### 4.5.3 Treated Water Transmission

#### (1) Concept

During the period for the immediate projects, water treatment plant will be expanded or newly constructed in eastern area whereas western area are expected to have great increase in water demand. Considering introduction of zoning system as discussed in the previous section treated water should be transmitted from treatment plants to distribution centers in western area through treated water transmission pipeline. Required construction of transmission pipeline during Part 1 and Part 2 of Second Phase of Second Stage are follows:

**Part 1 of Second Phase of Second Stage, Target Year 2005**

BUARAN III ⟶ DC-R1 ⟶ DC-R6

EXISTING L=13.5Km

NEW L=33.5Km

**Part 2 of Second Phase of Second Stage, Target Year 2008**

CIPAYUNG ⟶ DC-R5 ⟶ DC-R4

NEW L=23.5Km

NEW L=16.5Km

#### (2) Pipe Alignment

1) Proposed Pipe Alignment

Proposed treated water transmission pipeline routes from DC-R1 to DC-R6 and from Cipayung water treatment plant to DC-R5 and DC-R4 are studied.

It was found by site investigation that installation of large diameter pipe along existing local road is difficult because of heavy traffic. Therefore, it is recommended to install treated water transmission pipeline along the highwayins instead of the local road. From DC-R1 to DC-R6, treated water transmission pipe may be installed along Pelabuhan Highway and from Cipayung water treatment plant to DC-R5 and DC-R4 treated pipe may be installed along planed Outer Ring Highway.

The proposed route of treated water transmission pipes from DC-R1 to DC-R6 and pipes

from Cipayung water treatment plant to DC-R5 to DC-R4 are presented in **Figure-453.1** and **Figure-453.2** respectively.

### (3) Criteria for Design

Treated water transmission faciolities should be designed to convey treated water from clear water reservoir with low water level in treatment plant to receiving facilities with high water level in distribution center. Transmission methods should be selected considering low construciton and running cost and easy operatin and maintenance. Trated water transmisssion facilities should interconnect several tratment plants with different water resources in order to convey water to each distribution center even in the emergency cases such as water resource shortage and failure in treatment plant.

Treated water transmission pipe should be designed on day maximum water demand basis. 130 is applied for C-value of Hazen-williams formula considering water transmission condition.

### (4) Preliminary Proposed System

1) Mehod of Treated Water Transmission

As for transmission of treated water, there are two methods, namely transmission and pumping transmission methods. In northern part of Jakarta the gravity transmission method will not be practicable due to flat geographical condition. Trated water is planed to be transmitted by pump from DC-R1 to DC-R6.

On the other hand Cipayung Treatment Plant is located in south east of Jakarta where is geographically higher (about 65 meter above sea level) than the location of DC-R5 and DC-R4. Gravity transmission method is recommended to be applied from Cipayung Treatment Plant to DC-R5 to DC-R4 since it requires simple and easy operation and maintenance of the system.

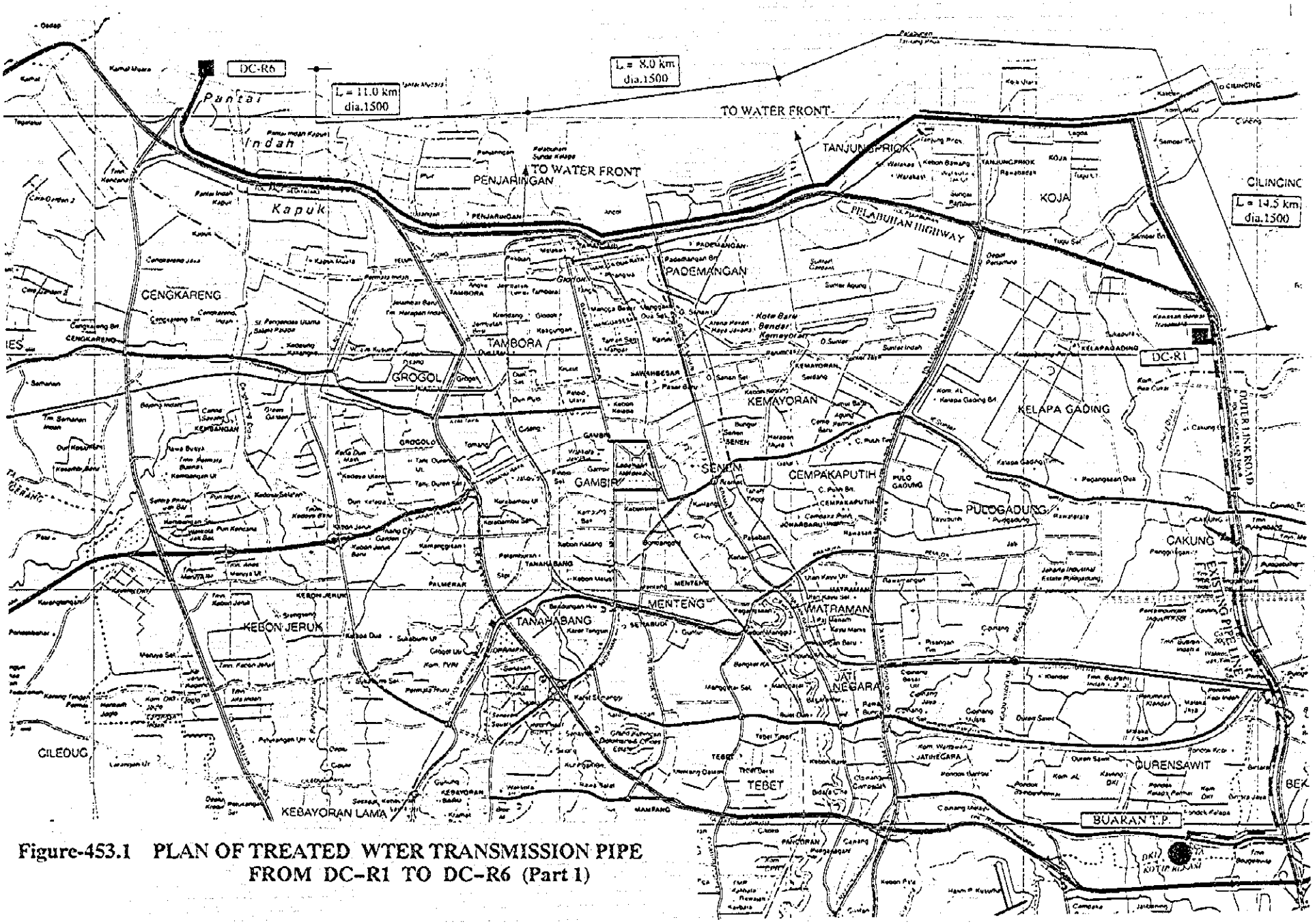



**Figure-453.1 PLAN OF TREATED WTER TRANSMISSION PIPE FROM DC-R1 TO DC-R6 (Part 1)**

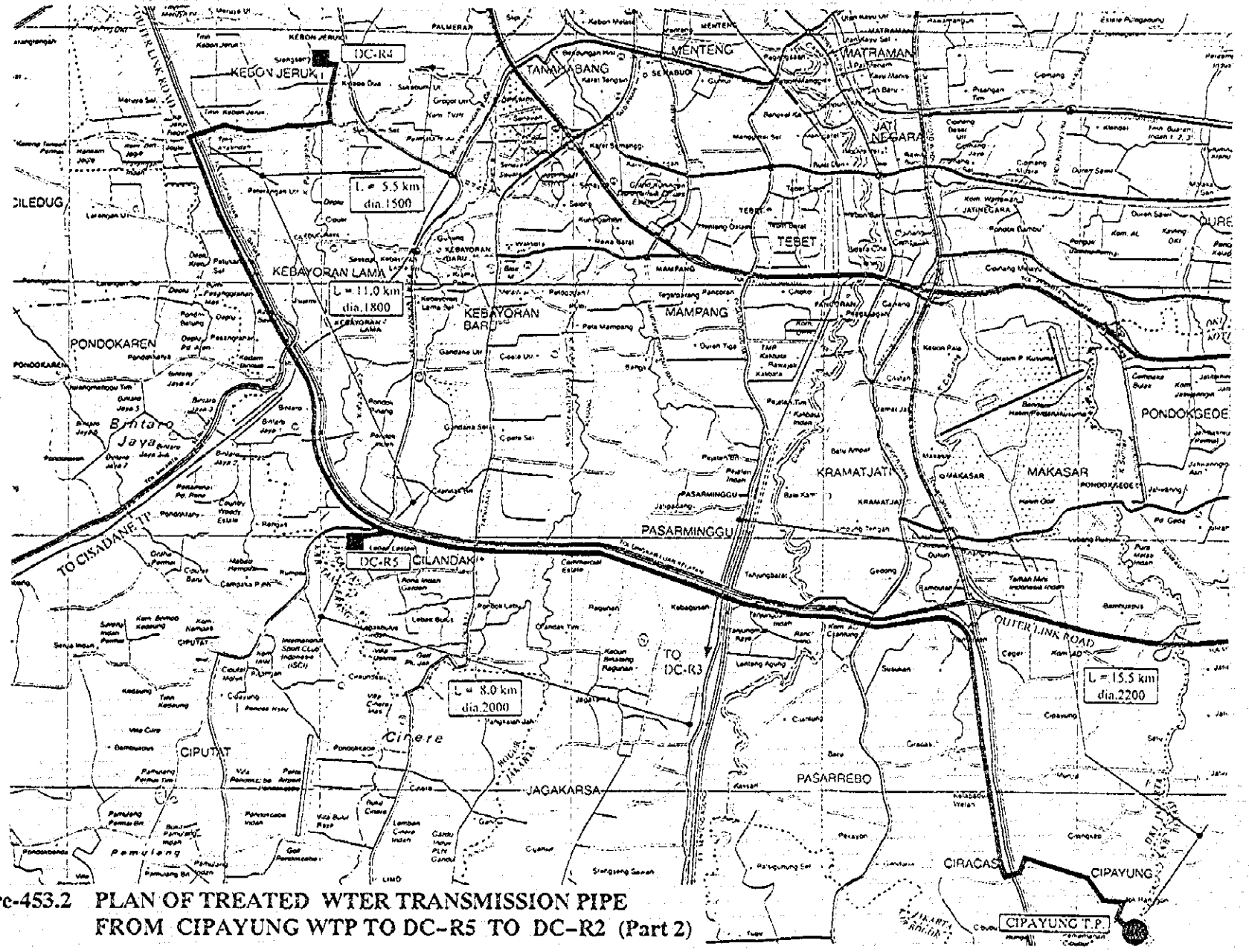



**Figure-453.2 PLAN OF TREATED WTER TRANSMISSION PIPE FROM CIPAYUNG WTP TO DC-R5 TO DC-R2 (Part 2)**

2) Length and Diameter of Treated Water Transmission Pipeline

Dimension of treated water transmission pipeline is selected considering economical diameter as follows :

**Part 1 of Second Phase of Second Stage, Target Year 2005**

- Length of 35.5 km with diameter of 1,500mm from DC-R1 to DC-R6

**Part 2 of Second Phase of Second Stage, Target Year 2008**

- Length of 15.5 km with diameter of 2,200mm form Cipayung treatment plant to the junction for DC-R3.
- Length of 8.0 km with diameter of 2,000mm form junction t for DC-R3 to junction for DC-R5.
- Length of 1.5 km with diameter of 1,000mm form junction t for DC-R5 to DC-R5.
- Length of 11.0 km with diameter of 1,8000mm form junction t for DC-R5 to junction for DC-R4.
- Length of 5.5 km with diameter of 1,500mm form junction t for DC-R4 to DC-R4.

The results of hydraulic calculation are shown in **Table-453.1**. This table shows hydraulic calculation results until the target year of Master Plan for the reference.

### 4.5.4 Distribution Center

#### (1) Concept

Distribution centers are to be newly constructed or expanded in order to distribute water in each zone properly as water distribution terminals for zoning system. Distribution center has duty to regulate the fluctuations occurring between the quantity of transmitted and delived. DC-R1 has, in addition to above, another function as a pump station for treated water transmission.

The distribution center is composed of operational reservoir, distribution pump facilities and chlorination facilities. Operational reservoir is to store water which can be drawn upon during those hours of the day when distribution system demand is high and then replenished during the night when the system demand is low. Chlorination facilities are required to supplement the disinfection in the treatment plant considering long transmission pipeline from the plant and detention in operational reservoir and distribution pipelines.

## Table-453.1 Hydraulic Gradient of Clear Water Transmission

**F/S : 2002 - 2005**



| Root | From | To | Q(m3/sec) | D(mm) | L(km) | C | V(m/sec) | i(o/oo) | Loss(m) | H(m) | dH(m) | iWL(m) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Buaran* | | Buaran | | | | | | | | 48.10 | 40.00 | 8.10 | Pump actual head |
| | Buaran | ST2 | 5.00 | 1,500 | 2.9 | 130 | 2.83 | 3.57 | 10.35 | 37.75 | | | 0.57 |
| | ST2 | ST3 | 5.00 | 1,650 | 3.3 | 130 | 2.34 | 2.24 | 7.41 | 30.34 | | | |
| | ST3 | R1 | 5.00 | 1,650 | 7.3 | 130 | 2.34 | 2.24 | 16.39 | 13.95 | -5.28 | 8.67 | |
| *R1* | | R1 | | | | | | | | 47.00 | 45.00 | 2.00 | Pump actual head |
| | R1 | W1 | 3.00 | 1,500 | 14.5 | 130 | 1.70 | 1.39 | 20.12 | 26.88 | | | 3.00 |
| | W1 | W2 | 2.70 | 1,500 | 8.0 | 130 | 1.53 | 1.14 | 9.14 | 17.74 | | | |
| | W2 | R6 | 2.10 | 1,500 | 11.0 | 130 | 1.19 | 0.72 | 7.89 | 9.85 | -4.85 | 5.00 | |
| *Cisadane* | | Cisadane | | | | | | | | 56.80 | 23.80 | 33.00 | Pump actual head |
| | Cisadane | R5" | 2.80 | 1,500 | 14.0 | 130 | 1.58 | 1.22 | 17.10 | 39.70 | | | 0.50 |
| | R5" | R5 | 1.60 | 1,200 | 2.0 | 130 | 1.41 | 1.29 | 2.57 | 37.13 | -3.63 | 33.50 | |
| | R5" | R4 | 1.20 | 1,200 ****** | 15.0 | 130 | 1.06 | 0.76 | 11.33 | 25.80 | -12.85 | 12.95 | |

**F/S : 2006 - 2008**

| Root | From | To | Q(m3/sec) | D(mm) | L(km) | C | V(m/sec) | i(o/oo) | Loss(m) | H(m) | dH(m) | iWL(m) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Buaran* | | Buaran | | | | | | | | 48.10 | 40.00 | 8.10 | Pump actual head |
| | Buaran | ST2 | 5.00 | 1,500 | 2.9 | 130 | 2.83 | 3.57 | 10.35 | 37.75 | | | 0.57 |
| | ST2 | ST3 | 5.00 | 1,650 | 3.3 | 130 | 2.34 | 2.24 | 7.41 | 30.34 | | | |
| | ST3 | R1 | 5.00 | 1,650 | 7.3 | 130 | 2.34 | 2.24 | 16.39 | 13.95 | -5.28 | 8.67 | |
| *R1* | | R1 | | | | | | | | 47.00 | 45.00 | 2.00 | Pump actual head |
| | R1 | W1 | 3.10 | 1,500 | 14.5 | 130 | 1.75 | 1.47 | 21.38 | 25.62 | | | 3.00 |
| | W1 | W2 | 2.70 | 1,500 | 8.0 | 130 | 1.53 | 1.14 | 9.14 | 16.48 | | | |
| | W2 | R6 | 1.80 | 1,500 | 11.0 | 130 | 1.02 | 0.54 | 5.93 | 10.55 | -5.55 | 5.00 | |
| *Cipayung* | | Cipayung | | | | | | | | 54.00 | | 54.00 | |
| | Cipayung | R3' | 4.20 | 2,200 | 15.5 | 130 | 1.10 | 0.40 | 6.21 | 47.79 | | | |
| | R3' | R5' | 4.20 | 2,000 | 8.0 | 130 | 1.34 | 0.64 | 5.10 | 42.70 | | | |
| | R5' | R5 | 1.60 | 1,000 | 1.5 | 130 | 2.04 | 3.12 | 4.69 | 38.01 | -4.51 | 33.50 | |
| | R5' | R4' | 2.60 | 1,800 | 11.0 | 130 | 1.02 | 0.44 | 4.82 | 37.87 | | | |
| | R4' | R4 | 2.60 | 1,500 | 5.5 | 130 | 1.47 | 1.06 | 5.86 | 32.02 | -19.07 | 12.95 | |
| *Cisadane* | | Cisadane | | | | | | | | 56.80 | 23.80 | 33.00 | Pump actual head |
| | Cisadane | R5" | 2.80 | 1,500 | 14.0 | 130 | 1.58 | 1.22 | 17.10 | 39.70 | | | 0.50 |
| | R5" | R5 | 1.60 | 1,200 | 2.0 | 130 | 1.41 | 1.29 | 2.57 | 37.13 | -3.63 | 33.50 | |
| | R5" | R4 | 1.20 | 1,200 ****** | 15.0 | 130 | 1.06 | 0.76 | 11.33 | 25.80 | -12.85 | 12.95 | |

**M/P : 2009 - 2011**

| Root | From | To | Q(m3/sec) | D(mm) | | L(km) | C | V(m/sec) | i(o/oo) | Loss(m) | H(m) | dH(m) | iWL(m) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cipayung* | | Cipayung | | | | | | | | | 54.00 | | 54.00 | |
| | Cipayung | R3' | 3.90 | 2,200 | | 15.5 | 130 | 1.03 | 0.35 | 5.41 | 48.59 | | | |
| | R3' | R3 | 0.80 | **1,500** | | **2.0** | 130 | 0.45 | 0.12 | 0.24 | 53.76 | -5.76 | 48.00 | |
| | R3' | R5' | 3.10 | 2,000 | | 8.0 | 130 | 0.99 | 0.36 | 2.91 | 45.68 | | | |
| | R5' | R5 | 0.50 | 1,000 | | 1.5 | 130 | 0.64 | 0.36 | 0.54 | 45.14 | -11.64 | 33.50 | |
| | R5' | R4' | 2.60 | 1,800 | | 11.0 | 130 | 1.02 | 0.44 | 4.82 | 40.86 | | | |
| | R4' | R4 | 1.70 | 1,500 | | 5.5 | 130 | 0.96 | 0.49 | 2.67 | 38.19 | -25.24 | 12.95 | |
| | R4' | R6 | 0.90 | **1,800** | | **10.0** | 130 | 0.35 | 0.06 | 0.62 | 37.58 | -32.58 | 5.00 | |
| *Cisadane* | | Cisadane | | | | | | | | | 56.80 | 23.80 | 33.00 | Pump actual head |
| | Cisadane | R5" | 5.80 | 2,162 | 1,500 | 14.0 | 130 | 1.58 | 0.79 | 11.09 | 45.71 | | | 0.50 |
| | | | | | **1,800** | | | | | | | | | |
| | R5" | R5 | 2.70 | 1,200 | | 2.0 | 130 | 2.39 | 3.39 | 6.77 | 38.94 | -5.44 | 33.50 | |
| | R5" | R4 | 3.10 | 1,562 | 1,200 | 15.0 | 130 | 1.62 | 1.21 | 18.17 | 20.77 | -7.82 | 12.95 | |
| | | | | | **1,200** | | | | | | | | | |

**M/P : 2012 - 2015**

| Root | From | To | Q(m3/sec) | D(mm) | | L(km) | C | V(m/sec) | i(o/oo) | Loss(m) | H(m) | dH(m) | iWL(m) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cipayung* | | Cipayung | | | | | | | | | 54.00 | | 54.00 | |
| | Cipayung | R3' | 10.60 | 2,863 | 2,200 | 15.5 | 130 | 1.65 | 0.62 | 9.54 | 44.46 | | | |
| | | | | | **2,200** | | | | | | | | | |
| | R3' | R3 | 2.10 | 1,500 | | 2.0 | 130 | 1.19 | 0.72 | 1.43 | 52.57 | -4.57 | 48.00 | |
| | R3' | R5' | 8.50 | 2,603 | 2,000 | 8.0 | 130 | 1.60 | 0.65 | 5.20 | 39.26 | | | |
| | | | | | **2,000** | | | | | | | | | |
| | R5' | R5 | 1.20 | 1,000 | | 1.5 | 130 | 1.53 | 1.84 | 2.75 | 36.51 | -3.01 | 33.50 | |
| | R5' | R4' | 7.30 | 2,343 | 1,800 | 11.0 | 130 | 1.69 | 0.82 | 9.02 | 30.24 | | | |
| | | | | | **1,800** | | | | | | | | | |
| | R4' | R4 | 4.40 | 1,500 | | 5.5 | 130 | 2.49 | 2.82 | 15.50 | 14.74 | -1.79 | 12.95 | |
| | R4' | R6 | 2.90 | 1,800 | | 10.0 | 130 | 1.14 | 0.54 | 5.36 | 9.38 | -4.38 | 5.00 | |
| *Cisadane* | | Cisadane | | | | | | | | | 56.80 | 23.80 | 33.00 | Pump actual head |
| | Cisadane | R5" | 3.60 | 2,162 | 1,500 | 14.0 | 130 | 0.98 | 0.33 | 4.59 | 52.21 | | | 0.50 |
| | | | | | 1,800 | | | | | | | | | |
| | R5" | R5 | 2.00 | 1,200 | | 2.0 | 130 | 1.77 | 1.94 | 3.89 | 48.32 | -14.82 | 33.50 | |
| | R5" | R4 | 1.60 | 1,562 | 1,200 | 15.0 | 130 | 0.84 | 0.36 | 5.34 | 42.98 | -30.03 | 12.95 | |
| | | | | | 1,200 | | | | | | | | | |

| Root | From | To | Q(m3/sec) | D(mm) | | L(km) | C | V(m/sec) | i(o/oo) | Loss(m) | H(m) | dH(m) | iWL(m) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Cipayung* | | Cipayung | | | | | | | | | 54.00 | | 54.00 | |
| | Cipayung | R3' | 10.20 | 2,863 | 2,200 | 15.5 | 130 | 1.58 | 0.57 | 8.88 | 45.12 | | | |
| | | | | | 2,200 | | | | | | | | | |
| | R3' | R3 | 2.50 | 1,500 | | 2.0 | 130 | 1.41 | 0.99 | 1.98 | 52.02 | -4.02 | 48.00 | |
| | R3' | R5' | 7.70 | 2,603 | 2,000 | 8.0 | 130 | 1.45 | 0.54 | 4.33 | 40.79 | | | |
| | | | | | 2,000 | | | | | | | | | |
| | R5' | R5 | 0.00 | 1,000 | | 1.5 | 130 | 0.00 | 0.00 | 0.00 | 40.79 | -7.29 | 33.50 | |
| | R5' | R4' | 7.70 | 2,343 | 1,800 | 11.0 | 130 | 1.79 | 0.90 | 9.95 | 30.83 | | | |
| | | | | | 1,800 | | | | | | | | | |
| | R4' | R4 | 3.30 | 1,500 | | 5.5 | 130 | 1.87 | 1.66 | 9.10 | 21.73 | -8.78 | 12.95 | |
| | R4' | R6 | 4.40 | 1,800 | | 10.0 | 130 | 1.73 | 1.16 | 11.60 | 10.13 | -5.13 | 5.00 | |
| *Cisadane* | | Cisadane | | | | | | | | | 56.80 | 23.80 | 33.00 | Pump actual head |
| | Cisadane | R5" | 6.30 | 2,162 | 1,500 | 14.0 | 130 | 1.72 | 0.92 | 12.92 | 43.88 | | | 0.50 |
| | | | | | 1,800 | | | | | | | | | |
| | R5" | R5 | 3.20 | 1,303 | 1,200 | 2.0 | 130 | 2.40 | 3.10 | 6.20 | 37.67 | -4.17 | 33.50 | |
| | | | | | **700** | | | | | | | | | |
| | R5" | R4 | 3.10 | 1,562 | 1,200 | 15.0 | 130 | 1.62 | 1.21 | 18.17 | 19.50 | -6.55 | 12.95 | |
| | | | | | 1,200 | | | | | | | | | |

(2) **Criteria for Design**

1) Operational Reservoir

a. Effective Capacity : 5 hours' storage of Day Maximum Water Demand

Effective capacity of operational reservoir is planed as shown in **Table-454.1.**

**Table-454.1 EFFECTIVE CAPACITY OF RESERVOIR**

| To maintain | Capacity |
|---|---|
| Daily fluctuation | 2.7 hours |
| Power suspension and other accident | 2.0 hours |
| Sudden change in supply such as fire fighting | 0.3 hours |
| **Total** | **5.0 hours** |

For determination of the effective capacity for daily fluctuation, typical curves representing hourly consumption patterns is prepared and shown in **Figure-454.1.** Existing reservoir with insufficient capacity are to be expanded to satisfy the figure. The effective capacity of reservoir for treated water transmission pump station is designed as one hour's storage of Day Maximum water demand considering water shortage of short period due to the difference between transmitted water quantity and production.

b. Number of Basin : more than 2 units.

Each reservoir should be connected with pipe and should have same high and low water level in order to make operation easy.

c. Depth of reservoir : form 3 to 6 meters

The depth of expanded reservoir should be same as the existing. The depth of 5 meters is applied for new reservoirs in this plan due to the difficulty of land acquisition.

d. Structure :

Reservoir should be sealed up in order to avoid contamination of clear water from outside. Wall for flow arrangement should be constructed to regulate the flow and to get rid of dead water.

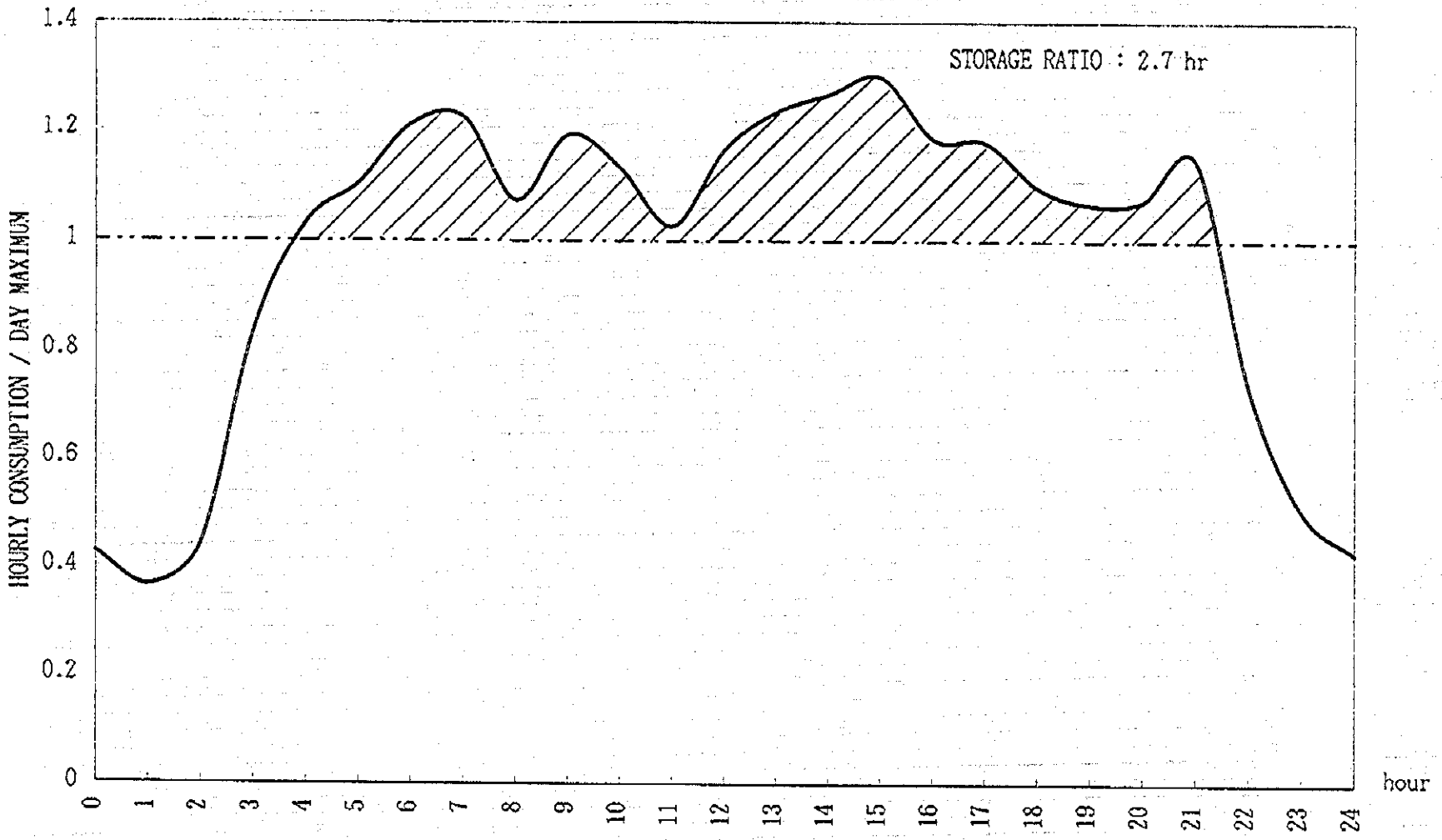



**Figure-454.1** ESTIMATED HOURLY FLUCTUATION OF WATER CONSUMPTION

2) Pump Facility

Number of Pump : More than 4 units

More than 4 units of pump will be required for the control of pump to cope with the variation of yearly and daily water demand. Distribution pump should have enough capacity to distribute hourly maximum water demand (130% of day maximum water demand), while transmission pump is designed to transfer day maximum water demand.

3) Chlorination Facilities

Dosage rate : 0.5 mg/l (average)
: 1.0 mg/l (maximum)

Chlorine should be dosed to satisfy the standard of residual chlorine concentration in the distribution water.

**(3) Scope of Priority Projects**

Required capacity of operational reservoir and pump facilities is shown in **Table-454.2.**

**Table-454.2 Required Capacity of Reservoir and Pump Facilities**

| | | Part One Program | | Part Two Program | |
|---|---|---|---|---|---|
| | | DC-R1 | DC-R6 | DC-R4 | DC-R5 |
| Reservoir Capacity (m3) | Existing | 27,000 | - | 21,600 | 21,600 |
| | Newly required | 18,360 | 32,400 | 46,800 | 36,000 |
| | Required Total | 45,360 | 32,400 | 68,400 | 57,600 |
| Pump Capacity (l / sec) | Existing | 3,000 | - | 1,200 | 1,600 |
| | Newly required | 2,000 | 21,000 | 2,600 | 1,600 |
| | Required Total | 5,000 | 21,000 | 3,800 | 3,600 |

Facilities to be expanded or newly required for distribution centers are planed as follows:

1) DC-R1

Operational Reservoir : 18,360 m3 ( 3,672 m2 x 5.0 m depth)
Pumps : 5 units ( 1 unit for Stand-by)
Q 47 m3/min x H 45 m x P 470 kW x 5 units

2) DC-R6

Operational Reservoir : 32,400 m3 ( 6,480 m2 x 5.0 m depth)
Pump Building
Pumps : 4 units ( 1 unit for Stand-by)
Q 47 m3/min x H 40 m x P 410 kW x 4 units

Chlorination Facilities
Power Receiving Facilities

3) DC-R4

| | |
|---|---|
| Operational Reservoir | : 46,800 m3 ( 6,500 m2 x 7.2 m depth) |
| Pump Building | |
| Pumps | : 6 units ( 1 unit for Stand-by)<br>Q 27 m3/min x H 45 m x P 270 kW x 6 units |
| Chlorination Facilities | |
| Power Receiving Facilities | |

4) DC-R5

| | |
|---|---|
| Operational Reservoir | : 36,000 m3 ( 500 m2 x 7.2 m depth) |
| Pump Building | |
| Pumps | : 6 units ( 1 unit for Stand-by)<br>Q 18 m3/min x H 45 m x P 180 kW x 6 units |
| Chlorination Facilities | |
| Power Receiving Facilities | |

Required Capacity of Reservoir and Design Capacity of Pump is summarized in **Table-454.3** and **Table-454.4** respectively.

DC-R1 and DC-R5 are planed to be expanded in the existing area while land acquisition is required for DC-R6 construction and DC-R4 expansion. Location of DC-R6, which was recommended by the Steering Committee to be constructed in Water Front City, is proposed to be selected near the Outer Ring Road.

General Layout of DC-R1, DC-R6, DC-R4 and DC-R5 of existing and proposed facility are presented in **Figure-454.2, Figure-454.3, Figure-454.4** and **Figure-454.5** respectively.

### 4.5.5 Distribution Pipe Network

#### (1) Concept

Distribution pipeline will be classified into three categories by pipe sizes and purposes, namely, primary trunk main, secondary main and tertiary main as recommended in Master Plan in 1985.

Primary trunk main forms distribution pipe networks and distribute water to secondary mains which compose elementary zones. The size of primary trunk mains is 300 mm in diameter and larger. Secondary mains from 150 mm to 250 mm in diameter, distribute water to tertiary mains which have diameter of 100 mm and smaller. House connections are to be branched

## Table-454.3 Reqired Capacity of Reservoir

| | | | Transmission | Distribution | Total | |
|---|---|---|---|---|---|---|
| | | Detention time | 1.0 | 5.0 | | hr |
| | | Intake | 5.0 | | | min |
| *Intake* | | Flow rate | 5.25 | | 5.25 | m³/sec |
| | | Required capacity | 1,575 | | 1,575 | m³ |
| *Booster* | | Flow rate | 5.25 | | 5.25 | m³/sec |
| | | Required capacity | 18,900 | | 18,900 | m³ |
| *Buaran* | | Flow rate | 5.0 | 5.0 | 10.0 | m³/sec |
| | | Capacity | 18,000 | 90,000 | 108,000 | m³ |
| | | Existing capacity | | | 26,800 | m³ |
| | | Required capacity | | | 81,200 | m³ |
| *Cipayung* | F/S | Flow rate | 4.2 | 0.8 | 5.0 | m³/sec |
| | | Required capacity | 15,120 | 14,400 | 29,520 | m³ |
| | M/P | Flow rate | 10.2 | 4.1 | 14.3 | m³/sec |
| | | Required capacity | 36,720 | 73,800 | 110,520 | m³ |
| *R1* | F/S | Flow rate | 3.1 | 1.9 | 5.0 | m³/sec |
| | | Capacity | 11,160 | 34,200 | 45,360 | m³ |
| | | Existing capacity | | | 27,000 | m³ |
| | | Required capacity | | | 18,360 | m³ |
| | M/P | Flow rate | 1.5 | 3.5 | 5.0 | m³/sec |
| | | Capacity | 5,400 | 63,000 | 68,400 | m³ |
| | | Existing capacity | | | 27,000 | m³ |
| | | Required capacity | | | 41,400 | m³ |
| *R4* | F/S | Flow rate | | 3.8 | 3.8 | m³/sec |
| | | Capacity | | 68,400 | 68,400 | m³ |
| | | Existing capacity | | | 21,600 | m³ |
| | | Required capacity | | | 46,800 | m³ |
| | M/P | Flow rate | | 6.4 | 6.4 | m³/sec |
| | | Capacity | | 115,200 | 115,200 | m³ |
| | | Existing capacity | | | 21,600 | m³ |
| | | Required capacity | | | 93,600 | m³ |
| *R5* | F/S | Flow rate | | 3.2 | 3.2 | m³/sec |
| | | Capacity | | 57,600 | 57,600 | m³ |
| | | Existing capacity | | | 21,600 | m³ |
| | | Required capacity | | | 36,000 | m³ |
| *R6* | F/S | Flow rate | | 1.8 | 1.8 | m³/sec |
| | | Required capacity | | 32,400 | 32,400 | m³ |
| | M/P | Flow rate | 2.0 | 2.4 | 4.4 | m³/sec |
| | | Required capacity | 7,200 | 43,200 | 50,400 | m³ |

## Table-445.4 Design Capacity of Pumps

| | | Flow rate | | Peak flow | | Existing | | | | | | Total | F/S : 2008 | | | | | | | Total | M/P : 2019 | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Q | H | P | Nos | Volume | Volume | | Q | H (m) | | H | P | Nos | Volume | Volume | Q | H | P | Nos | Volume | Volume |
| | | m³/sec | m³/min | m³/min | | m³/min | m | KW | | m³/min | m³/min | | m³/min | Actual | Loss | m | KW | | m³/min | m³/min | m³/min | m | KW | | m³/min | m³/min |
| Intake | Bekasi | 5.25 | 315 | | Large | | | | | | | | 79 | 21.5 | 23.5 | 45 | 780 | 4 | 316 | 316 | 79 | 45 | 780 | 4 | 316 | 316 |
| | | | | | Small | | | | | | | | | | | | | | | | | | | | | |
| | | | | | Stand-by | | | | | | | | 79 | 21.5 | 23.5 | 45 | 780 | 1 | | | 79 | 45 | 780 | 1 | | |
| | Booster | | | | Large | | | | | | | | 79 | 32 | 21 | 53 | 920 | 4 | 316 | 316 | 79 | 53 | 920 | 4 | 316 | 316 |
| | | | | | Small | | | | | | | | | | | | | | | | | | | | | |
| | | | | | Stand-by | | | | | | | | 79 | 32 | 21 | 53 | 920 | 1 | | | 79 | 53 | 920 | 1 | | |
| Bueran | Transmission | 5.0 | 300 | | Large | 60 | 40 | 550 | 4 | 240 | 240 | | 90 | 0.57 | 39.43 | 40 | 790 | 2 | 180 | 300 | 90 | 40 | 790 | 2 | 180 | 300 |
| | | | | | Small | | | | | | | | 60 | 0.57 | 39.43 | 40 | 550 | 2 | 120 | | 60 | 40 | 550 | 2 | 120 | |
| | | | | | Stand-by | 60 | 40 | 550 | 1 | | | | 60 | 0.57 | 39.43 | 40 | 550 | 1 | | | 60 | 40 | 550 | 1 | | |
| | Distribution | 5.0 | 300 | 390 | Large | 48 | 54 | 600 | 4 | 192 | 216 | | 86 | 0 | 0 | 54 | 1,020 | 4 | 344 | 392 | 86 | 54 | 1,020 | 4 | 344 | 392 |
| | | | | | Small | 24 | 54 | 300 | 1 | 24 | | | 48 | 0 | 0 | 54 | 600 | 1 | 48 | | 48 | 54 | 600 | 1 | 48 | |
| | | | | | Stand-by | 24 | 54 | 300 | 1 | | | | 48 | 0 | 0 | 54 | 600 | 1 | | | 48 | 54 | 600 | 1 | | |
| Cipayung | Distribution | 0.8 | 48 | 62.4 | Large | | | | | | | | 32 | 0 | 0 | 41 | 290 | 2 | 64 | 64 | 86 | 41 | 580 | 3 | 258 | 322 |
| | | (4.1) | (246) | (319.8) | Small | | | | | | | | | | | | | | | | 32 | 41 | 290 | 2 | 64 | |
| | | | | | Stand-by | | | | | | | | 32 | 0 | 0 | 41 | 290 | 1 | | | 32 | 41 | 580 | 1 | | |
| R1 | Transmission | 3.1 | 186 | | Large | | | | | | | | 47 | 3 | 42 | 45 | 470 | 4 | 188 | 188 | 47 | 45 | 470 | 2 | 94 | 94 |
| | | (1.5) | (90) | | Small | | | | | | | | | | | | | | | | | | | | | |
| | | | | | Stand-by | | | | | | | | 47 | 3 | 42 | 45 | 470 | 1 | | | 47 | 45 | 470 | 3 | | |
| | Distribution | 1.9 | 114 | 148.2 | Large | 90 | 56 | 1,200 | 3 | 270 | 315 | | 90 | 0 | 0 | 56 | 1,200 | 2 | 180 | 180 | 90 | 56 | 1,200 | 3 | 270 | 270 |
| | | (3.5) | (210) | (273.0) | Small | 45 | 56 | 600 | 1 | 45 | | | | | | | | | | | | | | | | |
| | | | | | Stand-by | 45 | 56 | 600 | 1 | | | | 90 | 0 | 0 | 56 | 1,200 | 1 | | | 90 | 56 | 1,200 | 2 | | |
| | | | | | | | | | | | | | 45 | 0 | 0 | 56 | 600 | 2 | | | | | | | | |
| R4 | Distribution | 3.8 | 228 | 296.4 | Large | 273 | 45 | 245 | 6 | 163.8 | 163.8 | | 27 | 0 | 0 | 57 | 340 | 6 | 162 | 297 | 27 | 57 | 340 | 6 | 162 | 502 |
| | | (6.4) | (384) | (499.2) | Small | | | | | | | | | | | | | | | | | | | | | |
| | | | | | Stand-by | 273 | 45 | 245 | 1 | | | | 27 | 0 | 0 | 57 | 340 | 1 | | | 27 | 57 | 340 | 1 | | |
| | | | | | Large | | | | | | | | 27 | 0 | 0 | 57 | 340 | 5 | 135 | | 27 | 57 | 340 | 5 | 135 | |
| | | | | | Small | | | | | | | | | | | | | | | | | | | | | |
| | | | | | Stand-by | | | | | | | | 27 | 0 | 0 | 57 | 340 | 1 | | | 27 | 57 | 340 | 1 | | |
| | | | | | Large | | | | | | | | | | | | | | | | 41 | 57 | 520 | 5 | 205 | |
| | | | | | Small | | | | | | | | | | | | | | | | | | | | | |
| | | | | | Stand-by | | | | | | | | | | | | | | | | 41 | 57 | 520 | 1 | | |
| R5 | Distribution | 3.2 | 192 | 249.6 | Large | 273 | 45 | 245 | 6 | 163.8 | 163.8 | | 273 | 0 | 0 | 45 | 245 | 6 | 163.8 | 253.8 | 273 | 45 | 245 | 6 | 163.8 | 254 |
| | | | | | Small | | | | | | | | | | | | | | | | | | | | | |
| | | | | | Stand-by | 273 | 45 | 245 | 1 | | | | 273 | 0 | 0 | 45 | 245 | 1 | | | 273 | 45 | 245 | 1 | | |
| | | | | | Large | | | | | | | | 18 | 0 | 0 | 45 | 180 | 5 | 90 | | 18 | 45 | 180 | 5 | 90 | |
| | | | | | Small | | | | | | | | | | | | | | | | | | | | | |
| | | | | | Stand-by | | | | | | | | 18 | 0 | 0 | 45 | 180 | 1 | | | 18 | 45 | 180 | 1 | | |
| R6 | Distribution | 1.8 | 108 | 140.4 | Large | | | | | | | | 47 | 0 | 0 | 50 | 520 | 3 | 141 | 141 | 47 | 50 | 520 | 4 | 188 | 188 |
| | | (2.4) | (144) | (187.2) | Small | | | | | | | | | | | | | | | | | | | | | |
| | | | | | Stand-by | | | | | | | | 47 | 0 | 0 | 50 | 520 | 1 | | | 47 | 50 | 520 | 1 | | |

( ) : M/P

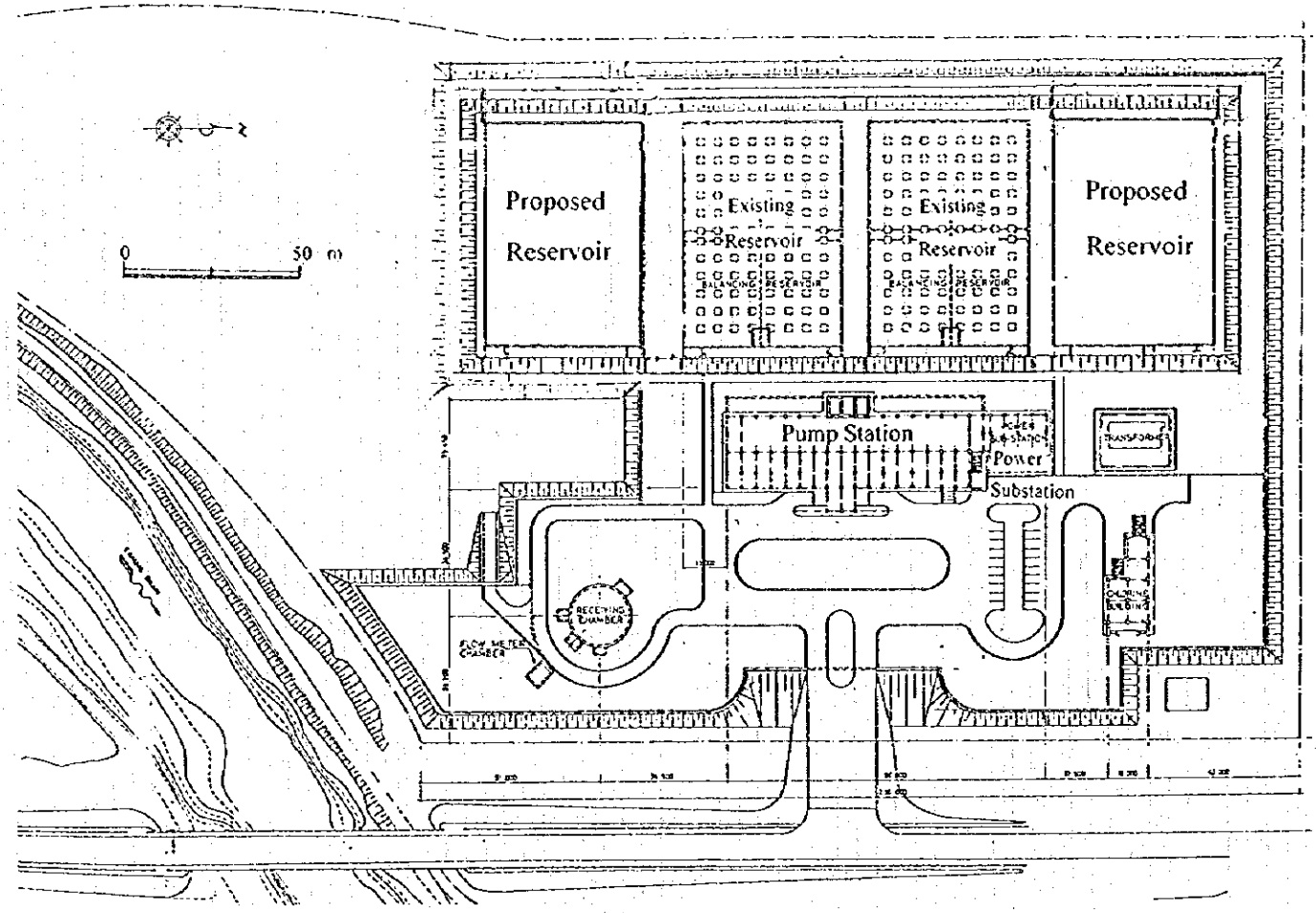
Peak factor : 1.3

New pumps

Actual head and Pipe loss is estimated.

**Figure-454.2**

**GENERAL LAYOUT OF DISTRIBUTION CENTER R-1 (Par 1 Program)**



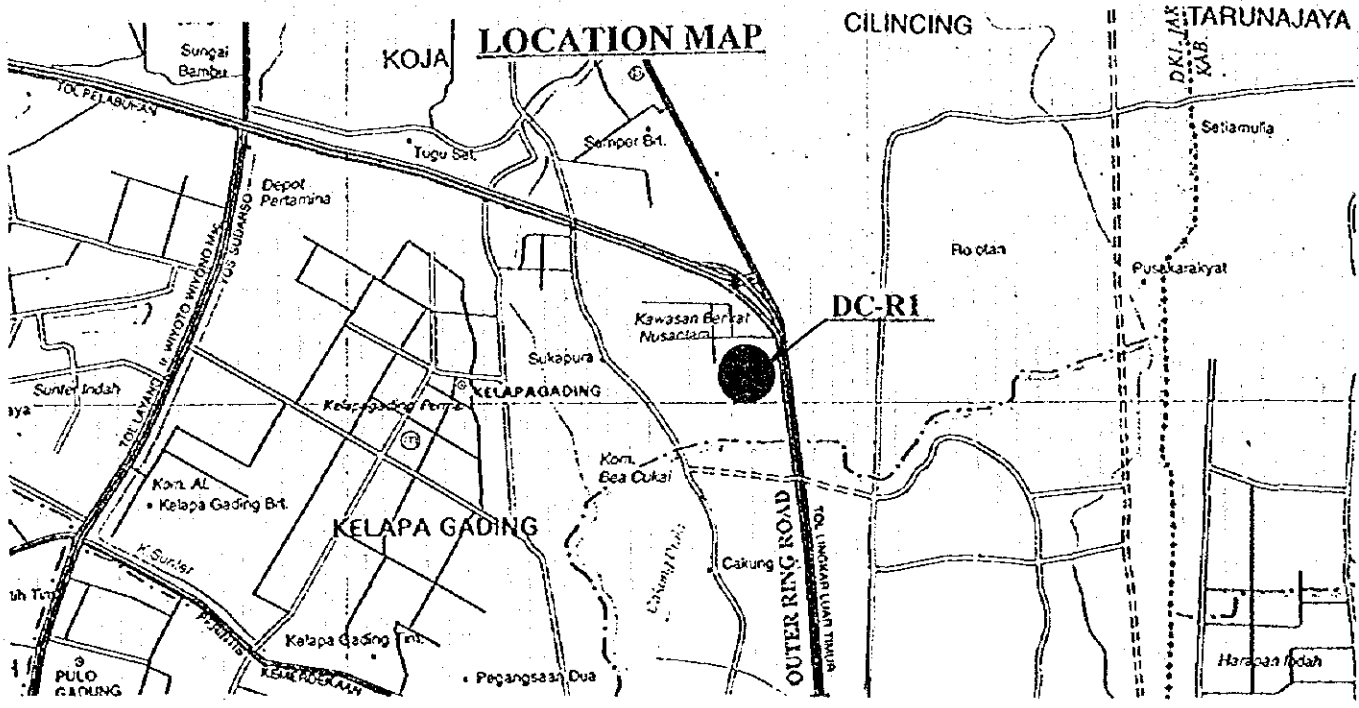
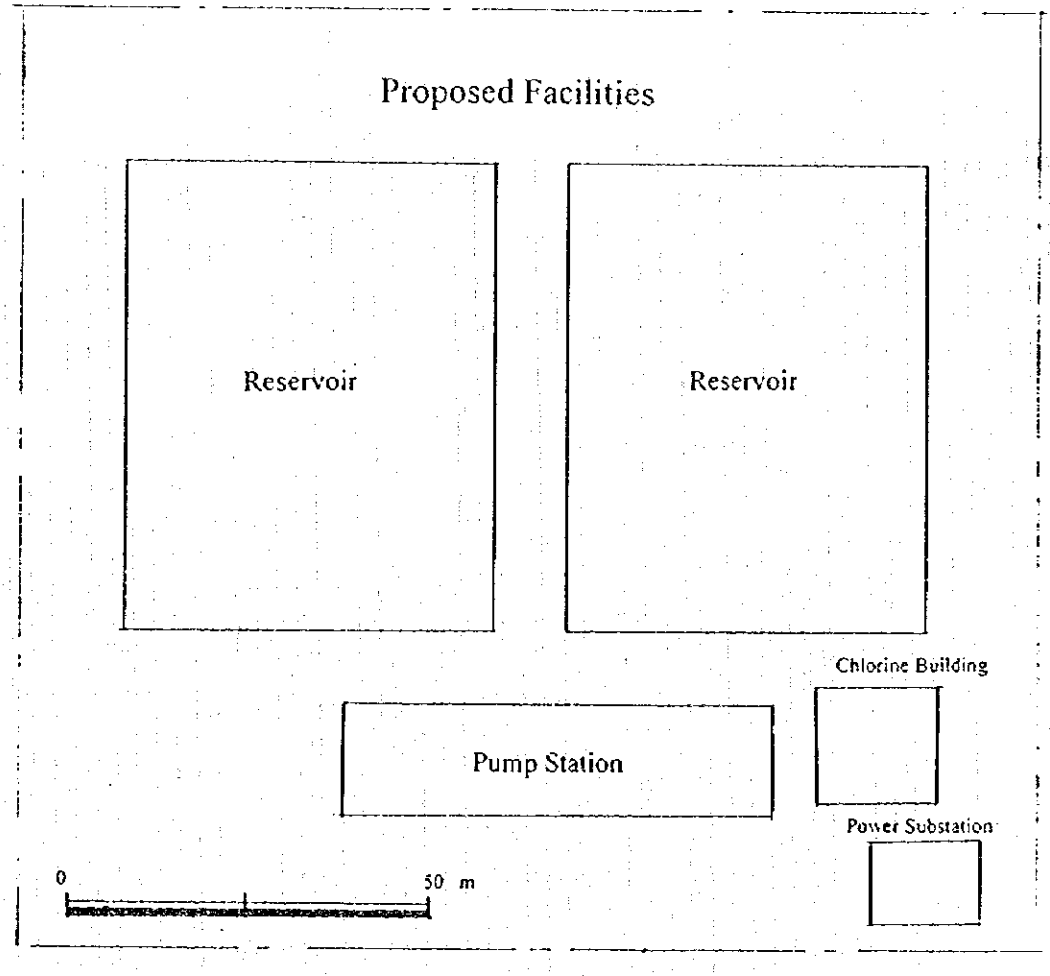



**Figure-454.3**

**GENERAL LAYOUT OF DISTRIBUTION CENTER R-6 (Par 1 Program)**



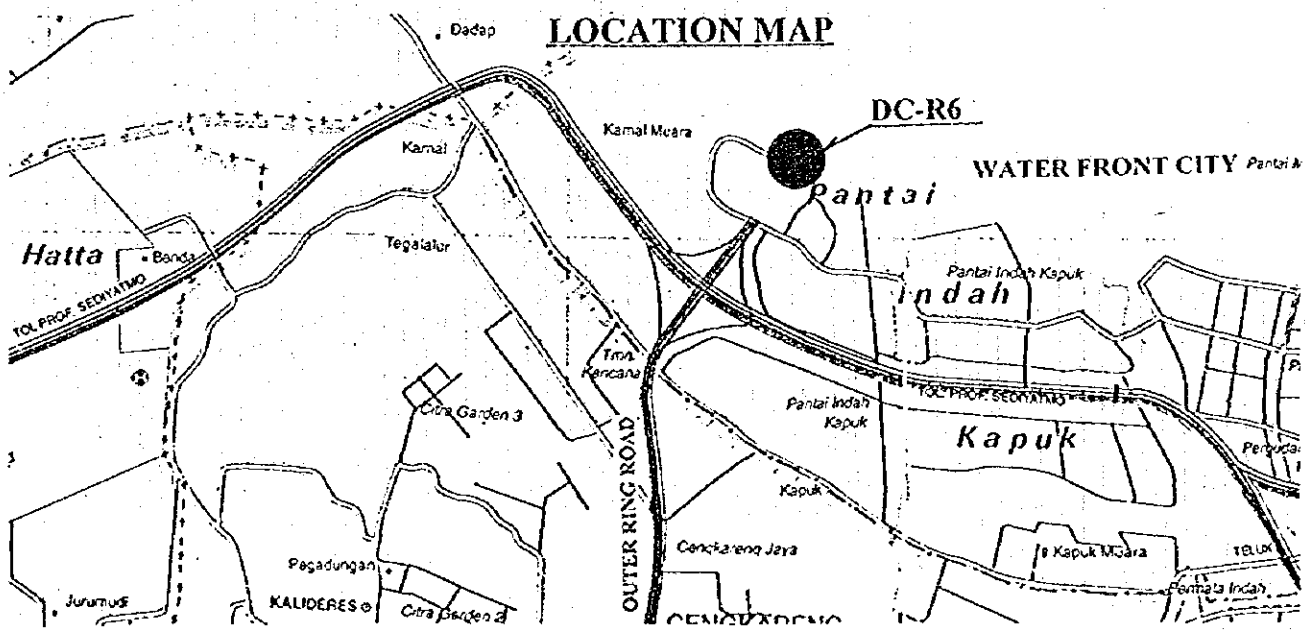
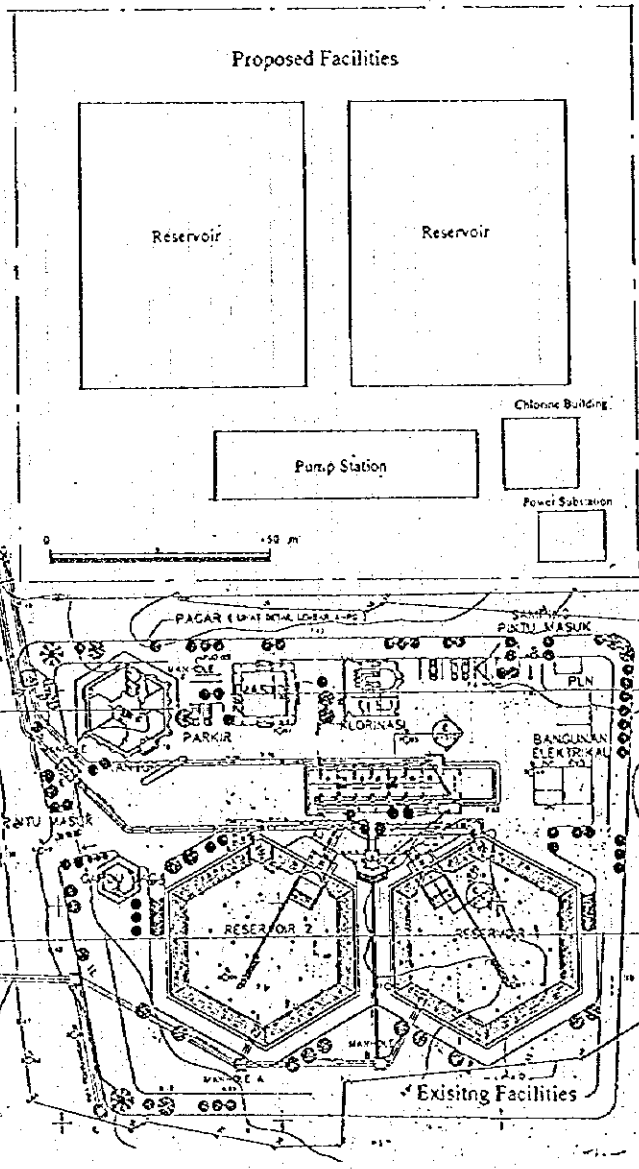



**Figure-454.4**

**GENERAL LAYOUT OF DISTRIBUTION CENTER R-4 (Par 2 Program)**



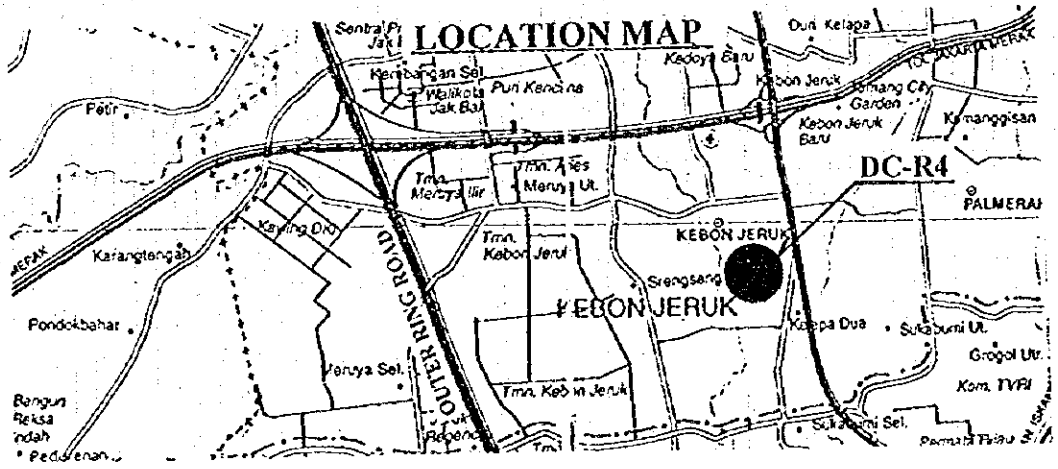
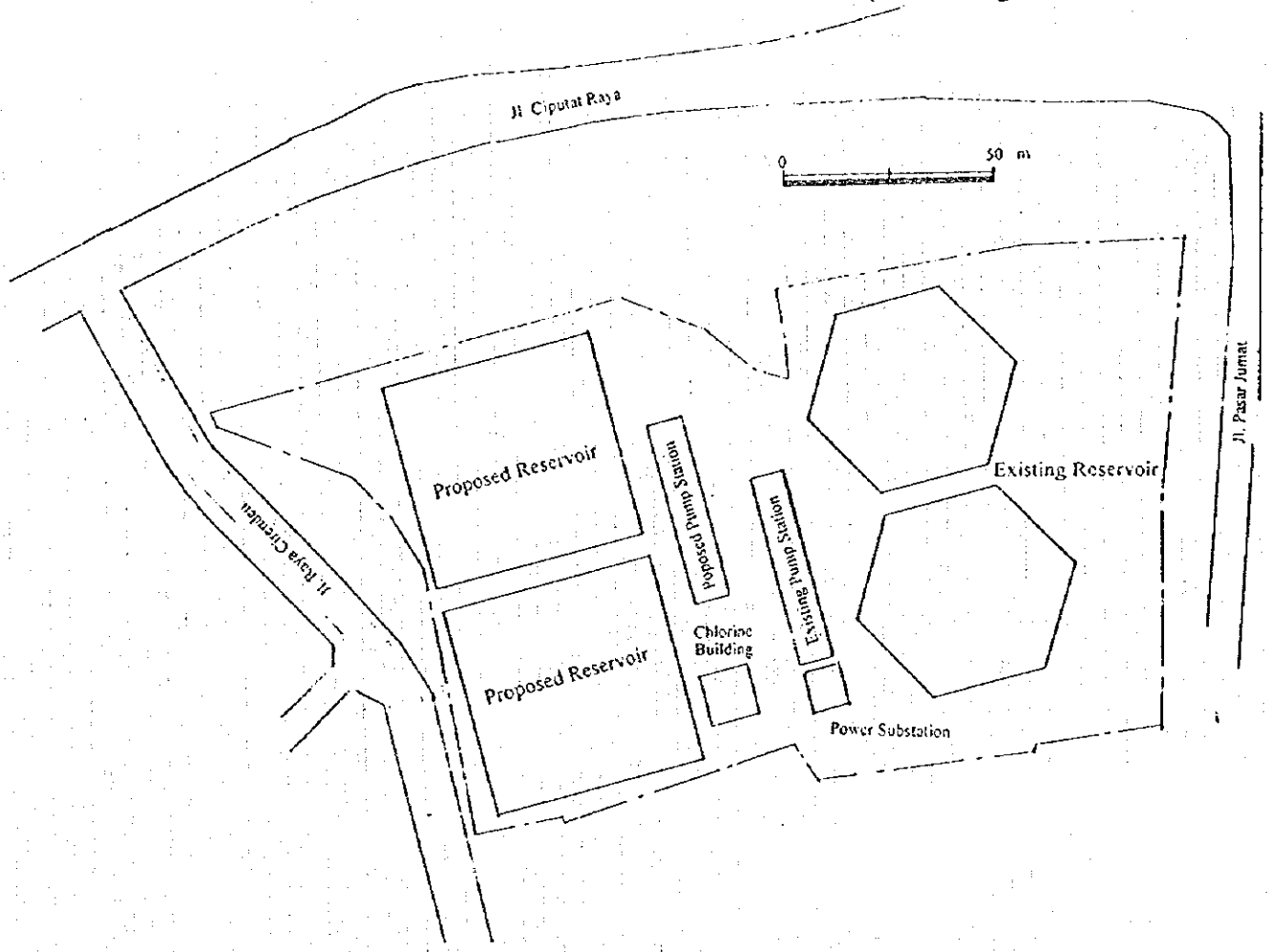
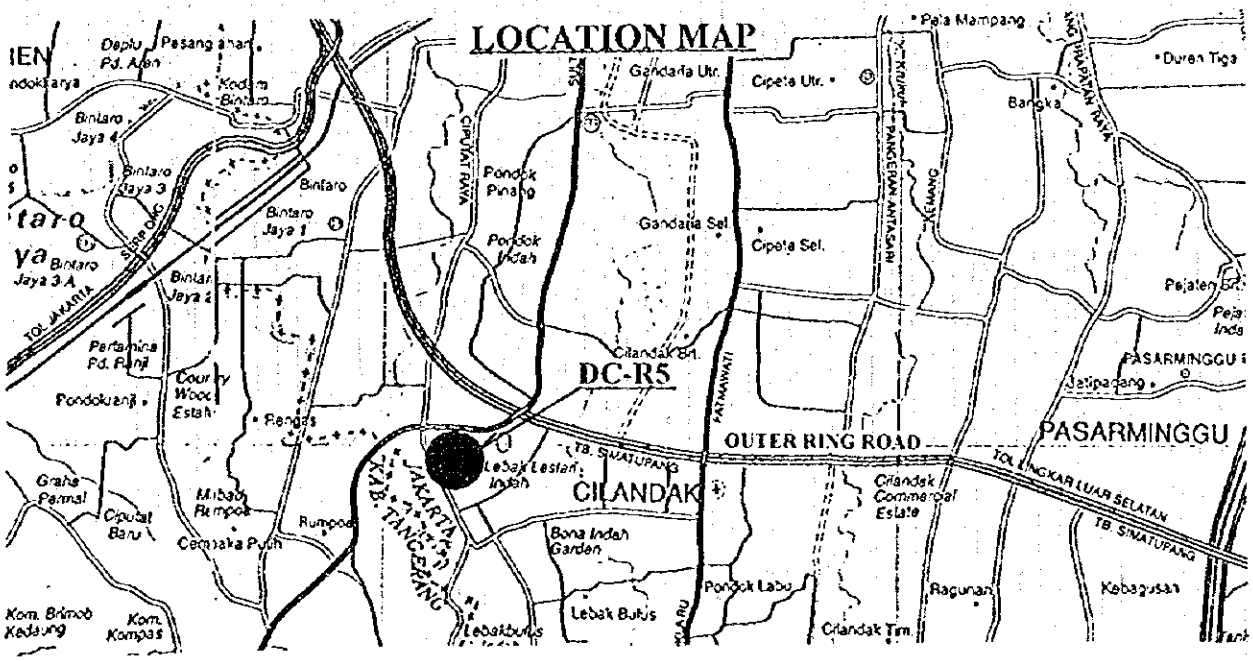



**Figure-454.5**

**GENERAL LAYOUT OF DISTRIBUTION CENTER R-5 (Par 2 Program)**



from the tertiary mains only.

### (2) Justification

Distribution facilities have responsibility in conveyance and delivering of potable water from water treatment plants to consumers. Following three items are the main points to be considered for water distribution works:

**Flow rate :**

It is important to monitor flow rate in water distribution facilities in order to find water leakage and to prepare repair plan of the facilities. Such water leakage reduction is worth with development of new water resources.

**Water Pressure :**

It is a must to keep water pressure in pipes always positive in order to prevent contamination by inflow of dirty water and offer appropriate service to consumer. Water pressure should be kept even by controlling valves taking account of monitoring results. It is efficient for preventing increase of water leakage caused by high water pressure and for the level up of consumer service.

**Water Quality :**

It is necessary to keep good water quality in distribution pipes and serve potable water to consumers. Chlorine dosage rate at treatment plant or distribution center can be decided properly by reflecting the results of water quality monitoring in distribution system. Appropriate control of water flow rate and water pressure in distribution facilities will result in appropriate water quality control.

For appropriate and easier management of water distribution facilities, introduction of zoning is an effective methods as recommended in the Master Plan.

### (3) Pipe Installation Route and Pipe Network Analysis

Route of primary trunk mains are selected along the existing and planned road for preliminary pipe network analysis. Considering existing underground utilities, traffic condition and other obstacles, the actual route should be decided before construction.

Primary pipe networks were analyzed in order to preliminarily design appropriate distribution pipe reticulation for the year of 2005, the target year of Part One program and for the year of 2008, the target year of Part Two Program. Condition of the hydraulic calculation is defined as same as the Master Plan.

### (4) Proposed System

The proposed distribution system is designed to distribute the following demand.

Ordinary Condition : Hourly Maximum Demand (Day Maximum Demand x 1.3)
During Fire Fighting : Water for Fire Fighting + Day Maximum Water Demand

**Table-455.1** provides a list of pipe length to be installed during Part One and Part Two programs. The proposed distribution pipe network system as the results of preliminary pipe network analysis for the year of 2005, the target year of Part One program, and 2008, the target year of Part Two Program, are shown in **Figure-455.1** and **Figure-455.2** respectively. The results of preliminary pipe network analysis for year of 2005 and 2008 are attached in **Annex-45.**

The proposed system in Part One and Part Two programs in each zone is described below.

**Zone 1 :**

Buaran water treatment plant in zone 6 will supply to south east part of kecamatan Gambir in zone 1 along Jl.Letjen. Haryono in order to supply water from zone 6 to zone 5 during Part One program. The remaining whole zone will be supplied from the water supply terminals of zone 1, namely Pejompongan I and II WTP and DC-R6. After Part One program, the whole area of Zone 1 can be hydraulically independent. The movement of boundary will be adjusted by

operating valves.

**Zone 2 and Zone 3 :**

Zone 2 and zone 3 can not be separated during the priority project since the distribution capacity of DC-R1 will be insufficient for zone 3. Treated water will be transmitted to Kemayoran Development area through distribution pipeline with positive water head, although water will be conveyed to Water Front City through treated water transmission pipe. Pulogadung WTP, Buaran WTP and DC-R1 are the water supply points for the combined zone.

**Zone 4 and Zone 7 :**

The service area will be expanded and include Zone 7 during Part Two Program. The area will be covered by water supply system of zone 4, since the service area and water to be supplied in zone 7 will be very small during the priority project. In addition to DC-R4, DC-R6, which will supply water only to zone 1 in the target year of master plan, should supply water to zone 4 and zone 7 during the priority project.

**Zone 5 and Zone 6 :**

During the priority project Cibrial system should still supply water in zone 6 even though whole the system can be used by the neighbors in Bogor after this period.

Until 2005, the target year of Part One program, zone 5 and zone 6 cannot be separated because of capacity shortage of water supply terminal in zone 5. About 800 l/sec of water will be transmitted from zone 5 to zone 6 though two distribution pipelines of diameter 1000 mm along Jl. Letjen. Haryono and 400 mm along Jl.Kalibata across Ciliwung river which is the boundary of west and east concession area. During this period, the combined zone is supplied by Buaran T.P. and DC-R5 in addition to Ciburial system and Cilandak WTP which supplies water to hydraulically isolated sub-zone in zone 5.

After expansion of DC-R5 in 2006 as a Part Two Program, zone 5 and zone 6 can be supplied independently. In other words, east and west concessional area can be separated in this period. Zone 5 will be supplied from DC-R5 together with Cilandak WTP which has its sub-zone while zone 6 will have Buaran WTP, Cipayung WTP and Cibrial system as water supply terminal points.

Though some newly expanded service area with high geographical level does not satisfy the minimum target of effective water head, 17 m(1.7 kg/cm2), during the priority project period, water can be supplied around such area.

**Table-455.1 BREAKDOWN OF PRIMARY MAINS PIPE LENGTH**

| Diameter (mm) | Existing Length * (m) (a) | Part One Program Newly reqired Length(m) (b) | Part One Program Accumulated Length(m) (c)=(a)+(b) | Part Two Program Newly reqired Length(m) (d) | Part Two Program Accumulated Length(m) (e)=(c)+(d) |
|---|---|---|---|---|---|
| 300 | 117,789 | 37,135 | 154,924 | 88,245 | 243,169 |
| 350 | 27,217 | 190 | 27,407 | 0 | 27,407 |
| 400 | 123,718 | 27,024 | 150,742 | 8,120 | 158,862 |
| 450 | 4,650 | 0 | 4,650 | 0 | 4,650 |
| 500 | 55,423 | 15,192 | 70,615 | 4,410 | 75,025 |
| 550 | 2,504 | 0 | 2,504 | 0 | 2,504 |
| 600 | 123,898 | 69,977 | 193,875 | 26,780 | 220,655 |
| 700 | 0 | 10,500 | 10,500 | 2,400 | 12,900 |
| 800 | 61,422 | 54,800 | 116,222 | 29,370 | 145,592 |
| 900 | 17,977 | 7,680 | 25,657 | 2,360 | 28,017 |
| 1000 | 27,126 | 19,220 | 46,346 | 12,034 | 58,380 |
| 1100 | 6,442 | 0 | 6,442 | 0 | 6,442 |
| 1200 | 5,590 | 16,930 | 22,520 | 0 | 22,520 |
| 1350 | 1,912 | 9,100 | 11,012 | 0 | 11,012 |
| 1500 | 640 | 15,492 | 16,132 | 900 | 17,032 |
| 1600 | 2,619 | 2,250 | 4,869 | 1,710 | 6,579 |
| 1800 | 2,962 | 7,634 | 10,596 | 580 | 11,176 |
| Total | 581,889 | 293,124 | 875,013 | 176,909 | 1,051,922 |

Note :

* Figures of existing pipe length are referred to JWSSP Distribution System Report in 1995. The length includes pipes to be installed by PJSIP Phase 1 and Phase 2

### 4.5.6 Service Mains and House Connections

Length of service mains which should be installed during Priority Projects are shown on **Table-456.1.** Number of Domestic Connection and Public Hydrant in each year during the Priority Project is shown in **Table-456.2** and **Table-456.3** respectively.

Figure-455.1 **PROPOSED PRIMARY DISTIBUTION SYSETM (YEAR 2005)**
**(Existing and Propsed Pipelines)**

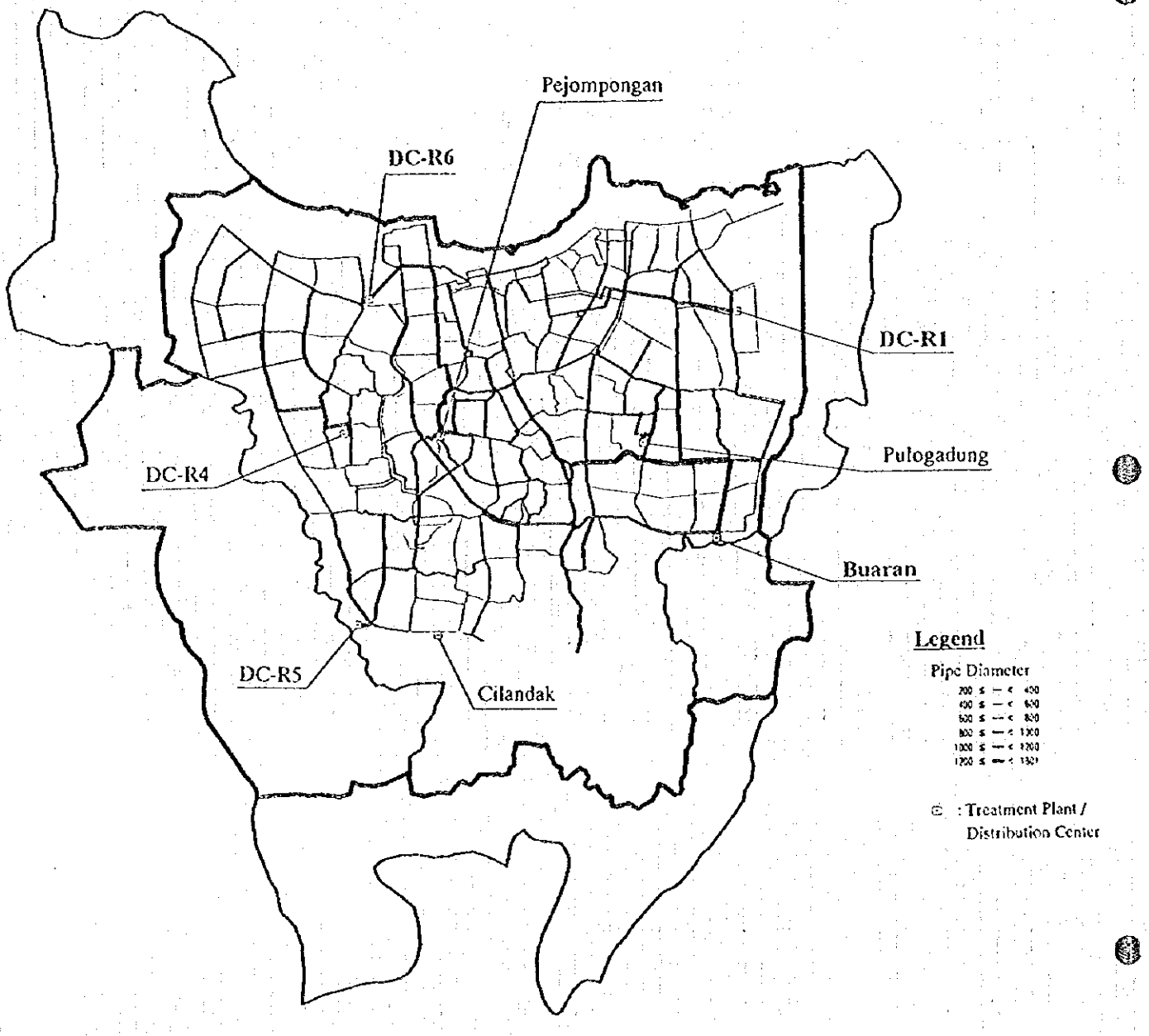
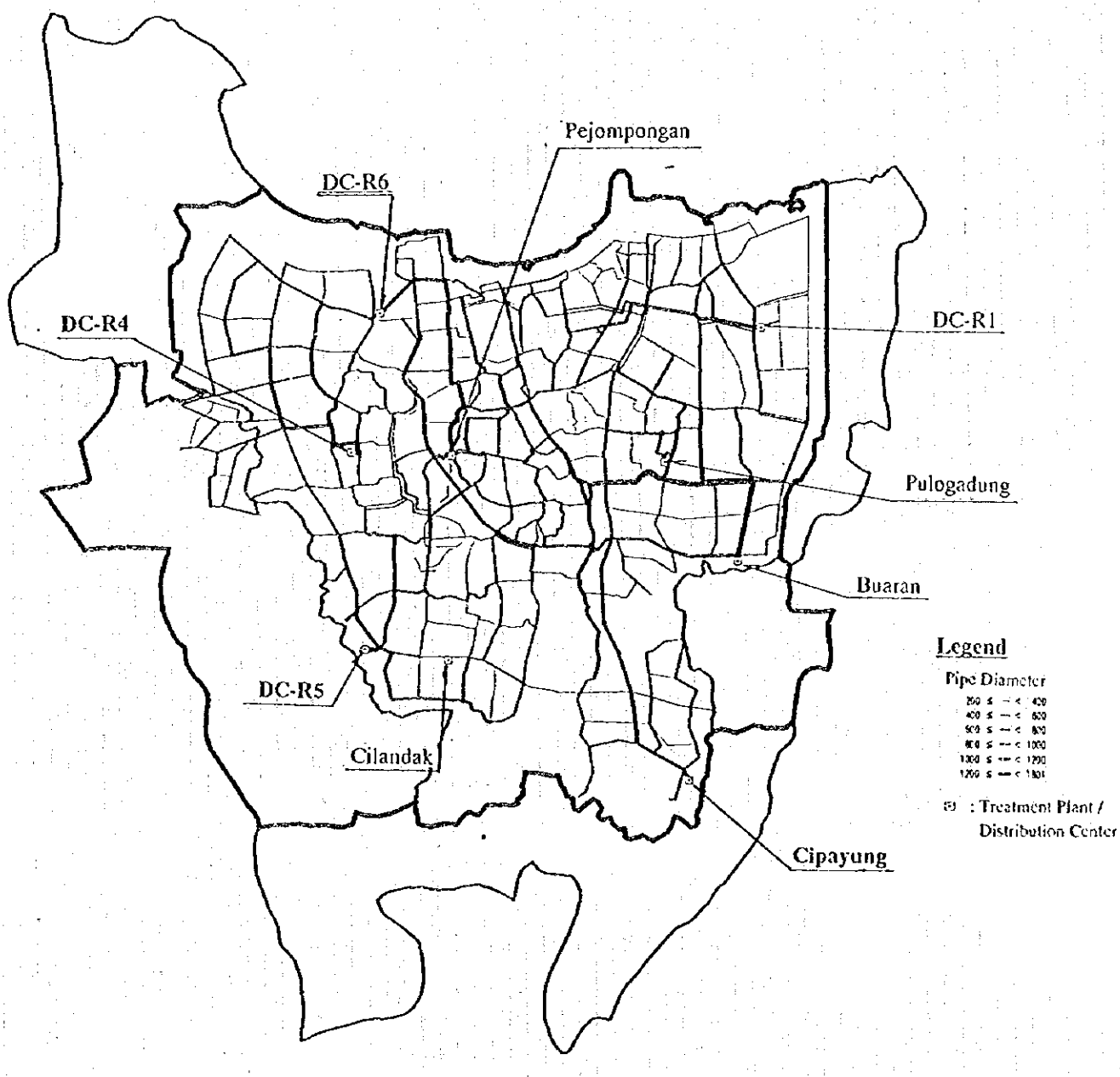


Figure-455.2 PROPOSED PRIMARY DISTIBUTION SYSETM (YEAR 2008)
(Existing and Propsed Pipelines)



## Table-456.1 SERVICE MAIN LENGTH REQUIRED TO BE INSTALLED DURING PRIORITY PORJECTS

**Part One Project, until Year 2005**

Unit : km

| Dia. (mm) | Western Area | | | Eastern Area | | | Grand Total |
|---|---|---|---|---|---|---|---|
| | Jakarta | Fringe Area | Total | Jakarta | Fringe Area | Total | |
| 250 | 84 | 0 | 84 | 57 | 0 | 57 | 141 |
| 200 | 166 | 0 | 166 | 112 | 0 | 112 | 279 |
| 150 | 338 | 0 | 338 | 228 | 0 | 228 | 566 |
| 100 | 511 | 0 | 511 | 346 | 0 | 346 | 857 |
| 75 | 623 | 0 | 623 | 422 | 0 | 422 | 1,045 |
| 50 | 853 | 0 | 853 | 577 | 0 | 577 | 1,430 |
| Total | 2,576 | 0 | 2,576 | 1,742 | 0 | 1,742 | 4,318 |

**Part Two Project, until Year 2008**

Unit : km

| Dia. (mm) | Western Area | | | Eastern Area | | | Grand Total |
|---|---|---|---|---|---|---|---|
| | Jakarta | Fringe Area | Total | Jakarta | Fringe Area | Total | |
| 250 | 32 | 10 | 42 | 26 | 0 | 26 | 68 |
| 200 | 63 | 20 | 83 | 51 | 0 | 51 | 134 |
| 150 | 128 | 41 | 169 | 103 | 0 | 103 | 272 |
| 100 | 194 | 62 | 256 | 156 | 0 | 156 | 412 |
| 75 | 237 | 75 | 312 | 191 | 0 | 191 | 503 |
| 50 | 324 | 103 | 427 | 261 | 0 | 261 | 688 |
| Total | 980 | 310 | 1,290 | 788 | 0 | 788 | 2,078 |

## Table-456.2 NUMBER OF DEMESTIC CONNECTION

| | YEAR | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| West of Jakarta | 125,783 | 153,083 | 180,383 | 207,682 | 234,982 | 262,282 | 292,013 | 321,743 | 351,474 | 381,204 | 410,935 | 435,129 | 459,322 | 513,510 |
| East of Jakarta | 171,807 | 192,715 | 213,623 | 234,532 | 255,440 | 276,348 | 299,377 | 322,407 | 345,436 | 368,466 | 391,495 | 419,297 | 447,100 | 474,902 |
| Total of Jakarta | 297,600 | 345,798 | 394,006 | 442,214 | 490,422 | 538,600 | 591,390 | 644,150 | 696,910 | 749,670 | 802,400 | 864,426 | 926,422 | 988,418 |
| West of Fringe Area | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10,242 | 20,484 | 30,726 |
| East of Fringe Area | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total of Fringe Area | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10,240 | 20,486 | 30,730 |
| Water Front City | 0 | 0 | 0 | 0 | 0 | 0 | 6,794 | 13,588 | 20,382 | 27,176 | 33,970 | 40,796 | 47,622 | 54,448 |
| Grand Total | 297,600 | 345,798 | 394,006 | 442,214 | 490,422 | 538,600 | 598,184 | 657,738 | 717,292 | 776,846 | 836,370 | 915,462 | 994,524 | 1,073,596 |

## Table-456.3 NUMBER OF PUBLIC HYDRANT

| | YEAR | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
| West of Jakarta | 724 | 724 | 724 | 724 | 724 | 724 | 724 | 724 | 724 | 724 | 724 | 724 | 724 | 724 |
| East of Jakarta | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 | 1,160 |
| Total of Jakarta | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 |
| West of Fringe Area | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 53 | 79 |
| East of Fringe Area | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total of Fringe Area | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 50 | 80 |
| Water Front City | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Grand Total | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,900 | 1,930 | 1,950 | 1,980 |

## 4.6 OPERATION / MAINTENANCE AND MONITORING SYSTEM

### 4.6.1 Operation and Maintenance

#### (1) General

The standard operation and maintenance of water supply facilities was studied and presented in the Master Plan. Operation and maintenance plan for the facilities to be constructed under the Priority Project is prepared hereunder.

Among operation and maintenance of water supply facilities, daily inspection is most important and effective method to keep the facilities in good condition. So, standard daily inspection lists as a part of the operation and maintenance plan are prepared in this study for assisting private sectors to perform efficient operation and maintenance.

Preliminary estimation of operation and maintenance costs for the Priority Projects including electric power and chemical costs is also conducted in this report. For the cost estimates, consumption of electric power and chemicals are calculated in advance. As to organization for operation and maintenance, refer to financial projection.

#### (2) Maintenance Plan

Both of Buaran Treatment Plant and Distribution Center I are the newest facilities among the existing Jakarta Water Supply System and their operation and maintenance seem satisfactory. Moreover, facilities under Part I of the Priority Project are expansion of Buaran Treatment Plant and Distribution Center I (R1). Considering the above, operation and maintenance of the treatment plants and distribution centers are planned referring to these existing facilities.

Periodical inspection such as daily, monthly, and annual inspection is a fundamental of maintenance of water supply facilities, among these periodical inspection, daily inspection especially for mechanical/electrical facilities is the most important duty to maintain these facilities in good working condition.

In daily inspection, energy consumption, i.e. electrical current, is mainly checked because energy consumption represents operating condition of mechanical/electrical facilities. A visual inspection on site together with check on abnormal noise, vibration, heat and odor is important as well.

Hence, the feasibility study provides standard daily inspection report to be applied to the newly constructed treatment plant and distribution center.

The recommenced standard Daily Inspection Reports are as follows and formats are included in **Annex-46**.

- Treatment Plant
  - Power Substation
  - Transmission Pump Station
  - Distribution Pump Station
  - Load Center
- Distribution Center
  - Power Substation
  - Electric Room

### 4.6.2 Monitoring System

The monitoring system proposed in the Master Plan is divided into two categories of monitoring of water quality and monitoring of water supply operation, so these two categories are presented in this chapter.

#### (1) Monitoring of Water Quality

The monitoring and strengthening of water quality is executed by the newly proposed Central Laboratory and laboratory at each treatment plant. The PAM JAYA monitors and controls overall water quality through cross check of distributed water at newly constructed Central Laboratory, and laboratory at each treatment plant.

The items to be analyzed and overall layout and necessary equipment at the Central Laboratory are proposed in the Feasibility Study.

1) Items to be analyzed by Central Laboratory

The items to be analyzed by central laboratory are listed in **Table-462.1**. These items are selected and proposed based on the following:

1. Referring to the Indonesian standard of Ministry of Health and Secretary of President
2. Referring to Guide Line, Target, and Carcinogen of WHO
3. Water quality items of raw water and purified water should be analyzed by the Central Laboratory
4. Priority 1 are items of drinking water standard and others, Priority 2 are items of environmental protection standard

The items are suggested to be analyzed at least once a month by Central Laboratory as shown in **Table-462.1.**

2) Equipment

The major equipment necessary to analyze water quality items described above are as follows:

1. Gas chromatography - mass spectrometry
2. Gas chromatography
3. Atomic absorption spectrophotometry
4. ICP
5. High performance liquid chromatography
6. Ion chromatography
7. Absorptiometry, ETC

These equipment and items to be analyzed are shown in **Table-462.2.**

3) Layout Plan of Central Laboratory

The layout plan of central laboratory is shown in **Section 4.4.7.**

### (2) Monitoring of Water Supply Operation

The monitoring of water supply operation is executed by proposed PAM SCADA System described in the Master Plan. The proposed procedure of introduction of PAM SCADA System is as follows:

a. Study on monitoring points
b. Detailed design of flow/pressure meter installation
c. Installation of flow/pressure meter
d. Accumulation of above data including outlet of treatment plant, transmission/distribution trunk main and distribution main of each supply subsystem
e. Analysis of accumulated data
f. Establishment of water supply operation strategy
g. Study on PAM SCADA System and detailed design
h. Study on organization for central supervisory system and pipeline maintenance
i. Training of operating engineer
j. Installation of PAM SCADA System

In the Feasibility Study ,monitoring points and, function of PAM SCADA System were studied as follows:

#### 1) Monitoring Points

In order to maintain water supply facilities in economical/optimum water supply operating condition water supply facilities should be controlled through continuous monitoring. Monitoring of operating condition at strategic points of transmission and distribution system including production facilities is indispensable.

The strategic points of transmission and distribution for continuous monitoring were selected based on the following concept as shown in **Figure-462.1.**

Confirmation of flow and pressure at;

- Outlet of production facility
- Receiving facility at Distribution Center
- Outlet of Distribution Center
- Branch point of distribution main

The proposed monitoring points, meter installation points more than 600 mm diameter, are approximately 200 as shown in **Figure-462.2.**

2) Installation of pressure and flow meter

The installation of pressure and flow meter at the strategic points in transmission and distribution pipeline is divided into two steps, step1 and step2, considering SCADA System functions effectively. Sensors of pressure and flow rate, instrument, and recorder will be installed in step1 period and after collected data were analyzed Remote Terminal Unit (RTU) as a component of SCADA System, real time on-line monitoring system, will be installed in step2. These stepwised installation of pressure and flow meter is shown in **Figures-462.3** and **462.4.**

3) Hardware Layout of PAM SCADA System

The layout of hardware of PAM SCADA System basically consists of the followings as shown in **Figure-462.5.**

<u>At site</u>
- Remote Terminal Unit (RTU)
- Radio Transmitter and Receiver

<u>At Eastern and Western SCADA System</u>
- Central Processing Unit
- Peripherals
- Graphic Panel
- CRT Console
- Radio Transmitter and Receiver

At PAM SCADA System
- CRT Display
- CRT Console
- Radio Transmitter and Receiver

The brief explanation of the function of above hardware are as follows:

Remote Terminal Unit (RTU);
- Data collection from various facilities as shown in **Figure-462.5**
- Store collected data
- Data transmission upon request of Central Processing Unit

Radio Transmitter and Receiver;
- Data receiving from RTU
- Data transmission to Central Processing Unit

Central Processing Unit;
- Data collection from RTUs
- Numerical calculation of collected data
- Data store
- Data transmission to graphic panel and CRT display

Graphic Panel;
- Graphical display of pressure and flow rate of water production ,transmission, and distribution

CRT Console
- Display of list, graphic data, figure, alarm, etc

Peripherals includes;
- Report printer
- Alarm printer
- Hard copy
- External memory

Table 462-1 WATER QUALITY STANDARD & ITEMS TO BE ANALYZED BY CETRAL LABORATORY

| No | Quality Items | Parameter | STANDARD | | | | | | | | | CLASIFICATION | | | PROPOSED ITEMS TO BE ANALYZED BY CENTRAL LABORATORY | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | INDONESIAN STANDARD | | | | | | WHO | | | | | | PRIORITY | |
| | | | Ministry of health | | Secretary of President | | | | | | | Organic Pollution | Maintenance | Eutrophication | 1 | 2 |
| | | | Potable Water | Clean Water | A AIR MINUM | B AIR BAKU AIR MINUM | C PERIKANAN DAN PETERNAKAN | D PERTANIAN DAN USAHA PER KOTAAN | GIDELINES | TARGET | CARCINOGEN | | | | | |
| | A.FISIKA | A.Physical | | | | | | | | | | | | | | |
| 1 | Bau | Odor | O | | O | | | | | O | | O | O | O | O | |
| 2 | Zat padat terlarut(TDS) | Total disolve solid | O | O | O | O | O | O | | O | | | O | | O | |
| 3 | Kekeruhan | Turbidity | O | O | O | | | | | O | | | O | | O | |
| 4 | Rasa | Tasted | O | O | O | | | | | O | | | O | | O | |
| 5 | Suhu | Temperature | O | O | O | O | O | O | | O | | | O | | O | |
| 6 | Warna | Color | O | O | O | | | | | O | | | O | | O | |
| 7 | Daya hantar listrik | umhos/cm(25C) | | | | | | O | | | | O | O | | | O |
| | B.KIMIA | B.Chemical | | | | | | | | | | | | | | |
| | a.Kimia Anorganik | a Unorganic chemical | | | | | | | | | | | | | | |
| 1 | Air raksa | Mercury | O | O | O | O | O | O | O | | | | | | O | |
| 2 | Amoniak Bebas | NH4-N | | | O | O | O | O | | O | | O | O | | O | |
| 3 | Aluminium | AL | O | | O | | | | | O | | | | | O | |
| 4 | Arsen | As | O | O | O | O | O | | O | | O | | | | O | |
| 5 | Barium | Ba | O | | O | O | | | O | | | | | | O | |
| 6 | Besi | Fe | O | O | O | O | | | | O | | | | O | O | |
| 7 | Flourida | F | O | O | O | O | O | | O | | | | | | O | |
| 8 | Boron | B | | | | | | O | O | | | | | | | O |
| 9 | Kadmium | Cd | O | O | O | O | O | O | O | | | | | | O | |
| 10 | Kesadahan CaCO3 | Hardness(CaCO3) | O | O | O | | | | | | | | | | O | |
| 11 | Klarida | CL | O | O | O | O | | | | O | | O | | | O | |
| 12 | Kobalt | Co | | | | | | O | | | | | | | | O |
| 13 | Kromium Valensi 6 | Cr-6 | O | O | O | O | O | O | O | | | | | | O | |
| 14 | Mangan | Mn | O | O | O | O | | O | O | O | | | | O | O | |
| 15 | Natrium | Na | O | | O | | | O | O | | | | | | O | |
| 16 | Nitrat,sebagai N | NO3 | O | O | O | O | | | O | | | | | | O | |
| 17 | Nitrit,sebagai N | NO2 | O | O | O | O | O | | O | | | | | | O | |
| 18 | Perak | Ag | O | | O | | | | | | | | | | O | |
| 19 | Nikel | Ni | | | | | | O | O | | | | | | | O |
| 20 | Oksigen terlarut | OO | | | O | | | | | | | O | | O | | O |
| 21 | pH | pH | O | O | O | O | O | O | | O | | O | O | O | O | |
| 22 | Selenium | Se | O | O | O | O | O | O | O | | | | | | O | |
| 23 | Seng | Zn | O | O | O | O | O | O | | O | | | | | O | |
| 24 | Sianida | SN | O | O | O | O | O | | O | | | | | | O | |
| 25 | Sulfat | SO4 | O | O | O | O | | | | O | | | | | O | |
| 26 | Sulfida,sebagai H2S | H2S | O | | O | O | O | | | O | | | | | O | |
| 27 | Sodium Absorption Ratio(SAR) | | | | | | | O | | | | | | | | O |
| 28 | Tembaga | Cu | O | O | O | O | O | O | O | O | | | | | O | |
| 29 | Timbal | Pb | O | O | O | O | O | O | O | | | | | | O | |
| 30 | Residual Sodium CArbonat(RSC) | | | | | | | O | | | | | | | | O |
| | b.Kimia Organik | b.Organic chemical | | | | | | | | | | | | | | |
| 1 | Aldrin dan dieldrin | | O | O | O | O | | | | | | | | | O | |
| 2 | Benzene | | O | O | O | | | | O | | O | | | | O | |
| 3 | Benzo (a) pyrene | | O | O | O | | | | O | | O | | | | O | |
| 4 | Chlordane (total isomer) | | O | O | O | O | | | O | | | | | | O | |
| 5 | Chloroform | | O | O | O | | | | O | | O | | | | O | |
| 6 | 2,4-D | | O | O | O | | | | O | | | | | | O | |
| 7 | BHC | | | | | | O | | | | | | | | | O |
| 8 | DDT | | O | O | O | O | O | | O | | | | | | O | |
| 9 | Detergent | | O | O | O | | | | | | | O | | | O | |

Table-462-1 WATER QUALITY STANDARD & ITEMS TO BE ANALYZED BY CETRAL LABORATORY

| No. | Quality Items | Parameter | STANDARD | | | | | | | | | CLASIFICATION | | | PROPOSED ITEMS TO BE ANALYZED BY CENTRAL LABORATORY | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | INDONESIAN STANDARD | | | | | | WHO | | | | | | PRIORITY | |
| | | | Ministry of health | | Secretary of President | | | | | | | Organic Pollution | Maintenance | Eutrophication | 1 | 2 |
| | | | Potable Water | Clean Water | A AIR MINUM | B AIR BAKU AIR MINUM | C PERIKANAN DAN PETERNAKAN | D PERTANIAN DAN USAHA PERKOTAAN | GIDELINES | TARGET | CARCINOGEN | | | | | |
| 10 | 1,2 Dichloroethane | | O | O | O | | | | O | | O | | | | O | |
| 11 | 1,1 Dichloroethene | | O | O | O | | | | O | | | | | | O | |
| 12 | Endrine | | | | | O | O | | | | | | | | | O |
| 13 | Fenol | | | | | O | O | | | | | | | | | O |
| 14 | Heptachlor dan heptachlor epoxide | | O | O | O | O | | | O | | | | | | O | |
| 15 | Karbon Kloroform Ekstrak | | | | | O | | | | | | | | | | O |
| 16 | Hexachlorobenzene | | O | O | O | | | | O | | O | | | | O | |
| 17 | Gamma-HCH(Lindane) | | O | O | O | O | | | O | | | | | | O | |
| 18 | Methoxychlor | | O | O | O | O | | | O | | | | | | O | |
| 19 | Minyak dan Lemak | | | | | O | O | | | | | | | | | O |
| 20 | Organofosfat dan Carbamate | | | | | O | O | | | | | | | | | O |
| 21 | PCB | | | | | O | | | | | | | | | | O |
| 22 | Senyawa Aktif Biru Metilen | | | | | O | O | | | | | | | | | O |
| 23 | Toxaphene | | | | | O | | | | | | | | | | O |
| 24 | Pentachlorophenol | | O | O | O | | | | O | | | | | | O | |
| 25 | Pestisida total | | O | O | O | | | | | | | | | | O | |
| 26 | 2,4,6-Trichlorophenol | | O | O | O | | | | O | | O | | | | O | |
| 27 | Zat Organik(KMnO4) | | O | O | O | | | | | | | O | | O | O | |
| | Microbiologi | | | | | | | | | | | | | | | |
| 1 | Koliform tinja | Fecal coliform | O | O | O | O | | | O | | | O | O | | O | |
| 2 | Total Koliform(MPN) | Total coliform | O | O | O | O | | | O | | | O | O | | O | |
| | Radioactivitas | | | | | | | | | | | | | | | |
| 1 | Aktivitas Alpha(Gross Alpha Activity) | | O | O | O | O | O | O | O | | | | | | | |
| 2 | Aktivitas Beta(Gross Beta Activity) | | O | O | O | O | O | O | O | | | | | | | |
| | | | | | | | | | | | | | | | | |
| 1 | KOD | BOD | | | | | | | | | | O | | O | | O |
| 2 | KOK | COD | | | | | | | | | | O | | O | | O |
| 3 | Alkalinity | | | | | | | | | | | | O | | O | |
| 4 | Fosfat | T-P | | | | | | | | | | | | O | | O |
| 5 | Orto Fosfat | PO4 | | | | | | | | | | | | O | | O |
| 6 | N | T-N | | | | | | | | | | | | O | | O |
| 7 | Chl-a | Chl-a | | | | | | | | | | | | O | | O |
| 8 | Zat Tersuspensi | SS | | | | | | | | | | O | O | | | O |
| 9 | Sisa Chlorine | Residual Chlorine | | | | | | | | | | | O | | O | |
| 10 | CO2 Bebas | | | | | | | | | | | | O | | | O |
| 11 | BrO3 | | | | | | | | O | | O | | | | | O |

## Table-462.2 EQUIPMENT AND PARAMETER TO BE ANALYZED

| No. | Quality Items | Parameter | gas chromatography-mass spectrometry | gas chromatography | atomic absorption spectrophotometry | ICP | high-performance liquid chromatography | ion chromatography | absorpti ometry | OTHERS |
|---|---|---|---|---|---|---|---|---|---|---|
| | A.FISIKA | A.Physical | | | | | | | | |
| 1 | Bau | Odor | | | | | | | | O |
| 2 | Zat padat terlarut(TDS) | Total disolve solid | | | | | | | | O |
| 3 | Kekeruhan | Turbidity | | | | | | | | O |
| 4 | Rasa | Tasted | | | | | | | | O |
| 5 | Suhu | Temperature | | | | | | | | O |
| 6 | Warna | Color | | | | | | | | O |
| 7 | Daya hantar listrik | umhos/cm(25C) | | | | | | | | O |
| | B.KIMIA | B.Chemical | | | | | | | | |
| | a.Kimia Anorganik | a.Unorganic chemical | | | | | | | | |
| 1 | Air raksa | Mercury | | | O | | | | | |
| 2 | Amoniak Bebas | NH4-N | | | | | | | O | |
| 3 | Aluminium | AL | | | O | | | | | |
| 4 | Arsen | As | | | O | | | | | |
| 5 | Barium | Ba | | | O | O | | | | |
| 6 | Besi | Fe | | | O | | | | | |
| 7 | Flourida | F | | | O | | | | | |
| 8 | Boron | B | | | | O | | | O | |
| 9 | Kadmium | Cd | | | O | | | | | |
| 10 | Kesadahan CaCO3 | Hardness(CaCO3) | | | | | | | | O |
| 11 | Klorida | CL | | | | | | | | O |
| 12 | Kobalt | Co | | | O | O | | | | |
| 13 | Kromium Valensi 6 | Cr-6 | | | O | | | | | |
| 14 | Mangan | Mn | | | O | | | | | |
| 15 | Natrium | Na | | | O | | | | | |
| 16 | Nitrat,sebagai N | NO3 | | | | | | O | | |
| 17 | Nitrit,sebagai N | NO2 | | | | | | O | | |
| 18 | Perak | Ag | | | O | O | | | | |
| 19 | Nikel | NI | | | O | | | | | |
| 20 | Oksigen terlarut | DO | | | | | | | | O |
| 21 | pH | pH | | | | | | | | O |
| 22 | Selenium | Se | | | O | | | | | |
| 23 | Seng | Zn | | | O | | | | | |
| 24 | Sianida | SN | | | | | | | O | |
| 25 | Sulfat | SO4 | | | | | | | | O |
| 26 | Sulfida,sebagai H2S | H2S | | | | | | | | O |
| 27 | Sodium Absorption Ratio(SAR) | | | | | | | | | |
| 28 | Tembaga | Cu | | | O | | | | | |
| 29 | Timbal | Pb | | | O | | | | | |
| 30 | Residual Sodium CArbonat(RSC) | | | | | | | | | |
| | b.Kimia Organik | b.Organic chemical | | | | | | | | |
| 1 | Aldrin dan dieldrin | | O | O | | | | | | |
| 2 | Benzene | | O | | | | | | | |
| 3 | Benzo (a) pyrene | | | | | | O | | | |
| 4 | Chlordane (total isomer) | | O | O | | | | | | |
| 5 | Chloroform | | O | | | | | | | |
| 6 | 2,4-D | | | | | | | | | |
| 7 | BHC | | O | O | | | | | | |
| 8 | DDT | | O | | | | | | | |
| 9 | Detergent | | | | | | | | O | |
| 10 | 1,2 Dichloroethane | | O | | | | | | | |
| 11 | 1,1 Dichloroethene | | O | | | | | | | |
| 12 | Endrine | | O | | | | | | | |
| 13 | Fenol | | | | | | | | O | |
| 14 | Heptachlor dan heptachlor epoxide | | O | O | | | | | | |
| 15 | Karbon Kloroform Ekstrak | | | | | | | | | |
| 16 | Hexachlorobenzene | | O | | | | | | | |
| 17 | Camma-HCH(Lindane) | | O | O | | | | | | |
| 18 | Methoxychlor | | | | | | | | | |
| 19 | Minyak dan Lemak | | | | | | | | | |
| 20 | Organofosfat dan Carbamate | | | | | | | | | |
| 21 | PCB | | | O | | | | | | |
| 22 | Senyawa Aktif Biru Methen | | | | | | | | | |
| 23 | Toxsphene | | O | O | | | | | | |
| 24 | Pentachlorophenol | | O | O | | | | | | |
| 25 | Pestisida total | | | | | | | | | |
| 26 | 2,4,6-Trichlorophenol | | O | O | | | | | | |
| 27 | Zat Organik(KMnO4) | | | | | | | | | O |
| | Microbiologi | | | | | | | | | |
| 1 | Koliform tinja | Fecal coliform | | | | | | | | O |
| 2 | Total Koliform(MPN) | Total coliform | | | | | | | | O |
| | | | | | | | | | | |
| 1 | KOO | BOO | | | | | | | | O |
| 2 | KOK | COO | | | | | | | | O |
| 3 | Alkalinity | | | | | | | | | O |
| 4 | Fosfat | T-P | | | | | | | O | |
| 5 | Orto Fosfat | PO4 | | | | | | | O | |
| 6 | N | T-N | | | | | | | O | |
| 7 | Chl-a | Chl-a | | | | | | | | O |
| 8 | Zat Tersuspensi | SS | | | | | | | | O |
| 9 | Sisa Chlorine | Residual Chlorine | | | | | | | O | |
| 10 | CO2 Bebas | | | | | | | | | O |
| 11 | BrO3 | | | | | | | | | |

Figure-462.2 Locatoion of Pressure / Flow Meter Installation

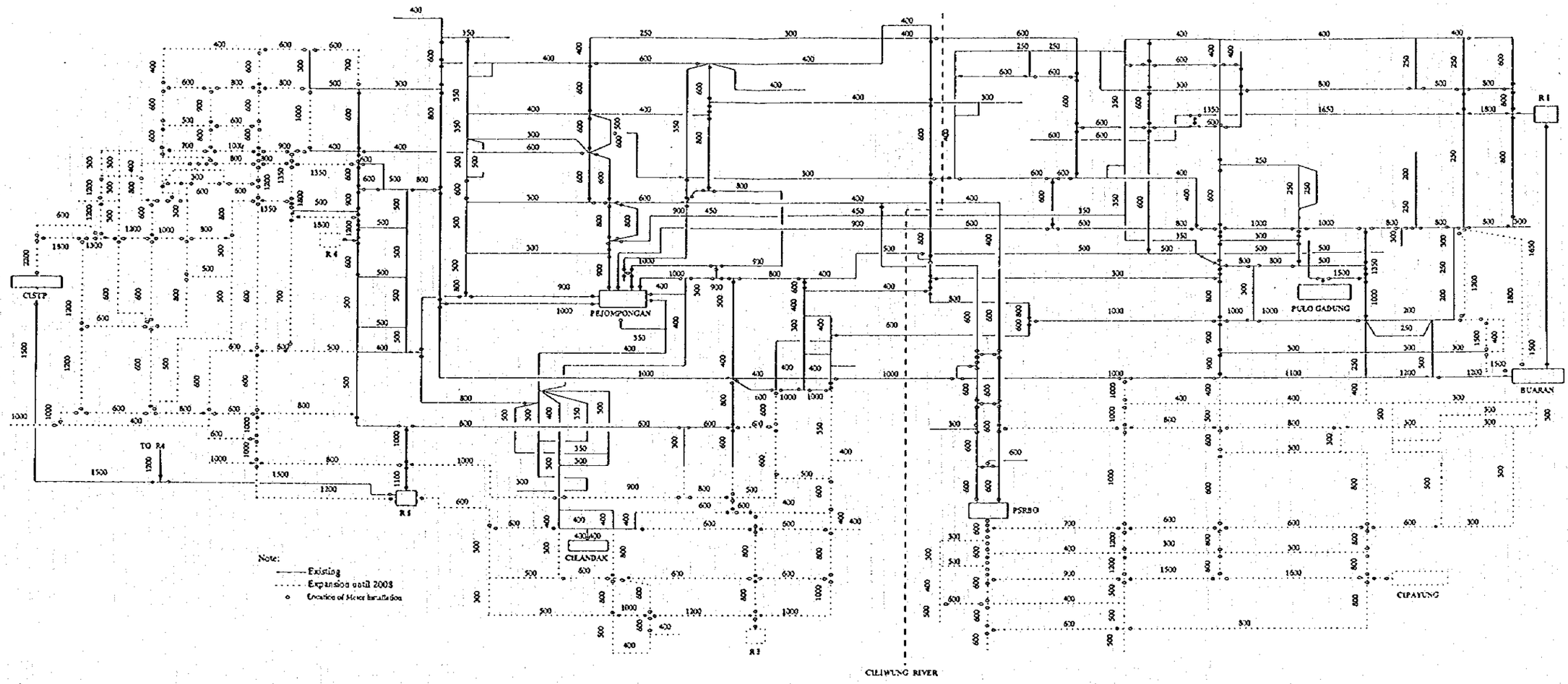
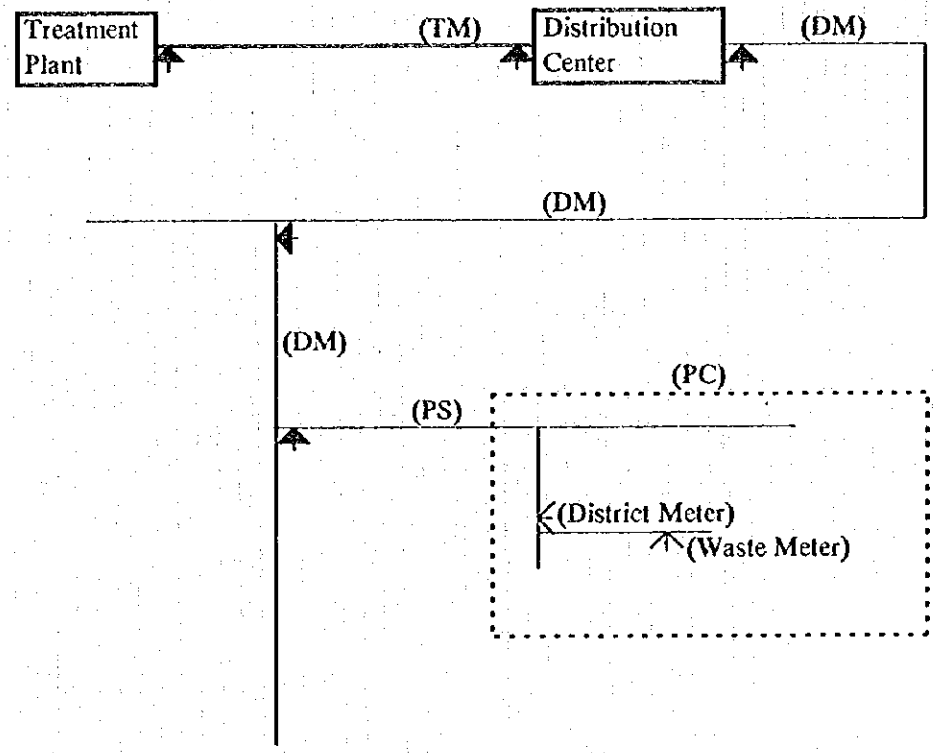


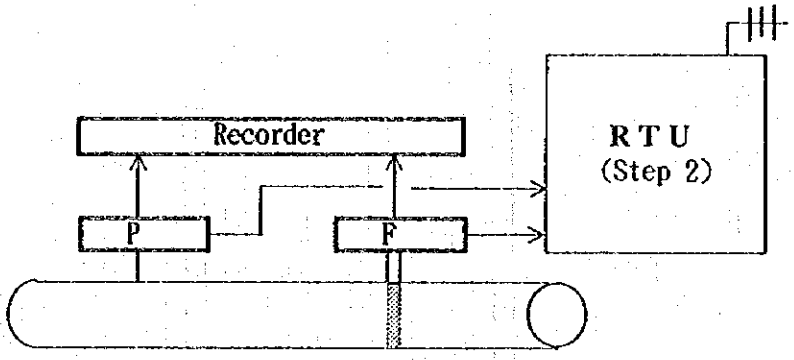
Figure-462.1

## Concept of Pressure/Flow Measurement Point For PAM JAYA SCADA SYSTEM

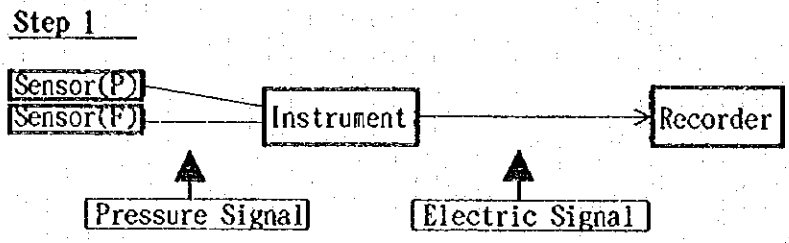



Note: TM; Transmission Main
DM; Distribution Main
PS; Primary System
PC; Primary Cell
→ ; Measurement and continuous monitoring
⇢ ; Intermittent measurement

**Figure-462.3 Installation of Pressure / Flow Meter**




Note: P; Pressure Meter
F; Flow Meter



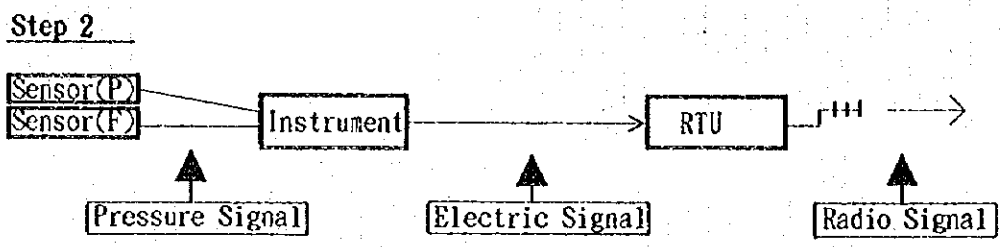
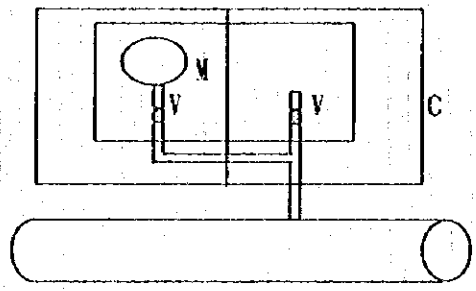



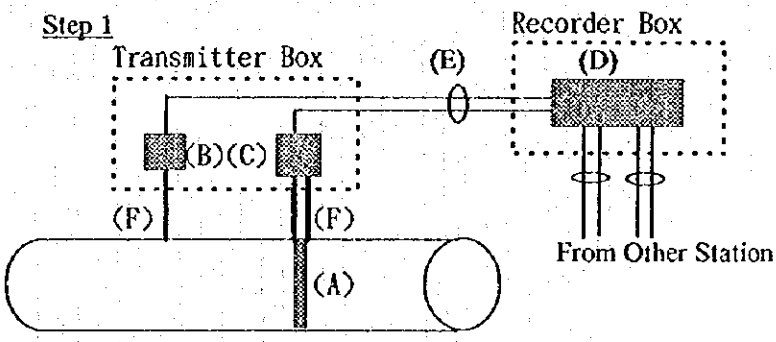
**Figure-462.4 Existing condition of Pressure Meter and Installation of Pressure / Flow Meter ,Transmitter and Recorder**

Existing Pressure Meter




Note:
M; Pressure Meter
V; Valve
C; Concrete Box

Installation of Pressure/Flow Meter, Transmitter and Recorder

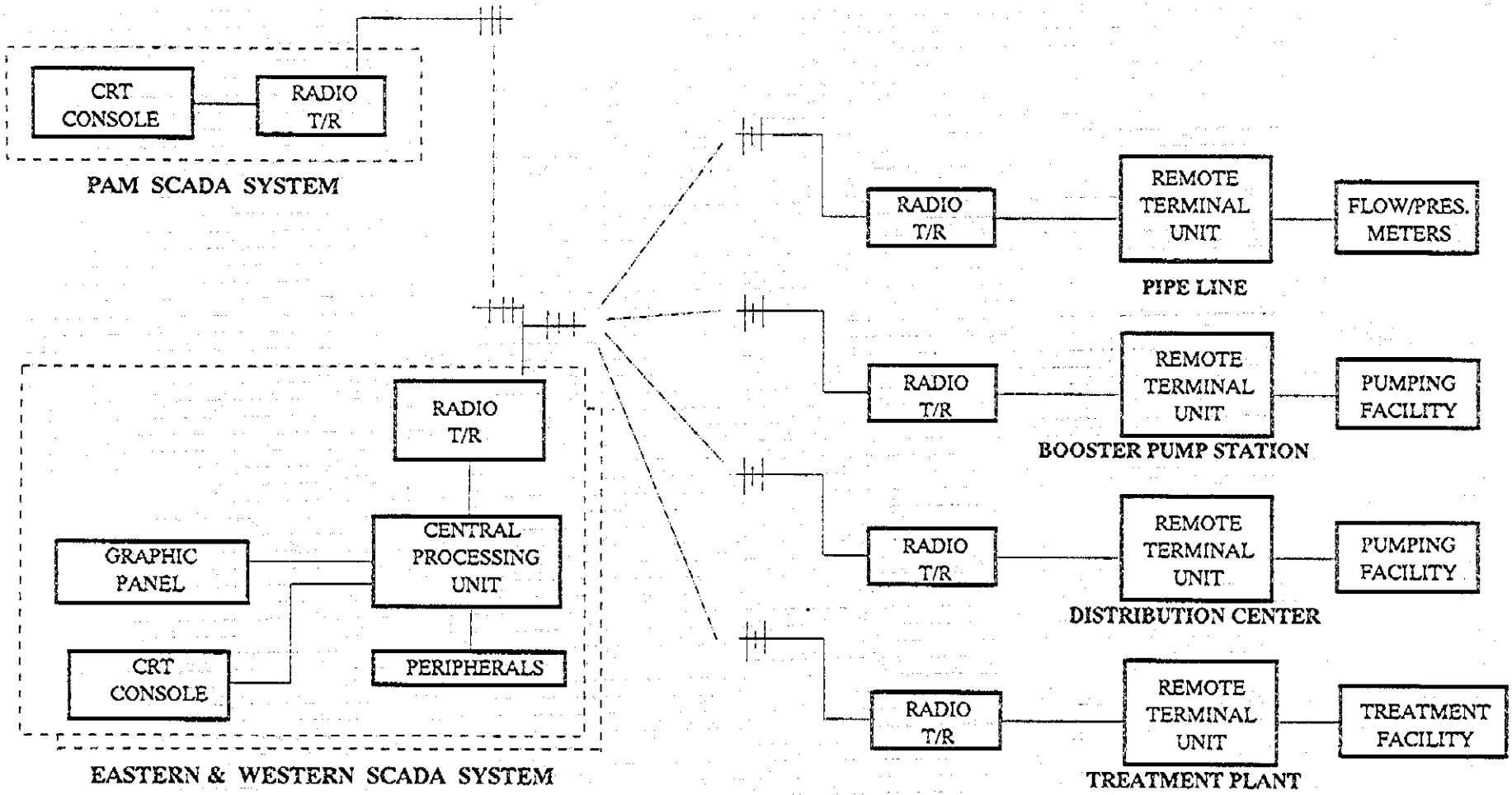



Note:

(A) ; Flow Meter Sensor
(B) ; Pressure Transmitter
(C) : Flow Transmitter
(D) ; Recorder
(E) ; Cable
(F) ; Piping

The recorder will be replaced with RTU in Step 2.

Figure-462.5 HARDWARE LAYOUT OF PAM SCADA SYSTEM




Note: T/R Transmitter & Receiver

## 4.7 PRELIMINARY COST ESTIMATES

### 4.7.1 Unit Costs

For the preliminary cost estimation, unit costs of recent projects were referred to. Although the standard price of Ministry of Public Works and DKI Jakarta were also referred to, these standard prices were usually different from the actual market price. Therefore, unit costs included in tender or contract for the recent projects were applied.

List of projects referred to are as follows;

| | |
|---|---|
| Treatment Plant : | Ujung Pandang Project |
| | Buaran I and Buaran II Projects |
| | Cisadane Project |
| Distribution Center : | Buaran II Project |
| Primary Mains : | Buaran I and Buaran II Projects |
| | PJSIP I |
| Service Mains : | Buaran I and Buaran II Projects |
| | PJSIP |

Unit prices obtained from projects listed above were adjusted by price escalation rate and modified into 1996 price. More detailed information are available in Annex-47.

### 4.7.2 Imported and Local Materials

Costs required for the priority projects were preliminarily estimated in foreign currency portion and local currency portion, separately. The foreign currency portion will be disbursed mainly to imported materials and the local currency portion will be disbursed mainly to locally available materials.

For each facilities, foreign and local portion were assumed as follows;

Treatment Plants

Foreign Currency Portion
- Equipment (mechanical and electrical)
- Monitoring and control equipment
- Large diameter pipes
- Apparatus of in-plant piping (valves etc.)

Local Currency Portion
- Transportation of equipment
- Installation of equipment
- All civil works
- Pipe installation works

Distribution Centers, Raw Water Pumping Station, and Booster Pumping Station

Same as "Treatment Plant"

Pipelines (Raw Water and Treated Water Transmission, Primary, and Service)

Foreign Currency Portion
- Monitoring and control equipment
- Large diameter pipes (more than 300 mm)
- Apparatus of piping (valves etc.)

Local Currency Portion
- Transportation of materials
- Small diameter pipes (small than 300 mm)
- All civil works (bridges, thrust blocks)
- Pipe installation works

### 4.7.3 Investment Cost

Summary of investment costs are as shown on **Table-473.1**.

### 4.7.4 Operation and Maintenance Costs

Costs for operation and maintenance for the facilities to be newly constructed under the priority project were estimated referring to actual costs of existing treatment facilities. These costs include chemicals, raw water, electricity, maintenance, and personnel costs.

The average operation and maintenance cost per cubic meter of produced water per month at a

treatment plant in 1995 were applied to estimation for the new facilities considering escalation. The referred treatment plant was newly constructed and the facilities may be similar to the proposed facilities in this feasibility study, so this cost estimation will be appropriate.

**Table-473.1 SUMMARY OF INVESTMENT COST**

Unit : Million

| | Foreign Currency Yen | Local Currency Rupiah | Total Equivalent Yen |
|---|---|---|---|
| **2nd Phase, Part One** | **54,967** | **986,743** | **101,952** |
| Buaran III Treatment Plant | 6,726 | 115,479 | 12,226 |
| Distribution Center R1 II | 390 | 16,434 | 1,173 |
| Distribution Center R6 I | 409 | 37,869 | 2,212 |
| Treated Water Transmission Main R1 - R6 | 7,203 | 31,993 | 8,727 |
| Primary Mains | 24,639 | 171,096 | 32,787 |
| Service Mains | 7,336 | 340,276 | 23,539 |
| Engineering Services | 3,268 | 21,392 | 4,284 |
| Land Acquisition Costs | 0 | 162,500 | 7,738 |
| Phisycal Contingency | 4,996 | 89,704 | 9,266 |
| **2nd Phase, Part Two** | **47,749** | **1,000,973** | **95,409** |
| Cipayung Treatment Plant | 4,709 | 86,753 | 8,839 |
| Distribution Center R4 II | 741 | 36,596 | 2,484 |
| Distribution Center R5 II | 312 | 27,127 | 1,604 |
| Raw Water Transmission Pipeline | 7,608 | 54,332 | 10,195 |
| Treated Water Transmission Pipeline R5, R4 | 13,078 | 46,838 | 15,310 |
| Primary Mains | 8,750 | 80,100 | 12,566 |
| Service Mains | 5,363 | 248,812 | 17,212 |
| Engineering Services | 2,838 | 17,418 | 3,667 |
| Land Acquisition Costs | 0 | 312,000 | 14,857 |
| Phisycal Contingency | 4,341 | 90,997 | 8,675 |

Excange Rate: 1 Yen = 21Rp.
1996 Price.

### 4.7.5 Disbursement of Costs Required for the Priority Projects

Cost disbursement schedule are prepared based on the proposed implementation schedule and shown on **Tables-475.1, 475.2, and 475.3.**

Operating expenses required for the priority projects are also estimated and shown on **Table-475.4.**

## Table-475.1 DISBURSEMENT SCHEDULE — Foreign Currency Portion (Japanese Yen)

UNIT : MILLION YEN

| | | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2nd Stage | | | | | | | | | | | | | | |
| 2nd Phase, Part One | 54,967 | 0 | 0 | 0 | 11,473 | 13,337 | 16,430 | 9,410 | 2,159 | 2,159 | 0 | 0 | 0 | 0 |
| Buaran III | 6,726 | 0 | 0 | 0 | 1,345 | 2,690 | 2,690 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DC - R1 II | 390 | 0 | 0 | 0 | 0 | 156 | 234 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DC - R6 I | 409 | 0 | 0 | 0 | 82 | 164 | 164 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TM R1 - R6 | 7,203 | 0 | 0 | 0 | 2,161 | 2,161 | 2,881 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PRIMARY MAIN | 24,639 | 0 | 0 | 0 | 6,160 | 6,160 | 6,160 | 6,160 | 0 | 0 | 0 | 0 | 0 | 0 |
| SERVICE MAIN | 7,336 | 0 | 0 | 0 | 0 | 0 | 1,831 | 1,835 | 1,835 | 1,835 | 0 | 0 | 0 | 0 |
| ENGINEERING SERVICE | 3,268 | 0 | 0 | 0 | 682 | 793 | 977 | 560 | 128 | 128 | 0 | 0 | 0 | 0 |
| LAND COST | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PHYSICAL CONT. | 4,996 | 0 | 0 | 0 | 1,043 | 1,213 | 1,493 | 855 | 196 | 196 | 0 | 0 | 0 | 0 |
| 2nd Phase, Part Two | 47,740 | 0 | 0 | 0 | 0 | 0 | 0 | 3,849 | 9,496 | 12,717 | 14,247 | 4,517 | 1,943 | 972 |
| Cipayung T. P. | 4,709 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 942 | 1,884 | 1,884 | 0 | 0 | 0 |
| DC - R4 II | 741 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 148 | 296 | 296 | 0 | 0 | 0 |
| DC - R5 II | 312 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 125 | 187 | 0 | 0 | 0 |
| RAW WATER TRANSMIT | 7,608 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,522 | 3,043 | 3,043 | 0 | 0 | 0 |
| TM CIPAYUNG - R5, R4 | 13,078 | 0 | 0 | 0 | 0 | 0 | 0 | 3,270 | 3,270 | 3,270 | 3,270 | 0 | 0 | 0 |
| PRIMARY MAIN | 8,750 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,188 | 2,188 | 2,188 | 2,188 | 0 | 0 |
| SERVICE MAIN | 5,363 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,238 | 1,650 | 1,650 | 825 |
| ENGINEERING SERVICE | 2,838 | 0 | 0 | 0 | 0 | 0 | 0 | 229 | 564 | 756 | 847 | 268 | 116 | 58 |
| LAND COST | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PHYSICAL CONT. | 4,341 | 0 | 0 | 0 | 0 | 0 | 0 | 350 | 863 | 1,156 | 1,295 | 411 | 177 | 89 |

## Table-475.2 DISBURSEMENT SCHEDULE — Local Currency Portion (Indonesian Rupiah)

UNIT : MILLION RUPIAH

| | | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2nd Stage | | | | | | | | | | | | | | |
| 2nd Phase, Part One | 986,743 | 0 | 178,750 | 0 | 94,086 | 136,282 | 239,858 | 144,898 | 96,435 | 96,435 | 0 | 0 | 0 | 0 |
| Buaran III | 115,479 | 0 | 0 | 0 | 23,096 | 46,192 | 46,192 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DC - R1 II | 16,434 | 0 | 0 | 0 | 0 | 6,574 | 9,860 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DC - R6 I | 37,869 | 0 | 0 | 0 | 7,574 | 15,148 | 15,148 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TM R1 - R6 | 31,993 | 0 | 0 | 0 | 9,598 | 9,598 | 12,797 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PRIMARY MAIN | 171,096 | 0 | 0 | 0 | 42,774 | 42,774 | 42,774 | 42,774 | 0 | 0 | 0 | 0 | 0 | 0 |
| SERVICE MAIN | 340,276 | 0 | 0 | 0 | 0 | 0 | 84,931 | 85,115 | 85,115 | 85,115 | 0 | 0 | 0 | 0 |
| ENGINEERING SERVICE | 21,392 | 0 | 0 | 0 | 2,491 | 3,608 | 6,351 | 3,836 | 2,553 | 2,553 | 0 | 0 | 0 | 0 |
| LAND COST | 162,500 | 0 | 162,500 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PHYSICAL CONT. | 89,704 | 0 | 16,250 | 0 | 8,553 | 12,389 | 21,805 | 13,173 | 8,767 | 8,767 | 0 | 0 | 0 | 0 |
| 2nd Phase, Part Two | 1,000,973 | 0 | 0 | 0 | 0 | 343,200 | 0 | 13,267 | 76,218 | 128,774 | 200,004 | 109,418 | 86,729 | 43,364 |
| Cipayung T. P. | 86,753 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17,351 | 34,701 | 34,701 | 0 | 0 | 0 |
| DC - R4 II | 36,596 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7,319 | 14,638 | 14,638 | 0 | 0 | 0 |
| DC - R5 II | 27,127 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10,851 | 16,276 | 0 | 0 | 0 |
| RAW WATER TRANSMIT | 54,332 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10,866 | 21,733 | 21,733 | 0 | 0 | 0 |
| TM CIPAYUNG - R5, R4 | 46,838 | 0 | 0 | 0 | 0 | 0 | 0 | 11,710 | 11,710 | 11,710 | 11,710 | 0 | 0 | 0 |
| PRIMARY MAIN | 80,100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20,025 | 20,025 | 20,025 | 20,025 | 0 | 0 |
| SERVICE MAIN | 248,812 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 57,443 | 76,548 | 76,548 | 38,273 |
| ENGINEERING SERVICE | 17,418 | 0 | 0 | 0 | 0 | 0 | 0 | 351 | 2,018 | 3,410 | 5,296 | 2,898 | 2,296 | 1,149 |
| LAND COST | 312,000 | 0 | 0 | 0 | 0 | 312,000 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PHYSICAL CONT. | 90,997 | 0 | 0 | 0 | 0 | 31,200 | 0 | 1,206 | 6,929 | 11,706 | 18,182 | 9,947 | 7,885 | 3,942 |

## Table-475.3 DISBURSEMENT SCHEDULE Total Costs (Equivalent Japanese Yen)

UNIT : MILLION YEN 21

| | | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2nd Stage | | | | | | | | | | | | | | |
| 2nd Phase, Part One | 101,952 | 0 | 8,511 | 0 | 15,953 | 19,827 | 27,853 | 16,309 | 6,750 | 6,750 | 0 | 0 | 0 | 0 |
| Buaran III | 12,226 | 0 | 0 | 0 | 2,445 | 4,890 | 4,890 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DC - R1 II | 1,173 | 0 | 0 | 0 | 0 | 469 | 704 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| DC - R6 I | 2,212 | 0 | 0 | 0 | 443 | 885 | 885 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TM R1 - R6 | 8,727 | 0 | 0 | 0 | 2,618 | 2,618 | 3,491 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PRIMARY MAIN | 32,787 | 0 | 0 | 0 | 8,197 | 8,197 | 8,197 | 8,197 | 0 | 0 | 0 | 0 | 0 | 0 |
| SERVICE MAIN | 23,539 | 0 | 0 | 0 | 0 | 0 | 5,875 | 5,888 | 5,888 | 5,888 | 0 | 0 | 0 | 0 |
| ENGINEERING SERVICE | 4,284 | 0 | 0 | 0 | 800 | 965 | 1,279 | 742 | 249 | 249 | 0 | 0 | 0 | 0 |
| LAND COST | 7,738 | 0 | 7,738 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PHYSICAL CONT. | 9,266 | 0 | 773 | 0 | 1,450 | 1,803 | 2,532 | 1,482 | 613 | 613 | 0 | 0 | 0 | 0 |
| 2nd Phase, Part Two | 95,409 | 0 | 0 | 0 | 0 | 16,343 | 0 | 4,482 | 13,126 | 18,849 | 23,771 | 9,729 | 6,073 | 3,037 |
| Cipayung T. P. | 8,839 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,768 | 3,536 | 3,536 | 0 | 0 | 0 |
| DC - R4 II | 2,484 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 497 | 993 | 993 | 0 | 0 | 0 |
| DC - R5 II | 1,604 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 642 | 962 | 0 | 0 | 0 |
| RAW WATER TRANSMIT | 10,195 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2,039 | 4,078 | 4,078 | 0 | 0 | 0 |
| TM CIPAYUNG - R5, R4 | 15,310 | 0 | 0 | 0 | 0 | 0 | 0 | 3,828 | 3,828 | 3,828 | 3,828 | 0 | 0 | 0 |
| PRIMARY MAIN | 12,566 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,142 | 3,142 | 3,142 | 3,142 | 0 | 0 |
| SERVICE MAIN | 17,212 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3,973 | 5,296 | 5,296 | 2,647 |
| ENGINEERING SERVICE | 3,667 | 0 | 0 | 0 | 0 | 0 | 0 | 246 | 660 | 918 | 1,099 | 406 | 225 | 113 |
| LAND COST | 14,857 | 0 | 0 | 0 | 0 | 14,857 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PHYSICAL CONT. | 8,675 | 0 | 0 | 0 | 0 | 1,486 | 0 | 408 | 1,193 | 1,713 | 2,161 | 885 | 552 | 277 |

## Table-475.4 OPERATING EXPENSES AFTER COMPLETION OF BUARAN III

UNIT : MILLION RUPIAH

| | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|
| Operating Expenses | | | | | | | |
| Fuel and Power | 8,389 | 8,586 | 8,787 | 8,984 | 12,478 | 13,093 | 13,707 |
| Chemicals Used | 3,590 | 3,769 | 3,954 | 4,134 | 7,328 | 7,890 | 8,452 |
| Maintenance Material | 1,918 | 1,963 | 2,009 | 4,343 | 3,898 | 4,038 | 4,179 |
| Purchase of Raw Water | 3,062 | 3,216 | 3,373 | 3,527 | 6,252 | 6,731 | 7,210 |
| Salaries & Wages | 296 | 296 | 296 | 296 | 1,004 | 1,004 | 1,004 |
| General Expenses | 178 | 178 | 178 | 178 | 603 | 603 | 603 |

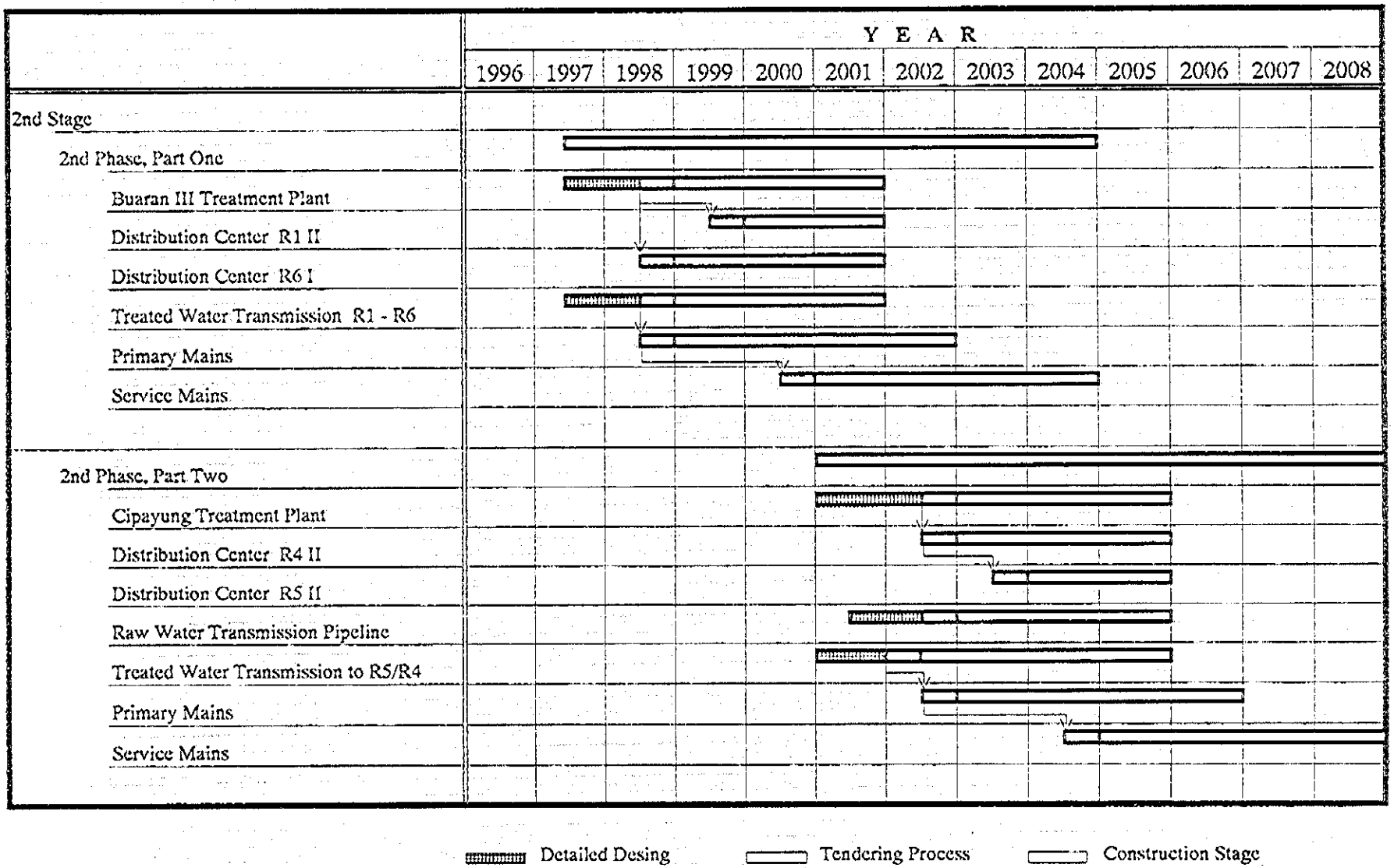
## 4.8 IMPLEMENTATION SCHEDULE

Implementation schedule for the priority projects, namely Part One and Part Two, 2nd Phase of 2nd Stage are proposed as shown on **Figure-480.1**. Implementation schedule is prepared mainly taking the timing completion of upgrading works of WTC into account as explained in the previous **Section 3.12**.

To satisfy increasing water demand in the service area, implementation of the priority projects should not be delay from this schedule. Part One Project will be commenced in the middle of year 1997. It is necessary to start selection of consultants for detailed design works from the beginning of the year 1997 in order to start detail design works on schedule.

It also should be noted that land acquisition for Buaran III and Cipayung Treatment Plant is recommended to be completed as soon as possible. For the smooth implementation of the land acquisition, private sectors and PAM JAYA are recommended to have coordination discussion with agencies concerned and people those who are living in the planed land.

Figure-480.1 IMPLEMENTATION SCHEDULE



## 4.9 ROLE SHARING BETWEEN PUBLIC AND PRIVATE SECTORS

In the Master Plan, desirable allocation of principal functions are defined. Based on the definition, further detailed role sharing between public and private sectors are considered taking risk assignment into account.

Results of the consideration on the risk assignment will be utilized for further consideration of role sharing between public and private sectors. Based of the role sharing derived from risk assignment, required organization of PAM JAYA will be discussed in the next **Chapter 4.10**.

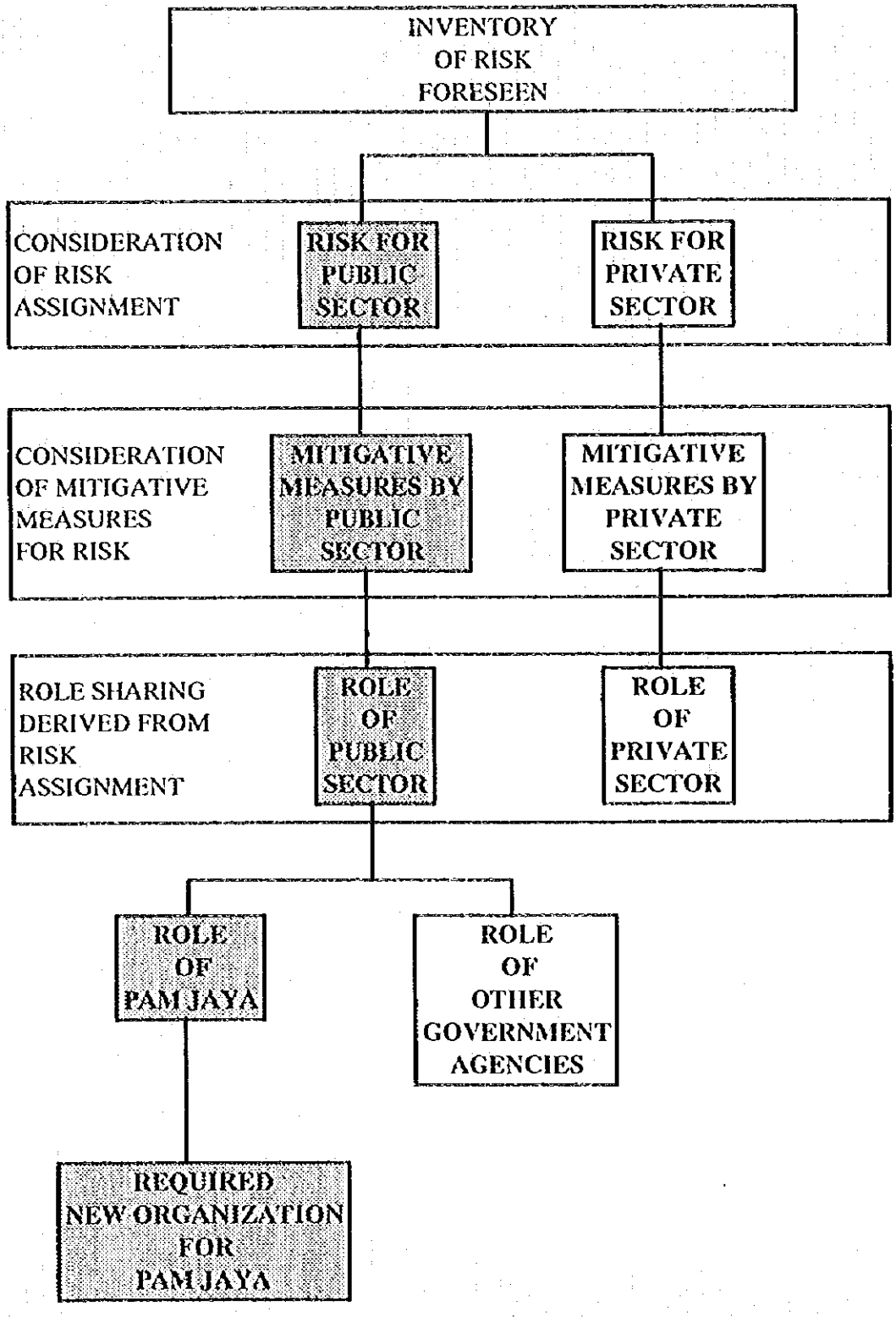
Flow of these consideration is shown on **Figure-491.1** from inventory of risk foreseen to establishment of required new organization for PAM JAYA.

### 4.9.1 Perception of Risk

Private sector participation in provision of infrastructure usually involves four parties which are government, private investor (or operator), customers and staff. In the case of the Jakarta water supply, these four parties can be interpreted as (1) PAM JAYA, (2) consortia, (3) customers, and (4) PAM JAYA employees. These four parties will have to assume certain risk in exchange for expected benefits from private sector participation.

It should be noted that the perception of the risk varies according to the parties. Generally speaking, the risk is perceived most systematically by the private sector than the public sector, customers and employees because the private sector has to measure the risk in order to justify the investment. For most of customers and employees already dependent on existing services, the risk inherent in PSP will be perceived more narrowly and straightforwardly. Customers may associate privatization with the risk of price increase and employees tend to be afraid of possible loss of jobs.

Figure-491.1 FLOW OF CONSIDERATION TO ESTABLISH NEW ORGANIZATION FOR PAM JAYA



In fact, risk perceived by one party is also a risk for other parties from different viewpoints. For example, price increase is a risk for consumers but on the other hand stable price or price decrease may be a risk for the private sector who relies on cash flow from the investment. Risk of losing job perceived by employees can be also viewed by the private investor as a risk of having redundancy.

### 4.9.2 Risk Mitigation and Assignment

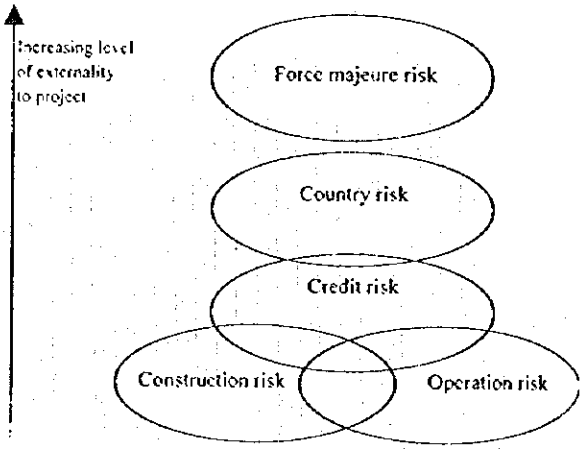
Once the risk is identified, it has to be mitigated and assigned to the parties concerned. Quantification of risk is also required to possible and understandable extent. In assignment of risk, the party most able to handle the risk should undertake it so that the risk load for each party is best mitigated and the total risk load is minimized.

Risk can be itemized most conveniently on the basis of classification used by the private sector. However it should be kept in mind that government, consumers and employees are also exposed to the risk which may be the other side of the coin.

#### (1) Definition of Risks

The risk associated with a PSP in water supply services has been argued in various reports including Feasibility Studies of each consortium, JWSSP and PURSE reports. In this section, an attempt is made to classify the risk on the basis of conceptual distance. To begin with, five major risk categories are selected which are (1) construction risk, (2) operation risk, (3) credit risk, (4) country risk, and (5) force majeure risk. Each risk is not easily separable form the others and they are overlapping in many aspects. In addition, such categories as construction and operation risks are clearly internal to the project and easier to be sensed, while force majeure risk is mostly external to the project and difficult to be foreseen by definition. This conceptual map of the risk is illustrated in **Figure-492.1**.

Figure-492.1 RISK CATEGORIES ASSOCIATED WITH WATER SUPPLY PROJECT




Major risk categories have to be further broken down into subrisks in order for the relevant parties to obtain better understanding of the risk nature. The smaller those subrisks are classified, the better way of mitigation and allocation the parties can find. Examples of subrisk are summarized in subsequent subchapters.

1) Construction Risk

Construction risk is the risk that unexpected events occur prior to completion of the facilities. It is critical to all parties that the construction of facilities is completed, because that is when the water supply services start and generate revenues in order to service debt and provide and equity return. This risk has both technical and managerial nature which may lead to financial loss. Subrisks which fall in this categories are as follows:

- **Cost overrun risk** - During construction stage, unit price or quantity of raw materials and labor often increases whereby the total construction cost is boosted.

- **Delays in construction risk** - It is possible that the project will not be constructed to specification on time.

- **Completion risk** - In the worst case, the construction can not be possibly finished.

- **Land acquisition risk** - Delay or incompletion of the construction may also be due to not being able to obtain land or land use rights or delays in obtaining them.

- **Capacity shortfall risk** - Even when the construction is finished, there will remain the chance that the treatment plant will not have the capacity and ability to deliver the proposed quantities of water at the proposed quality.

- **Environmental risk** - This is the risk of inability to meet environmental standards during facility construction and operation period. The impact is twofold. Firstly it may limit some financing sources especially when the project is financed by international lending agencies which require environmental standards to be met as a condition to their involvement. Secondly the occurrence of environmental damage obviously threaten the project viability by incurring additional expense

2) Operating Risk

This risk can be defined as the potential failure of the project to meet the demand and availability within the specified performance criteria and achieve the required level of quality. Risks emerging after completion of the facilities fall on this category. Like construction risk, this risk too has a both technical and managerial nature which may result in financial adversity. Depending on how each aspect of the project is highlighted, subrisks can arise in a number of ways.

- **Raw water shortage risk** - This includes the risk that insufficient quantity of raw water is available to supply the facilities at the times required.

- **Raw water quality risk** - This risk is defined as the risk that the quality of raw water is deteriorated and falls outside the parameters for which the facilities are designed.

- **Water demand shortage risk** - This is defined as the market risk that there will not be enough customers for the project's services.

- **Treated water quality risk** - There is the risk that the treated water produced by the project facilities can not meet the standards of water quality on sale to customers.

- **Technology risk** - This is the risk that the technology used in the project fails to achieve the required level of water supply

- **System maintenance risk** - This is defined as the potential failure in operating and maintaining the facilities as originally required.

- **Public liability risk** - Important consideration in the context of this risk is to fulfill the social objective of water supply services for the sake of people's benefit.

- **Tariff setting risk** - The tariff level and structure directly affects the water sales revenue on which the project's commercial viability is dependent. The determination method of the tariff is principal concern. This risk is also critical especially when the tariff revision procedure is not periodic or may not follow the change of costs in a timely manner.

3) Credit Risk

Credit risk is defined as the risk that the parties of the project does not have enough creditworthiness to meet its financial obligations to the project. Both public and private party perceive the credit risk of the other, therefore this risk is further divided as follows:

- **Public sector credit risk**
- **Private sector credit risk**

4) Country Risk

Country risk can be defined in both broad and narrow sense. In a broad sense, it contains political, economic and legal risks, representing a host country's overall creditworthiness. In a narrow sense, it depends on legal and regulatory environment and can be referred to as "Sovereign Risk". In this report, subrisks classified under country risk are as follows:

- **Legal risk** - There is the risk that the interpretation and implementation of laws related to the project is different between the private and public sector. It also includes the risk that disputes can not be resolved due to uncertainty of legal environment and that civil action can not be brought before court.

- Change in law risk - Dramatic changes of law through nationalization or expropriation naturally affect project economies. However, more subtle changes of laws and regulations may have a significant impact upon the project, such as (1) changes in law of general application, (2) discriminatory changes in law, (3) changes in law which increase the cost of the project, and (4) changes in law which reduce market demand for the project's product.

- Approval risk - This can be defined as the risk that the project can not obtain appropriate permits or government approvals related to the construction and operation due to lack of regulatory coordination, bureaucratic obstacles, etc.

- **Economic risk** - This risk includes such macro-economic factors as inflation, interest rates and exchange rate volatility. These risks affect the project both pre and post completion and usually have a material effect on construction costs, revenues, operating costs.

- **Currency risk** - This risk includes the risk of a mismatch between local currency sales and foreign currency debt servicing. This risk will be much less of a concern in more developed countries where the local currency is freely convertible or where lenders may accept debt servicing in the same currency as the project revenues.

5) Force Majeure Risk

The occurrence of a disaster during construction and operation of the project facilities will seriously impact the cash flow generating capacity of the project and will require substantial additional investment to restore the project to full operating capacity. Depending on the type of disaster, there are several subrisks in this categories.

- **Natural disaster risk** - Natural disaster like fire, earthquake, drought, flood, typhoon, lighting and tornado may damage or destroy the project.

- **Civil disturbance risk** - Occurrence of civil disturbances, strikes or riots which cause damage to the project facilities can not be ignored.

- **Political risk** - Political structure of the country may change and the project may be nationalized, expropriated or adversely impacted. This risk can also fall on "Country risk"

### (2) Principle of Risk Mitigation and Assignment

In the previous subchapter, major risks and subrisks associated with a PSP in water supply services have identified and defined in general terms. It goes without saying that the specific circumstances of each particular project has its own peculiar character. Therefore, original risk distribution among the parties and risk tolerance of each party vary as well. This leads to the understanding that there is no single recipe of risk mitigation and allocation applicable to all PSPs in water supply. In the face of difficulty to find a panacea, it is worthwhile to confirm the principles for mitigation and assignment.

It should be noted that risk can not possibly eliminated to the full extent. However, the mitigation is possible by efficient assignment to the parties. Risk assignment is the process of allocating the responsibility of managing particular risk or subrisk to a particular party. The most efficient risk assignment among the parties should realize the most acceptable financial structure which minimizes the project cost to be earmarked for reducing the risk.

To this end, there exists only one principle, i.e., **"The party best able to manage and mitigate the risk should assume it"**. In other words, the party unable to bear the consequence of the risk should not take the risk concerned.

**Table-4.2.1** explains the proposed assignment of the risks associated with the PSP in Jakarta water supply. The rationale of the assignment and mitigative measures of each risk are

explained in the subsequent paragraphs.

1) Construction Risk and Operating Risk

These risks should be basically taken by the private sector as the private sector is able to manage most of the risks associated with undertaking the capital works and subsequent operation of the facilities. There are, however, risks that the private sector can not manage such as raw water risk and tariff setting risk.

Raw water volume risk and raw water quality risk over which the private sector has no control should be assigned to the supplier of raw water. In case of Jakarta, the central and the local governments are the suppliers. The public sector itself perceives the raw water risk due to the existing regulatory system of water resources. Establishment of well-organized bulk water supply companies might be a mitigative measure.

Table-492.1 PROPOSED RISK ASSIGNMENT

| Type of Risk | Main assignee of Risk | | REMARKS |
|---|---|---|---|
| | Public | Private | |
| **Construction risk** | | | |
| Cost overrun risk | | X | D/D, S/V, Budgetary arrangement are Private Sector's responsibility |
| Delays in construction risk | | X | Construction works and S/V are Private Sector's responsibility |
| Completion risk | | X | Construction works and S/V are Private Sector's responsibility |
| Land acquisition risk | X | | Procurement of land itself or assistance for procurement is Public Sector's responsibility |
| Capacity shortfall risk | | X | Capacity and quality of constructed facilities are Private Sector's responsibility |
| Environmental risk | | X | Environmental impacts should be minimized by contractor, Private Sector |
| **Operating risk** | | | |
| Raw water shortage risk | X | | Raw water quantity should be secured by Public Sector |
| Raw water quality risk | X | | Raw water quality should be guaranteed by Public Sector |
| Water demand shortage risk | | X | Promotion should be executed by Private Sector |
| Treated water quality risk | | X | Operation of water supply facilities is Private Sector's responsibility |
| Technology risk | | X | Required technology level should be maintained by Private Sector |
| System maintenance risk | | X | Operation of water supply facilities is Private Sector's responsibility |
| Public liability risk | | X | Social benefit should be maximized by Private Sector under S/V of Public Sector |
| Tariff setting risk | X | | Tariff should be decided by Public Sector |
| **Credit risk** | | | |
| Public sector credit risk | | X | Project feasibility should be carefully checked by Private Sector |
| Private sector credit risk | X | | Public Sector should carefully select contractor |
| **Country risk** | | | |
| Legal risk | X | | Private Sector will not be able to control the risk |
| Change in law risk | X | | Private Sector will not be able to control the risk |
| Approval risk | X | | Public Sector's assistance is indispensable |
| Economic risk | X | | Private Sector will not be able to control the risk |
| Currency risk | X | X | Both sides should pay attention |
| **Force majeure risk** | | | |
| Natural disaster risk | X | X | Not controllable |
| Civil disturbance risk | X | | Private Sector will not be able to control the risk |
| Political risk | X | | Private Sector will not be able to control the risk |

2) Credit Risk

Private sector credit risk is perceived by the public sector. By definition this risk will never be transferred from the public sector to the private sector. The public sector instead, can mitigate the private sector credit risk by selecting a qualified operator through a bidding process and demanding a guarantee bond to the private sector.

The public credit risk which is perceived by the private sector can not be transferred to the public sector either. The private sector should evaluate overall performance of the public sector and the country itself. As a result, if any risk still remains, the private sector may ask the public sector or the central government to issue a certain type of government guarantee. Otherwise, the private sector can simply renounce the investment in the country and head for other opportunities.

3) Country Risk

By definition, the public sector is better able to manage these risks. For example, the private sector has little control over exchange rate fluctuation, while the government has various tools to control the national economy. As another example, legal risk related to approval, tariff determination or taxation can not be handled by the private sector. Only the central and the local governments can alleviate the risk by assuring the private sector of no adverse effect to the project.

4) Force Majeure Risk

Force majeure risk can be mitigated to certain extent through the purchase of insurance by private and public insurers. The remaining uninsured risk, however, should be shared between the private and the public sector.

**Table-492.2** summarizes mitigative measures for each risk as explained in previous paragraphs. In the case of Jakarta Water Supply, the Cooperation Agreement which legally defines the specific PSP model is expected to be concluded in late 1996. In terms of the risk assignment and mitigation, the Agreement should be as specific as possible, taking into consideration the principles mentioned so far. Amendments of the

Cooperation agreement after certain period of startup will be also needed, reflecting the findings which can determine the conditions of the Agreement more reasonably. The risk assignment and mitigative measures should be also modified accordingly.

### (3) Administrative Arrangement

The required administrative arrangements for the first stage project, taking PSP into consideration, should be based on the analyses of risk assignment and desirable allocation of functions in the previous subchapters. Such administrative arrangement will include clearer division of functions between the public and private sectors in Jakarta water supply services.

In this subchapter, such administrative arrangement is elaborated for the purpose to provide the guideline. The most practical organizational setup, however, can be achieved with adequate modification in compliance with the latest situation.

#### 1) Legal setup

Legal setup is one of the two regulatory functions required for the water supply operation. This function is two-fold; (1) Preparation and enactment of laws and regulations, and (2) Execution of legal actions. These functions are presently performed by the Central Government and the Local Government (City of Jakarta). This system should remain the same especially at the introductory stage of PSP. The governmental ministries such as the Ministry of Home Affairs and the Ministry of Public Works should be the driving force to establish the legal framework for water supply services by PSP. However, the degree of decentralization should be increased at later stage so that the City of Jakarta or local governments would be more involved in the future.

#### 2) Monitoring

It can be opined that the public sector should minimize to monitor the private sector after starting the PSP. This is true if the private sector does not make the public sector perceive the operational risk. In assuming this function, it is vital, therefore, to carefully select areas that the public sector is better able to manage and produce fruit than the

private sector does or no one does.

The basic object for monitoring is contractual performance of the private consortia. Contractual performance includes all service standards stipulated in the Cooperation Agreements between PAM JAYA and the private consortia. Those uncovered in the Cooperation Agreement should be regulated in an overall institutional framework. Most important technical standards are of water quality and quantity. For example, water flow, pressure and continuity at the distribution system should be carefully monitored and laboratory test of water quality should be centralized by PAM JAYA.

In addition, financial standards will be stipulated in the Cooperation Agreement too. These financial standards include tariff determination and financing for capital work. PAM JAYA will be the most suitable party for the monitoring.

Technical guidance is related with technical audit or monitoring. At present, Cipta Karya of the Ministry of Public Works is charged with technical guidance to PAM JAYA, having specialized facilities and experts in its hand. This function can remain with the same Cipta Karya or PAM JAYA, depending on the decentralization policy of the Central Government. These facilities currently used for technical guidance such as training center should be open to the private consortia if they lack the technical expertise. Technical monitoring will serve to judge whether the technical guidance is necessary for the private consortia.

Water resource arrangement to secure raw water and land acquisition for capital investments will be other areas that PAM JAYA should coordinate between the private consortia and the governmental agencies as a result of performance monitoring.

Table 492.2 MITIGATIVE MEASURES FOR RISK

| Type of Risk | Main assignee of Risk | | MITIGATIVE MEASURES |
|---|---|---|---|
| | Public | Private | |
| **Construction risk** | | | |
| Cost overrun risk | | X | Careful Detailed Design/Supervision by Contractor |
| Delays in construction risk | | X | Careful Detailed Design/Supervision by Contractor |
| Completion risk | | X | Completion test to contractor |
| Land acquisition risk | X | | Careful site selection |
| Capacity shortfall risk | | X | Selection of experienced contractor/Employment of proven technology |
| Environmental risk | | X | Assistance by public sector in environmental regulatory information |
| **Operating risk** | | | |
| Raw water shortage risk | X | | Guarantee by public sector/Establishment of bulk water supply company |
| Raw water quality risk | X | | Guarantee by public sector/Establishment of bulk water supply company |
| Water demand shortage risk | | X | Careful Feasibility Study/Control of groundwater abstruction |
| Treated water quality risk | | X | Selection of experienced contractor and proven technology |
| Technology risk | | X | Employment of proven technology |
| System maintenance risk | | X | Employment of experienced operator/Training |
| Public liability risk | | X | Confirmation of obligation/Monitoring by public sector |
| Tariff setting risk | X | | Speeding-up of approval process by public sector/Agreement of timely revision system |
| **Credit risk** | | | |
| Public sector credit risk | | X | Careful F/S by private/Guarantee letter |
| Private sector credit risk | X | | Selection of experienced operator/Guarantee bond |
| **Country risk** | | | |
| Legal risk | X | | Government guarantee/Legal support and coordination by public sector |
| Change in law risk | X | | Government guarantee/Legal support and coordination by public sector |
| Approval risk | X | | Assistance by public sector/Careful preparation by private sector |
| Economic risk | X | | Careful F/S by private sector |
| Currency risk | X | X | Government guarantee/Exchange rate hedging with bank |
| **Force majeure risk** | | | |
| Natural disaster risk | X | X | Insurance/Allocation to all parties |
| Civil disturbance risk | X | | Government guarantee |
| Political risk | X | | Government guarantee |

Coordination between the East and West consortia has to be done by the public party or PAM JAYA, if necessary. Possible needs for coordination will exist for concerted works or arbitration between both sides. The examples are transmission of treated water from one side to another and compilation of water supply data in Jakarta as a whole.

3) Capital Investments and O/M

These functions will be executed only by the private consortia. However, a part of O/M such as integral water supply monitoring will be actually done by PAM JAYA, alleviating the duty of the private consortia to some extent.

Based on the consideration of the risk assignment and its mitigative measures, role sharing among public and private sectors is summarized as shown on **Table-492.3.**

Table-492.3 ROLE SHARING DERIVED FROM RISK ASSIGNMENT

| Type of Risk | Main assignee of Risk | | ROLE SHARING | |
|---|---|---|---|---|
| | Public | Private | Public Sector | Private Sector |
| **Construction risk** | | | | |
| Cost overrun risk | | X | - | Detail Planning, D/D, S/V, Budgetary arrangement |
| Delays in construction risk | | X | Monitor work progress | S/V |
| Completion risk | | X | Observe completion tests | Execution of completion tests |
| Land acquisition risk | X | | Land acquisition or Assist land acquisition | Assist Public Sector |
| Capacity shortfall risk | | X | Observe completion tests | Completion of project implementation |
| Environmental risk | | X | Assist Private Sector in regulatory aspects | Execute necessary measures to reduce impacts |
| **Operating risk** | | | | |
| Raw water shortage risk | X | | Guarantee required quantity | Measurement and payment of raw water |
| Raw water quality risk | X | | Guarantee quality conforming to the Standard | Check raw water quality (routine) |
| Water demand shortage risk | | X | Planning | Promotion for increasing customer |
| Treated water quality risk | | X | Periodical cross check of data from Private Sector | Check treated/distributed/tap water quality (routine) |
| Technology risk | | X | Technical audit | Maintain suitable technlgy level/assign qualified enginr. |
| System maintenance risk | | X | Technical audit/research on customer satisfaction | Maintain suitable technlgy level/assign qualified enginr. |
| Public liability risk | | X | Planning/research on customer satisfaction | Effort for max. of social benefit under plan of PAM |
| Tariff setting risk | X | | Review proposal from private/approval of new tariff | Review tariff/preparation of proposal for new tariff |
| **Credit risk** | | | | |
| Public sector credit risk | | X | Guarantee | - |
| Private sector credit risk | X | | Financial Audit | Issuance of Guarantee Bond |
| **Country risk** | | | | |
| Legal risk | X | | Legal support and coordination/Guarantee | - |
| Change in law risk | X | | Legal support and coordination/Guarantee | - |
| Approval risk | X | | Legal support and coordination/Guarantee | - |
| Economic risk | X | | Legal support and coordination/Guarantee | - |
| Currency risk | X | X | - | - |
| **Force majeure risk** | | | | |
| Natural disaster risk | X | X | - | - |
| Civil disturbance risk | X | | Legal support and coordination/Guarantee | - |
| Political risk | X | | Legal support and coordination/Guarantee | - |

## 4.10 DESIGNING NEW ORGANIZATION STRUCTURE OF PAM JAYA

As described in the preceding chapter, the operation of Jakarta water supply by the two consortia will invite significant changes in both roles and organization structure of PAM JAYA. Nonetheless, a recent agreement between PAM JAYA and the private consortia requires that the existing organization (DKI Governor's Decree No. 360) continue for one year after the execution of the cooperation between the parties concerned.

In this chapter, new organization structure needed after the one year period is proposed, giving full regard to the role sharing among public and private sectors as summarized in **Table-492.3.**

### 4.10.1 Roles of PAM JAYA

As the first step, role of PAM JAYA should be identified from the role of public sector which is summarized in Table-492.3. Among various roles of public sector, PAM JAYA should have responsibility for monitoring performance of private sectors and coordination between private sectors and other government agencies. Roles of PAM JAYA is summarized on **Table-4101.1**.

Based on the identified roles of PAM JAYA shown on **Table-4101.1**, detail of each role, actions required for each role, and responsible director/bureau are shown on **Table-4101.2**. Required new organization after the private sector participation will be discussed taking responsible director/bureau shown on the Table into account.

Table-4101.1 ROLE SHARING AMONG PUBLIC SECTOR

| Type of Risk | Main assignee of Risk | | ROLE OF PUBLIC SECTOR | | |
|---|---|---|---|---|---|
| | Public | Private | | PAM JAYA | OTHER GOVERNMENT AGENCIES |
| **Construction risk** | | | | | |
| Cost overrun risk | | X | - | - - | - - |
| Delays in construction risk | | X | Monitor work progress | X Monitoring | |
| Completion risk | | X | Observe completion tests | X Observation | |
| Land acquisition risk | X | | Land acquisition or Assist land acquisition | X Procurement | X Assistance |
| Capacity shortfall risk | | X | Observe completion tests | X Observation | |
| Environmental risk | | X | Assist Private Sector in regulatory aspects | X Assistance | X Approval |
| **Operating risk** | | | | | |
| Raw water shortage risk | X | | Guarantee required quantity | X Monitoring/Coordination | X Guarantee |
| Raw water quality risk | X | | Guarantee quality conforming to the Standard | X Monitoring/Coordination | X Guarantee |
| Water demand shortage risk | | X | Planning | X Forecasting/Planning | |
| Treated water quality risk | | X | Periodical cross check of data from Private Sector | X Quality check for monitoring | |
| Technology risk | | X | Technical audit | X Quality check for monitoring | |
| System maintenance risk | | X | Technical audit/research on customer satisfaction | X Research | |
| Public liability risk | | X | Planning/research on customer satisfaction | X Planning/Research | |
| Tariff setting risk | X | | Review proposal from private/approval of new tariff | X Review | X Approval |
| **Credit risk** | | | | | |
| Public sector credit risk | | X | Guarantee | X Coordination | X Guarantee |
| Private sector credit risk | X | | - | X Keep Guarantee Bond | |
| **Country risk** | | | | | |
| Legal risk | X | | Legal support and coordination/Guarantee | X Coordination | X Legal support/Guarantee |
| Change in law risk | X | | Legal support and coordination/Guarantee | X Coordination | X Legal support/Guarantee |
| Approval risk | X | | Legal support and coordination/Guarantee | X Coordination | X Legal support/Guarantee |
| Economic risk | X | | Legal support and coordination/Guarantee | X Coordination | X Legal support/Guarantee |
| Currency risk | X | X | - | - - | - - |
| **Force majeure risk** | | | | | |
| Natural disaster risk | X | X | - | - - | - - |
| Civil disturbance risk | X | | Legal support and coordination/Guarantee | X Coordination | X Legal support/Guarantee |
| Political risk | X | | Legal support and coordination/Guarantee | X Coordination | X Legal support/Guarantee |
| | | | Overall coordination between East and West | X Coordination | |

**Table-4101.2 ORGANIZATIONAL ARRANGEMENT REQUIRED FOR PAM JAYA'S NEW ROLE**

| Type of Risk | ROLE OF PAM JAYA | Action Required | | RESPONSIBLE DIRECTOR/BUREAU |
|---|---|---|---|---|
| **Construction risk** | | | | |
| Cost overrun risk | - | - | | - |
| Delays in construction risk | Monitor work progress | Monitoring | | Technical Director |
| Completion risk | Observe completion tests | Observation | | Technical Director |
| Land acquisition risk | Land acquisition or Assist land acquisition | Procurement | | Planning/Finance Bureau |
| Capacity shortfall risk | Observe completion tests | Observation | | Technical Director |
| Environmental risk | Assist Private Sector in regulatory aspects | Assistance | | Technical Director |
| **Operating risk** | | | | |
| Raw water shortage risk | Guarantee required quantity | Monitoring/Coordinatio | Quality analysis | W. Quality Monitoring Breu. |
| Raw water quality risk | Guarantee quality conforming to the Standard | Monitoring/Coordinatio | Quality analysis | W. Quality Monitoring Breu. |
| Water demand shortage risk | Planning | Forecasting/Planning | | Planning Bureau |
| Treated water quality risk | Periodical cross check of data from Private Sector | Quality check for monitoring | Quality analysis | W. Quality Monitoring Breu. |
| Technology risk | Technical audit | Quality check for monitoring | | Technical Director |
| System maintenance risk | Technical audit/research on customer satisfaction | Research | PAM SCADA System | O/M Bureau |
| Public liability risk | Planning/research on customer satisfaction | Planning/Research | PAM SCADA System | O/M Breu./Public Relation |
| Tariff setting risk | Review proposal from private/approval of new tariff | Review | | Planning/Finance Bureau |
| **Credit risk** | | | | |
| Public sector credit risk | Guarantee | Coordination | | Finance Bureau |
| Private sector credit risk | - | Keep Guarantee Bond | | Finance Bureau |
| **Country risk** | | | | |
| Legal risk | Legal support and coordination/Guarantee | Coordination | | General Affairs Bureau |
| Change in law risk | Legal support and coordination/Guarantee | Coordination | | General Affairs Bureau |
| Approval risk | Legal support and coordination/Guarantee | Coordination | | General Affairs Bureau |
| Economic risk | Legal support and coordination/Guarantee | Coordination | | General Affairs Bureau |
| Currency risk | - | - | | |
| **Force majeure risk** | | | | |
| Natural disaster risk | - | - | | |
| Civil disturbance risk | Legal support and coordination/Guarantee | Coordination | | General Affairs Bureau |
| Political risk | Legal support and coordination/Guarantee | Coordination | | General Affairs Bureau |
| | Overall coordination between East and West | Coordination | PAM SCADA System | O/M Bureau |

### 4.10.2. Variations from the Existing Organization

A significant change in organization stems from transferring branch (cabang), sub-branch (rayon) and treatment plants to the private consortia since private investors handle operations, maintenance and customer-related tasks, making it unnecessary for PAM JAYA to directly deal with consumers and facilities. In other words, PAM JAYA will indirectly interface with customers and facilities as a regulatory body, which necessities only headquarters function.

### 4.10.3 Alternatives of New Organization Structure of PAM JAYA

Four organization structures are presented here by taking into consideration the aforementioned PAM JAYA's roles after the private sector participation and the existing headquarters' functions of PAM JAYA. Main differences between four alternatives are the number of directors (vertical relationship) and managerial layers, more specifically, the existence of bureaus (horizontal relationship). The four alternatives of new organization structure of PAM JAYA is depicted in the form of an organization chart as presented in **Figure-4103.1, Figure-4103.2, Figure-4103.3** and **Figure-4103.4**, respectively.

Figure-4103.1 PROPOSED ORGANIZATION STRUCTURE OF PAM JAYA AFTER SEPTEMBER 1997 (Alternative 1)

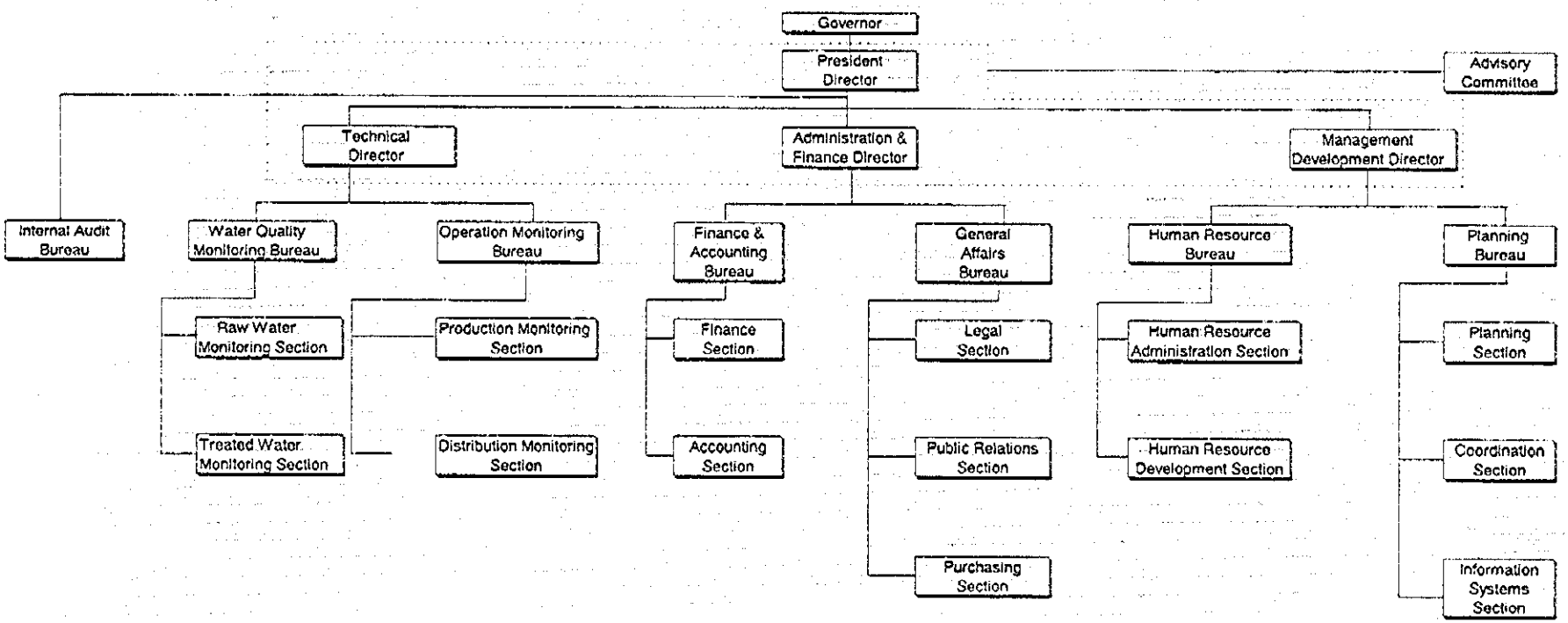


Figure-4103.2 PROPOSED ORGANIZATION STRUCTURE OF PAM JAYA AFTER SEPTEMBER 1997 (Alternative 2)

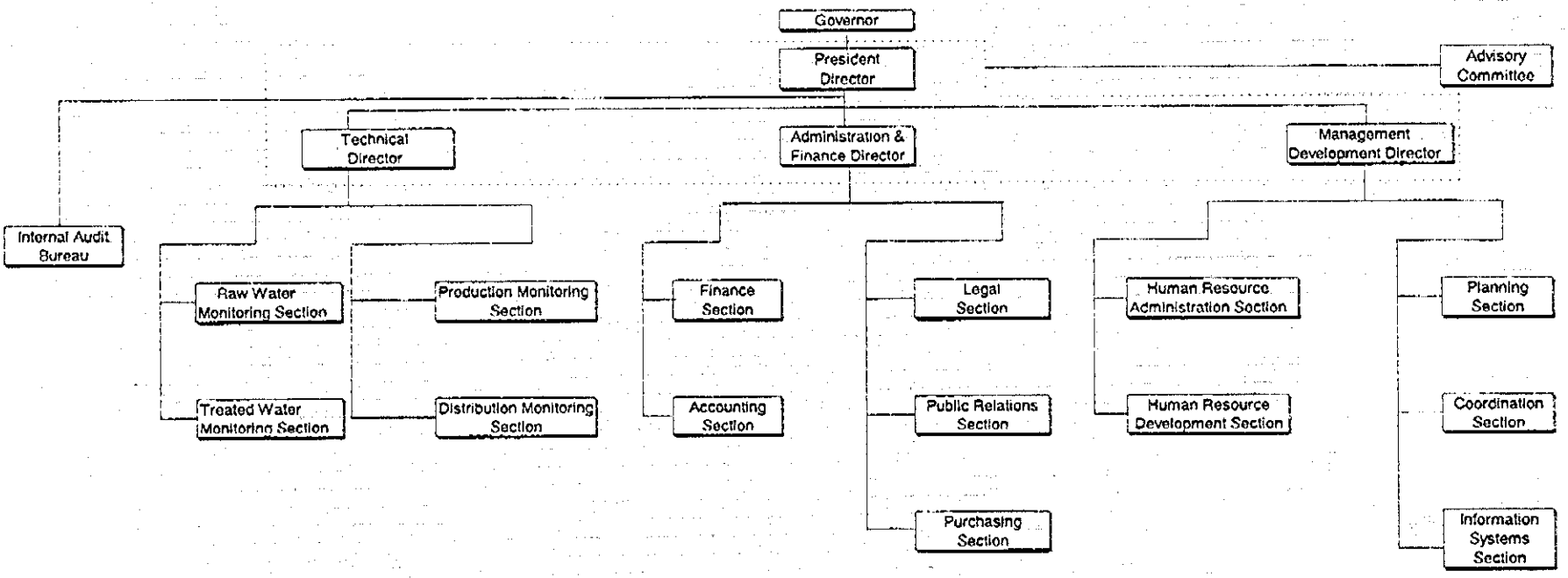


Figure-4103.3 PROPOSED ORGANIZATION STRUCTURE OF PAM JAYA AFTER SEPTEMBER 1997 (Alternative 3)

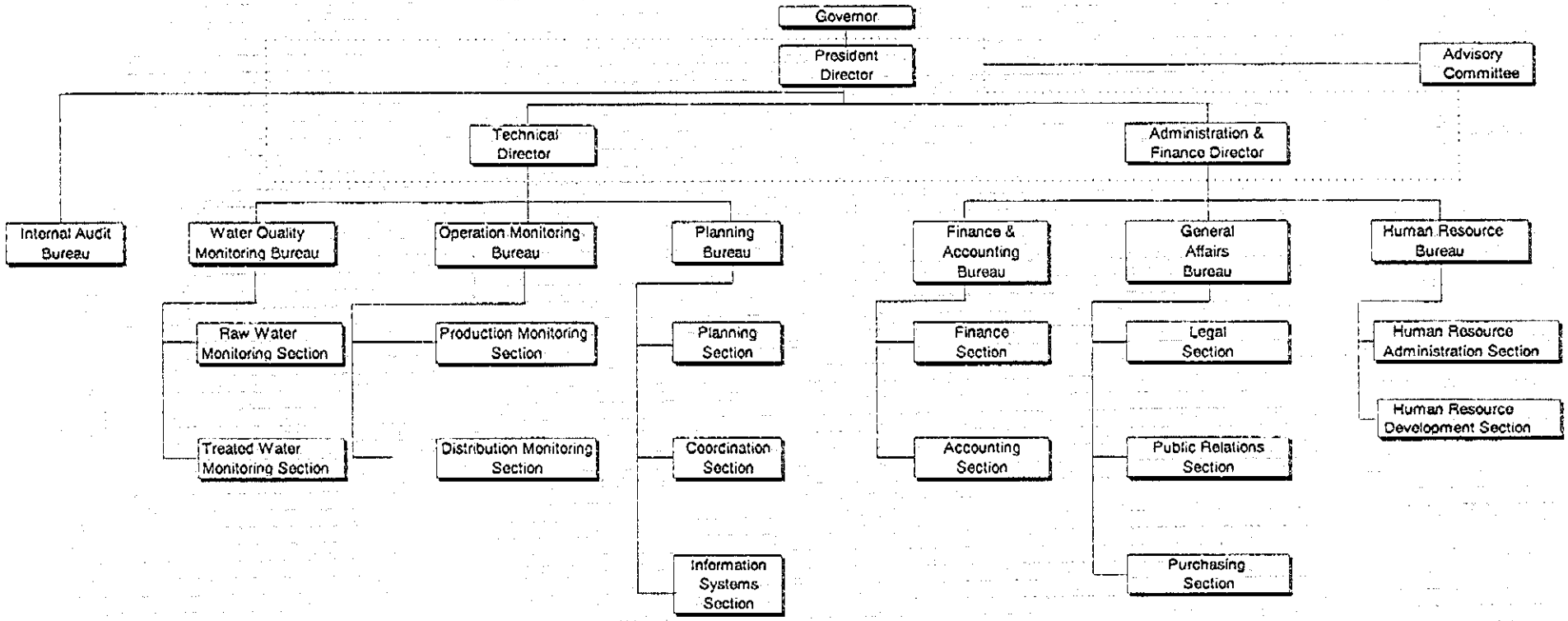
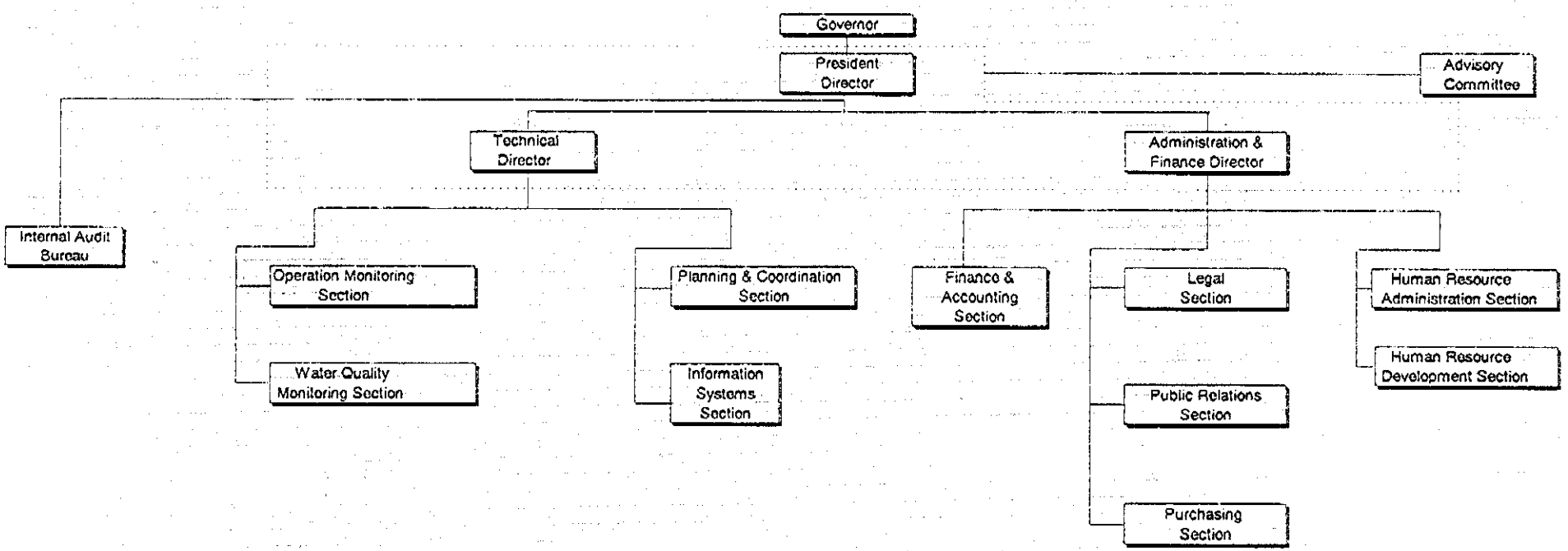


Figure-4103.4 PROPOSED ORGANIZATION STRUCTURE OF PAM JAYA AFTER SEPTEMBER 1997
(Alternative 4)



### 4.10.4 Comparison Between and Selection of Alternatives

Relative advantages and disadvantages of four alternatives are given in the table below.

| Alternative | Differences | Advantages | Disadvantages |
|---|---|---|---|
| 1 | 4 directors and 7 bureaus under directors. | Able to hire more staff. | Tends to be overstaffed. Administrative costs are high. |
| 2 | 4 directors. Sections are directly under defectors with no bureaus. | Able to reduce the number of layers of middle management, therefore, costs can be reduced. Able to speed up decision making. | Reduce opportunities for promotion. Becomes difficult to supervise sections. |
| 3 | 3 directors and 7 bureaus under directors. | Same as alternative 1. | Tends to be overstaffed. Administrative costs are high. Maybe difficult for each director to control subordinate bureaus and sections. |
| 4 | 3 directors. Sections are directly under directors with no bureaus. | Fewer staff are needed, therefore, able to reduce costs. Able to hasten decision making. Communication can be effective. | Need more skilled staff. Limit opportunities for promotion. Difficult for each director to control their responsible sections. |

Alternative 1 and 2 are similar to the existing organization in that bureaus are under three directors while Alternative 3 and 4 are departmentalized and based on technical and non-technical functions and each function is under Technical Director, and Administration and Finance Director. Furthermore, Alternative 1 and 3 have three layers (Directorate, Bureau and Section) whereas Alternative 2 and 4 have two layers (Directorate and Section).

In selecting an alternative, particular attention should be paid to advantages and disadvantages of each alternative and the latest situation at the time of reorganization. However, considering the new experience of PAM JAYA as a regulatory organization as opposed to the old roles as an operator, quick reductions in both organization and staff may bring about confusion. It is feasible, therefore, to select Alternative 1 at the initial period of private participation. After PAM JAYA fully possesses expertise as a regulator and coordinator, it is desirable that PAM JAYA should select Alternative 4 because this alternative will contribute to fast decision making, effective communication, and reduction in costs which will reflect in tariffs.

It is important to note that organization structures are provided as a guideline, therefore, they should be modified, if necessary, after the negotiation with the private consortia which will determine the number of the staff and roles of PAM JAYA

### 4.10.5 Main Tasks of Each Bureau/Section

Main tasks of each bureau or section based on the alternative 1 are described below by taking into consideration the functions and subfunctions of PAM JAYA recommended in Section 4.9. Tasks of the other three alternatives, however, are not explained here in that fundamental functions each section and/or bureau (if any), perform(s) are much the same in all the alternatives.

#### (1) Board of Directors

Board of directors formulates policy and goal of Jakarta water supply sector and is responsible for corporate and financial performance.

*Internal Audit Bureau*

Internal Audit Bureau, which directly reports to president director, undertakes financial as well as operational audit.

### (2) Management Development Directorate

*Planning Bureau*

Planning section is responsible for Planning and development of strategies for future water supplies within the regional context in accordance with policy and goals of the board of directors and conducts a review of plan of each consortia, demand projections and setting tariffs payable by customers.

Coordination section coordinates through formal and informal arrangements of the activities of the private consortia and the relevant governmental authorities.

Information systems section is responsible for receiving such key data as technical, finance and customer from the private consortia and distributing these date to the relevant organization components for analyses and also producing PAM JAYA internal data for organization components concerned.

*Human Resource Bureau*

Human resource administration section is responsible for salaries, incentives, benefits, company rules and regulations, welfare, disciplinary action and appeal procedures, and coordination with the private consortia regarding personnel matters. Human resource development section is in charge of recruitment, selection and assignment, training, personnel appraisal and promotion, and maintenance of personnel data.

### (3) Administration and Finance Directorate

*Finance and Accounting Bureau*

Finance section is responsible for budgeting, reimbursing and borrowing of loans, preparing

financial plan, and analysis of financial performance of the private consortia. Accounting section is in charge of bookkeeping, preparation of financial reports, maintaining assets, and maintaining escrow accounts.

*General Affairs Bureau*

Legal section is mainly responsible for evaluating and monitoring that the terms and conditions of the cooperation agreement between PAM JAYA and the private consortia are being met, advising the private consortia as to laws and regulations of the relevant government authorities, and assisting the private consortia in procuring licenses and permits.

Public relations section is in conjunction with the private consortia, interface with customers such as informing the public, local government units and mass media about activities of water enterprise, doing research on customer satisfaction, issuing publications and information to the people about drinking water, and implementing efforts to improve public participation in conserving water. Purchasing section is in charge of purchasing supplies and equipment and of warehousing thereof.

**(4) Technical Directorate**

*Operation Monitoring Bureau*

Production monitoring section monitors and evaluates technical performance targets and construction projects (mainly treatment plants) of the private consortia, and reviews and gives advice on water treatment plant activities.

Distribution monitoring section monitors and evaluates service targets and performance, such as water pressure, NRW reduction, and coverage, and also monitors distribution related projects of the private consortia.

*Water Quality Monitoring Bureau*

Raw water control section conducts monitoring on raw water quality and quantity. Treated water control section monitors water quality of supplied water to the customers.

*Project Implementation Unit for Priority Projects*

Since all the construction and investments will be undertaken by the private consortia, it is not necessary for PAM JAYA to set up project implementation units. However, staff from relevant bureau and/or section such as legal, coordinating, and operation monitoring section should assist the private consortia in procuring licenses and permits and in land acquisition, and also monitor construction of the projects. Therefore, inclusion of PAM JAYA staff in Project implementation unit of the private consortia should be considered.

### 4.10.6 Additional Steps Required for Effective Implementation of New Organization

After the number of staff remained with PAM JAYA and roles of PAM JAYA are agreed upon and therefore required sections and/or bureaus are determined, certain actions must be taken to successfully carry out new organization.

1) Work analysis such as allocation of duties and responsibilities among sections and bureaus and between individuals are performed by management consultants.
2) Based on the analysis above, detailed job description of each staff should be prepared and required staff should be assigned in accordance with his/her skills and expertise.

As mentioned in the preceding chapter, regulatory roles of PAM JAYA will necessitate further strengthening its managerial capabilities as well as staff skills. Strengthening skills and abilities of all levels of personnel in the organization should be done through effective training. In order to secure the full benefits of successful training, full regard should be given to the following.

1) There should be a clear set of objectives and defined policy for training.
2) The training program should be planned carefully.
3) Consideration must be given to the choice of the most appropriate methods of raining. These can include: in-houses courses and external courses in the private consortia.
4) There should be an effective system of review and evaluation including the on-going monitoring of progress, a supporting appraisal system and the maintenance of suitable training records.

## 4.11 FINANCIAL AND ECONOMIC ANALYSIS OF PROJECT

In this chapter, the project proposed in this study is evaluated in financial and economic terms. For the assessment of financial feasibility of the project, financial internal rate of return (FIRR) is used to measure and subsequently assess the overall financial sustainability. In respect of economic evaluation, economic internal rate of return is obtained in order to analyze the project's contribution to the Indonesian national economy as a whole. The project's intangible econimic benefits, which cannot be assessed in actual monetary terms, but should be entered into investment considerations, are described.

### 4.11.1 General Assumption for Analysis

Major assumptions underlying the analyses are as follows:

1) Project life is assumed to be 30 years from project implementation.

2) In accordance with generally accepted guidelines for financial and economic analysis, the costs used in both the analysis are in constant early 1996 prices.

3) In connection with 2) above, price contingencies which allow for general inflation are omitted from both the financial and the economic analysis. Physical contingency allowances are not added to the baseline cost.

4) Reference money - ¥1 = Rp 21. The foreign currency portion for each year is converted from Yen to Rupiah on the basis of the ¥1/Rp21

### 4.11.2 Financial Analysis

Financial viability of the project will be measured by Financial Internal Rates of Return (FIRR) that makes the net present value of the incremental net benefit stream or incremental cash flow equal zero. It is the maximum interest that a project could pay for the resources used if the project is to recover its investment as well as operating expenses. The mathematical statements of FIRR is given below.

In the mathematical formulation,

$$\sum_{t=1}^{t=n} \frac{Bt - Ct}{(1+i)^t} = 0$$

Bt = benefit in each year

Ct = cost in each year

t = 1,2,...,n

n = number of years

I = interest (discount) rate

### 4.11.3 Assumptions for Financial Analysis

#### (1) Tariff

For the calculation of FIRR, the projected tariff in 1997 of scenario A3 of financial projections prepared in the Master plan is taken as the initial tariff applied to the first year of the project, thus assuming that there will be a 2.1 percent increase every three years in real term, which is equivalent to a 30 percent increase every three years in nominal term as in scenario E of the financial projections.

#### (2) Cost elements and expenditures

In keeping with generally accepted guideline for financial analysis, an inflation factor or price escalation is eliminated, therefore, unit variable costs are assumed constant at present level. As described in the general assumptions above, the investment cost without price escalation is counted.

### 4.11.4 Result of Financial Analysis

The calculation of FIRR of the priority projects is shown in Table-.4114.1. The FIRR for the proposed projects works out at 9.17 percent. In order for the project to be financially feasible, this rate (9.17%) should be larger than the rate at which the water supply enterprise is able to borrow money. Provided that the private consortia are able to obtain Rupiah at the borrowing rate between 9 and 10 percent as PAM JAYA can currently do through such public funds as OECF and IBRD, this project is acceptable.

Even if the average tariff remains unchanged in 1997, the FIRR is the same as the original scenario where the average tariff is increased in 1997 by 30 % in nominal term (2.1 % in real term). This is due to the fact that from 1997 to 2001 revenue is not dependent variable of the average tariff because incremental production is still zero in these periods and therefore tariff revenue from this project is nil in the same period.

### 4.11.5 Economic Analysis

#### (1) Economic Internal Rate of Return

Economic analysis of the project will be conducted using Economic Internal Rate of Return (EIRR) to estimate the economic value of the project to the nation as a whole. The financial prices described in the above financial analysis are adjusted as needed to reflect the value to the society as a whole of both the inputs and outputs of the project. The mathematical formulation for calculating EIRR, however, is the same as that of FIRR.

**Table-4114.1 Calculation of Financial Internal Rate of Return**

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Incremental Consumption (Million m3/Yr) | 0 | 0 | 0 | 0 | 0 | 101 | 106 | 111 | 116 | 206 | 219 | 232 | 237 | 234 | 231 |
| Unaccounted-for water (UFW) | | | | | | 10.0% | 10.0% | 10.0% | 10.0% | 10.0% | 11.2% | 12.3% | 13.5% | 14.6% | 15.8% |
| Incremental Production (Million m3) | 0 | 0 | 0 | 0 | 0 | 112 | 118 | 124 | 129 | 229 | 247 | 264 | 274 | 274 | 274 |
| Average Tariff (Rp/m3) | 1,856.40 | 1,856.40 | 1,856.40 | 1,895.38 | 1,895.38 | 1,895.38 | 1,935.19 | 1,935.19 | 1,935.19 | 1,975.83 | 1,975.83 | 1,975.83 | 2,017.32 | 2,017.32 | 2,017.32 |
| *Inflow* | | | | | | | | | | | | | | | |
| Tariff Revenue | 0 | 0 | 0 | 0 | 0 | 191,349 | 205,160 | 215,191 | 224,983 | 407,232 | 432,823 | 457,614 | 478,790 | 472,405 | 466,021 |
| Total Cash Inflow | 0 | 0 | 0 | 0 | 0 | 191,349 | 205,160 | 215,191 | 224,983 | 407,232 | 432,823 | 457,614 | 478,790 | 472,405 | 466,021 |
| *Outflow* | | | | | | | | | | | | | | | |
| Operating Expenses | | | | | | | | | | | | | | | |
| Fuel and Power | 0 | 0 | 0 | 0 | 0 | 8,389 | 8,586 | 8,787 | 8,984 | 12,478 | 13,093 | 13,707 | 14,062 | 14,062 | 14,062 |
| Chemicals Used | 0 | 0 | 0 | 0 | 0 | 3,590 | 3,769 | 3,954 | 4,134 | 7,328 | 7,890 | 8,452 | 8,776 | 8,776 | 8,776 |
| Maintenance Material | 0 | 0 | 0 | 0 | 0 | 1,918 | 1,963 | 2,009 | 4,343 | 3,898 | 4,038 | 4,179 | 4,260 | 4,260 | 4,260 |
| Purchase of Raw Water | 0 | 0 | 0 | 0 | 0 | 3,062 | 3,216 | 3,373 | 3,527 | 6,252 | 6,731 | 7,210 | 7,487 | 7,487 | 7,487 |
| Salaries & Wages | 0 | 0 | 0 | 0 | 0 | 296 | 296 | 296 | 296 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 |
| General Expenses | 0 | 0 | 0 | 0 | 0 | 178 | 178 | 178 | 178 | 603 | 603 | 603 | 603 | 603 | 603 |
| Capital Expenditures | 162,500 | 0 | 304,563 | 690,498 | 531,730 | 396,920 | 336,666 | 403,125 | 368,199 | 185,697 | 115,930 | 57,965 | 0 | 0 | 0 |
| Changes in Inventories | 0 | 0 | 0 | 0 | 0 | 37 | 38 | 419 | 458 | 117 | 117 | 68 | 0 | 0 | 0 |
| Total Cash Outflow | 162,500 | 0 | 304,563 | 690,498 | 531,730 | 414,391 | 354,713 | 422,142 | 390,119 | 217,377 | 149,406 | 93,187 | 36,193 | 36,193 | 36,193 |
| *Net benefit before financing* | | | | | | | | | | | | | | | |
| Total | -162,500 | 0 | -304,563 | -690,498 | -531,730 | -223,042 | -149,553 | -206,951 | -165,136 | 189,854 | 283,417 | 364,426 | 442,597 | 436,213 | 429,828 |
| Incremental | -162,500 | 0 | -304,563 | -690,498 | -531,730 | -223,042 | -149,553 | -206,951 | -165,136 | 189,854 | 283,417 | 364,426 | 442,597 | 436,213 | 429,828 |
| Financial Internal Rate of Return (FIRR) | 9.17% | | | | | | | | | | | | | | |

Table-4114.1 Calculation of Financial Inter

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Incremental Consumption (Million m3/Yr) | 228 | 225 | 222 | 218 | 215 | 212 | 209 | 206 | 207 | 208 | 210 | 211 | 213 | 214 | 215 |
| Unaccounted-for water (UFW) | 16.9% | 18.1% | 19.2% | 20.4% | 21.5% | 22.7% | 23.8% | 25.0% | 24.5% | 24.0% | 23.5% | 23.0% | 22.5% | 22.0% | 21.5% |
| Incremental Production (Million m3) | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 |
| Average Tariff (Rp/m3) | 2,059.68 | 2,059.68 | 2,059.68 | 2,102.94 | 2,102.94 | 2,102.94 | 2,147.10 | 2,147.10 | 2,147.10 | 2,192.19 | 2,192.19 | 2,192.19 | 2,238.22 | 2,238.22 | 2,238.22 |
| *Inflow* | | | | | | | | | | | | | | | |
| Tariff Revenue | 469,288 | 462,769 | 456,251 | 459,176 | 452,520 | 445,865 | 448,432 | 441,649 | 444,593 | 456,936 | 459,942 | 462,948 | 475,739 | 478,808 | 481,878 |
| Total Cash Inflow | 469,288 | 462,769 | 456,251 | 459,176 | 452,520 | 445,865 | 448,432 | 441,649 | 444,593 | 456,936 | 459,942 | 462,948 | 475,739 | 478,808 | 481,878 |
| *Outflow* | | | | | | | | | | | | | | | |
| Operating Expenses | | | | | | | | | | | | | | | |
| Fuel and Power | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 | 14,062 |
| Chemicals Used | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 | 8,776 |
| Maintenance Material | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 | 4,260 |
| Purchase of Raw Water | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 | 7,487 |
| Salaries & Wages | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 | 1,004 |
| General Expenses | 603 | 603 | 603 | 603 | 603 | 603 | 603 | 603 | 603 | 603 | 603 | 603 | 603 | 603 | 603 |
| Capital Expenditures | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Changes in Inventories | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Cash Outflow | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 | 36,193 |
| *Net benefit before financing* | | | | | | | | | | | | | | | |
| Total | 433,095 | 426,577 | 420,058 | 422,983 | 416,328 | 409,672 | 412,240 | 405,456 | 408,400 | 420,743 | 423,749 | 426,755 | 439,546 | 442,616 | 445,685 |
| Incremental | 433,095 | 426,577 | 420,058 | 422,983 | 416,328 | 409,672 | 412,240 | 405,456 | 408,400 | 420,743 | 423,749 | 426,755 | 439,546 | 442,616 | 445,685 |

Financial Internal Rate of Return (FIRR)

### 4.11.6 Adjustments

Adjustments of financial prices to economic values are outlined below.

**(1) Benefits**

Assuming that the real economic value of water free from market distortion in Jakarta is reveled in the consumers' willingness to pay, the actual tariff used in the financial analysis are replaced by the willingness to pay at an estimated Rp. 1,920 as a constant value and used as a proxy for benefits. In estimating Rp. 1920, we consider the price of vended water of Rp. 500/20 litter in addition to Rp. 950/$m^3$ of willingness pay to the piped water obtained by questionnaire in the Master plan because households are paying much more for vended water than would be necessary to provide and sustain a piped distribution system. In other words, vending practice in this area can be a useful indicator of consumers' ability and willingness to pay for a piped system.

No indirect and intangible benefits are taken into account for the calculation of EIRR.

**(2) Adjustment for direct transfer payments**

Direct transfer payments are those payments that represent only the transfer of resources from one party in the society to another. Examples of transfer payments are loans, receipts, repayments of principal and interest payments. These payments should be excluded to reflect economic values.

**(3) Adjustment for price distortions in traded items**

Since we use the conversion factor approach, the border price of imports (CIF price) is expressed in domestic currency converted at the official exchange rate.

**(4) Adjustments for price distortions in nontraded items**

The standard conversion factor (SCF) of 0.9 (presently used by the World Bank) is used to convert nontraded item to an equivalent boarder price that reflects the effect of trade distortions

on domestic prices of that good or service.

### (5) Valuing land

The opportunity cost of land is the net value of production forgone when the use of the land is changed from its without-project use to its with-project.[1] We will use the rental value of the land as the economic opportunity cost of the land.

### (6) Valuing labor

We will shadow-price unskilled labor using conversion factor of 0.75 to accurately reflect the opportunity cost of shifting labor from its without-project occupation to its with-project use. Wages for skilled labor are assumed to represent the true marginal value product of those labor and therefore market value of the wages are used in the economic accounts.

## 4.11.7 Result of Economic Analysis

**Table-4117.1** represents the calculation for the EIRR on an incremental basis resulting from investment in the priority projects.

The EIRR of this proposed project is estimated at 9.16 percent. With the current opportunity cost of capital of somewhere between 8 and 10 percent, if this tangible benefit is combined with intangible economic benefits explained below, the proposed project is economically viable and acceptable.

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[1] Gittinger, J. Price. 1984. Economic analysis of agricultural projects

Table-4117.1 Calculation of Economic Internal Rate of Return

| | 1997 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Forecasted consumption (Million m3/Yr) | 0 | 0 | 0 | 0 | 0 | 101 | 106 | 111 | 116 | 206 | 219 | 232 | 237 | 234 | 231 |
| Unaccounted-for water (UFW) | | | | | | 10.00% | 10.00% | 10.00% | 10.00% | 10.00% | 11.15% | 12.31% | 13.46% | 14.62% | 15.77% |
| Production (Million m3) | 0 | 0 | 0 | 0 | 0 | 112 | 118 | 124 | 129 | 229 | 247 | 264 | 274 | 274 | 274 |
| Average Tariff (Rp/m3) | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 |
| *Inflow (Gross Benefit)* | | | | | | | | | | | | | | | |
| Tariff Revenue | 0 | 0 | 0 | 0 | 0 | 193,834 | 203,550 | 213,502 | 223,218 | 395,726 | 420,594 | 444,684 | 455,693 | 449,616 | 443,539 |
| Total Cash Inflow | 0 | 0 | 0 | 0 | 0 | 193,834 | 203,550 | 213,502 | 223,218 | 395,726 | 420,594 | 444,684 | 455,693 | 449,616 | 443,539 |
| *Outflow (Gross Cost)* | | | | | | | | | | | | | | | |
| Operating Expenses | | | | | | | | | | | | | | | |
| Fuel and Power | 0 | 0 | 0 | 0 | 0 | 7,550 | 7,727 | 7,909 | 8,086 | 11,230 | 11,783 | 12,336 | 12,656 | 12,656 | 12,656 |
| Chemicals Used | 0 | 0 | 0 | 0 | 0 | 3,231 | 3,392 | 3,558 | 3,720 | 6,595 | 7,101 | 7,606 | 7,899 | 7,899 | 7,899 |
| Maintenance Material | 0 | 0 | 0 | 0 | 0 | 1,727 | 1,767 | 1,808 | 3,909 | 3,508 | 3,635 | 3,761 | 3,834 | 3,834 | 3,834 |
| Purchase of Raw Water | 0 | 0 | 0 | 0 | 0 | 2,756 | 2,894 | 3,036 | 3,174 | 5,627 | 6,058 | 6,489 | 6,739 | 6,739 | 6,739 |
| Salaries & Wages | 0 | 0 | 0 | 0 | 0 | 231 | 231 | 231 | 231 | 783 | 783 | 783 | 783 | 783 | 783 |
| General Expenses | 0 | 0 | 0 | 0 | 0 | 139 | 139 | 139 | 139 | 470 | 470 | 470 | 470 | 470 | 470 |
| Capital Expenditures | 146,250 | 0 | 296,010 | 646,909 | 509,925 | 382,541 | 322,057 | 384,825 | 352,190 | 175,750 | 108,046 | 54,023 | 0 | 0 | 0 |
| Changes in Inventories | 0 | 0 | 0 | 0 | 826 | 34 | 35 | 377 | 412 | 105 | 105 | 61 | 0 | 0 | 0 |
| Total Cash Outflow | 146,250 | 0 | 296,010 | 646,909 | 510,751 | 398,208 | 338,242 | 401,883 | 371,861 | 204,069 | 137,981 | 85,530 | 32,381 | 32,381 | 32,381 |
| Total | -146,250 | 0 | -296,010 | -646,909 | -510,751 | -204,374 | -134,692 | -188,381 | -148,644 | 191,656 | 282,612 | 359,154 | 423,312 | 417,235 | 411,158 |
| Incremental | -146,250 | 0 | -296,010 | -646,909 | -510,751 | -204,374 | -134,692 | -188,381 | -148,644 | 191,656 | 282,612 | 359,154 | 423,312 | 417,235 | 411,158 |

Economic Internal Rate of Return (EIRR) 9.16%

Table-4117.1 Calculation of Economic Int

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Forecasted consumption (Million m3/Yr) | 228 | 225 | 222 | 218 | 215 | 212 | 209 | 206 | 207 | 208 | 210 | 211 | 213 | 214 | 215 |
| Unaccounted-for water (UFW) | 16.92% | 18.08% | 19.23% | 20.39% | 21.54% | 22.69% | 23.85% | 25.00% | 24.50% | 24.00% | 23.50% | 23.00% | 22.50% | 22.00% | 21.50% |
| Production (Million m3) | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 | 274 |
| Average Tariff (Rp/m3) | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 | 1,920 |
| *Inflow (Gross Benefit)* | | | | | | | | | | | | | | | |
| Tariff Revenue | 437,462 | 431,386 | 425,309 | 419,232 | 413,155 | 407,079 | 401,002 | 394,936 | 397,569 | 400,201 | 402,834 | 405,467 | 408,100 | 410,733 | 413,366 |
| Total Cash Inflow | 437,462 | 431,386 | 425,309 | 419,232 | 413,155 | 407,079 | 401,002 | 394,936 | 397,569 | 400,201 | 402,834 | 405,467 | 408,100 | 410,733 | 413,366 |
| *Outflow (Gross Cost)* | | | | | | | | | | | | | | | |
| Operating Expenses | | | | | | | | | | | | | | | |
| Fuel and Power | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 | 12,656 |
| Chemicals Used | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 | 7,899 |
| Maintenance Material | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 | 3,834 |
| Purchase of Raw Water | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 | 6,739 |
| Salaries & Wages | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 | 783 |
| General Expenses | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 | 470 |
| Capital Expenditures | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Changes in Inventories | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Cash Outflow | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 | 32,381 |
| Total | 405,082 | 399,005 | 392,928 | 386,851 | 380,775 | 374,698 | 368,621 | 362,555 | 365,188 | 367,821 | 370,454 | 373,087 | 375,720 | 378,352 | 380,985 |
| Incremental | 405,082 | 399,005 | 392,928 | 386,851 | 380,775 | 374,698 | 368,621 | 362,555 | 365,188 | 367,821 | 370,454 | 373,087 | 375,720 | 378,352 | 380,985 |

Economic Internal Rate of Return (EIRR)

### 4.11.8 Intangible Economic Benefits

#### (1) Contribution to Local and National Economy

This project will absorb unskilled labor, thus will create jobs in the project area in particular. In addition, the project will stabilize the development of the manufacturing, commerce and service industry, which will create and increase employment opportunities in the area. Job creation resulting from this project together with procurement of materials during construction and operational period of the project will significantly promote the regional economy, which will indirectly contribute to the national economy as a whole.

#### (2) Health Improvement Effect

This project will reduce infant mortality and incidence of waterborne disease such as Acute Diarrhea, Bacillary Dysentery, Enteric Fever, Typhoid and Conjunctivitis, which will subsequently decrease medical expenditures. The improvement of sanitation and beautification will also contribute to further development of this thriving city.

#### (3) Fire Loss Reduction

As a result of the expansion of water supply service through this project, the fire fighting capabilities will be strengthened, which will protect property values. Thanks to reduced fire loss, personal injury and loss of human lives will be considerably reduced.

#### (4) Consideration for Women in Development (WID)

Expansion of the piped water through this project will emancipate women from drawing water and therefore lighten their household duties. This can contribute to improving the welfare of women in the project area.

## 4.12 Evaluation of Feasibility of the Priority Project

### 4.12.1 Technical Feasibility

Component of the proposed priority projects are expansion and new construction of treatment plants, distribution centers, and installation of transmission and distribution pipes. These construction works has been experienced in Jakarta Water Supply during last two decades.

Methodology employed in the new treatment plants are same method as practiced in the existing treatment plant. Therefore, it is judged that the priority projects are technically feasible.

It should be noted that the land space required for the priority projects such as for treatment plant and distribution centers should be acquired as soon as possible to realize implementation of the priority project.

Based on the results of environmental impact assessment , no fatal flaw has been found that renders the proposed project non-viable from an environmental impact point of view. The construction of treatment plants, pipelines and related infrastructure will not cause substantial disturbance. The environmental consequences associated with these impacts are not considered to be significant.

### 4.12.2 Financial Feasibility

Financial feasibility of the project has been assessed by the calculation of a financial internal rate of return which is based on an incremental net benefit flow. In calculating the financial rate of return, the projected tariff of Scenario A3 (30 % tariff increase every 3 years) of financial projections in the Master Plan is taken because with this tariff rate the Jakarta water supply sector would be financial viable. However, the FIRR indicates that for this particular project the water supply enterprise should raise money with interest rate of 9.17 percent of lower for the priority project to be financially viable.

### 4.12.3 Economic Feasibility

The economic aspect of the project has been evaluated by the economic internal rate of return which will determine the likelihood that the proposed project will contribute to the development of the total economy of Indonesia and that its contribution will be enough to justify using scarce resources.

The EIRR under the proposed project is estimated at 9.16 percent. Considering this EIRR as well as intangible economic benefits such as employment generation, health improvement effect, fire loss reduction, consideration for WID as described in the preceding section, this project is economically viable and acceptable.