that if the supply capacity were not limited, the potential population might be served.

Population served by income group is summarized below in Table 6.5

Table 6.5 Population Served by Income Group
(In 1,000)

Year	Income Group I	Income Group II	Income Group III	Income Group IV	Income Grpoup V	Total
1980	1,085	1,241	506	284	346	3,462
1985	1,025	1,248	586	351	661	3,871
1990	1,027	1,358	737	470	1,145	4,736
1995	1,002	1,475	929	624	1,812	5,843
2000	902	1,503	1,094	768	2,518	6,785
2005	793	1,557	1,306	948	3,393	7,997

6.2 Water Requirement

6.2.1 Water Demand Projection

PDAM, at present classifies their consumers to 26 categories as shown in Table 6.6, 6.7 and 6.8. As the present domestic consumption is 46 % of total consumption, it is proposed, for the purpose of projection of future water consumption to classify consumers to two major categories i.e,. Domestic Use and Non-Domestic Use, and Non-Domestic Use consumer is further classifie into twelve categories.

Proposed categories are as follows:

A. Domestic Use

A-1 Public hydrants

A-2 Residential service connections

B. Non-Domestic Use

B-1 Public Use

a. Government offices

b. Schools

c. Religious Places

d. Hospital (Government and Private Hospitals)

e. Boarding Houses

B-2 Industrial Use

a. Industries (Industrial Enterprises and Store Houses)

b. Small Industries

B-3 Trade and Services

a. Hotels

b. Trades and Services (Trade Enterprise, Bank, Judge/Lawyer, Taylor, Steambath, Night Club, Barbershop, Service Station, Gp Doctor)

B-4 Port Tanjug Priok

B-5 Armed Forces (Military Installation)

B-6 Depok National Housing (Depok)

(1) Domestic Use : (A)

As discussed in the Section 6.1.3 Population Served, the population served is distributed to five income groups. Considering the service connection cost, including material and piping cost, required by PDAM to consumers, it is assumed that consumers of income group I and II are unable to afford to have a conneciton, and they will rely fully for their domestic use on stand pipe, Public hydran or water vendor. Income group III, IV and highest income group V will receive piped water from residential service connection.

a). Public Hydrant : (A-1)

- Per Capita demand for income groups I and II

The present consumption per capita is estimated based on field consumption survey by interveiwing and, on the other hand, taking into account the average ability to pay, taken as 4 % income. As the result, per capita consumption is estimated to be 7-25 lpcd, 16 lpcd in average. For demand projection it is proposed to employ 20 lpcd for income groups I and II, while some of them will purchase the water from vendor and they must pay some transportation cost which might cause some reduction of actual per capita consumption

b) Residential Service Connection : (A-2)

i) Per capita demand for income groups III and IV. : (a)

Taking into account average consumption per residential connection of 1 m3/conn/day which is derived from billing record of the year 1980 through 1983 May, per capita consumption is estimated as 125 lpcd in assuming household of 8 persons. Considering the living condition improvement such as for washing, bathing and so on it is proposed to employ 150 lpcd and apply this per capita consumption for income groups III and IV.

In considering average ability to pay, per capita consumption is estimated from 138 lpcd to 154 lpcd, 146 lpcd in average which is about 150 lpcd.

Considering all the above, per capita consumption for income groups III and IV is estimated as 150 lpcd.

ii) Per capita demand for income group V. : (b)

According to the analysis of the existing consumption record, area where rather higher income goup housing located and piped water system is improved in respect to pressure and water quality satisfactory to the consumers, those area are served by 1.5 - 1.6 times of average consumption per residential conneciton of 1.0 m3/conn/day. It is assumed that this higher per capita demand could be applied for the highest income level V group.

Under the assumption above, it is estimated that per capita consumption for income group V is 225 - 240 lpcd and is concluded to apply 250 lpcd for income group V.

The per capita demand for Domestic Use by income group is summarized as shown below.

Income Group I and II	: 20 lpcd	(Indirect Consumers, Public Hydrant, Standpipe and water Vendor)
Income Group III and IV	: 150 lpcd	(Direct Consumers, Residential Service Conn.)
Income Group V	: 250 lpcd	(" " ").

By applying the above per capita demand to the population served of each income group, the domestic demand is calculated and is summerized as shown below.

Table 6.6 Summary of Projected Domestic Water Demand (In 1,000 m3/d)

Classification	1980	1985	1990	1995	2000	2005
1. Residential Servie Connection	101.0	305.8	467.2	686.1	908.8	1,186.3
2. Public Hydrant	9.1	45.5	47.7	49.5	48.1	47.0
T o t a ; :	110.1 (1,270 l/s)	351.3 (4,070 l/s)	514.9 (5,960 l/s)	735.6 (8,510 l/s)	956.9 (11,080 l/s)	1,233.3 (14,270 l/s)

(1') Alternative Estimate of Domestic Use : (A')

Although in the discussion of 6.1.3, groundwater was assumed to be available in Zone II, there may be some possibility that groundwater is not available. For, the groundwater table has been declining in these years in the said area, by 5 to 10 meters a year. In that case, all people have to rely on piped water. Hereunder, therefore, an alternative estimate of domestic use will be made based on the percentage of population served as shown on Table 6.3a which is prepared by revising Table 6.3 in 6.1.3.

Table 6.3a Percentage Applied For Projection of Population Served

	Income Group I %	Income Group II %	Income Group III %	Income Group IV %	Income Group V %
Zone I	100	100	100	100	100
Zone II	100	100	100	100	100
Zone III	30	40	60	80	90

Population served projected by five-years intervals is summerized below in Table 6.4a

Table 6.4a Population Served VS Population in Service Area

Year	Service Area (km2)	Population Served	Population in Service Area	Population in DKI boundaries
1980	283	* 4,024,000 (62 %) (81 %)	4,949,000 (76 %) (100%)	6,468,500
1985	283	4,419,000 (58 %) (82 %)	5,372,000 (70 %) (100%)	7,630,100
1990	338	5,357,000 (60 %) (82 %)	6,538,000 (74 %) (100%)	8,872,900
1995	383	6,523,000 (66 %) (81 %)	8,002,000 (80 %) (100%)	9,949,600
2000	414	7,497,000 (68 %) (82 %)	9,092,000 (83 %) (100%)	11,004,900
2005	454	8,784,000 (72 %) (84 %)	10,496,000 (87 %) (100%)	11,998,900

* Note on Table 6.4 to be applied here

Population Served by income group is summerized in Table 6.4a below::

Table 6.4a Population Served by Income Group (in 1,000)

Year	Income Group I	Income Group II	Income Group III	Income Group IV	Income Group V	Total
1980	1,354	1,489	540	294	346	4,027
1985	1,277	1,493	625	362	661	4,424
1990	1,304	1,637	787	485	1,145	5,361
1995	1,289	1,787	990	643	1,812	6,524
2000	1,182	1,839	1,167	791	2,518	7,498
2005	1,072	1,945	1,397	976	3,393	8,785

By applying the percapita demand to the population served of each income group, the domestic demand is calculated and is summerized below.

Table 6.5a Summary of Projected Domestic Water Demand (In 1,000 m3/d)

Classification	1980*	1985	1990	1995	2000	2005
1. Residential Service Connection	101.0	313.4	447.1	698.1	923.2	1204.4
2. Public Hydrant	9.1	55.4	58.8	61.5	60.4	60.4
	110.1	368.8	535.9	759.6	983.6	1264.8
	(1,270 l/s)	(4,270 l/s)	(6,200 l/s)	(8,790 l/s)	(11,380 l/s)	(14,640 l/s)

* Water Demand in 1980 shows actual average day consumption derived from billing record provided by PDAM.

(2) Non-Domestic Use : (B)

Future water demand for non-domestic use will be projected based on the analytical results of records and information provided by PDAM and other relevant data collected, such as Jakarta Master Plan, land use plan, employment forecast and statistical data. The details of projection are described in the following.

a) Public Use. : (B-1)

i) Government Offices : (a)

The water demand of Government offices is projected considering the number of government office employees and the land use map.

Employment forcast prepared by DKI Jakarta SDP group, compiled in Mid-March 1983, indicates the number of government office in the year 1980, 1995 and 2005 are 258,300, 402,400 and 546,600 respectively.

On the other hand, assuming the government offices in service area fully rely on the piped water, average unit consumption per employee is estimated as 243 lpcd based on water consumption record. From the above, 250 lpcd is assumed for projection of water demand.

The results of the projection are shown in Table 6.10

Table 6.7 Average Water Consumption Per Month By Consumer (Categories)

(In 1000 M3/ Month)

	1980 (8 months)	1981 (12 months)	1982 (10 months)	1983 (1 month)
1. Residential Use	3029.9 (42.9)	2995.1 (41.0)	3178.4 (41.0)	3324.7 (42.6)
2. Office	1646.5 (23.3)	1844.1 (25.2)	1742.3 (22.5)	784.5 (10.0)
3. School & Institution	36.3 (0.5)	36.5 (0.5)	41.0 (0.5)	43.3 (0.5)
4. Boarding House	155.7 (2.2)	154.5 (2.1)	165.5 (2.1)	141.9 (1.8)
5. Religious Place	17.5 (0.2)	35.2 (0.4)	30.6 (0.3)	37.0 (0.4)
6. Government Hospital	104.1 (1.4)	113.8 (1.5)	128.2 (1.6)	118.0 (1.5)
7. Industrial Enterprise	143.5 (2.0)	153.2 (2.1)	165.7 (2.1)	87.6 (1.1)
8. Store House	25.6 (0.3)	22.4 (0.3)	22.3 (0.2)	20.1 (0.2)
9. Trade Enterprise	456.7 (6.4)	422.4 (6.0)	467.4 (6.0)	600.5 (7.7)
10. Market	0.4 (0.0)	0.5 (0.0)	0.5 (0.0)	0.5 (0.0)
11. Small Industry	146.6 (2.0)	145.7 (1.9)	159.5 (2.0)	166.7 (2.1)
12. Hotel	236.4 (3.3)	262.1 (3.5)	281.6 (3.6)	293.2 (3.7)
13. Steambath	16.3 (0.2)	11.6 (0.1)	9.2 (0.1)	8.1 (0.1)
14. Night Club	7.3 (0.1)	4.4 (0.0)	3.5 (0.0)	4.2 (0.0)
15. Barber Shop	1.3 (0.0)	1.5 (0.0)	3.2 (0.0)	57.3 (0.7)
16. Taylor	12.2 (0.1)	7.3 (0.1)	10.3 (0.1)	5.7 (0.0)
17. G.P. Doctor	60.2 (0.8)	72.8 (0.9)	68.1 (0.8)	26.6 (0.3)
18. Judge/Lawyer	7.4 (0.1)	6.3 (0.0)	6.6 (0.0)	13.4 (0.1)
19. Bank	75.1 (1.0)	89.0 (1.2)	80.1 (1.0)	90.4 (1.1)
20. Service Station	9.7 (0.1)	15.7 (0.2)	16.0 (0.2)	13.7 (0.1)
21. Private Hospital	22.5 (0.3)	11.9 (0.1)	15.5 (0.2)	47.0 (0.6)
22. Public Hydrant	272.1 (3.8)	294.0 (4.0)	335.1 (4.3)	310.7 (3.9)
23. Depok	167.4 (2.3)	160.4 (2.2)	181.2 (2.3)	174.5 (2.2)
24. Windmill/etc.	3.0 (0.0)	3.1 (0.0)	3.0 (0.0)	4.3 (0.0)
25. Port Tanjung Priok	403.7 (5.7)	406.0 (5.5)	279.3 (3.6)	492.4 (6.3)
26. Army	0.0 (0.0)	0.0 (0.0)	347.0 (4.4)	924.2 (11.8)
27. DKI Jakarta	7058.3 (100.0)	7290.7 (100.0)	7742.2 (100.0)	7791.8 (100.0)

Table 6.8 Number of Connection by Consumer (Categories)

	1980	1981	1982	1983
1. Residential Use	92177 (89227)	99797 (93598)	105119 (96897)	111451 (103698)
2. Office	1784 (1628)	1824 (1634)	1849 (1613)	1201 (1105)
3. School & Institution	239 (232)	267 (258)	284 (275)	302 (296)
4. Boarding House	139 (136)	146 (143)	153 (147)	155 (151)
5. Religious Place	305 (297)	333 (320)	357 (348)	390 (384)
6. Government Hospital	50 (46)	56 (53)	57 (55)	59 (55)
7. Industrial Enterprise	324 (320)	327 (319)	337 (321)	261 (257)
8. Store House	300 (295)	294 (289)	292 (282)	293 (292)
9. Trade Enterprise	8321 (8087)	8569 (8179)	9118 (8724)	9650 (9366)
10. Market	4 (4)	4 (4)	4 (4)	5 (5)
11. Small Industry	5291 (5058)	5656 (5368)	6086 (5732)	6519 (6243)
12. Hotel	109 (107)	107 (103)	113 (105)	114 (114)
13. Steambath	226 (225)	204 (199)	204 (201)	218 (215)
14. Night Club	49 (47)	47 (38)	49 (35)	48 (37)
15. Barber Shop	38 (38)	40 (40)	40 (40)	44 (43)
16. Taylor	156 (155)	158 (156)	156 (153)	158 (153)
17. G.P. Doctor	546 (544)	569 (566)	577 (572)	577 (573)
18. Judge/Lawyer	68 (67)	70 (70)	71 (71)	71 (71)
19. Bank	131 (130)	136 (134)	140 (136)	147 (144)
20. Service Station	131 (129)	135 (133)	135 (132)	136 (136)
21. Private Hospital	89 (89)	85 (84)	93 (90)	81 (80)
22. Public Hydrant	1149 (871)	1231 (866)	1197 (953)	1417 (1070)
23. Depok	2 (2)	1 (1)	1 (1)	1 (1)
24. Windmill/etc.	51 (25)	43 (20)	43 (20)	42 (19)
25. Port Tanjung Priok	7 (7)	8 (8)	6 (6)	9 (9)
26. Army	0 (0)	0 (0)	3 (3)	624 (509)

Note : 1. Number shows registered connection number. The figures in ( ) shows number of connections issued bills on them.

2. Number of connection is average number of connection.

3. Number of connection in year 1983 is the number of connection in May 1983.

Table 6.9 Average Daily Consumption By Consumer (Categories)

(In M3/Conn./ Day)

	1980	1981	1982	1983
1. Residential Use	1.1	1.0	1.0	1.0
2. Office	33.1	37.1	35.6	22.9
3. School & Institution	5.1	4.6	4.9	4.7
4. Boarding House	37.4	35.5	36.9	30.3
5. Religious Place	1.9	3.5	2.9	3.1
6. Government Hospital	74.8	69.9	76.1	69.2
7. Industrial Enterprise	14.6	15.6	17.0	10.9
8. Store House	2.8	2.5	2.6	2.2
9. Trade Enterprise	1.8	1.7	1.7	2.0
10. Market	3.5	4.3	4.2	3.6
11. Small Industry	0.9	0.8	0.9	0.8
12. Hotel	72.3	83.5	88.4	82.9
13. Steambath	2.3	1.9	1.5	1.2
14. Night Club	5.0	3.7	3.2	3.6
15. Barber Shop	1.1	1.2	2.6	42.9
16. Taylor	2.5	1.5	2.2	1.2
17. G.P. Doctor	3.5	4.2	3.9	1.4
18. Judge/Lawyer	3.6	2.9	3.0	6.1
19. Bank	18.8	21.8	19.4	20.2
20. Service Station	2.4	3.8	3.9	3.2
21. Private Hospital	7.7	4.6	5.6	18.9
22. Public Hydrant	10.2	11.1	11.5	9.3
23. Depok	2746.2	5048.4	5987.6	5631.2
24. Windmill/etc.	3.9	4.9	4.9	7.3
25. Port Tanjung Priok	1892.0	1556.3	1398.3	1764.9
26. Army	0.0	0.0	3792.5	58.5

Table 6.10 Projected Water Demand For Government Offices

Year	Unit Demand L/employee/d	Total Numbers of employee	No.of Employee in Service Area	Total Demand '000 m3/d
1980	243	258,300	255,500	54.9
1985	250	306,300	259,300	64.8
1990	250	354,300	311,600	77.9
1995	250	402,400	371,800	93.1
2000	250	474,500	434,400	108.6
2005	250	546,600	508,400	127.1

ii) Schools : (b)

The water demand for schools is developed based on the number of student and unit per pupil (Student) consumption. Average daily consumption of school is 5 m3/conn./day. The numbers of connections registered and billed in the year 1980 are 239 and 232 respectibely.

According to the statistical data,the average number of students per school is 310-350 in 1980. Ohter statistical data indicates that in Jakarta, it has adopted the double-shift school system i.e, 1.5 schools per one school building. From the above, it is estimated that 500 students in average attend schools and thus consumption per student is estimated as 10 litres.

Population of school ages, and the student attendance are developed based on the statistical data and those figures are shown in Table 6.11

Service ratio in year 1980 is 10 percent which is derived from the number of connections and number of schools in the service area and 1.5 shift school system as discussed in the above. The service ratio is assumed to increase and reach to 100 percent in year 1995.

The projection for water requirment for schools is then projected as shown in Table 6.11

Table 6.11 Projected Water Requirement For Schools

Year	Pop'n ('000)	Pop'n of School Age ('000)	Total Student Attend-ance ('000)	Pop'n in Service Area (%)	Student in Service Area ('000)	Service Ratio (%)	Student Served ('000)	Unit Con-sumption (lpcd)	Total Demand ('000 m3/d)
1980	6,469	2,700	1,474	76	1,120	10	112	10	1.2
1985	7,630	3,182	1,997	70	1,397	35	488	12	5.9
1990	8,873	2,629	2,748	74	2,033	60	1,219	14	17.1
1995	9,948	3,999	3,100	80	2,480	100	2,480	16	39.7
2000	11,005	4,346	3,237	83	2,686	100	2,686	18	48.3
2005	11,999	4,656	3,755	87	3,266	100	3,266	20	65.3

iii) Religious Place : (c)

Average daily consumption per connection of religious place through year 1980 to 1983 is approximately 3.0 m3/conn/day. The numbers of connection registered and billed in year 1980 are 305 and 297 respectively. According to statistical data, the total number of religious place in year 1980 is 6,803. The number of the religious places in service area is estimated as proportional to the population in the service area. The service ratio in the service area is thus obtained as 6 % of numbers of religious place in the service area in 1980. It has been projected that the service ratio in the service area will increase gradually and will reach to 100 percent in year 1995. The projection of water demad, based on the above, is shown in Table 6.12

Table 6.12 Projected Water Demand For Religious Place

Year	Pop'n ('000)	No.of Place	Pop'n in Service Area (%)	No.of Place in Service Area	Service Ratio (%)	No.of Place Served	Unit Con-sumption (M3/p)	Demand ('000 m3/d)
1980	6469	6803	76	5180	6	297	2	0.6
1985	7630	8030	70	5620	20	1120	3	3.4
1990	8873	9350	74	6920	50	3460	3	10.4
1995	9948	1070	80	8380	100	8380	3	25.1
2000	11005	11580	83	9610	100	9610	3	25.8
2005	11999	12630	87	10990	100	109990	3	33.0

iv) Hospitals : (d)

Average daily consumption per connection for government hospital and private hospitals through years 1980 to 1983 is 70 - 76 m3 and 5 - 8 m3 respectively. According to the statistical data, the numbers of hospitals and meternity hospitals are 46 and 186 in 1980, and on the other hand, registered numbers of connection of government hospitals are 50 and private hospitals 89 respectively.

If it is assumed that "Hospital" be government hospital and "maternity hospital" be private hospital, then the ratio would be 100 % and 60 % in the service area respectively.

The numbers of bed per hospital and meternity hospital are 158 - 210 and 17 - 20, and population per one bed is developed as 521 in 1971, 533 in 1975, 531 in 1980. I could be applied, for demand projection, that 200 beds per hospitals and 20 beds per maternity hospitals, and 500 persons per bed. These data are presented in Table 6.13 below.

From the average daily consumption and numbers of bed per hospital, the unit consumption per bed is estimated as some 400 l/bed/day.

Table 6.13 Number of Hospitals, Beds
(Fory Year 1971, through 1981)

Year	Pop'n	Number of Hospital			Number of bed			Number of beds per Hospital	
		Hospital	Maternity Hospital	Total	Hospital	Maternity Hospital	Total	Hospital	Maternity Hospital
					%	%			
1071	4576	39	127	166	6178 (70)	2596 (30)	8744	158	20
72	4755	37	135	172	6362 (70)	2663 (30)	9025	171	19
73	4973	37	140	177	6583 (70)	2770 (30)	9353	177	19
74	5182	38	155	193	6952 (71)	2866 (29)	9818	182	18
75	5403	40	163	203	7253 (71)	2892 (29)	10145	181	17
76	5701	40	171	211	7380 (71)	3087 (29)	10467	184	18
77	5925	41	171	212	7627 (71)	3104 (29)	10731	186	18
78	6081	43	179	222	9072 (74)	3248 (26)	12320	210	18
79	6239	45	179	224	8840 (73)	3248 (27)	12088	196	18
80	6503	46	186	232	8871 (72)	3366 (28)	12237	192	18
81	6555	44	196	240	9137 (73)	3461 (27)	12598	207	17

The service ratio in the service area for the Government hospital is estimated as 100 % from 1980 up to year 2005, and for the maternity hospital is developed for year 1980, as 60 % (89/186 x 0.76) and the ratio is estimated to be increased to 100 % in the year 1995.

The projection of water demand for hospitals are presented in Table 6.14

Table 6.14 Projected Water Demand of Hospitals

Projected Numbers of Beds

i) General Hospital

Year	Population (In 1000)	No. of Bed	No.of Bed (70%)	Unit Con-sumption (l/Bed)	Demand (In 1000 M3/D)	Number of Conn.
1980	6,469	12,900	9,100	400	3.6	46
1985	7,630	15,300	10,700	400	4.3	53
1990	8,873	17,800	12,400	400	7.1	62
1995	9,948	19,900	13,900	400	8.0	70
2000	11,005	22,000	15,400	400	8.8	77
2005	11,999	24,000	16,800	400	9.6	84

ii) Maternity Hospital

Year	No.of Bed (30%)	Pop'n in Service Area (%)	No.of Bed in Service Area	Service Ratio (%)	No.of Bed	Unit Con-Sumpt-ion (l/Bed)	Demand (In 1000 M3/D)	No.of Conn.
1980	3900	76	3000	60 %	1800	400	6.0	1:89
1985	4600	70	3200	70 %	2200	400	0.9	110
1990	5300	74	3900	85 %	3300	400	1.3	165
1995	6000	80	4800	100 %	4800	400	1.9	240
2000	6600	83	5500	100 %	5500	400	2.2	275
2005	7200	87	8300	100 %	8300	400	3.3	415

v) Boarding Houses : (e)

Average water consumption per month of boarding houses is 155.700 m3/Month (5,190 m3/day)

Assuming that the water consumption of the boarding houses are proportional to the annual increase of domestic visitors to Jakarta of 2.2 percent as discussed later on e). i). Hotels, water demand of boarding houses is projected as shown in Table 6.15

Table 6.15 Projected Water Demand For Boarding Housis

Year	Water Demand (m3/day)
1980	5,190
1985	5,800
1990	6,500
1995	7,200
2000	8,000
2005	8,900

* Annual increases is assumed as 2.2 %.

b). Industries Use : (B-2)

i) Large and Medium Industries : (a)

According to employment forecasts prepared by DKI Jakarta SDP group, the number of employee in 1980, 1995 and 2005 is 151,000, 262,500 and 316,400, respectively.

Based on the Land Use Map, number of employees in the service area is estimated and the employee figures are further distributed to each physical zone of I, II and III as shown in Table 6.16

Table 6.16 Estimated Number of Employees in Service Area

Year	Number of Employees in Service Area ('000 employee)			
	Zone I,	Zone II,	Zone III	Total
1980	84.5	36.5	6.7	127.7
1985	97.1	43.5	11.6	152.2
1990	111.9	63.1	16.8	191.8
1995	120.4	72.2	22.0	214.6
2000	125.6	100.7	26.2	252.5
2005	130.9	137.0	30.6	298.5

In year 1980, service ratio is estimated as about 4 % from the following three factors, namely,the unit consumption per employee 1,000 l/emplyee/day, the water consumption (4,780 m3/day) and estimated number of employee 127,700. It is assumed that at present most of the industries use groundwater for operation in addition to piped water. The above unit consumption of 1,000 l/employee/day is derived from the statistical data of industries consumption in Japan, in reference to unit consumption of the industries of food stuffs, clothing, wood works, furnitures, publishing and printing, rubber goods, chemicals, ceramic, metal goods, electircal appliance, light mechanical products, and so on which are assumed to be main facotries located in the service area.

It is estimated that, in the year 1980, service ratio in Zones I, II and III are 3 %, 5 % and 7 %, 4 % in average as stated above. It is assumed that the percentage of service ratio will increase from 3 % to 100 %, from 5 % to 50 % and from 7 % to 5 % in each zone. The assumed service ratio and projected water demand are presented in Table 6.17

Table 6.17 Projected Water Demand For Large and Medium Industries

Year	Service Ratio in each Physical Zone			Demand ('000 m3/day)			
	Zone I %	Zone II %	Zone III %	Zone I	Zone II	Zone III	Total
1980	3	5	7	2.4	1.9	0.5	4.8
1985	10	10	8	9.7	4.4	1.2	15.3
1990	25	20	10	28.0	12.6	1.7	42.3
1995	50	30	15	60.2	21.7	3.3	85.2
2000	75	40	20	94.2	40.3	5.2	139.7
2005	100	50	25	130.9	68.5	7.7	207.1

* Unit water consumption of 1,000 l/employee/day is applied for demand projection after multiplying estimated number of employees (shown in Table 6.16) by the service ratio (shown in Table 6.17)

ii) Small Industries : (b)

Average consumption per connection, is 0.97 m3/conn/day. According to employement forecast made by DKI Jakarta, the numbers of works in 1980, 1995 and 2005 are 97,500, 233,700 and 330,200 respectively.

The small industries is defined as home industries and small size workshop with residence. The number of workers the service area is estimated as proportional to the population in the service area to the total population.

It is estimated that the average consumption per worker as 190 lpcd assuming the average number of works per small industries is 5 persons. For future estimation 200 lpcd will be applied.

From the above and number of connection, service ratio in service area in year 1980 is developed as 34 %.

It is assumed that the percentage of service ratio will increase from 34 % in 1980, to 100 % in 2005. The projected water demand, together with

service ratio is shown in Table 6.18

Table 6.18 Projected Water Demand For Small Industries

Year	Number of Labours ('000)	Number of Labours in the Service Area ('000)	Service Ratio (%)	Number of Labours ('000)	Unit Demand lpcd	Total Demand ('000 m3/day)
1980	97.5	75.1 (77%)	34	25.5	190	4.9
1985	142.9	101.5 (71%)	43	43.6	200	8.7
1990	188.3	139.3 (74%)	57	79.4	200	15.9
1995	233.7	187.0 (80%)	63	117.8	200	23.6
2000	282.0	234.1 (83%)	77	180.3	200	36.1
2005	330.2	287.1 (78%)	100	287.3	200	57.5

c). Trade and Service : (B-3)

i) Hotels : (a)

Average numbers of connection registered and billed are 109 and 107 respectively. Average water consumption per month of the hotels is 236,400 m3/month (7,888 m3/day).

Total number of hotels in Jakarta in 1980 is 145 and those hotels have 10,618 rooms in total. These figures and room occupancy rate shown in the Table 6.15 below were obtained at DKI Jakarta. Estimated number of rooms occupied is shown in Table 6.19

Table 6.19 Number of Rooms Occupied (In 1990)

Classification of Hotels	Number of Rooms	Room Occupancy Rate	Number of Rooms occupie
4 and 5 stars	4,218	0.72	3,049
3 stars	1,485	0.53	790
2 stars	1,567	0.36	560
1 stars	514	0.54	280
Non stars	2,834	0.68	1,930
	10,618	0.62 (62%)	6,610

The Service ratio is estimated based on the number of connection served and number of hotels in Jakarta, assuming one connection per hotel, and is arrived at as 75 % (109/145). By applying the above ratio, the number of rooms served is estimated as 7,980 (10,168 x 0.75). From the above, unit demand per room in average is estimated as 1,000 l/room/day.

For estimation of future water demand the number of rooms required which is the basis of the water demand Projection will be estimated, as detailed below.

DKI estimated that domestic visitors and foreign visitors to Jakarta in 1985 are 6,830,000 and 480,000 and annual increase rates are 2.2 % and 10 % respectively up to year 1988. Applying same increase rates, the number of visitors in future has been developed. Further, assuming that 10 % of the domestic visitors to Jakarta will stay in hotel, and other 90 % visitors will stay with relatives or in friend residence and for foreign visitors, 90 % foreign visitor will stay in hotel during their stay in Jakarta, numbers of persons staying in hotel are projected. These ara shown in Table .6.20) below.

Table 6.20 Number of Person Staying in Hotel

Year	Visitors ('000)		Number of Person Staying in Hotel ('000)		
	Foreign (1)	Domestic (2)	Foreign (3) = (1)x90%	Domestic (4) = (2)x10%	Total (3) + (4)
1985	480	6,830	430	680	1,110
1990	770	7,620	690	760	1,450
1995	1,240	8,490	1,120	850	1,970
2000	2,000	9,470	1,800	950	2,750
2005	3,230	10,560	2,900	1,060	3,960

For developing the required number of room at hotel, following assumption employed by DKI Jakarta, i.e (1) visitor will stay in Hotel about 2.13 days in average and (2) room occupancy rate is estimated as 60 %. From the above assumption, required number of rooms has been developed and is presented in the Table 6.21

Table 6.21 Required Number of Rooms Projected

Year	Estimated Number of Person Staying in Hotel	Required Number of Room in Total
1985	1,110,000	10,700
1990	1,450,000	13,900
1995	1,970,000	18,900
2000	2,750,000	26,400
2005	3,960,000	38,000

Following the above procedure, water demand is developed and is presented in the Table 6.22

Table 6.22 Projected Water Demand For Hotel

Year	Required No.of Room	Served Ratio	No.of Room Served	Unit Demand per Room (l/Room)	Total Demand ('000 m3/d)
1980	10,618	75 %	7,900	1,000	7.9
1985	10,700	80 %	8,600	1,000	8.6
1990	13,900	90 %	12,500	1,000	12.5
1995	18,900	100 %	18,900	1,000	18.9
2000	26,400	100 %	26,400	1,000	26.4
2005	38,000	100 %	38,000	1,000	38.0

ii) Trade and Service : (b)

Average consumption per month in 1980 is 646,200 m3/month (21,500 m3/d). The numbers of connection registered and billed are 9,66 and 9,422 respectively. Average consumption per connection in 1980 is 2.3 m3/conn/d. Based on the statistical data, year book in 1980, 20 persons per establishment in average is estimated, by which, per capita consumption is derived as 115 lpcd. For future estimateion 110 lpcd is applied.

According to the employement forecast by DKI Jakarta, numbers of work place in 1980, 1995 and 2005 are 1,288,900 2,321,000 and 3,436,700

respectively. Number of establishment in 1980 will be 64,400.

Work place in the service area is estimated based on the Land use map, and 1,157,600 work place are estimated in 1980. Number of establishment in the service area is, then, developed as 57,800 in applying 20 persons per establishment.

Service ratio in year 1980 is estimated as 17 % (9,422/57,800). It is assumed that service ratio will increase and will arrive at 70 percent in 2005 by 6 % annual increase. The projection of service ratio is shown in Table 6.23

Table 6.23 Projected Water Demand For Trade and Service

year	No.of Work Place	No.of W.P. in Service Area	Service Ratio	No.of Work Place Served	Unit Demand (lpcd)	Total Demand ('000 m3/day)
	('000)	('000)	(%)	('000)		
1980	1,288.9	1,157.6	17	193.3	110	21.5
1985	1,568.1	1,388.6	22	305.5	110	33.6
1990	1,907.9	1,720.7	30	516.2	110	56.8
1995	2,321.2	2,098.8	40	839.6	110	92.4
2000	2,820.1	2,608.5	55	1,434.7	110	157.4
2005	3,436.7	3,222.8	70	2,256.0	110	248.2

d) Port Tanjung Priok : (B-4)

Average consumption per month at Port Tanjung Priok in 1980 is 403,700 m3/month (13,500 m3/d).

According to the statistical data by Port Administration Tanjung Priok, number of ships entering Tanjung Priok Port by type of ship from the year 1970 through 1979 is as shown in Table 6.24

Table 6.24 Number of Ship Entering Tanjung Priok Prot

(1970 - 1979)

Year	Inter Island Ships	Ocean Going Ships	Tanker	Total	
1970	1,286	1,470	288	3,044	
1971	1,569	1,500	290	3,359	
1972	1,730	1,651	363	3,744	
1973	1,652	1,774	418	3,844	
1974	1,696	1,712	451	3,859	
1975	2,104	1,945	534	4,583	
1976	1,949	2,030	520	4,502	
1977	1,838	2,078	495	4,411	
1978	2,919	1,181	523	4,623	
1979	2,415	1,976	509	4,900	(5% increase in average)

Table 6.23 indicates that the annual increase ratio of ships entering the Port is 5 % in average.

For future water demand projection, 5 % annual increase rate is assumed on the 1980 water consumption of 13,500 m3/d. Table 6.25 presents water demand on the basis of the above assumption.

Table 6.25 Projected Water Demand For Port Tanjung Priok

Year	Total Demand ('000 m3/d)
1980	13.5
1985	17.2
1990	22.0
1995	28.0
2000	35.8
2005	45.7

e) Armed Forces : (B-5)

Records on water consumption for the year 1980 are not available. Average water consumption in May 1983 is 30,800 m3/d and numbers of connections registered and billed are 624 and 509 respectively.

As no other data or information for the projection of the Armed Forces Water demand is available, the water demand is projected based on the assumption that the demand increases is proportional to be population increases.

Table 6.26 Projected Water Demand For Armed Forces

Year	Water Demand ('000 m3/d)
1980	(30.0)
1985	35.4
1990	41.1
1995	46.2
2000	51.0
2005	55.6

f) Depok National Housing : (B-6)

Depok National Housing, however, receives approximately 65 l/sec, 5600 m3/d out of 300 l/sec of PDAM Ciburial Spring system through one (1) bulk water meter installed on the pipeline branched from the trunk main at Depok.

It is assumed that the same amount of spring water will be diverted to the Depok up to year 2005.

(3) Unaccounted-for water

The overall unaccounted-for water at present time is estimated as 54 % or around. For the development of water production required, however, it is assumed that the following figures are, at present, most realistic, and are employed in projection of water production.

1) Target unaccounted-for water in the year 2005 is 25 %.

2) Target annual reduction rate of unaccounted-for water at every five years are as shown in Table below :

Year	Decrease of Unaccounted-for water	Unaccounted-for water
1980	2 % *	54 %
1985	4 %	49 %
1990	4 %	40 %
1995	4 %	33 %
2000	3 %	29 %
2005	3 %	25 %

* The percentage is the rate of annual descrease against the previous year's pecentage.

(4) Summary of Water Demands

As described earlier in 6.2.1 A and A', domestic use was estimated for two cases, i.e., 1) in Zone II, groundwater is available, and 2) groundwater is not available. Therefore, summary of water demends is prepared for the two cases, as shown on Table 6.27 . (for the former case) and Table 6.27' (for the latter case).

Difference between the two cases is some 300 l/sec or equivalent to one percent of the total water requirement. For planning the future water supply system, the former case is recommeded to be adopted, becaouse such a small difference can be taken care of by flexible operation of the water supply facilities and, more important, economy of construction is of primary concern for the present project.

6.2.2 Water Demand and Proposed Production

Based on the projected water demand so far made, a schedule of water supply is prepared as shown on Fig. 6.3 In preparing the schedule, the following matters are taken into consideration.

(1) Three mini plants of Muara Karan, Sunter and Pesing will be put out of regular service and maintained for emergency use or standby

Table 6.27 SUMMARY OF WATER DEMANDS (AVERAGE DEMAND IN 1,000 M3/DAY)

CLASSIFICATIONS	1980	1985	1990	1995	2000	2005
A. Domestic Use						
A-1 Residential Service Connections	101.0 (204.9) [a]	305.8	467.2	686.1	908.8	1,186.3
A-2 Public Hydrant	9.1 (46.5) [a]	45.5	47.7	49.5	48.1	47.0
Total A (A-1 and A-2)	110.1 (251.4) [a]	351.3	514.9	735.6	956.9	1,233.3
B. Non-Domestic Use						
B-1 Public Use						
a. Government Office	54.9	64.8	77.9	93.0	108.6	127.1
b. Schools	1.2	5.9	17.1	39.1	48.3	65.3
c. Religious Places	0.6	3.4	10.4	25.1	28.8	33.0
d. Hospitals	4.2	5.2	8.4	9.9	11.0	12.1
e. Boarding Houses	5.2	5.8	6.5	7.2	8.0	8.9
	66.1	85.1	120.3	174.3	204.7	246.4
B-2 Industries Use						
a. Industries	4.8	15.3	42.3	85.2	139.7	207.1
b. Small Industries	4.9	8.7	15.9	23.6	36.1	57.5
	9.7	24.0	58.2	108.8	175.8	264.6
B-3 Trade and Service						
a. Hotels	7.9	8.6	12.5	18.9	26.4	38.0
b. Trade & Service	21.5	33.6	56.8	92.4	157.8	248.2
	29.4	42.2	69.3	111.3	184.2	286.2
B-4 Port Tanjung Priok	13.5	17.2	22.0	28.0	35.8	45.7
B-5 Armed Forces	(30,0)	35.4	41.1	46.2	51.0	55.6
B-6 Depok	5.6	6.0	6.0	6.0	6.0	6.0
B-7 Others						
Total B (B-1 thru B-7)	123.3 (154.3)	209.9	316.9	474.6	657.5	904.5
Total Average Demand (Net Consumption A thru B)	234.4 (2700 l/s) 405,7 [a] (4,700 l/s)	560.2 (6500 l/s)	831.8 (9600 l/s)	1210.2 (14000 l/s)	1614.4 (18700 l/s)	2137.8 (24800 l/s)
Unaccounted-for Water (% of Production Required) (Case 3)	275.6 (54)	537.8 (49)	554.2 (40)	595.8 (33)	659.6 (29 %)	712.2 (25)
Production Required (In Average (1,000 M3/Day) (l/sec)	510 (682) [a] 5,900 (10,200) [a]	1,098 12,700	1,386 16,000	1,806 20,900	2,274 26,300	2,850 33,000
Total Population Served (In 1,000 persons)	2,100 3,461	3,871	4,736	5,843	6,785	7,937
Gross Percapita Demand (lpcd)	243 (254) [a]	284	293	309	335	356
Day Maximum Demand (l/sec) (Day Average x 1.15)	6,800 (11,700)	14,600	19,400	24,000	30,200	38,000
Raw Water Requirement (l/sec) (Day Maximum x 1.07)	7,300 (12,500) [a]	15,600	19,700	25,700	32,300	40,700

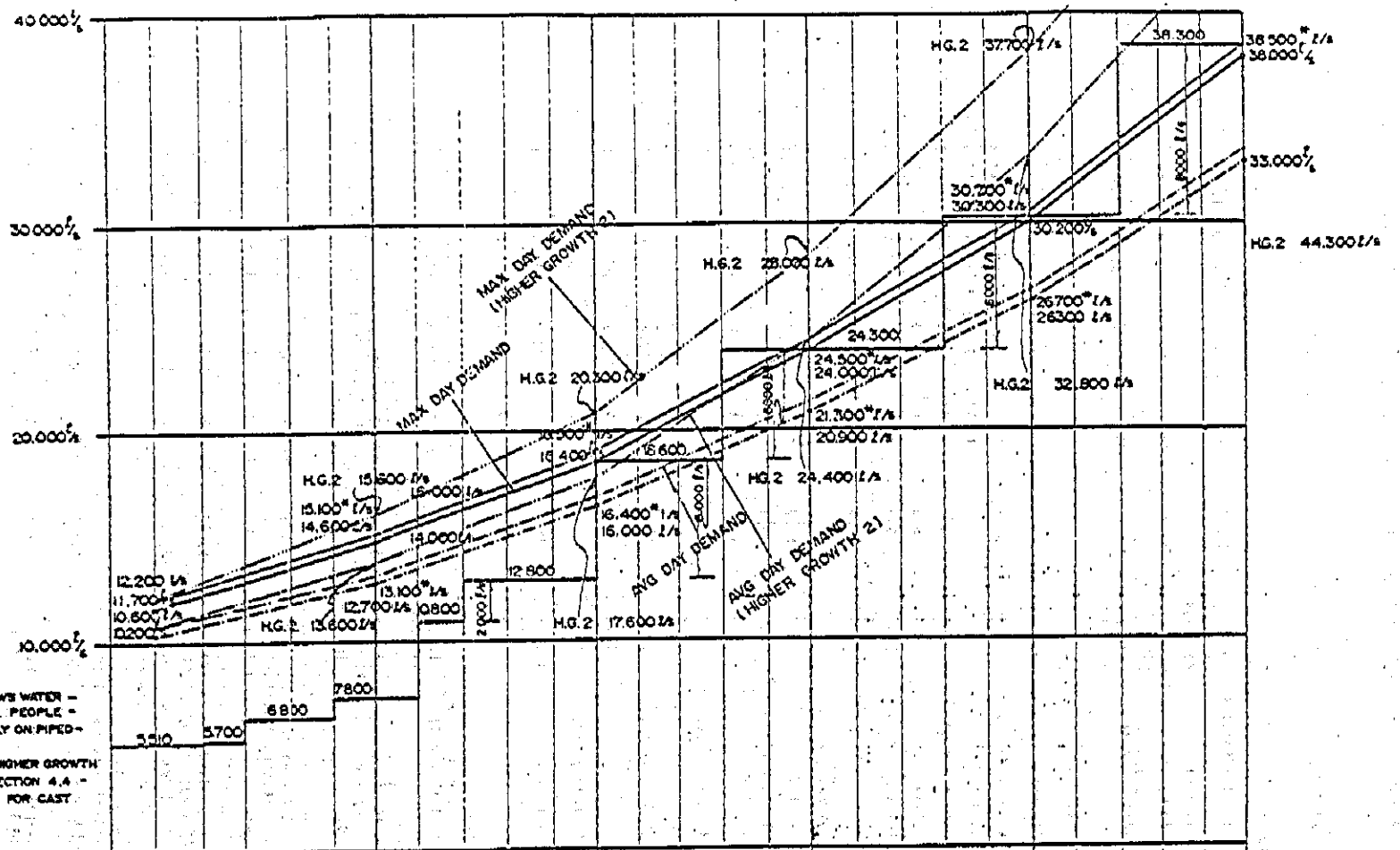
[a] Theoritical water demand projected for the year 1980.

Table 6.27' SUMMARY OF WATER DEMANDS (AVERAGE DEMAND IN 1,000 M3/DAY)

CLASSIFICATIONS	1980	1985	1990	1995	2000	2005
A. Domestic Use						
A-1 Residential Service	101.0	313.4	477.1	698.1	923.2	1,204.4
Connections	(211.5)*					
A-2 Public Hydrant	9.1 (56.8)	55.4	58.8	61.5	60.4	60.4
Total A (A-1 and A-2)	110.1 (268.3)	368.8	535.9	759.6	983.6	1,264.8
B. Non-Domestic Use						
B-1 Public Use						
a. Government Office	54.9	64.8	77.9	93.0	108.6	127.1
b. Schools	1.2	5.9	17.1	39.1	48.3	65.3
c. Religious Places	0.6	3.4	10.4	25.1	28.8	33.0
d. Hospitals	4.2	5.2	8.4	9.9	11.0	12.1
e. Boarding Houses	5.2	5.8	6.5	7.2	8.0	8.9
	66.1	85.1	120.3	174.3	204.7	246.4
B-2 Industries Use						
a. Industries	4.8	35.3	42.3	85.2	139.7	207.1
b. Small Industries	4.9	8.7	15.9	23.6	36.1	57.5
	9.7	24.0	58.2	108.8	175.8	264.6
B-3 Trade and Service						
a. Hotels	7.9	8.6	12.5	18.9	26.4	38.0
b. Trade & Service	21.5	33.6	56.8	92.4	157.8	248.2
	29.4	42.2	69.3	111.3	184.2	286.2
B-4 Port Tanjung Priok	13.5	17.2	22.0	28.0	35.8	45.7
B-5 Armed Forces	(30,0)	35.4	41.1	46.2	51.0	55.6
B-6 Depok	5.6	6.0	6.0	6.0	6.0	6.0
B-7 Others						
Total B (B-1 thru B-7)	121.3 (154.3)	209.9	316.9	474.6	657.5	904.5
Total Average Demand (Net Consumption A thru B)	234.4 (2700 l/s) 422.6 * (4900 l/s)	578.2 (6,700 l/s)	852.8 (9,900 l/s)	1,234.2 (14,300 l/s)	1,641.1 (19,000 l/s)	2,169.3 (25,100 l/s)
Unaccounted-for Water (% of Production Required) (Case 3)	275.6 (54)	556.3 (49)	568.2 (40)	607.8 (33)	693.9 (29 %)	722.7 (25)
Production Required (In Average (1,000 M3/Day)	510	1,133	1,421	1,842	2,311	2,892
(l/sec)	(919)* 5,900 (10,600)*	13,100	16,400	21,300	26,700	33,500
Total Population Served (In 1,000 persons)	2,100 4,027	4,424	5,361	6,524	7,498	8,785
Gross Percapita Demand (lpcd)	243 (228)*	256	265	282	308	329
Day Maximum Demand (l/sec) (Day Average x 1.15)	6,000 (12,200)*	15,100	18,900	24,500	30,700	38,500
Raw Water Requirement (l/sec) (Day Maximum x 1.07)	7,300 (13,100)	16,200	20,223	26,200	32,900	41,200

* Potential water demand projected for the year 1980

Fig. 6.3 WATER DEMAND VS PROPOSED WATER PRODUCTION



NOTE :

1. FIGURES WITH ASTERISK SHOWS WATER DEMAND, IN A CASE THAT ALL PEOPLE LIVING IN ZONE I AND II RELY ON PIPED WATER.
2. IN RESPECT TO POPULATION HIGHER GROWTH PATTERNS OF 2, REFER TO SECTION 4.4 - COMPARISON OF POPULATION FOR CAST

YEAR	1980	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000	1	2	3	4	5
PHASING	1ST PHASE			2ND PHASE				1MM	1ST PHASE			2ND PHASE					1ST PHASE						2ND PHASE			
	FIRST STAGE								SECOND STAGE								THIRD STAGE									
EXISTING PRODUCTION	5.500 l/s (473.000 M3/D)		5.700	6.800 l/s (588.000 M3/D)			7.600 l/s (674.000 M3/D)	10.800	10.800 l/s (1.133.000 M3/D)			10.600 l/s (916.000 M3/D)			10.300 l/s (890.000 M3/D)						10.300 l/s (890.000 M3/D)			10.300 l/s (890.000 M3/D)		
NEW TREATMENT PRODUCTION									2.000 l/s (173.000 M3/D)			8.000 l/s (691.000 M3/D)			14.000 l/s (1.210.000 M3/D)						20.000 l/s (1.728.000 M3/D)			28.000 l/s (2.419.000 M3/D)		
TOTAL PRODUCTION	5.500 l/s (473.000 M3/D)		5.700	6.800 l/s (588.000 M3/D)			7.800 l/s (674.000 M3/D)	10.800	12.800 l/s (1.106.000 M3/D)			18.600 l/s (1.607.000 M3/D)			24.000 l/s (2.100.000 M3/D)						30.300 l/s (2.618.000 M3/D)			38.300 l/s (3.309.000 M3/D)		

Table 6.28 PRODUCTION CAPACITY BY SYSTEM

SYSTEM	PRESENT RATED CAPACITY (l/sec)	YEARS IN SERVICE
SURFACE WATER SYSTEM		
PEJOMPONGAN I	2000	1957
PEJOMPONGAN II	3000	1973
PULOGADUNG	1,000	1982
(MINI – PLANT)		
(CILANDAK)	200	1977
PESING	5	1980
MUARA KARANG	100	1982.
CENGKARENG	50	1982
SUNTER	50	1982
CAKUNG	25	1982
PEJATEN	5	1976
(CONDET)	–	–
(TAROGONG)	–	–
SPRING SYSTEM		
BOGOR CIBURIAL SPRING	300	1922
DEEP WELL SYSTEM		
DEEP WELL	(120)	
PROPOSED NEW TREATMENT PLANT		
(MMEDIATE PROGRAM OF STAGE II		
FIRST PHASE OF STAGE II		
SECOND PHASE OF STAGE II PROGRAM		
FIRST PHASE OF STAGE III PROGRAM		
SECOND PHASE OF STAGE III PROGRAM		
TOTAL PRODUCTION	6,735 l/s	

PROPOSED PRODUCTION CAPACITY BY SYSTEM (l/sec.)

1983	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000	1	2	3	4	5
	2000				2000					2000					2000					2000		
	3000				3000					3000					3000					3000		
					600					600					600					600		
	1000				1000					1000					1000					1000		
				EXPANSION	3000					3000					3000					3000		
	200				200					200					200					200		
			EXPANSION		250					250					250					250		
	5				5					5					5					5		
															Stand – By or Emergency use							
	100				100					100					100					100		
					100																	
															Canal Extention Program							
	50				50					50					50					50		
															Stand – By or Emergency Use Only							
	50				50					50										50		
	25				25					25					25					25		
	5				5					5					5					5		
	100			NEW MINI PLANT						100					100					100		
		100		NEW MINI PLANT						100					100					100		
	300				300					300					300					300		
						3000				2000					2000					2000		
										6000					6000					6000		
											6000				6000					6000		
																6000				6000		
																				6000		
6.735	6.635	7.785	7.785					18 630 l/s		24.330 l/s			24.330 l/s		30.330 l/s		30.330 l/s			38.330 l/s		
6.700	6.600	7.600	7.800	10.600	12.600 l/s			18 600 l/s		24.300 l/s			24.330 l/s		30.300 l/s		30.300 l/s			38.300 l/s		

(2) Bogor Ciburial Spring water, 300 l/sec, will be wholly supplied to the Depok housing area, including the areas along the trunk main.

To cope with the increaseing water demand, the schedule of water supply expansion on the other hand is worked out based on the following consideration.

(1) For realistic and rasonable implementation of the expansion project, the long range project will be staged as Stage II up to year 1995 and Stage III from 1996 to 2005

(2) Considering the acute shortage of water, prevalent now and around the year 1987, an immediate project will be planned, which is incidentally possible as a result of the West Tarum Canal enlargement.

(3) For the water demand after the immediate project onward, water source will become available, as the Government is now carrying out various studies of water resources development.

6.2.3 Graundwater Use

Applying same unit consumptions, as discussed in the preceding section, to consumers who are in the service area and out side of service area in DKI administrative area and will not receive piped water, groundwater requirement has been projected and is shown in Table 6.29

Table 6.29 Projected Groundwater Demand (Case I)

Year	Groundwater Demand (m3/sec)	Remarks
1980	5.4	Domestic Use
1985	7.0	Income Group
1990	7.9	I and II : 20 lpcd
1995	7.8	III and IV : 150 lpcd
2000	7.8	V : 250 lpcd
2005	7.0	

In case, domestic per capita consumption of groundwater for income group I and II, income group III and IV, and income group V are 20 lpcd, 60 lpcd, and 150 lpcd respectively, and unit consumption of Trade and Service is 50 % of unit consumption as discussed in the preceding section projected groundwater consumption will be as shown in Table 6.30

Table 6.30 Projected Groundwater Demand (Case 2)

Year	Groundwater Demand (m3/sec)	Remarks
1980	4.1	Domestic Use Income Group
1985	5.2	I and II : 20 lpcd
1990	5.7	III and IV : 60 lpcd
1995	5.5	V : 150 lpcd
2000	5.4	Trade and Service,
2005	4.6	50 % of unit consumption applied in Case 1.

In isrecommended that, to ascertain the potential of groundwater, comprehensive systematic groundwater studies in Jakarta City including analysis on mechanism of groundwater recharge, sustainable yield and conservation of groundwater be made as early as possible, and the demand figures be subject to a careful review and adjustment based on the result of the studies prior to implementation of the Second Stage Project or during the detailed design period for the project.

II. REASSESSMENT OF WATER DEMAND

REASSESSMENT OF WATER DEMAND

Table of Contents

Reassessment of Water Demand

This paper deals with the reassessment of water demand, in respons to the requirement presented in DOCUMENT "A" attached to a LIST OF MATTERS TO RECEIVE, THE ATTENTION OF JICA prepared and issued by DSE for Master Plan and Feasibiiity Study for the Jakarta Water Supply Development Project.

The water demand estimates have been made in compliance with the requirement in the DOCUMENT "A", on different basis presented as First (The First Case) and Second (The Second Case) which are projected based on the proposed per capita demand by JICA study team and lower per capita demand with revised income distribution conducted by panel review team respectively. In addition to the above two (2) cases, demand projection on the basis of Government Policy Pleita IV applying up to year 2005 in spite of that the Pelita IV could be applied up to year 1990, since no target figures on Government Policy after Pelita IV is available at present time.

Service Area

1. Guided Land Development (GLD) Programme, prepared by Jakarta Master Plan group, provided a basic concept for the development in the east-west direction with specific land and community development. These areas are shown on Fig. 4.1B in Appendix MII-1 by indicating the areas with district center development.
However, as year by year development program to the east-west direction is not discussed in the GLD program, for determining the proposed boundaries forecasted population density prepared by DKI Master Plan group are also referred and considered as stated later on

2. North east and north west areas, shown on the Fig. 4.1B are reserved and postponed to utilized because of high land cost required for improvement, therefore these areas are left out from the proposed service area by the year 2005.

3. Population density is also to be considered as one of the factors in determining boundaries of service area for most feasible extension. The densely populated area will pollute groundwater quality, so that the people using groundwater and living in the densely populated area will gradually rely on piped water. Suppose wells are located some 15 - 20 meters apart from pit privy etc. of housings, some 20 - 25 meters apart, densities of population assumed to be some 100 - 150/ha, groundwater might be potable especially Zone III. Higher densities of population say, over 150/ha, however, piped water might be required at least for domestic purpose such as drinking and cooking. For the above purpose and reason, population density of such areas to be considered is proposed basically above 150/ha for the planning purpose.

4. Population density by subdistrict (Kecamatan) in the year 1980, 1995, and 2005 are shown in Fig. B-3, B-4 and B-5 in Appendix MII-1 pectively. Population density in further divided areas, which was provided by DKI Jakarta for the year 1980, 1995 and 2005 are shown in Figs. A-1, A-2 and A-3 respectively. The areas of 100 - 150 persons/ha left out are shown in the above figures.

5. Southward area beyond outmost highway, shown in Fig. 4.1B in Jakarta are planned as non development area of reserved open space and as low dense residence area with strict restriction on wastewater and sanitation, and rivers are protected from pollution. These areas are planned and considered as groundwater recharge and coservation area and development are not encouraged. Population density along and adjacent to the highway are forecasted between 150 - 200 and beyond this area mostly 100 - 150 or less, in the year 2005. (See Fig.A-3).

   The south east area is used as Halim Airport (1), recreational area (2) and reserved for military area (3) and are left out from service area except airport terminal buildings offices and housings and Taman Mini Indonesia areas.

6. There are no specific boundaries to the areas which have been followed. Highway and public road construction plans provided in the Master Plan has been referred and considered in planning the service area, as they would reveal information on future extension of city development such as housing and commercial establishment due to accessibility of better transportation.

7. Based on the concepts discussed in section 6.1.1 Service area, and the above, service area up to the year 2005 has been delineated as shown in Fig. 6.1 Future Service Area.

6. The areas proposed to be extended in the immediate near future by the year 1990 as service area are as follows : (See Fig. A-2).

1) In accordance with a housing plan, Kel. Penjaringan, in Jakarta Utara, has been developing and at present, many of newly constructed houses are located along the road to Kel. Muara Angke. Besides this housing, huge area on both side of the road is developed by embarking the land and housing construction work is actively now under way. This housing program in this area will be accomplished within couple of years (See Fig. A-2).

2) Highway construction work, crossing Jl. Let. Jend. S. Parman and extending Jl. Kyaicaringin is now under way in Jakarta Barat. The service area will be required to be developed along the highway and road crossing this highway and running from north to south. Future extension of city activity, such as housing and commercial establishment is expected due to accessibility of better transportation. There are many housing existed around this proposed service area to be extended.

3) It has been developed new housing area on north side of the Jl. Perintis Kemerdekaan. At present, inner land of this area is being developed and housing construction work is being progressed. This area will be developed also as industrial area and industrial estate will be established in addition to existing one and require to recieve system water in the near future.

4) East side along Jl. Jend. D.I. Panjaitan in Kel. Cipinang Besar is now served by system. Further, inner area to east has rather congested housing area up to Jl. Pahlawan Revolusi and some housing complex are located beyond this road.

5) Southward area from Jl. Let. Jend. MT. Haryono, along Jl. Raya Besar Pasar Minggu and Jl. Dewi Sartika in Jakarta Selatan and Timur has at present many housings and will be more congested in near future. According to the field survey, area westward of Jl. Raya Pasar Minggu still has huge area of open space, therefore, it is proposed to expand the area between Jl. Raya Pasar Minggu and Jl. Dewi Sartika as service area at an earlier stage.

Population in Service Area

1. Population in the service area is on the basis of the forecasted population in the district shown on Table 4.4 and the population in the district, not fully covered by the projected service area, is estimated on the basis of population density with area to be included in the service area, by referring to the population density in the areas further divided shown in Figs. A-1, A-2 and A-3.

2. Population in service area in every years from the year 1980 up to the year 2005 are projected by the manner stated in the above and the population in the service area is further distributed according to physical zone.

3. Population in the service area distributed to income group by applying income distribution ratio of each subdistrict shown in Tables 3.8 and 3.9 for the year 1980 and 2005 respectively. Income distribution ratio of intermediated ratio by five-year intervals are projected linearly based on the ratio of the years 1980 and 2005.

4. Following the above procedures, the population in the service area by physical zone and by income group are projected and the result is shown on Table F-1 through F-6 and these are summarized in Table F-7. The computed figures are counted fraction,5 and over as units and cut away the rest. Therefore, the accumulated total population figures from each zone are not necessarily same as the population figures in the column of population in service area.

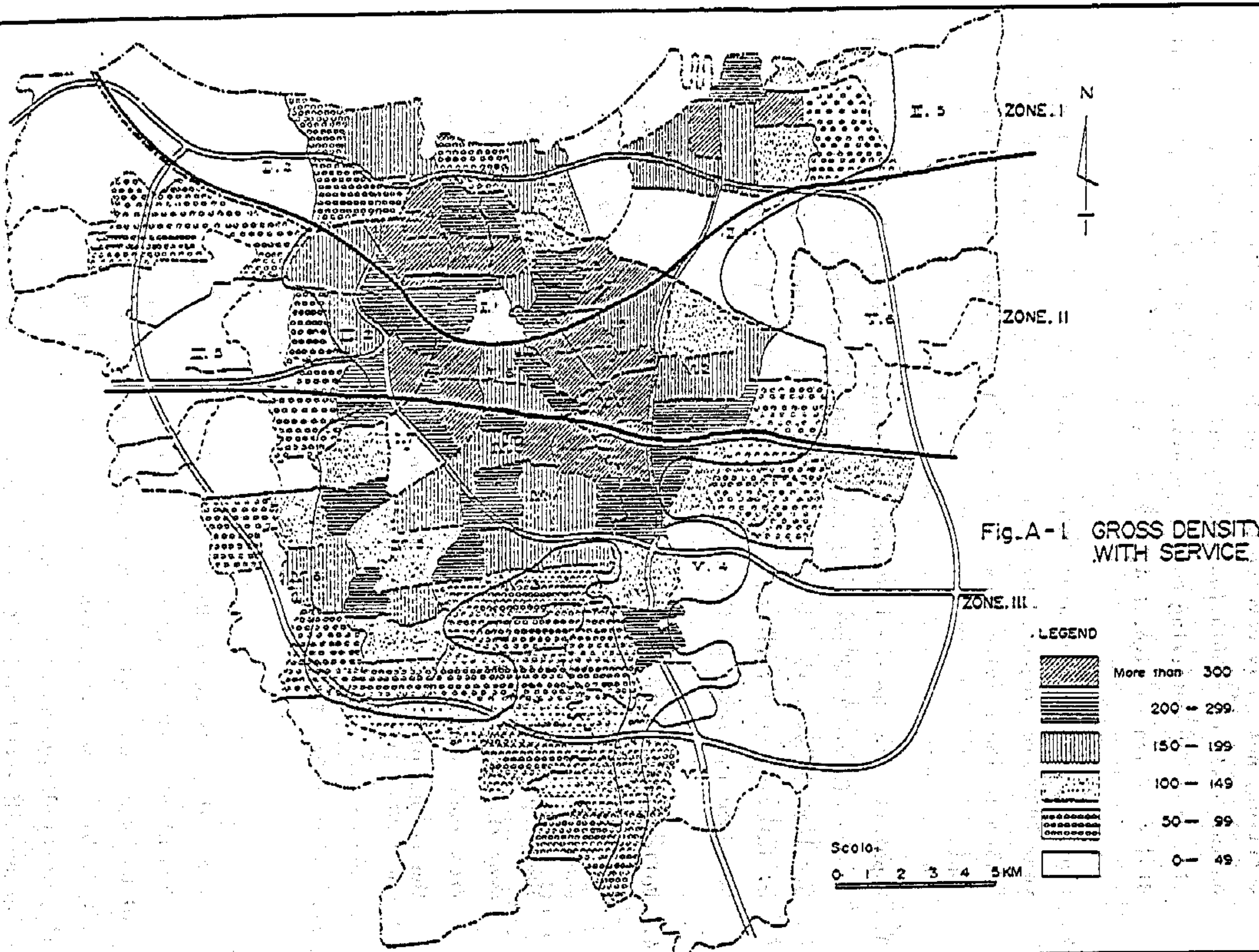


Fig. A-1 GROSS DENSITY 1980 WITH SERVICE AREA 1980/1985.

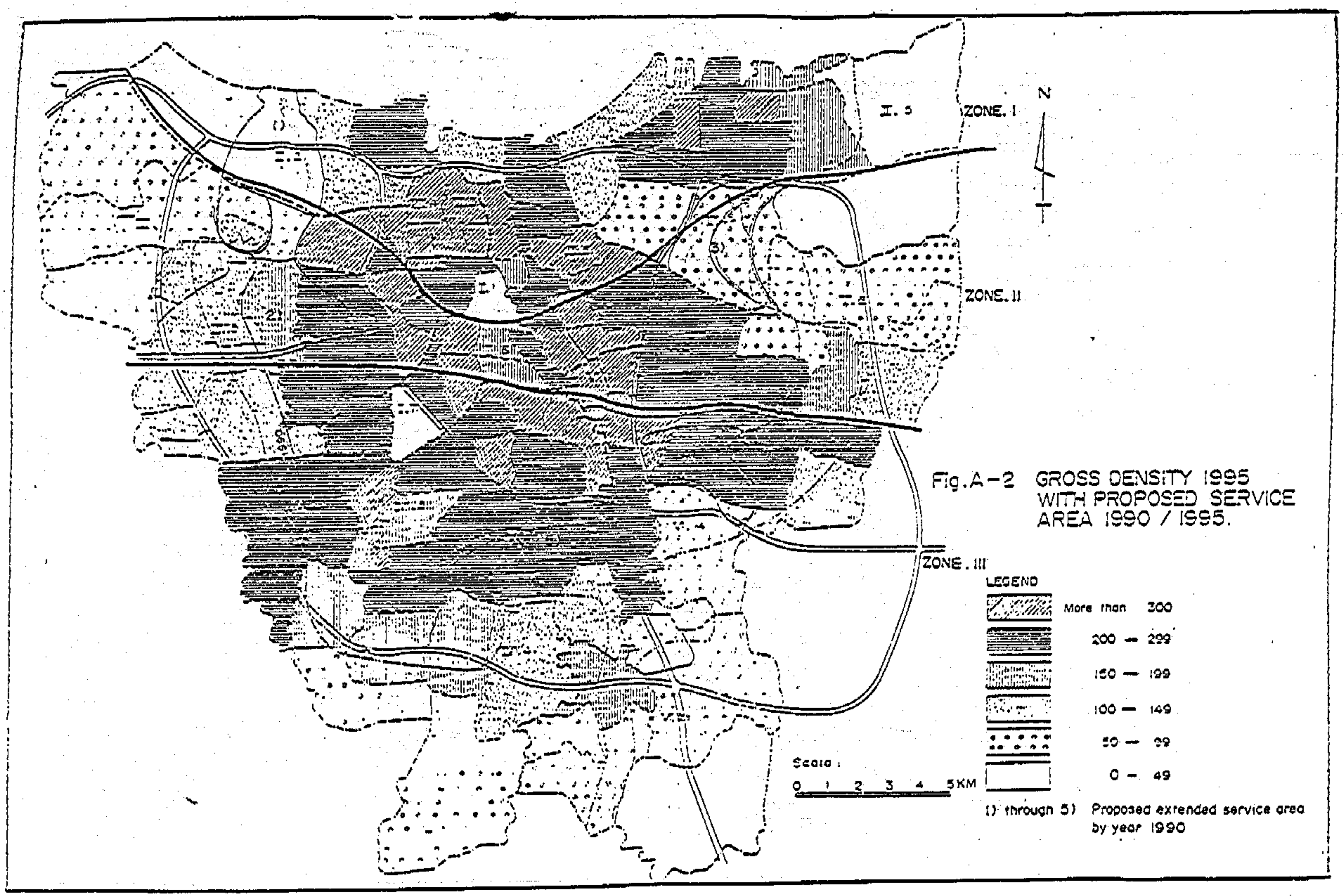


Fig.A-2 GROSS DENSITY 1995 WITH PROPOSED SERVICE AREA 1990 / 1995.

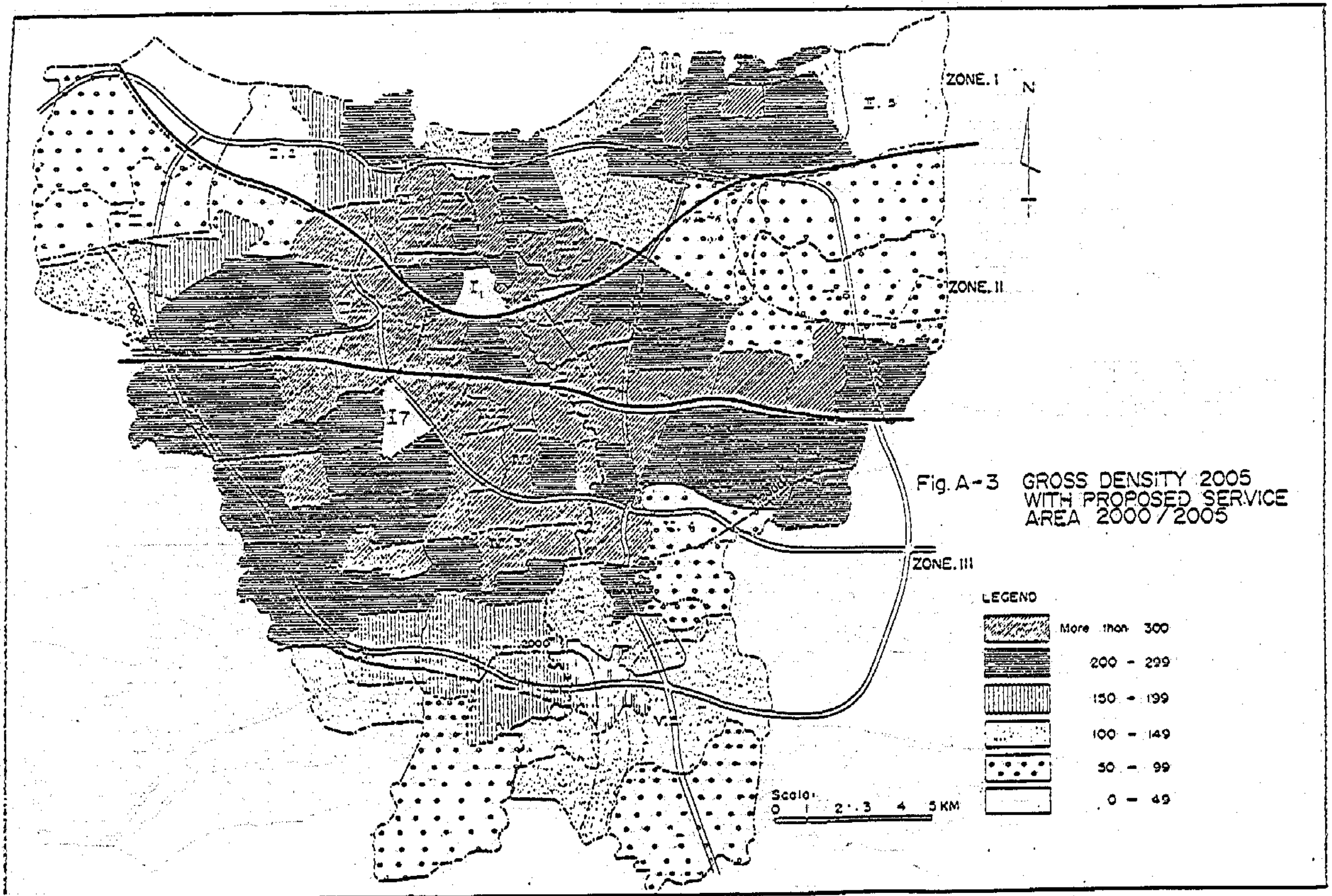


Fig. A-3 GROSS DENSITY 2005 WITH PROPOSED SERVICE AREA 2000 / 2005

Table F-1 Population in Service Area by Zone and Income Group in 1980

	POPULATION IN SERVICE AREA			YEAR 1980 INCOME GROUP RATIO					ZONE-1						ZONE-2						ZONE-3					
REC	ZONE 1	ZONE 2	ZONE 3	I	II	III	IV	V	I	II	III	IV	V	TOTAL	I	II	III	IV	V	TOTAL	I	II	III	IV	V	TOTAL
I-1	140	5	0	35.8	32.1	13.7	7.8	10.4	50.1	44.9	19.2	10.9	14.6	139.7	1.8	1.6	0.7	0.4	0.5	5.0	0.0	0.0	0.0	0.0	0.0	0.0
I-2	157	0	0	36.4	35.2	14.0	6.9	7.4	57.1	55.3	22.0	10.8	11.6	156.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-3	230	0	0	34.3	41.2	14.0	5.9	4.4	78.9	94.8	32.2	13.6	10.1	229.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-4	45	90	0	31.1	38.7	14.8	7.7	7.5	14.0	17.4	6.7	3.5	3.4	45.0	28.0	34.8	13.3	6.9	6.8	89.8	0.0	0.0	0.0	0.0	0.0	0.0
I-5	9	206	0	34.1	39.2	12.8	6.4	7.3	3.1	3.5	1.2	0.6	0.7	9.1	70.2	80.8	26.4	13.2	15.0	205.6	0.0	0.0	0.0	0.0	0.0	0.0
I-6	0	115	0	35.3	32.8	12.0	7.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	40.6	37.7	13.8	8.1	14.7	114.9	0.0	0.0	0.0	0.0	0.0	0.0
I-7	0	124	115	35.7	39.7	12.0	5.8	6.7	0.0	0.0	0.0	0.0	0.0	0.0	44.3	49.2	14.9	7.2	8.3	123.9	41.1	45.7	13.8	6.7	7.7	115.0
									203	216	81	39	40	580	185	204	69	36	45	539	41	46	14	7	8	115
II-2	293	0	0	43.3	37.3	9.8	4.2	5.2	126.9	109.3	28.7	12.3	15.2	292.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-3	233	0	0	35.3	42.7	13.0	5.5	3.4	82.2	99.5	30.3	12.8	7.9	232.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-4	246	8	0	40.9	38.7	11.4	5.0	3.8	100.6	95.2	28.0	12.3	9.3	245.4	3.3	3.1	0.9	0.4	0.3	8.0	0.0	0.0	0.0	0.0	0.0	0.0
II-5	103	4	0	41.7	40.0	10.7	4.5	3.0	43.0	41.2	11.0	4.6	3.1	102.9	1.7	1.6	0.4	0.2	0.1	4.0	0.0	0.0	0.0	0.0	0.0	0.0
									353	345	98	42	36	873	.5	5	1	1	0	12	0	0	0	0	0	0
III-1	0	28	0	51.4	36.1	6.9	2.7	2.8	0.0	0.0	0.0	0.0	0.0	0.0	14.4	10.1	1.9	0.8	0.8	28.0	0.0	0.0	0.0	0.0	0.0	0.0
III-2	32	287	34	38.6	34.4	12.5	6.7	7.7	12.4	11.0	4.0	2.1	2.5	32.0	110.8	98.7	35.9	19.2	22.1	286.7	12.1	11.7	4.3	2.3	2.6	34.0
III-3	150	0	0	33.2	36.7	15.2	7.0	7.7	49.8	55.1	22.8	10.5	11.6	149.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-4	270	0	0	42.3	38.1	10.5	4.7	4.2	114.2	102.9	28.4	12.7	11.3	269.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-5	0	0	7	41.7	37.0	9.7	4.5	7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.9	2.6	0.7	0.3	0.5	7.0
									176	169	55	25	25	451	125	109	38	20	23	315	16	14	5	3	3	41
IV-1	0	0	257	36.0	32.5	12.5	7.5	11.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	92.5	83.5	32.1	19.3	29.0	256.4
IV-2	0	0	231	35.6	43.5	12.4	5.4	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.6	100.5	28.6	12.5	11.6	230.8
IV-3	0	0	142	34.8	40.0	11.7	5.8	7.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.4	56.8	16.6	8.2	10.7	141.7
IV-4	0	0	29	35.3	40.0	12.4	6.5	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.2	11.6	3.6	1.9	1.6	28.9
IV-5	0	0	202	37.8	29.0	12.3	6.9	14.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	76.4	58.6	22.8	13.9	29.7	201.4
IV-6	0	0	186	29.9	41.7	12.8	6.6	8.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.6	77.6	23.9	12.3	16.4	185.7
IV-7	0	0	68	30.2	37.5	12.1	7.2	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.5	25.5	8.2	4.9	8.7	67.8
									0	0	0	0	0	0	0	0	0	0	0	0	382	414	136	73	108	1113
V-1	0	154	26	27.7	40.8	15.9	8.0	7.4	0.0	0.0	0.0	0.0	0.0	0.0	42.7	62.8	24.5	12.3	11.4	153.7	7.2	10.6	4.1	2.1	1.9	25.9
V-2	0	251	5	27.6	36.3	14.7	9.3	11.8	0.0	0.0	0.0	0.0	0.0	0.0	69.3	91.1	36.9	23.2	29.6	250.2	1.4	1.8	0.7	0.5	0.6	5.0
V-3	0	0	228	32.0	39.9	14.6	7.4	6.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.7	91.0	33.3	16.9	15.7	227.6
V-4	0	0	168	29.8	41.4	14.1	8.1	6.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	50.1	69.6	23.7	13.6	10.8	167.8
V-5	0	1	27	37.8	40.8	11.3	6.1	3.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.2	11.0	3.1	1.6	1.0	26.9
V-6	0		0	39.5	46.6	8.7	2.6	2.4	0.0	0.0	0.0	0.0	0.0	0.0	20.5	24.2	4.5	1.4	1.2	51.8	0.0	0.0	.0	0.0	0.0	0.0
	1908	1324	1725	1042	1110	358	180	206	0	0	0	0	0	0	133	178	66	37	42	456	240	184	65	35	30	453
			4957						732	730	235	107	101	1905	448	496	174	93	111	1322	579	658	219	117	149	1722

Table F-2 Population in Service Area by Zone and Income Group in 1985

POPULATION IN SERVICE AREA — YEAR 1985 — INCOME GROUP RATIO

SEC	ZONE 1	ZONE 2	ZONE 3	I	II	III	IV	V	ZONE-1 I	II	III	IV	V	TOTAL	ZONE-2 I	II	III	IV	V	TOTAL	ZONE-3 I	II	III	IV	V	TOTAL
I-1	143	6	0	30.8	29.2	14.2	8.6	17.2	44.0	41.8	20.3	12.3	24.5	142.9	1.8	1.8	0.9	0.5	1.0	6.0	0.0	0.0	0.0	0.0	0.0	0.0
I-2	165	0	0	31.6	32.5	14.9	7.8	13.1	52.1	53.6	24.6	12.9	21.6	164.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-3	237	0	0	30.1	38.6	15.5	7.0	8.6	71.3	91.5	36.7	16.6	20.4	236.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-4	46	91	0	26.9	35.3	15.6	8.7	13.3	12.4	16.2	7.2	4.0	6.1	45.9	24.5	32.1	14.2	7.9	21.1	90.3	0.0	0.0	0.0	0.0	0.0	0.0
I-5	9	212	0	29.7	36.2	13.7	7.3	13.0	2.7	3.3	1.2	0.7	1.2	9.1	63.0	76.7	29.0	15.5	27.6	211.8	0.0	0.0	0.0	0.0	0.0	0.0
I-6	0	120	0	30.2	29.2	12.2	7.6	20.7	0.0	0.0	0.0	0.0	0.0	0.0	36.2	35.0	14.6	9.1	24.8	119.7	0.0	0.0	0.0	0.0	0.0	0.0
I-7	0	126	120	31.1	36.8	13.0	6.7	12.3	0.0	0.0	0.0	0.0	0.0	0.0	39.2	46.4	15.4	8.4	15.5	125.9	37.3	44.2	15.6	8.0	14.8	119.9
									183	206	90	47	74	599	165	192	75	41	81	554	37	44	16	8	15	120
II-2	323	0	0	39.2	35.2	10.8	5.0	9.6	126.6	113.7	34.9	16.2	31.0	322.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-3	269	0	0	31.2	40.9	14.6	6.6	6.5	83.9	110.0	39.2	17.8	17.5	268.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-4	262	10	0	36.2	37.1	12.9	6.0	7.7	94.8	97.2	33.8	15.7	20.2	261.7	3.6	3.7	1.3	0.6	0.8	10.0	0.0	0.0	0.0	0.0	0.0	0.0
II-5	118	5	0	37.7	38.6	12.2	5.5	5.9	44.5	45.5	14.4	6.5	7.0	117.9	1.9	1.9	0.6	0.3	0.3	5.0	0.0	0.0	0.0	0.0	0.0	0.0
									350	366	122	56	76	971	6	6	2	1	1	15	0	0	0	0	0	0
III-1	0	32	0	46.4	35.7	8.1	3.5	6.2	0.0	0.0	0.0	0.0	0.0	0.0	14.8	11.4	2.6	1.1	2.0	31.9	0.0	0.0	0.0	0.0	0.0	0.0
III-2	36	309	37	33.5	31.6	13.4	7.7	13.8	12.1	11.4	4.8	2.8	5.0	36.1	103.5	97.6	41.4	23.8	42.6	308.9	12.4	11.7	5.0	2.8	5.1	37.0
III-3	152	0	0	28.7	33.6	16.1	7.9	13.6	43.6	51.1	24.5	12.0	20.7	151.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-4	272	0	0	37.5	36.3	11.9	5.7	8.5	102.0	98.7	32.4	15.5	23.1	271.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-5	0	0	9	37.4	34.7	10.3	5.2	12.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.4	3.1	0.9	0.5	1.1	9.0
									158	161	62	30	49	460	128	109	44	25	45	341	16	15	6	3	6	46
IV-1	0	0	278	30.9	29.4	12.9	8.2	18.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	85.9	81.7	35.9	22.8	51.2	277.5
IV-2	0	0	246	29.5	40.9	13.7	6.3	9.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.6	100.6	33.7	15.5	23.4	245.6
IV-3	0	0	162	30.2	36.6	12.3	6.6	14.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.9	59.3	19.9	10.7	22.8	161.6
IV-4	0	0	38	30.8	37.1	13.5	7.6	10.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.7	14.1	5.1	2.9	4.1	37.9
IV-5	0	0	227	32.3	26.1	11.4	7.4	22.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.3	59.2	25.9	16.8	51.3	226.5
IV-6	0	0	217	25.7	37.6	13.4	7.5	15.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.8	81.6	29.1	16.3	34.1	216.9
IV-7	0	0	87	25.8	33.6	12.2	7.7	20.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	22.4	29.2	10.6	6.7	17.8	86.7
									0	0	0	0	0	0	0	0	0	0	0	0	371	426	160	92	205	1253
V-1	0	160	26	23.9	37.2	16.7	9.0	13.1	0.0	0.0	0.0	0.0	0.0	0.0	38.2	59.5	26.7	14.4	21.0	159.8	6.2	9.7	4.3	2.3	3.4	25.9
V-2	0	284	5	23.5	32.4	14.8	10.0	19.0	0.0	0.0	0.0	0.0	0.0	0.0	66.7	92.0	41.0	28.4	54.0	283.1	1.2	1.6	0.7	0.5	1.0	5.0
V-3	0	0	247	26.8	36.8	15.3	8.3	12.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.2	90.9	37.8	20.5	31.2	246.5
V-4	0	0	100	25.3	37.9	14.9	9.1	12.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	48.2	72.8	28.2	17.2	22.8	189.2
V-5	0	0	32	34.8	38.7	12.2	6.9	7.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.1	12.4	3.9	2.2	2.2	31.9
V-6	0	72	0	35.7	45.2	9.9	3.4	5.6	0.0	0.0	0.0	0.0	0.0	0.0	25.7	32.5	7.1	2.4	4.0	71.7	0.0	0.0	0.0	0.0	0.0	0.0
0	2032	1427	1921	914	1031	383	205	363	0	0	0	0	0	0	131	184	76	45	79	515	134	187	75	43	61	499
			5380						690	734	274	133	198	2029	419	491	197	112	206	1425	558	671	257	146	286	1918

Table F-3 Population in Service Area by Zone and Income Group in 1990

ZONE	POPULATION IN GROUP OF AREA 1	2	3	YEAR 1990 INCOME GROUP RATIO I	II	III	IV	V	ZONE-1 I	II	III	IV	V	TOTAL	ZONE-2 I	II	III	IV	V	TOTAL	ZONE-3 I	II	III	IV	V	TOTAL
I-1	147	6	0	25.8	26.3	14.7	9.3	23.8	37.9	38.7	21.6	13.7	35.0	146.9	1.5	1.6	0.9	0.6	1.4	6.0	0.0	0.0	0.0	0.0	0.0	0.0
I-2	172	0	0	26.8	29.7	15.9	8.7	18.8	46.1	51.1	27.3	15.0	32.3	171.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-3	244	0	9	25.9	36.0	17.0	8.2	12.8	63.2	87.8	41.5	20.0	31.2	243.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-4	47	92	0	22.7	32.0	16.4	9.7	19.1	10.7	15.0	7.7	4.6	9.0	47.0	20.9	29.4	15.1	8.9	17.6	91.9	0.0	0.0	0.0	0.0	0.0	0.0
I-5	9	217	0	25.3	33.2	14.6	8.1	18.7	2.3	3.0	1.3	0.7	1.7	9.0	54.9	72.0	31.7	17.6	40.6	216.8	0.0	0.0	0.0	0.0	0.0	0.0
I-6	0	125	0	25.1	25.7	12.4	8.2	28.6	0.0	0.0	0.0	0.0	0.0	0.0	31.4	32.1	15.5	10.3	35.8	125.1	0.0	0.0	0.0	0.0	0.0	0.0
I-7	0	129	125	26.5	33.9	14.0	7.6	17.9	0.0	0.0	0.0	0.0	0.0	0.0	34.2	43.7	18.1	9.8	23.1	128.9	33.1	42.4	17.5	9.5	22.4	124.9
									160	196	99	54	109	618	143	179	81	47	119	569	33	42	18	10	22	125
II-2	369	0	0	35.1	33.1	11.8	5.8	14.1	129.5	122.1	43.5	21.4	52.0	368.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-3	322	0	0	27.2	39.1	16.2	7.8	9.6	87.6	125.9	52.2	25.1	30.9	321.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-4	282	33	0	31.5	35.5	14.3	7.0	11.5	88.8	100.1	40.3	19.7	32.4	281.3	10.4	11.7	4.7	2.3	3.8	32.9	0.0	0.0	0.0	0.0	0.0	0.0
II-5	137	7	0	33.7	37.2	12.7	6.5	8.8	46.2	51.0	18.8	8.9	12.1	137.0	2.4	2.6	1.0	0.5	0.6	7.1	0.0	0.0	0.0	0.0	0.0	0.0
									352	399	155	75	127	1109	13	14	6	3	4	40	0	0	0	0	0	0
III-1	0	72	0	41.4	35.3	9.3	4.3	9.7	0.0	0.0	0.0	0.0	0.0	0.0	29.8	25.4	6.7	3.1	7.0	72.0	0.0	0.0	0.0	0.0	0.0	0.0
III-2	41	378	53	28.3	28.8	14.2	8.6	20.0	11.6	11.8	5.8	3.5	8.2	40.9	107.0	108.9	53.7	32.5	75.6	377.7	15.0	15.3	7.5	4.6	10.6	53.0
III-3	155	0	0	24.2	30.4	16.9	8.9	19.5	37.5	47.1	26.2	13.8	30.2	154.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-4	274	0	0	32.8	34.4	13.2	6.7	12.7	89.9	94.3	36.2	18.4	34.8	273.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-5	0	129	107	33.0	32.4	10.9	5.9	17.6	0.0	0.0	0.0	0.0	0.0	0.0	42.6	41.8	14.1	7.6	22.7	128.8	35.3	34.7	11.7	6.3	18.8	106.8
									139	153	68	36	73	469	179	176	75	43	105	579	50	50	19	11	29	160
IV-1	0	0	380	25.8	26.4	13.3	8.9	25.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.4	79.2	39.9	26.7	76.5	299.7
IV-2	0	0	262	25.5	38.3	14.9	7.3	14.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	66.8	100.3	39.0	19.1	36.7	261.9
IV-3	0	0	268	25.6	33.2	12.9	7.4	20.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.6	89.0	34.6	19.8	55.5	267.5
IV-4	0	0	65	26.3	34.3	14.7	8.8	15.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	17.1	22.3	9.6	5.7	10.3	65.0
IV-5	0	0	255	26.7	23.1	11.6	7.9	30.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	68.1	58.9	29.6	20.1	77.8	254.5
IV-6	0	0	328	21.6	33.5	13.9	8.3	22.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	70.8	109.9	45.6	27.2	73.8	327.3
IV-7	0	0	111	21.4	29.7	12.3	8.7	28.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	23.8	33.0	13.7	9.2	31.2	110.9
									0	0	0	0	0	0	0	0	0	0	0	0	393	493	212	128	362	1587
V-1	0	167	26	20.1	33.6	17.5	10.0	18.8	0.0	0.0	0.0	0.0	0.0	0.0	33.6	56.1	29.2	16.7	31.4	167.0	5.2	8.7	4.6	2.6	4.9	26.0
V-2	0	318	5	19.4	28.5	15.0	10.7	26.3	0.0	0.0	0.0	0.0	0.0	0.0	61.7	90.6	47.7	34.0	83.6	317.6	1.0	1.4	0.8	0.5	1.3	5.0
V-3	0	0	380	22.7	33.8	16.0	9.2	18.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86.3	128.4	60.8	35.0	69.2	379.7
V-4	0	0	251	22.0	34.5	15.7	10.1	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	55.2	86.6	39.4	25.4	44.2	250.8
V-5	0	0	38	31.9	36.6	13.1	7.7	10.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.1	12.9	5.0	2.9	4.0	37.9
V-6	0	99	0	32.0	43.9	11.1	4.2	8.8	0.0	0.0	0.0	0.0	0.0	0.0	31.7	43.5	11.0	4.2	8.7	99.1	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	2199	1772	2574	786	952	408	230	521	0	0	0	0	0		127	190	88	55	124	584	160	239	111	66	124	699
			6545						651	748	322	165	310	2196	462	559	249	148	352	1771	636	824	359	215	537	2571

Table F-4 Population in Service Area by Zone and Income Group in 1995

	POPULATION IN SERVICE AREA			YEAR 1995 INCOME GROUP RATIO					ZONE-1						ZONE-2						ZONE-3					
REG	ZONE 1	ZONE 2	ZONE 3	I	II	III	IV	V	I	II	III	IV	V	TOTAL	I	II	III	IV	V	TOTAL	I	II	III	IV	V	TOTAL
I-1	150	6	0	20.7	23.4	15.2	10.1	30.5	31.1	35.1	22.8	15.2	45.8	150.0	1.2	1.4	0.9	0.6	1.8	5.9	0.0	0.0	0.0	0.0	0.0	0.0
I-2	180	0	0	22.0	27.0	16.8	9.7	24.5	39.6	48.6	30.2	17.5	44.1	180.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-3	251	0	0	21.8	33.4	18.4	9.3	17.0	54.7	83.8	46.2	23.3	42.7	250.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-4	49	92	0	15.5	28.6	17.2	10.7	24.9	9.1	14.0	8.4	5.2	12.2	48.9	17.0	26.3	15.8	9.8	22.9	91.8	0.0	0.0	0.0	0.0	0.0	0.0
I-5	9	223	0	20.9	30.2	15.4	9.0	24.4	1.9	2.7	1.4	0.8	2.2	9.0	46.6	67.3	34.3	20.1	54.4	222.7	0.0	0.0	0.0	0.0	0.0	0.0
I-6	0	129	0	20.0	22.1	12.7	8.7	36.4	0.0	0.0	0.0	0.0	0.0	0.0	25.8	28.5	16.4	11.2	47.0	128.9	0.0	0.0	0.0	0.0	0.0	0.0
I-7	0	131	130	22.0	31.0	15.0	8.6	23.4	0.0	0.0	0.0	0.0	0.0	0.0	28.8	40.6	19.7	11.3	30.7	131.1	28.6	40.3	19.5	11.2	30.4	130.0
									136	184	109	62	147	639	119	164	87	53	157	580	29	40	20	11	30	130
II-2	415	0	0	31.0	31.0	12.9	6.5	18.5	128.7	128.7	53.5	27.0	76.8	414.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-3	357	0	0	23.1	37.4	17.9	8.9	12.7	82.5	133.5	63.9	31.8	45.3	357.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-4	304	39	0	26.9	33.9	15.8	8.0	15.4	81.8	103.1	48.0	24.3	46.8	304.0	10.5	13.2	6.2	3.1	6.0	39.0	0.0	0.0	0.0	0.0	0.0	0.0
II-5	160	9	0	29.8	35.7	15.1	7.6	11.8	47.7	57.1	24.2	12.2	18.9	160.1	2.7	3.2	1.4	0.7	1.1	9.1	0.0	0.0	0.0	0.0	0.0	0.0
									341	422	190	95	188	1236	13	16	8	4	7	48	0	0	0	0	0	0
III-1	0	116	0	36.5	34.8	10.5	5.0	13.1	0.0	0.0	0.0	0.0	0.0	0.0	42.3	40.4	12.2	5.8	15.2	115.9	0.0	0.0	0.0	0.0	0.0	0.0
III-2	47	414	58	23.2	26.0	15.1	9.6	26.1	10.9	12.2	7.1	4.5	12.3	47.0	96.0	107.6	65.5	39.7	108.1	413.9	13.5	15.1	8.8	5.6	15.2	58.1
III-3	156	0	0	19.7	27.3	17.8	9.8	25.3	31.1	43.1	28.1	15.5	40.0	157.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-4	276	0	0	28.0	32.6	14.6	7.8	17.0	77.3	90.0	40.3	21.5	46.9	276.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-5	0	240	198	28.7	30.2	11.6	6.7	22.9	0.0	0.0	0.0	0.0	0.0	0.0	69.7	73.4	28.2	16.3	55.6	243.2	56.8	59.8	23.0	13.3	45.3	198.2
									119	145	76	42	99	481	208	221	103	62	179	773	70	75	32	19	60	256
IV-1	0	0	315	20.7	23.3	13.8	9.6	32.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	65.2	73.4	43.5	30.2	102.4	314.7
IV-2	0	0	273	21.4	35.7	16.2	8.2	18.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	58.4	97.5	44.2	22.4	50.2	272.7
IV-3	0	0	446	21.1	29.9	13.5	8.1	27.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	94.1	133.4	60.2	36.1	122.2	446.0
IV-4	0	0	140	21.9	31.4	15.8	9.9	20.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.7	44.0	22.1	13.9	29.3	140.0
IV-5	0	0	273	21.2	20.2	11.7	8.3	38.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	57.9	55.1	31.9	22.7	105.1	272.7
IV-6	0	0	590	17.4	29.5	14.5	9.2	29.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.7	174.1	85.6	54.3	173.5	590.2
IV-7	0	0	142	17.1	25.8	12.5	8.8	35.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	24.3	36.6	17.8	12.5	30.8	142.0
									0	0	0	0	0	0	0	0	0	0	0	0	433	614	305	192	634	2178
V-1	0	173	26	16.3	29.9	18.3	10.9	24.4	0.0	0.0	0.0	0.0	0.0	0.0	28.2	51.7	31.7	18.9	42.2	172.7	4.2	7.8	4.8	2.8	6.3	25.9
V-2	0	347	5	15.4	24.5	15.2	12.3	33.5	0.0	0.0	0.0	0.0	0.0	0.0	53.4	85.0	52.4	39.2	116.2	346.2	0.8	1.2	0.8	0.6	1.7	5.2
V-3	0	0	590	18.5	30.7	16.7	10.1	23.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	109.2	181.1	98.5	59.6	141.0	589.4
V-4	0	0	296	18.0	31.0	16.6	11.1	23.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	53.3	91.8	49.1	32.9	68.7	295.8
V-5	0	0	46	28.9	34.6	14.1	8.6	13.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.3	15.9	6.5	4.0	6.3	46.0
V-6	0	200	0	28.2	42.5	12.2	5.0	11.9	0.0	0.0	0.0	0.0	0.0	0.0	56.4	85.0	24.4	10.0	23.8	199.6	0.0	0.0	0.0	0.0	0.0	0.0
	0	2356	2122	3528	659	874	433	255	678	0	?	0	0	0	0	138	222	109	68	182	719	181	298	160	100	224	962
				8006					596	752	374	199	434	2355	479	624	306	187	525	2120	713	1027	516	322	948	3527

Table F-5 Population in Service Area by Zone and Income Group in 2000

	POPULATION IN SERVICE AREA			YEAR 2000 INCOME GROUP RATIO					ZONE-1						ZONE-2						ZONE-3					
	ZONE 1	ZONE 2	ZONE 3																							
REG	1	2	3	I	II	III	IV	V	I	II	III	IV	V	TOTAL	I	II	III	IV	V	TOTAL	I	II	III	IV	V	TOTAL
I-1	154	6	0	15.7	20.5	15.7	10.8	37.2	24.2	31.6	24.2	16.6	57.3	153.9	0.9	1.2	0.9	0.6	2.2	5.8	0.0	0.0	0.0	0.0	0.0	0.0
I-2	184	0	0	17.2	24.2	17.8	10.6	30.2	31.6	44.5	32.8	19.5	55.6	184.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-3	255	0	0	17.6	30.8	19.9	10.5	21.2	44.9	78.5	50.7	26.8	54.1	255.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I-4	50	93	0	14.3	25.3	18.0	11.7	30.7	7.2	12.7	9.0	5.9	15.4	50.2	13.3	23.5	16.7	10.9	28.6	93.0	0.0	0.0	0.0	0.0	0.0	0.0
I-5	9	277	0	14.5	27.2	16.3	9.8	30.1	1.5	2.4	1.5	0.9	2.7	9.0	37.5	61.7	37.0	22.2	68.3	226.7	0.0	0.0	0.0	0.0	0.0	0.0
I-6	0	135	0	14.9	18.6	12.9	9.3	44.3	0.0	0.0	0.0	0.0	0.0	0.0	20.1	25.1	17.4	12.6	59.8	135.0	0.0	0.0	0.0	0.0	0.0	0.0
I-7	0	134	134	17.4	28.1	16.0	9.5	29.0	0.0	0.0	0.0	0.0	0.0	0.0	23.3	37.7	21.4	21.7	38.9	134.0	23.3	37.7	21.4	12.7	38.9	134.0
									109	170	118	70	185	652	95	149	93	59	198	595	23	38	21	13	39	134
II-2	449	0	0	20.9	28.9	13.9	7.3	23.0	120.8	129.8	62.4	32.8	103.3	449.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-3	383	0	0	19.2	35.6	19.5	10.1	15.8	73.2	136.3	74.7	38.7	60.5	383.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
II-4	316	44	0	22.2	32.3	17.2	9.0	19.2	70.2	102.1	54.4	28.4	60.7	315.8	9.8	14.2	7.6	4.0	8.4	44.0	0.0	0.0	0.0	0.0	0.0	0.0
II-5	174	11	0	25.8	34.3	16.6	8.6	14.7	44.9	59.7	28.9	15.0	25.6	174.1	2.8	3.8	1.8	0.9	1.6	10.9	0.0	0.0	0.0	0.0	0.0	0.0
									309	428	220	115	250	1322	13	18	9	5	10	55	0	0	0	0	0	0
III-1	0	197	0	31.5	34.4	11.7	5.8	16.6	0.0	0.0	0.0	0.0	0.0	0.0	62.1	67.8	23.0	11.4	32.7	197.0	0.0	0.0	0.0	0.0	0.0	0.0
III-2	49	434	61	18.0	23.2	15.9	10.5	32.3	8.8	11.4	7.8	5.1	15.8	48.9	78.1	100.7	69.0	45.6	140.2	433.6	11.0	14.2	9.7	6.4	19.7	61.0
III-3	159	0	0	15.2	24.1	18.6	10.8	31.2	24.2	38.3	29.6	17.2	49.6	158.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-4	277	0	0	23.3	30.7	15.9	8.8	21.2	64.5	85.0	44.0	24.4	58.7	276.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-5	0	354	324	24.3	27.9	12.2	7.4	28.2	0.0	0.0	0.0	0.0	0.0	0.0	68.0	98.8	43.2	26.2	99.8	354.0	78.7	90.4	39.5	24.0	92.4	324.0
									98	135	81	47	124	484	226	267	135	83	273	985	90	105	49	30	111	385
IV-1	0	0	334	15.6	20.3	14.2	10.3	39.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	52.1	67.8	47.4	34.4	132.3	334.0
IV-2	0	0	282	17.4	33.1	17.4	9.2	22.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.1	93.3	49.1	25.9	64.4	282.0
IV-3	0	0	506	16.5	26.5	14.1	8.9	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	83.5	134.1	71.3	45.0	172.0	505.9
IV-4	0	0	211	17.4	28.6	17.0	11.1	26.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.7	60.3	35.9	23.4	54.9	211.2
IV-5	0	0	293	15.6	17.2	11.9	8.8	46.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	45.7	50.4	34.9	25.8	136.0	292.8
IV-6	0	0	739	13.3	25.4	15.0	10.0	36.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.3	187.7	110.9	73.9	267.5	738.3
IV-7	0	0	153	12.7	21.9	12.6	9.4	43.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.4	33.5	19.3	14.4	66.4	153.0
									0	0	0	0	0	0	0	0	0	0	0	0	385	627	369	245	894	2527
I-1	0	175	26	12.5	26.3	19.1	11.9	30.1	0.0	0.0	0.0	0.0	0.0	0.0	21.9	46.0	33.4	20.8	52.7	174.8	3.3	6.8	5.0	3.1	7.8	26.0
I-2	0	363	5	11.3	20.6	15.3	12.0	40.8	0.0	0.0	0.0	0.0	0.0	0.0	41.0	74.8	55.5	43.6	148.1	363.0	0.6	1.0	0.8	0.6	2.0	5.0
I-3	0	0	709	14.4	27.7	17.4	11.0	29.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	102.1	196.4	123.4	78.0	209.2	709.1
I-4	0	0	350	14.1	27.6	17.4	12.1	28.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.4	96.6	60.9	42.4	100.8	350.1
I-5	0	0	51	24.0	32.5	15.0	9.4	17.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.3	16.6	7.7	4.8	8.8	51.2
I-6	0	283	0	24.5	41.2	13.4	5.8	15.1	0.0	0.0	0.0	0.0	0.0	0.0	69.3	116.6	37.9	16.4	42.7	282.9	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	2459	2456	4178	531	795	458	280	835	0	0	0	0	0	0	132	237	127	81	244	821	169	317	198	129	329	1141
			9093						516	732	420	231	559	2459	466	672	365	228	724	2455	667	1087	637	415	1372	41

Table F-6 Population in Service Area by Zone and Income Group in 2005

	POPULATION IN SERVICE AREA			YEAR 2005 INCOME GROUP RATIO					ZONE-1						ZONE-2						ZONE-3					
	ZONE	ZONE	ZONE																							
NEC	1	2	3	I	II	III	IV	V	I	II	III	IV	V	TOTAL	I	II	III	IV	V	TOTAL	I	II	III	IV	V	TOTAL
I-1	157	6	0	10.7	17.6	16.2	11.6	43.9	16.8	27.6	25.4	18.2	68.9	156.9	0.6	1.1	1.0	0.7	2.6	6.(	0.0	0.0	0.0	0.0	0.0	0.0
I-2	188	0	0	12.4	21.5	18.7	11.5	35.9	23.3	40.4	35.2	21.6	67.5	188.0	0.0	0.0	0.0	0.0	0.0	0.(	0.0	0.0	0.0	0.0	0.0	0.0
I-3	260	0	0	13.4	28.2	21.4	11.6	25.4	34.8	73.3	55.6	30.2	66.0	259.9	0.0	0.0	0.0	0.0	0.0	0.(	0.0	0.0	0.0	0.0	0.0	0.
I-4	50	94	0	10.1	21.9	18.8	12.7	36.5	5.1	11.0	9.4	6.4	18.3	50.2	9.5	20.6	17.7	11.9	34.3	94.(	0.0	0.0	0.0	0.0	0.0	C
I-5	9	231	0	12.1	24.2	17.2	10.7	35.8	1.1	2.2	1.5	1.0	3.2	9.0	28.0	55.9	39.7	24.7	82.7	231.(	0.0	0.0	0.0	0.0	0.0	(
I-6	0	140	0	9.8	15.0	13.1	9.9	52.2	0.0	0.0	0.0	0.0	0.0	0.0	13.7	21.0	18.3	13.9	73.1	140.(	0.0	0.0	0.0	0.0	0.0	(
I-7	0	135	139	12.8	25.2	17.0	10.4	34.6	0.0	0.0	0.0	0.0	0.0	0.0	17.3	34.0	23.0	14.0	46.7	135.(	17.8	35.0	23.6	14.5	48.1	139.0
									81	155	127	77	224	664	69	133	100	65	239	60(	18	35	24	15	48	139
II-2	486	0	0	22.8	26.8	14.9	8.1	27.4	110.8	130.2	72.4	39.4	133.2	486.0	0.0	0.0	0.0	0.0	0.0	0.(	0.0	0.0	0.0	0.0	0.0	0.0
II-3	410	0	0	15.0	31.8	21.1	11.2	18.9	61.5	138.6	86.5	45.9	77.5	410.0	0.0	0.0	0.0	0.0	0.0	0.(	0.0	0.0	0.0	0.0	0.0	0.0
II-4	329	50	0	17.5	30.7	18.7	10.0	23.1	57.6	101.0	61.5	32.9	76.0	329.0	8.8	15.4	9.4	5.0	11.6	50.2	0.0	0.0	0.0	0.0	0.0	0.0
II-5	190	12	0	21.8	32.9	18.1	9.6	17.6	41.4	62.5	34.4	18.2	33.4	189.9	2.6	3.9	2.2	1.2	2.1	12.(	0.0	0.0	0.0	0.0	0.0	0.0
									271	432	255	136	320	1415	11	19	12	6	14	62	0	0	0	0	0	0
III-1	0	337	0	26.5	34.0	12.9	6.6	20.0	0.0	0.0	0.0	0.0	0.0	0.0	89.3	114.6	43.5	22.2	67.4	337.0	0.0	0.0	0.0	0.0	0.0	0.0
III-2	54	458	65	12.9	20.4	16.8	11.5	38.4	7.0	11.0	9.1	6.2	20.7	54.0	59.1	93.4	76.9	52.7	175.9	458.0	8.4	13.3	10.9	7.5	25.0	65.1
III-3	162	0	0	10.7	21.0	19.5	11.7	37.1	17.3	34.0	31.6	19.0	60.1	162.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-4	279	0	0	18.5	28.9	17.3	9.8	25.5	51.6	80.6	48.3	27.3	71.1	278.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
III-5	0	468	618	20.0	25.6	12.8	8.1	33.5	0.0	0.0	0.0	0.0	0.0	0.0	93.6	119.8	59.9	37.9	156.8	468.0	123.6	158.2	79.1	50.1	207.0	618.0
									76	126	89	53	132	495	242	328	180	113	400	1263	132	172	90	58	232	683
IV-1	0	0	346	10.5	17.2	14.6	11.0	46.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.3	59.5	50.5	38.1	161.6	346.0
IV-2	0	0	288	13.3	30.5	18.7	10.1	27.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	38.3	87.8	53.9	29.1	78.9	288.0
IV-3	0	0	542	11.9	23.1	14.7	9.7	40.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	64.5	125.2	79.7	52.6	220.1	542.1
IV-4	0	0	278	12.9	25.7	18.1	12.2	31.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.9	71.4	50.3	33.9	86.5	278.0
IV-5	0	0	306	10.1	14.3	12.0	9.3	54.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.9	43.8	36.7	28.5	166.2	306.1
IV-6	0	0	795	9.1	21.3	15.6	10.9	43.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	72.3	169.3	124.0	86.7	342.6	794.9
IV-7	0	0	165	8.3	18.0	12.7	9.9	51.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.7	29.7	21.0	16.3	84.3	165.0
									0	0	0	0	0	0	0	0	0	0	0	0	292	587	416	285	1140	2720
V-1	0	178	26	8.7	22.7	19.9	12.9	35.8	0.0	0.0	0.0	0.0	0.0	0.0	15.5	40.4	35.4	23.0	63.7	178.0	2.3	5.9	5.2	3.4	9.3	26.1
V-2	0	378	5	7.2	16.7	15.4	12.7	48.0	0.0	0.0	0.0	0.0	0.0	0.0	27.2	63.1	58.2	48.0	181.4	377.9	0.4	0.8	0.8	0.6	2.4	5.0
V-3	0	0	881	10.2	24.6	18.1	11.9	35.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	89.9	216.7	159.5	104.8	310.1	881.0
V-4	0	0	408	10.2	24.1	18.2	13.1	34.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.6	98.3	74.3	53.4	140.4	408.0
V-5	0	0	89	23.0	30.4	15.9	10.2	20.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.5	27.1	14.2	9.1	18.2	89.1
V-6	0	484	0	20.7	39.8	14.6	6.6	18.3	0.0	0.0	0.0	0.0	0.0	0.0	100.2	192.6	70.7	31.9	88.6	484.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	237	1971	4151	403	716	483	306	992	0	0	0	0	0	0	143	296	164	103	334	1040	155	349	254	171	480	1409
			10496						1428	712	471	266	696	2574	465	776	456	287	987	2971	596	1	784	529	1901	4951

Table F-7 Population in Service Area by Zone and Income Group (in 1,000 persons)

Year	Zone	Income Group					
		I	II	III	IV	V	TOTAL
1980	I	732	730	235	107	101	1,905
	II	448	496	174	93	111	1,322
	III	579	658	219	117	149	1,722
		1,759	1,884	628	317	361	4,949
1985	I	690	734	274	133	198	2,029
	II	419	491	197	112	206	1,425
	III	558	671	257	146	286	1,918
		1,667	1,896	728	391	690	5,372
1990	I	651	748	322	165	310	2,196
	II	462	559	249	148	352	1,771
	III	636	824	359	215	537	2,571
		1,749	2,131	930	528	1,199	6,538
1995	I	596	752	374	199	434	2,355
	II	479	624	306	187	525	2,120
	III	713	1,027	516	322	948	3,527
		1,788	2,403	1,196	708	1,907	8,002
2000	I	516	732	420	231	559	2,459
	II	466	672	365	228	724	2,455
	III	667	1,087	637	415	1,372	4,178
		1,649	2,491	1,422	874	2,655	9,092
2005	I	428	712	471	266	696	2,574
	II	465	776	456	287	987	2,971
	III	596	1,142	784	529	1,901	4,951
		1,489	2,630	1,711	1,082	3,584	10,496

Population Served

1. Due to the salinity water intrusion and lowering of water table level in Zones I and II, the percentage served in these zones is employed to be 100 %. Because of the availability of groundwater in zone III, on the bases of assumption, apply percentage for projection of population served by each income group as shown in Table 6.3a in the Interim Report, which are as follows :

Table F-8 Percentage Applied For Projection of Population Served

	Income Group I	Income Group II	Income Group III	Income Group IV	Income Group V
	%	%	%	%	%
Zone I	100	100	100	100	100
Zone II	100	100	100	100	100
Zone III	30	40	60	80	90

2. By applying the above percentage to the population in service area shown in Table F-7, the population served by zone and income group has been projected and the result are shown in Table F-9.

Table F-9 Population Served by Zone and Income Group (In 1,000 persons)

Year	Zone	Income Group I	II	III	IV	V	TOTAL
1980	I	732	730	235	107	101	1,905
	II	448	496	174	93	111	1,322
	III	174	263	132	94	134	797
		1,354	1,489	541	294	346	4,024
1985	I	690	734	274	133	198	2,029
	II	419	491	197	112	206	1,425
	III	167	269	154	117	258	965
		1,276	1,494	625	362	662	4,419
1990	I	651	748	322	165	310	2,196
	II	462	559	249	148	352	1,770
	III	191	330	215	172	483	1,391
		1,304	1,637	786	485	1,145	5,357
1995	I	596	752	374	199	434	2,355
	II	479	624	306	187	525	2,121
	III	214	411	310	258	854	2,047
		1,289	1,787	990	644	1,813	6,523
2000	I	516	732	420	231	559	2,459
	II	466	672	365	228	724	2,455
	III	200	435	382	332	1,235	2,583
		1,182	1,839	1,167	791	2,518	7,497
2005	I	428	712	471	266	696	2,574
	II	465	776	456	287	987	2,971
	III	179	457	470	423	1,711	3,239
		1,072	1,945	1,397	976	3,394	8,784

Water Demand Projection (First Case)

A. Projected Domestic Water Demand

1. Per capita demand

1) Per capita demand of Income Groups I and II.

a. It is assumed that the lower income group of I and II are unable to afford to have a connection and they will rely fully for their domestic use on standpipes, public hydrant or water vendors

b. In compli ance with the conclusion made by DSE as the result of the discussion in the steering committee and offer made during meeting held on 11 the January 1984, the per capita consumption is taken as 30 lpcd.

2) Per capita demand of Income Groups III and IV.

a. Taking into account average consumption per residential connection of 1 m3/conn/day which is derived from billing record of the year 1980 through 1983 May, per capita consumption is estimated as 125 lpcd in assuming household of 8 perons. Considering the living condition improvement such as for washing, bathing and so on it is proposed to employ 150 lpcd and apply this per capita consumption for income groups III and IV.

b. The average ability to pay, taken as 4% income, of income groups III and IV is Rp. 3,800 - Rp. 5,300.- in average. Considering basic charge, administration fee and present water rate, average consumption per connection is estimated as follows :

	Size of Connection 3/4"	1"
Basic charge	Rp. 750.-	Rp. 1,000.-
Administration fee	Rp. 300.-	Rp. 300.-
Water charge		
0 - 15 m3, 15 m3 x 40 Rp/m3	Rp. 600.-	Rp. 600.-
15 - 30 m3, 15 m3 x 80 Rp/m3	Rp. 1,200.-	Rp. 1,200.-
30 - 33 m3, 3 m3 x 300 Rp/m3	Rp. 900.-	
30 - 37 7 m3 x 300		Rp. 2,100
	Rp. 3,750.- (33 m3/month)	Rp. 5,200.- (37 m3/mouth)

Per capita consumption is estimated from 138 lpcd to 154 lpcd in assuming household of 8 persons, 146 lpcd in average which is about 150 lpcd.

c. Considering the above condition, per capita consumption for income groups III and IV is estimated as 150 lpcd.

3) Per capita demand of Income Group V.

According to the analysis of the existing consumption record, area where rather higher income group housing located and piped water system is improved in respect to pressure and water quality satisfactory to the consumers, such as Cempaka Putih, Tanah Abang areas and Jakarta Selatan, those areas are served by 1.5 - 1.6 times of average consumption per residential connection of 1.0 m3/conn/day. It is assumed that this higher per capita demand could be applied for the highest income level V group.

Under the assumption above, it is estimated that per capita consumption for income group V is 225 - 240 lpcd and is concluded to apply 250 lpcd for income group V.

4) Summary of per capita demand applied for Domestic Demand Projection for the First case.

Income Group I and II : 30 lpcd

Indirect consumers, who receive water from public standpipes, public hydrant, and vendors

Income Group III and IV : 150 lpcd

Direct consumers, Piped connections

Income Group V : 250 lpcd

Direct consumers, Piped connections.

2. Domestic Water Demand

Applying per capita demand to population served by zone and income group shown in Table F-9, domestic water demand on both direct and indirect consumers are computed and the result is shown on Table F-10. The summary of the projected water demand is shown in Table F-11.

Table F-10 Projected Domestic Water Demand (In 1,000 m3/d)

Year	Zone	Income Group					
		I	II	III	IV	V	TOTAL
1980	I	22.0	21.9	35.3	16.1	25.3	120.6
	II	13.4	14.9	26.1	14.0	27.8	96.2
	III	5.2	7.9	19.8	14.1	33.5	80.5
		40.6	44.7	81.2	44.2	86.6	297.3
1985	I	20.7	22.0	41.1	20.0	49.5	153.3
	II	12.6	14.7	29.6	16.8	51.5	125.2
	III	5.0	8.1	23.1	17.6	64.5	118.3
		38.3	44.8	93.8	54.4	165.5	396.8
1990	I	19.5	22.4	48.3	24.8	77.5	192.5
	II	13.9	16.8	37.4	22.2	88.0	178.3
	III	5.7	9.9	32.3	25.8	120.8	194.5
		39.1	49.1	118.0	72.8	286.3	565.3
1995	I	17.9	22.6	56.1	29.9	108.5	235.0
	II	14.4	18.7	45.9	28.1	131.3	238.4
	III	6.4	12.3	46.5	38.7	213.5	317.4
		38.7	53.6	148.5	96.7	453.3	790.8
2000	I	15.5	22.0	63.0	34.7	139.8	275.0
	II	14.0	20.2	54.8	34.2	181.0	304.2
	III	6.0	13.1	57.3	49.8	308.8	435.0
		35.5	55.3	175.1	118.7	629.6	1014.2
2005	I	12.8	21.4	70.7	39.9	174.0	318.8
	II	14.0	23.3	68.4	43.1	246.8	395.6
	III	5.4	31.7	70.5	63.5	427.8	580.9
		32.2	58.4	209.6	146.5	848.6	1295.3

Table F-11 Summary of Projected Domestic Water Demand (In 1,000 m3/d) (THE FIRST CASE)

Classification	1980*	1985	1990	1995	2000	2005
1. Residential Service Connection	101.0	313.7	447.1	698.5	923.4	1,204.7
2. Public Hydrant	9.1	83.1	88.2	92.3	90.8	90.6
	110.1	396.8	565.3	790.8	1,014.2	1,295.3
	(1,270) (l/s)	(4,590) (l/s)	(6,540) (l/s)	(9,150) (l/s)	(11,740) (l/s)	(14,990) (l/s)

* Water Demand in 1980 shows actual average day consumption derived from billing record provided by PDAM.

B. Projected Non- Domestic Water Demand.

Non-Domestic water demand projection is disccused in the Interim Report. However, minor amendments have been made in compliance with the request by DSE on the demand projection on Government office, large and medium, and small industries and Port Tanjung Priok. The detailed of projections amended are described in the following :

1. Government office.

The water demand of Government office is projected considering number of government office employees and the land use map. Employment forecast prepared by DKI Jakarta SDP group, compiled in Mid-March 1983, indicates the number of government office in the year 1980, 1995 and 2005 are 258,300, 402,400 and 546,600 respectively.

On the other hand, assuming the government offices in service area fully rely on the piped water, average unit consumption per employee is estimated as 243 lpcd based on the water consumption record which is considered to be rather high compare to the present average per capita consumption of 125 lpcd. It will be required to have a program of metering and waste control if any, by PDAM staff concerned. It is recommended that the demand figures be subject to a carefull review and adjustment based on the result of the program before or during detailed design period for next coming project.

Unit consumption per employee is estimated to be 80 lpcd which is derived from statistical data of Government office consumption (minimum) in average among the Central Government office, Telephone office, Police office, Tax office, Government local office, and Post office in Tokyo metropolitan in the year 1972.

It is assumed that the improved metering and waste control program will gradually reduce per employee consumption from present 243 lpcd and will reach to 80 lpcd in the year 1995.

The result of the projection is shown on Table B-1 below :

Table B-1 Projected Water Demand For Government Office

Year	Unit consumption L/employee/d	Total numbers of employee	No. of Employee in Service area	Total (Demand) ('000 m3/day)
1980	243	258,300	255,500	54.9
1985	200	306,300	259,300	51.9
1990	120	354,300	311,600	37.4
1995	80	402,400	371,800	29.7
2000	80	474,500	434,400	34.8
2005	80	546,600	508,400	40.7

2. Large and Medium Industries

According to employment forecast prepared by DKI Jakarta SDP group, the number of employee in 1980, 1995 and 2005 is 151,000, 262,500, and 316,400 respectively. On the other hand, it is estimated on the basis that the employee increase is proportionate to population increase, which result the number of employee in year 1995 and 2005 is 231,300 and 279,100 respectively which is slightly lower than the SDP group estimate.

For the demand projection the later case which assumes an employee increase proportionate to total population is applied.

Based on the Land Use Map, number of employee in the service area is estimated and the employee figures are further distributed to each physical zone of I, II and III as shown in Table B-2. below.

Table B-2 Estimated Number of Employee in Service Area

Year	Number of Employees in Service Area ('000 employee)			
	Zone I	Zone II	Zone III	Total
1980	84.5	36.5	6.7	127.7
1985	91.5	41.0	10.9	143.4
1990	102.4	57.7	15.4	175.5
1995	106.1	63.6	19.4	189.1
2000	111.1	89.0	23.2	223.2
2005	115.5	120.8	27.0	263.3

In year 1980, service ratio is estimated as about 4 % from the following three factors, nemely, the unit consumption per employee 1,000 l/employee/day, the water consumption (4,780 m3/day) and estimated number of employee 127,700. It is assumed that at present most of the industries use groundwater for operation in addition to piped water. The above unit consumption of 1,000 l/employee/day is derived from the statistical data of industries consumption in Japan, in reference to unit consumption of the industries of food stuffs, clothing, wood works, furnitures, publishing and printing, rubber goods, chemicals, ceramic, metal goods, electrical appliance, light mechanical products, and so on which are assumed to be main factories located in the service area.

It is estimated that, in the year 1980, service ratio in Zones I, II and III are 3 %, 5 %, 7 %/and 4 % in average as stated above. It is assumed that the percentage of service ratio will increase from 3 % to 100 %, from 5 % to 50 % and from 7 % to 25 % in each zone. The assumed service ratio and projected water demand are presented in Table B-3 below.

Table B-3 Projected Water Demand For Large and Medium Industries

Year	Service Ratio In Each Physical Zone			Water Demand ('000 m3/day)			
	Zone I %	Zone II %	Zone III %	Zone I %	Zone II %	Zone III %	Total %
1980	3	5	7	2.4	1.9	0.5	4.8
1985	10	10	8	9.2	4.1	0.9	14.2
1990	25	20	10	25.6	11.5	1.5	38.6
1995	50	30	15	53.1	19.1	2.9	75.1
2000	75	40	20	83.3	35.6	4.6	123.5
2005	100	50	25	115.5	60.4	6.8	182.7

Note : Unit water consumption of 1,000 l/employee/day is applied for demand projection after multiplying estimated number of employees (shown in Table B-2) by the service ratio (shown in Table B-3).

3. Small Industries.

Average consumption per connection, is 0.97 m3/conn/day. According to employement forecast made by DKI Jakarta, the numbers of works in 1980, 1995 and 2005 are 97,500, 233,700 and 330,200 respectively.

However it is assumed that the employee increase is proportionated to total population increase as required by DSE and the number of employee is projected as 149,400 and 180,200 in year 1995 and 2005 respectively.

The small industries are defined as home industries and small size workshop with residence. The number of workers the service area is estimated as proportional to the population in the service area to the total population.

It is estimated that the average consumption per worker as 190 lpcd assuming the average number of works per small industries is 5 persons. For future estimation 200 lpcd will be applied.

From the above and number of connection, service ratio in service area in year 1980 is developed as 34 %.

It is assumed that the percentage of service ratio will increase from 34 % in 1980 to 100 % in 2005. The projected water demand, together with service ratio is shown in Table B-4 below.

Table B-4 Projected Water Demand For Small Industries

Year	Number of Labours ('000)	Number of Labours in Service Area ('000)	Service Ratio (%)	Number of Labours ('000)	Unit Demand (lpcd)	Total Demand ('000 m3/d)
1980	97.5	75.1 (76%)	34	25.5	190	4.9
1985	114.5	80.2 (70%)	43	34.5	200	6.9
1990	133.1	98.5 (74%)	57	56.1	200	11.2
1995	149.4	119.5 (80%)	63	75.3	200	15.1
2000	165.2	137.1 (83%)	77	105.6	200	21.1
2005	180.2	156.8 (87%)	100	156.8	200	31.4

The maximum berthing capacity is estimated based on the above number of the present berth and is shown in Table B-6 as 26,280 berth-day. According to the port authorities account, they planned to improve port facilities and to train personnel in order to make more efficient work to meet the increased demand of berthing up to the year 1995 or around. The present port area is assumed to be extended to meet increased number of ship call after this year.

The average berthing time from year 1979 through 1983 for Ocean Going, Inter Island and Tanker are 3.3, 3.9 and 2.6 hours in average. It is assumed that, by making efforts to improve prot facilities and to train personnels, the berthing time will be reduced to 3.0, 3.5 and 2.5 hours respectively, and the maximum numbers of ships can be berthed in future will be increased.

Under the conditions descussed in the eabove, the estimated maximum berthing capacity is 129 % of present berthing capacity occupied, however the maximum numbers of ships berthed will be increased to 145 % of present numbers of ships call. These projection is reflected and shown in Table B-6.

From the above, 2.5 % annual increase rate is assmued on the year 1980 water consumption of 13,500 m3/d up to year 1995 which arrives

1.45 times 1980 demand. Further up to the year 2005 employ 3.0 % annual increase rate. Table B-7 presents water demand on the basis of the above assumption.

Table B-7 Projected Water Demand For Port Tanjung Priok

Year	Total Demand ('000 m3/d)
1980	13.5
1985	15.3
1990	17.3
1995	19.5
2000	22.7
2005	26.3

4. Port Tanjung Priok

Average consumption per month at Port Tanjung Priok in 1980 is 403,700 m3/month (13,500 m3/d).
According to the data obtained from the Tanjung Priok Port authorities, at present there are 75 berths which include ;

Ocean Going Vessels Berth	:	35 berths (Length of Ship 160 m)
Inter Island Vessels Berth	:	33 berths (Length of Ship 80 m)
Bulk Vessels Berth	:	3 berths
Tanker Berth	:	4 berths
		75 berths

The ship waiting time, service/ berthing time and ship call at the port in year 1979 through 1983 were obtained and are shown in Tables B-5 and B-6.

Table B-5 Port of Tanjung Priok, Port Traffic of 1979 - 1983
Ship Call (Unit)

	1979	1980	1981	1982	1983
Commercial Call					
Ocean Going	1,831	2,021	2,102	2,169	1,972
Inter Island	2,006	2,202	2,881	2,640	2,634
Tanker	509	496	426	422	432
Sub - Total	4,346	4,719	5,409	5,251	5,038
Non-Commercial & Emmergency Call					
Ocean Going	145	150	107	82	88
Inter Island	409	374	841	1,010	519
Sub - Total	554	524	948	1,092	607
T o t a l					
Ocean Going	1,976	2,171	2,209	2,251	2,060
Inter Island	2,415	2,576	3,722	3,650	3,153
Tanker	509	496	426	442	432
	4,900	5,243	6,357	6,343	5,645

Source : Tanjung Priok Port Administration

Table B-6 Berthing Capacity VS Numbers of Ships Berthed

Year Vessels Classification	Service/ Berthing Time		No.of Ships Call	Berthing Capacity Occupied	No.of Berth Existing	Maximum Berthing Capacity Available	Estimated Berthing Time In Future	Maximum No.of Ships Berthed In Future	Ratio	
	Hours	Day	Vessels	VesselsxDay	Berth	BerthxDay	Day	Vessles	Capacity	No.of Ships
	(1)*	(2) =(1)/(24)	(3)*	(4) =(2)x(3)	(5)*	(6) =(5)x365 days	(7)	(8) =(6)/(7)	(9) =(6)/(4)	(10) (8)/(3)
1979										
Ocean Going	103	4.3	1,976	8,497	35	12,775	3.0	4,258	1.50	2.15
Inter Island	106	4.4	2,415	10,626	33	12,045	3.5	3,441	1.13	1.42
Tanker	86	3.6	509	1,832	4	1,460	2.5	584	(0.80)	1.15
			4,900	20,995		26,280		8,283	1.25	1.69
1980										
Ocean Going	83	3.5	2,171	7,599	35	12,755	3.0	4,258	1.68	1.96
Inter Island	85	3.5	2,576	9,016	33	12,045	3.5	3,441	1.34	1.34
Tanker	49	2.0	496	992	4	1,460	2.5	584	1.47	1.18
			5,243	17,607		26,280		8,283	1.49	1.58
1990										
Ocean Going	83	3.5	2,209	7,732	35	12,755	3.0	4,258	1.65	1.93
Inter Island	108	4.5	3,722	16,749	33	12,045	3.5	3,441	(0.72)	(0.92)
Tanker	46	1.9	426	809	4	1,460	2.5	584	1.80	1.37
			6,357	25,290		26,280		8,283	1.04	1.30
1982										
Ocean Going	68	2.8	2,251	6,303	35	12,775	3.0	4,258	2.03	1.89
Inter Island	86	3.6	3,650	13,140	33	12,045	3.5	3,441	(0.92)	(0.94)
Tanker	66	2.8	442	1,238	4	1,460	2.5	584	1.18	1.32
			6,343	20,681		26,280		8,283	1.27	1.31
1983										
Ocean Going	59	2.5	2,060	5,150	35	12,775	3.0	4,258	2.48	2.01
Inter Island	82	3.4	3,153	10,720	33	12,045	3.5	3,441	1.12	1.09
Tanker	68	2.8	432	1,210	4	1,460	2.5	581	1.21	1.34
			5,645	17,080		26,280		8,283	1.54	1.47
Total (1979 through 1983, 5 years)										
Ocean Going		3.3	10,667	35,281						
Inter Island		3.9	15,516	60,251						
Tanker		2.6	2,305	6,081						
Average Per Year										
Ocean Going		3.3	2,133	7,039	35	12,775	3.0	4,258	1.81	2.00
Inter Island		3.9	3,103	12,102	33	12,045	3.5	3,441	(0.96)	1.11
Tanker		2.6	461	1,991	4	1,460	2.5	581	1.22	1.26
			5,697	20,340		26,280		8,283	1.29	1.45

* Source : Tanjung Priok Port Administration.

Summary of Water Demand

Summary of water demands is prepared based on the projected water demand on domestic use discussed earlier and non-domestic use as projected in the Interim Report with some minor amendments on water demands of Government office, large and medium, and shown industries, and Port Tanjung Priok, as shown of Table F-12 for the First case

Water Demand and Proposed Production

Based on the projected water demand so far made, a schedule of water supply is prepared as shown of Figs. D-1 and D-2. In preparing the schedule, the following matters are taken into consideration.

(1) Three mini plants of Muara Karang, Sunter and Pesing will be put out of regular service and maintained for emergency use or standby.

(2) Bogor Ciburial Spring water, 300 l/sec, will be wholly supplied to the Depok housing area, including the areas along the trunk main.

To cope with the increasing water demand, the schedule of water supply expansion on the other hand is worked our based on the following consideration.

(1) For realistic and reasonable implementation of the expansion project, the long range project will be staged as Stage II up to year 1995 and Stage III from 1996 to 2005.

(2) Considering the acute shortage of water, prevalent now and around the year 1987, an immediate project will be planned, which is incidentally possible as a result of the West Tarum Canal enlargement.

(3) For the water demand after the immediate project onward, water source will become available, as the Government is now carrying out various studies of water resources development

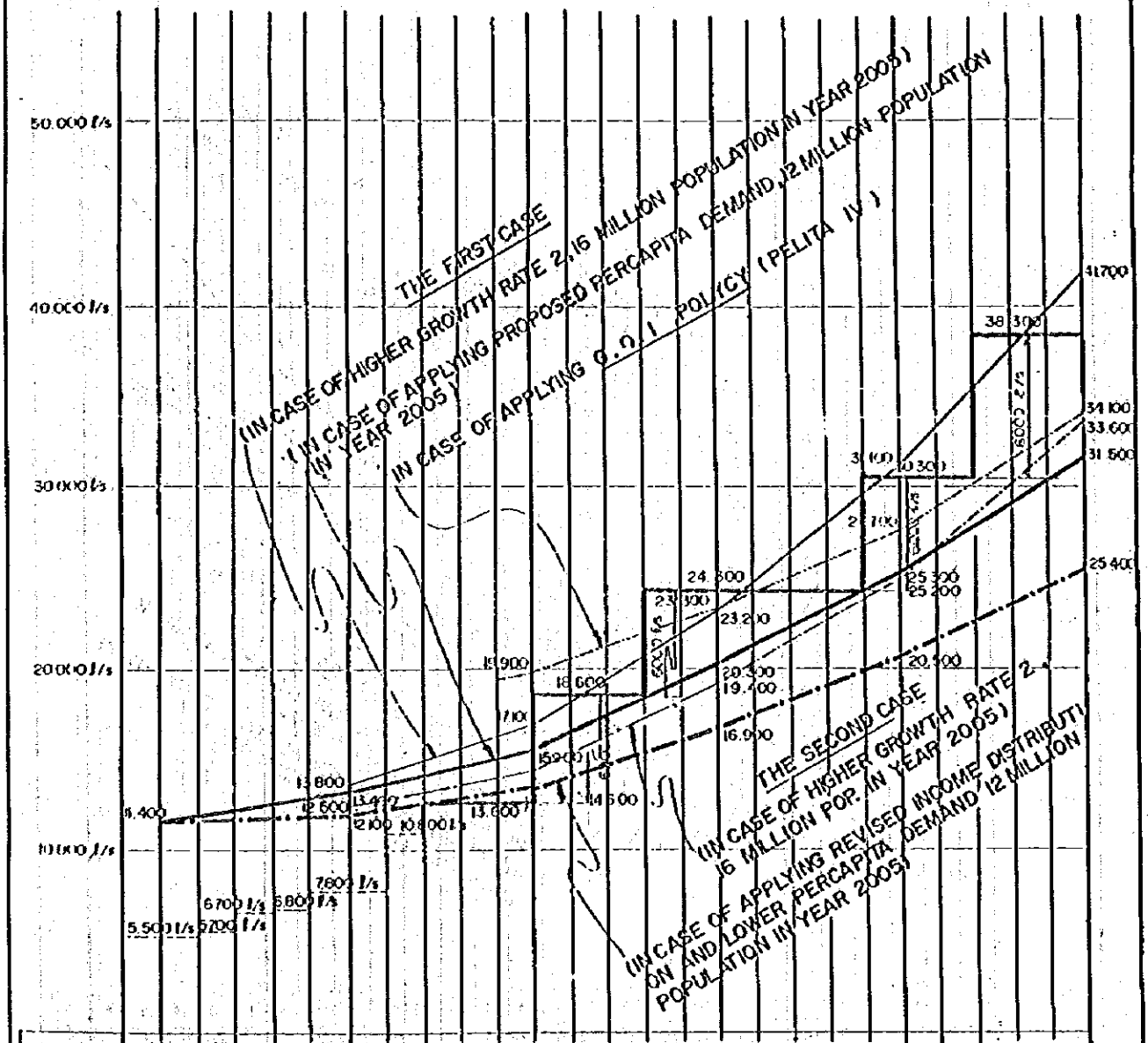
The above matters are reflected in Table F-13.

Table F-12 SUMMARY OF WATER DEMAND (AVERAGE DEMAND IN 1,000 M3/DAY) (THE FIRST CASE)

CLASIFICATIONS	1980	1985	1990	1995	2000	2005
A. Domestic Use						
A-1 Residential Service Connections	101.0 (212.0) *	313.7	477.1	698.5	923.4	1,204.7
B-1 Public Hydrant	9.1 (85.3)	83.1	88.2	92.3	90.8	90.6
Total A (A-1 and A-2)	110.1 (297.3)	396.8	565.3	790.8	1,014.2	1,295.3
B. Non-Domestic Use						
B-1 Public Use						
a. Government Office	54.9	51.9	37.4	29.7	34.8	40.7
b. Schools	1.2	5.9	17.1	39.1	48.3	65.4
c. Religious Places	0.6	3.4	10.4	25.1	28.8	33.0
d. Hospitals	4.3	5.2	6.3	7.5	8.4	9.2
e. Boarding Houses	5.2	5.8	6.5	7.2	8.0	8.9
	66.2	72.2	77.7	108.6	128.3	157.1
B-2 Industries Use						
a. Industries	4.8	14.2	38.6	75.2	123.5	182.7
b. Small Industries	4.9	6.9	11.2	15.1	21.1	31.4
	9.7	21.1	49.8	90.3	144.6	214.1
B-3 Trade and Service						
a. Hotels	7.9	8.6	12.5	18.9	26.4	38.0
b. Trade & Service	21.5	33.6	56.8	92.4	157.8	248.2
	29.4	42.2	69.3	111.3	184.2	286.2
B-4 Port Tanjung Priok	13.5	15.3	17.3	19.5	22.7	26.3
B-5 Armed Forces	(30.0)	35.4	41.1	46.2	51.0	55.6
B-6 Depok	5.6	6.0	6.0	6.0	6.0	6.0
Totals (B1 thru B-6)	124.4 (154.4)	192.2	261.2	381.9	536.8	745.3
Total Average Demand Net Consumption A thu B	234.5 (2700) 451.7 * (5,200)	589.0 (6,800)	826.5 (9,600)	1,172.7 (13,600)	1,551.6 (18,000)	2,040.6 (23,600)
Unaccounted-for Water (% of Production Required) (Case 3)	275.5 (54)	565.9 (49)	551.0 (40)	557.6 (33)	633.8 (29)	680.2 (25)
Production Required (In Average (1,000M3/Day) (l/sec)	510 (982.0) * 5,900 (11,400) *	1,154.9 13,400	1,377.5 15,900	1,750.3 20,300	2,185.4 25,300	2,720.8 31,500
Total Population Served (in 1,000 persons)	2,100 4,024	4,419	5,357	6,523	7,497	8,784
Gross Percapita Demand (lpcd)	243 (244) *	261	257	268	291	309
Day Maximum Demand (l/Sec) (Day Average x 1.15)	6,800 (13,100) *	15,400	18,300	23,300	29,100	36,200
Raw Water Requirement (l/sec) (Day Maximum x 1.07)	7,300 (14,000)	16,400	19,600	24,900	31,100	38,700

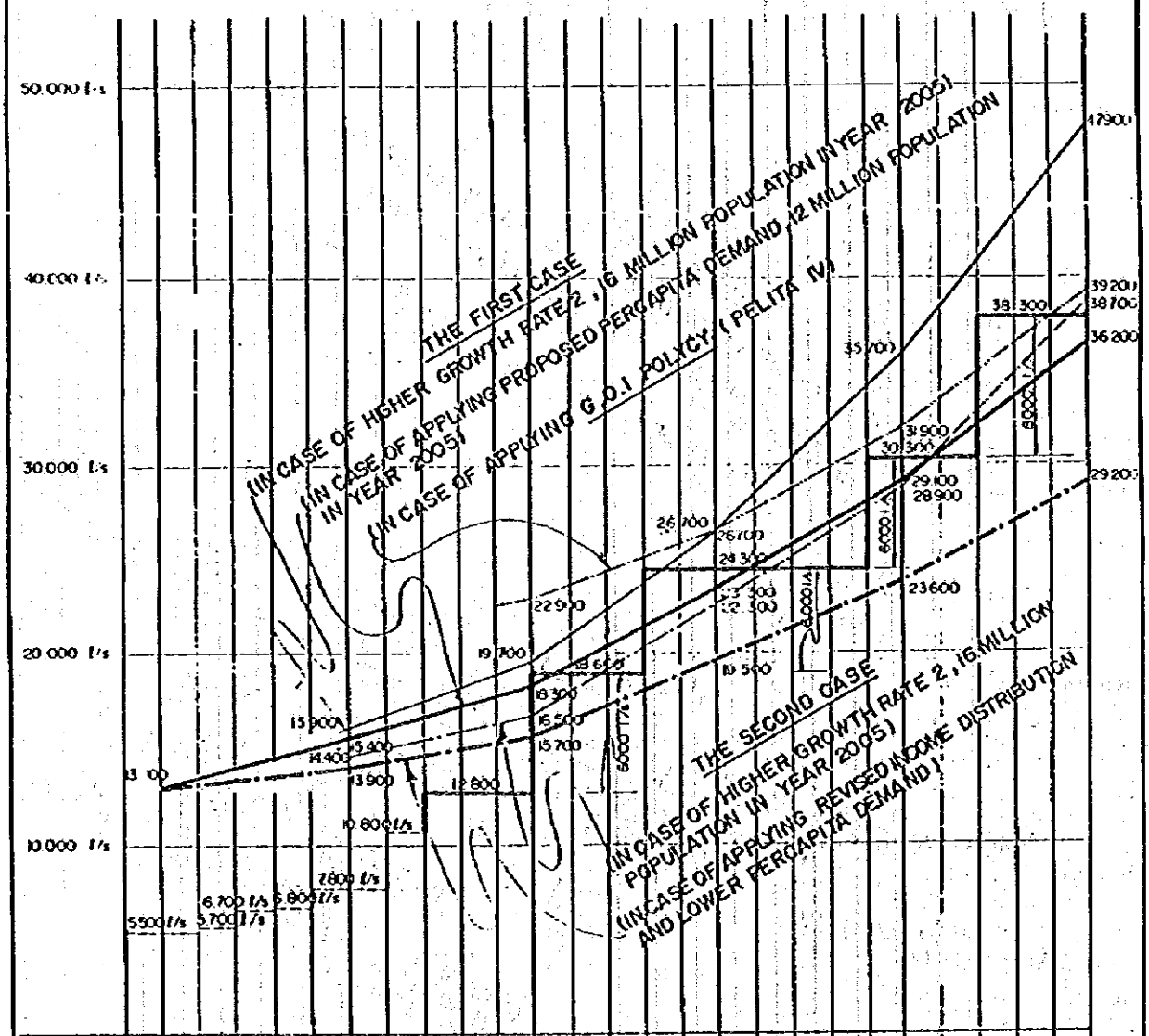
* Potential water demand projected for the year 1980

FIG. D-1 WATER DEMAND AND PROPOSED WATER PRODUCTION
(AVERAGE DAY DEMAND)



YEAR	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85
PHASING	1ST PHASE			2ND PHASE				IMM	1ST PHASE			2ND PHASE				1ST PHASE				2ND PHASE					
	FIRST STAGE								SECOND STAGE							THIRD STAGE									
EXISTING PRODUCTION	5.500 l/s (475.000 M3/D)		5.700	6.700	6.800	7.800 l/s (588.000 M3/D)		10.800	10.800 l/s (1933.000 M3/D)			10.800 l/s (1916.000 M3/D)				10.300 l/s (1890.000 M3/D)				10.300 l/s (1890.000 M3/D)					10.300 l/s (1830.000 M3/D)
NEW TREATMENT PRODUCTION									2.000 l/s (173.000 M3/D)			8.000 l/s (691.000 M3/D)				14.000 l/s (1.210.000 M3/D)				20.000 l/s (1.728.000 M3/D)					28.000 l/s (2.419.000 M3/D)
TOTAL PRODUCTION	5.500 l/s (475.000 M3/D)		5.700	6.700	6.800	7.800 l/s (588.000 M3/D)		10.800	12.800 l/s (1.106.000 M3/D)			18.800 l/s (1.607.000 M3/D)				24.300 l/s (2.100.000 M3/D)				30.000 l/s (2.618.000 M3/D)					38.000 l/s (3.309.000 M3/D)

FIG. D-2 WATER DEMAND AND PROPOSED WATER PRODUCTION
(MAXIMUM DAY DEMAND)



YEAR	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000	1	2	3	4	5
PHASING	1ST PHASE			2ND PHASE				MM	1ST PHASE			2ND PHASE					1ST PHASE						2ND PHASE			
	FIRST STAGE								SECOND STAGE								THIRD STAGE									
EXISTING PRODUCTION	5 500 l/s (475000 M3/D)		5700	6700	6800	7800 l/s (568000 M3/D)		0.800	10.800 l/s (933.000 M3/D)			10.600 l/s (916.000 M3/D)				10.300 l/s (890.000 M3/D)					10.300 l/s (890.000 M3/D)			10.300 l/s (890.000 M3/D)		
NEW TREATMENT PRODUCTION									2.000 l/s (173.000 M3/D)			80.000 l/s (159.000 M3/D)				14.000 l/s (1.210.000 M3/D)					20.000 l/s (1.728.000 M3/D)			28.000 l/s (2.419.000 M3/D)		
TOTAL PRODUCTION	5 500 l/s (475000 M3/D)		5700	6700	6800	7800 l/s (568000 M3/D)		0.800	12.800 l/s (1.106.000 M3/D)			18.600 l/s (1.607.000 M3/D)				24.300 l/s (2.100.000 M3/D)					30.000 l/s (2.618.000 M3/D)			38.000 l/s (3.309.000 M3/D)		

Table F-13 PRODUCTION CAPACITY BY SYSTEM

SYSTEM	PRESENT RATED CAPACITY (l/sec)	YEARS IN SERVICE
SURFACE WATER SYSTEM		
PEJOMPONGAN I	2000	1957
PEJOMPONGAN II	3.000	1973
PULOGADUNG	1.000	1982
(MINI – PLANT)		
(CILANDAK)	200	1977
PESING	5	1980
MUARA KARANG	100	1982.
CENGKARENG	50	1982
SUNTER	50	1982
CAKUNG	25	1982
PEJATEN	5	1976
(CONDET)	–	–
(TAROGONG)	–	–
SPRING SYSTEM		
BOGOR CIBURIAL SPRING	300	1922
DEEP WELL SYSTEM		
DEEP WELL	(120)	
PROPOSED NEW TREATMENT PLANT		
IMMEDIATE PROGRAM OF STAGE II		
FIRST PHASE OF STAGE II		
SECOND PHASE OF STAGE II PROGRAM		
FIRST PHASE OF STAGE III PROGRAM		
SECOND PHASE OF STAGE III PROGRAM		
TOTAL PRODUCTION	6.735 l/s	

PROPOSED PRODUCTION CAPACITY BY SYSTEM (l/sec.)

YEAR	1983	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	2000	1	2	3	4	5
TOTAL PRODUCTION	6.735	6.835	7.785	7.785					18 630 l/s			24.330 l/s		24.330 l/s			30.330 l/s		30.330 l/s			38.330 l/s	
	6.700	6.800	7.800	7.800	10.600	12.800 l/s			18 600 l/s			24.300 l/s		24.330 l/s			30.300 l/s		30.300 l/s			38.300 l/s	

Water Demand Projection (Second Case)

A. Domestic Water Demand.

1. Income group ratio

In compliance to the statement in the document "A", the total percentages shown in Table 3.9, in the Interim Report, under the various income groups are revised to show not more than 20 % of the population in Group V, with the percentage in the other Groups I through IV shift from low to middle income groups by year 2005, as shown in Table S-1. The income group ratio, intermediate five-years interval are projected linearly based on the ratio of the year 2005.

2. The population in service area by zone and income group is computed based on the population in service area and the revised income group ratio, and the result are shown in Table S-2. and summarized in Table S-2'.

3. Per capita demand applied for the Second Case are as advices as follows :

Income Group I and Standpipe Supply : 30 lpcd.
Indirect consumers,
Income Groups II (Low income group), and
III (lower middle income group): 125 lpcd
Direct consumers, piped connection
Income Groups IV (Upper middle income group)
and V (Hihger income group) : 180 lpcd
Direct consumers, piped connection.

4. Population served.

Population in service area of zones I and II, 100 % supplied, and zone II are assumed as shown in Table S-3 below, which indicate slightly higher percentage compare to the First case on groups I and II to arrive public supply at 60 % of population.

Table S-1 Revised Population Ratio by Income Group (%)

Year	Income Group I	Income Group II	Income Group III	Income Group IV	Income Group V
1980 1)	35.8	38.6	12.4	6.2	7.0
1985	32	36	15	7/	10
1990	30	33	17	8	12
1995	26	30	20	9	15
2000	23	28	23	9	17
2005 2)	20	25	25	10	20

Note : 1. Basic data taken from 1980 DKI Census, and Modified by Jabotabek Advisory Team Service (JARS)

2. Basic data taken from JATS; DKI Jakarta Stategis Development Plan, Socioeconomic Parameters Base (Survey) and Forecast Data, and Revised on the basis of assumption which highest Income Group V will be not more than 20 % and more middle income group will be expected than forcasted by JATS.

Table S-2 POPULAITON IN SERVICE AREA BY ZONE AND INCOME GROUP

YEAR	POPULATION IN SERVICE AREA ('000)			REVICED INCOME GROUP RATIO (%)					ZONE - 1						ZONE - 2						ZONE - 3					
	ZONE 1	ZONE 2	ZONE 3	I	II	III	IV	V	I	II	III	IV	V	TOTAL	I	II	III	IV	V	TOTAL	I	II	III	IV	V	TOTAL
1980	1,908	1,324	1,725 4,957	35.8	38.6	12.4	6.2	7.0	683	736	237	118	134	1,908	474	511	164	82	93	1,324	618	666	214	107	121	1726
1985	2,032	1,427	1,921 5380	32	36	15	7	10	650	732	305	142	203	2,032	457	514	214	100	143	1,428	615	692	288	134	192	1921
1990	2,199	1,772	2,574 6,545	30	33	17	8	12	660	726	374	176	264	2,200	532	585	301	141	213	1,772	772	849	438	206	309	2574
1995	2,356	2,122	3,528 8,006	26	30	20	9	15	613	708	471	212	353	2,357	551	637	424	191	318	2,121	917	1,058	706	318	529	3528
2000	2,459	2,456	4,178 9,093	23	28	23	9	17	566	689	566	221	418	2,460	565	688	565	221	418	2,457	961	1,170	961	376	710	4178
2005	2,574	2,971	4,951 10,496	20	25	25	10	20	515	644	644	257	515	2,575	594	743	743	297	594	2,971	990	1,238	1,238	495	990	4951

Table S-2' Population in Service Area by Zone and Income Group (In 1,000 persons)
(Revised)

Year	Zone	Income Group					
		I	II	III	IV	V	TOTAL
1980	I	683	736	237	118	134	1,908
	II	474	511	164	82	93	1,324
	III	618	666	214	107	121	1,726
		1,775	1,913	615	307	348	4,958
1985	I	650	732	305	142	203	2,032
	II	457	514	214	100	143	1,428
	III	615	692	288	134	192	1,921
		1,722	1,938	807	376	538	5,381
1990	I	660	726	374	176	264	2,200
	II	532	585	301	141	213	1,772
	III	772	849	438	206	309	2,574
		1,964	2,160	1,113	523	786	6,546
1995	I	613	708	471	212	353	2,357
	II	551	637	424	191	318	2,121
	III	917	1,058	706	318	529	3,528
		2,081	2,403	1,601	721	1,200	8,006
2000	I	566	689	566	221	418	2,460
	II	565	688	565	221	418	2,457
	III	961	1,170	961	376	710	4,178
		2,092	2,547	2,092	818	1,546	9,095
2005	I	515	644	644	257	515	2,575
	II	594	743	743	297	594	2,971
	III	990	1,238	1,238	495	990	4,951
		2,099	2,625	2,625	1,049	2,099	10,497

Table S-3 Percentage Applied For Projection of Population Served

	Income Group I	Income Group II	Income Group III	Income Group IV	Income Group V
	%	%	%	%	%
Zone I	100	100	100	100	100
Zone II	100	100	100	100	100
Zone III	40	50	60	80	90

5. Cost of connection by PDAM at present by land property of houses are as follows :

Land Property in m2	Connection Fee		
	Connection Fee in Rp.	Administration Fee in Rp.	Total in Rp.
1 - 100	150,000	25,000	175,000
101 - 200	200,000	25,000	225,000
201 - 300	275,000	25,000	300,000
301 - 400	400,000	25,000	425,000
401 - 500	500,000	25,000	525,000
501 - 600	600,000	25,000	625,000

Note : 1. The connection fee shown is applied in case that the distance from tap on the service pipe to Meter installed in the consumers property is 6 meters or less. If distance is above 6 meters connection fee is increased in accordance with the piping materials and installation work required additionally.

The income per household of Group II is Rp.38,000 - Rp.75,000 per month which means 2.3 - 4.6 times income amount is required to have a connection in case land property of 1 - 100 m2. The Income per household of Group III is Rp.75,000 - Rp.11,300 per month which means about 1.5 - 2.3 times income is required to have a connection for the same space of property above.

Direct consumers at present paid 80 - 95 Rp./m3/conn in average which is assumed based on the present tariff structure as follows :

(1)	Meter maintenance fee (1/2" - 3/4")	: Rp. 300 - Rp.750
(2)	Administration fee	: Rp. 300
(3)	Water charge : (30 m3/month/conn/ in average)	
	0 - 15 m3, 15 x 40 Rp./m3	: Rp. 600
	15 - 30 m3, 15 x 80 Rp./m3	: Rp.1200
	Total cost per 30 m3	: Rp.2400 - Rp.2,850.-

On the other hand, cost of water through public hydrant is Rp.125/m3 and through vendors is Rp.2,500/m3 or more which means indirect consumer pay about 1.5 - 25 times water charge per m3, compare to billings to direct consumers.

Suppose an indirect consumer of lower income level lives near public standpipes and is easy to access to the standpipes to receive water, he will intend to have the water from the standpipe because of the lower amount of water charge required for their domestic purpose. On the other hand, if indirect consumers, who live far from the standpipes and buy water from vendors, will be accomodated with money by any means to be able to have connection, some of them might intend to have connection since he will recover the cost of connections by certain years. Fig. S-1 shows comulated water charge by the service levels. Following assumption could be made on the Fig. S-1.

(1) In the case that indirect consumer buys water of 7.2 m3/month (30 lpcd x 8 persons household x 30 days) with the price of Rp.1,000/m3 (Average of Standpipes, Tanks and vendor), or 2.9 m3/month (12 lpcd x 8 x 30) with the price of Rp.2,500/m3 from vendor, while it required 3.2 times of amoung of average ability to pay taken as 4 % income group II, 1.9 times for Group III he will recover the cost of connection by using 7.2 m3/month through the connection by $2\frac{1}{3}$ years in net value and $2\frac{3}{4}$ years in present value.

(2) In the case that indirect consumer buys water of 7.2 m3/month (30 lpcd x 8 persons household x 30 days) with the price Rp.2,500/m3 all from vendors, although it is not realistic considering required water charge of Rp.18,000/month which is 8 times of the average ability to pay of income group II, 4.8 times for Group III, he will recover the cost of connection

(3) In the case that the water tariff of service connection will increase to 150 % including administration fee and meter maintenance cost, and the same indirect consumer stated earlier in (1) will recover the cost of connection by $2\frac{1}{2}$ years in the net value and $3\frac{1}{4}$ years in present value.

Considering the above conditions, it is assumed that about 10 % of the Group II have a connection and other 90 % of Group II rely on standpipes or vendors. On the other hand, 90 % of the Group III is assumed to have connection and remained 10 % will receive water from standpipes or vendors.
Percentage applied for projection of public supply for income groups is tabulated in Table S-3.

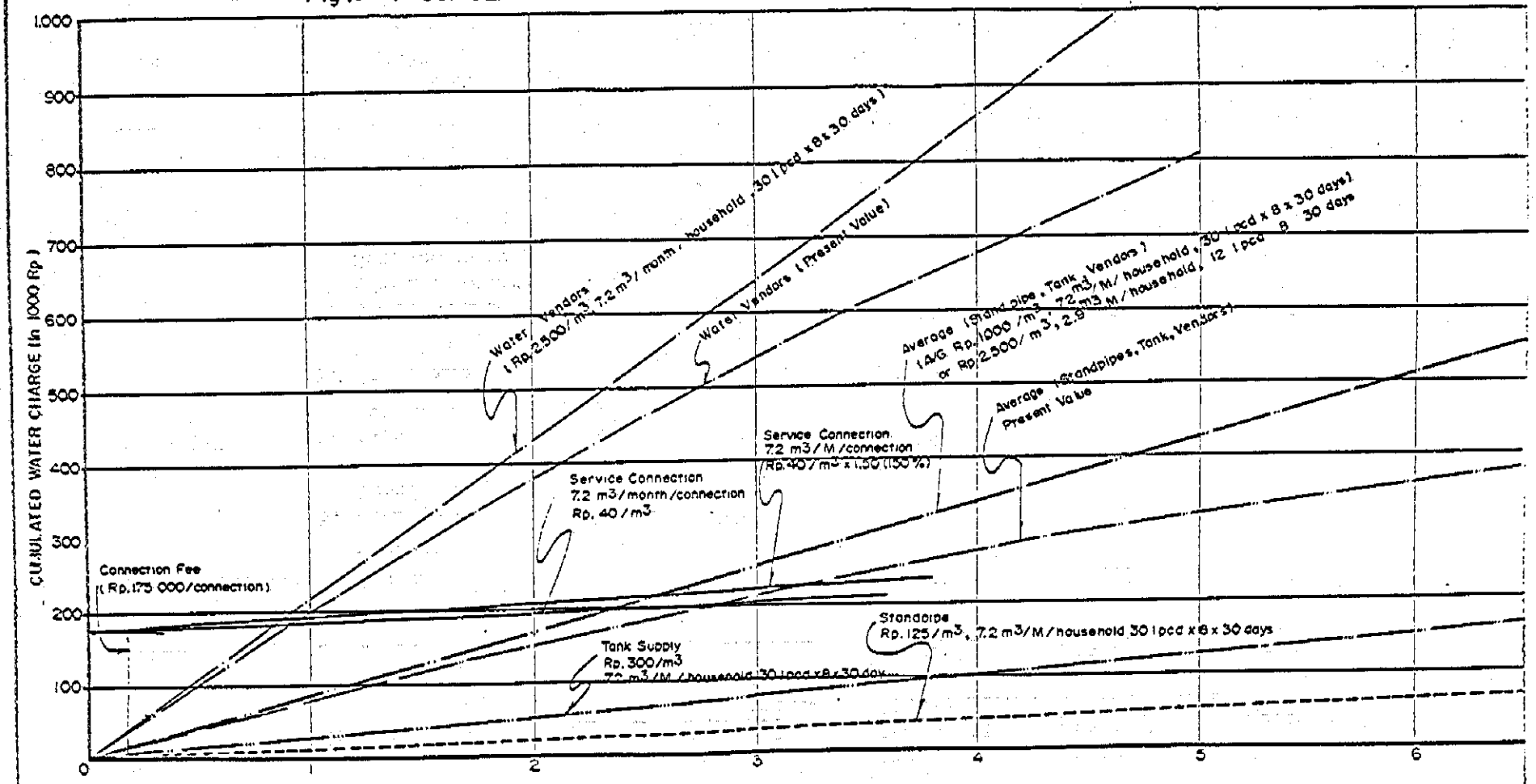
6. By applying the percentage shown in Table B-3 to the population in service area by zone and income group of Table S-2, population served has been projected and the result is presented in Table S-4.

7. By applying per capita demand, presented earlier , for the Second case, to population served in Table S-4, domestic water demand are computed and the result is shown in Table S-5. The summary of the projected domestic water demand is shown in Table S-6.

8. Summary of water demand is then prepared using the same non-domestic demand discussed under the First Case and is shwon in Table S-7.

9. Water demand curve under the estimation of the Second case is shown in Figs. D-1 and D-2 prepared under the First Case.

Fig. S - 1 CUMULATED WATER CHARGE BY SERVICE LEVELS



NOTE
1. Current water tariffs, effective since in May 1983, are applied.
2. Indirect consumer percapita consumption applied is 30 l pcd, and household of 8 persons
3. For Caluculation of present value of the water charge, single payment at 1% monthly (12% annually) applied

Table S-3 Percentage Applied For Projection of Population Served

Zone	Supply Condition	Income Group I	Income Group II (Low income groups)	Income Group III (Lower middle Income groups)	Income Group IV (Upper middle Income groups)	Income Group V (Higher income groups)
		%	%	%	%	%
Zone I and II	a. Piped Supplies	0	10	90	100	100
	b. Standpipes Supplies	100	90	10	0	0
Zone III	a. Piped Supplies	0	5	55	80	90
	b. Standpipe Supplies	40	45	5	0	0
	c. Other sources (Ground Water/ Surface water)	60	50	40	20	10

Table S-4 Population Served by Zone and Income Group (In 1,000 persons)

Year	Zone	Supply Condition	Income Group I	II	III	IV	V	TOTAL
1980	I	a. Piped Supplies	-	74	213	118	134	539
		b. Standpipe Supplies	683	662	24	-	-	1,369
			683	736	237	118	134	1,908
	II	a. Piped Supplies	-	51	148	82	93	374
		b. Standpipe Supplies	474	460	16	-	-	950
			474	511	164	82	93	1,324
	III	a. Piped Supplies	-	33	118	86	109	346
		b. Standpipe Supplies	247	300	11	-	-	558
		c. Other Sources (Ground water/ Surface water)	371	333	85	21	12	822
			618	666	214	107	121	1,726
1985	I	a. Piped Supplies	-	73	274	142	203	692
		b. Standpipe Supplies	650	659	31	-	-	1,340
			650	732	305	142	203	2,032
	II	a. Piped Supplies	-	51	193	100	143	487
		b. Standpipe Supplies	457	463	21	-	-	941
			457	514	214	100	143	1,428

	III	a. Piped Supplies	-	35	158	107	173	473
		b. Standpipe Supplies	246	311	14	-	-	571
		c. Other Sources (Ground water/ Surface water)	369	346	116	27	19	877
			615	692	288	134	192	1,921
1990	I	a. Piped Supplies	-	73	337	176	264	850
		b. Standpipe Supplies	660	653	37	-	-	1,350
			660	726	374	176	264	2,200
	II	a. Piped Supplies	-	59	271	141	213	684
		b. Standpipe Supplies	532	526	30	-	-	1,088
			532	585	301	141	213	1,772
	III	a. Piped Supplies	-	42	241	165	278	726
		b. Standpipe Supplies	309	382	22	-	-	691
		c. Other Sources (Ground water/ Surface water)	463	425	175	41	31	1,135
			772	849	438	206	309	2,574
1995	I	a. Piped Supplies	-	71	424	212	353	1,060
		b. Standpipe Supplies	613	637	47	-	-	1,297
			613	708	471	212	353	2,357

	II	a. Piped Supplies	-	64	382	191	318	955
		b. Standpipe Supplies	551	573	42	-	-	1,166
			551	637	424	191	318	2,121
	III	a. Piped Supplies	-	53	388	254	476	1,171
		b. Standpipe Supplies	367	476	35	-	-	878
		c. Other Sources (Ground water/ Surface water)	550	529	283	64	53	1,479
			917	1,058	706	318	529	3,528
2000	I	a. Piped Supplies	-	69	509	221	418	1,217
		b. Standpipe Supplies	566	620	57	-	-	1,243
			566	689	566	221	418	2,460
	II	a. Piped Supplies	-	69	508	221	418	1,216
		b. Standpipe Supplies	565	619	57	-	-	1,241
			565	688	565	221	418	2,457
	III	a. Piped Supplies	-	59	529	301	639	1,528
		b. Standpipe Supplies	384	526	48	-	-	958
		c. Other Sources (Ground water/ Surface water)	577	585	384	75	71	1,692
			961	1,170	961	376	710	4,178

2005	I	a. Piped Supplies	-	64	580	257	515	1,416
		b. Standpipe Supplies	515	580	64	-	-	1,159
			515	644	644	257	515	2,575
	II	a. Piped Supplies	-	74	669	297	594	1,634
		b. Standpipe Supplies	594	669	74	-	-	1,337
			594	743	743	297	594	2,971
	III	a. Piped Supplies	-	62	681	396	891	2,030
		b. Standpipe Supplies	396	557	62	-	-	1,015
		c. Other Sources (Ground water/ Surface water)	594	619	495	99	99	1,906
			990	1,238	1,238	495	990	4,951

Table S-5 Projeted Domestic Use by Zone and Income Group (In 1,000 m3/day)

Year	Zone	Supply Condition	Income Group I	II	III	IV	V	TOTAL
1980	I	a. Piped Supplies	-	9.3	26.6	21.2	24.1	81.2
		b. Standpipe Supplies	20.5	19.9	0.7	-	-	41.1
			20.5	29.2	27.3	21.2	24.1	122.3
	II	a. Piped Supplies	-	6.4	18.5	14.8	16.7	56.4
		b. Standpipe Supplies	14.2	13.8	0.5	-	-	28.5
			14.2	20.2	19.0	14.8	16.7	84.9
	III	a. Piped Supplies	-	4.1	14.8	15.5	19.6	54.0
		b. Standpipe Supplies	7.4	9.0	0.3	-	-	16.7
			7.4	13.1	15.1	15.5	19.6	70.7
1985	I	a. Piped Supplies	-	9.1	34.3	25.6	36.5	105.5
		b. Standpipe Supplies	19.5	19.8	0.9	-	-	40.2
			19.5	28.9	35.2	25.6	36.5	145.7
	II	a. Piped Supplies	-	6.4	24.1	18.0	25.7	74.2
		b. Standpipe Supplies	13.7	13.9	0.6	-	-	28.2
			13.7	20.3	24.7	18.0	25.7	102.4

	III	a. Piped Supplies	-	4.4	19.8	19.3	31.1	74.6
		b. Standpipe Supplies	7.4	9.3	0.4	-	-	17.1
			7.4	13.7	20.2	19.3	31.1	91.7
1990	I	a. Piped Supplies	-	9.1	42.1	31.7	47.5	130.4
		b. Standpipe Supplies	19.8	19.6	1.1	-	-	40.5
			19.8	28.7	43.2	31.7	47.5	170.9
	II	a. Piped Supplies	-	7.4	33.9	25.4	38.3	105.0
		b. Standpipe Supplies	16.0	15.8	0.9	-	-	32.7
			16.0	23.2	34.8	25.4	38.3	137.7
	III	a. Piped Supplies	-	5.3	30.1	29.7	50.0	115.1
		b. Standpipe Supplies	9.3	11.5	0.7	-	-	21.5
			9.3	16.8	30.8	29.7	50.0	136.6
1995	I	a. Piped Supplies	-	8.9	53.0	38.2	63.5	163.6
		b. Standpipe Supplies	18.4	19.1	1.4	-	-	38.9
			18.4	28.0	54.4	38.2	63.5	202.5

		II	a. Piped Supplies	-	8.0	47.8	34.4	57.2	147.4
			b. Standpipe Supplies	16.5	17.2	1.3	-	-	35.0
				16.5	25.2	49.1	34.4	57.2	182.4
		III	a. Piped Supplies	-	6.6	48.5	45.7	85.7	186.5
			b. Stanpipe Supplies	11.0	14.3	1.1	-	-	26.4
				11.0	20.9	49.6	45.7	85.7	212.9
M7-b-49	2000	I	a. Piped Supplies	-	8.6	63.6	39.8	75.2	187.2
			b. Standpipe Supplies	17.0	18.6	1.7	-	-	37.3
				17.0	27.2	65.3	39.8	75.2	224.5
		II	a. Piped Supplies	-	8.6	63.5	39.8	75.2	187.1
			b. Standpipe Supplies	17.0	18.6	1.7	-	-	37.3
				17.0	27.2	65.2	39.8	75.2	224.4
		III	a. Piped Supplies	-	7.4	66.1	54.2	115.0	242.7
			b. Standpipe Supplies	11.5	15.8	1.4	-	-	28.7
				11.5	23.2	67.5	54.2	115.0	271.4

2005	I	a. Piped Supplies	-	8.0	72.5	46.3	92.7	219.5
		b. Standpipe Supplies	15.5	17.4	1.9	-	-	34.8
			15.5	25.4	74.4	46.3	92.7	254.3
	II	a. Piped Supplies	-	9.3	83.6	53.5	106.9	253.3
		b. Standpipe Supplies	17.8	20.1	2.2	-	-	40.1
			17.8	29.4	85.8	53.5	106.9	293.4
	III	a. Piped Supplies	-	7.8	85.1	71.3	106.4	324.6
		b. Standpipe Supplies	11.9	16.7	1.9	-	-	30.5
			11.9	24.5	87.00	71.3	160.4	355.1

Table S-6 Summary of Projected Domestic Water Demand (In 1,000 m3/d) (THE SECOND CASE) (Revised)

Classification	1980 *	1985	1990	1995	2000	2005
1. Residential Service Connection	101.0	254.3	350.5	497.5	617.0	797.4
2. Public Hydrant	9.1	85.5	94.7	100.3	103.3	105.4
	110.1	339.8	445.2	597.8	720.3	902.8
	(1270) (l/s)	(3,930) (l/s)	(5,150) (l/s)	(6,920) (l/s)	(8,340) (l/s)	(10,450) (l/s)

* Water Demand in 1980 shows actual average day consumption derived from billing record provided by PDAM.

Table S - 7 SUMMARY OF WATER DEMANDS (AVERAGE DEMAND IN 1,000 M3/DAY)
(THE SECOND CASE)

CLASSIFICATIONS	1980	1985	1990	1995	2000	2005
A. Domestic Use						
A-1 Residential Service	101.0	254.3	350.5	492.5	617.0	797.4
Connection	(191.6)[a]					
A-2 Public Hydrant	9.1	85.5	94.7	100.3	103.3	105.4
	(86.3)					
Total A (A-1 and A-2)	110.1	339.8	445.2	592.8	720.3	902.8
	(277.9)					
B. Non-Domestic Use						
B-1 Public Use						
a. Government Office	54.9	51.9	37.4	23.7	31.6	40.7
b. Schools	1.2	5.9	17.1	39.1	48.3	65.3
c. Religious Places	0.6	3.4	10.4	25.1	28.8	33.0	
d. Hospitals	4.3	5.2	6.3	7.5	8.4	9.2
e. Lodging Houses	5.2	5.8	6.5	7.2	8.0	8.9
	66.2	72.2	77.7	108.6	128.3	157.1
B-2 Industries Use						
a. Industries	4.8	14.2	38.6	75.2	123.5	182.7
b. Small Industries	4.9	6.9	11.2	15.1	21.1	31.4
	9.7	21.1	49.8	90.3	144.6	214.1
B-3 Trade and Service						
a. Hotels	7.9	8.6	12.5	18.9	26.4	38.0
b. Trade & Service	21.5	33.6	56.8	92.4	157.8	248.2
	29.4	42.2	69.3	111.3	184.2	286.2
B-4 Port Tanjung Priok	13.5	15.3	17.3	19.5	22.7	26.3
B-5 Armed Forces	(30.0)	35.4	41.1	46.2	51.0	55.6
B-6 Depok	5.6	6.0	6.0	6.0	6.0	6.0
Total B (B-1 thru B-6)	124.4	191.2	261.2	381.9	536.8	745.3
	(154.4)					
Total Average Demand Net Consumption A thru B)	234.5	532.0	706.4	979.7	1,257.1	1,648.1
	(2700 l/s)	(6,200l/s)	(8,200 l/s)	(11,300l/s)	(14,500 l/s)	(19,100 l/s)
	451.7[a]					
	(5,200l/s)					
Unaccounted-for Water (% of Production Required) (Case 3)	225.6	511.3	470.9	482.5	513.5	549.4
	(54)	(49)	(40)	(33)	(293)	(25)
Production Required (In Average (1,000 M3/Day) (l/sec)	510	1,043.1	1,177.3	1,462.2	1,770.6	2,197.5
	(920.0)[a]					
	5,900	12,100	13,600	16,900	20,500	25,400
	(11,400)[a]					
Total Population Served (In 1,000 persons)	2,100					
	4,136	4,504	5,389	6,527	7,403	8,591
Gross Percapita Demand (lpcd)	243					
	(244) [a]	231	218	224	239	255
Day Maximum Demand (l/sec) (Day Average x 1.15)	6,800	13,900	15,700	19,500	23,600	29,200
	(13,300)[a]					
Raw Water Requirement (l/sec) (Day Maximum x 1.0)		14,900	16,800	20,800	25,200	31,300
	7,300					
	(14,000)					

[a] Potential water demand projected for the year 1990

Water Demand Forecasts in Case of 16 million Population in 2005

1. Population forecasts made by the Jakarta Master Plan studies have been taken as the principal basis of the studies. This population forecast is based on annual growth rates declining from 4.17 % in 1971 - 1980 to 1.76 % in 2000 - 2005 which might be a large reduction. If the modest deconcentration to the other centers not be actualized in accordance with the Master Plan, population growth will duly increase and target population of 12 millions may be reached before the year 2005.

2. In case of the population growth rate of 3.28 % in 2000 - 2005 is estimated which is of a rectilinear decline in comformity with the trends of the rate in 1971 - 1980, the population in the year 2005 will reach to approximately 16 millions.

3. Water demand in case of the above growth pattern is estimated based on the demand projection of 12 million in 2005 discussed in earlier in the First and Second case demand projections and applying population ratio between 16 million and 12 million population curves in each year on the domestic and non-domesctiv demand projected.

4. Demand curve in the case of the higher population growth, 16 million population in year 2005 is shown in Figs. D-1 and D-2.

Water Demand Projection (Government Policy)

(Applying PELITA IV figures by the year 2005)

1. JICA study team was informed the G.O.I PELITA IV POLICY WATER SUPPLY LEVELS OF SERVICE, and a table showing the policy is attached to this paper. This policy is, in principle, shall be applied as the year 1990 target of water supply levels. The demand projection, however, for further future up to year 2005 have been projected based on the above policy in the terms of per capita consumption, which is for house connection 210 lpcd, for public standpipe suppply 30 lpcd for the purpose of comparison of demand to other projections such as the First case and Second case as discussed earlier.

2. The population served in 1990 is 75 % of total population according to the above policy. For the demand projection for the year 1990, assumed 74 % of total population be served which imply that the all population in the service area will be served by public system in accordance to the study. Percentage of population served, in case of following G.O.I. policy for future, assumed to be 80 % in the year 1995, 83 % and 87 % in the year 2000 and 2005 respectively which imply the percentage of all population in the service area in the each year.

3. Population in the service area by income groups is same figures employed in the First case and is shown in Table F-7.

4. Non-domestic demand is as same as discussed and derived under the First case and Second case projections.

5. The summary of water demand projected under the above condition is shown in Table G-1.

Table G-1 SUMMARY OF WATER DEMAND IN CASE OF FOLLOWING G.O.I. POLICY (PELITA IV)

	Year	1990	1995	2000	2005
	Percentage of Population to be served	74 %	80 %	83 %	87 %
A.	Domestic Demand				
	Direct House Connection)	666,910 m3/day	943,610 m3/day	1,039,710 m3/day	1,339,170 m3/day
	Public Standpipes	116,400 m3/day	125,730 m3/day	124,200 m3/day	123,570 m3/day
	Total A	783,310 m3/day	960,340 m3/day	1,163,910 m3/day	1,462,740 m3/day
B.	Non-Domestic Demand	248,700 m3/day	381,900 m3/day	536,800 m3/day	745,300 m3/day
	Total Average Demand (Net consumption A + B)	1,032,010 m3/day (11,900 l/sec)	1,342,240 m3/day (15,500 l/sec)	1,700,710 m3/day (19,700 l/sec)	2,208,040 m3/day (25,600 l/sec)
	Unaccounted-for water (% of Production Required)	40 %	33 %	29 %	25 %
	Production Required (In average m3/day) (l/sec)	1,720,000 m3/day (19,900 l/sec)	2,003,340 m3/day (23,200 l/sec)	2,395,270 m3/day (27,700 l/sec)	2,944,050 m3/day (34,100 l/sec)
	Total Population Served	6,537,000 (74%)	8,002,000 (80%)	9,091,000 (83%)	10,496,000 (87%)
	Gross Per capita Demand to Total Population Served (lpcd)	263	250	263	280
	Total Population in DKI, JKT	8,872,000	9,949,600	11,004,900	11,998,900
	Per capita to Total Population	194	201	218	245
	Day Maximum Requirement (l/sec)	22,900	26,700	31,900	39,200
	Raw Water Requirement (l/sec) (Day Maximum x 1.07)	24,500	28,500	34,100	41,900

NOTE : 1. PELITA IV G.O.I. Policy is applied in terms of per capita demand up to year 2005.
Residential connection : 210 lpcd, Public standpipes : 30 lpcd.

2. Percentage of population to be served is also implied the percentage of population in service area projected.

G.O.I. PELITA IV POLICY - WATER SUPPLY LEVELS OF SERVICE

Town Category	1 Metro	2 Large City	3 Medium Town	4 Small Town	5 IKK
Population (1000's)	over 1000	500 to 1000	100 to 500	20 to 100	1 to 20
Percent of 1990 population to be served (1)	75	75	75	75	75
	U.U.A. Programme				IKK Programme
DOMESTIC DEMAND (Litres/cap./day)					
Direct House or yard Connections (2)	210	170	150	90	60 (3)
Public standpipe (2)	30	30	30	30	30
TOTAL AVERAGE DOMESTIC DEMAND (litres/cap./day)	120	100	90	60	45
NON-DOMESTIC DEMAND (% of domestic demand)	Based on Survey of Requirements (For budgeting purposes only) 60%	40%	30%	20%	5%
ALLOWANCE FOR UNACCOUNTED WATER (% of Total Production) (4)	20%	20%	20%	20%	15%

Notes :

(1) Represents National target. Percentage population served by individual schemes may vary in accordance with density of development, alternative water supplies, boundaries of town and service area etc.

(2) The ratio of population served by House/Yard connections to the population served by Public Standpipes should reflect the national target of 50 : 50. This ratio may vary for individual schemes (based upon Socio-economic survey) in which case the domestic demand for the house/yard connections should be varied so that the Total Average Domestic Demand target is achieved.

(3) Yard connections only. Domestic demand for yard connections should not be reduced but the ratio of yard connections to public standpipes may be varied, based upon a socio-economic survey, between the limits 80 : 20 and 20 : 80, utilizing the full capacity of the module.

(4) Minimum allowance. For existing systems this may be increased on the basis of a survey of actual losses and estimated trend.

MASTER PLAN FOR
JAKARTA WATER SUPPLY DEVELOPMENT PROJECT

M8. APPENDIX MIV-2

PRELIMINARY STUDY ON IMMEDIATE PROJECT

PRELIMINARY STUDY ON IMMEDIATE PROJECT

Table of Contents

ATTACHMENTS

LIST OF FIGURES

LIST OF TABLES

1. Background

Raw water for the existing treatment plants, Pejompongan I and II and Pulogadung, relies on the West Tarum Canal in the dry season. Present flow rate of the Canal is maximum 6 m3/sec, as actually measured, and meets the present water production for Pejompongan treatment plants of 5 m3/sec and Pulogadung treatment plant of 1 m3/sec. Upon completion of Pulogadung Plant, now under construction by the Japanese Government aid, its total water production becomes at 4 m3/sec. Despite the above increase of production, another 3 m3/sec of raw water is required for water demand in 1988. Under the circumstances of raw water requirement for water supply, Directorate General of Water Resource Development (DGWED), Ministry of Public Works, performed the water resource development study for future urban water requirement to the Jabotabek area.

To meet foreseen urgent necessity of raw water for the water supply, DGWRD planned the enlargement of the Canal between the Sunter River and the Curung, and the design capacity between Bekasi and Jakarta is 19 m3/sec, aiming at the target year 1988. As a result of the enlargement of the Canal, surplus water of about 2.2 m3/sec will be provided, and is committed to be allocated for water supply use.

The Immediate Project, therefore, is planned to meet the potential demand as expeditiously as possible, making full use of the above mentioned 2.2 m3/sec water. The project consists of construction of a new treatment plant and installation of new trunk mains, which are planned to be connected with the distribution mains to be installed under the Second Phase of First Stage Project to minimize the construction cost.

2. Water Source

The West Tarum Canal is the supply source for the Project as described above. The Canal flows westward from Curung on the Citarum river to the Ciliwung river in Jakarta, intercepting the rivers of Cibeet, Cikarang and Bekasi on its way to Jakarta.

The Canal is the only existing system with the possibility of feeding additional raw water to the Metropolis and Nedeco Consultants, Netherlands, proposed in 1981 to enlarge the existing canal for the purpose of meeting the short term needs of the City of Jakarta, since all other alternative programs would take time for the acquisition of land and the construction of a new conveyance system.

Under such circumstances, the enlargement of the West Tarum Canal was decided by the Government in June 1982. According to this program, its enhanced capacity is 19 m3/sec, including water for the new treatment plant, and is planned to be allocated for the following use:

Pejompongan Plant	:	5.6 x 1.1* = 6.2 m3/sec
Pulogadung Plant	:	4.0 x 1.1* = 4.4 m3/sec
Immediate Proejct	:	2.0 x 1.1* = 2.2 m3/sec
Flushing Use	:	5.0 m3/sec
Loss in the Canal	:	1.2 m3/sec
Total	:	19.0 m3/sec **

Note : * Added 10 % for losses in the treatment plant.

** In current study, the allocation of water has been planned as 21.1 m3/sec added raw water of 3.3 m3/sec for the First Phase of Second Stage.

The detailed design of the enlargement is now in progress, and the target of the proejct completion is determined at the end of 1988. Upon completion, the enlarged canal is expected to provide additional raw water to not only the existing water treatment plants with their capacities increased, but the immediate proejct to meet the demand up to the year 1990 as well.

The present conditions and the enlargement plan of the Canal are shown in Table 1.

Table 1. Enlargement of West Tarum Canal Capacities

No.	Design Section		Length (km)	Design Capacity (m3/s)	Existing Capacity 1982 (m3/s)	Enlargement Target Capacity (m3/s)
1.	Curung	Ia	7.2	85	56	81
	to	Ib	10.5	84	55	79
	Cibeet	IIa	3.9	81	40	73
		IIb	2.3	77	44	72
2.	Cibeet	III	2.5	80	48	80
	to	IVa	4.2	66	41	56
	Cikarang	Ivb	2.4	57	41	54
		Ivc	6.2	49	33	49
3.	Cikarang	V	2.1	45	24	39
	to	VIa	6.8	32	18	35
	Bekasi	VIb	3.9	29	25	32
		VIc	2.1	21	19	31
4.	Bekasi to Buaran		8.5	14	2.8	19
	Sunter		1.9	14	5.8	19
	Capinang	VIIc	1.6	14	5.1	12
	Ciliwung	Tunnnel	1.2	10.8	7.2	11.7

Note : Existing Capacity of the WTC at full supply water level
Source, Nedeco Consultants, 1982 - 1983

3. Capacity of Water Treatment Plant

Whereas the surplus water of 2.2 m3/sec is to be utilized for water supply use as metnioned in the previous section, the capacity of the distribution mains, which will be installed under the Second Phase of First Stage Project and connected with new mains under the Immediate Project, is examined, as described below.

As the results of hydraulic calculation under the following conditions, it is found that the capacity of the existing mains to accommodate additional water is maximum 2.0 m3/sec (refer to hydraulic calculation) :

1) Diameter of the exisiting distribution mains are 800 mm and 1,000 mm.

2) New treatment plant covers partially the service areas of the Central District, Tebet and part of South District.

3) Conjunction points with the existing mains are :
   a. Intersection of Jl. D.I. Pangaitan and Jl. Jatinegara Raya (the existing main of 800 mm in diameter)
   b. Intersection of Jl. Gatot Subroto and Jl. Rangkaya Rasuna Said (the existing main of 1,000 mm in diameter)

4) The new treatment plant is assumed to be operated constantly under full load, 2 m3/sec.

After completion of the Immediate Project, still 2.1 m3/sec of water will be short for average potential water demand in 1987 (refer to Fig.4.2 Water Demand and Proposed Water Production in the Master Plan Report). However, since the supply of 2.0 m3/sec produced by the Immediate Project is planned to Cover the areas of Central Jakarta and Tebet, and the water from the plants of Pejompongan and Pulogadung will be supplied to south-western and western parts and north-eastern parts of the existing service area, respectively, the supply conditions in northern and north-western parts of the service area, where consumers are suffering from the chronic water shortage, will be greatly improved under sufficient water pressure.

To solve the chronic water shortage and supply water to new areas to be developed, succeeding expansion of the water supply system, say the Second Stage Project should be proceeded in accordance with the proposed schedule in the present Master Plan.

4. Water Quality and Treatment Process

4.1 Water Quality of the West Tarum Canal

Quality of the West Tarum Canal water covering all analysis items is shown on Table 2. The quality parameters of the Canal water are almost same between Curug and Bekasi and have low concentrations. Water quality analysis was done by the JICA Study Team and the Institute of Hydraulic Engineering (DPMA), DGWRD, to investigate the situation of pollution of the Canal water. Results are shown on Table 3 and Figs. 1 to 4. The Canal water between the Bekasi and the Buaran Rivers also has

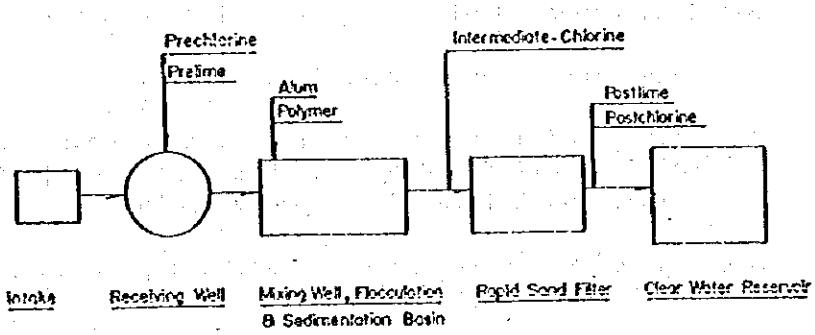
low concentrations of pollutants, but the water between the Sunter and the Canal end has higher concentrations of Ammonium and COD, and more Faecal Coli.

Meanwhile, water quality monitoring of the Canal water by DPMA has started for one year period to ascertain fluctuations of water quality parameters.

4.2 Treatment Process and Chemical Application

To take raw water of better wuality and simplify the treatment process, the intake site will be selected at upstream of the crossing point of the Canal with the Buran River shown as point 3 in Figs. 1 and 2, as point 6 in Figs. 3 and 4, respectively, as stated in later section. It is considered that highly turbid water from the Bekasi River will flow into the Canal in the rainy season. Therefore, the treatment process shall be fit for the fluctuation of turbidity. Taking into account the present treatment technique, the following process and chemical application are recommendable :

Fig. 6 Flow Chart of Treatment Process



1) Alum and Polymer : To remove suspended solid by Alum and accelerate setting veolocity of the floc by polymer.

2) prechlorine : To oxidize organic matters and dissolved iron and manganese

3) Intermediate chlorine : To prevent Faecal Coli from prpagating in the sand bed of filter and oxidize remaining pollutants in clarified water

4) Postchlorine : To disinfect filtered water

5) Postlime : To control pH value to non-corrosive level

Most of concentration of Fe and Mn is of suspended solids and caused by the inflow of river water, and these concentrations are removed by the conventional treatment process such as coagulation and sedimentation. Based on the result of coagulation test, the chemical dosage rate is estimated for the Canal water as shown on Table 4.

Table 4. Chemical Application

Chemicals	Dosage (ppm) Max.	Aver.	Min.
Prechlorine	10	4-5	1
Intermediate chlorine	3	1-2	0
Postchlorine	3	1-2	0
Alum	70	30	10
Polymer (as Zuclor)	0.1	0.03	0
Postlime	24	15-20	-

5. Locations of Intake Site and Treatment Plant

Locations of intake site and treatment plant site are selected at the south bank of the Canal and upstream of the crossing with the Jati Kramat River considering the following :

1) Water quality at the proposed site is generally good, and concentrations of organic matters, an indicator of pollution, are low, compared with other locations along the WTC.

2) Raw water intake by gravity is possible.

3) Acquisition of land with an area of more than 5 hectares will not be difficult for proposed treatment plant, as the area consists of uncultivated and paddy field.

4) Drainage of waste water from treatment processes can be made to the Jati Kramat River.

In future, the north side area neighbouring the Canal will be urbanized according to the city plan up to the year 2005. For protection of the Canal water from pollution, such protective measures as fences, drainage and sewage diversion and refuse collection should be taken.

On the other hand, the Canal water will be mostly of the Bekasi River so that the measures for pollution in watershed of the Bekasi River are needed. At present, there are many factories such as soap, cement and others along the river which use water in large quantity, and these factories discharge their wastewater after treated to the river. It is recommendable, therefore, that PDAM should investigate the location of these factories, dengerous chemical used and treatment of their effluent, and monitor the presence of some changes in chemical qualities of the raw water in the Canal by general monitoring of using fish tank in the treatment plants.

6. Selection of Pipeline Route

As pipeline route for distribution main, the following routes will be considered :

1) North of the Canal (Jl. Tarum Barat at Halim Airport Jl. Gen. Haryono (refer to Fig. 7.8) uncultivated land (land for pipeline to be purchased)

2) South side of the Canal (land for pipeline to be purchased)

3) Within site of toll road which is under plan between Jakarta and Cikampek.

In the case of 2), as hillocks where houses stand are in southern part along the Canal, the pipeline has to take a circuitous route. Therefore, the length of pipeline will be longer and the land acquisition cost greater. In the case of 3), the plan of toll road, such as location and construction schedule, is not determined yet. So this route cannot be taken at this stage.

Thus, it is recommended that the route of 2) is selected. Although there may be hindrance of traffics, it is possible to avoid this problem by installing the pipes in the shoulder of paved road.

7. Proposed Facilities

7.1 Comparative Study of Alternative Water Supply Systems

Water supply system to be constructed for the Immediate Project will be proposed, as described in the following, based on the least cost solution selected from among possible alternative plans, and also taking into consideration other factors concerning operation and maintenance of the constructed facilities.

Possible alternative systems will be composed as briefed below :

(1) Alternative I (Figs. 7 and 8)
Intake site : South bank of the Canal at Kali Buaran
Treatment Plant : Pulogadung treatment plant

(2) Alternative II (Figs. 9 and 10)
Intake site : South bank of the Canal at Kali Buaran
Treatment Plant : Near Kali Buaran

(3) Alternative III (Figs. 11 and 12)
Intake site : South bank of the Canal at Kali Cakung (about 5.3 km upstream from Kali Buaran)
Treatment Plant : Near Kali Cakung (joining with the plant to be constructed under the Second Stage Project).

For the above three alternatives, construction cost and operation/maintenance costs are estimated and the outcome is shown on Table 5.

Table 5 Comparision of Costs for Alternatives

Alternatives	Construction Cost 1/ F/C (US$ 1,000)	L/C (Rp. million)	Total (Rp. million)	OM Costs 2/ (Rp. million)
I	21,000	19,300	39,880	1,567
II	17,000	15,300	31,960	1,427
III	21,000	17,400	37,980	1,595

Note : 1/ Including costs for intake, raw water main, treatment and distribution facilities, engineering cost and contingencies for physical and price.

2/ Including personnel, power and chemicals and maintenance costs.

3/ For details, refer to attachment

As is clear in the above table, Alternative II is the lowest costs of both construction and operation compared with other Alternatives, and is the most advantageous. Therefore, Alternative II is recommendable for the Immediate Project. Particularly, the following countermeasures should be considered in future :

(1) The intake site, which is located within the DKI boundary, will be urbanized so that necessary countermeasures for the prevention of pollution, as described in previous section, must be made.

(2) To cope with fluctuations of turbidity caused by the Bekasi River water, the chemical application must be controlled properly.

7.2 Water Supply Facilities

The facilities proposed in the Immediate Project are new treatment plant with a capacilty of 2,0 m3/sec and distribution trunk mains which are to be connected to the existing mains. Water produced in the plant is distributed to the existing service area, mainly parts of central and southern areas shown on Fig. 13.

The facilities proposed are shown in Table 6, and general plan and profile of proposed treatment plant are shown on Figs. 14, 16 and 17.