

### **E.5.5 NON-STRUCTURAL MEASURES**

To support and sustain proposed structural measures, the following non-structural measures are recommended.

#### **(1) Countermeasures for Rapid Urbanization**

Urbanization in the core area, especially in Makati and Taguig areas, has been largely in progress. Open and green space is being converted into commercial and business complexes. Due to the urbanization, stormwater retention capacity in the catchment area is decreasing. Also, infiltration capacity to underground is decreasing because of asphaltting of ground surface. As a result, runoff coefficient of storm water is expected to increase remarkably. Against such negative impacts, some countermeasures to lower runoff coefficient or to retard storm water temporarily are recommended in collaboration with urban development planning in view of effective utilization of improved drainage systems and sustainable floodplain management in the core area.

#### **(2) Application of Existing Floodplain Management System**

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

## **E.5.6 SUPPORTING MEASURES**

In order to support and sustain the structural and non-structural aspects, a powerful supporting system is indispensable. In this regard, integrated supporting measures are proposed.

### **(1) Establishment of Community-Involved Solid Waste Management**

To mitigate illegal activity such as illegal dumping of solid waste into esteros, resident participation is necessary. To enhance these, Barangay Environmental Manager (BEM) and Team ESTERO activities are proposed. In the master plan, execution of information, education and communication campaign at barangay level is also proposed.

### **(2) Improvement of Operation and Maintenance Organization and Activities**

Improvement of Operation and Maintenance organization, especially for MMDA, is proposed. Insufficient budget results in low rate accomplishment of daily activity for O/M. Setting up the responsibility and roles required for O/M activities is recommended to be able to draw up the required budget.

In the present study, it is proposed to establish community-involved operation and maintenance by utilizing the proposed community participation activities in Solid Waste Management Plan.

Establishment of Inspectors is proposed. The Inspectors will collaborate with BEM and Team ESTERO who control activities at barangay level. The Inspectors are composed of Superintendents and normal inspectors. Superintendent is nominated by the Coordination Committee that consists of DPWH, MMDA, and LGUs, and is appointed by City Mayor of LGUs. The Superintendent appoints the normal inspectors and the normal inspector may support the Superintendent. The Inspectors will periodically submit inspection report to MMDA and LGUs so that the O&M-related government agencies can monitor and support the community participation activities.

### **(3) Installation of Equipment and Facilities for Effective Operation and Maintenance**

The following supporting systems for effective O/M of drainage system are proposed.

- Installation of Rainfall and water level observation equipment
- Introduction of Emergency operation and maintenance equipment
- Various management systems for O/M of drainage system

### **(4) Preparation of Guideline for Resettlement**

In order to recover present system functions, relocation of informal settlers is indispensable. For recovering present drainage system, minimum-level relocation will be proposed. Informal settlers intruding into the channels are principally to be relocated in the proposed master plan. To mitigate negative impact to them, well-considered and socially acceptable relocation should be executed by implementing agencies. The proposed master plan will show the social framework of resettlement and prepare the guideline for resettlement.

## **E.5.7 FEATURE AND PHASING OF STRUCTURAL MEASURES**

### **(1) Feature of Structural Measures**

Structural measures consist of 1) rehabilitation works of existing drainage channels by dredging and declogging, 2) rehabilitation works of drainage pump equipment and appurtenant facilities by repair and replacement, and 3) additional works for severe regional inundation area.

Proposed works and their locations are illustrated in *Figure E.5.10*. The simulated inundation condition after completion of the proposed works is shown in *Figure E.5.11*. The rainfall given here is the design rainfall for a 10-year return period. The simulated results validate the proposed works.

### **(2) Basic Idea for Phasing**

Rehabilitation works such as dredging and declogging are most effective to reduce the inundation depth and duration for the entire study area. However, the existence of the informal settlers within esteros will make it difficult to implement in earlier phase because the well-considered relocation will take time to implement in general. Declogging of drainage mains is effective after dredging of esteros, because without improving the downstream part of a drainage main, which is usually esteros, storm water cannot be drained effectively. It is more effective to implement dredging and declogging for same drainage area simultaneously. Therefore, the rehabilitation works should be limited in the most critical area for mitigating inundation condition in earlier phase.

Additional works can be started in earlier phase, because it will not be accompanied by severe relocation problem. However, it should be noted that additional works usually require higher cost than rehabilitation work.

Twelve of the 15 large pumping stations are very old. It should be rehabilitated as soon as possible.

### **(3) Phasing of Proposed Structural Measures for Implementation**

Drainage improvement is planned to be implemented in 3 phases aiming at the target year of 2020 commencing in the year 2006. *Table E.5.14* shows the phasing of the proposed structural measures.

The proposed phasing for the dredging and declogging is as follows.

#### ***Phase 1:***

- Dredging 139,000 m<sup>3</sup>
- Declogging 20,000 m<sup>3</sup>
- Related Works
- Relocation 825 families (15% of 5,500 families)

#### ***Phase 2:***

- Dredging 360,000 m<sup>3</sup>
- Declogging 50,000 m<sup>3</sup>
- Related Works
- Relocation 1925 families (35% of 5,500 families)

**Phase 3:**

- Dredging 340,000 m<sup>3</sup>
- Declogging 11,000 m<sup>3</sup>
- Related Works
- Relocation 2750 families (50% of 5,500 families)

The phasing for each channel division is shown in *Tables E.5.15 and E.5.16* and in *Figure E.5.12*.

It is proposed to execute the rehabilitation works of the drainage pumping stations as follows.

**Phase 1: 12 Pumping Stations**

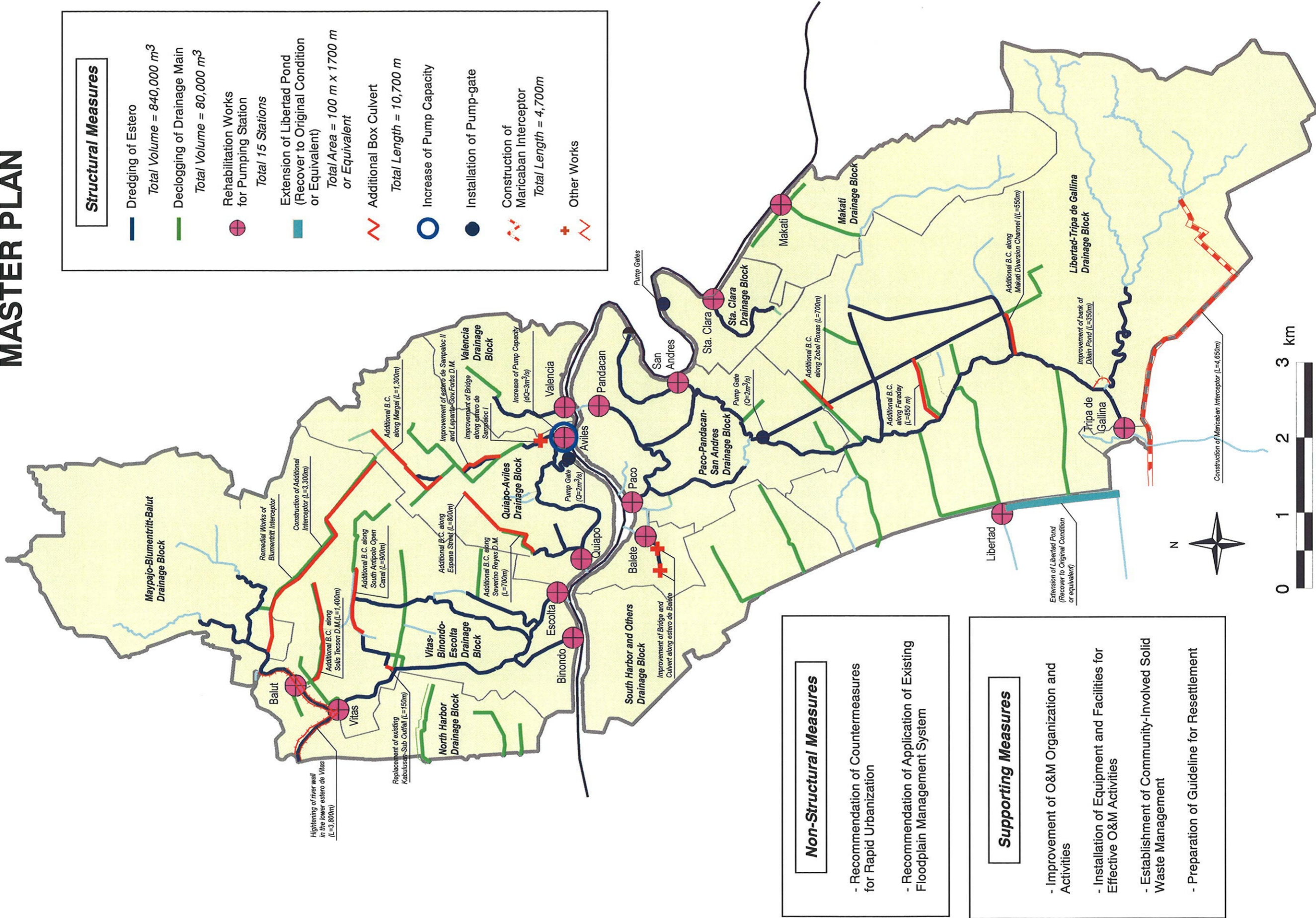
Quiapo, Aviles, Valencia, Tripa de Gallina, Pandacan, Binondo, Paco, Sta. Clara, Makati, Libertad, Balete and Escolta

**Phase 2: 3 Pumping Stations**

Vitas, Balut and San Andres

The additional works are listed in *Table E.5.14*.

# MASTER PLAN



### Structural Measures

- Dredging of Estero  
Total Volume = 840,000 m<sup>3</sup>
- Declogging of Drainage Main  
Total Volume = 80,000 m<sup>3</sup>
- Rehabilitation Works for Pumping Station  
Total 15 Stations
- Extension of Libertad Pond (Recover to Original Condition or Equivalent)  
Total Area = 100 m x 1700 m or Equivalent
- Additional Box Culvert  
Total Length = 10,700 m
- Increase of Pump Capacity
- Installation of Pump-gate
- Construction of Maricaban Interceptor  
Total Length = 4,700m
- Other Works

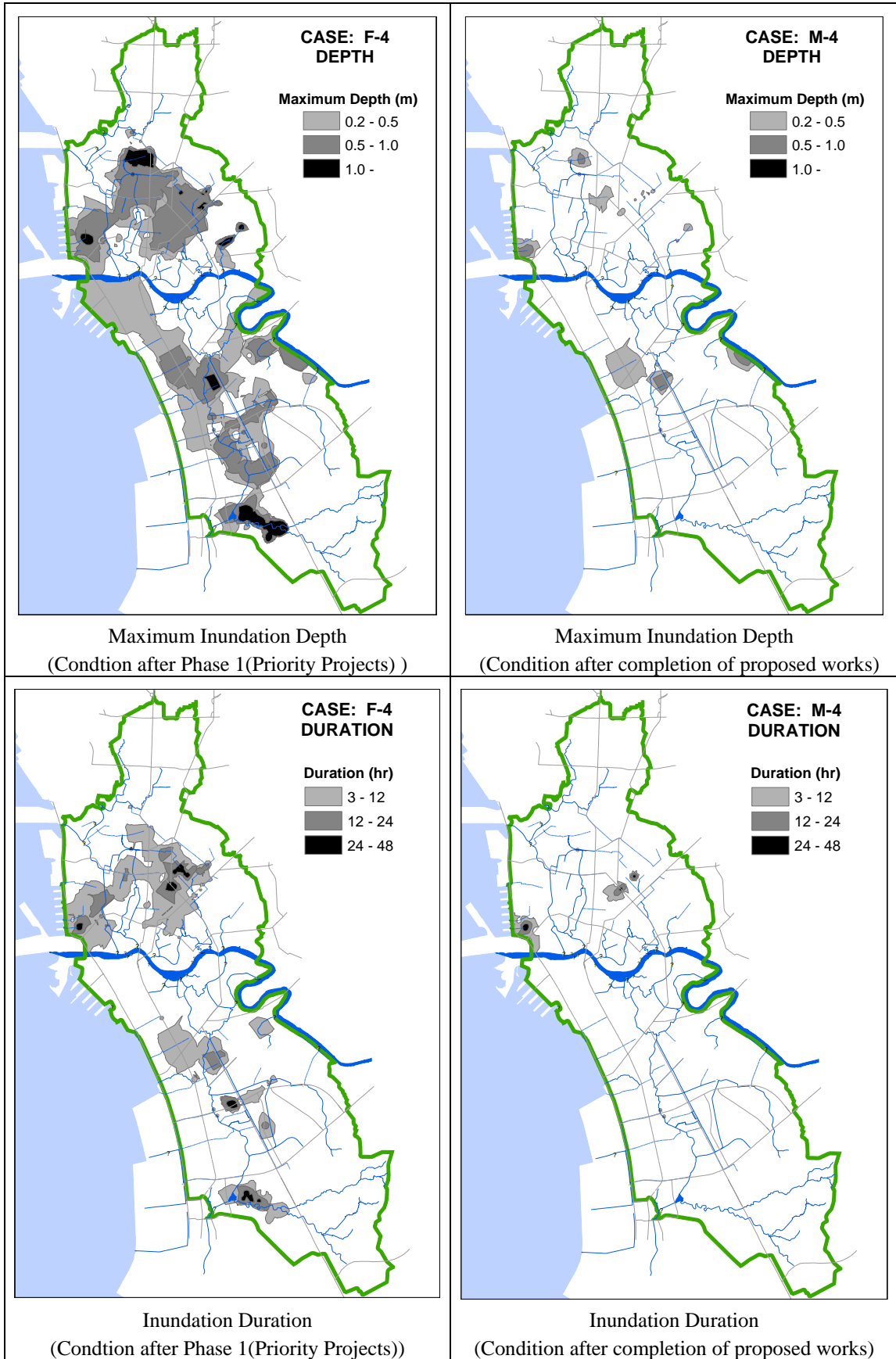
### Non-Structural Measures

- Recommendation of Countermeasures for Rapid Urbanization
- Recommendation of Application of Existing Floodplain Management System

### Supporting Measures

- Improvement of O&M Organization and Activities
- Installation of Equipment and Facilities for Effective O&M Activities
- Establishment of Community-Involved Solid Waste Management
- Preparation of Guideline for Resettlement

Figure E.5.10 Master Plan



**Figure E.5.11 Simulated Inundation Conditions after Completion of Proposed Works**

**Table E.5.14 Phasing of Proposed Structural Measures**

Drainage Block		Item	Sub-Item	Phase 1	Phase 2	Phase 3
<b>Rehabilitation Works</b>						
		Rehabilitation works of drainage channels		x	x	x
		Rehabilitation works of drainage pumping stations		x	x	
<b>Additional Works</b>						
N01	Vitas-Binondo-Escolta	Additional works of South Antipolo area	Replacement of existing Kubulusan Sub Outfall Additional B.C. along South Antipolo Open Canal Additional B.C. along Solis Tescon D.M.		x	x
N02	Quiapo-Aviles	Additional works of channel to Quiapo Pumping Station	Additional B.C. of Severino Reyes D.M. Extension of B.C. along Espana Street Additional B.C. along Margal		x	
		Additional works for Aviles drainage area	Improvement of a Bridge along Estero de Sampaloc I and Lepanto-Gov. Forbes D.M. Increasing of Pump Capacity at Aviles P.S. Installation of Pump Gate at Uli-Uli floodgate	x		
N04	Maypajo-Blumentritt-Balut	Additional works of Estero de Vitas	Hightenning of river wall in the lower estro de Vitas			x
		Additional works of Blumentritt Interceptor	Remedial works of existing Blumentritt Interceptor Construction of Additional Interceptor	x		
S01	Libertad-Tripa de Gallina	Additional works for severe inundation area in South Manila	Additional B.C. along Zobel Roxas D.M. Additional B.C. along Faraday D.M.	x		
		Additional works of Libertad pond	Additional B.C. along Makati Diversion Channel		x	
		Additional Works of Dilain/Maricaban Creek area	Expansion of the existing Libertad pond Construction of Maricaban Interceptor Improvement of Dilain Pond			x
S02	Balete	Additional works in Estero de Balete	Improvement of Padre Burgos B.C. Improvement of bridge cross San Maecelino St.			x
S03	Paco-Pandacan-San Andres	Additional works on Perilita Creek	Installation of Pump Gate on Perilita Creek		x	
S04	Sta.Clara	Additional works in Sta.Clara drainage basin	Installation of Pump Gates in Sta.Clara drainage basin			x

**Table E.5.15 Phasing of Dredging for Each Channel Section (1/2)**

Waterway	Name of Estero	SECCODE	Length (m)	Channel Category	Dredging Volume (m <sup>3</sup> )	Estimated number of buildings within channel	Dredging Phasing	D-VOL (m <sup>3</sup> ) Phase-1	D-VOL (m <sup>3</sup> ) Phase-2	D-VOL (m <sup>3</sup> ) Phase-3	No of buildings Phase-1	No of buildings Phase-2	No of buildings Phase-3
NE01	Estero De Vitas	NE0101	873	Trunk	76085	34	2	0	76085	0	0	34	0
NE01	Estero De Vitas	NE0102	171	Trunk	800	0	2	0	800	0	0	0	0
NE01	Estero De Vitas	NE0103	948	Trunk	32662	17	2	0	32662	0	0	17	0
NE02	Estero De Sunog Apog/ Maypajo	NE0201	606	Trunk	27825	0	1	27825	0	0	0	0	0
NE02	Estero De Sunog Apog/ Maypajo	NE0202	1221	Trunk	63650	37	1	63650	0	0	37	0	0
NE02	Estero De Sunog Apog/ Maypajo	NE0203	270	Secondary	11623	2	3	0	0	11623	0	0	2
NE02	Estero De Sunog Apog/ Maypajo	NE0204	263	Tertiary	2530	26	3	0	0	2530	0	0	26
NE02	Estero De Sunog Apog/ Maypajo	NE0205	813	Tertiary	5772	39	3	0	0	5772	0	0	39
NE02	Estero De Sunog Apog/ Maypajo	NE0206	1093	Tertiary	0	3	-	0	0	0	0	0	0
NE02b1	Estero De Sunog Apog/ Maypajo	NE02b1	176	Tertiary	0	-	-	0	0	0	0	0	0
NE02b2	Estero De Sunog Apog/ Maypajo	NE02b2	499	Tertiary	0	-	-	0	0	0	0	0	0
NE03	Casili Creek	NE0301	901	Secondary	6025	0	3	0	0	6025	0	0	0
NE03	Casili Creek	NE0302	1474	Tertiary	0	0	-	0	0	0	0	0	0
NE04	Estero Dela Reina	NE0400	172	-	0	-	-	0	0	0	0	0	0
NE04	Estero Dela Reina	NE0401	538	Trunk	9853	0	3	0	0	9853	0	0	0
NE04	Estero Dela Reina	NE0402	256	Trunk	4281	0	3	0	0	4281	0	0	0
NE04	Estero Dela Reina	NE0403	352	Trunk	1927	0	3	0	0	1927	0	0	0
NE04	Estero Dela Reina	NE0404	312	Trunk	3692	12	3	0	0	3692	0	0	12
NE04	Estero Dela Reina	NE0405	489	Trunk	761	3	3	0	0	761	0	0	3
NE04	Estero Dela Reina	NE0406	897	Trunk	10739	97	2	0	10739	0	0	97	0
NE05	Estero De Binondo	NE0500	119	-	0	-	-	0	0	0	0	0	0
NE05	Estero De Binondo	NE0501	922	Trunk	7310	0	3	0	0	7310	0	0	0
NE06	Estero De Magdalena	NE0601	846	Secondary	16970	12	3	0	0	16970	0	0	12
NE06	Estero De Magdalena	NE0602	666	Tertiary	1925	23	3	0	0	1925	0	0	23
NE07	Estero De San Lazaro	NE0701	1012	Secondary	27788	31	3	0	0	27788	0	0	31
NE07	Estero De San Lazaro	NE0702	176	Tertiary	2923	-	3	0	0	2923	0	0	-
NE07	Estero De San Lazaro	NE0703	509	-	0	-	-	0	0	0	0	0	0
NE07	Estero De San Lazaro	NE0704	428	Tertiary	2142	-	3	0	0	2142	0	0	-
NE07	Estero De San Lazaro	NE0705	708	Tertiary	2130	-	3	0	0	2130	0	0	-
NE08	Estero De Kabulusan	NE0801	690	Secondary	8371	5	2	0	8371	0	0	5	0
NE09	South Antipolo Open Canal	NE0901	182	Tertiary	0	0	-	0	0	0	0	0	0
NE09	South Antipolo Open Canal	NE0902	371	Tertiary	1834	17	-	0	0	0	0	0	0
NE09	South Antipolo Open Canal	NE0903	276	Tertiary	1730	42	-	0	0	0	0	0	0
NE10	North Antipolo Open Canal	NE1001	257	Tertiary	2351	0	-	0	0	0	0	0	0
NE10	North Antipolo Open Canal	NE1002	523	Tertiary	2783	95	-	0	0	0	0	0	0
NE11	Estero De Tutuban	NE1101	450	Tertiary	0	-	-	0	0	0	0	0	0
NE12	Estero De Qulapo	NE1200	211	-	0	-	-	0	0	0	0	0	0
NE12	Estero De Qulapo	NE1201	155	Trunk	3206	4	2	0	3206	0	0	4	0
NE12	Estero De Qulapo	NE1202	219	Trunk	4003	10	2	0	4003	0	0	10	0
NE12	Estero De Qulapo	NE1203	529	Trunk	6855	5	2	0	6855	0	0	5	0
NE13	Estero De San Sebastian	NE1301	379	Tertiary	1685	5	3	0	0	1685	0	0	5
NE14	Estero De San Miguel/ Uli Uli	NE1401	630	Tertiary	6045	0	3	0	0	6045	0	0	0
NE14	Estero De San Miguel/ Uli Uli	NE1402	698	Trunk	12155	24	3	0	0	12155	0	0	24
NE14	Estero De San Miguel/ Uli Uli	NE1403	1346	Trunk	17808	22	3	0	0	17808	0	0	22
NE15	Estero De Alix	NE1501	216	Tertiary	0	-	-	0	0	0	0	0	0
NE15	Estero De Alix	NE1502	270	Tertiary	0	-	-	0	0	0	0	0	0
NE15	Estero De Alix	NE1503	165	Tertiary	0	-	-	0	0	0	0	0	0
NE16	Estero De Aviles	NE1601	345	Trunk	1783	0	3	0	0	1783	0	0	0
NE17	Estero De Sampaloc I	NE1700	63	-	0	-	-	0	0	0	0	0	0
NE17	Estero De Sampaloc I	NE1701	123	Trunk	2156	0	2	0	2156	0	0	0	0
NE17	Estero De Sampaloc I	NE1702	537	Trunk	7240	0	2	0	7240	0	0	0	0
NE18	Estero De Sampaloc II	NE1801	506	Tertiary	4786	1	2	0	4786	0	0	1	0
NE19	Estero De Calubcob	NE1901	337	Tertiary	1136	4	2	0	1136	0	0	4	0
NE20	Estero De Valencia	NE2000	98	-	0	-	-	0	0	0	0	0	0
NE20	Estero De Valencia	NE2001	490	Trunk	13993	58	3	0	0	13993	0	0	58
NE20	Estero De Valencia	NE2002	637	Trunk	4930	72	3	0	0	4930	0	0	72
	Total (North Manila)					700		91475	158038	166053	37	177	329

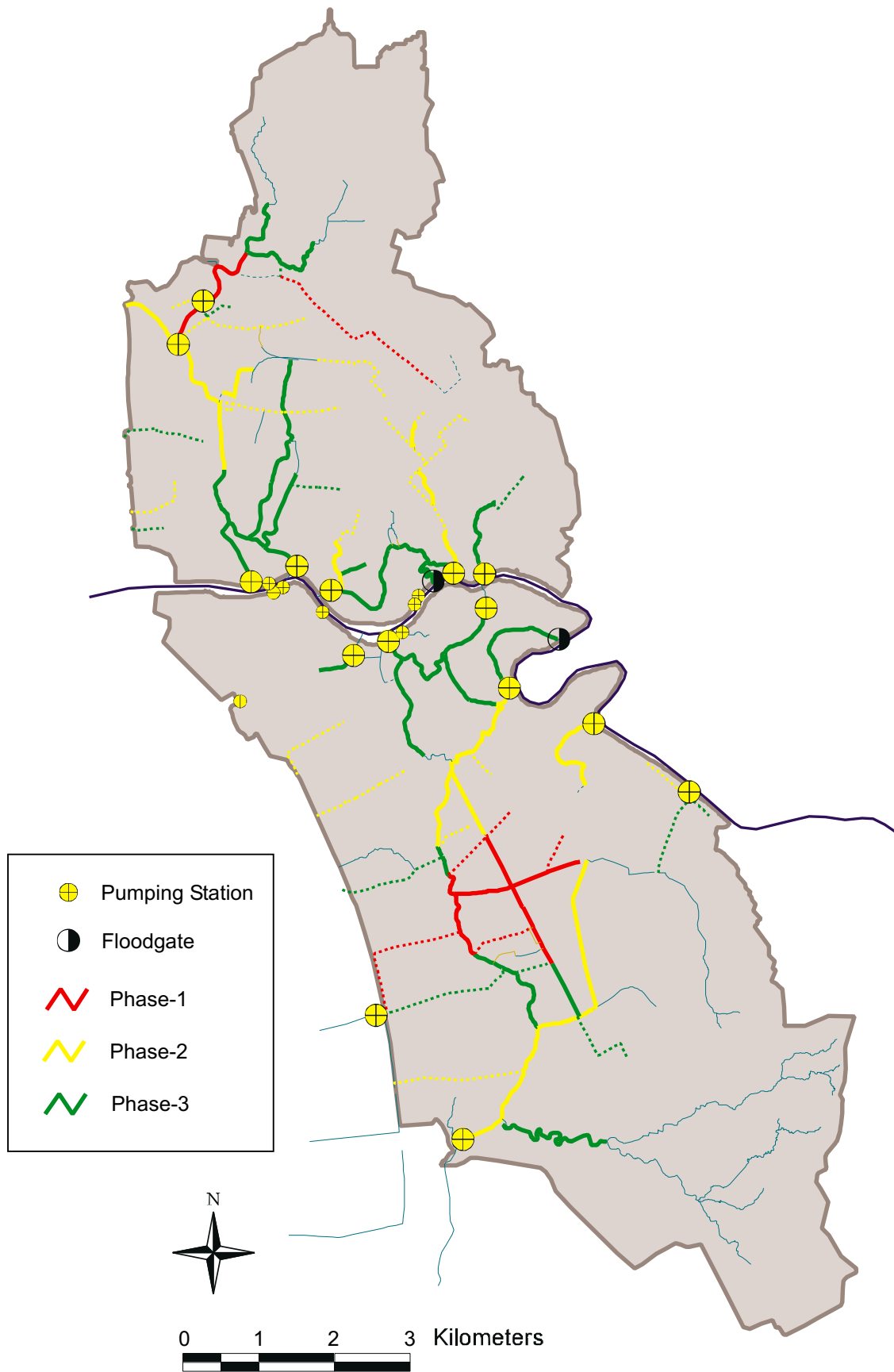


**Table E.5.15 Phasing of Dredging for Each Channel Section (2/2)**

Waterway	Name of Estero	SECCODE	Length (m)	Channel Category	Dredging Volume (m <sup>3</sup> )	Estimated number of buildings within channel	Dredging Phasing	D-VOL (m <sup>3</sup> ) Phase-1	D-VOL (m <sup>3</sup> ) Phase-2	D-VOL (m <sup>3</sup> ) Phase-3	No of buildings Phase-1	No of buildings Phase-2	No of buildings Phase-3
SE01	Estero De Provisor	SE0101	1018	-	0	0	-	0	0	0	0	0	0
SE02	Estero De Tanque	SE0201	344	-	0	0	-	0	0	0	0	0	0
SE03	Estero De Balete	SE0301	550	Trunk	4601	11	3	0	0	4601	0	0	11
SE04	Estero De Santebanez	SE0401	516	Tertiary	0	4	-	0	0	0	0	0	0
SE05	Santa Clara Creek	SE0500	95	-	0	-	-	0	0	0	0	0	0
SE05	Santa Clara Creek	SE0501	487	Trunk	5685	0	2	0	5685	0	0	0	0
SE05	Santa Clara Creek	SE0502	905	Trunk	10431	10	2	0	10431	0	0	10	0
SE06	Estero De Paco	SE0600	127	-	0	-	-	0	0	0	0	0	0
SE06	Estero De Paco	SE0601	288	Trunk	2958	1	3	0	0	2958	0	0	1
SE06	Estero De Paco	SE0602	266	Trunk	3207	0	3	0	0	3207	0	0	0
SE06	Estero De Paco	SE0603	1217	Trunk	11232	209	3	0	0	11232	0	0	209
SE06	Estero De Paco	SE0604	499	Trunk	0	68	-	0	0	0	0	0	0
SE07	Estero De Concordia	SE0701	1070	Trunk	24702	0	3	0	0	24702	0	0	0
SE08	Estero De Pandacan	SE0800	351	-	0	0	-	0	0	0	0	0	0
SE08	Estero De Pandacan	SE0801	853	Trunk	10115	0	3	0	0	10115	0	0	0
SE08	Estero De Pandacan	SE0802	710	Trunk	6005	25	3	0	0	6005	0	0	25
SE08	Estero De Pandacan	SE0803	366	Trunk	1915	26	3	0	0	1915	0	0	26
SE08	Estero De Pandacan	SE0804	292	Trunk	2446	0	2	0	2446	0	0	0	0
SE08	Estero De Pandacan	SE0805	1657	Trunk	7148	1	3	0	0	7148	0	0	1
SE08	Estero De Pandacan	SE0899	89	-	0	-	-	0	0	0	0	0	0
SE09	Estero de Tripa de Gallina	SE0900	100	-	0	-	-	0	0	0	0	0	0
SE09	Estero de Tripa de Gallina	SE0901	436	Trunk	40900	1	2	0	40900	0	0	1	0
SE09	Estero de Tripa de Gallina	SE0902	305	Trunk	34362	20	2	0	34362	0	0	20	0
SE09	Estero de Tripa de Gallina	SE0903	575	Trunk	18337	126	2	0	18337	0	0	126	0
SE09	Estero de Tripa de Gallina	SE0904	613	Trunk	22220	168	2	0	22220	0	0	168	0
SE09	Estero de Tripa de Gallina	SE0905	887	Trunk	26670	114	3	0	0	26670	0	0	114
SE09	Estero de Tripa de Gallina	SE0906	215	Trunk	9379	17	3	0	0	9379	0	0	17
SE09	Estero de Tripa de Gallina	SE0907	132	Trunk	3750	22	3	0	0	3750	0	0	22
SE09	Estero de Tripa de Gallina	SE0908	281	Trunk	8586	51	3	0	0	8586	0	0	51
SE09	Estero de Tripa de Gallina	SE0909	355	Trunk	11865	49	1	11865	0	0	49	0	0
SE09	Estero de Tripa de Gallina	SE0910	533	Trunk	10184	131	1	10184	0	0	131	0	0
SE09	Estero de Tripa de Gallina	SE0911	359	Trunk	6833	50	1	6833	0	0	50	0	0
SE09	Estero de Tripa de Gallina	SE0912	269	Trunk	4882	9	3	0	0	4882	0	0	9
SE09	Estero de Tripa de Gallina	SE0913	150	Trunk	1698	8	3	0	0	1698	0	0	8
SE09	Estero de Tripa de Gallina	SE0914	1054	Trunk	10421	72	2	0	10421	0	0	72	0
SE09	Estero de Tripa de Gallina	SE0915	135	Trunk	1615	3	2	0	1615	0	0	3	0
SE09	Estero de Tripa de Gallina	SE0916	313	Trunk	3832	12	2	0	3832	0	0	12	0
SE09	Estero de Tripa de Gallina	SE0917	926	Trunk	9378	5	2	0	9378	0	0	5	0
SE10	Perilita Creek	SE1001	922	Tertiary	3264	12	2	0	3264	0	0	12	0
SE11	PNR Canal	SE1101	731	Tertiary	1533	6	1	1533	0	0	6	0	0
SE11	PNR Canal	SE1102	313	Tertiary	1011	1	1	1011	0	0	1	0	0
SE11	PNR Canal	SE1103	839	Tertiary	2426	2	1	2426	0	0	2	0	0
SE11	PNR Canal	SE1104	771	Tertiary	1499	105	3	0	0	1499	0	0	105
SE12	Calatagan Creek I	SE1201	763	Secondary	6679	6	1	6679	0	0	6	0	0
SE12	Calatagan Creek I	SE1202	948	Secondary	6483	0	1	6483	0	0	0	0	0
SE13	Calatagan Creek II	SE1301	609	Secondary	0	0	-	0	0	0	0	0	0
SE13	Calatagan Creek II	SE1302	388	Secondary	0	0	-	0	0	0	0	0	0
SE14	Calatagan Creek III	SE1401	1031	Secondary	0	0	-	0	0	0	0	0	0
SE14	Calatagan Creek III	SE1402	504	Secondary	0	0	-	0	0	0	0	0	0
SE14	Calatagan Creek III	SE1403	1023	Tertiary	0	0	-	0	0	0	0	0	0
SE14b1	Calatagan Creek III	SE14b1	217	Tertiary	0	-	-	0	0	0	0	0	0
SE15	Zanzibar Creek	SE1501	329	Tertiary	0	-	-	0	0	0	0	0	0
SE16	Makati Diversion Channel I	SE1601	549	Secondary	6818	0	2	0	6818	0	0	0	0
SE16	Makati Diversion Channel I	SE1602	265	Secondary	4349	43	2	0	4349	0	0	43	0
SE16	Makati Diversion Channel I	SE1603	980	Secondary	0	0	-	0	0	0	0	0	0
SE17	Makati Diversion Channel II	SE1701	607	Secondary	14958	0	2	0	14958	0	0	0	0
SE17	Makati Diversion Channel II	SE1702	836	Secondary	10535	0	2	0	10535	0	0	0	0
SE17	Makati Diversion Channel II	SE1703	550	Secondary	2810	0	2	0	2810	0	0	0	0
SE18	Dilain Creek/ Maricaban Creek I	SE1801	115	Secondary	0	-	-	0	0	0	0	0	0
SE18	Dilain Creek/ Maricaban Creek I	SE1802	2151	Secondary	45823	9	3	0	0	45823	0	0	9
SE18	Dilain Creek/ Maricaban Creek I	SE1803	478	Tertiary	0	0	-	0	0	0	0	0	0
SE18	Dilain Creek/ Maricaban Creek I	SE1804	492	Tertiary	0	15	-	0	0	0	0	0	0
SE18	Dilain Creek/ Maricaban Creek I	SE1805	3086	Tertiary	0	-	-	0	0	0	0	0	0
SE18b1	Dilain Creek/ Maricaban Creek I	SE18b1	987	Tertiary	0	-	-	0	0	0	0	0	0
SE18b2	Dilain Creek/ Maricaban Creek I	SE18b2	395	Tertiary	0	-	-	0	0	0	0	0	0
SE19	Maricaban Creek II	SE1901	759	Tertiary	0	0	-	0	0	0	0	0	0
SE19	Maricaban Creek II	SE1902	3482	Tertiary	0	-	-	0	0	0	0	0	0
SE19b1	Maricaban Creek II	SE19b1	1080	Tertiary	0	-	-	0	0	0	0	0	0
SE19b2	Maricaban Creek II	SE19b2	1253	Tertiary	0	-	-	0	0	0	0	0	0
SE19b3	Maricaban Creek II	SE19b3	242	Secondary	0	-	-	0	0	0	0	0	0
SE20	Estero de San Antonio Abad	SE2001	384	Secondary	0	0	-	0	0	0	0	0	0
SE20	Estero de San Antonio Abad	SE2002	612	Secondary	0	0	-	0	0	0	0	0	0
SE20	Estero de San Antonio Abad	SE2003	757	-	0	0	-	0	0	0	0	0	0
SE21	Libertad Channel	SE2100	177	Secondary	0	-	-	0	0	0	0	0	0
SE21	Libertad Channel	SE2101	914	Secondary	0	-	-	0	0	0	0	0	0
SE21	Libertad Channel	SE2102	1691	-	0	-	-	0	0	0	0	0	0
SE21b1	Libertad Channel	SE21b1	2486	-	0	-	-	0	0	0	0	0	0
SE21b2	Libertad Channel	SE21b2	725	-	0	-	-	0	0	0	0	0	0
SE22	Slo Ni- Creek	SE2201	168	Tertiary	0	-	-	0	0	0	0	0	0
SE99	Paranaque	SE9901	1994	-	0	-	-	0	0	0	0	0	0
Total (South Manila)								47013	202362	174169	245	472	608
Total								138489	360400	340222	282	649	937
%											15	35	50

**Table E.5.16 Phasing of Declogging for Each Channel Section**

Waterway	Name of Channel	Length (m)	SEC CODE	Channel Category	Dredging Volume (m <sup>3</sup> )	Declogging Phasing	D-VOL (m <sup>3</sup> ) Phase-1	D-VOL (m <sup>3</sup> ) Phase-2	D-VOL (m <sup>3</sup> ) Phase-3
ND01	Pacheco	1157	ND0101	Secondary	1879	3	0	0	1879
ND02	Lakandula	737	ND0201	Tertiary	3507	2	0	3507	0
ND02	Lakandula	136	ND0202	Tertiary	13	2	0	13	0
ND03	Zaragoza Sub	429	ND0301	Tertiary	279	3	0	0	279
ND04	Buendia	295	ND0401	Secondary	459	2	0	459	0
ND04	Buendia	216	ND0402	Secondary	135	2	0	135	0
ND05	Blumentritt Interceptor	183	ND0501	Tertiary	861	3	0	0	861
ND05	Blumentritt Interceptor	1568	ND0502	Secondary	5895	1	5895	0	0
ND05	Blumentritt Interceptor	1024	ND0503	Secondary	3817	1	3817	0	0
ND05	Blumentritt Interceptor	201	ND0504	Tertiary	0	-	0	0	0
ND05	Blumentritt Interceptor (NEW)	590	ND05N01	Secondary		-	0	0	0
ND06	Kanlaon	452	ND0601	Tertiary	188	-	0	0	0
ND06	Kanlaon	178	ND0602	Tertiary	5	-	0	0	0
ND07	Pampanga-Earnshaw Sub	653	ND0701	Secondary	606	2	0	606	0
ND07	Pampanga-Earnshaw Sub	386	ND0702	Tertiary	1017	3	0	0	1017
ND08	Solis-Tecson	61	ND0801	Tertiary	47	3	0	0	47
ND08	Solis-Tecson	756	ND0802	Tertiary	1498	2	0	1498	0
ND08	Solis-Tecson	319	ND0803	Tertiary	370	2	0	370	0
ND08	Solis-Tecson	289	ND0804	Tertiary	388	2	0	388	0
ND09	South Antipolo	1229	ND0901	Tertiary	7261	2	0	7261	0
ND09	South Antipolo	151	ND0902	Tertiary	358	2	0	358	0
ND10	Kabulusan Sub	143	ND1001	Secondary	415	-	0	0	0
ND11	Kabulusan	366	ND1101	Secondary	1935	2	0	1935	0
ND12	Tayuman	859	ND1201	Secondary	2921	2	0	2921	0
ND12	Tayuman	739	ND1202	Tertiary	834	2	0	834	0
ND13	Fugoso	367	ND1301	Tertiary	915	3	0	0	915
ND13	Fugoso	302	ND1302	Tertiary	350	3	0	0	350
ND14	Severino Reyes	231	ND1401	Secondary	77	2	0	77	0
ND14	Severino Reyes	415	ND1402	Secondary	243	2	0	243	0
ND15	Lepanto-Gov. Forbes	1160	ND1501	Secondary	7817	2	0	7817	0
ND16	Lepanto-Josefina	900	ND1601	Tertiary	1290	2	0	1290	0
ND16	Lepanto-Josefina	163	ND1602	Tertiary	144	2	0	144	0
ND17	Economia	256	ND1701	Secondary	1562	2	0	1562	0
ND17	Economia	567	ND1702	Tertiary	469	2	0	469	0
ND18	Washington-P. Margal	212	ND1801	Tertiary	485	2	0	485	0
ND19	Visayas	326	ND1901	Tertiary	610	3	0	0	610
ND19	Visayas	272	ND1902	Tertiary	493	3	0	0	493
ND19	Visayas	76	ND1903	Tertiary	0	3	0	0	0
SD01	Padre Faura	450	SD0101	Secondary	375	2	0	375	0
SD01	Padre Faura	291	SD0102	Secondary	250	2	0	250	0
SD01	Padre Faura	417	SD0103	Secondary	276	2	0	276	0
SD02	Remedios	597	SD0201	Secondary	1990	2	0	1990	0
SD02	Remedios	368	SD0202	Secondary	828	2	0	828	0
SD02	Remedios	384	SD0203	Secondary	375	2	0	375	0
SD03	Masukol	132	SD0301	Tertiary		-	0	0	0
SD04	Makati Headrace-I	626	SD0401	Secondary	2280	2	0	2280	0
SD05	Makati Headrace-II	393	SD0501	Secondary	374	3	0	0	374
SD06	Zobel Orbit	1219	SD0601	Secondary	505	3	0	0	505
SD07	Onyx	414	SD0701	Tertiary	456	2	0	456	0
SD08	Estrada	307	SD0801	Tertiary	538	2	0	538	0
SD08	Estrada	211	SD0802	Tertiary	144	2	0	144	0
SD09	Zobel Roxas	700	SD0901	Secondary	2026	1	2026	0	0
SD09	Zobel Roxas	454	SD0902	Secondary	94	1	94	0	0
SD10	Faraday	466	SD1001	Secondary	53	1	53	0	0
SD10	Faraday	351	SD1002	Secondary	47	1	47	0	0
SD11	Pasong Tamo	543	SD1101	Tertiary	911	1	911	0	0
SD12	SSH-Way	570	SD1201	Tertiary	150	3	0	0	150
SD12	SSH-Way	323	SD1202	Tertiary	161	3	0	0	161
SD12	SSH-Way	214	SD1203	Tertiary	0	3	0	0	0
SD13	Vito Cruz	1450	SD1301	Secondary	521	3	0	0	521
SD14	Buendia Outfall	1992	SD1401	Secondary	7152	1	7152	0	0
SD15	Libertad Outfall	1796	SD1501	Secondary	2816	3	0	0	2816
SD16	EDSA Outfall	1731	SD1601	Secondary	10142	2	0	10142	0
SD17	Dolores	434	SD1701	Tertiary		3	0	0	
SD18	United Nations Interceptor	169	SD1801	Tertiary		-	0	0	0
	Total (North Manila)						9713	32370	6452
	Total (South Manila)						10282	17653	4527
	Total						19995	50023	10979



**Figure E.5.12 Phasing of Rehabilitation Works of Drainage Channels**

## **E.5.8 PRIORITY PROJECTS**

Proposed Phase 1 projects in the master plan are taken up as the priority projects. Outline of the priority projects is presented in *Figure E.5.13*.

### **(1) Menu of Structural Measures**

#### ***Rehabilitation Works of Drainage Channels***

- Dredging of Esteros/Creeks : 139,000 m<sup>3</sup>  
Estero de Sunog Apog/Maypajo (partially), Estero de Tripa de Gallina (partially),  
PNR Canal (partially), Calatagan Creek I
- Declogging of Drainage Mains: 20,000 m<sup>3</sup>  
Blumentritt Interceptor, Buendia Outfall, Zobel Roxas D.M.,  
Faraday D.M., Pasong Tamo D.M.

#### ***Rehabilitation Works of Drainage Pumping Stations***

- Rehabilitation: 12 Pumping Stations  
(Quiapo, Aviles, Valencia, Binondo, Escolta, Tripa de Gallina, Pandacan, Paco, Sta.Clara,  
Libertad, Makati, Balete)

#### ***Additional Works for North Manila***

- Additional works for Aviles drainage area  
Increase of pump capacity at Aviles Pumping Station
- Additional works of existing Blumentritt interceptor  
Remedial works of existing Blumentritt Interceptor  
Construction of Additional Interceptor

#### ***Additional Works for South Manila***

- Additional works for severe inundation area in South Manila  
Additional B.C. along Zobel Roxas D.M.  
Additional B.C. along Faraday D.M.

### **(2) Effect of Structural Measures in the Priority Projects**

The above-mentioned rehabilitation works and additional works for drainage channels will bring about the improvement of inundation condition. The inundation condition after implementing the priority project is simulated by MOUSE and is presented in *Figure E.5.11*

### **(3) Menu of Supporting Measures**

- 1) Improvement of Operation and Maintenance Organization and Activities and Promotion of Community-Involved Activities
  - Improvement of the existing O&M organization and activities including establishment of community-involved O&M
  - Community-Involved Solid Waste Management
- 2) Installation of Additional Hydrological Equipment
- 3) Introduction of Emergency Operation and Maintenance Equipment
- 4) Preparation of Guideline for Resettlement

## E.5.8 PRIORITY PROJECTS

Proposed Phase 1 projects in the master plan are taken up as the priority projects. Outline of the priority projects is presented in *Figure E.5.13*.

### (1) Menu of Structural Measures

#### *Rehabilitation Works of Drainage Channels*

Dredging of Esteros Creek : 139,000 m<sup>3</sup>  
Estero de Sunog Apog Mapap (partially), Estero de Tripa de Gallina (partially),  
PNR Canal (partially), Calatagan Creek  
Declogging of Drainage Mains: 20,000 m<sup>3</sup>  
Blumentritt Interceptor, Buendia Outfall, Zobel Roas D.M.,  
Faraday D.M., Pasong Tamo D.M.

#### *Rehabilitation Works of Drainage Pumping Stations*

Rehabilitation: 12 Pumping Stations  
(Quiapo, Aviles, Valencia, Binondo, Escolta, Tripa de Gallina, Pandacan, Paco, Sta. Clara,  
Libertad, Makti, Balete)

#### *Additional Works for North Manila*

Additional work for Aviles drainage area  
Increase of pump capacity at Aviles Pumping Station  
Additional work of existing Blumentritt interceptor  
Remedial work of existing Blumentritt Interceptor  
Construction of Additional Interceptor

#### *Additional Works for South Manila*

Additional work for severe inundation area in South Manila  
Additional B.C. along Zobel Roas D.M.  
Additional B.C. along Faraday D.M.

### (2) Effect of Structural Measures in the Priority Projects

The above-mentioned rehabilitation work and additional work for drainage channels will bring about the improvement of inundation condition. The inundation condition after implementing the priority project is simulated by MOUSE and is presented in *Figure E.5.11*

### (3) Menu of Supporting Measures

- 1) Improvement of Operation and Maintenance Organization and Activities and Promotion of Community Involved Activities
  - Improvement of the existing O&M organization and activities including establishment of community involved O&M
  - Community Involved Solid Waste Management
- 2) Installation of Additional Hydrological Equipment
- 3) Introduction of Emergency Operation and Maintenance Equipment
- 4) Preparation of Guideline for Resettlement

# PRIORITY PROJECTS

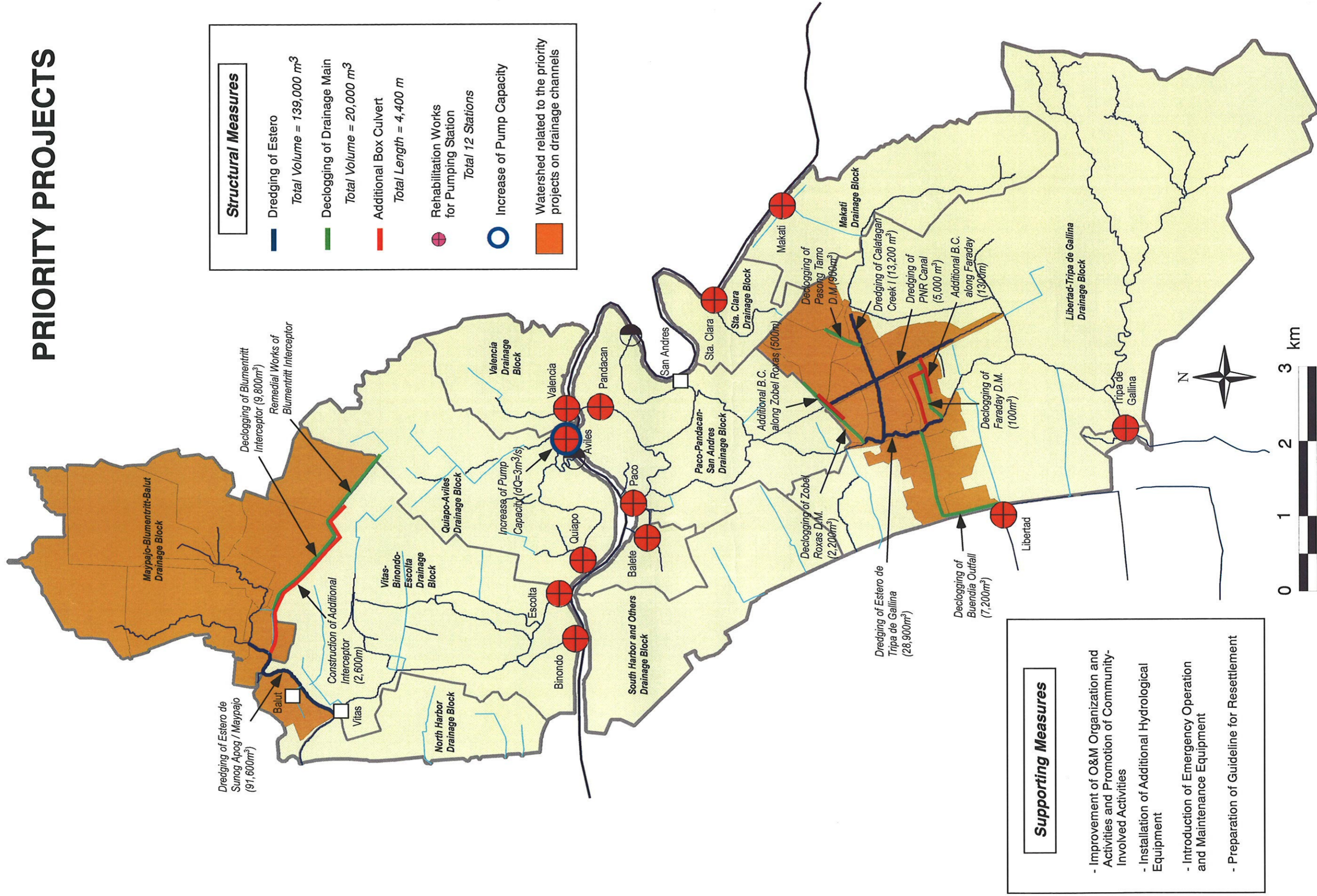


Figure E.5.13 Priority Projects

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- <sup>3</sup> DPWH, JICA, Flood Control and Drainage Project in Metro Manila, 1990.
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