Japan International Cooperation Agency

National Water Resources Board The Republic of The Philippines

The Study on Water Resources Development for Metro Manila in the Republic of the Philippines

Final Report

Volume III Master Plan Study Supporting Report

March 2003

Nippon Koei Co., Ltd. NJS Consultants

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The cost estimate is based on the price level and exchange rate of June 2001. The exchange rate is:

US\$1.00 = PHP52.0 = \$125.0



THE STUDY ON WATER RESOURCES DEVELOPMENT FOR METRO MANILA IN THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

VOLUME III PHASE 1: MASTER PLAN STUDY SUPPORTING REPORT

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ABBREVIATION

ACP :	Asbestos Cement Pipe
ADB :	Asian Development Bank
AMSL :	Above Mean Sea Level
ANR :	Assisted Natural Regeneration
ASEAN :	Association of Southeast Asian Nations
AWLR :	Automatic Water Level Recorder
AWSOP :	Angat Water Supply Optimization Project
AWWA :	American Waterworks Association
BIR :	Bureau of Internal Revenue
BOD :	Biochemical Oxygen Demand
BOO :	Build Operate Own
BOT :	Build-Operate-and-Transfer
BP :	Bank Policy
BRS :	Bureau of Research and Standards
BSWM :	Bureau of Soils and Water Management
CA :	Concession Agreement
CALABARZON :	"Cavite, Laguna, Batangas, Rizal and Ouezon Provinces"
CAPEX :	Capital Expenditure
CARP	Comprehensive Agrarian Reform Program
CBFM :	Community-Based Forestry Management
CD ·	Community Development
CDO ·	Cease and Desist Order
CENRO :	Community Environment and Natural Resources Office
CERA ·	Currency Exchange Rate Adjustment
CFRD :	Concrete Face Rockfill Dam
CO ·	Community Organization
COA ·	Commission On Audit
CPC ·	Certificate for Public Convenience
CPCN ·	Certificate for Public Conveniences and Necessity
CPI ·	Consumer's Price Index
DA ·	Department of Agriculture
DAO ·	DENR Administrative Order
DAR ·	Department of Agrarian Reform
DBCC ·	Development Budget Coordination Committee of NEDA
DECS ·	Department of Education Culture and Sports
DENR ·	Department of Environment and Natural Resources
DFI ·	Development Financing Institutes
DILG ·	Department of Interior and Local Government
DMA ·	District Metering Area
DMS ·	Detailed Measurement Survey
DMZ ·	District Monitoring Zone
DO ·	Dissolved Oxygen
DOE ·	Department Energy
DOF ·	Department Of Finance
DOH ·	Department of Health
DPWH ·	Department of Public Works and Highways
DSCR ·	Department of Fuore works and flighways Debt Service Coverage Ratio
	Department of Social Welfare and Development
	Department of Social Wenare and Development

DTI	:	Department of Trade and Industry
EA	:	Executing Agency
ECAs	:	Environmentally Critical Areas
ECC	:	Environmental Compliance Certificate
ECPs	:	Environmental Critical Projects
ECRD	:	Earth Core Rockfill Dam
EDCOP	:	Engineering and Development Corporations Of the Philippines
EIA	:	Environmental Impact Assessment
EIARC	:	EIA Review Committee
EIRR	:	Economic Internal Rate of Return
EIS	:	Environmental Impact Statement
ELC	:	ELC Electroconsult
EMB	:	Environmental Management Bureau
EMMP	:	Environmental Management and Monitoring Plan
EMP	•	Environmental Management Plan
EMS		Environmental Management System
EO	•	Executive Order
EPA	•	Extraordinary Price Adjustment
FRB	•	Energy Regulatory Board (of DOE)
EVAT		Expanded Value Added Tax
FC	:	Foreign Currency
FGD	•	Focus Group Discussion
FIRR	:	Financial Internal Rate of Return
FMB		Forest Management Bureau
F/S	•	Feasibility Study
FSI	•	Full Supply Level
GS	•	Gauging Station
GDP	•	Gross Domestic Products
GHD	:	Gutteridge Haskins and Davey Pty I td
GI	:	Galvanized Iron
GNP	•	Gross National Products
GOCC	:	Government Owned and Controlled Corporations
GOL	:	Government of Japan
GOP	•	Government of the Philippines
GPDP	:	Gross Regional Domestic Products
	•	Uloss Regional Domestic Floudets
	•	Hydropower Howing and Urban Development Coordinating Council
HUDCC	•	Housing and Orban Development Coordinating Council
	•	Ingli Water Level
	•	Implementing Agencies
IBKD	•	International Bank for Reconstruction and Development of the
100		world Bank
	•	Investment Coordination Committee of NEDA
ICCS	•	Indigenous Cultural Communities
IEC	:	Information-Education and Communications
IEE	:	Initial Environmental Examination
IICDA	:	Infanta Integrated Community Development Assistance
IOL	:	Inventory of Losses
IPS	:	Indigenous Peoples
IPRA	:	Indigenous People's Right Act
IRR	:	Implementing Rules and Regulations

IU	:	International Union for the Conservation of Nature and Natural		
		Resources		
JBIC	:	The Japan Bank for International Cooperation		
JICA	:	Japan International Cooperation Agency		
JVC	:	Joint Venture Company		
JWWA	:	Japan Waterworks Association		
LC	:	Local Currency		
LCB	:	Local Competitive Bidding		
LFPR		Labor Force Participation Rate		
LGU	÷	Local Government Unit		
LLDA	·	Laguna Lake Development Authority		
Lpcd		Liter per capita per day		
LPG	•	Liquefied Petroleum Gas		
LTPDP	•	Long-term Philippines Development Plan		
IWI		Long-term I imposites Development I tun		
	:	Local Water Litilities Administration		
M/P	:	Master Plan Study		
	•	Manila Pizal Laguna Quezon		
MANILAQUE	•	"MADECOP Environmental Management Systems, Inc."		
MENT	•	Multi Dertite Environment Menitoring Team		
	•	Muril-Partice Environment Monitoring Team		
MERALCO		Mania Electric Company		
MGB		Mines and Geosciences Bureau		
MLD	:	Million Liter per Day		
MMDA	:	Metro Manila Development Authority		
MMI	:	Multi-partite Monitoring leam		
MMUTIS	:	Metropolitan Manila Urban Transportation Information System		
MOA	:	Memorandum of Agreement		
MOL	:	Minimum Operation Level		
MTPDP	:	Medium-Term Philippines Development Plan		
MWCI	:	Manila Water Company Inc.		
MWSI	:	Maynilad Water Services Inc.		
MWSP	:	Manila Water Supply Project		
MWSRP	:	Manila Water Supply Rehabilitation Project		
MWSS	:	Metropolitan Waterworks and Sewerage System		
NAMRIA	:	National Mapping and Resource Information Authority		
NATM	:	New Austrian Tunneling Method		
NCIP	:	National Commission on Indigenous Peoples		
NCR	:	National Capital Region		
NEDA	:	National Economic and Development Authority		
NEPC	:	National Environmental Protection Council		
NGO	:	Non-Government Organization		
NGOs	:	Non-Government Organizations		
NIA	:	National Irrigation Administration		
NP Junction	:	Novaliches Portal Junction		
NPC	:	National Power Corporation		
NPCC	:	National Pollurion Control Commission		
NRW	:	Non-Revenue Water		
NSCB	•	National Statistical Coordination Board		
NSDW	:	National Standard for Drinking Water		
NSO	:	National Statistical Office		
NTFW	:	Non-timber Forest Product		

NTU	: Nephelometric Turbidity Unit
NWDCC	: National Water Data Coordinating Center (to be created)
NWRB	: National Water Resources Board
NWRMP	: National Water Resources Master Plan
O&M	: Operation and Maintenance
ODA	: Official Development Assistance
OP	: Office of the President
PAC	: Poly Aluminum Chloride
PAFs	Project Affected Families
PAGASA	• Philippine Atmospheric Geophysical and Astronomical Services
	Administration
PAMB	· Protected Area Management Board
PAPs	· Project Affected Persons
PD	· Presidential Decree
PENRO	Provincial Environment and Natural Resources Officer
PEDA	· Philinine Fisheries Development Authority
PHILVOLCS	· Philippine Institute of Volcanology and Seismology
DHD	· Dhilippine Deso
DME	· Drobable Maximum Flood
	Drobable Maximum Precipitation
	Dhilipping National Standards for Drinking Water
	. Philippine National Standards for Drinking water
	. Propies Organization
	. Public Relations
PROC D/S	. Proclamation
P/S	Dhilinging Statistical Vaschards 2000
PSY 2000	Philippine Statistical YearDook 2000
PIFWKDM	Presidential Task Force on water Resources Development and
DUC	Management
	Poly vinyl Chloride
QUEZELCO	: Quezon Electric Company
KA	: Republic Act
RAP	: Resetlement Action Plan
RBW	Receiving Body of Water
RBWA	River Basin and Watershed Authorities
RCCD	: Roller Compacted Concrete Dam
REECS	: "Resources, Environment and Economics Center for Studies"
RIZWADA	: Rizal Water Districts Association
ROE	: Return on Equity
ROW	: Right Of Way
RPV	: Pressure Reducing Valve
SAMAKA	: Samahang Mahalin ang Kalikasan
SAMAKABAY	: Samahang Magsasaka ng Bantay Bayan
SCP	: Strategic Communications Plan
SEC	: Securities and Exchange Commission
SES	: Socio-Economic Survey
S.G.S.	: Streamflow Gauging Station
SMBDSM	: Samahan ng Magsasaka sa Bundok na Dahilig ng Sierra Madre, Inc.
SO2	: Sulfur Oxides
STP	: Sewerage Treatment Plant
SR	: Service Reservoir
SRD	: Social Resettlement Division

TBM	: Tunnel Boring Machine	
TCD	: Tribal Community Development	
TCU	: True Color Unit	
TDS	: Total Dissolved Solids	
TOR	: Terms Of Referece	
TRANSCO	: National Transmission Company	
TSS	: Total Suspended Solids	
UATP	: Umiray-Angat Transbasin Project	
UP	: Univerdity of the Philippines	
UPSARDFI	: "UP Social Action and Research for Development F	oundation, Inc."
WACC	: Weighted Average Cost of Capital	
WB	: World Bank	
WCS	: Water Conveyance Schemes	
WCT	: Water Conveyance Tunnel	
WD	: Water District	
WRAP	: Water Resources Authority of the Philippines	
WRDP	: Water Resources Development Project	
WTP	: Water Treatment Plant	
WtP	: Willingness to Pay	

Measurements

<u>Length</u>

Area

mm cm m km	= = =	millimeter centimeter meter kilometer	m ² ha km ² cu m	= = =	square meter hectare square kilometer cubic meter
<u>Volume</u>			Derived	Measur	<u>es</u>
cm ³ l kl m ³	=	cubic centimeter liter kiloliter cubic meter	m/sec m ³ /sec kWh MWh GWh PPM kmph MLD mg/l		meter per second cubic meter per second kilowatt hour megawatt hour gigawatt hour parts per million kilometer per hour million liter per day milligram per liter
<u>Weight</u>			Currency	Z	
g kg ton	= =	gram kilogram metric ton	PHP ¥ US\$	= = =	Philippine Peso Japanese Yen US Dollar
sec min hr d y	= = =	second minute hour day year	% °C 10 ³ 10 ⁶ 10 ⁹	= = = = = =	percent degree degree(s) Celsius thousand million billion

Energy

W	=	watt
kW	=	kilowatt
MW	=	Megawatt

Part-A

Socio-Economic Framework

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Part-A: SOCIO-ECONOMIC FRAMEWORK

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Part-A: SOCIO-ECONOMIC FRAMEWORK

A1 Profiles of Region, Province and Municipality in the Study Area

The Study area extends to National Capital Region (NCR) and three provinces in the Region IV (Southern Tagalog Region), namely Rizal, Cavite and Quezon Provinces. Of these administrative divisions, NCR and Rizal Province are wholly included in the Study area, but Cavite and Quezon Provinces are included only partially. In order to comprehend the whole characteristics of the Study area, each area is compared with the whole Philippines in terms of the land area, population, GRDP, employment structure and family income and expenditures as shown in Table 2.1 of Volume II.

(1) National Capital Region (NCR)

The NCR has the land of only 0.2% (636 km²) of the whole Philippines. The population of 13.0% (9,933 thousands) of the whole country, however, concentrates in NCR area resulting in a high population density of 15,574 persons per km². The low population growth of 1.0% per annum that corresponds to less than half of the nation's average growth rate (2.3% per annum) may prove that NCR is saturated with inhabitants already.

The GRDP share of NCR to the country's total was 30.7% in 1999. The population of 13% who lives in the area of 0.2% of the total land produces 30% of products of the whole country. In industry sector, the share of NCR amounts to 35% of the country and it amounts to as much as 41% in the services sector. When GRDP of the Region IV that is located adjacent to NCR is added, the total GRDP of the two regions reaches 46% of the country. In the industry sector, the total share of NCR and Region IV amounts to 55% of the country and it amounts to as high as 52% in the services sector. Namely, more than half of the country's products in both the industry and services sector is generated in these two regions.

The unemployment rate (19%) is higher in NCR than the country's average (14%). What is peculiar in NCR with respect to employment is that its share of agriculture sector is only 1% of the total employment as compared with 37% of the country's average.

The average annual family income of NCR (Peso 271,000) is more than double that of the country's average (Peso 123,000) and the average annual family expenditures of NCR (Peso 218,000) is also more than two times the average of the country (Peso 100,000). The percent share of expenditures shows that the share of food expense in NCR is very low (36%) and that of rent is high (22%) as compared with the averages of the country and other provinces.

The NCR currently administers 12 cities and five municipalities. According to the Population Census conducted in May 2000, the total population of NCR reached 9.9 million. The result of the Population Census 2000 is summarized hereunder.

	Land area	Population	Density	Growth 1995-
	(km ²)	May 2000	(persons/km ²)	2000
	, , ,	(thousand)	ч ́	(% p.a.)
Las Pinas City	41.5	473	11,398	2.8
Manila City	38.3	1,581	41,279	-0.9
Makati City	29.9	445	14,883	-1.7
Mandaluyong	26.0	278	10,692	-0.6
City				
Marikina City	38.9	391	10,051	1.8
Muntinlupa City	46.7	379	8,116	-1.1
Paranaque City	38.3	450	11,749	2.9
Pasig City	13.0	505	38,846	1.4
Valenzuela City	47.0	485	10,319	2.1
Caloocan City	55.8	1,178	21,111	2.9
Pasay City	13.9	355	25,540	-2.8
Quezon City	166.2	2,174	13,081	1.8
Malabon	23.4	339	14,487	-0.5
Navotas	2.6	230	88,462	0.1
Pateros	10.4	57	5,481	0.7
San Juan	10.4	118	11,346	-1.0
Taguig	33.7	467	13,858	4.2
Total NCR	636.0	9,933	15,574	1.0

Population.	density a	and growth	rate of NCR	in May 2000
- i opulation,	achistey e	ana siona	Tute of French	minuy 2000

Source: Population Census 2000, NSO Web site (Final Counts)

The population growth rate of NCR was 1.0% per annum which was less than the national average of 2.3% per annum. The population has decreased in five years of 1995-2000 in seven cities/municipalities: they are Manila City, Makati City, Mandaluyong City, Muntinlupa City, Pasay City, Malabon municipality and San-Juan municipality.

The highest population density is recorded in Navotas municipality of which area is as small as 2.6 km^2 . The second highest is Manila City whose population showed decrease in these five years. Pasig City was ranked at third highest population density.

The gross regional domestic products (GRDP) of NCR rebounded with a growth rate of 2.5% in 1999 after reducing 0.3% in 1998. The per capita GRDP of NCR was more than two times that of the whole country in recent years as shown hereunder.

	Philip	pines	NCR		
	GDP	Per capita	GRDP	Per capita	
	(Peso thousand)	(Peso)	(Peso thousand)	(Peso)	
1997	893,151	12,146	272,991	28,781	
1998	887,905	11,814	272,295	27,227	
1999	917,382	12,273	279,045	27,373	

GDP/GRDP and Per capita: NCR vs. Philippines

Source : NCR Development Plan 2000-2004, MMDA, April 2001

Note : GRDP at 1985 constant prices

The contribution of NCR to the country economy is accounted for mostly by the services sector registering more than 40% of the country's services sector in these years. Nearly 30% of the Country's GDP are attributed to NCR as shown hereunder.

	1997		1998		1999	
	(Peso	% to	(Peso	% to	(Peso	% to
	thousand)	Nation	thousand)	Nation	thousand)	Nation
Agriculture	-	-	-	-	-	-
Industry	112,513	35.1	106,838	34.0	106,350	33.6
Services	160,478	41.4	165,457	41.3	172,695	41.4
GRDP	272,991	30.6	272,295	30.7	279,045	30.4

Recent Sector GRDP of NCR

Source : NCR Development Plan 2000-2004, MMDA, April 2001 Note : GRDP at 1985 constant prices

The annual per capita poverty threshold for NCR was estimated at Peso 14,200, the highest in the country. Based on this scale, 6.4% of total household or 127,900 people fall below this threshold in NCR in 1997. This is, however, an improvement from 8.0% in 1994.

	1994		1997		
	Philippines	NCR	Philippines	NCR	
Annual per capita poverty threshold (Peso)	8,885	11,230	11,319	14,299	
Magnitude of poor families	4,531,170	141,671	4,511,151	127,873	
Incidence of poor families	33.5%	8.0%	31.8%	6.4%	

Poverty Incidence: NCR and the Philippines in 1994 and 1997

Source: NCR Development Plan 2000-2004, MMDA, April 200

(2) Rizal Province

Rizal Province has the population of 2.2% (1,707 thousands) of the nation in the land area of 0.4% (1,309 km²) of the whole country. The population density is five times (1,305 persons per km²) the country's average and the population growth more than two times (5.4% per annum) the national average. Judging from its relatively low population density and its vicinity to Metro Manila, its population is expected to increase at a high rate in the future.

The province of Rizal currently administers one city and 13 municipalities. According to the Population Census conducted in May 2000, the total population of the province reached 1.7 million. The result of the Population Census 2000 is summarized hereunder. The population concentrates in City of Antipolo, Cainta and Taytay municipalities. The total population of these three city/municipalities amounts to more than 910 thousands and corresponds to about 53% of the total population of the province.

	Land area	Population	Density	Growth 1995-
	(km ²)	May 2000	(persons/	2000
		(thousand)	km ²)	(% p.a.)
Antipolo City	306.1	471	1,539	6.4
Angono	26.0	75	2,885	4.9
Baras	23.4	25	1,068	4.6
Binangonan	72.7	188	2,586	5.9
Cainta	10.2	243	23,824	3.8
Cardona	31.2	39	1,250	1.6
Jala-Jala	49.3	23	467	2.8
Rodriguez	312.8	115	368	7.5
Morong	37.6	42	1,117	3.1
Pililla	74.0	45	608	4.0
San Mateo	64.9	136	2,096	6.6
Tanay	243.4	78	320	2.5
Taytay	38.8	198	5,103	6.4
Teresa	18.6	30	1,613	4.6
Rizal Total	1,309.0	1,707	1,305	5.4

Population, density and growth rate of Rizal Province in May 2000

Source: Population Census 2000, NSO Web site (Final Counts)

The City of Antipolo, Rodriguez and Tanay have the biggest land area covering 862.3 km² and correspond to about 66% of the total provincial land area. Due to these wide land areas, the population density of these city/municipalities are currently not so high. The highest population density is observed in Cainta $(23,824 \text{ persons per km}^2)$ whose area is the smallest (10.2 km^2) in the province.

The population growth rate of Rizal was 5.4% per annum which was more than two times the national average of 2.3% per annum. Particularly, those municipalities whose population is more than 100,000 have shown rapid increase. These include Antipolo City, Binangonan, Rodriguez, San Mateo and Taytay. Only exception is Cainta of which high population density seems to have hindered from further growth of population.

The unemployment rate in Rizal (15%) is higher than the country's average but is lower than NCR. What is peculiar to Rizal with employment is that the share of industry sector is high (35%) that is more than two times the country's average (16%). To the contrary, that of agriculture is very low (8%) as compared with the country's average (37%).

The average annual family income in Rizal (Peso 189,000) is ranked at the highest among 78 provinces throughout the country in 1997. The average annual family expenditures (Peso 129,000) are also high, being ranked at second in the same year.

The commerce and industry in the province is very active sector. The province had a total of 23,837 business establishments in 1996. Companies dealing with household goods had the largest number of 12,262 with a 51% share followed by manufacturing industries of 4,604 firms (19% share). Among 10 companies with the employees of more than one thousand, seven firms are in the manufacturing sector. The third ranking area is the hotel and restaurants business with 1,892

firms for 8% share. The majority of the business establishments in the province (23,400 firms) have less than 50 employees which corresponds to 98% of the total establishment.

Business fields		Num	ber of emp	ployees / f	ïrms	
	1-49	50-99	100-	500-	1000 -	Total
			499	999		
Agriculture \$ forestry	155	6	3	2	0	166
Fishing	52	1	0	0	0	53
Mining & quarrying	16	2	0	0	0	21
Manufacturing	4,417	82	85	13	7	4,604
Electricity, Gas & water supply	77	4	2	0	0	12
Whole sale, retail, repair of motor	413	5	5	1	3	427
Household goods	12,224	24	13	1	0	12,262
Hotels & restaurants	1,882	10	0	0	0	1,892
Transport, storage & communication	287	5	6	0	0	298
Financial intermediation	596	0	0	0	0	596
Real estate & renting	1,405	1	2	0	0	1,408
Education	211	15	7	0	0	233
Health & social work	760	4	0	0	0	764
Other community, social & personal activities	1,094	3	4	0	0	1,101
Total	23,400	162	130	17	10	23,837

Number of business establishments as per number of employees: Province of Rizal in 1996

Source: Socio-Economic Profile, Province of Rizal, 2000

10 major industries have been proven viable in the province. They are textile, garments, leather goods, gifts, toys, house-wares, stuffed toys, dolls, wooded novelty items and handcrafted items. Cainta, Taytay and Antipolo are the areas considered as more industrialized due to the presence of various types of industrial establishments. Most of the major companies are located in Cainta due to its favorable terrain and proximity to Metro Manila. As a whole, industrialization of Rizal is primarily attributed to its proximity to Metro Manila and its favorable climate for growth, as support and infrastructure facilities are adequate.

The trend of poverty incidence in the province shows a downward during the period from 1991 to 1994. The families below poverty threshold decreased from 43,211 in 1991 to 32,088 in 1994 reducing the poverty incidence from 26.9% to 18.4% in this period.

(3) Cavite Province

Cavite Province has the population of 2.7% (2,063 thousands) of the nation in the land area of 0.4% (1,288 km²) of the whole country. The population density is more than six times (1,602 persons per km²) the country's average and the population growth more than two times (5.1% per annum) the national average. Its location adjacent to Metro Manila may bring the same effect of population pressure as Rizal Province.

The Study area is situated at the lowland in the northern part of the province that is bordered by Manila Bay. It covers the City of Cavite and five municipalities of Bacoor, Imus, Kawit, Noveleta and Rosario. The Study area covers 137 km² in total corresponding to 10.6% of the total land area of the province (1,288 km²).

Since it is difficult to describe socio-economy of the Study area discriminately due to the limited availability of the information, the socio-economy of Cavite Province as a whole will be introduced hereinafter focussing on the Study area as far as statistics allow.

	Land area (km ²)	Population May 2000	Density (persons/km ²)	Growth 1995- 2000
	()	(thousand)	(1	(% p.a.)
Cavite City	10.9	99	9,083	1.3%
Bacoor	25.0	306	12,240	4.0%
Imus	89.0	195	2,191	2.0%
Kawit	13.4	63	4,701	2.0%
Noveleta	5.6	32	5,714	3.5%
Rosario	3.6	74	20,556	6.5%
Study area Total	136.6	670	4,905	3.4%
Cavite Prov. Total	1,287.6	2,063	1,602	5.1%

Population, density and growth rate of the Study area in Cavite Province in 2000

Source: Population Census 2000, NSO Web site (Final Counts)

According to the Population Census of May 2000, the total population of the Study area was 670 thousands that is 32.5% of the provincial population (2,063 thousands) in 2000. The population concentrates in the municipalities of Bacoor and Imus with 75% of the total population of the Study area. That is due to their immediate proximity to Metro Manila area. The highest population density is observed in Rosario (20,556 persons per km²) whose area is the smallest (3.6 km²) in the province.

The population growth rate of the Study area was 3.4% per annum which was lower than the provincial average of 5.1% per annum in the period of 1995-2000. The highest growth was observed in Rosario with 6.5% per annum, while it is the lowest (1.3% per annum) in Cavite City.

The industrialization in Cavite and the province's advantage of proximity to Metro Manila enables a large segment of the population to be absorbed in non-agricultural activities. As a whole, Cavite Province has a total of 26 industrial estates accommodating 466 establishments. These generate a total of 114,842 employment to the people of Cavite. While, those 138 industrial establishments which are located outside Industrial Estates have 12,789 employment.

Prevalent skills of the workers in Cavite are in metal working, woodworking, garments production (sewing and embroidery), automotive and engine rebuilding, shell-crafts, rattan-craft, bamboo-craft and in the emerging electronics industries.

In the Study area, 264 companies are operating in five industrial estates employing 74,700 workers as shown below. Averaged number of employees per company varies from 18 (in Cavite City) to 490 (in Imus).

City/municipality	No. of company	Capitalization	Employment
		(Peso billion)	
Bacoor	10	0.103	963
Imus	23	2.745	11,316
Noveleta	2	0.006	251
Rosario	225	0.026	62,146
Cavite City	4	0.011	73
Total	264	2.891	74,749

Data of companies located in industrial estates in the Study area in 1999

Source: Socio-Economic Profile, Province of Cavite, 1999

While, the number of establishment registered in the Study area amounts to 2,160 in retail trade, 270 in manufacturing, 1,870 in services and 6 in agriculture subsectors in 2000 as shown below. Small and medium establishments are dominant with the averaged number varying from two employees (in retail trade) to 18 employees (in manufacturing).

	Retail trade		Manufacturing		Services		Agriculture	
	No.	Employ.	No.	Employ.	No.	Employ.	No.	Employ.
Bacoor	906	2,061	119	491	842	2,997	2	61
Cavite City	216	532	13	68	185	591	0	0
Kawit	92	268	20	83	77	370	0	0
Noveleta	113	184	11	29	64	231	0	0
Rosario	223	538	28	3,754	158	443	0	0
Imus	613	1,624	79	455	545	2,117	4	164
Total	2,163	5,207	270	4,880	1,871	6,749	6	225

Number of registered establishments in the Study area in 2000

Source: Socio-Economic Profile, Province of Cavite, 1999

The unemployment rate (16%) is higher than the country's average (14%) but is lower than that of NCR (19%). The share of industry sector in employment (33%) is relatively high in the region reflecting the concentration of industrial estates in the province.

Like Rizal, the average annual family income in Cavite (Peso 164,000) is high enough to be ranked among all the provinces at second following Rizal in 1997. The average annual family expenditures (Peso 128,000) are also high, being ranked at third following Rizal in the same year.

(4) Quezon Province

The province of Quezon stretches as a narrow belt along the eastern coast of Luzon from Camarines in the south to Desada Point, General Nakar in the north. The province is one of 11 provinces of the Southern Tagalog Region or the Region IV. The total land area is $8,626 \text{ km}^2$ representing the second largest in the region (18%).

The Sierra Madre runs along the entire length of the province with Mt. Banahaw (an active volcano) towering 2,237 m above sea level. The topography of Quezon is characterized by rugged terrain with few plains, valley and swamps. Only narrow strips of land along the coast and river valleys are available for crop

growing. The modulating lowlands along the coast are well drained. The province is very narrow with an average of about 30 km in width.

Quezon Province has the population of 2.2% (1,679 thousands) of the nation in the wide land area of 2.9% (8,626 km²) of the whole country. The population density (195 persons per km²) is less than the country's average (260 persons per km²) and the population growth (1.6% per annum) is also less than national average (2.3% per annum). Forest reserve occupies the large area of provincial land in this province.

The unemployment rate (10%) is comparatively lower as compared with those of the country average (14%) and NCR (19%). This may be attributed to its high share of agriculture sector (36%) in employment. To the contrary, the share of industry sector in employment (18%) is relatively low in the region.

The average annual family income in Quezon (Peso 100,000) is relatively low in the region being ranked at 23rd among all the 78 provinces in 1997. The average annual family expenditures (Peso 82,000) of Quezon was ranked at 19th in the same year. What is peculiar to Quezon in expenditure composition is that expenditure for education is relatively high (4.4%) in the surrounding areas as compared with NCR (3.6%) and the country average (3.7%).

The Study area covers a portion of Quezon Province extending to the Agos River Basin where the source of water to be supplied to Metro Manila is situated. Therefore the description of the province of Quezon as a whole is being limited to general concerns. Instead, more efforts are made to picture the socio-economic features of Infanta City and General Nakar municipality that are located within the catchment of the Agos River.

(5) Infanta City

The city of Infanta is situated on the northern part of Quezon Province. It is bounded on the north and northwest by General Nakar, on the east and southeast by Polillo Strait and Lamon Bay and on the west by the provinces of Rizal and Laguna.

While bigger portion of the municipality (62%) is free from flooding, there exist the flood prone areas where the concentration of people and economic activities are located. Among the Barangays that experience flooding, those that are within the influence area of estuarine rivers in the mangrove forestland facing Lamon Bay are subject to severe seasonal flooding. Severe flooding is experienced in Barangays Amolongin, Bironoan, Alitas, Balobo, Cawayanin, and portions of Abiawin and Dinahican covering 4,500 ha. Areas subject to slight seasonal flooding are those around (and including) the Poblacion Barangays with an aggregate land area of nearly 4,000 ha. Flood control and drainage facilities are found in Barangays Boboin, Poblacion 38, Bantilan and Ilog.

Degree of flooding	Area (ha)	Percent to total
No flooding	14,012	62.3%
Slight seasonal flooding	3,962	17.6%
Severe seasonal flooding	4,526	20.1%
Total land area of Infanta	22,500	100.0%

Flood prone areas in Infanta

Source: Ecological Profile, City of Infanta, 1999

According to the Population Census conducted in May 2000, the total population of Infanta was 51 thousands with a population density of 379 persons per km² that far exceeded the average of Quezon Province (193 persons per km²). While, the recent population growth in Infanta was very high at 5.0% per annum in the period of 1995-2000, which was higher than both the national average (2.3% p.a.) and provincial average (1.6% p.a.).

Population, density and growth rate of Infanta in May 2000

	Land area (km ²)	Population May 2000	Density (persons/km ²)	Growth 1995- 2000
		(thousand)		(% p.a.)
Infanta City	134.6	51	379	5.0

Source : Population Census 2000, NSO Web site (Final Counts)

Note : The land area of Infanta City shown in the above Census differs from that found in land use statistics.

Infanta is predominantly rural. Only four out of 36 Barangays, namely Bantilan, Poblacion 1, Poblacion 38 and Poblacion 39 are considered urban. In 1995, there were 5,800 persons in the urban area and 33,900 persons in rural areas with an urbanization ratio of 14.7%.

In terms of relative shares of the three sectors in total employment, Population Census 1995 recorded a total of 13,241 employed persons in Infanta. Out of this, 5,930 (45%) were engaged in agriculture and fishery, 5,480 (41%) in trade and services, and only 1,830 (14%) in quarrying, manufacturing, construction, and utilities.

The primary sectors, particularly agriculture and fisheries, dominate the local economy of Infanta. There is, however, significant share of tertiary sector activities like trading and services. This indicates the important role of Infanta as the service center of northern Quezon. The secondary sector has the smallest contribution with small-to-medium sized rice mills, furniture shops, bakeries, nipa palm industries and hollow blocks making.

In Infanta, seasonal crops are dominated by rice including irrigated, rain-fed and upland varieties. Other seasonal crops include corn, vegetables, root crops and legumes. While, permanent crops are dominated by coconut. Out of the total cropland, rice lands occupied one-fourth, while coconut lands covers seven-tenths. All other crops appear very insignificant.

The fishery sub-sector is a very significant economic activity in Infanta due to the presence of several fishing grounds from inland to near shore and offshore.

Inland resources include rivers, creeks and swamps. Near shore fishing grounds include municipal waters in the Polillo Strait and Lamon Bay. For offshore fishing, Infanta fishermen have access to the vast Pacific Ocean.

As of end year 1998, there were 72 registered establishments that can be classified as manufacturing activities. These include 15 bakeries, four hollow block making, 30 furniture shops and 23 rice mills. Manufacturing employed a total of 670 residents of Infanta in 1995 or 5.0% of all employed persons.

Beach and riverside resorts have been increasing these years in Infanta. Local tourists from nearby Metro Manila area enjoy clean and beautiful beaches at weekend or vacations. There are about 28 beach and riverside resorts, 22 restaurants and 18 recreational halls in 1999. However, most of the resorts still need to be up-graded to reach an international level.

(6) General Nakar Municipality

The municipality of General Nakar lies on the northern extremity of Quezon Province. It is bounded on the north by Aulora Province, on the east by the Polillo Strait, on the south by Infanta and Real. It is a coastal municipality facing the Pacific Ocean with its back against the Sierra Madre Range to the west. It has a land area of 1,344 km² with 19 Barangays.

The topography is rugged and hilly with the areas that are level or gently sloping covering only 2% of the total land area. Close to nine-tenth (89%) of the total land area have slopes higher than 18%.

In terms of actual cover, almost 94% of total land area is forestland with the remaining 6% being devoted to non-forest activities. Of this small area, 60% is devoted to coconut plantations. Coconut plantations in flat areas accommodate a number of activities like rice, fruit trees and human settlements. The flat land in the coastal plain and along the floodplains of major rivers is being cultivated to paddy rice.

There are two major concentrations of human settlements in the municipality: one is the Kabilugan area in the south and another is Barangay Umiray in the north.

There are at least four types of natural hazards to which the residents of General Nakar are vulnerable: ground shaking, flooding, soil erosion and typhoon. Seasonal flooding is experienced by residents of the Kabilugan area and along the Agos River and by residents in Barangay Umiray.

General Nakar is drained by a total of 106 rivers and creeks with a total length of 1,075 km. Four major river systems define the drainage pattern: Umiray, Kanan, Kaliwa and Agos.

Rivers and watersheds	Number	Length (km)	Area (ha)
Coastal zones rivers	34	172	30,749
Agos river/tributaries	4	42	4,783
Kaliwa river/tributaries	8	105	22,428
Kanan river/tributaries	20	258	37,638
Umiray river/tributaries	40	438	57,174
Total	106	1,075	152,772

Water Resources	in	General	Nakar	Muni	cipality

Source: Ecological Profile, Municipality of General Nakar, 1998

Four major water uses are currently observed: irrigation, domestic water supply, transports and power generation.

According to the Population Census conducted in May 2000, the total population of General Nakar was 24 thousands with a population density of 18 persons per km² that was 11 times lower than the average of Quezon Province (193 persons per km²). While, the recent population growth was 2.7% per annum in the period of 1995-2000 that was higher than both the national average (2.3% p.a.) and provincial average (1.6 % p.a.).

Population, density and growth rate of General Nakar in May 2000

	Land area (km ²)	Population May 2000	Density (persons/km ²)	Growth 1995- 2000
		(thousand)		(% p.a.)
General Nakar	1343.3	24	18	2.7

Source: Population Census 2000, NSO Web site (Final Counts)

General Nakar is predominantly rural. Only the Poblacion is classified as urban while the remaining 18 Barangays are rural. In 1995, there were 940 residents in urban while 20,140 people lived in rural area with an urbanization ratio of only 4.7%. There is no modern means of transportation in General Nakar. It is isolated from other towns because of the big river of Agos that separates General Nakar from the adjacent municipality of Infanta. Residents are forced to use a ferry to cross the river. When a bridge beyond the Agos River is constructed, the population is anticipated to increase rapidly in the future.

The croplands of General Nakar are devoted to the cultivation of such crops as coconuts, upland rice, irrigated rice, non-irrigated rice, fruit trees, citrus, banana, cacao, coffee, corn, cassava, sweet potato and pineapple.

A total of 51,380 ha of agricultural land were reported in 1996. Out of this number, 95% are planted with perennial crops (principally coconuts), while the remainders are utilized for annual crops. The leading annual crop in General Nakar is palay.

There are a total of 276 fishermen, 55% of whom are non-motorized, while the remainder are motorized. Fishing activities of these fishermen are confined within the municipal waters or within the Polillo Strait. Fish caught are directly distributed in some of the Barangays or delivered to the market in Infanta.

The economic activities in the primary sector including agriculture, forestry and

fishery are dominant (75%) in General Nakar. There is a very tiny secondary sector in General Nakar. Small-scale processing of wood fliches, charcoal making, own-use boat building and furniture making are among the activities that can be observed.

Tables

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	Items	1	.997	199	98	1	1999	2000	2001	2002
1)	GDP growth		5.2		-0.5		3.2	3.9	3.1	4.2
	Agriculture	2.9		-6.6		6.6		3.3	2.5-3.3	2.7-3.6
	Industry	6.1		-1.9		0.5		3.9	1.8-2.3	4.2-4.6
	Services	5.4		3.5		3.9		4.4	4.8-5.2	5.0-5.4
2)	Gross domestic investment / GDP		24.9		20.4		18.8	17.6	16.0	19.0
3)	Gross domestic savings / GDP		19.6		22.3		19.8	17.0	15.0	15.5
4)	Inflation rate (consumer price index))	5.9		9.8		6.6	4.4	7.0	6.0
5)	Money supply (M3) growth		20.9		7.4		19.3	5.2	10.0	10.0
6)	Fiscal balance / GDP		0.1		-1.8		-3.6	4.1	-3.5	-2.0
7)	Merchandise exports growth		22.8		16.9		18.8	8.7	3.0	8.0
8)	Merchandise imports growth		14.0	-	18.8		4.1	2.1	5.0	10.0
9)	Current account balance / GDP		-5.3		1.7		9.1	11.5	8.0	5.0
10)	Debt-service ratio		11.6		12.7		13.1	14.2	14.3	15.3
11)	Per capita GNP (in US\$)		1,122		871		998	n.a	. n.a	. n.a.
12)	Unemployment rate		7.9		9.6		9.4	n.a	. n.a	. n.a.

 Table A1.1
 Major Economic Indicators in the Philippines, 1997-2001 (in %)

Sources: Asian Development Outlook 2001, ADB, June 2001

Medium-term Philippine Development Plan (MTPDP) 1999-2004, NEDA, Dec. 1999 Medium-term Growth Projections, NEDA, July 7, 2001 Philippine Statistical Yearbook 2000, NSCB, October 2000

	19	93	19	96	199	99	Growth 93-99
GDP sector share (Peso milli	on)						
Agriculture	167,053	22.8%	179,451	21.1%	183,407	20.0%	1.6%
Industry	251,459	34.3%	302,126	35.6%	316,650	34.5%	3.9%
Services	315,644	43.0%	367,544	43.3%	417,325	45.5%	4.8%
GDP	734,156	100.0%	849,121	100.0%	917,382	100.0%	3.8%
Employment structure (thou	sand)						
Agriculture	11,194	45.8%	11,451	41.7%	11,342	39.1%	0.2%
Industry	3,793	15.5%	4,567	16.6%	4,518	15.6%	3.0%
Services	9,457	38.7%	11,424	41.6%	13,143	45.3%	5.6%
Total	24,444	100.0%	27,442	100.0%	29,003	100.0%	2.9%
Productivity (Peso / employe	e)						
Agriculture	14,923	50	15,671	51	16,171	51	1.3%
Industry	66,296	221	66,154	214	70,086	222	0.9%
Services	33,377	111	32,173	104	31,753	100	-0.8%
Total	30,034	100	30,942	100	31,631	100	0.9%
Foreign trade structure (USS	6 million)						
Exports to:							
ASEAN	760	6.7%	2,817	13.7%	4,917	14.0%	36.5%
Japan	1,827	16.1%	3,671	17.9%	4,664	13.3%	16.9%
USA	4,371	38.4%	6,966	33.9%	10,445	29.8%	15.6%
Total	11,375	100.0%	20,543	100.0%	35,037	100.0%	20.6%
Imports from:							
ASEAN	1,897	10.8%	3,788	11.7%	4,248	13.8%	14.4%
Japan	4,037	22.9%	7,129	22.0%	6,136	20.0%	7.2%
USA	3,522	20.0%	6,361	19.6%	6,365	20.7%	10.4%
Total	17,597	100.0%	32,427	100.0%	30,742	100.0%	9.7%
Export share of "electronics	products"	(US\$ millio	on)				
Elect. & elect'l equipm'ı	3,551	31.2%	9,988	48.6%	21,166	60.4%	34.7%
Total exports	11,375		20,543		35,037		20.6%
	GDP sector share (Peso milli Agriculture Industry Services GDP Employment structure (thou Agriculture Industry Services Total Productivity (Peso / employe Agriculture Industry Services Total Exports to: ASEAN Japan USA Total Imports from: ASEAN Japan USA Total Imports from: ASEAN Japan USA Total Imports from: ASEAN Japan USA Total Imports from: ASEAN Japan USA Total Export share of "electronics Elect. & elect'l equipm't Total exports	GDP sector share (Peso million) Agriculture 167,053 Industry 251,459 Services 315,644 GDP 734,156 Employment structure (thoustry) 3,793 Services 9,457 Total 24,444 Productivity (Peso / employee) 4,923 Industry 66,296 Services 33,377 Total 30,034 Productivity (Peso / employee) 4,923 Industry 66,296 Services 33,377 Total 30,034 Proreign trade structure (USS million) 1,827 LSA 4,371 Total 11,375 Imports from: 4,037 ASEAN 1,897 Japan 4,037 USA 3,522 Total 17,597 USA 3,522 Total 17,597 Export share of "electronics" roducts" USA 3,522 Total 3,551	Image: Im	Image: construct the sector share (Peso million) Image: construct the sector share sector share sector sector share sector secto	I993 I993 GDP sector share (Peso million) × Agriculture 167,053 22.8% 179,451 21.1% Industry 251,459 34.3% 302,126 35.6% Services 315,644 43.0% 367,544 43.3% GDP 734,156 100.0% 849,121 100.0% Employment structure (thousand) Agriculture 11,194 45.8% 11,451 41.7% Industry 3,793 15.5% 4,567 16.6% Services 9,457 38.7% 11,424 41.6% Total 24,444 100.0% 27,442 100.0% Productivity (Peso / employee) Agriculture 14,923 50 15,671 51 Industry 66,296 221 66,154 214 Services 33,377 111 32,173 104 Total 30,034 100 30,942	Image: I	1993 1996 1999 GDP sector share (Peso million) 22.8% 179,451 21.1% 183,407 20.0% Agriculture 167,053 22.8% 179,451 21.1% 183,407 20.0% Services 315,644 43.0% 367,544 43.3% 417,325 45.5% GDP 734,156 100.0% 849,121 100.0% 917,382 100.0% Employment structure (thousand Agriculture 11,194 45.8% 11,451 41.7% 11,342 39.1% Industry 3,793 15.5% 4,567 16.6% 4,518 15.6% Services 9,457 38.7% 11,424 41.6% 13,143 45.3% Total 24,444 100.0% 27,442 100.0% 29,003 100.0% Productivity (Peso / employee) 33,377 111 32,173 104 31,531 100 Agriculture 14,923<

Table A1.2 Trend Analysis of Major Indices of Philippine Economy

Source: Philippine Statistical Yearbook 2000, NSCB, October 2000

							(in milli	on Pesos at 19	35 const. prices)
	1993	1994	1995	1996	1997	1998	1999	% to nation 1999	Average Growth 1993- 99
The Philippine s									
Agriculture, Fishery and Forestry	167,053	171,390	172,848	179,451	185,004	173,106	183,407		1.6%
Industrial Sector	251,459	265,972	283,858	302,126	320,689	313,881	316,650		3.9%
Service Sector	315,644	329,006	345,518	367,544	387,458	400,918	417,325		4.8%
Total GDP	734,156	766,368	802,224	849,121	893,151	887,905	917,382		3.8%
ditto growth rate (% p.a.)	2.1	4.4	4.7	5.9	5.2	-0.6	3.3		
NCR (Metro Manila)									
Agriculture, Fishery and Forestry	0	0	0	0	0	0	0	0	-
Industrial Sector	88,116	93,269	100,806	105,132	112,513	106,838	106,351	33.6%	3.2%
% share to the nation	35.0%	35.1%	35.5%	34.8%	35.1%	34.0%	33.6%		-0.7%
Service Sector	128,033	134,079	141,362	150,868	160,478	165,457	172,695	41.4%	5.1%
% share to the nation	40.6%	40.8%	40.9%	41.0%	41.4%	41.3%	41.4%		0.3%
Total of NCR	216,149	227,348	242,168	256,000	222,699	272,295	279,046	30.4%	4.3%
% share to the nation	29.4%	29.7%	30.2%	30.1%	24.9%	30.7%	30.4%		0.5%
Region IV (Southern Tagalog)									
Agriculture, Fishery and Forestry	31,626	32,206	32,634	34,458	35,966	34,186	33,696	18.4%	1.1%
% share to the nation	18.9%	18.8%	18.9%	19.2%	19.4%	19.7%	18.4%		-0.5%
Industrial Sector	48,441	51,775	54,517	59,734	62,221	59,769	60,972	19.3%	3.9%
% share to the nation	19.3%	19.5%	19.2%	19.8%	19.4%	19.0%	19.3%		0.0%
Service Sector	34,720	36,173	38,096	40,623	42,726	44,874	47,407	11.4%	5.3%
% share to the nation	11.0%	11.0%	11.0%	11.1%	11.0%	11.2%	11.4%		0.5%
Total of Region IV	114,787	120,154	125,247	134,815	140,913	138,829	142,075	15.5%	3.6%
% share to the nation	15.6%	15.7%	15.6%	15.9%	15.8%	15.6%	15.5%		-0.2%

Table A1.3 Historical GDP/GRDP by Sector by Region

Source: "2000 Philippine Statistical Yearbook" for the whole Philippines

Table A1.4 GDP/GRDP by Region for 1999-2004 based on MTPDP

								ditto in	ditto in	
							Growth 99-	MTPDP (low	LTPDP (low	Growth 2003-
	1999	2000	2001	2002	2003	2004	2004	case)	case)	2004
The Philippine s										
Agriculture, Fishery and Forestry	183,407	189,826	190,775	197,453	205,351	207,404	2.5%	2.6%		1.0%
Industrial Sector	316,650	332,483	348,442	369,348	394,464	420,498	5.8%	5.1%		6.6%
Service Sector	417,325	439,443	460,097	485,862	516,958	546,941	5.6%	5.2%		5.8%
Total GDP	917,382	961,752	999,314	1,052,663	1,116,772	1,174,844	5.1%	4.7%	5.5%	5.2%
ditto growth rate (% p.a.)	3.3	4.8	3.9	5.3	6.1	5.2				
NCR (Metro Manila)										
Agriculture, Fishery and Forestry	0	0	0	0	0	0	0.0%	2.5%		0.0%
Industrial Sector	106,351	111,669	117,587	125,465	133,997	143,377	6.2%	5.3%		7.0%
Service Sector	172,695	182,193	192,760	203,941	216,381	230,229	5.9%	5.5%		6.4%
Total of NCR	279,046	293,862	310,347	329,406	350,378	373,606	6.0%	5.4%		6.6%
Region IV (Southern Tagalog)										
Agriculture, Fishery and Forestry	33,696	34,370	35,057	35,758	36,474	37,203	2.0%	4.0%		2.0%
Industrial Sector	60,972	63,960	67,541	71,796	76,535	81,892	6.1%	5.3%		7.0%
Service Sector	47,407	50,014	52,865	55,931	59,343	63,022	5.9%	5.4%		6.2%
Total of Region IV	142,075	148,344	155,464	163,486	172,352	182,118	5.1%	5.0%		5.7%
C INC. I. C DUTL D	1 (D1	1001 2004	" () (TDDD)	NEDA C /	1 1000					

Source: "Medium-term Philippine Development Plan 1994-2004" (MTPDP) NEDA, September 1999 Note: The sector GRDP was computed by applying the target growth rates of each sector shown in MTPDP.

Table A1.5 Per Capita GDP Projected in 2025

	1990	1995	2000	2005	2010	2015	2020	2025
GDP Growth (% per annum)	3.0%	4.5%	3.7%	5.2%	5.3%	5.5%	5.6%	5.8%
GDP at 1985 constant prices (mil. Peso)	720,690	802,224	961,752	1,236,393	1,604,300	2,097,669	2,760,440	3,652,072
GDP deflator (1985=100)	149.4	237.5	340.2	436.6	506.1	586.7	680.1	788.5
GDP at current prices (mil. Peso)	1,076,711	1,905,282	3,271,880	5,398,093	8,119,364	12,307,024	18,773,750	28,796,586
Population ('000)	57308	64839	76499	84241	91868	99016	105507	113661
Per capita GDP (current Peso)	18,788	29,385	42,770	64,079	88,381	124,293	177,938	253,355
Exchange rate (Peso/US\$)	24.3	25.7	26.2	26.2	26.2	26.2	26.2	26.2
Per capita GDP (US\$) at current prices	773	1,143	1,631	2,444	3,371	4,741	6,787	9,664
Note: (1) Exchange rate after 2000 was assumed at the same level as those before the Asian financial crisis in 1997								

(2) GDP deflator (1985=100) was extrapolated after 1999 by the Study Team.

(3) Population after 2005 is the projection of the Study Team.

Part-B

Water Supply Area and Demand Projection

Part-B: WATER SUPPLY AREA AND DEMAND PROJECTION

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Part-B: WATER SUPPLY AREA AND DEMAND PROJECTION

B1 General

The field investigation for the water demand projection was performed by the Water Supply Planner of the JICA Study Team in collaboration with his counterpart personnel of the NWRB (hereinafter referred to as the Water Supply Planning Group). In the initial investigation stage, the relevant aspects were studied based on the data and information collected through the field investigation placing a focus on the following items:

- Collection of data/information on the current water supply (Chapter B2)
- Current status of the water supply (Chapter B3)
- Water demand projection (Chapter B4)

During the field investigation, the Water Supply Planning Group attempted to collect the data/information required for the water demand projection from Business Area Offices of the two concessionaires in Metro Manila. For the purpose, the JICA Study Team distributed to each of the 11 Business Area Offices (Balara, Cubao, Makati, Marikina, San Juan, Pasig and Rizal under the MWCI, and Central, North East, North West and South under the MWSI) with the NWRB's letter, which formally requested each Office to fill in the questionnaire form. As a result, the filled questionnaire form was collected only from two (2) Business Area Offices, Central Business Area and South Business Area under the MWSI. The filled questionnaire sheets are attached in Volume VI: Databook.

B2 Data/Information Collection on the Current Water Supply

B2.1 Data Collection from Metropolitan Waterworks and Sewerage System (MWSS)

The following information was collected from the MWSS:

- Situation of the current water supply
- Concession Agreement
- Annual report for year 1993, 1994 and 1996
- Quarterly record of water production, gross billed volume and consumption by the two (2) Concessionaires for year 2000

Since the privatization of the water supply in Metro Manila was realized in 1997, the MWSS has been monitoring the operation of the two (2) concessionaires, MWCI and MWSI. Hearing to the concerned personnel of the MWSS, it was pointed out that some issues and problems on NRW still remain presently. The contents of the Concession Agreement were utilized especially to project the future population to be served based on service coverage by city/municipality under the two Concessionaires. Although the quarterly water supply records do not show those by municipality or business area, they were utilized for reviewing current water supply status.

B2.2 Data Collection from the Manila Water Company Incorporation (MWCI) and Maynilad Water Service Incorporation (MWSI)

The following information was gathered from the two (2) concessionaires:

- Current status of water supply (1997 2000)
- Maps on distribution pipelines and water supply availability
- On-going and planned project under the respective concessionaire

The current status of water supply was mainly obtained from the quarterly service performance report of MWCI and MWSI. The location maps of the facilities (distribution mains) and water supply maps depicting served areas were gathered. The information on the on-going/planned water supply projects was collected through interview/discussion with the personnel concerned of the two (2) Concessionaires.

B2.3 Data Collection from the National Water Resources Board (NWRB)

The following information was gathered from the NWRB:

- List of granted water right by municipality
- Rapid Assessment of Water Supply Sources (province of Cavite, Rizal and Quezon)

At the NWRB office, the JICA Study Team collected a copy of the database on granted water right as of end of year 2000. The reports titled as 'Rapid Assessment of Water supply Sources' were utilized for evaluation of existing

groundwater sources and possibility of further development in the Study area, in particular at Infanta and General Nakar located at the lowermost Agos.

In addition to the above, available information on the existing Water Districts in Cavite, Rizal and Quezon province was collected in assistance of Mr. Ichiro Yokota, JICA Expert to the LWUA.

B3 Current Situation of Water Supply in Metro Manila

B3.1 Privatization of MWSS and Present Organizations Concerned with Water Supply

Since the Concession Agreement was signed on 1st August 1997, the water supply for Metro Manila has been undertaken by the two Concessionaires, MWCI (Manila Water Company Inc.) for east zone and MWSI (Maynilad Water Service Inc.) for west zone of the Metro Manila area, under the Regulatory Office set up to oversee the two private companies within MWSS,

(1) Concession Agreement

Major conditions stipulated in the Concession Agreement are as follows:

- i) Concession period: 25 years up to 2022
- ii) Operations and performance

Concessionaires have the right to bill and collect for water and sewerage services supplied in each Zone. In return, Concessionaires are responsible for the management, operation, repair, and refurbishment of the MWSS facilities in its service area.

iii) Water, sewerage and sanitation coverage targets

Concessionaires are required to expand the existing water supply and sewerage systems by making new connections sufficient to meet coverage target percentages of the population in the designated municipalities at the time of the targets determined by the Concession Agreement.

iv) Continuity of supply

There must be an uninterrupted 24-hour supply of water to all connected customers by June 30 2000. The water pressure must be a minimum of 16 psi. for all conveyance pipelines by the tenth anniversary of the Commencement Date of the Concession.

- v) Customer service standard Concessionaires are required to make efforts to satisfy customers in providing prompt responses to customer inquiries and complaints and others.
- vi) Tariff structure and rate regulation

Tariff rate regulation will be made through the following three measures:

- Annual CPI adjustments
- Extraordinary Price Adjustments (EPA) (Force majeure like El Nino phenomenon)
- Rate Rebasing

vii) Concession Fees

Concessionaires are required to pay Concession Fees to MWSS. A part of concession fee includes debt services obligation of MWSS. And it is shared by MWSI and MWCI, according to the proportion

of 90% to MWSI and 10% to MWCI as indicated in Concession Agreement.

(2) MWCI

Based on the Concession Agreement signed between MWSS on August 1, 1997, the Manila Water Company Inc. (MWCI) started its operation to supply water and sewerage services to the East Zone of Metro Manila area. Main features of the company are follows:

i) Consortium Members

Ayala Corporation of the Philippines	(37.5%)
United Utilities of the UK	(20%)
Bechtel Enterprises of the US	(10%)
Mitsubishi Corporation of Japan	(10%)
Others:	(22.5%)

ii) Initial equity capital:

P1.0 billion (Additional P1.0 billion a year later)

iii) East Zone coverage:

Pasig City, Pateros, San Juan, Taguig, Mandaluyong, a small part of Old Manila, most of Makati, Marikina, Quezon City, and Rodriguez and San Mateo in Rizal, and all of the Rizal municipalities of Angono, Antipolo, Baras, Binangonan, Cainta, Cardona, Jala-Jala, Morong, Pililla, Tanay, Taytay and Teresa.

iv) Number of employees: 1,560

(3) MWSI

The Maynilad Water Services Inc. (MWSI) was established simultaneously with MWCI based on the same Concession Agreement signed between MWSS except for some Zone specific matters. Since no company profiles were availed to the Study Team, all the following are based on indirect information obtained from other sources than the Company. Main features of the company are follows:

i) Consortium Members:

Lopez Corporation of the Philippines Benpres Holdings Corporation Suez-Lyonnaise des Eaux

- ii) Number of employees: 3,000 (estimated)
- iii) West Zone coverage:

Caloocan City, Las Pinas City, Malabon, a part of Makati City, a part of Manila City, a part of Marikina City, Muntinlupa City, Navotas, Paranaque City, Pasay City, a part of Quezon City, a part of Rodriguez, a part of San Mateo, Valenzuela City in Metro Manila and Cavite City, Bacoor, Imus, Kawit, Noveleta and Rosario in Cavite Province.
There were nearly 5,600 employees of MWSS at the time of the privatization in 1997. Most of them were absorbed in the two private companies leaving only 170 workers including Regulatory Office in the existing MWSS. The MWSS Board of Trustees, at the time of privatization, has established the Regulatory Office which currently accommodates 68 staffs in four (4) offices of legal matters, technical regulation, financial regulation and customer services regulation.

Due to the El Nino phenomenon occurred in 1997 and 1998, available water in reservoirs reduced considerably. The depreciation of Philippines Peso toward US dollar also damaged concessionaires through the increase of Peso payment for Concession Fees that includes MWSS's debt services to foreign currency loan. The Peso depreciation hit MWSI more heavily than MWCI, because Concession Fees are heavier to MWSI than MWCI by the proportion of 90% vs 10% according to the Concession Agreement.

Evaluation of the privatization of Metro Manila water supply and sewerage is difficult to be done at this stage. As far as water rate is concerned, customers currently enjoy the reduced rates comparing to those prior to the privatization. This is the result brought about by the competitive bidding at the time of international open tender. The level of satisfaction customers can receive from the concessionaire's services and the attainment of targets given to concessionaires will be the barometers of success or failure of the privatization though concessionaire's financial sustainability is its precondition.

B3.2 Service Area and Population Served

Figure B3.1 shows cities/municipalities to be served under the Concession Agreement. Presently, the recipient city/municipality under MWCI are Manila (part), Quezon City (part), Makati, Mandaluyong, San Juan, Marikina, Pasig, Pateros and Taguig of NCR and Antipolo, Cainta, Taytay, Rodoriguez and San Mateo of Rizal Province. Other municipalities in Rizal province are also included in service areas under the Concession Agreement, however, those municipalities are served by Water Districts, municipal waterworks, community waterworks and privately owned waterworks as shown in Table B3.1.

While, MWSI supplies the water to Manila, Quezon City, Makati (part), Caloocan, Pasay, Malabon, Navotas, Valenzuela, Paranaque, Las Pinas and Muntenlupa of NCR and Cavite City, Bacoor, Imus, Kawit, Noveleta and Rosario of Cavite province. Thus, Manila, Quezon City and Makati are divided into the jurisdictions of the two concessionaires.

According to the latest Census 2000, the total population of service area managed by two (2) concessionaires counts about 11,847,000 (excluding 9 municipalities of Rizal province being served by WDs/municipal waterworks/community waterworks). The present population served is estimated at 8,120,000 (3,273,000 for MWCI and 4,847,000 for MWSI) on an assumption of 9.2 persons per connection. Thus, the gross service coverage in year 2000 is derived at 69%, which consists of 72% (MWCI) and 67% (MWSI). Table B3.2 shows the present population served by city/municipality. Higher service coverage has been already achieved at Manila, Quezon City, Makati, Pasay, Malabon, Mandaluyong, Marikina, Pasig, Pateros and San Juan. While, Caloocan, Las Pinas, Muntinlupa, Paranaque, Taguig and other municipalities in Rizal and Cavite Provinces are not adequately served by the two concessionaires yet. Current water supply condition by concessionaire is summarized below.

Item	East Zone	West Zone	Total
Operating Body	Manila Water Company	Maynilad Water Service	-
	Inc. (MWCI)	Inc. (MWSI)	
Area	$1,400 \text{ km}^2(72\%)$	$540 \text{ km}^2 (28\%)$	1,940km ²
Population*	4,562,000 (39%)	7,285,000 (61%)	11,847,000
Pop. Served	3,273,000	4,847,000	8,120,000
Coverage	72%	67%	69%

Note: * excluding nine (9) municipalities in Rizal Province

B3.3 Existing Water Supply Facilities

(1) Water Sources

At present, water supply for Metro Manila relies on two (2) sorts of water sources, namely the Angat Dam on the Angat River and groundwater from deep wells. Raw water from the Angat River, as main source of water sources for Metro Manila, occupies about 4,000 MLD (98%), and deep wells provide water to limited area with about 90 MLD (2%) at present. The followings are the concerned facilities for existing water sources:

(a) Angat Dam

The dam with a storage capacity of 850 million m^3 was constructed in 1920, and its catchment area is 629 km². Water level of the dam is controlled between EL. 217m and 101m. The discharge flows down into the Ipo Dam. Schematic diagram of water source including the water conveyance system is shown in Figure B3.2.

(b) Ipo Dam

The dam with a storage capacity of 3.9 million m^3 was constructed in 1984 for the purpose of water supply. Its catchment area is 665 km^2 . The water level is controlled between EL.101m and 93 m. Raw water is conveyed to La Mesa Dam and La Mesa Water Treatment Plant (WTP), about 20 km away from the dam through tunnel/conveyance pipes.

(c) Alat Dam

The dam is located 2 km upstream of La Mesa Dam. Its catchment area is 14 km^2 and discharge is conveyed to La mesa Dam by gravity.

(d) La Mesa Dam

The dam stores water conveyed from Ipo and Alat Dam as well as rainwater from a catchment area of 27 km². Its storage capacity is 45.36 m^3 and water is used for water supply.

(e) Deep wells

Deep wells are located at many cities/municipalities (Quezon City, Mandaluyong, San Juan, Antipolo, Taguig, Malabon, Cainta, Makati, Marikina, Valenzuela, Caloo can, Paranaque, Pasay, Las Pinas, Muntinlupa, Rodoriguez, San Mateo, Taytay, Cavite City, Bacoor, Imus, Kawit, Noveleta and Rosario). The updated inventory (operational/non-operational) of the deep wells is shown in Table B3.3-3.4. Total rated yield of deep wells is estimated to be about 130 MLD. Actual yield is assumed at 90 MLD (70% of rated yield) referring to current operation.

Water from Angat Dam on the Angat River is fully utilized to cover the current water demand. The latest completion of the Umiray-Angat Transbasin Project enables to augment the water source for Balara and La Mesa WTPs by 9 m^3 /sec (800 MLD) through transbasin diversion of raw water from the Umirai River to the Angat Reservoir.

(2) Water Conveyance Facilities

Existing water conveyance facilities are broken down into three (3) components, which consists of Ipo Dam-La Mesa Dam system, La Mesa Dam-Balara WTPs system and NP Junction-La Mesa WTPs.

(a) Ipo Dam - La Mesa Dam

Three (3) waterways consisting of 3 tunnels and 5 aqueducts deliver the raw water from Ipo dam to La Mesa Dam. Horseshoe/diameter of the tunnels are 2.04 m x 2.19 m/ 3.00 m x 3.00 m/ 3.40 m with a length of 6.4 km each. While, those of aqueducts range from 3.40 m to 2.70 m x 2.70 m with a total length of 62.6 km.

(b) La Mesa Dam - Balara WTPs

Three (3) waterways consisting 3 aqueducts convey water from La Mesa Dam to Balara No.1 and 2 WTPs. Horseshoe/diameter of the aqueducts are $1.73m \times 2.03 m$ to $2.70 m \times 2.90 m$. Aside from this, the bypass line is facilitated to divert the raw water from Ipo Dam – La Mesa Dam system at Novaliches Potal Junction (NP Junction) for delivery to Balara WTPs directly.

(c) NP Junction - La Mesa WTPs

The raw water for La Mesa No.1 and 2 WTPs are conveyed from the NP Junction through the aqueduct, respectively.

These water conveyance facilities were constructed in 1929 to 1992. Among them, the aqueduct to Balara No. 1 WTP is the oldest one that has been used for more than 70 years. Presently, the facilities need to be reviewed and studied from the technical aspects (structural strength, water leakage, etc.). With regard to this, the MWCI is studying rehabilitation of the water conveyance to augment delivery capacity by 350 MLD.

(3) Water Treatment Facilities

The majority of East Zone under MWCI is supplied water from Balara No.1 and No.2 WTPs. Likewise, West Zone under MWSI is supplied from La Mesa No.1 and No.2 WTPs.

(a) Balara No.1 WTP

The nominal plant capacity is 470 MLD. The WTP consists of 2 units of accelerator/sedimentation tank and 10 units of dual media filter (anthracite + sand) with filtration rate of 290 m/day. Chemicals used are aluminum sulfate and poly-electrolyte for coagulation and liquid chlorine for pre-, intermediate and post chlorination.

(b) Balara No.2 WTP

The nominal plant capacity is 1,130 MLD. Each of the WTP consists of flocculation basin, sedimentation basin and 20 units of dual media filter with filtration rate of 348 m/day. Chemicals used are same as those for Balara No.1 WTP. The WTP was expanded 3 times since its completion in 1958 and rehabilitated in 1996 with grant-aid project by the Japanese Government.

(c) La Mesa No.1 WTP

The La Mesa No. 1 WTP was constructed in 1985 with a design capacity of 1,500 MLD. The treatment process of the WTP employed the traditional type. Main facilities consist of 6 units of flush mixing tank, 12 units each with flocculation and sedimentation basin and 24 units of dual media filter with filtration rate of 348 m/day. Chemicals used are aluminum sulfate for coagulant, poly-electrolyte for coagulant aid and liquid chlorine for pre-, intermediate and post chlorination. Sodium slice fluoride and slaked lime are also used for the purpose of prevention of tooth decay and pH control, respectively.

(d) La Mesa No.2 WTP

The La Mesa No. 2 WTP was constructed in 1994 with a design capacity of 900 MLD. The treatment process of the WTP employed pulsator type (Degremont). Main facilities consist of 4 units of flush mixing tank, 8 units of pulsator and 20 units of dual media filter with filtration rate of 280 m/day. Chemicals used are aluminum sulfate/poly aluminum chloride (PAC) for coagulant, poly-electrolyte for coagulant aid and chlorine.

Water quality of the treated water depends on the production rate and raw water quality, feeding rate of coagulant/s and performance of filter washing. Although the treated water complies with the Philippine National Standards for Drinking Water (PNSDW), the overloaded operation affects treated water quality. In addition, the difference in water treatment performance (turbidity of treated water in particular) is observed among the above WTPs.

(4) Distribution Facilities

Major distribution facilities in MWSS's service area are presented in Table B3.5. For the East Zone (MWCI), the treated water from Balara WTPs is delivered to major distribution facilities of San Juan Reservoir, Pasig Reservoir, Balara Pump Station and others. From these facilities, water is distributed to service areas by gravity or booster pump. One of the most important facilities is San Juan Reservoir which transmits the water to other downstream reservoirs. However, the capacity of the reservoir is not effectively utilized because of lack of due practice for water supply control and management.

For the West Zone (MWSI), the treated water from La Mesa WTPs is delivered to major distribution facilities of Bagbag Reservoir, Algeciras Reservoir, La Mesa Reservoir and others.

As for the distribution pipes, a total length of pipes with diameters of 50 mm to 3,000 mm is estimated at about 6,200 km within the service area as of 2001. Figure B3.3 shows existing primary main. Pipe materials are steel (SP), cast iron (CIP), asbestos (ACP), poly vinyl chloride (PVC) and others. Among them, the share of ACP and PVC pipes are estimated at about 20 and 30% of the whole length, respectively. The majority of pipes with a diameter of 75 to 600 mm are generally installed at 0.3 to 1.5 m below the ground level of the road. Traffic load affects the pipes continuously. The deteriorated pipes and improperly installed pipes cause water leaks.

Figure B3.4 presents the current availability of water supply. Although the water pressure at the faucet is recommended to assure at 1.1 kg/cm^2 or more, the service area of full water supply is limited. The area of 24 hours with adequate pressure is estimated at 40 to 50% out of a total service area.

B3.4 Current Water Production and Billed Water

(1) Water Production and Billed Water

Tables B3.6 and B3.7 as well as the following figures present the trend of water volume for production/distribution, billed and non-revenue water (NRW) of MWCI and MWSI for last three (3) years, respectively.





As for the water production, the average water volume for year 2000 reached about 1,700 MLD for MWCI and 2,000 MLD for MWSI, respectively. Produced and distributed water of MWCI includes the cross boundary water transfer to MWSI, and its average volume is estimated at about 280 MLD. A total of water production is estimated at about 3,700 MLD in 2000. Likewise, for the billed water in year 2000, the average water volume of MWCI and MWSI are estimated at about 680 MLD (excluding cross boundary water transfer) and 760 MLD, respectively. Thus, a total of the billed water is estimated at 1,440 MLD, which corresponds to 39% of the produced and distributed water.

It is noted that Metro Manila experienced the unusual decrease of water supply in 1998 as shown below. This implies that EL Nino phenomenon taking place in 1997 seriously affected the water production due to insufficient water source of Angat Dam. However, the produced and distributed water has generally increased year by year as a whole.

Year	Production Capacity (MLD)	Distributed Water (MLD)	Domestic (MLD)	Commercial (MLD)	Industrial (MLD)	Billed Total (MLD)	(%)
1985	3,190	2,107	503	287	41	831	39%
1986	3,190	2,395	535	276	40	851	36%
1987	3,190	2,287	598	279	45	922	40%
1988	3,190	2,327	619	309	57	985	42%
1989	3,190	2,433	647	314	69	1,030	42%
1990	3,190	2,491	671	312	69	1,052	42%
1991	3,190	2,466	694	296	69	1,059	43%
1992	3,190	2,333	701	281	67	1,049	45%
1993	3,190	2,556	731	290	67	1,088	43%
1994	3,900	2,922	771	306	71	1,148	39%
1995	3,900	3,287	800	300	69	1,169	36%
1996	3,900	3,250	811	310	73	1,194	37%
1997	3,900	3,076	746	297	67	1,109	36%
1998	3,900	2,520	713	311	72	1,094	43%
1999	3,900	3,488	904	. 369	79	1,351	39%
2000	4,090	3,663	919	418	94	1,433	39%

Past Trend of Water Volume

(2) Assumed Composition of Billed Water by City/Municipality

As for area distribution of the billed water in year 2000, no available data could be collected during the course of the First Field Investigation. Thus, the billed water in 1999 by business area under MWCI (Tables B3.8 and B3.9) and the number of service connection by city/municipality under MWSI (Table B3.10) were examined to assume water consumption by city/municipality. The area distribution of water consumption by water use is summarized in Table B3.11.

(3) Non-Revenue Water (NRW)

As for the Metro Manila water supply system, a high NRW has been the most important issue to date. Out of a total water production of 3,700 MLD in year 2000, about 2,230 MLD or 61% of water volume (730 MLD for MWCI and 1,500 MLD for MWSI) is estimated as the physical and commercial losses which are defined as the NRW. In the past 3 years, NRW ratio of the MWCI's service area was more or less 50% and may have a sign of slight improvement. While, the NRW ratio of the MWSI's service area was 66%, which has increased up to date. This situation indicates difficulty in NRW reduction.

On the other hand, in the latest reports (Technical Annex of Business Plan both of the MWCI and MWSI), a ratio of about 55% of physical loss and 45% of commercial loss in terms of the composition of NRW is assumed.

If such percentage of water leakage to total NRW is applied to the recent NRW for year 1997- 2000, the physical loss is estimated as below.

	110000000000000000000000000000000000000		jeurs	
	1997	1998	1999	2000
Billed Water	35.5%	43.2%	38.7%	39.1%
NRW Ratio	64.5%	56.8%	61.3%	60.9%
Physical Loss	35.5%	31.2%	33.7%	33.5%
Commercial loss	29.0%	25.6%	27.6%	27.4%

Assumed Physical Loss for Last 3 years

To reduce NRW, the two concessionaires have practiced leakage repair works continuously. For example, following table shows relation between water leaks and repair work in the MWCI's service area. The number of leaks has not decreased in spite of leak repair works of 1,900 to 3,400 numbers done every month.

		Leakage	Work Summar	y, MWCI, 2000) (U	Jnit: number)
Month	Reported Leaks	Cum. Total	Backlog	Leaks Repaired	Cum. Total	Leak Repair Efficiency
Jan	2,039	2,039	526	1,874	1,874	73%
Feb	2,273	4,312	382	2,417	4,291	86%
Mar	2,429	6,741	407	2,404	6,695	86%
Apr	2,211	8,952	418	2,200	8,895	84%
May	2,319	11,271	481	2,256	11,151	82%
Jun	2,735	14,006	563	2,653	13,804	82%
Jul	2,288	16,294	507	2,344	16,148	82%
Aug	2,530	18,824	500	2,537	18,685	84%
Sep	2,757	21,581	664	2,593	21,278	80%
Oct	3,372	24,953	597	3,439	24,717	85%
Nov	3,212	28,165	604	3,205	27,922	84%
Dec	2,972	31,137	575	3,001	30,923	84%
Total	31,137		6,224	30,923		83%

Source: Service Performance Report, MWCI

Likewise, following table shows the number of illegal connections. Although a considerable number of new illegal connections took place every month, the balance has decreased due to the countermeasures undertaken by the MWCI.

In addition, presently, MWCI has been practicing/operating NRW reduction program actively. It is called "Tubig Para sa Barangay (Water for Barangay)" program which aims to convert NRW in many areas of the city into billed water. MWCI drives to eliminate the problem of widespread water pilferage, illegal water selling by syndicates, and danger of water contamination due to poorly connected waterlines.

	Ille	gal Connections, M	IWCI, 2000	(Unit: number)
Month	Outstanding	Newly Reported	Reduction	Balance
Jan.	3,312	155	805	2,662
Feb	2,462	340	346	2,456
Mar	2,456	212	200	2,468
Apr	2,468	97	196	2,369
May	2,369	85	189	2,265
Jun	2,265	44	66	2,243
Jul	2,243	189	140	2,292
Aug	2,292	168	532	1,928
Sep	1,928	79	138	1,869
Oct	1,869	261	374	1,756
Nov	1,756	69	116	1,709
Dec	1,709	62	73	1,698
Total		1,761	3,175	

Source: Service Performance Report, MWCI

The project has benefited over 150,000 urban poors, particularly those living in densely populated areas where access to safe and potable water had traditionally been a problem. The project has been successfully undertaken in coordination with the East Zone's local government units, from Mayors down to the Barangay level, particularly in the heavily populated communities of Quezon City, Pasig, Marikina, Mandaluyong and Makati.

Through the project, all of the service pipes in the specified Barangays were properly replaced and individual water meters placed at selected locations for easier meter readings. At some Barangays, the water volume consumed is measured with a bulk meter(s) and water bills are paid as a total amount of the Barangay. Barangay officials collect water bills based on the individual meter. It looks like a kind of community water supply and the practice/operation under the program contributes to the NRW reduction relative to illegal connection, meter error and water leakage from service pipes. The MWCI intends to continue this program up to year 2005 and budgetary arrangement for year 2001 was made with a total of 61 Million Pesos.

MWSI also plans to commence the same program. However, actual implementation has been delayed due to financial constraints.

- (4) Issues and Problems on Water Supply
 - (a) Water sources and insufficient capacity of water supply facilities

The existing water source of 4,090 MLD is already insufficient to meet maximum daily water demand of Metro Manila. Considering the magnitude of current water production/distribution (3,700 MLD), the maximum daily water demand seems to have already exceeded the design capacity of Balara and La Mesa WTPs (a total of 4,000 MLD). In fact, Balara WTPs (design capacity of 1,600 MLD) and La Mesa WTPs (2,400 MLD) sometimes produce treated water up to 1,800 MLD and 2,700 MLD, respectively. Thus, the existing WTPs are occasionally operated under the 10% overloaded condition according to the water demand and available water source of the Angat Dam.

Furthermore, due to the insufficient capacity of facilities (service reservoirs/booster pumps and distribution pipes), it is not able to maintain acceptable service level to the beneficiaries equally. 50-60% of service areas are affected by insufficient water pressure.

(b) Non-revenue water (NRW)

Presently, a large volume of NRW, which corresponds to 61% of distributed water, affects operation/management of water supply seriously. Physical loss which is estimated at about 40% of distributed water causes unnecessary use of water sources/water production. This situation directly relates to shortage of water source mentioned above.

(c) Water supply to the municipalities presently unserved by Concessionaire

Water supply for fringe municipalities (Angono, Baras, Binangonan, Cardona, Jala-Jala, Morong, Pililla, Taytay and Teresa) in Rizal province would need to be coordinated between the Concessionaire and LWUA/community water works, before implementation of the long-term water supply project.

B3.5 Water Tariff in MWSS's Service Area

Tables B3.12 and B3.13 present the tariff of MWCI and MWSI in 2001, respectively. Average tariff rate in 2001 is 2.95 Pesos/cu.m for MWCI customers and 6.58 Pesos/m³ for MWSI. There is a large difference between two concessionaires. In spite of current higher tariff, MWSI has petitioned the Government of the Philippines for increasing tariff in order to recover the deficit affected by depreciation of the currency since taking over MWSS. According to the latest newspaper of Japanese edition published in Manila, MWSS agreed to raise the water rate of MWSI by Peso 4.21 per cubic meter for 14 months from October 20, 2001 to December 2002. In addition, the company's foreign exchange loss will be compensated by MWSS starting from July 2002 to the termination of the Concession Agreement in 2021.

B4 Water Demand Projection

B4.1 General

Basically, water demand consists of billed water and non-revenue water (NRW) as follows:

Water demand = Billed water (domestic water + commercial water + industrial water) + NRW

In projecting the future water demand, the planning factors to be set are per capita consumption, population projection, service coverage, commercial and industrial water demand, NRW ratio and peak day demand factor.

B4.2 Domestic Water Demand

(1) Per Capita Consumption

The past trend (1985 - 2000) of average per capita consumption is shown below. The per capita consumption for year 1997 - 2000 (Table B4.1) was calculated based on number of regular connections in order to compare with those during the MWSS's operation before 1997. Average per capita consumption (about 140 - 160 Lpcd) in the late 1980s has decreased to 119 Lpcd in 2000. This reveals that water supply to meet the growth of the population/served population has not fulfilled to potential water demand due to delay of system expansion/rehabilitation (distribution system in particular) for the last 10 years. In addition to this, regarding the unusual drop of unit consumption in 1997 and 1998, El Nino phenomenon might have affected water supply in Metro Manila.



Per Capita Consumption

In assuming per capita consumption, the relationship between per capita consumption and per capita income (or GDP) is usually employed. In case of Metro Manila, however, constraints of water source availability, capacity of water supply facilities or water supply availability and other factors could not catch up the past domestic water demand. In addition, the data on area distribution of domestic water were not made available in the course of the Study. Thus, the examination on correlation between per capita water consumption and per capita income was discarded.

According to the previous JICA study (Water Supply and Sewerage Master Plan for Metro Manila, 1995), on the other hand, an average per capita water consumption of 148 Lpcd (for year 2000) to 186 Lpcd (for year 2015) were proposed. In line with this, per capita consumption in the target year 2025 is projected to reach 206 Lpcd on the average. This figure was also employed in the previous JICA study (the M/P study on Water Resources Management in the Philippines, 1998).

Considering the current status that the per capita water consumption of about 140 - 160 Lpcd in late 1980s has decreased to about 120 Lpcd in 2000, some conservative projection might be accepted in assuming the per capita water consumption.

With regard to the above, the following conditions are assumed in this Study:

(a) Per capita consumption in the base year 2000

The current average per capita water consumption (119 Lpcd in 2000) is applied commonly to all of the concerned cities/municipalities as the base year's per capita consumption.

(b) Per capita consumption in the target year 2025

Per capita consumption in the target year 2025 is set at in line with the previous JICA study (Metro Manila Water Supply and Sewerage Master Plan) as shown in Table B4.2. As a result, 230 Lpcd for high consumption area, 210 Lpcd for middle consumption area and 180 Lpcd for low consumption area are initially obtained. In addition to this, per capita consumption of each city/municipality is modified by applying population distribution by income level referring to "Total and Average Family Income and Expenditure by Income Class, NSO 1994" and "1999 Philippine Statistical Yearbook". Per capita water consumption for the blighted people is fixed at 40 Lpcd.

(c) Per capita consumption in year 2005

Per capita consumption in year 2005 is fixed at 125 Lpcd uniformly for all cities/municipalities assuming that a large scale of water source development will not be realized within next 5 years.

(d) Per capita consumption in year 2010, 2015 and 2020

Per capita consumption in intermittent years (year 2010, 2015 and 2020) are estimated by interpolating in linear between those in year 2005 and 2025.

Under the above assumption, an average per capita consumption in late 1980's will be recovered in the period between 2015 and 2020. Proposed average per capita consumption in service area of each Concessionaire is summarized below. An average per capita consumption in year 2025 will reach 188 Lpcd ranging from 163 to 200 Lpcd by city/municipality. The details on per capita consumption are shown in Table B4.3.

Service Area	2000	2005	2010	2015	2020	2025
East Zone	119	125	139	155	172	191
West Zone	119	125	138	152	168	185
Total	119	125	139	153	170	188

Proposed Average Per Capita Consumption (Lpcd)

(2) Service Coverage

The target service coverage ratios are clearly presented in the Concession Agreement as shown in Table B4.4. While, the past trend of service coverage and population served is shown below. Although the coverage marked 71% as a peak in 1994 since commencement of water supply, it has declined to more or less 65% recently.



Past Trend of Service Coverage and Population Served

Basically, in setting up the future targets by city/municipality, final service coverage ratios presented in the Concessionaire Agreement are considered to be attained in year 2025. As for the targets in the near future (Year 2005 and 2010), more realistic targets are established for specific cities/municipalities considering current service coverage and higher coverage ratios presented in the Concessionaire Agreement.

Thus, the following conditions are assumed in this Study:

(a) Service coverage for next 10 years

The service coverage ratios of cities/municipalities are assumed to increase at annual rate of 1% for next 10 years except for those whose service coverage ratio has reached almost 100%.

(b) Service coverage for municipalities in Rizal province

For the municipalities of Angono, Baras, Binangonan, Cardona, Jala-Jala, Morong, Pililla, Tanay and Teresa in Rizal Province, on the other hand, it is projected that such an increase would not take place until 2010, since water supply of those municipalities are presently under the jurisdiction of Water District, community waterworks (municipal waterworks, Barangay waterworks, privately owned waterworks in sub-divisions) and such a new water source as the Agos River will not be available within several years.

(c) Service coverage for city/municipality with current higher level

For the cities/municipalities with higher coverage (almost 100%), the targets in Concession Agreement are adopted to maintain current higher service level. Likewise, for the city/municipality of Las Pinas, Montinlupa, Paranaque, Cavite City, Bacoor and Imus, the targets set up in the Concession Agreement are employed, assuming that the planned project (300 MLD Bulk Water Supply Project) will be realized by year 2005.

(d) Service coverage after 2010

Service coverage in the intermittent year after 2010 is set to achieve the targets stated in Concessionaire Agreement. The service coverage between year 2010 and 2025 is projected by interpolating those in 2010 and 2025.

Based on the above conditions, proposed service coverage by city/municipality is set at as shown in Table B4.5. Table below summarizes the proposed service coverage by concessionaire.

	Proposed	Service	Coverag	;e	
			Year		

Service Area			Ye	ear		
Service Area	2000	2005	2010	2015	2020	2025
East Zone	72%	63%	61%	71%	82%	95%
West Zone	67%	77%	86%	90%	93%	98%
Total	69%	71%	75%	81%	88%	97%

Likewise, applying the projected population, the population to be served is calculated as shown in Table B4.6. A total population to be served will reach 19.109 million (9.156 million for MWCI and 9.953 million for MWSI) in 2025.

(3) Domestic Water Demand

Applying the per capita consumption and served population estimated above, domestic water demand by city/municipality is computed as shown in Table B4.7. Water demand for domestic use in year 2025 will arrive at 3,596 MLD (1,752 MLD in MWCI supply area and 1,845 MLD in MWSI supply area). Table below summarizes the projected water demand for service area of each Concessionaire.

Service Area	Year											
Service Area	2000	2005	2010	2015	2020	2025						
East Zone	423	455	556	835	1,206	1,752						
West Zone	496	758	1,009	1,281	1,536	1,845						
Total	919	1,213	1,565	2,116	2,742	3,596						

Projected Domestic Water Demand (MLD)

B4.3 Commercial Water Demand

In assuming commercial water demand, correlation between water consumption and GRDP is generally applied. Table below presents the trend for the last 15 years of water supplied for commercial use and GRDP. Billed water for commercial use has increased from 276 MLD to 418 MLD or to 1.51 times. Water for commercial use was mainly consumed at cities/municipalities under the jurisdiction of NCR and current share is estimated at 97.8 % in 2000. Thus, GRDP for NCR was adopted in examining correlation.

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Billed (MLD)	276	279	309	314	312	296	281	290	306	300	310	297	311	369	418
GRDP	1(0.4	100 (107.2	2147	221.0	221.0	215 5	216.1	227.2	242.2	256.0	272.0	272.0	200.7	2011
(Billion P)	169.4	180.6	197.3	214./	221.8	221.0	215.5	216.1	227.3	242.2	256.0	273.0	2/3.0	280.7	296.4

Past Trend of Commercial Water and GRDP

Although there are some fluctuations on water consumption during the period, a correlation coefficient between water consumption and GRDP was derived to be 0.723.



As a result, the following regression formula is obtained:

Commercial Water Demand (MLD) = 134.114 + 0.00076 x GRDP (Million Pesos)

Applying the GRDP projected in Part-A of this Supporting Report, the commercial water demand is computed as shown below. As a result, it is projected that the commercial water demand in year 2025 will reach 1,082MLD.

Projected Commercial Water Demand (MLD)

Year	2005	2010	2015	2020	2025
Water Demand	428	528	662	842	1,082

B4.4 Industrial Water Demand

In projecting the industrial water demand, correlation between water consumption and GRDP is generally applied as well as the projection of the commercial water demand mentioned above. Table below shows past water consumption for industrial use and GRDP. The industrial water supply has increased from 40 MLD to 94 MLD or to 2.35 times for the last 15 years. Water for industrial use was consumed at cities/municipalities under the jurisdiction of NCR with current share of 98.9 % in 2000.

Year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Billed (MLD)	40	45	57	69	69	69	67	67	71	69	73	67	72	79	94
GRDP (Million P)	169.4	180.6	197.3	214.7	221.8	221.0	215.5	216.1	227.3	242.2	256.0	273.0	273.0	280.7	296.4

Past Trend of Industrial Water and GRDP

Although there is a slight decrease in water consumption due to lack of water source in the period affected by El Nino phenomenon, a correlation coefficient between industrial water consumption and GRDP was derived at 0.867.



The following formula was obtained in the same manner as that in the commercial water demand projection described in the foregoing Section B4.3.

Industrial Water Demand (MLD) = 26.500+ 0.00019 x GRDP (Million Pesos)

In addition, water conservation by recycling/re-use is taken into consideration for the projection of industrial water use. The previous JICA Study (Master Plan Study on Water Resources Management in the Philippines, 1998) recommends recycled water to be used up to 20% of the total industrial water in year 2025. In this Study, the industrial water demand was projected considering the future recycling rates in accordance with the policy of the previous JICA M/P study. The recycling rate is set at 5% in year 2010 and 20% in year 2025. The recycling rates in both years are interpolated to project those in their intermediate years. Consequently, the industrial water demands are projected as shown below. Water demand for industrial use in year 2025 will arrive at 208MLD.

Projected Industrial Water Demand (MLD)

Year	2005	2010	2015	2020	2025
Water Demand	99	117	141	170	208

B4.5 Total Water Demand

(1) Billed Water

On a basis of the sectoral water demand projections, the total water demand in 2025 is estimated to reach 4,886 MLD on a billed water basis, which is about 3.41 times the present billed water. The share of domestic water to total water demand is projected to increase from 64% in 2000 to 74% in 2025 in accordance with population increase and increase of service coverage in the residential areas.

Year	Water Demand by Use (MLD)						
	Domestic	Commercial	Industrial	Total			
2000	919	418	94	1,433			
2005	1,213	428	99	1,740			
2010	1,565	528	117	2,210			
2015	2,116	662	141	2,919			
2020	2,742	842	170	3,754			
2025	3,596	1,082	208	4,886			

Projected Water Demand (Billed water base)

(2) Proposed Targets of NRW

As mentioned in Section B3.4, the reduction of NRW has been a big issue since early stage of water supply in Metro Manila. The projection of future NRW ratio will greatly affect the required development scale of water resource development in the future. The latest several studies (Metro Manila Water Supply and Sewerage Master Plan, Master Plan Study on Water Resources Management in the Philippines, Manila Water Supply III Project, etc.) show 20% to 30% of NRW ratios as the final targets. To achieve such targets, the rehabilitation programs aiming the NWR reduction need to be planned and implemented intensively.

Regarding the reduction of the NRW ratio, the actual practices experienced through Manila Water Supply Rehabilitation Project I (1984-1993) and II (1991-1994), both of which were financially assisted by ADB, reveal the importance of intensive rehabilitation projects. Tables below represent change of NRW before and after rehabilitation under MWSRP I and II, respectively. These tables indicate that the NRW ratio decreased from 72% before operation to 31% after operation and 60% to 24% under the MWSRP I and II, respectively.

Change of NKW under WWSKI 1							
Item	Before Operation	After Operation					
NRW	430 MLD	85 MLD					
Billed Water	170 MLD	190 MLD					
Total	600 MLD	275 MLD					
Increased RW		20 MLD					
Reduced Delivery		325 MLD					
NRW (%)	72%	31%					

Change of NRW under MWSRP I

Item	Before Operation	After Operation
NRW	109 MLD	27 MLD
Billed Water	74 MLD	84 MLD
Total	183 MLD	111 MLD
Increased Billed Water		10 MLD
Reduced Delivery		72 MLD
NRW (%)	60%	24%

Change of NRW under MWSRP II

Although the objective areas for the NRW reduction under the aforesaid project were limited to a total of 56 zones, the rehabilitation works implemented thereby contributed to the NRW reduction especially on water leakage. Based on assessment of estimated zonal demand for the 56 zones, composition of NRW was assumed as 71% of water leakage (physical loss), 16% of illegal use, 7% of unbilled water supply and 6% of meter error.

Taking into account of on-going and planned NRW reduction activities of the concessionaires, it is considered that reduction of commercial losses will be accelerated compared with that of physical losses. In this connection, 27.4 % of current commercial loss is assumed to decrease to about 10% composing some 5% of meter error and some 5% of illegal use at final stage. Accordingly, in this Study, composition of NRW in intermittent years is set up in order to reach to 70% of physical loss and 30% of commercial loss in the target year of 2025.

Considering the previous studies and current practices, accordingly, NRW ratio presented below is recommended as NRW reduction plan in this Study. Final target of NRW ratio is set at 30% (20% for physical loss and 10% for commercial loss).

Year	2000	2005	2010	2015	2020	2025
NRW Ratio	60.9%	54%	48%	42%	36%	30%
Physical Loss	33.5%	30%	28%	26%	23%	20%
Commercial loss	27.4%	24%	20%	16%	13%	10%

Proposed NRW Reduction Target

(3) Average and Maximum Daily Water Demand

In addition to the total water demand in terms of the average daily demand examined above, the peak day demand factor (ratio of maximum daily demand to average daily demand) is set to project the maximum daily demand. The factors of 1.21 to 1.25 are adopted in the previous studies. In this Study, 1.21 of peak factor, which is recommended in the latest study (Project Review of Manila Water Supply Project III, 1997), is employed.

As a result, the average daily and maximum daily demands in the target year 2025 are projected to be 6,980 MLD and 8,446 MLD, respectively, as shown below.

	Billed Water (MLD)				NRW		Average	Maximum
Vear							Daily	Daily
Tour	Domestic	Commercial	Industrial	Sub-total	(MLD)	(%)	Demand	Demand
							(MLD)	(MLD)
2000	919	418	94	1,433	2,230	60.9%	3,663	4,090
2005	1,213	428	99	1,740	2,043	54.0%	3,783	4,577
2010	1,565	528	117	2,210	2,040	48.0%	4,250	5,143
2015	2,116	662	141	2,919	2,114	42.0%	5,033	6,090
2020	2,742	842	170	3,754	2,112	36.0%	5,866	7,097
2025	3,596	1,082	208	4,886	2,094	30.0%	6,980	8,446

To check accuracy of the results of water demand projection mentioned above, the water demand projections using the time series analysis method (annual average growth, annual average growth rate and logistic curve) were also made as shown in figure below. The comparison of the results of both water demand projections shows that the results of water demand are judged to be within the acceptable level.



Comparison of Water Demand Projection with Time-Series Analysis

(4) Area Distribution of Water Demand

As for area distribution of the sectoral water demand between year 2005 and 2025, the following conditions were assumed:

- i) The domestic water demands by city/municipality are fixed referring to the projection discussed in Section B4.2
- ii) For the commercial and industrial water use until year 2010, the projected total water demand is distributed to each city/municipality based on the share presented in Table B3.11.
- After year 2010, the commercial and industrial water demands are firstly distributed to the municipalities (Angono, Baras, Binangonan, Cardona, Jala-Jala, Morong, Pililla, Tanay and Teresa) based on the current share (domestic: 90%, commercial: 8%, industrial: 2%) in other city/municipality (Antipolo, Cainta, Taytay, Rodriguez and San Mateo) of Rizal Province. Then, the balance is distributed in the same manner with (ii) above.

Tables B4.8 to B4.12 present the projected water demand by city/municipality in year 2005 to 2025, respectively.

B4.6 Comparison with Previous Water Demand Projections

The various water demand projections were made in the past studies. For evaluation, the water demand projected in this Study is compared with the future water demands projected in other studies such as JICA studies (1995 and 1998) and Manila Water Supply III Project (MWSS). Table below presents the comparison of the projection results in this Study with those of the previous water demand projections. As for the 1995 JICA study, water demands between year 2015 and 2025 are extrapolated using a regression formula, since the demand projection was made until year 2015. With regard to the 1998 JICA study, the demand projection is modified using population projected in this Study.

Year	JICA Study 1995 ¹⁾	JICA Study 1998 ²⁾	MWSS Projection ³⁾	This Study
2000	4,200	3,635	3,600	4,090
2005	4,861	4,297	4,000	4,577
2010	5,405	4,943	5,000	5,143
2015	5,932	5,955	6,000	6,090
2020	6,880	6,838	7,000	7,097
2025	8,124	8,509	8,200	8,446

Comparison of Water Demand Projection with Previous Studies

Note: 1) Water demand for year 2020 and 2025 is assumed by using regression formula.

2) Water demand was modified using population projected in this Study.

3) NRW ratio in MWSS Projection was set at 21%.

The maximum daily water demand of 8,466 MLD in 2015 which is projected in this Study is higher than those projected in the 1995 JICA study (8,124 MLD) and MWSS demand projection (8,200 MLD) by 322 MLD (4.2%) and 246 MLD (3.2%), respectively. On the other hand, water demand (8,509 MLD) projected in the 1998 JICA study is almost same as the water demand projected in this Study. It is considered that the difference between the MWSS water demand projection and this Study results mainly from NRW ratios adopted by both studies. In the MWSS projection, a NRW ratio of 21% was adopted. If a NRW ratio of 30% adopted in this Study is used, the water demand in the MWSS projection would come to 9,250 MLD. Thus, projected water demand in this Study falls within a range of previous projections.



B4.7 Water to be Exploited in the Agos River Basin to Meet Water Demand of MWSS's Service Area

(1) Interim Water Supply Projects and MWSS's Intention on Their Implementation

At the present Study stage, the following water sources for Metro Manila are taken up as the possible water sources to meet the future water demands in Metro Manila based on the latest information obtained from the MWSS and two Concessionaires during the First Field Investigation.

(a) Angat Dam

The existing water source of Angat River is 4,000 MLD. According to the MWCI, two (2) projects are now under study: (i) Rehabilitation plan of water conveyance aqueducts to augment delivery capacity by 350 MLD; (ii) Antipolo Water Supply Project utilizing the Angat water source with a total capacity of 120 MLD. Especially for augmentation of delivery capacity of Agnat water conveyance with a total capacity of 4,350 MLD, MWSS is seeking financial source.

(b) Wawa River

50 MLD Wawa Extraction Project is now under study by MWCI. The purpose of the project is to deliver 50 MLD of treated water to Rodriguez and San Mateo by year 2005. With regard to realization of the project, the MWCI is seeking financial source.

(c) Laguna Lake

MWSS prepared 300 MLD Bulk Water Supply Project which aims at utilizing lake water for water supply to Las Pinas, Muntenlupa, Paranaque, Cavite City, Bacoor, Imus, Kawit, Noveleta and Rosario. MWSS intends to implement the project on BOT basis by year 2005. Design and bidding documents were already completed by local consultant. However, with regard to utilization of lake water, the project has issues and problems. Influence on the lake fishery and compensation for the fishermen are still issue to be solved. The proposed water treatment method employing conventional type is still questionable considering the contaminated and saline water. Installation of proposed distribution main on the bottom of the lake may not be feasible.

(d) Deep Well

It is estimated that a total of 90 MLD of deep well sources is presently available at MWCI and MWSI. As for utilization of groundwater, Metro Manila has been facing serious problem of contamination and saline water intrusion as well as ground sinking due to over pumping. Table B4.13 shows 256 MLD of the potential deep well capacity outlaying Metro Manila. While, water right for deep wells granted by NWRB for concerned areas in Cavite and Rizal province counts 117 MLD at present. However, it is

considered that potential groundwater sources have been fully developed, since most of them have been utilized without permission. In line with this, further development of deep well sources is considered not feasible.

Although implementation of the above interim water supply projects is not yet confirmed, the total supply capacity of the possible water sources is estimated at 4,790 MLD including 350 MLD of Angat water conveyance augmentation, 50 MLD Wawa Extraction Project and 300 MLD Bulk Water supply Project.

(2) Water to be Exploited in the Agos River Basin to Meet Water Demand of MWSS's Area

Assuming that the above possible water sources are to be exploited till the new long-term water resource development project proposed in this Study be realized, water balance in the Study area was examined on the basis of maximum daily demand. Table below summarizes the water balance and development scale of the water source in the Agos River basin to meet the water demands until the target year 2025. All exploitable water of water resources is assumed to cover the peak day demand. A balance of daily peak demand and water resources in 2025 will be 3,656MLD, which will be equal to the daily average demand of about 3,000MLD, if a day peak factor of 1.21 is assumed.

On the basis of the results of water demand projection and water sources likely to be exploited in the near future as the interim schemes, water to be exploited in the Agos River Basin is estimated to be about 3,000 MLD to meet the water demand of Metro Manila area in year 2025.

		Exploitabl						
Year	Year Water Der	Demand	Angat	Laguna	Wawa	Deep	Total	Balance
			River	Lake	River	Wells	Total	
2000	Peak	4,090	4,000			90	4,090	0
2000	Avg.	3,663						
2005	Peak	4,577	4,350	300	50	90	4,790	213
2005	Avg.	3,783						
2010	Peak	5,143	4,350	300	50	90	4,790	Δ 353
2010	Avg.	4,250						
2015	Peak	6,090	4,350	300	50	90	4,790	Δ 1,300
2015	Avg.	5,033						
2020	Peak	7,097	4,350	300	50	90	4,790	Δ 2,307
2020	Avg.	5,866						
2025	Peak	8,446	4,350	300	50	90	4,790	Δ 3,656
2025	Avg.	6,980						Δ 3,021

Water Sources and Daily Peak Demand

B4.8 Recommended Measures to Lower Non-Revenue Water Ratio

To achieve the targeted NRW ratio proposed in this Study, the principles of NRW reduction over the long term will have to incorporate:

- Repair of all visible leaks within one month of reporting
- Periodical field survey of water leakage

- Regular patrolling/monitoring rehabilitated zones or sub-zones at least quarterly
- Monitoring all large meter bills
- Carrying out comprehensive rehabilitation works
- Improvement of meter reading and water tariff collection system
- Community involvement
- (1) Required Field Survey Works to Clarify Water Leakage

Daily flow, night flow and billed water monitoring will have to be carried out in order to establish priorities for rehabilitation works. Ideally it should be at zonal level, 5,000 - 10,000 connections, and it should be carried out at least quarterly. There are difficulties in defining and bounding suitable sized zones due to the mixture of pumped and gravity system, a significant residual of service connections directly on primary and secondary mains, and the nature of the ring main supply, whereby small block sized areas draw the water directly from the primary main at frequent intervals. These blocks need to be incorporated into a large area, isolatable from the primary main.

Updating of inventory and drawings of the concerned facilities is indispensable for the survey.

(2) Recommended Rehabilitation Works on Water Leakage

As described in Subsection B3.4, the actual practices experienced through Manila Water Supply Rehabilitation Project I and II, both of which were financially assisted by ADB. MWSS has spent a total of 3 Billion Pesos on two rehabilitation projects to about 80% of the geographical service area of MWSS over the past years. As a result of the projects, NRW ratio reduction was achieved at approximately 10% between 1985 and 1992.

Presently, MWCI has a NRW reduction plan to invest 1.4 Billion Pesos until end of the Concession Period. However, it is considered that additional financial arrangement (2-3 times) be required to attain a significant result of rehabilitation project. MWSI will also proceed with NRW reduction program with necessary financial arrangements.

The Study recommends the following components of rehabilitation works to be carried out:

- (a) Rehabilitation of Distribution Facilities
 - Rehabilitation of distribution facilities includes: i) leak repairs; ii) closing/legalizing of illegal connections; iii) testing/repair/replacement of meters: iv) repair/replacement/installation of valves; v) replacement of service connections and "spaghetti" connections; vi) replacement/rehabilitation/interconnection of water mains; vii) laying of new water mains; viii) closing of inactive connections; ix) installation of flow pressure monitoring stations; and x) procurement of equipment, instruments, vehicles, tools, and other supplies for the investigation, design and carrying out of rehabilitation works.

- (b) Operational and Institutional Support To ensure rehabilitation works, operational modernization to support and modernize the operation and maintenance activities by providing equipment, instrument, vehicles, tools and other supplies is necessary. Likewise, institutional support to train staff need to be extended.
- (c) Community Involvement For comprehensive rehabilitation works, participation/cooperation of beneficiaries/community need to be considered.
- (3) Diffusion of Water Tariff Collection System on a Community Basis

As discussed in Section B3.4, MWCI has been practicing/operating NRW reduction program on a community basis, which is called "Tubig Para sa Barangay". It is recommended to diffuse the water tariff collection system for the Barangay areas where appropriate to adopt it so as to reduce the NRW ratio.

Tables

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Province	Municipality	Waterworks/WDs	Water	No. of Barangay
TTOVINCE	winnerpairty	Water Works/ WDS	Source	Served
	Angono	Barangay Council	DW	6
	Aligono	Subdivision	DW	5
	Antipolo	MWSS	DW	8
	Antipolo	Subdivision	DW	1
	Paras	Baras WS	DW	6
	Dalas	Subdivision	DW	1
		Barangay Darangan Coop.	DW	1
		Barangay Palangoy Coop.	DW	1
	Binangonan	Barangay Pantok Coop.	DW	1
		Mun. Gov't	DW	7
		Subdivision	DW	5
	Cainta	Subdivision	DW	14
	Cainta	MWCI	Surf/DW	-
		Barangay Boor Assn.	DW	1
		Barangay Calahan Assn.	DW	1
Rizal	Carlana	Barangay Dalig Assn.	DW	1
	Cardona	Barangay Look Assn.	DW	1
		Barangay San Roque Assn.	DW	1
		Mun. Gov't	DW	4
	Jala-Jala	Jala-Jala WD	DW	-
	Morong	Morong WD	DW	4
	Pililla	Pililla WD	DW	5
	Dadamianar	MWCI	Surf/WD	7
	Rodoliguez	Subdivision	DW	7
	San Mataa	MWCI	DW	9
	San Mateo	Subdivision	DW	2
	Танат	Tanay Eastern Rezal WD*	DW	10
	Tallay	Subdivision	DW	1
	Terrterr	Subdivision	DW	7
	Taylay	MWCI	Surf/DW	-
	Teresa	Teresa WD	DW	-

Table B3.1 Other Waterworks in MWSS's Service Area

Source: Provincial Water Supply, Sewerage and sanitation Sector Plan (PW4SP), JICA

City/Municipality		Pop. Census 2000	No. of Service Connection	Pop. Served*	Service Coverage	Pop. Served Adjusted**	Service Coverage
						5	Adjusted
(West Zone)	Deres	255,000	21.020	204.000	020/	204.000	020/
NCK	Pasay	355,000	31,920	294,000	83%	294,000	83%
	Caloocan	1,1/8,000	66,664	613,000	52%	613,000	52%
	Las Pinas	473,000	7,934	73,000	15%	73,000	15%
	Malabon	339,000	31,175	287,000	85%	287,000	85%
	Valenzuela	485,000	34,996	322,000	66%	322,000	66%
	Muntinlupa	379,000	1,710	16,000	4%	16,000	4%
	Navotas	230,000	17,896	165,000	72%	165,000	72%
	Paranaque	450,000	25,415	234,000	52%	234,000	52%
Cavite	Cavite City	99,000	8,785	81,000	82%	81,000	82%
	Bacoor	306,000	5,462	50,000	16%	50,000	16%
	Imus	195,000	1,182	11,000	6%	11,000	6%
	Kawit	63,000	5,091	47,000	75%	47,000	75%
	Noveleta	32,000	1,024	9,000	28%	9,000	28%
	Rosario	74,000	1,974	18,000	24%	18,000	24%
(East Zona)							
(Last Zolle)	Mandaluwong	278 000	42 012	287 000	1200/	278 000	100%
INCK	Mariliano	278,000	42,012	387,000 402,000	13970	278,000	100%
	Dagig	591,000	59,449	492,000	12070	591,000	100%
	Pasig	505,000	58,409	538,000	10/%	505,000	100%
	Pateros	57,000	6,193	57,000	100%	57,000	100%
	San Juan	118,000	17,404	160,000	136%	118,000	100%
DIZAI	Taguig	467,000	10,666	98,000	21%	98,000	21%
RIZAL	Antipolo	4/1,000	7,727	71,000	15%	71,000	15%
	Cainta	243,000	7,978	73,000	30%	73,000	30%
	Angono						
	Baras						
	Binangonan						
	Cardona						
	Jala-Jala						
	Morong						
	Pililla						
	Rodoriguez	115,000	2,723	25,000	22%	25,000	22%
	San Mateo	136,000	3,595	33,000	24%	33,000	24%
	Tanay						
	Taytay	198,000	4,509	41,000	21%	41,000	21%
	Teresa						
(Common Co	oncession Area)						
NCR	Quezon City	2,174,000	261,453	2,406,000	111%	2,174,000	100%
	East	994,000	121,489	1,118,000	112%	994,000	100%
	West	1,180,000	139,964	1,288,000	109%	1,180,000	100%
	Manila	1,591.000	204,949	1,885.000	118%	1,591.000	100%
	East	196.000	24,569	226,000	115%	196.000	100%
	West	1,395.000	180.380	1,659,000	119%	1,395.000	100%
	Makati	445,000	57.801	531.000	119%	445,000	100%
	East	393.000	48.091	442,000	112%	393.000	100%
	West	52,000	9,710	89,000	171%	52,000	100%
	Total	11,847,000	980,156	9,017,000	76%	8,120,000	69%
	East	4,562,000	408,874	3,761,000	82%	3,273,000	72%
	West	7,285,000	571,282	5,256,000	72%	4,847,000	67%

 Table B3.2 Present Service Coverage by City/Municipality (CY 2000)

* Service connection x 9.2 persons/connection ** Adjusted pop. served due to overshooting in initial calculation

Table B3.3	Inventory	of Deep	Well	(MWCI)
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	~		Citv/Munic	Yield (r	n³/min)	Depth
	Station	Location	inality	Rated	Actual	(m)
1	ML. Ouezon	ML Quezon St	Antipolo	0.38	0.36	84
2	Sto. Nino	Sto Nino St	Antipolo	0.76	0.77	163
3	P. Burgos	P Rurgos St	Antipolo	0.95	0.49	152
4	Nursery, San Mateo	<u>Processon</u> Circumferential Rd	Antipolo	0.76	0.26	100
5	Circumferencial	Circumferencial Rd	Antipolo	0.57	0.28	152
6	Sumulong	Sumulang Flementary Sch	Antipolo	1.14	1.70	183
7	San isidro. Tavtay	San Isidro Elementary Sch	Antipolo	1.32	1.21	180
8	Ang Tahanan	Ang Tahanan Compound	Antinolo	1.14	1.02	213
9	Saguinsin	Saminein St	Antipolo	1.14	1.17	125
10	Buliran	Ruliran	Antipolo	0.95	0.53	244
11	Parugan	Sitio Parugan San Jose	Antinolo	0.76	0.68	132
12	Tubigan	Sitio Tubigan San Roque	Antipolo	0.95	0.81	151
13	Masangkay	Masangkav St	Antipolo		2.00	I
14	Cogeo #4	Rd 31-A Cogeo Village. Bagong Nayon	Antinolo	0.95	0.61	111
15	Cogeo #5	Rd 2 Cogeo Village, Bagong Nayon	Antinolo	0.57	0.00	152
16	S. Fabian	San Fabian ST San Juan	Cainta	1.14	0.76	183
17	Mapandan	Manandan St. Boy San Juan	Cainta	0.76	0.61	160
18	Sumulong, Taytay	Sumulong St	Tavtav	0.38	0.15	203
19	San Isidro, Taytay	Cainta-Tavtav Boundary	Tavtav	0.95	0.77	177
20	Sta. Ana Elem.	Sta Ana Elementary Sch., BA Cruz St.	Tavtav	1.14	0.88	152
21	Tavtay Elem.	Tavtav Elementary Sch. Compound,	Tavtav	0.38	0.19	131
22	San Victores	San Victores Elem Sch. Compound	Tavtav	0.76	0.30	152
23	Rosario	Rosario St. Boy San Juan	Tavtav	1.14	0.70	171
24	Bangad	Velasmez St	Tavtav	1.32	1.15	183
25	San Mateo public Market	MH Del Pilar public Market	San Mateo	1.14	1.06	137
26	Malv	Ro Malv	San Mateo	0.95	0.84	240
27	San Jose, Montalban	San Jose Public Market	Rodriguez	0.95	1.05	189
28	Sta. Maria	Sta Maria Subd. Ampid	San Mateo	0.38	0.55	226
29	San Jose II	Molave St San Jose	Rodriguez	1.40	0.95	169
30	Nursery, San Mateo	Nurserv Compound	San Mateo	0.00	1.78	
31	Manggahan	Manggahan St.	Rodriguez	1.32	0.78	213
32	Aranzazu	Anav St., Ananzazu Subd.	Rodriguez		·	
33	Signal Village #1	Signal Village	Taguig	0.38	0.23	177
34	Signal Village #3	Signal Village	Taguig			290
35	Loyola Grand Villas QC	Soliven I. Lovola Grand Villas	Marikina	0.38	ı	
36	Escopa Proj. 4, QC	P. Burgos St., Escopa Proj.4	Ouezon	0.76		256
37	Forbes Park #2	Tamarind St., Forbes park	Makati	0.95	0.65	259
38	Forbes Park #6	Tamarind St., Forbes park	Makati	0.95		305
39	Forbes Park #9	Narra St., Forbes Park	Makati	1.14	·	274
40	Forbes Park #12	Tamarind St., Forbes park	Makati	0.95	·	305
41	St. Ignacius	St. Ignacius Village, Bgy. St. Ignacius	Ouezon	0.17		266
42	Ayala Homes	Avala Homs Subd.	Mandaluyo	0.71		269
43	Blue Ridge	Blue Ridge Subd.	Ouezon	0.76	1.02	89
44	Banba-Ampid		San Mateo	1.14	0.61	180
45	White Plains 1		Ouezon	0.76	0.47	241
46	White Plains 2		Ouezon			
47	Ecology Village		Makati	0.57	0.35	241
48	Forbes Park #8		Makati	0.95	0.72	207
49	Forbes Park #10		Makati	1.14	0.78	305
50	Forbes Park #11		Makati	0.95	0.95	305
51	Dasmarinas #3		Makati	1.14	0.86	299
52	Dasmarinas #14		Makati	1.14	0.72	305
53	Dasmarinas #17		Makati	0.95	0.86	274
54	Dasmarinas #39		Makati	0.95	0.61	305
55	Dasmarinas #40		Makati	1.14	0.86	305
56	Oranbo		Pasig	0.90	1.32	284
57	Pag-Asa		Ouezon	0.38	0.41	290
58	Tandang Sora		Quezon	0.72	0.78	294
59	Project 4		Ω_{uezon}	0.83	0.95	251

	Station	City/Municipality	Yield (m^3/min)		Station	City/Municipality	Yield (m ³ /min)
	Station		Rated				Rated
1	Britanny	Quezon City	0.60	46	J. Felipe	Cavite City	0.62
2	Faiview #5	Quezon City	0.82	47	Magcawas	Cavite City	0.44
3	Filinvest 1	Quezon City	0.60	48	Manalac	Cavite City	0.34
4	Filinvest II 3	Quezon City	0.16	49	Militar	Cavite City	0.35
5	Filinvest II 4	Quezon City	0.42	50	Rivero	Cavite City	0.49
6	Filinvest II 5	Quezon City	1.09	51	Samonie Park	Cavite City	0.15
7	Filinvest II 6	Quezon City	1.62	52	San Nicolas	Cavite City	0.42
8	Filinvest II 8	Quezon City	1.59	53	Pandawan	Rosario	0.84
9	Goodwill Homes	Quezon City	0.54	54	Poblacion Rosario	Rosario	0.85
10	Greenfields 1	Quezon City	0.18	55	Aguinaldo	Kawit	0.66
11	Greenfields III	Quezon City	0.82	56	Balsahan	Kawit	0.63
12	Greenview 2	Quezon City	0.60	57	Josephine	Kawit	0.77
13	Greenview 3	Quezon City	0.61	58	Magdalo	Kawit	0.59
14	IBP #1	Quezon City	0.21	59	Malamok	Kawit	0.55
15	Lagro #1	Quezon City	0.49	60	Tirona	Kawit	0.56
16	Lagro #4	Quezon City	0.52	61	Georosville 1	Imus	0.64
17	Lagro #5	Quezon City	0.11	62	Imus Sector Cpd.	Imus	0.49
18	Nelsonville	Quezon City	0.14	63	Plaza Garcia	Imus	0.42
19	Pamahay Homes	Quezon City	0.13	64	Yengco	Imus	0.45
20	Philips North Point	Quezon City	0.20	65	Naga #2	Las Pinas	0.33
21	Remarville	Quezon City	0.79	66	Better Living, Standby	Paranaque	0.00
22	Rolling Meadows	Quezon City	0.60	67	Champaca	Paranaque	0.06
23	Rolling Meadows I	Quezon City	0.58	68	Coral	Paranaque	0.05
24	San Pedro	Quezon City	0.18	69	Don Aquedo Bemabe	Paranaque	0.04
25	Smile Citihomes	Quezon City	0.64	70	Esmeralda	Paranaque	0.12
26	Villa Gracia	Quezon City	0.14	71	Maharika	Paranaque	
27	Dona Juana	Malabon	0.35	72	Phase 10 #4	Paranaque	0.67
28	Ciudad Grande	Valenzuela	0.11	73	Maricaban #1	Pasay	0.67
29	Pacheco, standby well	Valenzuela	0.00	74	Maricaban #2	Pasay	0.63
30	Tanada	Valenzuela	0.6/	75	NAIA #3	Pasay	0.35
31	Castle Spring	Caloocan	0.44	76	NAIA #4	Pasay	0.71
32	Cristina Homes	Caloocan	0.42	70	Alabang Junction	Muntinlupa	0.19
33	Del Rey Village 3	Caloocan	0.42	70	Buendia	Muntinlupa	1.19
34	Good Harvest	Caloocan	0.13	/9	JPA Maatialaa Dliaa	Muntinlupa	0.75
33	HIII Crest 1	Caloocan	0.50	80	Muntiniupa Bliss	Muntinlupa	0.53
30	Hill Crest 2	Caloocan	0.50	81	Nutual 1	Muntinlupa	0.35
3/	Kingston 1	Caloocan	0.21	82	Sucat #1	Muntinlupa	0.34
38	Kingston 2	Caloocan	0.18	83	Tunasan	Muntiniupa	0.51
39	Naividad I	Caloocan	0.04	05	Noveleta WF#1	INOVEIEta Noveleta	0.//
40	Naividada IV	Caloocan	0.08	83 96	Noveleta WF#2	Noveleta	0.84
41	Individual IV	Caloocan	0.30	00	Noveleta WF#5	Noveleta	0.83
42	Antonio	Caloocali Covito City	0.08	0/	Noveleta WF#5	Noveleta	0.44
43	Pagong Pool	Cavite City	0.79	00	Noveleta WE#9	Noveleta	0.93
44	Gracia Exin	Cavite City	0.23	09	INUVCICIA WF#0	INOVEICIA	1.02
43		Cavine City	0.07				

т		Se	rvice Reserv	oir	Pump	Station	G : A
Lo	ocation	Cap. (m3)	HWL (m)	LWL (m)	Pump Nos.	Motor HP	Service Area
	Balara	19,000	51.6	43.8	7	500 250	Quezon
	Pasig	80,000	48	40.3	5	375	Pasig, San Juan Mandaluyong
MWCI	Makati	19,000	32.7	23.7	6	300	Makati
WI W CI	Fort Bonifacio	30,000	47.5	39.7	4	350	Part of Makati, Part of Taguig
	San Juan	56,000	51.4	43.5	6	500	San Juan, Mandaluyong,
		94,000	51.4	44.7	1	250	Pasig, Pateros, Taguig
	Cubao PS	-	-	-	4	200	Cubao
	Bagbag	100,000 100,000	71	65	-	-	Manila
- - - - -	Algeciras	38,000	26.8	12.8	5 3	225 200	UST, Espana
	Caloocan	19,000	34.4	25.4	3 2	225 200	Caloocan
	D. Tuazon	19,000	29.2	20.2	1 3	225 200	Roosvelt
	Tondo	19,000	21.8	12.8	3 2	225 200	Tond
MWSI	Espiritu	19,000	21.7	12.7	1 3	225 200	Pasay
	Ermita	19,000	21.6	12.6	3 2	225 200	Ermita
	Pasay	19,000	22.3	13.3	2 2	225 200	Pasay, Paranaque
I	La Mesa	50,000	7.6 m from bottom	1.98 m from bottom	8 operational,	248 - 563	Novaliches, Commomwealth, Valenzuela
	Binuksuk	30,000	6 m from bottom	n.a.	-	-	Novaliches, Valenzuela
	Sacred Heart	10,000	6 m from bottom	n.a.	-	-	Sacred Heart

 Table B3.5 Major Service Reservoir and Pump Station

n.a.: not available

							(Source: Serv	ice Peformano	ce Report)	
		W	ater Production	n (MLD)	Billeo	d Water (MLD		1	Unbilled Wate	21
		Balara Treatment Plant	Deep wells	Treated Water Sent to Distribution	Domestic, Commercial & Industrial	Interconnecti on Transfer	Total	NRW (MLD)	%	excl. inter- transfer
CY 1998	Jan	1,090	40	1,130	469	260	729	401	35.5%	53.9%
	Feb	1,136	46	1,182	477	312	789	393	33.2%	54.8%
	Mar	1,061	45	1,106	472	236	708	398	36.0%	54.3%
	Apr	1,049	45	1,094	484	222	706	388	35.5%	55.5%
	May	1,078	45	1,123	475	219	694	429	38.2%	52.5%
	Jun	1,171	41	1,212	504	244	748	464	38.3%	52.1%
	Jul	1,123	43	1,166	510	216	726	440	37.7%	53.7%
	Aug	1,289	41	1,330	555	231	786	544	40.9%	50.5%
	Sep	1,327	41	1,368	547	269	816	552	40.4%	49.8%
	Oct	1,303	38	1,341	538	238	776	565	42.1%	48.8%
	Nov	1,459	39	1,498	576	267	843	655	43.7%	46.8%
	Dec	1,542	39	1,581	593	285	878	703	44.5%	45.8%
		14,628	503	15,131	6,200	2,999	9,199	5,932	39.2%	51.1%
		1,219	42	1,261	517	250	767	494		

Table B3.6 Water Production and Distribution (MWCI)

							(Source: Serv	ice Peformand	e Report)	
		Wa	ater Production	n (MLD)	Billeo	d Water (MLD)	1	Unbilled Wate	I
		Balara Treatment Plant	Deep wells	Treated Water Sent to Distribution	Domestic, Commercial & Industrial	Interconnecti on Transfer	Total	NRW (MLD)	%	excl. inter- transfer
CY 1999	Jan	1,612	35	1,647	621	341	962	685	41.6%	47.5%
	Feb	1,598	34	1,632	605	350	955	677	41.5%	47.2%
	Mar	1,577	35	1,612	602	353	955	657	40.8%	47.8%
	Apr	1,571	33	1,604	608	326	934	670	41.8%	47.6%
	May	1,620	33 1,604 32 1,652		628	330	958	694	42.0%	47.5%
	Jun	1,621	35	1,656	637	332	969	687	41.5%	48.1%
	Jul	1,670	35	1,705	653	388	1,041	664	38.9%	49.6%
	Aug	1,682	36	1,718	658	396	1,054	664	38.6%	49.8%
	Sep	1,667	35	1,702	658	394	1,052	650	38.2%	50.3%
	Oct	1,665	35	1,700	672	403	1,075	625	36.8%	51.8%
	Nov	1,658	37	1,695	666	407	1,073	622	36.7%	51.7%
	Dec	1,660	37	1,697	640	395	1,035	662	39.0%	49.2%
		19,601	419	20,020	7,648	4,415	12,063	7,957	39.7%	49.0%
		19,601 419 20,02 1,633 35 1,66			637	368	1,005	663		

							(Source: Serv	ice Peformanc	e Report)	
		W	ater Production	n (MLD)	Bille	d Water (MLD)	ז	Unbilled Wate	r
	Month	Balara Treatment Plant	Deep wells	Treated Water Sent to Distribution	Domestic, Commercial & Industrial	Interconnecti on Transfer	Total	NRW (MLD)	%	excl. inter- transfer
CY 2000	Jan	1,653	40	1,693	673	363	1,036	657	38.8%	50.6%
	Feb	1,609	41	1,650	666	340	1,006	644	39.0%	50.8%
	Mar	1,636	44	1,680	667	316	983	697	41.5%	48.9%
	Apr	1,646	39	1,685	668	306	974	711	42.2%	48.4%
	May	1,660	40	1,700	674	273	947	753	44.3%	47.2%
	Jun	1,662	38	1,700	684	272	956	744	43.8%	47.9%
	Jul	1,699	35	1,734	681	284	965	769	44.3%	47.0%
	Aug	1,706	34	1,740	676	304	980	760	43.7%	47.1%
	Sep	1,690	34	1,724	700	280	980	744	43.2%	48.5%
	Oct	1,675	32	1,707	703	255	958	749	43.9%	48.4%
	Nov	1,635	31	1,666	692	232	924	742	44.5%	48.3%
	Dec	1,601	34	1,635	706	187	893	742	45.4%	48.8%
	Total	19,872	442	20,314	8,190	3,412	11,602	8,712		
	Ave.	1,656	37	1,693	683	284	967	726	42.9%	48.5%

(Source: Customer services, Regulatory Off)
		Distrib	outed Water	(MLD)				Bill	ed Water (M	ILD)		. 0	Unbilled	Water*
CY 1998	Surface Water Total	Deep Wells	Surface + Ground Water Total	Net Cross Boundary Transfer	Grand Total	Residential	Semi- Business	Commerci al	Industrial	Sea Transport	Water District	Total	NRW (MLD)	%
Jan	1,123	31	1,154	239	1,392	347	19	171	42	14		593	799	57.4%
Feb	1,123	31	1,154	239	1,392	347	19	171	42	14		593	799	57.4%
Mar	1,123	31	1,154	239	1,392	347	19	171	42	14		593	799	57.4%
Apr	1,126	30	1,156	229	1,385	325	23	157	39	15		559	826	59.6%
May	1,126	30	1,156	229	1,385	325	23	157	39	15		559	826	59.6%
Jun	1,126	30	1,156	229	1,385	325	23	157	39	15		559	826	59.6%
Jul	1,272	32	1,304	240	1,544	343	25	169	42	18		597	947	61.4%
Aug	1,272	32	1,304	240	1,544	343	25	169	42	18		597	947	61.4%
Sep	1,272	32	1,304	240	1,544	343	25	169	42	18		597	947	61.4%
Oct	1,439	33	1,473	254	1,726	359	27	178	43	20		627	1,099	63.7%
Nov	1,439	33	1,473	254	1,726	359	27	178	43	20		627	1,099	63.7%
Dec	1,439	33	1,473	254	1,726	359	27	178	43	20		627	1,099	63.7%
Total	14,880	380	15,260	2,883	18,142	4,122	283	2,023	498	204		7,130	11,012	60.7%
Ave.	1,240	32	1,272	240	1,512	344	24	169	42	17		594	918	60.7%

Table B3.7 Water Production and Distribution (MWSI)

*excl. Special

**Special water for Water District is included in Sea Transport

⁽Source: Customer services, Regulatory Office)

		Distrib	outed Water	(MLD)				Bille	ed Water (N	ILD)			Unbille	d Water*
CY 1999	Surface Water Total	Deep Wells	Surface + Ground Water Total	Net Cross Boundary Transfer	Grand Total	Residential	Semi- Business	Commerci al	Industrial	Sea Transport	Water District**	Total	NRW (MLD)	%
Jan	1,755	35	1,790	350	2,139	481	16	197	41	20		756	1,384	64.7%
Feb	1,755	35	1,790	350	2,139	481	16	197	41	20		756	1,384	64.7%
Mar	1,755	35	1,790	350	2,139	481	16	197	41	20		756	1,384	64.7%
Apr	1,772	34	1,806	320	2,126	455	16	180	39	18		708	1,418	66.7%
May	1,772	34	1,806	320	2,126	455	16	180	39	18		708	1,418	66.7%
Jun	1,772	34	1,806	320	2,126	455	16	180	39	18		708	1,418	66.7%
Jul	1,806	36	1,843	393	2,235	462	17	198	41	19		738	1,498	67.0%
Aug	1,806	36	1,843	393	2,235	462	17	198	41	19		738	1,498	67.0%
Sep	1,806	36	1,843	393	2,235	462	17	198	41	19		738	1,498	67.0%
Oct	1,824	38	1,862	402	2,263	449	19	199	43	20		730	1,534	67.8%
Nov	1,824	38	1,862	402	2,263	449	19	199	43	20		730	1,534	67.8%
Dec	1,824	38	1,862	402	2,263	449	19	199	43	20		730	1,534	67.8%
Total	21,471	430	21,901	4,392	26,292	5,544	204	2,322	491	230		8,792	17,500	
Ave.	1,789	36	1,825	366	2,191	462	17	194	41	19		733	1,458	66.6%

*excl. Special

**Special water for Water District is included in Sea Transport

(Source: Bilsum '00, Wprod Report, NRW Counceil and Service Performance Information 4th qtr. 2000, MWSI)

	1	Distrib	outed Water	(MLD)				Bille	ed Water (N	1LD)		I	Unbiller	d Water*
CY 2000	La Mesa WTPs	Deep Wells	Production Total	Net Cross Boundary Transfer	Total	Residential	Semi- Business	Commerci al	Industrial	Special (Sea Transport)	Special (Water District)	Total	NRW	%
Jan	1,741	37	1,778	367	2,145	477	35	216	53	3	10	794	1,351	63.0%
Feb	1,676	38	1,715	340	2,055	438	33	199	50	3	10	733	1,321	64.3%
Mar	1,648	43	1,691	316	2,007	430	32	187	47	3	10	710	1,297	64.6%
Apr	1,734	42	1,775	306	2,081	440	33	194	50	3	10	729	1,352	65.0%
May	1,880	42	1,922	282	2,204	471	35	201	53	3	10	773	1,431	64.9%
Jun	1,725	42	1,767	272	2,039	448	34	190	53	3	10	738	1,301	63.8%
Jul	1,910	38	1,949	284	2,233	443	34	192	51	3	10	733	1,500	67.2%
Aug	2,033	39	2,073	304	2,377	461	35	197	52	3	10	759	1,617	68.0%
Sep	2,181	40	2,220	288	2,508	496	38	212	59	3	10	818	1,690	67.4%
Oct	2,249	37	2,286	255	2,541	482	38	204	56	3	10	792	1,749	68.8%
Nov	2,205	37	2,242	233	2,476	490	39	208	57	5	10	808	1,667	67.4%
Dec	2,207	39	2,246	187	2,433	459	37	200	56	3	11	767	1,666	68.5%
Total	23,191	474	23,665	3,433	27,098	5,535	421	2,400	638	38	121	9,154	17,944	
Ave.	1,933	39	1,972	286	2,258	461	35	200	53	3	10	763	1,495	66.2%

*excl. Special Water

						Billed Water	r					Share	among Wat	er Use
		a) Domestic		b) Commercia	al		c) Industrial				Share	alliong was	
Business Area		Ave	Billed		Ave	Billed		Ave	Billed	Billed Tot	al (a+b+c)		Commercia	
	No. of W.S.	Consum.	Volume	No. of W.S.	Consum.	Volume	No. of W.S.	Consum.	Volume	Diffea 100	ui (u · c · c)	Domestic	1	Industrial
		(m3)	(MLD)		(m3)	(MLD)		(m3)	(MLD)				1	
Maj Accts	96	914	3	2,354	1,344	102	405	1,287	17	122	20.5%	2.3%	83.9%	13.8%
San Juan	17,383	68	38	1,666	126	7	341	142	2	46	7.8%	82.1%	14.6%	3.4%
Pasig	25,483	61	50	1,766	116	7	733	119	3	60	10.1%	84.2%	11.1%	4.7%
Cubao	19,781	69	44	1,964	118	7	576	137	3	54	9.1%	81.5%	13.8%	4.7%
Makati	27,446	57	50	2,954	118	11	481	136	2	64	10.8%	79.1%	17.6%	3.3%
Timog	22,277	70	50	2,749	128	11	564	194	4	65	11.0%	77.2%	17.4%	5.4%
Balara	24,875	67	54	1,816	122	7	569	125	2	63	10.7%	85.1%	11.3%	3.6%
Marikina	31,417	62	63	2,244	86	6	960	79	2	72	12.1%	87.9%	8.7%	3.4%
Taguig	19,020	70	43	883	114	3	157	149	1	47	7.9%	91.5%	6.9%	1.6%
Total	187,778	1,438	395	18,396	2,272	162	4,786	2,368	35	592	100%	66.7%	27.4%	5.9%

Table B3.8 Analysis of Billed Water (MWCI, 1999 Jan.)

Source: Analysis of Bill production, 1999 Jan, MWCI

Table B3.9 Estimated Area Distribution of Billed Water (MWCI, CY 2000)

City/Maniain		Domestic			Comr	nercial + Ind	ustrial		Distribu	ition by	1	Distribution b	w Water Lleo	
City/Municip	bas	ed on 1999 d	lata	bas	ed on 1999 o	lata	Adjı	isted	Munic	ipality	I	Distribution	y water Use	
ality	(MLD)	adjustment	Adjusted	(MLD)	Commercial	adustment	Commercial	Industrial	(MLD)	%	Domestic	Commercial	Industrial	Total
Manila (Part)	23.8	-1.7	22.1	21.2	18.9	0.5	19.4	1.8	43.3	6.3%	51.0%	44.9%	4.1%	100%
Quezon City	134.7	-9.6	125.1	74.1	56.9	1.6	58.4	15.7	199.2	29.2%	62.8%	29.3%	7.9%	100%
Makati	53.9	-3.8	50.1	60.3	50.6	1.4	52.0	8.3	110.4	16.2%	45.4%	47.1%	7.5%	100%
Mandaluyong	46.9	-3.3	43.5	41.8	37.3	1.0	38.3	3.5	85.4	12.5%	51.0%	44.9%	4.1%	100%
Marikina	61.2	-4.4	56.8	14.7	10.9	0.3	11.2	3.5	71.5	10.5%	79.4%	15.6%	4.9%	100%
Pasig	69.5	-4.9	64.6	21.0	15.2	0.4	15.6	5.4	85.6	12.5%	75.5%	18.2%	6.3%	100%
Pateros	6.6	-0.5	6.1	1.2	1.0	0.0	1.0	0.2	7.3	1.1%	83.4%	14.3%	2.3%	100%
San Juan	19.9	-1.4	18.5	17.8	15.9	0.4	16.3	1.5	36.3	5.3%	51.0%	44.9%	4.1%	100%
Taguig	10.8	-0.8	10.1	2.0	1.7	0.0	1.7	0.3	12.1	1.8%	83.4%	14.3%	2.3%	100%
Montalban	3.2	-0.2	2.9	0.6	0.5	0.0	0.5	0.1	3.5	0.5%	83.4%	14.3%	2.3%	100%
Cainta	8.9	-0.6	8.3	1.6	1.4	0.0	1.4	0.2	9.9	1.5%	83.4%	14.3%	2.3%	100%
Taytay	5.1	-0.4	4.7	0.9	0.8	0.0	0.8	0.1	5.7	0.8%	83.4%	14.3%	2.3%	100%
Antipolo	7.0	-0.5	6.5	1.3	1.1	0.0	1.1	0.2	7.8	1.1%	83.4%	14.3%	2.3%	100%
San Mateo	4.1	-0.3	3.8	0.8	0.6	0.0	0.7	0.1	4.6	0.7%	83.4%	14.3%	2.3%	100%
Total	455.6	-32.4	423.2	259.4	212.6	5.8	218.4	41.0	682.5	100%				
(Adjusted)	423.15	-	62%	-	218.4	-	32%	6%	-	100%				

City/Munic		Number (f Service C	onnection		estimated A	rea Distribu	tion by Wate	ar Use (MU
inality	Domestic	Commercia	Industrial	Total	0/2	Domestic	Commercia	Industrial	Total
Manila				10101	/0			12.0	10tai
Manila	140,666	19,824	2,696	163,186	31.8%	142.7	82.6	13.0	238.3
Callocan	58,495	5,225	1,994	65,714	12.1%	59.3	21.8	9.6	90.7
Pasay	28,392	2,480	371	31,243	5.5%	28.8	10.3	1.8	40.9
Quezon Cit	125,825	8,905	2,658	137,388	23.7%	127.7	37.1	12.8	177.6
Las Pinas	7,614	298	22	7,934	1.2%	7.7	1.2	0.1	9.1
Makati	7,752	1,311	260	9,323	1.9%	7.9	5.5	1.3	14.6
Malabon	27,288	2,553	1,120	30,961	5.8%	27.7	10.6	5.4	43.7
Nanotas	15,921	1,427	548	17,896	3.3%	16.2	5.9	2.6	24.7
Paranaque	22,207	2,007	182	24,396	4.2%	22.5	8.4	0.9	31.8
Valenzuela	30,781	2,809	1,098	34,688	6.4%	31.2	11.7	5.3	48.2
Muntinlupa	1,683	24	1	1,708	0.2%	1.7	0.1	0.0	1.8
Cavite City	8,281	443	29	8,753	1.4%	8.4	1.8	0.1	10.4
Bacoor	5,145	272	14	5,431	0.9%	5.2	1.1	0.1	6.4
Imus	1,111	68	3	1,182	0.2%	1.1	0.3	0.0	1.4
Kawit	4,842	228	14	5,084	0.8%	4.9	1.0	0.1	5.9
Noveleta	994	30	0	1,024	0.2%	1.0	0.1	0.0	1.1
Rosario	1,887	81	2	1,970	0.3%	1.9	0.3	0.0	2.3
Total	488,884	47,985	11,012	547,881	100.0%	496.0	200.0	53.0	749.0

Table B3.10 Number of Service Connection and Estimated Area Distribution of Billed Water, MWSI

Source: 4th Quarterly Report on Service Performance Information, CY 2000, MWSI

City/Municipality		Assumed Billed Water by Municipality (MLD)				Share to Billed Water by Municipality (%)			
		Domestic	Commercial	Industrial	Total	Domestic	Commercial	Industrial	Total
(West Zor	ne)								
NCR	Pasay	28.8	10.3	1.8	40.9	3.1%	2.5%	1.9%	2.9%
	Caloocan	59.3	21.8	9.6	90.7	6.5%	5.2%	10.2%	6.3%
	Las Pinas	7.7	1.2	0.1	9.1	0.8%	0.3%	0.1%	0.6%
	Malabon	27.7	10.6	5.4	43.7	3.0%	2.5%	5.7%	3.1%
	Valenzuela	31.2	11.7	5.3	48.2	3.4%	2.8%	5.6%	3.4%
	Muntinlupa	1.7	0.1	0.0	1.8	0.2%	0.0%	0.0%	0.1%
	Navotas	16.2	5.9	2.6	24.7	1.8%	1.4%	2.8%	1.7%
	Paranaque	22.5	8.4	0.9	31.8	2.5%	2.0%	0.9%	2.2%
Cavite	Cavite City	8.4	1.8	0.1	10.4	0.9%	0.4%	0.1%	0.7%
	Bacoor	5.2	11	0.1	6.4	0.6%	0.3%	0.1%	0.4%
	Imus	11	0.3	0.0	14	0.1%	0.1%	0.0%	0.1%
	Kawit	4.9	1.0	0.0	5.9	0.1%	0.1%	0.1%	0.1%
	Noveleta	1.0	0.1	0.1	1.1	0.5%	0.270	0.0%	0.1%
	Posorio	1.0	0.1	0.0	1.1	0.170	0.076	0.0%	0.170
	KOSallo	1.9	0.5	0.0	2.5	0.270	0.170	0.070	0.270
(East Zone	e)								
NCR	Mandaluvong	43.5	38.3	3.5	85.4	4.7%	9.2%	3.8%	6.0%
	Marikina	56.8	11.2	3 5	71.5	6.2%	2.7%	3 7%	5.0%
	Pasig	64.6	15.6	5.4	85.6	7.0%	3 7%	5 7%	6.0%
	Pateros	6.1	10	0.2	73	0.7%	0.2%	0.2%	0.5%
	San Juan	18.5	16.2	0.2	26.3	2.0%	2 00/2	1.6%	0.570
	Jan Juan Taguig	10.5	10.3	1.5	12.1	2.070	0.40/	0.20/	2.370
Direl	l'aguig	10.1	1./	0.3	12.1	1.170	0.470	0.5%	0.870
Rizal	Antipolo	0.3	1.1	0.2	/.8	0.7%	0.3%	0.2%	0.5%
	Cainta	8.3	1.4	0.2	9.9	0.9%	0.3%	0.2%	0.7%
	Angono								
	Baras								
	Binangonan								
	Cardona								
	Jala-Jala								
	Morong								
	Pililla								
	Rodoriguez	2.9	0.5	0.1	3.5	0.3%	0.1%	0.1%	0.2%
	San Mateo	3.8	0.7	0.1	4.6	0.4%	0.2%	0.1%	0.3%
	Tanay								
	Taytay	4.7	0.8	0.1	5.7	0.5%	0.2%	0.1%	0.4%
	Teresa								
(Commission	Concernie Arres								
	Concession Area)	252.0	05.5	20 5	276.0	27 50/	22.00/	20 404	26.204
NCR	Quezon City	252.8	95.5	28.5	3/6.8	27.5%	22.8%	30.4%	26.3%
	East	125.1	58.4	15.7	199.2	13.6%	14.0%	16.7%	13.9%
	West	127.7	37.1	12.8	177.6	13.9%	8.9%	13.6%	12.4%
	Manıla	164.8	102.1	14.8	281.6	17.9%	24.4%	15.7%	19.7%
	East	22.1	19.4	1.8	43.3	2.4%	4.6%	1.9%	3.0%
	West	142.7	82.6	13.0	238.3	15.5%	19.7%	13.8%	16.6%
	Makati	58.0	57.4	9.6	124.9	6.3%	13.7%	10.2%	8.7%
	East	50.1	52.0	8.3	110.4	5.4%	12.4%	8.9%	7.7%
	West	7.9	5.5	1.3	14.6	0.9%	1.3%	1.3%	1.0%
	T · 1	010.0	410.4	0.1.0	1 401 5	100.007	100.007	100.007	100.00/
	I otal	919.2	418.4	94.0	1,431.5	100.0%	100.0%	100.0%	100.0%
	East	423.2	218.4	41.0	082.3	40.0%	32.2% 17 00/	43.0% 56 10/	4/./%
	west	490.0	200.0	55.0	/49.0	34.0%	+/.0%	30.470	32.3%

Table B3.11 Assumed Share of Water Consumption by City/Municipality (CY 2000)

Table B3.12 Water Charge of MWCI

1. WATER CHARGE								
Effective Until Effective On			Effective Until Effective On					
Dec.31,2000 Jan. 1,2001			Dec.31,2000 Jan.1,2001					
A. BASIC								
RESIDENTIAL			SEMI-BUSINESS					
First 10 cu.m.	P 20.63 /conn.	P 22.15 /conn.	First 10 cu.m.	P 34 63 /conn.	P 37.20 fconn.			
Next 10 cu.nn.	2.51 /cu.m.	2.70 fcu.m.	Next 10 cu.m.	4.23 fcu.m.	4.54 /cu.m.			
Next 20 cu.m.	4.79 /cu.m.	5.14 fcu.m.	Next 20 cu.m.	5.20 fcu.m.	5.59 /cu.m.			
Next 20 cu.m.	6.29 /cu.m.	6.75 fcu.m.	Next 20 cu.m-	6.60 fcu.m.	7.09 /cu.m.			
Next 20 cu.m.	7.35 /cu.m.	7.89 fcu.m.	Next 20 cu.m.	7.68 fcu.m.	8.25 fcu.m.			
Next 20 cu.m.	7.68 /cu.m.	8.25 fcu.m.	Next 20 cu.m.	8.03 /cu.m.	8.63 fcu.m.			
Next 50 cu.m.	8.03 /cu.m.	8.62 fcu.m.	Next 50 cu.m.	8.39 fcu.m.	9.01 fcu.m.			
Next 50 cu.m.	8.39 /cu.m.	9.01 fcu.m.	Next 50 cu.m.	8.74 fcu.m.	9.39 fcu.m.			
Over 200 cu.m.	8.74 /cu.m.	9.39 fcu.m.	Over 200 cu.m.	9 09 fcu.m.	9.76 fcu.m.			
BUSINESS GROUP I			BUSINESS GROUP II					
First 10 cu.m.	P 93.73 /conn.	P 100.66 /conn.	First 10 cu.m.	P 101.42/conn.	P 108.91 /conn.			
Next 90 cu.m.	9.41 fcu.m.	10.11 fcu.m.	Next 90 cu.m.	10.21 fcu.m.	10.96 fcu.m.			
Next 100 cu.m.	9.44 fcu.m.	10.14 fcu.m.	Next 100 cu.m.	10.27 fcu.m.	11.03 fcu.m.			
Next 100 cu.m.	9.47 /cu.m.	10.17 fcu.m.	Next 100 cu.m.	10.35 fcu.m.	11.11 fcu.m.			
Next 100 cu.m.	9.50 /cu.m.	10.20 fcu.m.	Next 100 cu.m.	10.42 fcu.m.	11.19fcu.rn.			
Next 100 cu.m.	9.54 /cu.m.	10.24 fcu.m.	Next 100 cu.m.	10.49 fcu.m.	11.27 fcu.m.			
Next 100 cu.m.	9.58 fcu.m.	10.29 fcu.m.	Next 100 cu.m.	10,56 fcu.m.	11.34fcu.rn.			
Next 100 cu.m.	9.62 /cu.m.	10.33 fcu.m.	Next 100 cu.m.	10.63 fcu.m.	11.42 fcu.m.			
Next 100 cu.m.	9.65 fcu.m.	10.36 fcu.m.	Next 100 cu.m.	10.70 fcu.m.	11.49 fcu.m.			
Next 100 cu.m.	9.68 /cu.m.	10.40 fcu.m.	Next 100 cu.m.	10.77 fcu.m.	11.57 fcu.m.			
Next 100 cu.m.	9.71 fcu.m.	10.43 fcu.m.	Next 100 cu.m.	10.84 fcu.m.	11.64 fcu.m.			
Next 200 cu.m.	9.76 fcu.m.	10.48 fcu.m.	Next 200 cu.m.	10.90 fcu.m.	11.71 fcu.m.			
Next 200 cu.m.	9.79 fcu.m.	10.51 fcu.m.	Next 200 cu.m.	10.97 /cu.m.	11.78/cu.m.			
Next 200 cu.m.	9.83 fcu.m.	10.56 fcu.m.	Next 200 cu.m.	11.05 /cu.m.	11.87 fcu.m.			
Next 200 cu.m.	9.86 fcu.m.	10.59 fcu.m.	Next 200 cu.m.	11.11 /cu.m.	11.93 fcu.m.			
Next 200 cu.m.	9.89 fcu.m.	10.62 fcu.m.	Next 200 cu.m.	11.18/cu.m.	12.01 fcu.m.			
Next 500 cu.m.	9.93 fcu.m.	10.66 fcu.m.	Next 500 cu.m.	11.26 fcu.m.	12.09 fcu.m.			
Next 500 cu.m.	9.97 fcu.m.	10.71 fcu.m.	Next 500 cu.m.	11.32 fcu.m.	12.16 fcu.m.			
Next 500 cu.m.	10.00 fcu.m.	10.74 fcu.m.	Next 500 cu.m.	11.39fcu.rn.	12.23 fcu.m.			
Next 500 cu.m.	10.04 fcu.m.	10.78 fcu.m.	Next 500 cu.m.	11.47 fcu.m.	12.32 fcu.m.			
Next 500 cu.m.	10.06 fcu.m.	10.80 fcu.m.	Next 500 cu.m.	11.53 fcu.m.	12.38 fcu.m.			
Next 500 cu.m.	10.09 fcu.m.	10.84 fcu.m.	Next 500 cu.m.	11.61 fcu.m.	12.47 fcu.m.			
Next 500 cu.m.	10.14 /cu.m.	10.89 fcu.m.	Next 500 cu.m.	11.68 /cu.m.	12.54 fcu.m.			
Next 500 cu.m.	10.17 fcu.m.	10.92 fcu.m.	Next 500 cu.m.	11.74 fcu.m.	12.61 fcu.m.			
Next 500 cu.m.	10.21 fcu.m.	10.96 fcu.m.	Next 500 cu.m.	11.82 fcu.m.	12.69 fcu.m.			
Next 500 cu.m.	10.24 fcu.m.	11.00 fcu.m.	Next 500 cu.m.	11.89 /cu.m.	12.77 fcu.m.			
Next 500 cu.m.	10.27 fcu.m.	11.03 fcu.m.	Next 500 cu.m.	11.95 /cu.m.	12.83 fcu.m.			
Next 500 cu.m.	10.31 /cu.m.	11.07 fcu.m.	Next 500 cu.m.	12.03 fcu.m.	12.92 fcu.m.			
Next 500 cu.m.	10.35 fcu.m.	11.11 fcu.m.	Next 500 cu.m.	12.10 /cu.m.	12.99 /cu.m.			
Next 500 cu.m.	10.38 fcu.m.	11.15 fcu.m.	Next 500 cu.m.	12.17 fcu.m.	13.07 fcu.m.			
Next 500 cu.m.	10.42 fcu.m,	11.19 fcu.m.	Next 500 cu.m.	12.24 fcu.m.	13.14 fcu.m.			
Next 500 cu.m.	10.45 fcu.m.	11.22 fcu.m.	Next 500 cu.m.	12.31 fcu.m.	13.22 fcu.m.			
Over 10000 cu.m.	10.49 fcu.m.	11.27 fcu.m.	Over 10000 cu.m.	12.38 /cu.m.	13.29 fcu.m.			
D CED + D 1 00/ D 1 00/	_							

B. CERA P 1.00/cu.m. P 1.00/cu.m.

2. A. ENVIRONMENTAL CHARGE (EC) B. SEWERAGE CHARGE (SC)

EC = 10% of the Water Charge SC = 50% of the Water Charge for all customere

connected to MWSI sewerlines

3. MAINTENANCE SERVICE CHARGE (MSC) *

METERSIZE AMOUNT METERSIZE AMOUNT METERSIZE AMOUNT

(perconn.) (perconn.) (perconn.)

1/2"or13mm P 1.50 11/4"or40mm P 4.00 4"or100mm P 20.00

3/4" or 20mm 2.00 2" or 50mm 6.00 6" or 150mm 35.00

 1° or 25mm 3.00 3" or 75mm 10.00 8" or 200mm 50.00

4. VALUE-ADDED TAX (VAT) 10% of the Charges 1,2 and 3

THE MONTHLY BILL IS THE SUM OF 1, 2, 3 and 4.

* mai pending request for MSC and Automafic CERA (CERA II) acijustments
Table B3.13 Water Charge of MWSI

Effective Until Dec. 31, 2000 Effective On Jan. 1,200		01	Effective Until Dec. 31, 2000		Effective On Jan. 1,2001				
Regidential					Somi husinggo				
Residentia					Senii-Dusiness	_			
Firet 10 eu.m.	9.250	/conn.	9.872	/conn.	First 10 cu.m-	•(5.530	/conn.	16.575	/conn.
Next 10 eu.m.	1.13	/cu.m.	1.21	/cu.m,	Next 10 cu.m.	1.89	/cu.m.	2.02	/cu.m.
Next 20 eu.m.	2.14	/cu.m.	2.28	/cu.m.	Next 20 cu.m.	2.33	/cu.m.	2.49	/cu.m.
Next 20 cu.m.	2.82	/cu.m.	3.01	/cu.m.	Next 20 cu.m.	2.96	/cu.m.	3.16	/cu.m.
Next 20 cu.m.	3.29	/cu.m.	3.51	/cu.m.	Next 20 cu.m.	3.45	/cu.m.	3.68	/cu.m.
Next 20 cu.m.	3.45	/cu.m.	3.68	/cu.m.	Next 20 cu.m.	3.60	/cu.m.	3.84	/cu.m.
Next 50 cu.m.	3.60	/cu.m.	3.84	/cu.m.	Next 50 cu.m.	3.76	/cu.m.	4.01	/cu.m,
Next 50 cu.m.	3.76	/eu.m.	4.01	/cu.m.	Next 50 cu.m.	3.91	/cu.m.	4.17	/cu.m.
Over 200 cu.m.	3.91	/cu.m.	4.17	/cu.m.	Over 200 cu.m.	4.08	/cu.m.	4.35	/cu.m.
Business GrouD I					Business Grouo It				
Rrst 10 cu.m.	42.060	/conn.	44.890	/conn.	First 10 cu.m.	45.510	/conn.	48.572	/conn.
Next 90 cu.m.	4.21	/cu.m.	4.49	/cu.m.	Next 90 cu.m.	4.58	/cu.m.	4.89	/cu.m.
Next 100 eu.m.	4.23	/cu.m.	4.51	/cu.m.	Next 100 cu.m.	4.60	/cu.m.	4.91	/cu.m.
Next 100 cu.m.	4.25	/cu.m.	4.54	/cu.m.	Next 100 cu.m.	4.64	/cu-m.	4.95	/cu.m.
Next 100 cu.m.	4.26	/cu.m.	4.55	/cu.m.	Next 100 cu.m.	4.67	/cu.m.	4.98	/cu.m.
Next 100 eu.m.	4.28	/eu.m.	4.57	/cu.m.	Next 100 cu.m.	4.70	/cu.m.	5.02	/cu.m.
Next 100 eu.m.	4.29	/cu.m.	4.58	/cu.m.	Next 100 eu.m.	4.73	/cu.m.	5.05	/cu-m.
Next 100 cu.m.	4.31	/cu.m.	4.60	/cu.m.	Next 100 cu.m.	4.77	/cu.m.	5.09	/cu.m.
Next 100 cu.m.	4.33	/cu.m.	4.62	/cu.m.	Next 100 eu.m.	4,79	/cu.m.	5.11	/cu.m.
Next 100 cu.m.	4.34	/cu.m.	4.63	/cu.m.	Next 100 cu.m.	4.83	/cu.m.	5.15	/cu.m.
Next 100 cu m	4 35	/cu m	4 64	/cu m	Next 100 cu m	4 86	/cu m	5 19	/cu m
Next 200 cu m	4.38	/cu.m	4.67	/cu.m	Next 200 cum	4.89	/cu.m	5.22	/cu.m
Next 200 cu m	4.39	/cu.m	4.69	/cu.m	Next 200 cum	4.00	/cu.m	5.25	/cu.m
Next 200 cu m	4.40	/cu m	4 70	/cu m	Next 200 eu m	4.95	/cu m	5.28	/cu m
Next 200 cu m	4.42	/cu.m	4.72	/cu.m	Next 200 cum	4.98	/cu.m	5.32	/cu.m
Next 200 cu m	4.44	/cu.m	4.74	/ou.m	Next 200 cu m	5.02		5.36	
Next 500 cu m	4.44	/cu.m.	4.74	/cu.m	Next 500 cu.m.	5.02	/cu.m.	5.38	/cu.m
Next 500 cu.m.	4.45	/cu.m.	4.75	/cu.m.	Next 500 cu.m.	5.04	/cu.m.	5.30	/cu.m.
Next 500 cu.m.	4.47	/cu.m.	4.77	/cu.m.	Next 500 cu.m.	5.08	/cu.m.	5.42	/cu.m.
Next 500 cu.m.	4.40	/cu.m.	4.70	/cu.m.	Next 500 cu.m.	5.11	/cu.m.	5.45	/cu.m.
Next 500 cu.m.	4.50	/cu.m.	4.60	/cu-m.	Next 500 cu.m.	5.14	/cu.m.	5.49	/cu-m.
Next 500 cu.m.	4.52	/cu.m.	4.82	/cu.m.	Next 500 cu.m.	5.17	/cu.m.	5.52	/cu.m.
Next 500 cu.m.	4.53	/cu.m.	4.03	/cu.m.	Next 500 cu.m.	5.21	/cu.m.	5.50	/cu.m.
Next 500 cu.m.	4.54	/cu.m.	4.85	/cu.m.	Next 500 cu.m.	5.23	/cu.m.	5.58	/cu.m.
Next 500 cu.m.	4.57	/cu.m.	4.88	/cu.m.	Next 500 cu.m.	5.27	/cu.m.	5.62	/cu.m.
Next 500 cu.m.	4.58	/cu.m.	4.89	/cu.m.	Next 500 cu.m.	5.30	/cu.m.	5.66	/cu.m.
Next 500 cu.m.	4.59	/cu.m.	4.90	/cu.m.	Next 500 cu.m.	5.33	/cu.m.	5.69	/cu.m.
Next 500 cu.m.	4.60	/cu.m.	4.91	/cu.m.	Next 500 cu.m.	5.36	/cu.m.	5.72	/cu.m.
Next 500 cu.m.	4.63	/cu.m.	4.94	/cu.m.	Next 500 cu.m.	5.39	/cu.m,	5.75	/cu.m.
Next 500 cu.m.	4.64	/cu.m.	4.95	/cu.m.	Next 500 cu.m.	5.42	/cu.m.	5.78	/cu.m.
Next 500 cu.m.	4.65	/cu.m.	4.96	/cu.m.	Next 500 cu.m.	5.46	/cu.m.	5.83	/cu.m.
Next 500 cu.m.	4.67	/cu.m.	4.98	/cu.m.	Next 500 cu.m.	5.48	/cu.m.	5.85	/cu.m.
Next 500 cu.m.	4.69	/cu.m.	5.01	/cu.m.	Next 500 cu.m.	5.52	/cu.m.	5.89	/cu.m.
Over 10000 eu.m.	4,70	/cu.m.	5.02	/cu.m.	Over 10000 cu.m	5.55	/cu.m.	5.92	/cu.m.

B. CERA P1.00/cu.m. 2 A. ENVIRONMENTAL CHARGE (EC) EC '=10% of thé Water Charge

3 MAINTENANCE SERVICE CHARGE (MSC) METER SIZE AMOUNT (per conn.) 1/2" or 13 mm P1.50 2.00 3.00

4.00

3/4" or 20mm 1" or 25mm 1 1/4-or 40 mm

4 VALUE-ADDEDTAX(VAT) 10% of the Charges 1,2and3 THE

MONTHLY BILL IS THE SUM OF 1,2,3 and 4.

SEWERAGE CHARGE (SC) SC = 50% of thé Water Charge lbr an customers connected to MWCI sewenines

METER SIZE	AMOUNT
	(per conn.)
2" or 50 mm	P 6.00
3" or 75 mm	10.00
4"or 100 mm	20.00
6"or 150 mm	35.00
8" ot 200 mm	50.00

Area	Item	1997	1998	1999	2000	2001
	Total Production (MLD)	1,542	1,261	1,668	1,690	1,650
	Balara WTP	1,505	1,219	1,633	1,653	1,615
	Deep Wells	37	42	35	37	35
	Billed Water (MLD)	843	767	1,005	967	868
	Domestic, Commercial & Indu	496	517	637	683	702
	Interconnection Transfer	347	250	368	284	166
	Non-revenue Water (MLD)	700	494	663	723	782
	Non-revenue Water (%)	45%	39%	40%	43%	47%
MWCI*	Water Service Connections					
WI W CI	New Connections	2,868	15,920	10,228	11,341	2,580
	Total Regular Connections	310,682	323,553	332,582	339,491	342,071
	Total Household Connections	325,527	340,037	390,350	408,894	413,242
	Composition of Water Use (%)					
	Domestic	62%	62%	62%	62%	62%
	Commercial	32%	32%	32%	32%	32%
	Industrial	6%	6%	6%	6%	6%
	Unit Consumption					
	Domestic (Lpcd)	108	108	129	136	138
	Total Production MLD)	1,884	1,512	2,191	2,258	
	La Mesa WTP	1,549	1,240	1,789	1,933	
	Deep Wells	31	32	36	39	
	Interconnection Transfer	304	240	366	286	
	Billed Water (MLD)					
	Domestic, Commercial & Indu	631	594	733	763	
	Interconnection Transfer	-	-	-	-	-
	Non-revenue Water (MLD)	1,254	918	1,458	1,495	
	Non-revenue Water (%)	67%	61%	66%	66%	
MWGI ^{**}	Water Service Connections					
WIW SI	New Connections	-	-	-	-	-
	Total Regular Connections	415,919	424,478	452,301	500,579	-
	Total Household Connections	-	-	-	571,282	-
	Composition of Water Use (%)					
	Domestic	66%	62%	65%	65%	-
	Commercial	26%	28%	26%	26%	-
	Industrial	6%	7%	6%	7%	-
	Unit Consumption					
	Domestic (Lpcd)	109	94	114	108	-
Total	Average Unit Consumption					
	Domestic (Lpcd)	108	100	121	119	-

Table B4.1 Estimated Per Capita Consumption

Source: *MWCI, ** MWSI

	Table B4.2 Per Capita Consumption Based on JICA Study 1995Ur								Unit: Lpcd				
				Per C	apita Consur	nption			Dopulati	on Distributi	on hy Incon	aa Laval	Per Capita
City/	Municipality		JICA	Master Plan	1995		This	Study	Populati	on Distributi	on by meon	le Level	Consumption
		1995	2000	2005	2010	2015	2020	2025	High	Middle	Low	Blighted	2025
(NCR)	Psay	124	138	152	166	180	195	210	10%	51%	29%	10%	186
West Zone	Caloocan	135	149	162	176	190	205	210	9%	44%	31%	16%	175
	Las Pinas	148	159	169	180	190	200	210	33%	40%	21%	6%	200
	Malabon	134	148	162	176	190	205	210	13%	46%	28%	13%	182
	Valenzuela	123	137	151	166	180	195	210	16%	39%	31%	14%	180
	Muntinlupa	124	138	152	166	180	195	210	50%	30%	10%	10%	200
	Navotas	123	137	151	166	180	195	210	13%	46%	28%	13%	182
	Paranaque	190	193	195	198	200	215	230	33%	40%	21%	6%	200
East Zone	Mandaluyong	138	154	169	185	200	215	230	23%	49%	23%	5%	199
	Marikina	138	154	169	185	200	215	230	18%	54%	21%	7%	195
	Pasig	125	139	152	166	180	195	210	13%	54%	26%	7%	193
	Pateros	146	159	173	186	200	215	230	18%	54%	21%	7%	195
	San Juan	138	154	169	185	200	215	230	33%	40%	21%	6%	200
	Taguig	146	159	173	186	200	215	230	18%	54%	21%	7%	195
Common Ar	eaQuezon City	131	144	158	171	185	195	210	21%	47%	25%	7%	195
	Manila	119	134	150	165	180	195	210	12%	50%	28%	10%	187
	Makati	144	158	172	186	200	215	230	23%	49%	23%	5%	199
(Cavite)	Cavite City	107	120	133	147	160	175	180	5%	40%	33%	21%	163
West Zone	Bacoor	107	120	133	147	160	175	180	5%	40%	33%	21%	163
	Imus	107	120	133	147	160	175	180	5%	40%	33%	21%	163
	Kawit	107	120	133	147	160	175	180	5%	40%	33%	21%	163
	Noveleta	107	120	133	147	160	175	180	5%	40%	33%	21%	163
	Rosario	107	120	133	147	160	175	180	5%	40%	33%	21%	163
(Rizal)	Antipolo	124	138	152	166	180	195	210	23%	49%	23%	5%	199
East Zone	Cainta	124	138	152	166	180	195	210	23%	49%	23%	5%	199
	Angono	107	120	133	147	160	175	180	6%	40%	33%	21%	166
	Baras	107	120	133	147	160	175	180	6%	40%	33%	21%	166
	Binangonan	107	120	133	147	160	175	180	6%	40%	33%	21%	166
	Cardona	107	120	133	147	160	175	180	6%	40%	33%	21%	166
	Jala-Jala	107	120	133	147	160	175	180	6%	40%	33%	21%	166
	Morong	107	120	133	147	160	175	180	6%	40%	33%	21%	166
	Pililla	107	120	133	147	160	175	180	6%	40%	33%	21%	166
	Rodoriguez	139	154	170	185	180	195	210	6%	40%	33%	21%	166
	San Mateo	139	154	170	185	180	195	210	6%	40%	33%	21%	166
	Tanav	107	120	133	147	160	175	180	6%	40%	33%	21%	166
	Tavtav	124	138	152	166	180	195	210	6%	40%	33%	21%	166
	Teresa	107	120	133	147	160	175	180	6%	40%	33%	21%	166

Unit: Lpcd										
		Pro	posed Per Ca	pita Consump	tion		Growth Rate			
City/Municipality	2000	2005	2010	2015	2020	2025	(2005-2025)			
(WEST ZONE)										
Pasy	119	125	138	152	168	186	2.01%			
Caloocan	119	125	136	148	161	175	1.70%			
Las Pinas	119	125	141	158	178	200	2.38%			
Malabon	119	125	137	151	166	182	1.90%			
Valenzuela	119	125	137	150	164	180	1.84%			
Muntinlupa	119	125	141	158	178	200	2.38%			
Navotas	119	125	137	151	166	182	1.90%			
Paranague	119	125	141	158	178	200	2.38%			
1										
Cavite City	119	125	134	143	153	163	1.34%			
Bacoor	119	125	134	143	153	163	1.34%			
Imus	119	125	134	143	153	163	1.34%			
Kawit	119	125	134	143	153	163	1.34%			
Noveleta	119	125	134	143	153	163	1.34%			
Rosario	119	125	134	143	153	163	1.34%			
110500110	,	120	10.	1.10	100	100	1.0 . / 0			
(EAST ZONE)										
Mandaluvong	119	125	140	158	177	199	2.35%			
Marikina	119	125	140	156	174	195	2.35%			
Pasio	119	125	130	155	173	193	2.25%			
Pateros	119	125	140	155	173	195	2.20%			
	119	125	140	150	174	195	2.2370			
San Juan	119	125	141	158	1/8	200	2.38%			
Taguig	119	125	140	156	1/4	195	2.25%			
Antipolo	119	125	140	158	177	199	2.35%			
Cainta	119	125	140	158	177	199	2.35%			
Angono	119	125	134	144	155	166	1 43%			
Baras	119	125	134	144	155	166	1.43%			
Binanonan	110	125	134	144	155	166	1.43%			
Cardona	119	125	134	144	155	166	1.4370			
	119	125	134	144	155	166	1.4370			
Jala-jala Morona	119	125	134	144	155	166	1.4370			
Dilille	119	125	134	144	155	100	1.43%			
Pililla	119	125	134	144	155	100	1.43%			
Rodoliguez	119	125	134	144	155	100	1.43%			
San Maleo	119	125	134	144	155	100	1.43%			
Tanay	119	125	134	144	155	100	1.43%			
Taytay	119	125	134	144	155	166	1.43%			
Teresa	119	125	134	144	155	166	1.43%			
COMMON CONCESSI	NI ADEA)									
Ouezon City	110	125	140	156	174	105	2 25%			
East	117	125	140	150	174	195	2.2370			
West	117	125	140	150	174	195	2.2370			
West Manile	119	125	140	150	1/4	195	2.2370			
Fost	119	125	130	155	169	10/	2.05%			
East	119	125	130	155	169	10/	2.05% 2.020/			
West	119	125	138	155	109	10/	2.03%			
Iviakati	119	125	140	138	1//	199	2.33% 2.250/			
East	119	125	140	138	1//	199	2.33% 2.250/			
west	119	125	140	158	1//	199	2.33%			

Table B4.3 Proposed Per Capita Consumption

City/Multicipality 2001 2006 2011 2016 (West Zone) Image: City/Multicipality Image: City/Image: City/Ima	2021 100% 100% 100% 100% 95% 100%
West Zone) 100% 100% 100% 100% NCR Pasay 100% 100% 100% 100% Callocan 100% 100% 100% 100% 100% Las Pinas 58% 91% 93% 95% Malabon 84% 100% 100% 100%	100% 100% 100% 100% 95% 100%
NCR Pasay 100% 100% 100% 100% Callocan 100% 100% 100% 100% 100% Las Pinas 58% 91% 93% 95% Malabon 84% 100% 100% 100%	100% 100% 100% 100% 95% 100%
Callocan 100% 100% 100% 100% Las Pinas 58% 91% 93% 95% Malabon 84% 100% 100% 100%	100% 100% 100% 95% 100%
Las Pinas 58% 91% 93% 95% Malabon 84% 100% 100% 100%	100% 100% 100% 95%
Malabon 84% 100% 100% 100%	100% 100% 95% 100%
100/0 100/0 100/0	100% 95% 100%
Valenzuela 84% 100% 100% 100%	95% 100%
Muntinlupa 53% 86% 88% 90%	100%
Navotas 92% 100% 100% 100%	10070
Paranaque 76% 100% 100% 100%	100%
Cavite Cavite City 100% 100% 100% 100%	100%
Bacoor 58% 90% 92% 93%	95%
Imus 36% 61% 63% 65%	72%
Kawit 84% 100% 100% 100%	100%
Noveleta 60% 100% 100% 100%	100%
Rosario 42% 90% 90% 90%	90%
(East Zone)	
NCR Mandaluvong 100% 100% 100% 100%	100%
Marikina 92% 100% 100% 100%	100%
Pasig 92% 100% 100% 100%	100%
Pateros 84% 100% 100% 100%	100%
San Juan 96% 100% 100% 100%	100%
Taguig 44% 100% 100% 100%	100%
RIZAL Antipolo 78% 95% 95% 95%	97%
Cainta 64% 80% 77% 75%	79%
Angono 51% 96% 98% 100%	100%
Baras 34% 51% 53% 55%	58%
Binangonan 40% 81% 83% 85%	87%
Cardona 34% 51% 53% 55%	58%
Jala-Jala 34% 51% 53% 55%	58%
Morong 34% 51% 53% 55%	58%
Pililla 34% 51% 53% 55%	58%
Rodoriguez 83% 95% 95% 95%	98%
San Mateo 84% 100% 100% 100%	100%
Tanay 39% 75% 75% 75%	76%
Tavtav 92% 100% 100%	100%
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	61%
	0170
(Common Concession Area)	
NCR Quezon City 100% 100% 100%	100%
Fast 100% 100% 100%	100%
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	100%
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	100%
Fact	10070
$W_{est} = 100\% = 100\% = 100\% = 100\%$	100%
	100%
Fact 72/0 100/0 100/0 100/0	100/0
$W_{est} = 0.00707 + 1.00077 + 1.00$	1000/
72/0 100/0 100/0 100/0	100/0
Fact 87.4% 07.1% 07.4% 07.7%	08 10/-
Dast 07.1% 97.1% 97.1% 97.1% West 77.1% 94.1% 94.1% 94.1%	94.6%

 Table B4.4 Service Target under Concession Agreement

City/Mu	Proposed Service Coverage							
City/Iviu	merpanty	2000	2005	2010	2015	2020	2025	
(West Zone)								
NCR	Pasay	83%	72%	77%	85%	92%	100%	
	Callocan	52%	55%	60%	73%	87%	100%	
	Las Pinas	15%	58%	91%	93%	95%	98%	
	Malabon	85%	91%	96%	97%	99%	100%	
	Valenzuela	66%	80%	85%	90%	95%	100%	
	Muntinlupa	4%	53%	86%	88%	90%	95%	
	Navotas	72%	74%	79%	86%	93%	100%	
	Paranaque	52%	76%	100%	100%	100%	100%	
Cavite	Cavite City	82%	100%	100%	100%	100%	100%	
	Bacoor	16%	58%	90%	92%	93%	95%	
	Imus	6%	36%	61%	63%	65%	72%	
	Kawit	75%	93%	98%	99%	99%	100%	
	Noveleta	28%	52%	57%	71%	86%	100%	
	Rosario	24%	75%	80%	83%	87%	90%	
(East Zone)								
NCR	Mandaluyong	100%	100%	100%	100%	100%	100%	
	Marikina	100%	100%	100%	100%	100%	100%	
	Pasig	100%	100%	100%	100%	100%	100%	
	Pateros	100%	100%	100%	100%	100%	100%	
	San Juan	100%	100%	100%	100%	100%	100%	
	Taguig	21%	25%	30%	53%	77%	100%	
RIZAL	Antipolo	15%	20%	25%	49%	73%	97%	
	Cainta	30%	34%	39%	52%	66%	79%	
	Angono				33%	67%	100%	
	Baras				19%	39%	58%	
	Binangonan				29%	58%	87%	
	Cardona				19%	39%	58%	
	Jala-Jala				19%	39%	58%	
	Morong				19%	39%	58%	
	Pililla				19%	39%	58%	
	Rodoriguez	22%	34%	39%	59%	78%	98%	
	San Mateo	24%	41%	46%	64%	82%	100%	
	Tanay				25%	51%	76%	
	Taytay	21%	33%	38%	59%	79%	100%	
	Teresa				20%	41%	61%	
(Common Concess	ion Area)							
NCR	Quezon City	100%	100%	100%	100%	100%	100%	
	East	100%	100%	100%	100%	100%	100%	
	West	100%	100%	100%	100%	100%	100%	
	Manila	100%	100%	100%	100%	100%	100%	
	East	100%	100%	100%	100%	100%	100%	
	West	100%	100%	100%	100%	100%	100%	
	Makati	100%	100%	100%	100%	100%	100%	
	East	100%	100%	100%	100%	100%	100%	
	West	100%	100%	100%	100%	100%	100%	
	Total	69%	71%	75%	81%	88%	97%	
	East	72%	63%	61%	71%	82%	95%	
	West	67%	77%	86%	90%	93%	98%	

 Table B4.5
 Proposed Service Coverage

City/Mu		Pr	ojected Pop	ulation Serv	red		
City/Mit	interparity	2000	2005	2010	2015	2020	2025
(West Zone)							
NCR	Pasay	294,000	258,000	272,000	291,000	289,000	282,000
	Callocan	613,000	736,000	883,000	1,247,000	1,589,000	1,956,000
	Las Pinas	73,000	353,000	691,000	886,000	1,058,000	1,264,000
	Malabon	287,000	336,000	374,000	403,000	406,000	404,000
	Valenzuela	322,000	448,000	530,000	647,000	734,000	823,000
	Muntinlupa	16,000	248,000	480,000	562,000	614,000	684,000
	Navotas	165,000	181,000	200,000	230,000	246,000	258,000
	Paranaque	234,000	385,000	554,000	637,000	683,000	725,000
Cavite	Cavite City	81,000	97,000	94,000	92,000	89,000	85,000
	Bacoor	50,000	210,000	379,000	453,000	525,000	606,000
	Imus	11,000	86,000	176,000	210,000	246,000	305,000
	Kawit	47,000	62,000	70,000	74,000	78,000	80,000
	Noveleta	9,000	18,000	21,000	29,000	38,000	47,000
	Rosario	18,000	62,000	72,000	87,000	103,000	122,000
(East Zone)							
NCR	Mandaluyong	278,000	281,000	277,000	280,000	264,000	246,000
	Marikina	391,000	436,000	472,000	530,000	556,000	576,000
	Pasig	505,000	555,000	595,000	658,000	679,000	694,000
	Pateros	57,000	57,000	56,000	57,000	55,000	52,000
	San Juan	118,000	109,000	98,000	93,000	82,000	71,000
	Taguig	98,000	147,000	213,000	478,000	809,000	1,227,000
RIZAL	Antipolo	71,000	138,000	246,000	674,000	1,358,000	2,379,000
	Cainta	73,000	115,000	177,000	307,000	481,000	706,000
	Angono			-	41,000	95,000	160,000
	Baras				7,000	15,000	24,000
	Binangonan				77,000	172,000	281,000
	Cardona				9,000	17,000	25,000
	Jala-Jala				6,000	12,000	19,000
	Morong				9,000	19,000	27,000
	Pililla				11,000	23,000	37,000
	Rodoriguez	25,000	44,000	56,000	101,000	157,000	223,000
	San Mateo	33,000	65,000	83,000	140,000	209,000	290,000
	Tanay				28,000	60,000	95,000
	Taytay	41,000	75,000	97,000	178,000	277,000	392,000
	Teresa				8,000	18,000	28,000
(Common Concess	ion Area)						
NCR	Quezon City	2,174,000	2,285,000	2,343,000	2,533,000	2,554,000	2,549,000
	East	994,000	1,044,000	1,071,000	1,158,000	1,168,000	1,165,000
	West	1,180,000	1,241,000	1,272,000	1,375,000	1,386,000	1,384,000
	Manila	1,591,000	1,473,000	1,345,000	1,286,000	1,146,000	1,011,000
	East	196,000	181,000	165,000	158,000	141,000	125,000
	West	1,395,000	1,292,000	1,180,000	1,128,000	1,005,000	886,000
	Makati	445,000	443,000	432,000	426,000	391,000	356,000
	East	393,000	391,000	381,000	376,000	345,000	314,000
	West	52,000	52,000	51,000	50,000	46,000	42,000
	Total	8,120,000	9,703,000	11,286,000	13,785,000	16,147,000	19,109,000
	East	3,273,000	3,638,000	3,987,000	5,384,000	7,012,000	9,156,000
	West	4,847,000	6,065,000	7,299,000	8,401,000	9,135,000	9,953,000

		Domestic Water Demand (MLD)						
City/Mi	inicipality	2000	2005	2010	2015	2020	2025	
(West Zone)								
NCR	Pasay	29	32	38	44	49	52	
	Caloocan	59	92	120	185	256	342	
	Las Pinas	8	44	97	140	188	253	
	Malabon	28	42	51	61	67	74	
	Valenzuela	31	56	73	97	120	148	
	Muntinlupa	2	31	68	89	109	137	
	Navotas	16	23	27	35	41	47	
	Paranaque	23	48	78	101	122	145	
Cavite	Cavite City	8	12	13	13	14	14	
	Bacoor	5	26	51	65	80	99	
	Imus	1	11	24	30	38	50	
	Kawit	5	8	9	11	12	13	
	Noveleta	1	2	3	4	6	8	
	Rosario	2	8	10	12	16	20	
(East Zone)								
NCR	Mandaluvong	44	35	39	44	47	49	
	Marikina	57	55	66	83	97	112	
	Pasig	65	69	83	102	117	134	
	Pateros	6	7	8	9	10	10	
	San Juan	19	14	14	15	15	14	
	Таощо	10	18	30	75	141	239	
RIZAL	Antipolo	7	10	34	106	240	473	
	Cainta	8	14	25	49	85	140	
	Angono	0	17	25		15	27	
	Baras				1	2	27 4	
	Binangonan				11	27	47	
	Cardona				1	27	4	
	Iala-Iala				1	2	3	
	Morong				1	3	2 2	
	Pililla				2	2 2	6	
	Rodoriguez	3	6	8	15	24	37	
	San Mateo	4	8	11	20	32	48	
	Tanay		0	11	20 4	9	16	
	Tavtav	5	9	13	26	43	65	
	Teresa	5	,	15	1	3	5	
(Common Conce	sion Area)							
NCR	Ouezon City	252	286	278	305	111	107	
INCIN	Fast	125	∠00 121	520 150	195	202	+71 777	
	Wast	123	151	130	215	203	227	
	Monilo	120	193	170	107	104	180	
	Fost	105	104	100	197	194 24	109	
	East	142	25 160	25 162	24 172	24 170	25 166	
	West	143 59	55	103	67	1/0	71	
	Fast	50 50	33 40	00 52	0/ 50	09 61	/1	
	L'ast Wost	5U 0	49 7	55 7	<u>ه</u>	01	02 0	
	vv est	ð	/	/	ð	ð	ð	
	Total	919	1,213	1,565	2,116	2,742	3,596	
	East	423	455	556	835	1,206	1,752	
	West	496	758	1,009	1,281	1,536	1,845	

 Table B4.7 Domestic Water Demand Projection by City/Municipality

City/N	Aunicipality			Projecte	d Water Deman	d (MLD)		
City/N	viuncipanty	Domestic	Commercial	Industrial	Billed Total	NRW (54%)	Average Daily	Max Daily
(West Zor	ne)							
NCR	Pasay	32.3	10.6	1.9	44.7	52.5	97.2	117.6
	Caloocan	92.0	22.3	10.1	124.4	146.0	270.4	327.2
	Las Pinas	44.1	1.3	0.1	45.5	53.4	98.9	119.7
	Malabon	42.0	10.9	5.7	58.6	68.8	127.3	154.1
	Valenzuela	56.0	12.0	5.6	73.6	86.3	159.9	193.5
	Muntinlupa	31.0	0.1	0.0	31.1	36.5	67.6	81.8
	Navotas	22.6	6.1	2.8	31.5	37.0	68.5	82.8
a :	Paranaque	48.1	8.6	0.9	57.6	67.6	125.2	151.5
Cavite	Cavite City	12.1	1.9	0.1	14.2	16.6	30.8	37.3
	Bacoor	26.3	1.2	0.1	27.5	32.3	59.7	72.3
	Imus	10.8	0.3	0.0	11.1	13.0	24.0	29.1
	Kawit Novelete	7.8	1.0	0.1	8.8	10.3	19.1	23.1
	Roserio	2.3	0.1	0.0	2.4	2.8	5.2	0.3
	Kosano	/.8	0.3	0.0	8.1	9.5	17.0	21.5
(East Zon	e)							
NCR	Mandaluvong	35.1	39.2	3.7	78.1	91.6	169.7	205.3
	Marikina	54.5	11.5	3.7	69.7	81.8	151.4	183.2
	Pasig	69.4	16.0	5.7	91.0	106.8	197.8	239.4
	Pateros	7.1	1.1	0.2	8.4	9.8	18.2	22.0
	San Juan	13.6	16.7	1.6	31.9	37.4	69.3	83.9
	Taguig	18.4	1.8	0.3	20.4	24.0	44.4	53.8
Rizal	Antipolo	17.3	1.1	0.2	18.6	21.8	40.4	48.9
	Cainta	14.4	1.4	0.2	16.1	18.9	34.9	42.3
	Angono	-	-	-	-	-	-	-
	Baras	-	-	-	-	-	-	-
	Binangonan	-	-	-	-	-	-	-
	Cardona	-	-	-	-	-	-	-
	Jala-Jala	-	-	-	-	-	-	-
	Morong	-	-	-	-	-	-	-
	Pililla	-	-	-	-	-	-	-
	Rodoriguez	5.5	0.5	0.1	6.1	7.2	13.3	16.1
	San Mateo	8.1	0.7	0.1	8.9	10.5	19.4	23.4
	Tanay	-	-	-	-	-	-	-
	Taytay	9.4	0.8	0.1	10.3	12.1	22.5	27.2
	Teresa	-	-	-	-	-	-	-
(Common	Concession Are	9)						
NCR	Quezon City	a) 285.6	07.8	30.0	413.5	185 1	808 8	1 087 6
NCK	Fast	130.5	59.8	16.6	206.9	242.8	449 7	544.1
	West	155.1	38.0	13.5	206.5	242.0	449.1	543 5
	Manila	184.1	104 5	15.5	304.2	357.1	661.3	800.1
	East	22.6	19.9	19	44.4	52.1	96.5	116.8
	West	161.5	84.6	13.7	259.8	305.0	564.7	683.3
	Makati	55.4	58.8	10.1	124.2	145.9	270.1	326.8
	East	48.9	53.2	8.8	110.8	130.1	240.9	291.5
	West	6.5	5.6	1.3	13.4	15.7	29.2	35.3
	Total	1,212.9	428.5	98.9	1,740.3	2,042.9	3,783.2	4,577.6
	East	454.8	223.7	43.1	721.5	847.0	1,568.5	1,897.9
	West	758.1	204.8	55.8	1,018.7	1,195.9	2,214.6	2,679.7

Table B4.8 Projected Water Demand by City/Municipality for Year 2005

City/	Municipality	Projected Water Demand (MLD)								
City/	Municipanty	Domestic	Commercial	Industrial	Billed Total	NRW (48%)	Average Daily	Max Daily		
(West Zo	one)									
NCR	Pasay	37.5	13.1	2.2	52.8	48.8	101.6	122.9		
	Caloocan	120.1	27.5	12.0	159.6	147.3	306.9	371.3		
	Las Pinas	97.4	1.6	0.1	99.1	91.5	190.6	230.7		
	Malabon	51.2	13.4	6.7	71.4	65.9	137.3	166.2		
	Valenzuela	72.6	14.8	6.6	94.0	86.8	180.8	218.7		
	Muntinlupa	67.7	0.1	0.0	67.8	62.6	130.4	157.8		
	Navotas	27.4	7.5	3.3	38.2	35.3	73.5	88.9		
	Paranaque	78.1	10.6	1.1	89.8	82.9	172.6	208.9		
Cavite	Cavite City	12.6	2.3	0.2	15.1	13.9	29.0	35.1		
	Bacoor	50.8	1.4	0.1	52.3	48.3	100.6	121.7		
	Imus	23.6	0.4	0.0	24.0	22.1	46.1	55.8		
	Kawit	9.4	1.2	0.1	10.7	9.8	20.5	24.8		
	Noveleta	2.8	0.2	0.0	3.0	2.7	5.7	6.9		
	Rosario	9.6	0.4	0.0	10.1	9.3	19.4	23.5		
(East Zor	ne)									
NCR	Mandaluyong	38.8	48.4	4.4	91.5	84.5	176.0	213.0		
	Marikina	66.1	14.1	4.4	84.6	78.1	162.7	196.9		
	Pasig	82.7	19.7	6.7	109.1	100.7	209.8	253.9		
	Pateros	7.8	1.3	0.2	9.4	8.7	18.0	21.8		
	San Juan	13.8	20.6	1.9	36.3	33.5	69.7	84.4		
	Taguig	29.8	2.2	0.4	32.3	29.9	62.2	75.3		
Rizal	Antipolo	34.4	1.4	0.2	36.1	33.3	69.4	84.0		
	Cainta	24.8	1.8	0.3	26.9	24.8	51.6	62.5		
	Angono	-	-	-	-	-	-	-		
	Baras	-	-	-	-	-	-	-		
	Binangonan	-	-	-	-	-	-	-		
	Cardona	-	-	-	-	-	-	-		
	Jala-Jala	-	-	-	-	-	-	-		
	Morong	-	-	-	-	-	-	-		
	Pililla	-	-	-	-	-	-	-		
	Rodoriguez	7.5	0.6	0.1	8.2	7.6	15.9	19.2		
	San Mateo	11.1	0.8	0.1	12.1	11.1	23.2	28.1		
	Tanay	-	-	-	-	-	-	-		
	Taytay	13.0	1.0	0.2	14.2	13.1	27.3	33.0		
	Teresa	-	-	-	-	-	-	-		
(Commo	n Concession Are	a)								
NCR	Quezon City	328.0	120.6	35.6	484.3	447.0	931.3	1,126.8		
	East	149.9	73.8	19.6	243.3	224.6	467.9	566.2		
	West	178.1	46.9	16.0	240.9	222.4	463.3	560.6		
	Manıla	185.6	128.9	18.4	332.9	307.3	640.3	774.7		
	East	22.8	24.5	2.2	49.5	45.7	95.3	115.3		
	West	162.8	104.3	16.2	283.4	261.6	545.0	659.4		
	Makati	60.5	72.5	11.9	144.9	133.8	278.7	337.3		
	East	53.3	65.6	10.4	129.3	119.4	248.7	301.0		
	west	/.1	6.9	1.6	15.6	14.4	30.0	36.3		
	Total	1,564.9	528.4	117.3	2,210.6	2,040.6	4,251.2	5,143.9		
	East	555.9	275.8	51.1	882.9	815.0	1,697.9	2,054.4		
	West	1,009.0	252.6	66.2	1,327.7	1,225.6	2,553.3	3,089.5		

 Table B4.9 Projected Water Demand by City/Municipality for Year 2010

City/N	Aunicipality	Projected Water Demand (MLD)								
City/1	viuneipanty	Domestic	Commercial	Industrial	Billed Total	NRW (42%)	Average Daily	Max Daily		
(West Zon	ne)									
NCR	Pasay	44.2	16.3	2.7	63.2	45.8	109.0	131.8		
	Caloocan	184.6	34.3	14.3	233.2	168.9	402.1	486.5		
	Las Pinas	140.0	2.0	0.2	142.1	102.9	245.0	296.5		
	Malabon	60.9	16.8	8.0	85.7	62.0	147.7	178.7		
	Valenzuela	97.1	18.5	7.9	123.4	89.4	212.7	257.4		
	Muntinlupa	88.8	0.2	0.0	89.0	64.4	153.4	185.6		
	Navotas	34.7	9.4	3.9	48.0	34.8	82.8	100.2		
	Paranaque	100.6	13.2	1.3	115.1	83.4	198.5	240.2		
Cavite	Cavite City	13.2	2.9	0.2	16.3	11.8	28.1	34.0		
	Bacoor	64.8	1.8	0.1	66.7	48.3	114.9	139.1		
	Imus	30.0	0.4	0.0	30.5	22.1	52.6	63.6		
	Kawit	10.6	1.5	0.1	12.2	8.8	21.0	25.4		
	Noveleta	4.1	0.2	0.0	4.3	3.1	7.5	9.1		
	Rosario	12.4	0.5	0.0	13.0	9.4	22.4	27.1		
	``							298.7		
(East Zon	e)		(D. 1	5.0	100.0	70.6	100 5	220.2		
NCK	Mandaluyong	44.2	60.4	5.3	109.9	79.6	189.5	229.2		
	Marikina	82.7	17.6	5.3	105.6	76.4	182.0	220.2		
	Pasig	102.0	24.6	8.0	134.6	97.5	232.0	280.8		
	Pateros	8.9	1.6	0.3	10.8	7.8	18.6	22.5		
	San Juan	14.7	25.7	2.2	42.6	30.9	/3.5	88.9		
D' 1	laguig	74.6	2.7	0.4	100.5	56.3	134.0	162.1		
Rizal	Antipolo	106.5	1.8	0.3	108.5	78.6	187.1	226.4		
	Cainta	48.5	2.2	0.3	51.1	37.0	88.1	100.0		
	Angono	5.9	0.5	0.1	0.0	4.8	11.3	13.7		
	Dalas	1.0	0.1	0.0	1.1	0.8	1.9	2.3		
	Cardona	11.1	1.0	0.2	12.5	8.9	21.2	23.7		
		1.3	0.1	0.0	1.4	1.0	2.3	3.0		
	Jala-Jala Morong	0.9	0.1	0.0	1.0	0.7	1.7	2.0		
	Pililla	1.5	0.1	0.0	1.4	1.0	2.3	3.0		
	Rodoriguez	14.5	0.1	0.0	1.0	1.5	3.0 26.7	3.7		
	San Mateo	20.2	0.8	0.1	21.3	11.2	20.7	52.5 44.5		
	Tanay	20.2	0.4	0.2	21.5	3.2	50.8	93		
	Tavtav	4.0 25.6	1.3	0.1	4.5 27.1	19.6	16.7	56.6		
	Teresa	1.2	0.1	0.2	13	0.9	+0.7	27		
	101050	1.2	0.1	0.0	1.5	0.9	2.2	2.7		
(Common	Concession Are	a)								
NCR	Ouezon City	395.1	150.6	42.5	588.3	426.0	1.014.3	1.227.3		
	East	180.6	92.1	23.5	296.2	214.5	510.7	617.9		
	West	214.5	58.5	19.1	292.1	211.5	503.6	609.4		
	Manila	196.8	160.9	22.0	379.7	275.0	654.7	792.2		
	East	24.2	30.6	2.7	57.5	41.6	99.1	119.9		
	West	172.6	130.3	19.4	322.2	233.3	555.6	672.2		
	Makati	67.3	90.5	14.3	172.1	124.6	296.8	359.1		
	East	59.4	81.9	12.4	153.7	111.3	265.1	320.7		
	West	7.9	8.6	1.9	18.4	13.3	31.7	38.4		
	Total	2,115.8	662.3	140.8	2,918.9	2,113.7	5,032.5	6,089.3		
	East	834.9	346.9	61.7	1,243.5	900.4	2,143.9	2,594.1		
	West	1,281.0	315.4	79.1	1,675.4	1,213.2	2,888.6	3,495.2		

 Table B4.10 Projected Water Demand by City/Municipality for Year 2015

City/	Municipality	Projected Water Demand (MLD)								
enty/maineipainty		Domestic	Commercial	Industrial	Billed Total	NRW (36%)	Average Daily	Max Daily		
(West Zo	ne)									
NCR	Pasay	48.6	20.6	3.2	72.4	40.7	113.1	136.9		
	Caloocan	255.8	43.5	17.3	316.6	178.1	494.7	598.5		
	Las Pinas	188.3	2.5	0.2	191.0	107.4	298.4	361.1		
	Malabon	67.4	21.3	9.7	98.3	55.3	153.7	185.9		
	Valenzuela	120.4	23.4	9.5	153.3	86.2	239.5	289.8		
	Muntinlupa	109.3	0.2	0.0	109.5	61.6	171.1	207.0		
	Navotas	40.8	11.9	4.7	57.5	32.3	89.8	108.6		
	Paranaque	121.6	16.7	1.6	139.9	78.7	218.5	264.4		
Cavite	Cavite City	13.6	3.7	0.3	17.6	9.9	27.4	33.2		
	Bacoor	80.3	2.3	0.1	82.7	46.5	129.2	156.4		
	Imus	37.6	0.6	0.0	38.2	21.5	59.7	72.3		
	Kawit	11.9	1.9	0.1	14.0	7.8	21.8	26.4		
	Noveleta	5.8	0.2	0.0	6.1	3.4	9.5	11.5		
	Rosario	15.8	0.7	0.0	16.5	9.3	25.7	31.1		
(East Zon	ne)									
NCR	Mandaluyong	46.7	76.5	6.3	129.6	72.9	202.4	244.9		
	Marikina	96.7	22.3	6.3	125.4	70.5	195.9	237.1		
	Pasig	117.5	31.1	9.7	158.3	89.0	247.3	299.2		
	Pateros	9.6	2.1	0.3	12.0	6.7	18.7	22.6		
	San Juan	14.6	32.5	2.7	49.8	28.0	77.9	94.2		
	Taguig	140.8	3.4	0.5	144.7	81.4	226.1	273.6		
Rizal	Antipolo	240.4	2.2	0.3	242.9	136.6	379.6	459.3		
	Cainta	85.1	2.8	0.4	88.4	49.7	138.1	167.1		
	Angono	14.7	1.3	0.3	16.4	9.2	25.6	30.9		
	Baras	2.3	0.2	0.1	2.6	1.5	4.0	4.9		
	Binangonan	26.7	2.4	0.6	29.6	16.7	46.3	56.0		
	Cardona	2.6	0.2	0.1	2.9	1.6	4.6	5.5		
	Jala-Jala	1.9	0.2	0.0	2.1	1.2	3.2	3.9		
	Morong	2.9	0.3	0.1	3.3	1.8	5.1	6.2		
	Pililla	3.6	0.3	0.1	4.0	2.2	6.2	7.5		
	Rodoriguez	24.3	1.0	0.1	25.5	14.3	39.8	48.2		
	San Mateo	32.4	1.3	0.2	33.9	19.1	52.9	64.1		
	Tanay	9.3	0.8	0.2	10.3	5.8	16.1	19.5		
	Taytay	42.9	1.6	0.2	44.8	25.2	70.0	84.7		
	Teresa	2.8	0.2	0.1	3.1	1.7	4.8	5.9		
(Commor	n Concession Are	a)								
NCR	Quezon City	444.4	190.8	51.3	686.5	386.1	1,072.6	1,297.8		
	East	203.2	116.6	28.3	348.2	195.8	544.0	658.2		
	West	241.2	74.1	23.0	338.3	190.3	528.6	639.6		
	Manila	193.7	203.8	26.6	424.1	238.5	662.6	801.7		
	East	23.8	38.8	3.2	65.9	37.0	102.9	124.5		
	West	169.8	165.0	23.3	358.2	201.5	559.7	677.2		
	Makati	69.2	114.7	17.2	201.1	113.1	314.2	380.2		
	East	61.1	103.8	15.0	179.8	101.1	280.9	339.9		
	West	8.1	10.9	2.3	21.3	12.0	33.3	40.3		
	Total	2,742.4	841.6	170.4	3,754.4	2,111.9	5,866.3	7,098.2		
	East	1,206.0	442.1	75.1	1,723.2	969.3	2,692.6	3,258.0		
	West	1,536.4	399.5	95.3	2,031.2	1,142.5	3,173.7	3,840.2		

Table B4.11 Projected Water Demand by City/Municipality for Year 2020

City/	Municipality	Projected Water Demand (MLD)								
City/1	viuncipanty	Domestic	Commercial	Industrial	Billed Total	NRW (54%)	Average Daily	Max Daily		
(West Zor	ne)									
NCR	Pasay	52.5	26.5	3.9	82.8	35.5	118.3	143.2		
	Caloocan	342.3	55.8	21.0	419.0	179.6	598.6	724.3		
	Las Pinas	252.8	3.2	0.2	256.2	109.8	366.0	442.9		
	Malabon	73.5	27.3	11.8	112.6	48.2	160.8	194.6		
	Valenzuela	148.1	30.0	11.5	189.7	81.3	270.9	327.8		
	Muntinlupa	136.8	0.3	0.0	137.1	58.7	195.8	236.9		
	Navotas	47.0	15.2	5.8	67.9	29.1	97.1	117.5		
	Paranaque	145.0	21.4	1.9	168.3	72.1	240.5	291.0		
Cavite	Cavite City	13.9	4.7	0.3	18.9	8.1	27.0	32.7		
	Bacoor	98.8	2.9	0.1	101.8	43.6	145.5	176.0		
	Imus	49.7	0.7	0.0	50.5	21.6	72.1	87.2		
	Kawit	13.0	2.4	0.1	15.6	6.7	22.3	27.0		
	Noveleta	7.7	0.3	0.0	8.0	3.4	11.4	13.8		
	Rosario	19.9	0.9	0.0	20.8	8.9	29.7	35.9		
(East Zon	e)									
NCR	Mandaluyong	49.0	98.1	7.7	154.7	66.3	221.0	267.5		
	Marikina	112.3	28.6	7.7	148.6	63.7	212.3	256.9		
	Pasig	133.9	39.9	11.8	185.6	79.5	265.1	320.8		
	Pateros	10.1	2.7	0.4	13.2	5.7	18.8	22.8		
	San Juan	14.2	41.7	3.3	59.2	25.4	84.6	102.3		
	Taguig	239.3	4.4	0.6	244.3	104.7	349.0	422.3		
Rizal	Antipolo	473.4	2.9	0.4	476.7	204.3	681.0	824.0		
	Cainta	140.5	3.6	0.5	144.6	62.0	206.6	250.0		
	Angono	26.6	2.4	0.6	29.5	12.6	42.2	51.0		
	Baras	4.0	0.4	0.1	4.4	1.9	6.3	7.7		
	Binangonan	46.6	4.1	1.0	51.8	22.2	74.0	89.6		
	Cardona	4.2	0.4	0.1	4.6	2.0	6.6	8.0		
	Jala-Jala	3.2	0.3	0.1	3.5	1.5	5.0	6.1		
	Morong	4.5	0.4	0.1	5.0	2.1	7.1	8.6		
	Pililla	6.1	0.5	0.1	6.8	2.9	9.7	11.8		
	Rodoriguez	37.0	1.3	0.2	38.5	16.5	55.0	66.5		
	San Mateo	48.1	1.7	0.2	50.0	21.4	71.5	86.5		
	Tanay	15.8	1.4	0.4	17.5	7.5	25.0	30.3		
	Taytay	65.1	2.1	0.3	67.4	28.9	96.3	116.6		
	Teresa	4.6	0.4	0.1	5.2	2.2	7.4	8.9		
(Common	Concession Are	a)								
NCR	Quezon City	497.1	244.6	62.3	804.0	344.6	1,148.5	1,389.7		
	Easdt	227.2	149.6	34.3	411.1	176.2	587.3	710.6		
	West	269.9	95.1	27.9	392.9	168.4	561.2	679.1		
	Manila	189.1	261.4	32.2	482.7	206.9	689.5	834.3		
	East	23.4	49.8	3.9	77.0	33.0	110.1	133.2		
	West	165.7	211.6	28.3	405.6	173.8	579.5	701.2		
	Makati	70.8	147.1	20.9	238.8	102.3	341.1	412.8		
	East	62.5	133.1	18.2	213.7	91.6	305.3	369.4		
	West	8.4	14.0	2.7	25.1	10.8	35.8	43.4		
	Total	3,596.4	1,081.9	207.7	4,885.9	2,094.0	6,979.9	8,445.7		
	East	1,751.5	569.6	92.0	2,413.2	1,034.2	3,447.4	4,171.3		
	West	1,844.8	512.2	115.7	2,472.8	1,059.8	3,532.6	4,274.4		

Table B4.12 Projected Water Demand by City/Municipality for Year 2025

Municipality		Average Capacity per Well $(x \ 10^3 \text{ L pd})$		Inflow (x 10^3 Lpd)		Potential Max.		Potental Well Capacity		
		SW DW		SW Area DW Area		SW DW		SW DW To		Total
Rizal	Angono	38.7	444.9	1,638	4,423	40	10	1.55	4.45	6.00
	Antipolo	54.7	591.8	9,644	10,391	180	20	9.85	11.84	21.68
	Baras		432	ŕ	4,424		10	0.00	4.32	4.32
	biniangonan	38.7	444.9	916	13,285	20	30	0.77	13.35	14.12
	Cainta	56.4	540	5,141	2,285	90	10	5.08	5.40	10.48
	Cardona		444.9		5,898		20	0.00	8.90	8.90
	Jala-Jala		444.9		9,320		20	0.00	8.90	8.90
	Rodoriguez	63.1	432	9,855	65,185	160	150	10.10	64.80	74.90
	Morong		432		7,108		20	0.00	8.64	8.64
	Pililla		673.9		13,970		20	0.00	13.48	13.48
	San Mateo	63.1	432	20,448	6,134	320	20	20.19	8.64	28.83
	Tanay		673.9		93,559		140	0.00	94.35	94.35
	Taytay	56.4	540	18,336	1,711	320	10	18.05	5.40	23.45
	Teresa		432		3,516		10	0.00	4.32	4.32
								65.58	256.77	322.35
Cavite	Cavite City	138.7		3,879		30		4.16	0.00	4.16
	Bacoor	53.6		8,219		150		8.04	0.00	8.04
	Imus	61.9		29.261		470		29.09	0.00	29.09
	Kawit	44.9		4,406		100		4.49	0.00	4.49
	Noveleta	43.2		1,841		40		1.73	0.00	1.73
	Rosario	43.2		1184		30		1.30	0.00	1.30
								48.81	0.00	48.81

 Table B4.13 Potential Well Capacity

(Source: Rapid Assessment of Water Supply Sources, May 1982, NWRB)