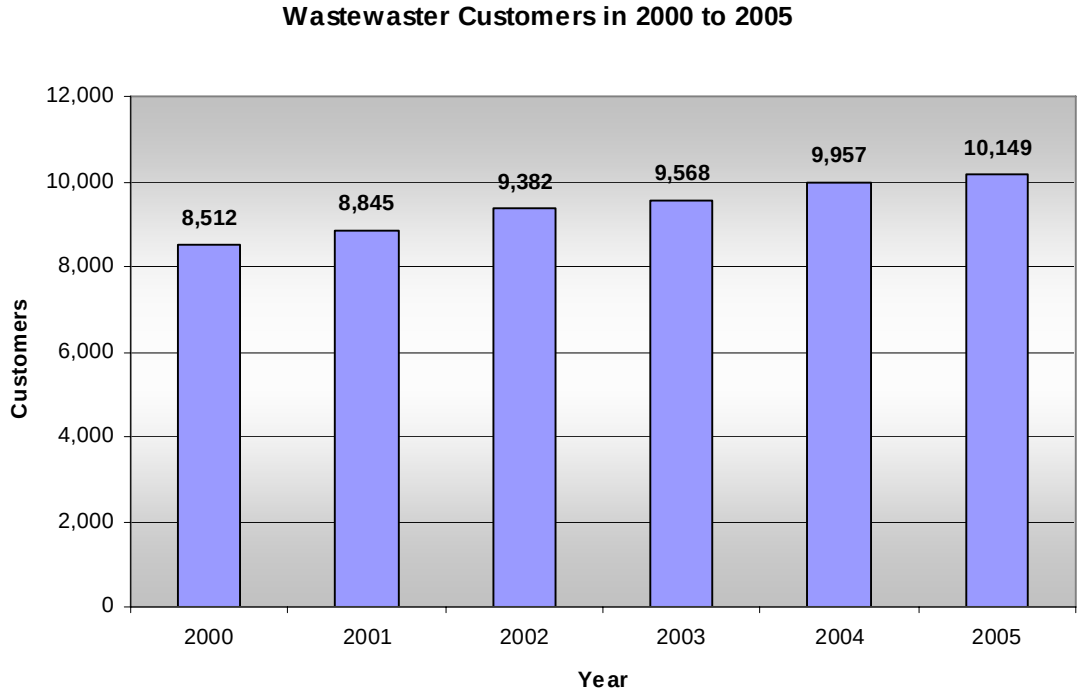
As an incentive the employees receive 18 salaries per year. For hospitalization PDAM covers all cost up to a certain plafond for the employee, wife and two children. The plafond is quite high with Rp300 million per person per year for a department head as example.

60% of the profit is distributed to the employees in certain kinds. 5% is distributed direct to the employees in cash.

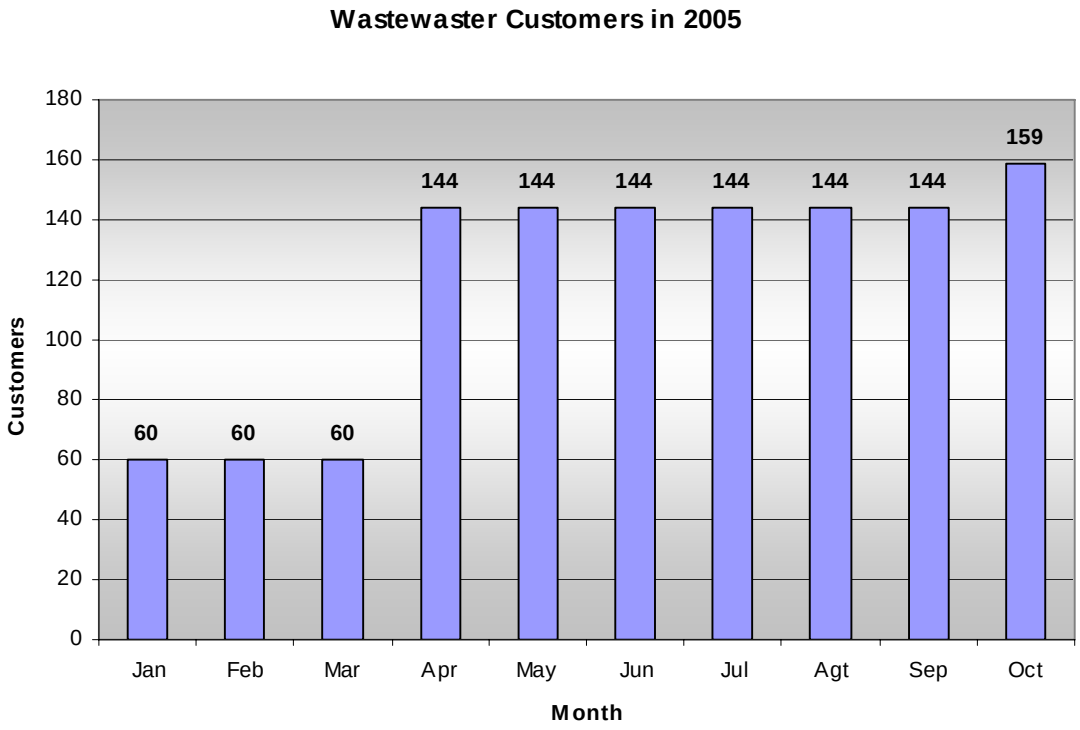
Customer Relation & Marketing

Only few new customers are connecting to the sewer in the last years (see graphics below).

Graphic Customer – PDAM Tirtanadi



Graphic Customer – PDAM Tirta Nadi – Kota Parapat



In 2004 only 19 houses had been connected in Prapat. In March/April 2005 an environmental campaign was conducted to increase the number of connections (free wastewater connection fee). Customer satisfaction survey has been conducted together with clean water service. The satisfaction was rated as fair. A brochure is available as marketing tool. Marketing is conducted by the 4 branches.

5. FINANCIAL ASPECTS

5.1 KOTA MEDAN

Investment and Source of Funds

The sanitation system was built during the period 1991-1995. The first constructions were the sewer and house connections lateral spread in zone 1 to 6. The sewer was designed to serve 16,000 connections. Unfortunately, records of total investment for zone 1,2 and 3 cannot be located yet, while for zone 4,5 and 6 total investment was Rp4.9 billion and US$264,460.59, financed 78% by ADB loan and 22% by GoI/MoF under MUDP Project. The second was construction of the plant in 1995 located in Cemara, with total investment of around Rp 4 billion financed by the same donor.

Table below shows the breakdown of the investment.

Description	Source of fund	Amount
Sewer, zone 4,5,6 (1991-1993)	ADB Loan 919-INO (78%)	Rp 3,707,241,591.40
		US$ 264,460.59
	GOI (22%)	Rp 1,182,507,531.36
	Total	Rp 4,889,749,050.76 US$ 264,460.59
WWTP Cemara (1993-1995)	ADB Loan 919-INO (78%)	Rp 3,092,789,700,00
	GOI (22%)	Rp 872,325,300.00
	Total Investment	Rp 3,965,115,000,00

Investment Plan

PDAM has prepared some investment programs for the period of 2006-2010 but when this comparative study was done the cost estimate was not yet made. The following is overview of planned programs of wastewater division:

Sanitation Service and Development Program

1. Tariff adjustment
2. Procurement of equipment to analyse COD + refrigerator
3. Rehabilitation of some infrastructure and facilities
4. Washing off Aerator and Facultative ponds
5. Procurement of 4 units of aerator
6. Procurement of some submersible and vertical pumps
7. Improvement of the laboratory

Outstanding Loans and Debt Service Coverage

The investment was financed through a grant from Central Government to the Local Government. There are some small portions of loan for wastewater investment but PDAM does not maintain separate record for it. Most of loan portion is for the water supply system.

Tariff, Revenue and Subsidy

The tariff for waste water is stipulated in 2002 as mentioned in Governor Decree No. 539/1023/2002 dated 23 December 2002 and PDAM Tirtanadi Directors SK No. 151/KPTS/2002 dated 25 November 2002. Tariff is applied per square meter of the building and is classified into 2 (two) classes. Class A is to customers who have water consumption less than 30m^3 per month and class B for more than 30 m^3 per month. There has never been any tariff adjustment since then. This tariff rate is too low to support the operation and maintenance needs and therefore need to be subsidized, either by local government or by water division.

Waste Water Tariff

Governor Decree No. 539/1023/2002 dated 23 December 2002 and

PDAM Tirtanadi Directors SK No. 151/KPTS/2002 dated 25 November 2002

Tariff Classification		A Class *) Rp/m^2	B Class **) Rp/m^2
A	Social		
1	General Social - S1	25	25
2	Special Social - S2	35	55
B	Non Commercial		
1	Household A - NA1	45	65
2	Household B - NA2	55	75
3	Household C - NA3	65	80
4	Household D - NA4	70	85
5	Embassy/Consult - NA5	80	100
6	Gov't Institution	55	95
C	Commercial		
1	Small Commercial - N1	140	140
2	Large Commercial - N2	175	175
D	Industry		
1	Small Industry - IN1	170	140
2	Large Industry - IN2	175	175
E	Special Commercial	575	170

Note: *) for water consumption < 30m^3/month
**) for water consumption < 30m^3/month

With such a tariff structure the mean monthly bill of a customer in 2004 is Rp.15,000 (see table below).

Cost Recovery

Expectedly, which such low tariff, the revenue can not cover the whole operation and maintenance cost, as shown in table of financial statement below.

The cost recovery is low, ranging between 28% and 60% from 2000 to 2005. PDAM has planned a tariff increase petition scheduled to be effective in 2006, but whether it will be followed by increase in waste water tariff is not clear.

Even without the depreciation cost, the existing tariff is not sufficient to cover the O&M cost. Operating ratio is still 108%, meaning the O&M cost is 8% higher than the tariff revenue. But with the existing tariff PDAM can almost cover the current O&M cost. Although it must be considered that sufficient O&M would require more budget.

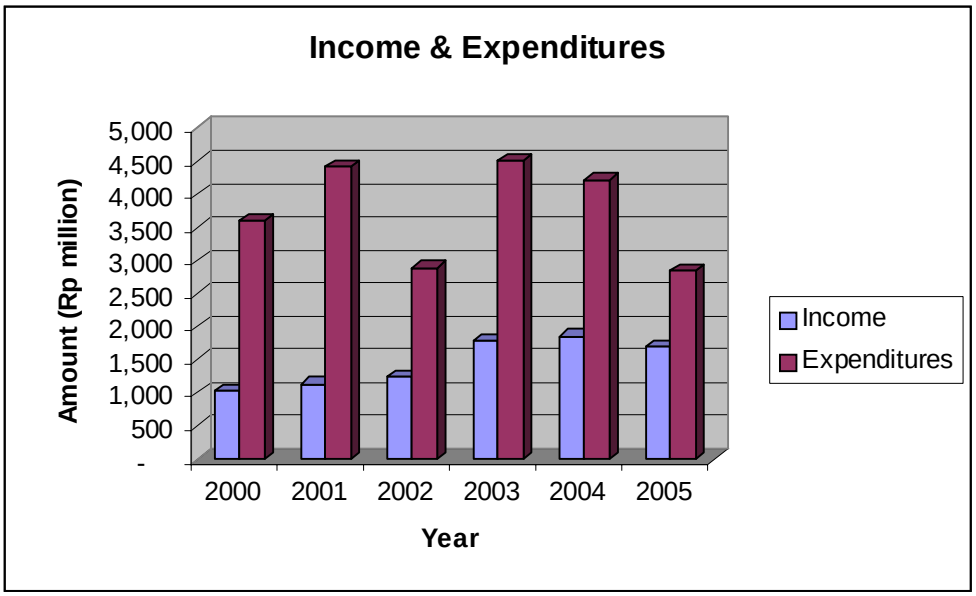
Medan Waste Water

Description	2000	2001	2002	2003	2004	2005 July
Operating Income:						
Waste Water Retribution	1,024	1,137	1,255	1,785	1,866	994
Operating Expenditures						
Personnel	582	714	740	914	894	287
Electricity	-	-	492	181	630	203
Maintenance	401	647	465	553	435	117
General & Adm.	271	342	31	429	47	106
Depreciation	2,364	2,728	1,168	2,426	2,219	950
Other						
Total	3,618	4,431	2,895	4,503	4,226	1,665
Net Income	(2,594)	(3,294)	(1,641)	(2,717)	(2,359)	(670)
No of connections *)	8,512	8,845	9,363	9,548	9,897	9,999
Cost Recovery	28%	26%	43%	40%	44%	60%
Operating Ratio	353%	390%	231%	252%	226%	167%
Tariff/Connection	10,024	10,716	11,166	15,582	15,715	8,285
Cost/Connection	35,419	41,749	25,771	39,299	35,580	13,873

*) Excl. Parapat

(All values in billion Rupiahs)

The financial performance of the waste water management is shown in chart as follows:



Collection Efficiency

Almost all of the wastewater customers are connected to the piped water system (except 1%). The waste water bill is combined with the water bill that ensures the collection efficiency of waste water bill. PDAM is using a third party service to collect the bills. The requirement is that a collection efficieny below 85% will not be paid. This encourages the collection efficiency to reach 97%.

Operation and Maintenance Expenditures

There is no separation into cost centres in the waste water division. The personnel cost is always the highest, followed by electricity expenditures. The costs are fluctuating (see chart) from year to year probably related to the operational practice or the way PDAM records the transaction in their bookkeeping.

Accounting System

PDAM has established a rreasonable complete computerized accounting system for the wastewater division. The system generates separate records and financial statement for the wastewater activities.

5.2 KOTA PARAPAT

Investment and Source of Funds

Project wastewater treatment facility in Parapat – Ajibata began in year 1994/1995 with funding by the central government. Operation started in 2000 with 16 connections. Current number of connections based on monthly report (October 2005) is 159 connections. The detailed connection distribution is presented in the table below:

Number of Connections

No.	Category of connections	Total
1	General – Social	3
2	Special – Social	3
3	Household – B	130
4	Household – D	2
5	Small – Commercial	6
6	Large – Commercial	15
	Total	159

There is no record about project investment cost.

Investment Plan

An investment plan is established for expansion to serve all Parapat area but right now, they are only focusing on rehabilitation and optimization of the number of connection.

Outstanding Loan and Debt Service Coverage

There is no loan because as mentioned above all investment is funded by central government as a grant.

Tariff, Revenue and Subsidy

The same tariff structure is applied to wastewater system in kota Parapat.

The revenue of wastewater in Parapat is only 5.7 million rupiahs as of 2004, while the operational cost of IPAL Parapat is 369.9 million rupiahs. There is a huge shortfall that needs to be subsidized by revenue from water supply.

Collection Efficiency

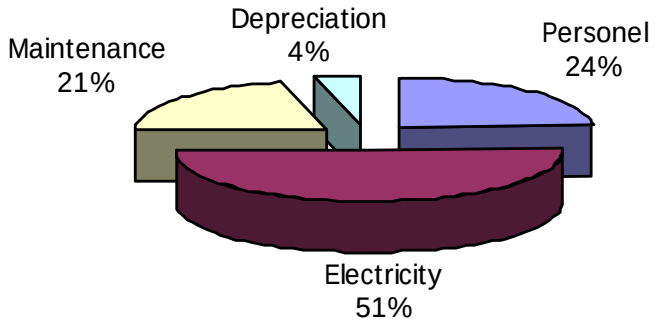
The wastewater bill is included in the water bill and the fee is collected together with the water bill. The collection efficiency is 85%.

Operation and maintenance cost
Table and figure below show the operational and maintenance cost.

Operation and Maintenance Cost

Description	Rp. 000	%
Personel	88,477.9	23.92
Electricity	189,142.7	51.13
Maintenance	77,735.0	21.01
Depreciation	14,570.9	3.94
Total	369,926.6	

Composition of Operation and Maintenance Cost



Information obtained from PDAM staff in charge of the wastewater installation, the ideal operational cost should be around one billion rupiahs per year, meaning that the current operational costs are around 30% of ideal operational cost.

6. TECHNICAL ASPECTS

6.1. TREATMENT SYSTEMS USED

6.1.1. Medan

The plant was designed for the treatment of 60,000m³/day.
After two screens, a coarse one and a fine one, the wastewater flows through a grit chamber. The fine screen and the grit chamber are equipped with automatic cleaners.

In an Upflow Anaerobic Sludge Blanket (UASB) reactor the wastewater is treated an-aerobically. The UASB has no return system and also no pH adjustment system as usually designed. After the UASB the wastewater flows into a facultative lagoon. At the influent point the lagoon is equipped with two aerators, probably to aerate immediately the anaerobe effluent of the UASB. The aerators are operated for only 4-5 hours each day to reduce energy cost. The aeration time is not based on technical needs.

The effluent is discharged into river Kera.

Sludge from the UASB is daily discharged, but only to keep the pumps running everyday. There are sludge drying beds but they are completely flooded. No control exists to discharge the sludge.

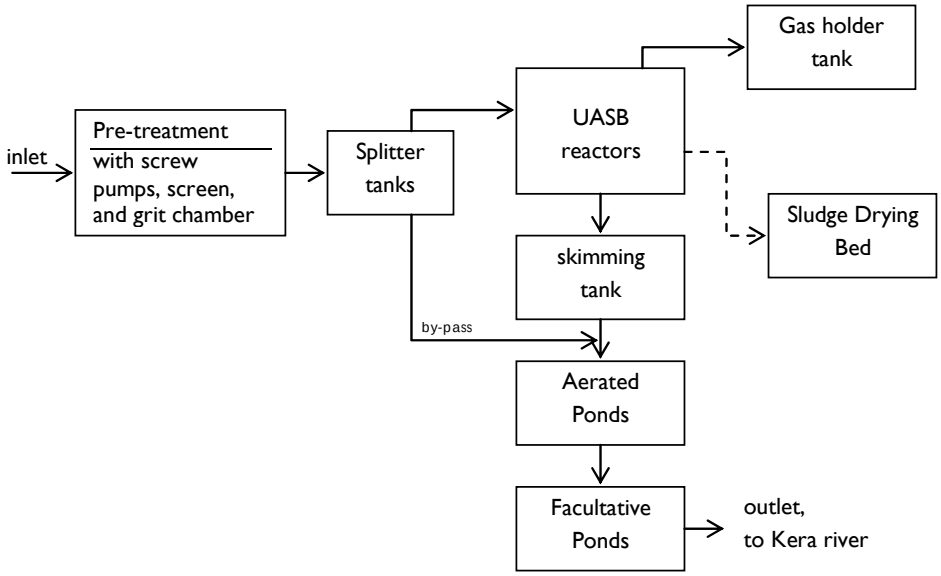
Maintenance of building and landscape is good.

Capacity used
16,000m³ or 10,000 connections are served. This is about 27% of the capacity planned.

Performance
The COD and BOD reduction is low in the UASB with only about 4-9%. Well functioning plants can achieve a reduction up to 80%. In the lagoon COD and BOD is reduced by 40-50%. The effluent COD is in the range of 50 to 75mg/l and the BOD between 40 and 55mg/l.

The WWTP in Medan is called WWTP Pulau Brayan Bengkel and has an anaerobic UASB and aerobic system.

The process diagram of the WWTP Medan as follows:



Monitoring
BOD, COD, pH, TSS, TDS, DO, Oil & Grease are measured every two weeks in the PDAM water laboratory. Samples are taken at four points: one from the influent, one from a compartment of the UASB at a depth of about one meter, one from within the aeration pond (after the aerators) and one at the effluent point.

Although the sampling point in UASB is not exactly the effluent of the UASB, the results can be used for a rough calculation of the UASB performance.

Debit cannot be recorded because no flow meter is installed. Pump hours are recorded and flow could be calculated by using a factor for the debit of the pumps.

Three wells are installed to monitor ground water pollution. But no serious evaluation of the well monitoring is conducted.

Sewerage system
130 Km sewer is installed according to the project files. But data are incomplete and the exact length of the sewer is not known. Many pipes recorded in the as-built-drawing do not exist.

Pipes used are between 100 and 1,300 mm made of PVC or HDPE.

5 pumps stations are used to pump the wastewater to the treatment plant.

Capacity Sewerage system
The data of the sewer system are not complete.

Maintenance
The sewer is cleaned in breakdown modus and not on a preventive maintenance plan. Although a preventive maintenance plan exists the activities cannot be carried out because of lack of staff.

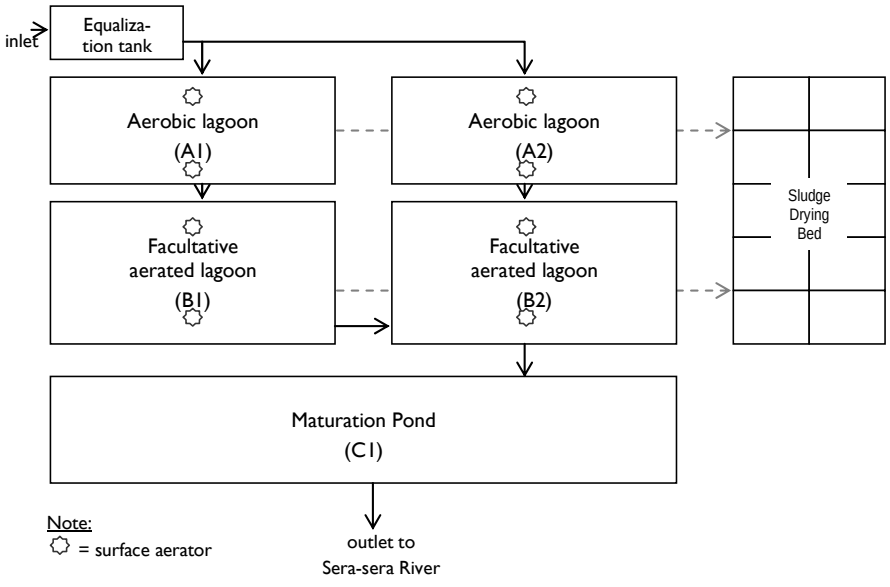
Two people died during maintenance activities in the sewer. Lack of oxygen was diagnosed as reason. PDAM should evaluate carefully the cause and find improvements for working in the sewer. This should be implemented through appropriate training and documented work instructions.

6.1.2. Parapat

The treatment consists of 5 lagoons. The influent goes into two parallel aerated lagoons (A1 and A2) with HRT design of 7 days. Then the flow proceeds from A1 to a facultative aerated lagoon (B1) and from there to another facultative lagoon (B2). The lagoons have a design HRT of 7 days. The wastewater from A2 goes directly to B2. From B2 the wastewater flows to a maturation pond with HRT design 4 days for final treatment.

It is not clear, why the facultative lagoons are not parallel. With the design implemented the treatment is not equal for the streams A1-B2-C1 and A2-B1-B2-C1.

The layout of WWTP Parapat is as follows:



Capacity used
Only about 5% of the design capacity of the plant is used. There is much spare for additional connections.

Performance of treatment
In accordance to the analytical results dated 14.4.2004 COD is reduced by 82% from 350 to 60mg/l and BOD is reduced by 85% from 200 to 30mg/l. These are quite good results, but probably also related to the small BOD load of the plant.

The lagoons are aerated for about one hour a day. Because of the low BOD load it could be considered to stop aerating and to change the operation to a facultative aeration pond.

Monitoring
No monitoring is conducted in Parapat. The last water analysis is dated 14.4.2004. Temperature, pH, TSS, TDS, TS, COD, BOD, DO, conductivity, and alkalinity were measured. No records available in the plant but all send to office Medan.

Maintenance
Maintenance of the plant building and landscape is fine. But no maintenance exists for mechanical equipment.

Sewerage system
In Parapat around 7.5 Km sewer are installed. Three sequential pump stations deliver the wastewater to the sewer.

Capacity Sewerage system
The sewer is still not used for the full capacity of 760 connections or 2000m^3/day. But only 150 customers are connected to the sewer. Therefore there is still much idle capacity as it is for the treatment plant.

Maintenance
Pipes are broken in many locations but not repaired. One collection tank of a pump station is leaking and not repaired. After pumping, water of the Toba Lake leaks into the tank. Therefore also wastewater could leak into the Toba Lake. At another place the pipe is broken close to the water intake of a hotel in the lake.

Laboratory
The laboratory used for both installations is the clean water lab of PDAM, which is ISO 17025 certified and makes a very good impression. For all processes procedures are developed and records are implemented. All samples are analyzed there. The use of this qualified lab seems to be the better solution than to analyze in Parapat, although the transport of the samples is quite far. But it will be much effort to conduct qualified analysis in Parapat.

7. PHOTOS

7.1. WWTP of Medan


Photo by: Edzard Ruehe
Date: November,29 '05
Location: WWTP Pulau Brayan Bengkel (Cemara) – Medan
Remarks: (Left picture) equalization tank
(Right picture) screw pump, two hole (on the right) to increase capacity (expansions)



Photo by: Oni Hartono
Date: November,29 '05
Location: WWTP Pulau Brayan Bengkel (Cemara) – Medan
Remarks: (From left) bar screen ; garbage cleaning with mechanical screen ; fine screen

Photo by: Edzard Ruehe
Date: November,29 '05
Location: WWTP Pulau Brayan Bengkel (Cemara) – Medan
Remarks: Pre-treatment (grit chamber) with mechanical remover of grit (left picture).

Photo by: Edzard Ruehe
Date: November,29 '05
Location: WWTP Pulau Brayan Bengkel (Cemara) – Medan
Remarks: Situation of WWTP Pulau Brayan Bengkel (Cemara) – Medan

Photo by: Oni Hartono
Date: November,29 '05
Location: WWTP Pulau Brayan Bengkel (Cemara) – Medan
Remarks: (From left): UASB left part ; UASB right part ; outlet from UASB

Photo by: Edzard Ruehe
Date: November,29 '05
Location: WWTP Pulau Brayan Bengkel (Cemara) – Medan
Remarks: (From left): Gas storage from UASB ; Aerated Pond ; Outlet (overflow) to Kera river

Photo by: Oni Hartono
Date: November,29 '05
Location: WWTP Pulau Brayan Bengkel (Cemara) – Medan
Remarks: (From left): Sludge Drying Bed

7.2. WWTP of Parapat

Photo by: Oni Hartono
Date: December,05 '05
Location: WWTP Parapat - Ajibata
Remarks: Situation of WWTP Parapat - Ajibata



Photo by: Edzard Ruehe
Date: December,05 '05
Location: WWTP Parapat - Ajibata
Remarks: (From left): aerated pond ; sludge drying bed ; outlet to Sera-sera river


Photo by: Edzard Ruehe
Date: December,05 '05
Location: Parapat
Remarks: (Left): sewerage pipe line
(right): pipe bed is used by boats.

8. DATASHEET

	Medan - PDAM				Medan - Parapat			
General								
Population	1,979,340				16,562			
Area (Ha)	26,510				500			
Houses	400,164				3,312			
PDAM Customer	308,213				2,515			
Connections (wastewater)	10,149				159			
Coverage population (%)	2.5				5			
Coverage area (Ha)	642				5			
Coverage area (%)	2				1			
Coverage PDAM customer (%)	77				76			
WW customer connected to piped water (%)	99				80			
Capacity of system (connections)	36,000				2,025			
No People per houses (person/houses)	5				5			
Water consumption (m³/conn./month)	40				24			
WWTP Capacity used (%) (based on connections)	28				8			
Technical								
Wastewater System	**IPAL Cemara**				**IPAL - Parapat Ajibata**			
Sewer System								
Length of Sewerage System (km)	130				7			
Capacity of sewer (installed):								
- m³/day	18,490							
- for house connection					760			
Capacity of sewer (used):								
- m³/day	16,000							
- house connection					159			
Capacity used in %	87				21			
WWTP								
Q (design) m³/day	60,000				2,000			
Q (production or used) m³/day	16,000				100			
Capacity used %	27				5			
Unit Process	**Pre-Treatment**	**UASB Reactors**	**Aerated Ponds**	**Facultative Ponds**	**Pre-Treatment**	**Aerated Ponds**	**Facultative Ponds**	**Maturation Ponds**
COD in (mg/L)	260				350			
COD out (mg/L)		250	160	155				60
Removal %		**4**	**36**	**3**				**83**
BOD in (mg/L)	175				200			
BOD out (mg/L)		160	82	80				30
Removal %		**9**	**49**	**2**				**85**
SS in (mg/L)	220				51			
SS out (mg/L)		155	133	88				19
Coliform in (MPN/100 ml)								
Total Coliform out (MPN/100ml)								
Treatment Systems	**Anaerobic and Aerobic Systems**				**Aerated Systems**			
V tanks (m³)	1,005	3,000	155,000	465,000		11,200	12,600	1,600
A tanks (m²)	335	658	77,500	232,500		1,600	1,800	800
depth (m)	3	5	2	2		7	7	2
HRT design (day)	0.02	0.1	3	8		6	6	1
HRT actual (day)	0.1	0.2	10	29		112.0	126.0	16.0

Financial (based on 2004)		
Initial Investment		
Investment Treatment System (million)	Rp 3,965,115,000,00	NA
Investment Sewerage System (million)	Rp 4,889,749,050.76 + US$ 264,460.59	NA
Investment Pumps (million)	NA	NA
Financing Source (APBN/APBD Prov/APBD LG/Donor)	APBN/Donor (ADB Loan 919-INO)	
Loan / Grant	Grant	Grant
Debt service	-	0
Interest	-	0
Loan Period	-	0
Grace Period	-	0
Subsequent Investment	NA	NA
Investment Treatment System (million)	NA	NA
Investment Sewerage System (million)	NA	NA
Investment Pumps (million)	NA	NA
Financing Source (APBN/APBD Prov/APBD LG/Donor)	NA	NA
Loan / Grant	NA	NA
Debt service	-	0
Interest	-	0
Loan Period	-	0
Grace Period	-	0
Average Tariff (per conn)	15,715	35,911.95
Connection Fee	#REF!	0
Tariff Revenue (Rp million/year)	1,866,429,663	5,710,000.00
Total Revenue (Rp million/year)	1,866,429,663	5,710,000.00
O&M Subsidy (Rp million/year)	0	0.00
Billed (Rp million/year)	1,866,429,663	5,710,000.00
Collected Bills (Rp million/year)	1,810,436,773	4,853,500.00
Collection efficiency (%)	97%	85%
O + M Cost (Rp/year)	**2,006,511,369**	**355,355,615**
Personnel	893,864,375	88,477,900.00
Energy	630,123,765	189,142,735.00
Chemicals	0	0.00
Administration (incl. Deprec. Office)	47,447,134	0.00
Maintenance	435,076,095	77,734,980.00
Depreciation (Rp/year)	2,219,149,515	14,570,944.16
Other	0	0.00
Total Cost incl. depr+interest (Rp/year)	**4,225,660,884**	**369,926,559**
Cost of New Connection	#REF!	0
Investment/m3 used	133	NA
Investment/m3 designed	35	NA
Investment/connection used	1,133,064	NA
Investment/connection designed	319,430	NA
Total Cost/m3 used	734	10,276
Total Cost/conn.	416,362	2,326,582
O + M Cost /m3 used	348	9,871
O + M Cost /conn.	197,705	2,234,941
Operating Ratio %	2	1.61%
Cost Recovery % (Total)	0	1.54%
Mean monthly fee per Connection	#REF!	0
O&M cost sewer	NA	NA
O&M cost installation	NA	NA
O&M cost sewer/connection	NA	NA
O&M cost sewer/Km	NA	NA
O&M cost installation/connection	NA	NA
O&M cost installation/m^3	NA	NA

APPENDIX 7: SUMMARY OF WASTEWATER TREATMENT PLENT PDAM SURAKARTA

SUMMARY OF WASTEWATER TREATMENT PLANT PDAM SURAKARTA

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Two installations are established; one of the plants does not function. Only 15% of the customers pay for the service.

Strength

- Plant Mojosongo available for 5000 HC
- Sewer network for 10,000 HC available but only 4,500 houses currently connected. Additional 500 houses can easily get connected. For another 5000 sewer available but a new plant has to be built.
- Sewer for additional 19, 000 HC available in the South (Semanggi) (with investment of another 6 Km lateral pipes)
- Independent from Mayor

Weaknesses

- Currently no cost recovery
- Tariff too low for cost recovery
- Bill collecting system not effective (collection efficiency 15%)
- Accounting system not fully separated from water accounting system
- Installation Semanggi technically not appropriate
- Additional plant has to be built in Semanggi for additional 19,000 HC. With the space available only possible with activated sludge, RBC, or UASB
- In general no control of WWTP by means of written procedures, monitoring, evaluation, corrective action
- Operator skill not sufficient
- No preventive maintenance of sewer system
- No preventive maintenance of WWTP

Opportunities

- Sewer available for additional customers
- Support from central government
- Have good relationship to local government to receive subsidies for WWTP
- In new proposed PERDA connection to sewer will be compulsory

Threats

- It is not clear how WWTP PDAM can achieve cost recovery in the near future
- Awareness of people regarding sanitation is not high

Recommendations

1. Revenue has to be increased by increased fees and increased billing efficiency
2. Accounting system for wastewater has to be developed
3. Campaigns should be conducted to increase awareness of community and to increase number of customer
4. Re-design of IPAL Semanggi

5. Design of activated sludge system in Semanggi, improvement of grit chamber for easy maintenance, improvement of equalization tank (use as sedimentation tank with sludge removal), drying beds, flow meter, treatability study to check for problems with industrial waste.
6. Study what treatment plant should be built in addition to existing one in Semanggi for more customers (activated sludge, RBC, UASB, aerated lagoon, lagoon, etc.)
7. Implement O&M system in both plants including: measurement of flow, measurements of process and water parameters like COD, BOD, SS, P, NH4, NO3, after each treatment step as appropriate. Measurements of process parameters like DO, MLSS, etc.). Preventive maintenance of pumps and aerators and other equipment, cleaning, preventive maintenance plan. Develop SOPs. O&M training for Semanggi should only be provided after re-design of the plant
8. Consider to implement a quality management system (ISO 9001 or lower, FORKAMI certification of laboratory)
9. Measurements in own laboratory as far as feasible
10. Training for all technical staff involved
11. Develop preventive maintenance for sewer system
12. Probably more staff is needed in WW department especially for maintenance of sewer system
13. Consider to exchange aerators in Mojosongo with heavy duty aerators if the existing aerators break down

2. GENERAL DATA

Province
Central Java

District/Municipal
City Surakarta

Topography
In general flat, divided by river Kali Sodetan in a northern and southern part.

Area
4 404 Ha

Population (2005)
556 000

Water supply situation
PDAM has 54,000 water connections and covers almost 50% of all households.

3. INSTITUTIONAL ASPECTS

Owner and Operator
Owner of PDAM is the Mayor and the installations are operated by PDAM Surakarta. Reportedly the mayor does not interfere into the internal decisions of PDAM. The owner increases its capital each year by about Rp 2 billion for additional 1000 new connections.

History
Existing sewer system from Dutch period. In 1982 Surakarta implemented project SUDP with a target of 54,000 new house connections for drinking water and 10,700 connections for wastewater until year 2000. In 1998 PDAM was established as operator for wastewater treatment in Struktur Organisasi dan Tata Kerja (SOT). In Perda 3/1999 the role of PDAM as operator of the wastewater treatment has been defined. PDAM Solo has good relationships with the central government which pays every year for O&M cost (see below).

Scope of work of PDAM now is to treat wastewater and septic tank sludge.

Coverage & Connections
The sewer system is covering about 9% of Solo area and also 9% of the population. Only 17% of these customers receive also water from PDAM.

Relation with Local Government
In Perda no 3 1999 the responsibilities of PDAM as wastewater treatment operator are determined as the procedure of tariff setting. A new Perda is proposed which makes the connection to the sewer system compulsory.
An agreement exists that all decisions about investments below Rp 25 billion are proposed by PDAM and agreed by the Mayor. DPR is informed about the investment.

In Peraturan Propinsi 10/2004 thresholds are defined for BOD (50mg/l) and COD (150mg/l).

Billing system
Previously billing efficiency has been only 10%. Currently a new billing approach with door-to-door approach is conducted leading to a billing efficiency of 15%. Cooperation with Lurah (local village chief) has been established to increase the billing efficiency. A general problem in the billing, that only about 17% of the customers are receiving water from PDAM and are billed for that. In these cases the bill is combined, but for 83% of the customers the wastewater bill is separate and enforcement of the payment is difficult.

4. MANAGEMENT ASPECTS

Strategic management / Business plan
A business plan is developed for the timeframe 2005 – 2010 for whole PDAM. The plan includes also the wastewater departments. In accordance to the Balanced Score Card model a SWOT analysis has been conducted and targets for corporate and wastewater department have been set based on mission and vision. Nevertheless the related programs are not clearly defined and the necessary budget is not secured (central government).

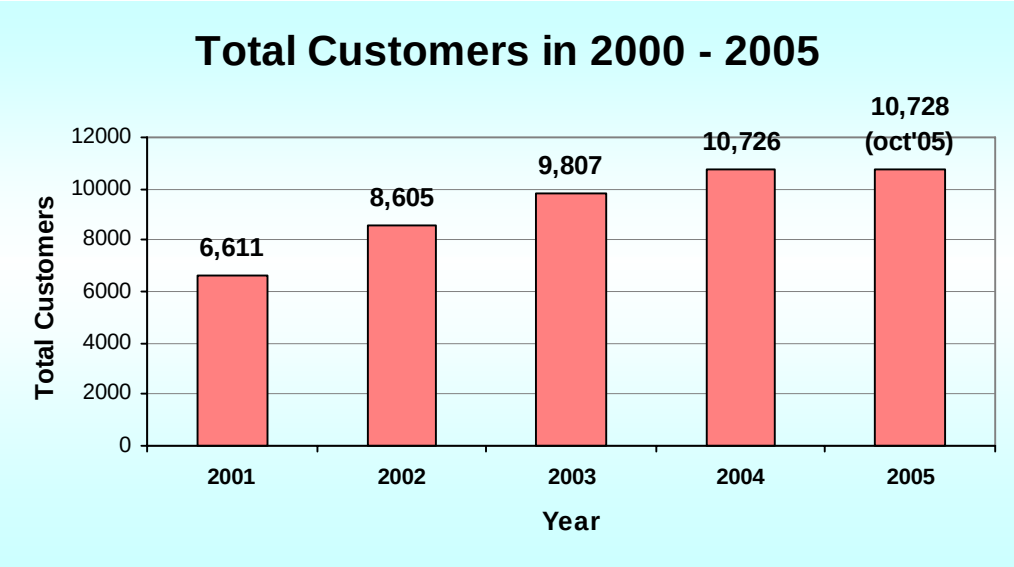
Quality management system
The wastewater unit is direct under the managing director, not under the technical director. No procedures, SOPs, work instructions are in place. Almost no records are available and no monitoring is carried out. The general impression is that the processes are not controlled.

HRD / Employees

Job descriptions have been defined in SK direksi PDAM 800/1637.1/PDAM, 22.12.2004. 17 employees of PDAM work exclusively for wastewater treatment and collection. 14 of them are in the technical and 3 are administrative staff.
An incentive of Rupiah 175,000 monthly is paid as lump sum for overtime for people in the field.

Customers

Most of the customers belong to the lower income class. Currently 10,738 connections or 10 % of the population of Solo is serviced in regard to wastewater treatment. In the graphic below the increase from 2001 until 2005 with an average of about 1000 connection per year is shown.



Marketing

Currently new connections are promoted with zero connection fees. PDAM bears all cost (on average Rp 2,000,000 per connection) for the complete connection into the house.

PDAM has developed a brochure based on comic to increase the awareness of the people regarding health and sanitation.

5. FINANCIAL ASPECTS

Investment and Source of Funds

The sanitation system was built during the period 1995-2001, for around Rp41 billion, financed by aWorld Bank loan, which was on-granted to the Local Government by GoI/MoF, APBN and APBD under SSUDP Project. The investment was used to build two (2) treatment plants in Semanggi and Mojosongo and the sewerage system, as shown in table below. The assets were transferred to PDAM in October 24, 2001.

Description	Source of fund	Amount (Rp)
WWTP Semanggi	World Bank Loan 3749-IND	18,213,000,000
	APBN 2002	3,020,191,900
	APBD	8,579,000,000
	Total	29,812,191,900
WWTP Mojosongo	World Bank Loan 3749-IND	10,981,000,000
	Total Investment	40,793,191,900

Subsequent investment was made in 2003 for equipment, office equipment, and sewer at the amount of Rp0.55 billion, and at Rp1.8 billion in 2004, financed either through APBN or APBD.

Investment Plan

For 2006 PDAM plans to install an additional 800 connections in Northern and Southern area, with an approximate cost of Rp2 billion. PDAM has set a coverage service target of 22% for 2010, increasing by 12% from present coverage of 10%. To achieve this target PDAM needs approximately Rp55.3 billion to invest on new connection for 15,000 more households, improvement of the existing treatment plant and rehabilitation secondary and tertiary pipes. The financing source is expected to come from central and local government, grant or loan from donors.

SANITATION SERVICE AND DEVELOPMENT PROGRAM

No	Description	Amount (Rp million)
I	Year 2006	
1	Connections (Pipes & Accessories)	8.40
2	Material (Pipes & Accessories)	1,116.01
3	Connections (Pipes & Accessories)	635.04
4	Installation	58.37
	Total	1,817.82
II	Year 2006-2010	
1	15,000 units of new household connections	37,690.00
2	Improvement of Semanggi WWTP	7,000.00
3	Improvement of Mojosongo WWTP	4,000.00
4	Addition of 6 km secondary pipes	6,200.00
5	Pipes rehabilitation (Kasunanan and Mangkunegaran system)	448.00
	Total	55,338.00

Source: Service and Development Plan – Surakarta Sewerage 2006-2010

Outstanding Loans and Debt Service Coverage

PDAM has no outstanding debt. The investments were financed through a grant from Central Government to the Local Government.

Tariff, Revenue and Subsidy

The tariff for waste water has actually been set in 2002 as stipulated in SK Walikota No. 15 Year 2002 but implemented only in January 2003. However, this tariff rate at Rp7,500 per month for households – HOUSEHOLD II - was not accepted by the customers. Most of the customers included in this tariff classification refused to pay. PDAM had collected Rp609.4 million in that year but had to return it to the customers. PDAM finally managed to apply the tariff after revising the criteria of Household groups, as stipulated in SK Walikota No. 5 Year 2004 (see tariff structure below) in July 2004. The change is in the criteria of building space, from 21m^2 to 100m^2 for the benchmark, meaning HOUSEHOLD II pays lower tariff of Rp5,000. This tariff rate is obviously too low to support the operation and maintenance needs and therefore need to be subsidized, either by local government or by water division.

Waste water tariff structure

Tariff	Customers Classification	Tariff Rate	Change of criteria	
			SK Mayor No 15 Yr 2002	SK Mayor No 4 Yr 2004
A	HOUSEHOLDS I	5,000	Building space <21m^2	Building space <100m^2
B	HOUSEHOLDS II	7,500	Building space >21m^2	Building space >100m^2
C	COMMERCIAL I	20,000		
D	COMMERCIAL II	30,000		
E	BUSINESS I	50,000		
F	BUSINESS II	100,000		

Cost Recovery

Expectedly, which such low tariff, the revenue can not cover the whole operation and maintenance cost, as shown in table of financial statement below.

Description	2000	2001	2002	2003	2004	2005
						June
Operating Income			-	*	636.47	500.84
Operating Expenditures						
Personnel	58.45	80.90	83.11	176.60	230.54	213.42
Electricity	6.02	8.66	36.71	53.58	133.64	145.90
Chemical	-	-	-	-	5.78	-
Operation	9.48	11.84	14.37	27.26	28.95	24.45
Maintenance	-	24.47	17.68	21.32	29.67	34.39
General & Adm.	8.38	73.96	24.51	166.77	71.74	71.63
Allowance for Bad Debt	-	-	-	-	234.18	-
Depreciation	-	168.20	316.17	295.10	415.82	280.68
Other	-	-	-	-	26.87	-
Total Expenditure	82.32	368.03	492.54	740.62	1,177.18	770.46
Net Income	**(82.32)**	**368.03)**	**492.54)**	**740.62)**	**540.71)**	**(269.62)**
Cost Recovery					**54%**	**65%**
Operating Ratio					**185%**	**154%**

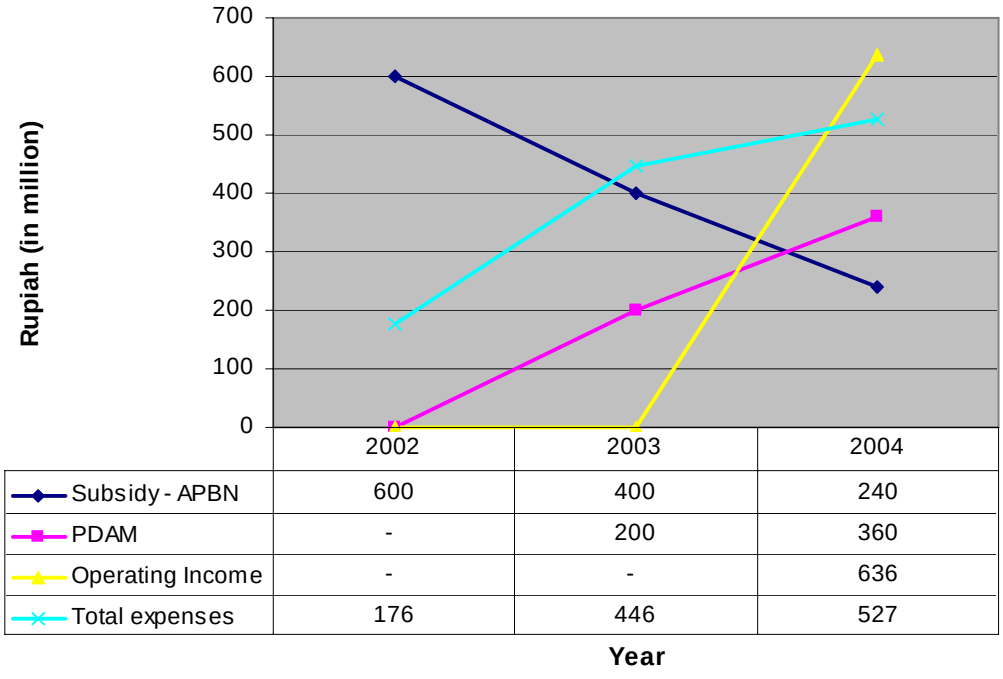
* PDAM had collected Rp 609.4 million in that year but had to return it to the customers.

Collection Efficiency

The collection efficiency is very low, less than 15%. This is also due to the fact that only 1,806 or 17%of the customers are PDAM customers. The rest have to be billed separately and collected through a door-to-door system. Some of the customers are reluctant to go to the payment point, that just for a very small amount they have to stand in a line or make some trip. PDAM has also signed MOU with several kecamatans (sub-districts) to coordinate the collection of the bills but has not shown any effective result so far.

Under consideration of 15% billing efficiency and subsidy by ABPN the cross surplus/subsidy of PDAM can be calculated. Almost every year (except 2002) PDAM had to cross subsidy the wastewater department.

Description (in million)	2000	2001	2002	2003	2004	2005 June
Operating Income			-		636.47	500.84
Collection efficiency 15%						
Collected bills					95.47	75.13
Subsidy - APBN			600.00	400.00	240.00	50.00
Total revenue			600.00	400.00	335.47	125.13
Operating Expenses	82.33	199.83	176.38	445.53	527.19	489.79
Surplus/deficit to be covered by PDAM	(82.33)	199.83)	423.62	(45.53)	(191.72)	(364.66)

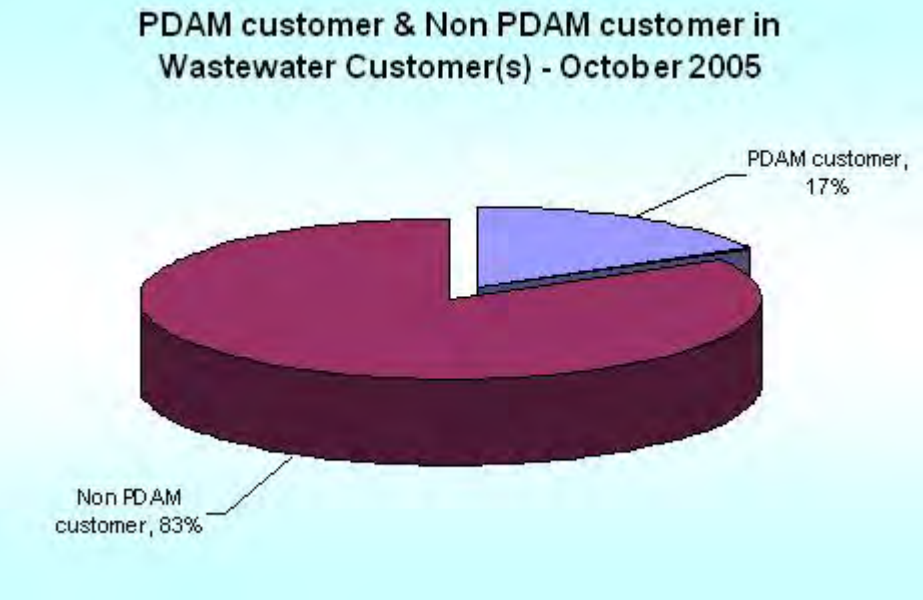


Operation and Maintenance Expenditures

There is no separation to cost centres in the waste water division. The personnel cost is always the highest. Electricity comes to second. The costs are quite fluctuating from year to year that related probably to the operational practice or to the way PDAM recording the transaction in their bookkeeping.

Accounting System

PDAM has not established a complete computerized accounting system for waste water division that it takes time to extract the financial data, especially expenses, of the waste water. This is due to the fact that most of the waste water customers do not have connection to piped water. Among **10,728** waste water customers, only **1,806** are connected to PDAM piped-water system.



6. TECHNICAL ASPECTS

Two different installations are established. The two sewer systems are separated by the river Kali Sodetan and are connected to two separate treatment plants: Mojosongo and Semanggi.

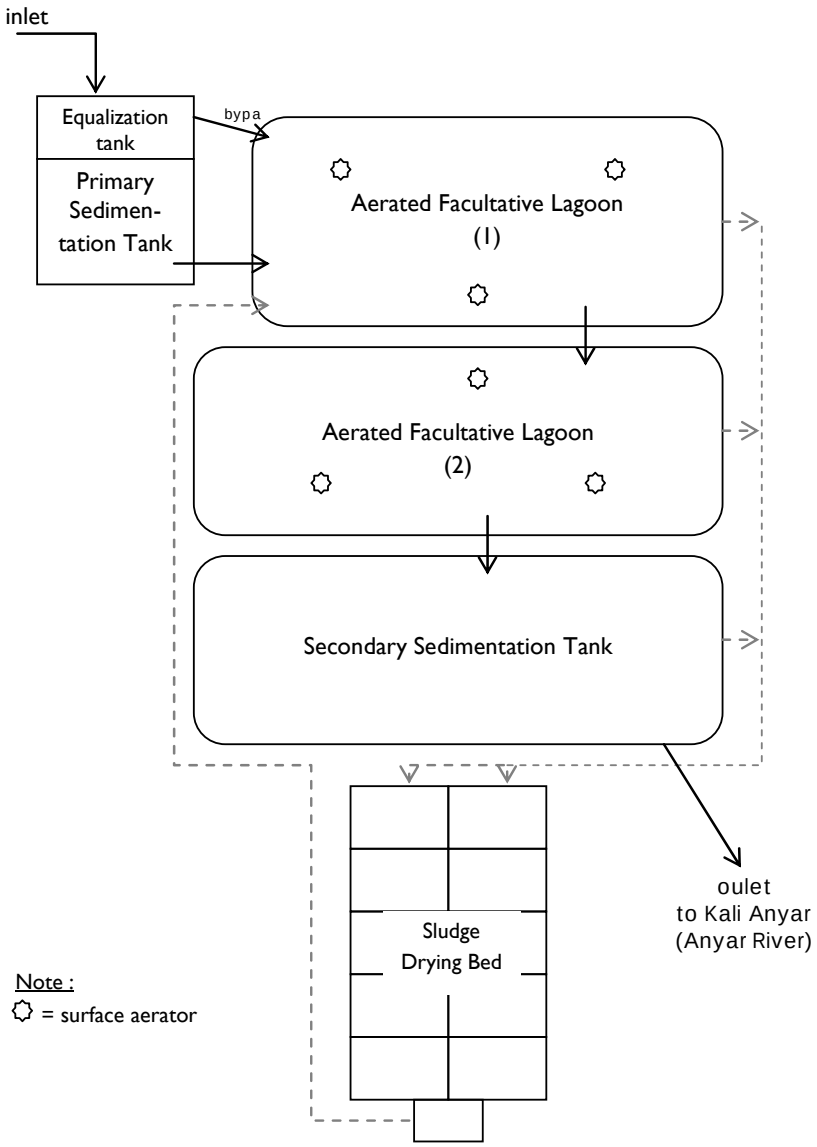
Mojosongo Treatment Plant

The plant was developed for 5,000 connections.

The wastewater is pumped to the treatment plant by a sump pump. It flows through a V-notch into a grit chamber. The grit chamber is followed by a facultative aerated lagoon with HRT 3.7 days (depth 3.5m) and a second aerated lagoon with the same dimension. The last treatment is in a maturation pond (depth 2m). Aerators work for 12 hours a day. The V-notch has no electronic measuring device for flow measurement.

The treated water is discharged to Kalianyar river.

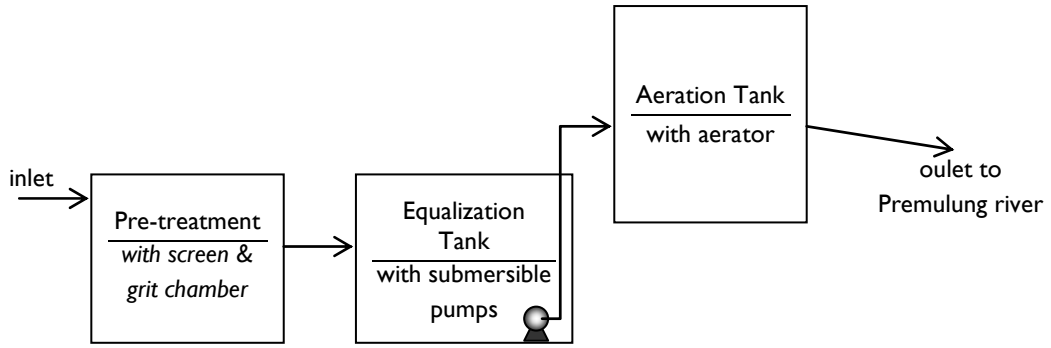
The layout of WWTP Mojosongo as follows:



Semanggi Treatment Plant
The plant was developed for 6,000 connections.

The wastewater flows by gravity through a grit chamber (closed on top) and a screen to an equalization tank (closed on top). From the lowest point it is pumped into an aeration tank. The aeration tank is equipped internally with a plate settler and aerators are installed for aeration of the wastewater. As there is no sludge return from the settler the function of the aeration tank is that of an aerated lagoon. The original depth of the tank of about 6 m has been reduced by building a new floor to about 4m, reducing the effective volume by about 30%. The reason was not enough pressure of the pumps to pump to that water level. The effluent is discharged into the river. The sludge flows into a sludge pump station. No pump is installed there and no drying bed or other facility exists for the sludge drying. The treated water is discharged to Premulung river.

The flow diagram of WWTP Semanggi as follows:



Textile small scale industry and other SMEs are discharging their wastewater to the sewer without permission, disturbing the treatment.

GTZ is planning to facilitate of building a treatment plant for the textile home industry which discharges to Semanggi plant.

Problems:

1. Grit chamber is seldom cleaned (maybe because closed and difficult to access).
2. Sludge in equalization tank is not removed (maybe because closed and difficult to access).
3. Pumps are often burnt (maybe clogging by waste, water level controller function not clear, maybe does not work, no maintenance of pumps).
4. Water in aeration tank is black (reportedly black since start up of plant). This means that the plant has never been functioned as planned.
5. Plate settler is broken down and clogged.
6. Sludge not discharged, dried and deposited.
7. The aerators are only operated 77 hours in August and 23 hours in September (out of about 720 hours) for economically reasons. This is by far not sufficient. With an aeration of less then 10% no aerobic process can be achieved and all bacteria turn an-aerobic. This is very easily observable by the black color of the bacteria mass in the aeration tank.

Performance of treatment

Mojosongo plant

No systematic monitoring is conducted and therefore performance of the plant cannot be assessed.

Semanggi plant

Measurements are rarely conducted. Results dated 15.2.2005 gave identical values (170 mg/l) for COD inlet and outlet and for BOD almost identical values considering the error of BOD measurements (inlet 63 mg/l outlet 42 mg/l). Based on these values and the general appearance of the plant the performance can be concluded that almost no reduction of organic pollutants is achieved.

Capacity used

In Mojosongo about 90% and in Semanggi about 100% of the design capacity is used, which gives not much room for additional connections. (In the case of Semanggi this is only a theoretical value, because the plant does not function).

Quality Management System
In both systems no operational control is in place. The understanding and knowledge of the process by the operator is also quite low. No documented procedures, WI or SOPs are available and records exist only for pump and aerator operation.

Plant Maintenance
Maintenance carried out is quite limited. Pumps are maintained based on a yearly schedule, but not on working hours.

Sewerage system
108 Km sewer are installed, divided into two parts: 40 Km serving the plant Mojosongo in the North and 68 Km serving the plant Semanggi in the South. The south system is based on a system from the Dutch and was rehabilitated. The Northern system was built by Perumnas and Netherland grants in 1984.

Capacity Sewerage System
Mojosongo sewer system has a capacity of 10,000 connections, 4,700 or 47% of them are used. Semanngi has a capacity of 25,000 connections, but only about 6,000 or 24% are utilized.
Therefore quite some capacity is idle but limited by the capacities of the treatment facilities (despite the problems of the Semanggi plant).

	Installed	Used	%
Plant Semanggi m^3/d	2590	2680	103
Sewer Semanggi m^3/d	25,000	6,000	24
Plant Mojosongo m^3/d	2074	1876	90
Sewer Mojosongo m^3/d	10,000	4,700	47

Sewer Maintenance
The sewer Kasunanan is cleaned by flushing from Bendung Kleco, the sewer Mangkunegaran from sungai balekambangan, and sewer jebres is flushed from the backwash water from swimming pool Tirtomoyo.

For maintenance purposes PDAM has a Rom Combi truk, which can spray water with high pressure to clean pipes.

7. PHOTOS


Photo by: Edzard Ruehe
Date: October,27 '05
Location: WWTP Mojosongo - Solo
Remarks: (Left picture) flow measurement and primary sedimentation
(Right picture) outlet from sedimentation pond with over flow to aeration pond

Photo by: Oni Hartono
Date: October,27 '05
Location: WWTP Mojosongo - Solo
Remarks: Aerated facultative lagoon with surface aerator.


Photo by: Edzard Ruehe
Date: October,27 '05
Location: WWTP Mojosongo - Solo
Remarks: (Left picture) surface aerator in aerated facultative lagoon
(Right picture) sludge drying bed


Photo by: Edzard Ruehe
Date: October,28 '05
Location: WWTP Semanggi - Solo
Remarks: (Left picture) inlet unit
(Right picture) fine screen (cleaning by manual)


Photo by: Oni Hartono
Date: October,28 '05
Location: WWTP Semanggi - Solo
Remarks: (Left picture) aeration unit
(Right picture) aeration building and outlet tank



Photo by: Oni Hartono
Date: October,29 '05
Location: Solo
Remarks: (left) Balekambangan pond for flushing the sewerage system
(centre) Tirtomoyo swimming pool for flushing the sewerage system
(right) Truck Rom Combi, for maintaining the sewerage system

8. DATASHEET

	Solo (PDAM)							
General								
Population	556,054							
Area (Ha)	4,404							
Houses	115,000							
PDAM Customer	54,000							
Connections (wastewater)	10,728							
Coverage population (%)	9							
Coverage area (Ha)	411							
Coverage area (%)	9							
Coverage PDAM customer (%)	47							
WW customer connected to piped water (%)	17							
Capacity of system (connections)	11,000							
No People per houses (person/houses)	5							
Water consumption (m³/conn./month)	22							
WWTP Capacity used (%) (based on connections)	98							
Technical								
Wastewater System	**Mojosongo**					**Semanggi**		
Sewer System								
Length of Sewerage System (km)	40					68		
Main Pipe (Ø 600 - 1300)mm	7					12		
Sekunder & Lateral Pipe (Ø 150 - 500)mm	33					56		
Capacity of sewer (installed):								
- m³/day								
- for house connection	10,000					25,000		
Capacity of sewer (used):								
- m³/day								
- house connection	4,700					6,028		
Capacity used in % (based on connections)	47					24		
WWTP								
Q (design) m³/day	2,074					2,592		
Q (production or used) m³/day	1,876					2,680		
Plant capacity used (%)	90					103		
Unit Process	**Pre-Treatment**	**Aerated Facultative Lagoon I**	**Aerated Facultative Lagoon II**	**Sedimentation Pond**	**Sludge Drying Bed**	**Pre-treatment**	**Equalization tank**	**Aerated tank**
COD in (mg/L)	no data					no data		
COD out (mg/L)				no data				50
Removal %								
BOD in (mg/L)	385					617		
BOD out (mg/L)				no data				16
Removal %								97
SS in (mg/L)	no data					no data		
SS out (mg/L)				no data				424
Coliform in (MPN/100 ml)								
Total Coliform out (MPN/100ml)								
Treatment Systems	**Aerated Lagoon**					**Aerated Tank**		
V tanks (m³)	105	2,690	2,615	5,162	2,714	58	270	540
A tanks (m²)	30	769	747	2,581	1,872	29	60	120
depth (m)	4	4	4	2	1	2	5	5
HRT design (day)	-	4	4	2.6	30	-	0.2	0.2
HRT actual (day)	0.1	1	1	3		0.02	0.1	0.2

Financial (based on 2004)	
Initial Investment	40,793,000,000
Investment Treatment System (million)	-
Investment Sewerage System (million)	-
Investment Pumps (million)	-
Financing Source (APBN/APBD Prov/APBD LG/Donor)	APBN/Donor
Loan / Grant	Grant
Debt service	-
Interest	-
Loan Period	-
Grace Period	-
Subsequent Investment	-
Investment Treatment System (million)	11,000,000,000
Investment Sewerage System (million)	44,338,000,000
Investment Pumps (million)	-
Financing Source (APBN/APBD Prov/APBD LG/Donor)	-
Loan / Grant	-
Debt service	-
Interest	-
Loan Period	-
Grace Period	-
Average Tariff (per conn)	4,944
Connection Fee	0
Tariff Revenue (Rp million/year)	636,470,000
Total Revenue (Rp million/year)	636,470,000
O&M Subsidy (Rp million/year)	-
Billed (Rp million/year)	636,470,000
Collected Bills (Rp million/year)	95,470,500
Collection efficiency (%)	15%
O + M Cost (Rp/year)	761,370,000
Personnel	230,540,000
Energy	133,640,000
Chemicals	5,780,000
Administration (incl. Deprec. Office)	332,790,000
Maintenance	58,620,000
Depreciation (Rp/year)	415,820,000
Total Cost incl. depr+interest (Rp/year)	1,177,190,000
Cost of New Connection	0
Investment/m3 used	1,658
Investment/m3 designed	1,619
Investment/connection used	3,802,479
Investment/connection designed	1,165,514
Total Cost/m3 used	718
Total Cost/conn.	109,731
O + M Cost /m3	464
O + M Cost /conn.	70,970
Operating Ratio %	2
Cost Recovery % (Total)	54%
Mean monthly fee per Connection	0
O&M cost sewer	NA
O&M cost installation	NA
O&M cost sewer/connection	NA
O&M cost sewer/Km	NA
O&M cost installation/connection	NA
O&M cost installation/m^3	NA

APPENDIX 8: SUMMARY OF WASTEWATER TREATMENT PLANT KOTA TANGERANG/ BANTEN

SUMMARY OF WASTEWATER TREATMENT PLENT KOTA TANGERANG/ BANTEN

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Strength

- Good treatment plant based on activated sludge (IPAL)
- 8 other treatment plants based on aerated lagoon (3 plants) and lagoon (5 plants) technology

Weaknesses

- No income from customers
- Budget for maintenance not sufficient (120 million Rp/year)
- No operational control of activated sludge process by measurements
- Not sufficient knowledge of operators about activated sludge process
- Cleaning of sand trap in lagoons not carried out
- Not sufficient commitment by management of operator

Opportunities

Threats

- Without revenue operation and maintenance will detoriate

Recommendations

Activated sludge is a process which needs continual process control. The knowledge about the process is not sufficient. Therefore technical support in regard to process control seems to be necessary.

The same is valid for the sewer system. But before TA can be applied, preconditions have to be fulfilled:

- Budget for basic equipment like pH, DO meter, flow meter and for external analysis has be made available or a lab for necessary analysis like BOD, COD, SS,.. has to be established.
- Budget for sewer maintenance has to be made available.

Necessary seems to be as well support regarding tariff, facilitation with Mayor and other government stakeholders and accounting/ financial management.

2. GENERAL DATA

Province
Banten

Kota
Tangerang

Topography
Flat

Area
1,645 Ha

Population
1,38 million

3. INSTITUTIONAL ASPECTS

Owner
Pemda Kota Tangerang owns the plant and the plant is operated by Dinas Perumahan dan Permukiman, Sub Dinas Pengelolaan, Kota Tangerang.

History
Previously the plant was operated by PDAM Tangerang. After Kota Tangerang and Kabupaten Tangerang separated, the plant was transferred to Pemda Kota Tangerang.
In 2004 Kota Tangerang rehabilitated the plants.

Coverage
33 Ha out 1645 Ha are covered, which is about 2%. With 5620 connections about 2% of the population is served.

Connections
A total of 5620 connections are served; 3700 are connected to the WWTP Tanah Tinggi (activated sludge treatment system) and 1920 houses are connected to 8 oxidation ponds.

Billing system
Theoretically billing is carried out directly. But no bills are charged until now.

4. MANAGEMENT ASPECTS

Strategic management / Business plan
No business plan or strategy could be identified.

Quality management system
No SOPs and no records are available in the treatment plants. No systematic approach for quality management.

HRD / Employees

5 people are operating the activated sludge plant and carry out the maintenance in the sewer system. This is far below the amount of people needed to have a solid operation and maintenance. No job descriptions are developed.

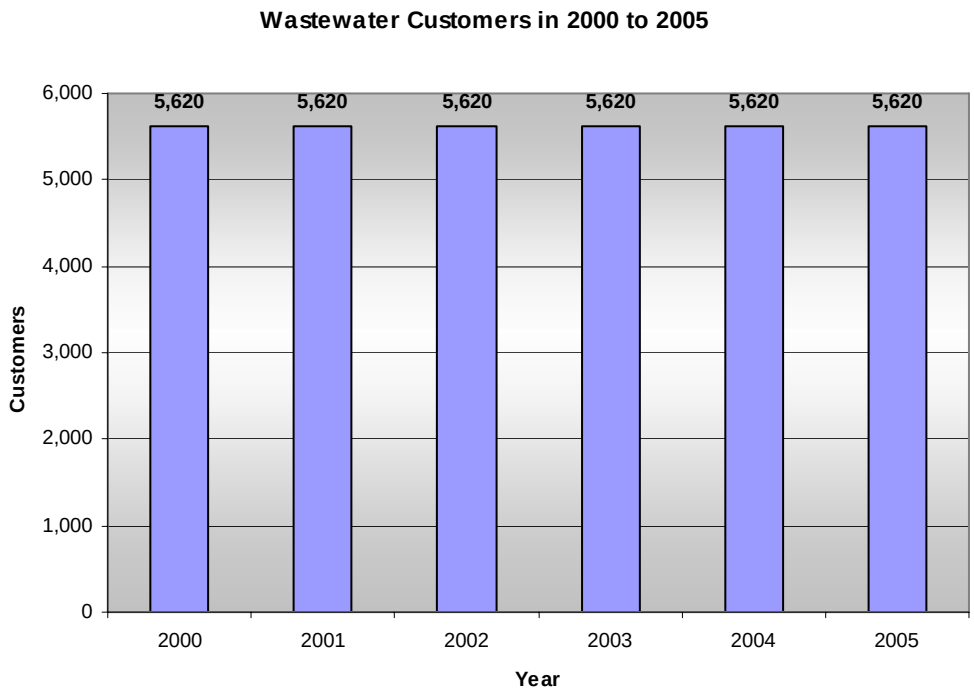
The competence of the responsible persons is not sufficient to run the plant. But from the management side the competences are assessed as good.

Customers

The IPAL with activated sludge is serving 3700 HC, the Oxidation ponds are serving together 1920 HC. All of them are PDAM customer.

The number of customer is constant in the last 5 years.

Graphic Customer – Dinas Perumahan & Permukiman Kota Tangerang



Population in city Tangerang: 1.4 million or about 280 000 Houses.

Marketing

People are interested to connect to sewer, but the connection fee of Rp1,000,000 is seen as too expensive.

High income households are assessed as easier to connect. Socialization programs are conducted with woman through kelurahan.

Currently it is difficult to market new connections, because of bad experiences in the past. At that time the collection system was not properly managed and people got problems with clogged sewer. After this experience many houses have been built own septic tanks. Currently the amount of HC is decreasing, although the number in the database is constant (see above).

5. FINANCIAL ASPECTS

Kota Tangerang is now operating wastewater systems which serve the city population who live in Perumnas housing complex and a residential area. In Perumnas housing complex are being operated 8 oxidation basins and 1 wastewater treatment plant serves people in Tanah Tinggi. Currently the treatment plants are operated by Walikota office under Dinas PU Kota Tangerang and its operation is under Sub Directorate of Wastewater. Meanwhile people of Perumnas residence have been also involved in operating the oxidation basin located in Perumnas.

The wastewater treatment plant (called IPAL) was financed by central government thru Ministry of Public Works and Dutch grant and all oxidation basins in Perumnas were built by housing developer-Perumnas. Currently, due to lack of cash available in Municipality office of Kota Tangerang, proper maintenance can not be implemented for the plants. In year 2005 the plant has been rehabilitated with an amount of Rp900 mill, mostly for new pumps, which have not been maintained properly.

Currently the service provided by LG/Dinas PU is free of charge, even though the tariff structure has been set up by Local Government since year 2000 thru LG Regulation no. 10/2000. LG is now still in monitoring period for its waste water plant and also introducing the benefits of the system to the people in Kota Tangerang. It is not clear yet when the tariff can be implemented properly to all wastewater customers.

Monthly tariff stucture is divided into 3 categories :

- Rp. 25,000 for luxury house,
- Rp. 20,000 for medium house and
- Rp. 17.500 for small house.

This tariff structure is prepared by Dinas PU Kota Tangerang.

Currently total customers served is 10.000 house connections which 3.000 units located in Babakan and Sukasari and 7.000 units located in Perumnas housing complex.

The annual budget is prepared by Dinas PU Kota Tangerang not by Sub Directorate of Wastewater as well as its operation cost is recorded in Dinas PU book. Total staff work for wastewater system is 5 people meanwhile average salary of staff is Rp. 400.000 and one manager is paid approximately Rp. 2 Million.

The operational and maintenance cost are about Rp167 mill for sewer sewer maintenance and Rp20 mill for pump maintenance. In addition Rp84 mill are spend for electricity and Rp48 mill for salary of staff. This gives total cost of about Rp319 mill per year.

6. TECHNICL ASPECT

Treatment system used

Activated Sludge system (called IPAL).

The activated sludge system is built as a carrousel. Before entering the oxidation ditch sand is removed in a grit chamber and debris in a screen. After the oxidation ditch the sludge is settled and returned to the ditch. If the bacteria mass in the ditch rises over a certain level sludge is discharged to a drying bed after thickening in a sludge thickener.

Usually the aerators were used 50%, one hour on and one hour off. Before the visit the aeration time was switched to 1 hour on and 5 hours off to save energy. But the bacteria went an-aerob and black because of lack of oxygen.

No monitoring and measurements are conducted for operation or maintenance purposes. But good process control is essential to run an activated sludge process. One employee, who was still trained by the Dutch consultants, is running the plant with his experiences.

There are 8 aeration ponds in public housing estates (Perumnas), 3 of them are equipped with an aerator. There is usually an operator at the plant, living in a house in the treatment plant compound. The aerated pond visited is equipped with a sand trap. The trap was full of sand and was not cleaned for three years.

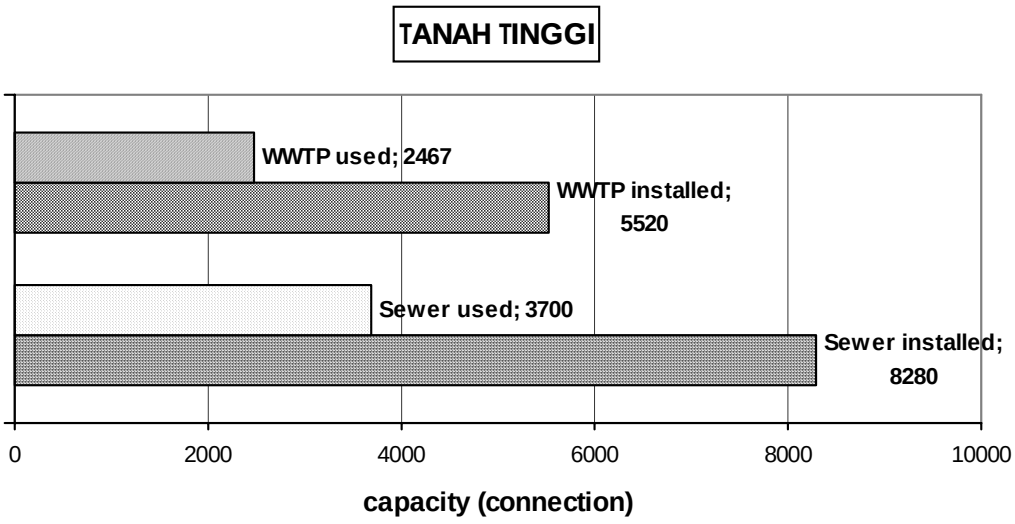
The sludge is taken by people for use as fertilizer.

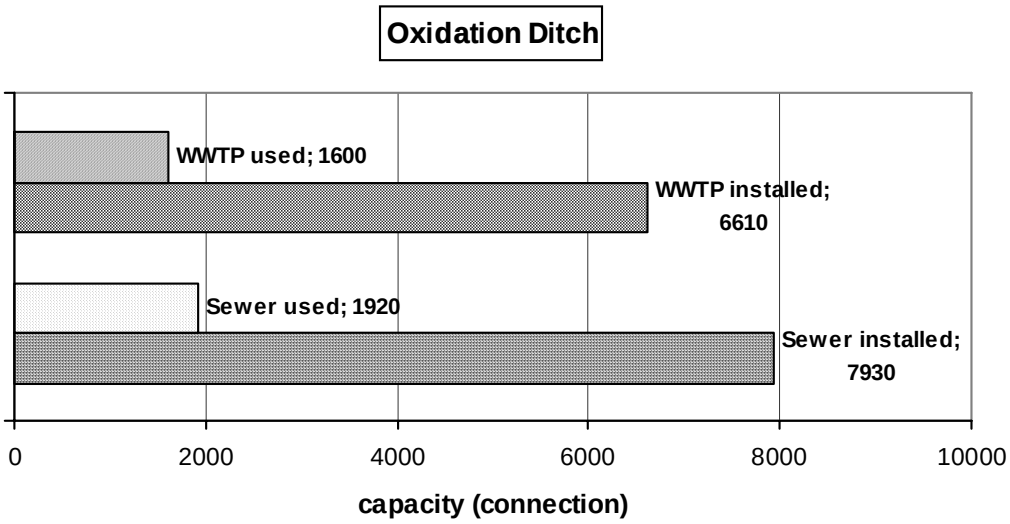
Performance of treatment
No data are available.

Capacity used

	IPAL Tanah Tinggi	Oxidation Ditch
Sewer installed	8280	7930
Sewer used	3700	1920
% capacity used	45	24
WWTP installed	5520	6610
WWTP used	2467	1600
% capacity used	45	24

From the table above can be seen that all installations are under load and have idle capacities. The activated sludge system has still 55% idle capacity, for the sewer and for the treatment plant. The oxidation ditchs have even 76% idle capacity.





Quality Management system

No management system could be identified.

Maintenance

Maintenance of the aerators is carried out every 6 month; the oil is changed, but no other maintenance is conducted.

7. PHOTOS


Photo by: Edzard Ruehe
Date: October,19 '05
Location: WWTP 'Tanah Tinggi' – Kota Tangerang
Remarks: Aeration unit.


Photo by: Edzard Ruehe
Date: October,19 '05
Location: WWTP 'Tanah Tinggi' – Kota Tangerang
Remarks: Clarifier tank with mechanical scraper.

Photo by: Edzard Ruehe
Date: October,19 '05
Location: WWTP 'Tanah Tinggi' – Kota Tangerang
Remarks: Sludge Drying Bed.


Photo by: Edzard Ruehe
Date: October,19 '05
Location: Oxidation Ditch, Jl. Cendrawasih III (jl.Pandan Raya)-Perumnas, Tangerang
Remarks: Pretreatment unit (with screen).

Photo by: Edzard Ruehe
Date: October,19 '05
Location: Oxidation Ditch, Jl. Cendrawasih III (jl.Pandan Raya)-Perumnas, Tangerang
Remarks: Aeration unit (with surface aerator).

8. DATASHEETS

	Tangerang (Dinas Perkim)						
General							
Population	1,381,311						
Area (Ha)	1,645						
Houses	277,000						
PDAM Customer	no data						
Connections (wastewater)	5,620						
Coverage population (%)	2						
Coverage area (Ha)	33						
Coverage area (%)	2						
Coverage PDAM customer (%)	no data						
WW customer connected to piped water (%)	no data						
Capacity of system (connections)	16,212						
No People per houses (person/houses)	5						
Water consumption (m³/conn./month)	25						
WWTP Capacity used (%) (based on connections)	35						
Technical							
Wastewater System	**IPAL Tanah Tinggi**					**Kolam Oksidasi (8 unit)**	
Sewer System							
Length of Sewerage System (km)	25					no data	
Capacity of sewer (installed):							
- m³/day							
- for house connection	8,280					7,932	
Capacity of sewer (used):							
- m³/day							
- house connection	3,700					1,920	
Capacity used in %	45					24	
WWTP							
Q (design) m³/day	5,520					6,610	
Q (production or used) m³/day	2,467					1,600	
Plant capacity used (%)	45					24	
Unit Process	**Pre-Treatment**	**Aerator Basin**	**Final Clarifier**	**Sludge Thickener**	**Sludge Drying Bed**	**Pre-Treatment**	**Aerated Lagoon**
COD in (mg/L)	no data					no data	
COD out (mg/L)	no data					no data	
Removal %							
BOD in (mg/L)	no data					no data	
BOD out (mg/L)	no data					no data	
Removal %							
SS in (mg/L)	no data					no data	
SS out (mg/L)	no data					no data	
Coliform in (MPN/100 ml)	no data					no data	
Total Coliform out (MPN/100ml)	no data					no data	
Treatment Systems	Activated Sludge					Aerated pond	
V tanks (m³)		1,560	519	56	1,000		222,715
A tanks (m²)			346	23	100		44,543
depth (m)		2	2	3	1		5
HRT design (day)	0	0.28	0.09	0.01		0	34
HRT actual (day)	0	0.63	0.21	0.02		0	139
Financial (Based on 2004)	Data not available						

APPENDIX 9: SUMMARY OF WASTEWATER TREATMENT PLANT PDAM YOGYAKARTA SEWON

SUMMARY OF WASTEWATER TREATMETN PLANT PDAM YOGYAKARTA SEWON

1. SUMMARY OF FINDINGS AND RECOMMENDATIONS

Good controlled plant almost completely subsidized by city and provincial government. Maintenance could be improved.

Under the assumption of 100% capacity utilization an average payment per month of approximately Rp127,000 per connection would cover all cost including depreciation cost. Calculation of Operation & Maintenance Cost gives Rp 8,800/month/house-connection, either for full capacity or existing connections. The consequence of this tariff is that the system will not be able to generate enough funds for the expansion of the system nor to do necessary replacement of assets.

Strength

- Commitment of Dinas Kebersihan.
- Commitment of Provincial Government
- Good technical WWTP
- No pumping necessary

Weaknesses

- Due to local budget (DIPA) institution has no funds in the first 5 months of each year for operational cost and salaries
- Completely subsidized and depending on local budget
- Not support by public. Public is not willing to pay even basic tariff
- Expensive collection system (door to door collection)

Opportunities

- Sewer can be easily extended
- New PERDA in progress which makes it compulsory to connect to sewer
- Houses not connected to sewer system but in reachable distance can be connected

Threats

- Almost no own income from customers,
- almost all operational cost subsidized by local and provincial government, which can lead to a breakdown of services if the government reduces the subsidy.

Recommendations

- Training improvement process control
- Training laboratory
- Training and implementation on Cost Benefit calculation
- Facilitation to increase tariff
- O&M sewer
- Training /Development of marketing strategy
- Socialization to people, hotels, restaurants, etc.

2. GENERAL DATA

Province:
Yogyakarta

Kabupaten:
City Yogyakarta, Sleman, Bantul

Topography
The whole covered area is down-slope from Sleman through the City of Yogyakarta to the treatment system. Only houses at the rivers are located lower than the sewer system and cannot be reached.

Area
3,257 Ha

Population
436 000 (2002)

Water supply situation
The service coverage of water supply is about 45% of total population and total customers is 34 583, divided in domestic 31,318 (91%) and non domestic 3,265 (9%). PDAM has water sources as surface water (6%), spring water (11%), and deep well (83%) with a total production capacity of about 602 l/s and distribution capacity of about 579 l/s. Currently the basic tariff is 1,000 Rp/m3.

3. INSTITUTIONAL ASPECTS

Owner and Operator
Owner of the plant is the Province of Yogyakarta and the plant is also operated and paid by provincial staff. The City of Yogyakarta (Dinas kebersihan, keindahan, dan pemakaman) is operating and maintaining the sewer system because most of the sewer is located within the City of Yogyakarta and almost all customers are from the City. Operator and O&M operation of the sewer system and the WWTP are completely separated. The different stakeholders are coordinated by a Sekretariat Bersama, which coordinates beside wastewater also other issues between province and Kabupaten.

The city of Yogyakarta is currently conducting a program to clean up the city. This supports also activities related to wastewater, e.g. public septic tanks are installed at Marlioboro Street to treat the wastewater from the street food vendors. The environmental department of the City of Yogyakarta is currently extending the number of decentralized wastewater treatment plants (type BORDA/DEWATS) in the regions at the rivers, where it is not possible to connect house direct to the sewer.

History
Wastewater collection and treatment is conducted in the City of Yogyakarta based on Perda 9/1991. This Perda defines also the tariff for connection and monthly fees. Previously a plant from the Dutch time was operated, including a sewer system. With construction of the new plant in 1995, which started its operation in 1996, the old sewer system has been connected to the new system. The old treatment plant is not operated anymore.

Coverage
The coverage in the City of Yogyakarta is about 9660 customers, but a census between year 2000 and 2005 showed that about 14,200 households discharge to the sewer. Total number of households in Yogyakarta is 88,000 which is equivalent of 16%, and 527 Ha out of 3,257 Ha which correlates also to 16% of the area. Some hotels discharge their wastewater to the sewer. Almost no houses from the Kabupaten Sleman and Bantul are connected. Industry is not allowed to discharge to sewer, but some small scale companies release their wastewater to the WWTP.

Government Back up
It seems that the Dinas Kebersihan as operator of sewer and the provincial operator of the WWTP has good support from mayor and governor. Almost all O&M cost are paid by them. But since two years DPRD of province is trying to reduce the subsidy for the WWTP.

Drafts of two new Perda have been developed; one will increase the tariff; the other will make it compulsory to connect to the sewer if the sewer is reachable from the house. It is planned that the Perda will be approved by 2007.

Kantor Pengendalian Dampak Lingkungan (KPLD), the local environmental agency, provides technical support. Once every 6 months the outlet of the IPAL is controlled. But the results are not communicated to IPAL operator. Only in case of high pollution values the WWTP operator is invited for further discussion.

Thresholds for wastewater are defined in the province regulation 214/KPTS/1991.

Coordination between the involved provincial and local governments Yogyakarta, Bantul and Sleman is reported to be difficult.

Billing system
The bills are collected monthly direct from the customers by Dinas Kebersihan or through RT by door-to-door approach.

4. MANAGEMENT ASPECTS

Strategic Management / Business Plan

Dinas is planning to extend the sewer system. A proposal is already provided to BAPPENAS to extend the piping system by 5km with a budget of 9 billion Rupiah. But this proposal does not include new house connections and secondary pipes.

Quality management system

In the plant a manual is available covering the technical issues including operation of the aerator and analytical procedures.

HRD / Employees

Treatment plant:

The plant has 19 employees and 12 civil servants supported part-time in the past. This year the 12 civil servants did not support the plant anymore because allowance has not been paid. Skills are seen as sufficient by Dinas. This could be confirmed by the consultant regarding technical knowledge of the people in the plant.

Each year the non-government employees have to wait for there salaries for 5 months until June due to the late local budget (DIPA). No thirteenth salary (THR) is paid and also no other incentives. Absenteeism is not measured but not seen as a serious problem.

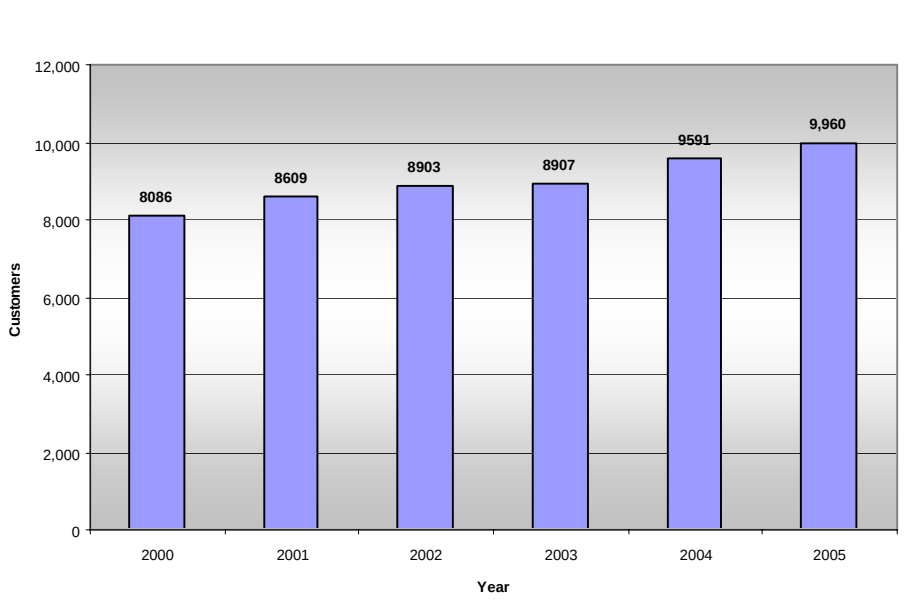
Sewer System:

Dinas Kebersihan employs 47 civil servants, mostly working for maintaining the sewer system. 37 of them are in the field for properly maintaining the sewer and collecting the bills. But they estimate that a total of 67 is necessary for properly maintaining the sewer system and collecting the bills.

Customers

The number of customers increases slowly almost every year as shown in the graphic below.

Graphic Customer – Yogyakarta (DKKP)



Reportedly the awareness regarding sanitation of the people living in Yogyakarta is increasing.

Marketing
Brochure and pricelist have been developed to promote domestic wastewater treatment. Currently a project is conducted to extend the sewer system to the north and to connect more houses to the treatment plant.

5. FINANCIAL ASPECTS

Investment and Source of Funds
The sanitation system was built during the period 1994-1996, amounting to around Rp68 billion for the plant and sewer, financed by grant from the Government of Japan (JICA) through the Ministry of Public Work. The investment was to build a treatment plant in Desa Pendowoharjo, Kecamatan Sewon, Kabupaten Bantul, as the solution for disposing domestic waste water from Kota Jogja, part of Kabupaten Bantul and Sleman. The existing sewer, of 110 km length, has been built in 1936. Dinas Kebersihan and Pertamanan is the organization responsible to operate the system.

Investment Plan
The domestic wastewater service coverage will be developed gradually to reach service target in 2012 of 59% or 273,000 of total population, increased by around 46% from present coverage (13%). To meet this target an investment plan has been roughly calculated at Rp 17.2 billion to expand the main pipe by 6.35 km, flushing pipe by 6 km to serve Sleman and Jogja and another 4,025 m flushing pipe to serve Bantul. The financing source is expected to come from central and provincial government. Work has already started with an extension of 1.2 km funded by provincial government.

Outstanding Loans and Debt Service Coverage
PDAM has no outstanding loan. The investment was financed through a grant from the Government of Japan through the Ministry of Public Work.

Tariff, Revenue and Subsidy
The tariff for wastewater has actually been set in 1991 as stipulated in Governor SK No. 24/KPTS/1992 and SK Walikota No. 9 Year 2001. However, this tariff was set only for the operation and maintenance of the sewer system; therefore there is no income for the plant. The tariff has been prevailing since then and never been renewed now. Several efforts have been taken to get the tariff adjustment approved but turned down due to some political reasons.

Wastewater tariff structure - Perda No. 9 Year 1991

No	Customers Classification	Maintenance (per month)	Admin. Form	Connection Permit Fee	Remarks
	HOUSEHOLDS				
1	K1	500	500	2,000	1-5 ps
2	K2	1,000	500	2,500	6-10 ps
3	K3	2,000	500	3,000	11-20 ps
4	K4	4,000	500	3,500	21-50 ps
5	K5	8,000	500	4,000	>50 ps

No	Customers Classification	Maintenance (per month)	Admin. Form	Connection Permit Fee	Remarks
	ENTERPRISES				
1	P1	3,000	500	2,500	0-25 million
2	P2	6,000	500	5,000	>25 million
3	P3	12,000	500	7,500	>50 million

Ps: Persons; enterprises distinguished based on yearly revenue

This tariff rate is obviously too low to support the operation and maintenance needs and therefore need to be subsidized by the government.

Since the plant serves 3 municipalities i.e. Kota Yogja, Kabupaten Sleman and Bantul, the three governments agreed to allocate a certain amount of money for the O&M of the plant; each depends on the number of connection. To fill the shortage the provincial government is injecting subsidy to keep the plant running. The arrangement is as follows:

	2003	2004	2005
O&M of WWTP	Rp 550,000,000	Rp 625,000,000	Rp 795,000,000
Source of funds:			
- Kota Jogja	Rp 100,000,000	Rp 125,000,000	Rp 125,000,000
- Kab. Sleman	-	-	Rp 10,000,000
- Kab. Bantul	-	-	Rp 10,000,000
- Subsidy (DIJ Province)	Rp 450,000,000	Rp 500,000,000	Rp 650,000,000

However, the budget allocation from the province was approved very late, in July 05, affecting the operation of the plant. The province has expressed that at this moment they are still supporting the plant operation, but it is uncertain how long they can continuer to provide this substantial subsidy. This would yield to a serious shortcoming of O&M funds.

The Dinas has planned and proposed a tariff petition and has prepared a draft Perda (Local Government Regulation) for the new tariff. The new tariff is expected to be effective in 2006.

Dinas is proposing two alternatives of base tariff calculation, both take into account the O&M costs for the WWTP, as shown below:

Alternative	Formula	Proposed tariff
I	(WWTP O&M Cost + Capital Expenditure)/Population Served ***plus*** (Sewer O&M Cost + Capital Expenditure)/ Population Served in Kota Jogja	Rp 634,131 per HH per month
II	WWTP O&M Cost/Population Served ***plus*** Sewer O&M Cost/ Population Served in Kota Jogja	Rp 5,131 per HH per month

It is much likely that Pemda will approve Alternative II.

Cost Recovery

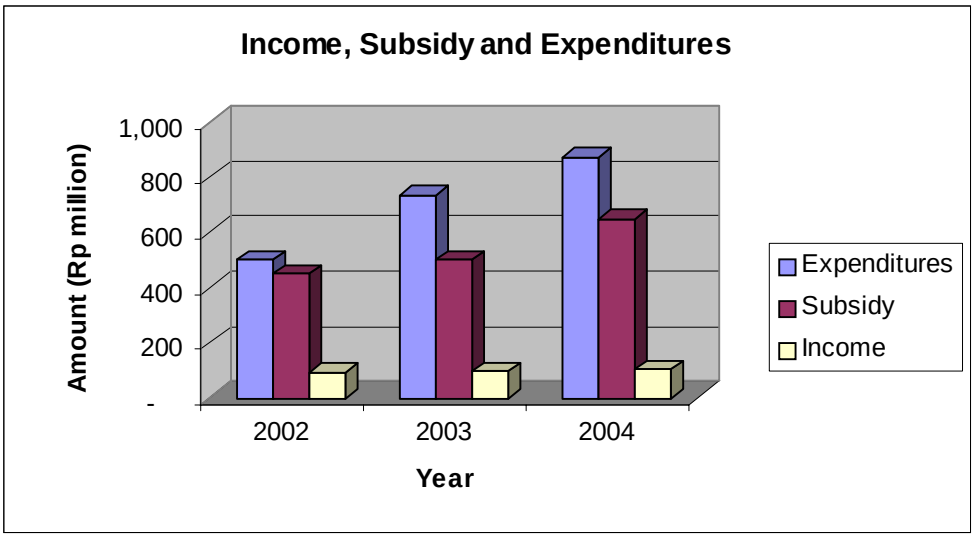
It is very obvious that with such low tariff, the revenue can not cover the operation and maintenance cost. The revenue from retribution is far below the expenses, as shown in table below.

	2000	2001	2002	2003	2004
A.INCOME FROM WASTE WATER RETRIBUTION					
Households	34,237,000	51,949,500	53,947,000	54,473,000	58,680,000
Enterprises	20,898,000	28,938,000	29,490,000	30,432,000	30,276,000
	55,135,000	80,887,500	83,437,000	84,905,000	88,956,000
B.OTHER INCOME					
Sludge Truck Rental Fee		2,250,000	3,800,000	4,200,000	6,300,000
Toilet		900,000	1,600,000	2,400,000	2,400,000
Public Toilet		2,760,000	4,000,000	4,800,000	4,800,000
		5,910,000	9,400,000	11,400,000	13,500,000
C.NEW CONNECTION PERMIT					
Households	346,500	310,000	32,000	40,000	27,500
Enterprises	20,000	15,000	-	20,000	22,500
Administration	86,500	79,500	7,500	12,000	9,000
	453,000	404,500	39,500	72,000	59,000
Total Income	**55,588,000**	**87,202,000**	**92,876,500**	**96,377,000**	**102,515,000**
D.OPERATION & MAINTENANCE					
Sewer	NA	NA	NA	185,040,000	247,059,003
WWTP	NA	NA	NA	550,000,000	625,000,000
Total O & M				735,040,000	872,059,003
E. NET INCOME				(638,663,000)	(769,544,003)
No of connection	7,644	8,510	8,901	8,883	9,573
Average tariff/con	601	792	781	797	774
Cost/con				6,896	7,591
Cost Recovery				12%	10%
Cost/con for sewer				1,736	2,151
Operating Ratio- for sewer				**192%**	**241%**
Cost Recovery-for sewer				46%	36%

Cost recovery is incredibly low with Rp774/month and the operating ratio is incredibly high, even if it is calculated to the sewer only. Reckoning WWTP, the cost recovery is about 10%-12%, while for sewer only the cost recovery is around 36%-46%.

Operation ratio as comparison between O&M cost and operational income is very high because the tariff is much too low compared to the O&M cost.

The chart below shows the comparison of the expenditures and available funds to finance it.



Collection Efficiency

The collection of the retribution is done by door to door system, which results in high efficiency at around 80%.

Operation and Maintenance Expenditures

Dinas Kebersihan dan Pertamanan is responsible to maintain the report on the operation and maintenance of Sewer, while the province maintains the report on the operation and maintenance of the WWTP. Data provided is very limited. The complete breakdown is available only for year 2005.

O&M Sewer	
Personnel	86,460,000
Goods & Service	15,867,500
Duty Travel	-
Maintenance	370,310,000
	472,637,500
O&M WWTP	
Personnel	113,880,000
Chemical	27,000,000
Electricity	306,000,000
Maintenance:	
- Vehicle	16,500,000
- Plant	156,316,000
	619,696,000
General Administration	89,358,000
Capital Expenditures	85,946,000
	795,000,000

Note: spare parts for equipments in the WWTP are difficult to find in local market.

Accounting System

There is no accounting system applied since the wastewater system is operated under Dinas Kebersihan, Keindahan dan Pemakaman and the plant is operated under the Provincial (Dinas Kimpraswil). The reporting system follows the municipal budget for revenue and expenditures system. The separation of the management makes it difficult to measure the efficiency of the operation of the wastewater system and to ensure adequate fund to maintain sustainable operation.

Tariff Simulation

Adopting the formula for water tariff, the following shows the calculation of wastewater tariff based on the yearly operating and capital expenditures for the sewer and the treatment system:

SEWERAGE EXPENDITURES		
O&M costs		
1	Wages	497,222,400
2	Maintenance	150,356,000
3	General Adm.	82,896,000
	Total O&M costs	730,474,400
Capital Expenditures		
1	New connections	2,393,000,000
2	Pipes	37,563,000,000
3	Equipment	1,102,000,000
4	Building	41,000,000
5	Land	1,140,000,000
6	Sewer network (from Jogja)	672,259,000
7	Sewer network (from DIJ)	250,000,000
	Total CapEx	43,161,259,000
	Total Expenditures	43,891,733,400

WWTP EXPENDITURES		
O&M costs		
1	Wages/Salary	100,475,000
2	Chemical	23,181,300
3	Electricity	300,000,000
4	Maintenance	250,102,500
5	General Adm.	31,291,200
	Total O&M costs	705,050,000
Capital Expenditures		
1	Land	6,080,000,000
2	Building	41,905,000,000
3	Equipment	47,413,000,000
	Total CapEx	95,398,000,000
	Total Expenditures	96,103,050,000

Assumptions:

1 Financing Plan will be: Land and new connections will be financed by grant from province. The rest will be financed through commercial loan.
2 Accounting cost is used as tariff calculation basis
3 No of population to be served (WWTP Max. Capacity)= 110,000 person
4 No of population served in Kota Jogya = 67,708 person (49,785 ps + approx.36% illegal connections)
5 No of member of HH = 5 person
6 Max. WWTP Capacity = 22,000 HH

Assumed Loan Term

Loan amount	128,946,259,000
Interest	18%
Loan Repayment period	15 years
Debt service:	25,325,404,063
Interest	23,210,326,620
Principle	2,115,077,443

Depreciation:	Cost	Depreciation	Life time
Building	41,946,000,000	2,097,300,000	20
Equipment	48,515,000,000	3,234,333,333	15
Pipes	40,878,259,000	2,725,217,267	15
		8,056,850,600	

	Accounting Cost/year		At max cap.	Current service
I	Operational Cost (at max cap.)	Rp.	2,332,186,507	1,435,524,400
	Interest	Rp.	23,210,326,620	23,210,326,620
	Depreciation of new assets		8,056,850,600	8,056,850,600
	Total cost	Rp.	33,599,363,727	32,702,701,620
	Cost/person/month	(max. cap)	25,454	
	Cost/connection/month (max cap)	(max. cap)	127,270	
	Cost/person/month in Kota Jogja	(served)		42,250
	Cost/connection/month in Kota Jogja	(served)		201,248
II	Operational Cost (at max cap.)	Rp.	2,332,186,507	1,435,524,400
	Interest + Principle	Rp.	25,325,404,063	25,325,404,063
	Total cost	Rp.	27,657,590,570	26,760,928,463
	Cost/person/month	(max. cap)	20,953	
	Cost/connection/month	(max. cap)	104,764	
	Cost/person/month in Kota Jogja	(served)		32,937
	Cost/connection/month in Kota Jogja	(served)		164,683
III	Operational Cost (at max cap.)	Rp.	2,332,186,507	
	Operational Cost (current operation)	Rp.	1,435,524,400	
	Cost/person/month	(max. cap)	1,767	
	Cost/connection/month	(max. cap)	8,834	
	Cost/person/month in Kota Jogja	(served)		1,767
	Cost/connection/month in Kota Jogja	(served)		8,834

The first two scenarios shows quite high tariff rate that undoubtedly will require very hard work and long time to make it applicable. The scenario I produces a tariff of Rp 127,270 per connection and the scenario II Rp104,764 per connection assuming that all capacity has been utilized. While the calculation under consideration of the existing connections will yield to a higher tariff of Rp 201,248 per connection for the first scenario and Rp164,683 for the second scenario. It should be noted though, that the depreciation for the existing assets has not been calculated due to lack of data. Scenario III, adopting the Dinas' calculation of tariff based only on the O&M costs, shows much lower tariff rate at Rp 8,800, either for full capacity or existing connections. The consequence of this tariff is that the system will not be able to generate enough funds for the expansion of the system nor to do necessary replacement of assets.

6. TECHNICAL ASPECTS

Treatment system used
The treatment plant is based on 2 parallel lines of an aerated lagoon system (facultative ponds) followed by maturation ponds. The HRT (hydraulic retention time) of the facultative ponds is designed for 5.5 days, while the HRT of the maturation ponds is for 1.3 days. Because not 100% of the plant is used the actual HRT are 8 days and 4 days respectively.

Before the inlet to the lagoon system the wastewater is cleaned with mechanical screens and a grit chamber. The sludge is dried in drying beds and the dried sludge is used by the people as fertilizer.

The BOD inlet concentration is low with 162 mg/l, because the sewer is permanently flushed with river water to increase the flow for cleaning.

The local government (Pemkot Jogjakarta) is building a micro hydro power plant. The micro-hydro power plant will be connected to the outlet of WWTP before discharge to the river. The building is already constructed, but some technical problems are still preventing to supply power to the WWTP. The plant will just provide enough energy for lighting of the plant.

Capacity
The plant is designed for 110 000 people or 22 000 houses (5 people in one house).
The capacity of the plant is 15 500 m3/day with a BOD of max. 332 mg/l, which is equivalent to 5 146 kg BOD/d.

In 2004 the hydraulic load was 9370 m3/day, the BOD 162 mg/l. BOD load 1520 Kg BOD/d or 30% of the design capacity.

Quality Management system
An operational manual and procedure to measure and control oxygen in the aeration basin exist. Records are available for the measured parameters, but the original data are not recorded for BOD.

Monitoring
Flow (calculated by pump capacity and working hours), BOD, COD, pH, SS, T, DO of inlet and outlet are monitored daily.

Oxygen supply for aerated facultative ponds is controlled by measurement of daily BOD load. It should be considered to measure COD and BOD performance also after first and second facultative pond and DO in the facultative ponds for control of aerators.

Laboratory
Laboratory makes a good impression with competent staff. BOD analysis should be reviewed in relation to blank measurement. COD as the most expensive analysis should also be reviewed in regard to number of measurements.

Plant Maintenance
The optical impression of the plant is good. But reportedly the maintenance is not supported with sufficient budget. According to the plant manager instead of about Rp700 Mill the estimated amount necessary is Rp1 billion.

Performance of treatment (all data means of 2004)
With an incoming BOD of 162 mg/l and an effluent concentration of 18.5 mg/l the reduction is almost 90 %.

COD influent is 495 mg/l, outlet 55.5 mg/l. This is equivalent to a reduction of almost 90%. The very high COD values compared to BOD in the inlet needs some further investigation of the analytical procedures.

Sewerage system
147 Km sewer are installed. Material used is clay, concrete and pralon/PVC. The slope of the lateral pipes is 0.3-0.5%, of the main pipes 1-2%, meaning that the wastewater does not flow too fast.

Capacity Sewerage system
The capacity of the sewer system is about 22, 000 houses, but currently only 9960 customer are connected.

Sewer Maintenance
Preventive maintenance is carried out on a regular basis. 20 Km pipes are cleaned every year (subcontracted) and another 12 Km are cleaned by DKKP themselves. With a network of 166 Km every pipe is cleaned about every 5 years. All maintenance is carried out manually without proper equipment, no cleaning equipment is available. Repair maintenance is usually subcontracted.

Preventive maintenance has been increased in the last years. In 2003 the number of maintenance personnel was more than doubled from 13 to 29 for maintenance activities. Interestingly Pemda could feel the direct outcome by reduced breakdown maintenance of about 50%.

7. PHOTOS


Photo by: Edzard Ruehe
Date: October,25 '05
Location: WWTP Sewon – Bantul - Yogyakarta
Remarks:(Left picture) Pre-treatment (screen and grit chamber) with mechanical system
(Right picture) grit chamber



Photo by: Edzard Ruehe
Date: October,25 '05
Location: WWTP Sewon – Bantul - Yogyakarta
Remarks: (from left) - screw pump, motor, and power panel

Photo by: Oni Hartono
Date: October,25 '05
Location: WWTP Sewon – Bantul - Yogyakarta
Remarks: Situation of WWTP Sewon – Bantul , Yogyakarta. Aerated Pond with surface aerator.

Photo by: Oni Hartono
Date: October,25 '05
Location: WWTP Sewon – Bantul - Yogyakarta
Remarks: Maturation Pond, outlet with weir.

Photo by: Edzard Ruehe
Date: October,25 '05
Location: WWTP Sewon – Bantul - Yogyakarta
Remarks: (left) sludge drying bed, (right) outlet from WWTP.

Photo by: Edzard Ruehe
Date: October,25 '05
Location: WWTP Sewon – Bantul - Yogyakarta
Remarks: Micro Hydropower plant 'Pembangkit Listrik Tenaga Mikro Hidro' using water fall from outlet WWTP planed by local government (but now is not yet functioning)

8. DATASHEETS

	Yogyakarta (DKKP)		
General			
Population	436,294		
Area (Ha)	3,257		
Houses	88,000		
PDAM Customer	34,583		
Connections (wastewater)	13,960		
Coverage population (%)	16		
Coverage area (Ha)	517		
Coverage area (%)	16		
Coverage PDAM customer (%)	45		
WW customer connected to piped water (%)	- (separate management)		
Capacity of system (connections)	22,187		
No People per houses (person/houses)	5		
Water consumption (m³/conn./month)	20		
WWTP Capacity used (%) (based on connections)	63		
Technical			
Wastewater System	**IPAL Pendowohardjo - Sewon**		
Sewer System			
Length of Sewerage System (km)	147		
- induk	33		
- lateral	114		
Capacity of sewer (installed):			
- m³/day	15,408		
- for house connection			
Capacity of sewer (used):			
- m³/day	11,353		
- house connection			
Capacity used in %	74		
WWTP			
Q (design) m³/day	15,500		
Q (production or used) m³/day	11,353		
Plant capacity used (%)	73		
Unit Process	**Pre-Treatment**	**Facultative Aerated**	**Maturation Pond**
COD in (mg/L)	494		
COD out (mg/L)			56
Removal %			**89**
BOD in (mg/L)	162		
BOD out (mg/L)			19
Removal %			**88**
SS in (mg/L)	296		
SS out (mg/L)			32
Coliform in (MPN/100 ml)			
Total Coliform out (MPN/100ml)			
Treatment Systems	**Aerated Systems**		
V tanks (m³)	43	86,240	43,680
A tanks (m²)	36	21,560	10,920
depth (m)	1	4	4
HRT design (day)	0.001	5.5	1.3
HRT actual (day)	0.004	8	4

Financial (based on 2004)	
Initial Investment	68,000,000,000
Investment Treatment System	NA
Investment Sewerage System	4,617,389,332
Investment Pumps	NA
Financing Source (APBN/APBD Prov/APBD LG/Donor)	APBN/Donor (JICA)
Loan / Grant	Grant
Debt service	-
Interest	-
Loan Period	-
Grace Period	-
Subsequent Investment	17,200,000,000
Investment Treatment System	-
Investment Sewerage System	NA
Investment Pumps	NA
Financing Source (APBN/APBD Prov/APBD LG/Donor)	GOI/APBD Provincial
Loan / Grant	Grant
Debt service	-
Interest	-
Loan Period	-
Grace Period	-
Average Tariff (per conn)	774
Connection Fee	800,000
Tariff Revenue (Rp/year)	88,956,000
Total Revenue (Rp/year)	102,515,000
O&M Subsidy (Rp/year)	-
Billed (Rp/year)	88,956,000
Collected Bills (Rp/year)	71,164,800
Collection efficiency (%)	80%
O + M Cost (Rp/year)	872,059,003
Personnel	NA
Energy	NA
Chemicals	NA
Administration (incl. Deprec. Office)	NA
Maintenance	NA
Depreciation (Rp/year)	NA
Other	-
Total Cost incl. depr+interest (Rp/year)	872,059,003
Cost of New Connection	800,000
Investment/m3 used	1,109
Investment/m3 designed	812
Investment/connection used	6,649,066
Investment/connection designed	4,871,060
Total Cost/m3 used	213
Total Cost/conn.	87,556
O + M Cost /m3 used	213
O + M Cost /con	87,556
Operating Ratio %	9
Cost Recovery % (Total)	0
Mean monthly fee per Connection	0
O&M cost sewer	NA
O&M cost installation	NA
O&M cost sewer/connection	NA
O&M cost sewer/Km	NA
O&M cost installation/connection	NA
O&M cost installation/m³	NA

APPENDIX 10: LIST OF PDAM MANAGING WASTEWATER TREATMENT PLANT

NO.	INSTANSI	ALAMAT	TELP.	FAX.	EMAIL	CONTACT PERSON
1	PDAM Tirta Nadi Prop. Sumatera Utara	Jl. S.M. Raja No. 1 Medan, Sumatera Utara	(061)457 1666	(061) 4572771	tirtamdn@idola.net.id	Ir. H. Sugeng Hadi Sungkono MM
2	PDAM "Bandarmasih" Kota Banjarmasin	Jl. Jend. A. Yani No. 12 Kotak Pos 30 Banjarmasin 70236	(0511) 251690 / 416010 / 270210	(0511) 253238	-	Drs. H. Zainal Arifin Muh. Muhidin
3	PDAM Kota Cirebon	Jl. Tuparev 25 Cirebon 45131	(0231) 202594 / 204800	(0231) 207508	-	Air Limbah
4	DINAS TANGERANG					
5	PDAM Kota Surakarta	Jl. L.U. Adisucipto No. 143 Surakarta 57145	(0271) 712536 / 723648 / 723093	(0271) 712536	pdamsolo@indo.net.id	Abimanyu Agus Saryono
6	DINAS YOGYAKARTA					
7	PDAM Kota Bandung	Jl. Badaksinga No. 10 Bandung 40132	(022) 2506584	(022) 2508063		Drs. Komara Affandi Dra. Betty Wediawaty
8	PDAM Kota Balikpapan	Jl. R.E. Martadinata, Kota Balikpapan	(0542) 424068 / 732159	(0542) 731215		Firmansyah
9	PD PAL JAYA	Jl. Sultan Agung No.1, Setia Budi, Jakarta Selatan 12980	(021) 8305309 / 8354252/ 8354253 / 8354255	(021) 8301470		Ir. Pudjo Prihadi Santoso, MM

APPENDIX 11: DRAFT QUESTIONNAIRE FOR STRATEGIC MANAGEMENT PLANNING

DRAFT QUESTIONNAIRE FOR STRATEGIC MANAGEMENT PLANNING

To get an overview about the actual situation of the centres in regard to general management issues the Plants shall provide information for a first evaluation. The information can be supported by related data, documents, or records.

The Questions are related to 11 topics:
Institutional, Policy and Mission/Vision, Partnership, Management System, Finance, Customer, Employees/HRD, Treatment Plant, Laboratory, Sewer/Piping System, Maintenance,

1. INSTITUTIONAL
   History: how / why system was started

   Ownership / Independence / Agency Responsible

   Legal framework / basis for operation

   based on what do you charge fees ?

   How do you bill?

   Responsibilities (centralized, decentralized)

   Organization chart (units, organizational system) (please attach)

   Lay out incl. location of installation, labs. Etc. (please attach)

   What are the government regulations (pusat, provinsi, kabupaten) related to sewerage treatment and discharge?

2. POLICY, VISION, MISSION, STRATEGY
   Quality Policy

   Other Policies if available

   Vision

   Mission

   The Strategy for the future (1 year or 5 years or for other timeframe)

   Do have goals or targets for the company?

   Do you have goals or targets for the departments?
   If yes, please fill in or attach.

   How do you control targets and programs

3. PARTNERSHIPS, SOCIETY

Partnerships

Do you have any partnership within Indonesia or abroad?
If yes, please describe

Relation with others (water supply, internal/external, G'ment, masyarakat)

Complain by neighbours?

4. QUALITY MANAGEMENT SYSTEM
How do you ensure quality of your products and services?

Are you satisfied with the quality of your products and services?
Please explain.

Documentation (Procedures, work instructions, SOP, monitoring, recording)

Quality Manual:
Do you have one quality system applied for the whole installation?

If the manual applies only for parts of the installation, for which parts of it applies?

Productivity:
Do you measure productivity? (e.g. Connections per employee, installation usage,…)
Please explain.

5. FINANCE

Revenue:

Total revenue including subsidies from government

Please mention all kinds of revenue (subsidy, user, …)

How do you set your tariff / changes

Revenue per kind

Amount of subsidy from the government and other sources (absolute and %)

Direct & indirect subsidies

Billing system (separate / combined), recovery rates, problems

Cost:

How much are your total Cost?

What are the biggest cost centres?

What are the costs for?

- Depreciation (investment cost)
- & M
- Maintenance
- Chemicals
- Electricity
- Lab material
- HR / Staff
- Cleaning
- Administration
- Stationary
- others (please list important other cost)

Shared (hidden) cost with others (like overheads by PDAM)

Do you know the unit cost of your services? If yes please provide data.
Cost per m3, Cost per HC

How much (%) is your cost recovery?

Prices:
Based on what the tariff is (per HC, per m3) is based?

How much is the price per m3?

How much is the connection fee?

How (based on what) do you calculate prices?

How is your price compared to your competitor or alternative treatments? (Higher, same, lower)

Investment:
Initial / subsequent investment

How (based on what) do you make investment decisions

How much do you invest per year related to total assets?

Do you calculate NPV or IRR or payback period before you make an investment decision?

Debt:
Do you have any amount of debt?

If yes, how much are your debt?

Do you pay them back on-time?

If no, what are the reasons?

6. CUSTOMERS / CONNECTION
   How many customers / connections do you have?

   Direct Connection

   Connection through Interception

   Connection through Control Chambers

   Coverage area

   % of population in town

   % of PDAM customer

   Do you treat sludge of septic tanks?

   Why customers connect to your systems? What are their incentives?

Marketing:
Do you have any marketing plan or marketing strategy?
If yes, please describe the marketing plan

Please describe your marketing activities

Which market is the target group?

How would you describe your customers in relation to your products / services? What kind of customers do you have? Why are they coming to you?

From what social level your customers come from?

What is the amount of customers / HC and what is the development in the last 5 years?

Customer service:
Do you have a hotline, website, brochure, pricelist etc.?

Customer satisfaction and expectation:
Do you measure customer expectation?
If yes, how do you do it and what are the results?

Do you measure customer satisfaction?
If yes, how do you do it and what are the results?

Sold product
Wastewater treated per month: (last 12 month)

Others treated per month

What is the development over the last 5 years?

7. EMPLOYEES / HRD
   Total number of staff

   Number of staff per division, per unit, department, etc.

   How much staff is technical and how much is administrative?

   How many connections per person?

   For which staff job descriptions are established?

   What is described in the job descriptions?

   Are authority and responsibilities clearly defined?

   Are authority and responsibility balanced?

   Do you implement a system of employee empowerment?
   If yes, please describe.

Employee development
Do you evaluate the competence of your staff?
If yes, please describe.

Are the competence / skill of your employees sufficient?

How much training is carried out for your staff?

The decision about who gets training is based on what?

How much budget per year is available for training of your staff?

Do you have any performance evaluation of your staff?
If yes, please describe.

Is there any program implemented for employee development (Career)?
If yes please describe:

Employee satisfaction
How would you describe the motivation of your employees?

Are the working conditions satisfactory for the employees?

Is employee satisfaction measured?

What measures do you use to enhance motivation of employees?

Do you have any incentive system?
If yes, please describe.

If yes, based on what incentives are being paid? Are incentives related to performance?

Do you measure absenteeism and evaluate it? (illness, ijin, without excuse,…)

Do you measure losses of working time because of absenteeism? If yes, how much %?

Do you have a staff rotation in place? If yes what are the reasons?

8. TREATMENT PLANT

Technical Description

On what system is your treatment process based on? Please explain all steps of the process. Please provide a flow diagram as well. Please provide supporting data.

Equipment:

What equipment is available?

Please list the mayor equipment with estimated price (if necessary put into appendix)

To which river do you discharge?

For what capacity the plant was developed?

How much % capacity is used / idle?

What are the parameters you measure and control?

- COD influent
- COD effluent
- BOD influent
- BOD effluent
- pH
- TN influent
- TN effluent
- NH3influent
- NH3 effluent
- TPin
- TPout
- PO4 in
- PO4 out
- Detergents
- Coliform
- Fecal Coli
- E Coli
- Flow

- Qr
- Volume of (aeration) tanks
- Surface of tanks
- Volume of clarifier
- Surface area of clarifier
- Settling depth in clarifier
- F/M
- MLSS
- MLVSS
- DOSS in sludge
- SV
- Sludge by Microscope
- Sludge age
- Amount of wasted sludge

How much do you reduce pollution?

Do you control the reduction of pollution parameter at each step?

Potential for (quick/easy) expansion (of customers, piping, …….)

Any problems in the treatment process?
(WW from industry, control of process, fish in river,…)

How do you treat your sludge?

9. LABORATORY

Which parameters do you analyze?

How often do you monitor and which parameters?

Do you outsource laboratory work?

Quality Assurance in laboratory?

For what activities do you have SOPs?

- Analysis
- Sampling
- Recording
- Corrective action

10. SEWER / PIPING SYSTEM

How many km sewer do you have?

For what capacity the sewer system was developed?

What are the diameters of the pipes?

Material of pipes

Please describe your pumping system, if any

For what activities do you have SOPs?

11. MAINTENANCE:
    How do you manage your maintenance?
    Please explain.

    Do you have a maintenance budget?
    If yes, how much is the total maintenance budget?

    Do you calculate your maintenance budget based on investment cost or other parameters?
    If yes, please explain.

    Do you have a preventive maintenance plan?

    Do you have procedures, formsheets and records regarding maintenance?

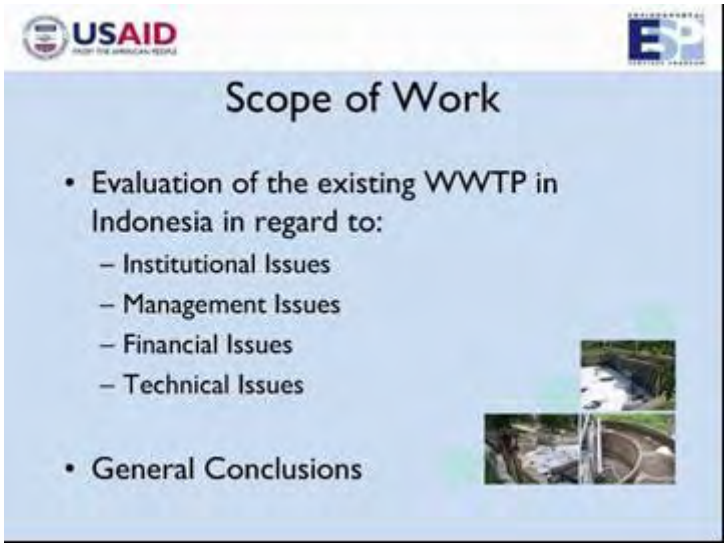
    Maintenance for treatment plan
    Cleaning
    Screens, Pumps, Genset, mechanical moving parts,

    Maintenance for sewer system

    Cleaning of sewer

APPENDIX 12: DRAFT PRESENTATION


USAID
Centralized
Wastewater Treatment Plants
in Indonesia
A Survey:
• Dr. Edzard Ruehe
• Oni Hartono
• Poppy Lestari
• Benny Djumhana
• Nugroho Andiwiwinarno


USAID
Scope of Work
• Evaluation of the existing WWTP in Indonesia in regard to:
– Institutional Issues
– Management Issues
– Financial Issues
– Technical Issues
• General Conclusions


USAID
Visited Domestic Installations
• PDAM Bandung
• PDAM Balikpapan
• PDAM Banjarmasin
• PDAM Cirebon
• PD PAL Jakarta
• PDAM Medan/Parapat
• PDAM Surakarta
• Dinas Tangerang
• Dinas Yogyakarta

Visited Installations in ISSDP area's

- PDAM Banjarmasin
- PDAM Surakarta

Visited Private Centralized Installations

- Lippo Karawaci
- Bandung Industry
- KIM Medan

Findings and Conclusions

1. Strong Support and Commitment by local Government
2. Strong Commitment by Operating Organization
3. Institutional Set-up
4. Tariff and Billing
5. Adequate Budget

Findings and Conclusions

6. Socialization and Communication
7. Adequate Sewer and Treatment System
8. Good Operation Practice / QMS
9. Good Maintenance
10. Human Resources

1. Strong Support & Commitment by local Government

- Grants for installations
- Perda for mandatory connections
- Adequate (min. O&M cost) tariff for households
- Adequate tariff for commercial customers
- Building permit only with connection
- Pressure by LH on private enterprises
- Control of operator through targets, not by influencing daily business

+

2. Strong Commitment by Operating Organization

- Budget to conduct O&M
- Clear defined targets for the future
- Regular control of the targets
- Separate accounting system
- Basic quality management system

3. Institutional Set-up

- Independent structure of operator
- Billing system connected to other billing system (water bill PDAM)

4. Tariff and Billing

- Coupling wastewater tariff to water tariff (best as % of water bill)
- No flat rates which are difficult to adjust through Mayor and DPRD
- Collection of wastewater bill together with water bill
- Establish sewer in area with high PDAM coverage
- Establish sewer in area with high commercial density

Collection Efficiency

City	Collection Efficiency %	Collection System
Bandung	80	PDAM Bill
Banjarmasin	86	PDAM Bill
Cirebon	93	PDAM Bill
Medan	98	PDAM Bill
Jakarta	60	PD PAL Bill
Surakarta	15	Separate
Yogyakarta	80	Separate

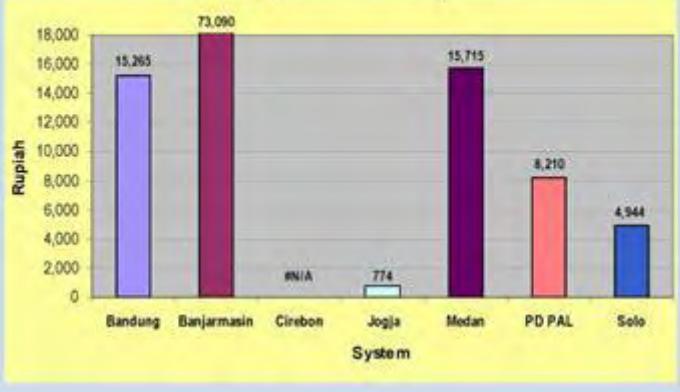
Billing Systems

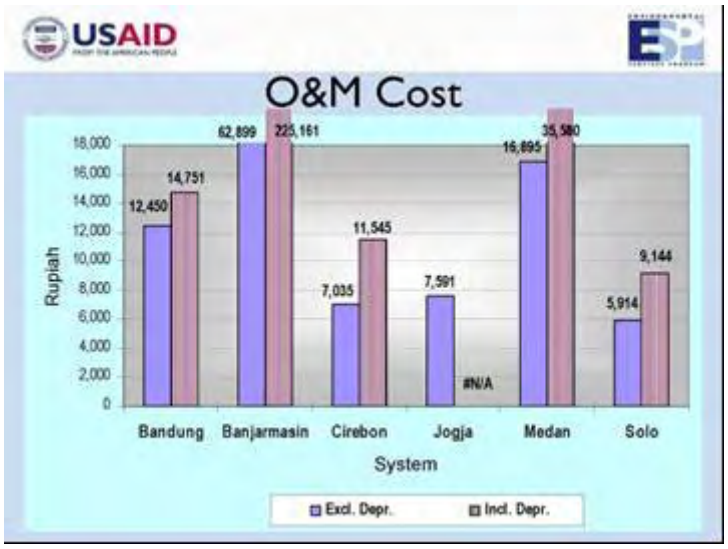
- Fixed price tariff
- Tariff based on square meters of houses
- Tariff based on water usage
- Percentage of water bill paid
- Percentage of water bill paid of all PDAM customers

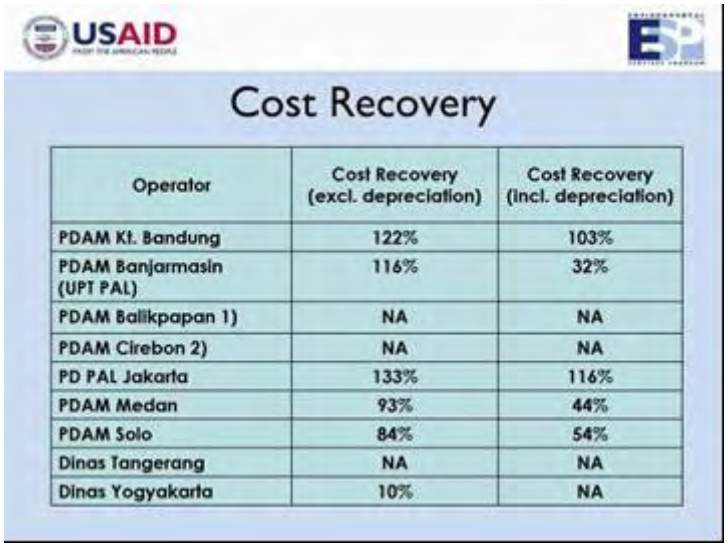
5. Adequate Budget

- Independency for subsidies for O&M
- Installations should be on grant basis or partly grant
- Installations should be utilized 100% to reduce fixed cost

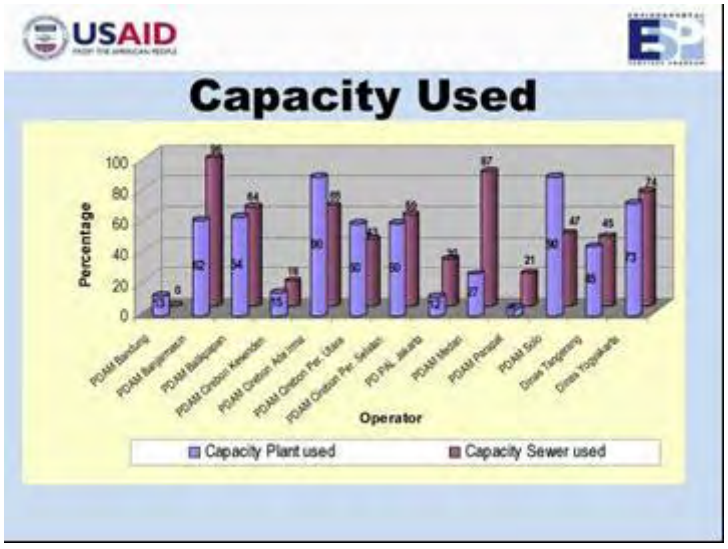
Average Monthly Bill







Operator	Cost Recovery (excl. depreciation)	Cost Recovery (incl. depreciation)
PDAM Kt. Bandung	122%	103%
PDAM Banjarmasin (UPT PAL)	116%	32%
PDAM Balikpapan 1)	NA	NA
PDAM Cirebon 2)	NA	NA
PD PAL Jakarta	133%	116%
PDAM Medan	93%	44%
PDAM Solo	84%	54%
Dinas Tangerang	NA	NA
Dinas Yogyakarta	10%	NA



Tariff Simulation

	Current Conditions (Rp/month/conn.)	100% Usage (Rp/month/conn.)
Banjarmasin	355,000	260,000
Yogyakarta	127,000	105,000

6. Socialization and Communication to Stakeholders

- People/Customers
- Mayor
- DPRD
- LH
- Tata Kota / Building License
- Control Board
- Media

7. Adequate Treatment System

WWTPs with low O&M cost (electricity) and less control need large space

- Aeration Ponds (no aerators)
- Aerated lagoons (aerators partly)
- Activated sludge, Rotating Batch Reactor (high energy)
- Upflow Anaerobic Sludge Blanket reactor (UASB)

BOD Reduction

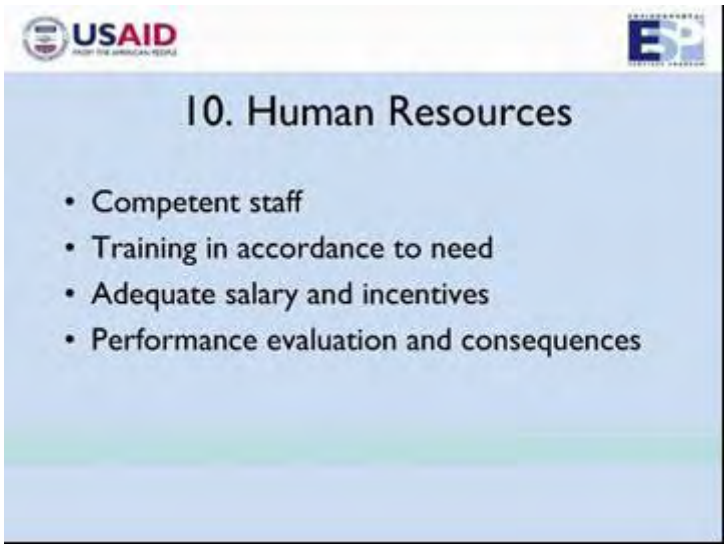
City	BOD in (mg/l)	BOD out (mg/l)	Reduction %
Bandung	151	63	57
Banjarmasin	38	4	89
Cirebon	22	18	18
PD PAL	106	53	45
Medan	175	80	54
Parapat	200	30	85
Yogyakarta	162	19	88

8. Good Operation Practice / QMS

- SOPs
- Monitoring
- Recording
- Evaluation
- Corrective Action
- Preventive Action

9. Good Maintenance

- Preventive Maintenance Plan
- Inspection and Cleaning of Sewer
- Adequate Budget


USAID
10. Human Resources
• Competent staff
• Training in accordance to need
• Adequate salary and incentives
• Performance evaluation and consequences


USAID
Proposed Activities
1. National Communication Forum between Operators
2. Training
3. Facilitation


USAID
Communication Forum
Directors and Manager of Operators
Facilitated by e.g. FORKALIM
• Exchange of information and discussion of optimal strategies regarding:
– Tariff
– Collection
– Perda
– LH, Tata Kota
– Communication & Marketing


USAID
Training
• Classroom Training
• Training on the Job: Determination of activities, targets, parameters to monitor
• Implementation (including basic Quality Management)


USAID
Training Topics
• Control of Processes
• Analysis / Lab
• Maintenance WWTP
• Maintenance Sewer
• Accounting
• Cost, Budgeting, Tariff


USAID
Facilitation
• Facilitation between Operator, Mayor, DPRD (Tariff, Collection, Investments, Independency)
• Customer Relation: Campaigns, New customers, Media

BALIKPAPAN (PDAM)

Strength

- Committed employees in WW department
- Installation technically appropriate and sufficient for operation
- Sufficient subsidy from local government for operation and maintenance
- Existing lab with competent personal for monitoring

Weaknesses

- No experiences because installation just taken over from Dinas Kebersihan
- Almost no data available of monitoring
- No data about cost available

Opportunities

- Customer living in environment where non-existing WW treatment influences their own environment

Threats

- Currently no revenue from customers. This will yield to financial problems when subsidies are not provided anymore.

BALIKPAPAN (PDAM)

RECOMMENDATIONS

Short term:

- With the convincing commitment of the staff in the WW department and good facilities in the plant (activated sludge) and lab, the WW department of PDAM Balikpapan could be the target for the first training. All modules could be developed and implemented on the job in this organization. The activated sludge process they have is the most complex process and the modules can then be transferred in reduced form to other treatment plants.
- The amount of 300 mill Rupiah for O&M as subsidy seems to be sufficient to carry out operation and maintenance. This is very important in case Balikpapan will be pilot project area.

Long term:

- Balikpapan could also be the pilot project area for the development of modules in regard to socialization of tariffs, public campaign and budget calculations.

BANDUNG (PDAM)

Strength

- Tariff: All clean water customers have to pay 30% of the water bill
- Billing System: The WW bill is combined with the water bill
- The ownership of the WW treatment plant is seen as strength
- The plant is well maintained.
- Commitment of top management

Weaknesses

- A strategic disadvantage in this PDAM is that there is no incentive for PDAM to connect new customers. The WW fee is included in the water bill and has to be paid by all clean water customers anyway.
- Efficiency is going down, because of lack of funds for O&M
- Substantial investment is necessary to build a WWTP for western area of Bandung
- No billing for customers who do not receive clean water

BANDUNG (PDAM)

Opportunities

- For eastern side number of connections can be increased
- Hotels like to connect

Threats

- PDAM is afraid of customer complaints for paying of not received services
- No PERDA exists that makes connection to the sewer compulsory.



BANDUNG (PDAM)

RECOMMENDATIONS

Short term:

- Establishment of a complete database of all WW customers
- Development of marketing plan.
- Development of SOPs and records for operation and maintenance. Establishment of maintenance plan for sewer and treatment plant.
- Training for lab staff regarding analysis of parameters like COD, BOD, DO, SS, pH
- Training for lab staff regarding lab management like monitoring plan, sampling, SOPs, records, interpretation of results, quality control. (PDAM has to provide sufficient funds for regular monitoring)

BANDUNG (PDAM)

RECOMMENDATIONS

Long term:

- Development of strategy regarding billing (which should include mayor and DPRD):
  1. develop a fair solution for PDAM customer who pay for WW but do not get service; e.g. free cleaning of septic tanks, PERDA with polluter fee which goes to PDAM for building sewer
  2. develop appropriate tariff and solution for non-PDAM customer which discharge to sewer
  3. develop appropriate tariff for business customers
- Increase cooperation with Dinas Pengawasan Bangunan and Dinas Tata Kota for new house connection and review for implementation in other cities.

CIREBON (PDAM)

Strength

- Environmental fee for WW treatment is implemented for WW operation and maintenance
- Qualified laboratory

Weaknesses

- In the combined bill for clean water and wastewater PDAM can not identify the revenue for the wastewater. This yield to the impression in the PDAM that wastewater generates only cost but no revenue.
- Non incentive for PDAM to connect new customer because no additional income will be achieved
- Budget for process control too small
- No analytical control of processes.
- PDAM responsible for drainage system, but Dinas PU is responsible for the cleaning.
- Almost no preventive maintenance; only repair maintenance because of limited budget.

CIREBON (PDAM)

Opportunities

- In three installations still enough capacity of sewer and plant available for new connections
- Flat topography

Threats

- Limited support by local government
- No enforcement by government institutions to connect
- Customer do not like to connect to sewer

CIREBON (PDAM)

RECOMMENDATIONS

- Support to calculate realistic O&M budget with relation to tariff.
- Implementation of accounting system for WW inclusive revenue.
- Technical assistance if sufficient budget is available for O&M and commitment of management for improvement.

JAKARTA (PD PAL JAYA)

Strength
- Customer are willing to get connected and paying their bills. O&M has not to be subsidized
- Many business customers
- Cost recovery

Weaknesses
- Wastewater cannot be treated in accordance to need because lagoons are used by PU for flood control

Opportunities
- Expanding of collection system to malls and other commercial buildings in the central district
- PD PAL sees a good market for decentralized small treatment plants
- Existing market for operation of wastewater treatment plants of commercial buildings

Threats
-

JAKARTA (PD PAL JAYA)

RECOMMENDATIONS

- Support PD PAL in its effort to separate wastewater and flood control. Before this problem is not solved no improvement in the treatment can be achieved.

MEDAN & PARAPAT (PDAM)

Strength
- Wastewater treatment staff committed

Weaknesses
- Not full support of the Top Management
- Not sufficient technical knowledge
- Internally wastewater is not accepted, it is seen only as a cost factor compared with clean water
- Not much initiative to connect more customers

MEDAN & PARAPAT (PDAM)

Opportunities

- Treatment plant sewer capacity in Medan for 60,000m3/day or 30,000 conn. But only 10,000 houses are connected and 16,000m3 are treated.
- Treatment plant and sewer capacity in Parapat for 760 connections, but only 159 houses are connected.

Threats

- Revenue too low
- Not sufficient support and commitment from external organizations like municipal government, provincial government, LH

MEDAN & PARAPAT (PDAM)

RECOMMENDATIONS

- ESP could consider supporting PDAM to develop a new tariff scheme, e.g. based on water bill.
- PDAM needs training on the UASB reactor and how to use it in the current situation (under-load). Training is also important regarding the control of the aerated lagoon in Medan and Parapat to optimize the process and energy usage.
- Training regarding occupational health and safety for working in sewer system
- If commitment of management increases ESP can support activities for new connections

TANGERANG (Din.Perkim)

Strength

- Good treatment plant based on activated sludge (IPAL)
- 8 other treatment plants based on aerated lagoon (3 plants) and lagoon (5 plants) technology

Weaknesses

- No income from customers
- Budget for maintenance not sufficient (120 million Rp/year)
- No operational control of activated sludge process by measurements
- Not sufficient knowledge of operators about activated sludge process
- Cleaning of sand trap in lagoons not carried out
- Not sufficient commitment by management of operator

Opportunities

-

Threats

- Without revenue operation and maintenance will detoriate

TANGERANG (Din.Perkim)

RECOMMENDATIONS

- Activated sludge is a process which needs continual process control. The knowledge about the process is not sufficient. Therefore technical support in regard to process control seems to be necessary.
- The same is valid for the sewer system. But before TA can be applied, preconditions have to be fulfilled:
  - Budget for basic equipment like pH, DO meter, flow meter and for external analysis has be made available or a lab for necessary analysis like BOD, COD, SS,.. has to be established.
  - Budget for sewer maintenance has to be made available.
- Necessary seems to be as well support regarding tariff, facilitation with Mayor and other government stakeholders and accounting/ financial management.

YOGYAKARTA (DKKP)

Strength

- Commitment of Dinas Kebersihan.
- Commitment of Provincial Government
- Good technical WWTP
- No pumping necessary

Weaknesses

- Due to local budget (DIPA) institution has no funds in the first 5 months of each year for operational cost and salaries

Opportunities

- Sewer can be easily extended
- New PERDA in progress which makes it compulsory to connect to sewer
- Houses not connected to sewer system but in reachable distance can be connected

Threats

- Almost no own income from customers, almost all operational cost subsidized by local and provincial government. This can lead to a breakdown if the government is reducing the subsidy.

YOGYAKARTA (DKKP)

RECOMMENDATIONS

- Training improvement process control
- Training laboratory
- Facilitation to increase tariff
- O&M sewer

BANJARMASIN (PDAM)

Strength

- Committed Top Management
- Good strategy to cover area with many commercial customers
- Tariff connected to water tariff which is regularly raised
- Functioning wastewater treatment plant with simple technology
- Back up from PDAM in case subsidies are paid late

Weaknesses

- O&M still paid by subsidies from local government
- No own revenue
- Low salaries of employees

Opportunities

- Committed Mayor supporting regularly with funds
- People accept treatment plant in their neighborhood in the center of the town

Threats

-

BANJARMASIN (PDAM)

RECOMMENDATIONS

- PDAM Banjarmasin can be used as example for good communication and socialization to all stakeholders. Their communication and socialization programs should be further evaluated as input for dissemination to the other institutions with wastewater treatment plants.
- PDAM should be supported in receiving funds for further investments.

SURAKARTA (PDAM)

Strength

- Plant Mojosongo available for 5000 HC
- Sewer for 10 000 HC connected to Mojosongo, but only 4500 houses currently connected. Additional 500 houses can easily get connected. For another 5000 a new plant has to be built.
- Sewer for additional 19 000 HC available in the South (Semanggi) (with investment of another 6Km lateral pipes)
- Independency from Mayor

SURAKARTA (PDAM)

Weaknesses

- Currently no cost recovery
- Tariff too low for cost recovery
- Bill collecting system not effective (collection efficiency 15%)
- Accounting system not fully separated from water accounting system
- Installation Semanggi technically not appropriate
- 100% of the capacity of the plant Semanggi is used with a design for 6,000 HC
- Additional plant has to be built in Semanggi for additional 19,000 HC. With the space available only possible with activated sludge, RBC, or UASB
- In general no control of WWTP by means of written procedures, monitoring, evaluation, corrective action
- Operator skill not sufficient
- No preventive maintenance of sewer system
- No preventive maintenance of WWTP

SURAKARTA (PDAM)

Opportunities

- Sewer available for additional customers
- Support from central government
- Will get subsidy for investment from local government for WWTP
- In new proposed PERDA connection to sewer will be compulsory

Threats

- It is not clear how WWTP PDAM can achieve cost recovery in the near future
- Awareness of people regarding sanitation is not high

SURAKARTA (PDAM)

RECOMMENDATIONS

- Revenue has to be increased by increased fees and increased billing efficiency
- Accounting system for wastewater has to be developed
- Campaigns should be conducted to increase awareness of community and to increase number of customer
- Re-design of IPAL Semanggi
- Design of activated sludge system in Semanggi, improvement of grit chamber for easy maintenance, improvement of equalization tank (use as sedimentation tank with sludge removal), drying beds, flow meter, treatability study to check for problems with industrial waste.
- Study what treatment plant should be built in addition to existing one in Semanggi for more customers (activated sludge, RBC, UASB, aerated lagoon, lagoon, etc.)

SURAKARTA (PDAM)

RECOMMENDATIONS



- Implement O&M system in both plants including: measurement of flow, measurements of process and water parameters like COD, BOD, SS, P, NH4, NO3, after each treatment step as appropriate. Measurements of process parameters like DO, MLSS, etc.). Preventive maintenance of pumps and aerators and other equipment, cleaning, preventive maintenance plan. Develop SOPs. O&M training for Semanggi should only be provided after re-design of the plant
- Consider to implement a quality management system (ISO 9001 or lower, FORKAMI certification of laboratory)
- Measurements in own laboratory as far as feasible
- Training for all technical staff involved
- Develop preventive maintenance for sewer system
- Probably more staff is needed in WW department especially for maintenance of sewer system
- Consider to exchange aerators in Mojosongo with heavy duty aerators if the existing aerators break down

BANDUNG (Industry)

PT. DAMBA INTRA



Strength

- Activated sludge process with flocculation pre-treatment for textile wastewater

Weaknesses

- Not enough funds for operation and maintenance
- Plant in bad condition



Opportunities

- Still much capacity available for more companies

Threats

- Flooding by river
- Without pressure of LH on textile industry to treat the wastewater revenue cannot be increased

MEDAN (Industry)

PT. Kawasan Medan Industri (KIM)

Strength

- Operator of wastewater plant is also operator of the whole industrial park giving many opportunities to ensure connection of the companies to the treatment plant.

Weaknesses

- There are problems between the operator (a state owned company) and the responsible governmental organizations to ensure that the companies are connected to the sewer.
- Income does not cover the operational cost.
- Wastewater plant does not run well.

Opportunities

- 322 companies are located in the park, but only 17 are connected giving opportunity for more customers.

Threats

- Proceeding with the actual treatment will not cover the O&M cost and will result in no sufficient treatment.


USAID
MEDAN (Industry)
PT. Kawasan Medan Industri (KIM)
RECOMMENDATIONS
• ESP could try to find out the problems between the stakeholders and operator and facilitate between them to enlarge the number of customer.


USAID
TANGERANG
PT. LIPPO KARAWACI
Strength
• Strong commitment from management for clean environment
• Good Treatment plant
• Easy access to customers
Weaknesses
-
Opportunities
-
Threats
• Must be financially feasible to compete with other real estates

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