No.

THE MINISTRY OF PUBLIC WORKS AND
THE PROVINCIAL GOVERNMENT OF YOGYAKARTA SPECIAL REGION
THE REPUBLIC OF INDONESIA

STUDY ON
REGIONAL WATER SUPPLY DEVELOPMENT PLAN
FOR
GREATER YOGYAKARTA
IN
THE REPUBLIC OF INDONESIA

Technical Report

Volume I
Executive Summary

March 2008

JAPAN INTERNATIONAL COOPERATION AGENCY

NIHON SUIDO CONSULTANTS CO., LTD.
and
KRI International Corp.

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PREFACE

In response to a request from the Government of Republic of Indonesia, the Government of Japan decided to conduct the study on Regional Water Supply Development Plan for Greater Yogyakarta in the Republic of Indonesia and entrusted to the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Takemasa MAMIYA of Nihon Suido Consultants Co., Ltd. and consists of KRI International Corp. between September 2006 and February 2008.

The team held discussions with the officials concerned of the Government of Indonesia and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this plan and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Indonesia for their close cooperation extended to the study.

March 2008

Ariyuki MATSUMOTO,
Vice President
Japan International Cooperation Agency

March, 2008

Mr. Ariyuki MATSUMOTO
Vice-President
Japan International Cooperation Agency

Letter of Transmittal

Dear Sir,

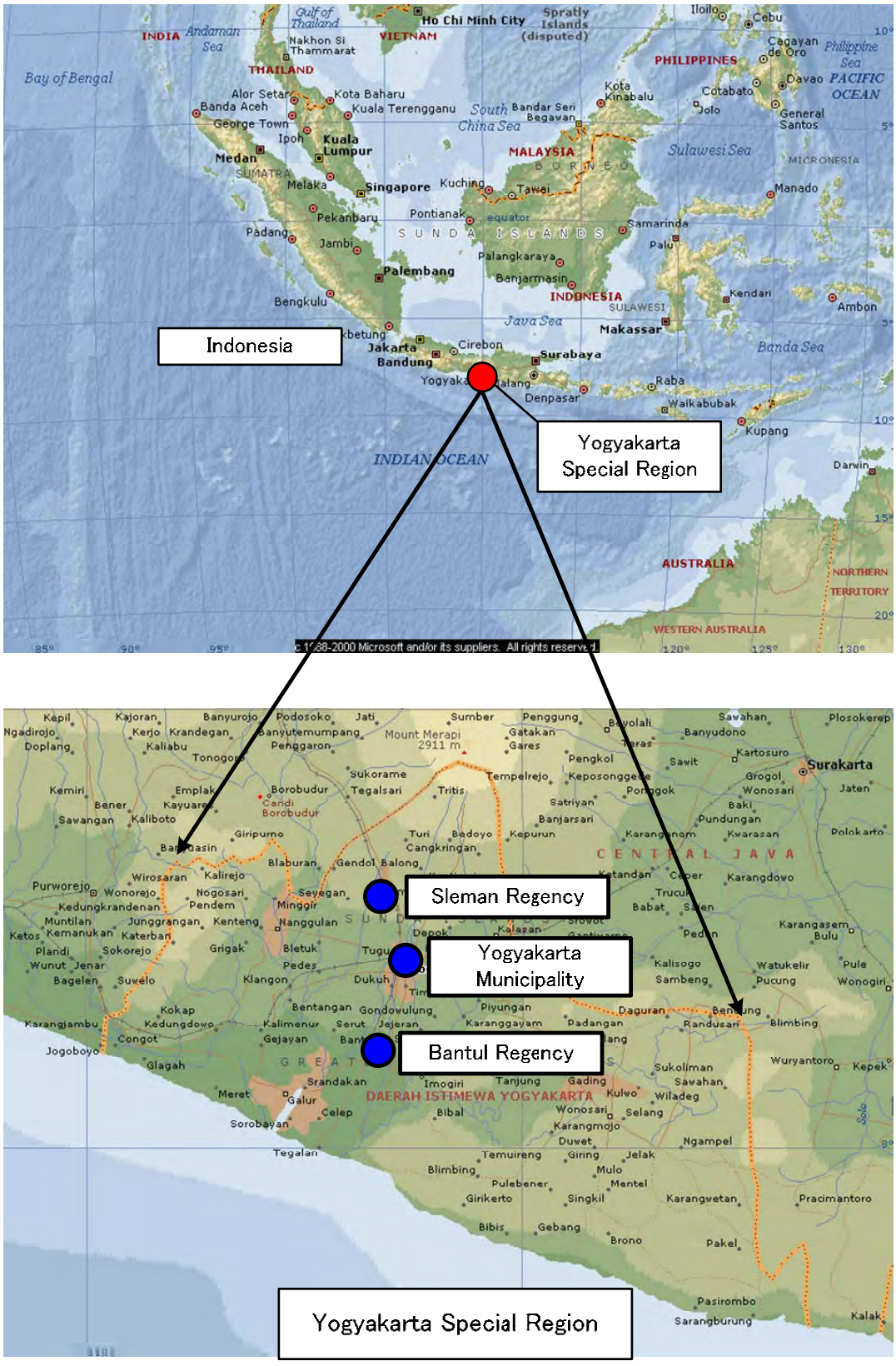
We are pleased to submit to you this Technical Report on the Study on Regional Water Supply Development Plan for Greater Yogyakarta in the Republic of Indonesia. This report incorporates the views and suggestions of the authorities concerned of the Government of Japan, including your Agency. It also includes the comments made on the Draft Technical Report by various agencies concerned of the Republic of Indonesia.

We wish to take this opportunity to express our sincere gratitude to your Agency, the Ministry of Foreign Affairs and the Ministry of Health, Labour and Welfare of the Government of Japan for their valuable advice and suggestions. We would also like to express our deep appreciation to the relevant officials concerned of the Government of Indonesia and Provincial Government of Special Region of Yogyakarta for their close cooperation and assistance extended to us throughout our Study.

Very truly yours,

Takemasa Mamiya, Team Leader
Study on Regional Water Supply
Development Plan for Greater Yogyakarta
in the Republic of Indonesia

LOCATION MAP



JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

THE MINISTRY OF PUBLIC WORKS
AND
THE PROVINCIAL GOVERNMENT OF YOGYAKARTA SPECIAL REGION
THE REPUBLIC OF INDONESIA

STUDY ON REGIONAL WATER SUPPLY DEVELOPMENT PLAN FOR GREATER YOGYAKARTA IN THE REPUBLIC OF INDONESIA

Technical Report

Volume II
Main Report

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Abbreviation

ADB	Asian Development Bank
AMD	Air Minum Desa (Community Water Supply)
APBD I	Anggaran Pendapatan dan Belanja Daerah Tingkat I (Provincial Budget)
APBD II	Anggaran Pendapatan dan Belanja Daerah Tingkat II (District Budget)
APBN	Anggaran Pendapatan dan Belanja National (National Budget)
ARI	Acute Respiratory Infections
AusAID	Australian Agency for International Development
BAPPEDA	Badan Perencanaan Pembangunan Daerah Tingkat-I and Tingkat-II (Development Planning Board for Provincial and District Level)
BAPPENAS	Badan Perencanaan Pembangunan Nasional (National Development Planning Board)
BDD	Bidan di Desa (Village midwife)
BHN	Basic Human Needs
BMG	Biro Meteorologi dan Geofisika (Meteorology and Geophysic Agency)
BPAM	Badan Pengelola Air Minum (Management Board for new Drinking Water Projects before being established as a PDAM
BPD	Village Representative Council
BPL	Below Poverty Line
BPPSPAM	Supporting Board for SPAM
BPS	Biro Pusat Statistik (Central Bureau of Statistics)
BPT	Break Pressure Tank
Broncaptering	Any small structure built to 'capture' a water source
Buis beton	Traditional concrete rings used to line hand-dug wells
Bupati	Kepala Kabupaten (Head of a District; sometimes called "Regent")
Camat	Kepala Kecamatan (Head of a Sub-District)
CARE	Co-operative for Assistance and Relief Everywhere (International NGO)
CCF	Christian Children's Fund
CIDA	Canadian International Development Agency
Cipta Karya	Direktorat Jenderal Cipta Karya (Directorate General of Human Settlements DGHS)
CMR	Child Mortality Rate
DATI I	Daerah Tingkat I (Provincial Government Level)
DATI II	Daerah Tingkat II (District Government Level)
DBOT	Design, Build, Operation, and Transfer
Desa	Rural village, lowest level of Government
DG	Directorate General
Dinas	Provincial or District level governmental department
DIP	Daftar Isian Proyek (List of Development Projects)
DIY	Yogyakarta Special Province
DPU	Generic term for all departments of Public Works now included in Kimpraswil
Dukun	Traditional birth attendant
DUPDA	Daftar Usulan Proyek Daerah (List of Proposed Yearly Development Projects at Tk.II)
Dusun	Sub-Village/Hamlet in rural area
EC	Electric Conductivity
EIIKK	Eastern Islands IKK Water Supply and Sanitation Project (Aus AID program)

ESWS	NTB Environmental Sanitation and Water Supply Project (Aus AID Program)
FGD	Focus Group Discussions
FIRR	Financial Internal Rate of Return
FLOWS	Flores Water Supply and Sanitation Reconstruction and Rural Development Project (Aus AID Program)
FRP	Fiber Reinforced Plastics
GIP	Galvanized Iron Pipe
GIS	Geographic Information System
GL	Ground Level
GOI	Government of Indonesia
GOJ	Government of Japan
Goton-Royong	Activity of Mutual Aid Society
GRDP	Gross Regional Domestic Product
GSP	Galvanized Steel Pipe
Hamlet	A small rural community not recognized as a Dusun
HC	House Connection (To a piped water supply system, usually metered)
HDPE	High Density Polyethylene Pipe
IBRD	International Bank for Reconstruction and Development
IEC	Information, Education and Communication
IGA	Income Generation Activities
IKK	Ibu Kota Kecamatan (Core Area of a Sub-District)
IMR	Infant Mortality Rate
Ir.	Insinyaur (The Professional title 'Engineer')
JBIC	Japan Bank for International Cooperation
JICA	Japan International Cooperation Agency
K. Desa	Kepala Desa (Head of a Village - Lowest official level of local Government)
Kabupaten/Kab	District/Regency (Local Government level II or Tk.II)
Kampung	General term for any sub-village or hamlet, but more commonly used in urban and rural areas
Kecamatan	Sub-District
Kelompok	An unofficial committee or group of people
Kelurahan	Urban village, the lowest administrative unit in status equal to a Desa
Kepala Desa	Head of a Village (Lowest official level of local Government)
Kepala Dusun	Head of a Hamlet
Kepala Suka	Traditional Religions Leader (In Sumba)
Keputusan	Decree
KFW	German Development Bank
KHPPIA	Kelangsungan Hidup Perkembangan Perlindungan Ibu dan Anak (Development and Protection for Mother and Child)
Kimpraswil	Same as “Cipta Karya”
KK or K/K	Kepala Keluarga (Head of a family)
Kotamadya	City-equivalent administrative status to a Kabupaten
Lb.	Labuhan (Common place name) Coastal plain behind the seashore
LBW	Low Birth Weight
LKMD	Lembaga Ketahanan Masyarakat Desa (Village self reliance organization, village development council)
LRWSS	Lombok Rural Water Supply and Sanitation Project (AusAID program)
M.A.	Mata Air (Spring)
MOH	Ministry of Health
MOHA	Ministry of Home Affairs (Dalam Negeri)

MOU	Memorandum of Understanding
MSRI	Ministry of Settlement and Regional Infrastructure
Musbangdes	Musyawarah Pembangunan Desa (Village development planning discussion)
NGO	Non-governmental Organization
NTB	Nusa Tenggara Barat (West Nusa Tenggara)
NTT	Nusa Tenggara Timur (East Nusa Tenggara)
O&M	Operasi dan Pemeliharaan (Operation and Maintenance)
O/H	Overhead (High tension electric power line)
OECF	The former Overseas Economic Cooperation Fund of Japan (now JBIC)
OJT	On-the-Job Training
P2AT	Proyek Pengembangan Air Tanah (Groundwater Development Project)
P3P	Proyek Peningkatan Prasarana Pemukiman (formerly P3AB) (Development and Management of Water Supply Construction Projects)
PAM	Perusahaan Air Minum (Water Enterprises) Generic term used for PDAM and BPAMs
PDAM	Perusahaan Daerah Air Minum (Regional Drinking Water Enterprise)
Peraturan	Regulation
PERPAMSI	Persatuan Perusahaan Air Minum Seluruh Indonesia (Indonesian Water Supply Association)
PH	Public Hydrant
PKK	Pembinaan Kesejahteraan Keluarga (Local Women's Welfare Organization)
PLN	Perusahaan Listrik Negara (National Electricity Enterprise)
PMD	Department of Community Empowerment
POKMAIR	Kelompok Pemakai Air (Name of WUO)
Polindes	Poliklinik Desa (Village health sub-center)
PPP	Public Private Partnership
Propinsi	Province (First level of local government Tk.I)
PU	Pekerjaan Umum (Public Works)
Puskesmas	Pusat Kesehatan Masyarakat (Village Health Center)
PVC	Unplasticized Pol y vinyl Chloride (Pipe)
PVP	Photovoltaic System
Rakorbang	Rapat Koordinasi Pembangunan (Project/Budget selection discussion at Tk.II)(Coordination Meeting for Development Budget Planning)
RC	RC (Reinforced Concrete)
RDWS	GOI Rural Water Supply Development Program
RESV	Reservoir
RK	Rukun Kampung (Hamlet in a rural area)
RRA	Rapid Rural Appraisal
RT/RW	Rukun Tetangga (Neighborhood)/Rukun Warga (Hamlet in an urban area)
RWSS	Rural Water Supply and Sanitation Project (ADB program)
S/W, SW	Scope of Work
Sawah	An area of irrigated land used for growing paddy
SC	Specific Capacity
Sekretaris	Secretary, as in Sekretaris Desa
SISKES	GOI Health Services Improvement Program
SPAM	Drinking Water Supply System
SSF	Slow Sand Filter (Water Treatment Plant)
SWL	Static Water Level
T	Temperature
TB	Tuberculosis
TBA	Traditional birth attendant

Tk.I	Tingkat I. The first level of local government. I.e. Province
Tk.II	Tingkat II. The second level of local government. I.e. District
TNI	Tentara Nasional Indonesia. The Indonesian armed force
TP-PKK	Women's movement Organization
U5MR	Under 5 Mortality Rate
UDKP	Usulan Kecamatan (List of Development Planning Proposals)
UFW	Unaccounted-for-Water
UNDP	United Nations Development Program
UNICEF	United Nation Children's Fund
UU	Undang Undang (Law)
VAP	Village Action Plan
VES	Vertical Electric Sounding
WSS	Water Supply and Sanitation
WSSLIC	Water Supply and Sanitation Project for Low Income Communities (World Bank program)
WTP	Water Treatment Plant
WUO	Water Users' Organization

CHAPTER 1 BACKGROUND OF THE STUDY

The study area covers the Yogyakarta Municipality, Sleman Regency and Bantul Regency. The total administrative area is about 1,200 km^2 and the total population in 2004 was about 2,100,000. The water supply system is operated by PDAM, under the jurisdiction of the respective regional administrative bodies (i.e. the municipality and the regencies). The water supply situation is deteriorating due to population increases, lack of timely facility improvement, and ageing of the facilities. Outside of the PDAM service area, people rely on community water supply systems. These systems are usually supplied from groundwater or spring water.

The groundwater has been used widely for domestic, industrial and commercial purposes. It is considered that this situation means that it may be difficult to further develop the groundwater resource within the study area. Therefore, the Government of the Special Province of Yogyakarta (DIY) has started preparatory work (by introducing private sector investment through the DBOT project) for a bulk water supply system.

In response to an official request from the Government of the Republic of Indonesia (GOI), the Government of Japan (GOJ) agreed to provide technical support for the study for the Regional Water Supply Development Plan for Greater Yogyakarta ("the Study"). This support is being provided through the Japan International Cooperation Agency (JICA). JICA is the GOJ's official agency responsible for implementation of technical cooperation projects.

The Study was originally scheduled to be conducted in the following three phases:

- Phase I: Formulation of Policy and Strategy
- Phase II: Formulation of Master Plan
- Phase III: Formulation of Action Plan

The scope of work was mutually agreed by the GOI and JICA on July 11, 2006. In this agreement, DIY requested to make the Master Plan in consistence with the bulk water supply project for which Yogyakarta Special Province has DBOT agreement signed on January 15, 2005. JICA understood the above DIY's request and it would consider, as given conditions for the Master Plan, the quality and quantity of the bulk water and its delivery points, which shall be reservoirs in Yogyakarta Municipality and Regencies of Bantul and Sleman.

JICA requested and DIY agreed to keep JICA informed of the bulk water supply project in order to implement the study work effectively."

Since the DBOT project is located as upstream side of the JICA Study, from raw water intake to the reservoirs, detailed information concerning the DBOT bulk water supply project was

indispensable for preparation of the Mater Plan by JICA. However, provision of sufficient authorized information of the DBOT project to the JICA Study Team was difficult for Indonesian side.

At the commencement of Phase II, JICA and Indonesian side held a series of meetings to discuss future direction and the scope of work of the Study.

In the Minutes of these meetings, following issues were confirmed by the both parties.

- The scope of Phase II for preparation of Master Plan could not be commenced under the current circumstances.
- In case that the necessary information such as the location/capacity of reservoirs and water quantity and quality of bulk water were not provided by Indonesian side, the Study would be regrettably terminated with the completion of the Part 1 of Phase II.

Indonesian side requested continuation of the Study and agreed to confirm conditions for continuation of the Study which were discussed during the meeting.

The DIY issued a confirmation letter on July 23, 2007, unfortunately, the contents of the letter were regrettably not sufficient to fulfill the requirements stated in the last Minutes of Meeting.

Upon receivable of the letter from the DIY, the JICA decided to terminate the Study in November 2007. This Technical Report was prepared to describe and to explain all the results by the Part 1 of Phase II. In this report, although the master plan was unfortunately not prepared, the issues should be discussed in future master plan are also listed up based on the results of analysis and field investigation of the JICA Study Team.

CHAPTER 2 OBJECTIVES OF THE STUDY AND STUDY AREA

2.1 Objectives of the Study

The original objectives of the Study which were agreed on July 11, 2006 between GOI and JICA were:

- to prepare a Master Plan on Regional Water Supply Development Project in Greater Yogyakarta (Yogyakarta Municipality, Sleman Regency and Bantul Regency) with a target year 2020,
- to prepare an Action Plan for the institutional strengthening for the water supply services in Greater Yogyakarta, and
- to carry out capacity building of counterparts through the participation in the Study

However, preparation of the Master Plan was suspended because of lack of sufficient authorized

information concerning DBOT Bulk Water Supply Project as described in Chapter 1. Preparation of the Action Plan was also suspended accordingly.

The Study was ended by preparation of this Technical Report and the Report includes issues to be discussed in future mater plan.

2.2 Study Area

The Study area covers Yogyakarta Municipality, Sleman Regency and Bantul Regency.

CHAPTER 3 NATURAL AND SOCIO ECONOMIC CONDITIONS OF THE STUDY AREA

3.1 Natural Conditions

The Study area is located at southern central Java Island in DIY which is comprised of Kulonprogo Regency, Bantul Regency, Gunungkidul Regency, Sleman Regency and Yogyakarta Municipality. The Target areas of the Mater Plan Study are Bantul Regency, Sleman Regency and Yogyakarta Municipality.

Table 3.1.1 Name of Capitals. Areas

Regency/Municipality	*Capital*	*Area (km2)*	*Area (%)*
Kulonprogo	Wates	586.27	18.40
Bantul	**Bantul**	**506.85**	**15.91**
Gunungkidul	Wonosari	1,485.36	46.63
Sleman	**Sleman**	**574.82**	**18.04**
Yogyakarta	**Yogyakarta**	**32.50**	**1.02**
DIY		3,185.80	100.00

Source: National Land Board of DIY

Topographically important features of the province or the study area are listed as follows.

- An active volcano Mount Merapi, as the highest mountain (2,911m) in this area rises on the north of the area and its slope extend to the south by the Indian Ocean.
- The study area lay between Mount Merapi and Indian Ocean.
- The complex system of tributary rivers are draining the Merapi slopes either to the Progo River or the Opak River
- Coastal alluvial plains of Kulonprogo and Bantul are stretching on the south.
- Volcanic and sedimentary hills dominant at the border of eastern Buntul and northern Gunungkidul.
- Old volcanic “West Progo” and limestone “Sentolo” hills of Kulonprogo is located on the west.

The geology of this area is complicated because of the volcanic activities that continue today and past changes in sea level. Large part of the study area is covered by alluvial deposits or volcanic sediments mainly originated from Mount Merapi. Lowland plain in the south part is covered by alluvial deposits derived mainly from the redeposited volcaniclastic materials. Important formations for water resources are the Tertiary and Quaternary deposits which consist of alluvial deposits and volcaniclastic sediments. Because of it's high permeability, these formation act as good aquifer. There is one really major aquifer in the study area, the Merapi granular aquifer which outcrops over most of Sleman and Bantul.

The climate of the study area is categorized as tropical monsoon by two seasons, the dry and rainy season. It is said that the dry season is from April until September and the rainy season is from October to March. Figure 3.1.1 stated the air temperature of a weather station, which is located in the rough center of the study area. Usually dry season is hotter than rainy season. The total rainfall was 1,862mm in 2005. The total amount of rainfall recorded in December was highest.

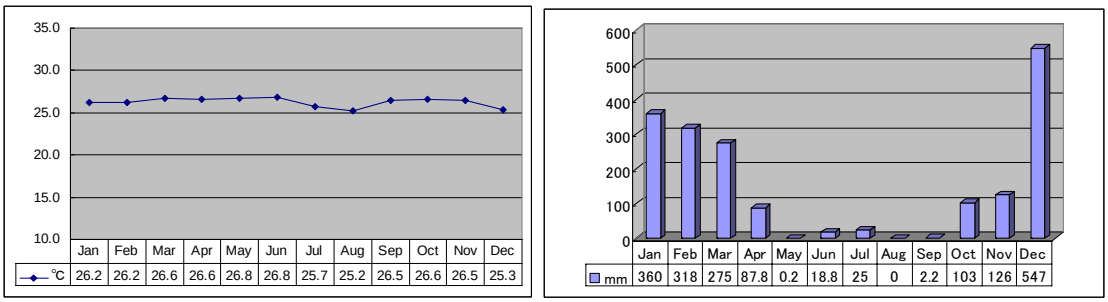


Figure 3.1.1 Temperature and Rainfall in the Study Area (2005)
Observed at Jitengan, Balecatur, Gamping, Sleman (S07'48'59'18', E110'17'42'00)
Source: Meteorological and Geophysical Agency

3.2 Socio Economic Conditions

3.2.1 Administrative Structure

The administrative (executive) structure of the Republic of Indonesia consists of three layers: the central government, provincial government, and regency's/municipality's government.

The profile of the districts comprising the Study Area is:

- Yogyakarta Municipality consists of 14 sub-districts (*Kecamatan*) and 45 towns/villages (Kelurahan).
- Sleman Regency consists of 17 sub-districts (*Kecamatan*) and 86 towns/villages (Kelurahan).
- Bantul Regency consists of 17 sub-districts and 75 towns/villages.

The Provincial and Municipality's/Regency's Government have similar organization structures. The Municipality's/Regency's government consists of head of Municipality/Regency (*gubernur* or *bupayi/warikota*) responsible for executive branch and the Municipality's/Regency's DPRD (House of Representative) for legislative branch. PDAM is a water supply service company 100 %-owned by the Municipality's/Regency's government.

Total budget of Rp991.5 billion of DIY was sourced from regional revenue (37%), allocation funds (44%) and other funds (18%). The share of DAU/DAK (transfer from central government) of the allocation funds is as high as 91%. The budget was allocated to development expenditure (30%), routine expenditure (45%) and allocation to district governments (25%). We can say the budget structure of DIY is not healthy in that most of the budget is eaten up by recurrent expenditures (salaries, overheads, maintenance, etc) and only 30% is able to allocate to new infrastructure investment.

3.2.2 Population

According to the results of the National Socio-Economic Survey in 2005, the population in DIY was recorded as 3,281,800 people, consisting of 50.78% females and 49.22 % males. The percentage of urban population is 58.11% and of rural population is 41.89%. The growth rate of the population is 1.88%, which is greater than that of 2004 and before.

3.2.3 Industry

The Major industries in the Study Area are; tourism and its relative services, small-scale manufacturing and agriculture. These categories share more than 70% of the total GDRP of the Study Area. The economic growth of DIY in 2005 based on 2000 constant prices was recorded at about 4.74% in accordance with the statistical data of BPS DIY. There is positive growth in all sectors.

3.3 Legislative System

3.3.1 Water Law

The legal system of Indonesia is of hierarchy structure of the three levels; UU (state law), PP (government regulation) and PM (ministerial regulation). The water supply sector in Indonesia is governed by two key legislations: the water resources law (UU7/2007) and the government regulation on SPAM (PP16/2005). UU 7/2004 is one of most advanced water laws in terms of

three superior points: (i) river-basin management system is institutionalized; (ii) transparent water charging mechanism is introduced; and (iii) water rights are clearly defined.

In order to implement SPAM development per UU 7/2004 a number of government regulations (PP) are needed. Out of these, PP 16/2005 has been enacted. In order to control and manage water resources effectively, two important regulations on surface water and groundwater are needed, which define specific rules and guidelines of each water resource. These regulations remain in draft form in Jakarta and have not been published (as of March 2007).

Likewise, PP 16/2005 calls for a number of ministerial regulations, including four important ones presented here. Out of these, regulations on BPPSPAM, tariff setting and financial restructuring for PDAMs have been enacted. But, specific guidelines for SPAM management, operation &maintenance, and monitoring & evaluation have not been published.

PP16/2005 stipulates roles and functions of the three-tire governments (central, province and district/PDAM). Therefore the institutional responsibility of entities concerned for three main functions of (i) policy making, (ii) regulation, and (iii) operation. Out of these the regulatory function needs to be clarified. There is a mention of Supervisory Board for SPAM management at Province level in PP 16/2005, but detailed rules of the Board have not been published.

The Indonesian Government has recently accelerated promotion of PSP/PPP in infrastructure development by enacting two important regulations. These are Presidential Regulation 67/2005 and Finance Ministry Regulation No. 38/PMK. 01/2006.

The JICA Study Team conducted a questionnaire survey to see if government officials concerned have a clear understanding and interpretation of related regulations. The questions divided into four main subjects: (i) water law, (ii) water policy, (iii) water administration, and (iv) sector performance. Ten (10) entities have responded to the questionnaire. These include: two from DIY Province (Secretary and PU); two from Yogyakata City (BAPPEDA and PDAM); three from Sleman Regency (BAPPEDA, PU and PDAM); and three from Bantul Regency (BAPPEDA, PU and PDAM).

The results of the questionnaire survey revealed that:

- The levels of governments (central, province and district) having prime responsibility for management of surface water, groundwater and water quality are different among entities. This suggests lack of clarity of institutional responsibility on this issue.
- The cost recovery policy varies among PDAMs. Yogyakarta (urban area only) adopts full cost recovery while Sleman and Bantul (urban-rural mixed area) does partial cost recovery policy. Full subsidy policy for capital cost is adopted for the rural area not

covered by PDAM.

- Regarding PSP policy, the government agencies (Secretary, BAPPEDA and PU) prefer PSP/PPP while the operators (PDAM) are reluctant to take it. However, all respondents (even PDAMs) favor user participation and decentralization in water sector.
- Perception of relative role and influence of government branches on domestic water supply varies among respondent. The PDAMs tend to perceive more decentralized institutional responsibility than regional governments.
- Regarding of operators overstaffing and the effect of PSP/PPP there is a sharp division of opinion among respondents. All three PDAMs do not consider PSP can lead to redundancy in operation staffs. They seem to seek improvement of operational efficiency by not resorting to PSP options.
- All entities do no think there is an independent body (regulator) for determining water price. This implies regulatory framework (including tariff regulation) is not established yet, and suggests area of policy improvement in this area.

Some respondents raised particular issues to be addressed.

- From the Secretary of DIY Province: areas needing technical assistance include: (i) development of stable water sources, (ii) equitable water use, (iii) prioritization of water use, (iv) management of water facilities by communities, and (v) watershed management and conservation
- From PU of DIY Province: needs support for areas such as (i) water resources management and (ii) improvement of SPAM management by PDAMs.
- From PDAM Sleman: areas to be improved include (i) how to motivate employees for making a profitable company, (ii) how to use cost-reducing technologies, (iii) how to reduce water losses, (iv) how to locate cheaper water sources, (v) how to replace water meters, (vi) how to make procedures simple, and (vii) how to upgrade team work capacity.

3.3.2 Legislation on Sanitation

The Regulation No. 16/2005 has the stipulations of the following related to sewer/sanitary facilities. The stipulations are summarized as follows.

1) The development of sanitation facility is based on the following considerations;

- Consideration into the poor and people in water-troubled areas
- Improvement of people's health
- Fulfillment of service standards
- No involvement in negative social impact

2) If the sewage facility has already been available, every person and group is prohibited to be disposed to sewage directly, without undergoing any process, to raw water resources for drinking water.

3) If the sewage facility has not been available yet, every person and group is prohibited to dispose sewage directly, without undergoing any process, to raw water resources

determined by the central government/concerned local government.

4) Centralized sewage disposal system is intended for populous areas with nothing the supporting capacity of an area and its water supply system and also considering people's socio-economic condition.

3.3.3 Environmental Laws

Initial Environmental Examination (IEE), i.e. *UKL* (Environmental Management Plan) and *UPL* (Environmental Monitoring Plan) are obligated during the full-scale study stage performing the Feasibility Study (F/S) in Indonesia.

With regard to *AMDAL* (EIA: Environmental Impact Assessment), the related ministries/agencies formulated the individual implementation guideline respectively. Furthermore, the agency governing the target project will give the final conclusive determination on *AMDAL*'s appraisal by obtaining the advices from the Central and/or Provincial Committee on Environment. For water supply sector, the demarcation line on judgment of necessity between IEE and EIA are summarized as Table 3.3.1 according to the information from *BAPEDALDA* of Sleman Regency, Yogyakarta City, and Bantul Regency respectively. Moreover, only submission of *SPPL* (Environmental Management Recommendation Letter) to *BAPEDALDA* is required while the very slight impact is anticipated.

Table 3.3.1 Demarcation Line on Judgment of Necessity between IEE and EIA

Classification	UKL & UPL（IEE）	AMDAL（EIA）	Remarks
1) Water Treatment Plant[*1]	Water treatment capcity with 50 - 100ℓ/s	Water treatment capacity over 100ℓ/s	
2) Withdrawal from River, Lake, and Spring[*2]	- Draw water below 250ℓ/s - Service area below 500ha - Length of transmission main below 10km (Length of transmission main with 2 - 10 km[*1])	- Draw water over 250ℓ/s - Service area over 500ha - Length of transmission main over 10km - Pipeline cross over 2 or more regencies[*2]	- Urban Area - Equivalent of supplied population of 200 thousands or medium-scale city
3) Pumping-up of Groundwater[*1*2]	Pump up water with 5 - 50ℓ/s	Pump up water over 50ℓ/s	- Per well - Pump up water from 5 wells within 10ha
4) Withdrawal from Spring[*1]	Draw water with 5 - 50ℓ/s	Draw water over 50ℓ/s	

*Note: *1 Source for Groundwater and Springs refers "Type of Documents for Environmental management in Business, Attachment III, Yogyakarta Regulation No.41, 2006.*
**2 "Business and/or Activities need Execution of EIA", Appendix, No.117/2001, Decree by State Minister for the Environment.*

CHAPTER 4 RELATED DEVELOPMENT PLANS AND ASSISTANCE OF OTHER DONOR AGENCIES

4.1 Development Plan of National Level

The existing Nation Development plan is PROPENAS 2004 – 2009. In the National Development Plan, improvement of safe water supply system considering the poor is stated conforming to the last 5 year National Development Plan.

GOI established "National Action Plan, Drinking Water Supply in Indonesia" as follows.

- GENERAL GOALS (Target):
  - Improve the people welfare through improve health rate with drinking water supply and clean environment
- NATIONAL LEVEL TARGET to 2015
  - Urban Area: Service ratio 80 %, with 100 l/d per capita consumption
  - Rural Area: Service ratio 60 %, with 60 l/d per capita consumption
- PROVINCIAL/REGIONAL LEVEL TARGET
  - To establish policy support on regional development
  - To prepare regional land use plan
  - To secure potential water resources
  - To prepare Master plan of drinking water supply in urban and rural area
  - To achieve MDGs with adequate regional capacity

According to the RPJMN (mid-term water supply sector development plan) 2004-2009, National development target by year 2009 is as follows.

Table 4.1.1 Future Served Population/Service Ratio, Target of RPJMN 2004-2009

No	Category	Present Served Population (million) (2004) (Service Ratio%)	Target Served Population (million) (2009) (Service Ratio%)	Increasing scope Million people
1	Urban	31.2 (33%)	77.0 (66%)	45.8
2	Rural	8.7 (7%)	36.0 (30%)	27.3
3	Total	39.5 (18%)	113 .0 (40%)	73.5

Source: Ministry of Public Works

Policy and strategy of SPAM development are described in the RPJMN 2004-2009 and its contents are:

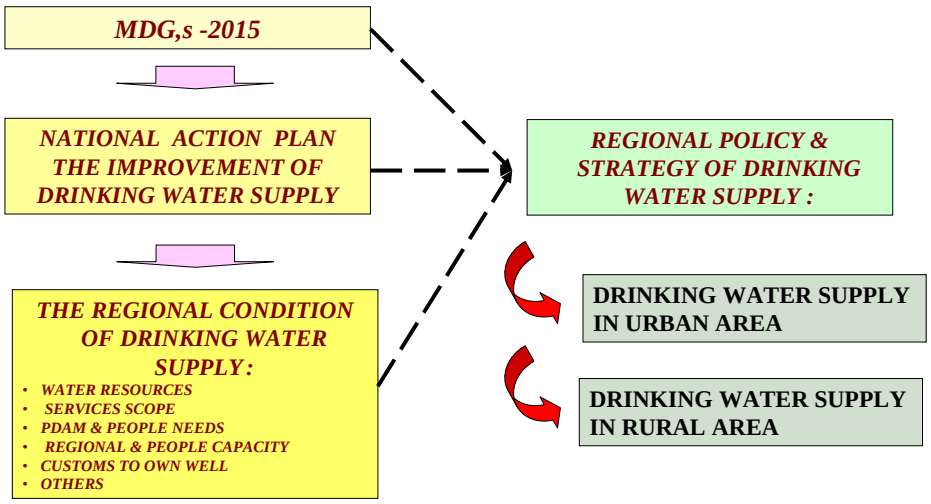
- Service Level and Quality
  - To increase the service level and quality consistently, step by step
  - To decrease water loss through adequate maintenance and rehabilitation
  - To put higher priority to supply water to low income people

- Funding
  - To increase the funding allocation of SPAM development through alternative source of fund
  - To improve management of PDAM financial situation
- Institution, Regulation, and Laws
  - To strength the regulator and operator function on SPAM management
  - To implemente business principle on the management of institution
  - To make a regulation

4.2 Development Plan of Provincial Level

4.2.1 Provincial Level Water Sector Development Plan

Provincial development plan for water sector is planned by BAPEDA together with KIMPRASWIL (Cipta Karya) and the future plan and policy/strategy are set up conforming to the national development policy. Relation between national policy and provincial policy is shown on figure below.



Source: Bappeda DIY

Figure 4.2.1 National and Regional Policies

To achieve MDGs, “Grand Strategy of Water Supply in DIY” is prepared as follows.

- Expansion of Water Supply Service
  By using water supply system optimally, using the PDAM idle production capacity, creating a new system, increasing the community role to achieve healthier life in Yogyakarta by Year 2010
- Maintain Sustainable Water Resources
  By increasing the efficiency of water usage, protecting and increasing the quality of water resources, and increasing the environment quality through cooperation with other region to secure sustainable water resources

- Technical assistance
  By facilitating and giving physical assistance, especially for poor community
- Mobilize Alternative Funding
  By funding of government and cooperation funding network of private parties both domestic and foreign
- Institutional Reformation
  By increasing stakeholder role in decision-making and water supply management
- Service Obligation
  By determining and facilitating the minimal service to all community layer

4.2.2 Inter Municipal Cooperation on Urban Infrastructure Management between Yogyakarta City, Sleman Regency, and Bantul Regency

In 2001, Kartamantul Joint Secretariat was established based on agreement among Yogyakarta City, Sleman Regency and Bantul Regency to support cross boundary cooperation among these three regions. The Joint Secretariat published "Inter Municipal Cooperation Kartamantul" in 2006 reviewing situation of seven sectors. The seven sectors are

- Roads Management,
- Transportation Management,
- Water Resource Management,
- Wastewater Management,
- Drainage Management,
- Solid Waste Disposal Management, and
- Organization Structure.

Vision of the Joint Secretariat is "*Take responsibility as a bridge for the realization of an equal, fair, participative, transparent, and democratic cooperation, in order to develop the comfort, beautiful, & health urban agglomeration area with the support of adequate infrastructure and a high community participation*".

For water resource sector, the Joint Secretariat targets cooperation which will be built with objective to fulfill of permanent amount of water demands/clean water in the urban agglomeration area in DIY. The Secretariat focus on issues such as management and services including water treatment plants, piping, reservoir, organization and mechanism, financing, tariff, and environment.

4.3 Assistance of Other Donor Agencies

Various donor agencies are actively implement many kinds of projects specially for restoration of damages caused by the last severe earthquake in May 2006.

Continuous assistance is made for water supply sector by USAID as a part of "Environmental Service Program (ESP)". Under the scope of the ESP, the USAID is focusing on capacity development of PDAM.

CHAPTER 5 WATER RESOURCES

5.1 General

The Progo River is the biggest river in the Study Area and provides irrigation water through the Mataram canal that reaches the Opak River at all times of the year even in dry season.

5.2 Water Resources for PDAM

PDAM water supply systems mainly cover urban areas in the study area. PDAM Sleman and PDAM Bantul have water sources in its own area but large number of the water sources for PDAM Yogyakarta located in Sleman Regency.

Water sources for PDAMs are classified into river, spring, shallow well and deep well. Table 5.2.1 shows the number of water sources for each PDAM and Table 5.2.2 shows the total quantity of water production capacity in each PDAM. According to these tables, deep well has 62% share of water source by number and has 63% by quantity in total 3 regions. River has 5%, spring has 15% and shallow well has 17% share of water source by water production capacity in all 3regions.

Table 5.2.1 Number of Water Sources for Each PDAM

unit:number

Type of Water Source	PDAM Yogyakarta		PDAM Sleman		PDAM Bantul		Total	
River	1	*2%*	0	*0%*	1	*5%*	2	*2%*
Spring	2	*4%*	2	*7%*	4	*19%*	8	*8%*
Shallow Well	11	*22%*	12	*43%*	5	*24%*	28	*28%*
Deep Well	36	*72%*	14	*50%*	11	*52%*	61	*62%*
Total	50	*100%*	28	*100%*	21	*100%*	99	*100%*

Source:Noted above information is collecting from staff of each PDAM

Table 5.2.2 Water Production Capacity in Each PDAM (by water source)

unit:L/s

Type of Water Source	PDAM Yogyakarta		PDAM Sleman		PDAM Bantul		Total	
River	80	*7%*	0	*0%*	15	*8%*	95	*5%*
Spring	128	*11%*	115	*23%*	22	*12%*	265	*14%*
Shallow Well	192	*16%*	90	*18%*	44.5	*24%*	326.5	*17%*
Deep Well	804	*67%*	295	*59%*	105	*56%*	1,204	*64%*
Total	1,204	*100%*	500	*100%*	186.5	*100%*	1,891	*100%*

Source:Noted above information is collecting from staff of each PDAM

For water supply of PDAMs in the study area, 74% by number of water sources and 88% by quantity of production capacity are depend on water sources in Sleman Regency.
Deep well is main source and shallow well is the second in all 3 regions.

5.3 Water Resources for Community Water Supply System

Community water supply systems cover rural areas where PDAM services cannot be provided. There are 104 community water supply systems in the study area. Spring water and shallow well are main water sources for community water supply systems.

Chapter 6 EXISTING CONDITION OF WATER SUPPLY SYSTEM

6.1 General

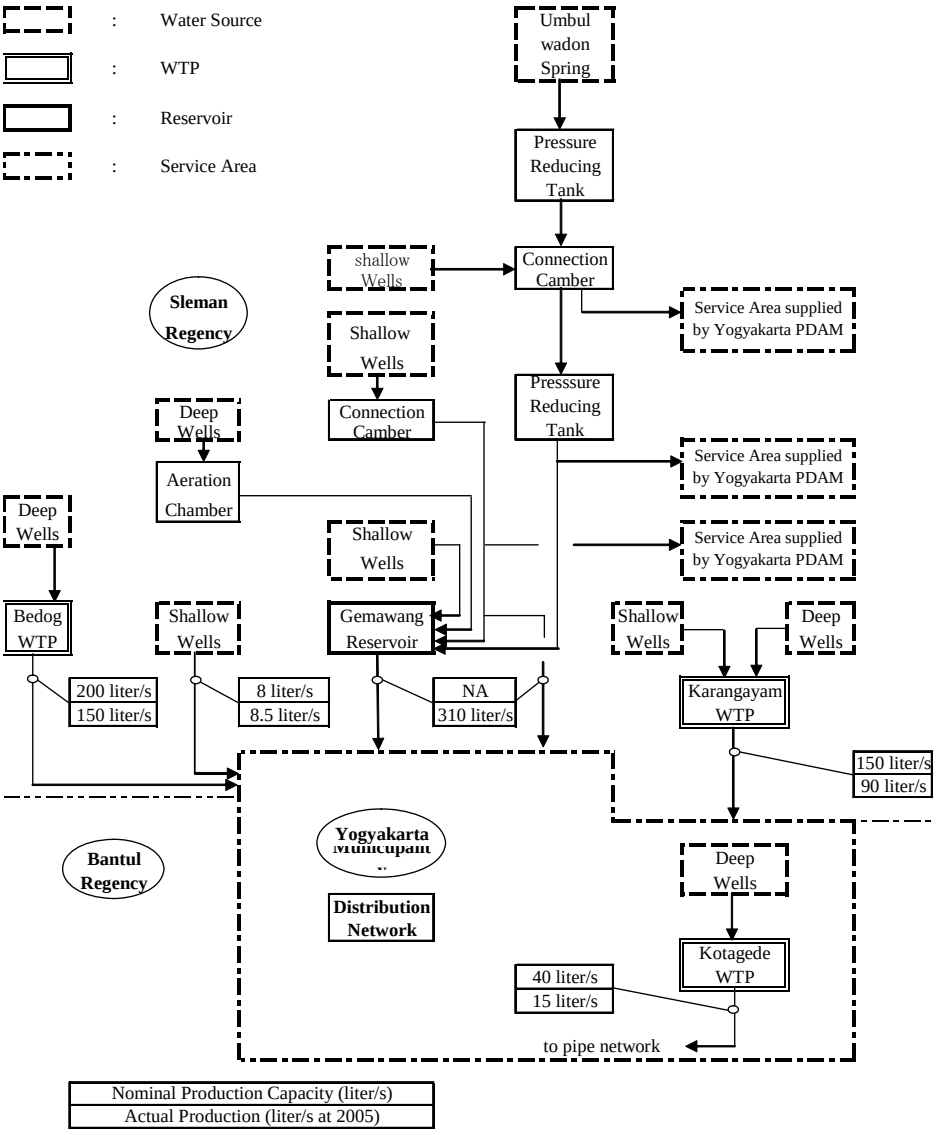
Water supply systems of Sleman Regency and Bantul Regency are managed, operated, and maintained by respective regencies' PDAMs and PU. PDAM is mostly in charge of urban areas and PU has responsibilities for community water supply system in rural area. Yogyakarta water supply system was transferred to PDAM Yogyakarta from Dutch company by authority of the regulation (Perda 3/1976) enforced in 1976.

6.2 PDAM Yogyakarta System

PDAM Yogyakarta is a water supply enterprise organization, having 151 technical staffs and 146 administrative staffs.

A schematic flow of water sources and water transmission system is shown in Figure 6.2.1. As shown on this figure, most of the water sources exist in Sleman Regency and they are transmitted to Yogyakarta Municipal area. Major inputs from the Sleman Regency are from

Gemawang Reservoir (spring water from Umbul Wadon Spring), Bedog WTP and Karangayam WTP. Only one system named Kotagede WTP exists in jurisdiction of Yogyakarta Municipality.



Source: PDAM Yogyakarta

Figure 6.2.1 Schematic Flow of Water Sources and Water Transmission

It should be noted that PDAM Yogyakarta has its service area in Sleman Regency along the transmission pipeline from Umbulwadon spring in Sleman to Yogyakarta. Althrough these service areas exist in Sleman Regency, they are managed by PDAM Yogyakarta

6.2.1 Performance of PDAM Yogyakarta

Performance of PDAM Yogyakarta is summarized in Table 6.2.1.

Table 6.2.1 Summary of PDAM Yogyakarta Performance

		1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Population	person	406,735	406,856	406,995	407,142	407,306	407,484	407,673	407,881	408,096	408,332
Total Water Production	l/sec	509.4	559.6	578.8	570.6	546.6	584.7	533.9	543.9	548.8	580.0
Total Water Consumption	l/sec	343.4	357.6	354.0	356.3	373.4	375.9	370.1	351.6	347.3	341.0
Public Services	l/sec	14.1	15.3	16.3	16.3	16.2	16.5	15.3	14.1	14.5	14.3
Domestic	l/sec	294.4	310.7	309.2	309.4	319.0	326.4	323.1	309.6	310.0	305.7
Commercial	l/sec	26.0	27.1	25.2	27.0	28.4	28.3	27.8	24.9	19.5	17.7
Industrial	l/sec	0.7	0.4	0.2	0.2	0.5	0.5	0.5	0.4	0.3	0.2
Public Standpipe	l/sec	4.7	1.8	0.4	0.6	6.3	0.5	0.5	0.4	0.6	0.7
Palace	l/sec	3.3	2.3	2.7	2.8	3.0	3.7	3.0	2.2	2.4	2.3
Non Revenue Water (NRW)	l/sec	166.0	202.0	224.7	214.3	173.3	208.8	163.7	192.4	201.4	239.0
NRW Ratio	%	32.6%	36.1%	38.8%	37.6%	31.7%	35.7%	30.7%	35.4%	36.7%	41.2%
Number of Domestic Connection	Nos	27,996	28,769	29,730	30,437	31,212	31,855	32,214	32,276	32,387	32,398
Served Population	person	139,980	143,845	148,650	152,185	156,060	159,275	161,070	161,380	161,935	161,990
(1 connection for 5 family members)		5	5	5	5	5	5	5	5	5	5
Service Ratio	%	34.4%	35.4%	36.5%	37.4%	38.3%	39.1%	39.5%	39.6%	39.7%	39.7%
Domestic Per Capita Water Consumption	lpcd	182	187	180	176	177	177	173	166	165	163

Source: PDAM Yogyakarta

NRW ratio is fluctuated between 31% and 40% while gradual increase is observed in these three years. Average NRW ratio is 35.6% in last 10 years from 1996 to 2005. House connections are categorized into five (5) categories such as Public Service (public office, institutions, religious places etc.), Domestic, Commercial, Industrial, and Kings Palace. Major portion of connection is category "Domestic" and it occupies about 90% in year 2005. Number of house connection has rapidly increased until year 2001 and it does not change after year 2002.

6.2.2 Operation and Maintenance

In each water supply system, intake water capacities by well pumps and distribution quantities from reservoirs are measured and recorded monthly as well as hourly. The facilities are operated under 24 hour basis.

There are no standby generators. Therefore in case of electric failure occurred, operation of intake pumps and treatment facilities would be suspended. Maintenances of transmission and distribution pipes are carried out by a distribution division in the PDAM. A water leakage survey and a rehabilitation of pipes are not conducted. Distribution pressure becomes relatively high at night and low at daytime.

PDAM Yogyakarta is preparing a distribution pipe network zoning. Up to now, the distribution pipe networks by Kotagede water supply facility and Karangayam water supply facility are isolated from neighboring system and are independent supply zone.

6.2.3 Summary of Problems Identified

- In dry season, groundwater abstraction from the shallow wells for Gemawang reservoir is declining and it will cause water shortage in Candi service area.
- Measures for reduction of NRW are required to be adopted as soon as possible.
- Main water sources (e.g., Umbulwadon Spring) for PDAM Yogyakarta are located in Sleman Regency. However, there is no clear agreement between both parties about sharing of water source (e.g., there is no clear agreement if the PDAM Yogyakarta maintain using existing water sources or increase intake volume from existing water sources in Sleman Regency when necessary in future). It is required consultations on sharing of spring water among related organizations including Sleman Regency.
- Some service areas in Sleman Regency (e.g., alongside the transmission main from Umbulwadon Spring to Gemawang Reservoir) are supplied by PDAM Yoyakarta. There might arise difficulties in terms of O&M in case multiple number of service providers exist in same area (e.g., it may be difficult to take necessary action promptly for possible damage or accident in case it is difficult to identify which PDAM is responsible for the damaged properties). It is necessary to have mutual understandings between PDAM Yogyakarta and PDAM Sleman with respect to:
  - Reviewing existing service area and considering restructure of service area in furure.
  - Demarcation of responsibilities for O&M.
- At Kotagede water treatment plant, an actual production is less than the nominal production capacity. It is caused by malfunction of treatment facilities and equipment, this condition should be rectified.

6.3 PDAM Sleman System

PDAM Sleman is a water supply enterprise organization, having 83 technical staffs and 115 administrative staffs.

Location of water unit is shown on Figure 6.3.1. As shown on the figure, small scale water units are dotted through whole area. In the urban area adjacent to Yogyakarta Municipality, several water units gather and others are scattered in rural area.

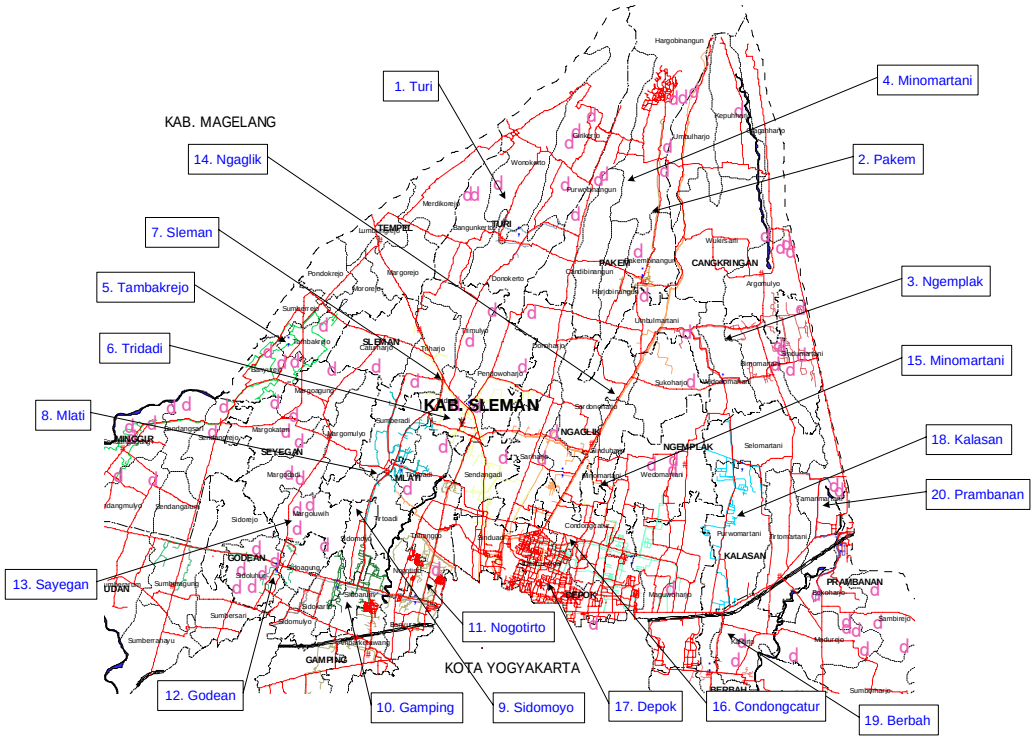


Figure 6.3.1 Location of PDAM Water Units

6.3.1 Performance of PDAM Sleman

Performance of PDAM Sleman is summarized in Table 6.3.1.

Table 6.3.1 Summary of PDAM Sleman Performance

		2004	2005
Total Population	person	948,146	960,803
Total Water Production	l/sec	159.3	178.0
Total Water Consumption	l/sec	96.1	95.4
Public Services	l/sec	3.3	4.0
Domestic	l/sec	88.9	87.7
Commercial	l/sec	2.1	1.8
Industrial	l/sec		
Public Standpipe	l/sec	1.8	1.8
Palace	l/sec		
Non Revenue Water (NRW)	l/sec	63.2	82.6
NRW Ratio	%	39.6%	46.4%
Number of Domestic Connection	Nos	18,788	18,994
Served Population	person	93,940	94,970
(1 connection for 5 family members)		5	5
Service Ratio	%	9.9%	9.9%
Domestic Per Capita Water Consumption	lpcd	82	80

Source: PDAM Sleman

6.3.2 Operation and Maintenance

PDAM Sleman has 17 water units (20 water supply facilities) and each unit is operated, managed, maintained by PDAM staffs. Personnel development trainings were held by biannual. A technical transfer was made by senior staffs on OJT at each water unit.

Some water sources and treatment plants are facing intake water shortages and insufficient treatment capacity. And water systems constructed in the 1980's to 1990's became superannuated.

6.3.3 Summary of Problems Identified

Major problems identified are summarized as below:

- In PDAM Sleman, a master plan, rehabilitation programs were not implemented except house connection meter replacement. Furthermore, an inventory on water supply system was not provided. Consequently it would be difficult to have a clear grasp of the actual condition of existing facilities.
- To improve operator's capability, it would be needed to provide operation and maintenance manuals both general matters and particulars.
- Difficulties of operation and maintenance were appeared in some water units, caused by equipment malfunctions.
- Because of complains from consumers on chlorine smell at tap water, chlorination at some water unit were not carried out.
- Reduction of NRW is to be carried out for energy saving on the water supply system and conservation of natural resources as soon as possible.
- As mentioned in section 6.2.3, it is required to have understandings among related organizations including Yogyakarta Municipality with respect to management of water source or service area restructuring.

6.4 PDAM Bantul System

PDAM Bantul is a water supply enterprise organization, having 50 technical staffs and 56 administrative staffs.

Location of water unit is shown on Figure 6.4.1. As shown on this figure, water units with several types and water production capacities are dotted in through whole Regency.

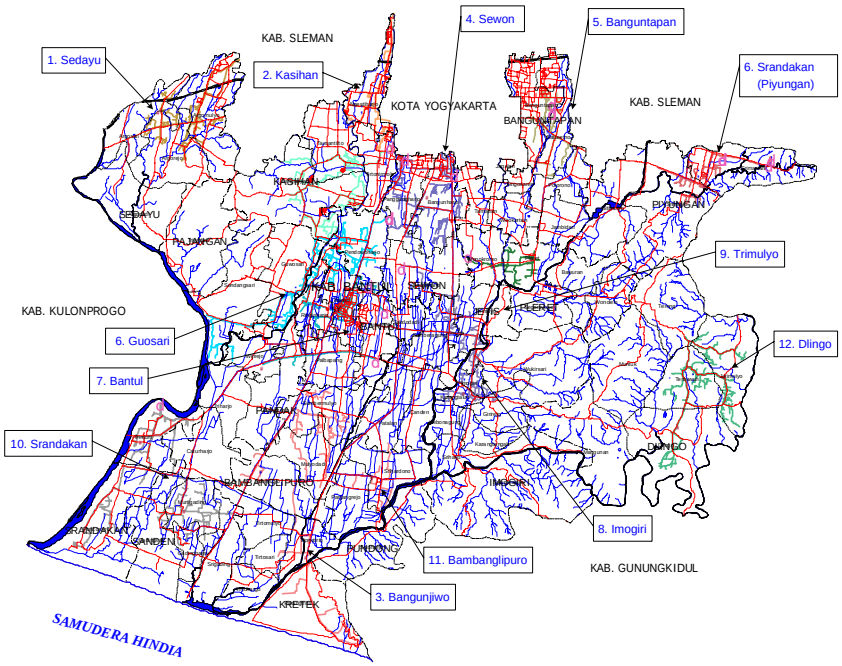


Figure 6.4.1 Location of PDAM Water Units

6.4.1 Performance of PDAM Bantul

Performance of PDAM Bantul is summarized in Table 6.4.1.

Table 6.4.1 Summary of PDAM Bantul Performance

		2004	2005
Total Population	person	816,100	825,285
Total Water Production	l/sec	102.7	107.4
Total Water Consumption	l/sec	61.6	62.8
Public Services	l/sec	1.4	2.7
Domestic	l/sec	57.8	59.4
Commercial	l/sec	0.3	0.5
Industrial	l/sec	0.1	0.1
Public Standpipe	l/sec	2.1	2.1
Palace	l/sec		
Non Revenue Water (NRW)	l/sec	41.0	44.6
NRW Ratio	%	40.0%	41.5%
Number of Domestic Connection	Nos	10,333	10,333
Served Population	person	51,665	51,665
(1 connection for 5 family members)		5	5
Service Ratio	%	6.3%	6.3%
Domestic Per Capita Water Consumption	lpcd	97	99

Source: PDAM Bantul

6.4.2 Operation and Maintenance

They have 12 water units and each water unit is operated, managed, maintained by PDAM staffs. Some water sources and treatment plants are facing intake water shortage and insufficient treatment capacity. Water supply facilities constructed in the 1990's became deterioration.

6.4.3 Summary of Problems Identified

- In PDAM Bantul, preparation of a master plan, future water demand estimation, rehabilitation program were not conducted. Furthermore, an inventory with water supply facilities was not provided. Consequently it would be difficult to have a clear grasp of the existing facilities.
- Trainings for personnel educations and technical trainings were not planed nor carried out periodically so it would become one reason of difficulty of proper operations and maintenances of water facilities, house connection meter readings and billing.
- A replacement and/or repair of water meters, which were installed in 1990's, were not made. Malfunctions of water meters were reported and PDAM already grasp actual condition of the meters.
- A poor operation and maintenance was appeared in some water units, caused by insufficient operation/maintenance technique, knowledge on water supply system and water treatment equipment malfunctions.
- Because of complains from consumers of chlorine smell in supplied water, chlorination injection to treated water was not made in some water unit.
- NRW ratio reaches approximately 40%. Reduction of NRW is to be carried out by proper measures for energy saving purpose and conservation of natural resources.

6.5 Comparison of Three PDAMs, Yogyakarta, Sleman, and Bantul

6.5.1 Total Water Production (l/sec)

Water production of Sleman and Bantul is far smaller than one of Yogyakarta. However, it should be noted that PDAM Yogyakarta depends on its water source on spring/wells in Sleman Regency mainly.

6.5.2 Total Water Consumption (l/sec)

Total water consumption in these three PDAMs is about 500 l/sec. On the other hand, total water production is about 850 l/sec.

6.5.3 Water Consumption by Category (l/sec)

Portion of domestic water consumption is the highest among all categories. Non-domestic

water consumption (other than domestic water consumption) is rather high in Yogyakarta, but the ratio of non-domestic water consumption is low in these three PDAMs.

6.5.4 Non Revenue Water Ratio

NRW ratios in these three PDAMs show high level, 40 % to 50 %. Measures for reduction of the NRW ratio should be planned and implemented.

6.5.5 Service Ratio

Service ratio of PDAM Yogyakarta is the highest and the other two PDAMs show very low service ratio by individual house connection. Including Yogyakarta PDAM, service ratios in these three PDAMs are still very low comparing to National Target.

6.5.6 Domestic per Capita Water Consumption (l/sec)

Domestic per capita water consumption in Yogyakarta is the highest and about 160 l/sec. Per capita water consumptions in Sleman and Bantul Regencies are low comparing to one of Yogyakarta. Per capita water consumption in these two PDAMs are average figure of respective PDAMs, therefore, per capita in rural area is also counted. (Yogyakarta is only urban area)

Table 6.5.1 Comparison of Problems Identified in Respective PDAMs

Field	*Yogyakarta PDAM*	*Sleman PDAM*	*Bantul PDAM*	*Remarks*
Availability of long-term development plan, system rehabilitation plan	Not available	Not available	Not available	Long-term development plan and system rehabilitation plan shall be prepared by respective PDAM based on diagnosis of existing conditions/problems for sustainable and better service.
Availability of asset data	Complete asset data is not available	Complete asset data is not available	Complete asset data is not available	More attention should be paid on asset management for adequate operation/ maintenance and for preparation of the long-term development plan and system rehabilitation plan mentioned above.
Human resource development	Only OJT is executed.	Personnel development plan is prepared and implemented occasionally. OJT is also conducted	Training plan is not available.	Policy of human resource development should be established first and development plan should be prepared based on the policy. It should be noted that Sleman PDAM prepared personnel development plan.

Asset condition	Some deterioration of mechanical/electrical equipment is observed.	Some deterioration of mechanical/electrical equipment is observed.	Some deterioration of mechanical/electrical equipment is observed.	Routine inspection of asset condition should be required and the inspection results should be used as a basis of system rehabilitation plan mentioned above.
Water meter condition	Implementation of meter replacement program has started. But many old metes are still under operation.	Meter replacement program is under implementation.	Meter replacement activities are not implemented.	Specially in Bantul PDAM, meter replacement program should be prepared and executed as soon as possible. Routine (periodical) meter replacement program should be prepared and implemented conforming to the regulations concerned.
Availability of O/M manual	Not available	Not available	Not available	O/M manual for respective facility/unit should be required for adequate O/M.
Disinfection	Chlorine is dosed to distributed water	Insufficient disinfection	Insufficient disinfection	According to the drinking water quality standard of Indonesia, residual chlorine should be detected from tap water. However, disinfection is insufficient due to complain from the consumers who do not understand the importance of disinfection.
Pipeline maintenance and leak reduction	Distribution section is in charge of pipeline maintenance work.	Pipe repair plan is prepared.	Distribution section is in charge of pipeline maintenance work.	Generally, passive leak repair is conducted by PDAM. Preventive and aggressive leak reduction activities are required.
Water quality analysis	PDAM has own Laboratory Health Department checks biological parameters.	PDAM does not have Laboratory Health Department checks biological parameters	PDAM does not have Laboratory Health Department checks biological parameters	The frequency of water quality analysis is insufficient. Laboratory in Yogyakarta PDAM can assist other PDAM when the agreement is arranged and the capacity is increased.
Location of water sources and Service Area	Majority of water sources exist in Sleman Regency. Yogyakarta PDAM has supply areas in Sleman Regency.	All water sources are in Sleman Regency. Yogyakarta PDAM has supply areas in Sleman Regency.	All water sources are in Bantul Regency. The supply area is in Bantul Regency.	PDAM Yogyakarta has service areas in Sleman Regency. These areas are supplied from Umbul Wadon spring in Sleman Regency. Royal palace is also supplied from Umbul Wadon spring. Coordination between Yogyakarta PDAM and Sleman PDAM will be required to make the system simple.

6.6 Community Water Supply System

6.6.1 Organization

Community Water Supply System (or *Air Minum Desa* in Indonesian, hereinafter referred to as "AMD") has been constructed by budget of responsible regency's PU in general.

Beneficiaries of AMD are advised by PU to organize Water User Organization (hereinafter referred to as "WUO"), which is organized by residents who receive the benefit of the water supply service through AMD. After the completion of construction, AMD is handed over to WUO. This means that daily management, operation and maintenance of the facilities are responsible of WUO. For example, repair and/or replacement of pump, electricity costs for pump operation or leak repair are covered by revenue of water charge or occasional contribution by the members of WUO when necessary.

6.6.2 General Features of Existing Community Water Supply System

General feature of existing AMD in the Study Area is summarized as follows:

- As of July 2007, there are totally 106 numbers of AMD in the Study Area (61 in Bantul, 44 in Sleman and 1 in Yogyakarta).
- There are approximately 50 to 60 numbers of household in most of AMDs.
- Breakdown by type of primary water source shows that 62 AMDs use springs, 29 AMDs use sallow wells, 10 AMDs use deep wells and 5 AMDs use river. This indicates that most of AMDs in the Study Area rely on groundwater/spring.
- Breakdown by type of method for transmission/distribution shows that 50 AMDs employ pumping system while 56 AMDs can supply by gravity.

6.6.3 Summary of Problems Identified

Following problems are identified through site visiting and interview with community people in sample AMDs with respect to facilities and O&M:

- Inventory of community water supply system, which would be basic information for O&M is not properly organized or kept in record systematically.
- Condition of existing facilities and situation of O&M are different from site to site. In well-managed AMDs, minor technical problems are smoothly recovered by revenue of water charge or occasional contribution by users. On the contrary, in poorly-managed AMDs, there were many cases that troubled or damaged facilities were unsolved and not repaired. It is necessary to exchange information and know-how among WUO leaders to learn lessons from case studies in other AMDs.
- Water quality does not seem to be checked at regular intervals as long as the Study Team interviewed at the site.
- It is important to select appropriate pump, pipe materials and pipe diameter according to its specific condition in planning and design stage. However, uniformly-designed facilities are introduced in many AMDs, without consideration of specific conditions such as geographical features, demand, etc..
- An user-friendly manual for O&M of community water supply system is required for appropriate and sustainable use of facility.

6.7 Existing Condition of NRW

In this section, the terms of NRW and UFW are defined as follows:

- NRW consists of UFW, meter error and unbilled authorized consumption.
- UFW is lost water volume through leakages or consumption by illegal connections.
- Unbilled authorized consumption such as water for fire fighting or use in public park can be negligible in these survey areas because the series of UFW survey were conducted within limited areas.

This UFW survey was categorized into following 2 types, according to actual site condition.

- Isolated Survey:
  In case there are not too many inlet pipes or customers in the survey area, survey area was hydraulically isolated to measure system input volume or consumption in the survey area.
- Non-Isolated survey:
  In case it is not feasible to complete hydraulic isolation work within limited time frame but considered to be important area in terms of comprehension of actual situation of UFW, the survey was focused on detection of leakage, its type, number (frequency per km) and OJT (on-the-job training) for leakage detection work in such area.

7 locations in the Study Area (4 isolated survey areas and 3 non-isolated survey ares) were selected for UFW survey based on the discussion with counterpart staff.

6.7.1 Outline of the UFW Survey

A series of UFW surveys have been conducted at the selected areas in the Study Area. The main objectives of this survey are:

- To comprehend actual situation of UFW in the Study Area.
- To pursue technology transfer on UFW survey and data analysis through on-the-job training for PDAM staff concerned.

6.7.2 Result of Survey

The major findings from the result of the survey are summarized as below:

- The average NRW ratio in the survey area was 54.3 %.
  - 4.0 % for meter error.
  - 50.3 % for UFW including leakage, illegal connection and others.
- Through leak detection works in the selected areas, covering 2,511 of service connections, with a total length of 35.78 km of distribution pipes:
  - 159 cases of leakage were identified and then repaired.
  - 6 cases for illegal connection were identified.
- Considering actual conditions, the major causes for leakage in survey area could be followings:
  - Sleman area: High pressure at end part of distribution area caused by extreme difference of elevation.

  - Yogyakarta area: Aged pipes and fittings.
  - Bantul area: Damage caused by recent earthquake disaster.
- As a result of leak repair work, the average UFW ratio in the selected areas could be reduced from 50.3 % to 38.5 %. This result suggests that leak repair could make huge contribution to reduction of UFW. A program of leak reduction should be focused in future master plan formulation stage.

6.7.3 Future Task

The result of the survey indicates that the major factor for or the cause of UFW would be a leakage. Therefore, water supply providers such as responsible PDAMs or concerned officials should be more aware of the importance of finding an efficient way of leak detection and repair, to save limited water resource or cost relating to water supply. In order to carry out leak detection and repair effectively and efficiently, following issues should be considered:

- Setting up organization/department for UFW Reduction, especially for leak detection and repair work.
- Setting up special program for UFW reduction,
- Securing sufficient budget for UFW reduction.
- Formulation of effective training program and its implementation.
- Construction, arrangement and maintenance of database for existing drawing so that officials concern can refer correct existing drawing at any time.
- Creating standard method of work flow for leak detection and repair work in order to facilitate quick and smooth operation.

However, at present, the PDAMs concerned in the Study Area do not have sufficient budget, equipment or human resources to formulate and to implement necessary countermeasures for UFW reduction. For the above reason, the PDAMs require assistance in terms of procurement of necessary equipment or training for UFW reduction program. As for the necessary equipment for UFW reduction, at least following items would be required:

- Leakage investigation devices
- Flow measurement devices

6.8 Results of Water Quality Analysis

6.8.1 Results of Water Quality Analysis of Water Sources

Water quality survey for water sources and drinking water was conducted in this Study in order to comprehend the outline of the quality of water supply service in the Study Area. Sampling points were selected based on the discussion with the counterpart staff so that the results could represent and reflect general trend and actual condition as much as possible. Analysis items were in accordance with the guidelines for Indonesian drinking water.

As for the survey for water sources, totally 52 samples were picked up from existing major water sources (50 samples from deep wells, shallow wells and springs) and 2 samples from the Progo River (one sample each at dry condition and wet condition). As for the survey for drinking water quality, 11 samples from the outlet of water treatment plants and 49 samples from water tap for individual connections.

(1) Existing Water Sources for PDAMs and Community Water Supply Systems

A series of sampling activities carried out for 39 PDAMs and 11 Community Water Supply Systems. The analysis result indicates that there are problems in terms of coliforms, iron, manganese, color and turbidity. Especially, samples for springs and shallow wells have a trend to show high value of coliforms. As springs or shallow wells are relatively vulnerable to pollution in general, following issues should be thoroughly taken into account:

- Necessity of protection of well in construction/O&M.
- Necessity of adequate recommendations in terms of improvement of sanitary facilities.

(2) Progo River

Sampling activities were carried out under both dry and wet conditions at the possible future intake point by the future DBOT project in the Progo River. The analysis result indicates that this water could be used for water source without any problem in terms of water quality as long as being accompanied by a conventional treatment method such as coagulation, flocculation, filtration and disinfection. Nevertheless, following issues should be noted and monitored to consider the Progo River as one of alternatives for future water source:

- Drastic water quality change originated from volcanic activity.
- Future land use change in upstream area (such as agricultural activities including usage of pesticides or new development of industry or housing area).

6.8.2 Results of Water Quality Analysis of Finished Water and Tap Water

(1) Treated Water from Water Treatment Plant of PDAM

The main water sources of the majority of WTP operated by PDAMs in the Study Area are deep wells. In general, typical treatment method is aeration, coagulation, sedimentation, filtration and disinfection by chlorination. The analysis result of the samples from 11 points of the PDAM's WTP indicates the followings.

- In general, iron and manganese are efficiently removed through treatment. However, color is not removed effectively. This fact suggests that sedimentation and filtration would not demonstrate sufficient effect in a treatment process.
- Coliforms are detected from finished water. This suggests that disinfection by chlorination is not conducted or insufficient in many WTPs.

(2) Tap Water

40 points for PDAM tap water and 9 points for tap water of community water supply systems were selected for this analysis. In the results of the analysis, excessive color over guideline value, insufficient amount of residual chlorine and detection of coliforms were observed in many sampling points. It is necessary to be well-considered for importance of disinfection to maintain appropriated concentration of chlorine at any water tap.

CHAPTER 7 ADMINISTRATION AND MANAGEMENT OF WATER SUPPLY SYSTEM

7.1 Overview of Water Sector Administration and Performance

The roles of province, regency/municipality and PDAM are clearly separated. The DIY Province is responsible only for policy planning and implementation crossing regencies/municipality. PDAMs are responsible for planning & design, financing, construction and operation of the facilities owned by the regency's/municipality's governments. Regency's/municipality's governments provide PDAMs with subsidies if necessary and act as an regulator by way of tariff appraisal/approval, performance monitoring & evaluation, etc.

With the consideration of the above difference of roles, water sector performance was assessed at two levels: (i) the country sector level, and (ii) the operator level.

Five (5) indicators are used to assess the sector level performance. Those include (i) sector organization, (ii) trend of investment, (iii) trend of subsidies, (iv) tariff structure, and (v) tariff level. Twelve (12) indicators are used to see the performance of the operators. Two indicators to see reliability of management plan; two for physical performance of water supply system; three for physical performance of sanitation system; two for operational performance; and three for financial performance.

The sector level evaluation is summarized as follows. The Indonesian water sector is evaluated as well-organized and even more progressive compared with other countries in that many functions are delegated to the operators. Regarding the trend of investment, the problem is the investment is declining for PDAM Bantul. As for the trend of subsidies, the problem is subsidies are heavy and growing for Sleman and Bantul while Yogyakarta Municipality has received no subsidy from the government. Regarding the tariff issues, the tariff structure itself is adequate for all the three PDAMs but the tariff level varies: adequate for Yogyakarta

Municipality, acceptable for Bantul, but should be reconsidered for Sleman.

The evaluation at the operator level revealed the following problems and issues to be addressed.

- **First**, availability of water sources: Kota and Bantul need water from outside, while Sleman is able to manage own demand from own source.
- **Second**, low water service coverage (direct access basis) for Sleman and Bantul. Yogyakarta Municipality is acceptable for water supply service coverage, but low for sewerage service coverage. Though sewerage is not PDAM's job, the Yogyakarta Municipality government should pay more attention to sanitation to upgrade clean image of the City as an international tourist destination.
- **Third**, high water losses for all PDAMs.
- **Fourth**, overstaffing for all.
- **Fifth**, poor financial performance particularly for Sleman and Bantul partially.

From this assessment and dialogues with persons concerned, the root problem for poor performance of Sleman and Bantul especially is lack of cost recovery from tariff revenues. Low cost recovery needs subsidy from the government, and then the government intervention reduces autonomy. Reduced autonomy causes lack of motivation for running the company well. This causes overstaffing and high losses. Overstaffing and high NRW brings low investment and poor O&M. Low investment and poor O&M makes consumers unsatisfied.

So we believe the core problems are low tariffs and lack of autonomy, and the core solutions include a transparent policy, an independent regulatory body, a paradigm shift in tariffs, and involvement of civil society.

7.2 Administration and Management of 3 PDAMs

(1) PDAM Yokyakarta

Piped water supply system in central city area of Yogyakarta was built in the Colonial era, and there was water service operation in 1948, which is now being operated by PDAM Tirtamarta Yogyakarta. Financial management is efficient. Actual tariff could almost cover full cost recovery. As the result, income statement shows stable revenue and profit increase. Break even point versus revenue in 2005 is 68 percent which shows fairly good position. Since there is only limited water source in the administrative boundary, it is essential to get water sources from outside.

It is capable for borrowing. Depending on investment plan, whether water source development and/or rehabilitation for water loss improvement or else, funding sources are needed.

(2) PDAM Sleman

PDAM Sleman started in 1981 as BPAM and changed status to PDAM under Sleman Prefecture

Regulation No.3, 1991. Since them, human resources have much administration staff among 186 permanent staff as of 2006, resulting high administration cost. In addition, price hike in fuel and electricity is burden for the PDAM. Actual tariff does not cover operating cost. From the beginning of operation, it has not made a good performance in financial aspect resulting red equity in the amount of minus Rp 5 billion after consumption of paid-in capital for Rp 15 billion. PDAM Sleman has geographical advantage such as water resources, increasing population, industry development and so on. Reconstruction of financial situation is essential to proceed improved policy and strategy. Central and Sleman regional government should consider comprehensive support to reconstruct PDAM management and operation including debt payment due to the central government and the regional government.

(3) PDAM Bantul

PDAM Bantul started in 1984 as BPAM, and changed status to PDAM and started operation with 17 systems in 1992. However it could not operate as a healthy corporation up to now and caused many complaints of quality and quantity from customers. Actual tariff does not cover operating cost. Even though revenue is increasing every year, profit cannot increase because of direct costs. Water source cost increased mainly due to electricity price hike for pumping. Collection system is one of strength because there is coordination with Bank Rakyat Indonesia and PDAM has service units at every Kecamatan in service. However, tariff has never been revised since 2002. It is recommended to revise periodically to catch up inflation.

7.3 Community Water Supply System

7.3.1 Development Plan and Construction Process

PU of district government deals with SPAM development for the area where PDAM does not provide service according to PP 16/2005. Following to MDG targets, DIY's policy and strategy aims at service coverage of 80% for urban area and 60% for rural area by 2015. At this stage, community demand initiates application for development to village head after water source finding.

Approval of Kabpaten PU by confirming WUO formation at the community and water quality check by Kabpaten Health Department is needed for water supply system construction. After the development of system, it is given to village for their independent operation and maintenance. Water users association is maintained by social work. PDAM may help WUO for O&M training at the request of village head.

7.3.2 Funding

Initial capital investment is made by the Central Government through DAK (special allocation fund of the central government). DAU (general allocation fund from the central government) is also used for capital investment to AMD. After the construction, O&M is WUO's responsibility but repair or replacement of property is often carried out donor's fund such as UNICEF.

7.3.3 Present WUO

In the study area there are community water supply system servicing clean water with water user organization. At present there are one system in Kota Yogyakarta for urban poor, 40 systems in Sleman region and 63 systems in Bantul region both for rural people. Organization is maintained by volunteer with the concept of GOTONG-ROYONG.

7.3.4 O&M Situation

O&M is carried out by WUO. Labor service is being normally done at volunteer base except pump operator and tap keeper. Tariff is decided to share recurrent O&M cost such as electricity consumption charges, over head tank cleaning charges and labor salary etc. Capital cost can not cover by the tariff. Door to door tariff collection is made by tap keeper. It is observed there are problems in electricity price hike and pump motor replacement cost to improve sustainability.

7.3.5 Governmental Administration

No data base is available in both PU at Sleman and Bantul even though PU of district government is obliged to deal with SPAM development. It is useful for WUO to make annual report to the regional government to exchange information and necessary assistance for sustainable operation and maintenance of the system including donor's support.

7.3.6 Recommendation

The DIY Government and the three District Governments are about to prepare the regional policy and strategy for SPAM. It is recommended that regional government put priority on funding for SPAM in rural area development, database construction for monitoring sustainability and invite donor's assistance.

CHAPTER 8 EXISTING CONDITION OF SEWERAGE SYSTEM/SANITATION

8.1 General

Sewerage system is developed in part of urban area and community plants are installed in riverside low level areas in Yogyakarta Municipality. Many households out of sewerage covered area use septic tanks.

In Sleman Regency and Bantul Regency, wastewater is treated by septic tanks which installed in many houses since neither sewerage system nor community plant systems are introduced in these area. However, the installation rate is not so high at present.

Wastewater from the houses without septic tanks penetrates into ground directly or is discharged to the river nearby. These are one of the causes of river pollution.

8.2 Sewerage

Sewerage system is developed in a part of Yogyakarta Municipality with trunk sewer and Sewon sewage treatment plant which were built by Japan’s Gtant Aid in 1996 and the other facilities such as another trunk sewer, sewer network and flushing pipe were constructed by aids from Netherlands and about 60,000 persons' wastewater, equivalent to 15% of municipal population, is treated.

Operation & maintenance and construction of sewer network are conducted by Yogyakarta Environment Service Department (DLH), and Sewon sewage treatment plant is operated by Yogyakarta Municipality.

Management and maintenance are carried out by the subsidies from Yogyakarta Municipality, Sleman Regency, Bantul Regency, and DIY, since sewer and the sewage treatment plant are not manageable only with a sewer tariff income.

Collection of the tariff is done by DLH independent apart from water tariffs. There is a plan to raise the sewerage tariff and to collect a sewerage tariff together with water rates in the future.

8.3 Community Plant

Community plant facilities have been operated in 39 sites in Yogyakarta Municipality. In Sleman Regency, although two facilities are under construction, there is no operating

community plant. There is no existing and planned community plant in Bantul Regency.

The representative of each community has responsibility for operation and maintenance and collecting tariff. Environmental Recovery & Wastewater Management Section in DLH which is the same department as sewerage O&M is doing overall management of each community plant.

8.4 Sanitation Facilities

As on-site treatment, septic tank + leaching pit or pit latrine, is installed in the Yogyakarta Municipality, the Sleman Regency and the Bantul Regency. The installation rate of septic tank + leaching pit for individual treatment is high in Yogyakarta Municipality and Sleman Regency. However, in Bantul Regency, night soil which is once stored in pit latrine is discharged to the river or underground infiltration without treatment in many cases.

Environmental Recovery & Wastewater Management Section in DLH which is same department as sewerage O&M is doing management of sanitary facility in Yogyakarta Municipality

Kepala Dinas Kimpraswilhub Kabupatan Sleman (KDKK, Head Official of Settlement & Infrastructure in Sleman) is conducting management of the sanitary facilities of Sleman Regency. However, removal of septic tank sludge is entrusted to the private company from each house or office directly.

Operation and maintenance of the sanitation facilities of Bantul Regency is done by Seksi Lingkungan Perumahan (SLP) of Bantul Regency.

8.5 Water Quality Analysis

Water quality survey for rivers, ground waters including spring and gray water in ditches were conducted to comprehend actual situation of deterioration of water environment in the Study Area. 20 sampling points were selected from the Study Area based on discussion with counterpart staff. The result of analysis suggests the followings:

- The concentrations of BOD in the three rivers show high values (5 to 33.8 mg/l), which indicates that the rivers are polluted to a certain extent, especially for Code River (BOD standard value is set as 5 mg/l for Japanese Environmental Quality Standard, Class C). In addition, very high values (43×10^3 to 24×10^5 MPN/100ml) of Total coliform in the three rivers also show that the rivers are polluted.
- The BOD concentration of treated wastewater at Sewon sewage treatment plant is 18 mg/l (89% of removal rate) which is less than regulated discharge value (50 mg/l) and represents a good operation performance.
- The BOD concentrations of effluents from three septic tanks show high values (108.5 to

122.7 mg/l). The BOD concentrations of three sallow wells are more than 4 mg/l. In addition, Total coliform and E-coli are detected in some shallow wells, which indicate that some sallow wells may be polluted by effluents of septic tanks.

8.6 Identified Problems of Sewerage System/Sanitation

(1) Low House Connection Ratio in Sleman Regency

Although the sewer pipe is installed in a part of Sleman Regency, wastewater in this area is not treated in Sewon sewage treatment plant, since the house connection pipe is not installed.

(2) Extension of Sewer and House Connection

Although sewage treatment plant has been operated for ten years, inflow amount is about 60% of the planned value. It is necessary to install additional sewer and house connection pipe in sewerage area.

(3) Operation and Maintenance Organization of Sewage Treatment Plant

Sewage treatment plant has been implemented operation and maintenance under DIY. However, this is temporarily and permanent organization hasn't been decided yet. It is necessary to determine the operation and maintenance organization of sewage treatment plant on discussion among DIY, Yogyakarta Municipality, Sleman Regency and Bantul Regency.

(4) Community Plant

39 community plants in Yogyakarta Municipality is operating in good condition at present. Most of all the community plants have been operated for less than 3 or 4 years, and the problem has not occurred since the facilities/equipment is still new.

(5) Low Septic Tank Installation Rate in Bantul Regency

Although pit latrine is installed in almost all the houses in Bantul Regency as sanitation facility, the installation rate of septic tank as on-site treatment is low compared with Yogyakarta Municipality and Sleman Regency.

(6) Influence to Shallow Well

It is anxious about the influence to shallow well, because a great portion of outflow water from pit latrine and treated water from septic tank is infiltrated into underground.

(7) Problem of Operation and Maintenance Organization

Although there are operation and maintenance organizations of sanitation facilities in

Yogyakarta Municipality, Sleman Regency and Bantul Regency, most sludge collection work is not done by those organizations since they do not own enough equipment. Since private companies are entrusted from respective houses, and are collecting sludge, those organizations do not grasp all the situation of respective house facilities. Those organizations should grasp the situation in their area.

CHAPTER 9 STATUS OF ON-GOING BULK WATER SUPPLY PROJECT

9.1 General and History of the DBOT Bulk Water Supply Project

Water supply requirements for Kartamantul are increasing from year to year, however sustainable water resource in Karamantul area is limited. Three PDAMs of the Kartamantul area are facing difficulties to satisfy the increasing water demand.

Under this situation, the DIY Provincial Government started to consider possibility of water transmission from spring water source in Magelang Regency as an action plan of Urban Water Supply Program in Yogyakarta. At the same time, the DIY Provincial Government agreed with private sector to design and implement the project as "DBOT Bulk Water Supply Project" (DBOT BWSP).

The first milestone was agreement concerning Urban Clean Water Supply for Yogyakarta Municipality and Regencies of Sleman and Bantul (MOU of DBOT BWSP) in June 2004. After the agreement, the DIY Government requested usage of spring water in Mangelang Regency as a water source for the DBOT BWSP in November 2004. Since it took about 10 months for having reply and agreement from Mangelang Regency in August 2005, DIY Government decided to alternate water source to the River of Plogo in July 2005. The contract between DIY Government and private sector "Design, Build, Operate and Transfer (DBOT) Agreement of Water Supply For the City of Yogyakarta and the Regencies of Sleman and Bantul in the Province of Special Region of Yogyakarta" was singed on January 15, 2005.

9.2 Scope of the DBOT Bulk Water Supply Project

According to the explanation by DIY, this project will be implemented as DBOT system. After DBOT agreement period (25 years), the facilities (assets) which were constructed by the private sector will be transferred to the DIY Government.

The private sector should conduct study and other assessments which are required to complete

feasibility study of the project before commencement of the construction work.

Major construction work which will be included in the DBOT BWSP are as follows.

- Construction of WTP of which capacity is 1,000 l/sec
- Installation of raw water transmission pipe
- Installation of treated water transmission pipe to reservoirs of respective PDAM
- Construction/expansion of reservoirs for respective PDAMs

9.3 Current Status of the Project and Issues Encountered

According to the DIY Provincial Government, EIA concerning BWSP should have been completed by August 2006 and upon approval of the EIA, detailed engineering design should have been started by private investor. However, as stated in the previous section, no significant progress of the BWSP was observed.

Since provision of detail information is precondition of the preparation of the Master Plan by the JICA Study Team, the JICA Study Team prepared and submitted "Major Information Required concerning DBOT Bulk Water Supply Project" to the DIY Government in January 2007.
Unfortunately, these requested information were not provided by DIY since the DBOT Bulk Water Supply Project was derailed as described in Chapter 1.

CHAPTER 10 RESULTS OF SOCIO-ECONOMIC SURVEY

10.1 Socio Economic Condition

The Study Team conducted the questionnaire survey in order to grasp the living conditions of the target areas' inhabitants. The primary focus was water usage and expectations with respect to water. The number of samples is 1200; 400 samples from the 2 regencies and 1 municipality (hereinafter called 3 regions) respectively.

The number of household members is 4.5 on average, and there are no large differences among 3 regions in this regard. 41.2% of them graduated from Sr. High, 5.8% received Diploma I-III and 9.3% have a bachelor's degree.

The average monthly household income is Rp.1,220,963/month. The average monthly expenditure per capita was Rp.216,847 consisted of Rp.124,143(57%) for food and Rp.92,704 (43%) for non-food while the provincial average surveyed by BPS in 2005 were Rp.337,747 consisted of Rp.145,352 (43%)for food and Rp.192.365 (57%). The expenditure dropped

35.8% and the balance of food and non-food was reversed. Since the methods of survey 2006 and 2005 were not same, it is hard to say the analysis of constant tendencies, but the natural disasters in 2006 might be influence their economic activities of daily life and the expenditure decrease drastically.

267 respondents out of 1,200 (22.3%) were customers of PDAM and most of them were inhabitants of the Yogyakarta Municipality. 54 respondents out of 1,200 (4.5%) were users of PU Community Water Supply System. 850 respondents (70.8%) were using other systems such as private wells, springs and/or private gravity water supplies.

With respect to basic utilities such as lighting and fuels, 99.0% of respondents' houses have already introduced the electric light. The most popular cooking fuel is gas stoves, present in 46.7% of houses, and next is charcoal and/or coal, in 33.5%. Living conditions have clearly improved in the last 20 years.

10.2 Domestic Water Use

According to the survey regarding the quantities of water usage, the highest frequency of water use per person per day was 100 – 199 liters which comprises 27% of respondents.
The average water consumption recorded was 325.5 liter per person per day since some people use large quantities of water, though that usage includes non-domestic water usage such as for restaurants, factories, etc. The majority, 57%, use less than 299 liters per day.

The overall monthly cost of water consumption per person is Rp.8,431 on average. The water consumption cost accounts for 4.00% of the expenditure and 3.53% of the income. When confining our attention to the payment to PDAM, the average monthly tariff for PDAM water is Rp.40,840 per household. The majority of households have paid around Rp.25,000 per month.

The willingness to pay for the initial cost of connection and registration is Rp.278,583 on average for all respondents. Comparing to the present payment of initial cost, which is Rp.242,586, the willingness to pay is rather high compared to the present level. Other than this, notable tendencies and features can be appointed. Some of the respondents living in Sleman answered that they could afford to pay even Rp.750,000 if an installment plan were allowed. Respondents in Yogyakarta Municipality are also motivated to be introduced to good systems even if the cost should be paid by beneficiaries. In other words, the respondents proposing a higher initial cost are ready to pay for the modern convenience of a safe water supply system and contribute to the cost for construction if necessary.

Findings are;

- Living standard has developed over the last 20 years.
- Gap between wealth and poverty is still large.
- Water consumption and water source depend on economic condition and topography
- Water management by purpose of drinking, bathing and agriculture is important
- Proper information regarding water quality is not enough

Strategic Considerations from the Socio-Economic View Point

- A ***Customer-oriented*** water distribution system is necessary, i.e. water systems for the wealthy and impoverished should be different in tariffs.
- ***Educational information*** about water quality such as taste and safety should be distributed by public relations.

CHAPTER 11 EMERGENCY PILOT PROJECT FOR RESTORATION OF EARTHQUAKE DAMAGES

About 140,000 houses were collapsed and important lifelines were damaged by the severe earthquake in central Java in May 2006. In order to restore damaged water supply system and facilities especially in Bantul, Emergency Pilot Project (EPP) was implemented as part of Phase I of the Study.

The project sites and the scope of the work were selected and agreed by GOI and JICA taking into account of the following criteria.

- Priority of Indonesian Side
- Urgency
- Effectiveness
- Clear demarcation with other Donors' or NGO's activities

The selected sites for EPP are as follows:

- PDAM Bantul: Unit Trimulyo, Unit Sewon, Unit Dlingo, Unit Imogiri, Unit Banguntapan, and Unit Bantul
- Community Water Supply System in Bantul Regency: Desa Mangunan (6 units) and Desa Terong (1 unit)

The major scope of work is summarized below.

- PDAM Bantul: Construction of water treatment plant of 5 l/sec capacity with facility of river intake, Construction of spring capture of 5 l/sec, Installation of transmission pipes, Replacement of Distribution Pipes, Construction of a shallow well, Construction/Repair of pipe bridges, Repair and Reconstruction of operation buildings, warehouses and a chemical building
- Community Water Supply System in Bantul Regency: Construction of shallow wells, Installation of intake/booster pumps, Installation/Replacement of transmission pipes, Restoration of reservoirs, Replacement of distribution pipes, Repair of public hydrants

The facilities, handed over to PDAM Bantul and communities, are now used in effective ways.

In order to evaluate the effects of EPP, four indices of the project evaluation were determined as follows:

- Index 1: Intake volume
- Index 2: Water pressure in distribution system
- Index 3: Number of house connection supplied
- Index 4: Operation and maintenance of water supply facilities

Baseline survey was carried out prior to the implementation and then the indices were monitored after the completion to evaluate and to analyze the effects of the project. Table 11.6.1 gives the indices used for the evaluation/analysis and outline of its result.

The evaluation results show that EPP contributed to recovery from the damage of the earthquake in all the above selected areas. Shallow wells are constructed in Unit Trimulyo, Desa Mangunan I, Cempluk II and Terong I, while intake pumps are installed in Desa Mangunan, Desa Kanigoro and Desa Lemahabang, where intake capacity is increased and/or water becomes available during dry season. EPP also makes possible the usage of spring water and river water for water supply of unit Dlingo in dry season.

Replacement of transmission / distribution pipe and/or repair of pipe bridges in Unit Sewon, Unit Imogiri, Unit Banguntapan and seven (7) community water supply systems contribute to increase of supply stability, supply pressure and supply connections. Buildings for office, pumps and chemical feedings in Unit Trimulyo, Unit Banguntapan and Unit Bantul are repaired to normalize office works, to reduce customers' complain, to make safe the chemical feeding and to store materials, tools and equipment in proper manner.

In addition to recovery from the damage by the earthquake, execution and evaluation of EPP gives information of required improvement, which will be useful to make water supply system strong against disaster as follows.

- Regarding PDAM
  - It is found that there is room for improvement especially in administration and capability of the PDAM staffs. It is expected to consider asset management and capacity development of PDAM for preparation of Master Plan and Action Plan.
- Regarding community water supply
  - Water supply system is operated by water user organization in community (WUO), which skill is not so high due to insufficient training or assistance from other organizations. Master Plan and Action Plan is expected to include capacity building of the operation / maintenance staff and development of relation among the community, PDAM, PU and other relevant authorities.

Table 11.6.1 Summary of Indices and Results of Project Evaluation

Water Supply System	Repaired Item	Water Intake Volume		Water Pressure in Distribution System		Number of Supplied Connections		*Evaluation of O/M of Water Supply Facilities		Explanation / Remarks
		Before EPP (m^3/day)	After EPP (m^3/day)	Before EPP (MPa)	After EPP (MPa)	Before EPP (nos)	After EPP (nos)	Before EPP (level)	After EPP (level)	
PDAM Bantul										
【Unit Trimulyo】	Construction of Shallow Well, Repair of Chemical bldg. and Retention Wall	295	278	—	—	—	—	2	5	Stability of Intake is increased. Office work becomes normal.
【Unit Sewon】	Repair of Pipe Bridge	—	—	—	—	0	75	—	—	Water supply of about 2.2 m^3/day to downstream becomes stable.
【Unit Dlingo】 Sub-unit Ngreboh / Sub-unit Grajekan	Construction of WTP (Intake, plant, reservoir), Spring capture , trans. pump and pipe. Repair of Office bldg.	476	971	—	—	—	—	1	5	Water can be supplied in dry season after increase of 10?/sec capacity. (5?/sec of spring water and 5?/sec of surface water)
【Unit Imogiri】	Construction of Pipe Bridge	—	—	—	—	0	260	—	—	Water supply of about 373m^3/day to downstream becomes stable.
【Unit Banguntapan】	Pipe Installation, Reconstruction of Office bldg.	—	—	0.025	0.220	0	247	2	5	Water supply of about 179m^3/day to downstream becomes stable.
【Unit Bantul】	Repair of Office bldg. and 2 warehouses	—	—	—	—	—	—	2	5	Required equipment and materials can be stored after repair of warehouses. PDAM will repair roof, which is out of the Scope.
Community Water Supply System in Bantul Regency										
【Desa Mangunan II】	Replacement of Transmission Pipe	7.1	10.0	—	—	25	40	—	—	Water supply becomes stable after the repair.
【Desa Mangunan I】	Construction of Shallow Well with Intake Pumps, Sump Well, andTransmission	0	5.2	—	—	0	70	—	—	Water supply is resumed after the repair
【Desa Cempluk II】	Construction of Shallow Well with Intake Pump, and Transmission Pipe	3.2	0 (8.4)	—	—	2	28	—	—	Water supply in dry season is resumed after the repair
【Desa Mangunan】	Installation of Intake Pump and Transmission Pipe	5.2	5.2	—	—	20	100	—	—	Water supply becomes stable after the repair.
【Desa Kanigoro】	Installation of Intake/Boost Pumps, Reservoir, and Distribution Pipe. Repair of Stand post	0	0 (7.3)	—	—	0	85	—	—	Water supply is resumed after the repair
【Desa Lemahabang】	Installation of Intake/boost Pumps, Transmission Pipe, and Reservoir	0	0 (18.9)	—	—	0	120	—	—	Water supply in dry season is resumed after the repair
【Desa Terong I】	Construction of Shallow Well with Intake/ boost Pumps, Transmission/ Distribution Pipe, abd Reservoir. Repair of Stand post	0	10.4	—	—	30	55	—	—	Water supply is resumed after the repair

Note 1) * Evaluation of Operation and Maintenance of Water Supply Facilities
Five Levels (1: Seriously problematic, 2: Problematic, 3.Middle, 4: Good, 5: Very Good)

Note 2) ( ) in column for "Water Intake Volume" shows expected usage volume in dry season. (Yield capacity x operation hour)

CHAPTER 12 VISION OF MASTER PLAN

12.1 Vision/Policy of Master Plan

At the end of the Phase 1 of the Study "Formulation of Vision/Policy and Strategy", Vision/Policy and strategy were formulated as a basis of the Master Plan.

These visions, policies, and strategies are developed taking account of national policy and development plan as well as ones of regional. How the future water supply system should be, vision and policy, and strategies to achieve the vision and policy were discussed with Indonesian side and finally vision, policy of the Master Plan were concluded as described hereunder.

12.2 National Policy/Action Plan and the Vision/Policy of the Master Plan

Visions, policies of the Master Plan shall conform to the national and regional policies and action plans. Vision/Policy of Master Plan will support Regional Action Plan which complies with the national action plan to achieve MDGs.

12.3 Future Water Supply System

To develop visions, policy and strategies of the Master Plan, aspects of water supply which should be furnished to were considered. Important aspects were derived from missions of water supply and those are

- Sustainability,
- Reliability/Stability, and
- Equity.

To improve water supply system in DIY, these three aspects were considered to develop visions, policies, and strategies.

12.4 Approaches for Improvement of Water Supply System

To materialize sustainable, reliable, stable, and equitable water supply system, several approaches were considered and vision and policies were identified for each approach as follows.

- Capacity Development Approach
  - Vision 1: Establishment of good customer relation
  - Vision 2: Transition to autonomous/sound provider

  - Vision 3: Coordination among PDAMs
  - Vision 4: Capacity development of PDAMs and water user association of AMD
- Legislative Improvement Approach
  - Vision 5: Legislative Improvement
  - Vision 6: Public Service Obligation
- Technical Improvement Approach
  - Vision 7: Upgrading service level
- Water Resource Conservation Approach
  - Vision 8: Secure sustainable water resources

12.5 Visions/Policies and Strategies

12.5.1 Capacity Development Approach

(1) Vision 1: Establishment of Good Customer Relation

To establish good customer relation, it is important to mature customer confidence. To mature customer confidence, following strategies will be required.

- Maintaining Transparency and Accountability
- Well Understanding Customer Needs

(2) Vision 2: Transition to Autonomous/Sound Provider

In order to realize efficient, reliable and sound water companies the PDAMs should be given more autonomy in terms of finance and operation aspects. There are several important strategies to attain this vision, which include:

- To become financially self-standing companies
- To improve operating performance by reducing NRW
- To improve staff performance based on incentives

(3) Vision 3: Coordination among PDAMs

This vision pursues the objective of inter-municipal cooperation of the three PDAMs under the Kartamantul initiative addressed by DIY Province Government.

- Joint development of new water source through PPP/PSP approach
- Joint construction of new interconnected transmission and distribution lines
- Cooperation of joint work for operational performance
- Sharing information and best practices between PDAMs

(4) Vision 4: Capacity Development of PDAMs and WUO of AMD

Capacity development of every PDAM and also WUO of SIPAS are essential for empowerment on the sustainable management and operation in order to achieve MDGs. To accomplish capacity development, following strategies will be necessary.

- Upgrading service level
- Adequate support to WUO of community

12.5.2 Legislative Improvement Approach

(1) Vision 5: Legislative Improvement

The Local Government should improve legislative environments pursuant to Water Resource Law (UU7/2004) and Water Supply Regulation (PP16/2005) to improve water supply sector performance. The strategies attaining this vision include:

- Put in place transparent regional water polices
- Tariff reform putting customers not governments in control
- Civil society involvement by consulting various problems
- Encourage PPP (Public Private Partnership) or PSP (Private Sector Participation) approach
- Address clear-cut division of roles of institutions
- Address poor people by pro-poor tariff setting and supporting community-based organizations

(2) Vision 6: Public Service Obligation (PSO)

Tariff is controlled because of area monopolized utility business for the public. It is decided within the framework of socio economy and poverty consideration. Full cost recovery is severe challenge for management, especially in population scattered area. Central government is considering transparent subsidy system to public service.

- Adequate tariff level
- Sustainable operation of SIPAS
- Government transparent subsidy system

12.5.3 Technical Improvement Approach

(1) Vision 7: Upgrading Service Level

Service level in aspects of quantity and quality should be upgraded to achieve MDGs. To upgrade the service level, following strategies will be required to be implemented.

- Adequate/Effective Water Supply System
- Secure Potable Water Quality
- Adequate/Effective Operation and Maintenance

12.5.4 Water Resource Conservation Approach

(1) Vision 8: Secure Sustainable Water Resources

Securing water resources for water supply is the most significant issue for the preparation of the

Master Plan. To secure sustainable water resources, following strategies will be necessary.

- Effective usage of water resources
- Water resource conservation

Chapter 13 FUTURE POPULATION AND WATER DEMAND PROJECTION

13.1 Future Population Projection

13.1.1 Procedures of Future Population Projection

The projection starts from collection of past population records and evaluation of them. Based on obtained data, future population is calculated applying typical statistic equations. The calculations is conducted for each Kelurahan/Desa. Population density is also checked and results of the population projection is evaluated by comparing with the other available future population forecasts.

13.1.2 Past Population Record for Future Population Projection

GOI conducts population census every decades and the last census was conducted in year 2000. The census survey is conducted by door to door and the census data is the most reliable population data according to BPS (BADAN PUSAT STATISTIK, Board of Statistic Center), DIY. In between the census year, after five years from the previous census, BPS conducts SUPAS (sample survey by BPS) to estimate population.

13.1.3 Future Population Projection

(1) Method of Predicting Future Population

Each Kabubaten (Municipality and Regencies) is divided into spatial units called Kecamatan and Kulurahan/Desa. The future population is projected for each Kelurahan using the five statistic equations. The past population record discussed in the previous section is applied to estimate the population size for all years up until 2020 which is the master plan target year.

(2) Results of Future Population Projections

The results of future population projections for each Kabubaten to year 2020 are shown on table below.

Table 13.1.1 Future Population Projection for Each Kabubaten

	2005	2006	2007	2008	2009	2010	2011	2012
Yogyakarta	408,332	408,577	408,835	409,110	409,393	409,690	410,000	410,322
Sleman	960,803	973,644	986,670	999,892	1,013,316	1,026,937	1,040,770	1,054,835
Bantul	825,285	834,594	844,041	853,616	863,334	873,184	883,183	893,332
Total	2,194,420	2,216,815	2,239,546	2,262,618	2,286,043	2,309,811	2,333,953	2,358,489

	2013	2014	2015	2016	2017	2018	2019	2020
Yogyakarta	410,650	410,997	411,343	411,697	412,063	412,438	412,818	413,205
Sleman	1,069,111	1,083,617	1,098,354	1,113,338	1,128,576	1,144,055	1,159,802	1,175,815
Bantul	903,634	914,083	924,691	935,458	946,392	957,498	968,769	980,225
Total	2,383,395	2,408,697	2,434,388	2,460,493	2,487,031	2,513,991	2,541,389	2,569,245

(3) Comparison with Other Population Projections

The BPS also projected future population until year 2009 by Kabubaten level. Following figure shows comparison of results of population projection.

As shown on Figure 13.1.1, results of future population projection by JICA Study Team are very similar to the projection made by the BPS.

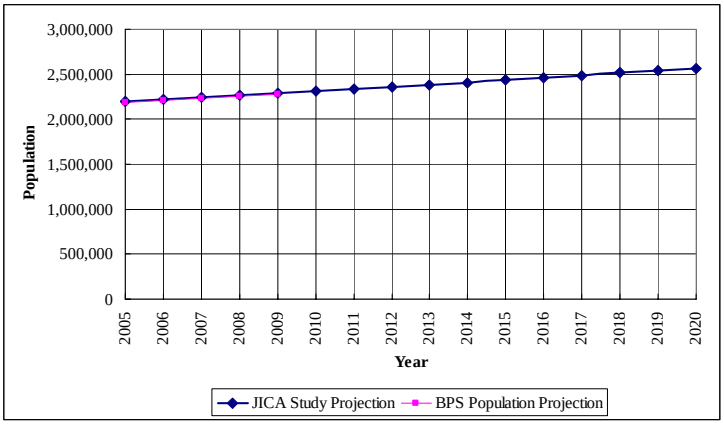


Figure 13.1.1 Total Population Projection (Yogyakarta, Sleman, and Bantul)
Comparison of Population Projection (by JICA Study and BPS)

13.2 Future Water Demand Projection

13.2.1 Domestic Per Capita Water Consumption

Future domestic per capita water demands are estimated for respective PDAMs and community water supply system as shown in the table below.

Table 13.2.1 Future Per Capita Domestic Water Demand (lpcd)

	Latest Data	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PDAM Yogyakarta	163.1	**165.0**	166.0	167.0	168.0	169.0	170.0	171.0	172.0	173.0	174.0	175.0	176.0	177.0	178.0	179.0	**180.0**
PDAM Sleman, Urban	80.6	**80.0**	86.7	93.3	100.0	106.7	113.3	120.0	126.7	133.3	140.0	146.7	153.3	160.0	166.7	173.3	**180.0**
PDAM Sleman, Rural	75.7	**75.0**	78.0	81.0	84.0	87.0	90.0	93.0	96.0	99.0	102.0	105.0	108.0	111.0	114.0	117.0	**120.0**
PDAM Bantul, Urban	99.8	**100.0**	105.3	110.7	116.0	121.3	126.7	132.0	137.3	142.7	148.0	153.3	158.7	164.0	169.3	174.7	**180.0**
PDAM Bantul, Rural	96.5	**95.0**	98.7	102.3	106.0	109.7	113.3	117.0	120.7	124.3	128.0	131.7	135.3	139.0	142.7	146.3	**150.0**
Community Water Supply		**60.0**	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	**60.0**

13.2.2 Future Domestic Service Ratio

Future service ratio is assumed as follows.

- PDAM Yogyakarta: Current Service Ratio -> 80% in Year 2015
- PDAM Sleman (Urban area) Current Service Ratio -> 80% in Year 2015
- PDAM Sleman (Rural area) Current Service Ratio -> 60% in Year 2015
- PDAM Bantul (Urban area) Current Service Ratio -> 80% in Year 2015
- PDAM Bantul (Rural area) Current Service Ratio -> 60% in Year 2015
- Community Water Supply System Current Service Ratio -> 60% in Year 2020

These target service ratio and target years are assumed complying with Indonesian national targets defied as Millennium Development Goals.

13.2.3 Future Domestic Water Demand

From domestic service ratio in respective Kelurahan/Desa, future served population is calculated. From the calculated served population and per capita domestic water demand which are discussed in previous sections, future domestic water demand is calculated.

13.2.4 Non-Domestic Water Demand

(1) Future Public Service Water Demand

Future public service water demand is projected to increase from current water consumption as public service applying increase ratio as same as total population increase ratio.

(2) Future Commercial Water Demand

1) General Commercial Water Demand

Future general commercial water demand is projected by assuming the increase ratio shall be 4.7 %, with a constant ratio up to the year of 2020. This ratio is regarded as same as the past 5 year average increase ratio of GDRP (Gross Domestic Regional Products).

2) Tourism Related Commercial Water Demand

Future tourism related commercial water demand is projected based on number of future tourist arrival to DIY.

(3) Future Industrial Water Demand

Future industrial water demand is projected by increase ratio of 4.7 % of which past 5 year average increase ratio of GDRP (Gross Domestic Regional Products). For Sleman Regency, since there is no data of industrial water demand, same figure of Yogyakarta Municipality is

applied.

13.2.5 Total Future Water Demand

From discussions made in previous sections, total future water demand is calculated as described in proceeding sections. To calculate total future water demand, following conditions are applied.

Net Water Demand:	This demand is summation of domestic and non-domestic water demands and is net water demand which does not include any peak factors and UFW.
UFW Ratio:	Target UFW ratio is set as 25 % in year 2020. The UFW ratio will be reduced from current level to the target UFW ratio.
Day Average Water Demand:	Summation of the Net Water Demand and UFW which will be calculated from UFW ratio (Day Average Water Demand) = (Net Water Demand) + (UFW) (UFW) = (Net Water Demand) x (UFW ratio)
Peak Factor:	Ratio of yearly average water demand and the maximum water demand in the year. Yearly average water demand and the maximum water demand in the year are obtained from past record of water supply quantity. (Peak Factor) = (Maximum demand in year) / (Average demand in year)
Day Maximum Water Demand:	This demand is the maximum water demand in the year and is the water demand to plan/design the water treatment plant. (Day Maximum Water Demand) = (Day Average Water Demand) x (Peak Factor)

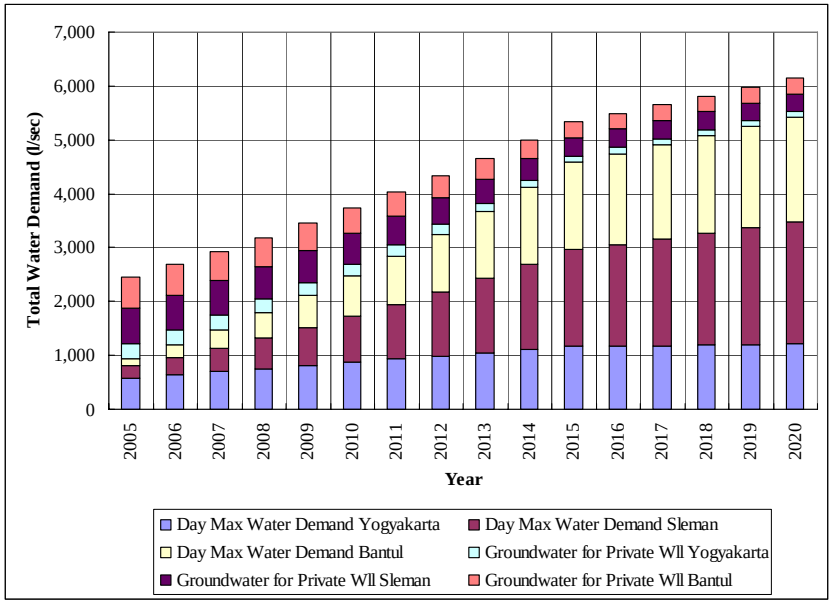
Total future water demand and groundwater requirements through private wells are calculated as shown on table and figure below.

Table 13.2.2 Summary of Future Water Demand (l/sec)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Day Max Water Demand, Yogyakarta	584	641	699	757	815	874	932	991	1,050	1,109	1,168	1,175	1,182	1,190	1,197	1,206
Day Max Water Demand, Sleman	225	326	439	565	702	851	1,014	1,188	1,376	1,577	1,791	1,885	1,979	2,074	2,170	2,267
Day Max Water Demand, Bantul	123	227	341	465	599	743	897	1,062	1,237	1,424	1,621	1,685	1,750	1,816	1,882	1,949
Groundwater for Private Well, Yogyakarta	292	282	270	257	242	226	208	188	167	144	119	116	114	110	107	103
Groundwater for Private Well, Sleman	656	646	631	613	589	561	528	490	447	398	343	339	336	332	329	325
Groundwater for Private Well, Bantul	566	559	548	533	512	488	458	424	384	338	288	287	287	287	286	286
Total	**2,446**	**2,681**	**2,929**	**3,189**	**3,460**	**3,742**	**4,037**	**4,343**	**4,660**	**4,989**	**5,329**	**5,488**	**5,648**	**5,809**	**5,972**	**6,136**

Note:

"Day Max Water Demand" includes day max water demand of PDAM system and community water supply system. "Groundwater for Private Well" includes groundwater demand through private wells by PDAM customers, by commercial, and by unserved population.



Note:
"Day Max Water Demand" includes day max water demand of PDAM system and community water supply system. "Groundwater for Private Well" includes groundwater demand through private wells by PDAM customers, by commercial, and by unserved population.

Figure 13.2.1 Summary of Future Water Demand (l/sec)

13.2.6 Case Study on Future Water Demand Projection

Basic data, methodologies, and results of future water demand projection are described in previous sections. According to the results of water demand projection, water demand which will be supplied by PDAM is 932 l/sec in 2005 (daily maximum basis, total of Yogyakarta, Sleman, and Bantul) and the demand will increase to 5,422 l/sec in 2020. This result means that the total capacity of three PDAMs should be expanded as 5.8 times from current capacity during next fifteen years.

Feasibility, adequacy, or practicability of this drastic expansion of water supply system within rather short period, 15 years, should be examined by forthcoming study from various aspects such as technical, financial, and capability of respective PDAMs. Although it will be examined in future, considering significant magnitude or rate of expansion, several cases of future water demand which represents lower future water demand are studied. In the case study, four cases are considered and compared as follows.

Case 1: Future water demand projection which is discussed in previous sections. Future domestic per capita water demand is gradually increased from current level. Concerning service ratio, national target ratio is adopted.

Case 2: Modified from Case 1 projection. Future domestic per capita water demand is set

125 lpcd for urban area and 80 lpcd for rural area. Service ratio in rural area is decreased from Case 1 to 40 %.

Case 3: Modified from Case 2 projection. Service ratio in urban area is decreased from Case 2 to 55 % and target year is postponed to 2020 except Yogyakarta Municipality.

Case 4: Modified from Case 3 projection. Service ratio is further decreased for all area. Service ratio is 50 % in urban area and 35 % in rural area.

Based on conditions/parameters of case study, future water demand is calculated for each case. Figure 13.2.2 shows difference (gap) between existing capacity of three PDAMs and future water demand which will be supplied by these PDAMs of each case.

In other words, the figure shows required PDAM capacity expansion to meet future water demand by 2020.

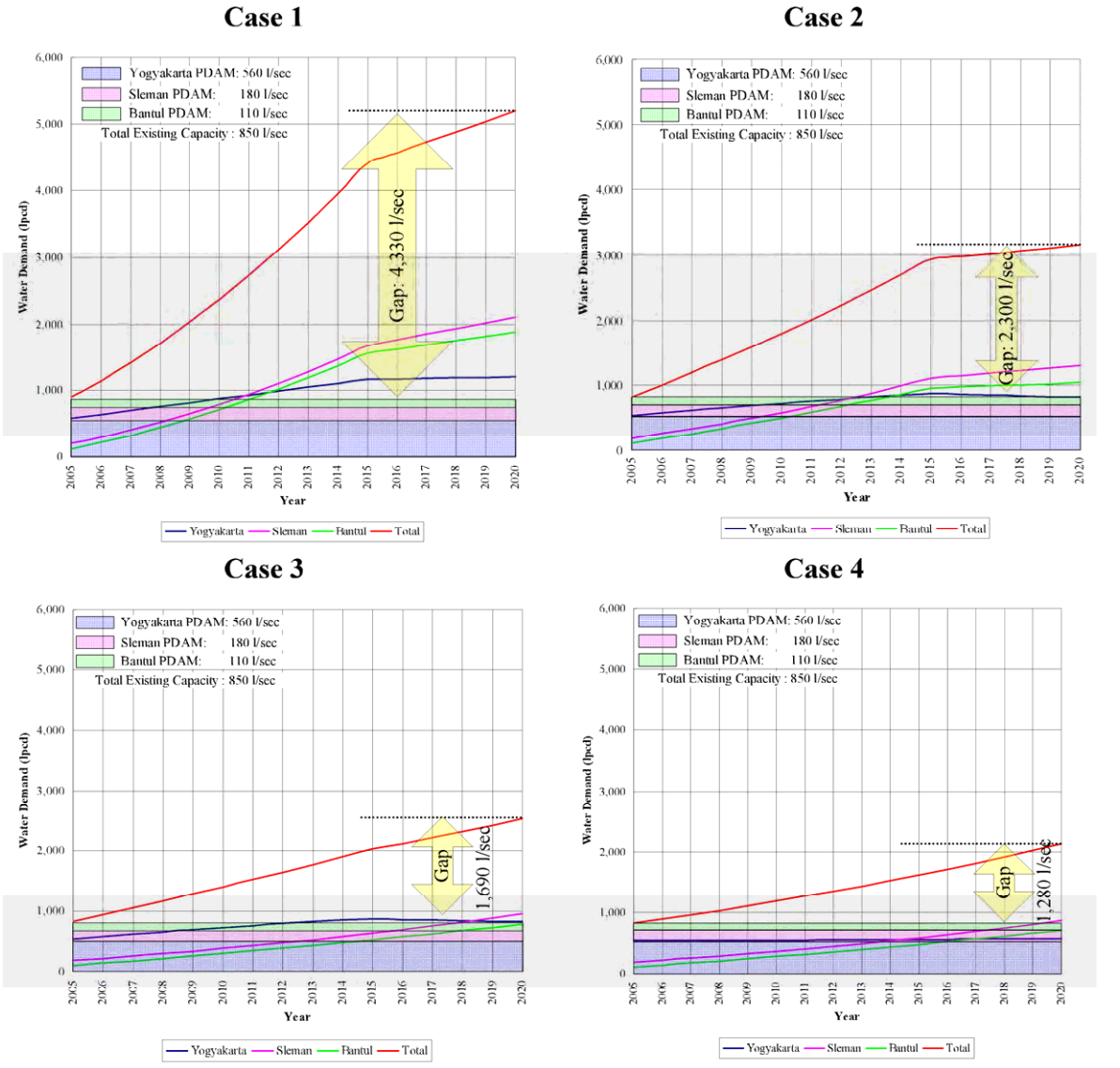


Figure 13.2 2 Shortage of PDAM Water Supply Capacity Against Future Water Demand

13.2.7 Area Wise Future Water Demand

(1) Study Area Zoning

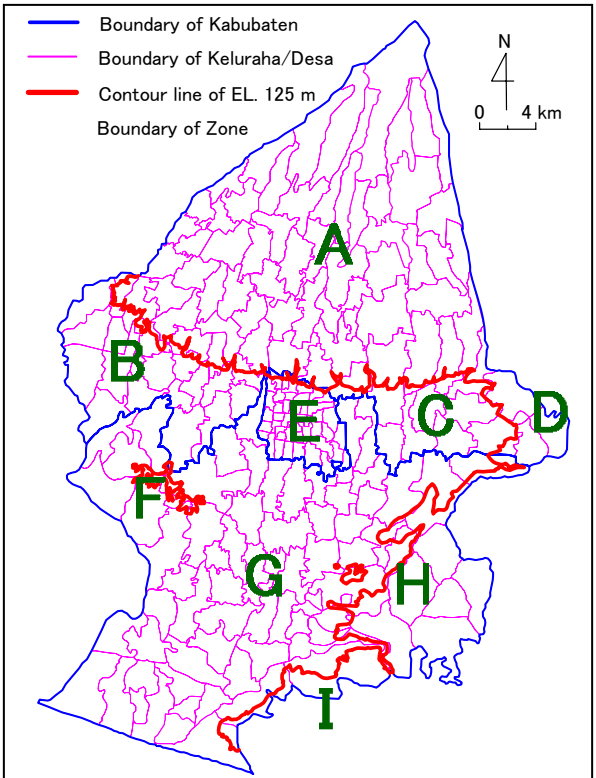


Figure 13.2.3 Study Area Zoning

For forthcoming water supply system planning, future water demand is distributed/allocated for each area, zone. Zoning of the Study Area is as shown on Figure 13.2.3 and each zone is defined based on respective aerial topographic and administrative characteristics. Contour line of EL. 125 m is also considered as key factor of the zoning. Mataram canal which will be the route of future clear water transmission line runs along with contour line of EL. 150 m toward Yogyakarta Municipality. From the elevation of the future clear water transmission pipeline (around EL. 150 m), area lower than EL. 125 m may be supplied by the new system taking account of piping head loss and residual pressure at customer taps.

(2) Zonal Future Water Demand

Kelurahan and Desa in respective zone are identified and future water demand of Case 4 which is discussed in previous section is allocated to each zone based on Kulurahan/Desa future water demand.

Zonal future water demand is shown on Figure 13.2.4

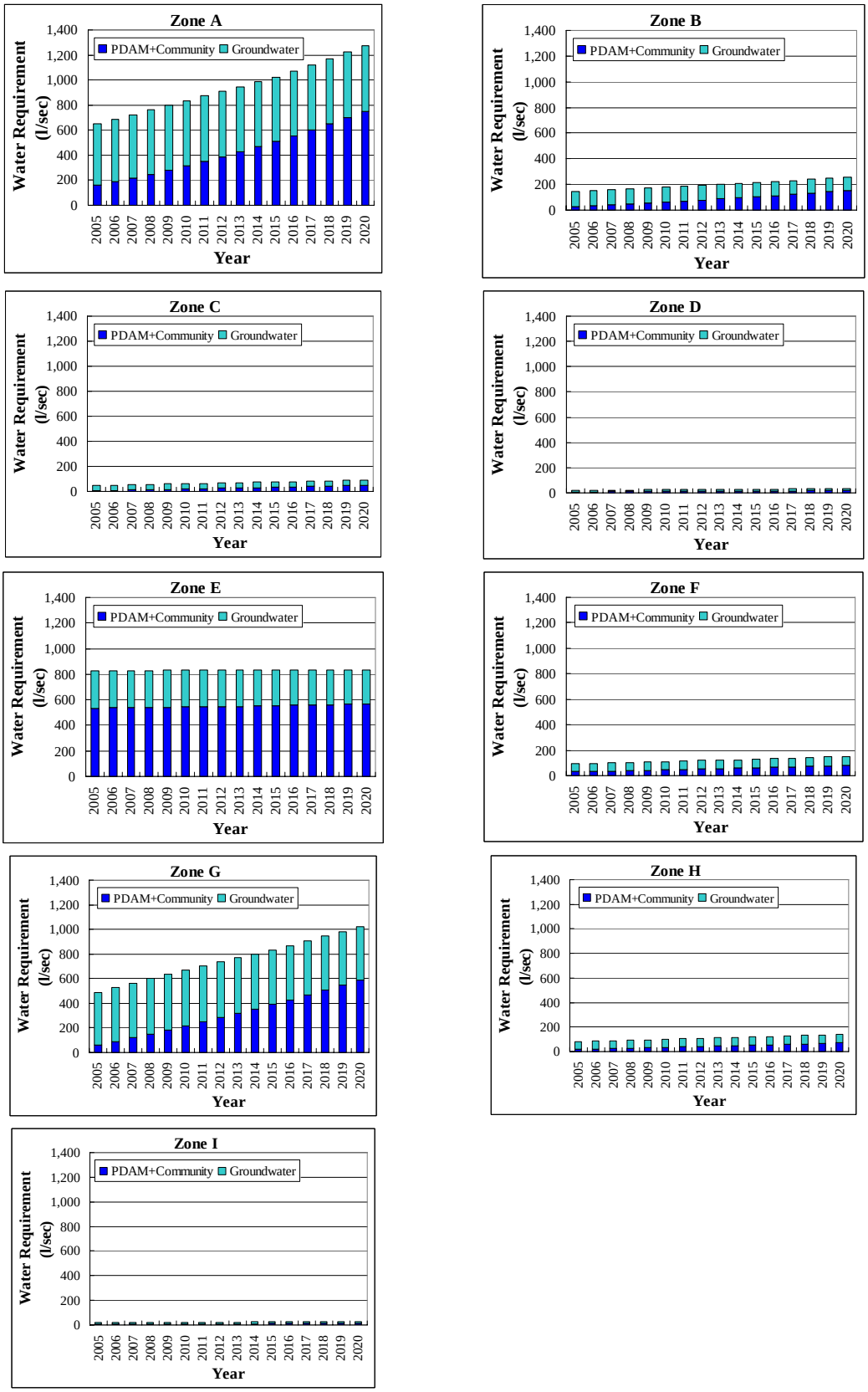


Figure 13.2.4 Zonal Future Water Demand

CHAPTER 14 FUTURE WATER RESOURCES

14.1 Groundwater Resources

14.1.1 Geophysical Exploration for Evaluating Groundwater Resources

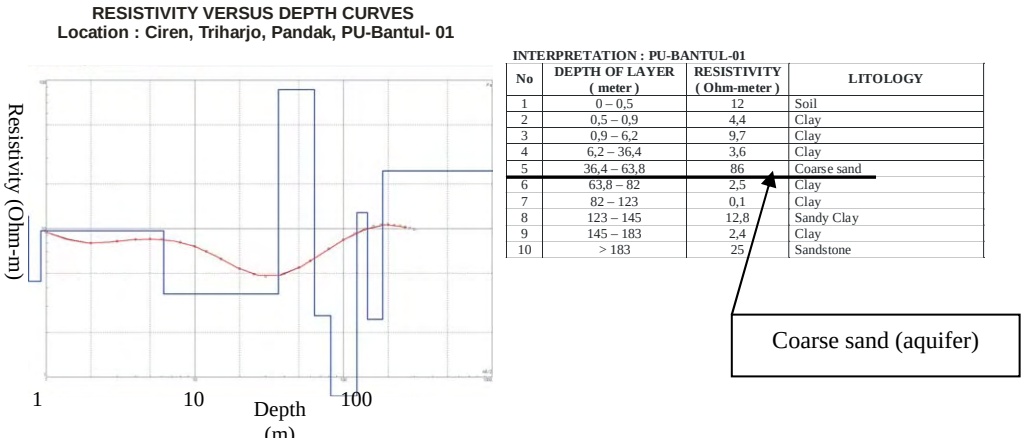
Geophysical exploration was carried out for evaluating groundwater resources in the study area and also for assisting to delineate promising areas for drilling and taking water from springs.

(1) Location of Geophysical Exploration and Method of Survey

80 survey points were selected. 60 points are in 3 districts for VES survey and 20 are in Sleman Regency for 2D imaging survey. VES method uses Schlumberger configuration, and 2D Imaging method uses Dipole-Dipole configuration.

(2) Results of the Geophysical Exploration

Figure 14.1.1 shows the result of VES survey in Batul. Figure 14.1.2 shows the result of 2D imaging survey in Sleman. These results are examples of existing aquifer.



INTERPRETATION : PU-BANTUL-01

No	DEPTH OF LAYER (meter)	RESISTIVITY (Ohm-meter)	LITOLOGY
1	0 – 0,5	12	Soil
2	0,5 – 0,9	4,4	Clay
3	0,9 – 6,2	9,7	Clay
4	6,2 – 36,4	3,6	Clay
5	36,4 – 63,8	86	Coarse sand
6	63,8 – 82	2,5	Clay
7	82 – 123	0,1	Clay
8	123 – 145	12,8	Sandy Clay
9	145 – 183	2,4	Clay
10	> 183	25	Sandstone

Figure 14.1.1 Result of VES survey (Ciren, Triharjo, Pandak, Bantul)

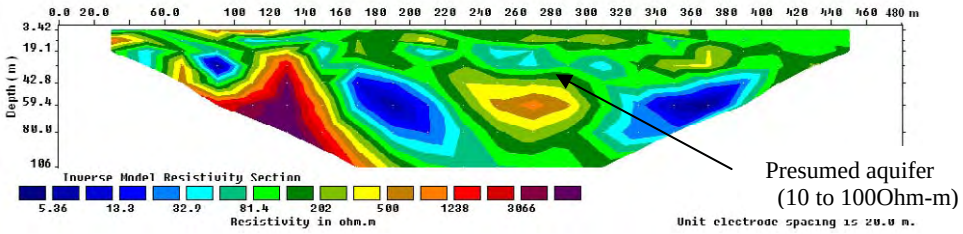


Figure 14.1.2 Result of 2D imaging survey (Kayen, Wedomartani, Ngemplak,Sleman)

According to previous studies, zone of 10 to 100 Ohm-m of resistivity value were presumed to be aquifer and especially zone of 30 to 100 Ohm -m have good groundwater for quality. In the 80 survey points, all points have this zone of 10 to 100 Ohm-m. Quaternary deposits act as good aquifer are distributed in the plain fields. It seems to be high potential in the plain fields in consideration of the result of geophysical exploration and geological conditions. On the other hand, eastern area and western area of Bantul are mountainous areas. Tertiary tuff and breccia those did not act as good aquifer are distributed in these mountainous areas so it seems to be difficult to develop groundwater. When developing groundwater in the tertiary area, detailed survey for geological condition and existing wells will be needed. Table 14.1.1 shows the average thicknesses of presumed aquifers until 100 meter depth on the VES survey points in each district. According to the table, thicknesses of aquifers tend to be thicker in southern area.

Table 14.1.1 Average thicknesses of Presumed Aquifers* in each district

District	Number of Samples	Average thickness of Presumed Aquifer(meter)
Sleman	21	35.6
Yogyakarta	35	40.5
Bantul	4	45.7

**: layers those have 10 to 100 Ohm-meter resistivity value until 100 meter depth*

Figure 14.1.3 shows the results of 2D Imaging survey in the study area. According to this figure, cross-sectional distributions of resistivity value in survey points are not regular and also regional characteristics of the results is not clear. Because past environment of sedimentation in the study area was complicated, geological layers in the study area are intricate. In order to select appropriate points for drilling in this complex surrounding, it is necessary to figure out the detailed hydrogeological condition of possible area of drilling.

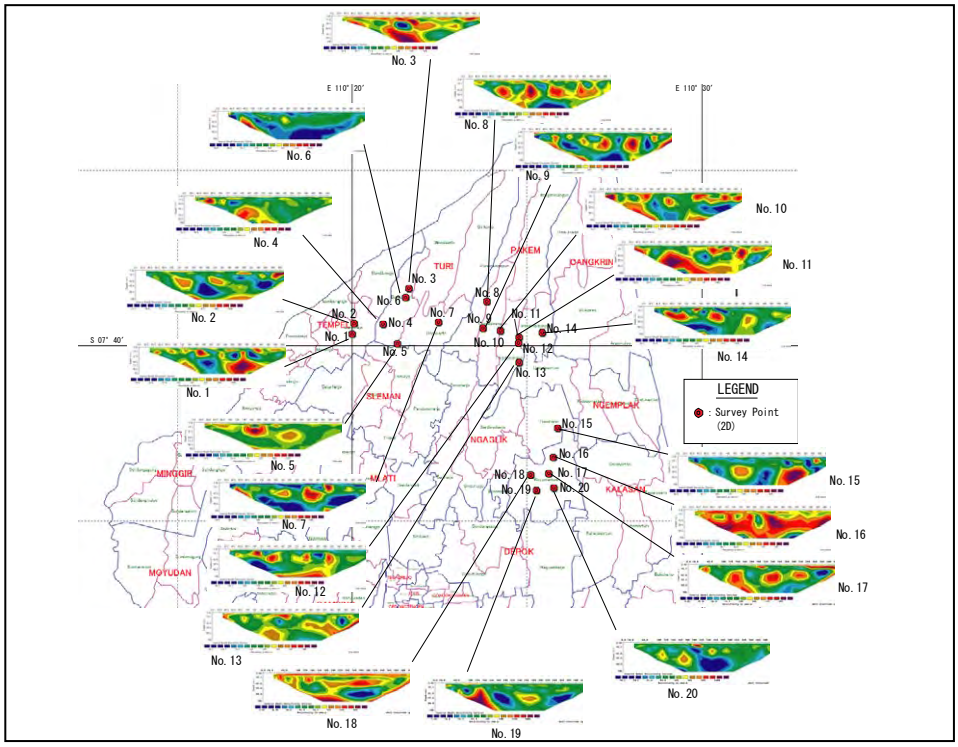


Figure 14.1.3 Results of 2D Imaging Survey

14.2 Potential Water Resources

In order to estimate the potential groundwater resources, meteorological and hydrological data were collected and analyzed.

Groundwater recharge was estimated by using following hydrological water balance formula
.

$$Gwi=(P-E)\times I+\Delta S$$

Where, Gwi: Groundwater Recharge
P: Precipitation, Rainfall
E: Evapotranspiration
I: Infiltration Rate
ΔS: Change of Groundwater Storage (set as 0 throughout the year)

As mentioned in main report, annual Precipitation (P) is 2,602mm/year, estimated evapotranspiration (E) is 1,063mm/year, estimated infiltration rate (I) is 0.90, and groundwater recharge (Gwi) is 1385.1mm/year, based on the following previous researches.

- Greater Yogyakarta Groundwater Resources Study (Vol.2 Hydrology), Sir M Macdonald & Partners in association with Binnie & Partners Hunting Technical Services Ltd., Under assignment by Overseas Development Administration, London, December 1984
- Good Governance in Water Resource Management (GGWRM), BUKU II Laporan Perumusan Masalah Untuk Penyusunan, (Problem Formulation for the Development of) Basin Water Resources Management Plan (BWRMP) SWS POO, European Union,

Finally multiply the extent of the study area 1000km^2 by 1385 mm of Gwi, so total amount of groundwater recharge of the study equals **1.385 billion m^3/year.**

In the study area, several studies for water resources had been conducted. According to the results of previous surveys, the total amount of groundwater recharge in the study area range from **1.0 billion m^3/year (=32,000L/s)** to **2.1 billion m^3/year (=67,000L/s)**.

It seems that groundwater recharge in the study area ranges from 1.0 to 2.0 billion m^3/year approximately.

Chapter 15 ISSUES TO BE CONSIDERED IN MASTER PLAN

15.1 General

In this chapter, issues to be considered in Master Plan, which is hoped to be prepared in future, are discussed based on results of various kinds of investigations and analysis on existing conditions/situations. When the Master Plan will be prepared, these issues highlighted in this chapter will become important reference.

15.2 Issues on Legislative and Institutional Aspects

15.2.1 Legislative Issues

In order to effectively implement the Water Resource Law (UU 7/2004) and the Regulations on Drinking Water Supply System (PP 16/2005), the following sub-laws should be established.

(i) The government regulations on management and control of surface water and groundwater should be enacted.
(ii) Specific guidelines for SPAM management, operation &maintenance, and monitoring & evaluation should be established.
(iii) There is a mention of Supervisory Board for SPAM management at Province level in PP 16/2005, but detailed rules of the Board have not been published.

15.2.2 Institutional Issues

The DIY Provincial Government intends to promote regional integration of water supply

operation of the three PDAMs under the initiative of Greater Yogyakarta (Kartamatul).

The regional integration must bring the win-win-win situation for the three PDAMs. Indonesia has not experienced area-wide integration in water services. As such we refer to experiences in Japan. There are three models of management integration by wide area operation to be considered to the Study Area.

- Model 1: The 3 PDAMs are merged and integrated into one water company.
- Model 2: The financially weak PDAMs (Sleman and Bantul) entrust operation to the financially strong Kota and Kota operates the wider area unified.
- Model 3: An independent water association will be created and each PDAM will entrust operation to this new entity.

In the master plan, the parties concerned (DIY, three regencies/municipality governments, three PDAM managements, etc) are recommended to discuss their likes/dislike, pros/cons and advantages/disadvantages of proposed options to see such regional integration is possible and if it is possible which option is the most favorable.

15.3 Issues on Water Supply Facility Planning

15.3.1 Water Resources

The northern high-altitude area of the study area has more rainfall than the lower part of the study area and has less evapotranspiration than other part, so groundwater recharge in the northern area must be much more than other part. This area has also advantage of distribution of water to lower area because of high altitude. Generally, potential of further groundwater development is high in the study area. To meet future water development, effective and sustainable groundwater should be carefully examined in the stage of master plan preparation.

15.3.2 PDAM Water Supply System

(1) Water Demand and Supply Capacity

According to the results of future water demand projection, existing water supply capacity is not sufficient for all cases of demand projections (Cases 1 to 4) as discussed in Chapter 13. In order to decide magnitude of system expansion, target future water demand should be selected from four cases of future water demand in the course of preparation of Master Plan. Feasibility, adequacy, and practicability of the planned project from various aspects such as technical, environmental, and financial should be confirmed very carefully in the Master Plan. In addition, appropriate phased planning with effective use of existing facilities and rehabilitation such as WTP or transmission/distribution pipelines should be considered.

(2) Effective Water Resource Allocation to Water Supply Facilities

In the Master Plan, water supply system development should be studied conforming to potential and availability of water resources of respective areas. Topographical and geographical conditions of area are also significant factors which should be taken into account for preparation of the Master Plan.

(3) Application of Appropriate Treatment Process

Treatment process, especially for removal of iron and manganese, should be examined as less energy consuming system such as bacteriological method. The most adequate treatment process should be selected considering technical appropriateness, required operation and maintenance level, and financial aspects.

(4) Transmission and Distribution System

1) Transmission Pipeline System

In order to apply gravity flow system as much as possible, location of water source and alignment of transmission pipeline from the water source should be carefully planned in the Master Plan.

2) Distribution Pipe Network System

When the distribution system is planned in Master Plan, zoning system or district metering system should be considered so as to maintain consistency with NRW reduction plan. In addition, considering that there are some service area supplied by PDAM Yogyakarta in Sleman Regency, appropriate zoning and demarcation of service between PDAMs concerned should be thoroughly studied in future master plan.

3) Individual (House) Connections

Standard design of connection should be studied in the Master Plan including recommendable specifications of suitable materials for connections.

(5) Monitoring/Measurement of Water Quantity

Monitoring water quantity is fundamental for water supply providers. Performance of water supply system could not be evaluated without accurate information of water quantity. Improvement of metering facilities should be carefully planned in the Master Plan.

(6) Implementation of Effective NRW Reduction Measures

In order to reduce NRW ratio, the most efforts should be put on leakage reduction for three

PDAMs. In the Master Plan, strategic leak reduction approach should be studied. The first priority should be establishment of leak reduction team in PDAM organization which solely works for leak survey and repair.

(7) Water Demand Management

Although it depends on selection of target future water demand cases which are described in Chapter 13, domestic per capita water demand should be reduced from existing level in several area for Cases 2 to 4. To have understanding of customers concerning water demand management, it is necessary to launch public relations campaign about water conscious life style and limited water resources.

(8) Public Relations

Well understanding on water supply system by customers is one of the most important aspects for provider. Without maturing mutual confidence, customers' cooperation to or understanding of water supply system will not be anticipated. To have confidence from customers, providers should provide good services such as supplying water continuously with adequate pressure and with suitable quality for drinking. Public relation activities should be implemented to help maturing mutual confidence.

15.3.3 Community Water Supply System

(1) For New Development

Master plan should be formulated with due consideration of following aspects:

- Think primarily of poverty reduction in line with the upper level plans such as MDGs or National Action Plan
- Focus on priority area
- Appropriate phasing

(2) For Future of Community Water Supply Service

Possibility of transfer from community water supply service to PDAM and vice versa should be discussed, with due consideration of the following viewpoints:

- Profitability (can this transfer case secure certain amount of customer to ensure profit?)
- Water tariff (can new water tariff meet affordability of customers after the transfer?)
- Quality of service (can this system maintain quality of service for customers?)

(3) Capacity Development Strategy and Technical Support for Appropriate O&M

For proper master planning and its effective implementation, following issues should also be well-considered and incorporated into the master plan:

- Capacity development strategy for PU and WUO
- Formulation of steady system for technical support by PDAM

15.4 Issues on Operation and Maintenance Planning

15.4.1 General Issues

In order to ensure sustainable development, long-term cost saving approach should be taken under efficient O&M planning. To realize this approach, appropriate asset management, incorporated the following ideas, should be considered in the master plan.

- To forecast future situation of existing facilities based on appropriate inspection/evaluation.
- To know appropriate timing of necessary action (e.g., rehabilitation/renewal) to minimize cost.

Appropriate asset management should be incorporated in formulation of master plan. In addition, proper institutional and organization structure should be examined in master planning stage.

15.4.2 Special Attentions for Community Water Supply

In addition to the above discussion, following matters should be considered for adequate and sustainable O&M for community water supply systems:

- Identify what WUO, PU or PDAM can do to make clear demarcation of their role.
- Consolidate legal systems for clear demarcation of roles of WUO, PU and PDAM.
- Implement capacity development program for:
  - WUO who are directly involved in daily O&M.
  - PU and PDAM specialists who are expected to undertake advisory role to WUO members, who should have leadership/ownership.

15.5 Issues on Water Quality Management

Due to lack of systematic water quality management strategy, water supply providers in the Study Area have not earned full-scale trust by customers. Therefore, following issues should be considered to establish appropriate water quality management, with reference to the “Water Safety Plans” by WHO:

- Monitoring of water source with reference to the relevant guidelines and standards
- Monitoring of treated water with reference to the relevant guidelines and stand
- Monitoring of treated water in distribution systems
- Furnishing laboratory
- Water quality monitoring for community water supply system

- Coordination with MOH

15.6 Issues on Financial Aspect

15.6.1 Issues on Each PDAM

(1) PDAM Yogyakarta

Financial management is generally efficient; there are however, some weakness in operation and maintenance. In the master plan the PDAM should consider renewal and expansion investment to decrease NRW and increase service coverage. Therefore the master plan should cover the fund source recommendation with comparison of terms and conditions including donors offering.

(2) PDAM Sleman

Financial condition is critical. The PDAM is making effort to restore the financial problem under the regional government support such as water meter installation, cash flow injection and so on. However the central government urgent intervention is essential. In the master plan the process of financial reconstruction should be confirmed and rescue plan should be studied even further.

(3) PDAM Bantul

Due to the recent earthquake disaster in the region, tariff revision has been suspended since 2002. Therefore, new tariff proposal will be the first priority for the master plan of the PDAM. Capacity development approach should be introduced to the PDAM in order to strengthen corporate governance with transparency and accountability for establishment of good customer relations.

(4) Cooperation among PDAMs

As discussed in Section 15.2.2, financial issues must be studied in the master plan.

15.6.2 Issues on Community Water Supply System

Tariff depends on system components and beneficiaries affordability. Basic tariff should recover at least recurrent costs. Full cost recovery requires depreciation cost for capital investment that may be considered as the regional PU responsibility for rural area. However it is recommended for WUO to keep some funds for urgent pump repair cost to protect community lifeline before replacement by the PU.

15.7 Issues on Social and Environmental Aspects

15.7.1 DBOT Bulk Water Supply Project

(1) River Discharge and Mataram Canal Flow

Since water quantity which will be used for the Bulk Water Supply Project is 1.0m^3/s from the Mataram canal and this quantity seems significant comparing to the total water flow of the canal in dry season, availability of water source for the Bulk Water Supply Project should be carefully confirmed.

(2) Land Acquisition and Resettlement for Treatment Plants and Reservoirs

Bligo water treatment plant (tentatively named) is planned to be constructed within the provincial domain with an area of approximately 10ha along the Mataram Canal. Currently, this land has being mainly utilized as paddy field and there are two small brickyards and seven farmhouses. The construction of the water treatment plant will not require large-scale resettlement.

(3) Water Rights and Stakeholders

With regard to the additional water diversion from the Mataram Canal for the Bulk Water Supply Project, public hearings or conferences among various stakeholders have not been held so far. Under such situation, whether the consensus concerning water abstraction for water supply by farmers (the majority of stakeholders) is positive or not is still uncertain.

15.7.2 Others

Other issues to be considered with regard to social and environmental consideration are:

- Impact of ground water exploitation.
- Necessity of improvement of sanitary facilities in response to future increase of wastewater volume which would be brought by increase of water supply volume.
- Negative impacts during construction stage.
- Task for environmental monitoring plan.

15.8 Other Issues

15.8.1 DBOT Bulk Water Supply Project

Since the bulk water supply project is located upstream of water supply system, difficult situation of preparation of water supply master plan will not change without resolution of the

DBOT Project. Therefore, before commencement of the preparation of the master plan, scope, conditions, and formation etc. of the DBOT Bulk Water Supply Project should be clearly planned and agreed among agencies concerned.

15.8.2 Issues on Water Source

(1) DBOT Project

Pricing information of the DBOT project is very limited, and beneficiary PDAM has dubious about price of raw water. Since the government must develop water source in the area, it may be required to make equity investment for development funding to reduce construction cost. After the mutual disclosure of pricing information among stakeholders with the involvement of civil society, a paradigm shift in tariffs should be studied as referred to Chapter 12.5.2 (1) Legislative Improvement and (2) Public Service Obligation concept.

(2) Coordination among PDAMs

Under the Kartamantur initiative, coordination among PDAMs is essential. Effective usage of limited water source and conservation should be studied in the master plan. The central government advises through BPPSPAM for sector monitoring especially finance evaluation will be useful for sustainable O&M improvement and capacity building.

15.8.3 Consideration on Sanitation System

The Master Plan which is discussed in this chapter is for water supply. However, sanitation system improvement should also be taken into account in the Master Plan. There is a possibility that the sanitation situation would be worsen with improvement of water supply system. Adequate and appropriate sanitation system should be considered and planned to protect public water bodies.