JAPAN INTERNATIONAL COOPERATION AGENCY
METROPOLITAN WATERWORKS AND SEWERAGE SYSTEM
THE REPUBLIC OF THE PHILIPPINES

STUDY ON WATER SUPPLY AND SEWERAGE MASTER PLAN OF METRO MANILA IN THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

VOLUME II
MAIN REPORT

FEBRUARY 1996

NIPPON JOGESUIDO SEKKEI CO., LTD.
TOHMATSU & CO.

EXCHANGE RATE (As of 1 August 1995)

US$ 1.0 = Peso 25.7 = Yen 88.3

JAPAN INTERNATIONAL COOPERATION AGENCY
METROPOLITAN WATERWORKS AND SEWERAGE SYSTEM
THE REPUBLIC OF THE PHILIPPINES

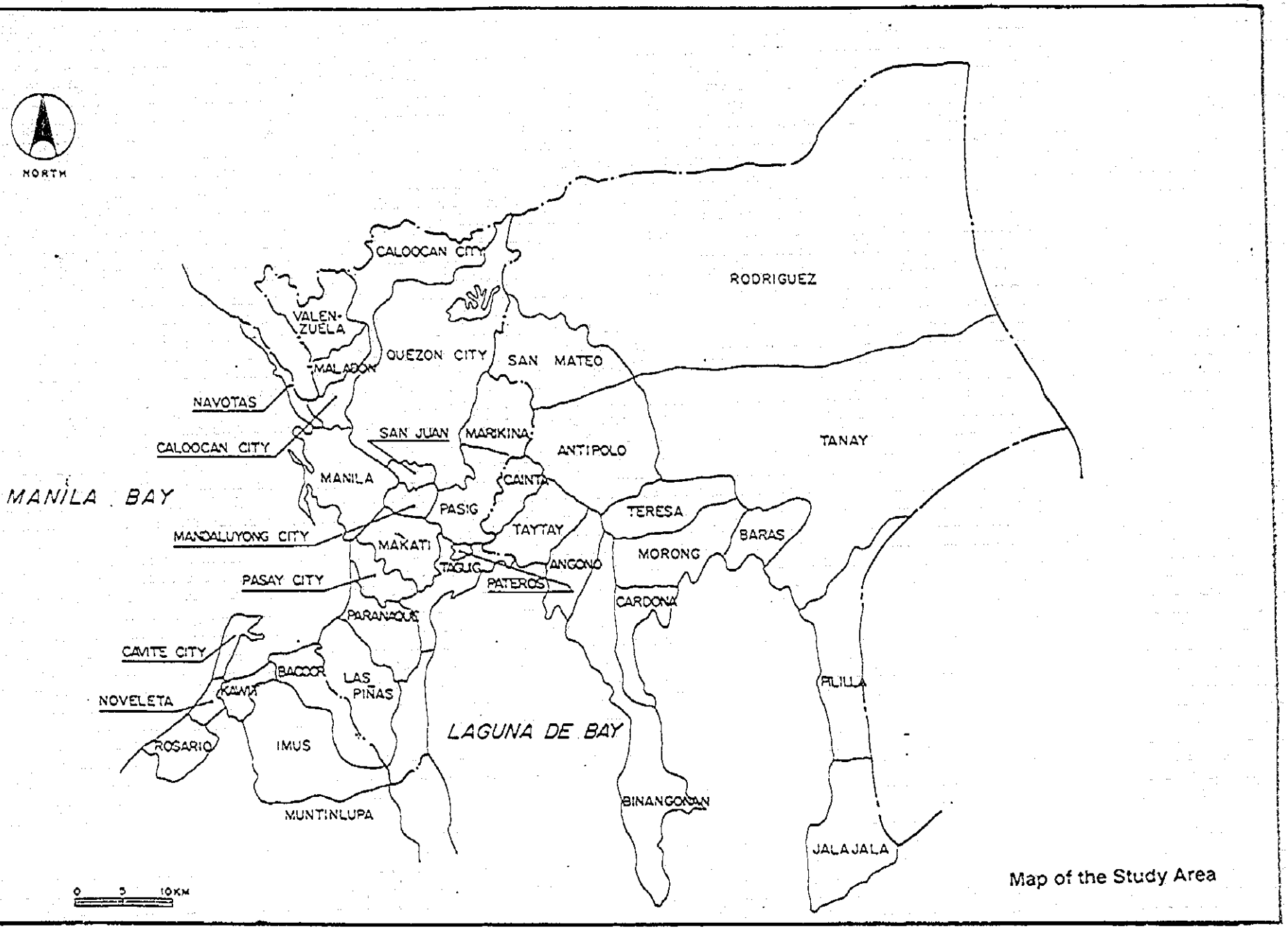
STUDY ON WATER SUPPLY AND SEWERAGE MASTER PLAN OF METRO MANILA IN THE REPUBLIC OF THE PHILIPPINES

FINAL REPORT

VOLUME II
MAIN REPORT

FEBRUARY 1996

NIPPON JOGESUIDO SEKKEI CO., LTD.
TOHMATSU & CO.



Map of the Study Area

STUDY ON WATER SUPPLY
AND
SEWERAGE MASTER PLAN OF METRO MANILA

FINAL REPORT
MAIN REPORT

Map of the Study Area

TABLE OF CONTENTS

Part II Water Supply

Part III Sewerage and Sanitation

Part IV Institution, Organization and Operations

Part V Financial Study

List of Tables

Page

Part I General

Chapter 2. Description of the Philippines and MWSS Service Area

Chapter 3. Project Framework

Part II Water Supply

Chapter 1. Review of Current Operation

Chapter 2. Master Plan

Chapter 3. Proposed Projects

Chapter 4. Evaluation

Part III Sewerage and Sanitation

Chapter 2. Review of Current Conditions

Chapter 3. Master Plan

Chapter 4. Proposed Projects

Chapter 5. Evaluation

Part IV Institution, Organization and Operations

Chapter 1. Introduction

Chapter 2. Review of Current Operation

Chapter 3. Strengthening Plan

Chapter 4. Proposed Projects

Chapter 5. Evaluation

Part V Finance

Chapter 3. Recommendations and Proposals

Chapter 4. Financing Scheme and Financial Projections

List of Figures

Page

Part I General

Chapter 3. Project Framework

Part II Water Supply

Chapter 1. Review of Current Operation

Chapter 2. Master Plan

Chapter 3. Proposed Project

Chapter 4. Evaluation

Part III Sewerage and Sanitation

Chapter 1. Introduction

Chapter 2. Review of Current Conditions

Chapter 3. Master Plan

Chapter 4. Proposed Project

Chapter 5. Evaluation

Part IV Institution, Organization and Operations

Chapter 2. Review of Current Operations

Chapter 3. Strengthening Plan

Chapter 4. Proposed Projects

Part V Finance

Chapter 2. Review of Operations

Chapter 4. Financing Scheme and Financial Projections

List of Abbreviations

Philippine Government Organizations:

barangay	Smallest administrative unit in the Philippines
BOI	Board of Investment
BSWM	Bureau of Soils and Water Management
COA	Commission on Audit
CSC	Civil Service Commission
DBM	Department of Budget and Management
DBP	Development Bank of the Philippines
DECS	Department of Education, Culture, and Sports
DENR	Department of Environment and Natural Resources
DOF	Department of Finance
DOST	Department of Science and Technology
DTI	Department of Trade and Industry
DPWH	Department of Public Works and Highways
EMB	Environmental Management Bureau
GOP	Government of the Philippines
HLURB	Housing and Land Use Regulatory Board
HSRC	Human Settlements Regulatory Board
HUDCC	Housing and Urban Development Coordinating Council
ICC	Investment Coordination Committee
LDPO	Local Development Planning Office
LFP	Locally Funded Project
LGU	Local Government Unit
LLDA	Laguna Lake Development Authority
LWUA	Local Water Utilities Administration
MGB	Mines and Geoscience Bureau
MMA	Metropolitan Manila Authority
MMDA	Metro Manila Development Authority
MWSS	Metropolitan Waterworks and Sewerage System
NAMRIA	National Mapping and Resource Information Authority
NEDA	National Economic and Development Authority
NEPC	National Environmental Protection Council
NHA	National Housing Authority
NHRC	National Hydraulic Research Center
NAPOCOR/NPC	National Power Corporation
NIA	National Irrigation Authority
NSO	National Statistics Office
NSCB	National Statistical Coordination Board
NWRB	National Water Resources Board
PCUP	Presidential Commission for the Urban Poor
PEA	Public Estates Authority
PIA	Public Information Agency
PID	Public Information Department
PHO	Public Health Office
PNR	Philippine National Railways
PPDCO	Provincial Planning and Development Coordination Office

PWWA	Philippine Waterworks Association
UP	University of the Philippines

Other Organizations:

AWWA	American Waterworks Association
ACI	American Cement Institute
ADB	Asian Development Bank
ASTM	American Society for Testing & Materials
IBRD	International Bank for Reconstruction and Development
ISO	International Standard Organization
JICA	Japan International Cooperation Agency
OECF	Overseas Economic Cooperation Fund
UNICEF	United Nations Children's Fund
WB	World Bank

Other Abbreviations:

AWSOP	Angat Water Supply Optimization Project
EMS	Environmental Management Strategy
FAP	Foreign Assisted Project
GOCC	Government Owned and Controlled Corporations
FAWSP	Fringe Areas Water Supply Project
GWD-MWSPII	Groundwater Development - Manila Water Supply Project II
IEPC	Industrial Efficiency and Pollution Control
LFP	Locally-funded Project
MAC	MWSS Action Center
METROSS	Metro Manila Sewerage and Sanitation Project
MMREIS	Manila Metropolitan Region Environment Improvement Study
MMWDP	Metro Manila Water Distribution Project
MRWDNP	Manila Renovation for Water Distribution Network Project
MSSP	Manila Sewerage and Sanitation Project
MSWDP	Manila South Water Distribution Project
MWSP II	Manila Water Supply Project II
MWSP III	Manila Water Supply Project III
MWSRP I	Manila Water Supply Rehabilitation Project I
MWSRP II	Manila Water Supply Rehabilitation Project II
NAWASA	National Waterworks and Sewerage Authority
NCR	National Capital Region
PROGRESS	Program to Reduce and Eliminate Sewage from the Streets
PRRP	Pasig River Rehabilitation Project
STAMP	Septic Tank Maintenance Program
UATP	Umiray-Angat Transbasin Project

Technical Terms:

AC	Asphaltic Concrete/Asbestos Cement
APC	Accredited Plumbing Contractor
BCR	Benefit/Cost Ratio
BOD, BOD5	Biochemical Oxygen Demand (5 days)
BOT	Build-operate-and-transfer
CDS	Central Distribution System
CERA	Current Exchange Rate Adjustment
CI	Cast Iron, Grey
CIF	Cost, Insurance and Freight
Cl	Chloride Ion
CMP	Change Management Program
COD	Chemical Oxygen Demand
COO	Chief Operating Officer
CPI	Consumer Price Index
DA	Deputy Administrator
DB	Data Base
DF/R	Draft Final Report
DO	Dissolved Oxygen
ECC	Environmental Compliance Certificate
EIRR	Economic Internal Rate of Return
EIS	Executive Information System
EO	Executive Order
EUC	End User Computing
F	Full Charge
FIRR	Financial Internal Rate of Return
forex	Foreign Exchange
F/R	Final Report
F/S	Feasibility Study
FY	Fiscal Year
FYE	Fiscal Year End
GDP	Gross Domestic Product
GI	Galvanized Iron
GIS	Geographic Information System
GNP	Gross National Product
GRDP	Gross Regional Domestic Product
GPP	Gross Provincial Product
HRD	Human Resources Development
IA	Implementing Arrangement
ICG	Internal Cash Generation
IC/R	Inception Report
ILA	International Lending Agency
IRR	Implementing Rules and Regulations
ISP	Integrated System Plan/ Information System Plan
IT	Information Technology
IT/R	Interim Report
IRR	Internal Rate of Return
JV	Joint Venture
LO	Letter Order
M/M	Man-months
M/P	Master Plan

MPN	Most Probable Number
MSA	MWSS Service Area
MSL	Mean Sea Level
MORE	Motivation by Resource and Evaluation
M&E	Monitoring and Evavluation
NCR	National Capital Region
NPV	Net Present Value
NRW	Non-Revenue Water
ODA	Official Development Assistance
O & M	Operation and Maintenance
P	Partial Charge
p.a.	Per Annum
PBX	Private Branch Exchange
pH	pH Value
PUPA	Philippine Urban Poor Analysis
PVC	Polyvinyl Chloride
R.A.	Republic Act
RO	Requisition Order
ROR	Rate of Return
R&D	Research and Development
SDA	Senior Deputy Administrator
SDR	Special Discount Rate
SIG	Special Interest Group
SOP	Standard Operating Procedure
TOR	Terms of Reference
UDHA	Urban Development and Housing Act
WACC	Weight Average Capital Cost

Units of Measurement:

baud	baud rate	Data transmission rate
°C	degree Celsius	Temperature Unit
cm	centimeter	Length Unit
d	day	Time Unit
g	gram	Weight or Mass Unit
ha	hectare	Area Unit
h	hour	Time Unit
HP	horsepower	Power Unit
Hz	hertz (cycle per second)	Frequency Unit
kg	kilogram	Weight Unit
km	kilometer	Length Unit
km^2	square kilometer	Area Unit
kV	kilovolt	Electrical Potential Unit
kW	kilowatt	Power Unit
kWh	kilowatt-hour	Energy Unit
l	liter	Volume Unit
m	meter	Length Unit
mm	millimeter	Length Unit

m/sec	meter per second	Velocity Unit
m^2	square meter	Area Unit
m^3	cubic meter	Volume Unit
m^3/s	cubic meter per second	Flow Rate
m^3/d	cubic meter per day	Flow Rate
MGD	million gallon per day	Flow Rate
Ml/d (MLD)	million liter per day	Flow Rate
m^3/min	cubic meter per minute	Flow Rate
$m^3/m^2/d$	cubic meter per square meter per day	Surface Loading
$m^3/m/d$	cubic meter per meter per day	Overflow Rate
mg	milligram	Weight or Mass Unit
mg/l	milligram per liter	Density Unit
P	peso	Philippine national currency
rpm	revolution per minute	Angular Velocity
s	second	Time Unit
yr	year	Time Unit

Part I

General

Chapter 1.

Introduction

Part I General

Chapter 1. Introduction

1.1 Authorization

The Study on the Master Plan of the MWSS's long-range strategy is in pursuance of the Implementing Arrangement, signed on April 15, 1994, between the Metropolitan Waterworks and Sewerage System (MWSS) and Japan International Cooperation Agency (JICA). JICA has organized a study team ("the Team") consisting of experienced specialists in the fields required in the study.

The Study started at the beginning of November 1994, and was completed by the end of January 1996. This Final Report compiles the results of the studies during the period from November 1994 to January 1996.

1.2 Background

The Republic of the Philippines is home to some 68 million people, 16 % of whom live in and around the capital of Manila. As with many of the other countries in the region, the main urban center of the Philippines (the Metropolitan Manila area) is suffering from an increasing population (2.41 % average annual growth rate) while its infrastructure is straining to meet the current demand placed on it by the existing populace. By the year 2015, the population of the area is projected to grow to 15.8 million people, further adding to the demand for infrastructure services.

The water supply in Metro Manila was established in 1878 by the found of Don Francisco Carriedo y Peredo in 1878 as shown in "Brief History of Manila's Water Supply", Supporting Report. Currently, water and sewage services are supplied to the populace of the Manila area by the Metropolitan Waterworks and Sewerage System (MWSS). The service area of MWSS covers 2,110 km^2, encompassing eight cities and 29 municipalities the National Capital Region (NCR), Cavite Province and Rizal Province. MWSS provides water supply to roughly 59 % of the people in the NCR, 32 % in Cavite Province and 16% in Rizal Province with water. MWSS

operates sewerage systems for about one million people, or 11% of the residents of the Metro Manila Region.

The seriousness of the difficulty facing MWSS is such that it was deemed best that a comprehensive study be conducted.

1.3 Objectives of the Study

The objectives of the study are as mentioned below:

(1) To establish the development strategy on expansion of service areas as well as quality improvement for water supply, sewerage and sanitation.

(2) To study how the MWSS (the implementing agency) should carry out efficient water supply, sewerage and sanitation services, and to establish strategies for strengthening the organization and management.

(3) To transfer the technology and expertise related to the relevant planning and strategic development to the MWSS.

In addition to the objectives outlined above, the Study adheres to the following general points:

- To follow a macro-level versus a micro-level approach. It is important in a study of this scale that the larger issues be considered as the primary effort. In so doing, the medium and long-range goals of the MWSS can best be served.
- To base the recommendations of the Study on a realistic approach. It is important that practical application be stressed so that the recommendations of the Study be put into practice rather than on a bookshelf.
- To review the Master Plan on a regular basis. The projections and assumptions contained in the Study must be examined and if necessary modified to ensure that they accurately reflect the actual conditions in the Study Area.

1.4 Study Area

The study area will cover the following eight cities and twenty nine municipalities in Metro Manila, Cavite and Rizal Province under the jurisdiction of the MWSS.

(1) National Capital Region (NCR)

Cities (7)

Manila, Pasay, Quezon, Caloocan, Mandaluyong, Pasig, Makati

Municipalities (10)

Las Pinas, Malabon, Marikina, Muntinlupa, Navotas

Paranaque, Pateros, San Juan, Taguig, Valenzuela

(2) Province of Cavite

City (1)

Cavite

Municipalities (5)

Bacoor, Imus, Kawit, Noveleta, Rosario

(3) Province of Rizal

Municipalities (14)

Angono, Antipolo, Baras, Binangonan, Cainta, Cardona, Morong,

Jala-jala, Pililla, Rodriguez, San Mateo, Tanay, Taytay, Teresa

1.5 Target Year

The project target is to develop a master plan to serve the water demand up to the year 2015 of the entire MWSS jurisdiction as well as to develop a practicable master plan of sewerage and sanitation systems.

1.6 Study Team Organization

Based on a mutual understanding between JICA and MWSS that the Study will be undertaken with close coordination of both parties. MWSS created the Steering Committee as well as Counterpart Team soon after the commencement of the Study in the Philippines. Since then, vital assistance has been provided to the Study Team by all the department of MWSS related to the Study.

JICA Advisory Committee

1.	Mr. Hidenori Aya	Chief, Advisory Committee Ph. D, Prof., Musashi Institute of Technology

2.	Mr. Sadao Nagaoka	Member, Public Corporation Management Ph.D, Prof., Seikei University
3.	Mr. Osamu Ikeda	Member, Water Supply Planning Chief Engr., Southern Fukuoka Water Supply Authority
4.	Mr. Hirofumi Okahisa	Member, Sewerage Planning Manager, Research and Technology Development Division, Japan Sewage Works Agency
5.	Mr. Shigeo Kanai	Member, Sewerage Planning Senior Counselor, Infrastructure Development Institute - Japan (After Stage III, replaced by Mr. Okahisa)

JICA Study Team

	Name	Position
1.	Toru Hayashi	Team Leader
2.	Takashi Kawabe	Public Corporation Management
3.	Yoshihiko Sato	Water Supply Planning (1)
4.	Masanobu Ishioka	Water Supply Planning (2)
5.	Satoshi Omoto	Sewerage/Sanitation Planning
6.	Kenji Hiramatsu	Organization Management (1)
7.	Toru Suetake	Organization Management (2)
8.	Kunio Kishino	Financial Management
9.	Arsenio J. Vistro	Laws & Regulations/Socioeconomics
10.	Masaharu Kina	City Planning
11.	Elmer E. Escoto	Water Quality/Environment
12.	Toshihiro Hanyu	Coordinator

MWSS Steering Committee

	Name	Position
1.	Mr. Eduardo M. Del Fierro	Chairman, Sr. Deputy Administrator
2.	Mr. Leovigildo S. Veroy	Member, DA for Engineering
3.	Ms. Macra A. Cruz	Member, DA for Construction
4.	Mr. Alfredo U. Tirante	Member, DA for Administration
5.	Ms. Loida S. Dino	Member, DA for Customer Service
6.	Mr. Gregorio N. Garcia	Member, Acctg. DA for Finance
7.	Mr. Nestor C. Fernando	Member, Acctg. DA for Operations
8.	Mr. Rolando E. Roca	Resource Person, Manager, PPD

MWSS Counterpart Team

	Name	Sector Involved	Position	
1.	Graciano B. Calayan, Jr.	Project Coordinator	Div. Manager.,	PPD
2.	Alfredo C. Abalos, Jr.	Asst. Proj. Coordinat'r	Principal Engr. A,	PPD
3.	Senen S. Dizon	Water Supply	Principal Engr. C,	PPD
4.	Evangeline B. Dacanay	Water Supply	Principal Engr. A,	PPD
5.	Edgardo Q. Esteban	Sewerage	Department Mgr.,	SSD
6.	Beneleo A. Fontanilla	Sewerage	Utilities Services Officer,	SSD
7.	Romeo P. Austria	Sewerage	Sr. Utilities Services	

			Officer,	SSD
8.	Rodrigo O. Yabut	Facility Management	Chief, Utilities Services	WSTD
9.	Amparo C. Canamo	Water Quality/Env't.	Chief Chemist,	WSTD
10.	Marietta G. Flores	City Planning	MIS Development Chief B,	PPD
11.	Merilyn O. Ortha	City Planning	Chief Economist	PPD
12.	Ma. Asuncion J. Bandiola	Organization Mgt./ Public Corp. Mgt.	IRD Chief,	HRDD
13.	Cristina A. Aguilar	Socioeconomics	Sr. Economist,	PPD
14.	Allan M. Mendoza	Socioeconomics	Administrative Services Officer	UATP
15.	Noel M. Angeles	Laws & Regulations	Sr. Corp. Atty.	LD
16.	Rolando C. Pulido	Customers Service	Acctg. Tech'l. Asst.	ODACS
17.	Philip E. Cases	Financial Mgt.	Division Manager	CORPLAN
18.	Basilisa P. Celso	Financial Mgt.	Sr. Corp. Budget Analyst,	FCBD

1.7 Organization of the Report

The Study has been conducted through the five stages as shown below. As a result of the study, Progress Report (1), Interim Report, and Progress Report (2) were prepared and submitted during Stage I, II, III, and IV.

Stage I	:	Review of present state
Stage II	:	Projection and set up of planning frame
Stage III	:	Establishment of corporate direction and strategy
Stage IV	:	Development of master plan
Stage V	:	Formation of projects

This Draft Final Report deals with the whole result of the study including the results of Stage V, Formulation of Projects., based on the previous studies during Stage I, II, III, and IV. It consists of five parts; Part I "General" , Part II "Water Supply", Part III "Sewerage/Drainage and Sanitation", Part IV "Institution, Organization and Operation", and Part V "Finance".

In addition, the following reports are prepared.

Summary Report (Volume I)

Supporting Report (Volume III)

Data Report (Volume IV)

The Summary Report presents the essential results of the whole Study which is extracted from the Main Report. Details are discussed in the Supporting Report in supplement to the main report. Further, data referred to the Main and Supporting Reports are summarized in the Data Report.

Chapter 2.

Description of the Philippines and MWSS Service Area

Chapter 2. Description of the Philippines and MWSS Service Area

The Philippines lies 966 kilometers off the southern coast of Asia, between latitude 4°23'N and 21°25'N and between longitude 116°E and 127°E. The archipelago is bounded in the west by the South China Sea, Pacific Ocean in the east, Sulu and Celebes seas in the south, and the Bashi Channel in the north.

The Philippines is composed of 7,107 islands, and the total land area is approximately 300,000 square kilometers, 92.31 % of which is contained within the largest islands named as follows: Luzon the biggest island, Mindanao, Samar, Negros, Palawan, Panay, Mindoro, Leyte, Cebu, Bohol and Masbate.

The Study Area lies on the southeast periphery of the Central Luzon Plain, which is bounded by the Sierra Madre in the east, the Luzon Upland in the south, and Manila Bay and the Zambales Range in the west. Its location is favorable since it is protected from typhoons or heavy winds with mountain ranges in the east and west and the alluvial soil is not sufficiently thick which makes it rather safe from earthquake.

2.1 Natural Conditions

2.1.1 Topography

The Study Area is made up of three basic geological formations; the Guadalupe Plateau, the Coastal Margin, and the Marikina Valley. The highest mountain is Mt. Pulog (2,930 m) near Baguio in Luzon.

The Study Area is relatively flat with elevation from 0 to 70 meters along the Laguna de Bay shores and sloping gently to steeply along the Sierra Madre range.

The Sierra Madre Mountain Range is characterized by a predominantly youthful topography. Extremely rugged and deeply dissected, the slopes are commonly highly precipitous and the ridges prevalently thin and sharply truncated. Prominent mountain peaks rise above the valley to elevations exceeding 600 masl.

In sharp contrast with the rugged Sierra Madre Mountains is the topographically subdued Central Luzon Plain which lies west of the Study Area and through which the lower stretches of the Marikina River System discharges. Characterized by broad, extremely flat to rolling topography, it truncates the western fringes of the Sierra Madre Range.

To the east of the Guadalupe Plateau is the Marikina Valley, a broad alluvial plain formed as a result of river deposition. The Laguna lowland is a marginal strip of flat land south of the Marikina Valley, along the western shore of the Laguna de Bay. Its physiographic character is similar to that of the Marikina Valley and the Coastal margin.

The Coastal margin comprises a relatively flat strip of land flanking Manila Bay. It is about 30 kms long, with a maximum width of six kms along the Pasig River and a minimum width of one kilometer at its southern end. Its urban area has an elevation range of 1.8m to 10m above mean sea level and slopes ranging from 0 to 1%.

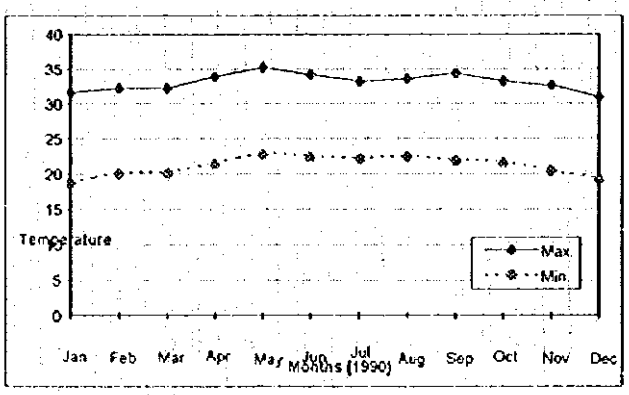
2.1.2 Meteorology

The Philippines has a tropical to semi-tropical climate with a hot dry season and a hot wet season. The Study Area climate is characterized by these two distinct seasons. The dry season from about November to April coincides with the north-east monsoon; and the wet season from about May to October coincides with the south-west monsoon. The warmest days are usually in April and May, while the coolest days are usually in December and January.

Table 1.2.1 Average Maximum and Minimum Temperature by Month in Luzon

Month	Maximum	Minimum
Annual Average	33.1	21.1
January	31.6	18.7
February	32.3	20.0
March	32.3	20.1
April	33.9	21.4
May	35.3	22.7
June	34.2	22.4
July	33.2	22.1
August	33.6	22.4
September	34.4	21.9
October	33.3	21.6
November	32.6	20.4
December	31.0	19.3

(Note) Unit: Degree Celsius
Source: NSO, The Philippine Yearbook in 1992



The average monthly temperature is about 27°C. January is the coldest month with an average temperature of 25.2°C, while May is the warmest at 29.0°C.

The wind climatology in the Study Area is described by three distinct synoptic wind regimes. During the months of June to August (southwest monsoon season), the prevailing wind is from the southwest bringing a deep warm layer of moist air mass. From December to January, the northeast monsoon prevails, and a cold dry air mass blows over the Study Area from the northeast. During the transition months, the monsoon winds die out and the easterlies prevail. However, Port Area Meteorological Station wind data shows that the easterly winds are modified by diurnal mesoscale circulation, such as land and sea breezes.

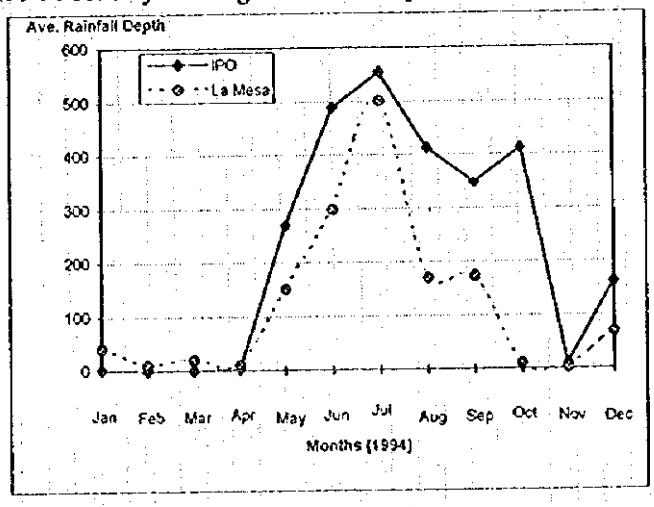
The monthly rainfall measured at the Ipo and La Mesa Dam sites, main watershed areas of the Angat-Novaliches Water Supply System is shown in Table 1.2.2. As shown, annual rainfall are 2,664.7 and 1,463.14 mm at the Ipo Dam site and the La Mesa Dam site, respectively.

About 90 % of the annual rainfall occurs during the wet months, May to October, and evapo-transportation generally exceeds rainfall during the dry months, November to April. The estimated annual average pan evaporation in the Study Area is about 1,470 mm.

Table 1.2.2 1994 Monthly Average Rainfall Depth

Month	IPO	La Mesa
January	1.70	41.90
February	0.00	10.54
March	0.00	20.60
April	3.60	10.70
May	269.90	151.40
June	489.10	299.00
July	554.00	501.00
August	413.50	170.80
September	348.10	173.60
October	412.50	10.70
November	10.30	3.80
December	162.00	69.10
Total	2,664.70	1,463.14

Source:: MWSS



2.1.3 Hydrogeology

The country has roughly 59 lakes including Laguna de Bay, and around 132 rivers. Major rivers are the 353 kilometer Cagayan River, the Agno River and the Pampanga River, all located in Luzon.

In the MWSS service area, there are four major rivers, the Pasig River, which flows through the center of the city from east to west, the Angat River, located in the north, the Paranaque River and Dongalo River located in the south. The Pasig River connects with the Marikina River in upper stream. The Paranaque River connects with the Dilain Creek and the Maricaban Creek.

Tectonism and volcanism, together with large relative sea-level changes during the late Tertiary and quaternary have produced the complex geological sequence underlying the Study Area.

The north-south trending graben forming the Marikina Valley occurs along the eastern margin of the Study Area. The Guadalupe Formation is exposed together with older basement rocks, which form a barrier to the groundwater flow westward, on the Antipolo Plateau east of the graben. Alluvium overlies the downfaulted Guadalupe Formation within the Marikina graben, which forms the western part of Laguna de Bay. A prominent scarp associated with the Marikina and other minor faults, forms the western side of the valley and extends from the eastern side of Quezon City to the western margin of Laguna de Bay. The Guadalupe Formation outcrops through much of the hilly area on the western side of the scarp and extends westward beneath the coastal plain and Manila Bay. Alluvium overlies the Guadalupe Formation on the coastal plain and beneath Manila Bay.

The alluvium is largely derived from the Guadalupe Formation and is difficult to distinguish from it in the Manila Bay area. These formations together are considered to form the Manila Bay Aquifer System, which underlies almost the entire Study Area. The Manila Bay Aquifer System is a multi-layered aquifer with highly variable hydraulic properties not vertically and laterally due to the variation in thickness and extent of individual layers. Indirect evidence, based on lithology and water quality data, suggests that the aquifer is anisotropic and semi-confined. Generally, the vertical permeability is probably much lower than the horizontal permeability. However, the magnitude of the difference is uncertain.

2.2 Social Conditions

2.2.1 Literacy

Literacy rate is the proportion of literates to the total population in a given group. The literacy rate of private household population 10 years old and over increased from 82.7 % in 1980 to 89.8 % in July 1989. National Capital Region (NCR) posted the highest literacy rate of 98.1 %, whereas in Central Mindanao, literacy rate was only 78.3 %.

2.2.2 Public Hygiene

The Department of Health (DOH) is responsible for public health, preventive, curative and rehabilitative programs, medical care, health and medical education services.

Statistics show that in 1990, the number one cause of morbidity is bronchitis at a rate of 1,215 per 100,000 persons followed by diarrhea at a rate of 1,520.7. Influenza and pneumonia ranked 3rd and 4th, respectively. Another cause of morbidity related to water and sanitation is malaria at a rate of 69.2. Diarrheal diseases are attributable to poor sanitation and undesirable health behavior, while malaria is mainly due to poor drainage, leaving stagnant pools of water, and indiscriminate disposal of water containing materials in which vectors breed.

The general health status of the populace in the province was relatively fair compared with the national condition taking into account the incidences of diseases.

2.2.3 Solid Waste Administration

(1) Administration

In compliance with the Local Government Code, the local governments have become more responsible for the collection and disposal of garbage. In the Metro Manila area, it is the Metropolitan Manila Authority or MMA which handles the matter of solid waste. The persistent institutional problem of garbage collection in Metro Manila is further aggravated by the following factors: a) lack of recognition on the importance of waste management; b) low budget; and c) lack of discipline among the populace.

(2) Existing Conditions

It is estimated that a total of 4,675 tons of garbage are generated per day in Metro Manila alone. Of the garbage generated, the MMA reported that 77 % was collected by the government in 1990, and the rest was dumped into the esteros and rivers or burned or recycled. This dumped garbage causes water pollution, clogging of drainage system and degradation of town aesthetics.

As of September 1994, two open dumping stations, one transfer station, and two sanitary landfill sites were in operation. The transportation of garbage from Manila to the Carmona Sanitary Landfill site is scheduled for effective transshipment at the transfer station in Las Pinas. However, garbage is still unofficially dumped in the Balut area, called Smokey Mountain, due to the shortage of transshipping facilities in the Transfer Station. Both the Carmona Sanitary Landfill site, which occupies an area of 65 ha., and the San Mateo Sanitary Landfill site, which occupies an area of 45 ha., are presently under transitory operation until the detailed design and environmental impact assessment are completed. Their existing capacities are nearing their maximum and expansion is urgently recommended.

(3) Solid Waste Management Plan in Metro Manila and National Policy

In 1988, the Presidential Task Force issued two volumes on solid waste in Metro Manila: 1) Solid Waste Management for Metro Manila, and 2) Program for Scavengers. The main concept of the report is summarized in two points: One is the construction of two sanitary landfill sites in the suburbs of Metro Manila instead of closing all open dumping sites. The second component is the construction of five transfer stations for effective garbage collection and transportation to two disposal sites. The second volume of the report includes provision of welfare to the scavengers living around the existing open dump sites. The management plan has been put into concrete shape gradually by the PTF in cooperation with the MMA.

In 1993, in response to a Presidential request, the PTF submitted the "Integrated National Solid Waste Management System Framework" with the appreciation of the DENR-EMB, and it was approved by the President. The framework plan includes: a) background on solid waste management; b) the Metro Manila SWM situation and over-all observation/analysis; c) Integrated Framework Plan; and d) Recommendations for Presidential Action.

In the review of the Metro Manila situation, the following problems are pointed out: 1) Need for continuous provision of funds for O & M work, 2) No environmental/sanitation standard for the collection and disposal of garbage, 3) No effort or minimal effort to reduce garbage at source, 4) Need for strengthening the system by clarifying institutional authorities, 5) No reasonable collection fee setting, 6) No single body with capability to set up technical standards; and 7) Need for a recognized legitimate land use.

2.2.4 Pollution Control

Water quality is regularly checked only in the Metro Manila Region (MMR). Outside MMR, limited water data could be obtained such as for Mactan Channel and major rivers in Cebu Province as part of the sewerage program for the Central Visayas Urban Project. Based on the data received by DENR-EMB, there were only 27 rivers and 4 beaches that were monitored/sampled in the year 1990 and 6 beaches, 3 bays and 70 rivers in 1991. Water quality parameters measured are DO, BOD, pH, temperature, solids, color, heavy metal ,etc.

During the period of 1972 to 1982, the former NPCC (now DENR-EMB) established a monitoring program for some rivers and lakes. The plan called for yearly and semestral sampling of major rivers and monthly sampling of Metropolitan Manila river. After the reorganization, constricted budgets have constrained sampling to less frequent intervals on a few selected rivers nationwide. However some water quality management projects have built-in monitoring activities like Pasig River Rehabilitation Project and River Revival Program (Ilog Ko Irog Ko Project). As to the Laguna Lake sampling has been done twice a month in the main point of the lake. Manila Bay has been monitored regularly under the Manila Bay Monitoring Program specifically the influence of the MWSS outfalls as well as determining the degree and extent of pollution in the bay.

For the whole country, about 10,660 tons of BOD are generated daily, 48 % coming from industries, 29 % from domestic wastewater, 16 % from garbage, and the rest from other sources. In the industrial sector, the livestock and poultry industry is the main generator in terms of BOD which accounts for about 90 % and in terms of nitrogen-about 98 %. In terms of suspended solids, the mining industry tops the list of generators with a contribution of 98 %. Mining industries both large scale and small scale also discharge toxic elements into the environment.

Regarding the MMR, pollution loading estimated by World Bank consultant showed that about 800 tons of BOD which is a measure of pollutional strength of organic matter are generated every day in Metro Manila in 1992. Of this load, 40 % is from domestic wastewater, 38 % from industrial source and 22 % due to solid wastes, mostly garbage. For industrial sources, the top 3 contributors of organic pollution in Metro Manila accounting for about 90 % of the industrial loading are the food processing, piggery and beverage production industry.

2.2.5 Housing

(1) Housing Statistics

The number of housing units in 1990 totaled 11.40 million in the country, an increase of 30.11 % from the 1980 figure of 8.76 million. Southern Tagalog region registered the highest number of housing units (1.60 million), 96.70 % of which 1.54 million were occupied and the remaining 3.30 % were vacant. The NCR was second with 1.48 million housing units. Compared to other regions of the country, only these two regions and Central Luzon (outside of the Study Area) reached the millionth mark.

As of 1990, the total number of dwelling units in the study area was about 1.7 million units. Out of this total, 84.1 % or 1,435,365 units are situated in the NCR, 10.6 % or 181,302 units in Rizal, and 5.3 % or 89,661 units in Cavite.

(2) Slum Areas

The alarming rate of rural to urban migration results to further deterioration of the housing sector. Rural-to-urban migration in 1990 accounted for the movement of some 1.2 million persons across the region. Of this number, in-migration to the NCR was the highest at 33 %, or approximately 396,000 persons for that year alone. There is also the perception of better employment opportunities in urban areas. However, the unemployment rate in urban areas for 1992 of 11.5 % is worse than that of the rate in rural areas which is only 6 % for the same year. As a result, urban centers have higher unemployment rates because there are more people than jobs. Urban centers have more homeless families because they cannot afford decent and legitimate housing without being gainfully employed.

The problem is compounded by the scarcity of inexpensive land and the negative stance held by the private sector to venture into low-cost housing. Table 1.2.3 shows that the magnitude of

squatter families increased dramatically. 1990 data reveals that there are a total of 309,484 squatter families in the NCR. Manila has the most number of squatter families totaling 68,187 families while San Juan has the least with 1,178.

Table 1.2.3 List of Slum Areas and Number of Squatter Families in the NCR (1990)

City/Municipality	No. of Slums	Slum Population	No. of Families (*)
1. Manila	83	545,496	68,187
2. Quezon City	74	516,000	64,500
3. Kaloocan City	28	226,559	28,320
4. Las Piñas	61	37,578	4,697
5. Makati	19	81,612	10,202
6. Malabon	40	73,374	9,172
7. Mandaluyong	10	108,380	13,548
8. Marikina	25	61,692	7,712
9. Muntinlupa	55	141,540	17,690
10. Navotas	14	102,714	12,839
11. Parañaque	102	76,776	9,597
12. Pasay	27	266,220	33,278
13. Pasig	16	100,688	12,586
14. Pateros	4	25,530	3,191
15. San Juan	4	9,420	1,178
16. Taguig	12	49,614	6,202
17. Valenzuela	4	52,682	6,585
TOTAL	578	2,475,875	309,484

Source: Presidential Commission for the Urban Poor
(*) It was assumed 8 persons per family

The clamor for home ownership and security of tenure has continuously been increasing in the NCR. It is estimated that about 60% of Filipino households do not own the houses they live in, while 22% do not have tenure over the land on which their houses are built.

2.2.6 Industry

The industry sector plays a vital role not only in regional economy but within the country as well. Industry continued to be the biggest contributor to the GRDP from 37.5 % in 1987 to 40.8 % in 1991. In the Study Area, the industry sector is composed of the following sub-sectors: manufacturing, construction, electricity, gas and water.

NCR and Region IV are more industrialized compared to the other regions in the country. Despite its relatively high share, Region IV would have been more industrialized if the industry was not over-concentrated in Metro Manila but distributed in such a way that it would have reflected the regional distribution of resources and demand patterns.

While investments are discouraged in the NCR in view of the industry dispersal thrust, the government supports the establishment of special estates in resettlement areas in the region. Manpower development programs have been implemented to encourage investments in resettlement areas particularly in regions outside of NCR.

At present, there are 17 major industrial estates within 35 km radius from Manila. Of the total, 9 are located in the Study Area, distributed as follows: 6 in NCR (Taguig (3), Caloocan (2) and Navotas (1)), 2 in Cavite (Rosario and Imus), and 1 in Rizal (Antipolo). Besides the industrial estates, many small and medium scale industries are scattered throughout the MWSS service area.

The present location of large industries contiguous to Metro Manila does not serve the government's objective of industrial decentralization. More emphasis should be given on locating industries in areas separated from Metro Manila.

Being part of the National Industrial Core Region, the growth of industry in the Study Area will largely reflect overall national trends. Government efforts to restructure the industry and maintain export growth will have a direct bearing on the development of Cavite and Rizal.

2.2.7 Transportation

(1) General Outline

There are four main transport systems in the Philippines, namely:

a. Road Transport

The road transport is the main transport system in the country and accounts for about 65% of the total domestic freight traffic and 90% of the total domestic passenger traffic. The system component is composed of train and motor vehicle fleets, such as bus, jeepney, taxi and others, which cater to passenger and freight movement around country.

b. Rail Transport

The country has two railway system lines: the Philippine National Railway (PNR) in Luzon and the Light Rail Transit (LRT) system in Metro Manila.

c. Sea Transport

Since the country is composed of many islands, it is largely dependent on water transportation in moving people and goods from one place to another. The sea transport is the complementary system for the road transport, and carries the majority of inter-island traffic. Sea transport handles 35% of the total freight and 7% of the passenger traffic.

d. Air Transport

The air sector handles some inter-island and virtually all the international passenger traffic.

(2) Road Network

Road network development is an important factor for future growth trends and to plan water supply, wastewater systems and drainage.

a. National Road Network

The Bureau of Maintenance under the Department of Public Works and Highways (DPWH) is responsible for the construction and maintenance of roads and bridges in the country. As of 1990, the existing road network reached 160,560 km, of which 55.03 % were barangay roads, 18.16% provincial roads, 16.36 % national roads, 7.98 % municipal roads and 2.46 % city roads. A large portion (80.31 %) of the country's road network was made of gravel. Other road surface types include asphalt (7.94 %), concrete (6.45 %) and earth (5.29 %).

b. Study Area Road Network

The road network in the Study Area consists of about 4,400 km. as of 1990. The major road network pattern consists of radial and circumferential roads, which are expanded from Metro Manila towards the suburban areas of Bulacan (north), Rizal (east) and Cavite (south), taking a radial shape development with center point in Manila City.

c. Major Proposed Transport Projects

The expressway will provide a higher type of transport facility within the NCR and towards the province of Cavite with the construction of C-5 and the Manila-Cavite expressways, and improve the accessibility of the Ninoy Aquino International Airport from the Coastal Road and

South Luzon Expressway. The Manila-Cavite expressway will help alleviate the traffic congestion on the major but narrow roads within its zone of influence and at the same time play an important role in promoting economic development in the area as it will provide a direct linkage between Manila and the Export Processing Zone in Cavite (CEPZ).

2.2.8 Electric Power

(1) Power Supply in the Study Area

In the Study Area, power is supplied by NPC at 115 kv or 230 kv and is distributed by Manila Electric Company (MERALCO), the biggest customer of NPC. The MERALCO service area covers a total area of 8,813 km2 comprising the whole NCR, Rizal, Cavite and Bulacan, portions of Laguna and Quezon. Thus, majority of the power produced by NPC on the Luzon Grid is bought and distributed by MERALCO.

On the electric energy generated/consumption, the industrial sector accounted for the biggest consumption share of 37.77 %, followed by the residential sector (21.31 %) and commercial sector (17.83 %).

2.3 National Economy

2.3.1 General Conditions

The following table shows major economic indicators for the past five years:

Table 1.2.4 Major Economic Indicators for the Philippines

Indicators		1990	1991	1992	1993	1994	Average Growth
Population (millions)		62.0	63.7	65.3	67.0	68.6	2.6%
Inflation		14.2%	18.7%	8.9%	7.6%	9.0%	
Forex rate vs. US dollar		28.00	26.65	25.29	27.74	24.56	
GDP (P billion):							
Agriculture sector	N	236.0	261.9	294.9	318.5	371.6	
			11.0%	12.6%	8.0%	16.7%	12.0%
	R	160.7	163.0	163.6	167.1	171.0	
			1.4%	0.4%	2.1%	2.3%	1.6%
Industry sector	N	371.4	424.5	443.8	481.9	552.2	
			14.3%	4.5%	8.6%	14.6%	10.4%
	R	255.6	248.8	247.4	251.5	266.9	
			-2.7%	-0.6%	1.7%	6.1%	1.1%
Service sector	N	465.8	558.0	612.8	674.7	763.7	
			19.8%	9.8%	10.1%	13.2%	13.2%
	R	301.8	302.7	308.0	315.9	327.9	
			0.3%	1.8%	2.6%	3.8%	2.1%
Total GDP	N	1,073.1	1,244.4	1,351.6	1,475.0	1,687.6	
			16.0%	8.6%	9.1%	14.4%	12.0%
	R	718.1	714.5	718.9	734.3	765.7	
			-0.5%	0.6%	2.1%	4.3%	1.6%
Net Income from Abroad	N	5.3	18.1	34.0	44.8	63.9	
	R	3.7	10.3	18.2	22.1	29.2	
GNP	N	1,082.6	1,266.1	1,385.6	1,519.8	1,751.5	
			16.9%	9.4%	9.7%	15.2%	12.8%
	R	724.4	726.8	737.1	756.4	794.9	
			0.3%	1.4%	2.6%	5.1%	2.3%

Source: Asian Development Bank, Key Indicators of Developing Asian and Pacific Countries 1994
Notes: N - current price, R - constant 1985 price Percentages indicate growth rates over previous year

The Philippine economy has a high growth potential with its large agricultural sector and a well-educated and trainable work force. Over the past decade, however, growth has been lackluster as a result of distorted market structures, inequitable land ownership, protective trade barriers, political bureaucracies and inadequate infrastructures. From 1990 to 1994, domestic production rose at an annual average of only 1.6 percent. The performance of the Philippine economy rates

poorly in comparison with neighboring ASEAN countries. For the same period, Malaysia and Thailand grew at more than 8 percent per year while Indonesia has achieved more than 6.5 percent growth per year.

Over the last three years, however, the economy has shown some signs of recovery with all sectors achieving positive growth rates. The economy emerged from a two year recession in 1993 with GDP growth reported at 2.1 percent and further advanced by 4.3 percent in 1994. GNP growth in 1993 and 1994 was reported to be 2.4 percent and 5.1 percent, respectively, mainly due to increased net income from abroad.

Growth continues to be driven mainly by domestic consumption. Increased investments and stronger export growth also contributed to the overall improved outcome. Social overhead expenditure and accelerated infrastructure development are the major elements in the growth of investments in real terms, reported at more than 9 percent in 1993 and expected to be over 13 percent in 1994. Private and foreign direct investments in regional growth centers such as the Subic Bay area, Cebu, and Davao-General Santos are expected to raise gross domestic investments considerably in the next few years.

The Government incurred fiscal deficits in 1993. New revenue measures, which are expected to be implemented starting in 1995, may help reduce deficits in the next few years, even with increasing expenditures in urgently needed infrastructure (i.e., power, water supply, transport and communications).

Despite higher growth rates in exports, the current account deficit increased slightly in recent years. Further export growth is expected over the next few years in view of the anticipated economic recovery in the major industrial countries and increasing demand in Asian countries. Imports are expected to grow more rapidly, however, leading to increasing current account deficits. In the long run, the strengthening of the external trade position of the Philippines will depend on the speed and vigor with which structural reforms towards improving the competitiveness of Philippine exports are put in place. In this regard, the Philippine government has already moved towards increased trade liberalization. In December 1994, the Senate also ratified the General Agreement on Tariffs and Trade (GATT).

With the recent moves by the Government, foreign investors have started showing increased interests in the Philippine economy. Equity investments in new enterprises and expansion

projects reached all-time highs in 1994. (Despite record highs, foreign investments in the Philippines still remain low compared to other ASEAN countries.) The International Monetary Fund granted the Philippines a three-year extended fund facility. This is expected to ease the flow of external financing, in turn allowing the economy to achieve sustainable growth over the long term. This will depend on the articulation of a realistic and definite development strategy and consistent adherence to stated objectives and policy instruments. On the other hand, recent successes in macroeconomic policy may become a double-edged sword should the IMF decide to exclude the Philippines from the list of countries requiring continued economic assistance.

In 1993, the economy was severely affected by power shortages, resulting in reduced manufacturing output. The situation was remedied by the end of the year, however, as the government undertook emergency measures. Exercising emergency powers granted by Congress under the Electric Power Crisis Act of 1993, the executive branch fast-tracked the implementation of power generation projects mainly through BOT arrangements with private sector firms. There are also moves to privatize some operations of the National Power Corporation (NPC) to improve operational efficiency and financial viability.

Similar shortages now beset the water sector, especially in Metro Manila. The recurrence of the El Niño phenomenon, which leads to reduced rainfalls in the country, brings about severe water shortages particularly during the summer months.

2.3.2 Major Sectors

(1) Agriculture Sector

Agricultural sector output increased by 2.0 percent in 1993 and 2.3 percent in 1994, recovering from a slump in the previous years. Higher growth could have been achieved had it not been for major calamities such as destructive typhoons and locust infestations that hit major agricultural areas of the country during 1993, particularly during the last quarter. Output of rice, corn and sugarcane increased strongly while livestock and poultry production remained flat. In contrast, fisheries production registered only a modest increase. Forestry production declined by almost one-half, mainly because of increasing forest conservation and environmental protection measures.

Industry Sector

Industrial activity grew by 6.1 percent in 1994, despite the 1993 power crisis. This is principally due to the construction sector, which progressed by 4.5 percent as a result of the priority given to public construction projects, especially for power generation, the rehabilitation of calamity-struck areas and public infrastructure. The mining and quarrying sub-sector performed poorly because of continuing weak demand for metal products in the world market. Output of non-metallic products, including crude oil, registered substantial growth of 27.4 percent. Mining output is mainly exported because the Philippine manufacturing sector remains underdeveloped. Manufacturing output remained generally weak for most of 1994 as a result of the power crisis.

(2) Services Sector

The services sector grew by 3.8 percent in 1994 over the previous year, mainly reflecting stronger growth in transport and communications services, the latter as a result of deregulation. In view of GATT, the Government intends to pursue further deregulation in these sub-sectors. Trade, finance and private services, particularly hotels and restaurants, were also more buoyant in 1994 than before. This sector, particularly establishments without ground water sources, is being adversely affected by the water shortage.

2.3.3 Water-Related Industry

The Philippines still relies heavily on agriculture that generates about a quarter of GDP. In contrast, the industry sector that includes mining, manufacturing, utility and construction produced 32.7 percent of GDP in 1994. The Philippine industry is heavily dependent on importation of manufacturing equipment, spare parts and raw materials from abroad.

Generally speaking, the production of piping and construction materials used in the water- and sewerage-related industries does not require advanced technology. The sub-industries that comprise MWSS's supplier base include manufacturing of cast iron, polyvinyl pipes, water meters and cement and civil work. There are local manufacturers producing materials needed that can supply MWSS. In most cases, the quality of these products appears to be satisfactory generally meeting the basic standards established by ISO and AWWA partly because manufacturing equipment and technologies have been imported from or introduced by such developed countries as Germany, Japan, USA and UK.

General weaknesses of the Philippine industry affect the MWSS operations, especially in its requirements for heavy equipment for water treatment plants or light equipment and machinery such as motors, pumps and construction vehicles. There are only a limited number of qualified vendors who can supply these to MWSS. In addition, only a limited number of cast iron companies can produce water pipes and valves of satisfactory quality. Furthermore, PVC pipe manufacturers are not abundant in the Philippines, either. Due to this situation, MWSS's choice of supply sources in the country is somewhat limited.

The weakness in the industry sector also affects manufacturing companies that supply materials, equipment and machinery to MWSS because they are dependent on foreign sources of various raw materials and engineering as indicated by the following examples:

- A local cast iron manufacturer uses equipment made in foreign countries and therefore, spare parts have to be imported from those countries.
- A PVC manufacturer uses equipment made in Japan, so a Japanese engineer is engaged to maintain the equipment. The same PVC manufacturer purchases polymer from a domestic petro-chemical company as a raw material, but this petro-chemical company can not produce polymer locally and has to import it from Japan.
- A cast iron company uses cokes as a raw material that is imported from China and Japan through a Japanese trading company.

Chapter 3.

Project Framework

Chapter 3. Project Framework

3.1 National Economy

3.1.1 General Economy

(1) General Condition

According to the NEDA's medium-term development plan and next century vision, the following conditions are anticipated. In addition, it is expected that the political and social environment will be more stable, and the country risk will be brought down, which will help attract more foreign investments.

a) Shift Towards Exports

Local industries will shift towards exports, especially high value-added products which, combined with other programs, will enable the country to reduce reliance on foreign credits to finance internal growth. The NEDA expects this shift to come mainly from the ranks of small- and medium-scale manufacturers.

b) Declining Role of Agriculture

The agriculture sector is expected to continue to play a major role in the economy, although on a declining basis. Agriculture accounted for 28.2% of GDP in 1979, declining to 23.0% in 1988 and further down to 21.7% in 1993. This trend is expected to continue.

c) Role of Service Sector

The service sector accounted for 38.1 % of GDP in 1970, increasing to 45.4 % in 1993. This sector is expected to contribute to the industry's shift to exports with growth especially in the trade and financial sub sectors. To maintain the high pace of GDP growth, the local banking and trading sub-sectors will become more active, especially with deregulation and incentives offered by the GOP.

(2) GDP

Table 1.3.1 presents a forecast of the Philippine economy up to the year 2015.

This forecast is based on NEDA's mid-term development plan and "The Philippines in the 21st Century: A Development Vision and Framework for the Next Generation", recently prepared as part of the long-term national development plan covering the period up to the year 2025. The forecast gives an average annual growth of 6 to 8 percent for GDP from 1995 to 2015 and 5 to 6 percent for GDP per capita for the same period using high and low assumptions.

Table 1.3.1 Forecast of GDP in the Philippines (1995 price)

Description		1995	2000	2005	2010	2015	Average Growth
Population in Philippines (mil.)		68.4	75.2	81.6	87.2	92.4	1.5%
Population in NCR (mil.)		9.0	10.0	10.9	11.7	12.4	1.6%
GDP (P bil.)	H	1,610	2,320	3,320	4,800	7,000	7.6%
	L		2,250	3,000	4,000	5,300	6.1%
GDP for NCR (P bil.):	H	481	650	860	1,150	1,500	5.9%
	L		600	730	880	1,070	4.1%
Agriculture	H	335	400	470	550	650	3.4%
	L		390	450	510	580	2.8%
Industry	H	544	830	1,260	1,930	2,950	8.8%
	L		790	1,100	1,500	2,100	7.0%
Services	H	731	1,100	1,590	2,320	3,370	7.9%
	L		1,060	1,430	1,940	2,610	6.6%
GDP per capita (P)	H	23,500	30,900	40,700	55,000	75,800	6.0%
	L		29,900	36,800	45,900	57,400	4.6%
GDP per capita for NCR (P)	H	53,500	65,000	78,900	98,200	122,000	4.2%
	L		59,600	66,700	75,200	86,400	2.4%

Note: H - High scenario; L - Low scenario; Growth - Average annual growth rate for 1995-2015
Source: National Statistical Coordination Board - Philippine Statistical Yearbook 1993
NEDA - Medium-term Philippine Development Plan 1993-1998
NEDA - The Philippines in the 21st Century: A development Vision and Framework for the Next Generation
ADB - Key Indicators of Developing Asian and Pacific Countries 1994

Using the mean values for the master planning, GDP for the nation is projected to grow from P1,610 billion (1995) to P6,150 billion (2015), representing an annual real growth of 6.9 percent. GDP per capita will likewise go up from P23,500 (1995) to P66,600 (2015), an average 5.3 percent real annual growth.

As for GDP for the NCR, it is expected to increase from P480 billion (1995) to P1,290 billion (2015), an average 5.1 percent real annual growth. GDP per capita for the NCR will be P104,200 (2015) as compared to P53,500 (1995), an average 3.4 percent real annual growth.

(3) Sector Composition

It is expected that the current composition of agriculture (22 %), industry (33 %) and service (45 %) will change to 10 %-41 %-49 % in the year 2015. For the NCR, the importance of the service sector will be more significant than the rest of the nation, as has been the case for other capital cities in Asia.

(4) Inflation

It is expected that the inflation rate will be further controlled and gradually go down from the current 8 percent level to 4 percent toward the year 2005 and then remain there through the year 2015.

(5) Foreign Currency Exchange Rate

There is a well-accepted theory that forex rate tends to fluctuate based upon the difference in inflation rates between two countries. The government last year estimated the exchange rate between Peso and US dollar to be P25.5 to US$1.00 at the end of the year 1995. The future forex rate of Peso to US dollar is estimated to gradually deteriorate from P25.5 to US$1.00 (1995) to P30.3 to US$1.00 (2005). It is expected to remain at that level through the year 2015. The above forecast is based upon the assumption that the annual inflation in the US will be 4% throughout the Master Plan period.

3.1.2 Industry

(1) Industrial Development Policy

The GOP through the NEDA has developed the Medium-Term Philippine Development Plan 1993 - 1998 (MTPDP) as the national development plan. The government policy on the industrial development is to set the plan, coordinate the efforts of the private sector, give incentives where needed and lead in the implementation on a few occasions. It basically leaves actual implementation in the hands of the private sector. The government assists indirectly through infrastructure development, such as national highways and ports. The government will also assist industrial development through human resources development such as training and education in specific skills. The direct assistance or initiatives to industrial development by the Government will therefore be limited.

One of the Government's thrusts is to narrow the wide gap between industrial development in Metro Manila and that in nearby centers. It also wants to set up satellite industries in identified growth centers from which industrial development could spread to other less developed areas. In the process, the Metro Manila area would change its role to that of a commercial, financial and trade center of the country.

(2) Forecast

It is expected that the Philippine industry will progress in terms of both quality and quantity in achieving the status of NICs in early 21st century. Industries related to the MWSS business will grow gradually with the help of various technical and financial assistance from abroad. The various problems mentioned in the previous sections are typical of developing countries and should be remedied as the industrial development advances.

With regard to the water consumption by the industry and service sectors, it is expected that there will be a general and steady shift from the use of ground water to the use of surface water, but a drastic change of water consumption pattern due to the change in the economy or the industry and service sectors is not anticipated.

3.2 Sector Plan

3.2.1 National and Sector Plans

Various studies related to the water supply and sewerage and sanitation sector have been conducted by government agencies and IIAs in the past 10 years to develop national and sector plans. These studies and plans are explained below in chronological order:

(1) Philippine Water Supply & Sanitation Profile

This study report was prepared by the ADB in March 1987 and provides basic information of sector institutions and sector profile data on MWSS service area, other urban areas and rural areas. The sector profile data include existing facilities, organization and management, O&M, financial aspect, training, development plans and issues.

(2) Water Supply, Sewerage & Sanitation Master Plan of the Philippines (1988 - 2000)

This master plan was developed in 1987 by five agencies of the government (NEDA, DPWH, DOH, MWSS and LUWA) to give directions to government policy makers and program implementation agencies in the execution of pipeline projects and to serve as a guide to all concerned in the industry and the external support agencies on the utilization of available resources for the sector.

(3) Medium-Term Philippine Development Plan (1993 - 1998)

This plan was prepared by the GOP through NEDA as a coordinating agency and approved by the Cabinet on December 15, 1992 to support the development vision of President Ramos for the Philippines to become a NIC at the turn of the century. MTPDP discusses development goals and strategies in the area of macro-economy and development financing, agri-industrial development, human development, infrastructure development and development administration. This plan is further explained in the next section since this has been the primary road map for the water sector lately.

(4) Philippines 2000

The President further articulated the vision of development spelled out in the MTPDP by launching "Philippine 2000" during the DOST Multi-Sectoral Workshop on January 21, 1993 and during the 7th EDSA Anniversary Celebration on February 25, 1993. Philippines 2000 is a vision towards which development efforts will be directed toward year 2000.

(5) Philippines Water Supply Sector Reform Study

This study was prepared by the IBRD and the GCMCC on September 14, 1993. The study was performed to develop policy and implementation options for structural and business related reforms of the water sector and formulate a viable timetable for the implementation of those reforms. The report covers water crisis, reform strategies, proposed reforms and action plan.

(6) Philippine Water Supply, Sewerage and Sanitation Investment Plan (1994 - 2000)

The investment plan was prepared by the USAID in November 1994 to project required financial resources and formulate investment strategies in order to attain water supply and sewerage and sanitation sector goals which has been set for the year 2000.

(7) Philippine Water Summit, 1994

The Philippine Water Summit was held in Manila in December 1994 to discuss various issues such as water quantity, water quality, health, development, efficiency, institutional, management and financing issues. Most recent government goals, policies and strategies were presented by heads of related agencies including the NEDA, the DPWH, the DOH and the DENR in the Summit.

(8) The Philippine in the 21st Century

This document was developed by the NEDA as a coordinating agency in January 1995 to formulate a development vision and framework for the Philippine society in the year 2025. The report covers the emerging global environment, the long-term development vision and long-term development issues.

3.2.2 Medium-Term Philippine Development Plan

(1) General

The Government of the Philippines, through the Medium-Term Philippine Development Plan (MTPDP) (1993-1998), has manifested its commitment to the development of safe and dependable water supply, sewerage and sanitation facilities. This document provides policies and investment programs which lay out the foundation of a strategy to accelerate sector development through institutional reforms at all government levels and equitable mobilization of resources between urban and rural areas. The guiding principles set in the MTPDP include:

- decentralization
- private sector-led development
- democratic consultation
- full cost recovery
- social equity
- macro-economics stability

(2) Goals and Objectives

The goals and objectives in the MTPDP are as follows:

- Continue provision of safe and adequate water supply and sanitation services.
- Pursue proper O&M of facilities for sustainable water supply in identified industrial centers and in both urban and rural areas.
- Undertake gradual construction and installation of sewerage facilities.
- Address the growing demand of Metro Manila and other outlying areas up to the year 2003 through the implementation of UATP.
- Encourage LGUs to develop their capabilities to implement local government-funded Level I systems.

(3) Policies and Strategies

The MTPDP outlined the following sector policies and strategies:

- Adopt an integrated planning and development strategy for an area-wide development scheme for purposes of combining irrigation, power, flood control and domestic and industrial water supply to realize optimum benefits;
- Implement cost recovery in the process of planning and selection of piped water supply projects;
- Improve efficiency in the collection of water supply service fees and tariff systems;
- Implement cost efficient water resources development projects for increased productivity and employment opportunities; and
- Develop more small and medium-scale projects which yield quicker results and can be developed and maintained through the active participation of the rural populace.

From the time the MTPDP has been prepared, there have been various government actions that supplement the above specified strategies. Notable ones are summarized below and explained later in detail:

- To maximize private sector participation in infrastructure development and operations through the BOT scheme and other variations, and by privatization of government owned or operated facilities. To this end the BOT Law has been amended to encourage more private sector participation.
- To pursue with greater vigor the provision of water supply, the President was recently granted by Congress emergency powers for a period of one year under the National Water Crisis Act of 1995, enacted in May 1995, to address the impending national water shortage, among other objectives. And to assure that red tape is cut across the bureaucracy, the application of some laws and regulations is suspended during the emergency power period.

(4) Targets

The key measurable targets in the MTPDP for the target year of 1998 are as follows:

- Increase the coverage of population (excluding Metro Manila) served with adequate potable water from 78 percent to 84 percent of the population corresponding to 71 percent in other urban areas, and possibly 94 percent in the rural areas.
- Construct sewerage facilities in Metro Manila and other highly urbanized areas.
- Construct 1,765,000 toilet facilities nationwide.

(5) Financing for Infrastructure Program

The MTPDP estimated the financing required for the infrastructure program of the sector for the following years (in million pesos at 1993 prices) as follows:

1993	1994	1995	1996	1997	1998	Total
3,914	4,864	5,471	6,506	5,879	5,115	31,749

3.2.3 National Sector Financing Policies

(1) Current Situation

The investments in water sector have been clearly one of the top priorities of the national government in addressing bottlenecks to economic growth. From 1987 to 1992, public investments in the sector reached over P31 billion, representing almost 22 percent of the total public infrastructure spending and ranking third behind the energy and transport sectors.

As evidenced by the presentation given by the secretary of the Department of Finance at the National Water Summit in December 1994, however, it is considered that compared with the demands of growing population and urbanization in the country, the pace and event of resource mobilization for the water sector requires urgent reform in view of the following indicators:

- Due to the national government's scarce fiscal resources and delays in project execution, infrastructure spending for water in the 1987 to 1992 plan period was only 56.8 percent of the target.
- In terms of physical accomplishments, only modest gains were attained over the previous plan period in regard to improving access to potable water supply. The level of

nationwide accessibility to potable water grew from about 63 percent in 1986 to about 76 percent by 1992.

- Over the medium-term, about P82 billion in infrastructure spending is planned under the Public Investment Program from 1995 to 1998. This covers water supply, irrigation, flood control, sewerage and sanitation and hydropower. In addition, some $3.8 billion (about P99 billion) in projects have been identified for private sector participation in the form of BOT and other similar schemes.

The DOF acknowledges that the past record of government financing and implementation of water infrastructure projects and the urgent future investment requirements in the sector have made it necessary to explore options to involve other players in the economy, broaden funding sources and improve financial administration.

(2) Financing Strategies

The objective for the water sector financing will be to enable higher levels and quality of investment to meet the demands of the public for well-being and growth. The thrust of water sector financial policy will therefore be to address the limited financial resources of the national government to fully support infrastructure investments over the medium term, promote better cost recovery in the provision of water and sanitation services, focus government intervention, and support and encourage the participation of local government units and the private sector in water service operations and investment. The DOF identifies the following four key strategies:

a) Greater Reliance on Market Forces

As water is an economic good, investments in water services should be customer-driven, i.e., anchored on desires shown by the recipient communities and baked up by projections of demand. This ensures that projects are in accordance with the user's willingness to pay and are appropriate to the community's level of development. Reliance on market forces also means that as economic growth takes place the level and quality of water service infrastructure would need to adapt to the higher and more complex needs of beneficiaries.

b) Local Government and Private Sector Initiatives

Given its broader responsibilities for public service delivery under the New Local Government Code and as reaffirmed under NEDA Resolution No. 4, LGUs are expected to assume an increasing role in the water sector. This will necessitate support to LGUs in acquiring technical and professional expertise to develop and manage water systems and in gaining broader access to financing from official donors and private capital markets to supplement their local revenue base. On the other hand, these factors will require that LGUs utilize appropriate institutions to operate water systems with the financial discipline that will ensure their viability and attractiveness to creditors/investors. In the area of private sector participation, the amended BOT Law provides the entry mechanism, but the regulatory environment needs to be made more supportive in terms of providing clear, predictable and enforceable rules on price setting, water standards and other legal arrangements that will protect both the private investors and the public.

c) Government Support for Water Sector Financing

With greater reliance on the market provision of water services, the government would need to focus its assistance on what will complement private sector financing in the sector. Accordingly, government assistance would generally be oriented toward:

- supporting infrastructure investments in the form of flood control, sanitation and other cases dictated by health or environmental considerations
- channeling the assistance through the most direct and transparent route possible
- continuing to mobilize official development assistance and private sector financing to the water sector over the long-term.

d) Full Cost Recovery

This involves the setting of appropriate tariff structures that will enable water providers to:

- generate revenues for operations, maintenance and, equally importantly, expansion of services in a sustainable manner
- assess customers' willingness to pay through the price system as guide for their investment decisions

- promote efficient utilization of water and high collection arrears from customers bsetting water agencies.

As in other forms of infrastructure, the introduction of cost recovery principles will help water providers, whether those operated by national, local or private organizations, attain financial autonomy and demand less from government assistance

3.2.4 Recent Developments and Action Plan

A number of important initiatives have been recently undertaken that are intended to broaden financing options for the water sector as well as to ensure its fiscal sustainability. The more notable ones together with action plans are as follows:

(1) NEDA Resolution No. 4

This law addresses the following:

- privatization of water utilities
- reorientation of LWUA as a specialized lending agency to improve its financial viability
- expanded role of LGUs in water supply.

The DOF will lead the implementation of pilot privatization of water supply utilities under a proposed technical assistance project. The LWUA will submit an implementation plan for its strengthening as the specialized lending agency for water districts to the NEDA Infrastructure Committee.

(2) NEDA Resolution No. 5

This defines the National Urban Sewerage and Sanitation Strategy. It invokes, among others, the principle that provision of sewerage and sanitation services should be generally based on the communities' willingness and ability to pay.

(3) Securing Grant Assistance

The GOP has secured grants for the following areas:

- the drafting of implementing rules and regulations for the delineation of agency responsibilities in the water sector
- study to strengthen the NWRB
- pilot privatization of water districts.

(4) New Local Government Code and Expanded BOT Law

These laws aim to strengthen the role of LGUs in the provision of water supply and enhance the participation of the private sector in the basic infrastructure, respectively.

(5) MWSS Privatization Task Force

This ad hoc task force is specifically mandated to look into technical, financial and legal options to introduce private sector participation in the activities of MWSS in order mainly to address the lack of supply and the high level of NRW in its franchise.

(6) NEDA Investment Coordination Committee

With inputs from the concerned departments, it will formulate policies and rules for cost recovery, including tariff systems, of water infrastructure services to ensure the sustainable operation and expansion of the water sector. Based upon the studies to be undertaken by the NEDA Secretariat and the DOF, it will also formulate criteria and institutional arrangements for the access by LGUs to national government and official development assistance.

(7) National Water Resources Board

In consultation with implementing or oversight agencies such as DILG, DOH, DPWH and DOF, it will formulate appropriate regulatory, financial and other mechanism to facilitate the participation of local government units and the private sector in water resource investments.

3.2.5 National Water Crisis Act of 1995

A very recent law, the National Water Crisis Act of 1995, gives emergency powers to the President for a period of one year to address the nationwide water crisis which adversely affects the health and well-being of the population, food production and industrialization process. Among the powers that the President could exercise under this law are:

- To enter into negotiated contracts, instead of by public bidding, for projects to be implemented under BOT and/or related schemes for the financing, construction, repair, rehabilitation, improvement and operation of water facilities and projects related to increasing water supply, its treatment and its distribution to industrial and household consumers

- To reorganize MWSS, including the privatization of any or all of its segments, operations or facilities, if necessary, to make them more effective and innovative to address the looming water crisis. For this purpose the President may abolish or create offices, transfer functions, equipment, properties, records and personnel, institute drastic cost cutting and other related measures. In the implementation of such reorganization, the Attrition Law shall not apply.

- To upgrade the compensation of MWSS personnel at rates commensurate with improved and efficient revenue collection as determined by the Board of Trustees to take effect upon reduction of NRW to 40%; these shall be exempted from the Salary Standardization Law.

The National Water Crisis Act of 1995, also addressed the problem of waste and pilferage of water by (i) broadening the definition of pilferage and other acts that are punishable, (ii) increasing the circumstances that constitute "prima facie" evidence in the commission of punishable acts, (iii) defining aggravating circumstances in such punishable acts and (iv) increasing the corresponding penalties.

This Act has created a Joint Executive-Legislative Water Crisis Commission which will conduct in-depth and detailed study of the entire water supply and distribution structure, among others.

3.2.6 MWSS Strategic Plan

In support of President Ramos' bid, which is envisioned in the MTPDP, to transform the Philippines into a Newly Industrialized Country (NIC) by the year 2000 and with Metro Manila being the showcase of the entire country's development, MWSS prepared its "MWSS Strategic Plan Toward Philippines 2000 (1994-2000)" in 1993.

The key objectives of the Strategic Plan is to increase its water supply coverage to 90 percent of the increased service area population and sewerage services to 14 percent of said area population, which is expected to reach 14 million by the year 2000. This will include satisfying the water requirements of industrial and commercial users whose participation is essential to the realization of a "NIC Philippines" by the year 2000.

The Key Components of MWSS Strategic Plan are:

- Infrastructure Expansion and Improvement Program
- Non-Revenue Water Reduction Program
- Enhanced Revenue Generation and Financial Operations Improvement Program
- Institutional and Organizational Streamlining Program
- Water Conservation Drive
- Financial Plan
- Privatization Options

3.3 Population

3.3.1 Past Trend

Population and its distribution largely determine the extent of urbanization, thus a close look into population trends in the Study Area from 1970 to 1990, has been undertaken.

In this period, the annual growth rate in Metro Manila decreased from 4.6 % to 2.7 %, while that outside NCR (Cavite and Rizal) increased from 4.9% to 6.3%. As regards to present density, NCR is the most densely populated area; however, growth in the inner core (inside EDSA) is declining, while the outer area of the metropolis, where density is moderate, is increasing rapidly due to the availability of low priced lands.

3.3.2 Population Projection and Future Growth Trends

The population projection of the Study Area for the year 2000 and the target year 2015 is based on analysis of the above past trends as shown in Urban Development Background Data, Supporting Report, and summarized in the following table.

Table 1.3.2 Population Projection (Summary)

Region/ Province	Population			Growth Rate (%)		Increase 1990-2015 (times)
	1990	2000	2015	2000/1990	2015/2000	
NCR	7,948,392	10,011,629	12,435,785	2.33	1.46	1.6
Cavite	457,020	617,582	875,774	3.06	2.21	1.9
Rizal	982,940	1,523,252	2,435,034	4.48	3.18	2.5
Total	9,388,352	12,152,463	15,728,593	2.61	1.73	1.7

The population for 1990 and projected population figures for 2000 and 2015 of cities and municipalities are shown in Table 1.3.3 and are presented in graphical form in Figure 1.3.1. As can be observed in the graph, the most populated areas are concentrated in the inner core of NCR, while the fastest growing areas are located in the intermediate and outer areas of NCR as a consequence of the decentralization of economic activities and resettlement areas. The absence of traffic and the low cost of lands also contribute to the reason why these are considered fastest growing areas.

Table 1.3.3 Population Projection of the Study Area

City / Municipality	1990 (a)	1995 (b)	2000 (c)	2005 (d)	2010 (e)	2015 (f)	Growth Rate b/a	c/b	d/c	e/d	f/e
NCR:											
Manila	1,601,234	1,667,970	1,707,538	1,725,542	1,726,405	1,719,511	0.82	0.47	0.21	0.01	-0.08
Pasay	368,366	407,903	442,902	472,916	497,778	517,753	2.06	1.66	1.32	1.03	0.79
Quezon	1,669,776	1,900,283	2,140,573	2,340,286	2,548,595	2,748,266	2.62	2.41	1.80	1.72	1.52
Caloocan	763,415	891,038	999,796	1,088,787	1,157,987	1,208,045	3.14	2.33	1.72	1.24	0.85
Mandaluyong	248,143	267,980	277,905	287,911	294,888	299,935	1.55	0.73	0.71	0.48	0.34
Las Piñas	297,102	382,811	470,244	565,280	664,913	770,817	5.20	4.20	3.75	3.30	3.00
Makati	453,170	489,156	511,060	529,989	546,080	560,148	1.54	0.88	0.73	0.60	0.51
Malabon	280,027	307,660	330,621	348,865	362,505	373,140	1.90	1.45	1.08	0.77	0.58
Marikina	310,227	359,638	405,708	447,715	483,982	516,014	3.00	2.44	1.99	1.57	1.29
Muntinlupa	278,411	362,151	435,341	497,373	550,487	598,897	5.40	3.75	2.70	2.05	1.70
Navotas	187,479	215,447	240,447	262,494	282,502	298,533	2.82	2.22	1.77	1.48	1.11
Parañaque	308,236	371,264	430,808	488,481	545,941	602,363	3.79	3.02	2.54	2.25	1.99
Pasig	397,679	461,691	523,636	583,541	641,439	691,353	3.03	2.55	2.19	1.91	1.51
Pateros	51,409	54,299	57,352	60,278	63,353	66,256	1.10	1.10	1.00	1.00	0.90
San Juan	126,854	136,792	143,770	148,283	151,800	153,784	1.52	1.00	0.62	0.47	0.26
Taguig	266,637	334,196	410,321	493,485	571,252	646,634	4.62	4.19	3.76	2.97	2.51
Valenzuela	340,227	413,938	483,607	549,831	610,637	664,336	4.00	3.16	2.60	2.12	1.70
Total	7,948,392	9,024,211	10,011,629	10,891,057	11,700,544	12,435,785	2.57	2.10	1.70	1.44	1.23
CAVITE:											
Cavite City	91,641	96,793	102,235	107,450	112,931	118,105	1.10	1.10	1.00	1.00	0.90
Bacoor	159,685	198,558	238,872	279,798	320,860	361,544	4.45	3.77	3.21	2.78	2.42
Imus	92,125	110,611	128,224	145,409	161,723	179,375	3.73	3.00	2.55	2.15	2.09
Kawit	47,755	55,093	62,333	68,820	75,983	83,071	2.90	2.50	2.00	2.00	1.80
Noveleta	20,409	23,545	26,509	29,412	32,473	35,329	2.90	2.40	2.10	2.00	1.70
Rosario	45,405	52,509	59,409	65,915	72,775	80,350	2.95	2.50	2.10	2.00	2.00
Total	457,020	537,109	617,583	696,805	776,745	857,774	3.28	2.83	2.44	2.20	2.00
RIZAL:											
Angono	46,014	57,369	70,641	83,294	98,212	113,855	4.51	4.25	3.35	3.35	3.00
Antipolo	210,588	282,346	377,843	445,948	526,074	609,864	6.04	6.00	3.37	3.36	3.00
Baras	16,880	21,036	25,704	30,322	35,753	41,448	4.50	4.09	3.36	3.35	3.00
Binangonan	127,561	158,964	193,497	228,154	269,017	311,864	4.50	4.01	3.35	3.35	3.00
Cainta	126,839	168,940	222,793	263,078	310,647	360,125	5.90	5.69	3.38	3.38	3.00
Cardona	32,962	38,866	45,827	54,008	63,651	72,015	3.35	3.35	3.34	3.34	2.50
Jala-Jala	16,318	19,240	22,688	26,738	31,510	35,649	3.35	3.35	3.34	3.34	2.50
Morong	32,165	37,926	44,719	52,702	60,685	68,660	3.35	3.35	3.34	3.34	2.50
Pililla	32,771	38,640	45,561	53,695	63,282	71,598	3.35	3.35	3.34	3.34	2.50
Rodriguez	67,074	79,087	93,252	109,954	129,647	146,684	3.35	3.35	3.35	3.35	2.50
San Mateo	82,310	97,099	114,545	135,061	159,251	184,616	3.36	3.36	3.35	3.35	3.00
Tanay	58,410	68,872	81,207	95,751	112,901	127,737	3.35	3.35	3.35	3.35	2.50
Taytay	112,403	132,535	156,273	184,262	217,264	245,814	3.35	3.35	3.35	3.35	2.50
Teresa	20,645	24,343	28,702	33,827	39,866	45,105	3.35	3.35	3.34	3.34	2.50
Total	982,940	1,225,263	1,523,253	1,796,795	2,117,760	2,435,032	4.51	4.45	3.36	3.34	2.83
TOTAL	9,388,352	10,786,583	12,152,465	13,384,656	14,595,049	15,728,591	2.82	2.41	1.95	1.75	1.51

Source: Population of 1990 (Census): National Statistics Office
NCR and Cavite: Population projected by the Study Team based on NSO population projection data
Rizal: Projected population based on the provincial growth rates estimated by NSO

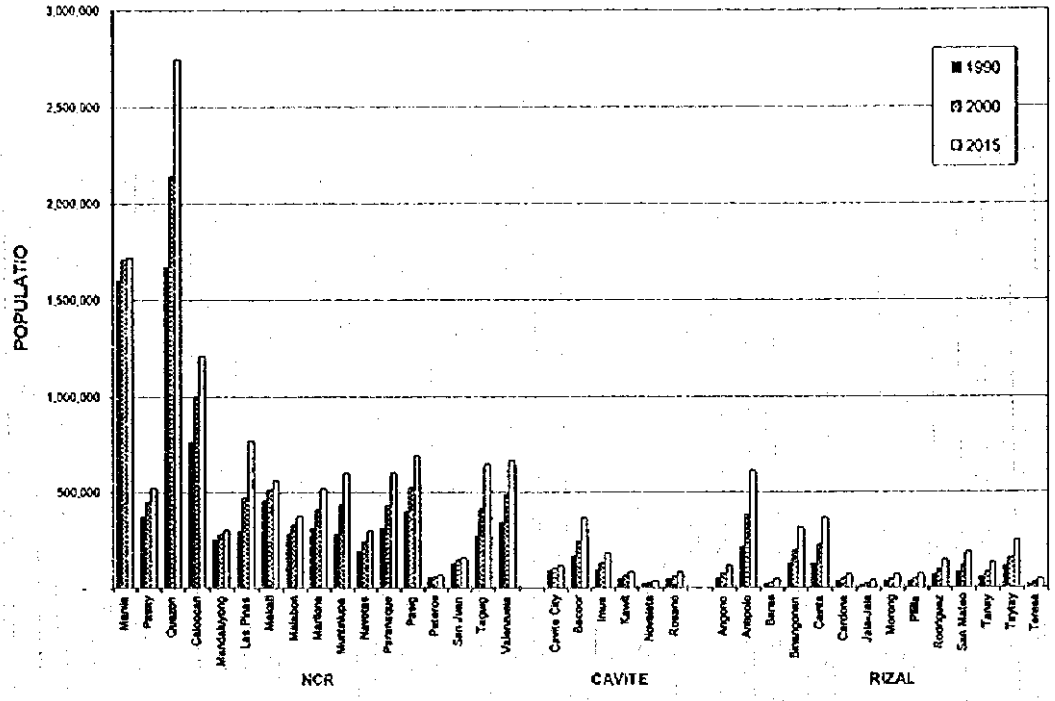


Figure 1.3.1 Projected Population (1990, 2000 and 2015)

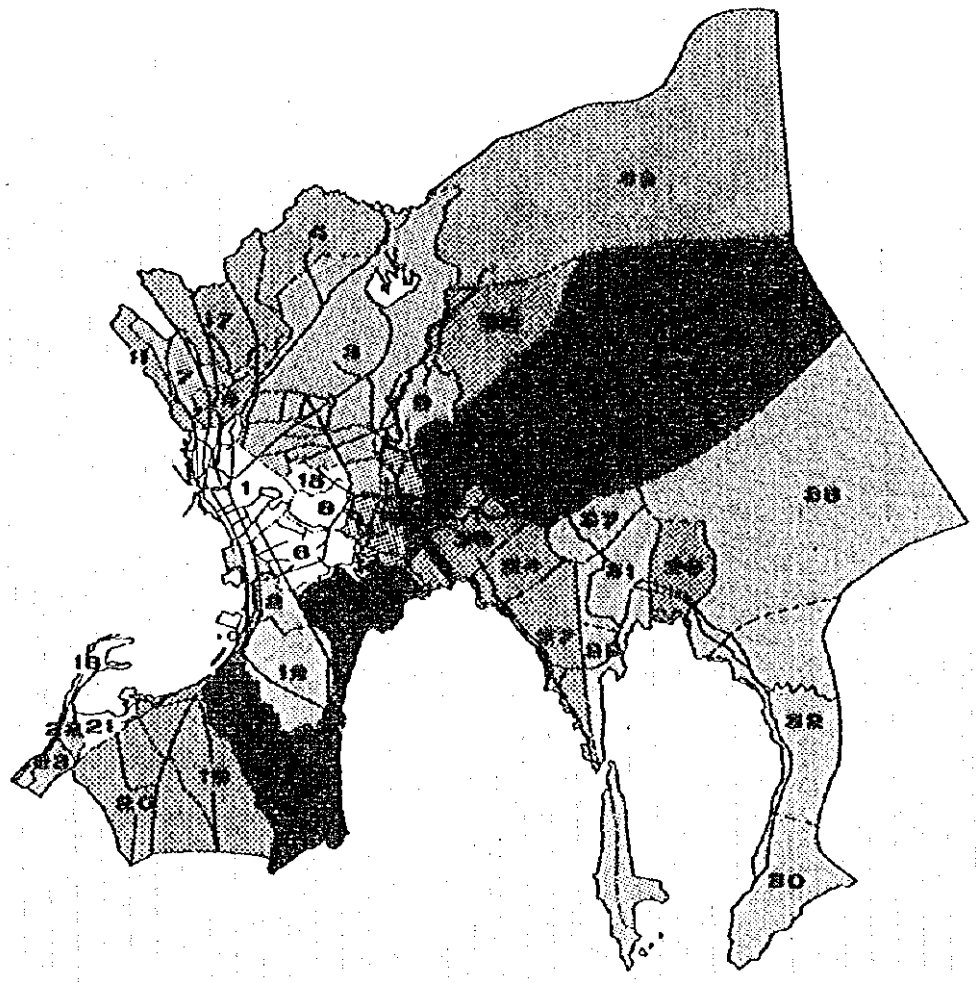
The results of the growth trends were translated into a map form (see Figure 1.3.2), showing the future growth trends of cities and municipalities. The map confirms the municipalities with the highest growth rates in the intermediate and outer areas of the NCR. These are:

NCR:	Las Piñas, Muntinlupa, Taguig, Valenzuela, Parañaque, North Caloocan
Cavite:	Bacoor and Imus
Rizal:	Antipolo, Cainta, Angono, San Mateo, Rodriguez

Even though the map refers to the municipalities of Antipolo and Rodriguez as high growth and medium growth areas, only 20 % of their land (western areas) can be theoretically considered as urban, as full development in their eastern parts is not possible due to geological constraints. The population growth of Cavite and Rizal municipalities are very much influenced by the spillover of NCR residents and the increase in migrants from rural areas.

The inner core of NCR (Manila, Makati, Mandaluyong) is seen to have the lowest growth rates, indicating that population is gradually leveling off in these areas.

Nevertheless, inner core cities and municipalities (Manila, Pateros, Mandaluyong, Makati.) still remain the most densely populated areas in the study area, although density in intermediate and outer areas (Las Piñas, Muntinlupa, Taguig, Bacoor, Antipolo, Angono, Cainta) is observed to be rapidly accelerating as well. Table 1.3.4 confirm the population growth trends in the intermediate and outer areas of NCR illustrated in previous graphical representations.



LEGEND

- High growth rate
- Medium high growth rate
- Medium growth rate
- Low growth rate

CITY/MUNICIPALITY

1. Manila
2. Pasay
3. Quezon
4. Caloocan
5. Las Piñas
6. Makati
7. Malabon
8. Mandaluyong
9. Marikina
10. Muntinlupa
11. Navotas
12. ParaÑaque
13. Pasig
14. Pateros
15. San Juan
16. Taguig
17. Valenzuela
18. Cavite City
19. Bacoor
20. Imus
21. Kawit
22. Noveleta
23. Rosario
24. Angono
25. Antipolo
26. Baras
27. Binangonan
28. Cainta
29. Cardona
30. Jala-Jala
31. Morong
32. Pililla
33. Rodriguez
34. San Mateo
35. Tanay
36. Taytay
37. Teresa

STUDY AREA

PROVINCIAL BOUNDARY

CITY / MUNICIPALITY BOUNDARY

SCALE

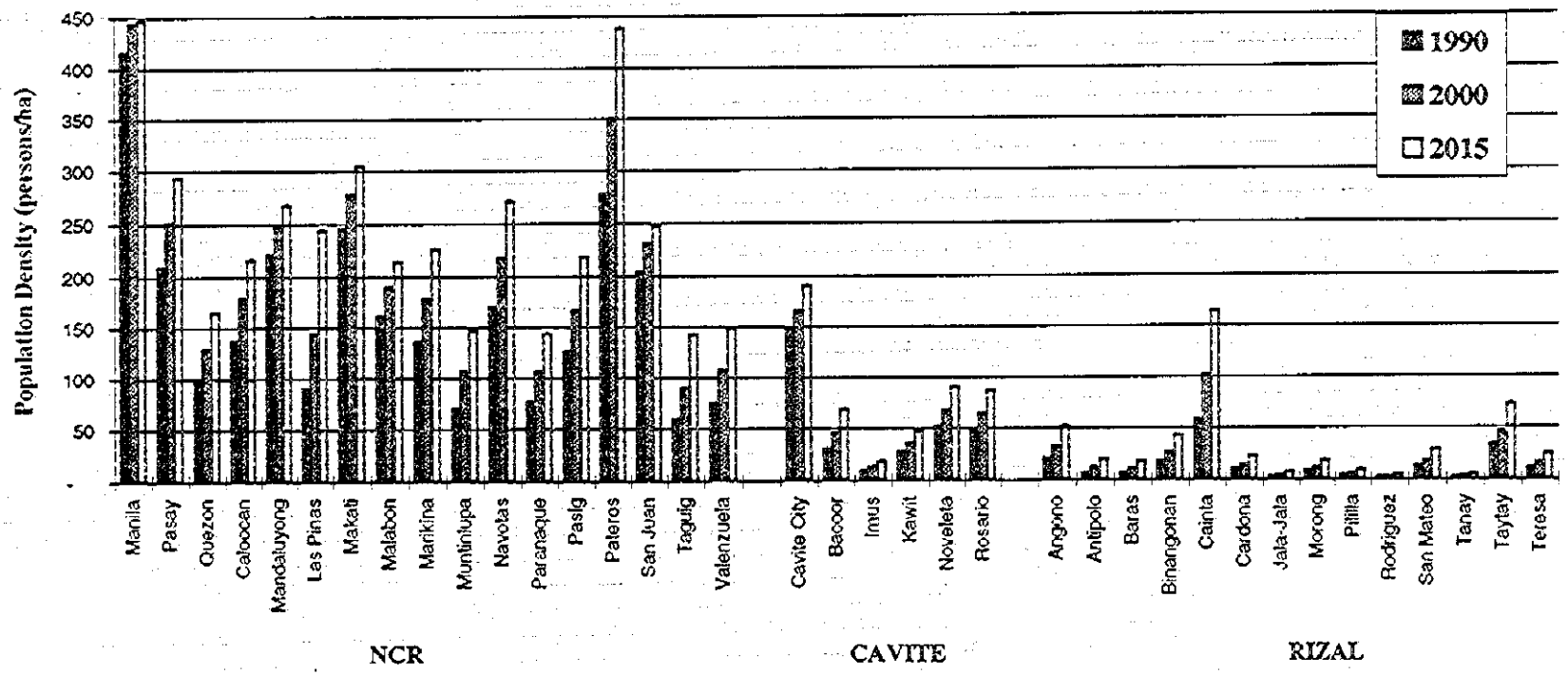
0 2 4 6 8 10km

STUDY ON WATER SUPPLY AND SEWERAGE MASTER PLAN OF METRO MANILA	Figure 1.3.2 FUTURE GROWTH TRENDS

Table 1.3.4 Population Density by Selected Years: 1980, 1990, 2000 and 2015

City/ Municipality	Area (Ha.)	POPULATIO				DENSITY (Persons/Ha)				Percentage of Population Increase (1990 - 2015)
		1980	1990	2000	2015	1980	1990	2000	2015	
NCR	61,240	5,925,884	7,948,392	10,011,629	12,435,785	97	130	163	203	56
Manila	3,850	1,630,485	1,601,234	1,707,538	1,719,511	424	416	444	447	7
Pasay	1,760	287,770	368,366	492,902	517,353	164	209	252	294	41
Quezon	16,660	1,165,865	1,669,776	2,140,573	2,748,266	70	100	128	165	65
Caloocan	5,580	467,816	763,415	999,796	1,208,045	84	137	179	216	58
Mandaluyong	1,120	205,366	248,143	277,905	299,935	183	222	248	268	21
Las Pinas	3,270	136,514	297,102	471,577	799,237	42	91	144	244	169
Makati	1,840	372,631	453,170	511,060	560,148	203	246	278	304	24
Malabon	1,740	191,001	280,027	330,621	373,140	110	161	190	214	33
Marikina	2,280	211,613	310,227	405,708	516,014	93	136	178	226	66
Muntinlupa	3,970	136,679	278,411	427,921	580,679	34	70	108	146	109
Navotas	1,100	126,146	187,479	240,447	298,533	115	170	219	271	60
Paranaque	4,020	208,552	308,236	429,556	577,222	52	77	107	144	86
Pasig	3,160	268,570	397,679	523,636	691,353	85	126	166	219	74
Pateros	185	40,288	53,409	64,691	81,195	218	278	350	439	58
San Juan	620	130,088	126,854	143,770	153,784	210	205	232	248	21
Taguig	4,538	134,137	266,637	410,321	646,634	30	59	90	142	142
Valenzuela	4,480	212,363	340,227	483,607	664,336	47	76	108	148	95
Reclaimed Land	1,067									
CAVITE	18,621	324,273	457,020	617,581	857,773	17	25	33	46	84
Cavite City	620	87,666	91,641	105,309	122,867	141	148	170	198	34
Bacoor	5,240	90,364	159,685	235,797	356,781	17	30	45	68	123
Imus	9,701	59,103	92,125	128,073	177,938	6	9	13	18	104
Kawit	1,550	39,368	47,755	62,484	84,508	22	27	36	48	79
Noveleta	390	14,460	20,409	26,509	35,329	37	52	68	91	74
Rosario	920	33,312	45,405	59,409	80,350	36	49	65	87	78
RIZAL	131,144	555,473	982,940	1,523,251	2,433,036	4	7	12	19	165
Angono	2,200	26,511	46,014	70,641	113,855	12	21	32	52	146
Antipolo	30,610	68,932	210,568	377,843	609,864	2	7	12	20	185
Baras	2,340	11,196	16,880	25,704	41,448	5	7	11	18	153
Binangonan	7,270	80,980	127,561	193,497	311,864	11	18	27	43	138
Cainta	2,190	59,025	126,839	222,793	360,125	27	58	102	164	184
Cardona	3,120	24,503	32,962	45,827	72,015	8	11	15	23	110
Jala-Jala	4,930	11,945	16,318	22,687	35,651	2	3	5	7	141
Morong	3,760	24,858	32,165	44,719	68,660	7	9	12	18	103
Pililla	7,390	23,222	32,771	45,561	71,598	3	4	6	10	142
Rodriguez	31,280	41,859	67,074	93,252	146,484	1	2	3	5	134
San Mateo	6,490	51,910	82,310	114,545	184,616	8	13	18	28	119
Tanay	24,340	40,443	58,410	81,207	127,737	2	2	3	5	162
Taytay	3,364	75,328	112,403	156,273	245,814	22	33	46	73	121
Teresa	1,860	14,781	20,645	28,702	45,105	8	11	15	24	120
TOTA	211,005	6,805,630	9,388,352	12,152,461	15,728,594	32	44	58	75	69

Figure 1.3.3 Projected Population Density (1990, 2000 and 2015)



tab242.xls 8/15/95

3.4 Land Use Plan

3.4.1 Future Land Use Estimate by Population Growth

The land use forecast based on current trends and plans was produced taking into consideration urban expansion in the Study Area. Reviewed data are referred to Urban Development Background Data, *Supporting Report*.

Basically, the estimation of population growth by residential land use is introduced to determine future residential conditions in each city or municipality. Population growth in the residential area is expected to reflect development conditions especially in NCR, and is taken into consideration in the future land use study. Thus, each land area is extrapolated using current and projected pattern of population growth and current land use areas.

Detailed adjustments in the measurements of the future land use categories were made in consideration of urban development, industrial growth, land availability, and government policies. Industrial growth estimates are detailed in a separate subsection due to their importance to water supply projects.

Table 1.3.5 shows the estimated major categories of future land use. Table 1.3.6 shows the measurement of these categories (in percentage) by selected years.

Comparative bar graphs are presented in Figure 1.3.4 by regions and for the entire study area, showing the changes in the land areas from 1994 to 2015.

A colored land use map (2015) has also been produced, giving the results of the study in a condensed form (Figure 1.3.5).

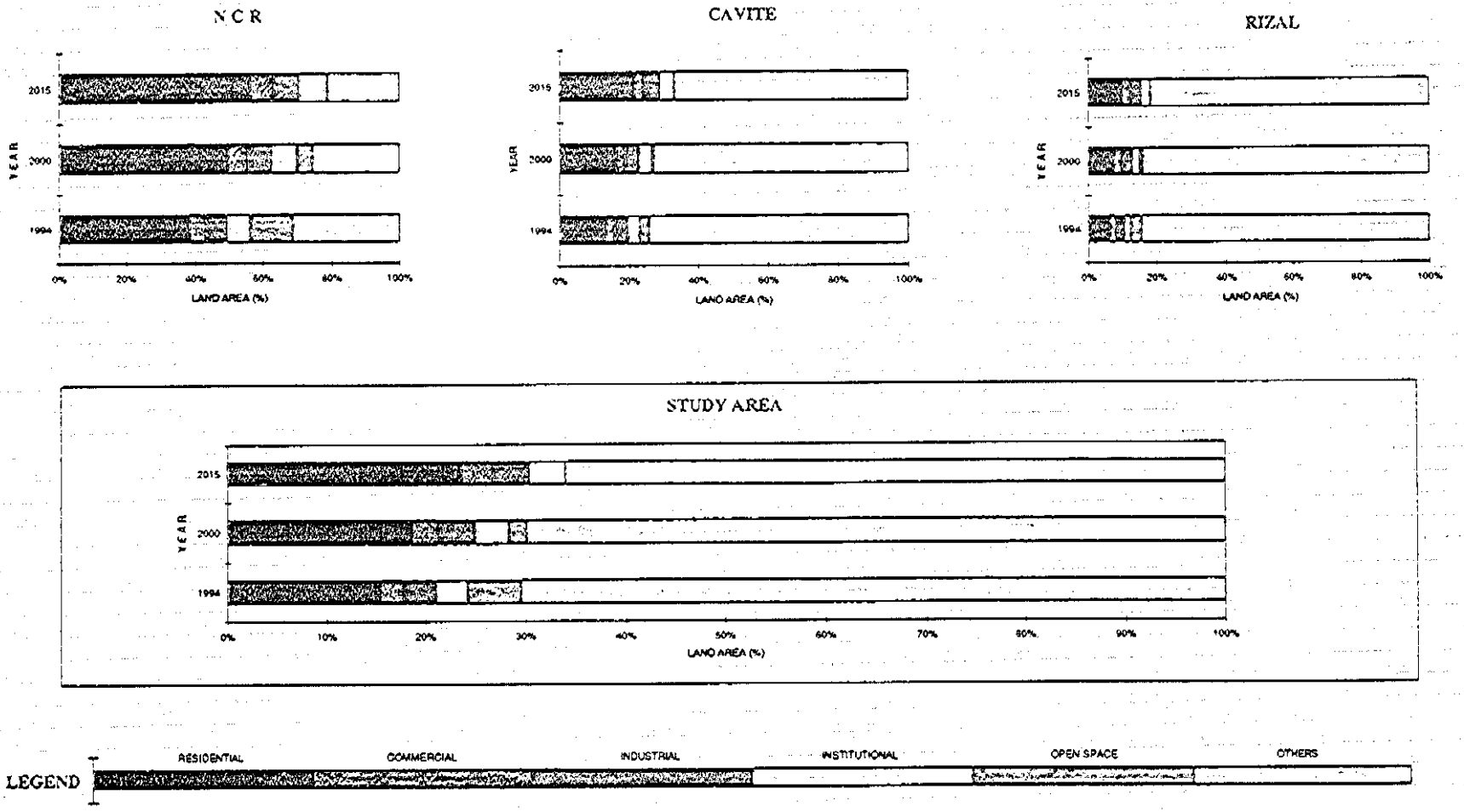
Table 1.3.5 Future Land Use (1994, 2000 and 2015)

City/ Municipality	Total Land Area (ha)	POPULATION 1994	POPULATION 2000	POPULATION 2015	1994 Built-up Area Resid	1994 Built-up Area Commer	1994 Built-up Area Indust	1994 Built-up Area Instit	1994 Open Space & Others (ha) Open Space	1994 Open Space & Others (ha) Others	2000 Built-up Area Resid	2000 Built-up Area Commer	2000 Built-up Area Indust	2000 Built-up Area Instit	2000 Open Space & Others (ha) Open Space	2000 Open Space & Others (ha) Others	2015 Built-up Area Resid	2015 Built-up Area Commer	2015 Built-up Area Indust	2015 Built-up Area Instit	2015 Open Space & Others (ha) Open Space	2015 Open Space & Others (ha) Others
NCR:																						
Manila	3,850	1,632,740	1,707,538	1,719,511	2,460	500	200	310	85	295	2,545	510	200	310	0	285	2,590	527	200	310	0	223
Pasay	1,760	394,433	442,902	517,753	740	170	40	570	73	167	830	190	40	570	0	130	970	220	40	530	0	0
Quezon	16,660	1,827,511	2,140,573	2,748,266	5,990	640	650	1,100	1,990	6,290	7,000	750	650	1,250	750	6,260	9,008	960	650	1,550	0	4,492
Caloocan	5,580	852,595	999,796	1,208,045	1,995	200	270	150	750	2,215	2,400	240	320	180	240	2,208	2,827	283	350	213	0	1907
Mandaluyong	1,120	260,432	277,905	299,935	590	100	160	155	13	102	630	112	160	155	0	63	679	120	140	155	0	26
Las Pinas	3,270	360,489	470,244	770,817	1,360	90	140	50	700	930	1,770	130	150	70	220	930	2,500	190	200	100	0	280
Makati	1,840	475,427	511,060	560,148	1,100	330	150	120	15	125	1,150	350	150	120	0	70	1,200	380	140	120	0	0
Malabon	1,740	297,968	330,621	373,140	665	80	200	54	110	631	740	90	200	60	20	630	830	100	200	68	0	542
Mariquina	2,280	344,589	405,708	516,014	960	100	220	100	468	412	1,200	125	240	115	190	410	1,430	150	250	120	0	330
Muntinlupa	3,979	336,145	455,341	598,897	1,130	100	180	120	1,170	1,279	1,500	130	250	150	700	1,240	2,013	180	320	210	0	1247
Navotas	1,100	206,795	240,447	298,533	340	40	70	30	80	540	430	50	70	30	0	520	491	58	70	35	0	446
Parañaque	4,020	351,510	430,808	602,363	1,645	120	290	170	800	995	2,100	160	290	200	300	970	2,819	210	320	250	0	421
Pasig	3,160	442,243	525,636	691,353	1,100	125	520	98	530	789	1,300	150	520	110	300	780	1,720	195	550	150	0	545
Pateros	185	56,177	57,352	66256	105	10	2	17	10	41	115	11	2	18	0	39	130	12	2	20	0	21
San Juan	620	132,979	143,770	153784	441	60	15	67	30	7	455	65	15	67	12	6	460	74	12	68	0	6
Taguig	4,538	315,249	410,321	646,634	810	90	135	975	250	2,278	1,100	120	150	975	0	2,193	1,660	200	200	975	0	1503
Valenzuela	4,480	392,803	483,607	664,336	1,430	170	540	130	344	1,866	1,761	210	570	130	0	1,809	2,420	290	630	150	0	990
Reclaimed Area:																						
Manila Side	331	0	0	0																		
Pasay Side	491	0	0	0																		
Parañaque Side	245	0	0	0																		
Total	61,240	8,680,085	10,011,629	12,433,785	22,861	2,925	3,785	4,214	7,436	20,020	27,026	3,393	3,977	4,510	2,732	19,610	33,747	4,149	4,274	5,024	0	14,046
CAVITE:					0																	
Cavite City	620	95,990	102,235	118105	275	32	3	198	21	91	293	34	3	210	0	80	340	39	4	210	0	27
Bacoor	5,240	186,141	238,872	361,544	700	26	16	30	128	4,340	950	35	21	40	0	4,194	1,400	50	31	60	0	3699
Imus	9,701	105,140	128,224	179,375	530	15	140	36	105	8,875	700	20	155	44	0	8,782	950	26	180	60	0	8485
Kawit	1,750	52,941	62,333	83,071	298	13	2	23	18	1,396	351	15	2	27	0	1,354	480	20	3	36	0	1210
Noveleta	390	22,581	26,509	35329	80	6	1	10	10	283	95	7	1	12	0	275	130	9	2	15	0	234
Rosario	920	50,337	59,409	80250	180	4	142	16	22	556	215	5	180	20	0	500	300	6	270	25	0	319
Total	18,621	513,130	617,582	857,774	2,063	96	304	313	304	15,541	2,604	116	362	353	0	15,185	3,600	150	490	406	0	13,974
RIZAL:																						
Angono	2,200	54,175	70,641	113,855	320	15	10	15	60	1,780	420	20	13	20	0	1,728	670	32	21	30	0	1447
Antipolo	30,610	262,776	377,843	609,864	1,070	23	45	0	617	28,855	1,550	33	65	0	0	28,962	2,400	53	105	0	0	28052
Baras	2,340	19,866	25,704	41,448	84	0	0	0	0	2,256	110	0	0	0	0	2,230	170	0	0	0	0	2170
Binangonan	7,270	150,126	193,497	311,864	630	0	0	0	0	6,640	810	0	0	0	0	6,460	1,200	0	0	0	0	6070
Cainta	2,190	157,438	222,793	360,325	890	50	200	32	390	628	1,200	71	250	45	0	624	1,400	110	300	65	0	315
Cardona	3,120	37,113	45,827	72,015	165	0	0	0	0	2,955	205	0	0	0	0	2,915	300	0	0	0	0	2820
Jala-Jala	4,930	18,373	22,688	35,649	85	0	0	0	0	4,845	105	0	0	0	0	4,825	160	0	0	0	0	4770
Morong	3,760	36,216	44,719	68,660	160	0	0	0	0	3,600	198	0	0	0	0	3,562	300	0	0	0	0	3460
Pililla	7,390	36,898	45,561	71,598	164	0	0	0	0	7,226	203	0	0	0	0	7,187	310	0	0	0	0	7080
Rodriguez	31,280	75,522	93,252	146,684	335	12	8	15	52	30,858	415	13	10	18	0	30,822	650	23	16	28	0	30563
San Mateo	6,490	92,712	114,545	184,616	400	10	130	16	64	5,850	500	12	160	20	0	5,798	790	20	190	30	0	5460
Tanay	24,340	65,766	81,207	127,737	290	0	0	0	0	24,050	340	0	0	0	0	23,980	560	0	0	0	0	23780
Taytay	3,364	126,559	156,273	245,814	560	20	60	18	70	2,636	700	25	74	20	0	2,545	1,000	39	117	55	0	2174
Teresa	1,860	23,245	28,702	45,105	100	0	0	0	0	1,760	125	0	0	0	0	1,735	190	0	0	0	0	1670
Total	131,144	1,156,785	1,523,252	2,433,034	5,293	130	473	96	1,253	123,939	6,901	176	572	123	0	123,373	10,100	277	749	188	0	119,831
Total	211,005	10,350,000	12,152,463	15,724,593	30,177	3,151	4,559	4,623	8,993	159,509	36,531	3,685	4,911	4,986	2,732	158,168	47,447	4,576	5,513	5,618	0	147,851

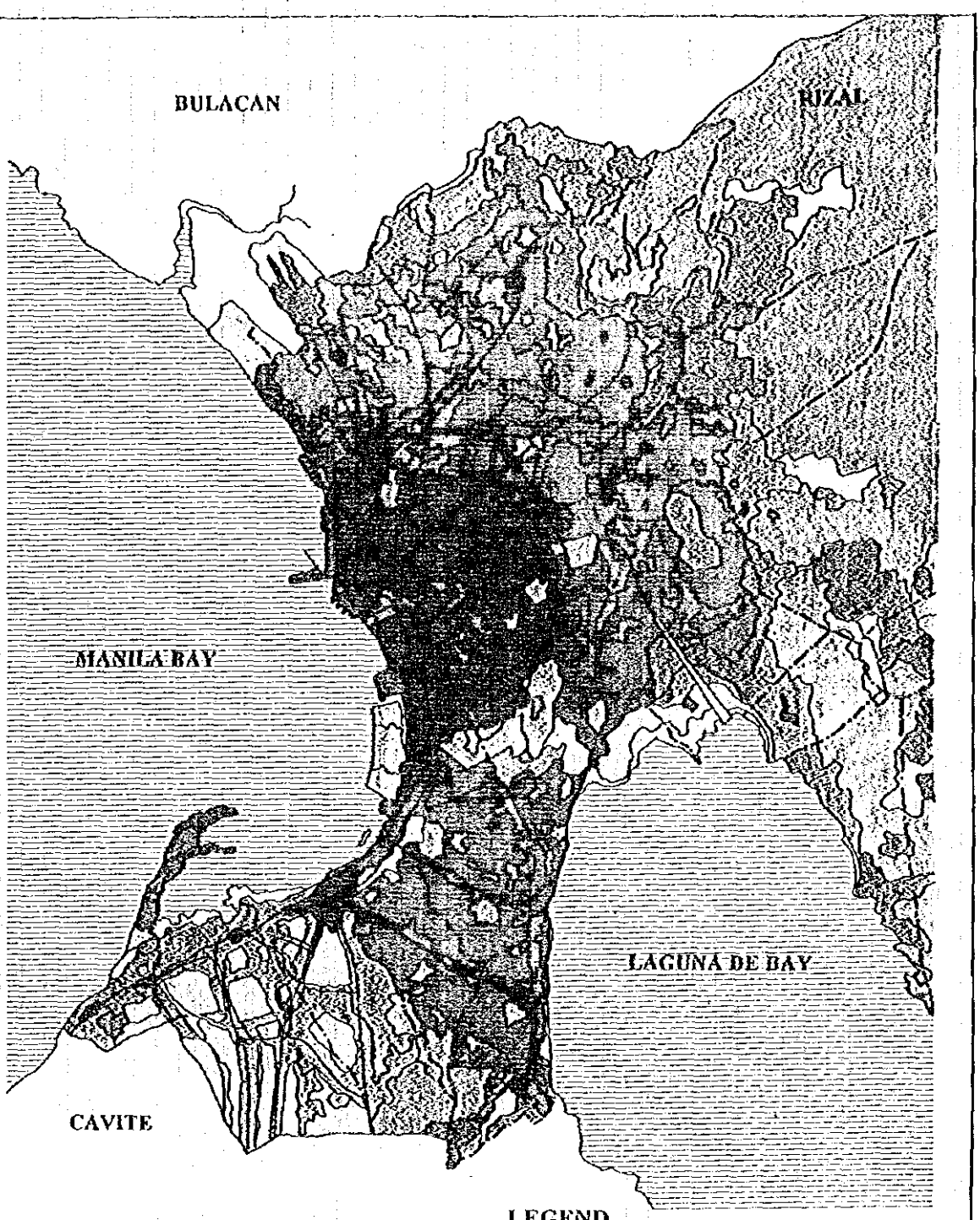
Table 1.3.6 Future Land Use (Percentage)

City/ Municipality	Total Land Area (ha)	1994 Built-up Area				1994 Open Space & Others (%)		2000 Built-up Area				2000 Open Space & Others (%)		2015 Built-up Area				2015 Open Space & Others (%)	
		Resid	Commer	Indust	Instit	Open Space	Others	Resid	Commer	Indust	Instit	Open Space	Others	Resid	Commer	Indust	Instit	Open Space	Others
NCR:																			
Manila	3,850	63.9	13.0	5.2	8.1	2.2	7.7	66.1	13.2	5.2	8.1	0.0	7.4	67.3	13.7	5.2	8.1	0.0	5.8
Pasay	1,760	42.0	9.7	2.3	32.4	4.1	9.5	47.2	10.8	2.3	32.4	0.0	7.4	55.1	12.5	2.3	30.1	0.0	0.0
Quezon	16,660	36.0	3.8	3.9	6.6	11.9	37.8	42.0	4.5	3.9	7.5	4.5	37.6	54.1	5.8	3.9	9.3	0.0	27.0
Caloocan	5,580	35.8	3.6	4.8	2.7	13.4	39.7	43.0	4.3	5.7	3.2	4.3	39.6	50.7	5.1	6.3	3.8	0.0	34.2
Mandaluyong	1,120	52.7	8.9	14.3	13.8	1.2	9.1	56.3	10.0	14.3	13.8	0.0	5.6	60.6	10.7	12.5	13.8	0.0	2.3
Las Pinas	3,270	41.6	2.8	4.3	1.5	21.4	28.4	54.1	4.0	4.6	2.1	6.7	29.4	76.5	5.8	6.1	3.1	0.0	8.6
Makati	1,840	59.8	17.9	8.2	6.5	0.8	6.8	62.5	19.0	8.2	6.5	0.0	3.8	65.2	20.7	7.6	6.5	0.0	0.0
Malabon	1,740	38.2	4.6	11.5	3.1	6.3	36.3	42.5	5.2	11.5	3.4	1.1	36.2	47.7	5.7	11.5	3.9	0.0	31.1
Mandaluna	2,280	42.1	4.4	9.6	4.4	21.4	18.1	52.6	5.5	10.5	5.0	8.3	18.0	62.7	6.6	11.0	5.3	0.0	14.5
Muntinlupa	3,970	28.5	2.5	4.5	3.0	29.5	32.0	37.8	3.3	6.3	3.8	17.6	31.2	50.7	4.5	8.1	5.3	0.0	31.4
Navotas	1,100	30.9	3.6	6.4	2.7	7.3	49.1	39.1	4.5	6.4	2.7	0.0	47.3	44.6	5.3	6.4	3.2	0.0	40.5
Paranaque	4,020	40.9	3.0	7.2	4.2	19.9	24.8	52.2	4.0	7.2	5.0	7.5	24.1	70.1	5.2	8.0	6.2	0.0	10.5
Pasig	3,160	34.8	4.0	16.5	3.0	16.8	25.0	41.1	4.7	16.5	3.5	9.5	24.7	54.4	6.2	17.4	4.7	0.0	17.2
Pateros	185	56.8	5.4	1.1	9.2	5.4	22.2	62.2	5.9	1.1	9.7	0.0	21.1	70.3	6.5	1.1	10.8	0.0	11.4
San Juan	620	71.1	9.7	2.4	10.8	4.8	1.1	73.4	10.5	2.4	10.8	1.9	1.0	74.2	11.9	1.9	11.0	0.0	1.0
Taguig	4,538	17.8	2.0	3.0	21.3	5.5	50.2	24.2	2.6	3.3	21.5	0.0	48.3	36.6	4.4	4.4	21.5	0.0	33.1
Valenzuela	4,480	31.9	3.8	12.1	2.9	7.7	41.7	39.3	4.7	12.7	2.9	0.0	40.4	54.0	6.5	14.1	3.3	0.0	22.1
Reclaimed Area:																			
Manila Side	331																		
Pasay Side	491																		
Paranaque Side	245																		
Total	61,260	37.3	4.8	6.2	6.9	12.1	32.7	44.1	5.5	6.5	7.4	4.5	32.0	55.1	6.8	7.9	8.2	0.0	22.9
CAVITE:																			
Cavite City	620	44.4	5.2	0.5	31.9	3.4	14.7	47.3	5.5	0.5	33.9	0.0	12.9	54.8	6.3	0.6	33.9	0.0	4.4
Bacoor	5,240	13.4	0.5	0.3	0.6	2.4	82.8	18.1	0.7	0.4	0.8	0.0	80.0	26.7	1.0	0.6	1.1	0.0	70.6
Imus	9,701	5.5	0.2	1.4	0.4	1.1	91.5	7.2	0.2	1.6	0.5	0.0	90.5	9.8	0.3	1.9	0.6	0.0	87.5
Kawit	1,750	17.0	0.7	0.1	1.3	1.0	79.8	20.1	0.9	0.1	1.5	0.0	77.4	27.4	1.1	0.2	2.1	0.0	69.1
Noveleta	390	20.5	1.5	0.3	2.6	2.6	72.6	24.4	1.8	0.3	3.1	0.0	70.5	33.3	2.3	0.5	3.8	0.0	60.0
Rosario	920	19.6	0.4	15.4	1.7	2.4	60.4	23.4	0.5	19.6	2.2	0.0	54.3	32.6	0.7	26.3	2.7	0.0	34.7
Total	18,621	11.1	0.5	1.6	1.7	1.6	83.5	14.0	0.6	1.9	1.9	0.0	81.5	19.3	0.8	2.6	2.2	0.0	75.0
RIZAL:																			
Angono	2,200	14.5	0.7	0.5	0.7	2.7	80.9	19.1	0.9	0.6	0.9	0.0	78.5	30.5	1.5	1.0	1.4	0.0	65.6
Anupolo	30,610	3.5	0.1	0.1	0.0	2.0	94.3	5.1	0.1	0.2	0.0	0.0	94.6	7.8	0.2	0.3	0.0	0.0	91.6
Baras	2,340	3.6	0.0	0.0	0.0	0.0	96.4	4.7	0.0	0.0	0.0	0.0	95.3	7.3	0.0	0.0	0.0	0.0	92.7
Binangonan	7,270	8.7	0.0	0.0	0.0	0.0	91.3	11.1	0.0	0.0	0.0	0.0	88.9	16.5	0.0	0.0	0.0	0.0	83.5
Cainta	2,190	40.6	2.3	9.1	1.5	17.8	28.7	54.8	3.2	11.4	2.1	0.0	28.5	63.9	5.0	13.7	3.0	0.0	14.4
Cardona	3,120	5.3	0.0	0.0	0.0	0.0	94.7	6.6	0.0	0.0	0.0	0.0	93.4	9.6	0.0	0.0	0.0	0.0	90.4
Jala-Jala	4,930	1.7	0.0	0.0	0.0	0.0	98.3	2.1	0.0	0.0	0.0	0.0	97.9	3.2	0.0	0.0	0.0	0.0	96.8
Morong	3,760	4.3	0.0	0.0	0.0	0.0	95.7	5.3	0.0	0.0	0.0	0.0	94.7	8.0	0.0	0.0	0.0	0.0	92.0
Pililla	7,390	2.2	0.0	0.0	0.0	0.0	97.8	2.7	0.0	0.0	0.0	0.0	97.3	4.2	0.0	0.0	0.0	0.0	95.8
Rodriguez	31,280	1.1	0.0	0.0	0.0	0.2	98.7	1.3	0.0	0.0	0.0	0.1	98.5	2.1	0.1	0.1	0.1	0.0	97.7
San Mateo	6,490	6.2	0.2	2.3	0.2	1.0	90.1	7.7	0.2	2.5	0.3	0.0	89.3	12.2	0.3	2.9	0.5	0.0	84.1
Tanay	24,340	1.2	0.0	0.0	0.0	0.0	98.8	1.5	0.0	0.0	0.0	0.0	98.5	2.3	0.0	0.0	0.0	0.0	97.7
Taytay	3,364	16.6	0.6	1.8	0.5	2.1	78.4	20.8	0.7	2.2	0.6	0.0	75.7	29.7	1.2	3.5	1.0	0.0	64.6
Teresa	1,860	5.4	0.0	0.0	0.0	0.0	94.6	6.7	0.0	0.0	0.0	0.0	93.3	10.2	0.0	0.0	0.0	0.0	89.8
Total	131,144	4.0	0.1	0.4	0.1	1.0	94.5	5.3	0.1	0.4	0.1	0.0	94.1	7.7	0.2	0.6	0.1	0.0	91.4
Total	211,005	14.3	1.5	2.2	2.2	4.3	75.6	17.3	1.7	2.3	2.6	1.3	75.0	22.5	2.2	2.6	2.7	0.0	0.0

Figure 1.3.4 Estimated Area (%) By Land Category



INDSCHT.XLS/30/96



STUDY ON WATER SUPPLY AND SEWERAGE MASTER PLAN OF METRO MANILA	Figure 1.3.5 FUTURE LAND USE

3.4.2 Industrial Land Projection

(1) Industrial Land Projection

Industrialization and urbanization are closely related. Industries are attracted to urban centers, especially Metro Manila and its nearby provinces, because of the availability of infrastructure and services, and the proximity to markets and ports. The rural population is attracted to urban centers because of the availability of employment in industries and services.

(2) Industrial Development Policy

Industrial development occurred in the late 1970s and early 1980s as a result of MMA's land use policies and the rapid growth in population, leaving no more space for further development in the 1990s. Consequently, the government encouraged industries to relocate in the countryside or redirect investments to the regions. Among the most notable strategies undertaken are the establishment of EPZ, and the amendment of the Investments Code to give fiscal incentives to manufacturing firms relocating outside of Metro Manila

While investments are discouraged in the NCR in view of the industry dispersal thrust, the government supports the establishment of special estates in areas outside of Metro Manila. Manpower development programs have been implemented during the 1993-1998 period banning further expansion of heavy industrial and manufacturing activities in Metro Manila.

Given the above considerations, the physical growth strategies are:

- Banning of construction and expansion of heavy industries in the main built-up areas, including some areas in Manila, Pasay, Quezon City, Caloocan, San Juan, Mandaluyong, and Makati.
- Planned development should be pursued in the urban consolidated zone (outside the borders of Muntinlupa, Las Piñas, Taguig, Caloocan (North) and Valenzuela), but only allowing the establishment of less pollutive industries.
- Preservation of the Novaliches and Marikina watersheds, Navotas, and the municipalities along the coast of Laguna Lake by prohibiting industrial development in these areas.

(3) Industrial Trend

Industries in the Study Area are considerably concentrated in the NCR, mostly along the waterfront (along Pasig and Marikina rivers) and major arteries (MacArthur Highway, Quirino Highway and Tandang Sora in the North, and Pasong Tamo, Alabang-Zapote Road and Manila South Expressway in the South).

Industrial development in the Study Area has accounted for about 2.3% of the total land area, and is projected to increase as follows:

Table 1.3.7 Industrial Trend

REGION	TOTAL LAND AREA		1994		2000		2015		INCREASE RATE (%) (1994~2015)
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(%)	
NCR	61,240	100	3,782	6.2	3,977	6.5	4,274	7.0	13.0
CAVITE	18,621	100	304	1.6	362	1.9	490	2.6	61.0
RIZAL	131,144	100	473	0.4	572	0.4	749	0.6	58.2

Given the strategies undertaken by the government in banning new industrial expansions and encouraging the establishment of industrial sites in outlying areas 50 km from Manila, an increase of only 13 % is expected from industrial land use in NCR (from 1994 to 2015), while a 61 % and 58.2 % increase respectively are expected in Cavite and Rizal in the same period.

The industrial area projections were extrapolated considering the following factors: data of past land use, land availability, population growth trend and policies concerning the new industrial location outside Metro Manila delineated by the government.

The estimated area by municipality and by selected years (1994, 2000 and 2015) is shown in Figure 1.3.6

As shown in the Figure, Quezon City has the largest industrial land area in NCR. However, growth in the industrial use of lands may remain constant or slightly change, depending on the growth in residential land use; industrial lands are supposed to decrease along with the rise in residential lands. The industrial land use trend in most cities and municipalities in the inner core of NCR is either going to remain constant (e.g. Quezon City) or will decrease, as in Manila, Pasay, Mandaluyong, Makati and San Juan.