Chapter 2

CHARACTERISTICS OF STUDY AREA

CHAPTER 2 CHARACTERISTICS OF STUDY AREA

2.1 NATURAL CONDITIONS

2.1.1 INTRODUCTION

In this chapter, natural condition in the study area is presented. Firstly, topographic and geological conditions are described. The latest information for ground elevation is utilized in this study. Tendency of land subsidence is also discussed. Secondly, overall condition of river and drainage system related to the study area is explained. The Pasig-Marikina River system, which gives boundary conditions for the drainage system in the study area, is presented. Thirdly, meteorological and hydrological conditions are summarized. The rainfall intensity, tide level at Manila Bay, as well as general meteorological conditions, are explained. Finally, environmental conditions especially for water and bottom sediment quality in the study area are presented.

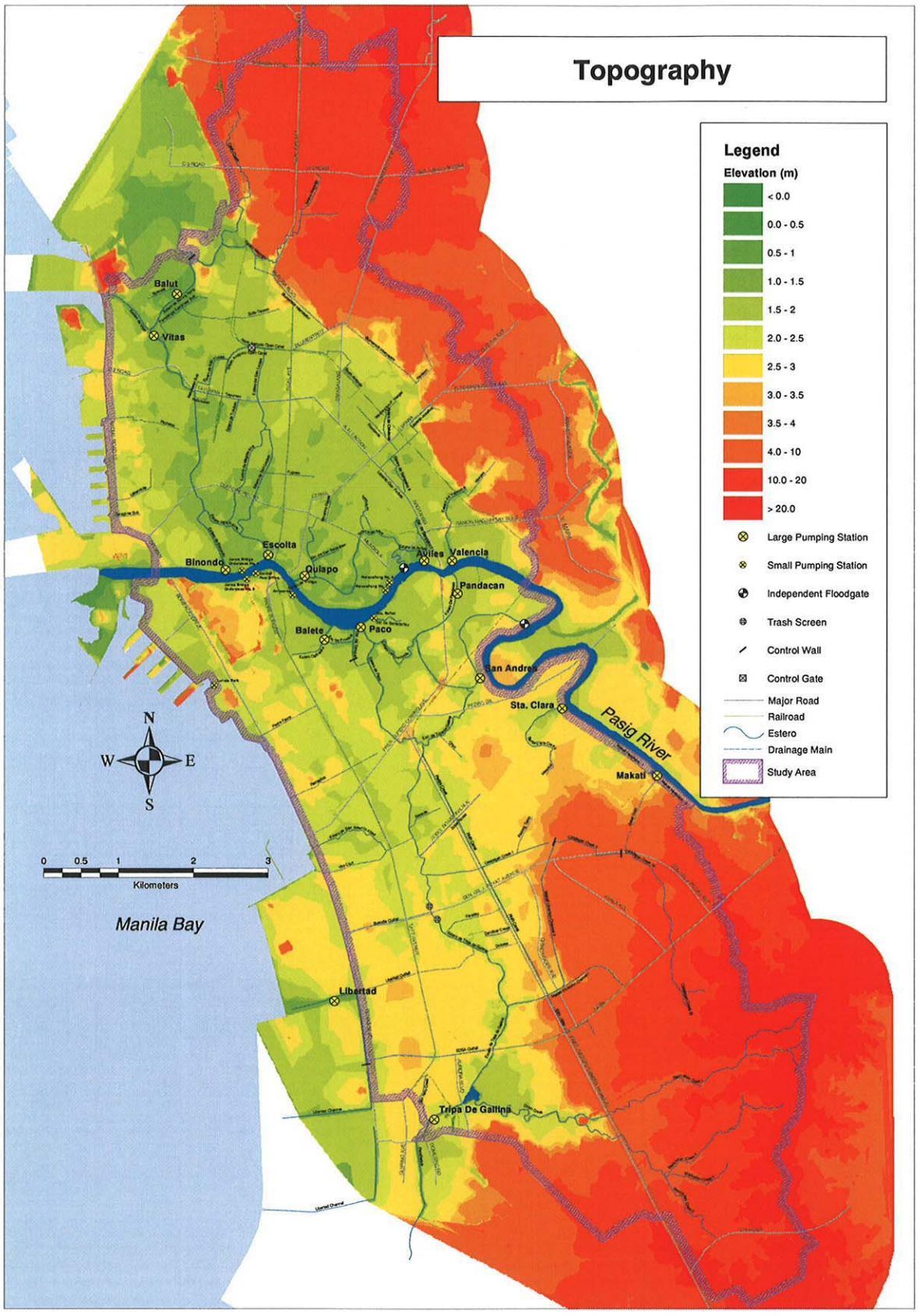
2.1.2 TOPOGRAPHY AND GEOLOGY

(1) General

Figure 2.1.1 shows the elevation contour in the study area. The west boundary of the study area is a coastline along Manila Bay, except for the newly developed reclamation area. On the other hand, there are mainly hilly zones along the east, north and south boundaries. Those boundaries are determined fundamentally based upon natural drainage basins. The highest elevation within the study area is about 40 m above the Mean Sea Level (MSL), whereas the lowest is the same as the MSL. About 60% of the study area is lower than 4 m above the MSL, which has mild slope.

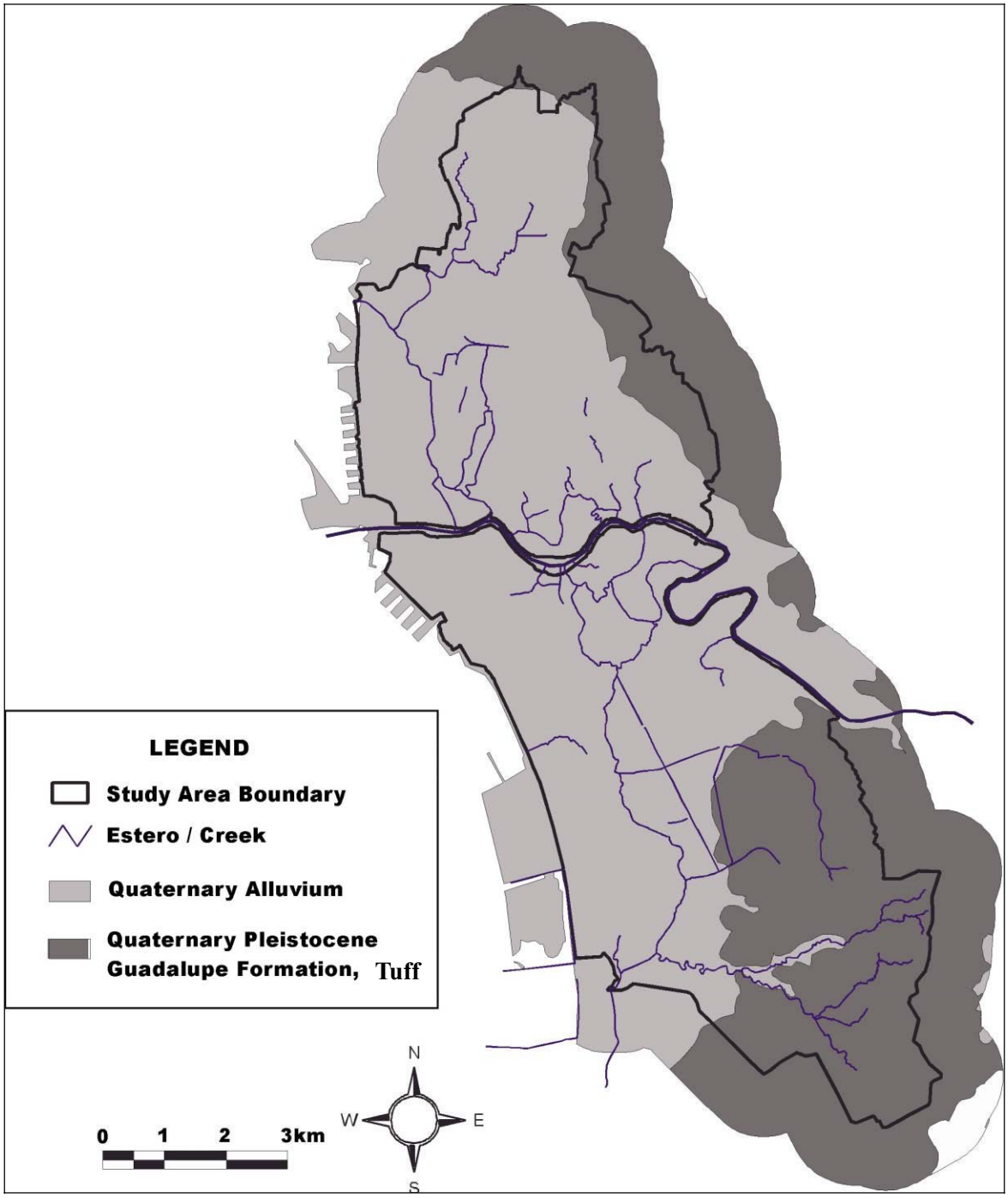
The study area consists of mainly two geological formations: volcanic tuff and quaternary alluvium as shown in *Figure 2.1.2*. The hilly areas, which are located in the southeastern and northeastern portion of the study area, have been formed by a ridge of volcanic tuff (the Guadalupe tuff), locally called “adobe”. The Guadalupe tuff is considered a suitable bedrock foundation. On the other hand, the low-lying area is filled with recent fluvial deposits of sand, silt, gravel and clay, which have been conveyed mainly by the Pasig River and other small rivers.

Figure 2.1.3 shows detailed land formation in the study area. The low-lying area consists of several different land formations. Delta area expands from the Pasig River to the north and south. There are transition areas between delta area and hilly area. Marsh area along esteros/creeks connecting to the Pasig River’s southern section is observed to have lower elevation than the surrounding areas. Along the coastal area it forms a coastal sand bar, of which the elevation is slightly higher than the surrounding marsh area.



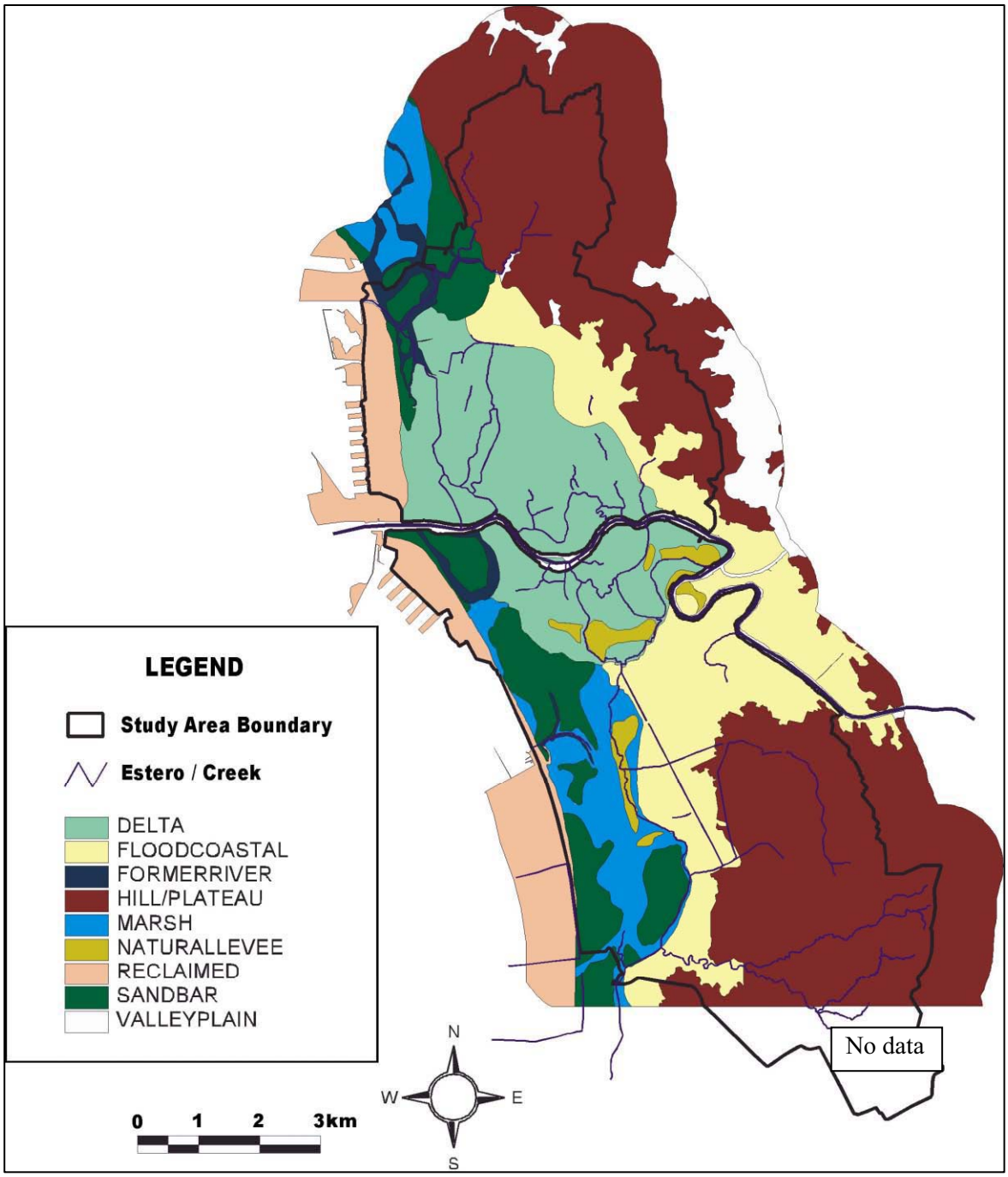
Source: JICA Study Team (2004)

Figure 2.1.1 Elevation Contour



Source: MMEIRS database (2004)

Figure 2.1.2 Geological Formation



Source: MMEIRS database (2004)

Figure 2.1.3 Land Formation

(2) Topographic Map

1) Available Digital Topographic Map

The following topographic maps on the study area are available:

- 1:10,000 scale digital mapping prepared by NAMRIA in 1999
  (based upon the 1:10,000 scale topographic maps prepared by JICA in 1982)
- 1:5,000 scale digital mapping prepared by JICA in 2004 (MMEIRS)[1]

The topographic map prepared by MMEIRS has 1.0 m interval contour (supplementary contour lines with 0.5 m), which gives most recent topographic information.

In addition to the above maps, more than 7,000 spot elevations referenced at the top of manholes in the study area are obtained from the JICA Study in 2000 (SEDLMM)[2] with BM-66, located at Port Area in Manila, as the base elevation. These spot elevation data are used to update the topographic information, especially in low-lying area. However, according to MMEIRS, it is possible that the elevation of BM-66, which was used as the primary benchmark in SEDLMM, is now lower than that in 1978. In SEDLMM, it was assumed that the elevation of BM-66 was the same as that in 1978. The place where BM-66 is located is the most possibly affected area by land subsidence. It is thereby required to confirm the elevation of BM-66 before using those data.

2) Arrangement of Topographic Information for Drainage Study

In the Study, topographic information is arranged based upon the 1:5,000 scale digital mapping prepared by MMEIRS and the updated spot elevations from the top of manholes obtained by SEDLMM. The procedure is shown in *Table 2.1.1*.

Table 2.1.1 Procedure to Arrange Topographic Information

Procedure-1	Checking and correction of benchmarks used in SEDLMM
Procedure-2	Correction of the spot elevations obtained by SEDLMM based upon the results of Procedure-1
Procedure-3	Selecting the spot elevations which are located within low-lying area that is lower than 4.0 m above MSL
Procedure-4	Removing strange contour by MMEIRS and strange spot elevations by SEDLMM
Procedure-5	Developing new contour with 0.2 m interval using both the contour with 1.0 m interval by MMEIRS and the spot elevations by SEDLMM within the area that is lower than 4.0 m above MSL
Procedure-6	Manually re-arranging connection zone between the original contour within the area that is higher than 4.0 m above MSL and the newly developed contour in Procedure-5

BM-4B, which had been used as a primary benchmark in many drainage and flood control projects, was demolished in 2003 and no longer exists. BM-ML3 located in Quezon City is the primary benchmark used in MMEIRS as recommended by NAMRIA, because of less possibility of land subsidence. It has been decided that the primary benchmark to be used for the Study is BM-ML3.

In *Procedure-1*, it was clarified that the elevation of BM-66 in 2004 is lower than that in 1978. The difference was estimated at 0.133 m. Therefore, all of the elevations used in SEDLMM have been adjusted based upon it. The analysis including hydrological and hydraulic analysis will be conducted using the arranged topographic information in the Study.

3) Expression of Elevation

In the previous projects related to drainage and flood control in Metropolitan Manila, a DPWH datum is employed to express elevations. The DPWH datum is defined as follows:

DPWH datum (m) = MSL (m) +10.0 m + Difference between MSL and MLLW (m)

(*Note: MSL = Mean Sea Level, MLLW = Mean Lower Low Water Level*)

Difference between MSL and MLLW varies slightly with selected tide series. In recent drainage and flood control studies in Metropolitan Manila, the tide series of 1970 to 1988 has been employed. Therefore, it is decided that the tide series of 1970 to 1988 is employed also in the Study.

Difference between MSL and MLLW = 0.475 m (based on the tide series of 1970 to 1988)

The DPWH datum defined here is used for expressing the elevation related to drainage facilities including drainage channels and pumping stations in the Study.

(3) Tendency of Land Subsidence

It is said that there is some amount of land subsidence in the core area. The previous report for flood control project in KAMANAVA area summarized the relationship between land subsidence estimated from reading of a tide gauge located in Port Area, Manila and groundwater extraction in Manila, as shown in *Figure 2.1.4*. The land subsidence in Port Area is estimated at about 0.5 m after 1960. The rate of subsidence was very high in 1964-1979—about 0.4 m within 15 years (0.027 m/year). During that period, amount of groundwater extraction was also very large. It indicates that large amount of groundwater extraction could be one of the causes of land subsidence. During 1980-1990, the rate of land subsidence was low compared to that in 1964-1979—about 0.1 m within 10 years (0.01m/year). This is probably because of significant reduction of groundwater extraction.

As shown in the previous section, the elevation of BM-66 located in Port Area, Manila in 2004 is about 0.13 m lower than that in 1978, which indicates that the rate of land subsidence around Port Area is about 0.13 m within the last 26 years (0.005 m/year). This fact supports the conclusion that the rate of land subsidence around Port Area has been decreasing and will be decreasing.

The spatial distribution of land subsidence in the core area is not still clear because there is not enough information and the effect of future land subsidence in the core area is not included in the drainage planning. However, it could be concluded that the rate of land subsidence in the core area will not be so high whenever severe groundwater extraction will not be executed in future. In the Study, the ground elevations are updated to the most recent one, and those updated elevations are employed to formulate the drainage improvement plan. It is recommended to conduct periodical elevation monitoring of the benchmarks and optimum regulation of groundwater extraction.

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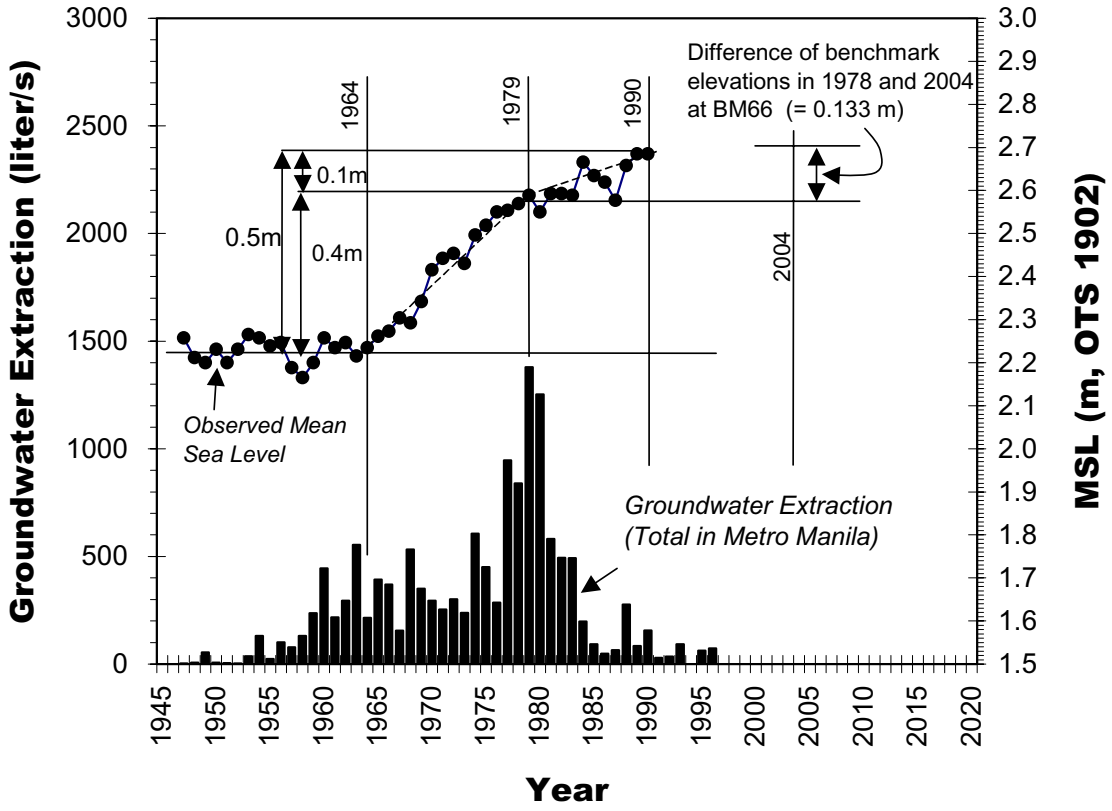


Source: DPWH, Metro Manila Flood Control Project (1998)[3]

Note: The original figure was modified by the Study Team.

Figure 2.1.4 Land Subsidence and Groundwater Extraction around Port Area

2.1.3 RIVER AND DRAINAGE SYSTEM

(1) Pasig-Marikina River System

The Pasig-Marikina River, which originates in the southern slope of Mt. Angilo in Sierra Madre Mountain Range, is the main drainage way in Metropolitan Manila. Rainwater on the core area of Metropolitan Manila is drained directly or through pumping station and floodgates either to the Pasig River or Manila Bay. Therefore, the water levels in Manila Bay and the Pasig River act as boundary conditions of the drainage system in the study area.

Figure 2.1.5 shows an outline of the Pasig and Marikina River system. Major tributaries in the lower reaches of the Pasig-Marikina River are the San Juan River on the right bank and Napindan Channel on the left bank, respectively. Total catchment area at the river mouth is around 700 km^2 (excluding that of Laguna de Bay) with a length of 80 km. The Pasig-Marikina River is divided into two parts outlined below.

- The Marikina River: from its origin to confluence of Napindan Channel (L= 63 km)
- The Pasig River: from confluence of Napindan Channel to river mouth (L= 17 km)

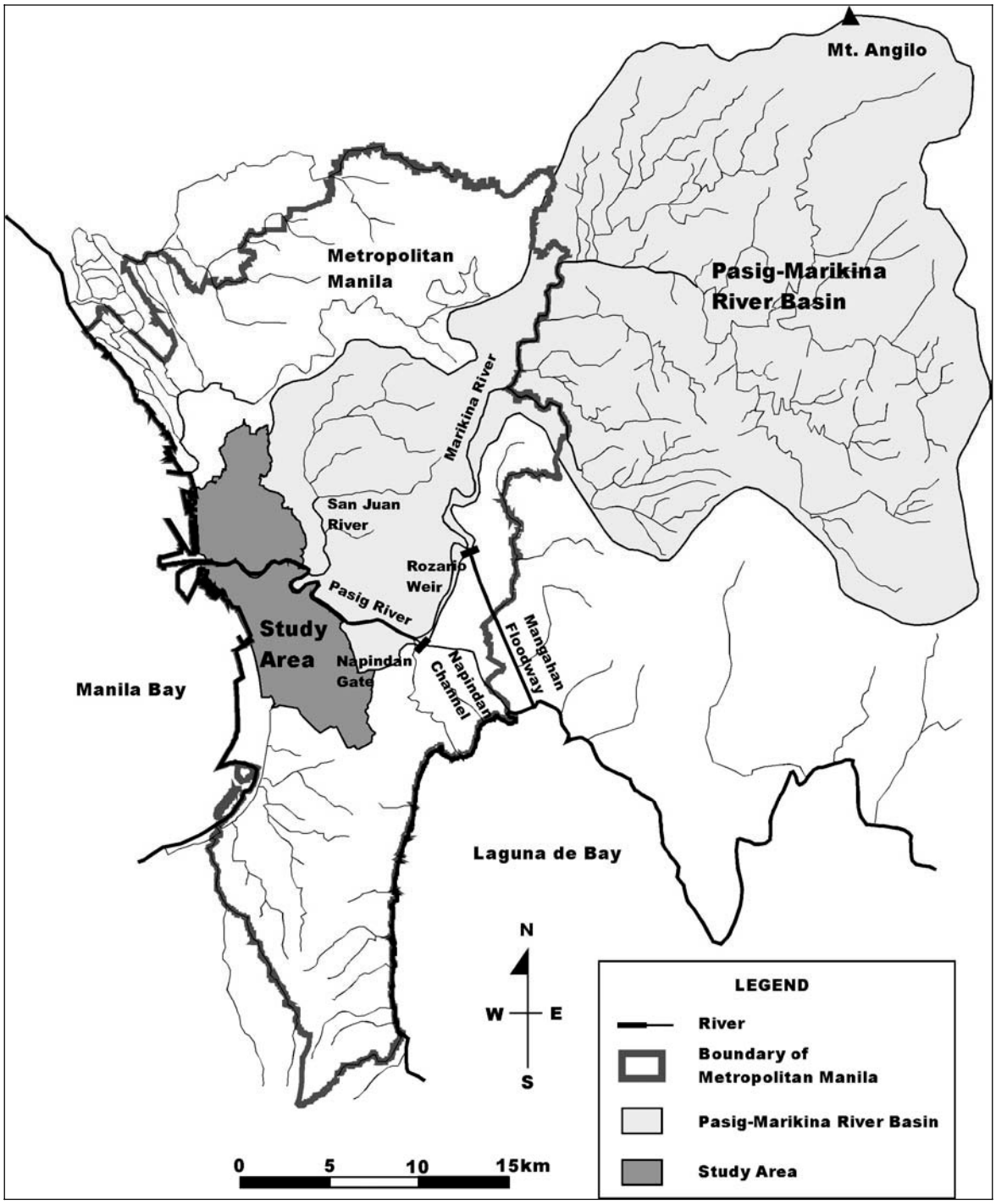


Figure 2.1.5 Pasig-Marikina River Basin

1) Marikina River

The Marikina River originates in the Sierra Madre Mountain Range. After passing through the mountainous areas and collecting several tributaries, it runs towards south-southeast. At Rosario, there is a made channel of the Mangahan Floodway completed in 1984. It diverts a part of flood to the Laguna de Bay through Rosario Weir consisting of eight vertical roller gates. The design discharge of the floodway is 2,400 m^3/s under a 100-year design flood. The total channel length and width between dikes are approximately 9 km and 250 m with trapezoidal section, respectively.

From the said diversion point, the Marikina River runs further towards south-southeast and reaches the confluence of Napindan Channel that drains water from the Laguna de Bay through Napindan Hydraulic Control Structures constructed in 1983. The Napindan Hydraulic Control Structures consist of four vertical roller gates, having such purposes of controlling the water level in Laguna de Bay, and preventing the flow of saline and polluted water from the Pasig River to Laguna de Bay. A total catchment area of the Laguna de Bay is approximately 4,000 km^2 where 21 river basins drain including that of the Marikina River (605 km^2). Total lake area and its reservoir volume are 900 km^2 and 3.2 billion m^3, respectively, with an average water depth of 2.8 m.

In the lower Marikina River towards the confluence of Napindan Channel, the existing major flood control and related structures are concrete revetments to protect bank line having a total length of 5,700 m, various drainage outlets, eight roadway bridges, etc. In this reach, the river has an average gradient of l/5,000 and width ranging from 70 m to 200 m.

2) Pasig River

After joining Napindan Channel, the river changes its course towards the southeastern direction and becomes the main drainage way called the Pasig River that runs through the densely populated area of Metropolitan Manila. At eastern edge of Manila City, the Pasig River joins the main tributary of the San Juan River having a catchment area of around 90 km^2 on the right bank. In the downstream reaches of the said confluence, flow direction changes towards west and finally discharges into Manila Bay. Along the portion from the river mouth to Del Pan Bridge, which is about 700 m in length, the riverbanks are utilized as wharves for the Port of Manila.

The existing major flood control and related structures in the Pasig River are as follows; concrete revetment and wall on both of the banks, 11 major drainage pumping stations that directly drain stormwater in the core area of Metro Manila to the Pasig River, various riverbank protection works and drainage outlets, 13 roadway and railway bridges, etc. The Pasig River at this reach has an average gradient of 1/5,000 and width ranging from 60 m to 250 m.

The Pasig-Marikina River Channel Improvement was identified as an urgent project under the "Study on Metro Manila Flood Control Project" conducted in the period from 1988 to 1990. Subsequently, the detailed engineering design of the urgent project was conducted under OECF's 23rd loan package in June 1999. The construction works with protection level of 30-year design flood were scheduled to commence in year 2004. The section to be improved is from river mouth to Marikina Bridge with a total length of about 30 km. It is expected that the project will significantly minimize flood and inundation damage resulting from overflow of water from riverbank and leakage of floodwater from the Pasig River either to urban area or drainage channels. According to the previous report[4] on Project for the

Pasig-Marikina River Flood Control, the design high water level along the reach neighboring the study area in the Pasig River varies from EL. 12 m (1.525 m above MSL) at the river mouth to EL. 13.5 m (3.025 m above MSL) at San Andres Pumping Station. These elevations are generally higher than the ground elevation in the low-lying area of the study area. If leakage of floodwater through drainage outlet along the Pasig River is not attended to, the study area will receive much reverse flow from the Pasig River, which makes the inundation situation worse significantly. *Figure 2.1.6* shows the areas that are lower than EL. 12 m, EL. 12.5 m, EL. 13 m and EL. 13.5 m (DPWH datum), which are potentially affected areas by the floodwater in the Pasig River.

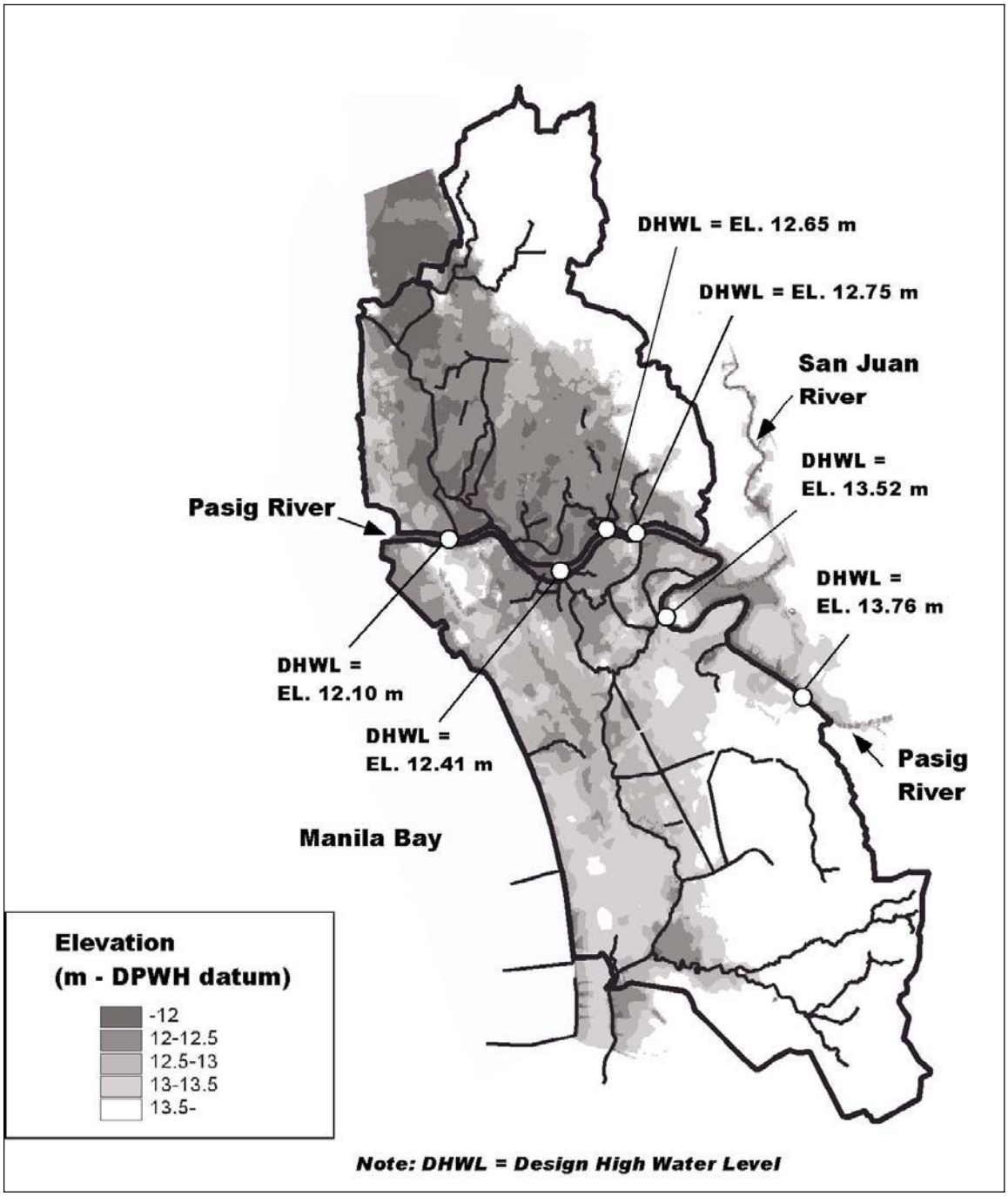


Figure 2.1.6 Potentially Affected Areas by Floodwater in the Pasig River

(2) Drainage System

The total catchment area of the drainage system in the core area is about 73 km^2. The drainage system in the core area is geographically divided by the Pasig River into two areas: South Manila (south or left bank of Pasig River) and North Manila (north or right bank of Pasig River). Both areas are influenced by the relatively flat topography and the low elevation in relation to the sea level in Manila Bay. The detail of the drainage conditions is discussed in *Chapter 2.5*.

2.1.4 METEOROLOGY AND HYDROLOGY

(1) Monitoring Network on Meteo-Hydrology

1) Meteorological Stations and Data

There are four rainfall stations in and around the study area: Port Area, Science Garden, NAIA and Napindan. Available rainfall data and general climatic data at all the above-mentioned four stations have been collected during the Study.

Thiessen polylines for calculating basin mean parameters are shown in *Figure 2.1.7*. It is found that Port Area has the most (56%) influence over the study area, NAIA and Napindan stations have almost same influence (17%) and the rest (10%) is influenced by Science Garden.

2) Hydrological Stations and Data

There are three water level stations located along the Pasig River within the reach of the study area, namely Fort Santiago, Pandacan and Napindan. A location map of the water level stations is shown in *Figure 2.1.7*

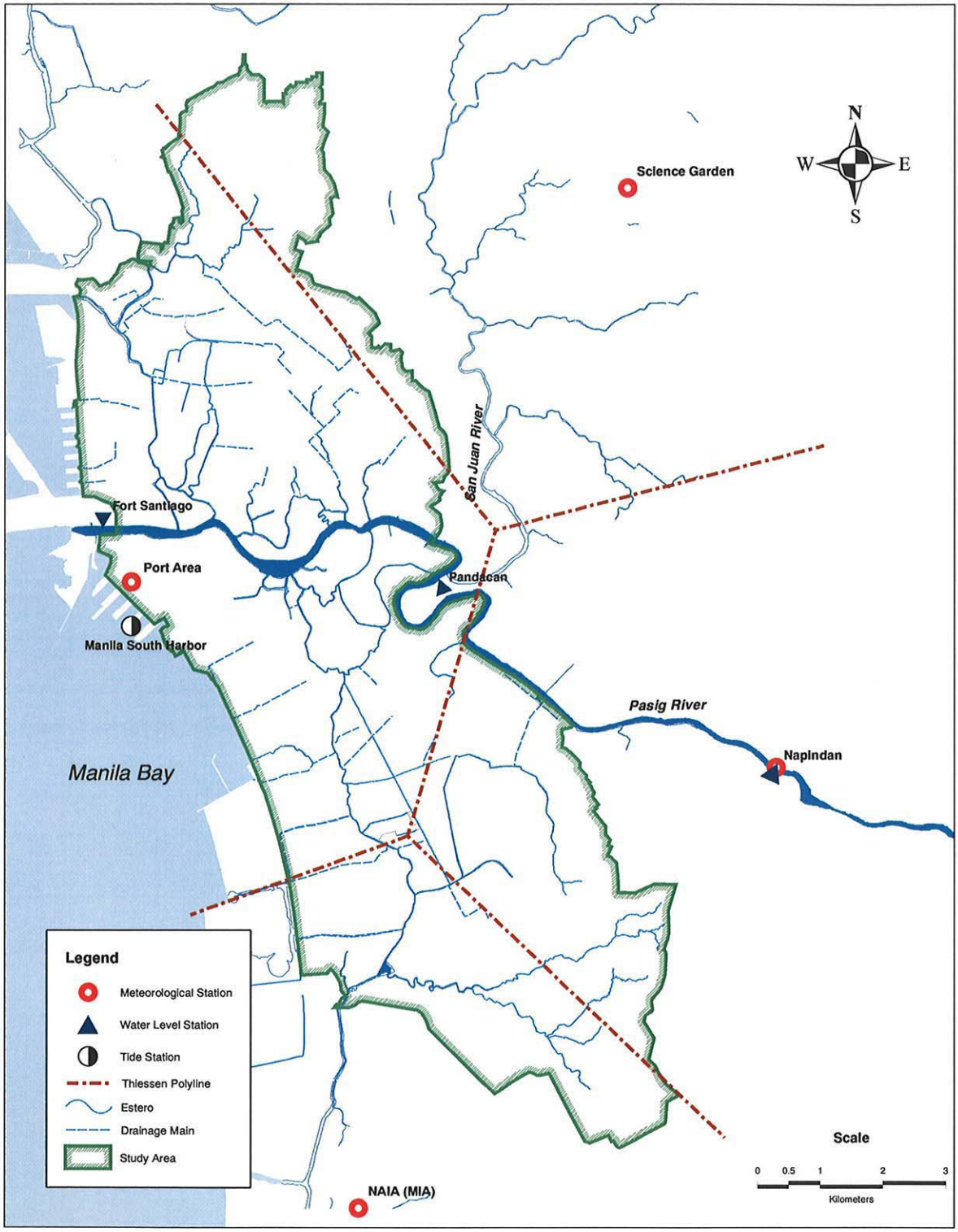


Figure 2.1.7 Monitoring Network on Meteo-Hydrology

(2) General Meteo-Hydrological Condition

1) Annual Rainfall

Annual average rainfall at Port Area, Science Garden, NAIA and Napindan stations are calculated at 2,171 mm, 2,483 mm, 1,836 mm and 2,050 mm, respectively. Over the study area, annual average rainfall is calculated at 2,125 mm.

2) Monthly Rainfall

Maximum rainfall over the study area occurs in the month of July (475 mm) and then in the month of August (425 mm). It can be seen that 81% of the annual total rainfall over the study area falls during the months of June to October, which can be called as Wet Season.

3) Monthly Pan Evaporation

Mean annual total pan evaporation at Science Garden is calculated at 1,334 mm. Maximum pan evaporation occurs in the month of April (162 mm) and then in the months of May (148 mm) and March (147 mm).

4) Monthly Temperature

In the study area, average monthly minimum and maximum temperatures are observed in the months of January (22°C) and April (34°C), respectively. Annual average temperature in the study area is calculated at 28°C with small monthly variation.

5) Monthly Relative Humidity

In the study area, average monthly minimum and maximum relative humidity are observed in the months of March-April (65%) and August-September (80%), respectively. Annual average relative humidity in the study area is calculated at 74%.

6) Tide Level on Manila Bay

Daily variation in tide level at Manila South Harbor for year 1999 is shown in *Figure 2.1.8*. It can be seen that highest tides occur in the months of July-September.

There exist calculated mean tide levels at Manila South Harbor for two series of tide cycles of 19-year periods, which are 1970-1988 series and 1901-1919 series. Mean tide values for the two series are presented in *Table 2.1.2*. It can be seen that the two different series produced the same mean tide values except Mean High Spring Tide (MHST), which was calculated as EL. 11.34 m for 1970-1988 series and EL. 11.30 m for 1901-1919 series. In order to check whether there is any change in tide levels in recent years compared with the previous two tide series, NAMRIA tide data for period 1999-2003 has been analyzed during this study. As shown in the last column in *Table 2.1.2*, MLLW and MHHW for the period 1999-2003 is calculated to be EL. 10.01 and EL. 10.98 m, respectively, which matches well with the previous values of the two tide series. Therefore, the mean tide values of the past two tide series are equally applicable for the present study.

Historical maximum (EL. 11.91 m) and minimum (EL. 9.33m) tide levels were observed in July 12, 1972 and February 3, 1913, respectively.

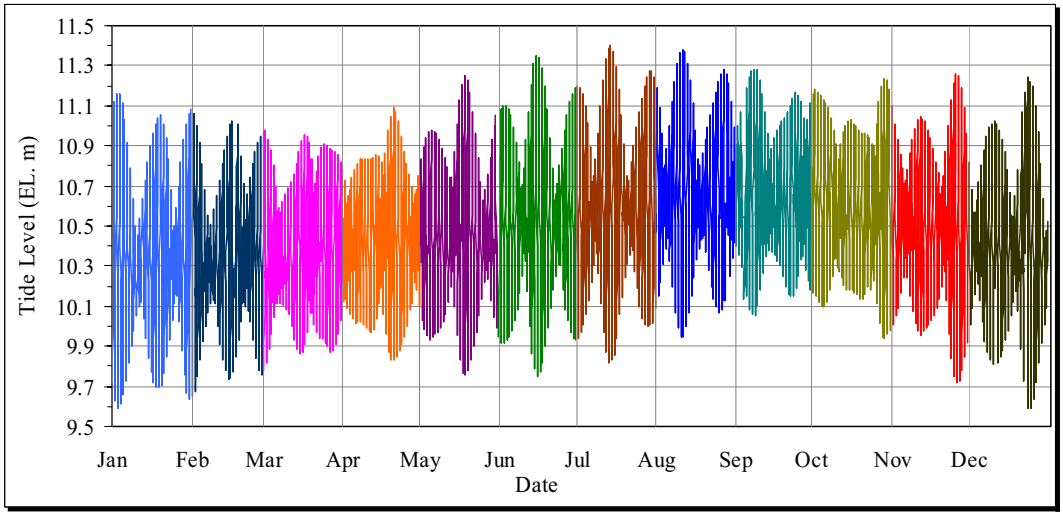


Figure 2.1.8 Daily Variation in Tide Level at Manila South Harbor for Year 1999

Table 2.1.2 Tide Levels at Manila South Harbor for Different Tide Series

Series	Tide Levels (EL. m) (DPWH Datum)			
	1970-1988[1)] (19 Years)	1901-1919[2)] (19 Years)	1984-1987[3)]	1999-2003 (This Study)
MLLW	10.00	10.00		10.01
MLW	10.10	10.10		
MHLW	10.20	10.20		
MSL	10.47	10.47		
MTL (MHW+MLW)/2	10.48	10.48		
MLHW	10.71	10.71		
MHW	10.86	10.86		
MHHW	11.00	11.01		10.98
MHST	11.34	11.30	11.25	
MR (MHW - MLW)	0.76	0.76		

Source:

1) DPWH, the Study on Flood Control and Drainage System Improvement for Kalookan-Malabon-Navotas-Valenzuela (KAMANAVA) Areas, 1998.
2) MPWH, Metro Manila Drainage System Rehabilitation Project (PH-66), Drainage Improvement Plans for Estero de Vitas and Other Catchment Areas, Supplementary Study Report, 1987.
3) MPWH, Metro Manila Drainage System Rehabilitation Project, Study Report, 1988

Definitions of Terms:

MLLW = Mean Lower Low Water: Average of 1st low (lowest) water levels of a tidal day
MLW = Mean Low Water: Average of the maximum height reached by each rising tide
MHLW = Mean Higher Low Water: Average of 2nd low water levels of a tidal day
MSL = Mean Sea Level: The average height of the surface of the sea for all stages of the tide over a 19-year period, usually determined from hourly height readings
MTL = Mean Tide Level: A plane midway between Mean High Water and Mean Low Water
MLHW = Mean Lower High Water: Average of 2nd low water levels of a tidal day
MHW = Mean High Water: Average of the minimum height reached by each falling tide
MHST = Mean High Spring Tide: Average of monthly 1st and 2nd high water levels (spring tides occurring at full and new moon SYZYGY)
MHHW = Mean Higher High Water: Average of 1st high (highest) water levels of a tidal day
MR = Mean Range: Difference in height between daily Mean High and Low Water

(3) Meteo-Hydrological Analysis

1) Probable Rainfall

The results of probability of annual maximum short duration rainfalls at Port Area and Science Garden stations are summarized in *Table 2.1.3*.

A comparison has been made between probable rainfall depths estimated during this study and those reported in previous studies, which is summarized in *Table 2.1.4*. As can be seen, MPWH Study in 1984 reported the maximum values of probable rainfall depths as calculated with adjustment of the original rainfall data by multiplication factor of >1.0 to account for different uncertainties in measured rainfall data. The table shows that probable rainfall depths calculated by this study is consistent with the previous studies, especially with the most recent FCSEC estimation.

Table 2.1.3 Results of Probability Analyses on Annual Maximum Rainfalls

Port Area

Unit: mm

Return Period (Years)	Probable Rainfall Depth (mm)								
	Minutes			Hours					
	10	30	60	2	6	12	24	48	72
2	20	39	54	76	110	136	153	219	256
3	23	45	62	88	131	162	184	268	318
5	26	51	70	101	154	192	218	324	387
10	*30*	*59*	*81*	*118*	*183*	*229*	*260*	*394*	*474*
20	34	67	92	134	211	264	301	461	558
30	36	72	98	143	226	285	324	499	606
50	39	77	106	155	246	310	354	548	665
100	43	85	116	171	273	345	393	613	746
Sample (n)	83	83	80	66	52	52	88	81	75

Period: 1903-2003

Science Garden

Unit: mm

Return Period (Years)	Probable Rainfall Depth (mm)								
	Minutes			Hours					
	10	30	60	2	6	12	24	48	72
2	21	39	52	75	108	141	171	242	283
3	24	47	64	90	131	165	198	278	330
5	28	55	76	107	157	192	229	319	383
10	34	66	92	128	189	227	267	371	449
20	39	77	108	149	220	259	304	420	512
30	41	83	117	160	237	278	325	448	549
50	45	90	128	175	260	302	352	484	595
100	50	101	143	195	290	334	388	531	656
Sample (n)	26	26	26	26	43	43	43	38	38

Period: 1961-2003

Table 2.1.4 Comparison on Estimated Probable Rainfall Depths by Different Studies

R = mm/hr; t = minutes

Return Period (Years)	Study Name	Data Used	Method of Probability Analysis	Probable Rainfall Depth (mm)									Equation for Rainfall Intensity - Duration Curve
				Minutes			Hours						
				10	30	60	2	6	12	24	48	72	
2	**This Study, 2004**	**1903-2003**	**Gumbel**	20	39	**54**	76	110	136	*153*	219	256	**$R=1{,}054/(t+14)^{0.69}$**
	PAGASA 1981	1950-1975	Gumbel	22	43	**57**	72						$R=1{,}774/(t+17)^{0.79}$
	MPWH 1984	1907-1974	Log Pearson Type III	27	51	**74**	104						$R=672/(t+5)^{0.53}$
	JICA 1990, JICA 2000	1907-1974	Log-Normal	23	40	**57**	80			*192*	192		$R=434.23/(t)^{0.498}$
	PEA Mar. 1995, DPWH 1998	1949-1990	Gumbel	20	37	**52**	66	94	115	*153*			
	PEA Nov. 1995	1949-1990	Log-Normal	19	37	**51**	65	93	114	*151*			
	FCSEC, 2003	1907-2000	Gumbel			**52**							$R = 4{,}860.10/(27.70+t^{1.02})$ & $R = 5{,}426.08/(58.15+t^{0.92})$
5	**This Study, 2004**	**1903-2003**	**Gumbel**	26	51	**70**	101	154	192	*218*	324	387	**$R=1{,}105/(t+11)^{0.64}$**
	BPW 1952	1907-1939	Least Square	22	48	**65**	76						$R=19{,}051/(t+50)^{1.21}$
	BPW 1974, BPW 1978, MPWH 1986, MPWH 1988, DPWH 1990		California	25	49	**70**	98						$R=858.8/(t+10)^{0.59}$
	PAGASA 1981	1950-1975	Gumbel	29	56	**75**	96						$R=2{,}112/(t+16)^{0.77}$
	MPWH 1984	1907-1974	Log Pearson Type III	31	61	**87**	122						$R=965/(t+8)^{0.57}$
	JICA 1990, JICA 2000	1907-1974	Log-Normal	28	49	**70**	100			*288*	336		$R=5{,}151.81/(t)^{0.487}$
	PEA Mar. 1995 & DPWH 1998	1949-1990	Gumbel	26	50	**70**	91	135	172	*220*			
	PEA Nov. 1995	1949-1990	Log-Normal	25	49	**67**	87	130	164	*214*			
	FCSEC, 2003	1907-2000	Gumbel			**70**							$R = 16{,}524.97/(74.85+t^{1.24})$ & $R = 17{,}502.14/(185.91+t^{1.02})$
10	**This Study, 2004**	**1903-2003**	**Gumbel**	30	59	**81**	118	183	229	*260*	394	474	**$R=1{,}216/(t+11)^{0.63}$**
	BPW 1952	1907-1939	Least Square	24	50	**72**	98						$R=1{,}490/(t+20)^{0.69}$
	BPW 1974, BPW 1978, MPWH 1986, MPWH 1988, DPWH 1990	1907-1972	California	28	53	**77**	112						$R=510.6/(t+1)^{0.46}$
	PAGASA 1981	1950-1975	Gumbel	33	63	**85**	108						$R=2{,}629(t+17)^{0.79}$
	MPWH 1984	1907-1974	Log Pearson Type III	34	67	**95**	132						$R=1{,}217/(t+10)^{0.60}$
	JICA 1990, JICA 2000		Log-Normal	31	55	**78**	112			*360*	432		$R=565.36/(t)^{0.483}$
	PEA Mar. 1995 & DPWH 1998	1949-1990	Gumbel	30	59	**82**	108	163	210	*265*			
	PEA Nov. 1995	1949-1990	Log-Normal	29	56	**78**	102	154	198	*252*			
	FCSEC, 2003	1907-2000	Gumbel			**83**							$R = 27{,}293.72/(107.26+t^{1.32})$ & $R = 6{,}017.42/(89.62+t)^{0.85}$
20	**This Study, 2004**	**1903-2003**	**Gumbel**	34	67	**92**	134	211	264	*301*	461	558	**$R=1{,}281/(t+10)^{0.61}$**
	BPW 1952	1907-1939	Least Square	26	57	**87**	132						$R=615/(t+10)^{0.46}$
	BPW 1974, BPW 1978	1907-1972	California			**90**							$R=3{,}007/(t+20)^{0.8}$
	PAGASA 1981	1950-1975	Gumbel	37	72	**97**	124						$R=2{,}733/(t+16)^{0.77}$
	MPWH 1984	1907-1974	Log Pearson Type III	37	74	**106**	146						$R=1{,}502/(t+12)^{0.62}$
	JICA 1990, JICA 2000	1907-1974	Log-Normal	34	73	**85**	122			*432*	528		
	PEA Mar. 1995, DPWH 1998	1949-1990	Gumbel	34	68	**94**	124	190	246	*307*			
	FCSEC, 2003	1907-2000	Gumbel										

BPW 1952: Plan for the Drainage of Manila and Suburbs, Volume I, 1952
BPW 1974: Technical Report on Engineering Design for Drainage Pumping Stations and Floodgates, 1974
BPW 1978: Technical Report on Engineering Design for Drainage Pumping Stations and Floodgates, 1974
MPWH 1984: Metro Manila Integrated Urban Drainage and Flood Control Master Plan, 1984
(for annual maximum rainfall data of 5 and 10 minutes before 1950, adjustment factors of 1.13 and 1.04 were applied and for the rest of the data up to 120 minutes, adjustment factor of 1.20 was applied)
(for annual maximum rainfall data of >120 minutes but <1-day, adjustment factor of 1.10 was applied and for annual maximum rainfall data of 1, 2 and 3 days, adjustment factor of 1.13, 1.04 and 1.03 were applied)
MPWH 1986: Drainage Improvement Plans of Estero de Vitas and Other Catchment Areas, 1986
MPWH 1988: Metro Manila Drainage System Rehabilitation Project, 1988
DPWH 1990: The Detailed Engineering and Construction Supervision of Metro Manila Flood Control Project (II), 1990
JICA 1990: The Study on Flood Control and Drainage Project in Metro Manila, 1990
PEA Mar. 1995: The Study on the Updated Drainage Plan for the Libertad Reclamation Area in Pasay City, Metro Manila, 1995
PEA Nov. 1995: The Study of and Updated Drainage Plan for Section II of Manila Bay Reclamation Area, Pasay City and Parañaque, Metro Manila, 1995
DPWH 1998: The Study on Flood Control and Drainage System Improvement for Kalookan-Malabon-Navotas-Valenzuela KAMANAVA) Areas, 1998

2) Rainfall Intensity-Duration-Frequency (RIDF) Curves at Port Area

Using the calculated probable rainfall depths, RIDF curves and equations for different return periods have been constructed as shown in *Table 2.1.5*. After a trail of several types of equations, finally, the form of RIDF equations selected is the Horner type, which fits the data quite well, has been used by other previous studies and has been recommended in ASCE Urban Drainage Manual.

Table 2.1.5 Rainfall Intensity – Duration – Frequency Curves at Port Area Station

RIDF Parameter	Values of RIDF Parameters for Different Return Periods							
	2-year	3-year	5-year	10-year	20-year	30-year	50-year	100-year
a	1054	1006	1105	1216	1281	1307	1419	1518
b	14	12	11	11	10	9	10	9
n	0.69	0.65	0.64	0.63	0.61	0.60	0.60	0.60

Note: Data of 1903 – 2003

Equation of Rainfall Intensity-Duration-Frequency Curve: $R = a/(t+b)^n$

Where: R = Rainfall Intensity (mm/hr), t = Time (minutes), a, b, n = Parameters.

3) Design Rainfall Hyetograph

Design rainfall hyetographs with 1-hour time interval have been prepared for different return periods, considering averaged mass curve of annual maximum rainfall events for period 1982 to 2003 and RIDF curve, as shown in *Figure 2.1.9*.

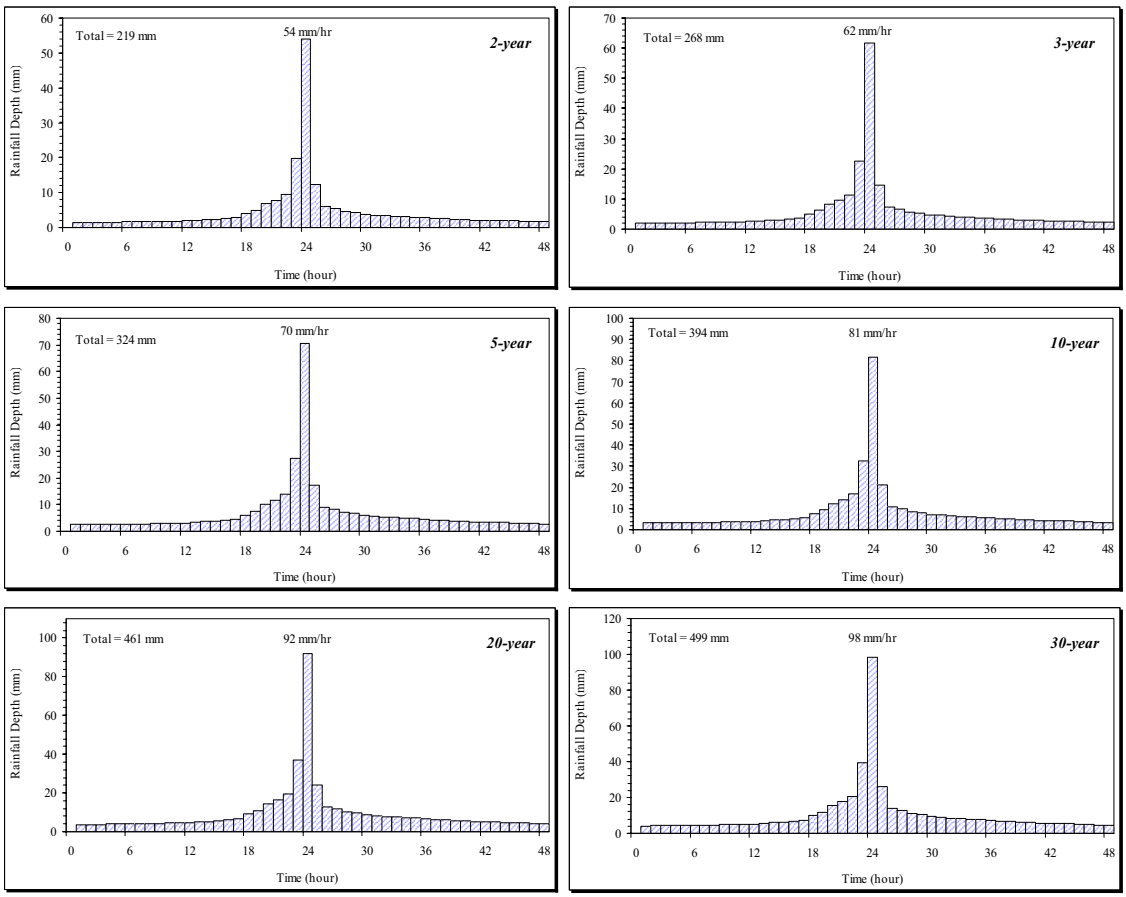
4) Areal Reduction Factor for Runoff Analysis

In order to take account of the spatial distribution of rainfall, areal reduction factor (ARF) has been applied to point rainfall data at Port Area. No areal reduction factor curve was available for Metro Manila. However, World Meteorological Organization (WMO, 1983) has published typical depth-area-duration (DAD) curves, which have been updated by this study for the core area using calculated values.

5) Design Tide and Water Levels

Since July-August are the most critical months in terms of inundation when both tide level and rainfall are high, the annual maximum tide pattern averaged over the last five years have been selected as the design tide pattern. As for the maximum and minimum design tide levels, mean high spring tide (MHST) level of EL. 11.34 m and mean lower low water (MLLW) level of EL. 10.00 m have been applied. The design tide level is shown in *Table 2.1.6*.

As for design water levels at the pump stations along the Pasig River and the Parañaque River, same design tide pattern as at Manila Bay with maximum water levels corresponding to 30-year return period (derived from previous studies since 30-year is the design scale of rivers surrounding the study area) and minimum water levels as calculated from the difference between MHST and MLLW at Manila Bay. The maximum water levels at the pump stations along the Pasig River and the Parañaque River are shown in *Table 2.1.7*.



Source: Constructed by this study based on probable rainfall depths calculated using data from 1903-2003

Figure 2.1.9 Design Rainfall Hyetographs at Port Area Station

Table 2.1.6 Design Tide Level on Manila Bay

Difference (hh:mm)	Time (dd hh:mm)	Tide Level (EL. m)
0:00	Day1 17:00	10.03
16:05	Day2 9:05	11.32
8:40	Day2 17:45	10.00
16:15	Day3 10:00	11.34
8:25	Day3 18:25	10.02
16:30	Day4 10:55	11.32
8:10	Day4 19:05	10.08
Maximum		11.34
Minimum		10.00

Table 2.1.7 Design Maximum Water Levels at Pump Stations

Pumping Station	Binondo	Escolta	Quiapo	Balete	Paco	Aviles
Maximum Water Level (m)	12.10	12.10	12.19	12.34	12.41	12.65
Pumping Station	Pandacan	Valencia	San Andres	Sta.Clara	Makati	Tripa de Gallina
Maximum Water Level (m)	12.73	12.75	13.52	13.67	13.76	12.61

2.1.5 ENVIRONMENT

(1) Water and Sediment Quality

1) Water Quality of Rivers and Esteros

The DENR-NCR is conducting quarterly monitoring and assessment of the water quality of the major rivers in Metropolitan Manila. The monitoring is conducted at specific sampling points along the Pasig-Marikina River, the San Juan River and other rivers. The monitoring parameters are limited to BOD, SS, pH, temperature and DO, but indicate the water quality of the rivers and changes in pollution loads. The results of quarterly assessment for the year 2003 are summarized in *Table 2.1.8*

Table 2.1.8 Quarterly Assessment of Water Quality of Major Rivers in Metropolitan Manila

River	Parameter	Value	Standard	Assessment	Rating
Marikina River	DO, mg/L	3.7	5	Failed	
	BOD, mg/L	23	10	Failed	
	SS, mg/L	36	-	-	
	pH	9.1	6.5-8.5	Failed	Poor
	Temp, ^{o}C	27.5	-	-	
	SS change	1	<3.0	Passed	
	Temp changes	0.25	<3^{o}	Passed	
Pasig River	DO, mg/L	4.7	5	Failed	
	BOD, mg/L	48	10	Failed	
	SS, mg/L	38	-	-	
	pH	8.9	6.5-8.5	Failed	Poor
	Temp, ^{o}C	26.4	-	-	
	SS change	17.5	<3.0	Passed	
	Temp changes	0.17	<3^{o}	Passed	
San Juan River	DO, mg/L	-	5	-	
	BOD, mg/L	-	10	-	
	SS, mg/L	-	-	-	
	pH	-	6.5-8.5	-	
	Temp, ^{o}C	-	-	-	
	SS change	-	<3.0	-	
	Temp changes	-	<3^{o}	-	

Source: DENR-NCR

Note:

Good: 0 Failed Parameters

Fair: 1 Failed Parameters

Poor: 2 Failed Parameters (particularly DO & BOD)

Water samples were taken at five spots along esteros/creeks and analyzed during the Study in order to conduct preliminary assessment of the water quality of esteros/creeks. The test results are shown in *Table 2.1.9.*

Table 2.1.9 Water Quality of Esteros

Parameter	DENR Standard For Class C Water		Sampling Site				
	Value	Unit	1	2	3	4	5
Temperature	-	^{o}C	27.5	27.6	27.6	29.1	28.2
Electric Conductivity	-	µS	471	386	451	463	488
pH	6.5-8.5	-	7.04	7.06	6.89	7.03	7.02
Total Coliform	5,000	MPN/ 100mL	$16x10^6$	$16x10^6$	$16x10^6$	$16x10^6$	$16x10^6$
DO (On site)	5.0	mg/L	1.8	1.9	0.9	-	1.2
Total Phosphate	5.0	mg/L	5.22	5.51	3.73	7.70	6.69
Total Nitrogen	5.0	mg/L	18.0	18.48	17.64	15.60	18.96
COD	-	mg/L	254	145	76	96.0	133.0
BOD	10	mg/L	54	38	40	72	128
Assessment of general condition			Poor	Poor	Poor	Poor	Poor

Note: Sampling Sites:
1 - Estero de Maypajo
2 - Estero de San Miguel
3 - Estero de Paco
4 - Estero de Tripa de Gallina (near Puyat Ave & Marconi St.)
5 - Estero de Tripa de Gallina (near Gen. J. Lacuña St.)
Date of Sampling: June 29-30, 2004

Although the esteros/creeks are not classified by the DENR, the test results are compared to the DENR's Water Quality Criteria for Class "C" in *Table 2.1.10*.

Table 2.1.10 Water Quality Criteria for Class "C" Fresh Waters

Parameters	Standards
BOD	7 mg/L (minimum), 10 mg/L (maximum)
SS	Not more than 30 mg/L increase
pH	6.5-8.5
Temperature	3^{o}C maximum rise
DO	5 mg/L

The results indicate that the water quality at the sample points along esteros is poor and unhealthy. Low values of Dissolved Oxygen (DO) indicate that the esteros have lost their capacity for aerobic decomposition. This would explain the foul odor of waters. The presence of excessive coliform, BOD and COD also confirms this condition. Generally, the condition of the water bodies is unsafe, meaning that it is highly inadvisable for any person to be in direct contact with the waters as these contain high levels of pathogenic organisms. This condition poses a high risk of water-borne diseases. Overflow of water from these esteros/creeks during flooding events therefore also poses health hazards.

2) Sediment Quality of Esteros

Samples of bottom sediment were taken at five spots along the esteros/creeks and analyzed during the Study to identify the presence of toxic substances. The results are shown in *Table 2.1.11*.

Table 2.1.11 Results of Bottom Sediment Analysis

Parameter	Unit	Sample Site Number					Procedural Manual Title III DAO 92-29 (October 2004)
		1	2	3	4	5	Classification of Hazardous Waste
Arsenic	mg/L	0.0283	<0.0001	0.0645	0.0268	0.0928	>5.0 mg/L
Barium	mg/L	1.610	0.619	0.703	2.100	1.590	>100 mg/L
Cadmium	mg/L	0.606	0.0491	0.0334	0.0403	0.0422	>5.0 mg/L
Chromium	mg/L	0.0432	0.0724	0.0038	0.0127	0.0192	>5.0 mg/L
Lead	mg/L	0.2582	0.1487	0.2700	0.3087	0.4107	>5.0 mg/L
Total Mercury	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	>1.0 mg/L
Selenium	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	>1.0 mg/L
Copper	mg/L	<0.0001	<0.0001	<0.0001	0.0022	<0.0001	--
Nickel	mg/L	1.887	0.3488	0.3893	1.598	0.4294	--
Tin	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	--
Zinc	mg/L	7.62	5.80	9.13	36.93	16.60	--
Fluoride	mg/L	0.4	0.3	0.40	nd	nd	--
Cyanide	Mg/L	nd	nd	0.025	0.029	0.0030	--
Chromium Hexavalent	mg/L	0.0319	0.0151	0.0291	0.0375	0.0207	--
Formaldehyde	µg/g	4.57	1.0	1.0	7.51	1.18	--
Organophosphate	µg/g	nd	nd	nd	nd	nd	--
Alkyl Mercury	µg/g	nd	nd	nd	nd	nd	--
Hydrogen Sulfide	--	Positive	Positive	Positive	Positive	Positive	--
Ignition Loss	%	9.83	5.44	13.12	14.07	8.86	--

Note: nd: not detected
Sampling Sites:
1 - Estero de Maypajo
2 - Estero de San Miguel
3 - Estero de Paco
4 - Estero de Tripa de Gallina (near Puyat Ave & Marconi St.)
5 - Estero de Tripa de Gallina (near Gen. J. Lacuña St.)
Date of Sampling: June 29-30, 2004

Disposal issues are the primary consideration in determining the types and amount of hazardous substance content of the bottom sediments. Assessment of the quality of the sediment becomes necessary in view of the proposed dredging activity. This may be used as guide for deciding on the manner by which the dredged materials will be temporarily stored, transported and finally disposed of.

In the absence of specific guidelines or criteria for classification of soil or sediment in the Philippines, the classification of hazardous waste as specified in DAO 92-29 (October 2004) was used as reference in the analysis. The dredged material is assumed to be waste matter, thus if its extract contains chemical substances in concentration greater than that specified in DAO 22-29, the dredged material would be considered hazardous.

Table 2.1.12 shows the standards of Japan for "Waste Disposal and Public Cleansing Law". It could be used as one of references, although the method of analysis of sediment used in the present study is different from one for the standard. The standards set the limit of concentration of the hazardous substances in the waste depending on the disposal method to be used.

Table 2.1.12 Standards for Sediment Quality in Japan

Disposal Method	Landfill	Dumping at Sea
Hazardous substances	Sludge & Slag (mg/L)	Organic Sludge (mg/kg)
Temperature	-	-
Arsenic and its compound	0.3	0.15
Barium and its compounds	-	-
Cadmium and its compound	0.3	0.1
Chromium and its compound	-	2
Lead and its compounds	0.3	1
Mercury and its compounds	0.005	0.025
Selenium and its compounds	0.3	0.1
Copper and its compounds	-	10
Nickel and its compounds	-	1.2
Tin	-	-
Zinc and its compounds	-	20
Fluorides	-	15
Cyanide	1	1
Chromium VI compounds	1.5	0.5
Formaldehyde	-	-
Organic phosphorous compounds	1	1
Alkyl Mercury compounds	ND	ND
Hydrogen Sulfide	-	-
Ignition Loss	-	-

Source: The Ministry of Environment, Government of Japan

3) Water Pollution Sources

During Initial Environmental Examination (IEE), pollution sources along esteros such as factories and commercial establishment were identified based on DENR list book. More than 150 factories or commercial establishments have been identified in the study area. Among them, no possible source to provide toxic materials has been observed.

(2) Flora and Fauna

Eighty percent of the study area has been urbanized based on the landuse map prepared in MMEIRS. There exist little agricultural, grassland and forest in the study area. Open space, park and recreational area are only 5% in the study area.

No aquatic plants or animals of economic or ecological value can thrive in any of the esteros/creeks, considering the very poor water quality. Ocular inspection during IEE revealed this situation. Terrestrial flora and fauna of great scientific, economic or ecological value no longer exists in the core area. Animals are limited to domesticated species such as dogs, cats, chicken, pigeon/birds, and others while plants are limited to a few standing trees or shrubs growing in some unpaved portions near the banks or otherwise planted as ornamentals.

References

[1] JICA, MMDA, PHIVOLCS, Draft Final Report on Earthquake Impact Reduction Study for Metropolitan Manila, Republic of the Philippines (MMEIRS), 2004.
[2] JICA, DPWH, MMDA, Final Report on Study on the Existing Drainage Laterals in Metro Manila in the Republic of the Philippines (SEDLMM), 2000.
[3] DPWH, Supporting Report on the Study on Flood Control and Drainage System Improvement for Caloocan-Malabon-Navotas-Valenzuela (KAMANAVA) Areas, Metro Manila Flood Control Project, 1998.
[4] DPWH, Project for Pasig-Marikina River Flood Control, 2002.

2.2 ECONOMIC CONDITIONS

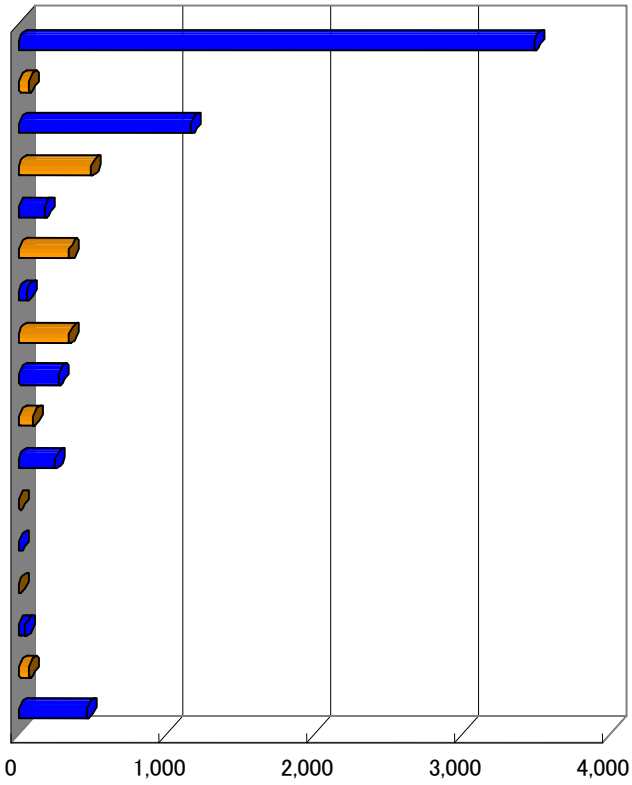
2.2.1 LAND USE – DEVELOPMENT TRENDS AND EXISTING CONDITIONS

In accordance with land use in Metropolitan Manila, in 1986 developed land was 50.4%, transformable land was 36.2% and unusable land was 13.2%. After that, at least half of the transformable land in 1986 was developed for the increasing population based on the estimation of land use change. If the same trend would continue, the green space in Metropolitan Manila is likely to disappear by 2006 and environmental problems are expected to be more serious.[1]

Among the existing land use in the study area, residential use occupies the most at 48%. Commercial use follows at 16% and Industrial use at 7%. Forestland is just at 2ha and there is no agricultural land use in the study area.

Table 2.2.1 Existing Land Use, 2003

		Study Area (ha)
1	Residential	3,492
	Residential (Informal Settlers)	68
2	Commercial & Business	1,163
3	Industrial	493
4	Government & Quasi-Public	177
5	Educational & Cultural	347
6	Health & Welfare	54
7	Park & Recreational	348
8	Religious & Cemetery	272
9	Transport & Service Facilities	94
10	Military	254
11	Agricultural Land	0
12	Grassland	0
13	Forestland	2
14	Water Related	46
15	Open Space	71
16	Water Body / Others	462
Total		7,342



Source: GIS Database, JICA Study Team

Republic Act 7160 of 1991, or "The Local Government Code (LGC)", prescribed the decentralization of the function of land use planning and the formation of Local Development Councils (LDCs) or special bodies to serve as venues for representation of communities, through their organizations, to express their views on issues affecting them.

Under Section 458, Para. 2, the LGC empowers the City/Municipal Councils to generate and maximize the use of resources and revenues for the development plans, program objectives and priorities of the LGUs (Local Government Units) by adopting a comprehensive land use plan and enacting integrated zoning ordinances in accordance with the approved comprehensive land use plan. To facilitate the implementation of this specific provision, Executive Order No. 72,

dated March 25, 1993, was issued providing for the preparation and implementation of the comprehensive land use plan of LGUs. The present administration, however, issued Presidential Memorandum, dated October 19, 1999, stating that failure of LGUs to adopt an updated comprehensive land use plan by the end of March 2000 shall result in withdrawal of authority from LGUs to issue development permits.

2.2.2 REGIONAL ECONOMY

(1) Economic Development

In the Philippine economy, the agriculture, the light industries, and its support service industry worsened and economic growth rate registered negative in 1998 as a result of the economic crisis and unpredictable weather in Asia. However, the rate returned to positive growth in the following year and stood at 4.5% in 2003. The government has promised that economic reorganization will continue to be pursued at the same pace of development growth as the NIEs countries. The strategies are infrastructure improvement, re-examination of a tax revenues system for revitalizing the annual revenue, further liberalization and privatization. Metropolitan Manila is the center of Philippine economy; its regional gross domestic product (GRDP) of Php1,433 billion occupied 36% of GDP in 2002.[2] Per capita GRDP of Metropolitan Manila is Php138,459 and is about 2.8 times of the national average. The manufacturing industry and the service industry are the major sector. Factory locations extend along the arterial road in recent years, at northern part of Bulacan, eastern part of Rizal Province, and southern part of Cavite Province. The tendency is especially remarkable in the Manila Bay area and the Laguna de Bay coast.

Table 2.2.2 Per Capita GDP and GRDP (NCR)

Unit : Peso

	1975	1980	1985	1990	1995	2000	2002
Per Capita GDP(National)	2,726	5,502	11,027	17,611	27,778	43,685	50,015
Per Capita GRDP(NCR)	6,691	13,471	25,020	43,249	65,997	118,259	138,459
Ratio	2.45	2.45	2.27	2.46	2.38	2.71	2.77

Source: Philippine Institute for Development Studies, National Statistical Coordination Board
Note: Figures are at current prices.

(2) Labor Force and Employment

The total labor force and employment have been growing at almost the same rate since 1996. However, unemployment remained high at about 10%. The unemployment rate is still one of the highest among the ASEAN countries. The population growth rate, which is also one of the highest in ASEAN, exacerbated unemployment. This is more apparent in Metropolitan Manila. The unemployment rate was 6.5% higher than national average in 2002.

Underemployment rate is also high. One of every six employed workers is underemployed, who is willing to accept shorter working hours or a lower-paying job instead of unemployment. In a country without unemployment insurance, workers find it sensible to preserve their jobs first, even if it means taking a wage cut or working fewer hours, or spending more hours in learning.[3]

Table 2.2.3 Labor Force and Employment

	1996	1997	1998	1999	2000	2001	2002
National							
Unemployment Rate [a]	7.4	7.9	9.6	9.4	10.1	9.8	10.2
Underemployment Rate [b]	19.4	22.8	23.7	22.1	19.9	16.6	15.3
NCR							
Unemployment Rate	11.6	14.5	15.1	16.0	17.8	16.5	16.7
Underemployment Rate	5.9	13.7	19.4	15.6	10.4	10.2	7.8

Sources: National Statistics Office / 2003 Philippine Statistical Yearbook, National Statistical Coordination Board
Note: [a] Percentage of the total labor force. [b] Percentage of the total employed.

(3) Income, Poverty and Human Development Index

Income index of Metropolitan Manila is about two times of national average. This shows that Metropolitan Manila is a center of economy and reflects the income. However, due to the economic crisis in 1998, the index of Metropolitan Manila in 2000 declined 8.6% compared to 1997, although the decline of national average was only 4.2%. It is assumed that the income level of the people in Metropolitan Manila keeps high, but it is very sensitive to the economic conditions because the income of commercial sector, service sector and international companies, etc are relatively high but these economic activities are connected to economic environment more directly. t can be said, therefore, that the system of social safety net for the economically and socially disadvantaged people is more important in the metropolis than in the other regions in the country.

Table 2.2.4 Average Family Income

	1991	1994	1997	2000
NCR	182,878	173,599	216,621	197,959
National	81,995	83,161	98,692	94,576

Source: Family Income and Expenditure Survey, National Statistics Office
Note: Unit = Php, at 1994 prices

GINI ratio is usually referred as the index showing the gap between rich and poor. The rate is keeping higher than 4% for both national and Metropolitan Manila.

Table 2.2.5 GINI Ratio

	1991	1994	1997	2000
NCR	0.4282	0.3967	0.4622	0.4451
National	0.4680	0.4507	0.4872	0.4818

Source: Family Income and Expenditure Survey, National Statistics Office

2.2.3 RELATED DEVELOPMENT PLANS

The National Economic Development Authority (NEDA) Board, which is chaired by the President of the Philippines, formulates national policies and strategies including those on the water resources sector. NEDA has been the leading agency in preparing the Medium-Term Philippine Development Plan (MTPDP), the Medium-Term Public Investment Plan (MTPIP)

and the Medium-Term Expenditure Framework (MTEF). These planning documents incorporate water resources sector plans at the national and regional levels. There are also coordinating committees established to align development of water resources with the national and fiscal direction of the government.

The role of National Water Resource Board (NWRB) in water resources management is confined to updating policies on water resources and integrating various sub-sectoral policies, strategies and plans on water resources. In this respect, NWRB is to recommend to NEDA suitable action plans to address emerging issues in the water resources sector as they evolve.

(1) National Level

Medium-Term Philippine Development Plan (MTPDP 2004-2010)

The MTPDP draws a blueprint for achieving the National Development Agenda, which identified fighting targets in support of the President's 10-point Agenda with target year 2010. The fighting targets are;

(Fighting Targets)

1. bring down the incidence of poverty from 34% to 17% by 2010 (at least 20%),
2. aim for a sustainable growth of 7% (at least 6%), which shall enable the economy to generate 10 million jobs in six years,
3. bring investments to 28% of GDP in two years (at least 25% by 2010) from the current rate of 19% of GDP, and
4. increase exports to $50 billion in two years.

To achieve these fighting targets, the National Development Agenda lays out five main strategies:

(Five Main Strategies)

1) stabilizing the economy and promoting higher economic growth by reducing the public sector deficit and strengthening the financial system,
2) generating jobs through more globally competitive agriculture, industry, and service sectors,
3) improving the provision of social services and protecting and empowering the vulnerable groups,
4) decentralizing development, and
5) improving governance and promoting national harmony.

GDP growth is expected to accelerate from 3.3-6.3% in the previous MTPDP to 4.9-8.0% (7% on the average) in the new MTPDP. This path hinges on the recovery and robust expansion in investments and exports as the economy benefits not only from greater renewed investor

confidence and sustained macroeconomic stability but also from measures to improve overall governance and the competitiveness of the agricultural, industrial and service sectors.

With regard to flood controlling, the MTPDP does not neglect and details the action plans for flood management in Metropolitan Manila as a part of strategies redounding to economic growth and healthier environment, i.e. “Clean and rehabilitate esteros, especially in eight major esteros in Metro Manila that contribute significantly to flooding on a sustained basis”

Specifically mentioned are as follows;

- Undertake sustained metro-wide clean up of esteros through the active involvement of LGUs, concentrated communities, private sector and NGOs, and
- Include clean-up of esteros as part of the civic requirements for students and ROTC (Reserve Officers' Training Corps) cadets.

Medium-Term Expenditure Framework (MTEF)

The Government introduced the Medium–Term Expenditure Framework (MTEF), which covers a three-year rolling plan based on the macroeconomic assumptions about the budget prepared by the National Economic Development Authority (NEDA) and the Department of Budget and Management (DBM). Instead of a one-year budget time frame, government agencies now have to quantify the three-year implications of their programs and projects. Under the MTEF, DBM estimates the baseline budget, which is an estimate of the financial requirements of on-going programs. Amounts over the baseline budget are divided by sector based on the departments’ priorities after examination of DBM and NEDA.

National Framework for Physical Planning (NFPP 2001-2030)

By virtue of Proclamation No. 65, National Framework for Physical Planning (NFPP) for 2001-2030 was adopted to lay out policy agenda which would set the direction for land use planning activities, environmental management, settlement pattern and the development of other physical resources in the country. It likewise aims to obtain the maximum possible social and economic benefits for the people towards a more sustainable development.

DPWH “Medium-Term Program”

The DPWH (Department of Public Works and Highways) is the biggest government agency in infrastructure construction. It is the country’s construction arm responsible for the planning, design, construction and maintenance of infrastructure facilities, particularly national highways, flood control and water resources development systems, and other public works, in accordance with national development objectives.

Its responsibility extends to six major areas of infrastructure development, construction and in some cases, their maintenance. A summary of DPWH’s water-related responsibilities is given below:

- Flood Control: Planning, funding, construction, maintenance of major flood control, drainage systems and seawalls. (Local drainage concern is with LGUs. The mandate in NCR is handled by MMDA.)
- Water Supply: Funding, design and construction of Level-1 facility (point source) with foreign financing. (Locally funded Level-1 is a concern of LGUs)
- Ports: Planning, funding, design and construction of foreign-assisted fishing ports and

municipal (feeder) multi-purpose ports (other ports are responsibility of DOTC and LGUs).

The former Bureau of Public Works (BPW) had started flood control in 1946, and following organizational restructuring, it became the Department of Public Works and Highways (DPWH) assuming the function/responsibility from BPW. JBIC (ex-OECF), the World Bank, ADB and JICA have assisted the Government of Philippines with a series of flood control and drainage projects in Metropolitan Manila such as the Pasig River Flood Control Project and Manila and Suburbs Flood Control and Drainage Projects: Construction of the Mangahan floodway and construction / rehabilitation of drainage pumping stations. On July 9, 2002, DPWH transferred the role of flood control in Metropolitan Manila to MMDA through Republic Act 7924. However, because of the problems of insufficient resource capacity, DPWH has still cooperated with MMDA on flood control.

As future infrastructure plan, DPWH has Medium-Term Program, Annual Program and projects for Official Development Assistance.

The latest Medium-Term Program (2001-2004) aims to improve national roads system to international standards in order to facilitate the major flows of people, goods and services among key production areas and urban-industrial growth centers nationwide. The length of paved national arterial roads is targeted to increase to 80% of total (17,631 km) in 2004.

Implementation of infrastructure projects are focused on those that supported the eight-point agenda of the President, namely, food; jobs and livelihood; infrastructure; housing; education and other social services; peace and order and security; business and economy; and governance. The Department also focused its infrastructure activities in support of the presidential priority directives which are: 1) Mindanao road development projects; 2) access roads to tourism hubs and spokes; 3) flood mitigation; 4) other priority projects in support of peace and order and regional development; 5) decongestion of traffic in the National Capital Region; and 6) decongestion of traffic in adjacent regions.

(2) Regional Level (MMDA)

MMDA “NCR Development Plan 2001-2004”

Republic Act 7924 created the Metropolitan Manila Development Authority (MMDA), of which the task is to formulate a Master Plan that shall serve as the framework for the local development plans of the component LGUs in NCR. The development framework plan named as “NCR Development Plan 2001-2004” is mainly aiming to expand and equalize access to economic and social opportunities, and inculcate receptivity to change and promote personal responsibility as stipulated in the national MTPDP. In accordance with flood control, the following three strategies are mentioned.

- To provide a physical framework for drainage system for the adaptive use from the national to the local levels.
- To provide an effective mechanism for a better coordination among the stakeholders in the design until the implementation of the policy, plan and project.
- To design a regular maintenance scheme of the facilities.

As to the third strategy especially, the plan puts the stress on the lack of funds as it states: “Generally speaking, there is a tremendous shortage of funds for the upkeep and maintenance of such facilities”. In order to ease the burden to afford these requirements, the MMDA brings

the view of innovative public–private partnership mechanism and foreign assistance on this flooding problem.

The issues on informal settlers on esteros, creeks and rivers are also enumerated as one of the man-made elements causing flood problems. The MMDA approaches this issue not only for relocating people to maintain drainage facilities but also for social welfare service such as housing program against the rapid urbanization of Metropolitan Manila and disaster management program, which save the people from the threat of floods and inundations in cooperation with HUDCC, NHA, DPWH, and DSWD

MMDA "Medium-Term Investment Plan 2001-2005"

Section 5 of RA 7924 also provides the functions and powers of the MMDA on preparation of investment programs with priority programs and projects. "Medium-Term Investment Plan 2001-2005" accounts for Php25,287 billion in total for five years consisting of 36 major programs including foreign-assisted projects, 7 solid waste management programs and 4 flood control and sewerage management programs in cooperation with DPWH.

(3) LGUs Level (City / Municipality)

While the national leadership has a vision for the Philippines as embodied in its short-term, medium-term, and long-term plan, based on the Republic Act 7160 of 1991, or "Local Government Code (LGC)", LGU's leadership likewise came to have a vision and philosophy which are embodied in the Comprehensive Development Plan.

Since the enactment of these legislations, each LGU has started to formulate future development policies and visions accompanying CLUP (Comprehensive Land Use Plan) on Land Use and Zoning System of its territory. The CLUP of each city and municipality is summarized as follows.

Manila City

Overall development vision, goal and strategies of the city's comprehensive land use plan compiled in 2000 are as follows.

(Vision)
Develop a highly productive community to reclaim the status of Regional Economic Center through mixed area development anchored on Public Service, Cultural Renewal and Empowerment of the constituents.

(Goal)

- Regain the city's image ability
- Employ the maximum potential of the city's accessibility
- Regain the city's lost usability

(Strategies)

- Core-frame concept, which recognizes a core of intensive land use.
- Neighborhood connectivity, which promotes the mixed-use development with minimum travel at employment centers.

- Multi-centered /Multi core Urban Development, which develops and promotes change to a balanced and characteristic multi-core urban structure with central core; sub-centers core in the inner and surrounding areas will be developed.

Makati City

Overall development vision, goal and strategies of the city's comprehensive land use plan compiled in 2000 are as follows.

(Vision)
Makati that is sustainable, highly developed, environmentally balanced and progressive urban center whose residents have a sense of well-being and are morally upright, educated, self-reliant, and community-oriented.

(Goal)
The Makati City government has identified several goals towards the realization of its vision. These include:

- Sustained status of Makati as the premier business and financial center of the country and a model for urban centers in the country and in the larger region.
- Balanced and orderly environment.
- Enhanced total human development, improved well-being, intellectual capacities, and socio-cultural environment of the city's constituents.
- Diffused economic growth, including narrower income level gaps, a larger economic base and broader employment opportunities, and an enhanced role as the business and financial center of the country.

(Strategies)

- Sustain economic growth through private-sector-led development to enhance employment generation and industry-labor linkage.
- Expand the basic services reflective of a balanced and rational utilization of resources that address the needs of majority of the constituents and in order to effect a conducive, wholesome, and productive urban center.

Pasay City

Overall development vision, goal and strategies of the city's comprehensive land use plan compiled in 2001 are as follows.

(Vision)
Strengthening the city's trade and commerce will be achieved through various institutional strategies. The tourism sector, on the other, shall capitalize on the strategic location of the city and the redevelopment of its existing tourist-oriented facilities and resources.

(Goal)
To emphasize and capitalize on the traditional strengths of Pasay City as a Business Hub and Convention Center of Metropolitan Manila and the country for the benefit of its residents.

(Strategies)

- Resolution of legal disputes over large areas

- Transform the Areas for Priority Developments (APDs) as economically viable communities
- Creation of a Business Development Office
- Involve the local Chamber of Commerce and civic institutions
- Participation of private individuals and non-government organization in the socio-economic programs of the LGU
- Encourage and promote events and festivals
- Highlight cultural sites, landmarks and amenities

Caloocan City

Overall development vision and mission of the city's comprehensive land use plan compiled in 2000 are as follows.

(Vision)
A self-reliant, progressive, peaceful and orderly city, with its southern part (South Caloocan) successfully transformed into a commercial and financial hub, while the northern part (North Caloocan) is bustling into an industrial center in the northwestern part of Metropolitan Manila, where all the residents enjoy the fullness of life.

(Mission)
To build a responsible community:

- That respects the dignity, uniqueness and diversity of its citizens;
- Of people, who respect their common historical and cultural heritage;
- Of people, who responsibly use their environment and finite resources;
- Of self-reliant, healthy and educated people, who are concerned with the well-being of their fellowmen;
- With citizens, who have equal access to socio-economic opportunities and public resources;
- With citizens, who have compassion, especially for those who have less in life.

Quezon City

Overall development vision and goal of the city's comprehensive land use plan compiled in 2000 are as follows.

(Vision)
It is a vision of a model city. A congenial community to live in and to work in. A beautiful city in many respects. A city of opportunities for the hardworking, for the talented, for the enterprising and creative, for the young with ambitions, and for a committed citizenry eager to define a future of peace and progress for a city they can love and work for.

(Goal)
Quezon City is geared towards achieving balanced physical development, sustained economic growth and an enhanced quality of life for its citizenry.

Taguig Municipality

Overall development vision, goal and strategies of the municipality's comprehensive land use plan compiled in 2000 are as follows.

(Vision)

The path to national development is envisioned to proceed towards the attainment of an industrialized country through the modernization of all sectors in the economy, such as agriculture, industry, and services, and where the prevailing conditions allow for the optimum utilization of land and other physical resources within the bounds of its carrying capacity supported by an empowered populace, where everyone has equal access to resources, development opportunities, benefits and services, and where there is a full participation in decision-making processes in all stages of developing and managing the country's resources.

(Goal)

- To lay the foundation that will increase economic productivity in the area based on the municipality's existing lands, water and human resources as well as its geographic advantage in Metro Manila.
- To establish a framework that will transform agricultural lands that will be affected by future land conversion into commercial and residential uses as well as road rights-of-way and other vital infrastructure.
- To encourage the creation of livelihood and entrepreneurial opportunities for the people of Taguig.
- To identify strategic areas where appropriate economic activities will be undertaken that are compatible with the environmental and zoning regulations of the national and the local government.

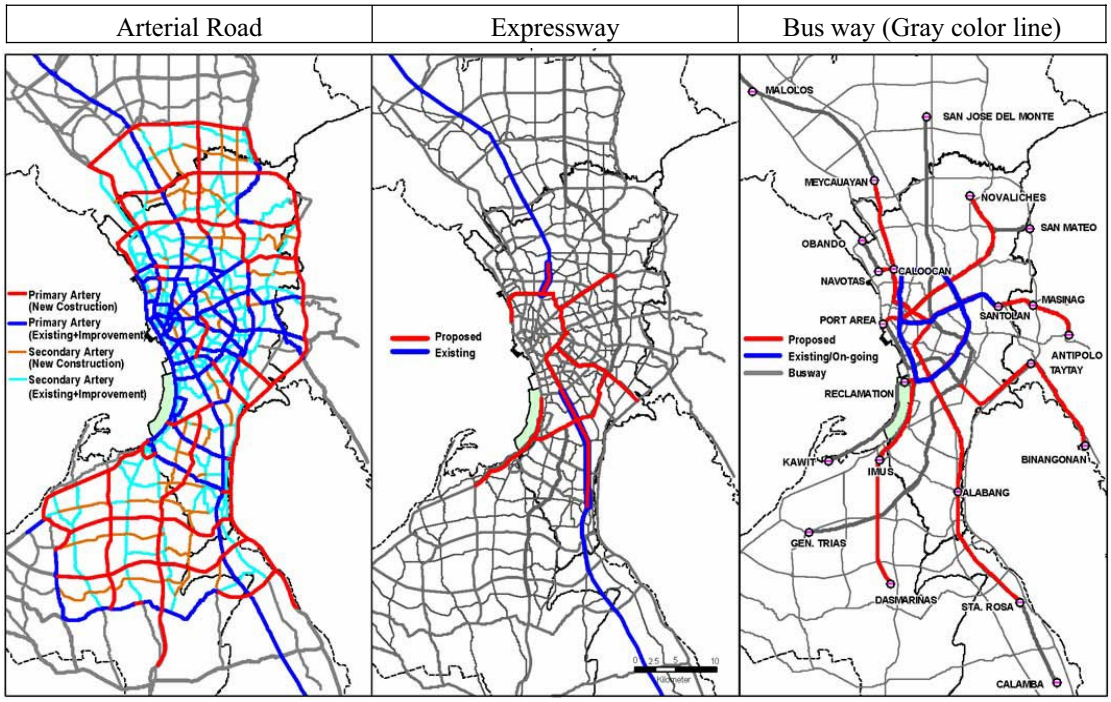
(Strategies)

- Establishment of public enterprises
- Organization of pilot cooperatives
- Create a One-Stop-Shop Business Service Committee
- Enhancement of local tourism
- Sustain environmentally based livelihood activities

2.2.4 ECONOMIC INFRASTRUCTURE

Road Traffic

The Metro Manila Urban Transportation Integration Study (MMUTIS) in 1999 summarized the existing transportation infrastructure and traffic situation, and proposed necessary projects for the future increasing demand. The following figures show the existing and proposed roads and public transport systems.

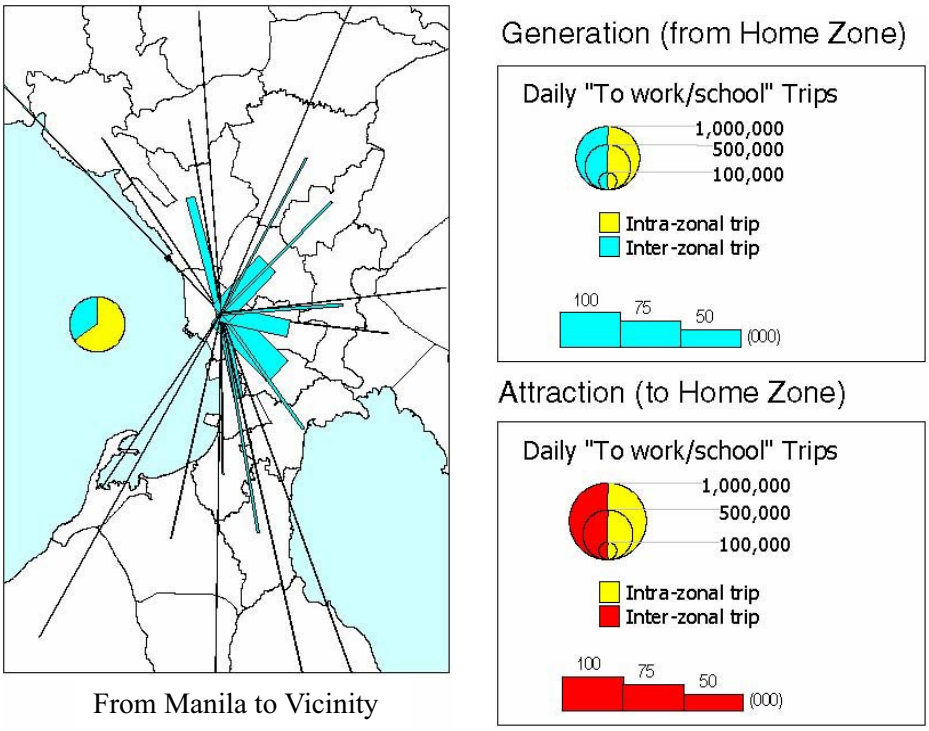


Source: MMUTIS

Note: Red = Proposed, Other colors = Existing & Ongoing

Figure 2.2.1 Road Network (Existing & Master Plan)

The following figure shows daily person trip in Metropolitan Manila. Generally, people prefer to travel shorter distances and to seek employment near their residences. However, this has not always been possible because of expansion of urban area and suburban sprawl, and there are evidences of growing cross-town trips in Metropolitan Manila. The cities of Manila and Makati attract traffic from all over Metropolitan Manila. This implies that the traffic disturbance would affect thousands of people at the present day when flood and inundation occur in the study area.



From Manila to Vicinity

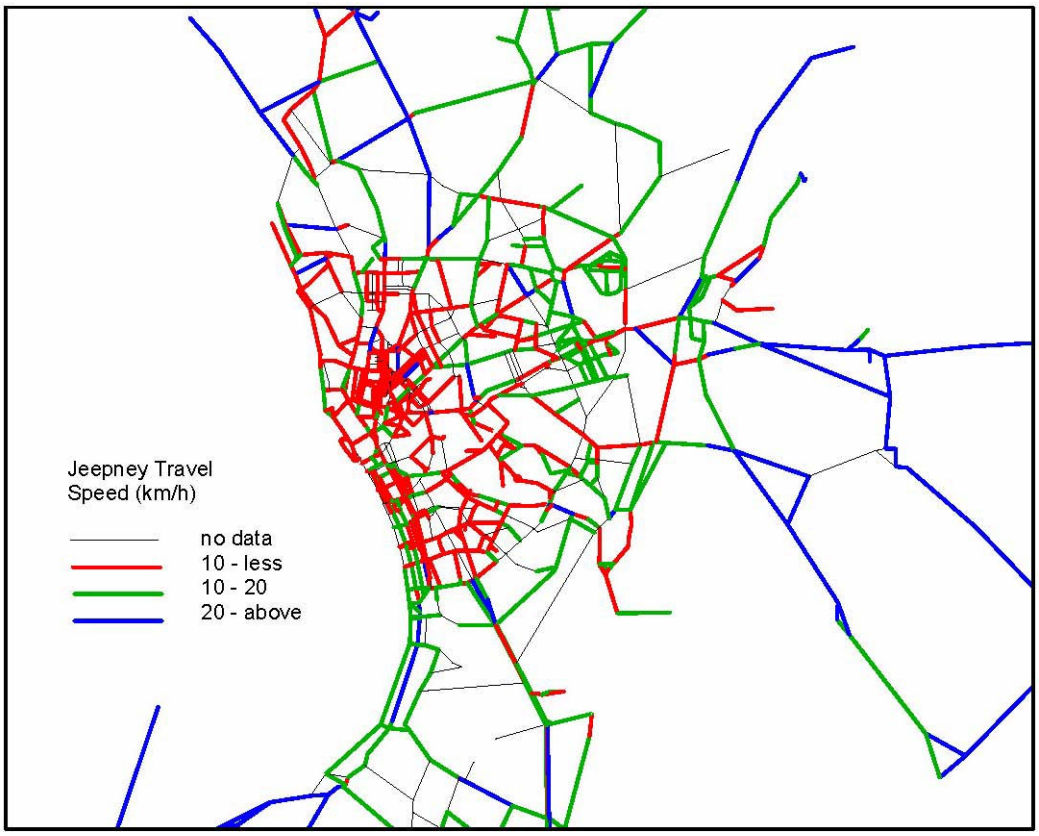
From Vicinity to Manila

From Vicinity to Makati

Source: MMUTIS

Figure 2.2.2 Person Trip in Metropolitan Manila, 1996

The following figure shows the travel speed of jeepneys in Metropolitan Manila. The travel speed of vehicles in the center of the metropolis is very slow even under normal condition. If once the flood occurs in this area, travel speed must further slow down and cause more serious congestions.



Source: MMUTIS

Figure 2.2.3 Average Travel Speed of Jeepneys

To cope with the worsening traffic problem in Metropolitan Manila, Metro Manila Development Authority (MMDA) has implemented many projects to ease traffic conditions such as "flyovers" (elevated roads) over various intersections and “Uniform Vehicular Volume Reduction Scheme”, locally known as “color-coding” where vehicles are banned from traveling on certain days depending on the ending digit of their plate numbers.

The DPWH has also started to modernize the traffic signals at major intersections in Metropolitan Manila, using a computerized demand-actuated system. Integrated transfer terminal facilities for provincial buses operating along the Northern Luzon-Metro Manila and the Southern Luzon-Metro Manila routes are also proposed at the northern and southern edge of Metropolitan Manila to reduce and eventually remove provincial public buses from the heavily congested thoroughfares of the metropolis.

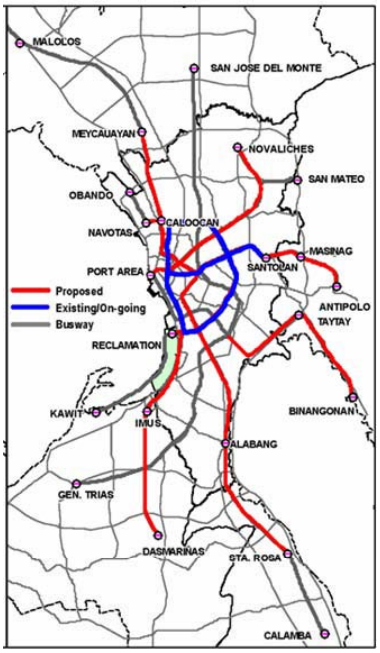
From the viewpoint of national economy, Metropolitan Manila has consistently dominated the country’s economic activities contributing about 36% to the total domestic output. In order to share and spread its development and new opportunities for growth into other regions, the government is challenging to decongest Metropolitan Manila. The government will lead in

this effort through decentralization and the establishment of new centers of government, business and housing in Luzon, Visayas and Mindanao. This will also entail the creation of a transport logistics system that will facilitate the decongestion of Metropolitan Manila by ensuring efficient linkages between its business centers and nearby provinces.

Railway

Metropolitan Manila has three types of rail transport line, i.e. the Light Rail Transit (LRT) system, the Metro Rail Transit (MRT) system and the Philippine National Railways (PNR). LRT and MRT deliver faster, safer and more reliable train services to commuters in the Metropolitan Manila and its suburbs with an average of 30 minutes travel time from end to end and 2 to 5 minutes between two adjacent stations.

LRT/MRT lines in Metropolitan Manila will be further enhanced such as the MRT 3-LRT Line 1 Loop as well as the adoption of an 82 Infrastructure unified ticketing system. Under the implementation of railway master plan, final phase of development of the MRT/LRT commuter loop is proposed at Php11,424 million at present. LGU involvement in the financing of these projects will also be encouraged.



Legend : Blue = Existing & Ongoing
Red = Proposed
Source: MMUTIS

Figure 2.2.4 Railway (MRT&LRT) Network

Civil Aviation

The NAIA (Ninoy Aquino International Airport) is the main international airport used for aircrafts engaged in international and domestic air navigation. It has a runway of 3,737 m long and 2,475 m wide and it serves more than 12 million passengers annually.

According to an estimation of the authority, the NAIA will reach its capacity in 2015. In order to maintain or improve its competitiveness in the global economy, Metropolitan Manila should construct a new airport to take the place of the NAIA.

In the Medium-Term Philippine Development Plan (MTPDP) 2004-2010, World-Class Diosdado Macapagal International Airport (DMIA) in Clark-Subic Special Economic Zones was proposed as alternative airport with Metropolitan Manila and the surrounding provinces through expressways and railways.

However, it would need a huge investment to provide accessibility because of the distance - it is 100 km far from Metropolitan Manila. In addition, DMIA is originally designed, built and utilized as a military airport, and so there is a need to rehabilitate and/or upgrade the airport infrastructure and facilities to suit international cargo and passenger airlines operations or civilian aviation as an alternative gateway to the Philippines.

Water transport

According to statistics,[4] 65 ports are operational in the Metropolitan Manila. Four of these, i.e. the Manila International Container Terminal (MICT), the Manila North Harbor, the Manila South Harbor and the Pasig River are classified as commercial public ports. Another three are fishing ports. Majority or 63 of these are commercial private ports, constructed primarily to serve the needs of the owners.

Telecommunication

In 2002, the number of telephone lines (excluding mobile phone) installed in Metropolitan Manila totaled to about 2.8 million lines, which is equivalent to 41% of total nationwide. Telephone density in Metropolitan Manila is 26.47 lines per 100 persons. This rate is the highest in the country. Density in other regions ranged from 1.36 to 9.4 and national average is 8.7[5].

Electricity

The Manila Electric Company (MERALCO), the largest electricity distributor in the country, serves the electricity needs of Metro Manila. Based on annual values for year-end 1998, the company had energized around 2.1 million of the potential 2.2 million households for electrification, giving an energization rate of 96% in Metropolitan Manila. Caloocan and Makati had perfect 100% energization rates. Manila, Taguig and Pasay were less energized with rates of 94%, 83% and 83%, respectively[6].

2.2.5 FINANCIAL CONDITIONS

In this section, the financial situation of public expenditure on flood control and related projects such as solid waste management, social welfare, and relief assistance for victims of flood disaster are summarized.

(1) National Government

The table below summarizes revenue performance. Public revenues consist of taxes, tariffs, charges and proceeds from public service and privatized companies. Although share of tax revenues has gradually declined since 1998 compared to the growth of national economy or GDP, they accounted for about 85% of total revenue. Tax revenue consisting of income tax accounted for about 44% of total tax revenue, excise taxes for 14%, and value-added tax for 12%.

Table 2.2.6 National Revenues

	1999	2000	2001	2002	2003
Revenue (Php Million)	478,502	514,762	563,732	567,141	626,630
Share	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %
Tax	90.2%	89.4%	86.9%	87.5%	85.8%
Non-tax Revenue	9.7%	10.4%	12.8%	12.3%	14.1%
Grants	0.1%	0.3%	0.4%	0.2%	0.2%

Sources: Bureau of the Treasury, Department of Finance

The Department of Budget Coordination Committee (DBCC) and the Investment Coordination Committee (ICC) review the MTPDP and the MTPIP to ascertain their adherence to established ceilings for government expenditures for the various sectors, the proper allocation of expenditures for each development activity, and to evaluate the fiscal and balance-of-payments implications of major projects. As shown in the following table, the share of flood control (including water resource development) projects is 0.7% to 1.2% recently, which amounted to about Php 6.7 billion in 2003.

Table 2.2.7 National Expenditure

Unit :Php Million

	2000	2001	2002	2003
Total Program Expenditure	682,460	577,436	626,797	725,004
Water Resource Development and Flood Control	4,632	7,207	6,541	6,768

Sources: Department of Budget and Management, 2003 Philippine Statistical Yearbook, Table 15.8

(2) DPWH

Although the expenditures on flood control are fluctuating more than 5 billion every year recently, the growth rate is very small compared to the growing total national expenditure. This is because the function of flood control was transferred to the MMDA in 2002. Looking at the share of the projects, "Foreign Assisted" projects had a share of 66% in 2003. Accordingly, the share of the projects in Metropolitan Manila is about 20%[7] of DPWH's total nationwide projects.

(3) National Housing Authority

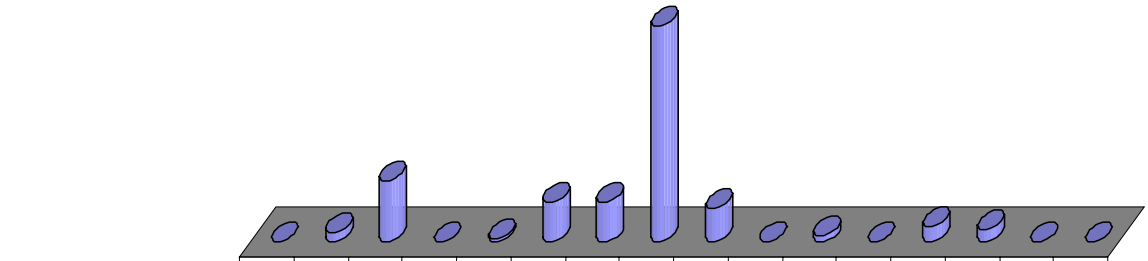
Under the coordination of Housing and Urban Development Coordinating Council (HUDCC) which is aiming to deliver better housing, National Housing Authority (NHA) provided 16,132 shelter security units under the programs in 2003 as the sole agency engaged in direct shelter production and targeting to benefit the lowest 30% of urban income-earners through slum upgrading, informal settlers relocation, development sites and services and through construction of core-housing units. Out of 16,132 units, 5,450 units were provided in Metropolitan Manila. The cost of these programs of NHA amounted to Php1,980 million throughout the country in 2003. As for the development in Metropolitan Manila, total cost of slum upgrading and resettlement was Php17 million in 2003.

(4) Calamity Fund

National Disaster Coordinating Council (NDCC) Issuances, Memorandum Order No. 02, series of 1999, defines revised policies and procedures on national calamity fund (NCF) management. The basis for this Memorandum is RA 8185, which was approved June 11, 1996, repealing some sections of the Local Government Code (RA 7160).

NCF is to be disbursed for relief, rehabilitation, reconstruction and other works or services in connection with man-made and natural calamities including pre-disaster activities such as acquisition of supplies, rescue equipment and training of personnel. Releases from this fund shall be made directly to the appropriate implementing agencies and/or LGUs in accordance with the recommendation of the NDCC and upon approval of the president of the Philippines.

While the fund can be available to LGUs, LGUs must prepare a counterpart budget. The rate or amount of the counterpart budget depends on the classification of LGUs.



	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Amount of Calamity Fund Released	1.6	49.3	344.6	0.0	15.7	221.3	226.1	1216.4	187.1	3.5	38.2	3.0	84.8	68.5	0.5	0.0

(Php Million)

Note: * includes Tropical Storm, Tropical Depression and Typhoon
Source: National Disaster Coordinating Council (NDCC), compiled by JICA Study Team

Figure 2.2.5 Amount of Calamity Fund Released by NDCC Caused by Destructive Typhoons Hitting NCR*

(5) Financial Assistance to Victims of Disasters

NDCC Issuances, Memorandum Order No. 13 (series of 1998, Amended Policies and Procedures on the Provision of Financial Assistance to Victims of Disasters) defines that this scheme covers disaster victims who die or get injured during the occurrence of natural disasters. Victims of man-made disasters, such as fires, vehicular accidents, grenade/bombing incidents, armed conflicts, and air/sea mishaps, are not included unless directed or approved by the

president of the Philippines upon the recommendation of NDCC. Amount of Financial Assistance is: 1) Php10,000.00 - For Dead Victims; 2) Php5,000.00 - For Injured Victims. The validity of claims is limited within one year from the disaster occurrence.

(6) Metropolitan Manila Development Authority (MMDA)

The composition of revenue of MMDA is shown in the table below. The central government allots 44%, compulsory contribution from member cities / municipalities of Metropolitan Manila is 32%, and independent revenue sources make up the remaining 24%.

Table 2.2.8 MMDA Revenues

	2002 (Actual)	2003 (Estimate)	2004 (Projection)
Revenue (Php Million)	2,295	2,693	2,739
Share	100%	100%	100%
Allotment from Central Government	43%	44%	44%
IRA*	13%	12%	12%
Other Subsidy	30%	32%	32%
Internal Revenue	9%	12%	24%
Loan Proceeds	2%	8%	7%
Fees and Charges	6%	3%	7%
Other Income	1%	1%	10%
5% Contribution from LGUs *	29%	32%	32%
Unappropriated Surplus	19%	11%	0%

Source: Data as of March 2004 provided by Budget and Financial Section, MMDA

Note: Details may not add up to totals due to rounding.

* IRA (Internal Revenue Allotment) is money apportioned to LGUs based on the national internal revenue collections. The local government units shall have a 40% share in the national internal revenue tax collections based on RA 7160.

* Five percent of the total annual gross revenue of each local government unit shall be paid to the MMDA according to RA 7924.

(7) LGUs and Barangays

1) Scheme of the LGUs' and Barangays' Revenue

IRA

Local Government Units (LGUs, namely cities and municipalities) have their shares of Internal Revenue Allotment (IRA) based on collections from the national internal revenue tax (representing 40% of total internal revenue collections). The distribution of the IRA to LGUs is as follows:

- Provinces 23%
- Cities 23%
- Municipalities 34%
- Barangays 20%

The share of each province, city and municipality is as follows:

- By population 50%
- By land area 25%
- By equal sharing 25%

According to this scheme, each barangay should receive at least Php80,000 /year.

Special Shares

Tobacco excise tax, Utilization and Development of national wealth under RA 7160, gross income tax, value-added tax, and franchise tax (only for the cities of Makati and Manila) are apportioned to LGUs.

Loan and Grant

Some programs and projects for LGUs are based on certain specific grant criteria/formula such as urban population, incidence of poverty, population growth rate, annual average income, degree of urban environmental degradation, efficiencies in basic services such as sanitation and wastewater disposal, storm drainage and flood prevention, solid waste collection and disposal, transport facilities and so on. These funds are provided to LGUs through the Municipal Development Fund (MDF), which is administered by the Bureau of Local Government Finance, the Department of Finance (BLGF-DOF) with loans and grants on a 70% to 30% ratio respectively, in order to address municipal/city infrastructure requirements.

Independent Revenue

LGUs have powers to levy local taxes and collect fees and charges as self-finance revenue source. LGUs are also able to issue bonds and other long-term securities although it is subject to the rules and regulation of the Central Bank and Securities and Exchange Commission.

2) Actual Performance of LGUs in Metropolitan Manila

Regarding the actual performance of LGUs expenditure in Metropolitan Manila, in accordance with the reports on income and expenditure which are obliged to be submitted from LGUs to Department of Finance, there had been no account on the activities for water resource management and/or flood control from 2000 to 2002.

The expenses for solid waste management are shown in the following table.

While some LGUs have a separate solid waste management office, which has its own budget and accounting record, a number of LGUs still have their solid waste management function incorporated with other departments such as the Mayor's Office, Administrator's Office, and Environment Office or simply included in the Non-Office account. In such cases, the true cost of solid waste management is very difficult to determine. For 2001, expenses of LGUs in Metropolitan Manila for solid waste management varied from about 5% to 24%, or an average of 13%, of their total expenditures.

Table 2.2.9 LGUs' Solid Waste Management Expenses, 2001

Unit: Php Million

	Expense for Solid Waste Management
Caloocan	357
Quezon	942
Manila	575
Makati	419
Pasay	244
Taguig	121
Other cities/municipalities	816
Total of Metropolitan Manila	3,474

Source: ADB Metro Manila SWM Project No.9

[1] Metro Manila : In Search of a Sustainable Future, University of the Philippines Press, 2002
[2] Gross Regional Domestic Product 2000 – 2002, National Statistical Coordination Board
[3] ADB, Country Economic Review Philippines CER:PHI 2002-07, July 2002
[4] METRO MANILA -A GATEWAY TO THE PHILIPPINES-, May 2000
[5] 2003 Philippine Statistical Yearbook, NSCB
[6] METRO MANILA -A GATEWAY TO THE PHILIPPINES-, May 2000
[7] General Appropriation Act 2003, Department of Budget and Management

2.3 SOCIAL CONDITIONS

2.3.1 PROFILES OF STUDY AREA

(1) Administrative Hierarchy and Metropolitan Manila

The Philippines consists of 16 regions, 79 provinces, 114 chartered cities and 1,496 municipalities spread across its 7,017 islands. The city of Manila locates in the National Capital Region (NCR).

NCR is also called as "Metropolitan Manila", defined as a capital area consisting of 16 cities and one municipality (as of June 2004) covering a land area of 616 km^2 and accounting for approximately 0.2% of the country's total land area.[1]

The cities and municipalities are called LGUs (Local Government Units), and administratively divided into districts, then, into zones and into "*barangays*". Barangays are the smallest administrative units. There are 41,939 barangays in the Philippines and about 4%, or 1,694 barangays are in Metropolitan Manila. (Census 2000)[1] The City of Manila, for example, is divided into 6 districts, and each district is composed of about 10 to more zones, totalling 99 zones. Each zone has several to more than 20 barangays. Each barangay is given numbers from 1 up to 897. Similarly, the City of Pasay is divided into two districts and 20 zones, then into 201 barangays. The administrative division of the City of Makati is slightly different. The city is divided into two districts, and then divided into 32 barangays; each barangay is given names instead of the numbers.

The Local Government Code (LGC), or Republic Act 7160, of 1991 devolved governance from the national government to LGUs, and mandates the LGUs to provide efficient and effective governance and promote general welfare within their respective territorial jurisdictions. With the passage of the LGC, several functions are devolved from the national government to the LGUs including, but not limited to, the provision of basic health services, land use planning, environmental management, agricultural development, and livelihood support development. In addition to these increased decentralization, the participation of NGOs and People's Organizations (POs) in the planning, implementation and monitoring of LGU-led projects relatively increased.

1) Barangays in the Area of Master Plan Study

The study area (73.4 km^2) covers the core area (or 12%) of Metropolitan Manila and consists of six LGUs as follows:

- Caloocan
- Manila
- Quezon
- Pasay
- Makati
- Taguig

Table 2.3.1 Number of Barangays in the Study Area

	Metropolitan Manila	Caloocan	Manila	Quezon	Pasay	Makati	Taguig
Study Area (Master Plan)	1,199	119	848	18	190	22	2
Total Area	1,694	188	897	142	201	33	18

Source: Census 2000, National Statistic office (NSO)

2) Organization of Barangay Office

Each barangay is headed by a barangay chairman or generally captain (*punong barangay*) who is elected by barangay people. The barangay captain leads the barangay council (*sangguniang barangay*) composed of seven barangay councillors (*kagawad*) and Youth Council (*Sangguniang Kabataan, or SK*) Chairman. There is also a barangay secretary and a barangay treasurer. The Youth Council composed of the SK Chairman and SK Councillors directs the youth-oriented activities in the barangay.

The barangay captain, councillors and Youth Council members are elected officials. They may run for office for three consecutive terms (one term = 3 years). The secretary and treasurer are appointed.

As for task and responsibility of a barangay captain, please refer to *Supporting Report I*.

(2) Population and Household

1) Population Concentration on Metropolitan Manila

The Philippines is experiencing rapid population growth and today's numbers of 76.5 million people is forecasted to reach 104.5 million people by the year 2025 even in low assumption. Metropolitan Manila is the largest, most densely populated and most economically advanced urban center in the country. Not surprisingly it is facing a range of environmental problems and issues similar to those being experienced in other megacities. Among the megacities in south-east Asia, Metropolitan Manila is one of the highly populated cities.

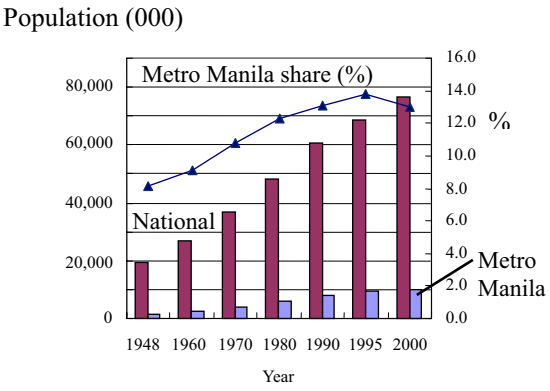
Based on the latest Population Census in 2000 conducted by the National Statistics Office (NSO), Metropolitan Manila has a total population of 9,932,560.[2] The top three LGUs in terms of total population are the cities of Quezon, Manila, and Caloocan.

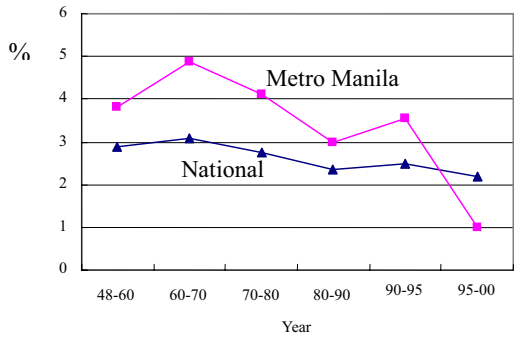
1	Tokyo	26,444
2	Changhai	12,887
3	Jakarta	11,018
4	Osaka	11,013
5	**Metro Manila**	10,870
6	Beijing	10,839
7	Seoul	9,888
8	Tianjin	9,156
9	Bangkok	7,281
10	Hong Kong	6,927

Table 2.3.2

Population Ranking of Urban Agglomerations in East Asia & South-East Asia, 2000

Source:
http://www.un.org/esa/population/publications/wup1999/WUP99CH6.pdf, United Nations





Sources: Philippine Institute for Development Studies
MMEIRS database, 2003

Figure 2.3.1 Population Growth

Figure 2.3.2 Population Growth Ratio

The figure above (left) shows population growth of Metropolitan Manila. Comparing the share of the population of Metropolitan Manila to that of the national, it was only 8% of the total population in 1948 but it shared almost 14% of the total population in 2000 due to the rapid centralization and urbanization that started in the 1980s.[3]

It can be interpreted from *Figure 2.3.2* that the annual population growth of Metropolitan Manila was always higher by 1% to 2% than the national growth ratio, except for the years of 1995 to 2000. Annual population growth decreased in 1995 to 2000 to 1% from 3.5% in 1990 to 1995.

2) Suburban Sprawl in Study Area

While the population in Metropolitan Manila continues to grow, the study area as the core area of Metropolitan Manila shows different trends recently. Although populations of Caloocan, Quezon and Taguig are growing, that of Makati has stopped, and populations of Manila and Pasay are declining after 1995. This trend is regarded as a suburban sprawl phenomenon in Metropolitan Manila.

Table 2.3.3 Population, 2000 / 1995 / 1990

LGU	Population			Population Growth	
	2000	1995	1990	95-00	90-95
NCR (Metropolitan Manila)	9,906,048	9,454,040	7,948,402	0.94%	3.53%
City of Manila	1,581,082	1,654,761	1,601,234	*-0.91%*	0.66%
City of Makati	444,867	484,176	453,170	*-1.68%*	1.33%
Caloocan City	1,177,604	1,023,159	763,415	2.85%	6.03%
Pasay City	354,908	408,610	368,366	*-2.78%*	2.10%
Quezon city	2,173,831	1,989,419	1,669,776	1.79%	3.57%
Taguig City	467,375	381,350	266,637	4.15%	7.42%

Source: MMEIRS, National Statistics Office, 2002, compiled by JICA Study Team

In 2000, total population and household population in the LGUs that comprise the study area is 6.16 million and 6.20 million, so that 40,000 people live in hotels, motels, dormitories, hospitals, welfare institutions, refugee camps and other institutional living quarters.

Table 2.3.4 Population and Household Number, 2000

	Metro Manila	Caloocan	Manila	Quezon	Pasay	Makati	Taguig	Total of Six LGUs
Area (km^2)	597.8	53.1	41.3	165.3	17.7	32.0	27.5	336.9
Total Population	9,932560	1,177,604	1,581,082	2,173,831	354,908	444,867	467,375	6,204,667
Household Population	9,862,978	1,174,673	1,568,092	2,158,367	353,798	442,144	462,591	6,159,667
Number of Households	2,132,989	249,567	333,547	480,624	78,180	98,225	102,723	1,342,866

Source: Report No. 1-M Population by Province, City/Municipality and Barangay, National Capital Region Census 2000, NSO

Data of residential area: MMEIRS database

Note: Total of six cities includes outside area across border of the study area.

3) High Population Density in Study Area

Population density of Metropolitan Manila was 16,615/km^2 in year 2000, far exceeding the national average of 226/km^2. Congestion is more evident in the study area. The following table shows that population density of LGUs in the study area exceeds the average of Metropolitan Manila except for the cities of Quezon and Makati.

Table 2.3.5 Population Density in Study Area, 2000 (City boundary basis)

	Metro Manila	Caloocan	Manila	Quezon	Pasay	Makati	Taguig	Total of Six LGUs
Total Area (km^2)	597.8	53.1	41.3	165.3	17.7	32.0	27.5	336.9
Population Density (Pop./km^2)	16,615	22,177	38,283	13,181	20,051	13,902	16,996	18,417
HH Population Density	16,499	22,122	37,968	13,057	19,989	13,817	16,822	18,283
Residential Area (km^2)	295.3	36.0	15.4	77.2	5.5	15.1	13.0	162.2
HH Population Density per Residential Area	41,391	32,646	102,017	27,942	64,253	29,236	35,573	48,611
Number of Households	2,132,989	249,567	333,547	480,624	78,180	98,225	102,723	1,342,866
HH Density (No. of HH/km^2)	3,568	4,700	8,076	2,908	4,417	3,070	3,735	3,986

Source: Report No. 1-M Population by Province, City/Municipality and Barangay, National Capital Region Census 2000, NSO

Data of residential area: MMEIRS database

Note: HH means Household

Total of six cities includes outside area across border of the study area.

Density of household people of Metropolitan Manila is 16,499/km^2. The density of household people in Manila, Caloocan and Pasay is about 38,000, 22,000 and 20,000/km^2, respectively. On the other hand, the cities of Quezon and Makati have a lower density of

household population than Metropolitan Manila average.

This distribution pattern of density of household number looks the same as that of population. Density of household number in Manila, Caloocan and Pasay is higher than Metropolitan Manila average (3,600 HH/km^2), i.e., 8,100, 4,700 and 4,400/km^2, respectively, and Quezon and Makati have lower density of household numbers.

4) Population Density by Barangay

The following table and figure show population density by barangay. The most congested barangay record 723,954 persons /km^2. Not only this area but also a much highly dense area is seen in the study area. As shown in the figure, very high population density barangays are generally located very close to esteros.

Table 2.3.6 Population Density in Study Area, 2000 (Barangay boundary basis)

	The Densest Area	
Manila	723,954 /km^2	(Barangay 123)
Makati	64,025 /km^2	(Barangay Kasilawan)
Caloocan	226,009 /km^2	(Barangay 20)
Pasay	242,638 /km^2	(Barangay 61)
Quezon	51,864 /km^2	(Barangay Sto. Niño)
Taguig	22,379 /km^2	(Barangay Western Bicutan)
Metropolitan Manila	16,117 /km^2	Average
Philippine	226 /km^2	Average

Source: Census data of National Statistics Office, GIS Database compiled by JICA Study Team

5) Household

Household size in cities in the study area is shown in the table below. Household size ranges from 4.50 to 4.71, and there is no large difference. It is 4.57 on average. And compared with Metropolitan Manila, household size in cities in the study area is smaller.

Table 2.3.7 Household Size by LGUs

	Metropolitan Manila	Caloocan	Manila	Quezon	Pasay	Makati	Taguig	6 LGUs Average
Average of HH Size	4.62	4.71	4.70	4.49	4.53	4.50	4.50	4.57

Source: Public Use File for NCR, Population and Housing Census, NSO

6) Types of House & Building Materials

Based on the data of NSO, more than 50% of buildings are classified as “single house”, followed by “multi-unit residential” in the cities in the study area.

Tenure status of the buildings classified as “owned/being amortized” and “rented” are dominant. Classification of “rent free without consent of owner”, that is, informal settlers still accounts for 8.9% in the study area.

Some 49% of housing units have floor space ranging from less than 10 m^2 and less than 30 m^2 and 78% units are less than 50 m^2. There is no significant difference among the cities.

However, in terms of building construction materials, “concrete/brick/stone materials” is highest in Caloocan, Quezon, Makati and Taguig, which are lower density cities of household population per residential area. In Manila and Pasay, dominant materials are combination of “concrete/brick/stone” and “half concrete/brick/stone/ and half wood”.

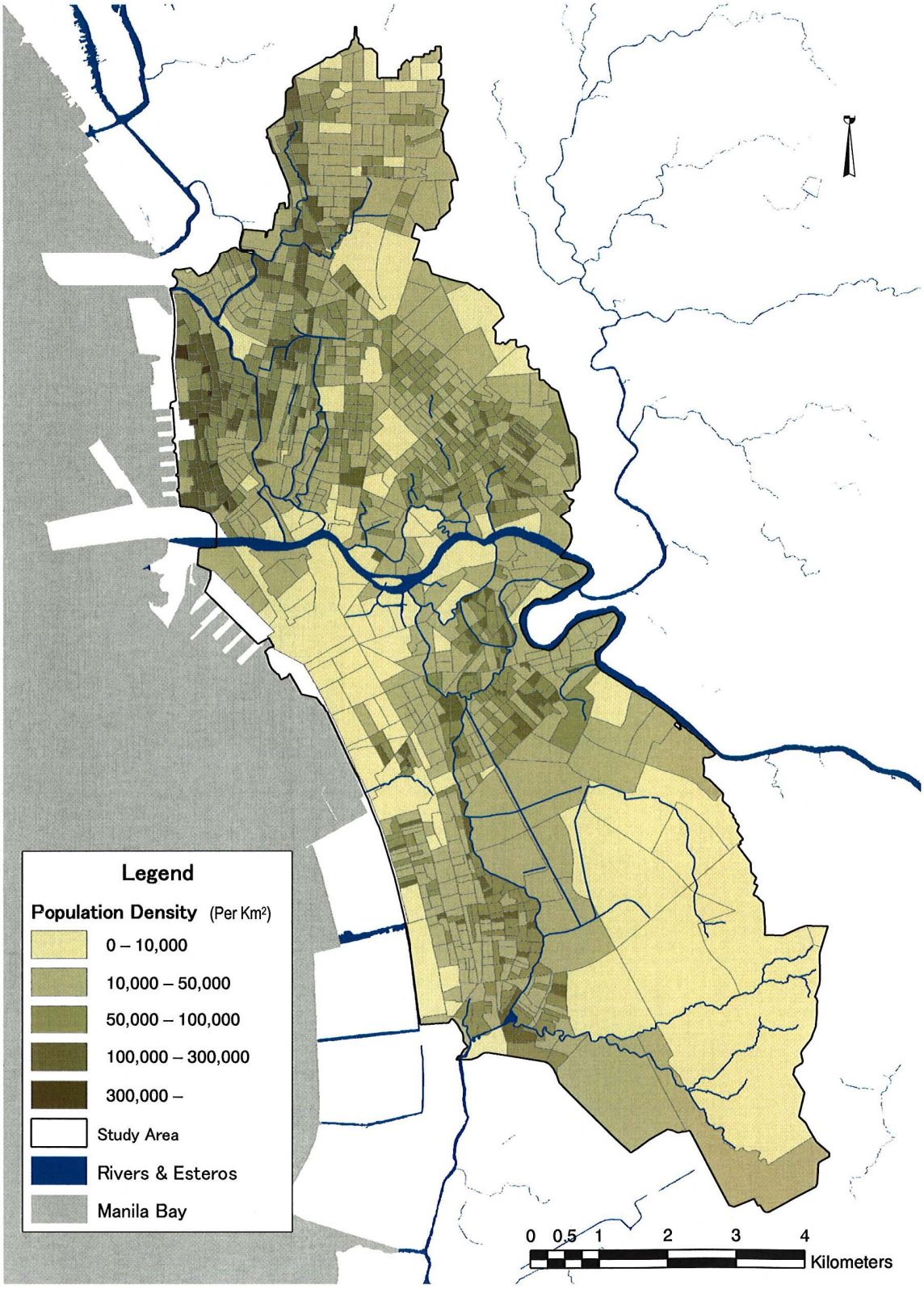


Figure 2.3.3 Population Density by Barangay

(3) Household Economy

Table 2.3.8 shows household income in the cities in the study area. According to NSO data, 50% of households in the area, excluding Caloocan, have annual incomes ranging from Php150,000 to less than Php500,000. Household income of Makati is higher than those of other cities and municipality, with 80% of its total households earning more than Php150,000 a year.

Table 2.3.8 Number of Families by Income Level

	Metro. Manila	Caloocan	Manila	Quezon	Pasay	Makati	Taguig & Pateros
Under P 10,000	0	0	0	0	0	0	0
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10,000 – 19,999	1,167	952	0	0	215	0	0
	0.1%	0.4%	0.0%	0.0%	0.2%	0.0%	0.0%
20,000 – 29,000	2,108	861	0	0	0	0	0
	0.1%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%
30,000 – 39,999	5,831	0	649	1,504	0	0	552
	0.3%	0.0%	0.2%	0.3%	0.0%	0.0%	0.5%
40,000 – 49,999	13,996	5,069	3,817	0	0	225	552
	0.6%	2.0%	1.2%	0.0%	0.0%	0.2%	0.5%
50,000 – 59,999	24,360	2,740	6,661	2,052	829	266	552
	1.1%	1.1%	2.0%	0.5%	0.9%	0.3%	0.5%
60,000 – 79,999	93,551	11,484	16,534	15,704	2,804	2,604	5,724
	4.3%	4.6%	5.0%	3.5%	3.1%	2.5%	5.0%
80,000 – 99,999	170,395	31,664	25,902	26,322	5,362	3,160	8,186
	7.8%	12.6%	7.9%	5.8%	6.0%	3.1%	7.1%
100,000 – 149,999	444,698	62,742	58,155	82,427	19,072	14,724	20,746
	20.3%	25.0%	17.6%	18.3%	21.4%	14.3%	18.1%
150,000 – 249,999	645,254	74,893	98,116	120,667	27,590	23,384	45,026
	29.5%	29.9%	29.8%	26.8%	31.0%	22.8%	39.2%
250,000 – 499,999	533,683	44,455	87,202	127,433	26,321	33,095	25,959
	24.4%	17.7%	26.5%	28.3%	29.5%	32.2%	22.6%
500,000 over	253,631	15,991	32,603	74,033	6,891	25,227	7,493
	11.6%	6.4%	9.9%	16.4%	7.7%	24.6%	6.5%
Total	2,188,674	250,851	329,639	450,142	89,084	102,685	114,790
	100%	100v	100%	100%	100%	100%	100%

50% over line

Source: Family Income and Expenditures Survey 2000, NSO

Note: Upper column: number of families, Lower column: %
Data of Taguig municipality is not available. Income of Taguig municipality is combined with Pateros in source data.

(4) Poverty

The 2000 Metro Manila poverty threshold set by the National Economic Development Authority is Php15,678 per capita per year. At an average size of families in Metro Manila of 4.62 and the study area's 4.57, the estimated family poverty thresholds are Php72,432.36 and Php71,678 per annum, respectively. These poverty thresholds are within the family income range of Php80,000 and below. As a matter of estimating the level of poverty, this can be represented by the number of families in this income bracket.

As shown in the table below, about 6% of the total number of families in the study area are within the poverty threshold and constitute about 58% of Metropolitan Manila's total. Among the six LGUs of the study area, Manila and Caloocan have the most number of families in the poverty threshold income level at 21,000 and 28,000, respectively, or about 8.5% of their respective total number of families. Makati has the least in both number and percentage.

Table 2.3.9 Number of Families Below Php80,000 Income Level

	Number of Families		
	Total	Below 80,000	
		Number	% of Total
Caloocan	250,851	21,106	8.41
Manila	329,639	27,661	8.39
Quezon	450,142	19,260	4.28
Pasay	89,084	3,633	4.08
Makati	102,685	3,095	3.01
Taguig	114,790	7,380	6.43
Sub-Total of 6 LGUs	1,337,191	82,135	6.14
Total Metro.Manila	2,188,674	141,013	6.44

Source: 2000 FIES and NEDA

According to the 2000 FIES (Family Income and Expenditures Survey), about 50% - 60% of the families in the study area and, in fact, in the whole of Metropolitan Manila, derive income from salaries and wages. Entrepreneurial activity is source of income for about 20%. All told, employment and dependency are indicators of poverty in addition to the amount of actual income received by families. According to the household survey conducted under this study, 55% of families depend on only one income earner. The table below shows a sense of income dependency in the study area and in the whole of Metropolitan Manila in 1995. Average dependency in the study area as it is in Metropolitan Manila is 2.7, which means that about two other persons are dependent on the income of one employed person. The actual dependency ratio could even be much higher considering that employed persons data presented in the table below includes all those that were employed anytime during the past year immediately proceeding the census year.

Table 2.3.10 Dependency Ratio, 1995

	Population			
		Employed		Dependency
	Total	Number	% of Total	Ratio
Metro.Manila	9,454,040	3,458,643	36.58%	2.73
Caloocan	1,023,159	343,313	33.55%	2.98
Manila	1,654,761	602,581	36.41%	2.75
Quezon	1,989,419	755,292	37.97%	2.63
Pasay	408,610	153,866	37.66%	2.66
Makati	484,176	198,464	40.99%	2.44
Taguig	381,350	133,775	35.08%	2.85
Total of 6 LGUs	5,941,475	2,187,291	36.81%	2.72

Source: Basic Data from 1995 Census, NCR

Socio-economic profiles contained in the Comprehensive Land Use Plans of the study area's LGUs show that unemployment rate could be more than 10% to about 20% of the labor force. The lowest unemployment rate is in the city of Makati while the highest is in the cities of Manila and Caloocan.

(5) Literacy, Education and Information

1) Literacy

Literacy rate of Caloocan and Makati is shown in the table below. There are different samples of estimation of literacy rate: Caloocan's samples are 6 years old and over and those of Makati range from 10 and 64 years old. Simple literacy rate (the ability to read and write a simple message in any language or dialect) is almost 99%. Functional literacy rate (possessing both simple literacy and numerical skills) is 92 % and 94%, slightly smaller than simple literacy rate. It can be said, therefore, that most people can read dissemination documents.

Table 2.3.11 Literacy Rate

	Caloocan*1 (1994)	Makati*2 (1994)
Simple Literacy Rate (%)	98.8	99.3
Functional Literacy Rate (%)	92.4	93.6

Source: *1: Caloocan Medium Term Development Plan 2000-2005
*2: Makati Comprehensive Land Use Plan 2000
Note: Samples for literacy rate of Caloocan are ages 6 years and over, and Makati, 10 -64 years old.

2) Education

The Philippine formal educational system consists of three main levels; elementary, high school and college education. Other categories are pre-school for children to prepare them for the formal schooling, vocational education for people with adequate literacy to learn skills for employment and other purposes and post-graduate education for people who have completed tertiary education and would like to pursue higher learning through acquisition of master's and doctorate degrees.

Regarding the educational attainment of people in the study area in 2000, the number of people under the category 'no grade completed' gives a confirmation of the area's literacy rate estimated to be within 98% to 99%. Likewise, the number of people who attained elementary to post-graduate levels of education confirms a functional literacy rate of about 95% to 96% as stated in the socio-economic profiles of the LGUs in the area. Although the six LGUs have almost similar educational attainment profile, by comparison, Makati City has a relatively better educated population with a much bigger portion of the total population attaining college level and post graduate level of education.

3) Information

A large majority of the population is functionally literate, meaning able to communicate (receive and send message) through reading and writing. It is an indication that information through various media can be understood and passed on.

Being part of the country's capital region, host to prime central business districts, the study area enjoys the adequacy of information via tri-media. There are 15 major daily newspapers, 10 broadsheets and 5 tabloids. In addition, several magazines and comics are regularly published monthly, bi-monthly or weekly. Broadsheets are more popularly read among college-educated people while tabloids are more common among elementary and high school level people since most tabloid news articles are written in Filipino language in contrast to broadsheets whose articles are mostly written in English language. Radio broadcasts are

facilitated by 31 AM stations and 25 FM stations. In addition, there are 23 television (TV) stations and 69 cable TV (CATV) networks, which enable subscribers to view TV channels in many countries, such as CNN, BBC, NHK, Bloomberg and ESPN. Local TV broadcasts 16 to 24 hours daily while CATV is in operation 24-hours daily.

Radio broadcast and TV are probably the most popular medium of information flow in both affluent and poor segments of the population. Most private cars and public utility vehicles such as taxicabs, jeepneys and buses have radio sets. TV sets are commodities commonly seen in affluent, middle class and poor dwellings. Ownership of TV sets in shanties around informal settlers' areas is very observable through TV antennas standing on the rooftops. In informal settlers' areas even people who do not own TV sets are able to access TV broadcasts through neighbors. Neighborhood watching of TV programs in convenience stores is a common sight in the slums.

(6) Public Health

1) Water Supply

Ratio of main water sources for drinking and/or cooking and laundry and/or bathing are almost the same so that same water sources are used for drinking and/or cooking and laundry and/or bathing. For this dual-purpose main water sources, "own use faucet of community water system" accounts for more than 50% of households in the study area excluding Taguig. One-third of households in Taguig use shared tubed and piped deep well with other neighbors. Next main water source of Taguig is shared faucet of community water system (20%).

Please refer to *Supporting Report I* for the statistic information on main sources of water supply for drinking and/or cooking and laundry and/or bathing.

2) Toilet Facilities

Major type of toilet facility is "water sealed sewer /septic tank, used exclusively by households". It accounts for almost 70% of households excluding Taguig. In Taguig, the above classification accounts for only 55%. This shared percentage is smaller compared with other cities. Other classification, "water sealed, other depository, used exclusively by households", also shared 20 % of households.

Please refer to *Supporting Report I*, for the statistic information on types of toilet facilities of households.

3) Morbidity

The common causes of morbidity in the LGUs in the study area are bronchitis and pneumonia, followed by diarrhea, hypertension, dengue fever, pulmonary tuberculosis and dermatological conditions. Very common causes of mortality are pneumonia, hypertension and cancer. Especially pneumonia and hypertension are prevalent in five out of the six cities and municipality.

Please refer to *Supporting Report I* for the statistic information on causes of morbidity and mortality by LGU.

(7) Solid Waste Management

Since the decentralization/localization policy of the government, function/responsibility of collection of solid waste was transferred from the MMDA to LGUs. After this localization, the present mandate of MMDA is focused on only the management of disposal sites.

Although LGUs are in charge of management of solid waste collection basically, each LGU is outsourcing most of the activities (to collect / to bring to disposal site / to collect for recycling & reuse) to private companies except a small part of direct management. In addition, barangays are also in charge of collection of solid waste at the locations and roads that are inaccessible to solid waste trucks.

(8) Other Social Services Related to Drainage Improvement

In the past projects on river development/rehabilitation, water resource management, drainage and sewerage projects in Metropolitan Manila, issues on informal settlers have been closely related and come up in the discussion and implementation because their houses / structures and the solid waste generated by them affect the discharge capacity and water flow and cause water pollution.

Under the coordination of HUDCC (Housing and Urban Development Coordinating Council), shelter development and related programs such as mortgage scheme and community-based programs have been implemented by NHA (National Housing Authority), NHMFC (National Home Mortgage Finance Corporation), HDMF (Home Development Mutual Fund), HIGC (Home Insurance Guaranty Corporation), and financial agencies such as DBP (Development Bank of the Philippines).

The DSWD (Department of Social Welfare and Development) is also assisting the urban poor by providing social welfare programs. The CIDSS (Comprehensive and Integrated Delivery of Social Services) is a presidential flagship and the department's major pro-poor program. The CIDSS seeks to empower targeted families and communities to enable them to meet the minimum basic needs (MBNs). During the localization and for continuity of the program, CIDSS has been implemented in cooperation with LGUs and NGOs. Among the CIDSS' programs are *Ahon Bata sa Lansangan* (facility for Street Children) Project and *Sagip Kalinga* (Save and Care) Project, which serve street children and street dwellers.

While population in Metropolitan Manila has dramatically increased, control and regulation of urban developments have not caught up. Because coherent land use plans have not been implemented, urban infrastructure development often lagged behind and increase of depressed residents caused the environmental degradation. Though the government is putting a priority onto the poverty alleviation in urban areas, the pressure of population growth seems to blot out the measures of the authorities.

2.3.2 INFORMAL SETTLERS

In this section the definition of informal settlers, what are the estimated or approximate numbers of informal structures and settlers, and further, the distribution of such structures are presented.

(1) General

One of the major problems of deteriorating conditions of drainage channels in the core area is the existence of a large number of informal settlers within and along esteros and creeks. These informal settlers are disturbing the drainage channels by throwing solid waste or indiscriminately discharging excreta and other solid waste in drainage channels contributing to the causes of reduced conveyance capacity and clogging of such drainage channels.

How to manage or handle the existing informal structures and the people who live in those structures is, accordingly, one of the most serious problems that the Study shall face in order to improve the drainage systems in the core area, because the drainage improvement requires dredging of esteros and creeks. Clearance of esteros and creeks of the informal structures and the people who live in the houses that are encroaching into such drainage channels is the first prerequisite condition for dredging.

The estimated numbers of the structures intruding into the esteros and creeks in the study area, and estimated numbers of families who live in such houses are presented here. It should be noted that various conflicting numbers and counting exist among different agencies and LGUs.

(2) Who Are the Informal Settlers

The definition of "informal settlers" who are generally called "squatters" is somewhat vague in its nature. The people who are counted as **"informal settlers" in the Study** are explained next.

1) The Definition

The definition of "informal settlers" set by the Study is the people or the group of people occupying structures on public lands, in this case, along or in esteros and creeks within the study area. Further, the numbers that are counted as informal structures to be relocated are only those that are **actually encroaching** in the drainage channels.

There are different types of informal settlers as explained in the following section. However, it is decided to consider all informal settlers, either owners or renters, who are dwelling in the encroached houses as qualified informal settlers. This is confirmed by a telephone conversation with PCUP (Presidential Commission on Urban Poor).

2) Different Types of "Informal Settlers" and Illegal Structures

In fact, the statuses of some of the so-called "informal settlers" or those who are classified as "informal settlers" in the Study are not necessarily equal. There are different combinations of types and natures of "informal settlers". The combinations may be of formal settlers, illegal settlers, and illegal structures, owners and renters as explained below.

a. The "informal settlers" who built the structures encroaching into esteros or creeks but do not have any rights or permission of provisional or permanent.

- Owner-dwellers of encroached structures without any permission.

b. The "informal settlers" who are occupying public lands within 3 meters of legal easement along waterways but have been given permission from LGUs or provisional permission to stay. These people built houses encroaching into esteros and rent them.

- The owners have some kind of permission to stay on the legal easement but built the adjoining houses encroaching into waterway and rented out the houses.
- Renters live in the encroached houses, the owners have some permission to stay on the 3 meters legal easement part.

c. Those who built structures on the 3 meters easement without having any permission and also built adjoining structures encroaching into waterways and rented them out.

- Renters live in the encroached houses, the owners do not have any permission to stay.

d. The formal settlers who have right to the neighboring lands, but built houses encroaching into the waterways and rented them out.

- The owners have legal land in the vicinity, renters live in the encroached houses built separately.

e. The structure built on the 3 meters easement without certificate or permission, and part of their structures is also encroaching into waterways.

- The owners built houses on 3 meters legal easement and a part of their houses are encroaching into waterways.

(3) Numbers of Informal Settlers in Metro Manila

Four different counting of informal settlers are presented below.

1) The number counted by the Housing and Urban Development Coordination Council (HUDCC)

According to the UN-Habitat report, informal settlements can be found in 526 communities, accounting for some 2.54 million located in all the cities and municipalities of Metropolitan Manila. Data available on informal settlers are currently surveyed in terms of the number of informal settlers, as derived from surveys conducted by HUDCC.

Table 2.3.12 Number of Households and Number of Informal Settlers, 2002

	Total Households	Depressed HHs (Informal Settlers)	% of Total
City of Manila	333,547	99,549	29.8
Quezon City	480,624	169,490	35.2
Caloocan City	249,567	67,292	26.9
Makati City	98,225	27,024	27.5
Pasay City	78,180	57,436	73.4
Municipality of Taguig	102,723	21,931	21.3

Source: HUDCC unpublished report, 2002,
Urban Slums Reports: The case of Manila, Philippines, UN-Habitat, 2003

2) Number of Informal Settlers along Esteros Surveyed by DPWH

According to the survey conducted by DPWH on October 28, 2003, the informal settlers who are identified as encroaching in and along esteros of high priority areas within the study area are as follows: (Only the esteros within the study area are listed.)

I. Estero Clearing (2002 Priority Areas)	
Estero de Valencia	279 families
Estero de San Miguel	336 families
Estero de Aviles	200 families
Estero de Kabulusan	300 families
North and South Antipolo	280 families
Sub Total:	1,395 families
II. Other Esteros for Clearing	
Manila	
Estero de Santibanez	151 families
Estero de Magdalena	858 families
Estero de San Lazaro	650 families
Estero de la Reina	350 families
Estero de Paco	1,160 families
Estero de Binondo	360 families
Sub Total:	3,529 families
Pasay	
Maricaban Creek	1,854 families
Grand Total:	6,778 families

The esteros covered by the above survey are only those that DPWH considered as priority esteros. There are many more esteros existing within the core area. Accordingly, the total number of the informal settlers within and along esteros in the core area as a whole shall be far larger than the above count.

3) Numbers of Buildings within Esteros based on Analysis of Aerial Photograph

According to the analysis made by the use of the aerial photograph by MMEIRS (JICA Study in 2004), the estimated total house buildings intruding into esteros in the core area is about 2,100. *Figure 2.3.4* shows the distribution of severity of encroachment into esteros together with the estimated number of buildings within esteros. Please refer to *Supporting Report I* for the detailed method for the estimation.

In the case of KAMANAVA Area Flood Control and Drainage System Improvement Project, the number of families is calculated by multiplying the number of house buildings by 3.0. However, the result of this calculation is considered a little higher comparing the result of actual counting of the number of structures and families along Estero de Tripa de Gallina or from the experiences of visiting various informal settler areas and listening to opinions of the concerned people; thus a multiplier of 2.8 is used. The result of the above conversion calculation yielded 6,000 as the approximate number of families living in the house buildings

in total. Some of the clustered areas of buildings that are within the esteros are shown below with approximate numbers of families:

Estero de la Reina	310 families
Estero de Magdalena	100 families
Estero de Valencia	360 families
Estero de Sunog Apog/Maypajo	300 families
Estero de Pandacan	145 families
Open Canal of South and North Antipolo	430 families
Estero de Tripa de Gallina (total)	2,400 families
PNR Canal	320 families

Note: The results for only representative esteros are shown.

The above number is estimated only for the numbers of families whose buildings are encroaching into esteros. Thus, if structures along esteros on the public lands that are within three meters area are included, the numbers shall be by far larger than the above.

It should be also noted that the structures that are not visible by the aerial photos such as the structures built under bridges are not included in this analysis.

4) Actual Counting of Number of Families within Estero de Tripa de Gallina

Actual counting of the number of families whose buildings are encroaching into Estero de Tripa de Gallina on both Pasay side and Makati side was made with the assistance of Barangays along the estero. The results are as follows: 1,745 families in 17 barangays in Pasay side and 328 families in 3 barangays in Makati side, for a total of 2,173 families. The Manila side of Tripa de Gallina has not been counted yet.

Further, the city official in charge of resettlement of the City of Pasay estimates the number of the informal settlers in and along Estero de Tripa de Gallina in Pasay City side who have to be relocated as 3,000 families.

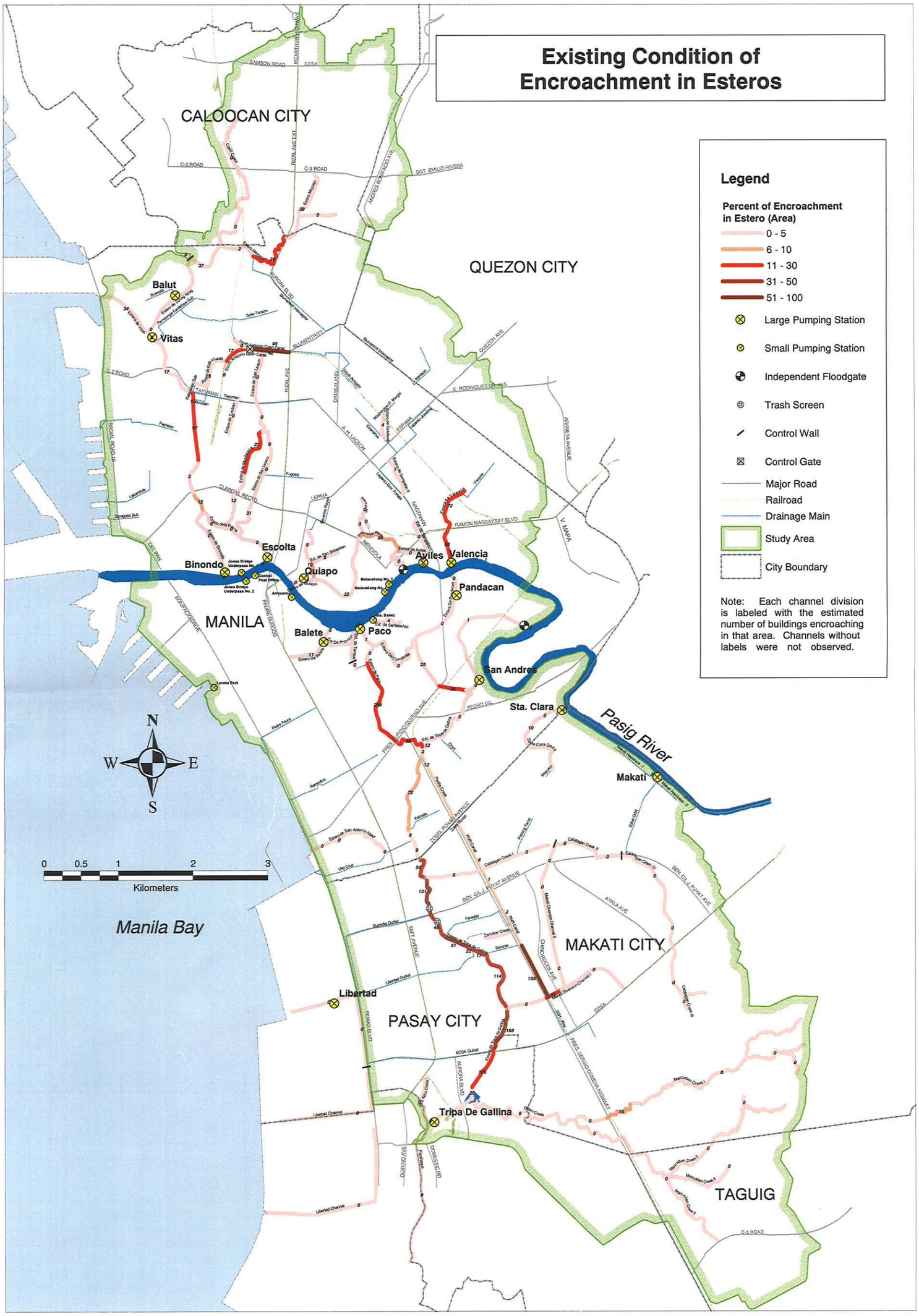


Figure 2.3.4 Encroachment within Esteros

2.3.3 SOCIAL SURVEYS

Three different kinds of social surveys were carried out in the Study as follows:

(1) Type of Surveys

1) House-to-house survey to the people living near drainage channels, namely esteros and creeks, and the people living in flood-prone areas. The number of samples is 542 households from 78 different barangays along esteros and in flood-prone areas, of which, 398 informal settler households are included. They are selected from the poor families, middle, and some rich families.

   The main purposes of the house-to-house survey are to find out the existing socio-economic conditions of those people, their perception on flood and waterways or drainage, and to find out their manner of solid waste disposal.

2) Key Informants survey to informants of concerned barangays in the core area. The informants may be barangay officials, responsible people of different organizations, or teachers. The survey was conducted by the use of prepared questionnaires. A total of 16 different barangays are visited in the Cities of Manila, Pasay, Makati, and Caloocan, and Municipality of Taguig.

   The purpose of the Key Informants' survey is mostly to verify the responses that are given by the individual household interviewed by the house-to-house survey, and to analyze general situations more objectively.

3) Mail survey to various organizations, institutes and business establishments by selecting more than 100 samples basically from estero and creek areas and flood-prone areas. However, in consideration of limited availability of mail services, the actual survey was carried out by hand delivery of questionnaires and pickup of the accomplished forms. Samples include schools, hospitals, clinics, government offices, banks, and big private companies, small businesses, transportation concerns, NGOs and small industries.

(2) Summary Results of Surveys

1) House-to-House Survey

The house-to-house survey in the core area of Metro Manila was conducted to obtain a general profile of the core area focusing on the four key factors as follows:

- Esteros,
- Informal settlers,
- Floods and
- Garbage

The cities covered were Manila, Pasay and Makati, which are the major core area, and three others: the Cities of Caloocan and Quezon, and the Municipality of Taguig where some part of the city or municipality located within the core area were also included.

a) Methodology and Sampling

The survey was conducted in the method of house-to-house interview by the use of a questionnaire prepared beforehand. The questions are composed of a wide range of items:

language-ethnicity, religion, household composition, income, occupation, educational attainment, flood-related questions, people's perception on flood, garbage, informal settlers, housing, and existing conditions on various matters.

Samples were taken from families of the barangays of aforementioned key focus areas such as along Esteros de Maypajo and Tripa de Gallina, and Sampaloc and P. Santos randomly. Please refer to *Supporting report I* for detailed explanation of sampling method.

b) Results of the Survey

The detailed survey results are presented in *Supporting Report I.* Only some of the important results are highlighted below focusing largely on the informal settlers in comparison with the situations of formal settlers.

Gender

Because the survey was conducted mainly during the day time due to security reasons, many respondents are female who tend to stay at home more than the male counterparts. The ratio, therefore, is 65% female and 35% male.

Ethno-linguistic

More than 50% of the families visited are Tagalog-speaking while Bisayan and Ilokano speaking people followed at 18% and 7%, respectively. Some are from Bicolano group and some others are Muslim/Lumad from Mindanao area.

Household Composition

Many families have two to three children. The category of two to three children occupies approximately 54% of the total formal settler families who have children, while 26% of informal settler families who have children have two children. In case of informal settler families, one child families and 3 children families also occupy about 34% of the families with children.

The average number of children of the surveyed families is about 3.04 children as a whole. While the average of formal settler families is some 2.97 children per family, the average of informal settler families is slightly higher than that, 3.07 children.

Household Size

An average household size of the surveyed group is about 4.75 persons per family. This number may look comparatively smaller than generally considered. The reasons may be the fact that 106 single families were included in the samples along with more than 20% of families without children as well. As a result, the average family size is relatively small.

The difference between the formal settler families and informal settler families is small. The average of formal settler families is 4.71 persons and that of the informal settlers is 4.81.

The families with one child among the formal settler families are 16% of the families with children, on the other hand, the families with one child among the informal settler families are 19%. Meanwhile, families with more than five children among formal setters are only 7%; in the case of the informal settlers, more than 10%. This shall tell that the household size of

the informal settler families is slightly larger than that of the formal settler families.

On average, a typical family is two to three children and the parents or in some cases, a parent.

Educational Attainment

More than half of the surveyed husbands and wives of both formal settlers and informal settlers revealed to having education of high school level. According to the results of survey, only 1 out of 286 informal settler husbands has no education, and 63% of them have high school level education. Further, 16% of them are reaching the college educational level.

Similarly, about a half of the wives of formal settlers have the level of high school education and about 37% of them are reaching higher educational level. For the wives of informal settlers, some 57% have high school level education and 24% of them have higher education.

The above result indicates that the informal settlers who are often referred as "poor and **uneducated**" could be a false picture.

Occupation

In average, 56% of the surveyed households are salaried men and women. Some 28% are engaged in small business and stores while about 15% are in the service sector. In comparison, salaried men and women of the formal settler families are about 60% and the same for informal setter families are 50%.

The above finding indicates that the economic situation of formal settler households may be a little more stable than that of the informal settlers where nearly 50% of the occupations come from the service sector, and small business and stores.

Estimated Monthly Income

Because income of the households is one of very sensitive and difficult questions that people tend to avoid giving their true incomes, the question was set to by brackets rather than the exact amounts. As a result only a very rough calculation is possible.

An average monthly income of the entire survey was found to be slightly over Php6,000. The mean (40%) of the formal settlers falls in the category of between Php5,000 and Php9,999. On the other hand, the mean (47%) of the informal settlers falls under between Php1,000 and 4,999.

A very rough calculation made based on the incomes by category revealed that an average income of the formal settler families is somewhere around Php7,300 and of the informal setter families is around Php4,900.

To the question "Does your income satisfy your needs?" more than half (51.5%) of the surveyed families answered "Yes". The percentage share of the "Yes" for the formal settlers and informal setters' families is 58% and 46%, respectively. However, this indicates that nearly half of the surveyed families are not earning sufficient income for their needs.

Ownership of Lot and House

It was found that 42% of the formal settlers are so-called "free occupants" of the housing lots and 18% of the **informal settlers own their lands**. This may be due to the fact that many of the informal settlers who live on some public lands, such as along esteros, have been given rights to stay or title for the land as explained in *Chapter 2.3.2.*

Regarding the houses, more than half of the families, both formal and informal setters, do not own the house they live in. Nearly 40% of the informal settlers who live in shanty-like houses, however, pay rent, often times more than Php500 per month, to the house owners.

Sizes of Lot and House

The highest percentage of the families, both the formal and informal, occupies the lot of between 20 to 30 m^2, of which, 29% of the formal settlers and 42% of the informal settlers fall under this category. The survey also revealed that seven of the informal settler families occupy lots of more than 100 or 200 m^2.

Similarly, including both formal and informal settler families, about 43% live in houses with floor space of 20 to 30 m^2. About 46% of the informal settlers and 39% of the formal settler families live in the space of 20 to 30 m^2 houses. Considering the average size of the households in the study area, which is about 4.75 persons, one can easily understand that it is a very small space. Of the surveyed families some 26% of the informal settlers and 17% of the formal settler families live in houses with floor space of less than 20 m^2.

This situation can be verified by the survey finding that, on average, 62.4% of the surveyed families, including the formal and informal families, live in one-room houses.

Environment

Of the 542 surveyed families, some 79% think the environment around them has changed, and of which 64 % said that the environment is worsening.

Thirty-five of the samples who said the environment is worsening think that the cause of worsening is due to "overpopulation", followed by "pollution" (27%) and "too much garbage 21%".

On Floods

Of the 401 samples of the flood-prone area, 350 families answered that they experienced floods in the past. Even 30 families of non-flooding area experienced floods. Half of the families who experienced floods (380 in total) responded that they suffered both human and material damages.

On the question of whether flood could be mitigated, nearly 80% of the surveyed families answered "yes".

As for the causes of floods, 62% of the samples answered that there was "too much garbage in esteros". Other causes they pointed out were "low elevation of the area" (14 %) and "narrowed drainage capacity" (14 %).

Garbage Collection

It was found that a very high rate (some 97%) of collection services is being provided for the surveyed families in the Metro Manila area. The result suggests that it may be wrong to say that one of the major causes of throwing garbage into esteros is due to low availability of collection services.

Further, among those who replied there are collection services, 70% of samples of Manila and 83% samples of Pasay responded that they enjoy daily collection services, and 100% of Makati samples said the same.

2) Key Informants Survey

This survey was concentrated on some of the barangays of problem esteros and flood-prone areas in Manila, Pasay, Makati, and Caloocan Cities.

a) Barangays Visited

Visited are 10 barangays in Manila City: seven barangays along esteros such as Esteros de Maypajo, Sunog Apog, Tripa de Gallina, San Lazaro and Vitas; three barangays in flood-prone areas. Also barangays along Estero de Tripa de Gallina and P. Santos in Pasay City; Pio del Pilar, a flood-prone area in Makati City; two barangays near Estero de Maypajo in Caloocan City, and a barangay along Maricaban Creek in Taguig Municipality.

b) Major Findings

Some of the major findings are presented next.

On Floods

Although the degree and duration of the floods have considerably been reduced by various rehabilitation and improvement measures taken in recent years, many parts of the visited barangays still experience floods when heavy rains come. Generally, flood waters come up to knee depth or ankle level, but in cases high tide coincides with heavy rains, the coastal areas suffer heavy floods.

In many areas, the people complain that the water comes from underground, that is, from the clogged drainage systems. They think the capacity of the drainage systems is reduced due to clogging by garbage or silt, or simply the sizes of the drainage pipes are too small.

The people in the flood-prone areas tend to accept floods as natural events or take them as a matter of course even though a considerable number of people suffer frequently from the floods. They think a bigger problem is that people are unable to report to work on time.

Sickness and Diseases

Various sicknesses and diseases such as diarrhea, dysentery, tetanus, typhoid fever, cholera and some kind of skin disease after floods are reported by barangays, but not to the degree of being widespread. One of the most dangerous diseases reported was leptospirosis, which is said to be caused by rat's urine.

Informal Structures and Settlers

There are various structures along esteros within the visited barangays. It seemed that not only houses of so called "informal settlers" but also some kinds of schools, clinics, day-care centers, or business companies and houses of formal settlers are encroaching into or built along esteros, or even barangay halls are built on or along esteros.

A majority of the barangays visited have expressed the problem of having a large number of informal settlers within the barangay. Those informal settlers they say, for example, contaminate their surroundings by throwing garbage into esteros or streets or even at people. Some of them are drug dealers, prostitutes, gamblers or connected with gangsters and give negative influences upon other residents around.

The informants say that the educational level of the informal settlers is low, but most of them send their children to public schools, from elementary school, and many of them to high school level.

The houses of informal settlers tend to look very poor and many of them are really quite poor. However, it was found that a considerable number of the informal settlers have been residing in the area for years, and have already firmly established. Many of them own, for instance, various belongings: a TV set, sofa, sideboard, refrigerator, electric fan, etc.

Garbage Collection

Except for the Municipality of Taguig, most barangays answered that a garbage collection truck comes every morning between 6 a.m. and 8 a.m. However, the informants state that the truck comes only as far as main roads but not to small streets within the barangay. They say this is one of the reasons that some people throw garbage into esteros or leave them on streets or wherever possible.

3) Mail Survey

As explained in the *Section (1) Type of Surveys,* this survey was actually done by hand delivery of the prepared questionnaire and then pickup of the questionnaire after completion.

Table 2.3.13 Number of Questionnaires Delivered and Retrieved

Cities Delivered	Number Delivered	Number Retrieved
Manila City	35 samples	34 samples
Pasay City	25 samples	21 samples
Makati City	21 samples	17 samples
Caloocan City	11 samples	11 samples
Quezon City	12 samples	12 samples
Taguig Municipality	5 samples	5 samples
Total delivered/Retrieved	**109 samples**	**100 samples**

Source: JICA Study Team Survey

The detailed results of the survey are presented in *Supporting Report I.* In this section, only some of the important responses are discussed.

On Environment

Some 90% of the surveyed establishments feel that environment is degrading. Some of the major symptoms of the degradation given by them (76%) is "rivers (esteros) are filled with garbage", followed by "streets are becoming dirty" (66%), "frequent floods"(58%) and "exhaust gas from vehicles" (58%) (Multiple answers allowed).

The establishments point out as some of the reasons for deteriorating environment, "people dump garbage wherever" (82%), then "increase in population" (70%) (Multiple answers allowed).

The results reveal that the majority of the surveyed establishments are well aware of the surrounding environments and their deterioration as well as the symptoms and causes of the problems.

Activities on Environmental Conservation

On the question of whether the establishment is participating in conservation activities, 82% replied "yes". Many are involved in street cleaning (63% of those who participate) and some (16%) are providing financial assistance of some kind.

Regarding the question of willingness to participate in activities proposed by the Study, 74% replied that they are willing to join. But when asked if they can provide financial assistance for the study activities, only 37% answered "yes" and 29% of them answered "no". Many did not answer, or chose to say "it depends".

Garbage Recycle and Collection

It was found that only 56% of the surveyed establishments practice recycling of the garbage. The largest category of recycle is paper and paper products—88% of those who answered "recycling". Other recycled items are "plastic products", "glasses and bottles", and "aluminum cans and metals".

The garbage collection services for the establishments are also available with 95% of the establishments who gave answers. Of this percentage, 70% are provided with daily morning collection. Those who answered two or three times per week are 22% altogether. Factories in the surveyed area have their own recycling and collection systems.

Flood Control

A majority (93%) of establishments consider that flood can be controlled. They say that this can be accomplished in the following manner (multiple answers were allowed): "improvement of drainage systems" (92%), followed by "clean garbage in rivers/esteros" (84%) and "people stop dumping garbage (in esteros or rivers) (82%).

The above answers indicate that many establishments feel that major causes of the floods are clogged or low capacity of the existing drainage systems, and dumping of garbage in waterways.

Should Informal Settlers be Relocated?

A high percentage (89% on average) of the surveyed establishments thinks that informal

settlers should be relocated. All of those surveyed in Quezon and Taguig feel that way, and some 81% of the establishments in Pasay City feel the same way too.

Some establishments added that the informal settlers have to be provided with thorough livelihood programs, and that resettlement sites should be made available.

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[1] As of June 2003, 2003 Philippine Statistical Yearbook, National Statistical Coordination Board, p15-20

[2] National Statistics Office

[3] MMDA-JICA, Earthquake Impact Reduction Study for Metropolitan Manila in the Republic of the Philippines, 2003