

Environmental and Social Impact Assessment (ESIA) – EXECUTIVE SUMMARY

Project Name:

Metro Manila Flood Management Project – Phase 1

Prepared by:



February 5, 2016





Environmental and Social Impact Assessment (ESIA)

EXECUTIVE SUMMARY

Metro Manila Flood Management Project - Phase 1

Prepared by:

Metro Manila Development Authority (MMDA)

February 5, 2016

EXECUTIVE SUMMARY

INTRODUCTION

- i. Metro Manila, the center of economy and trade in the Philippines and home to about 17 million people, has suffered recurrent flooding resulting in adverse consequences to people's lives and the economy. The effects of a changing climate, an increased frequency of stronger typhoons and storm rainfall, coupled with sea level rise, leads to a higher level of flood risk to Metro Manila. In 2009, Typhoon "Ondoy" (internationally named "Ketsana") caused substantial damage and losses equivalent to about 2.7 percent of the Gross Domestic Product (GDP). Normal business operations were hampered by access problems, power and water shortages, damaged machinery, and absent employees. Flooding has both short and long term effects on jobs, the economy and livelihoods.
- ii. The Government of the Philippines, with the technical and financial support from the World Bank, has prepared a Flood Management Master Plan for the Greater Metro Manila Area. The plan, approved by the National Economic and Development Authority (NEDA) Board on September 4, 2012, sets out priority structural and non-structural measures to facilitate sustainable flood management in the Metro Manila area. The total estimated cost for implementation of the Master Plan is up to PhP 352 billion (about US\$8 billion) over a 20-25 year period.
- iii. The Master Plan envisions three separate and distinct elements related to structural interventions: (1) flood protection works to reduce flooding from rivers that run through the city; (2) flood protection works along the floodplain surrounding Laguna de Bay; and (3) improvements to urban drainage capacity through modernization of existing pump stations, construction of new pump-stations serving flood-prone areas of an expanding Metro Manila, and cleaning of waterways and drainage channels that serve the pumping stations.

THE PROJECT AND YEAR 1 ACTIVITIES

- iv. The Metro Manila Flood Management Project (MMFMP) – Phase 1 (the "Project") relates to the key element of the Master Plan that addresses drainage issues in Metro Manila. Besides the interventions for the pumping stations and related waterways and drainage channels, the Project will also support improvements to solid waste management in waterways that are served by pumping stations and also physical resettlement and economic rehabilitation of project affected persons (PAPs) that would be obstructing the proper operation and maintenance (O&M) of the drainage systems. The majority of the PAPs are Informal Settler Families (ISFs) residing within the technical footprint areas of existing pumping stations which are to be rehabilitated or upgraded.
- v. The components of the Project are:
 - Component 1: Modernization of drainage areas;

- Component 2: Minimizing solid waste in waterways;
 - Component 3: Participatory housing and resettlement; and
 - Component 4: Project management and coordination.
- vi. The Metro Manila Development Authority (MMDA) and the Department of Public Works and Highways (DPWH) will implement the Project together with partner local government units, key shelter agencies and project-affected communities.
- vii. There is a long-list of drainage areas, identified by MMDA, DPWH, and Local Government Units (LGU). Out of this long-list five (5) drainage areas have been identified for modernization during Project Year 1 (PY1). These are drainage areas served by: (i) Vitas Pumping Station; (ii) Balut Pumping Station; (iii) Paco Pumping Station; (iv) Tripa de Gallina Pumping Station; and (v) Labasan Pumping Station. Vitas, Balut, and Paco are located within the City of Manila, while Tripa de Gallina is located in Pasay City and Labasan Pumping Station is located in Taguig City (see Map at the end of this Executive Summary).
- viii. A program of rehabilitating and augmenting the capacity of each of the five pumping stations will be implemented under Phase 1. This will involve the replacement of pumps and related equipment with new, more efficient, and higher capacity units. There will also be clearing of waterways through dredging and removal of solid waste.

OBJECTIVES AND SCOPE OF ESIA

- ix. The Project triggers the World Bank's Environmental Assessment Operational Policy (OP4.01) and the Involuntary Resettlement Policy (OP 4.12) and has been classified as Category A in accordance with the World Bank's Operational Guidelines. Therefore, an Environmental and Social Impact Assessment (ESIA) is required as part of Project financing.
- x. The objectives and scope of the ESIA are to: (i) assess the current environmental and social conditions; (ii) identify key environmental and social issues; (iii) assess the magnitude of impacts; (iv) develop mitigation measures through an Environmental and Social Management Plan (ESMP) and Environmental Codes of Practice (ECOP) that address the potential impacts and risks of the subprojects; and (v) determine the environmental monitoring and reporting requirements, emergency response procedures, institutional or organization arrangements, and capacity development measures to ensure the implementation of the ESMP.
- xi. The Social Impact Assessment (SIA) which forms part of this ESIA aims to examine the potential social impacts (positive and negative) of the proposed Project and to propose ways to avoid negative impacts while exploring ways to improve and ensure sustainability of the project through the following five entry points: (i) gender and diversity; (ii) institutions, rules, and behavior; (iii) stakeholder analysis; (iv) stakeholder participation; and (v) social risks. A Social Management Plan which includes elements of the Resettlement Policy Framework (RPF), Resettlement Action Plan (RAP), grievance redress system, and communication and participation framework has been prepared to

ensure that impacts of land acquisition, resettlement and physical or economic displacement of people in influence areas are addressed.

ESIA METHODOLOGY

- xii. The information presented in this ESIA report is based on field visits and assessment of the project sites, focused group discussions with government agencies and sectoral groups, and from related studies and available secondary information. Discussions were carried out among representatives of flood-prone communities across economic classes, age, and gender in Makati, Manila, Pasay, and Taguig while key informant interviews were done with local government officials, pumping station engineers, and representatives of civil society organizations such as youth groups, homeowners associations, and organization of senior citizens. The assessment was carried out following the Project's draft Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework.
- xiii. Several site visits and informal interviews with potential Project Affected Persons were conducted jointly by MMDA and World Bank between February and November 2015. Visits were also done in off-city and in-city resettlement sites and interviews conducted to understand their situation and assess significant difference between the two approaches. Dialogues with the National Housing Authority (NHA), Social Housing Finance Corporation (SHFC), and people's organizations engaged in resettlement were also conducted to understand the opportunities and constraints encountered.
- xiv. Water quality and sediment samples were collected from the various waterways where the five pumping stations are located. The samples were analyzed for the physico-chemical characteristics, total coliform, oil & grease, nitrate, phosphate, and heavy metals. The toxicity characteristic leaching procedure (TCLP) was used to determine the sediment toxicity. In addition, ambient noise monitoring at each pumping station site was conducted to determine baseline noise levels and the impacts of noise on workers and adjacent communities.
- xv. Demographics relevant to analyzing the social impacts of flooding were gathered. The main contention is that flooding affects different segments of society differently. Social dimensions with vulnerable groups such as women, children, the elderly, the unemployed, and the poor are given emphasis. As such, impacts were evaluated across gender, age, schooling, employment, livelihoods, and poverty rates.
- xvi. Since the subprojects involve existing pumping stations and waste disposal systems, due diligence on the offsite waste disposal facilities of solid waste collected at the pumping stations and at the existing pumping station facilities was conducted to assess the environmental performance and the management measures that are being undertaken and to recommend measures to improve the current environmental management system.
- xvii. A screening was carried out using the Environmental and Social Screening Matrix in the ESMF which confirmed that the environmental impacts are not expected to cause significant adverse environmental impacts and that negative impacts can be managed by

implementation of appropriate mitigation measures. Particular attention was given to the effects of dredging activities, effects on floodplain ecology, water quality, construction impacts, waste disposal, occupational and community safety and hazards, and socio-economic impacts on populations in the impact areas.

- xviii. A number of impact assessment criteria were used to determine the significance of the impact. These include impact balance, spatial extent, temporal context, and magnitude and level of confidence. For every Project activity identified, expected impacts are identified and rated for their significance using these criteria.
- xix. Environmental Codes of Practice were prepared that will apply to all pumping stations that will undergo modernization or rehabilitation works, require construction of resettlement sites, and other activities that may potentially result to construction-related impacts. Guided by the results of the environmental screening, other impacts which are not covered in the ECOP will be addressed in the ESMPs and RAPs. Construction contractors will be required to implement the ESMP and ECOPs as part of contract stipulations. They will also be ordered to desist from undertaking civil works in areas with PAPs until after a notice-to-proceed has been given by the PMO and the Bank after meeting all agreed safeguards requirements. Oversight will be provided by MMDA or DPWH (depending on what agency will be responsible for the drainage area) to assure that these measures are effectively implemented.

SIGNIFICANT ENVIRONMENTAL AND SOCIAL IMPACTS

Benefits of the Project

- xx. **Flood Reduction.** The main benefit of the Project is the reduction in human risks to life and property arising from flood protection. People currently residing in flood-prone areas will directly benefit from the Project. Considering that the rivers served by the pumping stations are affected by tidal flows or high main river water levels, the pumping stations are particularly important in periods of high tide when Manila Bay and Laguna de Bay water levels or receiving river water levels are much higher than the level of the flood control channels.
- xxi. **Improvement of Quality of Life.** With reduced flood incidence in these areas, there is anticipated improvement in the quality of life, health and sanitation of the people affected by flooding, ease of transport during rainy days, continuation of economic activities, increase in land values and property prices, and poverty reduction. Project benefits also include the reduction of damage to properties and infrastructure, income loss (livelihood and business), and of loss of lives and injuries. During typhoons and the rainy season, project beneficiaries composed of households, small businesses and economic enterprises, commuters, school goers, employees, and all other segments of society within the project areas will be able to carry on with their daily lives with minimal or less (flooding of urban areas can never be completely eliminated, with the level of flooding dependent on the rainfall intensity) disruption due to evacuation, unpassable roads, and absence of utility services. Diseases that occur from exposure to flood waters such as skin rashes, gastrointestinal infection, leptospirosis and other water-borne

diseases will also be minimized. There is also a lesser need for evacuation of people to safe areas during periods of intense rainfall and typhoons and resulting floods.

- xxii. Based on the assessment of effects of flooding on gender and diversity, men are more exposed to health risks than women and that poor families take more time to fully recover their asset base. With the proposed project, men will have less exposure to health risks while women will carry on with their normal household routines. Those living in poor areas need not reestablish their asset base as frequently as before allowing them to have a steadier economic growth path while the elderly and children will have less trauma from flooding as experienced in past devastating typhoons in Metro Manila.

Impacts during Construction Works

- xxiii. **Construction wastes.** Demolition and removal of equipment and facilities at the pumping stations will result in the generation of wastes consisting of old equipment, scrap metal, wires, lighting fixtures, aggregate and other construction spoils. Part of this waste is considered as recyclable, but the Project will produce residual waste materials that require appropriate disposal to prevent adverse environmental impacts. Solid waste will also be generated from the installation of equipment and facilities. These wastes generally consist of scrap metal, aggregates, empty cement bags, and other construction spoils. These materials should also be disposed properly to avoid negative impacts to land and waterways.
- xxiv. **Solid wastes.** The presence of construction workers at the site will generate solid wastes that consist of biodegradable wastes (food wastes, paper) and non-biodegradable wastes such as plastics, food containers, glass, bottles, and aluminum cans. These wastes will have a negative effect on the environment when improperly disposed on land and in waterways.
- xxv. **Oily wastes.** Waste oil and lubricants from the dismantling of motors, pumps, and other auxiliary equipment may result in negative impacts to land and waterways when disposed inadvertently. There are no anticipated PCB-containing transformers that will be decommissioned during Project implementation. The impact of waste oil will be confined to the working area and will occur during the extent of the construction activity only. In addition, the generation of waste oil and lubricants is limited in volume since most of these will be contained in dismantled motors and pumps. Adverse effects of waste oil may come from accidental spill or leaks from the dismantled equipment, but these will be cleaned up immediately and will result in a limited effect on the environment.
- xxvi. **Fugitive dust.** Dust will be generated from the movement of construction vehicles and from construction sites for the rehabilitation of pumping station buildings. Airborne dust will have a negative impact to health of workers and to communities along the access roads to the site. Dust will be mitigated through watering and dust abatement activities.
- xxvii. **Noise.** Noise impacts to surrounding communities are expected to be limited since noise dissipates with distance from the source. Most of the impacts will be confined within the site since the rehabilitation works will occur within existing property occupied by the

pumping stations. Nevertheless, noise producing construction works will not be allowed to take place at night.

- xxviii. **Occupational safety.** Construction activities may result in negative impact to workers due to accidents and mechanical, electrical, tripping, and fall hazards at the workplace. The impact of occupational hazards is not significant because occupational health and safety measures will be implemented as part of ECOP for construction.

Impacts of Dredging Activities

- xxix. **Resuspension of sediments.** The dredging of sediments from the waterways will result to resuspension of sediments which could cause a temporary negative impact on the water quality and aquatic life remaining in the rivers. Based on the results of secondary data review and actual sampling indicating the current poor water quality conditions in the esteros, resuspension of sediments will only have a limited and short-term effect and change to water quality.
- xxx. **Generation and disposal of dredged materials.** The disposal of dredged materials removed from waterways will cause a negative impact to the environment since these contain organic materials and in certain cases also contaminants such as heavy metals such as chromium (Cr+6), copper (Cu), zinc (Zn), lead (Pb), and nickel (Ni) as experienced during previous sediment sampling conducted at Manila Bay. Considering that the sediments in Manila Bay are eroded materials that were deposited from the estuaries and tributaries in Metro Manila, the dredged materials from the pumping station channels could be contaminated with these heavy metals as well. However, based on the toxicity analysis conducted on samples from the five PY1 waterways, the sediments were found not to be hazardous using the TCLP criteria. Before any desilting starts, there will be sampling to determine contamination of dredged material as part of the selection of final disposal sites.
- xxxi. **Removal of water hyacinths.** The waterway clearing operations will involve the removal of water hyacinth which proliferate in some waterways in Metro Manila. Limited impacts will occur on fisheries and other aquatic resources because of the deterioration of habitat of fish. The removal of water hyacinth will occur sporadically over the life of the Project where absolutely necessary for the proper O&M of the drainage system. The extent of water hyacinth is expected to persist due to the presence of high nutrient conditions. This impact is not applicable to all pumping station sites but rather in selected areas near the Laguna Lake and in Pasig River tributaries.
- xxxii. **Odor.** Foul odor is emitted during dredging because of the decomposition of organic materials that occurs in the river water and bottom sediments. When anaerobic conditions worsen, pollutants such as ammonium ions, nitrogen, phosphate, and hydrogen sulphide are released. Odor impacts will be minimized by removing dredged sediments from pumping stations on a regular basis and by reducing the amount of waste materials that enter the water ways, as addressed under Component 2.

Impacts during Operations

- xxxiii. **Generation of noise.** The operation of pumps and equipment at some pumping stations can generate noise levels that can harm hearing of workers and pose a nuisance disturbance to nearby communities. Signage and hearing protection will protect workers, while disturbance to nearby communities is expected to be minimal. Installation of modern pumps and electrification will reduce the generation of noise.
- xxxiv. **Disposal of Solid Wastes.** The solid waste management practices of the communities, particularly the improper disposal of garbage in waterways, has an impact on the long-term sustainability of a flood control project. A major operational concern for drainage areas is the accumulation of solid wastes trapped immediately upstream of the pumping stations and in the waterways. This affects the proper performance of the pumps and waterways and will also have a negative impact on the environment without regular collection and appropriate disposal methods. This waste will be removed by licensed contractors or directly by MMDA and disposed of in appropriate locations.
- xxxv. **Health and safety issues for workers.** The operation of pumps, motors, generator sets, conveyors, trash racks and other equipment at pumping stations are potential sources of mechanical hazards due to the presence of dangerous moving parts. Mechanical accidents may also be caused by unsafe methods and the lack of safety guards that are fitted to the machine and pumping station facilities. There are open channels at the pumping stations which require adequate guard rails and fences to avoid accidents and fall hazards. Designs will incorporate the required safety features in case they are not available or insufficient. Workers will be properly trained in hazards and provided appropriate personal protective equipment.

Specific Social Impacts

- xxxvi. **Relocation of Informal Settlers.** ISFs along waterways leading to the pumping stations are aware that their houses and structures, and the waste they contribute obstruct the flow of water and affect the efficiency of the pumping stations. Respondents in Vitas said that they are willing to move out of danger zones provided that they are relocated in livable areas where they can earn a living and their children can go to school. In Tripa de Galina where some ISFs in Maricaban Creek have already been relocated, respondents who used to be neighbors with them said that they missed their neighbors, but recognized that fewer ISFs led to easier water flow and lower floodwaters in the community.
- xxxvii. **Impacts on livelihood.** Under Components 1 and 2, the proposed project could potentially lead to economic displacement of marginal fisherfolk, water hyacinth pickers and weavers, and waste pickers and in the process impoverish them further. Waste pickers constitute a subgroup of ISFs relying on garbage picking as their main source of livelihood. However, almost all the recyclable garbage picked by them is done outside the waterways, so the impact of reduced garbage in the waterways on the waste pickers' livelihood would be small. Harvesters of water hyacinths comprise a very small fragment of Metro Manila's poor who supply dried water hyacinth stalks to local and international

buyers at extremely low prices. Water hyacinths will be removed from critical locations only where they affect the performance of the drainage systems, and the impact on hyacinth pickers will be very small. Livelihood restoration opportunities will be offered to affected vulnerable groups, including maintenance of access to waterways for fisher folks and provision of alternative job opportunities for affected waste pickers.

- xxxviii. **Resettlement legacy issue.** This issue is specific to the ISFs who were relocated from the direct footprint of the project waterways before the project identification. A World Bank commissioned study found that up to 72 percent of the surveyed households resettled off-city reported decreased income up to as much as a 43 percent. They also reported increased expenditure driven by higher costs of transportation to schools, work, and health services. About 35 percent of those resettled off-city also reported difficulties in finding assistance for their daily needs due to disruption in their social support network. Due diligence surveys will be carried out where resettlement took place before the identification of the project and management plan and action plan will be developed for these resettlement legacy issues in order to ensure that past resettlement of PAPs will as much as possible be consistent with the objectives of OP 4.12.
- xxxix. **Compensation discrepancies.** Host communities can be existing communities or new communities of resettlers within or outside Metro Manila that will live together with project affected displaced ISFs in the same neighborhood. Resettlement to nearby in-city resettlement sites will be least disruptive and there would normally be few compensation discrepancies. The case is different for off-city host communities where support to PAPs may be much higher than received by already resettled people. The project will study this inequity issue in more detail and will implement practical and doable interventions, such as community development ones that would benefit the larger resettled community.
- xl. **Community safety issues.** Community hazards and accidents from the movement of vehicles along narrow roads leading to the pumping stations may compromise people's safety. These risks will be minimized through the implementation of traffic control and safety measures, signage, and educational campaigns.

Key Impacts of the Five Subprojects

- xli. Aside from the abovementioned impacts that will occur during the construction and implementation of the subprojects, there are specific impacts which are highlighted at each pumping station site.
- xlii. **Vitas Pumping Station.** The rehabilitation of the Vitas Pumping Station and the clearing of the waterway of Estero de Vitas will affect about 165 ISFs who are currently living on the banks of the estero and underneath the bridge at Raxabago St. and Capulong St. In compliance with WB Op 4.12, an appropriate resettlement plan is necessary for the affected households. The Vitas Pumping Station site can be accessed through the narrow road (Raxabago St.) that is parallel to the estero. The said road is characterized by settlers on the banks of the estero near the bridge. This narrow access road and the presence of settlers along the road may result in adverse impacts on community health and safety from the movement of large hauling trucks and other equipment by

contractors. Extra caution must be exercised by haulers when passing through this narrow road to prevent accidents.

Under component 2 of the project, wastepickers will be provided additional formal employment to collect household waste and bring it to collection points for disposal. If needed, social preparation measures for them to transition smoothly into their new role will also be given i.e., seminars on waste segregation, what time they need to collect the garbage and where to bring them, how they get paid, etc. Formal employment will need to maintain some flexibility in terms of work arrangements, i.e., payment for amount of garbage collected instead of number of hours worked, so it is easier for wastepickers to adjust.

- xliii. **Balut Pumping Station.** The Balut Pumping Station serves the catchment area of Estero Sunog Apog where most of the drainage mains and laterals are closed canals. As compared to the other pumping stations with open drainage canals where garbage are readily deposited or thrown by the community, solid waste entrapment and accumulation at the Balut pumping station is not a major concern. A potential impact of the operation of the Balut pumping station is the noise and dust from the construction activities as well as the odor emanating from the cleaning of the retention pond at the site. Affected communities include the residential houses in front of the site along Buendia St. and the Paez Integrated School on the northwest.
- xliv. **Paco Pumping Station.** This pumping station receives the water from the Estero de Paco and the Estero de Concordia. A key concern specific to the rehabilitation of the Paco pumping station is on the proper disposal of solid wastes with water hyacinth and the noise that may disturb the residential area right beside the waterway near the pumping station. In the survey for the Due Diligence Report for the resettled families within the Paco Pumping Station technical footprint, 60% of the respondents claimed they are still working in or near Paco, Manila. Of these, 59% travel to Manila on a weekly basis, 26% travel daily and remaining 15% travel once or twice a month.¹ Apart from increased transportation costs, one can also imagine the difficult life of daily commuting in a 40 kilometer distance characterized by poor public transportation and massive traffic gridlock. On the other hand, people who travel weekly or monthly have to bear the impact of temporary separation from their loved ones in order to save money.
- xlvi. **Tripa de Gallina Pumping Station.** The impacts that would occur during the rehabilitation of the Tripa de Gallina pumping station are due to dredging activities and the generation of dredged materials and solid wastes which required proper management and transport to disposal sites. The pumping station serves a large catchment area and most of the drainage laterals and mains are open channels which are prone to garbage accumulation. As such, the pumping station receives significant volume of garbage that requires regular collection and disposal. In addition, the Tripa de Gallina pumping station is located adjacent to the facilities of the Light Rail Transit Authority on the east and residential communities across the estero on the north. Temporary impacts will occur during the physical works and dredging activities such as

¹ Due Diligence Report for Paco Pumping Station. The DDR was prepared as part of the appraisal requirement of the proposed project.

- increased dust, odor, and noise nuisance in the residential area across the pumping station site.
- xlvi. **Labasan Pumping Station.** The pumping station is located in the Laguna lakeshore area and functions to control habitual inundations caused by rising of water level of the lake. The pumping station receives water from the Taguig River and attenuation pond before it is channeled into the Laguna Lake. The Laguna Lake, including the attenuation pond of the Labasan pumping station, is characterized with water hyacinth which clogs the waterways and has affected the efficient operation of the pumping station. Proper disposal of large volumes of water hyacinth will be necessary for this subproject. Water hyacinth pickers do not come to this area to harvest but the project will coordinate with them how they can benefit from the water hyacinths to be disposed.

Induced and Cumulative Impacts

- xlvi. **Induced Impacts.** The induced impacts are expected to be positive. Floods disturb the normal course of life and pose a real threat to human life and property. As a result of flood mitigation measures, there will be positive effects to the communities because of reduced incidence and impact of annual flooding. There are other anticipated induced positive impacts to the community because of flood control and improvement measures, including possible changes in land use, increase in land values, and development of more business opportunities.
- xlvi. **Cumulative Impacts.** The scope of this ESIA involves the assessment of the potential environmental effects at a Project level assessment. A cumulative impact assessment (CIA) will be done during the second half of the Project as part of broader impact assessment studies to consider the impacts of cumulative improvements in a large number of drainage areas scattered throughout Metro Manila in a defined spatial and temporal framework. The CIA will assess these impacts on key valued components and identify management measures to be undertaken by the Government and other project proponents to provide collaborative solutions to minimizing cumulative negative impacts, if any.

ECOPS AND ENVIRONMENTAL AND SOCIAL MANAGEMENT PLANS

- xlix. The proposed interventions in drainage areas will create various impacts, both positive and negative. Based on a screening, it will be determined whether an ESMP or ECOPs will have to be prepared and implemented to mitigate Project impacts during construction and operation. Construction impacts will thus be addressed by either an ECOP or ESMP, including erosion and sediment control, air and water quality management, noise and vibration, solid waste management, occupational health and safety and vehicular traffic management. The ECOPs or ESMP will also include institutional arrangements for its implementation to ensure its sustainability and effectiveness. Involuntary resettlement impacts on the other hand will be mitigated and managed by site-specific resettlement plans or action plans as a result of due diligence reports.

CONCLUSIONS

- I. The Metro Manila Flood Management Project will have significant benefits in reducing flood risk and damage to residents and property along waterways. These benefits far exceed any impacts due to the Project.
- li. The Project will not result in significant adverse environmental impacts and the impacts are mostly confined within the site of the pumping stations and at the waterways. Environmental and social mitigation measures have been designed and these will be outlined in the ESMP and/or ECOP for each Project drainage to address any adverse impacts of project implementation. A RAP or DDR action plan will address involuntary resettlement impacts.
- lii. The following Project impacts are considered significant and will require ongoing due diligence measures to ensure that they can be minimized:
 - a. Disposal of dredged waste materials from waterways. Toxicity testing will be required and a waste management plan implemented to ensure proper disposal;
 - b. Legacy issues associated with past resettlement from Project areas – will require implementation of due diligence and a follow-up action plan.
- liii. The mitigation and management actions outlined in this ESIA should be included in construction contract documents to be adopted by the construction contractor. Additionally, MMDA and DPWH should implement a supervision and oversight program to assure adoption of these mitigation measures.

Figure 1: Identified Subprojects for Project Year 1
 Base map: Flood-prone areas in Metro Manila, Mines and Geosciences Bureau (MGB)

