2.1.12 Major Problems Identified on Jakarta Water Supply System

(1) Delay of Implementation of the Recommended Project in 1985 Master Plan

Comparing the implementation schedule recommended in the 1985 Master Plan and actual condition of implementation, the delay of system implementation is apparent. In order to meet water demand in the service area and to reduce groundwater abstraction, upgrading water supply capacity will be immediately necessary.

(2) Water Resources

1) Surface Water

Capacity of raw water available for Jakarta Water Supply will be insufficient in near future, estimated around year 2000. Unless new water resources is developed, Jakarta Water Supply is not able to supply water to meet water demand.

2) Groundwater

Land subsidence is also observed because of excessive abstraction of groundwater beyond its permissible level. Quantity of groundwater abstraction should be controlled. Quality of groundwater has become deteriorated by sea water intrusion specially in northern part of Jakarta.

(3) Water Treatment Facilities

Facilities and equipment in the water treatment plant are generally maintained in good condition since PAM JAYA has been put its effort for routine maintenance works. However, it should be noted that most of all water quantity measuring devises are out of order. Therefore, PAM JAYA is not able to monitor accurate amount of raw water taken, amount of production and amount of distribution. Quantity of water is the basic figure which should be monitored always by water supply enterprise.

(4) Water Quality

1) Jatiruhur Dam Water

Tendency of eutorophication has been observed from the results of water quality analysis. Jatiruhur dam has been biggest water source for Jakarta water supply system, and will also be the biggest even in the future. Thus, maintaining quality of the dam water in suitable range is very important to produce potable water at treatment plants and supply the same to the consumers.

2) Cisadane and Western Rivers

As previously described, quality data of raw water of Cisadane and other rivers located western part of Jakarta is insufficient to study future water treatment method or necessity of improvement of the river water quality. Quality data related to Jakarta water supply shall be accumulated as much as possible. To keep the present level of or to improve water quality of Cisadane and other rivers, such measures as construction of drainage system or any preventive measure to prevent the river basin from dumping contaminants in it.

On going Jabotabek Water Quality Management Project is considered to study Cisadane and western rivers, and it is expected to obtain appropriate measures for the above purposes.

3) Treated Water

Chlorination in treatment process has two roles, namely oxidization and disinfection. Considering from rather high concentration of manganese and wide distribution of residual chlorine in finished water, chlorine, especially pre-chlorine, feeding has not been always controlled properly, and oxidization of pollutant in raw water is though not always perfect.

Thus, consumption of chlorine by the finished water may continue even in the distribution networks. This phenomenon may be a cause of tap water of poor quality. Control of chlorine feeding at each treatment plant shall be strengthened.

4) Water Distributed

Consequently, chlorine concentration in distribution mains becomes zero which is experienced in some areas at present. In order to lessen deterioration of water quality in the distribution mains, service area of Jakarta water supply system shall be isolated into appropriate number of zones. By introducing the Zoning system, it will be possible to reduce detention time in distribution pipes and to distinguish service area by their water sources.

5) Private Receiving Tanks

Existence of a receiving tank regulates fluctuation of flow caused by hourly water use of each house or building and it is very useful for a stable supply of water where capacity of the public water supply systems is not sufficient or interruption of supply occurs frequently. However, it sometimes worsens quality of tap water, since it is generally installed at such a place where its maintenance is not easy and keeping its sanitary conditions well is not easy.

(5) Non Revenue Water (NRW)

NRW ratio is still high about 50 %. Although the ratio has became lower by implementing PJSIP I project, continuous efforts of PAM JAYA to reduce NRW ratio is indispensable.

(6) PJSIP Project

1) Customer File

The present work scope of PJSIP excludes the preparation of customer's file. The customer's consumption and conditions of their connections (composed of stop cock, water meter and check valve) shall be always grasped by PAM JAYA, since the consumption record is a basis for UFW assessment as well as source of revenue of PAM JAYA.

2) Organization

Since sound operation and maintenance of distribution network including UFW control is rather institutional issue which requires to manage large organization and maintain systematic activities continuously including measurement, recording and routine activities in the field. And therefore, it is considered that one of PJSIP's objective will establish organization of UFW

team and sequence of work for rehabilitation or continuous maintenance to maintain water loss in an allowable range. In this connection the staff from PAM JAYA are recommended to join the project to learn the procedure and techniques through the implementation of rehabilitation.

(7) Water Supply Plan for Water Front City

The development plan of water front area of Jakarta so called Water Front City which is planned by the DKI Jakarta municipal government is under preparation. However, water supply scheme for the water front area is still not clearly defined.

(8) Organization Structure

1) Organization

Analyses were made of organization structure by discussion with people with PAM JAYA, documents produced by PAM JAYA and its consultants and questionnaire conducted by the JICA study team. Particular attention was paid to interrelationship of organization components. The analyses identified various problems which hinder the economic and efficient performance of the organization and the level of resource utilization.

i) Many tasks are numerously overlapping between or among organization components. For example: Cabangs, rayons and new service connection subdivision of marketing division concerning new service connection. Cabang technical section and rayon technical group with respect to installation of new connections, disconnection and reconnection and maintenance and repair water pipes.

Big meter unit and rayons with respect to customer service, meter reading, billing and collection. Exactly the same tasks are performed by two organization components. Ratio of big meter unit staff and consumer is significantly high, compared to rayons, resulting in redundancies of staff, which hinders efficiency and increase operational costs.

Budgeting subdivision and cash and bank subdivision regarding control of budget realization. Duties of commercial audit subdivision and administration and finance audit subdivision concerning evaluation of bill collection are overlapping.

ii) Many responsibilities and authorities are not in the right organization component, for example: training section of program development division is not in personnel division. This practice makes it difficult for personnel division to formulate and implement manpower development plan.

Treatment plants which should be supervised for their operation are not under production division. This blurred hierarchical line hampers proper operation and maintenance of treatment facilities.

Equipment control, stock and supply subdivision of technical stock and supply subdivision coordinate water tank truck trips, which is more related to distribution. Distribution division, which requires closer coordination with production division, is not under the same director as production division.

iii) There are some organization components which remain in the organization chart, however, they are no more in operation, for example: jobs of data processing subdivision were taken over to subcontractor and the related tasks are currently undertaken by customer data subdivision. Also, most staff are transferred to customer data subdivision. However, there still exists data processing subdivision in PAM JAYA's organization chart and underemployed staff with "non jobs" can be seen in this subdivision.

iv) Unclear hierarchical links are present in the organization, for example: Cabangs, treatment plans and mini plants report to the board of directors, not to the relevant directors, resulting in overlapping areas of authority, unclear reporting relationship and/or lines of communication.

v) Organization structure of PAM JAYA creates boundaries between departments. One implication of this result is that deemphasis on interdepartmental cooperation and coordination in PAM JAYA, for example: coordination among rayons, cabangs, marketing division and

program development division of the head office with respect to setting water sales targets in practice does not work well. Water sales target is established by the head office every year based on rayons' projections. However, rayons' projections tend to be adjusted upwardly by the head office, causing overestimate of the targets and therefore the targets are not easily effectuated. Occasionally, rayons attempt to increase new customers with disregard for water shortage in order to achieve the targets, and accordingly leading to consumer complaints.

In connection with water shortage complains from consumers, lack of coordination among rayons, treatment plans and the head office has been observed, which results in delaying response to consumers.

2) Delegation of Authority

Lack of delegation of authority was observed. Excessive centralization of decisions at the head office hinder an effective level of service. As indicated by questionnaire, cabangs, rayons and treatment plants want more autonomy in carrying out their duties effectively.

3) Publicity

Publicity plays a key role in gaining the general public's awareness and understanding of water supply business. However, public relations subdivision lack personnel (presently only 3 staff), making it difficult to promote PAM JAYA and respond requests from general public in a timely manner.

4) Office Environment

Office equipment like typewriters and communication system are obsolete (in rayons particularly). Paper and documents are stacked up all over the offices because central filing systems are not well maintained.

5) Personnel Structure

Unbalanced personnel distribution in terms of age, place of assignment, and specialization is observed. For example, some 12 % of PAM JAYA employees are between ages of 21 and 30. With respect to place of assignment, approximately 50% of university graduate engineers are in the head office, only 17% are in treatment plants and the remaining 33% are in cabangs and

rayons. Accordingly, these operating components lack particular types of technical personnel. It appears that administrative staff are redundant for this particular business.

6) Training System

Training committee has not actively carried out its tasks, therefore, far from pursuing training policy. Training Committee does not recognize the importance of training section. Training section needs more comments, feedback and attention from training committee to successfully implement training programs. Responsibilities of training committee and training section are not clearly divided. Training section is unable to effectively identify the overall training needs of PAM JAYA.

Training section lacks personnel. Training section currently has 3 persons. The number of staff is not very enough, considering their workload. Their operations are limited only to training activities financed by IBRD and OECF, not PAM JAYA's own budget. Facilities and equipment are not sufficient

Coordination especially among personnel division, program development division and training section in planning and implementing training activities does not work well. For instance, duplication of training programs with the other divisions is observed. Currently, training section is only responsible for technical training. Administrative training is the responsibility of personnel division or other division.

Managers of cabangs, rayons and treatment plants are not actively involved in the process of training planing. This causes ineffective identification of training needs of these operating components. Evaluation of the effects of training programs are not done.

7) Employee Benefit and Incentive

Unclear distinction among benefit, incentive and allowance. No incentives are given for group or team work.

8) Disciplinary Actions

PAM JAYA does not have an effective punishment or penalty against violation of rules and regulations and against neglecting job assigned. Also, according to questionnaire, many

respondents cited discriminatory treatments between Pegawai Negri Sipil (government civil servant) and Non Pegawai Negri Sipil (PAM JAYA-recruited staff) in terms of disciplinary Actions.

9) Career Path System, Recruitment and Selection System and Employee Records As described in the preceding chapter, career path and recruitment and selection systems have not effectively been implemented, for instance:

With respect to recruitment and selection system, participation of the immediate head of division, cabang, rayons, and treatment plants and where appropriate, head of section of these organization components in the selection process is not done. To date, employee records to a large extent has not been completed.

(9) Financial Condition of PAM JAYA

1) Results of Operations

Higher levels of operating expenses such as chemical (due to inflation, new operation of Buaran I and inferior quality of raw water), personnel expenses because of significant increases in allowances, and purchase of raw water from POJ resulted in reduction of PAM JAYA's profit in 1993, which led PAM JAYA to re-increase its tariff effective June 1994. These expenses are expected to rise in each of coming years. It should be noted that high unaccounted-for water materially contributes to high production costs and therefore high water tariffs.

2) Financial Position

Long-term debt to total assets ratio in 1994 suggests that PAM JAYA's creditors supplied 71.32% of the utility's total financing. Note that higher this proportion, the greater the long-term solvency risk.

3) Cash Flows

Cash flows from operating activities to capital expenditures ratio (an average of 32% of the past five years) underscores the fact that only one third of the utility's long-term investments was financed through internally generated funds.

4) Depreciation

As explained in the preceding section, depreciation amount obtained from the current procedures (fiscal regulation) materially differs from where generally accepted accounting principles (useful life method) is followed, the net income based upon useful life significantly differs from that deriving from income-tax procedures (this does not represent economic usefulness of assets, therefore, distorts real profits), which, for example, also have a material effect on water tariff determination.

(10) Billing and Collection System

Meter readers are not frequently rotated, therefore the risk of collusion with consumers about bills are high.

The current collection system involves significant cash transactions, thus the likelihood of embezzlement of cash receipt by staff is high.

(11) Water Tariff Determination System

Basis of water tariffs of PAM JAYA does not include appropriate costs and provisions, making tariff determination process unclear.

Heavy cross-subsidization and use of depreciation based on fiscal (tax) rule in setting tariffs significantly contribute to very positive profits and cash flows for the projected years.

PAM JAYA does not take into consideration tariff rise effects on water consumption.

2.2 WATER SUPPLY SYSTEM IN BOGOR, TANGERANG, AND BEKASI

Water supply system in the fringe area of DKI Jakarta namely, Bogor, Tangerang, and Bekasi, are described in this section. Detailed information is illustrated in **Annex-22.**

2.2.1 Bogor Water Supply System

PDAM Kabupaten Bogor is responsible for all Kabupaten Bogor area excluding Kotamadya Bogor which has own water supply enterprise, PDAM Kotamadya Bogor. PDAM Kabupaten Bogor is under the regional government of Kabupaten Bogor.

PDAM Kabupaten Bogor has own Water Supply System, including water treatment plants and distribution pipes. Raw water of treatment plants is taken from rivers, wells, and springs.

Existing water treatment plants related to the JICA Study Area, including four Kecamatans namely, Cimanggis, Sawangan, Limo, and Beji, are listed on **Table-221.1.**

Table-221.1 Existing Water Treatment Plants

NAME	CAPACITY (l/sec)	LOCATION	SOURCE
1 Depok Pusat	195	Sukmajaya (Depok)	Ciliwung River
2 Extension of Depok Pusat	55	Sukmajaya (Depok)	Ciliwung River
3 Citayam	60	Pancoran Mas (Depok)	Ciliwung River
4 Boosterpump Cimanggis	71	Cimanggis	Ciburial Spring
5 Sukmajaya	1.7	Sukmajaya (Depok)	Deep Well *
6 Purmata Puri	5	Cimanggis	Deep Well *
7 Cinangka	5	Sawangan	Deep Well *
8 Sawangan	10	Sawangan	Krukuf River
TOTAL	402.7		

* : Depth of deep well ranges from 100 m to 150 m.

Existing service area for Kecamatans of Beji, Cimanggis, Pancoran Mas, and Sukmajaya is covered by one water distribution network. On the other hand two plants located at Sawangan have independent network system. According to the information obtained from PDAM Kabupaten Bagor, the present condition of these treatment facilities is generally acceptable.

Most of unserved people living outside the service area depend on groundwater (shallow well), while water of tankers from PDAM Kabupaten Bogor is also important alternative water source in the area where groundwater condition is inadequate and for mountainous region.

Groundwater quantity as a alternative water source is enough at present even in dry season.

2.2.2 Tangerang Water Supply System

PDAM Tangerang is an organization under the local government of Kabupaten Tangerang. However, PDAM Tangerang has a responsibility for water supply in not only Kabupaten Tangerang but also Kotamadya Tangerang.

PDAM Tangerang has own Water Supply System consist of water treatment plants, distribution pipe network, mini plants and several water terminals for rural area.

There are three major water treatment plants in the central area of Tangerang. List of the treatment plants with their production capacity are shown on **Table-222.1**.

Table-222.1 LIST OF TREATMENT PLANTS IN TANGERANG

TREATMENT PLANT	PRODUCTION CAPACITY (l/sec)
Cikokol	500
Babakan	80
Perumnas	60

In addition to the above three treatment plants, new treatment plant, Cisadane-Serpong Water Treatment Plant is recently constructed. Construction of the new treatment plant was recommended in the Master Plan in 1985. According to the Plan, the name of the new treatment plant was Lebakbulus Water Treatment Plant and planned to be constructed in the Jakarta City at Lebakbulus. However, it was difficult to secure land space required for planned

Lebakbulus plant, location of the new plant was moved from Lebakbulus to Serpong in Tangerang where is outside of DKI Jakarta. Under this situation, the execution agency for the construction of the new treatment plant was changed from PAM JAYA to the PDAM Tangerang.

New Cisadane-Serpong Water Treatment Plant is as follows:

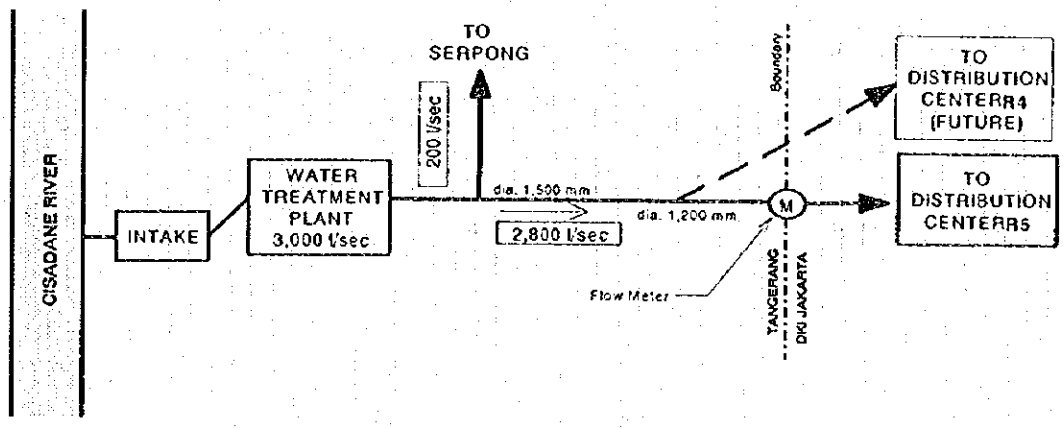
- Intake Facility — Capacity 3,200 l/sec (completed)
- Water Treatment Plant — Capacity 3,000 l/sec (completed)
  2,800 l/sec for PAM JAYA
  200 l/sec for PDAM Tangerang
  (supply to Serpong area)

It is agreed between PAM JAYA and PDAM Tangerang that the 2,800 l/sec of 3,000 l/sec will be supplied to PAM JAYA in bulk through the treated water transmission pipeline to Distribution Center R5 and R4. Treated water flow rate to PAM JAYA will be measured by flow meter which will be installed at the administrative boundary between DKI Jakarta and Tangerang.

Construction of intake and treatment plant were already completed at the end of 1993. However, treatment plant has not been operated yet, because installation of treated water transmission pipe has not been completed. Installation of pipe is still about 3.7 km because of a problem of land acquisition. Schematic layout of the treatment plant, treated water transmission and distribution centers are shown on **Figure-222.1.**

PDAM Tangerang has 13 mini plants which are under operation. Total capacity of these plants is 187.5 l/sec.

Figure-222.1 SCHEMATIC LAYOUT OF TREATED WATER TRANSMISSION PIPELINE



Served ratio in 1995 is about 22 % for municipal area (Kota) and less than 2 % for Kabupaten area.

Table-222.2 shows the number of house connection, and calculated served population and service ratio in each Kecamatan which are included in JICA Study Area. The number of house connection was obtained through hearing from a staff of the PDAM because no summarized table was available at PDAM Tangerang.

Table-222.2 NUMBER OF CONNECTION AND SERVICE RATIO

	NUMBER OF HOUSE CONNECTION	SERVED POPULATION	TOTAL POPULATION IN KECAMATAN	SERVICE RATIO (%)
Kabupaten Tangerang				
Ciptat	0	0	231,965	0
Pamulang	0	0	146,244	0
Pondok Aren	0	0	134,105	0
Teluknaga	251	1,381	92,246	1.5
Kosambi	48	264	67,543	0.4
Kotamadya Tangerang				
Ciledug	0	0	254,426	0
Cipondoh	526	2,893	180,045	1.6
Batu Ceper	1,107	6,089	145,082	4.2
Benda	0	0	44,167	0.

Total water consumption which was billed by the PDAM Tangerang was 1,027,855 m3/month (397 l/sec) in June 1995. Among the total water consumption, 3,962 m3/month (1.5 l/sec) was supplied to water tank car of PAM JAYA and 26,870 m3/month (10.4 l/sec)was directly injected to PAM JAYA distribution pipeline system. According to the information of the PDAM Tangerang, there is a bulk water meter to measure bulk water supply to PAM JAYA on the boundary between Tangerang and DKI Jakarta.

Most of unserved people living outside the service area depend on groundwater(shallow well), while rain water and water of tankers from PDAM Tangerang are also important alternative water souses in the area where groundwater condition is inadequate.

General information on the water quality of groundwater in Tangerang is as follows :

pH	:	6.4 ~ 6.7
Hardness	:	200 ~ 230 mg/l
Fe	:	1 ~ 2.6 mg/l
Mn	:	0.9 ~ 3.0 mg/l

These data were obtained from person in charge of PDAM Tangerang through hearing, since processed data was not available.

2.2.3 Bekasi Water Supply System

PDAM Bekasi is responsible for all Kabupaten area. The PDAM belongs to regional government of Kabupaten Bekasi.

According to the information from the PDAM, Kotip Bekasi, sub-city Bekasi, which consists of four Kecamatans, Bekasi Barat, Bekasi Utara, Bekasi Timur, and Bekasi Seratan, may become Kotamadya Bekasi, city of Bekasi, in 1996. As the change of administrative status, the existing PDAM Kabupaten Bekasi may be re-established into two PDAMs, namely PDAM Kabupaten Bekasi and PDAM Kotamadya Bekasi.

PDAM Bekasi has own Water Supply System consists of water treatment plants, distribution pipe network and water terminals for remote area.

List of the treatment plants with their production capacity and water source are shown on **Table-223.1.**

Service area is developed around each production facility and each service area is rather small. Therefore, there is no large diameter trunk mains such as observed in Jakarta City.

Number of connection of the PDAM Bekasi by each category in August 1995 is as shown on **Table-223.2.** In the study area of JICA Study Team, 4 Kecamatans namely TARUMAJAYA, BEKASI BARAT, PONDOK GEDE (including JATISAMPURNA area), and JATIASIH, there is no house connection except in Kecamatan Bekasi Barat. There are about 3,000 house connections in Kecamatan Bekasi Barat and service area is about 5 % of total area of Kecamatan Bekasi Barat. According to the information from the PDAM Bekasi, these 3,000 house connections have been installed in housing estates.

Table-223.1 LIST OF TREATMENT PLANTS IN BEKASI

	PRODUCTION CAPACITY (l/sec)	WATER SOURCE
Bekasi Sub-City (Kotip)		
Narogong Dan Jaka Permai	170	Surface Water
Poncol	80	Surface Water
Pondok Ungu	150	Surface Water
Kemang Pratama	20	Surface Water
Perumnas Rawalumbu	60	Surface Water
Kabupaten Bekasi		
Babelan	10	Surface Water
Setu	5	Groundwater
Sukatani	20	Surface Water
Cikarang/Cibitung I	40	Surface Water
Cikarang/Cibitung II	180	Surface Water
Lemah Abang I	200	Surface Water
Lemah Abang II	200	Surface Water
Lemah Abang III	100	Surface Water
Lemah Abang IV	5	Groundwater
Cabang Bungin	5	Surface Water
Tambun	20	Surface Water
TOTAL	1,265	

Table-223.2 NUMBER OF CONNECTION BY EACH CATEGORY

CATEGORY	NUMBER OF CONNECTION
Domestic	27,933
Public Hydrant	45
Social	78
Commercial	606
Industrial	2
TOTAL	28,664

Most of unserved people living outside the service area depend on groundwater (shallow well), while rain water and water from water terminals operated by the PDAM Bekasi are also important alternative water souses in the area where groundwater condition is inadequate. There are five water terminals in Kecamatan Tarmajaya and Kecamatan Bekasi Barat respectively.

In terms of groundwater quality, groundwater from shallow well in the Study Area contains rather high concentration of Fe generally, and Mn also observed in high concentration sometimes. In Kecamatan Tarumajaya, groundwater from shallow well contains salinity and high concentration of Fe and Mn. Northern area of Kecamatan Bekasi Barat, water quality of shallow well is also not suitable. In Kecamatans Pondok Gede, Jatiasih, and southern area of Bekasi Barat, water quality of shallow well is moderate. Contamination of groundwater is observed in shallow wells which are near from industrial estate or drain canal.

In the Study Area, quantity of shallow well in Kecamatans Pondok Gede, and Jatiasih are enough through the year. On the other hand, water quantity of shallow well in Kecamatan Bekasi Barat is not enough in dry season.

The PDAM Bekasi is now installing service pipes in the southern part of Kecamatan Bekasi Barat. This project is scheduled to be completed in December 1995. Installation of house connections is being executed simultaneously. After completion of the project, service area will become 50 % of the Kecamatan Bekasi Barat from the current ratio of 5%.

2.3 WATER SUPPLY CONDITION IN PULAU SERIBU (1,000 ISLANDS)

2.3.1 Administrative Status of Kecamatan Kepulauan Seribu

Kecamatan Kepulauan Seribu, Pulau Seribu, consists of many islands which are scattered in Java Sea north of Jakarta, **Figure-231.1**, are under the Regional Government of DKI Jakarta. The Kecamatan Kepulauan Seribu consists of four Kelurahan. At Present, there are 11 islands which are inhabited among 105 islands in Kecamatan Kepulauan Seribu as shown on **Table-231.1** together with name of each Kelurahan. Other islands are resort islands which have been developed by private companies or uninhabited islands.

Population and number of families in each Kecamatan are shown on **Table-231.2**.

2.3.2 Water Source for People Live in Islands

It is commonly difficult for people who live in an island to find their water source, and the situation regarding water in Pulau Seribu is not exceptional. Public water supply system has not been available in Pulau Seribu. Inhabitants have been struggling for water for their daily needs such as for drinking, bathing, washing clothes and dishes.

People in islands are depend mainly on water from shallow well. However, water quality of shallow well usually contains high salinity and not suitable for drinking purpose. For drinking purpose, people collect rain water or buy water from Java main island. To improve difficult situation of water, test boring of deep wells has been tried so far but suitable water, without salinity, has not been obtained.

(1) Shallow Well

There are many shallow wells which are main water sources for people in islands. They have been bored privately or bored by small local communities. Diameter of shallow wells ranges 70 cm to 120 cm and depth of the well is about 2 to 3 meters only. Water quality from shallow wells contain high salinity, therefore, people use the water from the shallow well for bathing and washing instead of for drinking. But there is one exceptional case that water from one shallow well in Pulau Kelapa is used for drinking because of low salinity.

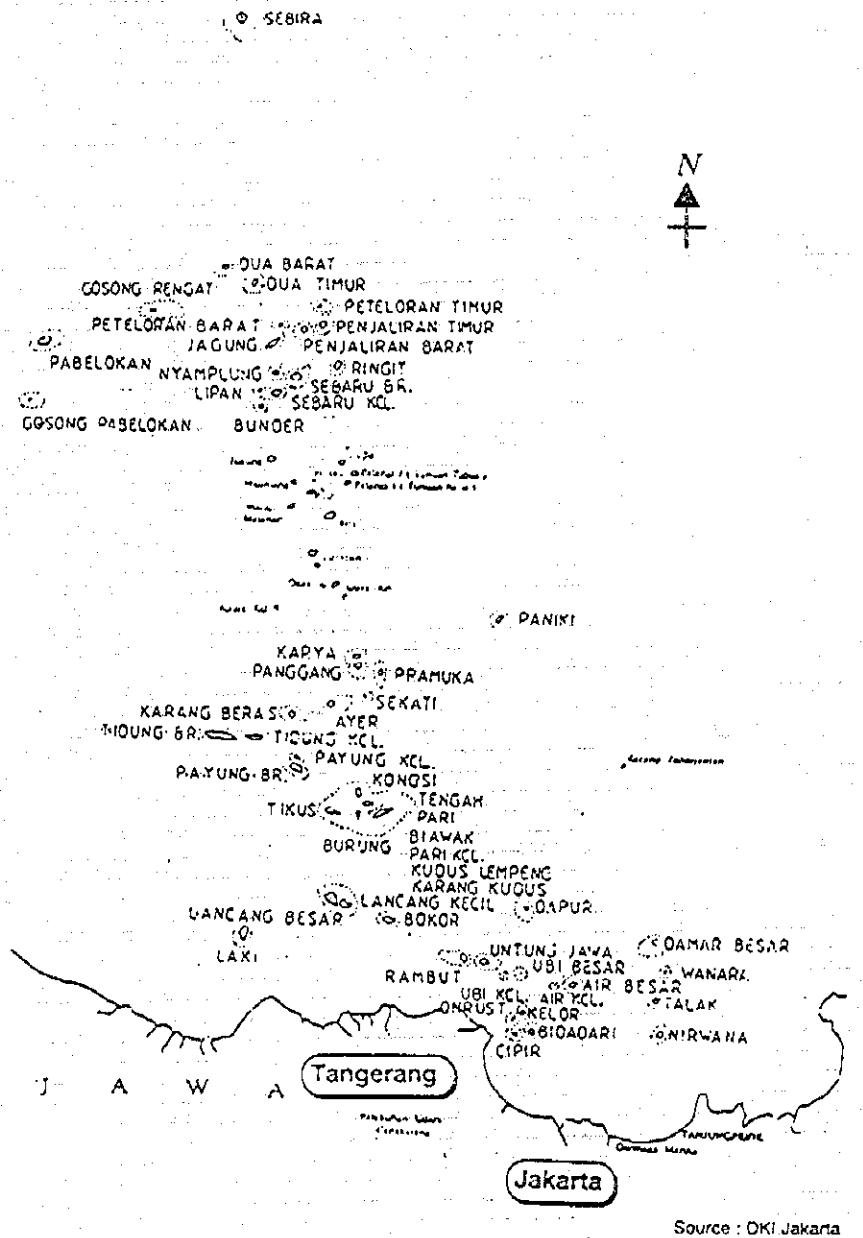
Table-231.1 NUMBER OF ISOANDS IN KECAMATAN

NAME OF KELURAHAN	NUMBER OF ISLANDS	NUMBER OF INHABITED ISLANDS
Pulau Panggang	11	2
Pulau Tidung	14	4
Pulau Kelapa	68	4
Pulau Untung Java	12	1
TOTAL	105	11

Table-231.2 POPULATION AND NUMBER OF FAMILY IN EACH KELURAHAN IN 1994

NAME OF KELURAHAN	POPULATION	NUMBER OF FAMILY
Pulau Tidung	4,347	1,171
Pulau Untung Java	1,391	327
Pulau Panggang	3,791	781
Pulau Kelapa	5,321	1,247
TOTAL	15,350	3,526

Figure-231.1 KECAMATAN KEPULAUAN SERIBU (1,000 ISLANDS)



Source : DKI Jakarta

In terms of quantity of water from shallow well, shallow wells in Pulau Kelapa and Pulau Panggang are dried up in dry season and no water from shallow wells are available. Some shallow wells are equipped with electrical pumps. Electricity for pump is generated by private gasoline generator.

(2) Water from Main Island, Java

In Pulau Untung Jawa and Pulau Panggang, people are buying water from main Java island. However, routine water conveyance system has not been established and people are buying water individually. Usually people ask fishermen to buy water when he goes the main island to sell fishes and he transports water to island on his return.

This water from main island is used for drinking only and cost is about 1,000 to 2,000 Rupiah per 20 litter including transportation cost. For other than drinking water, people depend on water from shallow wells as same as other islands.

(3) Rain Water

In islands where people do not buy water from main island or during rainy season, people use rain water for drinking. Rain water is kept in plastic or ceramic tank which is placed just below the edge of roof. Some tanks which were installed in public offices or schools were donated by tank manufacturers and they are maintained by users.

(4) Deep Well

Two deep wells are recently bored by Dinas Pertambangan DKI Jakarta. Water from the deep wells, unfortunately, still contain salinity and has unacceptable yellow color. Even though small scale filtration system is facilitated beside the wells, efficiency of water treatment is not enough and the water has not been used by inhabitants. Quality of water from each source mentioned above are analyzed by the JICA Study Team and the results of the analysis are described in the following section and detailed in **Annex-23.**

2.3.3 Condition of Water Sources

(1) Inhabited Islands

The Study Team visited four inhabited islands named Pulau Pramuka, Pulau Panggang, Pulau Kelapa, and Pulau Untung Jawa. These four islands were selected among 11 inhabited islands based on a recommendation from Chief of Kecamatan at the hearing.

The residents take water from deep and shallow wells and bring drinking water from Jakarta or Tangerang except Pulau Kelapa. Cost of drinking water in Pulau Untung Jawa is Rp. 2,000 per 30 l including Rp. 1,000 of transportation fee. Drinking water from Jakarta or Tangerang is transported by fisher boat when the boat returns from Jakarta or Tangerang after selling fishes.

One shallow well in Pulau Kelapa is being used as drinking water because of low salinity. Other shallow wells are used for other than drinking water. Deep wells investigated in Pulau Kelapa and Pulau Untung Jawa are no good quality compared with shallow wells.

(2) Resort Islands

In resort islands, bottled mineral water is used for drinking water and transported by own boat almost every day. For other than drinking, the resort islands mainly use shallow wells. In Pulau Bira, small scale filtration system is facilitated beside the shallow well for restaurant and pool, and every two cottages has a shallow well and elevated tank.

2.3.4 Results of Water Quality Test

Water quality tests is to identify a water quality conditions of water sources used by residents in islands of Kecamatan Kepulauan Seribu. Results of water quality tests are shown in **Annex-23** in detail.

(1) Water for Drinking Purpose

Sources of water which were brought from Jakarta or Tangerang could not be confirmed because the water conveyance was carried out by completely individual bases. Water from main Java Island did not contain residual chlorine while coliform was not found in the samples. Other items of water quality, as long as the results were obtained, did not exceed the limit defined in Potable water standard of DKI Jakarta.

To secure water quality for drinking purpose, water source in Jakarta and Tangerang should be carefully selected and the water should contain residual chlorine after being disinfected. Also, in order to avoid contamination, suitable management of water transportation and adequate reserving tanks at the islands should be considered.

Coliform was found from water of shallow well in Kelapa Island. Other items of water quality, as long as the results were obtained, did not exceed the limit defined in the potable water standard of DKI Jakarta. Suitable disinfection will be recommended to the shallow well for drinking purpose.

(2) Water for Other Purposes than Drinking Water

Water from shallow wells and deep wells which have been used for other purpose than drinking contained high salinity and therefore they are not suitable for drinking. Both of the two sample from deep wells show high degree of color. Water from deep well in Kelapa Island contains high NH4-N and Fe comparing with other samples. Coliform was found in many samples of shallow wells although the condition of color and turbidity are better than that of deep well.

CHAPTER 3

MASTER PLAN

CHAPTER 3 MASTER PLAN

3.1 BASIC POLICY AND STRATEGY

3.1.1. Basic Policy of the Study

(1) General

For the preparation of a long-range development plan for Jakarta water supply system towards its target year 2019, it is essential to establish a core policy of development which is to be pursued throughout the entire planning period taking into account the principles of the Constitution of Indonesia, the policies of Pelita VI as described in **INTRODUCTION 4, BASIC APPROACH TO THE STUDY** and the present water supply conditions of Jakarta and other cities of Asia.

(2) Background

Development of a modern water supply system in Jakarta virtually started in 1957 with the construction of Pejompongan 1 system, through a small-scaled water supply system using Ciburial spring water had been developed earlier and was already supplying a part of the city at that time.

The system, since then, has been developed by the construction of treatment plants and expansion of distribution system. Most of these developments have been implemented according to the development scheme of Master Plan which was first prepared in 1972 and later revised in 1985. These developments have steadily increased the production capacity of Jakarta water supply system though most of them delayed from the implementation schedule conceived in the Master Plan in 1985.

The development projects have been financed by both local and international sources, in which international finances were used mainly for the construction of major facilities such as water intakes, treatment plants, transmission facilities and trunk distribution networks, while PAM JAYA installed medium-to-small size distribution mains and service connections with its own

funds.

Due to a substantial delay in the progress of the PAM JAYA's works, the number of house connections and the ratio of accounted-for water have not increased as expected.
PAM JAYA, under the circumstances, has had to raise its water tariff to manage its operation as shown in **Table-311.1.**

Table-311.1 TREND OF NUMBER OF CONNECTIONS, UFW AND TARIFF

ITEMS	UNIT	1985	1986	1988	1990	1992	1994
Connection Nos.	1,000	155	155	159	228	299	341
UFW	%	54.24	52.76	52.42	54.00	54.00	52.56
Average Tariff	Rp./m^3	255	235	510	682	927	1,201

Note : INSTITUTIONAL DEVELOPMENT AND TRAINING (PAM JAYA SYSTEM IMPROVEMENT PROJECT - 1995)

In recent years, PAM JAYA has been implementing PAM JAYA System Improvement Project with the financial assistance of World Bank and Overseas Economic Cooperation Fund, Japan (OECF), and the project is expected to increase the number of house connections and decrease unaccounted-for water.

Despite these extension efforts, however, water supply conditions in Jakarta have not been satisfactory improved. This is primarily because of a rapid increase in water demand due to concentration of population and commercial and industrial developments in and around the city. An abundance of groundwater as an alternative water source has also allowed the above conditions. However, land subsidence and sea water intrusion resulting from its excessive abstraction have become serious problem in these days.

In **Table-311.2** which shows the water supply status in several large cities in Asia, the above water supply conditions in Jakarta is clearly seen when comparing data on the Table, specially in terms of service coverage, unaccounted-for water and water tariff.

More information on the water supply conditions in other Asian cities are graphically presented in **Annex-31.**

Table-311.2 WATER SUPPLY CONDITIONS OF LARGE CITIES IN ASIA

COUNTRY	INDONESIA	INDONESIA	PHILIPPINE	MALAYSIA	SINGAPORE	THAI	VIETNAM	KOREA	CHINA	INDIA	PAKISTAN
CITY	JAKARTA	BANDUNG	MANILA	KUALA LUMPUR	SINGAPORE	BANGKOK	HO CHIMING	SEOUL	BEIJING	GREATER BOMBAY	KARACHI
Data Year	1992	1992	1990	1991	1991	1992	1989	1991	1991	1991	1992
Population (1,000Nos)	8,350	1,817	7,929	1,145	2,763	5,609	2,924	10,904	5,770	9,800	9,100
Service Area (km^2)	266	165	1,488	180	633	710	120	605	396	438	500
Average Production ($1,000m^3/d$)	880	225	2,430	360	1,189	2,870	690	4,929	1,743	2,450	1,600
Nos. of House Connection (1,000)	243	71	618	105	728	768	214	1,389	N.A.	115	900
Service Coverage / Total Pops.(%)	25	39	71	100	100	79	65	100	95	N.A.	83
Water Availability (hr)	19	6	16	24	24	24	24	24	24	5	5
Per Capita Consumption (lcd)	148	96	133	222	168	217	131	180	149	N.A.	172
Unaccounted-for Water (%)	57	42	58	37	8	31	41	42	28	24	30
Average Tariff (US$/$m^3$)	0.363	0.268	0.232	0.327	0.442	0.242	0.045			0.069	0.047

Note : The above figures are quoted from WATER UTILITIES DATA BOOK by Asian Development Bank, November 1993
N.A. : Data not available

A most recent and important issue to Jakarta water supply system is the participation of private sectors, a new policy adopted by Government in June 1995. Another important issue is the new concept of water supply development, in which Jakarta water supply system is supposed to supply water beyond its administrative boundary in the future.

These issues are outlined as follows :

1) Division of the Water Supply System

In order to operate Jakarta water supply system on a competitive base, the system is split into two areas, eastern area and western area, with Ciliwng river being its boundary, and each area is operated by a different private consortium.

2) Participation of Private Sector

In order to improve the efficiency of PAM JAYA management and to accelerate expansion of water supply services in the city, two consortia have been appointed for participation to each area of Jakarta water supply, and agreement with PAM JAYA is scheduled to be made until March 1996.

3) Supply to Outside Areas

Urbanization and housing development have been very extensive and expanded beyond the administrative boundary of the city, and several studies related to future development

of infrastructure not only for Jakarta city but throughout for JABOTABEK area have been made. Jakarta water supply system is planned to supply water to these areas in the future.

(3) Basic Policy of the Study

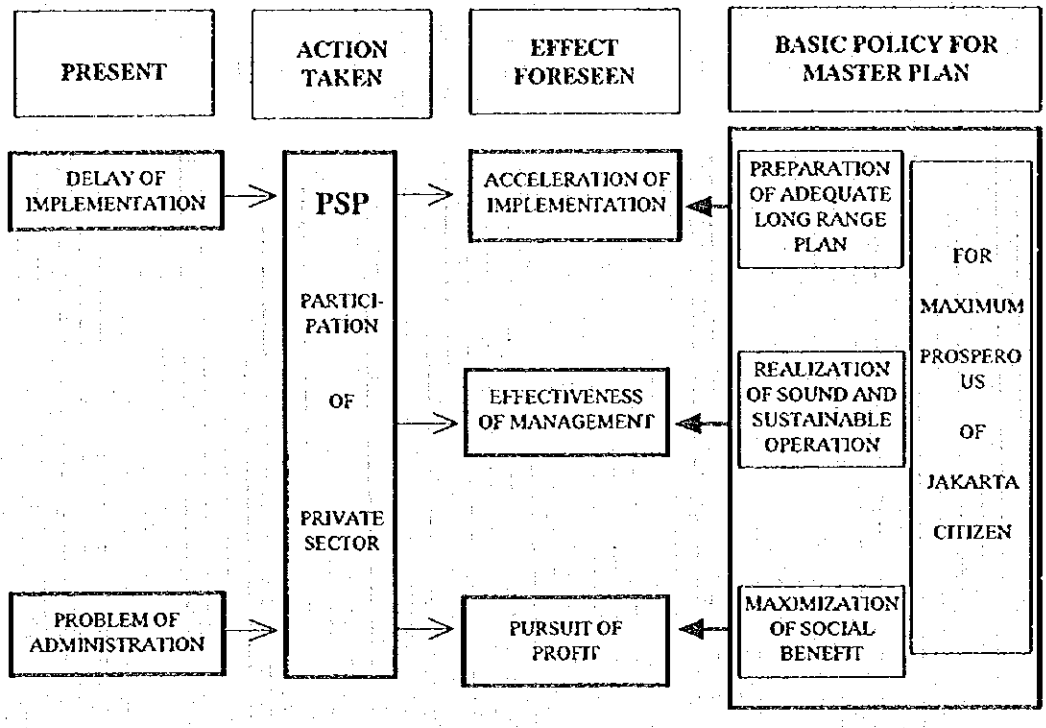
[Bumi, air dan kekayaan alam yang terkandung di dalamnya dikuasai oleh Negara dan dipergunakan untuk sebesar-besar kemakmuran rakyat. (Earth, water and natural riches contained in it are controlled by the Government and used for the prosperity of people as great as possible.)] is said in Chapter 33(3) article 14 "Social Welfare" of the Constitution of Indonesia. Basic requirement for water supply service is to supply clean and sufficient water at a reasonable price, and this is considered the same principle as the Constitution says.

On the other hand, the government policy set forth in Pelita VI is to eliminate the burden of the government funding for public investment. For instance, the Book IV says [Dalam penyediaan dan pengelolaan air bersih perkotaan, peluang dan iklim bagi peran serta usaha swasta dan masyarakat akan dikembangkan (Opportunity for participation of public and private sectors will be developed in order to supply and manage water in city areas.) in Chapter 38 "Perumahan dan pemukiman (Residence and Housing)".

In line with the government policy, PSP, Private Sector Participation, is planned to be adopted by Jakarta water supply system. In general, PSP in a water supply sector reduces government funding, accelerates project implementation and improve efficiency of management. On the contrary, it tends to force the business to seek for profit rather than to seek for public welfare.

Considering the policies defined in the Constitution and Pelita VI and the current trend of PSP, the basic policy is defined in the study as **"to prepare a most appropriate plan which will, on a sustainable basis, realize the maximum prosperity of Jakarta citizens from the standpoint of water supply"**. Or, it can also be expressed as **"to contribute to the improvement of public health and welfare to the extent possible through water supply service in Jakarta"**. The basic policy defined here in shown on **Figure-311.1**.

Figure-311.1 BASIC POLICY FOR THE MASTER PLAN



3.1.2 Strategy of the Master Plan

(1) Basic Concept

In order to realize the ultimate objective of the basic policy successfully, both existing water supply conditions and PAM JAYA's current administrative performance need to be improved. For the betterment of existing water supply conditions, there exists a need to increase (1) service coverage and to improve (2) stability and (3) safety of water supply. For the improvement of PAM JAYA's current administrative performance, it is necessary to increase (4) efficiency and (5) soundness of the PAM JAYA's administrative operation.

The needs above mentioned are considered as the basic concepts for the realization of the basic policy, as well as for the purpose of undertaking the present study.

Considering the situation of current water supply condition in Jakarta mentioned above and a long span of time until the target year, fundamental measures to be taken to actually materialize the above five basic concepts have been developed as shown in **Figure-312.1.**

(2) Concept of Stepwise Planning

Since the present study covers a long period of 25 years, construction of major facilities and improvement of managerial problems will have to be realized step by step as usually practiced in other development projects.

Among various measures to realize as shown in **Figure-312.1**, the highest priority should be given to improvement of water supply condition within the existing service area rather than bigger expansion of the service area. As an instance of poor water supply condition, service ratio in Jakarta city is still very low because of shortage of treated water. To increase the service ratio, construction of additional water treatment facility, installation of additional distribution pipes and reduction of unaccounted-for water should be implemented at first step.

Following the improvement of water supply condition within the existing service area, expansion of service area and upgrading of service quality should be considered as a second step. Further construction of treatment and distribution facilities will be required to expand service area until boundary of Jakarta city or even beyond the boundary. For upgrading the service quality, quality as portable water, sufficient quantity for 24 hours supply and adequate service pressure should be secured for all citizens including socially weak people of the city impartially.

Besides the stepwise improvement mentioned above, continuous efforts should be put for realization of effective and sound water supply services. The stepwise concept is shown in column of "PRIORITY" in **Figure-312.1**.

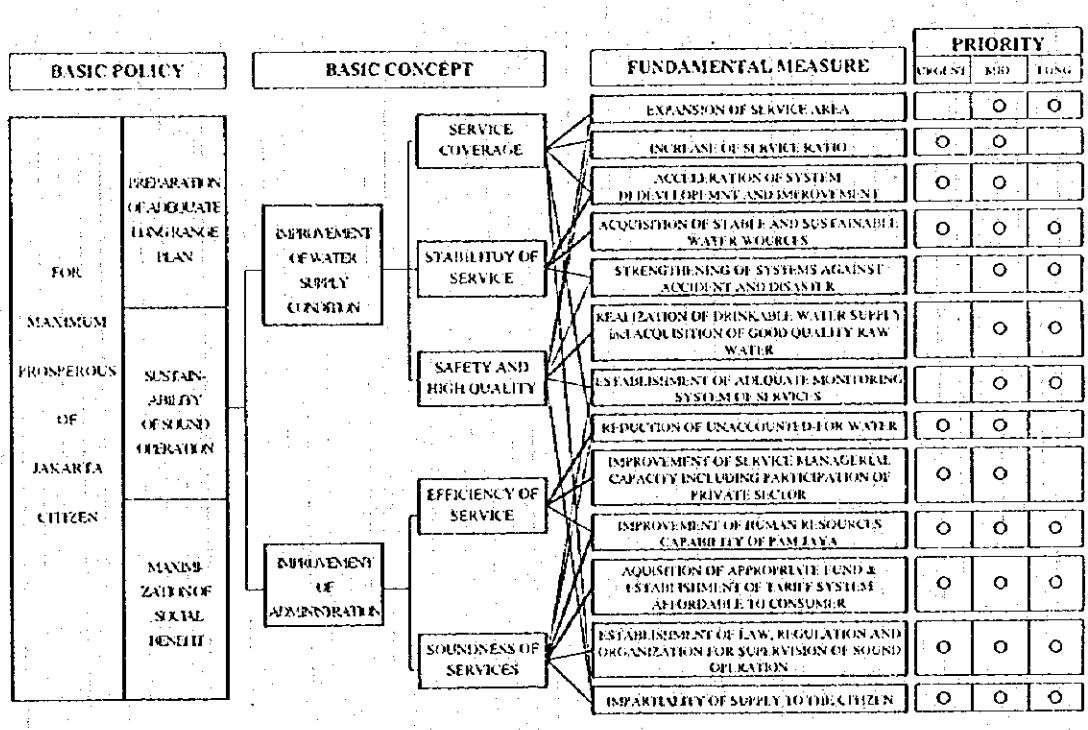
(3) Strategy for Planning

Figure-312.1 summarizes all the policy, concepts and measures which compose a basic strategy to be adopted in the present study.

The figure shows correlation between a concept and a measure as well as the priority of each fundamental measure for implementation. A thick line denotes that there is a strong correlation

between the two connected by the line.

Figure-312.1 STRATEGY FOR PREPARATION OF THE MASTER PLAN



3.2 RELATED STUDIES

After the preparation of Mater Plan for Jakarta Water Supply Development Plan in 1985, various studies have been conducted relating to water supply in Jakarta. These related studies area extended in several sectors other than water supply sector such as city planning, water resources, flood control and drainage. The results or recommendations which are obtained from these related studies are reflected to this study as much as possible after evaluation of these results or recommendations.

The list of these related studies is shown on **Table-321.1.**

Table-321.1 LIST OF RELATED STUDIES

RELATED STUDIES	EXECUTED BY	DATE
Jakarta Water Supply Development Project, Master Plan and Feasibility Study	JICA	1985
The Study on Urban Drainage and Waste Water Disposal Project in City of Jakarta	JICA	1991
Jabotabek Metropolitan Development Plan Review	Culpin Planing Ltd. et al	1993
Jabotabek Water Resources Management Study	Iwako et al	1994
The Study on Ciujung-Cidurian Integrated Water Resources	JICA	1994
Private Participation in Urban Services (PURSE PROJECT)	US Agency for International Development (USAID)	on-going
Jakarta Water Supply Sector Project	CMPS&F, MOTT MACDONALD, TASMAN ASIA PACIFIC, INFRATAMA YAKTI, VIRAMA KARYA	on-going
The Study on Comprehensive River Water Management Plan in Jabotabek	JICA	on-going

Brief explanation of each related study listed above is available in **Annex-32.**

3.3 ESTIMATION OF FUTURE POPULATION

As the first step of the formulation of the Master Plan, population in the Study Area is to be forecasted. Methodology and the results of forecast are described in the following sections. The results of forecast are also compared with other results of forecast by related studies.

3.3.1 Future Population in DKI Jakarta

(1) Past Record of Population

The records of past population from year 1984 to 1993 which was obtained from STATISTIC WILAYAH DKI JAKARTA, KANTOR STATISTIC PROPINSI DKI JAKARTA and these data are shown on **Table-331.1**. The annual population increase ratio was calculated as shown on the Table.

Table-331.1 PAST POPULATION IN DKI JAKARTA

YEAR	POPULATION (x 1,000)	ANNUAL INCREASE RATIO (%)
1984	6,203	
1985	6,329	2.03
1986	6,472	2.26
1987	6,761	4.47
1988	6,865	1.54
1989	7,003	2.01
1990	.	1.45
1991	7,207	1.45
1992	7,310	1.43
1993	7,395	1.16

As shown on the Table above, population in Jakarta have been increased by rather high increase ratio until 1989. From 1990, however, increase ratio become slightly lower and annual increase ratio from 1992 to 1993 was about 1.2 %.

The population record in year 1990 was not available from the office mentioned above because population census survey was executed in that year. The records of population census in 1971, 1980, and 1990 are shown in **Table-331.2**.

Table-331.2 RECORD OF POPULATION CENSUS

YEAR	POPULATION (x 1,000)
1971	4,567
1980	6,503
1990	8,223

These data shown on **Table-331.1** and **Table-331.2** are also shown on **Figure-331.1** graphically. As shown on the Figure, there is a gap between the data of population from the Statistic Office, on **Table-331.1**, and the results of census, on **Table-331.2**. The reason of gap will be explained from difference of the method of counting population. The record from statistic office is based on the number of issuance of identification card (KTP) by the municipal government. Therefore, the data of the statistic office does not include the population those who do not have KTP of DKI Jakarta. People from outside Jakarta who are working in DKI Jakarta such as house maid, general worker, etc. usually do not have KTP of DKI Jakarta. On the other hand, population census survey was executed door to door basis and the survey counted all population even though person who does not resister in DKI Jakarta.

Past population records in DKI Jakarta are shown in **Annex-33** by Kecamatan and By Kelurahan.

(2) Population Forecast

To forecast future population, five kinds of statistical lines or curves are employed for calculation as follows.

1. Arithmetic Linear Forecast
2. Geometric Curve

3. Exponential Curve
4. Power Curve
5. Logistic Curve

Past record of population and the results of past census were applied to these equations and most suitable curves for the past trend were composed, and future population by each equation was calculated from the selected curve. The results of population forecast using above five equations are shown in **Annex-33.**

According to the results of calculation, most suitable equation among them was the exponential curve because the annual population increase ratio become lower year by year. Considering future population by the other related studies as well, the future population by the exponential curve was employed in this study.

The planned future population is shown on **Table-331.3** and **Figure-331.1** together with population by the other studies.

According to the policy of Indonesian Government, Jakarta Water Supply System will be divided into two area, Western area and Eastern area, by Cilliung River as a boundary. Respective future population in each area are also shown on **Table-331.3** separately.

Table -331.3 FUTURE POPULATION IN DKI JAKARTA

YEAR	POPULATION (x 1,000) WEST	EAST	TOTAL	ANNUAL INCREASE RATIO (%)
1995	4,790	4,010	8,800	
2000	5,030	4,370	9,400	1.33
2005	5,260	4,640	9,900	1.04
2010	5,470	4,930	10,400	0.99
2015	5,700	5,200	10,900	0.94
2019	5,860	5,340	11,200	0.68

(3) Comparison with Other Forecasts

Forecasted future population which are shown on **Table-331.3** are compared with the results from other related studies. The studies which are used for comparison are as follows:

- Jakarta Water Supply Development Project, Master Plan Report, JICA, March 1985, (JWSDP)
- Jakarta 2005, DKI Jakarta, March 1984, (JKT2005)
- Proyeksi Penduduk Indonesia Per Kabupaten/Kotamadya 1990-2000, Biro Pusat Statistic Jakarta-Indonesia, March 1993, (BPS)
- JMDPR
- JWRMS, Scenario A, B, and C
- Water Demand Update Report, Jakarta Water Supply Sector Project, February 1995, (JWSSP)

Comparison of the results is shown on **Table-331.4** and **Figure-331.2.** As shown on the **Figure-331.2,** population forecast by this study shows the lowest population in future although the deference with JWSSP forecast is rather small. Considering declining increase ratio in recent years, referring to the data of "RCRD" (population record) on the figure, it is judged that the past trend of population increase will not be maintained in future and the results of forecast by this study seem to be the most reliable.

3.3.2 Future Population in Fringe Area

Fringe area of DKI Jakarta included in the Study Area is following Kecamatans.

Tangerang		Bekasi		Bogor	
1.	Kosambi	9.	Jakasampurna	14.	Limo
2.	Teluknaga	10.	Jatiasih	15.	Beji
3.	Batuceper	11.	Pondok Gede	16.	Cimanggis
4.	Cipondoh	12.	Bekasi Barat	17.	Sawangan
5.	Ciledug	13.	Tarumajaya		
6.	Ponduk Aren				
7.	Ciputat				
8.	Pamulang				

Figure-333.1 POPULATION IN DKI JAKARTA

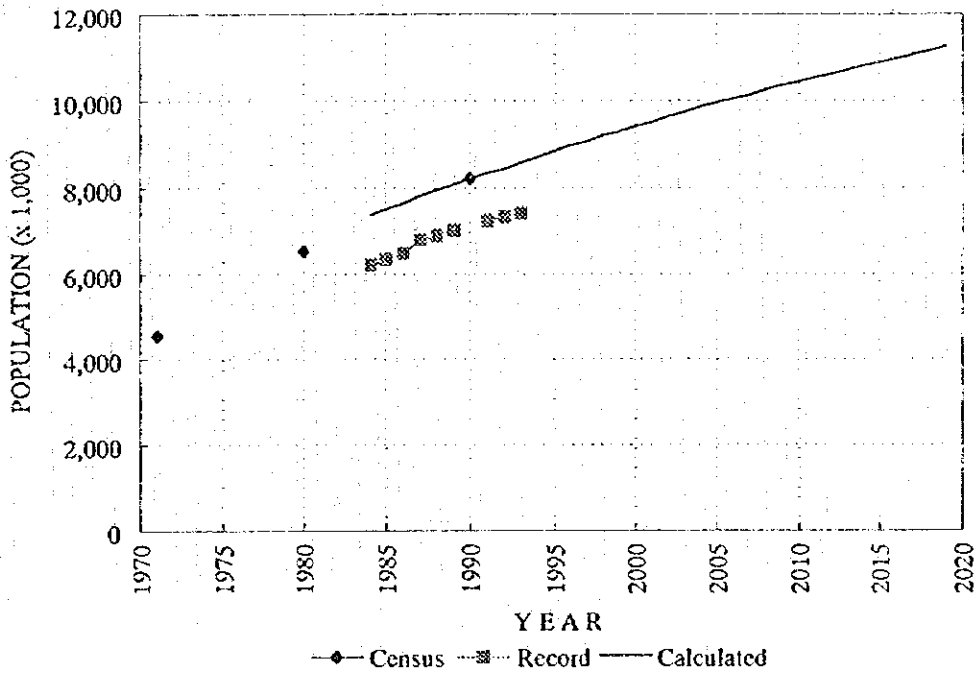


Figure-331.2 COMPARISON OF POPULATION FORECAST BY VARIOUS STUDIES

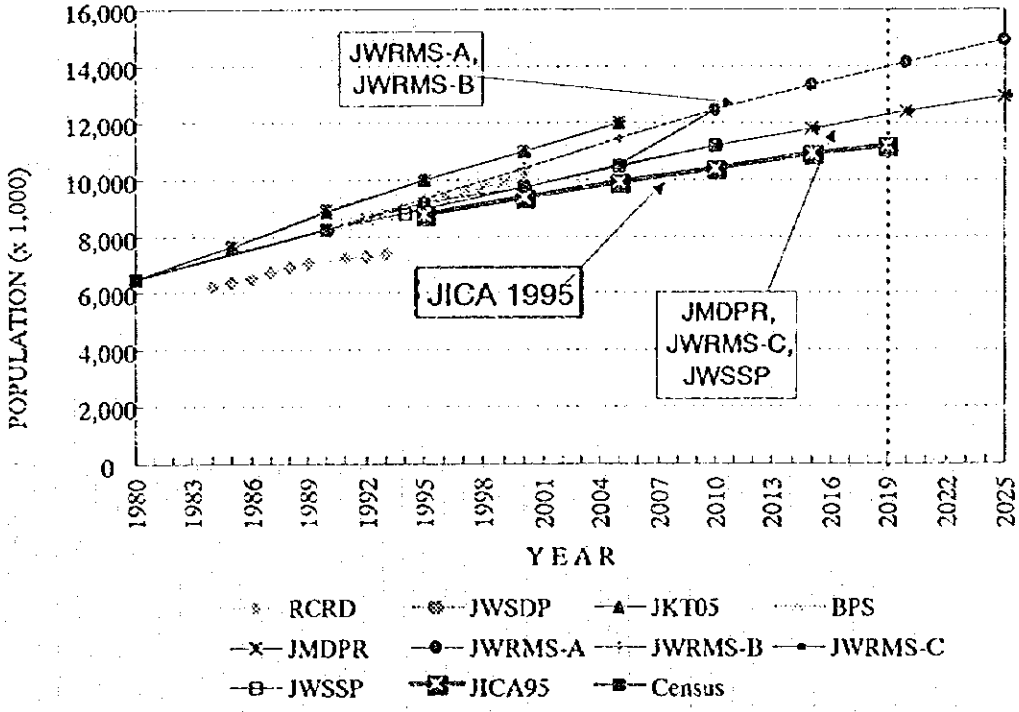


Table-331.4 COMPARISON OF POPULATION FORECAST BY RELATED STUDIES

Year	Recorded	JWSDP	JKT2005	BPS	JMDPR	JWRMS 6)			JWSSP	Revised
	RCRD	JWSDP	JK105	BPS	JMDPR	JWRMS-A	JWRMS-B	JWRMS-C	JWSSP	JICA95
	1)	2)	3)	4)	5)	S.A	S.B	S.C	7)	
1980		6,469	6,500							
1981										
1982										
1983										
1984	6,203									
1985	6,329	7,630	7,630							
1986	6,472									
1987	6,761									
1988	6,865									
1989	7,003									
1990		8,873	8,870	8,260	8,210	8,210	8,210	8,210		
1991	7,207			8,435						
1992	7,310			8,614						
1993	7,395			8,797						
1994				8,980					8,797	
1995		9,950	9,950	9,161	8,964	9,200	9,285	8,964	8,948	8,800
1996				9,341						
1997				9,524						
1998				9,705						
1999				9,882						
2000		11,005	11,000	10,055	9,738	9,700	10,389	9,738	9,721	9,400
2001										
2002										
2003										
2004										
2005		11,999	12,000		10,487	10,500	11,458	10,487	10,470	9,900
2006										
2007										
2008										
2009										
2010					11,178	12,443	12,443	11,178	11,161	10,400
2011										
2012										
2013										
2014										
2015					11,796	13,325	13,325	11,796		10,900
2016										
2017										
2018										
2019										11,200
2020					12,370	14,143	14,143	12,370		
2021										
2022										
2023										
2024										
2025					12,902	14,902	14,902	12,902		

1) STATISTIC WILAYAH DKI JAKARTA
KANTOR STATISTIC PROPINSI DKI JAKARTA

2) JAKARTA WATER SUPPLY DEVELOPMENT PROJECT : MASTER PLAN REPORT
JICA, March 1985

3) JAKARTA 2005 ; DKI JAKARTA, March 1984

4) PROYEKSI PENDUDUK INDONESIA PER KABUPATEN/KOTAMADYA 1990-2000
BIRO PUSAT STATISTIC JAKARTA-INDONESIA, March 1993

5) JMDPR

6) JWRMS

7) WATER DEMANDS UPDATE REPORT
JAKARTA WATER SUPPLY SECTOR PROJECT, Feb. 1995

(1) Past Record of Population

The records of past population from year 1984 to 1993 was obtained from each Kecamatan office or statistic office and total population in the Study Area in each year is shown on **Table-332.1** with annual increase ratio.

Table-332.1 PAST POPULATION IN FRINGE AREA

YEAR	POPULATION (x 1,000)	ANNUAL INCREASE RATIO (%)
1984	995	
1985	1,055	6.03
1986	1,151	9.10
1987	1,209	5.03
1988	1,261	4.30
1989	1,296	2.78
1990	1,964	51.54
1991	2,024	3.05
1992	2,095	3.51
1993	2,220	5.97

The data in **Table-332.1** are also shown on **Figure-332.1**. Annual population increase ratio have been fluctuated between 3 % and 6 % except 1986 and 1990 and is much higher than the ratio in DKI Jakarta shown on **Table-331.1**. Past population records in the fringe area are shown in **Annex-33** by Kecamatan and by Kelurahan.

(2) Population Forecast

To forecast future population, five kinds of statistical lines or curves are used for calculation as same as forecast of future population in DKI Jakarta.

Past record of population were applied to statistic equations and most suitable curve for past trend was selected and future population was calculated from the selected curve.

The results of population forecast using five equations are shown in **Annex-33**. According to the results of calculation, most suitable equation was the logistic curve.

The results of calculation of future population are shown on **Table-332.2** and **Figure-332.1**. Future population is shown on the Table separately such as western and eastern area of the Cilliung River as same as Jakarta.

Table -332.2 FUTURE POPULATION IN FRINGE AREA

YEAR	POPULATION (x 1,000)			ANNUAL INCREASE
	WEST	EAST	TOTAL	RATIO (%)
1995	1,590	710	2,300	
2000	2,070	730	2,800	4.01
2005	2,550	750	3,300	3.34
2010	3,010	790	3,800	2.86
2015	3,430	870	4,300	2.50
2019	3,600	1,000	4,600	1.70

(3) Comparison with Other Forecasts

Forecasted future population which are shown on **Table-332.2** are compared with the results from other related study. The study which is used for comparison is as follows:

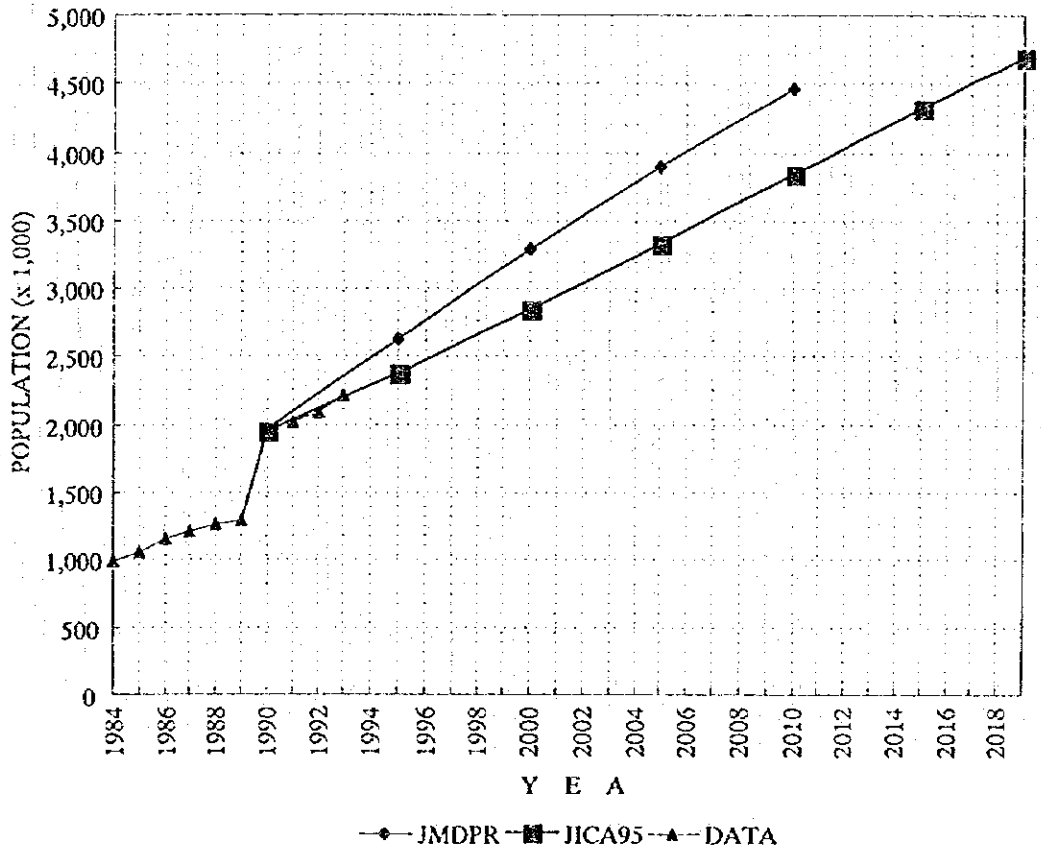
- JMDPR, FINAL REPORT, Strategic Land Use Plan

Comparison of the results is shown on **Figure-332.1**. As shown on the **Figure-332.1**, population forecast by this study shows the lower population in future.

3.3.3 Population in Water Front City

Area of the Water Front City (WFC) which is planned by DKI Jakarta is divided into two area. One is WFC development at the existing north coastal area and the other is at the new reclamation area. Future population is considered separately for existing north coastal area and the new reclamation area.

Figure-332.1 POPULATION FORECAST FOR FRINGE BY JMDPR AND JICA STUDY TEAM



(1) Future Population for existing north coastal area

The existing north coastal area consist of five Kecamatans in Jakarta Utara (North Jakarta) namely, Penjaringan, Pademangan, Tanjung Priok, Koja, and Cilincing.

Future population for above five Kecamatans are already considered in population forecast for DKI Jakarta which is explained in **Section 3.3.1**. DKI Jakarta presented its population forecast for these five Kecamatans in its report "Buku Rencana, PENGEMBANGAN KAWASAN PANTAI UTARA JAKARTA" and both population forecasts, by JICA Study Team and by DKI Jakarta, are shown on **Table-333.1** for comparison.

Table-333.1 POPULATION FORECAST FOR EXISTING NORTH COASTAL AREA

Unit:1,000 population

KECAMATAN	1995	2000	2005	2010	2015	2019
JICA Study Team	1,295	1,345	1,395	1,445	1,495	1,520
Penjaringan	280	300	320	340	360	370
Pademangan	155	165	175	185	195	200
Tanjung Priok	340	350	360	370	380	380
Koja	280	270	260	250	240	235
Cilincing	240	260	280	300	320	335
DKI Jakarta	1,133	1,297	1,450			
Penjaringan	192	228	267			
Pademangan	117	129	139			
Tanjung Priok	336	404	463			
Koja	224	233	242			
Cilincing	264	303	339			

There is no significant difference between two forecasts shown above. Considering time required to develop infrastructures to accommodate these population in the area, result of the JICA Study Team is employed for the existing north coastal area because the increase ratio is rather moderate comparing with the ratio of DKI Jakarta.

(2) Future Population for new reclamation area

According to the forecast by DKI Jakarta, population in year 2005 will be 750,000 in the new reclamation area. The area wide of the reclamation area is about 3,800 ha. Taking account of the area of the reclamation, it is considered rather difficult to complete such huge reclamation works and accommodate 750,000 people during coming 10 years.

Because of the difficulties mentioned above, future population was estimated that the reclamation works will be completed partially from year 2000 and population in the reclamation area will reach its ceiling 750, 000 in year 2019 as shown on the Table-333.2.

Table-333.2 POPULATION IN RECLAMATION AREA

Unit:1,000 population

YEAR	1995	2000	2005	2010	2015	2019
Population in Reclamation area	0	0	197	395	592	750

3.3.4 Future Total Population in the Study Area

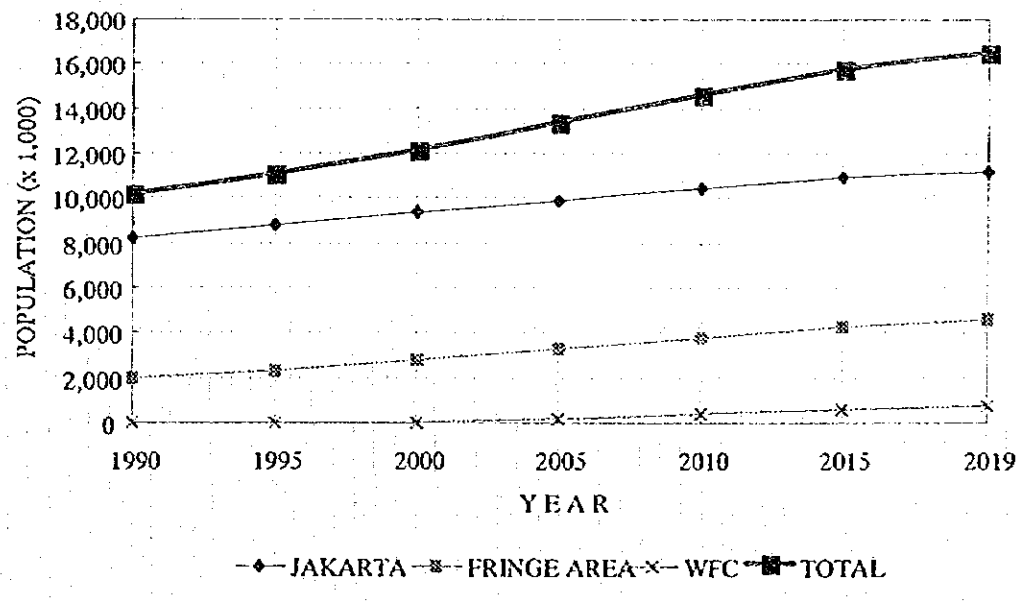
Combining the results of future population forecast for DKI Jakarta, **Table-331.3**, for fringe area, **Table-332.2**, and for new reclamation area, Table-333.2, future total population forecast is shown on **Table-334.1** and **Figure-334.1**.

Table-334.1 FUTURE TOTAL POPULATION IN THE STUDY AREA

YEAR	DKI JAKARTA (x 1,000)	FRINGE AREA (x 1,000)	WFC* (x1,000)	TOTAL (x 1,000)
1995	8,800	2,300	0	11,100
2000	9,400	2,800	0	12,200
2005	9,900	3,300	197	13,397
2010	10,400	3,800	395	14,595
2015	10,900	4,300	592	15,792
2019	11,200	4,600	750	16,550

* WFC: Water Front City
Figures show future population in new reclamation area only.

Figure-334.1 FUTURE TOTAL POPULATION IN THE STUDY AREA



3.4 SERVICE AREA

3.4.1 Basic Policy for Expansion of Service Area

(1) Definition of Service Area

The term of "Service Area" used in this Report is defined as the area where is covered by water distribution pipes owned by water supply enterprise concerned and ready for installation of house connection.

(2) DKI Jakarta

Groundwater condition as alternative water source for citizen other than PAM JAYA water supply and population density are taken into account to consider future service area in DKI Jakarta in year 2019.

Summary table of the future groundwater condition and the future population density in the present unserved area in DKI Jakarta is shown in **Annex-34**.(Kecamatan Kepulauan Seribu is not included in the Table and will be considered separately.) In all of the unserved area, the permissive yield of groundwater will be very limited compared with potential water demand. This means alternative water source other than groundwater should be secured by PAM JAYA in the unserved area. All of the unserved Kecamatan except for Kecamatan Cilincing will be in high population density in 2019. Taking into account of the development of important facilities like port and factories in Kecamatan Cilincing, all the unserved Kecamatan including Kecamatan Cilincing should be supplied by piped water.

Water should also be supplied by PAM JAYA in Kecamatan Kepulauan Seribu considering insufficiency or inadequacy of groundwater. Water will be supplied by water tanker and water terminal in the area instead of under-sea water transmission pipeline taking into account of the feature of location and low population density. PAM JAYA will also be necessary to supply water in bulk to the Water Front City which is descrived in **Section 1.4**. By year 2010, PAM JAYA is recommended to supply water in the whole area of DKI Jakarta.

(3) Fringe Area

1) Criteria

For selecting a Kecamatan from the fringe area to be included in the service area of PAM JAYA, the necessity of piped water supply service was evaluated at first taking into account of groundwater availability and population density. Upon the selection of the area where piped water would be necessary, the adequate supplier was chosen among PAM JAYA and respective local PDAM.

2) Necessity of Piped Water Supply System

Area where alternative water source was considered to be unavailable was selected. Alternative water source will be unavailable where

- **Quality of Groundwater** will be inadequate. (Salinity, High Contamination Risk)
- **Quantity of Groundwater** (permissive yield of groundwater) will be insufficient compared with **Potential Water Demand**.

And as the second condition, necessity of piped water supply was considered. Piped water supply will be required where

- **Population Density** will be considerably high.
- **Development Plan** (mainly **Housing Estate**) is prepared.

The selection of the area where piped water supply service would be required is summarized in **Annex-34**. Kecamatans which need piped water supply are shown on **Table-341.1**.

Table-341.1 KECAMATAN NEEDS PIPED WATER SUPPLY

KABUPATEN BOGOR	KABUPATEN BEKASI	KABUPATEN TANGERANG	KOTAMADYA TANGERANG
Limo	Pondok Gede	Ciputat	Ciledug
Beji	Jatiasih	Pamulang	Cipondoh
	Bekasi Barat	Pondok Aren	Batu Ceper
			Benda

3) The Appropriate Supplier to the Above Area.

The appropriate supplier to the above area was chosen among PAM JAYA and respective local PDAM as follows :

Respective local PDAM was considered to be the appropriate supplier where

- **Present Water Service Area** by the local PDAM is relatively dominant or expanding
- **Future Expansion of the Service Area** by the respective local PDAM would be easy

PAM JAYA was selected as an appropriate supplier where:

- **Ground Level** is not high (Special pumping facility will not be required)
- **Accessibility** from Jakarta is acceptable
- **Distance from PAM JAYA's facilities** is short

The selection of fringe area to be served by PAM JAYA system was summarized in **Annex-34** and the results are shown on **Table-341.2.**

Table-341.2 KECAMATAN TO BE SERVED BY PAM JAYA

KABUPATEN BOGOR	KABUPATEN BEKASI	KABUPATEN TANGERANG	KOTAMADYA TANGERANG
Limo	Pondok Gede	Ciputat	Ciledug
	Jatiasih	Pamulang	Cipondoh
		Pondok Aren	

Future service area by PAM JAYA which included DKI Jakarta and fringe area was shown in **Figure-341.1.**

4) Option of Water Supply to Fringe Area

There are two main options of water supply to the Kecamatans selected as service area from the fringe area as follows.

a) Bulk Water Supply to Fringe Area

When PAM JAYA supply bulk water to the Kecamatans selected as service area from the fringe area, PAM JAYA should have responsibility on water treatment and transmission of treated water to the local PDAMs. Fringe area is not included in PAM JAYA's Service Area. In this case, agreements with the local PDAM on several items, such as term, amount and price of bulk water supply, are necessary.

b) Direct Supply by PAM JAYA

In the case that PAM JAYA supplies water to the fringe area directly, beyond its boundary, the area should be considered as a part of PAM JAYA service area.

In PAM JAYA's service area, PAM JAYA should have all the responsibilities on water supply service such as water supply, pipe installation, house connection installation, operation / maintenance and bill collection. In this case, inter regional agreements among local governments of DKI Jakarta, Bogor, Tangerang and Bekasi are required on several items such as responsibility of water supply, ownership of facilities, decision of water tariff and distribution of revenue. Legal Framework of PAM JAYA should also be re-considered because the status of the PAM JAYA is under the municipal government of DKI Jakarta and does not belong to other local governments.

This Master Plan was studied following the concept of expanding PAM JAYA's service area to the fringe area, i.e. direct supply by PAM JAYA.

(4) Service Area Expansion Plan

The expansion plan of the subject service area was prepared and shown in **Figure-341.2(1)** and (2). The service area expansion plan by year 2000 was prepared taking into account of on-going PJSIP Project. The service area plan of year 2005 covered the area proposed by JWSSP Study. By 2010 service area was planned to expand to all over the Jakarta and to Kecamatan Pondok Aren and Kecamatan Cipondoh in Kotamadya Tangerang. Housing Estate areas in Kecamatan Pondok Gede in Kabupaten Bogor and Kecamatans Ciputat, Pamulang and Pondok Aren in Kabupaten Tangerang were planned to be covered by service area by 2015. Service area

was also planned to expand and cover Housing Estate areas in Kecamatan Limo in Kabupaten Bogor and in Kecamatan Jatiasih in Kabupaten Bekasi by the target year of 2019.

Remaining area where will not be supplied by PAM JAYA will be supplied by respective local PDAM or by individual well. According to the recent information, Indonesian government will conduct water supply development project in BOTABEK area using aid from Asian Development Bank.

3.4.2. Population in Future Service Area

Population in the future service area, in accordance with the expansion plan of service area, was estimated based on the future population forecast stated in the previous **Section 3.3** and shown in **Table-342.1.**

Table-342.1 FUTURE TOTAL POPULATION IN IN THE SERVICE AREA

(x1,000)

YEAR	DKI JAKARTA			FRINGE AREA			WFC*	TOTAL
	WEST	EAST	TOTAL	WEST	EAST	TOTAL		
1995	4,790	4,010	8,800	1,120	280	1,400	0	10,200
2000	5,030	4,370	9,400	1,420	280	1,700	0	11,100
2005	5,260	4,640	9,900	1,800	300	2,100	197	12,197
2010	5,470	4,930	10,400	2,100	300	2,400	395	13,195
2015	5,700	5,200	10,900	2,370	330	2,700	592	14,192
2019	5,860	5,340	11,200	2,500	400	2,900	750	14,850

* WFC : Water Front City
Figures show future population in new reclamation area only.

Scale : 1/300,000

Figure-341.1 FUTURE SERVICE AREA (2019)

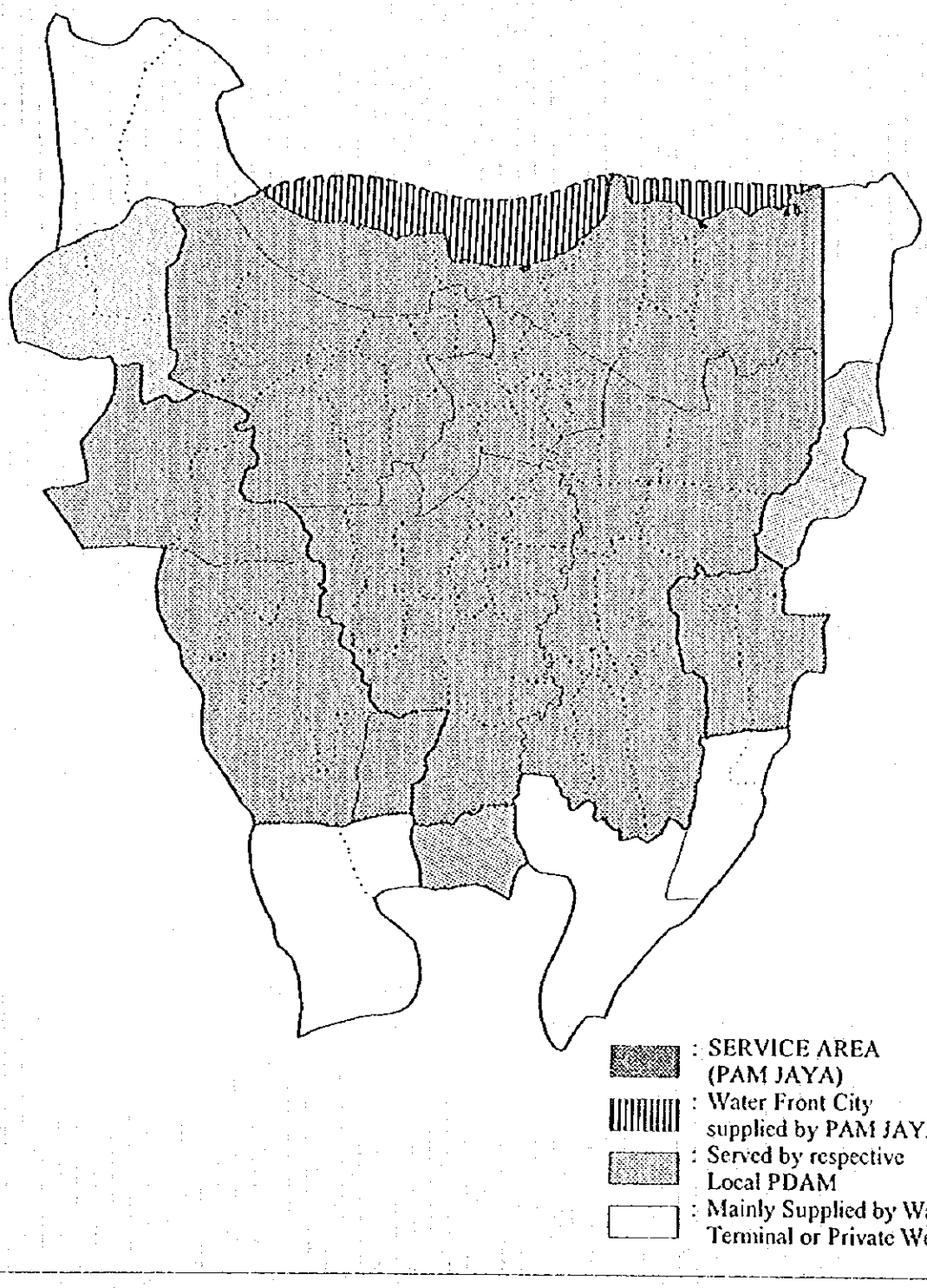
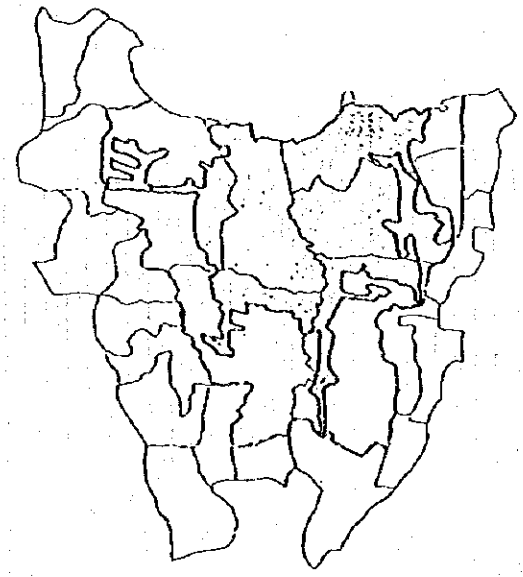


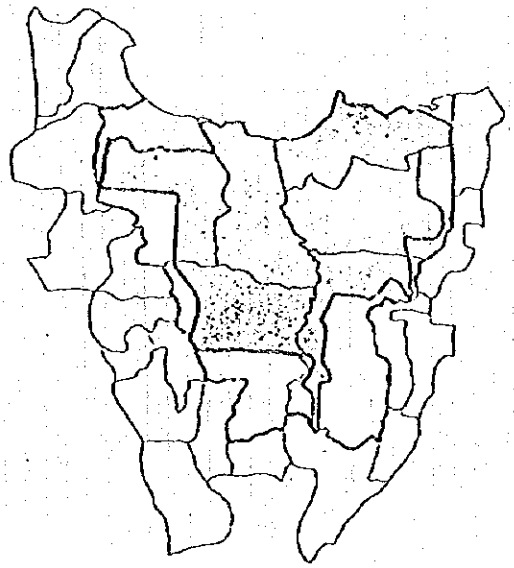
Figure-341.2 (1) SERVICE AREA EXPANSION

PRESENT
(A=316km2)



: by PAM JAYA

2000
(A=435km2)



2005
(A=505km2)

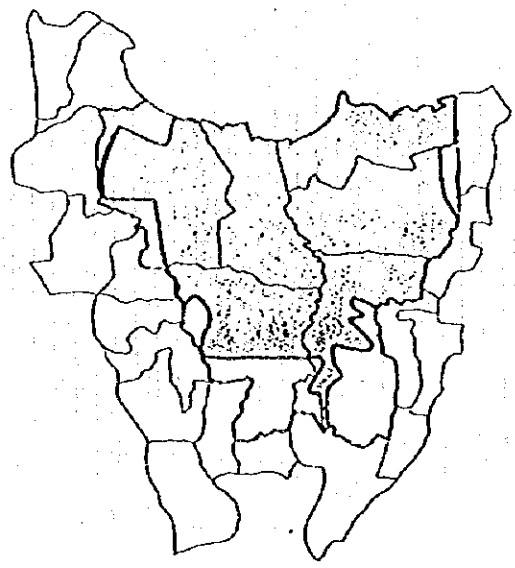
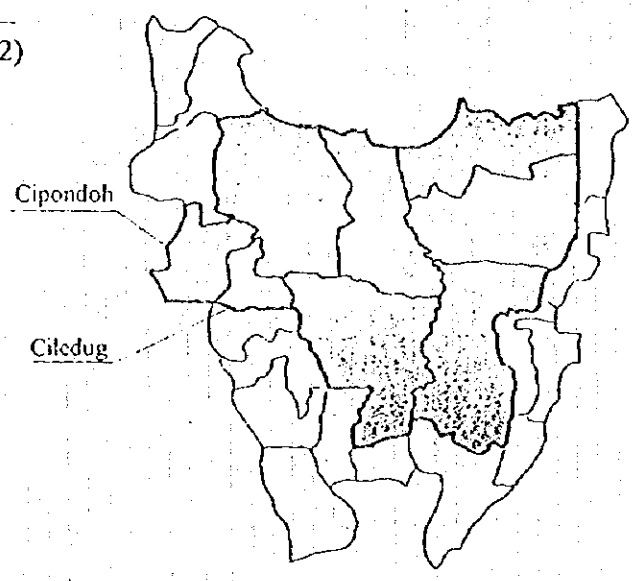


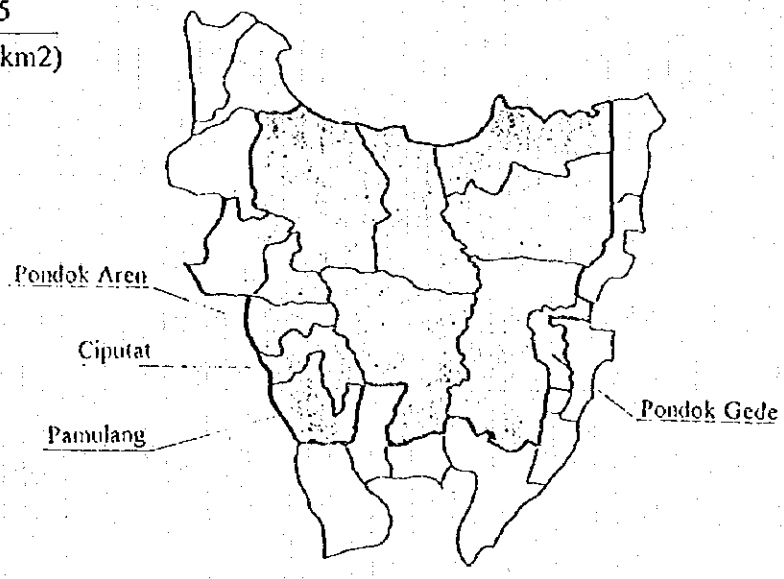
Figure-341.2 (2) SERVICE AREA EXPANSION

2010
(A=715km2)



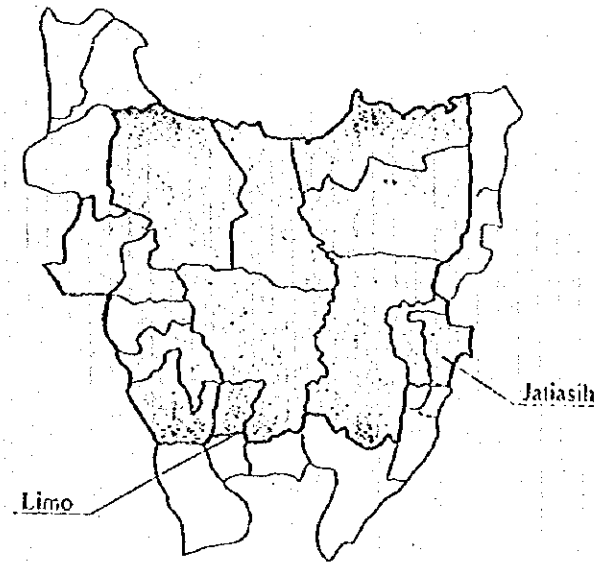
Include :
Ciledug and
Cipondoh

2015
(A=837km2)



Include :
Pondok Gede
Ciputat
Pamulang
Pondok Aren

2019
(A=871km2)



Include :
Limo
Jatiasih

3.5 ESTIMATION OF FUTURE WATER DEMAND

Estimation of future water demand in the future service area, DKI Jakarta and Kecamatan selected from fringe area as a service area which is explained in the previous **Section 3.4** is discussed in this section. Selected Kecamatan from the fringe area are as follows:

Kabupaten Bogor	Limo	Kabupaten Bekasi	Pondok Gede
			Jatiasih
Kabupaten Tangerang	Ciputat	Kotamadya Tangerang	Ciledug
	Pamulang		Cipondoh
	Pondok Aren		

Detail data and the results of calculation are available in **Annex-35.**

3.5.1 Methodology

Future water demand was estimated by introducing the concept of potential water demand. Potential water demand means the total water demand regardless of the water source.

Only two major alternative water sources are available in DKI Jakarta and in fringe area, namely water supply by PAM JAYA and groundwater. Groundwater has been main water source for people live in the Study Area and also for commercial and industrial activities. It is estimated that 70 % of total water demand in the Study Area has been served by the groundwater.

However, in recent years, environmental problems caused by exceeding groundwater abstraction have been criticized. As environmental problems, land subsidence and sea water intrusion have been observed. Unless the quantity of groundwater abstraction is limited by the strong government control, the condition will be worsen and worsen. To limit the groundwater usage until the permissible level of groundwater abstraction, it is indispensable not only introduction of the strict government regulation but also securing alternative water source other than groundwater for various kind of water demand.

Alternative source other than groundwater is only PAM JAYA water supply in the Study Area. Therefore, for the demand forecasting for PAM JAYA Water Supply System, amount of water demand would be switched from groundwater to PAM JAYA water supply should be included.

At the first step of the forecasting, overall total potential water demand for all category was estimated. Permissible groundwater abstraction in each year is estimated at the second step, and the balance of water demand, deduction of permissible groundwater abstraction from the total potential water demand, should be considered as water demand for PAM JAYA.

3.5.2 Current Water Consumption by Category

PAM JAYA has been divided its connections into many categories by the type of water usage. In this report, these many categories were summarized into main five categories such as;

Domestic,
Public Hydrant,
Commercial,
Industrial, and
Special.

Relation between the main five categories mentioned above and PAM JAYA's categories are shown on **Table-352.1.**

Number of connection, water consumption and unit consumption per connection for each category are shown on **Table-352.2.**

Table-352.1 CATEGORY OF CONNECTION

Code	PAM JAYA CATEGORY		CATEGORY USED IN JICA STUDY
1	SOSIAL	SOCIAL	
	A. SOCIAL UMUM	*A. PUBLIC SOCIAL*	
1A	Asrama Badan Sosial	Dormitory for social boards	Commercial & Services
1B	Rumah Yatim Piatu	Dormitory for orphan	Commercial & Services
1C	Tempat Ibadah	House of worship	Commercial & Services
	B. SOCIAL KHUSUS	*B. SPECIAL SOCIAL*	
1D	Rumah Sakit Pemerintah	Government hospital	Commercial & Services
2	NON NIAGA	NON COMMERCIAL	
	A. RUMAH TANGGA	*A. HOUSEHOLD*	
2A1	Rumah Tangga Sangat Sederhana	Very simple household	Domestic
2A2	Rumah Tangga Sederhana	Simple household	Domestic
2A3	Rumah Tangga Menengah	Middle-class household	Domestic
2A4	Rumah Tangga Mewah	Luxurious household	Domestic
2B	Kedutaan/Konsulat	Embassy/Consulate	Domestic
	B. INSTANSI PEMERINTAH	*B. GOVERMENT INSTITUTE*	
2C	Kantor Inst. Pemerintah	Government's office	Commercial & Services
2D	Kantor Perwakilan Asing	Foreign agency's office	Commercial & Services
2E	Lembaga Swasta Non Komersial	Non commercial of private organization	Commercial & Services
2F	Inst. Perguruan/Kursus	School/Nondegree course	Commercial & Services
2G	Instansi/ABRI	Institution/Indonesian armed forces	Commercial & Services
3	NIAGA	COMMERCIAL	
	NIAGA KECIL(A)	*SMALL COMMERCIAL(A)*	
3A	Kios/Warung	Kiosk/Small shop	Commercial & Services
3B	Bengkel Kecil	Small workshop	Commercial & Services
3C	Usaha Kecil	Small venture	Commercial & Services
3D	Usaha Kecil Dalam, Rumah Tangga/Losmen	Home industry/Cheap hotel	Commercial & Services
3E	Tempat Pangkas Rambut	Barber	Commercial & Services
3F	Penjahit/Taylor	Seamstress/Taylor	Commercial & Services
	NIAGA KECIL(B)	*SMALL COMMERCIAL(B)*	
3G	Rumah Makan/Restoran Kecil	Small restaurant	Commercial & Services
3H	RS Swasta/Poliklinik/Laboratorium	Private hospital/Polyclinic/Laboratorium	Commercial & Services
3I	Praktek Dokter	Clinic	Commercial & Services
3J	Kantor Pengacara	Lawyer's office	Commercial & Services
3K	Hotel Melati(Non Bintang)	Non-star hotel	Commercial & Services
	NIAGA BESAR(A)	*BIG COMMERCIAL(A)*	
3L	Hotel Berbintang1,2,3 dan Motel	1,2,3-stars hotel and Motel	
3M	Steambath/Salon	Steambath/Salon	Commercial & Services
3N	Night Club/Bar	Night club/Bar	Commercial & Services
3O	Bank	Bank	Commercial & Services
3P	Service Station(Bengkel Besar)	Service station(Big workshop)	Commercial & Services
3Q	Pers. Perdagangan/Niaga	Trading company	Commercial & Services
	NIAGA BESAR(B)	*BIG COMMERCIAL(B)*	
3R	Hotel Berbintang 4,5	4,5-stars hotel	Commercial & Services
3S	Gedung Bertingkat Tinggi & Kondominium	High-rising building & Condominium	Commercial & Services
4	INDUSTRI	INDUSTRY	
4A	INDUSTRI KECIL	SMALL INDUSTRY	Industrial
	INDUSTRI BUSAR	*BIG INDUSTRY*	
4B	Pabrik Es	Ice block factory	Industrial
4C	Pabrik Makanan/Minuman	Food & Beverage factory	Industrial
4D	Pabrik Kimia/Obat/Kosmetik	Chemicals/Drugs/Cosmetics factory	Industrial
4E	Pabrik/Gudang Perindustrian	Factory/Storehouse of industry	Industrial
4F	Pabrik Tekstil	Textile factory	Industrial
4G	Pergudangan/Industri Lainnya	Warehouse/Other industries	Industrial
5	KHUSUS	SPECIAL	
5A	Hidran & Ledeng Umum	Hydrant & Public taps	Hydrant & Public taps
5B	Station Air & Mobil Tangki	Water station & Water tank-car	Hydrant & Public taps
5C	Tongkang Air	Water tanker	Special
5D	BPP Tanjung Priok	BPP Tanjung Priok	Special
5E	BPP Ancol	BPP Ancol	Special
	RUMAH SUSUN	*FLAT*	
5F1	R Susun S Sederhana	Very simple flat	Domestic
5F2	R Susun Sederhana	Simple flat	Domestic
5F3	R Susun Menengah	Middle-class flat	Domestic
5F4	R Susun Mewah	Luxurious flat	Domestic

*BPP : Board of port management

Table-352.2 NUMBER OF CONNECTION BY CATEGORY

CATEGORY	NUMBER OF CONNECTION	RATIO (%)	MONTHLY CONSUMPTION (m^3/month)	RATIO (%)	UNIT CONSUMPTION PER CONNECTION (m^3/conc./day)
Domestic	297,590	86.2	7,910,010	56.8	0.89
Public Hydrant	1,884	0.5	914,434	6.6	16.18
Commercial	44,975	13.0	4,314,451	30.9	3.20
Industrial	833	0.3	420,681	3.0	16.83
Special	6	Nil	376,256	2.7	2,090.31
TOTAL	345,288	100.0	13,935,832	100.0	1.35

As of May, 1995
Source : PAM JAYA

3.5.3 Potential Water Demand

(1) Potential Domestic Water Demand

1) Per Capita Consumption

As a basic figure of domestic water consumption, per capita consumption in future is estimated taking account of existing per capita consumption by house types. Domestic per capita water consumption for each 5 year is as shown on **Table-353.1** and details are shown in **Annex-35.**

Table-353.1 FUTURE DOMESTIC PER CAPITA CONSUMPTION

YEAR	1995	2000	2005	2010	2015	2019
PER CAPITA CONSUMPTION (lpcd)	156	162	168	174	180	185

Per capita consumption shown above is applied for domestic water demand for all Study Area, DKI Jakarta and fringe area. Per capita consumption for person who is depending on only groundwater is estimated 120 lpcd.

2) Potential Domestic Water Demand

Potential domestic water demand was calculated by multiplying the future population and per capita consumption which is described in the previous section.

Results of calculation for DKI Jakarta and Fringe Area are shown on **Table-353.2** and **Table-353.3** respectively.

(2) Potential Public Hydrant Water Demand

1) Per Capita Water Demand and Number of Public Hydrant

Per capita water demand for public hydrant was calculated from the total water consumption by public hydrant and total number of public hydrant which were provided by PAM JAYA. Number of person per public hydrant is estimated as 250 persons which is also used by PAM JAYA to estimate the served population by the public hydrant.

Per capita water demand is calculated as follows (data from **Table-352.2**) :

Total water consumption by public hydrant :	914,434 m^3/month
Number of public hydrant :	1,884
Unit consumption per hydrant :	16 m^3/day
Number of person per hydrant :	250 person
Per capita consumption	approximately 60 lpcd

2) Potential Public Hydrant Water Demand

It is assumed that the number of public hydrant will not increase in future. Potential public hydrant water demand was calculated from the per capita consumption described above and the number of public hydrant.

Results of calculation for DKI Jakarta and Fringe Area are shown on **Table-353.2** and **Table-353.3** respectively.

(3) Potential Commercial Water Demand

Existing potential water demand was calculated by summation of PAM JAYA water consumption for commercial category and groundwater usage for commercial use. Amount of groundwater consumption for commercial use was provided by DINAS PERTAMBANGAN DKI JAKARTA.

According to the data from the Dinas Pertambangan, total number of registered well for commercial and service category was 2,498 in August 1995 and the total groundwater abstraction by these well was around 2,000,000 m^3/month.

Water consumption of PAM JAYA water reached more than 4,000,000 m^3/month in July 1995. Total water consumption, PAM JAYA and groundwater is calculated about 6,000,000 m^3/month.

Past trend of groundwater and PAM JAYA water consumption were studied and future potential commercial water demand is calculated based on the assumption that the commercial water demand in year 2019 will be two times of existing water demand.

Results of calculation for DKI Jakarta and Fringe Area are shown on **Table-353.2** and **Table-353.3** respectively.

(4) Potential Industrial Water Demand

Potential industrial water demand also calculated by same method as for potential commercial water demand. According to the data from the Dinas Pertambangan, total number of registered well for industrial category was 420 in August 1995 and the total groundwater abstraction by these well was arround 500,000 m^3/month.

Water consumption of PAM JAYA water reached more than 400,000 m^3/month in July 1995. Total water consumption, PAM JAYA and groundwater is calculated about 900,000 m^3/month.

Past trend of groundwater and PAM JAYA water consumption were studied and future potential industrial water demand in DKI Jakarta was calculated based on the assumption that the industrial water demand will increase same ratio as population increase. For the demand in the fringe area, demand growth will be higher than the rate in DKI Jakarta, and arithmetical linear increase was employed.

Results of calculation for DKI Jakarta and Fringe Area are shown on **Table-353.2** and **Table-353.3** respectively.

(5) Potential Special Water Demand

Potential special water demand such as for harbor was estimated that the demand will increase by same rate as population increase.

Results of calculation for DKI Jakarta and Fringe Area are shown on **Table-353.2** and **Table-353.3** respectively.

Table-353.2 POTENTIAL WATER DEMAND FOR DKI JAKARTA

unit : 1,000 m^3/day

Category	1995	2000	2005	2010	2015	2019
Domestic	1,061	1,202	1,354	1,540	1,767	1,868
Bottled Water	5	8	11	14	19	20
Domestic Total	1,066	1,210	1,365	1,554	1,786	1,888
Public Hydrant	28	28	28	28	28	28
Commercial	197	238	280	321	363	394
Industrial	30	32	34	36	36	37
Special	14	15	15	16	17	17
Total	1,335	1,523	1,723	1,955	2,230	2,364

Table-353.3 POTENTIAL WATER DEMAND FOR FRINGE AREA

unit : 1,000 m³/day

Category	1995	2000	2005	2010	2015	2019
Domestic	163	206	247	297	374	444
Bottled Water	1	2	3	4	5	6
Domestic Total	164	208	250	301	379	450
Public Hydrant	0	0	0	2	7	9
Commercial	16	19	22	25	29	31
Industrial	5	7	10	12	14	16
Special	0	1	2	3	4	5
Total	185	235	284	343	433	511

3.5.4 Permissible Groundwater Abstraction

(1) Total Permissible Groundwater Abstraction

Total permissible groundwater abstraction is shown on **Table-354.1**. The detail explanation on permissible groundwater abstraction is provided in **Section 3.6 "WATER RESOURCES"**.

Table-354.1 PERMISSIBLE GROUNDWATER ABSTRACTION

YEAR	DKI JAKARTA (l/sec)	FRINGE AREA (l/sec)	TOTAL (l/sec)
1995	9,654	1,928	11,581
2000	11,492	2,977	14,469
2005	7,659	3,864	11,523
2010	5,363	2,644	8,007
2015	3,067	1,423	4,490
2019	3,067	1,423	4,490

(2) Commercial Groundwater Use

It is assumed that the commercial groundwater use will be half of current consumption in year 2019. Charge for groundwater has been set higher than PAM JAYA water tariff, therefore, commercial groundwater user will switch his water source to PAM JAYA when PAM JAYA water supply is available.

(3) Industrial Groundwater Use

Same assumption as commercial groundwater use was employed.

(4) Domestic Groundwater Use

Available amount of groundwater for domestic use was calculated by deduction of commercial and industrial groundwater use from total amount of permissible groundwater abstraction.

(5) Total Groundwater Consumption

Total groundwater consumption for commercial, industrial and domestic was calculated by using method mentioned above and the results are shown on **Table-354.2** and **Table-354.3**, respectively for DKI Jakarta, Fringe Area, and Total (DKI Jakarta + Fringe Area). The portion of groundwater use in total potential water demand is shown on **Figure-354.1**. The balance of potential water demand and groundwater use should be supplied by PAM JAYA.

Table-354.2 FUTURE GROUNDWATER CONSUMPTION IN DKI JAKARTA

unit : 1,000 m^3/day

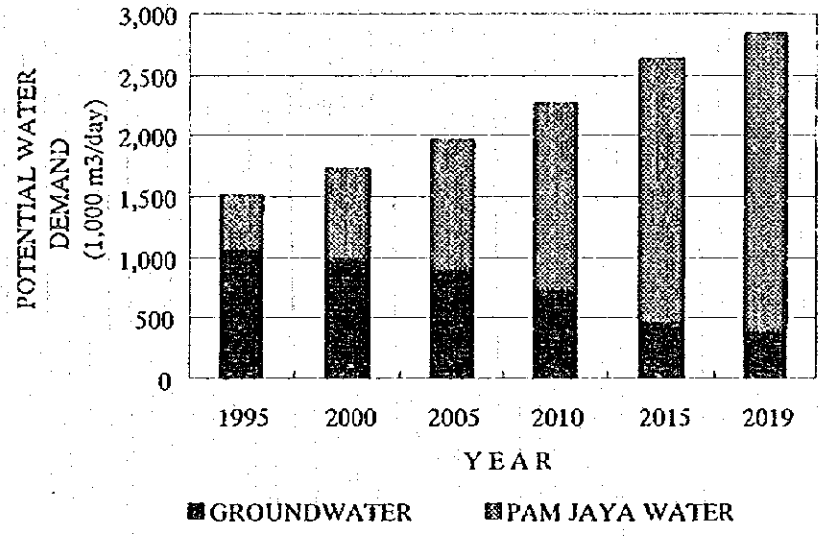
Category	1995	2000	2005	2010	2015	2019
Domestic	792	696	572	417	222	215
Public Hydrant	0	0	0	0	0	0
Commercial	62	55	48	40	32	32
Industrial	17	15	13	11	8	8
Special	0	0	0	0	0	0
Total	871	766	633	468	262	255

Table-354.3 FUTURE GROUNDWATER CONSUMPTION IN FRINGE AREA

unit : 1,000 m^3/day

Category	1995	2000	2005	2010	2015	2019
Domestic	163	206	247	245	185	109
Public Hydrant	0	0	0	0	0	0
Commercial	16	14	12	10	8	8
Industrial	5	4	4	3	2	2
Special	0	0	0	0	0	0
Total	184	224	263	258	195	119

Figure- 354.1 BREAKDOWN OF POTENTIAL WATER DEMAND (DKI Jakarta + Fringe Area)



3.5.5 Estimation of Water Demand for PAM JAYA System

Based on the amount which should be supplied by PAM JAYA, per capita consumption, and assumptions described in previous sections, domestic, public hydrant, commercial, industrial, and special water demand were calculated as shown on **Table-355.1.** Future water demand for Water Front City (New Reclamation Area) which is shown on the Table are explained in **Annex-35.** In addition to future water demand, domestic served population, number of connection, and service ratio were also calculated and the results are shown on **Table-355.2.**

Table-355.1 WATER DEMAND FOR PAM JAYA SYSTEM

JAKARTA unit : 1,000 m³/day

Category	1995	2000	2005	2010	2015	2019
Domestic	269	506	782	1,123	1,545	1,653
Public Hydrant	28	28	28	28	28	28
Commercial	135	183	232	281	331	362
Industrial	13	17	21	25	28	29
Special	14	15	15	16	17	17
Total	459	749	1,078	1,473	1,949	2,089

FRINGE AREA

unit : 1,000 m³/day

Category	1995	2000	2005	2010	2015	2019
Domestic	0	0	0	52	189	335
Public Hydrant	0	0	0	2	7	9
Commercial	0	0	0	9	21	23
Industrial	0	0	0	9	12	14
Special	0	0	0	0	0	0
Total	0	0	0	72	229	381

WATER FRONT CITY, NEW RECLAMATION AREA

unit : 1,000 m³/day

Category	1995	2000	2005	2010	2015	2019
Total	0	0	41	83	127	167

3.5.6 Future Water Demand for System Planning

(1) Day-Average Water Demand

Day-Average water demand means the net water demand for PAM JAYA System calculated in the above section. **Table-356.1** shows the summary of water demand for DKI Jakarta, fringe area and water front city (only for new reclamation area).

Table-356.1 FUTURE WATER DEMAND (DAY-AVERAGE)

YEAR	1995	2000	2005	2010	2015	2019
DKI Jakarta (1,000 m³/day)	459	749	1,078	1,473	1,949	2,089
Fringe Area (1,000 m³/day)	0	0	0	72	229	381
Water Front City (1,000 m³/day)	0	0	41	83	127	167
TOTAL 1,000 m³/day)	459	749	1,119	1,628	2,305	2,637
TOTAL (m³/sec)	5.3	8.7	13.0	18.8	26.7	30.5

(2) Non Revenue Water Ratio

Non Revenue Water (NEW) ratio is estimated as shown on **Table-356.2**. Detail explanation is available in **Section 3.8**.

Table-355.2 FUTURE SERVED POPULATION, NUMBER OF CONNECTION, AND SERVICE RATIO

	YEAR	1995	2000	2005	2010	2015	2019
Total Population in Study area x 1,000	Jakarta	8,800	9,400	9,900	10,400	10,900	11,200
	Fringe Area	2,300	2,800	3,300	3,800	4,300	4,600
	Water Front City	0	0	197	395	592	750
	Total	**11,100**	**12,200**	**13,397**	**14,595**	**15,792**	**16,550**
Total Population in Future Service Area in Year 2019 x 1,000	Jakarta	8,800	9,400	9,900	10,400	10,900	11,200
	Fringe Area	1,400	1,700	2,100	2,400	2,700	2,900
	Water Front City	0	0	197	395	592	750
	Total	**10,200**	**11,100**	**12,197**	**13,195**	**14,192**	**14,850**
Total Population in Future Service area in Respective Year x 1,000	Jakarta	5,500	7,100	8,200	9,731	10,900	11,200
	Fringe Area	0	0	0	1,000	2,400	2,700
	Water Front City	0	0	197	395	592	750
	Total	**5,500**	**7,100**	**8,397**	**11,035**	**13,892**	**14,650**
Served Population (Direct only) *1 x 1,000	Jakarta	2,200	3,600	5,100	6,900	9,100	9,400
	Fringe Area	0	0	0	300	1,200	2,000
	Water Front City	0	0	197	395	592	750
	Total	**2,200**	**3,600**	**5,297**	**7,595**	**10,892**	**12,150**
Served Population (Direct + Indirect) *2 x 1,000	Jakarta	3,000	4,700	6,300	7,800	9,100	9,400
	Fringe Area	0	0	0	400	1,200	2,000
	Water Front City	0	0	197	395	592	750
	Total	**3,000**	**4,700**	**6,497**	**8,595**	**10,892**	**12,150**
Number of Domestic Connection x 1,000	Jakarta	298	539	802	1,112	1,478	1,540
	Fringe Area	0	0	0	51	181	312
	Water Front City	0	0	34	68	102	129
	Total	**298**	**539**	**836**	**1,231**	**1,761**	**1,981**
Number of Public Hydrant	Jakarta	1,900	1,900	1,900	1,900	1,900	1,900
	Fringe Area	0	0	0	100	400	600
	Water Front City	0	0	0	0	0	0
	Total	**1,900**	**1,900**	**1,900**	**2,000**	**2,300**	**2,500**
Service Ratio (Direct + Indirect Served Populatin Base)	Jakarta	55%	66%	77%	80%	83%	84%
	Fringe Area	-	-	-	40%	50%	74%
	Water Front City	-	-	100%	100%	100%	100%
	Average	**55%**	**66%**	**77%**	**78%**	**78%**	**83%**

Note : *1 : 5.8 person/domestic connection, 250 person/public hydrant
*2 : 7.6 - 5.8 person/domestic connection, 380 - 250 person/public hydrant, for Water Front City, fixed at 5.8 person/domestic connection

Table-356.2 NRW RATIO IN FUTURE

YEAR	1995	2000	2005	2010	2015	2019
NRW RATIO (%)	53.5 %	40.0 %	30.0 %	28.0 %	26.0 %	25.0 %

(3) Peak Factor

Seasonal variation factor was estimated as 1.15. This peak factor is the same value as JWSSP study.

(4) Day-Maximum Water Demand

Day-Maximum Water Demand was calculated as follows

(Day-Average Water Demand + NRW) x Peak Factor 1.15

The result of the calculation is shown on **Table-356.3.**

Table-356.3 FUTURE WATER DEMAND (DAY-MAXIMUM)

	1995	2000	2005	2010	2015	2019
Day-Average						
(1,000 m^3/day)	459	749	1,119	1,628	2,305	2,637
(l/sec)	5.3	8.7	13.0	18.8	26.7	30.5
Day-Maximum						
(1,000 m^3/day)	1,135	1,436	1,838	2,600	3,582	4,043
(m^3/sec)	13.2	16.6	21.3	30.1	41.4	46.8

Total Day-Maximum water demand, total Day-Average water demand, and NRW ratio are shown on **Figure-356.1.**

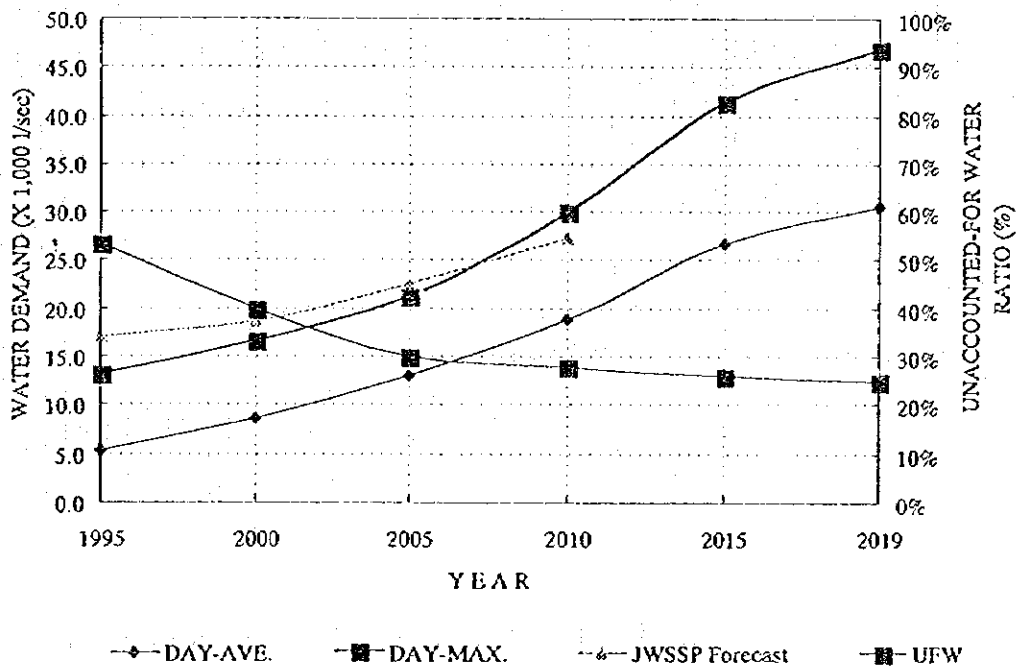
(5) Water Demand for Kecamatan Kepulauan Seribu (1,000 Islands)

Kecamatan Kepulauan Seribu, 1,000 Islands, is excluded from service area where is supplied water by pipe system, because huge investment will be required to install under sea water transmission pipeline from main island to the 1,000 Islands.

However, it should be noted that people living in the 1,000 Islands have been struggling to find water for drinking. Water for other than drinking such as for bathing and washing is available from shallow wells in those islands. Although the 1,000 Islands are excluded from piped service area, water for drinking purpose including for cooking should be conveyed from the main island.

Total water demand for drinking was calculated as 75 m^3/day (0.9 l/sec) based on per capita drinking water consumption was 5 lpcd and total population was 15,000 capita. The system of water conveyance and water terminal in islands are discussed in the following section.

Figure-356.1 DAY-AVERAGE AND DAY-MAXIMUM WATER DEMAND FOR SYSTEM PLANNING



3.6 WATER RESOURCES

3.6.1 Previous Water Resources Development Studies

(1) Jabotabek Water Resources Management Study (JWRMS)

The Jabotabek Water Resources Management Study (JWRMS) aimed to ; i) estimate municipal and industrial water demand, ii) estimate agricultural water demand, iii) formulate global plan for raw water supply by developing surface water and groundwater, vi) study water quality of the aforesaid water sources, and v) formulate water resources management plan, in time horizon till the year of 2025 in the Jabotabek area.

The JWRMS reviewed the potential water resources identified by the previous studies and screened those by comparing the project cost, unit development cost and environmental impacts. The inventory of the surface water resources development projects/schemes and water conveyance system schemes in the Jabotabek and its surrounding area prepared by the JWRMS is shown in **Figure-361.1.** As the results of the study, the JWRMS recommended to implement the following development projects/schemes under the Scenario C/Strategy 5 till the year of 2025 :

Eastern Area	:	*Upgrading of Existing West Citarum Canal* *Canal 2 Scheme*
Western Area	:	*Karian, Pasir Kopo, Tanjung & Cilawang Dam Schemes* *Karian-Serpong Water Conveyance System (KSCS) Scheme*
Southern Area	:	*Salak Contour Canal & Genteng Dam Schemes*

(2) The Study on Ciujung-Cidurian Integrated Water Resources in Indonesia (SCCIWR)

The Study on Ciujung-Cidurian Integrated Water Resources in Indonesia (SCCIWR) reviewed the raw water supply plan recommended by the JWRMS and as the results, the raw water supply plan from the Ciujung and Cidurian river basins for M&I water demand was updated and further detailed as mentioned below :

i) The Karian and Pasir Kopo reservoirs satisfy the M&I water demand of 5.5 m^3/sec and 8.2 m^3/sec in Serang area respectively.

ii) The Karian, Cilawang and Tanjung reservoirs release the discharge of 12.4 m^3/sec, 4.1 m^3/sec and 9.7 m^3/sec respectively to KSCS.

iii) The Pasir Kopo reservoir has effective storage capacity of 112.6 million m^3 and normal water level of EL. 100.5 m.

The implementation schedule for the water source and conveyance schemes recommended by the JWRMS and further detailed by the SCCIWR is shown in **Figure-361.2** and the commissioning schedule for the receptive projects/schemes is listed below :

Project/Scheme	*Commissioning Year*
Upgrading of West Tarum Canal	*2000*
Canal 2	*2001*
Salak Contour Canal	*2002*
Karian Dam	*2002*
Genteng Dam	*2007*
Pasir Kopo Dam	*2010*
Tanjung Dam	*2014*
Cilawang Dam	*2018*

Figure-361.1 SURFACE WATER RESOURCES DEVELOPMENT PROJECTS / SCHEMES AND WATER CONVEYANCE SYSTEM SCHEMES IN THE JABOTABEK AREA PREPARED BY JWRMS

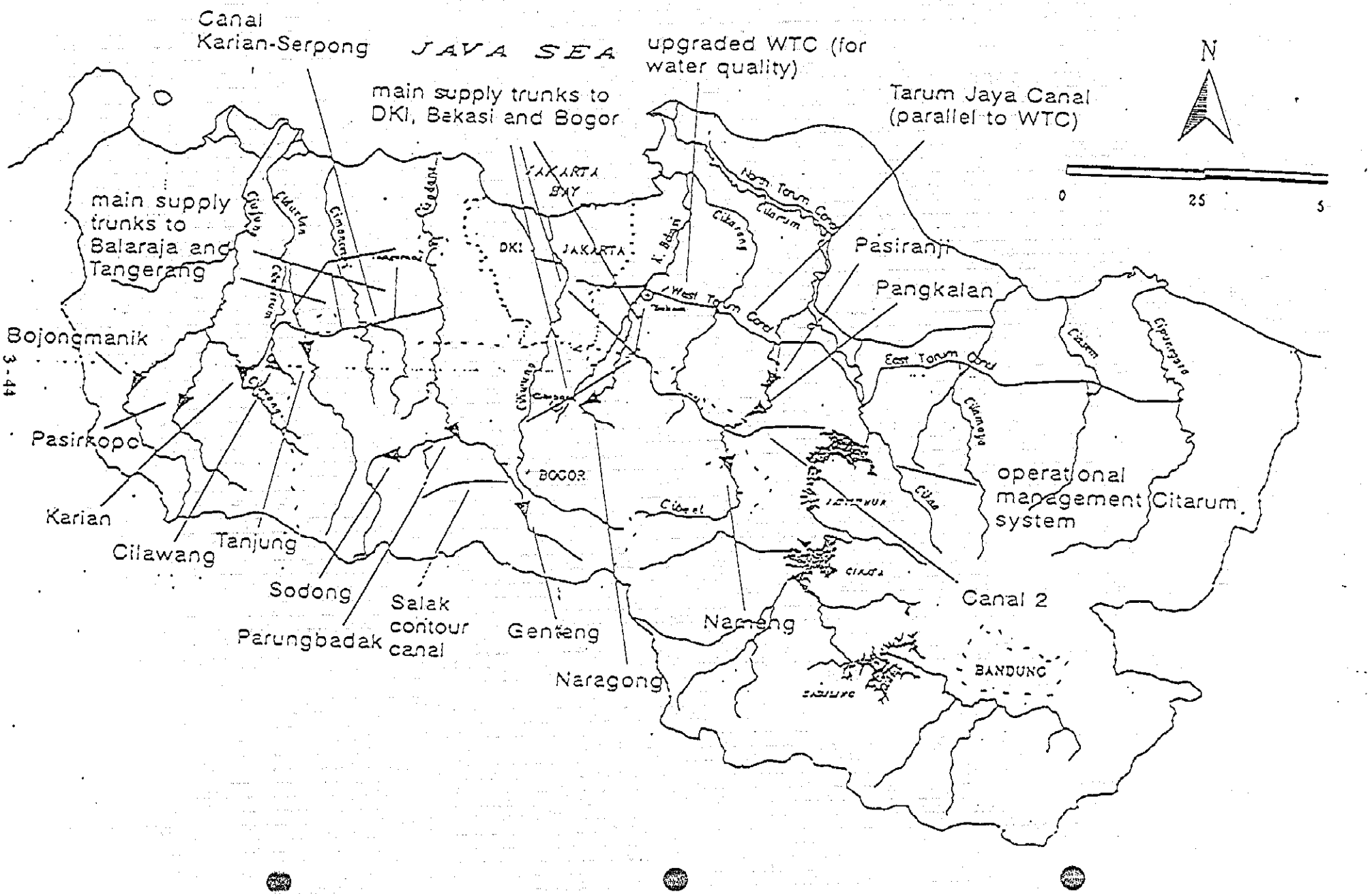
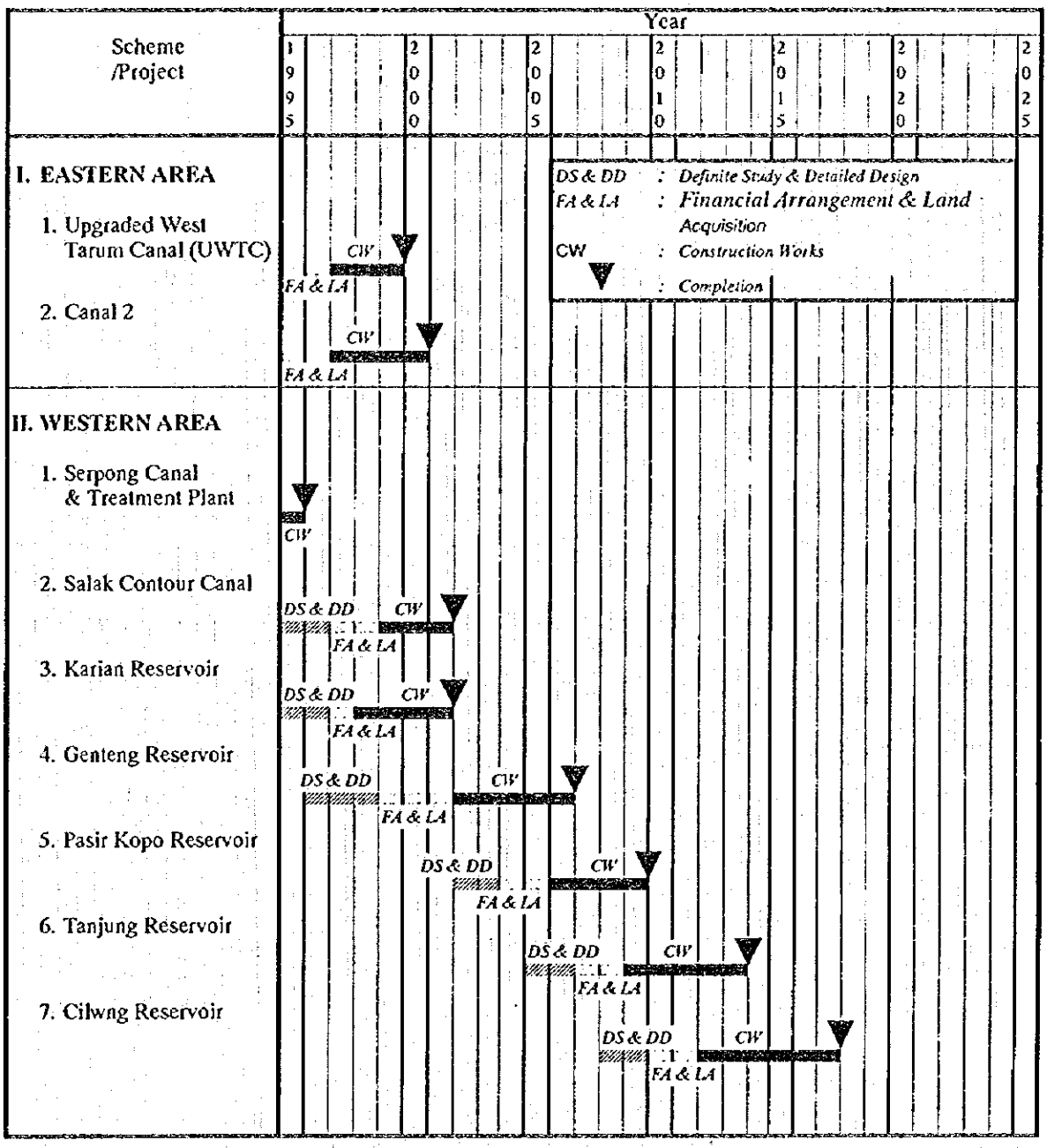
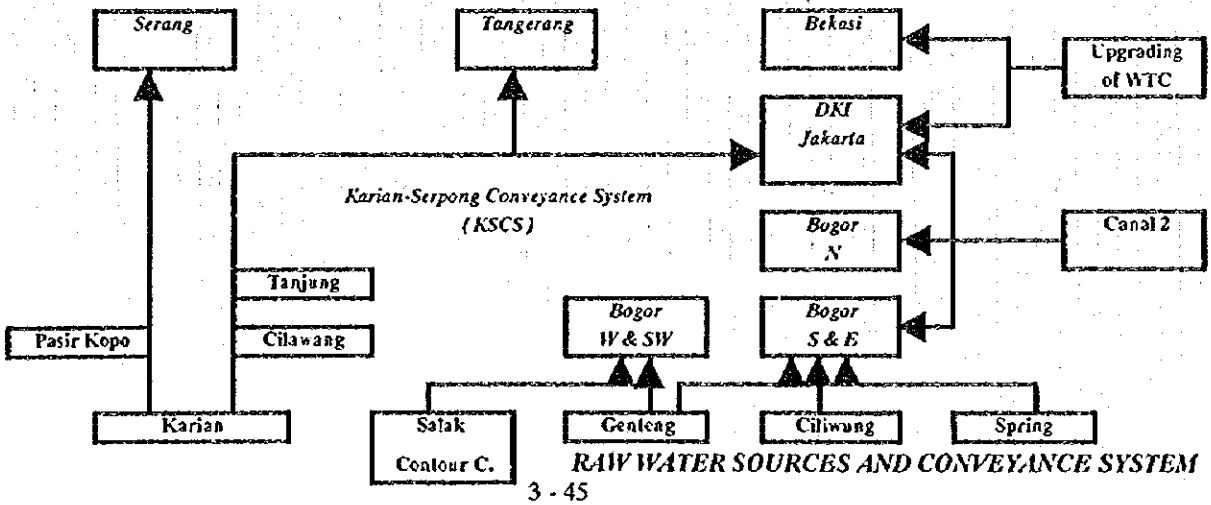


Figure-361.2 IMPLEMENTATION SCHEDULE OF WATER SOURCES DEVELOPMENT PLAN (PROPOSED BY JWRMS AND UPDATED BY STUDY ON CIUJUNG-CIDURIANG INTEGRATED WATER RESOURCES IN INDONESIA, FEBRUARY 1995, JICA)





RAW WATER SOURCES AND CONVEYANCE SYSTEM