

## 2.5.5 DRAINAGE CHANNELS

### (1) Drainage Network

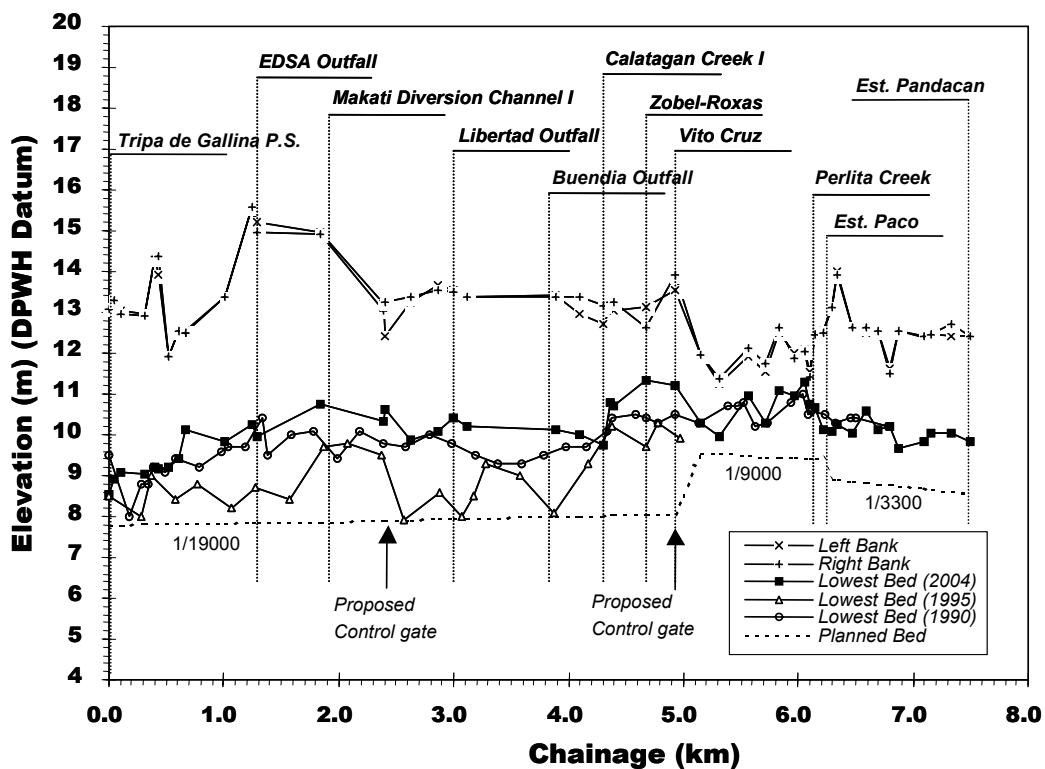
The identified esteros/creeks and drainage mains are shown in *Figures 2.5.1, 2.5.2.*

### (2) Dimensions of Drainage Channels

#### 1) Estero / Creek

There are 20 esteros/creeks in North Manila and 22 esteros/creeks in South Manila. Among those, longitudinal and cross-sectional profiles of 30 esteros/creeks were surveyed in 2000 in the course of SEDLMM. In the Study, a supplemental survey on most of the remained esteros/creeks has been conducted. The current conditions of esteros/creeks are analyzed using data obtained by both SEDLMM and the Study. *Table 2.5.7* summarizes main dimensions of esteros/creeks

*Figure 2.5.8* shows longitudinal variations of bed and bank elevations in Estero de Tripa de Gallina as an example. In *Figure 2.5.8*, longitudinal variation of bed elevations in Estero de Tripa de Gallina in 1990 and 1995 and the previously planned bed elevation are also shown. The bed elevation in 2004 is higher than those in 1990 and 1995 in general. Aggradations of riverbed are severe, which makes the existing riverbed 1 - 3 m higher than the planned one. It causes reduction of discharge capacity.



- Source:
- 1) JICA Study Team
  - 2) DPWH, JICA, the Study on Flood Control and Drainage Project in Metro Manila, 1990.
  - 3) DPWH, Metro Manila Flood Control (II) Project (PH-79), Drawings for Estero Improvement, 1991.
  - 4) Public Estates Authority, The Study on the Updated Drainage Plan for Section II of Manila Bay Reclamation Area, Pasay City and Paranaque, Metro Manila, 1995.

**Figure 2.5.8 Longitudinal Profile of Estero/Creek (Tripa de Gallina)**

**Table 2.5.7 Main Dimensions of Esteros/Creeks**

<i>Block_ID</i>	<i>Code</i>	<i>Name</i>	<i>Length (m)</i>	<i>Width (m)</i>	<i>Source</i>	
N01	NE01	<i>Estero de Vitas (*1)</i>	1990	15 - 72	<i>a</i>	
	NE04	<i>Estero dela Reina</i>	3020	8-21	<i>a</i>	
	NE05	<i>Estero de Binondo</i>	1040	15 -32	<i>a</i>	
	NE06	<i>Estero de Magdalena</i>	1510	5 - 36	<i>b</i>	
	NE07	<i>Estero de San Lazaro</i>	2830	3 - 16	<i>b</i>	
	NE08	<i>Estero de Kabulusan</i>	690	9	<i>b</i>	
	NE09	<i>South Antipolo Open Canal</i>	830	2.5 - 7	<i>b</i>	
	NE10	<i>North Antipolo Open Canal</i>	780	3 - 4.5	<i>b</i>	
	NE11	<i>Estero de Tutuban</i>	450	2 - 2.5	<i>a</i>	
	N02	NE12	<i>Estero de Quiapo</i>	1120	12 - 26	<i>b</i>
		NE13	<i>Estero de San Sebastian</i>	380	6 - 12	<i>b</i>
NE14		<i>Estero de San Miguel / Uli-Uli</i>	2670	7.5 - 21	<i>b</i>	
NE15		<i>Estero de Alix</i>	650	2.5 - 3	<i>a</i>	
NE16		<i>Estero de Aviles</i>	380	4.5 - 11	<i>b</i>	
NE17		<i>Estero de Sampaloc I</i>	720	8 -16	<i>b</i>	
NE18		<i>Estero de Sampaloc II</i>	510	2 -10	<i>a</i>	
NE19		<i>Estero de Calubcob</i>	340	9 - 10	<i>b</i>	
N03	NE20	<i>Estero de Valencia</i>	1220	5 - 27	<i>a</i>	
N04	NE02	<i>Estero de Sunog Apog / Maypajo</i>	4270	5 -72	<i>b</i>	
	NE03	<i>Casili Creek</i>	2380	2.5 - 7.5	<i>b</i>	
S01	SE09	<i>Estero de Tripa de Gallina (*2)</i>	7640	4 - 30	<i>a</i>	
	SE11	<i>PNR canal</i>	2660	1.5 - 3	<i>b</i>	
	SE12	<i>Calatagan Creek I</i>	1710	4.5 - 8	<i>b</i>	
	SE13	<i>Calatagan Creek II</i>	1000	6 - 8.5	<i>b</i>	
	SE15	<i>Zanzibar Creek</i>	330	5 - 7.5	<i>b</i>	
	SE16	<i>Makati Diversion Channel I</i>	1790	4 - 10	<i>b</i>	
	SE17	<i>Makati Diversion Channel II</i>	1990	6.5 - 10	<i>b</i>	
	SE18	<i>Dilain Creek / Maricaban Creek I</i>	6320	5 -15	<i>b</i>	
	SE19	<i>Maricaban Creek II</i>	4240	6 - 25	<i>b</i>	
	SE20	<i>Estero de San Antonio Abad</i>	1220	3 - 6	<i>a</i>	
	SE21	<i>Libertad Channel</i>	900	15 - 20	<i>a</i>	
S02	SE03	<i>Estero de Balete</i>	550	6 - 12	<i>a</i>	
S03	SE01	<i>Estero de Provisor</i>	1020	15 - 26	<i>a</i>	
	SE02	<i>Estero de Tanque</i>	340	5 - 25	<i>a</i>	
	SE04	<i>Estero de Santa Banez</i>	520	4 - 10	<i>a</i>	
	SE06	<i>Estero de Paco</i>	2400	6 - 23	<i>b</i>	
	SE07	<i>Estero de Concordia</i>	1070	3 - 18	<i>a</i>	
	SE08	<i>Estero de Pandacan</i>	4320	3 - 16	<i>a</i>	
	SE10	<i>Perlita Creek</i>	920	3 - 4	<i>b</i>	
S04	SE05	<i>Santa Clara Creek</i>	1490	3 - 8	<i>a</i>	
S05	SE14	<i>Calatagan Creek III</i>	2560	5.5 - 7	<i>b</i>	
S06	SE22	<i>Sio Nino Creek</i>	730	N/A	N/A	

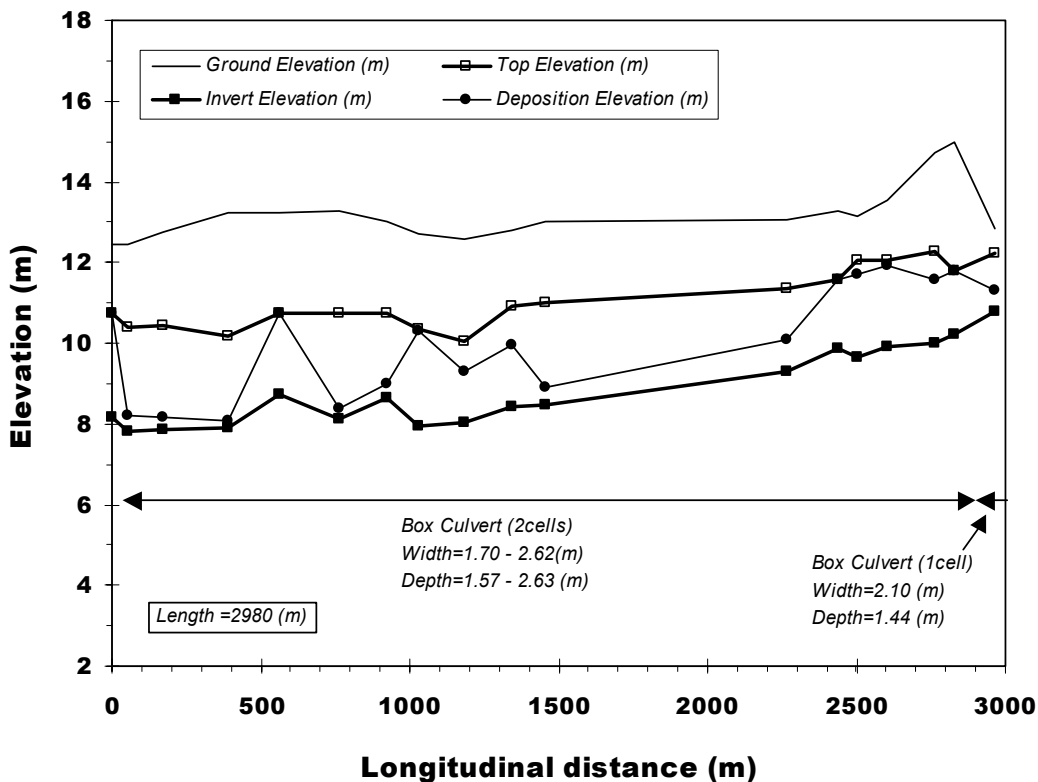
Source *a*: JICA Study Team, *b*: SEDLMM database (2000)

Note \*1: This is included also in N04. \*2: This is included also in S02.

## 2) Drainage Main

There exist 18 and 19 drainage mains in North Manila and in South Manila, respectively. Based upon the database for drainage laterals developed by SEDLMM, the dimensions of the drainage mains can be summarized as shown in *Table 2.5.8*.

In SEDLMM, the deposition depth in the drainage main was also investigated, which clarifies how much the drainage cross-section had been clogged by silt or solid waste at the moment the survey was conducted in 2000. The longitudinal profile of Blumentritt Interceptor is shown in *Figure 2.5.9* as an example. The outlet and the middle and upper parts in Blumentritt Interceptor have no conveyance capacity because of they are full of deposition. There are sections where no deposition is observed. However, only one neck point can significantly reduce discharge capacity even if other places have enough cross-sectional area. Thus, the discharge capacity of Blumentritt Interceptor was almost zero at the moment the survey was conducted in 2000.



Note: Condition of deposition in 2000 is shown.  
Data Source: SEDLMM database (2000)

**Figure 2.5.9 Longitudinal Profile of Drainage Main (Blumentritt Interceptor)**

Many of maintenance holes (or manholes) of drainage mains are improperly operated and maintained. Some of them are covered by road pavement or structures and no longer utilized for maintenance works. This would be one of the reasons why the bottom deposits has been accumulating so much in drainage mains.

**Table 2.5.8 Dimensions of Drainage Mains (1/2)**

Block_ID	Code	Name	Length (m)	Location of manhole (m)	Type	Number of Cell	Width (m)	Depth (m) or Diameter (m)
N01	ND07	Pampanga-Earnshaw Sub	1040	44 - 501	Box Culvert	2	2.60 - 2.80	2.40 - 3.36
				652 - 1037	Box Culvert	1	2.20 - 3.20	2.20 - 2.40
	ND08	Solis-Tecson	1430	0 - 60	Box Culvert	1	2.00	1.30 - 1.52
				166 - 1004	Box Culvert	2	1.50 - 2.00	1.09 - 1.53
				1041 - 1359	Box Culvert	1	2.00	1.15 - 1.48
				1428	Pipe	1		1.02
	ND09	South Antipolo	1370	0 - 1218	Box Culvert	1	3.00 - 4.50	1.85 - 2.67
				1375	Box Culvert	1	2.00	2.14
	ND10	Kabulusan Sub	140	14 - 142	Box Culvert	1	2.81	2.40
	ND11	Kabulusan	370	8 - 367	Box Culvert	1	3.35 - 5.80	2.00 - 2.70
	ND12	Tayuman	1600	0 - 692	Box Culvert	1	2.12 - 3.10	1.36 - 2.40
				875-1303	Box Culvert	1	1.85-1.91	1.48 - 1.89
	ND13	Fugoso	670	0 - 365	Box Culvert	2	2.00 - 2.20	1.63 - 2.87
470 - 546				Box Culvert	1	2.80 - 3.00	1.50	
N02	ND14	Severino Reyes	650	70 - 220	Box Culvert	1	3.10 - 3.20	1.60
				332 - 648	Box Culvert	1	2.65 - 3.20	1.60 - 1.77
	ND15	Lepanto-Gov. Forbes	1160	0 - 1160	Box Culvert	3	3.40 - 4.00	1.75 - 3.15
	ND16	Lepanto-Josefina	1060	0	Box Culvert	3	3.40	2.24
				133 - 223	Box Culvert	2	2.00 - 2.12	2.00 - 2.24
				916 - 1021	Box Culvert	1	4.10 - 4.30	3.00 - 3.24
	ND17	Economia	820	0 - 232	Box Culvert	3	2.30 - 3.40	2.25 - 2.70
				555 - 695	Box Culvert	1	1.40 - 1.53	2.20 - 2.70
ND18	Washington-P. Margal	210	12 - 167	Box Culvert	1	2.80	2.37 - 2.48	
N03	ND19	Visayas	670	2 - 324	Box Culvert	2	2.00	2.00
				403 - 573	Box Culvert	2	1.70	1.70
				673	Box Culvert	1	2.90	1.60
N04	ND05	Blumentritt Interceptor	2980	10 - 1463	Box Culvert	2	1.20 - 2.62	2.00 - 2.63
				2276 - 2840	Box Culvert	2	1.40 - 2.15	1.57 - 2.25
				2978	Box Culvert	1	2.10	1.44
	ND06	Kanlaon	640	0	Box Culvert	1	2.19	1.44
				328 - 459	Pipe	1		0.61
				483	Box Culvert	1	0.762	0.762
ND04	Buendia	510	125 - 293	Box Culvert	1	2.50 - 3.00	1.93 - 2.40	
			437 - 511	Box Culvert	1	2.50 - 3.00	1.66 - 1.67	
N05	ND01	Pacheco	1160	0 - 866	Box Culvert	1	4.00 - 4.40	1.60 - 2.72
				913 - 1041	Box Culvert	1	3.00	0.74 - 1.75
	ND02	Lakandula	870	0 - 212	Box Culvert	1	3.84 - 4.20	2.01 - 2.62
			740 - 873	Pipe	1		1.07	
ND03	Zaragoza Sub	430	0 - 429	Pipe	1		0.91	

Note 1) Dimensions are basically based upon SEDLMM database (2000).

**Table 2.5.8 Dimensions of Drainage Mains (2/2)**

Basin_ID	Code	Name	Length (m)	Location of manhole (m)	Type	Number of Cell	Width (m)	Depth (m) or Diameter (m)
S01	SD12	SSH-Way	1110	5 - 568	Box Culvert	1	3.00 - 5.30	2.50 - 3.70
				741	Box Culvert	1	2.00	0.95
				900 - 1108	Pipe	1		1.07 - 1.52
	SD09	Zobel Roxas	1160	0 - 725	Box Culvert	1	2.80 - 4.40	1.22 - 2.52
				764 - 1157	Pipe	1		1.22
	SD10	Faraday	820	30 - 453	Box Culvert	2	1.50 - 1.96	0.91 - 1.29
				567 - 821	Pipe	2		0.85 - 1.07
	SD11	Pasong Tamo	540	0 - 303	Box Culvert	1	3.50 - 4.05	1.55 - 1.90
	SD14	Buendia Outfall	1990	15 - 1977	Box Culvert	2	3.50 - 3.80	2.50 - 3.25
	SD15	Libertad Outfall	1800	14 - 1697	Box Culvert	1	3.00 - 4.80	2.35 - 3.13
SD16	EDSA Outfall	1720	25 - 911	Box Culvert	2	4.20 - 4.95	2.43 - 3.09	
SD17	Dolores	430	0 - 430	Box Culvert	1	1.80 (*1)	2.50 (*1)	
SD13	Vito Cruz	1450	200 - 941	Box Culvert	1	1.52 - 2.00	1.30 - 1.63	
S03	SD18	United Nations Interceptor	170	0 - 150	Box Culvert	1	-	-
	SD07	Onyx	410	6 - 413	Box Culvert	1	2.50 - 2.60	1.30 - 2.15
	SD08	Estrada	520	4 - 306	Box Culvert	1	2.50 - 2.83	1.20 - 1.67
388				Pipe	1		1.25	
S04	SD03	Masukol	130	0 - 130	Box Culvert	1	3.00 (*1)	2.00 (*1)
S05	SD04	Makati Headrace-I	630	0 - 626	Box Culvert	1	4.06 - 5.20	2.30 - 2.50
	SD05	Makati Headrace-II	390	0 - 265	Box Culvert	1	2.97 - 3.54	1.95 - 2.63
	SD06	Zobel Orbit	1220	0 - 541	Box Culvert	1	4.90 - 5.18	2.97 - 3.10
S06	SD01	Padre Faura	1160	0 - 374	Box Culvert	1	3.30 - 3.47	2.30 - 2.70
				577 - 650	Box Culvert	1	2.20 - 2.70	2.03 - 2.37
				982 - 1070	Box Culvert	1	2.20	1.33 - 1.88
	SD02	Remedios	1350	0 - 418	Box Culvert	1	4.40	2.26 - 3.20
				1082	Box Culvert	1	2.60	1.28
				1348	Pipe	1		1.22

Note 1) Dimensions are basically based upon SEDLMM database (2000).  
 2) \*1: based upon inventory maps provided by MMDA

### **(3) Discharge Capacity**

The drainage network in the study area is very complex and the flow direction varies with time in some places. It is necessary to employ hydrodynamic network model to evaluate such a complex system accurately. However, a simple estimation of discharge capacity with some assumptions is also useful to get a fundamental idea for understanding the existing drainage system. The assumptions are as follows:

- Esteros/Creeks: Uniform flow with bank flow condition. Manning's coefficient is assumed to be 0.030 for existing condition and 0.025 for improved condition.
- Drainage Mains: Pressure flow condition is assumed. Manning's coefficient is assumed to be 0.018 for existing condition and 0.015 for improved condition.

To evaluate the existing discharge capacity, probable peak discharges for several observation points of esteros/creeks and drainage mains have been estimated. Runoff coefficient based on the future expected land use was applied. Flow direction was assumed based on mainly originally planned pump drainage basins. Rational method is applied to estimate probable peak discharge.

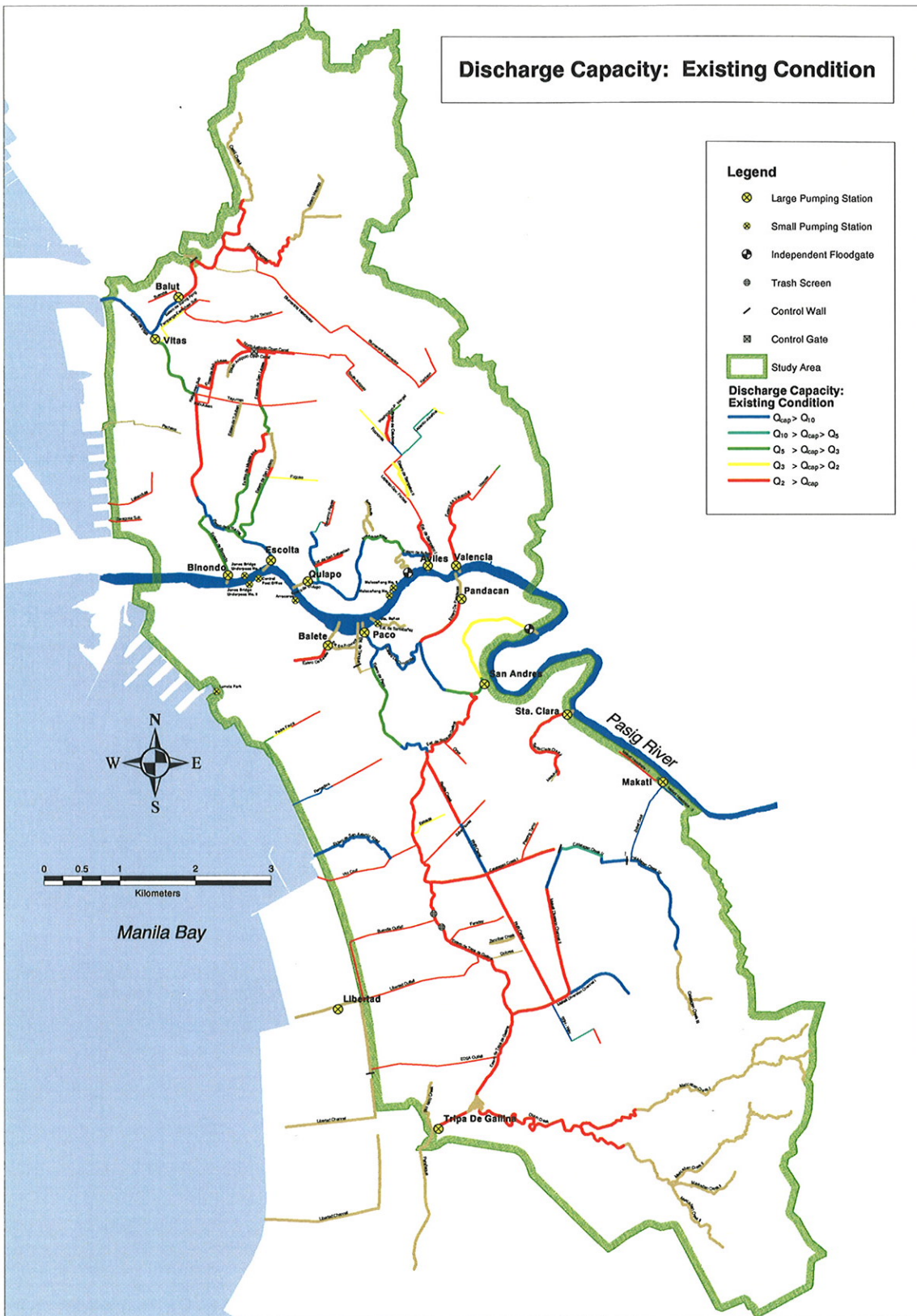
*Figure 2.5.10* shows the existing discharge capacity compared to probable peak discharge. Many channels have the capacity less than 2-year return period peak discharge. The main reason for this is the reduction of cross-sectional area due to heavy deposition of bottom deposits. It is noted that the existence of the encroached structures within channels as obstacles for water flow has not been taken into account directly in this analysis. However, if it is considered, the discharge capacity becomes smaller, although it is difficult to analyze quantitatively. The important finding here is that the reduction of cross-sectional area due to heavy deposition of bottom deposits is already enough to reduce the discharge capacity significantly.

### **(4) Effect of Dredging and Declogging**

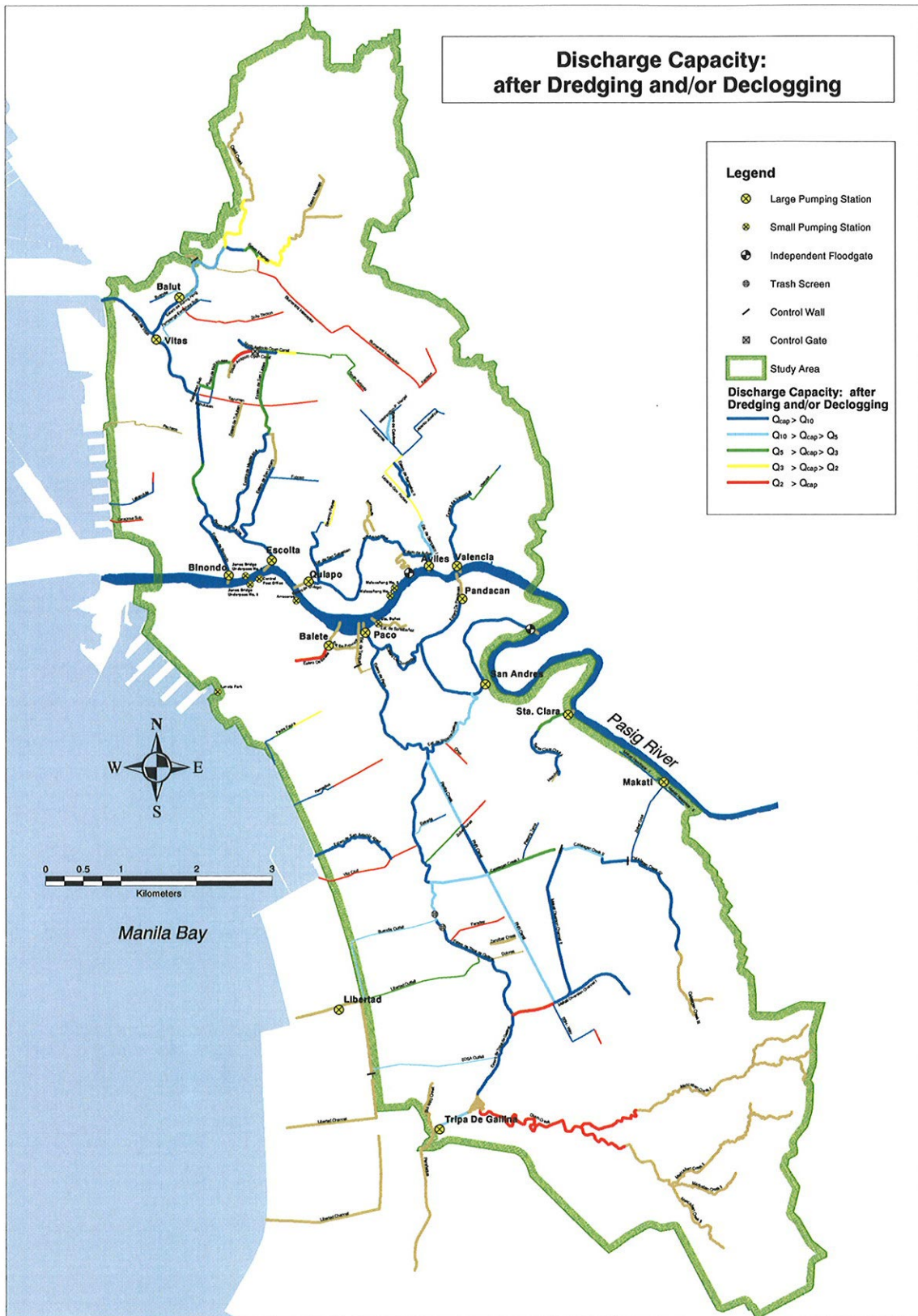
Based upon available previous reports and existing observed cross-sectional shapes, the original bed levels for each estero/creek are estimated. The bed levels to be recovered are then set by considering the connections of each channel. The original bank location is estimated using the surveyed cross-sectional shape of the channels. The width of the channel to be dredged is then set using the estimated bank location. The longitudinal profile to be recovered is shown in *Supporting Report E*.

Total volumes to be dredged and declogged from esteros/creeks and drainage mains are estimated at about 840,000 m<sup>3</sup> and about 80,000 m<sup>3</sup>, respectively.

By conducting the dredging of esteros/creeks and declogging of drainage mains, the discharge capacity can be recovered as shown in *Figure 2.5.11*. Discharge capacity for almost all of the esteros directly connecting to pumping stations will recover to the capacity of more than 10-year return period peak discharge. Many drainage mains have the capacity of more than 3-year return period peak discharge. This result clarifies that dredging and declogging can be significantly effective to regain the channel capacity and consequently to reduce inundation in the core area. However, as can also be seen in *Figure 2.5.11*, some drainage mains such as Blumentritt Interceptor in North Manila and Zobel-Roxas in South Manila have less capacity even if declogging is executed. The dredging and declogging are fundamental, but additional work may be still required in some places.



**Figure 2.5.10 Discharge Capacity of Drainage Channels in Existing Condition**



**Figure 2.5.11 Discharge Capacity of Drainage Channels After Dredging and Declogging**



## **2.5.6 NECESSITY OF ADDITIONAL WORK**

As shown in *Chapter 2.5.5*, dredging of esteros/creeks and declogging of drainage mains are significantly effective to recover the original function of drainage system in the core area. However, some additional works will be required to improve the inundation condition, especially in severely inundated areas. There are two notable regional inundation areas, one in Aviles, Sampaloc area in North Manila, and the other in San Isidro, San Antonio and Pio del Pilar area in South Manila.

Major causes of the regional inundation in North Manila are assumed as follows:

- Storm water coming from a hilly area in Quezon City is not intercepted by the present drainage system of Blumentritt Interceptor and consequently flows down into the upper catchment of Quiapo-Aviles drainage block;
- Improper function of inlet facilities of the existing upper Blumentritt Interceptor due to deposition in drainage gutter;
- Lack of channel flow capacity of Blumentritt Interceptor;
- Clogging of outlet of Blumentritt Interceptor due to heavily accumulated bottom deposits in the Estero de Maypajo.

Major causes of the regional inundation in South Manila are assumed as follows:

- Lack of channel flow capacities of the existing connection channels between Calatagan Creek I, PNR Canal, Zobel-Roxas, Makati diversion channel and Estero de Tripa de Gallina due to heavily accumulated bottom deposits and encroachment of informal settlers;
- Lack of connection channels (PNR and South Superhighway as flow barrier);
- Lack of channel flow capacity of Estero de Tripa de Gallina due to heavily accumulated bottom deposits and encroachment of informal settlers.

## **2.5.7 PROBLEMS AND CONSTRAINTS IN THE DRAINAGE SECTOR**

### **(1) General**

The present drainage system in the core area has been constructed and improved so far its construction in the 1940s. A well-considered system was developed with countless drainage channels of esteros, drainage mains and laterals. Before expansion of urbanization progressed in the last 2 to 3 decades, it is supposed that the drainage system was functioning and consequently, the face of Metropolitan Manila shows open space of water surface and green. It is observed that such valuable drainage channels and facilities are no longer working properly due to illegal social activities of clogging, encroachment of informal settlers, lack of integrated operation and maintenance system in combination with resident's participation, etc. In this section, problems and constraints in the drainage sector are summarized.

### **(2) Problems and Constraints**

Problems and constraints are categorized into the following 3 aspects of structural, non-structural, and supporting system.

#### **1) Structural Aspect**

The existing 15 large drainage pumping stations have been working effectively for the improvement of drainage conditions in the core area. However, 10 pumping stations have

been working for 20 to 30 years since their constructions in the 1970s and 1980s, and some pumping stations are exceeding their service life of pump equipment and appurtenant facilities, because an economic life of pump equipment and appurtenant facilities is generally to be 20 to 25 years. In this sense, aging pumping stations are remarkable problems. Also, lack of spare parts is reported at many of the pumping stations due to lack of proper O&M budget. It can be said that the same problems for the other pumping stations will have the same problems in the next 10 years.

In the existing drainage channels, the original functions of the drainage channels are missing due to huge deposition in the channels and informal house buildings encroaching drainage channels, due to lack of public awareness and lack of O&M budget. Channel flow capacities are considerably decreased compared with original design conditions, and dredging/declogging of the channels are indispensable.

For the regional inundation areas, basic facilities to collect and drain storm water are not enough to meet the runoff from the respective areas in question. In this regard, it is indispensable to carry out remedial and additional measures for the severe regional inundation areas.

## **2) Non-structural Aspect (Floodplain Management)**

The non-structure aspect (measures) aims to reduce damageable objects or properties in the inundation-prone areas or to lower vulnerability against repeating disasters by application of the respective systems of floodplain management, disaster preparedness, flood forecasting and warning, etc., and by means of resettlement for informal settlers residing in the drainage channels, etc., supported by legislation and establishment of consensus among the people and the authorities concerned.

Existing systems of EFCOS and Inter-agencies Floodplain Management are available for flood forecasting and warning, and floodplain management in the core area. Also, Disaster Management System for disaster preparedness is undertaken by Disaster Coordination Committees of National and Regional levels as well as City, Municipality and Barangay levels, and special arrangement of funding allotment is available at the emergency case. These existing systems under government services are applicable to floodplain management as non-structural measures in the core area of Metropolitan Manila.

Meantime, urbanization in the core area has been highly progressed. Open and green space including swamp and pond has been converted into commercial and business complexes. Due to such urbanization, stormwater retention capacity in the core area is decreasing. Also infiltration capacity to underground is remarkably decreasing because of asphaltting of ground surface. As a result, runoff coefficient of storm water is still increasing. In this sense, some countermeasures to lower runoff coefficient or to retard storm water temporarily (stormwater retention facilities and permeable pavement) are strongly needed in connection with urban development planning in view of effective utilization of present drainage systems and sustainable floodplain management in the core area.

### **3) Supporting Aspect**

In order to sustain the structural and non-structural aspects in effective condition, a setup of powerful supporting system is indispensable. In this regard, an integrated supporting system is insufficient at present and for future. The supporting system in this study consists of social education to improve illegal activities of solid waste dumping and encroachment of informal settlers, minimum-scale resettlement to secure necessary flow area of drainage channels, proper operation and maintenance system including resident's participation, funding system to sustain all related activities of drainage improvement, etc.

## 2.6 INSTITUTIONAL ORGANIZATION FOR FLOOD CONTROL AND DRAINAGE IMPROVEMENT

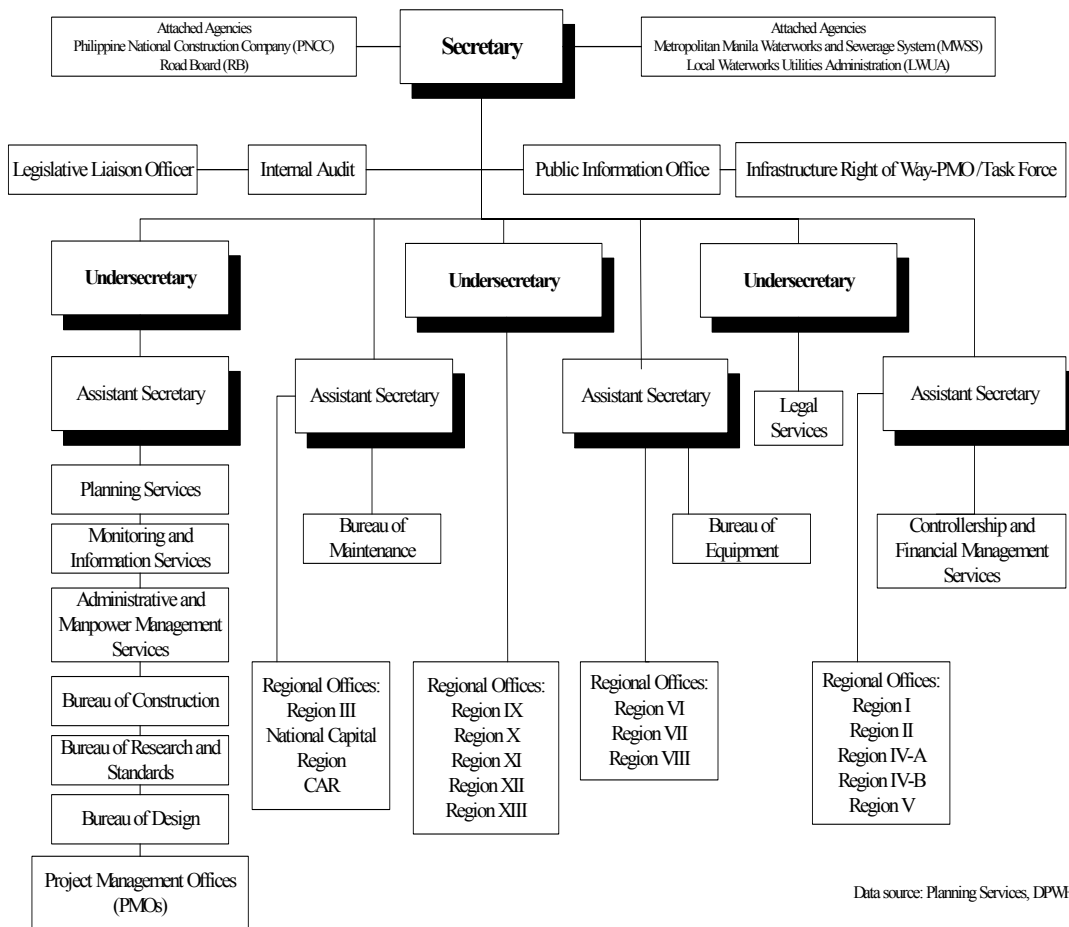
### 2.6.1 INTRODUCTION

There are 3 agencies responsible for flood control and drainage improvement in Metropolitan Manila. They are the Department of Public Works and Highways (DPWH) and the Metropolitan Manila Development Authority (MMDA) in the national government level, and six Local Government Units (LGUs). Six LGUs consist of five Cities of Manila, Makati, Pasay, Quezon, Caloocan, and the Municipality of Taguig. In this chapter, strategy of flood control and drainage improvement, general responsibilities and annual budget of the respective agencies and other related agencies to the drainage sector are discussed.

### 2.6.2 ORGANIZATION AND RESPONSIBILITY OF RESPONSIBLE AGENCIES

#### (1) DPWH

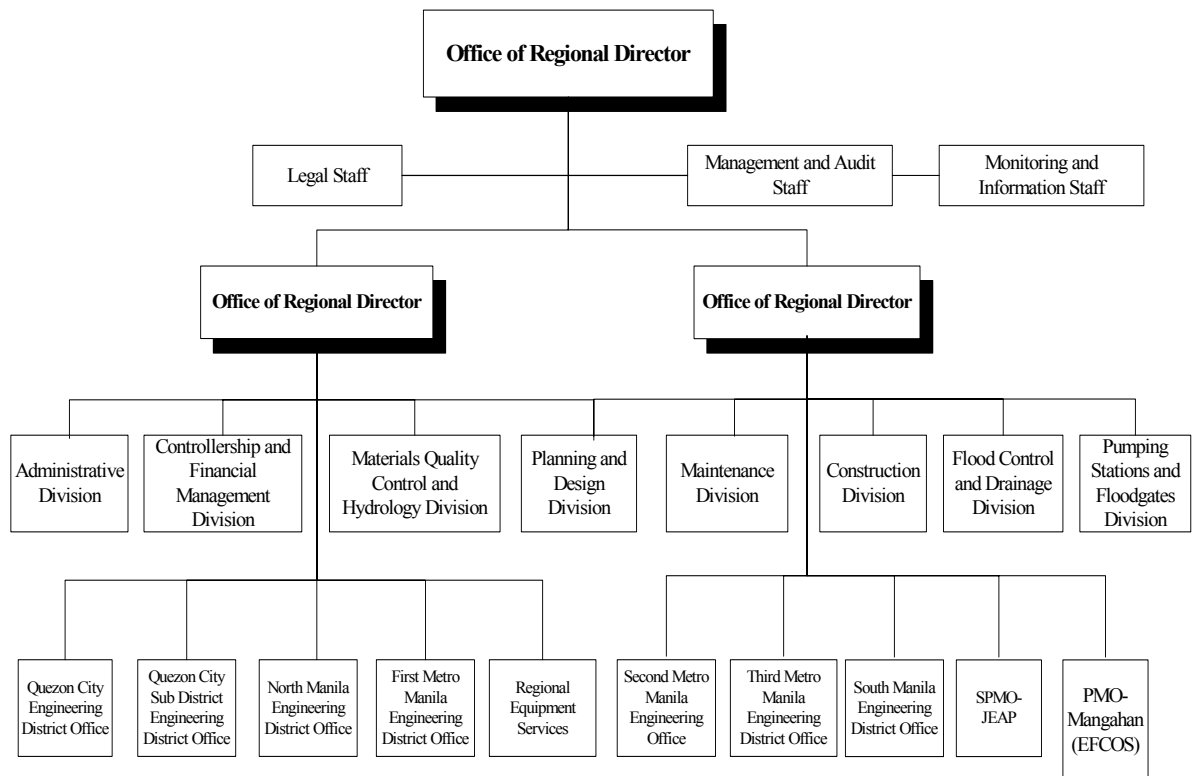
As mandated by Executive Order No. 124, DPWH is the principal agency responsible for planning, design, construction, and operation and maintenance of flood control and drainage improvement works. *Figure 2.6.1* presents general organization chart of DPWH.



**Figure 2.6.1 Organization Chart of DPWH**

The organization chart of the Regional Office of National Capital Region (NCR) is shown in *Figure 2.6.2*. NCR is one of 16 regional offices in DPWH, and is responsible for administration coordination and supervisions of the construction, operation and management of projects and activities in the region. The regional office has eight divisions under the control of regional director assisted by two assistant regional directors: one for construction and the other for maintenance. NCR head office has a total staff of about 400 as of February 2004.

NCR has eight district offices with a total staff of around 1,320 as of February of 2004, and assigns equipment among the district offices and among projects in the region in coordination with Regional Equipment Services (RES).



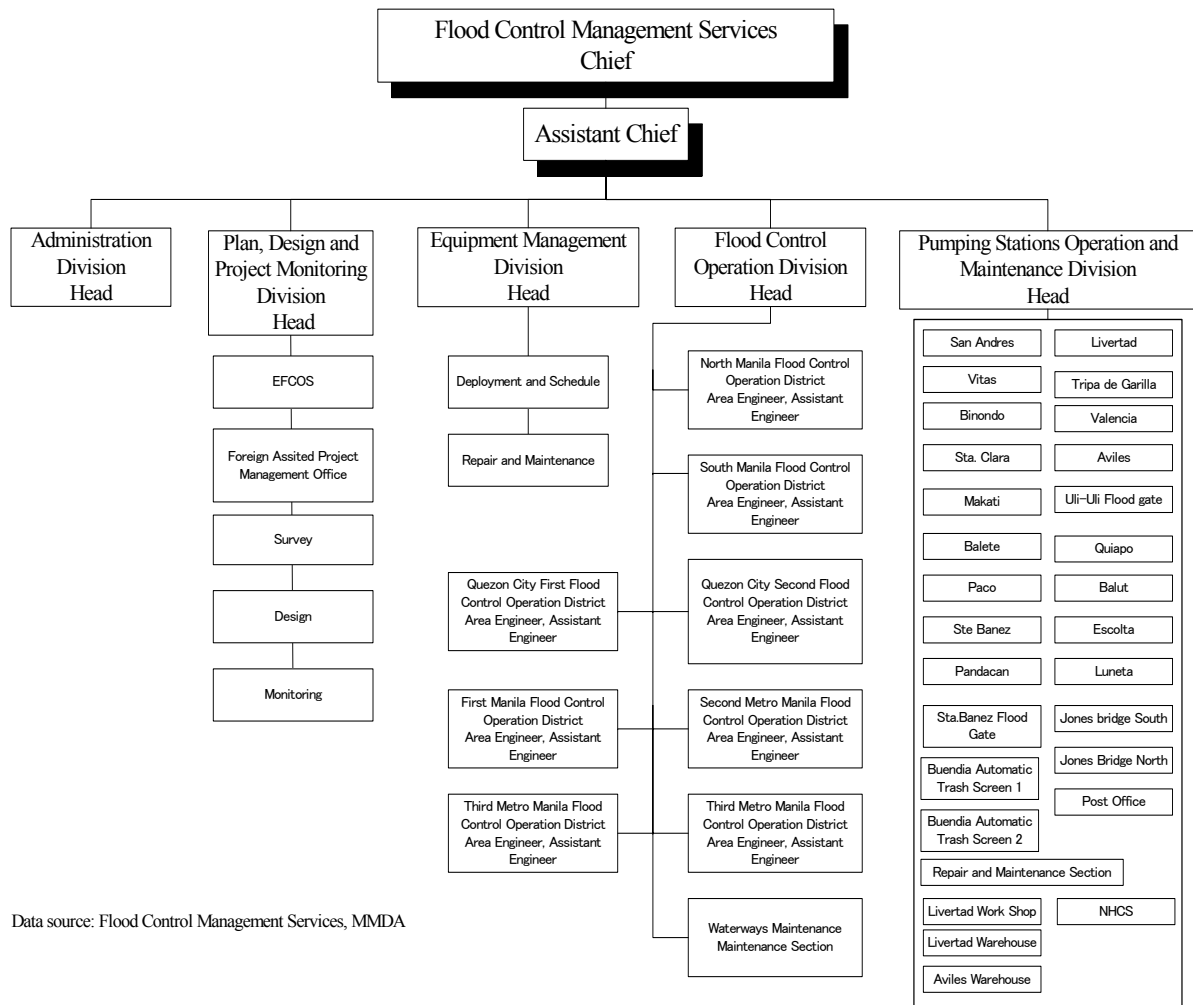
Data source: NCR, DPWH

**Figure 2.6.2 Organization Chart of DPWH-NCR**

Under the present medium-term development plan, major components of flood control and drainage sector in the Metropolitan Manila are large-scale flood control and drainage projects financed by foreign assistance, i.e. the Enhancement of Capabilities in Flood Control and Sabo Engineering of the DPWH, Stage I (JICA), KAMANAVA (Kaloocan-Malabon-Navotas-Valenzuela) Area Flood Control and Drainage System Improvement Project (JBIC), Linear Parks Development Project along the Pasig River (ADB), the Pasig River Environment Management and Rehabilitation Sector Development Project (ADB), etc. The details of the above projects are described in *Supporting Report E*.

## (2) MMDA

MMDA, directed by the Office of the President, is responsible for flood control and drainage management services covering 1) planning, design and construction of flood control works, drainage pumping stations, and drainage channels of esteros, outfalls, drainage mains and laterals along national roads, and 2) operation and maintenance of constructed channels and facilities in Metropolitan Manila, as mandated by Republic Act No. 7924 in 1994. The Flood Control Management Services in the Office of the Deputy Chairman is directly responsible for all of this as shown in *Figure 2.6.3*.



Data source: Flood Control Management Services, MMDA

**Figure 2.6.3 Organization Chart of MMDA**

The flood control management services consists of five divisions of 1) administration, 2) planning, design and project monitoring, 3) equipment management, 4) flood control operation, and 5) pumping station operation and maintenance. The divisions of flood control operation and pumping station operation are in charge of improvement and operation and maintenance activities of the existing drainage channels and facilities in Metropolitan Manila. A full complement of the flood control management services is as follows.

- Technical personnel: 168 persons
- Office personnel: 147 persons
- Skilled workers: 347 persons

- Laborer: 723 persons
- Total: 1,385 persons

Employment status of the above personnel is categorized as follows.

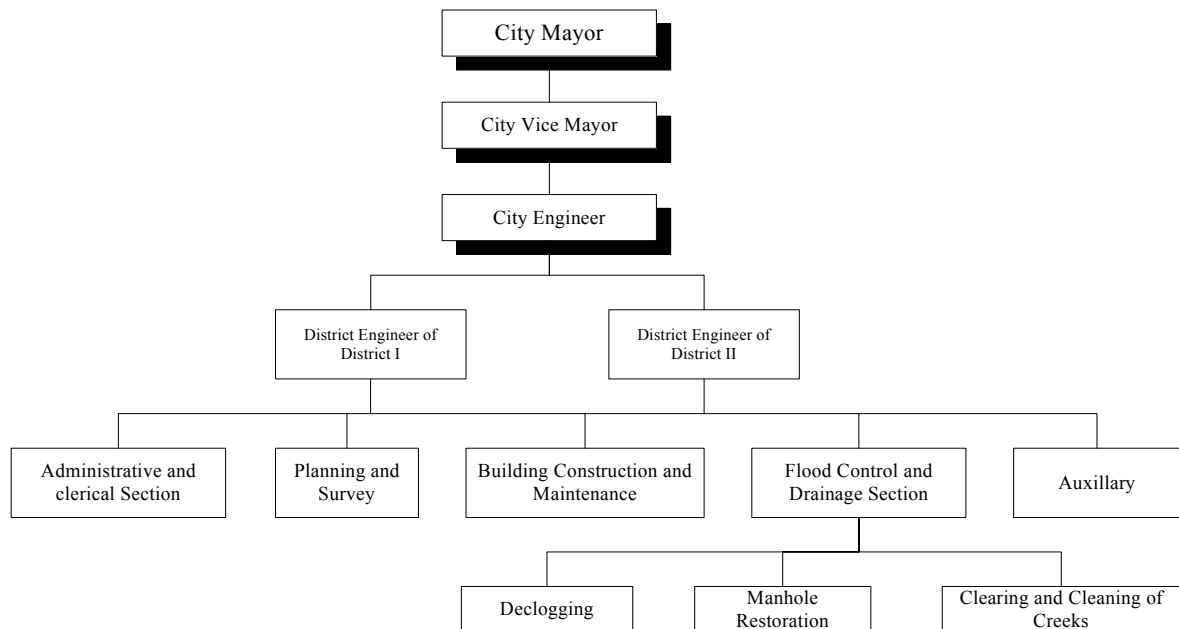
- Permanent: 152 persons
- Job order (daily basis, short period): 449 persons
- Casual (daily basis, long period): 784 persons
- Total: 1,385 persons

In line with the above mandate, MMDA conducts the management services of existing flood control and drainage facilities and minor infrastructure projects, which include dredging and declogging of drainage channels, fabrication and installation of manhole covers and steel grating, removal of water lily, constructions of additional drainage lines, bank protection works, etc.

### (3) LGUs

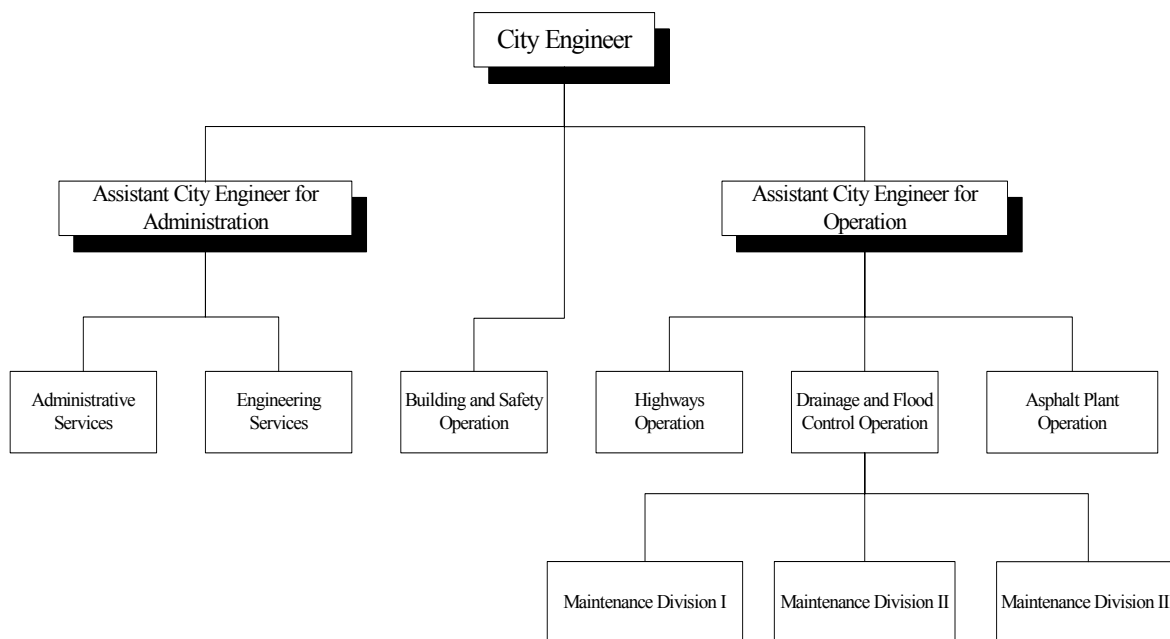
With the approval of the Local Government Code of 1991 dated Oct. 10, 1991 under Republic Act No.7160, LGUs are responsible for the management of flood control and other related facilities. Roles of LGUs in flood control and drainage sectors are planning, design, construction, and operation and maintenance of flood control and drainage facilities of laterals along local roads in the respective administrative areas. In line with the above mandate, the City Engineer's Offices of LGUs conduct the management services in the respective administrative areas.

Figures 2.6.4 and 2.6.5 show organization charts of the city engineer's offices of Makati and Manila, respectively. As shown in the figure, the city engineer's office is the implementing body for the construction, and operation and maintenance of flood control and drainage facilities.



Source: City Engineer's Office, Makati City

**Figure 2.6.4 Organization Chart of Makati City**



Source: City Engineer's Office, Manila City

**Figure 2.6.5 Organization Chart of Manila City**

#### (4) Other Related Agencies

Other agencies related to the flood control and drainage improvement in Metropolitan Manila are shown in *Table 2.6.1*.

**Table 2.6.1 Other Related Agencies**

	<i>Related Agencies</i>
<i>Watershed Management</i>	<i>DENR, Environmental and Natural Resources Offices in LGUs</i>
<i>Flood Forecasting and Warning</i>	<i>PAGASA and National Flood Forecasting Office</i>
<i>Disaster Preparedness</i>	<i>Disaster Coordination Committee by NDCC/RDCC/CDCC/MDCC/BDCC</i>
<i>River Land Management</i>	<i>Municipal and City Mayor Offices</i>
<i>Floodplain Management</i>	<i>Inter-agency Floodplain Management Committee by DPWH, NPC, Department of Interior and Local Government, NIA, NWRB and LGUs</i>
<i>Water Supply and Sewerage</i>	<i>MWSS</i>
<i>Resettlement</i>	<i>HUDCC, NHA</i>
<i>Environmental Impact Assessment</i>	<i>DENR</i>
<i>Environmental Improvement along the Pasig River</i>	<i>Pasig River Rehabilitation Commission (PRRC), DPWH, etc.</i>



### **2.6.3 NATIONAL AND LOCAL GOVERNMENT'S STRATEGY AND COMMITMENT**

In the Philippines, the 5-year Medium-Term Philippine Development Plan for the national development and the Medium-Term LGUs Development Plan for local development are underway with the target year of 2004 or 2005. Developments in various sectors have been made according to the development policy and strategy. The flood control and drainage improvement in the respective government development plans are elaborated below.

#### **(1) National Government's Strategy and Commitment**

The following are the strategic objectives of DPWH:

- Pursue comprehensive planning of prioritized major and principal river basins
- Identify inundation areas in major and principal river basins and rationalize prioritization of river segment protection
- Provide adequate flood control and drainage facilities in all flood/sediment-disaster-prone areas to mitigate flooding within tolerable levels
- Strengthen the Flood Control and Sabo Engineering Center (FCSEC) to conduct basic and applied research and development, human resources development, feasibility studies, serve as information center, and implement sabo engineering programs
- Establish database on river information including existing flood control drainage and sabo structures
- Pursue non-structural measures to mitigate floods, such as, flood forecasting, warning and monitoring system, evacuation plan, hazard mapping and reforestation
- Implement adequate erosion and sediment control programs in sediment-disaster-prone areas
- Keep optimum conveyance capacities of river channel, floodways, drainage canals, esteros, etc. through riverbank protection, dredging/desilting, observance of river easement, and efficient management in coordination with LGUs

Investment requirement of the flood control and drainage sector is Php34.78 billion reflected in the above medium-term plan for the period 1999 to 2004.

The strategy or commitment of MMDA is as follows:

- Cleaning, desilting and disposal operation of outfall, drainage mains and laterals
- Dredge and clean rivers, creeks, esteros and open canals
- Operate and maintain all flood control structures and facilities
- Implement flood control projects
- Work towards information dissemination by allowing visits by school children and public to the various flood control facilities
- Maintain equipment in operational conditions
- Maintain an alert, ready, equipped and effective manpower complement, etc.

#### **(2) Local Government's Strategy and Commitment**

Development in the local government administrative areas has been made by the respective LGUs under the present development plan. As representative of the related six LGUs, flood control and drainage sector targets of Caloocan City Medium-Term Development Plan are described below:

- Prepare drainage and sewerage master plan and flood control program for long-term development

- Conduct a periodical extensive training and capability upgrading program on drainage engineering
- Upgrade current fleet of maintenance equipment and motor pools capacity
- Improve channel capacity of all drainage lines needing improvement and remove all type of obstructions along natural drainage streams
- Construct terracing, cribs and other embankment improvement along all major river systems

## 2.6.4 ANNUAL BUDGET OF RESPONSIBLE AGENCIES

### (1) DPWH

Table 2.6.2 shows the DPWH infrastructure investment amounts in the last 5 years and in 2004.

**Table 2.6.2 Annual Allotted Budget of Flood Control and Drainage Improvement of DPWH**

Unit: Php million

<i>Particulars</i>	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>
<i>Total Amount</i>	<i>29,690</i>	<i>37,708</i>	<i>36,417</i>	<i>39,256</i>	<i>44,281</i>	<i>44,599</i>
<i>.Flood Control &amp; Drainage</i>	<i>4,283</i>	<i>4,230</i>	<i>5,346</i>	<i>4,519</i>	<i>4,936</i>	<i>5,176</i>
<i>Percentage</i>	<i>14.4 %</i>	<i>11.2 %</i>	<i>14.7 %</i>	<i>11.5 %</i>	<i>11.1 %</i>	<i>11.6 %</i>

Source: Department of Public Works and Highways

As seen in Table 2.6.2, approximately 10 to 15% of the total investment budget of DPWH has been allotted to flood control and drainage sector. Meanwhile, the following are the allotted flood control and drainage improvement budget of NCR in the year 2003 (as of September 2003).

- Locally funded by GOP: 0
- Foreign assisted: Php880,861,000 consisting of Php254,014,000 (GOP portion) and Php626,847,000 (loan portion)

### (2) MMDA

Table 2.6.3 shows the allotted budget for flood control and drainage improvement by MMDA in the last five years and in 2004.

**Table 2.6.3 Annual Allotted Budget of Flood Control and Drainage Improvement of MMDA**

Unit: Php million

<i>Particulars</i>	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>
<i>Flood Control &amp; Drainage</i>	<i>119.5</i>	<i>955.0</i>	<i>200.0</i>	<i>199.0</i>	<i>200.0</i>	<i>955.8<sup>*1</sup></i>

Source: Flood Control Management Services

Note: \*1 proposed budget

The proposed budget in the coming 5-year programming (Multi-Year Programming) is shown in *Table 2.6.4*, which indicates remarkable increase in budget for flood control and drainage improvement.

**Table 2.6.4 Proposed Budget of Flood Control and Drainage Improvement of MMDA in the Coming 5 Years**

Unit: Php million

<i>Particulars</i>	<i>2004</i>	<i>2005</i>	<i>2006</i>	<i>2007</i>	<i>2008</i>
<i>Flood Control &amp; Drainage</i>	<i>955.8</i>	<i>1,074.0</i>	<i>1,391.2</i>	<i>1,138.6</i>	<i>1,150.8</i>

Source: Flood Control Management Services, MMDA

### (3) LGUs

*Table 2.6.5* shows the allotted budget for flood control and drainage improvement by related LGUs in the last 5 years and in 2004.

**Table 2.6.5 Annual Allotted Budget of Cities/Municipality Engineer's Offices**

Unit: Php million

<i>City/Municipality</i>	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>	<i>2003</i>	<i>2004</i>
<i>Manila</i>	<i>-</i>	<i>10.3</i>	<i>29.0</i>	<i>20.7</i>	<i>47.6</i>	<i>-</i>
<i>Makati</i>	<i>118.3</i>	<i>126.7</i>	<i>73.0</i>	<i>29.5</i>	<i>5.2</i>	<i>211.9</i>
<i>Pasay</i>						
<i>Caloocan</i>	<i>4.7</i>	<i>50.8</i>	<i>73.3</i>	<i>22.2</i>	<i>31.4</i>	<i>206.4<sup>*1</sup></i>
<i>Taguig</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>36.0</i>	<i>31.0</i>	<i>115.5</i>
<i>Quezon<sup>*2</sup></i>	<i>1.0</i>	<i>1.0</i>	<i>1.0</i>	<i>1.0</i>	<i>1.0</i>	<i>1.0</i>

Source: respective City Engineer's Offices

Note: <sup>\*1</sup> Proposed budget, <sup>\*2</sup> Only for maintenance

## 2.7 O&M ORGANIZATION AND ACTIVITIES FOR DRAINAGE SYSTEM

### 2.7.1 INTRODUCTION

The existing drainage facilities in Metro Manila and its adjacent cities/municipalities are composed of esteros/creeks, drainage mains, outfalls, laterals, drainage pumping stations and floodgates. The Metro Manila Development Authority (MMDA) is in charge of operation and maintenance (O & M) of major drainage facilities: drainage pumping stations, floodgates, esteros/creeks and drainage mains. The local government units (LGUs), on the other hand, are responsible for O & M of minor drainage facilities: drainage facilities of local roads and laterals. In this chapter, existing condition of O & M organization and activities for drainage system are discussed.

### 2.7.2 O&M ORGANIZATION AND ACTIVITIES FOR DRAINAGE FACILITIES

#### (1) MMDA

MMDA is responsible for the flood control and drainage management service to formulate and implement policies, standards, programs and projects for an integrated flood control and drainage system in Metropolitan Manila by the government ordinance of RA 7924, Section 3-d.

Under the flood control management service, the major operations for drainage facilities are Pumping Stations and Floodgates Operation (PSFO), Drainage and Waterways Operation (DWO), and Equipment Support Group as follows.

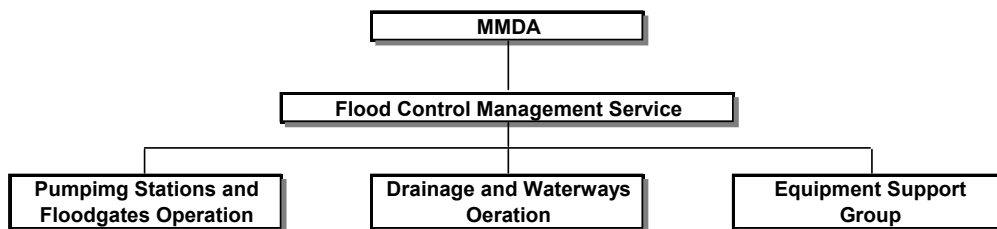


Figure 2.7.1 Organization of O&M under Flood Control Management Service

#### 1) Pumping Stations and Floodgates Operation (PSFO)

Drainage Pumping Stations and Floodgates Operation (PSFO) has been operating major flood control facilities: 15 major pumping stations, 8 small pumping stations and 20 relief pumping stations, since 2002, when the control of them were transferred from DPWH.

PSFO employs permanent and casual personnel with the proper training on the operation and maintenance of facilities of the pumping stations, including job order personnel. The staffs of the pumping stations consist of mechanical engineers, electrical engineers assisted by casual utility workers.

Three shifts are adopted for operation of each pumping station and the ancillary floodgate

during rainy season. During dry season the periodic operation and maintenance of the pumping stations are performed in order to cope with the floods in rainy season in accordance with the operational maintenance guidelines established.

The following two sections are responsible for the O&M under PSFO:

- **Operation Section**

1. To direct /supervise and be responsible for efficient operation of the pumping stations and floodgates;
2. To supervise and coordinate test-operation of equipment by staff for repair and maintenance after overhauling works;
3. To evaluate records and read instruments to determine the capacities and characteristics of pumps and engines;
4. To review and evaluate accomplishment reports, plans and manpower distributions to meet the workload and emergency need of the pumping stations; and
5. To coordinate with the Repair and Maintenance Section in connection with the operation conditions of the equipment and facilities of the pumping stations and floodgates.

- **Repair and Maintenance Section**

1. To direct/supervise /coordinate the preparation of plans, estimates and work programs for repair, maintenance and general reconditioning of the mechanical/electrical equipment;
2. To establish the annual schedule for maintenance, implement the overhauling and repair works;
3. To supervise periodic inspection and maintenance of the mechanical and electrical equipment and facilities of pumping stations, floodgates and workshop;
4. To manage the work activities and operate the workshop in connection with the manufacture of parts and repairs undertaken on the equipment referred for rehabilitation; and
5. To review all reports on the maintenance of the pumping stations, equipment and workshop.

## **2) Drainage & Waterways Operation (DWO)**

Drainage and Waterways Operation, which is responsible for making the entire roads in Metro Manila flood-free, manages 11 operational districts (see *Table 2.7.7*). Its principal responsibilities are as follows:

1. Dredging and cleaning open waterways
2. Desilting drainage mains
3. Declogging drainage laterals
4. Repairing and rehabilitating the existing drainage mains and laterals

## 5. Constructing additional drainage inlets/manholes

For operation and maintenance of the drainage and waterways, the Drainage and Waterways Operation handles all equipment under Equipment Support Group.

### (2) Local Government Units (LGUs)

The Local Government Units (LGUs) related to the study area are the Cities of Manila, Makati, Pasay, Quezon, Caloocan, and the Municipality of Taguig.

Based on the interview and questionnaire survey in March 2004, activities of the LGUs' sections, departments and divisions related to the O & M for drainage are summarized and listed in *Table 2.7.1*.

**Table 2.7.1 Local Government Units and Activities**

<b>Local Government Unit</b>	<b>Activity</b>
<u>Manila City</u> Department of Engineering District Operation Division (I, II) Flood Control & Drainage Section	Construction, maintenance, improvement of public works (road, bridge, drainage and other engineering) Cleaning of manholes, open canal, drop-inlet, and gutters
<u>Makati City</u> Engineering & Public Works Department Operation Division (I, II) Road & Drainage Maintenance Section	Construction, maintenance, improvement and repair of roads, bridges and other engineering and public works Supervise/monitor and control the construction, maintenance, improvement and repair of public works Declogging of open canal, hauling of debris, installation of manhole cover
<u>Pasay City</u> Engineering & Public Works Department	Dredging of open waterways, desilting of drainage mains and outfalls, declogging for drainage laterals Maintenance of clean esteros within MM (Bantay Estero Program)
<u>Quezon City</u> Engineering Department	Construction, maintenance, improvement of public works (road, bridge, drainage and other engineering) Cleaning of manholes, open canal, drop-inlet, and gutters
<u>Caloocan City</u> Engineering Department Construction & Maintenance Division	Construction, maintenance, improvement of public works (road, bridge, drainage and other engineering) Cleaning of manholes, open canal, drop-inlet, and gutters
<u>Taguig Municipality</u> Engineering Department	Construction, maintenance, improvement of public works (road, bridge, drainage and other engineering) Cleaning of manholes, open canal, drop-inlet, and gutters

### 2.7.3 MAJOR ISSUES FOR IMPROVEMENT OF O & M ACTIVITIES AND ORGANIZATION

#### (1) Outline of Pumping Stations

Table 2.7.2 shows the profile and dimension of the existing large 15 pumping stations such as the name of station, project cost, hydrological information of each drainage area, type of pump, unit, capacity, capacity of generator and the dimension of floodgate.

#### 1) Present Conditions of the Existing Pumping Stations

Data collection and interview surveys were carried out on the major equipment installed in the existing 15 pumping stations in order to grasp the existing conditions of the equipment.

Equipment inventories are listed in Table 2.7.3. Ten stations (Pandacan to Binondo PS in Table 2.7.4) were constructed from 1986 to 1985. In dry season, periodic maintenance has been carried out for the Pumping Stations, and the engines of No. 1 and No. 2 at Quiapo PS were overhauled in January 2004. The Repair and Maintenance Section has an overhaul plan as listed in Table 2.7.4.

Overhauling is proposed on 7 out of 15 pumping stations, namely Aviles, Quiapo, Valencia, Tripa de Gallina, Paco, Libertad, and Binondo, in 2004 as shown below:

**Table 2.7.4 Operational Status of Main Facilities in 2004**

Pumping Station	Engine No.								Pump No.								Generator No.		
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7	8	1	2	3
Pandacan	○	○							○	○							○	-	
Aviles	○	○	●	○					○	○	○	○					●	○	○
Quiapo	1/16	1/20	●	○					●	●	○	○					○	●	○
Valencia	●	●	●	●					●	●	●	●					○	●	○
Tripa de Gallina	○	●	●	○	○	○	○	○	●	●	●	●	●	●	●	●	●	○	○
Sta. Clara	○	○							○	○							○	○	
Paco	●	●	●						●	●	●						○	○	○
Libertad	●	●	●	●	○	○			●	○	●	○	●	○			○	●	
Makati	○	○							○	○							●	○	
Binondo	●	●	○	●					○	●	○	●					●	○	
Balete	-	-	-	-					○	○	○	○					○	○	
Escolta									-	-	-								
Vitas	○	○	○	○	○				○	○	○	○	○	○	○	○	○		
Balut									○	○							○		
San Andres	○	○	○	○					○	○	○	○					○		

● Proposed for Overhauling  
○ Operational

Source: The Repair and Maintenance Sections

#### 2) Present Management System

Under the OECF 12<sup>th</sup> Yen Loan in 1983, the management system has been established including the operation & maintenance and the workshop that manufactures the parts and achieves the complete repair works on some equipment, and the warehouse that stores the stock ensuring the year-round availability of parts.

At present, every operating and condition reports such as monthly operating hours, fuel consumption, and solid waste collection volume are made by the operators and management staff. The spare parts are stored at Libertad PS and Aviles PS.

**Table 2.7.2 Profile and Dimension of 15 Pumping Stations**

Profile/ Dimension	Station Name	Pandacan	Aviles	Quiapo	Valencia	Tripa de Gallina	Sia. Clara	Paco	Libertad	Makati	Binondo	Balete	Escolta	Vitas	Balut	San Andres
Date Constructed		1975	1975	1975	1975	1976	1976	1976	1976	1979	1980	1978		1994	1994	1994
Date Completed		1976	1976	1976	1976	1977	1977	1977	1982	1983	1985	1989	1991	1997	1997	1998
Fund Source		Japan Bank International Cooperation (JBIC) <sup>*)</sup>														
Civil Works Cost (*1000P\$)	3,381	7,218	8,643	5,040	36,754	1,769	133	182	779	151	279	52	279	578	49	356
Equipment Cost (*1000P\$)	5,050	11,250	9,600	9,600	36,940	36,940	5,298	10,029	29,071	4,694	12,885	3,557	5,476	162,495	34,154	130,736
Total Project Cost (1000P\$)	8,431	18,468	18,243	14,460	73,694	73,694	10,898	19,479	62,934	10,620	22,685	7,890	9,552	465,552	81,954	339,492
Drainage Area (has)	180	356	225	245	1,769	1,769	133	182	779	151	279	52	279	578	49	356
Run-Off Coefficient	0.68	0.6	0.63	0.59	0.6	0.6	0.56	0.64	0.64	0.62	0.64	0.52	0.64	0.7	0.7	0.66
Concentration Time (Min.)	21	54	48	36	101	101	36	67	53	40	99	26	99	45	45	66
Length, Estero Served (m)	460	2,030	950	1,080	7,850	7,850	850	2,900	3,200	1,900	2,600	400	400	2,300		1,940
Length, Conduit Served (m)	410	2,200	1,610	1,500			1,100		2,000		1,400					
Starting O.L. (m)	10.5	10.5	10.5	10.5	9.9	9.9	11.2	10.5	9.9	11.3	10	10.6	10	10.1	9.1	10.5
Stopping O.L. (m)	10.2	10.3	10.2	10.3	9.6	9.6	11	10.2	9.6	10.9	9.8	10.5	9.8	9.8	8.9	10.2
Average Width, Estero (m)	12	17	12	7	8	8	7	22	100		10			50		6
Bottom Elevation (m)	8.75	8	7.4	8	8.55	8.55	9.83	7.2	7.5	10.3	8.5	8.7	7.72	6.7	8.9	8
Top Revetment at P/S (m)	12.2	12.4	11.6	12.5	13	13	13.1	12.3	13	13.9	12.2	13.8	13.3	12.2	12.2	12.5
Main Pumps/Engine																
Type of Pump	VAF	VAF/S	VAF	VAF	HAF/S	HAF/S	VAF	VAF	HAF/HMF	VAF	VAF	S	S	HAF	S	HMF
Total No. of Units	2	4	4	4	8	8	2	3	6	2	4	3	3	5	2	4
Capacity (cu.m/s)	2.2	3.52	2.375	2.625	7.0	7.0	2.65	2.53	7.0	3.5	2.9	2.5	1.5	6.4	1	4.75
Total Capacity (cu.m/s)	4.4	14.1	9.5	10.5	56.0	56.0	5.3	7.59	42.0	7.0	11.6	2.5	0.4	32.0	2.0	19.0
Bore (m)	1.00	1.2	1.00	1.00	1.65	1.65	1.00	1.00	1.65	1.20	1.00	0.4	0.65	1.65	7.00	1.50
Total Dynamic Head (m)	3.1	3.1	3	3.3	3.2	3.2	3.5	2.8	2.8	3.6	2.9	3.5	3.5	3.2	3.6	4.3
Brake Horse Power (hp)	150	1,200	130	180	450	450	190	150	390	280	180			420	360	420
Generator/Engine																
Total No. of Units	1	2	2	2	2	2	1	2	2	1	2	1	1	1	1	1
Capacity(KVA)	55	75	75	75	55/150	55/150	55	75	200	55	75	165	165	200	60	200
Brake Horse Power	75	95	75	95	75/185	75/185	70	95	250	70	95	235	235	360	360	300
Floodgate																
Width (m)	4	4	4	4	8	8	5.17	14	10	5.1	6	4	4	10	2.2	3
Height (m)	4.75	6	6.3	6.2	5.3	5.3	5	6.5	5	5	3.65	4.9	5	4.35	2.2	2
No. of Gates (unit)	1	2	2	2	3	3	1	1	3	1	2	2	2	2	1	4

(Original Data provided by MMDA)

HAF: Horizontal Shaft Axious Flow  
HMF: Horizontal Shaft Mixed Flow  
VAF: Vertical Shaft Axious Flow  
S: Submersible Flow



**Table 2.7.3 Equipment Inventory of Large Pumping Stations (1/3)**

No.	Equipment Name	Pandacan		Avilares		Quiapo		Valencia		Tripa de Gallina	
		Qty	Specification	Qty	Specification	Qty	Specification	Qty	Specification	Qty	Specification
1	Completion Year		1975		1975		1975		1975		1975
2	Main Drainage Pump	2	1000 mm dia. Vertical axial flow, 2.20m <sup>3</sup> /s, 3030min-1x150PS	4	1200 mm dia. Vertical axial flow, 3.525m <sup>3</sup> /s, 3.1mx3000min-1x230PS	4	1000mm dia. vertical axial flow, 2.575m <sup>3</sup> /s, 2.5mx3000min-1x130PS	4	1000mm dia, vertical axial flow, 2.625m <sup>3</sup> /s, 3.3mx335min-1x180PS	8	1650mm dia, horizontal axial flow 7.0m <sup>3</sup> /s, 3.2mx210min-1x450PS
3	Engine	2	915min-1x150PS (Pump), 1200min-1x55KVA (Generator)	4	950min-1x230PS(Pump), 1200min-1x75KVA(Generator)	4	900min-1x130PS (Pump), 1200min-1x75KVA(Generator)	4	1005min-1x180PS(Pump), 1200min-1x75KVA(Generator)	8	950 min-1x450PS (Pump), 1200mins-1x150/55KVA (Gen)
4	Reduction Gear	2	Bevel type, 915min-1x303min-1	4	Bevel type, 950min-1x300min-1	4	Bevel type, 900min-1x300min-1	4	Bevel Type, 1005min-1x335min-1	8	Bevel Type, 950min-1x210min-1
5	Discharge Valve	2	1000mm dia. Butterfly valve, 0.82kw	4	1200mm dia, butterfly valve, 1.5kw	4	1000mm dia, butterfly valve, 0.82kw	4	1000mm dia, butterfly valve, 0.82kw	8	1650mm dia, butterfly valve, 2.4 kw
6	Automatic Screen	2	Rotary type, 3.4mx5.65m, 3.7KW	2	Rotary Type , 5.85mx6.9m,3.7KW	4	Rotary Type, 3.4mx7.0m,3.7KW	4	Rotary type, 3.4mx6.7m,3.7KW	6/2	Rotary Type, 5.35/5.45mx7.6m,3.7KW
7	Horizontal Belt Conveyor	1	750mmWx10mL, 1.5KW	1	750mmWx16.5mL, 1.5KW	1	750mmWx22mL, 1.5KW	1	750mmWx18mL, 1.5KW	1	750mmWx45.3mL, 2.2KW
8	Inclined Belt Conveyor	1	750mmWx8mL, 2.2KW	1	750mmWx13mL, 3.7KW	1	750mmWx8mL, 2.2KW	1	750mmWx9mL, 2.2KW	1	750mmWx15.5mL, 3.7KW
9	Hopper	N/A		1	6m3,0.75KWx2	1	6m3,0.75KWx2	N/A		1	6M3,0.75kwX2
10	Flood Gate	1	4.0mx4.75mx2.2KW	2	4.0mx6.0mx2.2KW	2	4.0mx6.0mx2.2KW	2	4.0mx6.2mx2.2KW	3	8.0mx4.25mx3.2KW
11	Cooling & Sealing Water Pump	3	50mm Horizontal, 0.2m <sup>3</sup> /mx15mx1750min-1x2.2KW	6	50mm horizontal, 0.2m <sup>3</sup> /mx15mx1750min-1x2.2KW	6	50mm horizontal, 0.2m <sup>3</sup> /mx15mx1750min-1x2.2KW	6	50mm horizontal, 0.2m <sup>3</sup> /mx15mx1750min-1x2.2KW	8	40mmhorizontal,0.11m <sup>3</sup> /mx15mx1750min-1x1.5KW
12	Clear Water Pump	1	50mm vertical, 0.25m <sup>3</sup> /mx15mx1750 min-1x1.5KW	2	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	2	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	2	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x0.75KW	4	80mm vertical, 0.9m <sup>3</sup> /mx15mx1750min-1x5.5KW
13	Lub. Oil Pump for Reduction Gear	2	20 mm gear type, 371/sx40mx1750min-1x0.75KW	4	20mm gear type, 371/sx40mx1750min-1x0.75KW	4	20mm gear type, 371/sx40mx1750min-1x0.75 KW	4	20mm gear type, 371/sx40mx1750min-1x0.75KW	8	20mm gear type, 371/sx40mx1750min-1x0.75KW
14	Vacuum Pump	N/A		N/A		N/A		N/A		8	65mm water seal type, 3.8m <sup>3</sup> /mx700mmHx1150min-1x1.5KW
15	Drain Pump	1	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750 min-1x0.75KW	2	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	2	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	2	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	2	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW
16	Air Compressor	2	17.9m <sup>3</sup> /hr, 30kgf/cm <sup>2</sup> , 850min-1x3.7KW	2	17.9m <sup>3</sup> /hr, 30kgf/cm <sup>2</sup> , 850min-1x3.7KW	2	17.9m <sup>3</sup> /hr, 30kgf/cm <sup>2</sup> , 850min-1x3.7KW	2	17.9m <sup>3</sup> /hr, 30kgf/cm <sup>2</sup> , 850min-1x3.7KW	4	17.9m <sup>3</sup> /hr, 30kgf/cm <sup>2</sup> , 850min-1x3.7KW
17	Cooling Tower	2	300L/min, 300,000kcal/hr, 0.4KW	3	1000L/min, 460,000kcal/hr, 1.5KW	3	660L/min, 260,000kcal/hr, 0.4KW	3	660L/min, 360,000kcal/hr, 0.4KW	5	1800L/min, 900,000kcal/hr, 1.5KW
18	Raw Water Pump	N/A		N/A		N/A		N/A		4	100mm vertical, 1.25m <sup>3</sup> /mx15mx1750min-1x11kw
19	Fuel Oil Transfer Pump	1	20mm gear type, 24L/sx30mx1750min-1x0.4KW	2	20mm gear type, 24L/sx30mx1750min-1x0.4KW	2	20mm gear type, 24L/sx30mx1750min-1x0.4KW	2	20mm gear type, 24L/sx30mx1750min-1x0.4KW	2	25mm gear type, 661/sx30mx1750min-1x1.5KW
20	Ventilation Fan	N/A		N/A		N/A		N/A		N/A	
21	Generator	1	Brushless Type, 55KVA, AC220V, 60Hz	2	Brushless type, 75KVA, AC220V, 60Hz	2	Brushless Type, 75KVA, AC220V, 60Hz	2	Brushless type, 75KVA, AC220V, 60Hz	2/1	Brushless type, 150/155KVA, AC220V, 60Hz
22	Overhead Travelling Crane	1	10 tons capacity, 10.86m span x 10m lift x 5.5KW	1	10 ton capacity, 11.66m spanx10mliftx5.5KW	1	10tons capacity, 10.86m span x 10m lift x 5.5KW	1	10ton capacity, 10.86m spanx10mliftx5.5KW	1	7.5 ton capacity, 14.46m spanx10m lift x 3.7KW

**Table 2.7.3 Equipment Inventory of Large Pumping Stations (2/3)**

No.	Equipment Name	Sta. Clara Specification		Paco Specification		Libertad Specification		Makati Specification		Binondo Specification		
		Qty	1976	Qty	1976	Qty	1978	Qty	1978	Qty	1978	
1	Completion Year											
2	Main Drainage Pump	2	1000mm dia, vertical axial flow, 2.65m <sup>3</sup> /sx3.5x342min-1x190 PS	3	1000mm dia, vertical axial flow, 2.20m <sup>3</sup> /sx3.1mx303min-1x150PS	4/2	1650mm dia. Axial/mixed, 7.0m <sup>3</sup> /sx2.8mx205/111min-1x390PS	2	1200 mm dia, vertical axial flow, 3.9m <sup>3</sup> /sx3.2mx300min-1x280PS	4	1000mm dia. Vertical axial flow, 2.9m <sup>3</sup> /sx2.9mx345min-1x180PS	
3	Engine	2	1020min-1x180PS(Pump) 1200min-1x55KVA(Generator)	3	960 min-1x150PS (Pump) 1200min-1x75KVA (Generator)	4/2	920/75MIN-1x390ps (Pump) 1200min-1x200KVA(Generator)	2	950min-1x280PS (Pump) 1200min-1x55KVA(Generator)	4	1005min-1x180PS (Pump) 1200 min-1x75KVA (Generator)	
4	Reduction Gear	2	Bevel Type:1020min-1,342min-1	3	Bevel Type, 960 min-1x318min-1	4/2	Bevel type,920min-1x205min-1750min-1x111min-1	2	Bevel type, 950min-1x300min-1	4	Bevel type, 1005min-1x345min-1	
5	Discharge Valve	2	1000mm dia, butterfly valve, 0.82kw	3	1000mm dia, butterfly valve, 0.82kw	6	1650mm dia, butterfly valve, 2.4kw	2	1200mm dia, butterfly valve, 0.82kw	4	1000mm dia, butterfly valve, 0.82kw	
6	Automatic Screen	2	Rotary type,3.4m <sup>3</sup> 6.0m <sup>3</sup> ,3.7kw	3	Rotary Type, 3.4mx7.3m,3.7KW	6	Rotary type, 5.4mx7.8,3.7KW	2	Rotary type,4.0mx6.2m,3.7KW	4	Rotary type, 3.4mx6.05m,3.7KW	
7	Horizontal Belt Conveyor	1	750mmWx10mL,1.5KW	1	750mmWx13.5mL,3.7KW	1	750mmWx38mL,2.2KW	1	750mmWx11.5mL, 1.5KW	1	750mmWx18mL,1.5KW	
8	Inclined Belt Conveyor	1	750mmWx8mL,2.2KW	1	750mmWx8mL,2.2KW	1	750mmx15.8mL,3.7KW	1	6m3.0.75KWx2	N.A		
9	Hopper	N.A		N.A		6M3.0.75KWx2	1	6m3, 0.75KWx2	N.A			
10	Flood Gate	1	5.0M5.7MX2.2kw	1	14.0mx6.5mx5.5KW	3	10.0mx5.0mx3.7KW	1	5.0mx5.1mx2.2KW	2	6.0MX4.65mx2.2KW	
11	Cooling & Sealing Water Pump	3	50mm horizontal, 0.2m <sup>3</sup> /mx15mx1750min-1x2.2KW	5	50mm horizontal, 0.2m <sup>3</sup> /mx15mx1750min-1x2.2KW	6	40mm horizontal,0.11m <sup>3</sup> /mx15m	3	50mm horizontal, 0.2m <sup>3</sup> /mx15mx1750min-1x2.2KW	6	50mm horizontal, 0.2m <sup>3</sup> /mx15mx1750min-1x2.2KW	
12	Clear Water Pump	1	50mm vertical , 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	2	50mm vertical , 0.2m <sup>3</sup> /mx15mx1750min-1x2.2KW	3	80mm vertical, 0.9m <sup>3</sup> /mx15mx1750min-1x5.5KW	1	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	2	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	
13	Lub. Oil Pump for Reduction Gear	2	20mm gear type, 37L/sx40mx1750min-1x0.75KW	3	20mm gear type, 37L/sx40mx1750min-1x1.5KW	6	20mm gear type, 37L/sx40mx1750min-1x0.75KW	2	20mm gear type, 37L/sx40mx1750min-1x0.75KW	4	20mm gear type, 37L/sx40mx1750min-1x0.75KW	
14	Vacuum Pump	N.A		N.A		80mm water seal type, 4m <sup>3</sup> /mx700mmHgx1150min-1x7.5KW	N.A	N.A	N.A			
15	Drain Pump	2	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	2	50mm vertical , 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	2	50mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	2	50mm vertical, 0.25m <sup>3</sup> /mx12x1750min-1x1.5KW	2	50 mm vertical, 0.25m <sup>3</sup> /mx12mx1750min-1x1.5KW	
16	Air Compressor	2	17.9m <sup>3</sup> /hrx30kgf/cm <sup>2</sup> x850min-1x3.7KW	2	17.9m <sup>3</sup> /hrx30kgf/cm <sup>2</sup> x850min-1x3.7KW	3	17.9m <sup>3</sup> /hrx30kgf/cm <sup>2</sup> x850min-1x3.7KW	2	17.9m <sup>3</sup> /hrx30kgf/cm <sup>2</sup> x850min-1x3.7KW	2	17.9m <sup>3</sup> /hrx30kgf/cm <sup>2</sup> x850min-1x3.7KW	
17	Cooling Tower	2	400L/minx380,000kcal/hrx1.5KW			4	1000L/minx780,000kcal/hrx1.5	1	500L/minx560,000kcal/hrx1.5KW	3	660L/minx360,000kcal/hrx0.4KW	
18	Raw Water Pump	N.A				15mm gear type, 21L/sx30mx1750min-1x0.4KW	3	100 mm vertical, 1.25m <sup>3</sup> /mx15x1750min-1x11KW	N.A			
19	Fuel Oil Transfer Pump	1	15mm gear type, 21L/sx30mx1750min-1x0.4KW			25mm gear type,65L/sx30mx1750min1x1.5KW	2	25mm gear type,65L/sx30mx1750min1x1.5KW	1	15mm gear type , 21L/sx30mx1750min-1x0.4KW	2	15mm gear type, 21L/sx30mx1750min-1x0.4KW
20	Ventilation Fan	N.A				Brushless type,75KVA, AC220V,60Hz	3	500m <sup>3</sup> /mx40mmAqx365min-1x7.5KW	N.A			
21	Generator	1	Brushless Type,55KVA-AC220V, 60Hz	2	Brushless type, 55KVA, AC220V,60Hz	2	Brushless type, 200KVA,AC220V,60Hz	1	Brushless type, 55KVA, AC220V, 60 Hz	2	Brushless type, 75KVA, AC220V, 60Hz	
22	Overhead Travelling Crane	1	10 tons capacity, 10.86m span x 10m lift, x5.5KW	1	10 tons capacity, 10.86m span x 10m lift, x 5.5KW	1	10 tons capacity, 14.46m span x 10m lift, x 5.5KW	1	10 tons capacity, 11.66m span x10m lift, x 5.5KW	1	10ton capacity, 10.86m spanx 10m liftx5.5KW	

**Table 2.7.3 Equipment Inventory of Large Pumping Stations (3/3)**

No.	Equipment Name	Baleite		Escolta		Vitias		Baltut		San Andries	
		Q'ty	Specification	Q'ty	Specification	Q'ty	Specification	Q'ty	Specification	Q'ty	Specification
1	Completion Year		1989		1991		1995		1995		1995
2	Main Drainage Pump	3	0.5m <sup>3</sup> /s, S.P (440V), 0.8m <sup>3</sup> /s, S.P. (440V), 1.0m <sup>3</sup> /s, S.P. (440V)	3	0.5 m <sup>3</sup> /s/sec. (SP) (220V)	5	1650mm dia. horizontal axial flow pump 6.4m <sup>3</sup> /s x 3.2m x 190mm <sup>-1</sup> x 420PS	2	700mm dia. submerged water pump 1.0m <sup>3</sup> /s x 3.6m x 590mm <sup>-1</sup> x 55kW	4	1500mm dia. horizontal mixed flow pump 4.75m <sup>3</sup> /s x 4.3m x 142mm <sup>-1</sup> x 340PS
3	Engine	1				5	420PS x 1200mm <sup>-1</sup>	N.A.	N.A.	4	420PS x 1200mm <sup>-1</sup>
4	Reduction Gear	1				5	Horizontal shaft, planetary type 420PS x 190/1200mm <sup>-1</sup>	N.A.	N.A.	4	Horizontal shaft, planetary type 420PS x 142/1200mm <sup>-1</sup>
5	Discharge Valve	1				5+5	1650mm dia. motorized butterfly valve / 2000mm dia. flap valve	2	700mm dia. motorized butterfly valve / 900mm dia. flap valve	4	1500mm dia. motorized butterfly valve / 1800mm dia. flap valve
6	Automatic Screen					5	5.4mW x 5.6mH automatic trash rakes and screen	2	2.1mW x 4.2mH automatic trash rakes and screen	4	5.4mW x 5.6mH automatic trash rakes and screen
7	Horizontal Belt Conveyor					5	750mmW x 32mL	1	750mmW x 8mL	2	750mmW x 32mL
8	Inclined Belt Conveyor					1	750mmW x 15.8mL	1	750mmW x 9.2mL	2	750mmW x 15.8mL
9	Hopper					1	6m <sup>3</sup>	1	2m <sup>3</sup>	2	6m <sup>3</sup>
10	Flood Gate	2	4.0m x 4.9m x 3.2 KW	2	4.0m x 5.4m x 2.2 KW	2	10000mmW x 4350mmH motorized roller gate	1	2200mmW x 2100mmH motorized sluice gate	2+2	3000mmW x 2000mmH motorized sluice gate / 3000mmW x 2000mmH motorized sluice gate
11	Cooling & Sealing Water Pump					3+5	80mm dia. vertical, 800l/min x 15m x 1750mm <sup>-1</sup> x 5.5kW / 32mm dia. Horizontal, 40l/min x 15m x 3500mm <sup>-1</sup> x 0.4kW	2	50mm dia. vertical, volute pump 250l/min x 15m x 1750mm <sup>-1</sup> x 2.2kW	4	40mm dia. volute pump 0.04m <sup>3</sup> /min x 15m x 1.5KW
12	Clear Water Pump					3	80mm dia. vertical volute pump 900l/min x 20m x 1750mm <sup>-1</sup> x 7.5kW	2	50mm dia. vertical volute pump 250l/min x 18m x 1750mm <sup>-1</sup> x 2.2kW	3	100mm dia. vertical turbine 0.74 m <sup>3</sup> /min x 20m x 7.5 KW
13	Lub. Oil Pump for Reduction Gear					5	38mm dia. gear pump 10.8l/min x 23.5kgf/cm <sup>2</sup> x 1740mm <sup>-1</sup> x 0.75kW	N.A.	N.A.	2	700mmHg x 11 KW 65mm dia x 57 m <sup>3</sup> /min
14	Vacuum Pump					3	65mm dia. water sealing type 4.5Nm <sup>3</sup> /min x 700mmHg x 1150mm <sup>-1</sup> x 7.5kW	N.A.	N.A.	2	50mm dia. vertical 100l/min x 12m x 3500mm <sup>-1</sup> x 0.75kW
15	Drain Pump					2+2	50mm dia. vertical pump 100l/min x 12m x 3500mm <sup>-1</sup> x 0.75kW / 50mm dia. SP H32 50l/min x 12m x 3500mm <sup>-1</sup> x 0.75kW	2	50mm dia. SP 50l/min x 12m x 3500mm <sup>-1</sup> x 0.75kW	2	50mm dia. vertical 100l/min x 12 m x 1.5 KW
16	Air Compressor					3	17.9m <sup>3</sup> /hr x 30kgf/cm <sup>2</sup> x 850mm <sup>-1</sup> x 3.7kW	2	14.7m <sup>3</sup> /hr x 30kgf/cm <sup>2</sup> x 2.2kW	3	19 m <sup>3</sup> /hr x 30 Kg/cm <sup>2</sup> x 3.7 KW
17	Cooling Tower					2	Cylindrical, 1.8kW	2	Cylindrical, 0.75kW	2	Cylindrical, 1.5 KW
18	Raw Water Pump					N.A.	N.A.	N.A.	N.A.	2	6 cartype, 35l/min 0.4 KW
19	Fuel Oil Transfer Pump					2	20mm dia. gear pump 37l/min x 4kgf/cm <sup>2</sup> x 1750mm <sup>-1</sup> x 0.75kW	2	15mm dia. gear pump 12l/min x 3kgf/cm <sup>2</sup> x 1750mm <sup>-1</sup> x 0.4kW	2	6 cartype, 35l/min 0.4 KW
20	Ventilation Fan					3	900mm dia., 500Nm <sup>3</sup> /min x 40mmAq x 365mm <sup>-1</sup> x 7.5kW	1	Roof fan, 350Nm <sup>3</sup> /min x 10mmAq x 1150mm <sup>-1</sup> x 2.2kW	2	40mmAq x 850m <sup>3</sup> /min x 11 KW
21	Generator	1	15 KVA 220V 60 Hz	1	165 KVA 220V 60 Hz	1	15 KVA 220V 60 Hz	1	200kVA x AC220V x 60Hz	1	200kVA x AC220V x 60Hz
22	Overhead Travelling Crane	1	220V 60 Hz	1	220V 60 Hz	1	Motor operated, 7.5ton x 14.6m span	1	Manually operated, 2ton x 5.5m span	1	Motor operated, 7.5ton x 13.8m span

The monitoring system of water levels at the pumping stations is not available, and the water level in the Pasig River and rainfall are monitored at Rosario Weir. The communication between the pumping stations and the monitoring station at Rosario Weir is made by radio transmission.

### 3) Operation Hours and Solid Waste Collection

The operation record at the pumping stations is well filed from the beginning of first operation. *Table 2.7.5* summarizes operation hours of each pump at the 15 pumping stations in 2003 and operation status in this year.

The following are pointed out in the table:

- The stations with a pump exceeding 700 operation hours are at five stations: Aviles, Tripa de Gallina, Libertad, Binondo and Balut.
- All pumps at Pandacan, Aviles, Quiapo, Valencia, Sta. Clara, Makati, Binondo Vitas, Balut, and San Andres were operated equally.
- The stations with approximately 200 operation hours in a year are at four stations: Pandacan, Sta. Clara, Makati, and San Andres.

**Table 2.7.5 Operation Status and Operating Hours**

Pumping Station	Year	Pump No.							
		1	2	3	4	5	6	7	8
Pandacan	1976	○ 219	○ 197						
Aviles	1976	○ 702	○ 763	○ 670	○ 643				
Quiapo	1976	● 465	● 467	○ 387	○ 588				
Valencia	1976	● 582	● 510	● 410	● 374				
Tripa de Gallina	1977	● 712	● 662	● 712	● 71	● 175	● 20	● 13	● 35
Sta. Clara	1977	○ 219	○ 209						
Paco	1977	● 312	● 175	● 783					
Libertad	1982	● 440	○ 875	● 496	○ 170	● 168	○ 258		
Makati	1983	○ 202	○ 134						
Binondo	1985	○ 714	● 432	○ 707	● 787				
* Balete	1989	○	○	○	○				
* Escolta	1991	-	-	-					
Vitas	1997	○ 469	○ 472	○ 456	○ 404	○ 387	○	○	○
* Balut	1997	○ 693	○ 838						
San Andres	1998	○ 196	○ 194	○ 196	○ 198				

Legend      \* PS with Submersible Pump for Main Equipment  
 ○ Operational  
 ● Proposed for Overhauling in 2004  
 738: Values of lower colums indicate OP hours in (2003)

A solid waste collection system is installed before the screen at pumping system to make smooth the vacuuming of water. The system is composed of trash rake, belt conveyor, and hopper. The solid waste collection is important for the operation/maintenance of pump equipment. The solid waste collection volume in 2003 reached to approximately 24,000 m<sup>3</sup>, of which over 10,000 m<sup>3</sup> was collected at Tripe de Gallina and over 3000 m<sup>3</sup> at Binondo and also at Vitas.

Solid waste at Tripa de Gallina



Pumping Sta.	Volume (m <sup>3</sup> )
Binondo	3,356
Quiapo	1,122
Aviles	357
Valencia	984
Pandacan	415
Paco	492
Sta. Clara	636
Makati	70
Libertad	1,245
Tripa de Gallina	10,168
Escolta	41
Balete	183
Vitas	3,796
San Andres	548
Balut	155
Total	23,568

#### 4) Annual Expenditure

The annual expenditure increased from Php52,500,000 in 1998 under full operation of all stations to Php71,300,000 in 2001. However, the expenditure went down to Php68,000,000 in 2002 when management was transferred to MMDA from DPWH.

Manpower cost in the annual expenditure is predominant and occupied about 50% in 2003. The manpower cost shall be increased in the future. Fuel cost was Php14,353,000, equivalent to 16% of the annual expenditure. The expenditure for procurement of spare parts and others rapidly increased to about Php12,225,000, or 14%, compared with other years. The increase is due to the renewal of the main parts exhausted over 15 years after the first operation.

**Table 2.7.6 Annual Expenditure of 15 Pumping Stations**

Item Expenditure	Unit: 1,000Pesos					
	1998	1999	2000	2001	2002	2003
Diesel Fuel consumption for 15 pump stations	-	-	-	13,087	11,371	14,353
Diesel Fuel Supply for Vehicle Services	-	-	-	520	593	448
Other Supplies, material Spare parts and Commodities, solid waste handling equipment	-	-	-	4,724	2,928	12,225
Repair/rehabilitation of deteriorating parts	-	-	-	9,420	764	785
Various Supplies from Petrophil Corporation	-	-	-	813	1,710	1,002
Payment to MERALCO for electricity	-	-	-	4,989	6,275	6,939
Payment to MWSS for Water Supply	-	-	-	541	775	817
Payment to PLDT for communication	-	-	-	291	245	362
Payment to Private Security Guard (CSA)	-	-	-	8,664	8,236	7,476
Cost for Personal Service	-	-	-	28,241	33,100	43,195
<b>Total</b>	<b>52,500</b>	<b>60,000</b>	<b>71,293</b>	<b>71,292</b>	<b>67,999</b>	<b>89,605</b>

Source: PSFO, MMDA

## (2) Outline of Drainage and Waterways Operations (DWO)

DWO manages Metropolitan Manila by 11 operational districts listed in *Table 2.7.7*.

**Table 2.7.7 District and Area of Drainage and Waterways Operations**

<b>Operations District</b>	<b>Area Covered</b>
1. North Manila	Tondo, Binondo & Sta. Cluz
2. Central Manila	Sampaloc & Sta. Mesa
3. South Manila	Ermita, Malate, Paco, Sta. Ana, San Andres, Port Area & Intramuros
4. Quezon City First	1 <sup>st</sup> & 2 <sup>nd</sup> Cong. District
5. Quezon City Second	3 <sup>rd</sup> & 4 <sup>th</sup> Cong. District
6. First East Metro-Manila	Pasig & Marikina
7. Second East Metro-Manila	San Juan, Taguig, Pateros
8. First South Metro-Manila	Pasay & Makati
9. Second South Metro-Manila	Las Pinas, Paranaque, & Muntinlupa
10. First North Metro-Manila	Malabon & Navotas
11. Second North Metro-Manila	Caloocan & Valenzuela

### 1) Equipment Allocation

DWO allocates to the 11 operational districts the facilities and equipment for the activity of hauling of spoils, dredging, desilting, declogging, water spraying and crew transporting, which are listed and shown in *Table 2.7.8*.

Allocated equipment in each district are registered taking note of the plate no., body no., project site, activity and operational condition under the Project Engineer in charge. Total units of the equipment allocated to the 11 operations districts are 73 as of December 2003. In addition, there are 42 units of equipment in which details of allocation are not listed. Twenty-six units are under repair.

**Table 2.7.8 Equipment Allocation for Activity of Drainage and Waterways Operations (1/2)**

AREA: NORTH MANILA FCOD (NMF COD)				PROJ. IN CHARGE: B. LUCIANO		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	2T Dumptruck	SDG557	DT2-01/90	Engine overhauling /105 base		For Repair
2	2T Dumptruck	SDG810	DT3-11/90	N&S Antipolo, Abad Santos	Hauling of Spoils	Operational
3	4T Dumptruck	SDF620	DT4-02/90	Gagalangin ,Tondo	Hauling of Spoils	-do-
4	11T Dumptruck		#01	NMF COD	Hauling of Spoils	-do-
5	11T Dumptruck	SDF680	DT11-06/90	NMF COD	Hauling of Spoils	-do-
6	Rec. Water Master		#009	to: FEMMF COD/ Engr. Ross	De- watering	-do-
7	Backhoe PW 100		#041	Tayuma D.M.	Dredging	-do-
8	Amphidege		AMPH. #50	fr: FSMMF COD	Dredging	

AREA: CENTRAL MANILA FCOD (CMF COD)				PROJ. IN CHARGE: S. ABELLO		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	3T Dumptruck	SEB945	DT3-07/93	Release bearing and other parts /103 Base		For Repair
2	3T Dumptruck	SEB975	DT3-10/93	R. Magsaysay Blvd.	Hauling of Spoils	Operational
3	3T Dumptruck	SEB966	DT3-13/93	R. Magsaysay Blvd.	Hauling of Spoils	
4	11T Dumptruck	SDF679	DT11-05/90	Air leak brake chamber/105 base		For Repair
5	Backhoe Kobelco	SK100	#118	Estero de uli uli	Dredging	Operational
6	Amphi. Excavator	2AE-01	AEXC-01/93	Derailed track link with missing parts/ 105 base		For Repair
7	IHI Crane	2W-02	WC27-02/93	Tayuma D.M.	Desilting	Operational
8	IHI Crane	2W-02	WC27-02/93	Estero de San Lasaro	Dredging	-do-

AREA: SOUTH MANILA FCOD (SMF COD)				PROJ. IN CHARGE: A MOHAMMAD		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	3T Dumptruck	SEB 807	DT3-02/93	Replace leaf springs		For Repair
2	3T Dumptruck		MDT#093	San Amdres, Malate Manila	Hauling of Spoils	Operational
3	11T Dumptruck	CTG 115	#123	L. Guinto/ South Super H- Way	Hauling of Spoils	-do-
4	Isuzu Elf Pumper	SGS 740	#072	Damaged oil cooler and oil pump		For Repair
5	Isuzu Vac. Truck		#41-A	Deffective Alternator		-do-
6	Tele Backhoe		#059	San Amdres, Malate Manila	Dredging	Operational
7	TM Backhoe	SGS500	#071	San Amdres, Malate Manila	Dredging	-do-

AREA: FIRST SOUTH METRO MANILA FCOD (FSMMF COD)				PROJ. IN CHARGE: E. ARGUILLES		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	2T Dumptruck	SDG 630	DT2-07/90	Engine Overhauling /103 base		For Repair
2	3T Dumptruck	SEB 826	DT3-05/93	PNR, Pasong Tamo	Hauling of Spoils	Operational
3	11T Dumptruck		#102	Pasong Tamo	Hauling of Spoils	-do-
4	Backhoe PW100		#040	Pasong Tamo	Dredging	-do-

AREA: SECOND SOUTH METRO MANILA FCOD (SSMMF COD)				PROJ. IN CHARGE: TAMAYO		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	2T Dumptruck	SDG350	DT2-07/90	Sucot Road	Hauling of Spoils	For Repair
2	3T Dumptruck	SEB 805	DT3-01/93	SSMMF COD	Hauling of Spoils	Operational
3	4T Dumptruck	SDF978	DT4-08/90	Quirino avenue	Hauling of Spoils	-do-
4	Hit. Excavator EX60		#088	Overheat/Talon Creek		For Repair
5	Hit. Excavator EX120		#112	Paranaque	Desilting	Operational
6	Isuzu Frwd. Vac. Truck		#122	Pump Bearing		For Repair
7	Mit. Vac. Truck		#003	Quirino Avenue	Declogging	Operational
8	Isuzu Wing Van		#092	SSMMF COD	Service of Crews	-do-

AREA: FIRST QUEZON CITY FCOD (FQCF OD)				PROJ. IN CHARGE: N. BADUEL		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	3T Dumptruck	SEB948	DT3-09/93	Engine overhaul /Electrical trouble		For Repair
2	4T Dumptruck	SDF619	DT4-13/90	Regalado Avenue	Hauling of Spoils	Operational
3	11T Dumptruck	SDF670	DT11-03/90	Commonwealth	Hauling of Spoils	-do-

AREA: SECOND QUEZON CITY FCOD (SQCF OD)				PROJ. IN CHARGE: T. VERGARA		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	3T Dumptruck	SEA878	DT3-11/93	QCSF COD	Hauling of Spoils	Operational
2	4T Dumptruck	SDF606	DT4-01/90	QCSF COD	Hauling of Spoils	-do-
3	4T Dumptruck	SDF988	DT4-09/90	Damaged air master / 103 base		For Repair
4	Isuzu Wing Van	SGK466	#21	QCSF COD	Service of Crews	Operational
5	TM Backhoe	SGS569	#070	QCSF COD	Dedging	-do-
6	Water Truck	SGS767	#080	QCSF COD	Declogging	-do-
7	Hit. Excavator	HE-03	EXCO.25-03/90	to: San Juan River/ SEMMF COD	Dredging	-do-

AREA: SECOND NORTH METRO MANILA FCOD (SNMMF COD)				PROJ. IN CHARGE: D. MINA		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	2T Dumptruck	SDG840	DT2-05/90	Peripheral Canac, Caloocan City	Hauling of Spoils	Operational
2	4T Dumptruck	SDF640	DT4-05/90	Peripheral Canac, Caloocan City	Hauling of Spoils	-do-
3	4T Dumptruck	SDF649	DT4-06/90	Peripheral Canac, Caloocan City	Hauling of Spoils	-do-
4	Backhoe PC200-3		#066	Radiator/ Remove all coolers/ Check oil leakage		-do-
5	Backhoe PW100		#039	Radiator Overheat/ defective Oil Cooler		For Repair
6	Vacuum		#027	Vacuum Pump / Suction line defective /105 base		-do-
7	Amphidredge		#002	Overhauling Hydraulic Pump		-do-
8	Isuzu Wing Van	SGK477	#065	SNMMF COD		Operational

**Table 2.7.8 Equipment Allocation for Activity of Drainage and Waterways Operations (2/2)**

AREA FIRST NORTH METRO MANILA (FNMMFCOD)				PROJ. IN CHARGE: S. OLGADO		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	2T Dumptruck	SDG617	DT2-03/90	Malabon, Navotas	Hauling of Spoils	Operational
2	3T Dumptruck	SEA898	DT3-08/93	Engine mounting / 105 base		For Repair
3	Fuso Vac. Truck		#001	Malabon, Navotas	Declogging	Operational
4	Water Truck	SEB965	WT5- 02/93	Malabon, Navotas	Declogging	-do-
5	Sewer Jet	SDF689	WJ5-02/93	Malabon, Navotas	Declogging	-do-

AREA SECOND EAST METRO MANILA FCOD (SEMMFCOD)				PROJ. IN CHARGE: E. CAPISTRANO		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	2T Dumptruck	SDG629	DT2-08/90	J. Baesa, San Juan	Hauling of Spoils	Operational
2	3T Dumptruck	SEB947	DT3-08/93	Mandaluyong	Hauling of Spoils	-do-
3	11T Dumptruck		#099	SEMMFCOD	Hauling of Spoils	-do-
4	11T Dumptruck	CTG125	#124	San Juan River	Service	-do-
5	Isuzu Cargo Truck	SEB715	CT6-01/93	San Juan River	Loading of barge	-do-
6	Backhoe PC150-5		#062	Pateros	Dredging	-do-
7	Hit. Excavator Truck		#113	Novaliches	Demolition	-do-
8	Hino Vac. Truck		#025	Tank defective / Vacuum pump / 105 base		For Repair
9	Komatsu PW 60		#107	Overhauling / c/o Globe		-do-
10	Isuzu Vac.	SDF698	VC-01/90	SEMMFCOD	Declogging	Operational

AREA FIRST EAST METRO MANILA FCOD (FEMMFCOD)				PROJ. IN CHARGE: S. ROSS		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	2T Dumptruck	SDG590	DT2-06/90		Defective PTO cable/ 103 base	For Repair
2	3T Dumptruck	SEB 815	DT3- 03/90	Bull Creek	Hauling of Spoils	Operational
3	11T Dumptruck		#103	Balanti Creek	Hauling of Spoils	-do-
4	Komatsu backhoe	PC-150-5	#119	Bull Creek	Dredging	-do-
5	Y Kobelco Backhoe		#114		Dredging	-do-
6	Isuzu Wing Van		#20	Replace worn out tires		For Repair

**MMDA FLOOD CONTROL EQUIPMENT WHEREABOUTS**

AREA ESG/ 103&105				PROJ. IN CHARGE: W. MANRIQUE & O. LACORTE		
No.	Equipment	Plate No.	Body No.	Proj. Site	Activity	Remarks
1	2T Dumptruck	SDG580	DT2-02/90	105 Base	Roving Mechanic	Operational
2	3T Dumptruck	SEB816	DT3-04/93	Metro Manila	Service/ Fuel Tender	-do-
3	3T Dumptruck	CTG116	#125	103 base c/o Balls	Monitoring	-do-
4	4T Dumptruck	SDF628	DT4-03/90	South Manila		-do-
5	4T Dumptruck	SDF998	DT4-10/90	103 base		-do-
6	11T Dumptruck	SDF669	DT11-02/90		Brake chamber & battery /105 Base	For Repair
7	Isuzu WT	SDF858	WT4-02/90	105 Base		Operational
8	Isuzu WT	SEB 958	WT-01/93	105 Base		-do-
9	Vacuum Truck	SGS821	#067	103 Base		-do-
10	Isuzu CT	SEB967	CT6-02/93	105 Base	Service Mechanics	Operational
11	Isuzu Frwd. BoomTruck		#075	Metro Manila / c/o Balisi / 103 Base	Lifting of manhole cover	-do-
12	Sreco FM		SFM-03		Defective brake booster/ NMFCOD	For Repair
13	Genset 20 KVA			105 Base	Lighting at LEY	-do-
14	Genset 45 KVA			105 Base	Vulc. \$ Weld. At LEY	-do-
15	Genset 850W			105 Base	Vulc. \$ Weld. At LEY	-do-
16	Backhoe PW 100		#091	FQCFOD		-do-
17	Mit Double Cab.	SGR529	#080	103 Base	Roving Mechanic	-do-
18	Mit Double Cab.	SGR539	#061		Engine Ovrhauling	For Repair
19	Mini Buldozer		#036	105 Base		Operational
20	Mit. Jam Stm. Washer		#095	103 Base		-do-
21	Servise Truck	SGS491	#069	103 Base		-do-
22	Fuso Vac. Truck		#002			-do-
23	Mit. Mini Buldozer		#079	107 Base	Suction in defective / 105 Base	For Repair
24	Sound Truck	XGD-992	CV#-085		Roving / Info Campa	Operational
25	Boom Truck	SDG926	PS-DWT-01	Pumping		-do-
26	Nissan Truck Traktor	SDF163	PM-18	103 Base	Equipment Transport	-do-
27	Sreco FM		SFM-01	SQCFCOD / Eng. Vergara	Declogging	Operational
28	Isuzu Vac. Truck		#026	SQCFCOD / Eng. Vergara	Declogging	-do-
29	Isuzu Cargo Truck	SGJ892	#86	103 Base	Equipment Transport	-do-
30	Crawler Loader		#038	105 Base		-do-
31	Tadano Crane	2Rt-01	RTC25-01/93	105 Base		-do-
32	Tadano TMC	2TC-01	TMC-01/93	105 Base	Lifting	-do-
33	Nissan Truck Traktor	SDF263	PM-10	103 Base	Equipment Transport	-do-
34	Mit. Pumper	SGS865	#081	No. Battey /103 base		For Repair
35	3T Dumptruck	SEB936	DT3-06/93	Admin FC	Monitoring	Operational
36	WRVC	SEB935	WRVC-01/93	103 Base		-do-
37	Kato Wrecker	CSA663	PSTC-01	103 Base		-do-
39	Tadano Crane	2RT-02	RTC25-02/93	Pasong Tamo DM/Eng. Argiules	Ooening of Manhole	-do-
39	Pumper Truck		#097	103 Base	De- watering	-do-
40	10W Fuel Truck		#115	103 Base		-do-
41	Tadano Crane	RT-3	RTC20-03/90	San Juan River/Engr. Capistrano	Lifting of Barge	-do-
42	Hino Water Truck		#10			Standby



## **2) Accomplishment in 2003**

The accomplishment rate of dredging of open waterways is 7% of all command length, desilting of drainage mains 37%, and declogging of drainage laterals 45%. These accomplishment rates are less than 50% of the command length.

The low rate of accomplishment may be due to insufficient equipment and manpower, or low working efficiency of hauling and distant dumping site at Navotas.

## **(3) Findings**

Through site reconnaissance, interview survey and analysis of the data and information, the findings on issues of operation and maintenance for drainage improvement are summarized as follows.

### ***Pumping Station***

- Annual operation hours of the four pumping stations at Aviles, Quiapo, Tripa de Gallina, and Libertad are increasing. The main factors of increasing operational hours are overloading of pumping facilities and increased intermittent operation due to the increment of solid waste in the drainages, reversed inflow from the Pasig River, and increased stormwater flow from other drainage areas.
- Periodic maintenance at Pumping Stations was well done by 1999. The operation has a deterrent caused by the lack of spare parts and stocks.
- The solid waste collection at the pumping stations is affecting pump operation and equipment. The collected solid waste at the pumping stations is temporarily stocked at Vitas and some other stations and causes social problems due to bad odor, flies, and breakout of diseases.
- Cost for personnel occupied approximately 50% of the annual expenditure in 2003 and the fuel cost of the pumping stations was 20%. Material, supply of spare parts for the pumping stations and solid waste handling equipment did not reach 5% of the annual expenditure except the year 2003. The procurement of spare parts necessary for overhauling is subject to insufficient annual budget. Appropriated fund is required for overtime work during heavy rains and flood emergencies.
- The number of qualified engineers and skilled labor for the operation and maintenance of pumping stations is decreasing due to the low wage level. In addition, the opportunities to improve their technology on manufacturing including repairing and to acquire the advanced technology on pumping equipment are few.

### ***Drainage and Waterways***

- Encroachment and increment of informal settlers along the drainage channels cause various difficulties: difficulties of collecting solid waste and hauling, dredging and desilting of drainage channels.
- There is not sufficient budget for the activities of DWO, whose rate of accomplishment is low. Additional equipment and manpower for desilting drainage mains and open waterways are required.

- Suitable equipment allocation to operations districts is required as well as the integrated management of the equipment in collaboration with PSFO and other local government units of Metropolitan Manila. For the shortening of hauling solid waste and spoils, dumping sites or solid waste treatment shall be developed.
- The establishment of a centralized warehouse with supply of fast moving parts for activity of DWO and PS equipment is required.
  - Solid waste thrown into the drainage and waterways shall be reduced considering public management and public involvement on solid waste disposal.



Solid waste thrown into Waterway



Plastics tangled around Pump Shaft

## **2.8 SOLID WASTE MANAGEMENT FOR THE DRAINAGE AREA**

### **2.8.1 INTRODUCTION**

There are two major problems for operation and maintenance of drainage system such as throwing solid waste into drainage channels and informal settlers along and within channels. One of the major reasons for throwing solid waste is inappropriate collection system along drainage channels and insufficient people's awareness regarding solid waste management. Therefore, it is necessary to understand the situations of solid waste management system along drainage channels. The existing conditions of solid waste management especially along drainage channels are describe in this section.

### **2.8.2 ORGANIZATIONAL STRUCTURE AND CAPACITIES**

*Table 2.8.1* shows the basic attributes of six LGUs of the core area regarding solid waste management. Solid waste management offices of the Cities of Quezon and Makati have been created by local government ordinances as divisions of the larger units called Department, i.e.:

- Environmental Protection and Sanitation Department in Quezon City
- Department of Public Services in Makati City

The Department of Public Services of the City of Manila is also a regular department created by an ordinance but unlike Quezon City and Makati City, it does not have a specific division. The Department undertakes solid waste management through a contractor, Leonel Waste Management, which undertakes solid waste collection and street sweeping. Six District Units complement the task of Leonel in street sweeping and also act as monitors of solid waste collection done by the contractor.

Environmental Sanitation Services Department of Caloocan City has a solid waste management setup almost similar with the City of Manila. Solid waste collection is done by a contractor through a Package Clean Up Contract. Street sweeping and clean up of main thoroughfares are complemented by the Department's sweepers and cleaning task force.

The role of barangays in SWM is presented in *Table 2.8.2*. The Solid Waste Management Office (SWMO) of Pasay City was created by Mayor Trinidad when he assumed office. Technical and office personnel were either hired or detailed to the office from other units of the City Government Office. Sweepers and other field personnel previously under various offices were placed under this office. The SWMO is under the office of the City Mayor. It supervises and sees to it that:

- solid waste within the city jurisdiction is totally collected such that no solid waste is in sight at any time especially along the main thoroughfares, and
- streets are properly cleaned and maintained.

The SWMO of the Municipality of Taguig is manned by 23 employees. It coordinates solid waste collection of the contractor, monitors collection and apprehends violators of ordinance on dumping of solid waste in undesignated solid waste dumping areas. It is a newly created office under the Environment Cluster. Unlike other LGUs, street sweeping and other street cleaning activities in Taguig are undertaken by the Environment and Natural Resources Office (ENRO) through the Clean and Green Program, which also undertakes drainage declogging activities, minor repair of roads, etc.

Although solid waste collection and hauling are done by contractors, the city government maintains the equipment for various cleanup operation (including drainage declogging) and

emergency responses. The equipment is under the Engineering Department of the City. The office of Environmental Sanitation Services of Caloocan City operates and maintains one piece of heavy equipment for sweeping.

**Table 2.8.1 Basic Attributes of the Core Area LGUs' Organization on Solid Waste Management**

	<b>Caloocan</b>	<b>Manila</b>	<b>Quezon</b>	<b>Makati</b>	<b>Pasay</b>	<b>Taguig</b>
<b>Name of Organization Unit</b>	Environmental Sanitation Services	Department of Public Services	Solid Waste Management Division	Solid Waste Management Division	Solid Waste Management Office	Solid Waste Management Office (SWMO) and Clean & Green Office (CGO)
<b>Status</b>	Regular Department of the City Government	Regular Department of the City Government created by an ordinance and undertaking other sanitation and beautification activities.	Regular division under the Environmental Protection and Sanitation Department created by a city ordinance	Regular division under the City Government of Makati	Created by Mayor Trinidad under the Office of the City Mayor to handle solid waste management in Pasay City upon assuming office	The SWMO is created by the Mayor to manage collection of waste and enforce regulations on waste disposal. The CGO maintains the cleanliness of the main streets and declogging of canals and drainage.
<b>Total Number of Staff</b>	309	329	209	489	300	SWMO = 23 CGO = 348
<b>Major Functions Related to Solid Waste Management</b>	1. Manages the package contract on street cleaning, collection and transport of waste	1. Collects city refuse including street sweepings, piles of dirt and silts from the street gutters on a day-and-night schedule	1. Implements and supervises waste collection and disposal in the city	1. Collects waste and other solid wastes in the city	1. Collects waste through waste contractors and ensures that no waste lie on the streets at anytime	1. Monitors collection, transport and disposal of waste within the municipality
	2. Undertakes street sweeping and maintenance of cleanliness along main and secondary thoroughfares.	2. Cleans and maintains main and secondary thoroughfares, sidewalks and traffic islands including trimming of grasses.	2. Controls, supervises and develops waste collection and disposal operations plan including its personnel, equipment for collection and facilities for disposal	2. Enforces city ordinances concerning waste management	2. Undertakes sweeping and cleaning of the city surroundings	2. Conducts trainings and seminars on solid waste management and other activities to disseminate information

	<b>Caloocan</b>	<b>Manila</b>	<b>Quezon</b>	<b>Makati</b>	<b>Pasay</b>	<b>Taguig</b>
	3. Conducts various activities on solid waste management information and education campaign in coordination with barangays, NGOs and the national government agencies	3. Manages the contract for waste collection, transport and disposal	3. Executes policies, laws rules and regulations and ordinances relative to environmental protection	3. Coordinates with the city and national government departments including subdivisions in the management and disposal of waste and other wastes	3. Apprehends violators of solid waste management-related city ordinances	
	4. Monitor waste collection and transport and maintenance of cleanliness in the city	4. Conducts various information and education campaign activities on solid waste management	4. Establishes and maintains a monitoring system that will ensure the proper implementation of waste collection and disposal in the city.	4. Manages, operates and maintains solid waste equipment and other facilities owned by the City of Makati		
		5. Monitors the collection and transport of waste and the maintenance of cleanliness of streets	5. Implements systems and new technologies on waste collection and disposal	5. Plans and implements Public Education Program on solid waste management and public sanitation responsibilities of city residents		
			6. Implements a reporting system to consolidate and collate data related to waste collection and disposal to be used as basis for evaluation and assessment of day-to-day operations			
			7. Conducts special cleaning operations to complement the regular waste collection such as declogging and street sweeping			

**Table 2.8.2 Role of Barangays in Solid Waste Management**

<b>Caloocan</b>	<b>Manila</b>	<b>Quezon</b>	<b>Makati</b>	<b>Pasay</b>	<b>Taguig</b>
1. Inform residents on waste collection schedules	1. Inform residents on waste collection schedules	1. Updating of information base (streets, alleys, inaccessible areas, waterways, etc.	1. Inform residents on waste collection schedules	1. Inform residents about schedule of waste collection	1. Inform residents on waste collection schedules
2. In vehicle-inaccessible areas, collect waste using carts and bring to trucks or areas where trucks can pick up	2. In vehicle-inaccessible areas, collect waste using carts and bring to trucks	2. Undertake community-based waste reduction activities such as segregation at source, establishment of MRF, flower/vegetable gardens and composting facility	2. Collect waste using carts from households located in the interior areas where access for waste trucks is difficult	2. Collect waste from interior parts of the barangay	2. Inform and gather residents during information dissemination activities in the barangay
3. Develop MRFs with the assistance of the city government and MMDA	3. Inform DPS/contractor about uncollected waste	3. Assist in the information-education campaign by facilitating dialogues and consultations, distribution of informative materials and undertaking public announcements	3. With the assistance of the city government and MMDA, develop their respective MRFs		
4. Assist in conduct of seminars	4. Assist in collection of bulky waste	4. Assist in collection of bulky waste by disseminating information on collection, guiding of trucks and trading of recyclables	4. Assist in the collection of bulky wastes		3. Assist in the collection of bulky waste
5. Undertake composting	5. Attest to accuracy of report of collection by contractor	4. Help in the collection of waste in areas with difficult access for trucks	5. Implement/enforce proper waste segregation		
	6. Undertake sweeping in the barangays and waterway clean up	5. Undertake sweeping in the barangays and waterway clean up	6. Undertake sweeping of streets assigned to barangays and clean up of waterways		
		6. Apprehend violators of solid waste regulations laws and ordinances	7. Inform SWMD/contractor about uncollected waste		
		7. Certify actual collection of waste in the barangay through countersigning of trip tickets	8. Certify actual collection of waste in the barangay through countersigning of trip tickets		

## 2.8.3 SOLID WASTE MANAGEMENT SYSTEM

### (1) Solid Waste Generation

At an estimated per capita solid waste generation of 0.58 kg/day and using the population data of the LGUs in the study area, solid waste generation is estimated as shown in *Table 2.8.3*. Solid waste generation of the six LGUs in 2001 was more than 1.3 million metric ton. Cost of containment of this generated solid waste totaled about Php2.66 billion. Taguig has the lowest cost per ton and cost per capita while Makati City shows the highest. This does not, however, pass judgment on cost efficiency of solid waste management of the LGU since there are several factors that affect the level of expenditure of an LGU.

**Table 2.8.3 Solid Waste Generation and Cost of Management in 2001**

LGUs	Generated Solid Waste (ton)	SWM Expenses (Php '000)	Cost Per Ton (Php)	Cost Per Capita (Php)
Caloocan	251,941	357,077	1,417	300
Quezon	465,078	941,828	2,025	429
Manila	338,263	574,990	1,700	360
Makati	76,141	418,577	5,497	1,164
Pasay	75,930	243,807	3,211	680
Taguig	99,992	120,949	1,210	256

Source: ADB Metro Manila SWM Project, Report No. 9, Financial Management

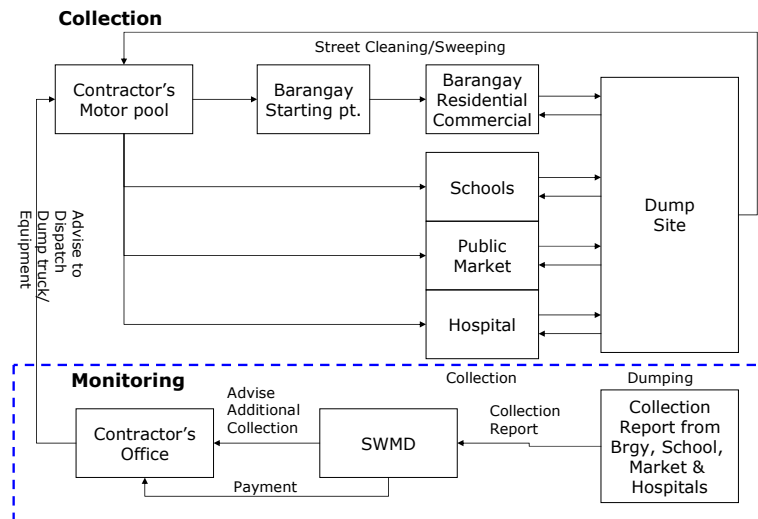
### (2) Solid Waste Segregation

Efforts to implement a solid waste segregation scheme are on the way. Although still a snail-paced development, some have established MRFs (Material Recovery Facilities) with the assistance of non-government organizations (NGOs). Since the enactment of the Solid Waste Management Act, several seminars have already been conducted to teach people how to segregate solid waste, specially biodegradable from non-biodegradable waste or wet from dry waste, and how to make compost from biodegradable waste particularly kitchen waste.

RA No. 9003 specifically mandates barangays or clusters of barangays to establish MRFs as a solid waste reduction measure. At this point in time, very few have initiated establishment with the assistance of NGOs and foreign-funded projects. Many barangays particularly in the Metro Manila Core Area do not have space to set up MRFs.

Model segregation scheme is currently being piloted by Makati City Government in Barangays Bangkal and Comembo. Under this scheme, the residents were taught how to segregate and how to recycle some of the materials they find in solid waste. They were also given two kinds of color-coded solid waste receptacles: green for biodegradable and yellow for non-biodegradable. Even as these receptacles are used by the residents, these remain as properties of Makati City Government and issued to users with "memorandum receipt" that makes the recipient totally responsible. The twin receptacles cost Php3,800, which is the same amount to be paid to the city government in case of loss. As intended, biodegradables should be placed in green receptacles and non-bio in yellow receptacles. Contents of yellow receptacle are collected Tuesdays-Thursdays-Saturdays-Sundays while contents of green receptacle are collected Mondays-Wednesdays-Fridays. Barangay hired inspectors who join the truck collectors to ensure that collection of solid waste is fully segregated and collection is carried out properly. This is particularly practiced in Barangay Bangkal through a solid waste collection system shown in *Figure 2.8.1*. As a matter of solid waste reduction, Barangay Bangkal implemented a regulation

policy for operation of junkshops. These were identified, organized and accredited. The junkshop owners and helpers are allowed to go around the barangay with pushcarts everyday to collect and buy junk and solid waste for recycling.



**Figure 2.8.1 Solid Waste Collection and Monitoring Scheme, Barangay Bangkal, Makati City**

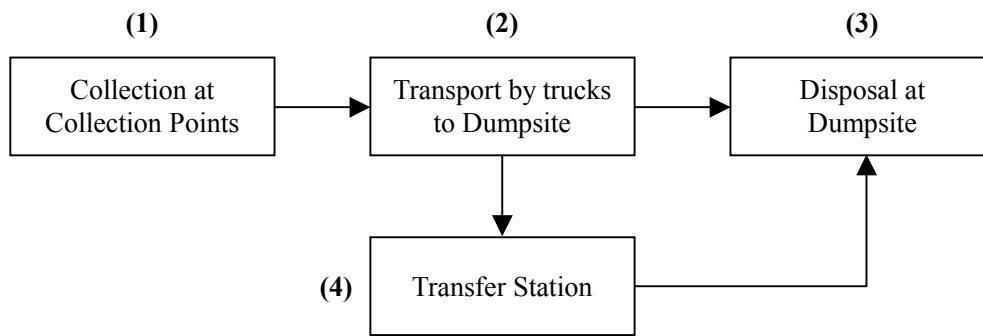
Although the project aims to document and measure the amount of Wdiverted from final disposal, monitoring system did not start at the onset of the project. At this point, the monitoring system has not yet established figures as to quantities of solid wastes diverted. However, there are already indications like drastic reduction in number of trucks/trips for hauling non-biodegradable wastes from seven to eight during the pre-segregation to four trucks during the project.

### (3) Solid Waste Collection and Transportation

Collection of solid waste in all LGUs is undertaken by private contractors. Basic features of contracts entered into by the city/municipal government are outlined in *Table 2.8.4*. The Cities of Quezon and Caloocan cover a package clean up contract where the contractor agrees to collect all solid waste and maintain cleanliness of main and secondary thoroughfares. Contract amount is based on the estimated volume of generation in the city and the manpower required to clean up streets everyday. Additional requirements, such as hauling of soil mounds and other street obstructions, may be requested by the LGU without additional charge. The City of Manila also implements a package clean up contract; however, street cleaning is augmented by the city's six districts. Generally, sweeping is done by the contractor while other cleaning works such as removal of posters and dirt on walls are done by the city field workers. In both Pasay City and Taguig Municipality, only solid waste collection is contracted and payment is based on the estimated volume of solid waste generation rather than number of trips made by dumptrucks. Likewise, Makati City contracts solid waste collection while street clean up is done by the city government and barangay. Main thoroughfares, including those with public transport routes, are maintained by the city. The barangay takes care of all other streets in various ways. Some barangays have their own pool of street sweepers and cleaners while some implement a policy that residents take responsibility of cleaning the streets in front or back of their houses. This is also a program being promoted by the City SWMD under "*Oplan Tapat-Tapat*".



Basically, the system of collection and transport follows the same route as follows:



**Figure 2.8.2 General System of Solid Waste Collection and Transportation**

Of the six LGUs covered by the core area, only the City of Manila uses a transfer station located at the back of NHA Housing in Tondo, Manila. All solid wastes brought to Montalban for final disposal pass through the transfer station for loading in 10-wheeler open trucks for purposes of minimizing cost. The Leonel Environmental Services assigned 99 10-wheeler open trucks to transport solid waste from transfer station to Montalban dumpsite. Solid wastes brought to Navotas for final dumping are loaded onto barges at Barangay Vitas, Tondo, Manila.

All the rest follow the 1-2-4 solid waste collection, transport and dumping route as shown in the figure above. Solid waste collection procedure efficiency and effectiveness is largely a matter of appropriateness of system adopted in a barangay. Information dissemination and implementation of schedules are key factors of clean up success. Solid waste collection is carried out by contractors and the city government and barangay in various modalities:

- 1) Condominiums, commercial establishments and privately operated wet markets have the option to manage their own solid waste. A lot of these establishments hire their own solid waste collection contractors. Otherwise, the city government collects the solid waste and a solid waste collection fee is paid in business permits.
- 2) Affluent barangays such as Forbes, Dasmarinas, San Lorenzo, Bel-Air and other subdivision-barangays also manage their solid waste with their own solid waste collection system under contract paid for by their own funds.
- 3) The Makati CBD also operates its own solid waste collection, transport and disposal system. Hence, the increase in population of Makati City during daytime due to the working population does not really impact the solid waste collection system of the city government of Makati.
- 4) Collection of solid waste in barangays both in commercial and residential areas is mapped and laid out by the LGUs through their solid waste management offices and the contractors and, in some cases, the barangay kagawads (councillors) in-charge of solid waste collection. This mapping includes scheduling, assignment of trucks, checkers and monitors, and policies and rules to be observed.
- 5) Some barangays collect solid waste from households and dump them in temporary dumping area where solid waste collection trucks can easily access. This is especially done in areas with very narrow streets. This system usually becomes problematic due to dumping of solid waste from other barangays and commercial establishments that are not covered by the LGU. More frequently, solid waste collection is not completed due to huge excess from estimated collection. Assigned dump trucks are not able to cope with the excess volume to be collected.

- 6) In barangays with good access for dump trucks, collection is done per household. Solid waste haulers paid by the barangay collect solid waste from households in interior areas just before the dumptruck arrives and bring them to street where the truck will pass by. This system works well when residents or solid waste sources are fully cooperative with the rules on bringing out solid waste only when trucks are already slowly driving by and collecting. Enforcement of rules is a very important aspect in this system.

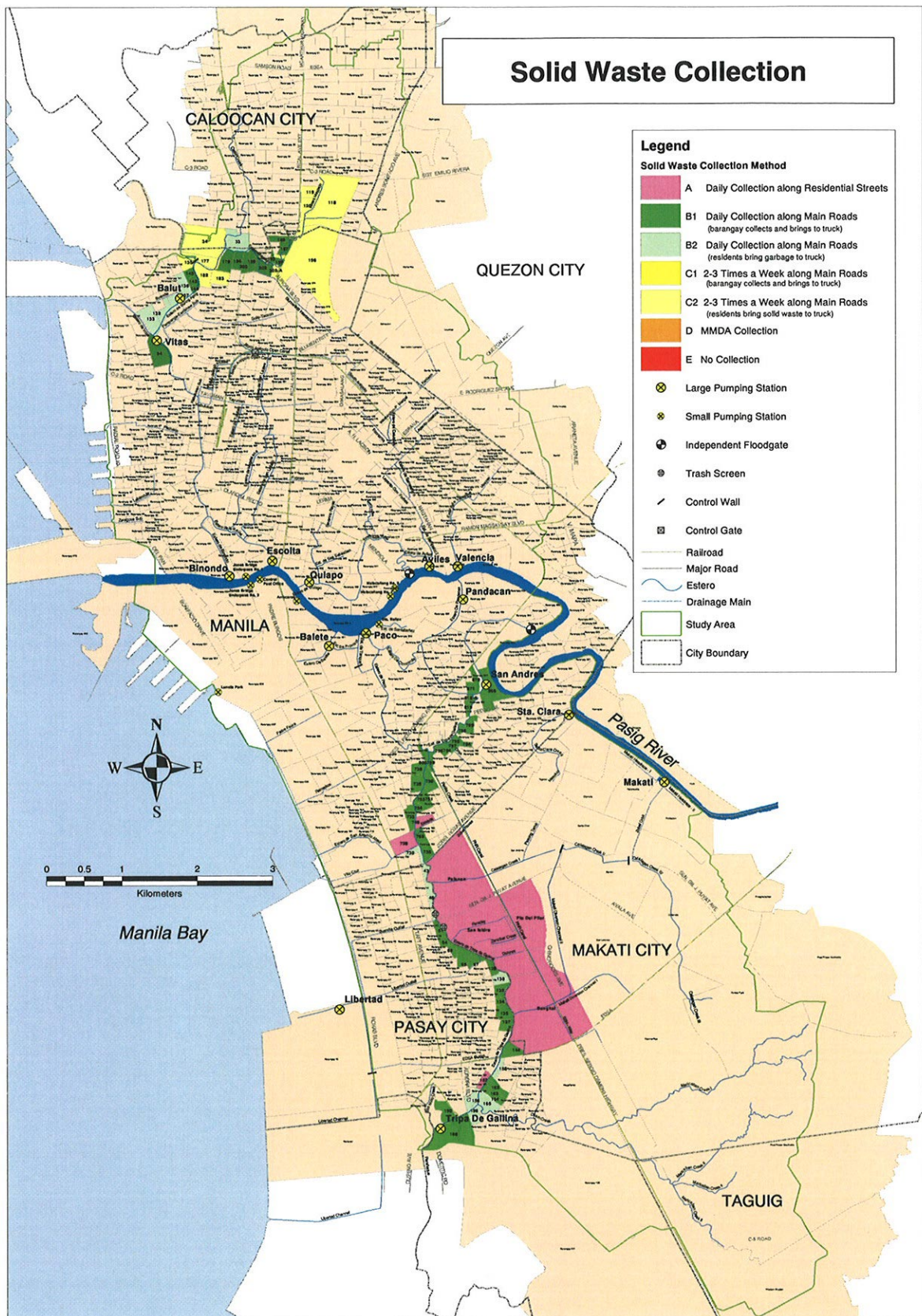
In many properly cleaned up barangays, it is assumed that there is significant degree of participation from residents.

*Figure 2.8.3* shows the solid waste collection method by barangay along Estero de Tripa de Gallina and Estero de Sunog Apog / Maypajo. This is prepared based on the results of hearing from each barangay. As shown in *Figure 2.8.3*, it is clarified that daily collection service by LGUs is provided for almost all of barangays along these esteros. In Makati City, daily collection service reaches to residents' streets. In the Cities of Manila and Pasay, residents or barangay have to bring solid waste to truck for collection, however.

**Table 2.8.4 Solid Waste Collection, Transport and Disposal Contracts and Monitoring**

<b>Particular</b>	<b>Caloocan</b>	<b>Manila</b>	<b>Quezon</b>	<b>Makati</b>	<b>Pasay</b>	<b>Taguig</b>
<b>Number of Contractors</b>	1	1	1	4	5	1
<b>Contract Scope of Work</b>	1. Collection, cleaning and disposal of solid wastes based on a Package Clean Up System	1. Total collection, transport and disposal of waste from commercial and domestic sources in areas covered by the contract	1. Collection, cleaning and disposal of solid wastes based on a Package Clean Up System	1. Total collection, transport and disposal of waste from commercial and domestic sources in areas covered by the contract	1. Total collection, transport and disposal of waste from commercial and domestic sources in areas covered by the contract	1. Total collection, transport and disposal of waste from commercial and domestic sources in areas covered by the contract
	2. Cleaning of streets, removal of litter and visual clutters	2. Provision of 250 sweepers for parks/plazas, main thoroughfares, markets, bridges, center islands and truck sweepers where necessary	2. Cleaning of streets, removal of litter and visual clutters	2. Cleaning of streets, removal of litter and visual clutters	2. Mopping up operations in main thoroughfares	2. Mopping up operations in main thoroughfares
	3. Mopping up or follow up waste collection along main roads and other streets as required by the city government.	3. Mopping up or follow up waste collection along main roads and other streets as required by the city government.	3. Mopping up or follow up waste collection along main roads and other streets as required by the city government.	3. Mopping up or follow up waste collection along main roads and other streets as required by the city government.		
	4. Collection of bulky and yard wastes every last Sunday of the month	4. Collection, transport and disposal of trimmings and bulky wastes on specified day of the week	4. Collection of bulky and yard wastes every last Sunday of the month	4. Collection, transport and disposal of trimmings and bulky wastes on specified day of the week		
	5. Provision of extra waste collection trips as necessary	5. Provision of extra waste collection trips as necessary	5. Provision of extra waste collection trips as necessary	5. Provision of extra waste collection trips as necessary		
<b>System of Ensuring Satisfactory Contractor Performance</b>	The system includes: 1. Certificate from the barangay captain attesting total collection of waste and clean up of area	The system includes: 1. Deployment of DPS personnel to monitor cleanliness of areas covered by collection and verify report of contractor	The system includes: 1. Daily certification of cleanliness and completeness of waste collection from the barangay captain confirmed by a city representative.	The system includes: 1. Daily Situational Report of the Datu Basurero consisting of dump truck identification, number of crew & appropriateness of gears, volume of waste collected.	The system includes: 1. Fielding out inspectors in all parts of the city who report to office of contractors about additional trucks needed to collect waste and to SWMO that collection of waste is totally accomplished	The system includes: 1. Spot check report of monitoring team conducted after the scheduled waste collection trip

	2. Cleanliness monitoring report of ESSD staff	2. DPS conducts meeting with contractor twice a month and with barangay captains, if necessary	2. Standard of cleanliness: no uncollected waste at all times, no left over or spillage, absence of litter and visual clutters along the streets, absence of soil mounds mixed with waste.	2. Trip tickets of each dumptruck countersigned by a barangay representative	2. Reports of barangay captains and residents used as basis for asking additional trips	2. Reports of complaint by residents
	3. Reports of complaint by residents	3. Reports of complaint by residents	3. Reports of complaint by residents	3. Reports of complaint by residents		
			4. Imposition of penalty for unsatisfactory performance			
<b>Unit of Collection Area</b>	Barangay, main thoroughfare, institution (school, hospital, commercial establishment, etc)	Barangay, main thoroughfare, institution (school, hospital, commercial establishment, etc)	Cell - an imaginary area of collection where waste generation is equivalent to one truckload, classified as barangay, main road or stationary (market, hospital, government offices, schools, etc.)	Barangay, main thoroughfare, institution (school, hospital, commercial establishment, etc)	Barangay, main thoroughfare, institution (school, hospital, commercial establishment, etc)	Barangay, main thoroughfare, institution (school, hospital, commercial establishment, etc)
<b>Waste Disposal Site</b>	Directly disposed of at Montalban Controlled Dumpsite	Final disposal at Montalban and Navotas with Transfer Station at Tondo, Manila where waste is treated with deodorizer and disinfectant	Directly disposed of at Payatas Controlled Dumpsite from collection	Directly disposed of at Montalban Controlled Dumpsite	Directly disposed of at Montalban Controlled Dumpsite	Directly disposed of at Montalban Controlled Dumpsite
<b>Schedule of Collection</b>	Once daily	Once daily in all barangays, markets, schools and hospitals. One regular collection and two mopping up along main thoroughfares	Twice a week per barangay, once daily (including Sundays) per main thoroughfare and stationary cells	Daily per barangay with designated days of collection for biodegradables and non-biodegradables	Twice daily along main thoroughfares- 1 regular collection and 1 mopping up. Five times a week for residential. Once a week-collection of bulky wastes "Kuyagot Day"	



**Figure 2.8.3 Solid Waste Collection System along Esteros**

#### **(4) Solid Waste Disposal**

The enactment of the Solid Waste Management Act seemed to have created a blurring of delineation of functions between LGUs and MMDA. Whereas RA No. 7924 specifically provided the responsibility of the LGUs (meaning cities and municipalities) in Metro Manila over solid waste collection and transport, disposal remained with MMDA. RA No. 9003, on the other hand, placed the full responsibility of managing solid wastes within their areas of jurisdiction from collection to transport to disposal. The blurring of responsibility areas has, however, turned out positive results. With the closure of San Mateo Landfill and MMDA unable to find immediately a suitable site, LGUs were forced to find their own disposal areas. Nevertheless, MMDA continue to recognize its responsibility over solid waste disposal by financially and technically providing support to LGUs in the development of their own dumpsites. The solid waste crisis was finally ended with some LGUs putting up and operating their disposal areas and MMDA finally getting a contract with the Municipality of Montalban to host the controlled dumpsite of Metro Manila while in search for a site to construct a sanitary landfill.

Disposal of solid waste from different LGUs is in various arrangements with MMDA. In the LGUs of the core areas of Metro Manila, such arrangements are described briefly as follows:

- 1) Quezon City. Currently, the local government of Quezon City uses the Payatas controlled dumpsite to dispose of its solid waste. The conversion of Payatas from an open dumpsite to a controlled dumpsite as well as its operation and maintenance are being undertaken by a local contractor named IPM Environmental Services, Inc. at a tipping fee rate of Php1,000 per ton of solid waste delivered, of which Php400 is being paid for by the City. Under a memorandum of understanding (MOU) between the City and MMDA, the latter agreed to pay the amount of Php600 per ton, or 60% of the contract amount, as tipping fee subsidy. The facility has an estimated capacity of 1,500 tons of solid waste per day for 2.5 years. Contract commenced January 2004 and is expected to terminate by the middle of 2007, which is in time for the Solid Waste Management Act's directive allowing only SLF for disposal of solid waste by 2008. The city government is now receiving proposals for site and development for construction of sanitary landfill (SLF) with an objective of establishing an SLF before 2008. Payatas is an exclusive facility for Quezon City.
- 2) Solid wastes of the cities of Caloocan and Makati and the municipality of Taguig are all disposed of at Montalban Solid Waste Disposal Facility in Rodriguez, Rizal, which is operated and managed by A.L. Salazar Construction, Inc. The tipping fee is paid for by MMDA at the rate of Php600 per ton or Php174 per m<sup>3</sup> of solid waste delivered. The facility is a controlled dumpsite with a guaranteed capacity of 5,000,000 tons of solid waste. Per MMDA record, the facility has already accommodated an estimated amount of 3.5 million m<sup>3</sup> of solid waste for years 2002 and 2003, costing MMDA about Php448 million in tipping fees and other disposal operations expenditures.
- 3) Two dumpsites, Montalban and Navotas-Pier 18, are used by the City of Manila to dispose of its solid waste. Navotas Disposal Facility is a 10-hectare facility located in the northernmost part of Barangay Tanza, in the municipality of Navotas. Solid waste is loaded onto a barge at Pier 18 and disposed of at Navotas Disposal Facility. For this facility, MMDA pays a tipping fee of Php171.42 per m<sup>3</sup> of solid waste delivered. For years 2002 and 2003, the City of Manila delivered a total of 829, 814 m<sup>3</sup> of solid waste in this facility.

According to MMDA-SWMO analysis of the 2003 disposal, the two dumpsites under MMDA could only accommodate 69% of the total solid waste generation in Metro Manila. The balance of 31% is still being dumped in the open dumpsites. With the imminent closure of these open

dumpsites (2004 as required by RA No.9003), there is a need for intensive efforts to reduce solid wastes through various modalities, such as reuse, recycling and resource recovery. Otherwise, additional controlled dumpsites will have to be developed.

MMDA's solid waste management functions are lodged in the Solid Waste Management Office provided with 80 DBM approved positions, of which, 73 are filled up. Its mandates are defined by RA No. 7924 and RA No. 9003, in view of the Chairmanship of MMDA Chairperson in the Metro Manila SWM Board. In addition to providing solid waste disposal service to Metro Manila LGUs, the agency undertakes the following functions:

- assist LGUs in adopting and implementing the Unified Approach to Solid Waste Management;
- organize the meetings of Metro Manila SWM Board; and
- undertake special projects to pilot resource recovery, reuse and recycling of solid wastes for purposes of solid waste volume reduction.

#### **(5) Solid Waste Management Campaign**

Good management of trash is a cultural thing. It takes time to educate people how to keep solid waste in receptacles and not dump them on the streets or in the esteros. With the passage of RA No. 9003, the importance of information–education–communication (IEC) campaign is recognized, thus proving a hefty pertinent provision. National government agencies such as the NSWMC and MMDA are currently undertaking related programs coordinated with LGUs. Seminars and workshops are organized to disseminate information on the Solid Waste Management Act, its requirements and its penal provisions. Posters bearing SWM-related slogans are posted in conspicuous places in the barangays by efforts of city and barangays, although improving on this will be of greater impact. At the moment, posters are rather small and not so many. Reward systems have also been used as a strategy. Imposition of penalties has always been a part of regulations under several laws and ordinances. However, enforcement may be a little challenging since litter on streets and solid waste in waterways are still very visible.

#### **2.8.4 CONDITIONS OF SOLID WASTE ON ESTEROS**

The following surveys were conducted by the Study:

- *Yearly and monthly trend of amount of floating solid waste by record at pumping stations*
- *Solid waste amount and composition survey at pumping stations*
- *Analysis of deposited solid waste on esteros*

The detailed methodology and results are described in *Supporting Report L*. The major findings are as follows:

#### **(1) Floating Solid Waste at Pumping Stations**

Pumping stations have devices that remove floating solid waste. MMDA measured collected solid waste at pumping stations. The Study Team also surveyed solid waste amount and composition of removed floating solid waste at the selected pumping stations including Aviles, Binondo, San Andres, Tripa de Gallina and Vitas pumping stations in March 2004. Outline of the result is as follows:

##### **1) Yearly and Monthly Trend of Amount of Floating Solid Waste by Record at Pumping Stations**

- There is an increase in the volume of collected solid waste in years 2000 and 2001. This increase is brought about by the “Garbage Crisis” in Metro Manila, which started in 1999

when the San Mateo Landfill had a forced suspension of operations. At these times, Metro Manila was out of options for disposal, and solid waste went largely uncollected.

- It can also be noticed that the volume of solid waste decreased in 2002 and 2003. The reduction of volume of solid waste collected from the pumping stations, as explained by MMDA, may be brought about by the following: the enactment of RA No. 9003 which led to the opening of additional dumpsites for disposal of solid waste; the massive clean-up of waterways by various District Engineering Offices concerned where solid wastes are automatically hauled-up; the massive information drive of MMDA relative to the illegal dumping of solid waste on the waterways; and the small number of weather disturbances that passed through Manila area.
- Among all pumping stations, Tripa de Gallina and Vitas Pumping stations collect much larger amount of solid waste than others.
- Total amount of collected floating solid waste at all pumping stations per year within the last five years is 15,000 - 25,000 m<sup>3</sup>/ year. This is equivalent to 5,000 - 8,000 ton/year when the apparent specific weight of the solid waste is about 0.3 ton/m<sup>3</sup>.

## **2) Solid Waste Amount and Composition at Pumping Stations**

- The amount of collected floating solid waste at selected pumping stations by the Study Team during March 15 to 19, 2004 shows same trend with the record on the collected floating solid waste at the pumping stations.
- Measured apparent specific weight for the collected floating solid waste ranges from 0.236 ton/m<sup>3</sup> to 0.349 ton/ m<sup>3</sup>.
- “Grass/Wood” and “Soft Plastics” is majority of composition in floating solid waste in esteros.
- The floating solid waste accumulated at the pumping stations is mainly household waste. It is supported by the fact that there is a large amount of plastic bags including left-overs, fruit and vegetable peelings and human waste; baby diapers, batteries, etc.

## **(2) Deposited Solid Waste on Esteros**

The Study Team surveyed deposited solid waste at 20 points on esteros in March 2004. Samples were analyzed for physical ratio of solid waste and composition of solid waste. Outline of the results is as follows:

- There exists much more amount of solid waste near the bank of esteros than at the center. The samples taken at the center consist of a large amount of silt.
- Silt samples taken in esteros have low organic content, which indicates that very small amount of organic waste is deposited in esteros.
- “Grass/Wood” and “Soft Plastics” is majority of composition in deposited solid waste in esteros.
- Most of the wooden materials and concrete pieces collected from deposited solid waste are composed of construction wood and concrete, which come from households living along the esteros and industrial waste.
- The percent of silt in weight for samples taken from the esteros varies from 10% to 77%. However, many exceed 50%. It indicates that deposited material in esteros is originated by not only household waste but also other sources. Only possible other sources seem to be illegal dumping of industrial waste, because deposition of natural sediment provided through watershed is minimum, considering the existing urbanized watershed condition. It is said that when “garbage crisis” occurred, solid waste that has no final disposal site was thrown into esteros. The survey data supports the fact of the illegal dumping at “garbage crisis”.

The amount of solid waste collected in pumping stations, which has been already transported to existing final disposal site, is much smaller than the total expected amount of solid waste generation in the entire Metro Manila. It is difficult to estimate the amount of household waste thrown into esteros by limited information. However, it is anticipated that it would be on the



order of one collected at pumping stations, because household waste includes many light material and is thrown with plastic bags usually, thus, much can reach to pumping stations. Therefore, the household waste thrown into esteros, even if it is collected and transported normally, would not threaten total capacity of final disposal site.

### 2.8.5 RELATED PLANS, PROGRAMS AND STRATEGIES ON SOLID WASTE MANAGEMENT

Table 2.8.5 shows a list of plans and programs being undertaken and intended to be pursued in the next medium term. Generally, strategies are geared towards further improvement of solid waste collection and reduction of solid wastes. Improvements in solid waste collection are expected to come in via systematizing hauling and education of solid waste generator and imposition of penalties. Among the strategies to reduce solid waste are: segregation, establishment of MRFs, promotion of buyback programs especially packaging materials and other recyclables. Information-Education-Communication (IEC) campaign through house-to-house campaigns will be pursued vigorously to help address both reduction and collection of solid wastes.

**Table 2.8.5 Plans and Programs on Solid Waste Management**

LGU/MMDA	Plans and Programs
<b>MMDA</b>	Establishment of Waste Reduction Facilities and Material Recovery Facilities Promotion of Market Waste Reduction Program Special Waste Reduction Projects <ul style="list-style-type: none"> <li>- Basura Palit Bigas, a program of giving incentives to promote recovery of dry recyclables</li> <li>- CIDA-sponsored community-based SWM System Project</li> <li>- The JICA-UNDP-funded Community-based Ecological SWM System Project</li> </ul> Institution-Building & Establishment of Support Facilities Pertinent to the Requirements of RA No. 9003 <ul style="list-style-type: none"> <li>- Constitution of the SWM Board for Metro Manila</li> <li>- Implementation of Socio-Economic Pact of 2001 Action Agenda on Solid Waste Management</li> </ul> Development of Learning Program on Ecological Solid Waste Management (ESWM) Study the possible utilization of the PNR rail lines in collecting and transporting waste  Seek Dialogue with the local governments of Carmona and San Mateo for possible re-opening of the closed sanitary landfill facilities Conduct studies and establish baseline data on how the MMDA can best assist, technical- and operation-wise, the metro local governments in handling, collecting and disposing of their waste Enlist the consent and approval of the Mayors Council for the Adoption of a Uniform system and mechanics in implementing solutions to waste problem in MetroManila
<b>Caloocan City</b>	Establishment of MRFs in Barangays and Cluster Barangays Waste Segregation at Source
<b>Manila City</b>	Information/education campaign on RA 9003 and other related laws and ordinances "Sama-sama sa Paghihiwalay ng Basura" Program and "Maynila, Kay Sigla, Sa Kalinisan, Atin Sya" Program - waste segregation program targeting residential, commercial and other institutions to take responsibility of clean up in their vicinity, established system of household waste segregation. Separation of stockpiled waste for final dumping and filling materials - targets the gradual phasing out of temporary transfer station in consonance with RA No. 9003 and segregation of biodegradable, non-biodegradable and residual wastes. Preparation of Feasibility Study and Site for Establishment of MRFs
<b>Quezon City</b>	Policy Formulation for enactment into ordinance Collection of used tires by Union Cement Corporation Special Collection Systems for Inaccessible Areas

<b>LGU/MMDA</b>	<b>Plans and Programs</b>
	Continuing Information and Education Campaign <ul style="list-style-type: none"> <li>- Solid Waste &amp; Environment Education Program Coordinators (SWEEP Coordinators) who undertake house-to-house campaign</li> <li>- Production of film clips on environment</li> </ul> Community-Based Ecological Solid Waste Management in the Philippines Community-Based Ecological Solid Waste Management Project for Barangay Holy Spirit Ecological Solid Waste Management Program for Quezon City Hall Complex Sagip-Batis sa Quezon City Suyod Basura Sa Kalsada - Implementation of a Package Clean Up System of Waste Collection Waste Paper Recovery Program for Quezon City Hall Disposal <ul style="list-style-type: none"> <li>- Saving the Precious Space of Payatas Disposal Site/Shredding of bulky Yard Wastes</li> </ul> Seminars Environmental Management
<b>Pasay City</b>	Systematized Waste Hauling System Approval of proposed ordinances on ecowaste handling and packaging Orientation on key implementation of approved ordinances Information dissemination and education campaign program Waste characterization Implement waste segregation at source and no collection for unsegregated waste Systematized Hauling System of Segregated Waste Increase buy-back centers Pursue backyard composting Pursue sectoral MRFs Impose penal sanctions Initiate ecolivelihood programs
<b>Makati City</b>	Source reduction/waste avoidance (3B-3K) Development of Mobile Materials Recovery Facilities (MRFs) Advocacy and Education through hosting of contests Development of composting areas
<b>Taguig Municipality</b>	Identify model site in Taguig to pilot the Waste Segregation Scheme Create the Solid Waste Management Committee in every barangay Disseminate information on municipal ordinances and waste segregation scheme Set up warehouse and impounding area in MRFs Set up dispatching depot to accommodate dumptrucks and heavy equipment for more efficient waste collection system Related Program Titles <ul style="list-style-type: none"> <li>Mag-Segregate Tayo (Let's Segregate)</li> <li>Operation Ubos Basura (Total Waste Collection)</li> <li>Oplan Tanggal Sagabal (Operation Obstruction Removal)</li> <li>Kariton at Tribike Para sa Barangay (Carts and Tribikes for Barangay)</li> </ul>

## **2.8.6 MAJOR ISSUES FOR IMPROVEMENT OF SOLID WASTE MANAGEMENT**

### **(1) Solid Waste Collection System at Barangay Level**

The problems of solid waste in barangays near esteros can be attributed largely to the huge population of informal settlers. The Cities of Manila, Caloocan and Pasay are among the LGUs in the core area with highest population densities. If barangay populations are further examined, high densities can be found in barangays near the esteros due to informal settlers on open spaces and vacant lots. Some barangays along estero have very narrow roads that only mini trucks can pass through. Some do not even have defined roads. Aside from access, these so-called interior barangays are often noted for harboring lawless elements of the society, which add up to lack of or insufficient solid waste collection in the area.

Without well-established and organized solid waste collection system at barangay level, residents can easily throw solid waste to the drainage/esteros disregarding rules or any education campaign that may have come their way. After all, if nobody sees the act of throwing solid waste, throwers are rarely identified. Participation in solid waste collection of barangay respected by the residents in these areas is imperative especially in information and education campaign.

### **(2) Solid Waste Source Reduction**

Even if collection services are provided daily, too much solid waste may not be collected properly, which can cause illegal dumping of solid waste into esteros. Reduction of generation of solid waste is also fundamental. Solid waste segregation and recycling significantly reduce the amount of the generation. According to the results of solid waste composition analysis in estero and pumping station in the Study, plastics, which are reducible and recyclable, are majority of percentage composition. It is thereby confirmed that there is high potential of recycling of the solid waste thrown in esteros.

### **(3) Illegal Activity**

During the previous solid waste crises caused by lack of disposal sites, many solid waste collectors who could not find a dumping site are forced to dump solid waste in esteros. It is said that Tripa de Gallina is one of the biggest recipients of solid waste during these crises. The results of sampling survey in the Study clarified that more than half of bottom deposit in esteros could be originated from illegal dumping of industrial waste, not from household waste initiated by residents along esteros.

Despite the chronic and recurrent occurrence of floods, there are no special programs to curb dumping of solid waste in esteros. These areas are usually treated like any other barangays. Informal settlers are almost on every embankment of the esteros while walls and concrete fences of many legitimate houses have also encroached the banks. The water code that prohibits construction of houses or any structure within 3 meters from either side of the banks of rivers and streams in urban area.

### **(4) Ensuring Disposal Site**

At present, there is capacity of solid waste disposal sites for Metro Manila. However, there is not enough space for construction of disposal sites in Metro Manila. Furthermore, it takes a time for planning, land acquisition, and construction for development of solid waste disposal sites. Therefore, it is necessary to ensure disposal sites as soon as possible. At the same time, solid waste reduction, recycling and reuse should be promoted in order to extend life span of the existing disposal sites.

## **2.9 LAW AND REGULATION**

Major laws and regulations for flood control and drainage, water management and environmental impact assessment have been collected and briefly explained as follows:

### **2.9.1 LAW AND REGULATION ON FLOOD CONTROL AND DRAINAGE IMPROVEMENT**

#### **(1) Water Code of the Philippines of 1976 (Presidential Decree: PD No. 1067)**

The Water Code of the Philippines instituted in 1976 is the basic water law in the Philippines. It is anchored on the principle that all waters belong to the Philippines. The objectives of the water code are:

- To establish the basic principles and framework relating to the appropriation, control and conservation of water resources to achieve the optimum development and rational utilization of these resources,
- To define the extent of the rights and obligations of water users and owners including the protection and regulation of such rights,
- To adopt a basic law governing the ownership, appropriation, utilization, exploitation, development, conservation and protection of water resources and right to land related thereto, and
- To identify the administrative agencies that enforce this Code.

The code consists of the following nine chapters consisting of 101 articles and supported by implementing rules and regulations with 88 sections.

- Chapter I: Declaration of Objectives and Principles
- Chapter II: Ownership of Waters
- Chapter III: Appropriation of Waters
- Chapter IV: Utilization of Waters
- Chapter V: Control of Water
- Chapter VI: Conservation and Protection of Waters and Watersheds and related Land Resources
- Chapter VII: Administration of Waters and Enforcement of the Provisions of This Code
- Chapter IX: Transitory and Final Provisions

On the other hand, Implementing Rules and Regulations (IRR) for effective enforcement of the water code consist of the following:

- Rule I: Appropriation and Utilization of Waters (26 sections)
- Rule II: Control, Conservation and Protection of Waters, watersheds and Related Land Resources (21 sections)
- Rule III: Administration and Enforcement (41 sections)

#### **(2) National Water Crisis Act of 1995 (Republic Act No. 8041)**

To complement the national water summit of 1994, Congress enacted Republic Act No. 8041 in 1995. The law meant to address the problems and ill-effects spawned by the water crisis then prevailing. By the Act, a Joint Executive-Legislative Water Crisis Commission (JELWCC) was established. Among the powers and purposes of the JELWCC are as follows:

- To undertake nationwide consultations on the water crisis and a study of the entire water supply and distribution structure.
- To facilitate coordination between Congress and executive department in formulating and implementing the government's water crisis management policy and strategy.
- To recommend measures to ensure continuous and effective monitoring of the entire water supply and distribution systems, and
- To conduct studies on policy options and strategies to resolve the water crisis and recommend remedial legislative measures.

The other aspect of the law is in authorizing the privatization of Metropolitan Manila Waterworks and Sewerage System (MWSS) and the Local Water Utilities Administration (LWUA).

### **(3) Laws on Flood Forecasting of 1978 (PD No.78)**

The Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) was established by Presidential Decree (PD) No.78 in 1972 and placed under the Department of National Defense in 1977. PD No. 1149 issued in 1977 organized the National Flood Forecasting Office as one of the major organization units of the PAGASA. This office is responsible for flood forecasting and warning activities. The present PAGASA is attached to the National Science and Technology Authority by Executive Order (EO) No. 128 in 1987.

### **(4) Laws on Flood Fighting of 1978 (PD No. 1566)**

Under PD No. 1566 dated June 11, 1978, a National Program on Community Disaster Preparedness was established to save lives, prevent needless suffering, protect property, and minimize damages during disasters and calamities. The National Disaster Coordination Council (NDCC) issued the Calamity and Disaster Preparedness Plan in 1988. Under NDCC in the central government level, PDCC, CDCC, MDCC and BDCC have been organized in the respective local government levels of province, city, municipality and barangay. Flood fighting is undertaken nationwide by virtue of this PD.

### **(5) Laws on River Land Management of 1972 (LOI No. 19 and PD No. 296)**

Letter of Instruction (LOI) No. 19 dated Oct. 2, 1972 directed then Secretary of Public Works and Communications, in the interest of public health, safety, and peace and order, to remove all illegal construction including buildings on and along esteros and riverbanks, and to relocate, assist in the relocation and determine sites for informal settlers and other persons to be displaced. Also PD No. 296 in 1973, directed all persons, natural or juridical, to renounce possession and move out of portions of rivers, creeks, drainage channels and other similar waterways encroached upon and prescribed penalty for violation.

### **(6) Laws on Floodplain Management (Water Code and Local Government Code)**

Under the Water Code, DPWH may declare flood control areas and promulgate guidelines governing floodplain management in these areas. In declared flood control areas, rules and regulations may be promulgated to prohibit or control activities that may damage or cause deterioration of lakes and dikes, obstruct the flow of water, change the natural flow of the river, increase flood losses or aggravate flood problems. Under the Local Government Code, a city or municipality may, through an ordinance passed by the Council after conduction of public hearing for the purpose, authorize the reclassification of agricultural lands and provide for the manner of their utilization and disposition.

## **(7) Other Laws on River Basin Management, Water Resources Development and Water Usages**

Major laws and regulation in this category are as follows:

- Executive Order No. 192 of 1987 mandates that the conservation, management, development and proper use of the country's environment and natural resources including those in the watershed shall be the responsibility of the Department of Environment and Natural Resources (DENR).
- Republic Act No. 4850, for creating the Laguna Lake Development Authority (LLDA).
- Republic Act No. 6234, for creating the Metropolitan Waterworks and Sewerage System (MWSS).
- The Provincial Water Utilities Act by PD No. 198 of 1973, for declaration of a national policy of local water utilities and for creating the Local Water Utilities Administration (LWUA).
- Executive Order No. 215 and 462, for private sector participation in hydrological endeavors.
- Republic Act No. 7924 of 1994, for creating the Metropolitan Manila Development Authority (MMDA), defining its powers and functions, providing funding therefore and for other purposes.
- Presidential Decree No. 772 of 1972, for penalizing informal settlers and other similar act.
- Anti-Flooding Act, House Bill (HB) No. 03660 of 1998, providing for flood control mechanism and for other purposes.
- Water Pollution Control Act, HB No. 00176 of 1998, for controlling discharge of pollutant in gulf, bays, rivers, creeks, esteros, drainage channels and other similar waterways, etc.

### **2.9.2 LAW AND REGULATION FOR SOLID WASTE MANAGEMENT**

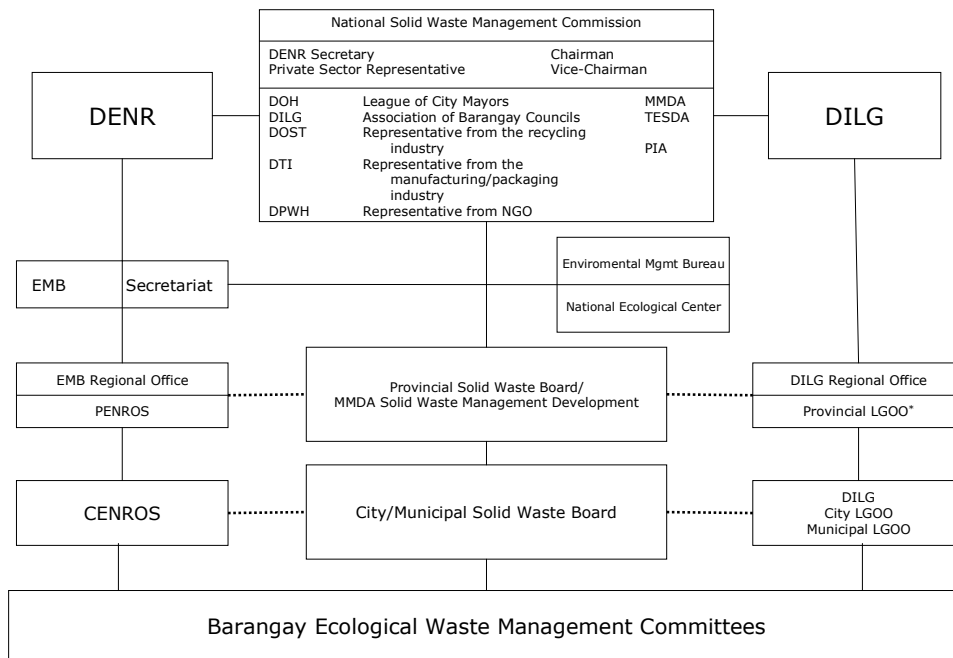
#### **(1) Legal and Institutional Framework of Solid Waste Management**

The Philippine Constitution provides the general framework of environment protection in the light of the right of every citizen and the future generations to enjoy a healthy and comfortable place to live in. In order to operationalize the broad policy, the Philippine Congress passed several laws on controlling externalities of human activities impinging on the ecology and human lives. These laws passed by the Congress including related Presidential Decrees issued under Martial Law are tabulated in *Table 2.9.1*.

There are three forms of anthropogenic environmental impact regulated by law; air emissions that pollute the atmosphere, water effluents that pollute the water sources and solid wastes that could invariably and adversely affect land, air and water. All three forms of pollution were regulated largely under Presidential Decree No. 984, now superseded by three separate laws: RA No. 8741 (The Clean Air Act), the newly enacted RA No. 9275 (The Clean Water Act) and RA No. 9003 (The Solid Waste Management Act).

The passage of RA No. 9003, The Solid Waste Management Act, has superseded all provisions on solid wastes of PD No. 984. RA No. 9003, coupled with its Implementing Rules and Regulations (IRR), is now the single law that defines the overall institutional framework of managing solid wastes including functions and responsibilities and coordination among national and local government agencies, NGOs, private sector and individual citizens. *Figure 2.9.1* was developed by the Metro Manila Solid Waste Management Project of the ADB showing the institutional linkages of various stakeholders of the Solid Waste Management Act. Although RA No. 9003 has not been explicit in identifying the role of MMDA on solid waste management, the agency takes

on the role of the Provincial Solid Waste Management Board (PSWMB) as an agency that handles trans-boundary services among the LGUs in Metro Manila. Currently, MMDA Chairman is also the chairman of the PSWMB.



**Figure 2.9.1 Institutional Linkages Among the NSWMC, DENR and DILG**

The local government units (LGUs) consisting of provincial/city, municipality and barangay governments are accorded powers to carry out stewardship of the natural environment within their defined jurisdiction (territorial boundaries) by RA No. 7160, or The 1991 Local Government Code (see *Table 2.9.1*). The Local Government Code and the Solid Waste Management Act, together provide the legal mandate and institutional framework for the LGUs' participation in the total solid waste management in the country.

As shown in *Table 2.9.1*, several laws with enactment dated back to the early part of the Philippine Republic are still in force. These continue to be the basis of implementation of solid waste management and apprehension for violators.

## **(2) Local Government Ordinances on Solid Waste Management**

*Table 2.9.2* is a matrix of local government policies pertaining to management of solid wastes issued as ordinances by the respective legislative bodies of each LGU, the Sangguniang Panglunsod and Sangguniang Bayan for cities and municipalities, respectively. Among the six LGUs in the core area, Quezon City has the most number of ordinances passed strengthening the regulatory regime for solid waste management. About eight of the 24 ordinances still in effect were passed in the last four years. New issuances of all local councils are responses to the requirements of the Solid Waste Management Act. These ordinances complement existing laws passed by Congress and other issuances by the national government such as Executive Orders of Presidents of the Philippines, Administrative Orders of the DENR, the DILG and other solid waste management-related national government regulatory agencies (see *Table 2.7.3* in Section 2.7.1). These are the basis of local government regulations, programs and activities implemented in their areas of jurisdiction.

**Table 2.9.1 Congressional Acts and Other Government Issuances Pertaining to Solid Waste Management by LGUs**

Title No.	Title and Provision
<p><b>RA No. 9003</b> <b>Sec 10 Chap II</b></p>	<p><b>The Role of LGUs in Solid Waste Management</b> Pursuant to the relevant provisions of RA No. 7160, otherwise known as the Local Government Code, the LGUs shall be primarily responsible for the implementation and enforcement of the provisions of this Act within their jurisdiction. Segregation and collection of solid waste shall be conducted at the barangay level specifically for biodegradable, compostable and reusable wastes. Provided, That the collection of non-recyclable materials and special wastes shall be the responsibility of the municipality or city.</p>
<p><b>Sec 13 Chap II</b></p>	<p><b>Establishment of Multi-Purpose Environment Cooperatives of Associations in every LGU</b></p>
<p><b>Sec 6 Chap III</b></p>	<p>Prepare 10-year solid waste management plans consistent with the National Solid Waste Management Framework including a timetable for the implementation of a solid waste management program.</p>
<p><b>Sec 16 Chap III</b></p>	<p>Ensure the efficient management of solid waste generated within its jurisdiction including reusing, recycling and composting.</p>
<p><b>Sec 17 Chap III</b></p>	<p>Develop a recycling component to include a program and implementation schedule which shows the methods by which the LGU shall, in combination with source reduction and composting components, reduce a sufficient amount of solid waste disposed of in accordance with the diversion requirements set in Section 20. Develop a:</p>
<p><b>Section 12</b></p>	<p><b>Community/Municipal Solid Waste Management Board</b> a) Develop the city or municipal solid waste management plan. b) Ensure the viability and effective implementation of solid waste management programs at the barangay level c) Monitor the implementation of this plan through its political subdivisions and in cooperation with the private sector and NGOs d) Adopt revenue-generating measures for the plan e) Recommend to local government authorities specific measures for franchise or Build-Operate-Transfer agreements</p>
<p><b>Section 21</b></p>	<p><b>Mandatory Segregation of Solid Waste</b> The LGUs shall evaluate alternative roles for public and private sectors in providing collection services, type of collection system, or combination of systems, that best meet their needs: Provided, further, that nothing in this section prohibits a local government unit from implementing reusing, recycling and composting activities designed to exceed the goal.</p>
<p><b>Section 22</b></p>	<p><b>Requirement for Segregation and Storage of Solid Wastes</b> a) There shall be separate container for each type of waste from all sources; Provided that, in case of bulky waste, it shall suffice that the same be collected and placed in a separate and designated area; and b) The solid waste container depending on the use shall be properly marked or identified for on-site collection as "compostable", "non-recyclable" or "special waste", or any other classification as may be determined by the Commission.</p>
<p><b>Section 32</b></p>	<p><b>Establishment of LGU Materials Recovery Facility</b> There shall be established a Materials Recovery Facility (MRF) in every barangay or cluster of barangays.</p>
<p><b>DENR A 2001-34</b> <b>IRR of RA No. 9003</b> <b>Rule VI</b> <b>Section 6</b></p>	<p><b>Creation of Local Solid Waste Management Committee</b> <b>Creation of Barangay Solid Waste Management Committee</b> The Barangay SWM Committee shall have the following functions and responsibilities:</p>



Title No.	Title and Provision
<p><b>Section 7</b></p> <p><b>RA No. 7924</b></p> <p><b>Section 2</b></p> <p><b>Section 3</b></p>	<p>a) Formulate the solid waste management program consistent with the city/municipal plan</p> <p>b) Segregation and collection of biodegradable and non-biodegradable, compostable and reusable wastes</p> <p>c) Establish Materials Recovery Facility</p> <p>d) Allocate barangay funds; find sources of funds</p> <p>e) Organize core coordinators</p> <p>f) Submit monthly report to city or municipality</p> <p><b>Membership of the Barangay Solid Waste Management Committee</b></p> <p>a) Barangay Chairman</p> <p>b) One (1) Kagawad</p> <p>c) SK Chairman</p> <p>d) President of Homeowners Association</p> <p>e) Public/Private school principals or representatives</p> <p>f) One (1) Parent-Teachers Association President or representative</p> <p>g) One (1) Religious organization representative</p> <p>j) President of Market Vendors Association</p> <p>k) One (1) representative from junkshop owners association</p> <p><b>Creation of the Metropolitan Manila Development Authority (MMDA)</b></p> <p>MMDA shall perform planning, monitoring and coordinative functions in the delivery of metro-wide services.</p> <p>Scope of MMDA Services on Solid Waste Management: Solid waste disposal and management which include information and implementation of policies, standards, programs and projects for proper and sanitary waste disposal. It shall likewise include the establishment and operation of sanitary landfill and related facilities and the implementation of other alternative programs intended to reduce, reuse and recycle solid wastes.</p>
<p><b>RA No. 7160</b></p> <p><b>Chapter 2</b></p> <p><b>Section 17</b></p> <p><b>PD No. 1150</b></p> <p><b>PD No. 856</b></p> <p><b>Section 79</b></p> <p><b>Section 82</b></p>	<p><b>The Local Government Code of 1991</b></p> <p><b>Provides for the Powers and Attributes of the LGUs</b></p> <p><b>Basic Services and Facilities.</b> LGUs shall discharge such other functions and responsibilities necessary to the provision of efficient and effective basic services and facilities, including:</p> <p>a) For a barangay, those related to general hygiene and sanitation, beautification and solid waste collection</p> <p>b) For a municipality, solid waste disposal system or environmental management system related to general hygiene and sanitation</p> <p>c) For a province, enforcement of pollution control law subject to national policies and DENR supervision</p> <p>d) For a city, all the services and facilities of the municipality and province.</p> <p>If such services and facilities are not available or are inadequate, the National Government or the next higher LGU level may provide or augment them.</p> <p>Funding for these basic services and facilities may come from the LGU's share of national taxes, other local revenues and funding support from the National Government.</p> <p>Investing Barangay Captains with the power to enforce pollution and environmental control laws</p> <p><b>Sanitation Code</b></p> <p>It shall be the responsibility of cities and municipalities to provide and maintain in a sanitary state and in good repair a satisfactory system of drainage in all inhabited areas where wastewater from buildings and premises could empty without causing nuisance to the community and danger to public health</p> <p>Cities and municipalities shall provide an adequate and efficient system of collecting, transporting and disposing of refuse from their areas of jurisdiction in a manner approved by the local health authority.</p>

Title No.	Title and Provision
<p><b>Commonwealth Act No. 383</b></p> <p><b>PD No. 825</b> <b>Section 1</b></p> <p><b>MMDA Regulation No. 99-004</b> <b>Section 3</b></p> <p><b>MMDA Regulation No. 98-008</b></p> <p><b>MMDA Regulation No. 96-009</b></p> <p><b>MMDA Resolution No. 02-35</b></p>	<p><b>An Act to Punish Dumping in Any River of Refuse, Waste Matter or Substances</b> Prohibits dumping that may cause rise of river bed levels or block the course of stream. Reclaiming a strip of land along river banks by whatever means or device is prohibited except with the authority of the Secretary of Public Works and Communications and only if such works were necessary and pose no harm to other parties. Transgression is penalized by imprisonment or a fine, or both, at the discretion of the court.</p> <p><b>Providing Penalty for Improper Disposal of Garbage</b> All citizens and residents of the Philippines, all universities, colleges and schools, and other similar institutions, all commercial and industrial establishments shall undertake the cleaning.</p> <p><b>Regulation Governing Proper Refuse Management at Source in MetroManila Area</b> Sorting at source shall be required and recycling and composting shall be promoted.</p> <p>Provides for various prohibited acts in dumping of litter or garbage and corresponding penalties for violators.</p> <p>Regulating the management, collection and disposal of hospital waste and those of similar institutions in Metro Manila</p> <p><b>Prohibiting Littering/Dumping of Garbage, Rubbish or Any Kind of Waste in Open or Public Places</b> Urging the LGUs in MetroManila through their respective city/municipal councils to enact a uniform ordinance adopting guidelines and procedures for unified approach on solid waste management in their areas of jurisdiction</p>
<p><b>DENR AO 98-491</b></p> <p><b>DENR AO No. 98-50</b> <b>MC No. 39-A</b></p> <p><b>DENR AO No. 93-90</b></p> <p><b>NSWMC Resolution No. 02-01</b></p>	<p>Guidelines for the disposal of municipal waste and operates on the premise of eventual phase-out of all open dumps in the country. DENR will provide technical assistance to LGUs to upgrade open dumps to more environment-friendly sites. LGUs shall develop their own action plans and pass regulations for the gradual closure of existing dumps.</p> <p><b>Adoption of Landfill Site Identification and Screening Criteria</b> <b>Reconstituting the Presidential Taskforce on Waste Management to include the Secretary of Interior and Local Government</b></p> <p><b>Creating the Project Management Office on SWM Under the Presidential Task Force on Waste Management</b></p> <p>a) Formulate an integrated national systems framework on solid waste management. b) Formulate specific strategies and plans. c) Formulate standards, systems and procedures, etc.</p> <p><b>Delegation of certain functions of the NSWMC Chairman to the DENR Regional Executive Directors and prescribing appropriate permits and clearances for solid waste management facilities</b></p>

**Table 2.9.2 Local Laws on Solid Waste Management by Local Government Unit**

<b>LGU</b>	<b>Ordinance No. and Provision</b>
<b>Caloocan City</b>	<p>Ordinance No. _____ S. 2001 - An ordinance mandating all drivers of public utility vehicles plying the streets of Quezon City to provide a receptacle conspicuously inside their respective vehicles for the proper disposal of trash/rubbish of their passengers and providing penalties for violation thereof.</p> <p>Ordinance No. _____ S. _____ - An ordinance prohibiting throwing of garbage in drainage areas.</p>
<b>City of Manila</b>	<p><b>1</b> Ordinance No. 7770 - Creation of DPS - An ordinance creating the Department of Public Services, defining the functions and prescribing the staffing pattern and for other purposes.</p> <p><b>2</b> Ordinance No. 7866 - An ordinance penalizing the disposal of garbage, debris and other waste materials in rivers and creeks, canals and waterways, providing penalties for violation thereof, allocating to the barangays 20% of the fine collected therefrom and for other purposes.</p> <p><b>3</b> Ordinance No. 7853 - An ordinance requiring the provision of garbage receptacles in all public utility vehicles in the city of Manila, providing for penalties for violation thereof, and amending/repealing for the purpose Ordinance No. 6747 and Ordinance No. 7436.</p> <p><b>4</b> Ordinance No. 7849 - An ordinance amending Section 4 of Ordinance No. 7695 of the city of Manila referring to disposal of garbage, by providing higher penalty for violation thereof and providing subsections thereto.</p> <p><b>5</b> Ordinance No. 7695 - An ordinance prohibiting the disposal of garbage, trash and refuse in open, uncovered or unsealed container, providing penalty for violation thereof, and for other purposes.</p> <p><b>6</b> Ordinance No. 6677 - An ordinance requiring public conveyances operating in or through the city of Manila to carry rubbish containers, providing penalty for violation thereof, and for other purposes.</p> <p><b>7</b> Ordinance No. 7876 - An ordinance requiring all residents of, and business establishments within the city of Manila to provide their homes and establishments with containers with which to segregate biodegradable and non-biodegradable garbage for composting and recycling, for the purpose of achieving and complying with objectives and methods of the "ZERO-WASTE TECHNOLOGY", and providing penalties for violation thereof.</p>
<b>Quezon City</b>	<p><b>1</b> Ordinance No. SP1323 S. 2003 - An ordinance adopting guidelines and procedures for a unified approach on solid waste management.</p> <p><b>2</b> Ordinance No. SP1203 S.2002 - An ordinance granting incentive to barangays practicing best solid waste management; Barangays to receive 50% of savings earned as a result of best SWM practice.</p> <p><b>3</b> Ordinance No. SP1191 S. 2001 - An ordinance providing incentives to all barangays utilizing their own trucks for solid waste collection service in their respective barangays.</p> <p><b>4</b> Ordinance No. SP1072 S. 2001 - An ordinance mandating all drivers of public utility vehicles plying the streets of Quezon City to provide a receptacle conspicuously inside their respective vehicles for the proper disposal of trash/rubbish of their passengers and providing penalties for violation thereof.</p> <p><b>5</b> Ordinance No. SP982 S. 2000 - An ordinance creating the City Environmental Protection and Waste Management Department, providing for the organizational structure and functions and funds for operation.</p>

6	Ordinance No. SP1054 S. 2001 - An ordinance amending Ordinance No. 982 S. 2001, by creating the Plans and Programs Division in the City Environmental Protection and Waste Management Department, revising its staffing pattern and appropriating additional funds therefor.
7	Ordinance No. SP941 S. 2000 - An ordinance regulating the operation of ambulant/pushcart junk dealers and providing penalties for violation thereof.
8	Ordinance SP856 S.2000 - An ordinance amending the penal provisions of all ordinance relating to waste and garbage collection and disposal and littering such as, but not limited to, Ordinance Nos. NC-106 s-89, NC-172S-90, Ordinance No. SP-111 S-93, prescribing uniform and graduated penalties therefor, and deputizing the elected barangay officials to help in the implementation thereof.
9	Ordinance No. SP813 S.99 - An ordinance imposing a city garbage collection service charge on all persons engaged in all forms of business activities/calling or undertaking.
10	Ordinance No. SP596 S.97 - An ordinance regulating the disposal of used motor oil in Quezon City and providing penalties for violation thereof.
11	Ordinance No SP156 S.94 - An ordinance adopting the various methods implementing a zero-waste management system through total recycling of domestic wastes and encouraging all residents, schools, universities, colleges and other similar institutions, both private and public, commercial and industrial establishments, to mandatory sorting of domestic wastes at source and separate the two kinds of wastes into biodegradables, compostable (for compost-making and animal feed) and the non-biodegradable, non-compostable as factory returnables.
12	Ordinance No SP111 S.93 - An ordinance requiring all industrial and commercial establishments to put adequate, sufficient and covered trash receptacles and its implements and accessories within the vicinity of their establishments and providing penalty and/or fine for violation thereof.
16	Ordinance No. 7770 - Creation of the Department of Public Services, the Department where Solid Waste Management functions are lodged.
17	Ordinance No. 7866 - An ordinance penalizing the disposal of garbage, debris and other waste materials in the rivers, creeks, canals and waterways, providing penalties for violation thereof and allocating to the barangays 20% of the fine collected therefrom and for other purposes.
18	Ordinance No. 7853 - An Ordinance requiring the provision of garbage receptacles in all public utility vehicles in the city of Manila, providing for penalties for violation thereof, and amending/repealing for the purpose Ordinance Nos. 6747 and 7436.
19	Ordinance No. 7849 - An ordinance amending Section 4 of Ordinance No. 7695 of the city of Manila referring to disposal of garbage, by providing a higher penalty for violation thereof and providing subsections thereto.
20	Ordinance No. 6677 - An Ordinance requiring public conveyances operating in or through the city of Manila to carry rubbish containers, providing penalty for violation thereof, and for other purposes.
21	Ordinance No. 7695 - An Ordinance prohibiting the disposal of garbage, trash, rubbish and refuse in an open, uncovered or unsealed container, providing penalty for violations thereon, and for other purposes.
22	Ordinance No. 7876 - An Ordinance requiring all residents and business establishments within the city of Manila to provide their homes and establishments with containers with which to segregate biodegradable and non-biodegradable garbage for composting and recycling, for the purpose of achieving and complying with the objectives and methods of "ZERO WASTE TECHNOLOGY and providing for penalties for violation thereof.

23	Ordinance No 172 S.90 - An ordinance prohibiting urinating, defecating and indiscriminate disposing of waste, trash and any form of garbage in public places, except in any designated allowable areas or places in Quezon City and providing penalties for violation thereof.
24	Ordinance No 9820 S.73 - An ordinance regulating solid waste disposal practices including the prohibition of open dumping on vacant lots, in esteros and in other water courses.
<b>Makati City</b>	
1	Ordinance No. 89-99 - An ordinance penalizing spitting, urinating and/or defecating in open vacant lots, sidewalks, street, plazas, public landmarks and in all public places, and imposing penalty for violation thereof.
2	Ordinance No. 90-264 - An ordinance requiring owners, lessees, tenants, and the like of residential houses, commercial establishments, buildings, and other entities in the municipality to maintain clean and sanitary surroundings on the frontage of their residences, establishments, buildings and the like, and for other purposes.
3	Ordinance No. 93-065 - (Memorandum for all barangay captains) An ordinance prohibiting the burning of garbage and other waste material.
4	Ordinance No. 93-172 - An ordinance amending Ordinance No. 03 S. 1988 of the Municipal Council of Makati, MetroManila, prohibiting the dumping of waste, refuse, garbage materials, papers, cigarette butts and the like, in any place in the streets or public building or property to include waterways, creeks and/or riverbanks not designated as dumping places, and providing for a penalty for violation.
5	Resolution No. 93-228 - A resolution affirming the creation of the Task Force on Solid Waste Management pursuant to the Memorandum of Agreement (MOA) between the Metro Manila Authority (MMA) and the municipality of Makati per MMC Resolution No. 1-92, and providing funds for the compensation, remuneration or incentives to the members of the Task Force and their corresponding Secretariat Staff in the form of allowance/honorarium funds to be taken from the RPT share of the MMA under the existing MOA subject to all legal and auditing rules and regulations.
6	Ordinance No. 93-299 - An ordinance requiring owners, lessees, tenants and the like of residential houses, commercial establishments, buildings, and other entities in this municipality to separate, sort out their solid wastes, refuse, garbage materials into biodegradable (wet) and nonbiodegradable (dry) and providing penalties for violation thereof.
7	Ordinance No. 93-396 - An ordinance controlling the discharge of industrial and other wastes into the atmosphere or body of water within the territorial limits of the municipality of Makati for the purpose of abatement and prevention of pollution, providing penalties for its violation and for other purposes.
8	Ordinance No 94-120 - An ordinance requiring/regulating the private garbage contractors to register their dumptrucks, compactors and other equipment for purposes of garbage hauling within the territorial jurisdiction of Makati with the Department of Environmental Services and providing for violation thereof.
9	Ordinance No. 94-121 - An ordinance regulating/requiring pushcart owners/operators in line with the recycling business to register their pushcart for purposes of garbage and junk collection within the territorial jurisdiction of the city of Makati with the Department of Environmental Services and providing penalties for violations thereof.

<p><b>Pasay City</b></p> <p><b>1</b></p> <p><b>2</b></p> <p><b>3</b></p>	<p>Ordinance No. 2536 S. 2002 - An ordinance adopting the guidelines for a unified approach on solid waste management in Pasay City and providing penalties for violation thereof.</p> <p>Ordinance No. 2535 S. 2002 - An ordinance mandating the owners/operators of all garbage trucks operating in Pasay City to install an 8" diameter bell to their trucks and providing penalties for violation thereof.</p> <p>Ordinance No. 1572 S. 1999 - An ordinance prohibiting littering/dumping/throwing of garbage, rubbish or any kind of waste in open or public places, requiring all residents, owners, lessees, occupants of residential, commercial institutions or establishment, whether public or private in the city of Pasay, to clean (and maintain clean) their frontage and immediate surroundings.</p>
<p><b>Taguig Municipality</b></p> <p><b>1</b></p> <p><b>2</b></p> <p><b>3</b></p> <p><b>4</b></p> <p><b>5</b></p>	<p>Ordinance No. 113 S.2002 - An ordinance adopting the Metropolitan Manila Development Authority (MMDA) guidelines and procedures for a unified approach on solid waste management in the Municipality of Taguig.</p> <p>Ordinance No. 61 S. 1996 - Ordinance mandating all residential units occupants/store owners to maintain sanitation of their respective frontage and surroundings, and providing penalties for violations thereof.</p> <p>Ordinance No. 32 S. 1996 - An ordinance regulating the disposal of toxic and hazardous waste and providing penalties for violation thereof.</p> <p>Ordinance No. 12 S. 1996 - An ordinance requiring all public transport operators and drivers operating in the municipality of Taguig, Metro Manila, to provide covered waste receptacles inside their vehicles and prescribing penalties for violation thereof.</p> <p>Ordinance No. 18 S. 1993 - An ordinance prohibiting the dumping of waste refuse, garbage materials, papers, cigarette butts, and any other polluting materials and the like, in any place in the streets, public building or property to include waterways, creeks, lakes, and or rivers banks not designated as dumping place, and providing penalty for violation thereof.</p>

### **2.9.3 LAW AND REGULATION FOR ENVIRONMENTAL IMPACT ASSESSMENT**

#### **(1) Basis of EIA Study**

Philippine Environmental Policy as basic policy for protection of valuable natural environment and utilization of natural resources (Presidential Decree No. 1151, 1977) declares that “all agencies and instrumentalities of the national government, including government-owned and controlled corporations, as well as private corporations, firms and entities to prepare, file and include in every action, project or undertaking which significantly affects the quality of the environment a detailed statement”, so that the Philippine Environmental Impact Statement (EIS) System, Presidential Decree No. 1586, was established in 1978 as first regulation of environmental impact assessment (EIA). Since 1978, regulations regarding EIA have been revised from time to time. Therefore, this section is based on the current regulations including the following regulations:

- Presidential Decree No. 1586, 1978 : Establishing an Environmental Impact Statement System including Management-Related Measures and for Other Purposes
- DENR Administrative Order No. 2003-30 : Implementing Rules and Regulations (IRR) for the Philippine Environmental Impact Statement (EIS) System
- DENR Administrative Order No. 96-37 : Procedural Manual for Environmental Impact Statement

Although Implementing Rules and Regulations (IRR) were revised in 2003, DENR Administrative Order (DAO) No. 37 (1996) was used as guidelines of EIS at the time. DAO No. 37 was used because new guidelines under DAO No. 2003-30 are still being processed for official declaration.

In general, EIS study is a very important and useful tool for development projects. EIA provides not only evaluation of environmental impact caused by implementation of the project but also information on changes and modification of the project including design of structure, construction methods and others before implementation from an environmental conservation point of view.

**(2) EIA-required Projects**

There are two levels of environmental impact studies in Philippine EIA such as Environmental Impact Statement (EIS) and Initial Environmental Examination (IEE). There are different study levels between EIS and IEE based on the following criteria:

- characteristic of the projects and undertakings;
- location of the project; and
- nature of the potential impact.

Under DENR Administrative Order No. 2003-30, Implementing Rules and Regulations (IRR) for the Philippine Environmental Impact Statement System, IEE and EIS are defined as follows:

- Environmental Impact Statement (EIS) : This is a document, prepared and submitted by the project proponent and/or EIA Consultant that serves as an application for an Environmental Compliance Certificate (ECC). It is a comprehensive study of the significant impacts of a project on the environment. It includes an Environmental Management Plan/Program that the proponent will fund and implement to protect the environment.
- Initial Environmental Examination (IEE) : This document is similar to an EIS, but with reduced details and depth of assessment and discussion.

According to DAO No. 30, 2003, projects and undertakings are categorized into the following four categories based on the above criteria:

**Table 2.9.3 Categories of Types of Project for EIA Study**

Categories	Types of Project
Category A	Environmentally Critical Projects (ECPs) with significant potential to cause negative environmental impacts
Category B	Projects that are not categorized as ECPs, but which may cause negative environmental impacts because they are located in Environmentally Critical Areas (ECAs)
Category C	Projects intended to directly enhance environmental quality or address existing environmental problems not falling under Category A or B.
Category D	Projects unlikely to cause adverse environmental impacts.

Criteria for EIA study of the projects and undertakings are shown in *Table 2.9.4*. Important criteria are that the project is categorized as Environmentally Critical Project (ECP) and/or Environmentally Critical Area (ECA). ECPs such as heavy industries, resources extractive industries and infrastructure projects and golf course projects and ECAs, which are environmentally sensitive areas, are defined in the following manner:

ECP : project or program that has high potential for significant negative environmental impact

ECA : area delineated as environmentally sensitive such that significant environmental impacts are expected if certain types of proposed projects or programs are located, developed or implemented in it

Definite examples of ECPs and ECAs are shown in *Table 2.9.5*.



**Table 2.9.4 Criteria for EIS Study of the Projects and Undertakings**

		APPLIED TO	DOCUMENTS REQUIRED FOR ECC/CNC APPLICATION	PROCESSING RESPONSIBILITY/ Endorsing Official	DECIDING AUTHORITY	MAXIMUM TIME TO GRANT OR DENY ECC APPLICATION (working days)
A: Environmentally Critical Projects	A-1: New	Co-located projects	Programmatic EIS based on an eco-profile and focused on the most critical environmental parameters	EMB Central Office (CO) Director	DENR Secretary	180 days
		Single Project	Project EIS	EMB CO Director	DENR Secretary	120 days
	A-2: Existing and to be expanded (including undertakings that have stopped operations for more than 5 years and plan to re-start, with or without expansion)	Co-located projects	Programmatic Environmental Performance Report and Management Plan (PEPRMP)	EMB CO/EIA Division Chief	EMB Central Office Director	120 days
B: Non-Environmentally Critical but located in an ECA	A-3: Operating without ECC	Single Project	Environmental Performance Report and Management Plan (EPRMP)	EMB CO/EIA Division Chief	DENR Secretary	120 days
		Single Project	Project IEE or IEE Checklist if available (IEE may be followed up by full EIA if required by EMB after its review of the IEE)	EMB/CO EIA Division Chief	EMB Central Office Director	60 days
	B-2: Existing and to be expanded (including undertakings that have stopped operations for more than 5 years and plan to re-start, with or without expansion)	Single Project	Environmental Performance Report and Management Plan (based on a checklist if available)	EMB Region/EIA Division Chief	EMB Regional Director	60 days
D: Not Covered	B-3: Operating without ECC	Co-located Project	PEPRMP	EMB CO/EIA Division Chief	EMB Central Office Director	60 days
			Project Description or Proof of Project Implementation Start prior to 1982 (if applying for a CNC)	EMB CO or RO /EIA Division Chief	EMB CO or RO Director	15 days

Source: DAO No. 2003-30, Implementing Rules and Regulations (IRR) for the Philippines Environmental Impact Statement (EIS) System

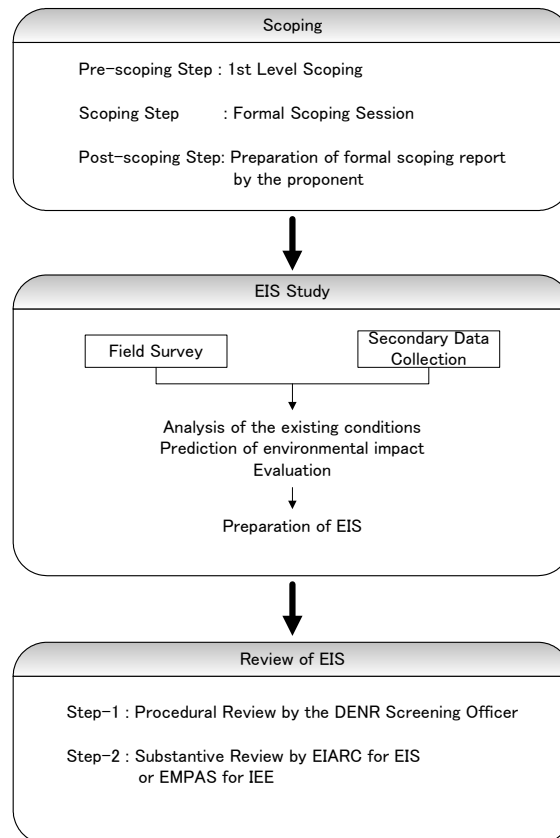
**Table 2.9.5 Criteria of ECPs and ECAs**

ECPs	ECAs
<p>i. Heavy industries</p> <ol style="list-style-type: none"> <li>1. Non-ferrous metal industries</li> <li>2. Iron and steel mills</li> <li>3. Petroleum and petrochemical industries, including oil and gas</li> <li>4. Smelting plants</li> </ol>	<p>i. All areas declared by law as national parks, watershed reserves, wildlife preserves, and sanctuaries</p>
<p>ii. Resource Extractive industries</p> <ol style="list-style-type: none"> <li>1. Major mining and quarrying industries</li> <li>2. Forestry projects                             <ol style="list-style-type: none"> <li>a. Logging</li> <li>b. Major wood processing projects</li> <li>c. Introduction of fauna (exotic animals) in public/private forests</li> <li>d. Forest occupancy</li> <li>e. Extraction of mangrove products</li> <li>f. Grazing</li> </ol> </li> <li>3. Fishery projects                             <ol style="list-style-type: none"> <li>a. Dikes for/and fishpond development projects</li> </ol> </li> </ol>	<p>ii. Areas set aside as aesthetic, potential tourist spots</p> <p>iii. Areas which constitute the habitat for any endangered or threatened species of indigenous Philippine wildlife (flora and fauna)</p> <p>iv. Areas of unique historic, archeological or scientific interest</p> <p>v. Areas which are traditionally occupied by cultural communities or tribes (indigenous cultural communities)</p> <p>vi. Areas frequently visited and/or hard-hit by natural calamities (geologic hazards, floods, typhoons, volcanic activity, etc.)</p> <p>vii. Areas with critical slopes</p> <p>viii. Areas classified as prime agricultural lands</p> <p>ix. Recharged areas of aquifers</p>
<p>iii. Infrastructure project</p> <ol style="list-style-type: none"> <li>1. Major dams</li> <li>2. Major power plants (fossil-fueled, nuclear-fueled, hydro-electric, or geothermal)</li> <li>3. Major reclamation projects</li> <li>4. Major roads and bridges</li> </ol>	<p>x. Water bodies characterized by one or any combination of the following conditions:</p> <ol style="list-style-type: none"> <li>1. tapped for domestic purposes</li> <li>2. within the controlled and/or protected areas declared by appropriate authorities</li> <li>3. which support wildlife and fishery activities</li> </ol>
<p>iv. Golf course projects</p>	<p>xi. Mangrove areas characterized by one or any combination of the following conditions:</p> <ol style="list-style-type: none"> <li>1. with primary pristine and dense young growth</li> <li>2. adjoining mouth of major river systems</li> <li>3. near or adjacent to traditional productive fry or fishing grounds</li> <li>4. which act as natural buffers against shore erosion, strong winds and storm floods</li> <li>5. on which people are dependent for their livelihood</li> </ol> <p>xii. Coral reefs characterized by one or any combination of the following conditions:</p> <ol style="list-style-type: none"> <li>1. with 50% and above live coralline cover</li> <li>2. spawning and nursery grounds for fish</li> <li>3. which act as natural breakwater of coastlines</li> </ol>

Source: DAO No. 96-37, Procedural Manual for EIS

### (3) Process of EIS Study

There are mainly three steps in EIS study such as scoping, EIS preparation and review of EIS as show in *Figure 2.9.2*.



**Figure 2.9.2 Process of EIS Study**

Those steps are summarized as follows:

#### 1) Scoping

Scoping aims to identify, discuss, clarify and agree on the key issues and concerns by key actors including the project proponent, preparer, Environmental Management Bureau (EMB) of DENR, DENR Regional Office (DENR RO), Provincial Environment and Natural Resources Officer (PENRO), Community Environment and Natural Resources Officer (CENRO), LGUs, other national government agencies, Environmental Impact Assessment Review Committee (EIARC) and other stakeholders. It is important that scoping is part of the assessing process for social acceptability of the project and EIA review process.

In principal, the proponent initiates and organizes the scoping process in coordination with DENR. Scoping process can be divided into three steps as follows:

There is the pre-scoping step in which the proponent sends an official written communication addressed to EMB or DENR RO. And then, a first scoping is conducted

by DENR as preparation for the scoping step.

At scoping step, a series of Formal Scoping Session(s) is held by the proponent.

After the scoping step, a post-scoping step follows in which the proponent submits a formal scoping report to EMB or DENR RO. The formal scoping report is reviewed by EMB or DENR RO. And then, EMB or DENR RO informs the proponent the approval if no objection is made.

## **2) EIS Study**

In order to prepare the EIS, the proponent conducts field survey and secondary data collection for analysis of the existing conditions and prediction of environmental impact caused by the project. The EIS is then prepared by the proponent through qualified consultants recognized by DENR.

## **3) Review of EIS**

The proponent submits the EIS to EMB for review. Review of EIS is divided into two steps: 1) Procedural Review by the DENR Screening Officer, and 2) Substantive Review by EIARC.

At Step 1, Procedural Review, the EIS is examined by the DENR Screening Officer based on completeness of information and adequacy of presentation of information as initial review. The DENR Screening Officer determines the completeness of the submitted EIS. The Screening Officer gives a preliminary judgment on acceptance and non-acceptance of the EIS. If the EIS is not accepted, the DENR Screening Officer returns the submitted EIS to the proponent for completion or revision of EIS.

Step 2, Substantive Review, the EIS is reviewed and evaluated by EISRC or EMPAS depending on compliance with the review criteria.

The review criteria include the following:

- completeness of information
- clarity of presentation
- appropriateness
- accuracy and precision in information or assessment
- degree of consistency
- responsiveness

The EIARC prepares a report for EMB Director. The EMB Director makes own recommendations to the Office of the Secretary of DENR for final decision. Finally, the Secretary of DENR grants or denies the issuance of ECC.

## **2.10 PROBLEMS AND CONSTRAINTS**

### **2.10.1 INTRODUCTION**

The core area is mostly developed in the low-lying area and drainage pumps are responsible for draining 70% of the core area. Major flood control and drainage works have been implemented since the 1970s and there are 15 large pumping stations, 74 km of esteros or creeks, 35 km of drainage mains (include outfalls) and laterals in the core area. Due to the rapid urbanization and development some remedial works and additional works will be required to meet the current runoff conditions and social conditions in the core area, which is urbanized and densely populated. In order to improve the existing drainage system, the existing drainage system and facilities and the existing solid waste collection management in the core area have been studied from various aspects. Major problems and constraints identified are discussed as follows:

### **2.10.2 INUNDATION**

#### **(1) Flood frequency is still high and serious inundation area remaining locally:**

The flood and inundation conditions (extension, depth and duration) have generally been improved, but there remained locally severely inundated areas in both North Manila and South Manila. It will be necessary to study on countermeasures including remedial works and/or additional works to the existing drainage facilities and measures to cope with the increased runoff during heavy rains.

According to the social survey conducted by the Study, most barangays still experience frequent floods; the extent of floodwater, depth and duration has been largely reduced compared with the past. The water may come up to knee or ankle level, and the duration is not long. However, floodwaters in some part of Aviles Sampaloc area in North Manila and San Isidro, San Antonio and Pio del Pilar in South Manila may come up to chest level when rain is heavy, and the duration is longer than one day in some area.

#### **(2) Floods and inundation are causing various adverse impacts to the core area and severe inundation causes serious problems to the urban transportation and socio-economic activities:**

Flood and inundation are disturbing traffic and transportation for business, work and schooling, and causing unhealthy living conditions and illness. Frequent floods and inundation disturb economic activities and people's daily lives and cause the lost of business opportunities.

Various cases of sickness and disease after the occurrences of floods are reported. And the most common of them are direct effects of contaminated water such as diarrhea, dysentery, tetanus, some kind of skin disease and cholera. One of the most dangerous diseases reported is Leptospirosis, which is caused by the urine of rats. People say this disease could develop to a very serious condition.

### **2.10.3 DRAINAGE BASIN AND DRAINAGE FACILITIES**

#### **(1) Most of the pump drainage basins are not independent and connected to other basins by estero or creek:**

The drainage system in the core area is based on many small gravity drainage areas and major 15 pump drainage areas; however, most of the pump drainage basins are connected with esterros/creeks or drainage channels and their drainage basins are not independent.

The study area is divided by the Pasig River into two areas: North Manila (right bank of the Pasig River) and South Manila (left bank of the Pasig River) as follows:

- North Manila area (28.78 km<sup>2</sup>) consists of 5 drainage blocks with 7 large pumping stations, esterros/creeks: 27.78 km, drainage mains (including outfalls): 17.78 km.
- South Manila (43.80 km<sup>2</sup>) consists of 8 large drainage pumping stations, esterros/creeks: 45.72 km, drainage mains (including outfalls): 17.00 km.

#### **(2) Drainage facilities are missing their discharge capacities affected by encroachment of informal settlers and by illegal dumping of solid waste:**

The drainage channels and waterways are missing their original discharge capacities due to illegal activities like informal settlements and illegal dumping of solid waste into drainage channels. Also the drainage channels are not meeting the discharge increase owing to the expanding urban development areas.

According to the rapid increase of the urban population, informal settlers are increasing and encroaching the public space along and in the drainage channels, and illegal dumping of household waste and industrial waste into drainage channels reduce discharge capacities. These informal activities largely contribute to the decreasing capacities of drainage channels and waterways. The number of informal house buildings located in the drainage channels is estimated to be 2,100 in the core area.

According to the questionnaire survey, solid waste collection services are available in most of the core area, but still illegal dumping of solid waste into drainage channels is observed and such informal activities are not controlled yet. There are still many people lacking public awareness about the impact of throwing solid waste into drainage channels.

#### **(3) The existing 15 large drainage pumping stations are fundamental drainage facilities in the core area, but 12 of them require urgent rehabilitation:**

The drainage pumping stations have been working significantly effective in improving the stormwater drainage in the core area. However, 10 out of the 15 stations have already been working for about 20 to 30 years and requiring rehabilitation and 2 others are also requiring replacement of pump equipment.

For the 10 stations constructed from 1976 to 1985 remarkable problems are deterioration of casing liner, erosion and corrosion of guide casing, crack of various major parts and units of engine, etc., due to aging, extremely low quality of water, clogged and overloaded with solid waste, decreasing of cooling effect, etc.

## **2.10.4 O & M OF DRAINAGE FACILITIES**

### **Drainage Pumping Station**

#### **(1) Increase of annual operation hours at some specific pumping stations:**

Because of the increment of the annual operation hours of drainage pumping stations, the pumping facilities are overloading. The operation hours of the four pumping stations: Aviles, Quiapo, Tripa de Gallina, and Libertad, are remarkable. Major causes are assumed as follows:

- Increment of solid waste in drainage channels,
- Reversed inflow from the Pasig River during floods, and
- Increased storm water from other drainage basins.

#### **(2) Insufficient budget allocation is causing shortage of spare parts and affecting the O & M activities:**

Lack of budget is a deterrent for procurement of spare parts and O & M activities, though periodic maintenance works were said to be conducted well at pumping stations until 1999.

According to the annual expenditure in 2003, personnel cost accounted for approximately 50% of the annual expenditure, fuel cost, 20%, and material and supply of spare parts for the pumping stations and solid waste handling equipment, 5%.

It is said that the budget for procurement of spare parts necessary for overhauling and for overtime work during heavy rains and flood emergencies is always an insufficient amount in annual budgets.

#### **(3) Number of O & M experts is decreasing due to low wage level:**

A number of qualified engineers and skilled labor are required for the O & M of pumping stations, but they are decreasing in number due to the low wage level. In addition, the opportunities to improve their technology on manufacturing including repairing and to acquire the advanced technology on pump equipment are scarce.

#### **(4) A large volume of solid waste must be collected daily at the pumping stations:**

A large volume of solid waste dumped into drainage channels is flowed down to the pumping stations and removed daily. The solid waste are affecting the operation of pumps and damaging the pump equipment, and the collected solid waste are causing social problems because of bad odor, flies, and health risks.

### **Drainage and Waterways**

#### **(5) Necessary to monitor and relocate informal settlers from critical parts:**

Numerous informal settlers have encroached public spaces along and in drainage channels and waterways, causing various difficulties of not only reducing the discharge capacity, but also disturbing normal O & M activities like dredging for drainage channels.

Informal houses or shanties are almost on or along the esteros while walls and concrete fences of many legitimate houses have also encroached on the banks, despite RA No. 7279, the law that prohibits construction of houses or any structure within 10 meters from either side of esteros and water bodies.

**(6) Insufficient budget allocation for the O & M activities of drainage channels:**

There is not sufficient budget for the activities of Drainage and Waterways Operation (DWO). As a result, its accomplishment of activities is at a low rate. Additional equipment and manpower for dredging drainage mains and open waterways are required.

**(7) No integrated management of O & M activities for PSFO, DWO and LGUs**

Suitable equipment allocation to sub-divisions is required and an integrated management of the equipment in collaboration with Pumping Stations and Floodgates Operation (PSFO), DWO and LGUs of Metropolitan Manila. It is also important to establish a centralized warehouse with supply of fast moving parts for activity of DWO and PSFO equipment.

There should be coordination between O & M activities for drainage and solid waste management for collection and transportation.

**(8) Need to improve the method of solid waste collection at barangays along drainage channels and waterways to reduce illegal dumping of solid waste:**

The problem of solid waste collection in barangays along drainage channels is accounted largely depending on the size of population of informal settlers in narrow spaces. In the core area the solid waste collection services are mostly available daily at barangays, but still there are a few percentages of settlers not covered by the collection services.

Some barangays in Pasay City, particularly those located along the Estero de Tripa de Gallina, have either no roads or very narrow roads that only mini trucks can pass through. Aside from access problem, there is either lack or insufficient solid waste collection in these so-called interior barangays. Without solid waste collectors, residents throw solid waste to the estero disregarding the rules.

**(9) Need to promote the Information, Education and Communication (IEC) campaign by MMDA and LGUs for enhancement of public awareness:**

It takes time to educate people on how to keep solid waste in receptacles and not on the streets or at the esteros.

The passage of RA No. 9003 recognized the importance of Information, Education and Communication (IEC) Campaign. National government agencies such as the NSWMC and the MMDA are currently undertaking related programs coordinated with the LGUs. Seminars and workshops are organized to disseminate information on the Solid Waste Management Act, its requirements and its penal provisions.

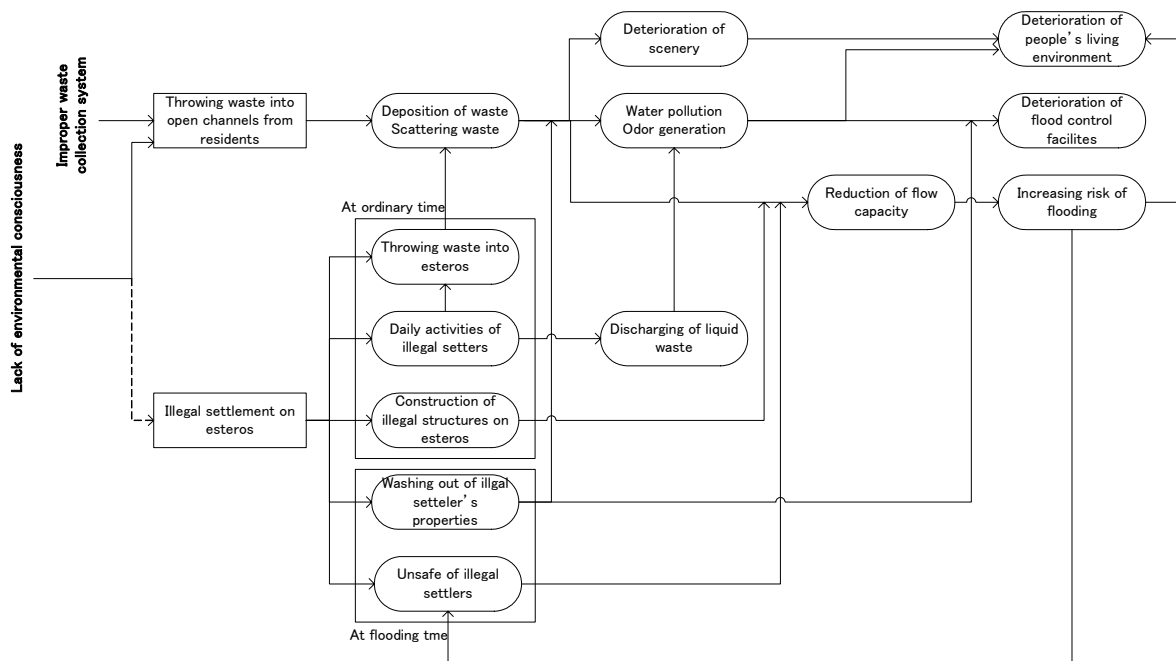


## 2.10.5 ENVIRONMENTAL AND SOCIAL ASPECT

There are two major problems from environmental and social aspects, namely:

- throwing solid waste into drainage channels, and
- informal settlements along the drainage channels and waterways.

These environmental and social problems seriously affect the discharge capacity of drainage facilities. At the same time, they also impact people's living environment and safety. In other words, thrown solid waste by people threatens people's safety and amenities as it rebounds on people later. Problem structure regarding environmental and social aspect is shown in *Figure 2.10.1* and is summarized in the following sections:



**Figure 2.10.1 Environmental and Social Problems Structure**

### (1) Throwing Solid Waste into Drainage Channels

People are known to throw waste just about anywhere—vacant space, roads, backyard of houses, rivers and other places, and waste is scattered in a number of roadsides and street corners in Metro Manila. And drainage channels are no exception. Solid waste is deposited and floated even on drainage channels. It seems that these problems stem from inappropriate solid waste collection system and lack of environmental consciousness. The Study will analyze results of the questionnaire survey for people who live along drainage channels in order to grasp the situation fully and propose improvement measures.

The abovementioned situation gives rise to the following other problems:

- reduction of flow capacity;

- pollution of water and generation of odor; and
- deterioration of urban environment and scenery.

Scattered and deposited solid waste lead to reduction of flow capacity of drainage channel. The household waste, concrete debris, sediment, metals and branches are clogging water flow. Drainage of closed channels, called drainage main, is also clogged by solid waste and sediment caused by soil and solid waste washed out by rainwater and inappropriate road sweeping.

Thrown solid waste which contains organic matters and harmful substances pollutes channel water and generates odors and mosquitoes. Polluted water brings about not only deterioration of flood control facilities but also deterioration of people's health and living environment. Scattered and floated solid waste causes deterioration of scenery. It is a fact that the sight of scattered and floated solid waste on esteros leads to trigger throwing of solid waste by more people. It is like a vicious spiral, and the situation is getting worse.

## **(2) Informal Settlements along and on Esteros and Waterways**

There are informal settlements encroaching public space along and in esteros, even atop esteros and under bridges. Informal settlement causes environmental and social problems at ordinary time and flooding time as follows:

### At ordinary time

- construction of illegal structure on channels creates a blight
- negative impact on daily life of informal settlers

### At flooding time

- washing out of illegal structures and settlers' properties
- posing safety concerns for settlers

At ordinary time, although construction of structure on channels is prohibited by law, there are lots of illegal settlement and structures. Constructed illegal structures give rise to clogged drainage and increased risk of flooding. Illegal settlers throw solid waste and also discharge liquid waste into channels. The solid waste generates water pollution and bad odor.

During flooding, water level is higher and water flow of esteros is extremely rapid. It is possible that bulky things such as furniture, refrigerator and kitchenware are washed out to esteros during flooding. It is expected that flow capacity will be reduced, and that these bulky things floating on esteros would damage flood control facilities. During flooding illegal settler's safety is threatened, and risk to settlers is increased.