SFG1779

Environmental and Social Impact Assessment (ESIA)

Project Name:

Metro Manila Flood Management Project – Phase 1

Prepared by:

February 5, 2016

Environmental and Social Impact Assessment (ESIA)

Metro Manila Flood Management Project - Phase 1

Prepared by:

Metropolitan Manila Development Authority (MMDA)

and

Department of Public Works and Highways (DPWH)

February 5, 2016

LIST OF ABBREVIATIONS AND ACRONYMS

BA	–	Barangay Assembly
CNC	–	Certificate of Non-Coverage
DENR	–	Department of Environment and Natural Resources
DP	–	Displaced Persons
DPWH	–	Department of Public works and Highways
DRM	–	Disaster Risk Management
EA	–	Environmental Assessment
ECC	–	Environmental Compliance Certificate
ECOP	–	Environmental Codes of Practice
ECP	–	Environmentally Critical Project
ESIA	–	Environmental and Social Impact Assessment
EIAM	–	Environmental Impact Assessment Monitoring
EMB	–	Environmental Management Bureau
ESA	–	Environmental and Social Assessment
ESMF	–	Environmental and Social Management Framework
ESMP	–	Environmental and Social Management Plan
GOP	–	Government of the Philippines
GRM	–	Grievance Redress Mechanism
IEC	–	Information and Education Campaign
LGU	–	Local Government Unit
MMDA	–	Metropolitan Manila Development Authority
MOA	–	Memorandum of Agreement
NGO	–	Non-Government Organization
NHA	-	National Housing Authority
O&M	–	Operation and Maintenance
PD	–	Project Management Office
PDO	–	Project Development Office
PMO	–	Project Management Office
POW	–	Program of Work
RAP	–	Resettlement Action Plan
RPF	–	Resettlement Policy Framework
SIA	–	Social Impact Assessment
SHFC	-	Social Housing Finance Corporation
SP	–	Subproject
TOR	–	Terms of Reference
WB	–	World Bank

Acknowledgements

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.

xlv. **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 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

xlvii. **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.

xlviii. **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

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

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

l. 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.

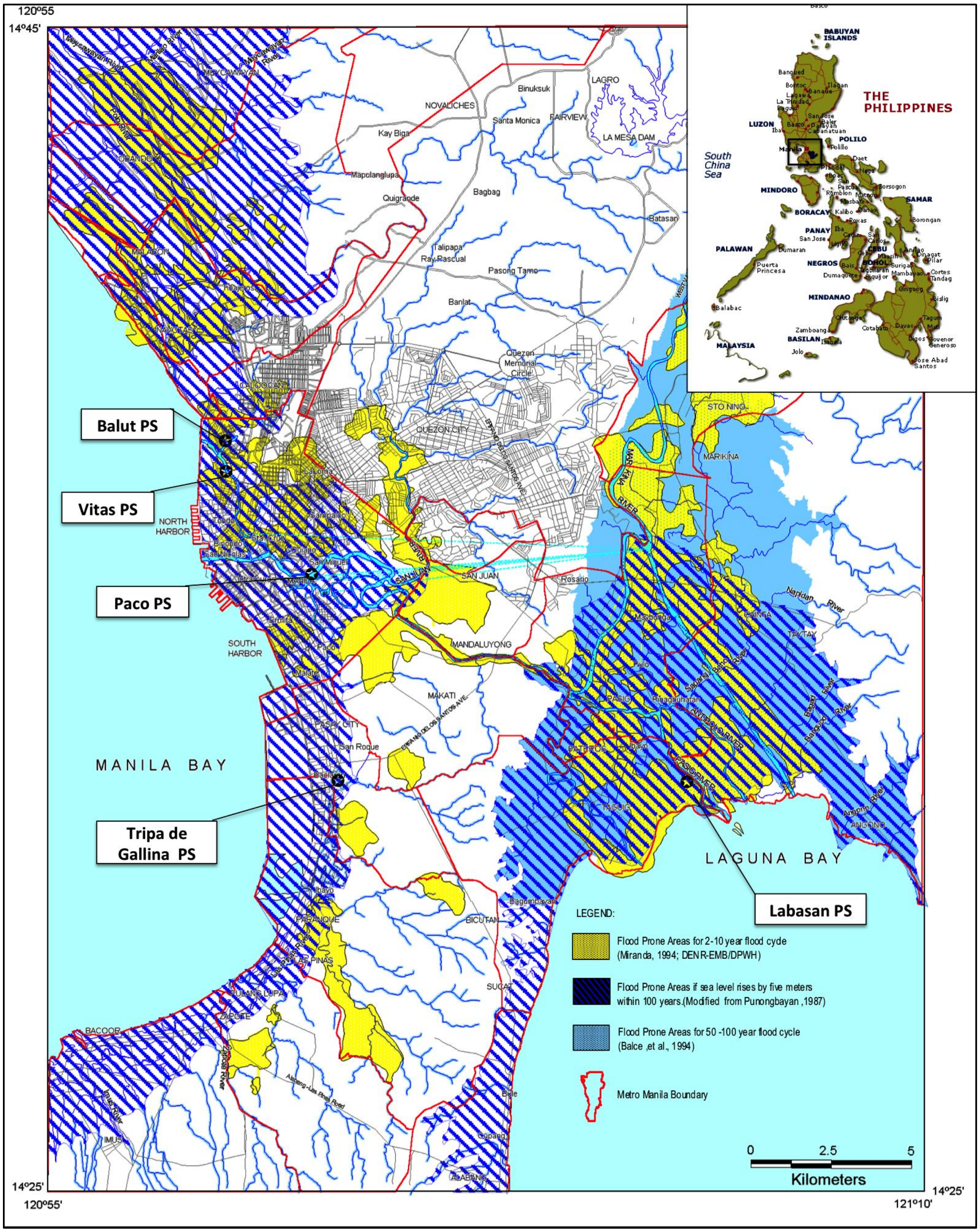
lii. The following Project impacts are considered significant and will require ongoing due diligence measures to ensure that they can be minimized:

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)



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INTRODUCTION

1. The geographic location of the Philippines makes it prone to typhoons, earthquakes, volcanic eruptions and other natural hazards. The United Nations Office for Disaster Risk Reduction reports that in the past 30 years more than 360 disasters befell the Philippines, with a total death toll of 33,000 people and affecting 120 million people. Direct economic damage from these disasters is estimated at US$7.4 billion. Of these natural disasters, typhoons and floods account for 80 percent of all deaths; 90 percent of the total number of affected people; and 92 percent of the total economic impact.

2. Metro Manila, which is the center of economy and trade in the Philippines and home to about 17 million people, has suffered recurrent flooding which resulted to adverse consequences to people's lives and the economy. There is increasing frequency of typhoons and storm rainfall, coupled with sea level rise that increases the flood risks in 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.

3. 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 on the order of PhP 352 billion (about US$8 billion) over a 20-25 year period.

4. The Master Plan envisions three separate and distinct components: (1) construction of a dam in the upper catchment of the Pasig-Marikina River; (2) flood protection interventions along the floodplain surrounding Laguna Lake; and (3) in-city works to ameliorate urban drainage capacity through modernization of existing pump stations and the construction of new pump-stations serving flood-prone areas of an expanding Metro Manila. This project, entitled Metro Manila Flood Management Project (MMFMP) Phase-1, is focused on amelioration of urban drainage.

5. This environmental and social impact assessment (ESIA) of Phase 1 includes the upgrading and rehabilitation of five pumping stations in Vitas, Balut and Paco, in the City of Manila; Tripa de Gallina in Pasay City; and at Labasan in Taguig (see Section 3 Project Description). The Phase-1 project will provide these areas in Metro Manila with more immediate flood relief and can be undertaken as an initial independent activity while still being a key part of the wider strategic plan for large scale flood control and management. The Phase-1 project will also support improvements to solid waste management in waterways served by these pumping stations. The strategy is more of a phased approach and sub-projects will be developed in a scaleable approach within the next five years.

PURPOSE AND BASIS OF ESIA

6. The Project triggers the World Bank's Environmental Assessment Operational Policy (OP 4.01) and the Involuntary Resettlement Policy (OP 4.12) and has been classified as Category A in accordance with World Bank's Operational Guidelines. An Environmental and Social Impact Assessment (ESIA) is required consistent with Bank Safeguard Policies as part of Project financing.

7. The objectives of the ESIA are:

   a) Assess the existing environmental and socio-economic baseline conditions of the five pump station areas, including identification of environmentally sensitive areas that may be affected by the proposed subprojects;

   b) Identify and assess the magnitude of key positive and negative impacts of the Project components on the physical, biological and socio-economic environment;

   c) Develop mitigation measures through the application of an Environmental and Social Management Plan (ESMP) and Environmental Codes of Practice (ECOP) that address the potential impacts and risks of the Project; and,

   d) Determine the environmental monitoring, supervision and reporting requirements, emergency response procedures, institutional or organizational arrangements, and capacity development measures to ensure the implementation of the ESMP.

8. 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 the elements of the Resettlement Policy Framework, 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 STUDY AND METHODOLOGY

9. 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 draft Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF) that was prepared by the World Bank for the MMFMP.

10. Several site visits and informal interviews with potential Project Affected Persons (PAPs) were conducted jointly by MMDA and World Bank during the period January to November 2015. Visits were also done in off-site 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.

11. Water quality and sediment samples were collected from the various waterways where the 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.

12. 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.

13. Since the subprojects involve existing pumping stations and waste disposal systems, due diligence on offsite waste disposal facilities of solid wastes collected at the pumping stations and at the existing pumping station facilities was conducted. The due diligence aims to: (i) determine the current condition at the disposal sites of collected solid waste and dredge materials, (ii) assess the environmental performance and the management measures that are being undertaken at the pumping stations; (iii) assess regulatory compliance and risk; and (iv) recommend measures to improve the environmental management system of these facilities.

14. Since pumping station rehabilitation works will have common and typical construction-related impacts, Environmental Codes of Practice (ECOPs) were developed and will apply to all pumping stations. Other impacts which are not covered in the ECOP will be addressed in the ESMPs and RAPs.

15. Potential environmental and social impacts were assessed at each of the Phase-1 five pumping stations and mitigation and management measures were proposed. Annex A presents the environmental screening matrices that were prepared for each of the five pumping stations.

16. Impacts were distinguished between significant positive and negative impacts, possible direct and indirect impacts, and immediate and long-term impacts, unavoidable or irreversible as well as an assessment of social impacts. Particular attention was given to the effects of associated dredging activities, effects on floodplain ecology, water quality, waste disposal, and socio-economic impacts on populations in the impact areas. A terms of reference was prepared to assess cumulative impacts to be completed at a later phase of the Project.

17. The following methodologies have been implemented in the conduct of the ESIA:

    a) Review of project-related documents and previous studies.

    b) Site visits to assess the conditions inside the pump stations and its immediate surroundings.

c) Water quality and bottom sediment sampling and analysis to establish baseline conditions and to determine pollution load and potential hazardous characteristics of the water and sediments.

d) Consultation with government agencies and stakeholders to present the proposed flood control project, discuss environmental issues related to the current disposal of dredged materials and solid wastes, and solicit comments and concerns to further improve the design and implementation of the proposed subproject.

e) Identify environmental and social impacts of the subproject.

f) Recommend the application of ECOPS for the construction and operation phases of the five pumping stations.

g) Develop an environmental and social management plan (ESMP) for each pumping station.

ESIA SCHEDULE

18. The ESIA was conducted from October to December 2015 with the MMDA and the WB Task Team.

CONSULTATIONS

FOCUS GROUP DISCUSSIONS

19. MMDA conducted consultation workshops and meetings with national government agencies (NGAs), local government units (LGUs), regional development council (RDC), and other Government agencies regarding the proposed project. **Table 1** outlines the consultation meetings with NGAs, LGUs and other Government agencies:

Table 1: Consultations with NGAs, LGUs, other non-Government Agencies and stakeholders

Activity	Date
Safeguards orientation workshop	January 22, 2015
Project orientation with LGUs	February 20, 2015
Workshop with LGUs (Validation of project scope)	April 13-15, 2015
Presentation of the project to the Regional Development Council (RDC)	July 7, 2015
Workshop / dialogue with Non-Government Agencies. LGUs, CSOs, NGOs, and private sector	October 20-26, 2015 October 28, 2015
Informal interviews with potential project affected persons and informal settler families (ISFs) in project areas, off-site and in-city resettlement sites	January to November 2015

CONSULTATIONS ON MODERNIZING PUMPING STATIONS

20. Consultation was conducted by the MMDA and WB Task Team on February 20, 2015 with concerned LGUs (Taguig, Makati, Pasay, Pasig, Navotas, San Juan, Valenzuela, Caloocan, Malabon,

Mandaluyong, Manila and Muntinlupa) to discuss the proposed Flood Control Improvement Project and to identify the Phase 1 project sites. The meeting was held at the MMDA Office at EDSA corner Orense St., Makati City. A total of 70 participants, mostly personnel from Engineering, Planning, Solid Waste Management, Urban Settlements Department of the LGUs, attended the meeting.

21. A series of follow-up consultation workshops with all the LGUs most affected by flooding was held in April 2015 on the selection of the pumping stations to be rehabilitated and in the identification of new pumping station sites. In the workshops, the LGUs were organized into small groups to create indicative maps showing location of flood problem areas, including information at the barangay level on depth and duration, location of ISF, and location of existing and proposed pumping station facilities.

22. In several planning meetings, MMDA and DPWH identified the necessary repairs, new equipment and other rehabilitation requirements per target pumping stations. On September 2, 2015, MMDA expressed the desire to build new pumping stations, a task originally assigned to DPWH. In the same meeting, MMDA suggested that for equipment allocated for solid waste removal from waterways, the Flood Control Department will handle the issue while the SWMO will take care of equipment for solid waste that are for processing e.g. waste-to-energy, water hyacinth, etc.

CONSULTATIONS ON SOLID WASTE MANAGEMENT

23. Stakeholder consultation workshops were held from October 20-28, 2015 as part of the broader process of project preparation with specific focus on Component 2 – Minimizing Solid Waste in Waterways. Around 80 participants representing national government agencies, local government units (LGUs), civil society organizations (CSOs), non-government organizations (NGOs), and private sector participated in the workshops. MMDA led the activities and presented the current MMDA activities for community-based solid waste management along pumping stations and selected waterways while the LGUs and other organizations shared experiences and challenges on the implementation of different solid waste management practices. In general, the participants recommended the following:

- Mapping out of locations of the waterways
- Specific activities should be undertaken depending on the location
- Colllection mechanism of waste should be strengthened, e.g. 24/7 for biodegradable and 2x a week for recyclables
- Introduce sound behavioural change interventions vis-à-vis structural measures
- Massive IEC campaigns which include LGU executives down to the barangal level
- Distinguish roles of LGUs, NGOs, COs and other Government agencies
- Partnerships should be formed within the different stakeholders
- MMDA to be the repository of data and that data needs to be available and comprehensive to be a more effective planning tool.

24. In relation to the preparation of the ESIA for Phase 1 subprojects, and on the concern about the disposal of solid wastes and dredged materials, a consultation meeting was held last November 10, 2015 with representatives of the DPWH District Engineering offices (North Manila, South Mania, and 1st District), Pasig River Rehabilitation Commission (PRRC), City Engineering Offices of

Manila, Pasay, Parañaque, and Taguig and LGU solid waste contractors (represented by IPM and Leonel Services). The meeting was held at the World Bank Office in Taguig City.

25. Issues discussed during the November 10 meeting were:

- DPWH rely on contractors in identifying disposal sites of dredged materials. Current disposal sites are former fishponds in Malabon and Navotas as well as private lands which need landfilling in Taguig and Quezon City.
- A Feasibility Study is necessary to determine the disposal options for the dredged materials. A suggestion was raised to develop a common dumping area for dredged materials, possibly at Road 10 and Pier 18. Other options for further study are (i) soil banking, (ii) underwater placement over-depth capping (UPOC) as previously implemented near the mouth of Manila Bay by PRRC, and (iii) containing the dredged materials in sacks with coco coir and nets and then placing these as embankments of the river similar to what has been done in Paco PS.
- PRRC conducted testing of dredged materials and detected heavy metals when the UPOC project was still ongoing. MMDA and DPWH have not tested the quality of the dredged materials. There is a need to establish the toxicity characteristics of the dredged materials. If found hazardous, a possible disposal option is at the sanitary landfill in Clark, Pampanga.
- The hauling of solid wastes collected at pumping stations is not included in the current scope of work of the LGU-contracted solid waste haulers. It was suggested to allocate separate budget for solid waste collection at the pumping stations to address sustainability of solid waste collection at the pumping stations.
- The processing of solid wastes from pumping stations for resource recovery was suggested by MMDA. Wastes can be compacted, baled and utilized for waste-to-energy project.
- The proliferation of water hyacinth particularly at the Labasan Pumping Station was discussed. Management options that were raised include the use of water hyacinth for livelihood projects, such as the experience of the Villar Sipag Foundation, processing into charcoal briquette, and feed to biogas production.

CONSULTATIONS WITH COMMUNITIES

26. As part of the social impact assessment, focus group discussions were held with representatives of flood-prone communities across economic classes, age, and gender in Makati, Manila, Pasay, and Taguig. Additionally, key informant interviews were undertaken with local government officials, pumping station engineers, and representatives of civil society organizations such as youth groups, homeowners association and organizations of senior citizens. The site visits and informal interviews with potential PAPs were conducted jointly by MMDA and World Bank during the period January to November 2015.

27. Based on the focused group discussions in Manila, Pasay, and Taguig, the participants indicated that responsibilities are different between men and women, In general, men are in charge of labor intensive tasks while women take on more nurturing roles. When households learn about a potentially strong storm or when it starts to rain, men put sandbags or other barriers to prevent floodwaters from entering their houses. Inside their houses, they also make additional makeshift elevated floors from scraps of plywood called “papag” in case floodwaters become really high. These will be temporary quarters for eating and sleeping while the house is flooded. Men also secure heavy household items like refrigerators, washing machines, and furniture to safer areas in

the home. On the other hand, the women make sure there is enough food for the family and try to ensure the comfort of each member. They secure the cookware dishes, utensils including beddings and clothes. When floods ensue and the family becomes trapped, food and resources run out. To ensure the household's survival, the men go out to buy or look for food and supplies. They also check on the extent of flooding in their areas and are relied upon to help in transporting goods and people within short distances. Because of this scenario, the men are the ones who usually become victims of leptospirosis. The women's household chores such as washing clothes and maintaining the house are put on hold during flood and chores such as cooking become inconvenient because everything transpires on the "papag", the second floors of their houses, or even on the roof. The women are also in-charge of taking care of sick family members. When floodwaters recede, the household starts to make the house livable again and cleans surrounding areas of mud debris, and other trash. Inside the house, the men take charge of disposing or moving heavy items while the women do the cleaning. Outside, the men shove the mud while the women sweep away leaves and garbage.

28. The poor and the rich also differ in the way they conceive flood impacts and how they cope and recover from these impacts. Both social classes say that Ondoy was the most devastating typhoon for them but for residents in Vitas and those living near Tripa de Galina, flood impacts are associated with having no food to eat because they ran short of supply or they are unable to earn a living to buy food. On the other hand, vulnerability for residents in Magallanes comes in losing their cars and not having their own personal mode of transportation. They mentioned the decrease in the value of real estate in their village compared with other high-end subdivisions in Makati. They also speak of losing things with sentimental value such as old pictures, a photographer's early works, and a pianist's concert pieces which were never mentioned in Manila, Pasay, or Taguig. They talk of missing their neighbors who left their communities and settled elsewhere. In coping with floods, residents in Vitas and Pasay rely on aid from government institutions such as relief goods from the barangay and rescue teams from MMDA. If needed, they also move to designated evacuation sites prepared for them by their local governments. In contrast, residents in Magallanes are the ones providing support to their household help. They give food and shelter to their maids, drivers, and gardeners. When they need to evacuate, they check in in hotels which gives them special calamity rates or rely on their kin to pick them up and let them stay in their houses. In terms of recovery from Ondoy, residents in Vitas and Taguig said life is back to normal within a week or a month at the most. Residents in Pasay said it took them around 6 months to recover everything in their household again, including repairs of appliances and renovation of their houses. On the other hand, residents in Magallanes said it took them more than a year for the community to get back to where it was originally. They mentioned being so traumatized by Ondoy that they did not talk about it with their neighbors. In absolute terms, the material losses of the rich are so much bigger than those of the poor but in relative terms, the material losses of the rich do not leave a dent on their financial standing. In fact, they are cognizant of their high economic status that allows them to cope with material losses due to floods. The period of their recovery takes into consideration recuperating from emotional and psychological stress due to flooding.

29. In Pasay, children were the ones who were traumatized by Ondoy. When it starts to rain, children feel alarmed and anticipate another big flood. In Makati, it was the elderly who suffered the most distress. They never visited their families there again. One of the reasons for this difference could be the fact that communities in Pasay experience flooding all the time while the respondents in

Makati are not used to it. In general, children are also more prone to diseases because they play in the floodwaters. The elderly feel more helpless during floods because of the need to move to higher ground or evacuate altogether. Living temporarily on rooftops is also very difficult for them.

30. Students are unable to attend classes during floods. For teenage students, they help their families cope with flood impacts by running errands and stowing light and valuable items. They experience the most impacts after the flood as they have to attend make-up classes during the weekends. With just one day of rest within a week, they feel stressed with schoolwork.

31. All respondents who have work said their employment is temporarily hampered during typhoons. Those who earn on a daily basis such as wastepickers, pedicab drivers, and harvesters of water hyacinths lament that flooding means days of foregone income. For wastepickers, floodwaters bring in a lot of garbage, but its height and flow make it dangerous for them to engage in wastepicking. Sometimes, floodwaters also move the garbage out to more remote areas which are already difficult for them to access. Harvesters of water hyacinths also do not go out to gather water hyacinths lest they endanger their lives. They also cannot dry previously harvested water hyacinths along the riprap. When floodwaters are high, pedicab drivers cannot go out to work. However, they start earning again when floodwaters subside and become useful in transporting people and goods in nearby areas.

32. Floods can be a source of income for people, particularly men, who find resourceful ways of transporting people and goods. Makeshift boats, huge hollow plastic containers, and even discarded refrigerator doors are used to move people and their things for a fee. Income from this activity is used to buy food for the family while other members are trapped inside their homes and cannot go out to work. After floodwaters have subsided, there is increased demand for carpenters to repair damages in structures and electricians to repair household appliances.

CONSULTATION WITH ISFS AND ON RESETTLEMENT

33. Visits were completed in off-city and in-city resettlement sites where interviews were conducted to understand significant difference between these two approaches. Moreover, dialogues with the National Housing Authority (NHA), Social Housing Finance Corporation (SHFC), and people's organizations engaged in resettlement were also conducted to better understand opportunities and constraints encountered. All these were done to provide Project partners with a number of options and strategies to finalize a sustainable resettlement approach acceptable to both the Government and the World Bank.

34. Three outstanding learnings emerged from these consultations, as follows:

- Off-city resettlement under "*Oplan Likas*" and past resettlement programs exhibited gaps and inadequacies that maintained rather than improved the general welfare of the resettled families.
- In-city resettlement had been less adverse to resettlers because although uprooted, they were still able to maintain the social and economic ties and safety nets.
- The People's Plan option offered the most participative approach to resettlement. A People's Plan was developed by the *Ang Grupo ng Organisadong Mamamayan* (AGOM), a

federation of basic sector organizations and SHARE Foundation, its CSO partner, with the ISFs in the Vitas Pumping Station area.

FUTURE COMMUNITY CONSULTATIONS

35. To adopt a process of meaningful and participatory consultations with potentially affected people and other stakeholders, future consultations will be integral to the project's communication and disclosure plan to be implemented by MMDA. The consultative process will continue at multiple levels, i.e. national (DPWH and other line agencies), LGUs (city, municipality and barangays), and at the target stakeholder groups (affected communities, NGOs, and other interest groups).

36. The ESIA report will be disclosed at the website of the MMDA as well as on the World Bank InfoShop. In addition, the PMO will keep records of the documentation of all public consultations that were conducted taking note of the salient issues that were raised by the stakeholders and the responses made by the implementing and executing agency to address these issues.

POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

WORLD BANK SCREENING AND CLASSIFICATION

37. The Metro Manila Flood Management Project Phase 1 is classified as a Category "A" investment with respect to World Bank safeguard policy OP 4.01 – Environmental Assessment. This categorization is based on the large number of subprojects to be implemented throughout the greater Metro Manila area and the resettlement of project affected people in a complex urban environment. Scoping and subsequent investigations carried out by MMDA and the WB Task Team indicated that significant social impacts will be associated with resettlement; many, if not most of those residing in waterway areas are informal settlers, who are generally very poor and reliant on income sources in the vicinity of their current locations. Impacts from land acquisition will be minimized to the extent possible, chiefly by keeping resettlement confined to the technical footprint areas needed for optimal performance of the pumping stations. Nevertheless for the entire project, the total number of households to be resettled is estimated in the range of 1,500 to 2,500 families.

38. Environmental impacts associated with pumping station rehabilitation and new pumping station subprojects are expected to be limited to civil works and related activities, which are localized, limited and manageable. Most environmental impacts will occur during the construction phase and can be effectively managed through the application of ECOPs.

39. A terms of reference for a project cumulative impact assessment has been developed as part of the ESMF and will be completed in Phase-2 of the Project.

APPROACH TO MANAGEMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

40. Anticipated environmental and social impacts of the Project are associated with the dredging and cleaning of waterways, disposal of solid waste and water hyacinth from the waterways, civil works for new pumping stations and rehabilitation of existing pumping stations to be outfitted with new pumps and related equipment. Impacts of pumping station rehabilitation works are anticipated to be minor, temporary and localized. Impacts from the dredging activities may be significant depending on the quality of sediment, especially if there is a presence of toxic elements. Impact management at each subproject will be addressed by means of environmental screening to identify and assess impacts for which appropriate mitigation and management measures will be applied. Such measures include the application of environmental codes of practice (ECOPs) and other specific measures included as part of an effective Environmental and Social Management Plan (ESMP).

41. Typical ESMPs will set out management and remediation measures to ensure safe disposal of construction debris, solid waste, dredged silt and spoils, disposal of worn-out pumps and equipment, spent fuel, oil and lubricants from the pumping stations. ESMPs will routinely include plans for occupational health and safety during construction and operation of the facilities. ESMPs will also address issues related to localized traffic disruptions, community safety and impacts on

economic activities in neighboring communities. The ECOPs will include the management of typical impacts related to construction. Environmental health and safety (EHS) prevention practices will also be included in the ECOP in relation to physical hazards, trips and falls, noise, injury from moving machine parts and provision of proper sanitation. Exposure to heavily polluted and sewage-contaminated river water is an occupational risk that needs to be managed through proper EHS practices, i.e., use of personal protective equipment and provision of emergency showers and hand and eye washing facilities.

42. Land acquisition, both permanent and temporary, may be needed, especially for the construction of new pumping stations. Clearing of limited sections of waterways, where access or flows are hampered by ISF settlements will be necessary in some subprojects for optimal functioning and sustainability of both old and new pumping stations. Land acquisition requirements will vary.

43. Construction phase social impacts are expected to be limited, however temporary impacts may necessitate mitigation measures, such as those to manage restriction of access to roadside commercial establishments and residential buildings. Clearing informal settlements along waterways is unavoidable both for the safety of ISFs from flood risks, which are recurrent and pose significant hazard and dangers, as well as for the proper functioning of the pumping stations. The approach to resettlement will focus on in-city rehousing to facilitate retention of income streams for those displaced whose current livelihoods are highly dependent on proximity to places of work. An ESMF and a Resettlement Policy Framework have been prepared and specific RAPs will be developed.

44. Impacts on physical cultural resources are highly unlikely, if not precluded for rehabilitation works to be carried out on existing sites. The ESMF provides for screening of new pumping station sites and off-site facilities for the presence of physical cultural properties. A chance finds procedure will be applied if objects or structures of cultural importance are discovered during implementation. The chance find procedure suspends construction activities; the site is delineated and secured to prevent any damage or loss of removable objects. The findings are evaluated by the Cultural Properties Division of the National Museum according to the various criteria relevant to cultural heritage, (including the aesthetic, historic, scientific or research, social and economic values.) The decision on how to handle the find is determined by the National Museum. Construction work will resume only after the responsible agencies give authorization.

45. Two of the five first year pumping station rehabilitation subprojects, Paco PS and Vitas PS, will involve some form of resettlement. A RAP has been prepared for about 50 families residing under a bridge and inside the waterway for Vitas PS. At Paco PS, a number of informal settler families were previously moved under the GOP's *Oplan Likas* resettlement program in 2011 – 2012. Due diligence was carried out to assess their current status vis-à-vis the general objectives of OP 4.12.

PHILIPPINE ENVIRONMENTAL IMPACT ASSESSMENT SYSTEM

46. The Philippine Government requires certain projects to undergo an Environmental Impact Assessment (EIA) by virtue of 1978 Presidential Decree 1586 or the Environmental Impact Statement (EIS) system. PD 1586 was originally devised as an administrative procedure for an action-forcing policy that requires project proponents of development projects to systematically study and disclose the environmental impacts of projects.

47. In accordance with PD 1586, development projects are required to conduct an EIA and to prepare an environmental assessment report for review and approval by the Environmental Management Bureau (EMB) under the Department of Environment and Natural Resources (DENR). The law stipulates that for undertakings or projects that have potential adverse effects on the environment, proponents must obtain an Environmental Compliance Certificate (ECC) or a Certificate of Non-Coverage (CNC) as a pre-requisite to implementation.

48. The Philippine EIS System is implemented with guiding documents that include its implementing rules and regulations (IRR), the Procedural Manual, and the EIA Review Manual, among others. As the system is being implemented, guiding documents are modified as necessary to improve the procedures and the system itself. The revised Procedural Manual for DENR Administrative Order No. 30, series of 2003 (DAO 2003-30) and amendments issued through Memorandum Circulars (MC) or Executive Orders (EO) are currently prevailing guides to the EIA process.

49. Included in the scope of the Philippine EIA are projects, which are classified as Environmental Critical Projects (ECPs) or projects, which are located in Environmentally Critical Areas (ECAs). EMB issued further guidance to determine the coverage and requirements for projects and undertakings by virtue of EMB Memorandum Circular No. 2014-005, issued on July 7, 2014. Project thresholds for coverage screening and categorization are provided in the guidelines. Under this circular, projects are classified into the following groups, namely:

- **Category A** – Projects or undertakings, which are classified as Environmentally Critical Projects (ECPs). Proponents of these projects implemented from 1982 onwards are required to secure an ECC;
- **Category B** – Projects or undertakings which are not classified as ECP under Category A, but which are likewise deemed to significantly affect the quality of the environment by virtue of being located in an Environmentally Critical Area (ECA). Proponents of these projects implemented from 1982 onwards are likewise required to secure an ECC;
- **Category C** – Projects or undertakings not falling under Category A or B which are intended to directly enhance the quality of the environment or directly address existing environmental problems. Project proponents may be issued a CNC subject to evaluation of a submitted Project Description report;
- **Category D** – Projects or undertakings that are deemed unlikely to cause significant adverse impact on the quality of the environment according to the parameters set forth in the Screening Guidelines. These projects are not covered by the Philippine EIS System and are not required to secure an ECC but may opt to secure a CNC from the DENR.

50. The documentary requirement for ECC application for Category A (ECPs) is an EIS while the documentary requirement for Category B (non-ECPs but located in ECA) could be an EIS or IEE checklist, depending on the project threshold defined under the screening checklist. Category C project are required to prepare a Project Description report to confirm non-coverage, hence, may

be issued a CNC by the DENR or to further classify as either Category A or B which will require an ECC. Projects that are unlikely to cause adverse environmental impacts and falls below the threshold levels established under the revised guidelines may secure a CNC from the DENR-EMB Regional Office by submitting a Project Description.

51. Initial screening with EMB was undertaken to determine the applicable project category for flood control projects. According to the revised guidelines for coverage screening and standardized requirements under EMB MC No. 2014-005 and as discussed with EMB, there is no distinct category for existing flood control projects. EMB suggested that the project may fall into Category C and may be issued a Certificate of Non-Coverage based on evaluation of the Project Description. Furthermore, the EMB may also upgrade it to Category A or B depending on the scale and scope of activities and potential environmental impacts.

52. **Table 2** summarizes the possible project categories based on the coverage screening under EMB Memorandum Circular 2014-005.

Table 2: Category and DENR Documentary Requirements for Flood Control Projects

Project	Project Size Parameters	Category A: ECP	Category B: Non-ECP		Category C	Category D
		EIS	EIS	IEE Checklist	PD	PD
1. Environmental enhancement or direct mitigation					To confirm non-coverage or further classify as either A or B	
2. Dams (including those for irrigation, flood control)	Reservoir flooded/inundated area or/and water storage capacity	≥25 hectares OR ≥20 million m^3	>5 hectares but <25hectares OR >5 million m^3 but <20 million m^3	≤300 hectares		None

Source: EMB Memorandum Circular No. 2014-005

53. For purposes of complying with PD 1586, the proposed Project will be required to initially submit a Project Description as outlined in DENR AO 2003-30 for further project screening with EMB to determine whether the project qualifies for non-coverage, or for classification as either Category A or B. The Project Description Report for Category C projects should include: (i) a description of how the Project enhances the environment or addresses environmental issues; (ii) project components list; (iii) description of project phases; (iv) project emission/effluent/hazardous waste/solid waste/other wastes; (v) project cost and duration; and (vi) collage of photos or plates of proposed project site(s). EMB will undertake a screening process to determine whether the project is covered or not by the Philippine EIS System. If a project is covered, screening further determines what document type the project should prepare to secure the needed approval, and what the rest of requirements are in terms of the ECC or CNC application, EMB evaluation, endorsement and decision.

54. If the project is determined by EMB to fall as Category A or B, the EIA process will follow the sequential phases of: (i) scoping; (ii) EIA study and report preparation; (iii) EIA report review and evaluation; (iv) Decision-making; and (vi) post-ECC monitoring, validation, and evaluation/audit.

Based on the approved scoping checklist, the proponent conducts an EIA study which includes an assessment of alternatives of the project, characterization of the project environment, impact identification and prediction, evaluation of impact significance, and formulation of environmental management and monitoring plan, with corresponding cost estimates and institutional support commitment.

55. Project disclosure, public consultations and public hearing are conducted as part of the EIA process. The study results are presented in an EIS report for which an outline is prescribed by the DENR. For subprojects requiring an IEE checklist, the EMB-prescribed IEE checklist for Irrigation, Flood Control and Minor Dam Projects should be filled-out and submitted to the DENR-EMB Regional Office with the required attachments and supporting documents.

56. The responsibility of reviewing the submitted documents and the decision to issue or deny the issuance of the ECC or CNC currently rests with the Regional Offices of the DENR-EMB, except for ECPs where the responsibility lies with the EMB Central Office. Review of EIS normally entails an EMB procedural screening, which is to be conducted by DENR-EMB within 3 days upon receipt of a copy of the EIS report. The Procedural screening checks the compliance of the document to the minimum requirements specified during the scoping.

57. The procedural screening is followed by substantive review by the EIA Review Committee (EIARC). The DENR-EMB and the EIARC is allowed a maximum of three meetings to discuss the proponent's responses to comments on the EIS including the site visit, public consultation or public hearing. After the EIARC finds the EIS and any additional information satisfactory, the EIARC prepares the review report together with the recommendations on the issuance of the ECC.

58. For Category A (ECPs), the maximum of review duration of the EIS is 40 working days while for Category B (non-ECPs) the maximum review duration of the IEE checklist is 20 working days. The DENR-EMB also prescribes that processing of CNC application should be completed within one day.

OTHER APPLICABLE ENVIRONMENTAL LAWS AND REGULATIONS

59. Other related environmental laws and issuances applicable to the Project include the following:

- **RA 9003: Ecological Solid Waste Management Act** – –RA 9003 has four objectives: (i) source reduction (avoidance) and minimization of waste generated at source; (ii) reuse, recycling, and resource recovery of wastes at the barangay level; (iii) efficient collection, proper transfer, and transport of wastes by city/municipality; and (iv) efficient management of residuals and of final disposal sites and/or any other related technologies for the destruction/reuse of residuals. Municipalities and cities are tasked to provide a "solid waste management disposal system or environment system and services or facilities related to general hygiene and sanitation." Solid wastes collected in the pumping stations shall be governed by this law including efforts to prevent garbage disposal in waterways.

- **RA 8749: The Philippine Clean Air Act (PCAA) of 1999**- the law that provides a comprehensive air pollution control policy. Specifically, it intends to apply air quality management in all sources

in order to implement the abatement and control of air pollution. This applies to the use of diesel generator sets and motors for pump station operations.

- **RA 9275: Philippine Clean Water Act of 2004** - the law provides a comprehensive water pollution control policy. Specifically, it intends to apply water quality management in all water bodies in order to implement abatement and control of pollution from land-based sources. Water quality criteria are also set for the classification of various river ways. Water quality management area approach is currently being used by the national and local agencies to improve water quality of the primary rivers in Metro Manila and Manila Bay.

- **RA 6969: Philippine Toxic Substances and Hazardous and Nuclear Waste Act** - this act mandates the regulation, restriction, or prohibition of the importation, manufacture, processing, sale, distribution, use, and disposal of chemical substances and mixtures that present unreasonable risk and/or injury to health and the environment, including toxicity tests for screening of the dredged materials.

- **RA 9512: Environmental Awareness and Education Act of 2008** - The act promotes environmental awareness through environmental education. It integrates environmental education in the school curricula at all levels, public or private, barangay day care and pre-school, and non-formal, vocational, and indigenous learning. This will be linked to a solid waste education campaign associated with the Component 2 of this subproject.

- **RA 9729: Climate Change Act (CCA) of 2009** - The act declares as a Philippine policy the adoption of the ultimate objective of the UNFCC convention, which is the stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the global climate system. Adaptative strategies and resilient interventions are required to be integrated in all city development plans.

- **RA 10121 - The Philippine Disaster Risk Reduction and Management Act of 2010**. As with the requirements of the CCA, local government units are mandated to integrate DRR into their development plans.

APPLICABLE LAWS AND REGULATIONS RELATED TO LAND ACQUISITION, RESETTLEMENT AND SOCIAL SAFEGUARDS

60. The Bill of Rights of the Constitution of the Republic of the Philippines is the enabling law, which ensures that no person is deprived of life, liberty or property without due process of law. In Article III, Section 9 of this law, private property cannot be taken for public use without just compensation. Other key legal and administrative provisions which ensure proper land acquisition, resettlement and social safeguards are the following:

- **Executive Order 1035 (1985)** – This order requires conducting of Feasibility Studies, Public Information campaigns, parcellary surveys and asset inventories. It also provides for compensation for acquired land at a fair market value based on negotiations between owner and appraiser; relocation assistance to tenants, farmers and other occupants; financial assistance to farmers and agricultural tenants equivalent to the average harvest for the last three years but not less than P 15,000/ha; Disturbance compensation to agricultural lessees

equivalent to 5 times the average gross harvest during the last 5 years; and compensation for improvement on land acquired under Commonwealth Act (CA) 141.

- **Commonwealth Act 141: Public Land Act (1936)**. The act institutes classification and means of administration, expropriation and disposition of alienable lands of the public domain.

- **1987 Supreme Court Ruling**. The Supreme Court defines just compensation as fair and full equivalent to the loss sustained to enable affected household to replace affected assets at current market prices.

- **Republic Act 6389.** The law provides for disturbance compensation to agricultural leases equivalent to four times the average gross harvest in the last five years.

- **Republic Act 8974 (2000)**. The law facilitates the acquisition of ROW, site or location for national government infrastructure projects and for other purposes. The law and its implementing rules and regulations of RA 8974 mandate the use of replacement value of land and structures (without depreciation).

- **Republic Act 7279 (1992): Urban Development and Housing Act.** This law mandates the provision of a resettlement site, basic services and safeguards for the homeless and underprivileged citizens.

- **Republic Act 7160 (1991): Local Government Code.** This law, which allows the LGUs to exercise the power of eminent domain for public use.

PROJECT DESCRIPTION

61. In order to improve the overall flood management conditions in Metro Manila, the Government of the Philippines (GOP) has prepared a Flood Management Master Plan for the Greater Metro Manila area with technical and financial assistance from the World Bank. The Master Plan which sets out priority structural and non-structural measures, was approved by the National Economic and Development Authority (NEDA) Board on September 4, 2012. The plan will be implemented over a period of 20 to 25 years.

62. 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 and the 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 latter is considered as Phase-1 of the Project.

MASTER PLAN FOR FLOOD MANAGEMENT

63. The main elements of the Master Plan for Flood Management are as follows:

- Structural measures to reduce flooding from river systems that run through Greater Metro Manila;
- Structural measures to eliminate long-term flooding in the flood plain of Laguna de Bay;
- Structural measures to improve urban drainage;
- Non-structural measures, such as flood forecasting and early warning systems, and community-based flood risk management; and
- Improved institutional organization and capacity to deal with flood management in an integrated manner.

64. In order to improve the overall flood management conditions in the Greater Metro Manila Area, all interventions under these elements will have to be implemented. Each element has unique solutions that are not linked and may be implemented independently from each other. Implementation of the master plan has started with ‘easy’ interventions, such as dredging, river bank protection, and improvements to a small number of pumping stations that will have direct and immediate localized impact.

65. Several agencies are involved in flood management activities, including DPWH, MMDA, LGUs, and PAGASA (weather agency), but there is a lack of overall inter-institutional coordination and management. The aim of the institutional studies to be financed with trust funds is to determine the best organization that can provide overall leadership, management, and responsibility for flood management, and to bring flood management within the government's proposed integrated water resources management agenda, as an integral part of river basin planning.

PROJECT COMPONENTS AND YEAR 1 ACTIVITIES

66. The Metro Manila Flood Management Project – 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 drainaeg 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.

67. There are four components of Phase 1 of the Project.

COMPONENT 1: MODERNIZATION OF DRAINAGE AREAS

68. Many of the 57 pumping stations managed by MMDA are over 30 years old and no longer operate at full capacity. MMDA has carried out an inventory of its existing pumping stations and it is expected that this component will modernize about 38 existing pumping stations and in addition add about 20 new stations; the exact number and locations are to be determined during project implementation. There is a long-list of drainage areas identified by MMDA, DPWG, and the Local Government Units (LGU). Out of this long list, five 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. (see **Figure 1).**

69. As part of the modernization program pumps will be replaced with modern, more efficient, and higher capacity units. The design discharge determination will be underpinned by hydrological studies of the drainage areas and the best type of pump will be selected for each given situation, including submersible pumps, possibly with variable speed drive, as well as horizontal axial pumps.

70. A program of increasing the water retention capacity within the project drainage areas will also be developed and implemented. This could include rooftop rainwater collection, retention of drainage water in public areas such as basketball courts, parking garages, etc.

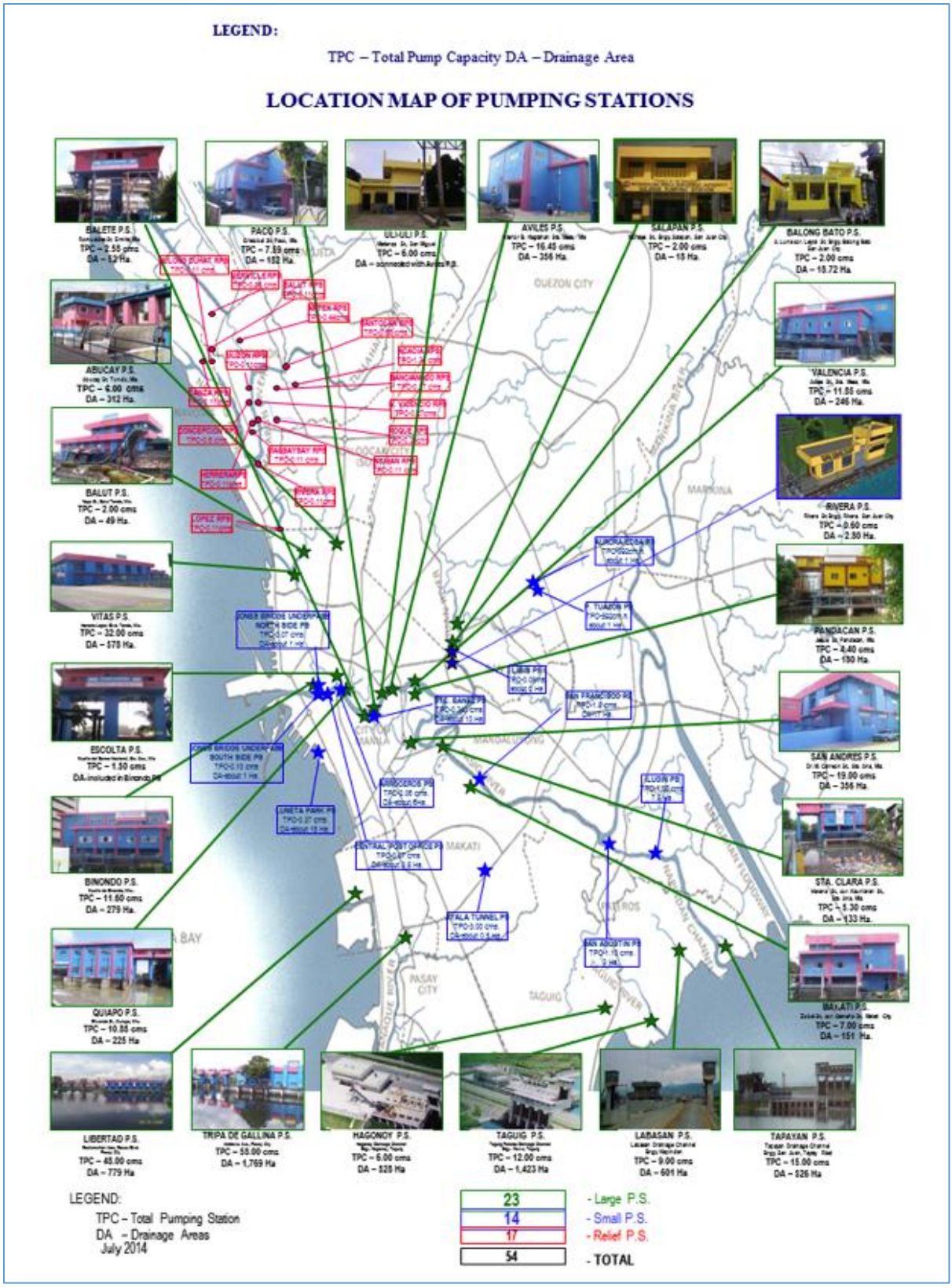


Figure 2: Pumping Stations operated by MMDA for Metro Manila flood control

COMPONENT 2: MINIMIZING SOLID WASTE IN WATERWAYS

71. Since the enactment of RA 9003, awareness of the threat posed by improper disposal of solid waste to the natural environment has increased, however, enforcement of this legislation varies significantly across and even within LGUs. Solid waste remains a major challenge threatening Metropolitan Manila's waterwaysv and severly hampers the optimal functioning of the pumping stations.

72. Urban drainage has been hampered by the accumulation of solid waste in waterways and at pumping stations, which intensifies the flood hazard and increases the risk of direct damage and economic losses. As seen in **Figure 3**, pumping stations are directly affected by the accumulation of solid waste: numerous pumping stations are functioning at less than their rated capacity, and this is compounded by functional obsolescence.

Figure 3: Solid wastes screen installed in Vitas Pump Station (left) and solid wastes collected by the trash rakes (right)

73. ISF communities are key contributors to solid waste that accumulates in Metro Manila's waterways, but they are not the sole contributor: businesses, both large and small, and residents with land tenure are responsible as well. Moreover, while communities along waterways are key contributors to solid waste accumulation, improperly disposed waste within the catchment area of each station ultimately enters the same waterways.

74. The specific objective of Component 2 is to improve solid waste management practices within the drainage areas of Project financed pumping stations, building on the existing systems implemented by LGUs, barangays, NGOs, and households. This will be achieved through strengthening existing waste collection systems and facilities, improving transport / disposal systems, raising community awareness, and providing incentives for individual behavioral modification.

75. Component 2 will support the following activities:

- Strengthening solid waste collection systems, including necessary equipment (garbage bins, recycling containers, material recovery facilities, garbage trucks, etc.) and supporting LGUs and barangays in community mobilization for waterway cleanup;
- Implementing an incentive-based approach to improve solid waste management efforts; and
- Conducting targeted Information, Education, and Communication campaigns on solid waste management.

76. Component 2 will support where feasible, MMDA's agenda to apply appropriate technologies such as "waste-to-energy", taking into account the full range of costs and benefits, including externality effects. Government has recently awarded a contract to prepare a feasibility study for waste-to-energy facilities. In case the studies show viable technical and financial solutions, loan proceeds may be used to support one to two viable interventions on a pilot basis.

77. This component will also address the management of water hyacinths or water lilies which is one of the causes of pump breakdowns and stoppages. The project will finance appropriate equipment for harvesting and preservation prior to processing, but also programs that encourage processing for reuse of products as community livelihood activities.

COMPONENT 3: PARTICIPATORY HOUSING AND RESETTLEMENT

78. This component will support a community participatory approach to resettlement of Informal Settler Families (ISF) to be affected by the drainage area improvements. Almost all pumping stations, both existing and proposed, are found in densely populated areas, with ISFs living along many of the waterways served by the pumping stations. Existing pumping stations to be modernized under the project are typically well fenced in with no informal settlers. However, a small number of new pumping stations would involve at least some resettlement, mostly of ISFs, from the area where new pumping stations are planned and from along a few waterways where ISFs have encroached on the water. For the entire project, the magnitude of project-affected people mostly ISFs is expected to be in the range of 1,500-2,500 families.

79. Component 3 aims to reduce the exposure of PAPs to flooding risks. It will also strengthen their resilience to external risks by increasing their access to better housing, basic community infrastructure, better livelihoods and stronger community organization. Component 3 will achieve this by consolidating and amplifying the gains made by government's existing innovative shelter solutions such as Social Housing Finance Corporation's (SHFC) High Density Housing (HDH) Program, DILG's LGU Seed Fund and NHA's In-city Resettlement Program.

80. Specifically, this component will fund land acquisition, housing construction, site development, rental support, livelihood assistance, and various technical assistance and capacity-building activities that help strengthen the communities and implementing agencies. Government counterpart fund will finance land acquisition and housing construction, whereas IBRD funding will be used for the remaining activities. Component 3 will comply with procedures and requirements under WB OP 4.12 (Involuntary Resettlement).

81. The component will also include a Technical Assistance to explore possible livelihood restoration measures for all ISFs that were resettled both in-city and off-city under "Oplan Likas". The TA will identify potential interventions along with implementation arrangements and costs for government consideration. Corrective livelihood measures may include transportation allowance or provision of transport for ISFs to commute to their jobs in Metro Manila at certain times of the day, as has been practiced by some LGUs under certain projects in the past.

82. Various resettlement options will be offered to affected communities with comprehensive and community-friendly information to allow them to make informed decisions. These will include

existing housing programs including SHFC's HDH Program, SHFC's CMP, DILG's LGU Seed Fund, NHA's In-city Resettlement Program, and NHA's off-city resettlement will be the last resort. Rental support may be provided as a transitory measure to communities that select any of the mentioned modalities to augment their rental payments in locations outside the flood-prone areas while they wait for the completion of their new housing units. The project will also consider variants or other feasible implementation modalities that may arise during community consultations and discussions.

COMPONENT 4: PROJECT MANAGEMENT & COORDINATION

83. Component 4 will support the operation of the Project Management Office (PMO) to be established by MMDA, headed by a Project Manager, to coordinate the overall planning, implementation, and supervision of Project activities, central procurement, and management of funds.

84. It is expected that Department of Public Works and Highways (DPWH) may become involved for the design and construction of a number of new pumping stations, but arrangements and extent of their involvement are still under discussion.

PROJECT ALTERNATIVES

85. The Government of the Philippines has prepared a Metro Manila Flood Management Master Plan that establishes the road map and provides the vision for sustainable and effective flood risk management in Metro Manila and surrounding areas until Year 2035. The Master Plan was approved by the NEDA Board on September 4, 2012.

86. The Master Plan was based on a study supported by the World Bank's Global Fund for Disaster Risk Reduction and the Government of Australia that identified possible measures and essential interventions to improve flood management in Metro Manila and surrounding areas. The study reviewed the exisitng situation and arrangements for flood risk management and evaluated mechanisms of floods and flood damage to enable the formulation of a framework for an integrated flood risk management plan.

87. The selection of alternatives was based on the following considerations:

- Severity of potential flood risk
- Severity of flood
- Technical, economic, social and environmental viabilities
- Balance of distribution among the areas and projects for the rivers and Laguna Lake
- Target year is 2035.

NO-PROJECT SCENARIO

88. Without the Project and its associated structural and non-structural intervention, Metro Manila and surrounding areas will continue to be vulnerable to flood hazard. As a result of climate change, this situation will likely worsen due to and increased frequency of typhoons and storm

rainfall and corresponding sea level rise that will only increase flood risks to Metro Manila and surrounding areas.

89. The existing flood risk management infrastructure is grossly insufficient. Based on assessment of the pumping stations, mechanical breakdowns are frequent and no spare parts are available. Furthermore, flood preparedness and response operation is inadequately conducted, the institutional system on flood risk management is not well established, and the land use and development in dangerous flood prone and low-lying areas is not well managed.

90. The rivers and esteros are also shallow. Very low water levels will not allow water to reach the pumps at the pumping stations, thus, there is a need to deepen the drainage channels or esteros. Currently, the esteros are filled with silt, garbage, and vegetation that retard the flow of water to the pumping stations. Ideally, the flow should at least be equal to the capacity of the pumping stations. However, in many esteros, the flow is partly blocked with silt, garbage, and vegetation, thus, reducing the storage. There are also informal settlers living on the banks of the esteros that contribute to flow retardation and makes them vulnerable to flooding problems.

91. There is also inefficient solid waste collection system in the catchment area. This leads to solid wastes finding its way into the rivers and esteros and clogs the impeller and damages the mechanical seals at the pumping stations.

ALTERNATIVES CONSIDERED

Metro Manila Flood Management Master Plan

92. Proposed flood control measures involve structural and non-structural measures to prevent overflow from rivers and reduce flood water level to 100-year safety level. A number of conceivable structural measures were studied including river improvement works by widening and deepening of the river channel, construction and/or rehabilitation of floodways, river flow control gates, dams in the upper watershed to reduce flood peak discharge, pipelines to convey floodwater, retarding basin, and diversion tunnel. **Table 3** shows the major alternatives that were evaluated in the Master Plan:

Table 3: Structural Alternatives for Metro Manila Flood Control

Alternative	Description of Alternative Structural Measure
A. Pasig-Marikina River Improvement	
River improvement	A mixture of excavation, dredging, revetments, and embankments for the Pasig-Marikina River to confine the 100-year flow discharge were considered in the river stretches. Each stretch of the river improvement will take into account the functions of river channel, natural characteristics, cost-effectiveness, and social impacts. Based on the evaluation, it will be difficult to widen the river width around the Marikina Bridge because the ground elevation of the area adjacent to the bridge is almost equal to a 10-year flood safety level and the area is densely populated.
Marikina-Laguna Floodway	Construction of a new floodway would divert floodwater from the

Alternative	Description of Alternative Structural Measure
	Upper Marikina River to the Laguna Lake. The floodway is seen as an alternative of the dam but the construction cost is 76 billion Pesos which is very much larger than that of a dam construction.
Rehabilitation of Manggahan Floodway	The rehabilitation of the floodway will involve the excavation of sediment deposits and water hyacinths that is estimated to be around 1.3 million m^3 and net cost at around 3 billion Pesos. There are about 85,000 people living on the banks and slopes of the floodway. The option presents problems in terms of presence of informal settlers and excessive sediment deposit. At the Pasig River downstream, there are also limitations for river improvement due to the clearance of bridges and the heavily populated area along the channel. Dredging is the only way to increase the flow capacity with careful consideration of the existing revetment and the balance of riverbed gradient between upstream and downstream of the Pasig River.
Inter-Basin Diversion by Pipelines (Marikina River to Malabon-Tullahan River)	The option involves the installation of 16 km of pipelines for the conveyance of flood water from the Upper Marikina River to the adjoining Malabon-Tullahan river basin. It will be impossible to install about 84 pipelines and maintain such large number of pipelines. The option will also cost about 310 billion Pesos. The option has technical, cost efficiency and land acquisition concerns.
River flow control gate	The Marikina control gate structure was proposed to divert the design flood peak discharge of 2,400 m^3/s to the Manggahan Floodway from the Upper Marikina River. The actual diversion is smaller by about 400 m^3/s than the design diversion discharge.
Dam	Small and large scale dams with other structural measures were evaluated. The 100-year flood discharge is so large that a dam is essential to water out the city during typhoon events but the overflow from rivers cannot be prevented simply by a dam.
Retarding basin	In the Upper Marikina River, the natural retarding basin is spread with 1.5 km in maximum width and 4.0 km in total length and divided into two portions: (i) the area between the Tumana Bridge and the San Mateo Bridge (ii) the area upstream of the San Mateo Bridge.
B. Laguna Lake Shore and Inflow Rivers	
Laguna ring road dike	The ring road dike was examined under the condition that the dike construction would surround the Laguna Lakeshore along the 13.2 m contour line that is the ground level equal to 10-year flood water level of the lake. The project cost and number of direct beneficiaries by the ring road dike are estimated to be about 66 billion Pesos and 0.2 million people, respectively.
West Laguna lakeshore land-raising	The raised land is planned with a road function to protect the residents along the western shores of Laguna Lake.
West Laguna lakeshore	The dike construction will be implemented along the 13.2 m

Alternative	Description of Alternative Structural Measure
dike	contour line.
Paranaque spillway	The Paranaque spillway is expected to reduce the maximum water level of the Laguna Lake by 60 cm throughout the year. The length of the spillway is 8.9 km including the tunnel portion (3.3 km) of 15m diameter and the width of the open channel portion ranges from about 15m to 20m.
Pacific Ocean spillway	The maximum water level of the Laguna Lake could be reduced by about 40cm. The length of the spillway is 20 km including tunnel portion (18.3km) with 15m diameter and the width of the open channel portions ranges from about 15m to 20m in the bed channel.
Inflow rivers to the Laguna Lake	Partial river improvement works were planned for Sta. Rosa River, San Cristobal River, San Cristobal/San Juan Rivers, Sta. Cruz River, Pagsanjan River, Sta. Maria River, and Tanay River.
Land raising for small cities	This will involve the land raising in the municipalities of Bay, Victoria, Sta. Cruz, and Mabitac.
Dredging in Laguna Lake	The volume of the lake has been reduced by sediment deposits. The Master Plan recommends only selective dredging, e.g. near the mouth of the Napindan River.
C. Drainage Improvement	
	This will involve pumping station modernization, dredging and cleaning of waterways and drains, solid waste management at the Manila Core Area, West Manggahan, Valenzuela, Obando, and Meycauayan areas.

Source: Master Plan for Flood Management in Metro Manila and Surrounding Areas, April 2013

Non-structural measures

93. Non-structural measures are proposed in the Master Plan to complement the structural measures. These measures include flood monitoring, warning and evacuation systems, as well as land use management. These measures are proposed to minimize flood damage in the floodplain when an unexpected large-scale flood or more than the design scale happens in the basin.

Phase 1 Alternatives

94. Based on the short list of mitigation and preparedness measures, priority projects to be implemented within the first 10 – 15 years were identified. The priority programs under Phase 1 includes the modernization of existing pumping stations, recovery of existing drainage channels and desilting to mitigate the inundation conditions in the urban drainage systems, particularly the Manila Core Area Drainage System. Solid waste management is also very important to keep the discharge capacity of the drainage system. Alternatives that were examined to implement Phase 1 are the following:

<u>Upgrading and modernization of pumping stations</u>

95. Metro Manila has about 50 pumping stations scattered throughout the city which are operated by the MMDA. Many of these pumping stations were constructed 20 to almost 40 years ago and are no longer performing well. The main function of the pumping stations is to pump out water from the estero side of the pumping stations into the Pasig River, Paranaque River, Laguna de Bay and the Manila Bay inorder to create a retarding reservoir for the local run-off water and prevent flooding in the downstream catchment area especially during the occurrence of heavy rains and inclement weather.

96. As part of the Master Plan and based on assessment by MMDA, selected pumping stations will be upgraded and modernized under Phase 1. Considering the urgency to start the implementation of the Master Plan, the NEDA Board approved an initial allocation of PhP 5 billion (US$120 million) for the implementation of a number of activities that require minimum design and that can be implemented quickly but will contribute to positive impact on flood management. The pumping stations in Vitas, Balut, Paco, Tripa de Gallina, and Labasan were identified as the facilities that would be rehabilitated and upgraded under Phase 1; all are all part of the Manila Core Area Drainage System.

Synchorination of operation of clusters of pumping stations

97. An option that was evaluated under Phase 1 is the clustering of pumping stations to optimize their use. Several pumping stations are serving esteros that are mutually connected. The coordination of these clusters of pumping stations may lead to a more equal pumping distribution over time. However, the clustering of pumping stations would require further study of flow characteristics of the esteros and the dredging activities to deepen the estero.

Replacement of diesel engines with electrical motors

98. The pumping stations are diesel engine driven. The pumps are either of the horizontal axial type or of the vertical wet pit axial type. Axial flow pumps are less resilient in the case of clogged inlets. The performance drops quickly if certain head is exceeded due to recirculation in the impeller. Also the shaft torque increases sharply and loads the motors or engines excessively. The operating cost is high and there are reliability problems in case of power interruption.

99. An option that was considered is the replacement of the diesel engines by electrical motors with standby generator sets to reduce the running costs and increase the reliability of the function during brownouts. Mixed flow pumps are better alternative to overcome torque problems. This implies that the pumping stations will have to be coupled to the 3-phase electrical network of MERALCO. There is also a need to apply diesel engine generator sets with large diesel tanks (one per pump) to accommodate for power interruption. This will guarantee that there will always be enough diesel fuel in the stations since the tanks will remain full during the normal electrical operation.

Dredging

100. Dredging is a continuing activity that is considered by MMDA for Phase 1 to increase the flow capacity and also as part of the maintenance of the esteros. Some portions of Estero de Vitas are being dredged by DPWH and dredged materials are disposed in DPWH-designated areas.

101. For this project, options evaluated include the deepening of the esteros or channels, or enlargement of the width of the esteros. The main effect of deepening of the estero will be the lowering of the flow velocity at a certain discharge, thereby, lowering the needed hydraulic gradient. Widening of the estero also lowers the flow velocity but the hydraulic resistance is not lowered as much as in the case of the deepening. Widening has an advantageous effect on the storage capacity of the drainage area, thereby lowering the flood levels. However, considering that most of the esteros have already defined drainage channels with revetments, and that there are settlements on both sides of the esteros, widening will require resettlement of affected households.

102. There are four sites that MMDA has identified for the disposal of dredged materials: a private lot and a DPWH dumping site in Taguig, a private lot in Catmon, Malabon, and another private lot in Bgy. Tanza, Navotas.

103. One of the possible sites is located a few meters off the C-6 Road (coordinates: N 14.52026, E 121.07996). The estimated area of this private land is more than 1 ha. It is bound by a road in the northeast, and beyond this road is the Taguig-Pateros River. A motorpool of a private company bounds the lot in the west and in the south. Various entities dispose their construction wastes in this area with the permission of the landlord and the Taguig LGU. An issue with this area is it is unverified whether this area has an ECC. Moreover, earth-moving equipment are unavailable. Another problem may be the access to this area. According to the MMDA, heavy vehicles such as dump trucks are not allowed to enter the C-6 Road. Special permits may have to be procured for the use of heavy vehicles along C-6.

104. The private lot in Taguig (coordinates: N 14.53514, E 120.95602) operated by DPWH is used for the disposal of dredged materials from the Marikina River. This could be a more suitable disposal site since the area already has an ECC. Furthermore, spoils disposed in the area is treated and compacted. Cement is mixed with the spoils transported to the area. Heavy equipment is then used to dispose and compact the treated spoils into the ground. According to the source from MMDA, the land is being developed because the area is hoped to become a housing development in the future.

105. The private lot in Catmon, Malabon (coordinates: N 14.67205, E 120.95602) is bound by the Tullahan River in the north, a retarding pond in the west, a vacant lot in the east, and the Gov. Pascual Ave. in the south. The MMDA has heavy equipment in this area since the lot is used for the disposal of excavated materials from Malabon and Navotas. The source stated that the landlord and barangay captain in the area does not permit dumping of excavated material from other areas. Moreover, it is uncertain whether this has an ECC.

106. Another possible disposal site for the excavated material is in Bgy. Tanza, Navotas. The property, owned by Worldsummit Hodlings Corporation, is 136.3014 ha. The company has applied an ECC

for their land development project. Hence, the company has offered its property to the DPWH as a site for depositing dredged materials. According to a source from the MMDA, the only problem that may arise if the area is selected as a disposal site is accessibility since roads to the disposal site may be inundated in the event of a high tide or heavy rains.

OPTIMUM PUMPING AREA

107. Typically, excess rainwater will runoff from roofs, roads, and other surfaces before entering drainage pipes. Runoff inside drainage pipes eventually discharge into ***waterways*** such as creeks, esteros, or tributary rivers before finally discharging into ***external water bodies*** such as Manila Bay or main drainages like the Pasig River.

108. Without pumping, runoff discharge from catchments by gravity is dictated by slope of the terrain and the elevation of external water bodies. Flooding occurs when water cannot be discharged fast enough (i.e., higher runoff generation due to urbanization of the catchment; due to intense rainfall; elevated levels of the external water body; or a combination of these and other factors). Pump stations address flooding by discharging rainwater of ***a served waterway*** faster that what gravity allows.

109. The critical portion of the downstream area is delimited as the "project footprint." The project footprint is further composed of (a) pump station area, (b) maintenance access point, (c) optimum pumping area of OPA and d) any other ancillary facility or development (e.g. access road). For the purpose of determining the Project area of influence, the OPA that runs along open channels will be the target area for environmental and social impact assessment.

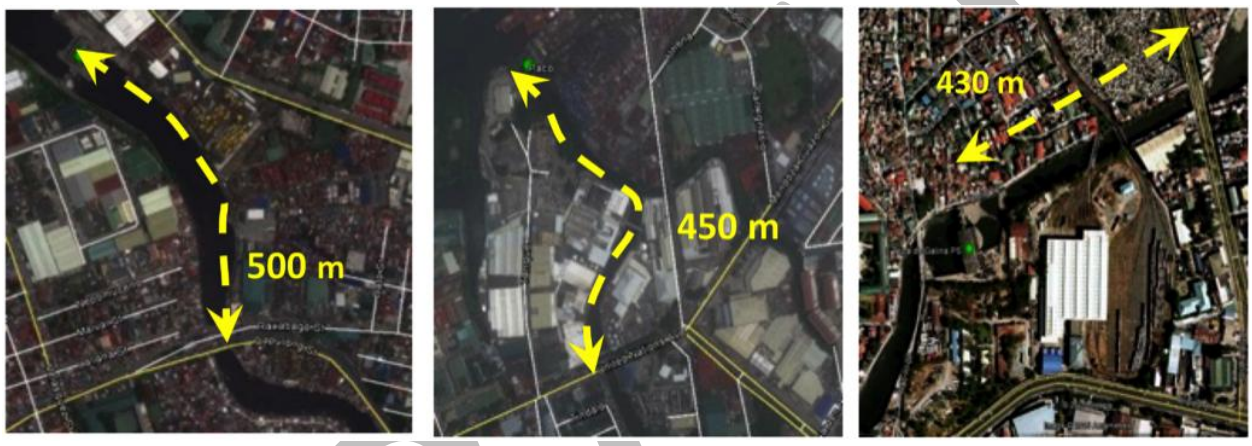
110. The ***optimum pumping area (OPA)*** is defined as the area corresponding to the volume of water stored in the waterway such that the pump station can operate at maximum capacity unimpeded to lower water level from just below street level (revetment elevation) until the stopping elevation (dictated by pump suction elevation) is within the ***time of concentration (T_c)***. T_c is the time required for runoff to travel from the hydraulically farthest point of the catchment to reach the outlet (i.e. pump station). For the purpose of planning, OPA is converted to a more tangible parameter, the corresponding length of OPA or OPA_{length}. This is derived by dividing OPA by the waterway's operating flood depth (i.e. elevation of street level minus suction stopping elevation).

111. The OPA (i.e., waterway along OPA_{length}) must be cleared of obstructions like sediment, solid waste, and informal structures to ensure unobstructed flow to the pump station and avoid pump problems such as vortices, uneven approach flow, uneven velocity profile in the pump, pre-rotation, vibrations, cavitation and increased energy consumption—among others. It is important to note that optimum maintenance is most critical in, but is not limited to, the OPA. OPA_{length} is computed for identified priority pump stations as shown **Table 4** and illustrated in **Figure 4**. Unless stated otherwise, data are provided by MMDA.

Table 4: Calculation of the Length of the OPA for Pumping Stations

Pump Station	Maximum Capacity (cms)	T_C [2] (minutes)	T_C (sec)	Optimum pumping volume (m^3)[3]	Depth operating [4] (m)	W_{ave} (m)	OPA_{length} (~m)
Paco	7.6	67	4,020	27,460	1.89	20	450
Vitas	32.0	45	2,700	77,760	2.16	43	500
Balut	2.0	45	2,700	4,860	2.34	NA	--[5]
Tripa de Gallina	58.0	101	6,060	178,898	5.40	50	420
Labasan	9.0	45	2,700	21,870	2.25	30	--[6]

Source: MMDA, 2015



PHASE-1 PUMPING STATIONS

Figure 4: OPA lengths for Vitas (left), Paco (middle), & Tripa de Gallina (right)

112. The following are descriptions of each of the five pumping stations.

VITAS PUMPING STATION

Catchment

113. Vitas Pumping Station is serving several barangays in the Tondo District in the City of Manila. The total catchment area is about 578 hectares as shown in **Figure 5**. Other information pertinent to the catchment area is shown in **Table 5**.

[2] Design T_c provided from design specifications by MMDA
[3] Adjusted for pump efficiency and total additional catchment storage
[4] Adjusted with factor of safety $\beta = 0.9$
[5] No open waterways, entire catchment served by covered drainage system
[6] Existing storm attenuation basin is 6.4 ha. OPA do not extend further into upstream waterway

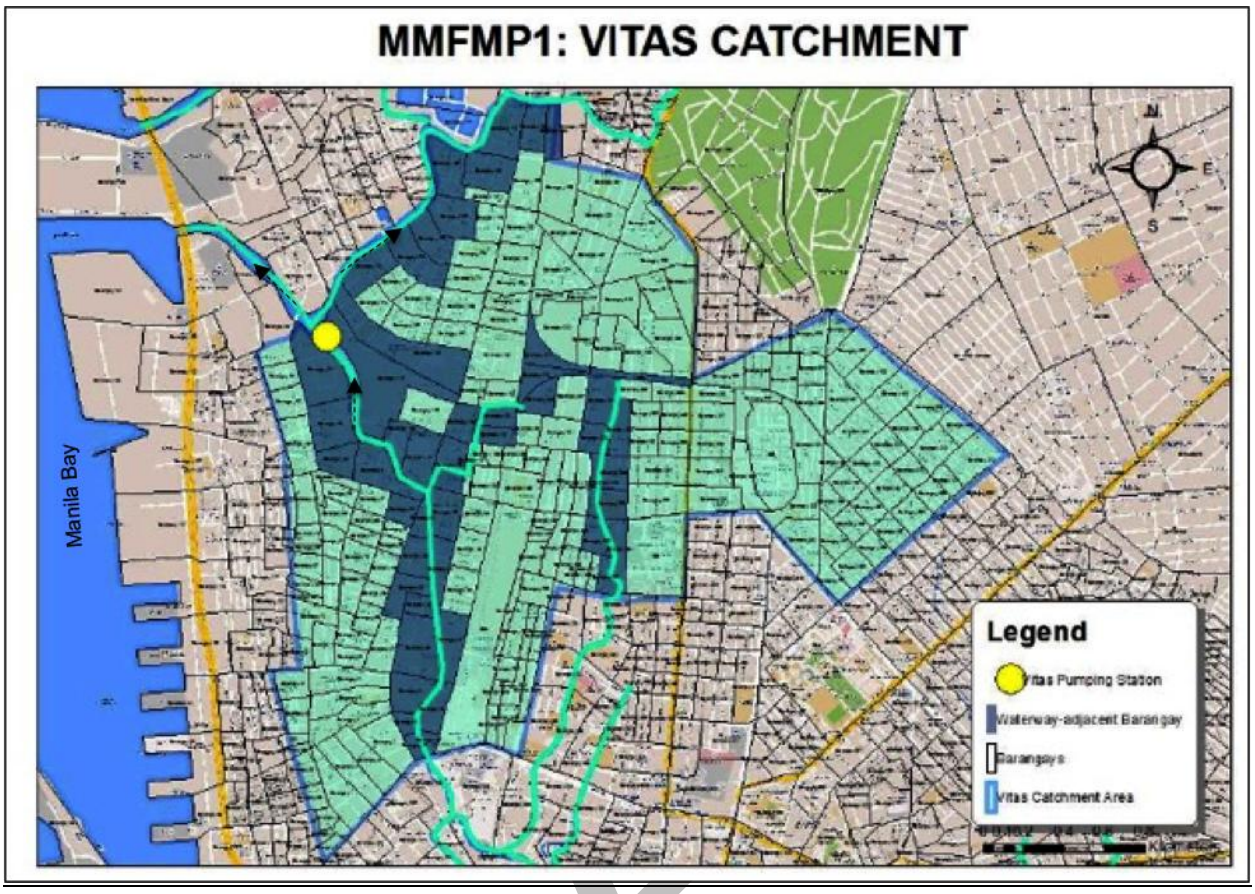


Figure 5: Catchment area of the Vitas Pumping Station

Table 5: Catchment area of Vitas Pumping Station

1	Type	Major pump Station	
2	Location	Tondo, Manila	
3	Total drainage area (hectares)	578	
4	Total population in the drainage area	~ 240,000	
5	Total length of drainage lateral (m)	98,000	
6	Total length of drainage mains (m)	3,257.80	
7	Total length of open waterways (m)	10,786.40	
8	Volume to be doclogged (m^3)		
	Lateral	Mains	Open waterways
	138,741.64	6,985.31	237,440.46

Key Components and Features

114. The key features of the Vitas pumping station are shown in **Table 6**. Site photos are shown in **Figure 6**.

Rehabilitation and Upgrading Works

115. The proposed rehabilitation works are listed in **Table 7**.

Table 6: Features of Vitas Pumping Station

Location		Honorio Lopez Blvd., Tondo, Manila	
Date Constructed		September 14, 1994	
Date Completed		December 15, 1997	
Fund Source		Overseas Economic Cooperation Fund	
Civil Works Cost		Php 162,495,000.00	
Equipment Cost		Php 294,057,000.00	
Drainage Area (served)		578 ha	
Run-off Coefficient (design)		0.70	
Time of Concentration		45 minutes	
Total Length of Estero Served		2.3km	
Total Length of Conduits Served		4.53km	
Pumps Starting Level		10.10m	
Pumps Stopping Level		9.80m	
Average Width of Estero		50m	
Bottom Elevation (m)		6.70 (estero); 4.65 (suction)	
Top of Revetment (m) at P/S		12.20m	
Main Drainage Pump/Engine			
	Type	Horizontal Shaft Axial Flow Pumps	
	Total no. of Units	5	
	Capacity	6.40 cu.m./s	
	Total Pumping Capacity	32.0 cu.m./s	
	Bore	1.65m	
	Total Dynamic Head	3.2m	
	Brake Horsepower	300 hp, Type: S165L-DT	
Diesel Generator/Engine			
	Total no. of Units	1	
	Capacity (KVA)	200	
	Brake Horsepower	300 hp, Type: S165L-T	
Floodgate			
	Width	10m	
	Height	4.35m	
	No. of Gates	2 unit	
Average Fuel Consumption/Engine/Hr		Main Engine	Generator
		84L	60L
Average Garbage Generated/Day		Rainy Season	Dry Season
		5 cu.m	1 cu.m
Final Disposal Site		Tanza, Navotas Sanitary Landfill	

Table 7: Rehabilitation works at Vitas Pumping Station

Station		Scope of Work
Vitas Pump Station	1	Replacement of prime power from diesel engine to electric motor
	2	Upgrading of pump capacity
	3	Supply and installayion of 2 generator sets as standby power
	4	Connection to Meralco power supply as primary power
	5	Rehabilitation / replacement of auxiliary equipment
	6	Rehabilitation / replacement of horizotal and inclined conveyor system
	7	Rehabilitation / replacement of one unit authentic trashrake assembly
	8	Rehabilitation of one unit garbage hopper
	9	Replacement of 5 units of secondary screens
	10	Replacement of all LCP, MCC and electrical wirings
	11	Rehabilitation of pump station building and lightings
	12	Rehabilitation of 3 units floodgates
	13	Installation of additional storage tank
	14	Rehabilitation of additional crane
	15	Rehabilitation and upgrading of Vitas Warehouse

Environmental Performance and Compliance

116. The Vitas pumping station does not have an environmental compliance certificate. The generator set does not have a valid permit to operate ecrtificate from the DENR. This project will address these gaps in environmental compliance.

Figure 6: Vitas Pumps Stations, Flood Gates, Pump House and Solid Waste Collector (clockwise)

BALUT PUMPING STATION

Catchment Area

117. Along with Vitas Pumping Station, the Balut Pumping Station is serving several barangays in the Tondo District in the City of Manila. The total catchment area is about 49 hectares as shown in **Figure 7**. Other information pertinent to the catchment area is shown in **Table 8**.

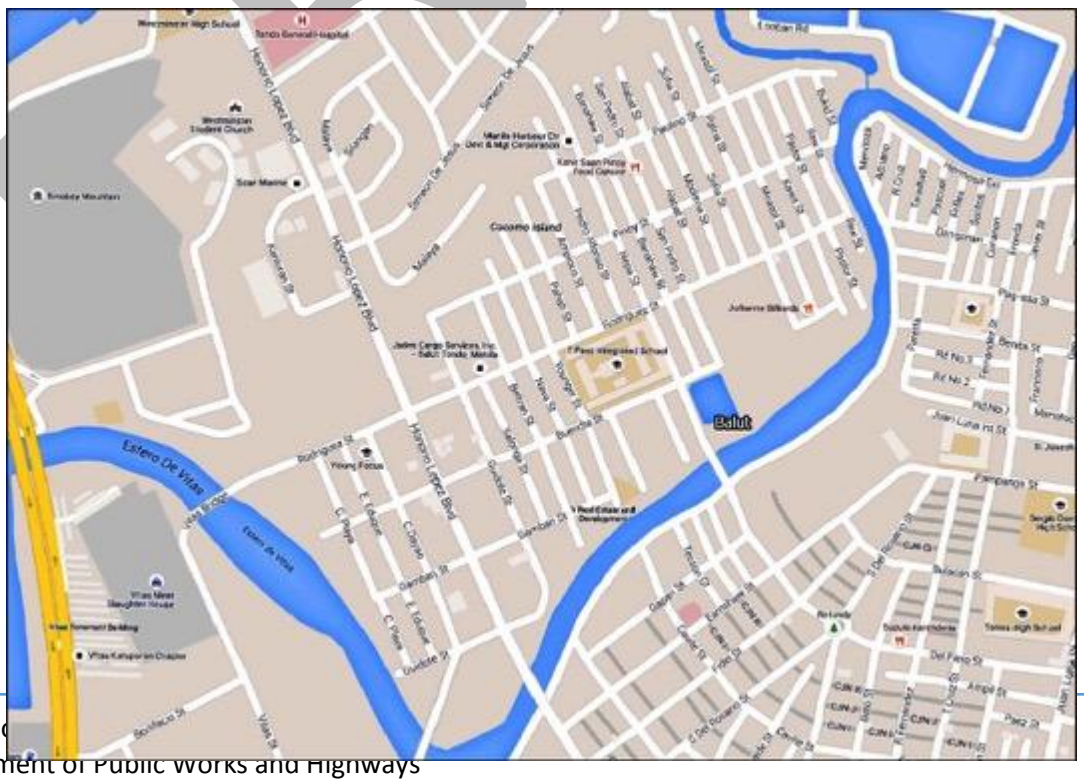


Figure 7: Balut Pumping Station Catchment Area

Table 8: Catchment area of Balut Pumping Station

1	Type	Major pump Station	
2	Location	Tondo, Manila	
3	Total drainage area (hectares)	49	
4	Total population in drainage area	~19,600	
5	Total length of drainage lateral (m)	8,632.60	
6	Total length of drainage mains (m)	2,005.00	
7	Total length of open waterways (m)	3,025	
8	Volume to be doclogged (m^3)		
	Lateral	Mains	Open waterways
	1,578.50	7,825.97	43,627.50

Key Components and Features

118. The key features of the Balut Pumping Station are shown in **Table 9**. Site photos are presented in **Figure 8**.

Table 9: Features of Balut Pumping Station

BALUT PUMPING STATION	
Location	Buendia St. cor. Nepa St., Balut, Tondo, Manila
Date Constructed	September 14, 1996
Date Completed	December 15, 1997
Fund Source	Foreign Loan (OECF)
Civil Works Cost	Php 34,154,000.00
Equipment Cost	Php 47,800,000.00
Total Project Cost	Php 81,954,000.00
Drainage Area (served)	49 ha
Time of Concentration	45 minutes
Total Length of Estero Served	Retarding Pond
Total Length of Conduits Served	Approximately 500m
Pumps Starting Level	9.10m
Pumps Stopping Level	8.90m

Average Width of Estero		Retarding Pond	
Bottom Elevation (m)		8.90m (Retarding Pond), 6.50m (Suction)	
Top of Revetment (m) at P/S		12.20m	
Main Drainage Pump/Engine			
	Type	Submersible Axial Pump, Type: 700 DSZ	
	Total no. of Units	2	
	Capacity	1 cu.m./s	
	Total Pumping Capacity	2 cu.m./s	
	Bore	700mm	
	Total Dynamic Head	3.6m	
	Brake Horsepower	360 hp x 1200 rpm	
Diesel Generator/Engine			
	Total no. of Units	1	
	Capacity (KVA)	300	
	Brake Horsepower	360 hp x 1200 rpm, Type: S165L-T	
Floodgate			
	Width	2.2m	
	Height	2.2m	
	No. of Gates	1 unit	
Average Fuel Consumption/Engine/Hr		Main Engine	Generator
		N/A	72L
Average Garbage Generated/Month		Rainy Season	Dry Season
		6 cu.m	1-2 cu.m

Figure 8: Balut Pumps Stations, Pump House, Solid Waste Collector and Diesel Storage Tank (clockwise)

Rehabilitation and Upgrading Works

119. The proposed rehabilitation works are listed in **Table 10**.

Table 10: Rehabilitation works at Balut Pumping Station

Station		Scope of Work
Balut Pumping Station	1	Rehabilitation / replacement of 2 units submersible pump
	2	Installation of additional 2 units submersible pumps and drainage pipes
	3	Rehabilitation / replacement of 2 existing trashrakes
	4	Rehabilitation / replacement of horizontal and inclined conveyors and hynges
	5	Upgrading of Meralco Power Supply
	6	Installation of additional generator set as stanby power for additional pumps
	7	Replacement of auxiliary equipment
	8	Rehabilitation of pump station buildings and lightings
	9	Rehabilitation of pump station perimeter fence

Environmental Performance and Compliance

120. The pumping station does not have an environmental compliance certificate. The generator set does not have a valid permit to operate ecrtificate from the DENR. This project will address these gaps in environmental compliance.

PACO PUMPING STATION

Catchment Area

121. Paco Pumping Station is serving several barangays in the Paco District in the City of Manila. The total catchment area is about 182 hectares as shown in **Figure 9**. Other information pertinent to the catchment area is shown in **Table 11**.

Table 11: Catchment area of Paco Pumping Station

1	Type	Major pump Station	
2	Location	Paco, Manila	
3	Total drainage area (hectares)	182	
4	Total population in drainage area	~72,000	
5	Total length of drainage lateral (m)	98,000	
6	Total length of drainage mains (m)	-	
7	Total length of open waterways (m)	3,025	
8	Volume to be doclogged (m^3)		
	Lateral	Mains	Open waterways
	21,538.50	-	71,451.00

Figure 9: Paco Pumping Station Catchment Area

Key Components and Features

122. The key features of the Paco pumping station are shown in **Table 12**. Site photos are in **Figure 10**.

Table 12: Features of the Paco Pumping Station

PACO PUMPING STATION		
Location	Cristobal St., Paco, Manila	
Date Constructed	May 1976	
Date Completed	July 1977	
Fund Source	Overseas Economic Cooperation Fund	
Civil Works Cost	Php 10,029,000.00	
Equipment Cost	Php 9,450,000.00	
Total Project Cost	Php 19,479,000.00	
Drainage Area (served)	182 ha	
Run-off Coefficient (design)	0.64	
Time of Concentration	67 minutes	
Total Length of Estero Served	2,900m	
Pumps Starting Level	10.50m	
Pumps Stopping Level	10.20m	
Average Width of Estero	22m	
Bottom Elevation (m)	7.20	
Top of Revetment (m) at P/S	12.30m	
Main Drainage Pump/Engine		
Type	Vertical Shaft Axial Flow Pumps	
Total no. of Units	3	
Capacity	2.53 cu.m./s	
Total Pumping Capacity	7.60 cu.m./s	
Bore	1m	
Total Dynamic Head	2.8m	
Brake Horsepower	150 hp, Type: 6 RL	
Diesel Generator/Engine		
Total no. of Units	2	
Capacity (KVA)	75	
Brake Horsepower	95 hp, Type: 4 KDL	
Floodgate		
Width	14m	
Height	6.5m	
No. of Gates	1 unit	
Average Fuel Consumption/Engine/Hr	Main Engine	Generator
	34.5L	23.75L
Average Garbage Generated/Month	1 cu.m	
Final Disposal Site	Tanza, Navotas Sanitary Landfill	

Rehabilitation and Upgrading Works

123. The proposed rehabilitation works in Paco Pumping Station are listed in **Table 13**.

Table 13: Rehabilitation works at Paco Pumping Station

Station		Scope of Work
Paco Pumping Station	1	Upgrading of pump capacity
	2	Replacement of prime power from diesel engine to electric motor
	3	Supply and installation of 2 units of generator sets as standby power
	4	Connection to Meralco power supply as prime power
	5	Rehabilitation / replacement of auxiliary equipment
	6	Repair / rehabilitation of one unit of floodgate
	7	Rehabilitation of pump station building and lightings
	8	Rehabilitation of one unit garbage hopper
	9	Replacement of all LCP, MCC and electrical wirings
	10	Installation of additional storage tank
	11	Rehabilitation of overhead crane

Environmental Performance and Compliance

124. The pumping station does not have an environmental compliance certificate. The generator set does not have a valid permit to operate ecrtificate from the DENR. This project will address these gaps in environmental compliance.

Figure 10: Solid waste collection at Paco Pumping Station

TRIPA DE GALLINA PUMPING STATION

Catchment Area

125. The Tripa de Gallina Pumping Station has the largest catchment area serving Pasay, Makati and portion of Taguig. The total catchment area is about 1,769 hectares as shown in **Figure 11**. Other information on the catchment area are shown in **Table 14**.

Table 14: Catchment area of Tripa de Gallina Pumping Station

1	Type	Major Pump Station	
2	Location	Pasay	
3	Total drainage area (hectares)	1,769	
4	Total population in drainage area	~530,000	
5	Total length of drainage lateral (m)	191,483.70	
6	Total length of drainage mains (m)	11,492.00	
7	Total length of open waterways (m)	14,837.00	
8	Volume to be doclogged (m^3)		
	Lateral	Mains	Open waterways
	38,238.03	196,552.50	237,358.50

Figure 11: Tripa de Gallina Pumping Station Catchment Area

Key Components and Features

126. The key features of the Tripa de Gallina PS are shown in **Table 15**. Site photos are in **Figure 12**.

Table 15: Features of Tripa de Gallina Pumping Stations

TRIPA DE GALLINA PUMPING STATION	
Location	Saint Andrew St., Pasay City
Date Constructed	1976
Date Completed	July 1977/1990
Fund Source	Overseas Economic Cooperation Fund
Civil Works Cost	Php 36,754,000.00
Equipment Cost	Php 36,940,000.00
Total Project Cost	Php 73,694,000.00

Drainage Area (served)		1,769 ha	
Run-off Coefficient (design)		0.60	
Time of Concentration		101 minutes	
Total Length of Estero Served		7,850m	
Pumps Starting Level		9.90m	
Pumps Stopping Level		9.60m	
Average Width of Estero		8m	
Bottom Elevation (m)		8.55m	
Top of Revetment (m) at P/S		13m	
Main Drainage Pump/Engine			
	Type	Horizontal Shaft & submersible Axial Flow Pumps	
	Total no. of Units	8	
	Capacity	7 cu.m/s	
	Total Pumping Capacity	57 cu.m/s	
	Total Dynamic Head	3.2m	
	Brake Horsepower	450 hp. Type: 6 MAL-HT	
Diesel Generator/Engine			
	Total no. of Units	2	
	Capacity (KVA)	55/150	
	Brake Horsepower	75/185, Type: 3 KDL/6 KDL	
Floodgate			
	Width	8m	
	Height	5.3m	
	No. of Gates	3 units	
Average Fuel Consumption/Engine/Hr		Main Engine	Generator
		90L	40L
Average Garbage Generated/Day		Rainy Season	Dry Season
		80 cu.m	20 cu.m
Final Disposal Site		Rodriguez, Rizal Sanitary Landfill	

Rehabilitation and Upgrading Works

127. The proposed rehabilitation works in Tripa de Gallina are listed in **Table 16**.

Table 16: Rehabilitation works at Tripa de Gallina Pumping Station

Station		Scope of Work
Tripa de Gallina Pumping Station	1	Costruction and installation of primary trashscreen including horizontal and vertical conveyors
	2	Replacement of auxiliary equipment
	3	Rehabilitation of 3 units of floodgates
	4	Rehabilitation of PS building and lightings
	5	Rehabilitation of one unit overhead crane
	6	Supply of 12 units of stop logs

Environmental Performance and Compliance

128. The pumping station does not have an environmental compliance certificate. The generator set does not have a valid permit to operate ecrtificate from the DENR. This project will address these gaps in environmental compliance.

Figure 12: Tripa de Gallina Pump Station (above) and solid wastes collected (below)

LABASAN PUMPING STATION

Catchment Area

129. The Labasan Pumping Station is serving several barangays in Taguig City. The total catchment area is about 601 hectares as shown in **Figure 13**. Other information on the catchment area are shown in **Table 17.**

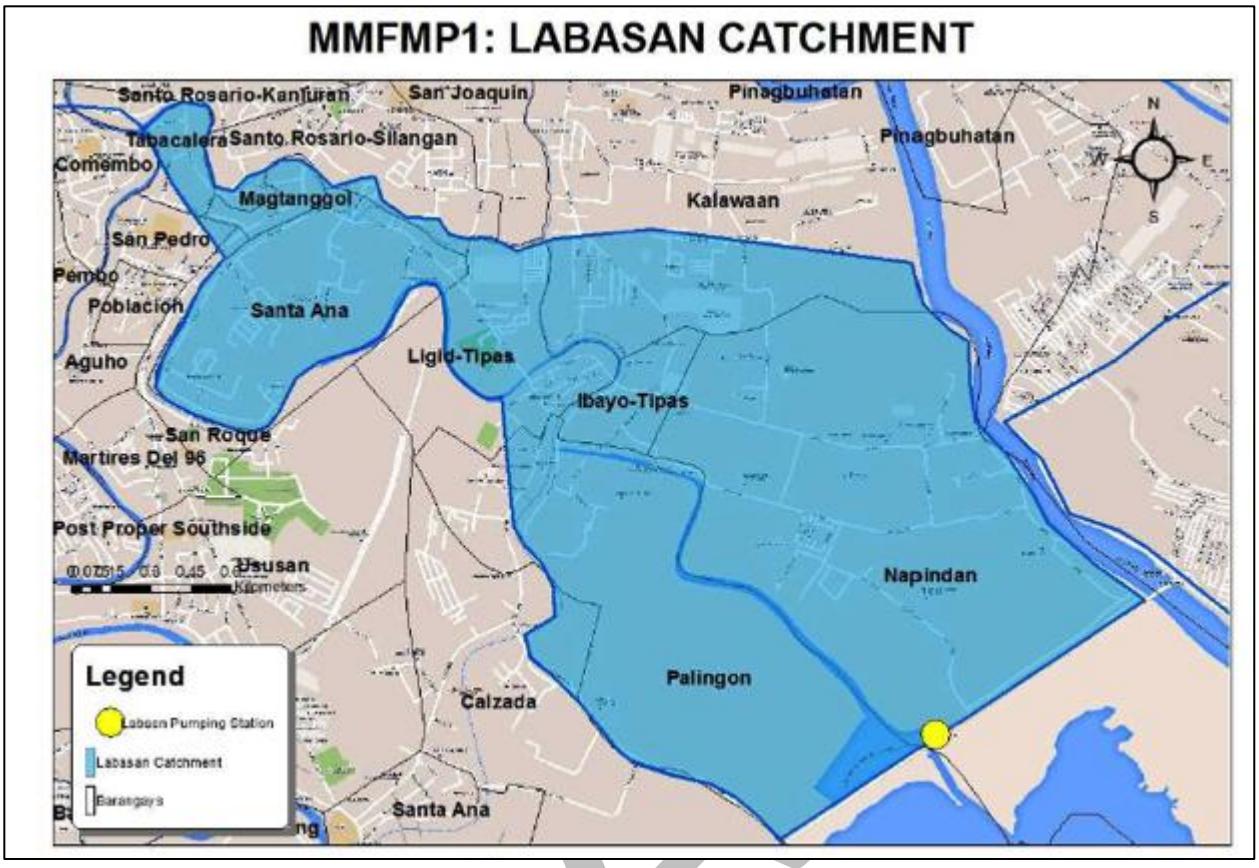


Figure 13: Catchment area of Vitas Pumping Station

Table 17: Catchment area of Labasan Pumping Station

1	Type	Major pump Station
2	Location	Taguig
3	Total drainage area (hectares)	601
4	Total population in drainage area	~100,000

Key Components and Features

130. The key features of the Labasan Pumping Station are shown in **Table 18**. Site photos are in **Figure 14**.

Table 18: Features of the Labasan Pumping Station

LABASAN PUMPING STATION	
Location	C6 Road, Labasan Drainage Channel, Taguig, Metro Manila
Date Constructed	August 31, 2002
Date Completed	November 17, 2004
Fund Source	JBIC (PH-P179)
Civil Works Cost	Php 199,500,000.00

LABASAN PUMPING STATION		
Equipment Cost	Php 224,130,000.00	
Total Project Cost	Php 423,630,000.00	
Drainage Area (served)	601 ha	
Total Length of Estero Served	5,300m	
Pumps Starting Level	11.50m	
Pumps Stopping Level	10.50m	
Average Width of Estero		
Bottom Elevation (m)	9.0m	
Top of Revetment (m) at P/S	12.5m	
Minimum Required Ground Elevation	12.0m	
Main Drainage Pump/Engine		
Type	1200 Submersible Pump	
Total no. of Units	3	
Capacity	3 cu.m/s	
Total Pumping Capacity	9 cu.m/s	
Bore	1.2m	
Total Dynamic Head	4.2m	
Suction Level of Pumps	EL. 10.3m to EL 12.0m	
Diesel Engine Specification		
Description	4 cycle, Turbocharged, Intercooled	
Model	Detroit Diesel 16V2000 (G70)	
Total no. of Units	2	
Displacement	31.9L	
Compression Ratio	16:1	
Generator Specification		
Description	Brushless, Permanent-magnet, Pilot exciter	
Model	Kohler 800ROZD4	
Power Rating (KVA)	919	
Total no. of Units	2	
Floodgate		
Type	Fixed Wheel Gate with Guide Frames and Wire Rope Hoist	
Width	5.0m	
Height	4.0m	
No. of Gates	4 units	
Average Garbage Generated/Day	Rainy Season	Dry Season
	1 cu.m	1 cu.m
	Note: Waste is not collected every day. Collected waste is mostly composed by water hyacinth.	
Final Disposal Site	Rodriguez, Rizal Sanitary Landfill	


Figure 14: Labasan Pumping Station: trash trap (left) and water hyacinth accumulating in the retention pond (right)

Rehabilitation and Upgrading Works

131. The proposed rehabilitation works are listed in **Table 19**.

Table 19: Rehabilitation works at Labasan Pumping Station

Station		Scope of Work
Labasan Pumping Station	1	Installation of additional three units submersible pumps
	2	Installation of additonal generator sets for the pumps
	3	Installation of 3 units of trashrakes
	4	Installation of horizontal conveyor
	5	Rehabilitation of existing generator sets and radiator
	6	Rehabilitation of existing submersible pumps
	7	Installation of additional storage tank
	8	Rehabilitation pf PS building and lighting
	9	Rehabilitation of existing submersible pump

Environmental Performance and Compliance

132. The pumping station does not have an environmental compliance certificate. The generator set does not have a valid permit to operate ecrtificate from the DENR. This project will address these gaps on environmental compliance.

DREDGING TO IMPROVE FLOW

133. Dredging, the removal of sediments, silt and other accumulated materials at the waterways leading to the pumping stations, will be a major component of the Project. Dredging will increase the depth of the channels and will effectively optimize the capacities of the pumps in removing floodwaters. As shown in **Figure 15**, dredging of narrow channels like in Estero de Paco and Estero de Vitas will require heavy equipment such as backhoe and cranes that will have to maneuver within a limited working area.

Figure 15: Dredging of narrow esteros leading to pumping stations
(Source: www.aarcon builders.com & www.abs-cbn.com)

134. Dredged materials removed from esteros are potentially contaminated with a variety of pollutants introduced in waterways from pollution sources such as sewage discharges, industrial effluents, and waste hydrocarbons and oils. Non-point sources also contribute pollution loads into the esteros through urban runoff and atmospheric deposition. Dredged materials must therefore be managed and handled using prescribed guidelines and must be disposed at designated disposal sites.

135. In the past, PRRC implemented the Underwater Placement with Over-depth Capping or UPOC. More than 60 hectares in Manila Bay were allotted for the disposal of dredged materials from Pasig River in 2009. The underwater disposal site was near the mouth of Pasig River in Manila Bay around 4 km from Delpan Bridge. The UPOC was designed to accommodate about 4.3 million m^3 of dredged materials from the dredging activities of PRRC. **Figure 16** shows the location of the UPOC in Manila Bay.

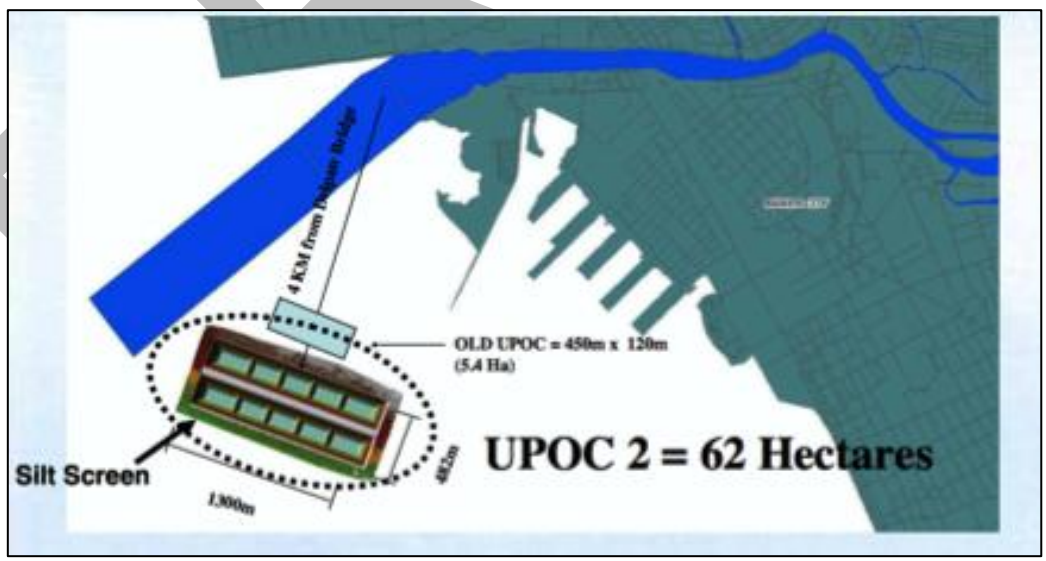


Figure 16: UPOC used by PRRC for the disposal of dredged materials from Pasig River
(Source: PRRC, 2009)

136. DPWH is currently using private contractors for the disposal of dredged material from its river cleanup activities. The materials are currently disposed off in private lots. For this project, disposal sites for dredged materials are yet to be identified. Candidate sites include disposal areas in Pier 18 or along Road 10. Disposal through either of these sites will require detailed feasibility study and permission from the Philippine Reclamation Authority (PRA) who has jurisdiction over foreshore areas and reclamation projects along Manila Bay.

137. The current practice of DPWH for the disposal of dredged materials is through landfilling of vacant private lots. The contractor through the coordination with the LGUs often implements this. There is no standard permitting procedure followed and the characteristics of the dredged materials are not established.

138. Sample sediments collected from the Phase 1 project sites passed the EMB toxicity tests. This implies that the dredged materials may be disposed off in ordinary landfills. In the future, MMDA must conduct regular testing of dredged materials to quantify the contaminants against prescribed standards. Should these materials exceed prescribed limits, disposal through Clark Sanitary Landfill may be explored.

MINIMIZING SOLID WASTES IN THE WATERWAYS

139. Component 2 of the Project involves solid waste management for the areas within the catchment basin of the pumping stations. Solid waste accumulation impedes water flow reducing pumping station capacity. Garbage indiscriminately disposed by residents along the banks inevitably overwhelms the trash traps and screens in the pumping station and has caused mechanical failures in the past.

140. Solid waste management is critical to the operation of the pumping stations to make the intake zones of the pumps free of garbage and other solid wastes. **Figure 17** shows the intake of Vitas and Balut pumping stations.

Figure 17: Intake of Vitas Pumping Station (left) and Balut PS (right)

141. The Paco Pumping Station is serving Estero de Paco and Estero de Concordia in Manila. These esteros was the focus of the rehabilitation effort of Kapit Bisig Para sa Ilog Pasig (KBPIP) under the auspices of the ABS-CBN Foundation and PRRC. Solid waste management and estero clean up have been a successful and notable undertaking of this group in improving the environmental conditions in the area and improving the performance of the Paco Pumping Station. **Figure 18** shows the rehabilitation effort of the KBPIP in terms of solid waste management along the estero.

Figure 18: Clean Up Works at Estero de Paco
(Source: PRRC and KBPIP)

PERSONNEL REQUIREMENTS (REHABILITATION WORKS & OPERATION)

142. During rehabilitation and upgrading works, the Phase-1 of the Project will employ about 50 persons to be comprised of engineers, skilled technicians, electricians and common laborers who are responsible for civil works, electrical, mechanical and painting works.

143. After the upgrading works, normal manpower complement will operate and maintain the pumping stations. Under this condition, MMDA will employ personnel, composed of operations, maintenance, safety and security staff. The manpower schedules for the 5 pumping stations during rehabilitation and operation phases are shown in **Table 20**.

Table 20: Personnel Requirements for the Pumping Stations

Project Phase	Particulars	Estimated Manpower Requirements				
		Vitas	Balut	Paco	Tripa	Labasan
Rehabilitation	Civil works, electrical, mechanical and painting works	50-100	50	50	50-100	50
Operation	Operations and maintenance, solid waste management, security	15	5	5	15	5

PROJECT COST FOR PHASE-1 SUBPROJECT

144. The rehabilitation works have a total estimated cost of PhP22.5 billion or $500 million which includes the following:

- Detailed engineering works
- Upgrading of pumping stations equipment
- Upgrading of mechanical equipment for solid wastes collection
- Acquisition of new equipment and generator sets
- Solid waste management activities
- Disposal of dredged materials

PROJECT TIMELINE

145. The procurement process for the project is expected to start mid 2016. The upgrading and rehabilitation of all the pumping stations will be done simultaneously and will be completed within 6 to 9 months. Component 3 particularly for the Vitas Pumping Station must be completed first prior to dredging and clearing of the waterways.

BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

DELINEATION OF PROJECT IMPACT AREAS

146. The project's direct impact areas are the actual footprint of the pumping stations where upgrading and rehabilitation works will be done and the opimum pumping areas in the waterways where the dredging activities will be conducted. It also includes any other ancillary facility (e.g. access road).

147. The indirect impact zones include communities around these direct impact zones. These indirect impact areas were delienated based on the anticipated impacts of the project activities particularly construction noise, access restrictions and nuisance from dredging activities.

148. The impact areas that serve as the study areas for this ESIA are shown in **Figures 19** to **21**.

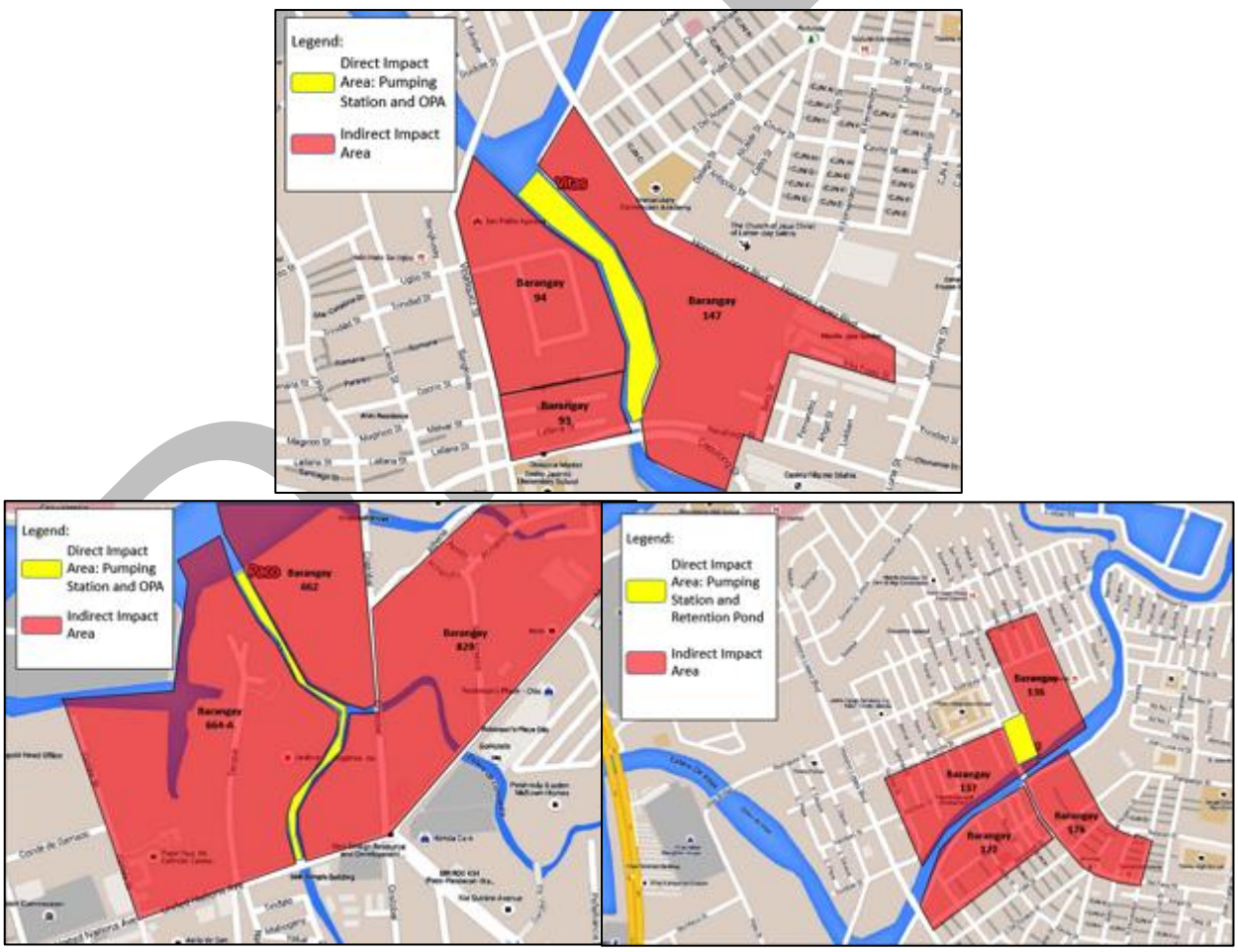


Figure 19: Project Sites in City of Manila and the Indirect Impact Areas: Vitas PS (top), Paco PS (bottom, left) and Balut PS (bottom, right)

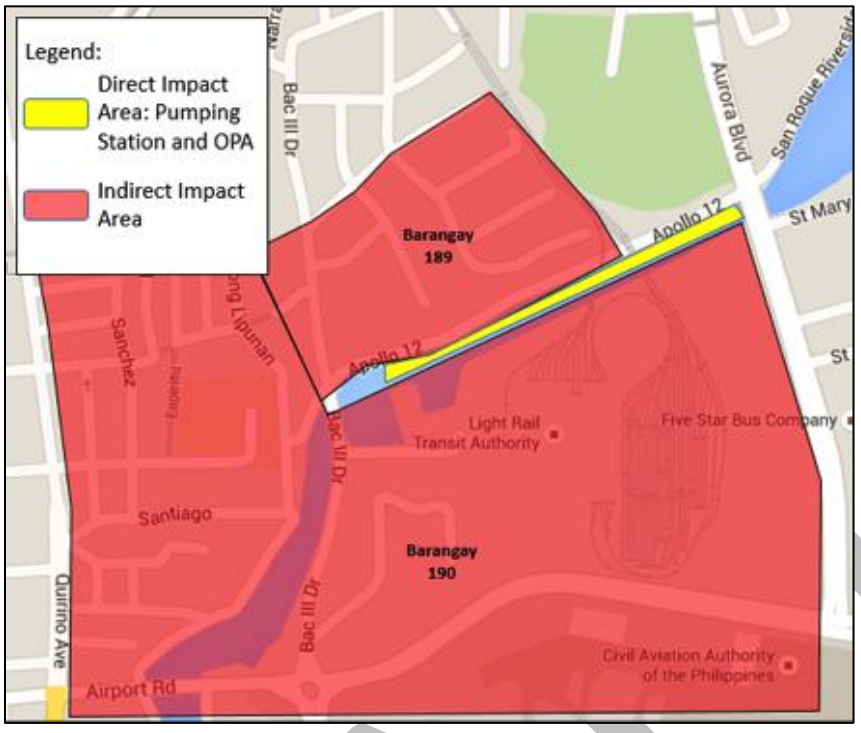


Figure 20: Tripa de Gallina and the indirect impact areas in Pasay City

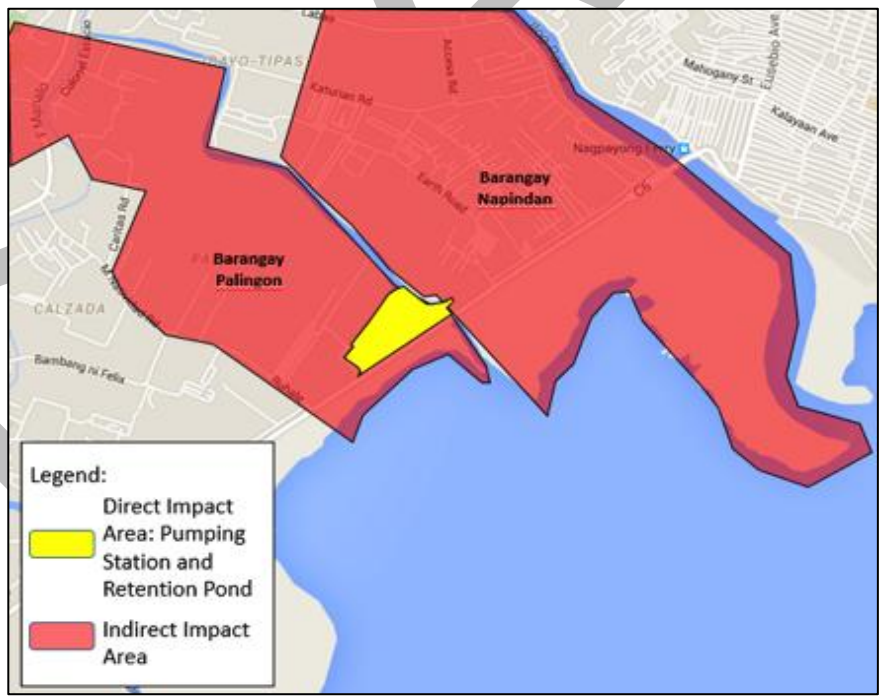


Figure 21: Labasan Pumping Station and indirect impact areas in Taguig City

LAND

REGIONAL GEOLOGY AND GEOMORPHOLOGY

149. The National Capital Region lies on a shelf, which has been essentially formed by a ridge of volcanic tuff deposits to the west. Fluvial deposits of sand, gravel and clay bound the ridge. To the east of the ridge are similar deposits, transported by the Marikina River, topping a valley formed by downward and tilted fracture or fault.

150. Metro Manila is be divided into zones of varying vulnerability to ground-shaking induced by high intensity earthquakes as shown in **Table 21** (Saldivar-Sali, 1991**).** The 'very high risk category' is assigned to areas underlain by very thick layers (greater than 15 meters) of soft clay or loose sand such as those found at the mouth (or delta) of the Pasig River and Marikina River. 'Very low risk areas' are those where the adobe bedrock is exposed or covered by no more than a couple of meters of soil.

151. The areas where the pumping stations, except for Tripa de Gallina in Pasay City, are located were classified as a very high -risk zone in terms of seismicity risk level. This finding must be put into consideration for the structural design especially where new structures will be constructed.

Table 21: Comparative Seismicity Risk Level by Saldivar-Sali *(Source: City of Manila website)*

Very Low Risk Zones	Low Risk Zones	High Risk Zones	Very High Risk Zones
Caloocan Malabon Valenzuela Novaliches Quezon City San Juan Mandaluyong Makati Paranaque	Pasay City Sampaloc Pandacan East Marikina	Marikina Ermita Malate Navotas South Marikina	Downtown Manila, Quiapo, Intramuros, Sta Cruz Binondo, Port Area Reclamation Area Along Roxas Boulevard Pasig Pateros East Taguig Coastal town of the Marikina Valley Plain

PEDOLOGY

152. The major soil types in the National Capital Region (NCR) of the Philippines are (a) eutropepts with dystropepts, (b) tropudults with tropudales, tropepts, and oxisols, and (c) pellusterts with udales, udorthents, and tropepts.

153. The soils in the City of Manila and Pasay are classified as eutropepts with dystropepts, while the soils in the area where Labasan Pumping Station is located are classified as pellusterts with udales, udorthents, and tropepts.

TERRESTRIAL ECOLOGY

154. The areas surrounding the Vitas, Balut, Paco and Tripa de Gallina pump stations are mixed residential and commercial built-up areas with several light industrial areas. Vegetation in the area, which is mostly planted, is found only on sidewalks and very limited open spaces. Inside the pumping stations, some trees are retained serving as noise barriers and landscape.

155. In Labasan Pumping Station, the vegetation cover of the floodplains is dominated by grasses with a few shrubs that characterize open, waste and generally damp habitats. The vegetation cover serves as primary producers in the ecosystem and as soil cover to prevent erosion. This also provides habitats for insects and other small field fauna.

156. There are no rare, threatened or endangered species of animals in these Project area due to its largely urban setting.

WATER

HYDROLOGY

157. Manila and Pasay are naturally drained by the Manila Bay through the Pasig and Paranaque River Systems, respectively, while Taguig City is drained by Laguna Lake.

158. Manila Bay is a semi-enclosed estuary facing the South China Sea, about 60 km long. The entrance to Manila Bay is 18 km wide between Corregidor and Caballo Islands. It consists of a gently sloping basin with the depth increasing at a rate of 1m / km from the interior to the entrance and has an average depth of 17 meters. It receives drainage from approximately 17,000km^2 of watershed consisting of 26 catchment areas.

159. Laguna Lake has a surface area of some 90,000 hectares. It serves as a natural detention reservoir for discharges from the surrounding tributary streams (Pila-Santa Cruz, San Juan, San Cristobal, Pagsanjan amd Romero-Sta. Maria Rivers). The lake's only outlet is the Napindan Channel and Pasig River. During extremely wet years, widespread flood damage occurs along the lakeshores (MTSP, 2005).

160. The depth, velocity, and direction of flow of the Pasig River was monitored by the Pasig River Rehabilitation Commission (PRRC) through the Pasig River Unified Monitoring Stations (PRUMS) project shown in **Figure 22**. According to the data presented in **Table 22**, the depth of the river is inconsistent; some areas downstream are shallower than some areas upstream. This is detrimental to the flow of the river from upstream to downstream. In fact, water in most stations flows upstream. The capacity of the river to dilute and degrade the pollution it absorbs is adversely affected by this impeded flow of water.

Table 22: Hydrological Data of Pasig River (Source: PRRC)

Station	April 2015			May 2015			June 2015		
	Weather: sunny			Weather: sunny to cloudy			Weather: sunny to cloudy		
	Depth (meter)	*Velocity (m/s)*	*Flow Direction**	*Depth (meter)*	*Velocity (m/s)*	*Flow Direction**	*Depth (meter)*	*Velocity (m/s)*	*Flow Direction**
C6 Bridge	3.10	0.23	upstream	2.33	0.27	Upstream	1.73	0.17	upstream
Bambang Bridge	3.60	0.20	upstream	2.97	0.11	Upstream	1.66	0.18	upstream
Vargas Bridge	0.83	0.19	upstream	1.07	0.10	Upstream	0.75	0.04	upstream
Marikina Bridge	1.00	0.23	downstream	1.03	0.18	downstream	0.93	0.21	upstream
BuayangBato Bridge	0.40	0.17	upstream	0.35	0.29	downstream	0.30	0.12	upstream
Guadalupe Ferry Station	2.70	0.20	upstream	2.20	0.10	downstream	1.87	ND	downstream
Guadalupe Nuevo	0.30	0.36	ND	0.50	0.13	downstream	0.50	0.11	downstream
Guadalupe Viejo	0.50	0.16	ND	0.47	0.22	downstream	0.60	0.06	downstream
Sevilla Bridge	1.85	0.19	ND	2.27	ND	Upstream	ND	ND	upstream
Lambingan Bridge	4.17	0.10	downstream	3.77	0.19	Upstream	2.87	0.04	upstream
Havana Bridge	0.47	0.19	downstream	0.70	0.18	ND	0.43	0.05	upstream
Nagtahan Bridge	3.60	0.10	downstream	4.20	0.13	downstream	4.57	0.02	upstream
Jones Bridge	2.60	0.16	Downstream	3.43	0.10	downstream	3.23	0.06	upstream
Manila Bay	2.50	0.11	Downstream	3.30	0.50	downstream	ND	ND	upstream

** Upstream direction leads to Laguna Lake; downstream direction leads to Manila Bay; ND – No data*

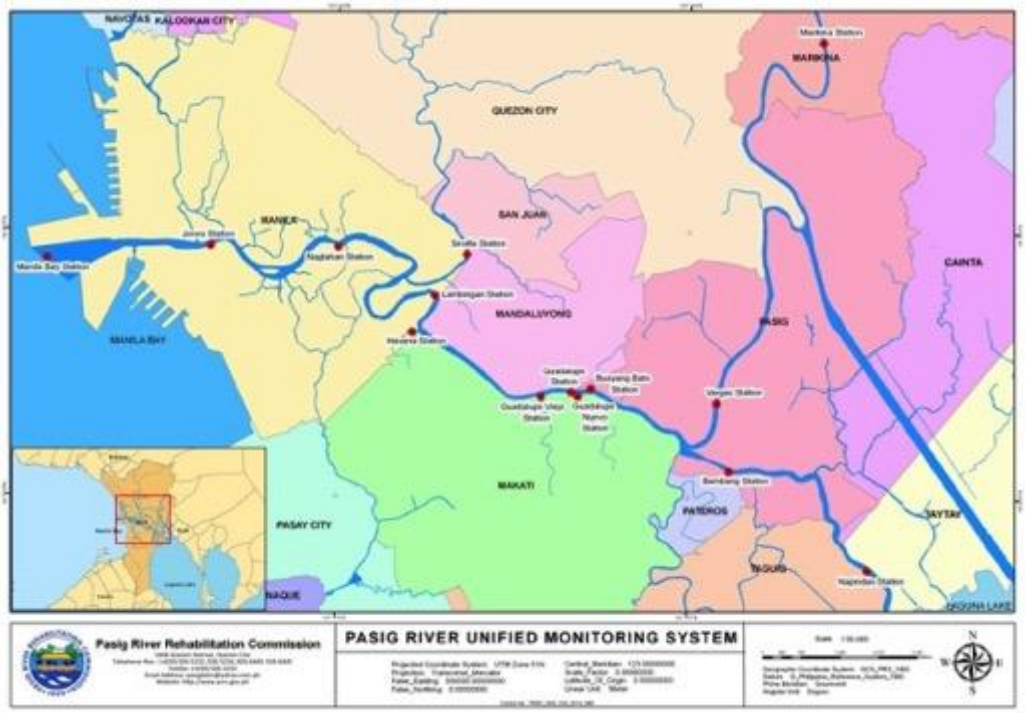


Figure 22: PRUMS Monitoring Station for Pasig River

WATER QUALITY

161. Data on the water quality of the Pasig River was provided by the PRRC through the PRUMS project. The water quality monitoring stations were classified as Class C, which is suitable for the propagation of fish and other aquatic resources, recreation, and industrial water supply. The water quality monitoring station in Manila Bay, categorized as coastal and marine waters, was classified as Class SB. Class SB is suitable for bathing, swimming, skin diving, and spawning areas for fish.

162. The following concerns on water pollution are observed for the river systems in Metro Manila (MBEMP report):

- Untreated domestic sewage discharged to Pasig River (and eventually to Manila Bayand Laguna Lake) from 11 major areas in Metro Manila is estimated at 168 metric tons per day.
- Nitrate, nitrite, ammonia and phosphate concentrations are increasing in the eastern part of the Bay;
- Heavy metals and pesticides are contaminating sediments and seafoods in Manila Bay;
- The red tide phenomenon, which is caused by the bloom of harmful algae, causes paralytic shellfish poisoning (PSP) in humans through consumption of contaminated shellfish;
- High organic loading manifested in low dissolved oxygen levels; and
- Oil and grease from land– and sea-based sources fouls shorelines, vessels and equipment, and inhibits living resources.

163. Water samples from the various waterways where the pumping stations are located. The results are outlined in **Tables 23** to **27** while **Annex G** presents the laboratory results. As seen in the tables, the organic pollution load measured as BOD exceeds the water quality criteria prescribed by EMB for Pasig River and Laguna Lake waters. The water samples indicated gross contamination of coliforms. Phosphates were also above the prescribed limits in all stations. Moreover, the mercury levels in Balut Pumping Station Pond and Vitas Pumping Station Outlet exceeded the water quality criteria.

Table 23: Water Quality around Balut PS

Parameters	Estero de Sunog Apog, Balut	Balut Pumping Station Pond	DAO 90-34 Class C Standards	Units
Arsenic	< 0.01	< 0.01	0.05	mg/L
Cadmium	< 0.006	< 0.006	0.01	mg/L
Chromium	< 0.02	< 0.02	0.05	mg/L
Lead	< 0.05	< 0.05	0.05	mg/L
Mercury	0.002	0.006	0.002	mg/L
Total Coliforms	1,700,000	9,200,000	5,000	MPN/100mL
pH onsite	6.9	6.9	6.5-8.5	-
Biological Oxygen Demand	53	70	7 (10)	mg/L
Chemical Oxygen Demand	153	153		mg/L
Total Suspended Solids	34	29	(a)	mg/L
Oil & Grease	< 0.3	< 0.3	2	mg/L

Parameters	Estero de Sunog Apog, Balut	Balut Pumping Station Pond	DAO 90-34 Class C Standards	Units
Nitrate	0.09	0.09	10 (b)	mg/L
Phosphate	1.8	2.1	0.4	mg/L
a: not more than 30 mg/L increase; b: only applies to lakes of reservoirs, and similarly impounded water				

Table 24: Water Quality around Paco PS

Parameters	Paco PS Inlet	Paco PS Outlet	DAO 90-34 Class C Standards	Units
Arsenic	< 0.01	< 0.01	0.05	mg/L
Cadmium	< 0.006	< 0.006	0.01	mg/L
Chromium	< 0.02	< 0.02	0.05	mg/L
Lead	< 0.05	< 0.05	0.05	mg/L
Mercury	0.002	0.0007	0.002	mg/L
Total Coliforms	940,000	940,000	5,000	MPN/100mL
pH onsite	7	6.9	6.5-8.5	-
Biological Oxygen Demand	27	18	7 (10)	mg/L
Chemical Oxygen Demand	76	74		mg/L
Total Suspended Solids	24	56	(a)	mg/L
Oil & Grease	< 0.3	0.4	2	mg/L
Nitrate	0.06	0.06	10 (b)	mg/L
Phosphate	1.6	1.2	0.4	mg/L
a: not more than 30 mg/L increase; b: only applies to lakes of reservoirs, and similarly impounded water				

Table 25: Water Quality around Vitas PS

Parameters	Vitas PS Inlet	Vitas PS Outlet	DAO 90-34 Class C Standards	Units
Arsenic	< 0.01	< 0.01	0.05	mg/L
Cadmium	< 0.006	< 0.006	0.01	mg/L
Chromium	< 0.02	< 0.02	0.05	mg/L
Lead	< 0.05	< 0.05	0.05	mg/L
Mercury	0.0008	0.004	mg/L	mg/L
Total Coliforms	1,600,000	2,400,000	5,000	MPN/100mL
pH onsite	7.1	6.9	6.5-8.5	-
Biological Oxygen Demand	33	47	7 (10)	mg/L
Chemical Oxygen Demand	68	99		mg/L
Total Suspended Solids	18	18	(a)	mg/L
Oil & Grease	2.8	1.8	2	mg/L
Nitrate	0.1	0.1	10 (b)	mg/L
Phosphate	1.6	1.6	0.4	mg/L
a: not more than 30 mg/L increase; b: only applies to lakes of reservoirs, and similarly impounded water				

Table 26: Water Quality around Tripa de Gallina PS

Parameters	Tripa de Gallina PS Inlet	Tripa de Gallina PS Outlet	DAO 90-34 Class C Standards	Units
Arsenic	< 0.01	< 0.01	0.05	mg/L
Cadmium	< 0.006	< 0.006	0.01	mg/L
Chromium	< 0.02	< 0.02	0.05	mg/L
Lead	< 0.05	< 0.05	0.05	mg/L
Mercury	0.0006	<0.0006	0.002	mg/L
Total Coliforms	3,500,000	16,000,000	5,000	MPN/100mL
pH onsite	7.1	7.1	6.5-8.5	-
Biological Oxygen Demand	44	39	7 (10)	mg/L
Chemical Oxygen Demand	107	94		mg/L
Total Suspended Solids	65	57	(a)	mg/L
Oil & Grease	3.2	4.3	2	mg/L
Nitrate	0.06	0.1	10 (b)	mg/L
Phosphate	2.3	2.3	0.4	mg/L
a: not more than 30 mg/L increase; b: only applies to lakes of reservoirs, and similarly impounded water				

Table 27: Water Quality around Labasan PS

Parameters	Labasan PS Inlet	Labasan PS Outlet	DAO 90-34 Class C Standards	Units
Arsenic	< 0.01	< 0.01	0.05	mg/L
Cadmium	< 0.006	< 0.006	0.01	mg/L
Chromium	< 0.02	< 0.02	0.05	mg/L
Lead	< 0.05	< 0.05	0.05	mg/L
Mercury	0.001	0.001	0.002	mg/L
Total Coliforms	160,000	160,000	5,000	MPN/100mL
pH onsite	6.7	6.7	6.5-8.5	-
Biological Oxygen Demand	29	21	7 (10)	mg/L
Chemical Oxygen Demand	68	55		mg/L
Total Suspended Solids	20	22	(a)	mg/L
Oil & Grease	< 0.3	1.2	2	mg/L
Nitrate	0.09	0.1	10 (b)	mg/L
Phosphate	3.5	3.3	0.4	mg/L
a: not more than 30 mg/L increase; b: only applies to lakes of reservoirs, and similarly impounded water				

SEDIMENT QUALITY

164. Sample bottom sediments were also collected and analyzed for hazardous characteristics. As prescribed by DAO 29 of RA 6969, the leaching procedure (TCLP) test was used to determine sediment toxicity. Under this test, extracts were collected from sediments and were analyzed for leachable components, mostly heavy metals. All sediment extract samples collected in the

pumping stations passed the TCLP limits. Hence, the sludges are not considered hazardous and may be disposed in ordinary sanitary landfill. The results are shown in **Table 28**.

Table 28: Results of the TCLP tests for the sample sediments from the pump stations

Parameters	Balut PS	Paco PS	Vitas PS	Tripa de Gallina PS	Standards from DAO 92-29:	Units
Arsenic	0.002	0.001	0.006	0.007	Must be < 5	mg/L
Barium	ND	ND	ND	ND	Must be < 100	mg/L
Cadmium	ND	ND	ND	ND	Must be < 5	mg/L
Chromium	ND	ND	ND	ND	Must be < 5	mg/L
Lead	ND	ND	ND	ND	Must be < 5	mg/L
Silver	ND	ND	ND	ND	-	mg/L
Mercury	0.01	0.002	0.002	0.001	Must be < 0.02	mg/L

AQUATIC ECOSYSTEM

165. Flora and fauna known to exist in Pasig River and Laguna Lake are water hyacinth and janitor fish, which are species known to thrive in polluted waters. The Paco and Labasan pumping stations are affected by water hyacinth infestations.

166. Water hyacinth (*Ecchornia crasspies*) is an invasive aquatic plant that pose physical and ecological impacts to aquatic ecosystems. It is able to clog waterways, impeding water flow. Furthermore, it suppresses photosynthesis by blocking sunlight that would be absorbed by phytoplankton. This results to lower dissolved oxygen levels in the water body, reducing diversity of aquatic life. Although water hyacinth is a nuisance both in Paco and Labasan pumping stations, the plants pose greater adverse impacts in Labasan Pumping Station. The Paco Pumping Station collects about 1 cu.m of solid waste every month, most of it is water hyacinth. In the case of Labasan Pumping Station, the retention pond adjacent to the facility estimated at about 90% is filled with water hyacinth on the surface.

167. There are no mangroves, coral reefs, mudflats, beach, seagrass beds, and tidal swamps near the and of the Phase-1 project sites.

AIR

REGIONAL METEOROLOGY AND CLIMATE CHANGE ANALYSIS

168. The Philippines experiences two seasons: the wet season from November to April and the dry season from May to October. As Manila experiences maximum rain period from June to September, the climate in Manila is Type I according to Corona's Classification. Manila experiences about five cyclones for every three years, or 1.7 cyclones every year.

169. The monthly range of temperature is from 20.9°C to 34.0°C with a mean of 17.4°C. The warmest recorded temperature from the period 1961 – 2002 was 38.5°C on 14 May 1987 while the coldest temperature was recorded on 01 March 1963 at 14.9°C.

170. From January to February, the area is affected by the Northeast Monsoon (NE wind flow) while during March to May, the area receives southeasterly winds. From June to September, the wind regime shifts to Southwest Monsoon. Finally, during the transition months of October to December, the wind flow affecting the area is the Northerly winds. Wind speeds range from 1 to 2mps. The strongest wind speed was recorded at 50mps which occurred on 03 November 1995.

171. According to climate projections by PAGASA, temperature is bound to increase by one degree Celsius by 2020 (2006-2035) and by two degrees Celsius by 2050 (2036-2065), with a baseline of about 27.5˚C observed from 1971-2000. Furthermore, rainfall and number of extreme events are also expected to increase due to climate change. More rainfall during the wet season and less rainfall during the dry season is expected. Extreme events that were considered are number of days when the maximum temperature is greater than 35˚C, number of days with rainfall that exceeds 200m, and number of dry days. The number of days with temperature greater than 35˚C is expected to climb, while the number of dry days is expected to lessen. Extreme storm events are therefore likely to increase.

AIR QUALITY

172. Ambient air quality monitoring data from the 2011 Metro Manila Air Quality Status Report is shown in **Table 29.** The air sampler is situated in Department of Health (DOH), Manila. Results are presented for total suspended particles (TSP) and particulate matter (PM_{10}). The values do not exceed the national standards set for TSP and PM_{10}.

Table 29: Metro Manila Ambient Air Quality Monitoring Data (2011)

Month	Concentration µ/Ncm	
	TSP	PM10
January	123	xx
February	54	xx
March	144	xx
April	138	64
May	130	72
June	126	62

Month	Concentration µ/Ncm	
	TSP	PM10
July	102	55
August	103	47
September	98	50
October	81	53
November	109	53
December	98	68
Ambient air quality standards (24-hour Averaging Time)	**230**	**150**

Note: xx - data not available; Source: DENR-EMB 2011 Metro Manila Air Quality Status Report Department of Environment Natural Resources, Environmental Management Bureau (DENR-EMB

NOISE

173. Noise control regulations are set by the National Pollution Control Commission (NPCC) through Memorandum Circular No. 002, Series of 1980. One-hour noise monitoring was conducted in four corners of each pumping station compound for the ambient noise monitoring. Furthermore, 5 to 15-minute noise readings were taken from various areas within the pumping station facility for the workplace noise monitoring. The results of the noise monitoring are shown in **Annex G**.

174. **Table 30** shows the ambient noise monitoring of each pumping station. Vitas, Balut, Paco, and Tripa de Gallina pumping stations are located in mixed use areas (residential, commercial and industrial) while Labasan Pumping Station is located in a residential zone. The ambient noise monitoring shows that all pumping stations exceed the standards for light industrial areas and residential areas.

Table 30: Ambient noise monitoring in the pumping stations, January 2016

Pumping Station	Corner 1 reading db(A)	Corner 2 reading db(A)	Corner 3 reading db(A)	Corner 4 reading db(A)	DENR Standard db(A)
Vitas	71.5	77.4	75.5	73.9	65*
Balut	71.0	65.1	71.7	74.2	
Paco	76.3	80.2	74.4	75.3	
Tripa de Gallina	94.3	92.0	83.5	75.4	
Labasan	85.5	85.7	82.1	79.1	50**

*NPCC standard for Class C areas - a section primarily reserved as a light industrial area for morning and evening measurement

**NPCC standard for Class A areas - a section or contiguous area which is primarily used for residential purposes for morning and evening measurement

175. According to standards set by the National Institute for Occupational Safety and Health, USA (NIOSH), the 8-hour shift noise exposure shall not exceed 85 db(A). Results presented in

176. **Table** 31 show that areas where pump station equipment, such as pumps and generator sets, exceed the limit, while the offices in the respective pumping stations are within the standards.

Table 31: Workplace noise monitoring in pumping stations, January 2016

Pumping Station	Area	Average Noise db(A)	Permissible Noise Exposure Limit db(A)
Vitas	Office	69.1	85*
	Pumping Machine Area (2nd Floor)	96.9	
	Pumping Machine Area (1st Floor)	99.1	
Balut	Office	72.5	
	1st Floor	82.0	
	Generator Area	103.6	
Paco	Pump and Generator Area (1st Floor)	100.2	
	Office 1	82.4	
	Office 2	83.6	
	Basement	93.5	
Tripa de Gallina	Generator Area	105.2	
	Pump Area	103.5	
	Office	72.9	
Labasan	Generator Area	103.5	
	Office	73.6	

*for 8-hr shift noise exposure (National Institute for Occupational Safety and Health, USA; NIOSH)

PHYSICAL AND CULTURAL HERITAGE SITES

177. There are no known historical sites near the Vitas, Balut, Tripa de Gallina and Labasan Pumping Stations. However, the Paco Pumping Station is located in an historical zone in the City of Manila.

178. According to the CLUP, there are 93 historical sites and structures in the City of Manila that were installed with historical markers. Moreover, there are 49 historical sites along the Pasig River identified through the Pasig River Rehabilitation Plan. Intramuros, known for its Baroque churches and Colonial architecture, is also within the City of Manila.

179. **Figure 23** shows historical sites near the Vitas, Balut, and Paco Pumping Stations. None of the historical sites are within the project footprints of Vitas and Balut Pumping Stations. Also, no historical sites are within the project footprint of the Paco Pumping Station, although there are some historical sites within 500 meters of the pumping stations, namely the Goldenberg Mansion

(54), Fabrica de Cerveza de San Miguel (81), Hospicio de San Jose (82/X), Old Warehouse (m), Tanduay Warehouse (l), and Old Manila (k).

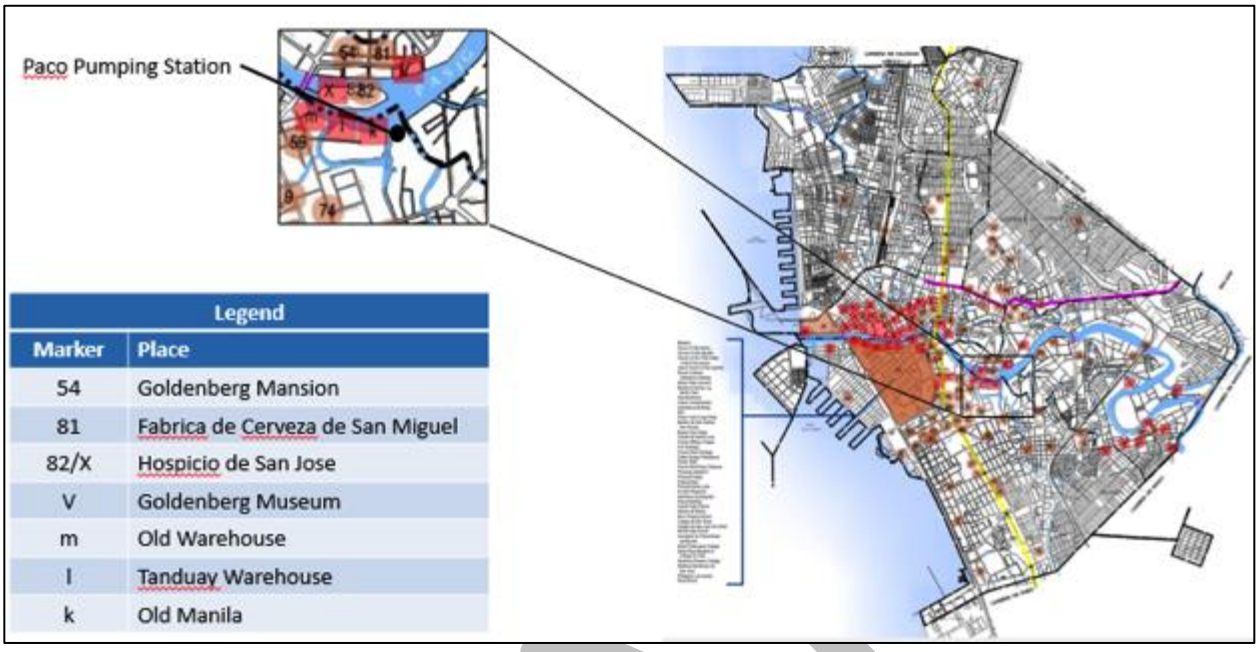


Figure 23: Location of Cultural and Historical Properties Near Paco Pumping Station

SOCIAL

DEMOGRAPHY

National Capital Region

180. All pumping stations are located within the National Capital Region (NCR), which has a population of 11,855,975 as of May 2010. It has a land area of 638.6 square kilometers and a population density of 18,565 persons per square kilometer. **Table 32** enumerates the population of the City of Manila, Pasay City, and Taguig City together with the total population of NCR.

Table 32: Population of cities where pumping stations are located, May 2010

City	Pumping Station	City Population
City of Manila	Vitas	1,652,171
	Balut	
	Paco	
Pasay City	Tripa de Gallina	391,456
Taguig City	Labasan	644,473
Total Metro Manila		**11,855,975**

Source: National Statistics Office

City of Manila

181. According to the National Statistics Office (NSO), the City of Manila has a population of 1,652,171 people as of May 2010. With a land area of 38.55 square kilometers, the population density of the City of Manila is 42,858 persons per square kilometer.

182. Vitas Pumping Station and Balut Pumping Station are located in Tondo, Manila, while Paco Pumping Station is located in Paco, Manila. **Table 33** shows the particular barangay where the Vitas, Balut, and Paco pumping stations are located, together with the population of each barangay as of May 2010.

Table 33: Population of the impact areas of Vitas, Balut, and Paco Pumping Stations, May 2010

Pumping Station	Barangay	Population
Vitas	147	1,435
Balut	137	1,179
Paco	662	2,677
TOTAL – CITY OF MANILA		**1,652,171**

Source: National Statistics Office

Pasay City

183. Pasay City remains as one of the most densely populated cities in Metro Manila. As of May 2010, the total population of Pasay is 391,456 with a density of 28,122 per square kilometer. Pasay has one of the lowest average household size of 4.0 persons. The annual growth rate is 1.02. According to **Table 34**, the population of Bgy. 190 as of May 2010 was 5,368.

Table 34: Population of the impact areas of Tripa de Gallina Pumping Station, May 2010

Pumping Station	Barangay	Population
Tripa de Gallina	190	5,368
TOTAL – PASAY CITY		**391,456**

Source: National Statistics Office

Taguig City

184. As of May 2010, Taguig City reportedly has a population of 644,473 of mixed cultural backgrounds. It has a population density of approximately 14,255 person/sq. km. as of 2010 and has an average annual growth rate of 3.26%. **Table 35** presents the population within the area of influence of the Labasan Pumping Station.

Table 35: Population of the impact areas of Labasan Pumping Station, May 2010

Pumping Station	Barangay	Population
Labasan	Napindan	13,354
	Palingon	11,863
TOTAL - TAGUIG CITY		**644,473**

Source: National Statistics Office

EXISTING LAND USE AND CLASSIFICATION

City of Manila

185. The Vitas, Balut, and Paco Pumping Stations are located within the jurisdiction of the City of Manila. The Pasig River runs through the City, dividing it into northern and southern portions. The city is bounded by Caloocan in the north, Quezon City in the northeast, Mandaluyong and San Juan in the east, Makati in the southeast, and Pasay in the south.

186. The total land area of the City of Manila according to their 2005-2020 Comprehensive Land Use Plan (CLUP) is about 3,855 ha. This land area is expected to grow due to reclamation along the coast of Manila Bay.

187. All pumping stations are in areas classified as Medium Intensity Commercial/Mixed-Use Zone. **Figure 24** shows the land use map of Manila and the location of the pumping stations.

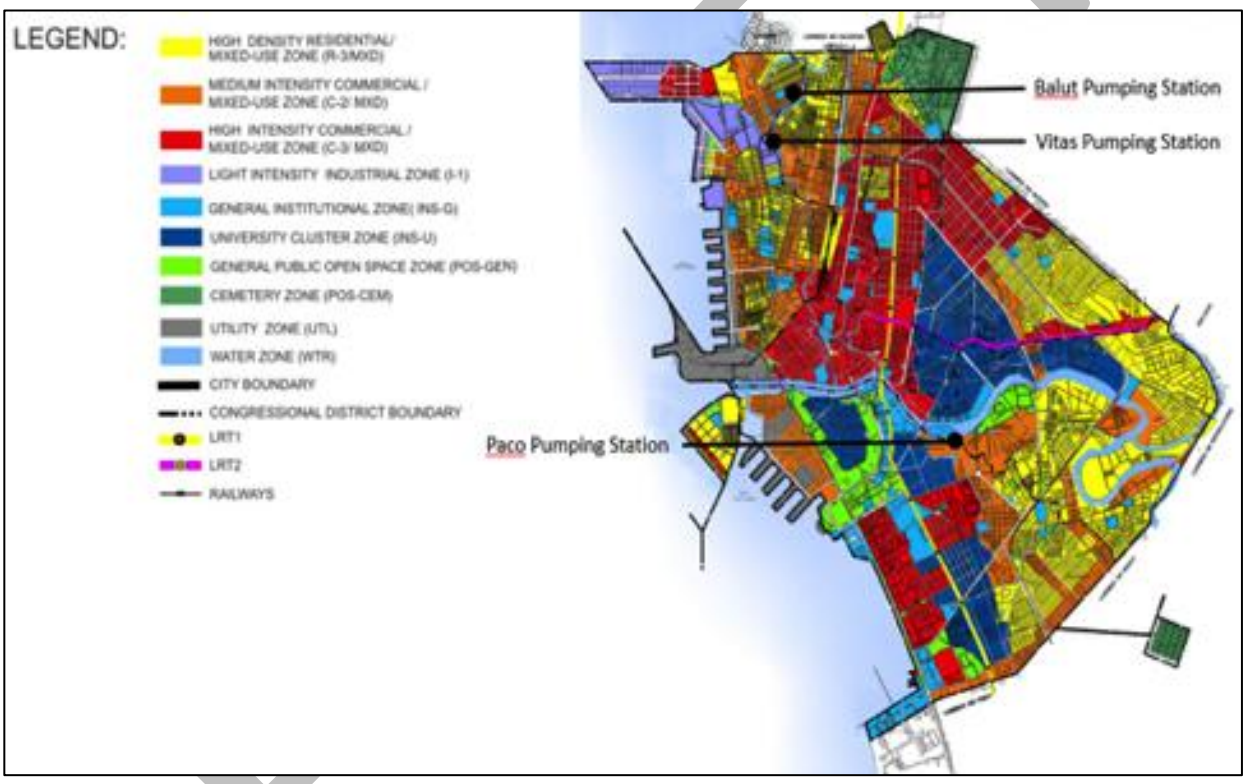


Figure 24: Existing Landuse of the City of Manila

Pasay City

188. The existing landuse of Pasay City is presented in **Figure 25**. Tripa de Gallina Pumping Station is located within the jurisdiction of Pasay City, which is at the western coast of Metro Manila. Pasay City has a land area of 1,805.1 ha and is considered as the third smallest political subdivision in Metro Manila but is among the most congested communities. In general, the vicinity of the pumping station is characterized by a mixture of residential, commercial and industrial establishments.

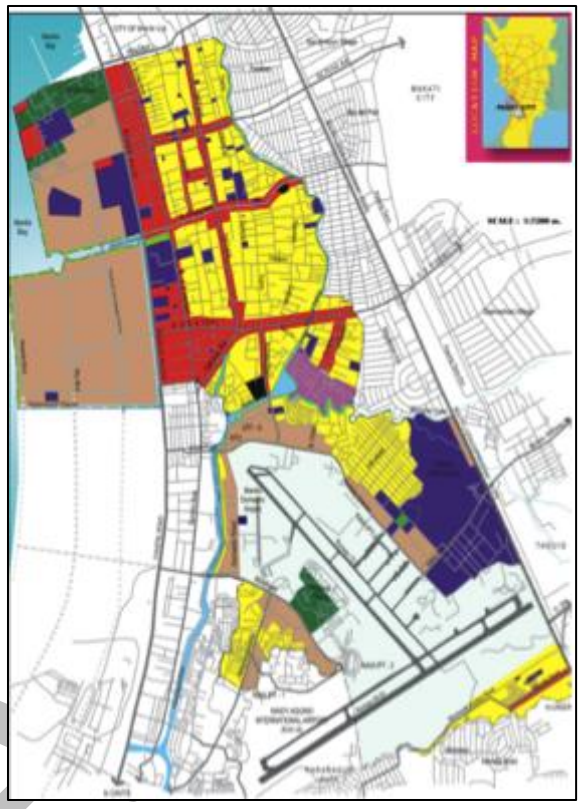


Figure 25: Existing Landuse of Pasay City

Taguig City

189. The proposed land use of Taguig City is shown in **Figure 26**. Labasan Pumping Station is loacted within residential zones near Laguna Lake.

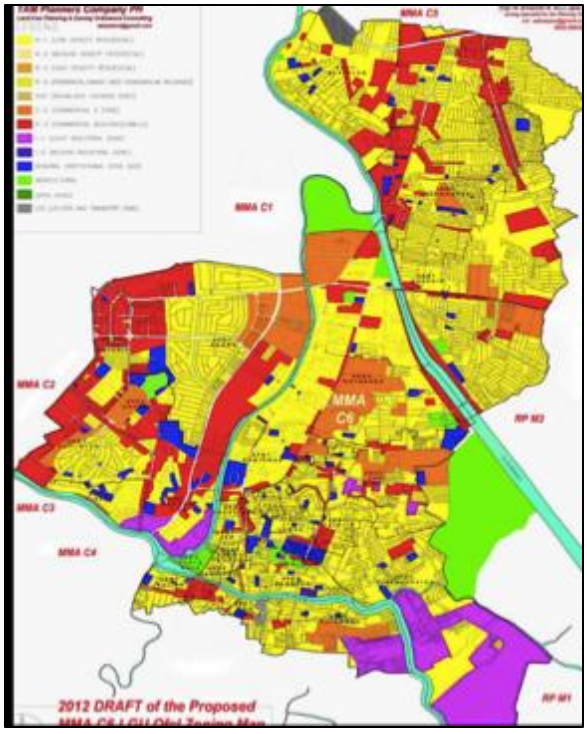


Figure 26: Existing Landuse of Taguig City

SOLID WASTE MANAGEMENT

City of Manila

190. The City of Manila has contracted the services of IPM Environmental Services to collect garbage around the City. The waste collected is brought to a transfer station in Vitas, before being transferred to the Navotas Sanitary Landfill located in Tanza, Navotas. The Navotas Sanitary Landfill is owned and operated by Phil Ecology Systems Corporation (Phil Eco) and serves the City of Manila, along with other cities such as Navotas and Malabon. The sanitary landfill has been operational since 2006.

191. Located in Bgy. Tanza, the area dedicated for the landfill is about 39.67 ha. Phase I, Phase II, and Phase II of the landfill are 11.3, 13.67, and 15.0 hectares, respectively. Phases I and II (11 cells) have already been used, while Phase III, composed of 9 cells, is currently in commission. Although Phases I and II have already been filled, it still has not reached its full vertical capacity of 25m. In fact, cells are only filled up to 10m to give the waste time to settle naturally. Depending on the availability of other sanitary landfills, it is estimated that it will take more or less 15 years to fill the Navotas landfill. **Annex E** presents the environmental due diligence conducted for this sanitary landfill.

Pasay City and Taguig City

192. Solid wastes generated from the two cities are collected by LGU accredited contractor and hauled to a sanitary landfill in Rodiguez, Rizal.

193. The sanitary landfill facility is owned and operated by International Solid Waste Integrated Management Specialist (ISWIMS), Inc. It was first opened in 2002. The facility serves most of Metro Manila. Among LGUs served are Makati, Mandaluyong, Pasay, Taguig, San Juan, Valenzuela, Muntinlupa, Pateros, Rodriguez, and Quezon City. Refer to **Annex E** for the details of this sanitary landfill.

ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

IMPACT ASSESSMENT METHODOLOGY

194. The identification, prediction and evaluation of the residual environmental and social impacts have been undertaken on the basis of the baseline and secondary data at the project affected sites. Residual impacts are the anticipated effect to be brought about by the project after the implementation of appropriate mitigation measures.

195. A number of impact assessment criteria were used to determine the significance of the residual impact. As presented in **Table 36**, these include impact balance, spatial extent, temporal context, magnitude and level of confidence. For every project activity identified, expected impacts are identified and rated for their significance using these criteria.

Table 36: Assessment Criteria Used in the Determination of Impact Significance*

Assessment Criteria	Definition	
Impact Balance		
Positive	Effect has a net benefit to the biophysical or socio-economic conditions.	
Neutral	Effect has no net benefit or loss to the biophysical or socio-economic conditions.	
Negative	Effect has a net loss or is a detriment to the biophysical or socio-economic conditions.	
Spatial Extent – Location of Effect		
Direct impact zone (Footprint)	The land area directly disturbed by the Project, including assessment, upgrading works, dredging, pumping station operations and decommissioning activities including associated physical works and activities. (e.g. access road) This is the project footprint + OPA (where dredging will occur).	
Indirect impact zone	The area extending beyond the footprint (adjacent barangays) that will be potentially disturbed by the Project, including assessment, upgrading, dredging, operation and decommissioning activities and including associated physical works and activities.	
City	The area within the specific city or LGU boundary.	
Regional	The area within Metropolitan Manila.	
National	The area extending beyond Metropolitan Manila.	
Temporal Context		
Duration (period of the event causing	Short-term	Event occurs during the extent of construction.
	Mid-term	Event occurs during the first 10 years of operations.

Assessment Criteria	Definition	
the effect)	Long-term	Ongoing event that extends greater than 10 years of operation
Frequency (how often would the event that caused the effect occur)	Accidental	Event occurs rarely over the life of the Project.
	Isolated	Event is confined to specified Project activity(ies).
	Occasional	Event occurs intermittently and sporadically over the life of the Project.
	Periodic	Event occurs intermittently however, repeatedly over the life of the Project.
	Continuous	Event occurs continually over the life of the Project.
Reversibility (period of time over which the residual effect extends)	Reversible	Effect is limited to Project construction.
	Irreversible	Effect is irreversible.
Magnitude – of the Residual Effect		
Negligible	No detectable change from existing (baseline) conditions.	
Low	Change is detectable and results in a limited effect on the environmental or social component.	
Medium	Change is detectable and results in a moderate effect on the environmental or social component.	
High	Change is detectable and results in a severe effect on the environmental or social component.	
Probability Of Occurrence or Llikelihood of Effect		
Low	Unlikely	
High	Likely	
Level Of Confidence – Degree of Certainty of the Assessment		
Low	Confidence is based on an incomplete understanding of cause-effect relationships and/or data availability pertinent to the Project.	
Moderate	Confidence is based on a reasonable understanding of cause-effect relationships and/or data availability pertinent to the Project.	
High	Confidence is based on a full understanding of cause-effect relationships and/or data availability pertinent to the Project.	
* Integrated Environments Ltd., also modified from Noble (2010)		

IMPACT ASSESSMENT PROCESS

196. The evaluation of environmental and social impacts involved the following steps:
- Preparation of a project description, identification of major project activities and environmental aspects;
- Review of baseline information on the environmental and social components;
- Site visits to pumping stations;
- Categorization of project impacts on environmental and social components using assessment criteria presented in **Table 36**;
- Prescription of mitigation and management measures to alleviate environmental and social impacts; and
- Determination of the significance of the residual impact following application of mitigation measures.

197. **Annex B** presents the analysis of environmental and social impacts.

ASSESSMENT OF DIRECT AND INDIRECT IMPACTS

198. The pumping stations in Vitas, Balut, and Paco are all situated within the jurisdiction of the City of Manila while the Tripa de Gallina is located within Pasay City. All of these four pumping stations serve to protect the riverine communities from tidal flows from the Manila Bay. The Labasan Pumping Station is located in Taguig City and protects the lakeshore communities from overflows from the Laguna Lake.

199. In addition to the common potential impacts, specific potential impacts and their corresponding mitigation measures for each pumping station have also been identified. The impacts of the project can be divided into two principal categories, i.e. (i) direct impacts which results from the physical presence, construction, and operation of the pumping stations, and (ii) indirect impacts which stems from the socio-economic activities surrounding the construction and the induced socio-economic effects resulting from the project. Cumulative impacts will be assessed at a later phase of the Project.

BENEFITS EXPECTED FROM THE PROJECT

FLOOD REDUCTION

200. Recent flooding in the Phillipines has caused large-scale displacement of communities not only in urban areas, but particularly in settlements along riverbanks. 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, the pumping stations are particularly important in periods of high tide when Manila Bay and Laguna Lake water levels are much higher than the level of the flood control channels.

201. Areas that benefit from the operation of the Vitas Pumping Station include barangays that are adjacent to the river with an estimated population of 21,103 people. The Balut Pumping Station will prevent flooding in nine barangays directly benefitting a population of 12,800 people. The

Paco Pumping Station will benefit a population of 9,789 people residing in the four affected barangays in the catchment area.[7]

202. Based on records of the maximum flood depth and duration, the operation of these pumping stations has reduced the extent of floods in the affected communities as shown in **Table 37** (DPWH/JICA, 2001). With the proposed operational improvements, the pumping station's efficiency will further help in reducing floods in these areas. This will be augmented by further flood control measures to be implemented in future phases of the Project.

Table 37: Impact on Flood Reduction at Vitas, Balut and Paco Pumping Stations

	1995	1998	1999	2000
Flood Duration (hour)				
Vitas	10	5	5	5
Balut	10	5	5	5
Paco				
Maximum Flood Depth (cm)[(a)]				
Vitas	100	30	30	20
Balut	100	30	30	30
Paco				

Source: Metro Manila Flood Control Project (II), March 2001, DPWH/JICA
Note: (a) Maximum flood depth is measured relative to road level in the affected area.

IMPROVEMENT OF QUALITY OF LIFE, HEALTH AND SANITATION

203. 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 include the reduction of damage to properties and infrastructure, income loss (livelihood and business), loss of lives and injuries brought about by the operation of the flood control facilities.

204. 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 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, and other water-related 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.

205. 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

[7] Population estimates were based on May 2010 census on population of affected barangays; (subject to further validation)

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 steady economic growth path while the rich will have less trauma from flooding as experienced in past devastating typhoons in Metro Manila.

KEY ADVERSE ENVIRONMENTAL AND SOCIAL IMPACTS COMMON TO ALL SITES

206. Based on the analysis of the key environmental and social impacts that may arise from the rehabilitation and operation of the pumping stations, the significant adverse environmental impacts include the generation of potentially contaminated dredged materials and the removal and disposal of large quantities of water hyacinth from dredging and clearing of waterways.

207. The impacts on the physical and human environment during construction will be minor and can be mitigated through the implementation of the Environmental Code of Practice (ECOP) during construction. The adverse impacts include the generation of solid wastes and waste oil, dust, noise, wastewater, and occupational hazards that will occur mainly from the installation of new equipment and piping, rehabilitation/replacement of pumps, upgrading of power supply lines, transport of equipment and materials to the pumping stations, and disposal of demolition materials, old equipment, metal scrap, waste oil and other related construction waste materials.

208. In the regular operation of the pumping stations, the major impacts include the generation of solid wastes collected from the flood gates and trash rakes, noise and occupational hazards from operation of mechanical and electrical equipment and unsafe working conditions at the stations.

209. Adverse social impacts include the involuntary resettlement from waterway clearing, legacy issues from past Government resettlement programs (Oplan Likas), potential tension caused by discrepancy between WB and Government compensation for PAPs, traffic, restriction to access and community hazards caused by movement of vehicles to the project sites.

210. **Tables 38** to **40** summarize key adverse environmental and social impacts that are common among all sites. The impacts are divided into (A) impacts during construction works, (B) impacts during dredging and waterway clearing, and (C) impacts during operation.

IMPACTS DURING CONSTRUCTION WORKS

Demolition and removal of equipment and facilities

211. Demolition and removal of equipment and facilities will result from the generation of wastes consisting of old equipment, scrap metal, wires, lighting fixtures, aggregates, empty cement bags, and other construction spoils. The majority are of wastes are considered as recyclable but the activity will still produce residual waste materials which requires appropriate disposal to prevent adverse environmental impacts.

212. Compact fluorescent lamps (CFLs) will be generated during the replacement of lighting fixtures. These are considered hazardous wastes because they contain mercury which when improperly disposed will cause negative environmental and social impacts.

Installation of equipment and facilities

213. 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 are inert but should be disposed properly to avoid negative impacts to land and waterways.

Rehabilitation of pumping station

214. The presence of construction workers at the site will also 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.

215. In general, the generation of solid wastes during the rehabilitation works will be insignificant since this will occur on a short-term basis and at low magnitude. Some of the waste materials are recyclable and can be separate and sold to recycling companies. The residual wastes can be properly managed through the existing solid waste collection and management at the pumping stations.

216. Waste oil and lubricants from the dismantling of motors, pumps and other auxiliary equipment may result to 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 quantity 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.

217. 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.

218. Dust generation is not expected to occur frequently and at high magnitude. Therefore, this is not anticipated to be a significant impact to workers and the community and can be mitigated through the implementation of dust control measures such as watering.

219. Construction activities will likely lead to short-term noise from the operation of construction equipment such as pumps, generators, and compressors as well as from the movement of trucks. A negative impact will occur to workers and to the nearest residential houses to the pumping stations. Based on the expected noise levels from construction equipment (Canter), noise levels of 75 dBA up to 90 dBA may be generated from the operation of the construction equipment and vehicles. The affected area could reach approximately 100-meter radius of the construction area.

220. Noise impacts on workers at pump stations will be mitigated by use of hearing protection and signage.

221. Noise impacts to surrounding communities are expected to be limited since noise dissipates with distance from the source. The impacts will be confined within the site since the rehabilitation works will occur within existing property occupied by the pumping stations.

222. Wastewater coming from the sanitation requirements of construction workers will cause a negative impact to the environment. The rehabilitation works is expected to employ about 50 workers which would result to the generation of domestic sewage amounting to about 10 m3/day.

223. Construction workers will use the existing toilets with septic tanks at the pumping stations. No discharges of untreated sewage will result.

224. Construction activities may result to 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.

Involuntary Resettlement

225. The resettlement of ISFs is a major issue in this Project especially since the Bank's policy on Involuntary Resettlement is triggered. 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 acknowledged that fewer ISFs led to easier water flow and lower floodwaters in the community. However, barangay officials said that remnants of their structures contribute to the garbage in waterways and remain as obstructions. In general, barangay officials find coordinating with national government agencies in charge of relocating ISFs smooth. However, they appealed for proper relocation for ISFs because they are put in a difficult situation when ISFs return to seek their help on lodging and work.

226. In addition, poorly planned resettlement sites without basic services may result in problems on health and sanitation for resettled families. Resettlement sites without proper solid waste disposal and wastewater management systems would lead to pollution of land and receiving waterways. Lack of water supply systems also lead to poor sanitation in the resettlement sites. **Annex F** presents the environmental due diligence of resettlement sites.

227. Resettlement of ISFs from Metro Manila waterways is a complex challenge and a set of comprehensive measures is needed to protect the welfare of the PAPs, especially the ISFs. Unfortunately, delays in their resettlement would also mean delays in the flood management project and the greater risk of endangering their lives as demonstrated by the previous flooding in 2009 that killed 423 people, 174 of those died of Leptospirosis, and massive economic losses.

Impact on livelihood

228. Under Components 1 and 2, the proposed project could also potentially lead to economic displacement of marginal fisherfolk, water hyacinth weavers and wastepickers and in the process impoverish them further. Wastepickers constitute a subgroup of ISFs relying on garbage picking as their main source of livelihood. 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. Local government officials and socially oriented entrepreneurs who provide livelihoods to hyacinth weavers are among their clients. Harvesting of water hyacinths is a seasonal form of employment as these are abundant only during the rainy season. Some harvesters work as such the entire year but suffer a dip in their income during summer. Dried water hyacinths are also very sensitive to water and lack of proper drying and storage facilities affects the quality and therefore the price of the items being sold. Subsistence-level fisherfolk can be found in estuaries and other water systems who fish mainly to provide food for their families. These stakeholders – wastepickers, harvesters of water hyacinths, and subsistence-level fisherfolk – are among the most vulnerable because they are very poor, very few, and unorganized. They support the project's goal of reducing flood impacts but not at the expense of them losing or limiting their livelihoods.

Resettlement legacy issues

229. Under Oplan Likas, 76% of the targeted ISFs were relocated off-city away from their sources of livelihood and moved them to areas with limited opportunities for employment and income-generating activities.[8] Successive governments' approach of off-city resettlement has been mired with resistance and criticisms in the past, owing to the lack of consideration for the socio-economic impacts (e.g., loss of livelihood and disruption of social networks) on the affected households. Absence of livelihood and/or mismatch between skills and job opportunities is often present during resettlement, resulting in a sharp decline in incomes after resettlement. Many decide to migrate back into the informal settlements in Metro Manila.

230. 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.[9] 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.

231. A World Bank commissioned study found that 72% of the surveyed households resettled off-city reported decreased income up to as much as a 43%. They also reported increased expenditure driven by higher costs of transportation to schools, work, and health services. 35% of those resettled off-city also reported difficulties in finding assistance for their daily needs due to

[8] This is a common finding among the different studies cited in this assessment.
[9] Due Diligence Report for Paco Pumping Station. The DDR was prepared as part of the appraisal requirement of the proposed project.

disruption in their social support network.[10] A separate study indicates that in-city resettlement sites tend to produce more favorable livelihood situation for the ISFs compared to off-city resettlement sites that significantly reduce the ISFs' income levels. ISFs resettled off-city suffer from higher expenditure levels due to transportation costs for their commute and access to basic services (having to purchase drinking water and diesel for generators). Off-city ISFs are therefore at a disadvantage both in terms of income and expenditure.[11] A recent study that surveyed over 11,700 ISFs in Metro Manila also found that 67% of the surveyed ISFs expressed preference for relocation in-city or near-city primarily to be close to their jobs, services, friends and families.[12] The IPC 2011 study found that a significant proportion of households in the two study sites were considering leaving their current place of residence (26% in Southville 5A and 39% in Eusébio Bliss). For those resettled off-city the main reason was the limited access to employment. For households resettled in-city, on the other hand, the main concern was the difficulty in making payments on their housing units.[13]

232. The probability that the living condition in the first two years in the resettlement area is worse than their pre-resettlement condition due to absence of much-needed basic services is another social risk. This has been apparent in the various studies. From its study of 10 resettlement sites, the Presidential Commission for the Urban Poor (PCUP) called the attention of NHA and other concerned agencies for the "serious issues on social services, power and water."[14] Full disclosure about the resettlement sites and the conditions or terms involved is critical in the decision-making process of the project-affected people, especially the ISFs. Data collected through the SIM (from both the qualitative and quantitative modules) indicated that information regarding resettlement was inadequate or unavailable during the relocation and resettlement of affected households. A significant proportion of those resettled did not have access to critical information on: (i) the location of the resettlement site, and (ii) on the cost of housing and payment schemes. Given the lack of information about the resettlement process, it was, therefore, significant that a large proportion of households attributed their decision to relocate primarily to the local government unit.[15]

233. The risks related to resettlement are also aggravated by the fact that provision of affordable shelter is not a priority for some LGUs in Metro Manila because of the substantial resources needed and the lack of LGU capacity to carry it out. Land for in-city resettlement may not be available, may be too costly, or may be encumbered and thus the high probability that land acquisition and resettlement may be delayed.

234. The cost and availability of land are not the only factors that could potentially hamper the smooth resettlement of affected people of this proposed project. In the context of Metro Manila, another factor, and risk, is the social issues that could be generated by the provision of entitlements and other forms of remedial measures to PAPs who will be co-mingled with the wider community of resettled people under the national government or local government programs, either in in-city or

[10] Institute of Philippine Culture (IPC), School of Social Sciences, Ateneo de Manila University. (2011). "The Social Impacts of Tropical Storm Ondoy and Typhoon Pepeng". Manila.
[11] Environs. (2015). "Final Report on the NHA Livelihood Program". Manila.
[12] UP Planades. (2013). "Socio-Economic Profiling and Community Organizing Final Report". Manila.
[13] The Social Impacts of Tropical Storm Ondoy and Typhoon Pepeng. Institute of Philippine Culture. 2011.
[14] Preliminary findings presented at the Consultative Forum on Resettlers called jointly by the Presidential Commission for the Urban Poor, the House of Representatives and the Senate on 22 October 2015.
[15] The Social Impacts of Tropical Storm Ondoy and Typhoon Pepeng. Institute of Philippine Culture. 2011.

off-city resettlement areas. Under the government's resettlement program, especially the most recent ones under Oplan Likas, the families are provided with family assistance (PHP18,000), moving assistance (vehicles to transport materials and families), housing options, and housing subsidy (30% for off-site, 22% for in-city). However, under the Resettlement Policy Framework of the proposed project following the World Bank's OP 4.12 policy, the ISFs as PAPs will also be entitled to compensation for affected structures and other properties and livelihood restoration measures. This puts the government in a difficult situation given the sheer number of resettlers who did not receive such forms of assistance. It should be noted that the government itself is cognizant of the livelihood issues of resettlers and has put in place measures to address this. This would however require careful planning as to the timing of livelihood restoration assistance under the proposed project to ensure that they are coordinated well with the timing of assistance to other resettlers. This should be done to avoid social equity issues that could trigger tensions between the PAPs and their host communities of resettlers or between resettlers and government agencies in-charge of resettlement.

235. The issue of inequity came out across groups of resettlers in nine sites of the IPC study which highlighted that the system put in place for the provision of recovery assistance had led to inequitable outcomes. In these areas, participants indicated that some groups in the community had been excluded. While community members did not consider politics to be the factor for the gaps in the provision of assistance, the research team did, however, find a number of instances where the provision of recovery assistance was highly personalized (i.e. direct cash or in kind assistance provided by local government officials). The study team also observed that there was lack of information both about the targeting process and about the existing sources of assistance which respondents believed partly explained the uneven distribution of support. Community members lamented the "monopoly of knowledge" by community leaders.[16]

Compensation discrepancies

236. Host communities can be existing communities or new communities of resettlers within or outside Metro Manila that will live together with displaced ISFs in the same neighborhood. In-city host communities are supportive of the project because they are most likely to be serviced by the pumping stations and will feel the impacts of reduced flooding. The case is different for off-city host communities who will not feel the positive impact of the proposed project and who will just experience the direct impacts of the sudden influx of ISFs as they compete for space, community facilities, and resources. In new communities of resettled ISFs, social tensions may also arise if displaced persons under the project receive higher compensation and more benefits than them. Social tensions between existing communities and relocated ISFs may also ensue due to the stigma and discriminatory notions attached to co-mingling with ISFs. For both in-city and off-city host communities, unless they have a strong homeowners association or a strong local leader and legislation regulating the influx of people, they have no choice but to accept the displaced ISFs.

[16] Ibid.

Community safety issues

237. Traffic and temporary restriction of community access in the vicinity of the sites of the pumping stations will occur and cause a negative impact to the people during the movement of large vehicles to transport equipment and materials to the sites.

238. The event is confined during the construction phase but will also occur intermittently during the operational phase due to the transport of accumulated and collected wastes out of the pumping stations to the disposal sites at least twice a year. The anticipated frequency of vehicle movement into and outside of the pumping stations during the construction phase and when the project operates is not significant.

239. Community hazards and accidents from the movement of vehicles along narrow roads leading to the pumping stations may compromise safety of the people. The impact to community safety will occur within the direct impact area of the project. The impact on community safety due to vehicle movement along access roads is likely to occur without appropriate implementation of traffic control measures. Due to the low magnitude of the effect and the high confidence in the implementation of the ECOP and ESMP, the impact to the community during movement of transport vehicles is not expected to be a significant effect.

Table 38: Summary of Environmental and Social Impacts during Construction

Project Activity	Impact	Mitigation	Significance of Impact	Risk to Bank and Remedy
Demolition and removal of equipment and facilities	Generation of old equipment, scrap metal, wires, waste concrete and other construction spoils	Implement solid waste management plan Optimize recycling of wastes Ensure contract or MOA with SWM contractors	Not significant	Improper waste disposal. Community safety issue. Maintain inventory of waste generated Implement waste tracking procedures including manifests
	Generation of waste CFLs during replacement of lighting fixtures	Send to hazardous waste recycling facility		
Installation of equipment and facilities	Generation of scrap metal, aggregates, empty cement bags, and other construction spoils	Implement solid waste management plan Optimize recycling of wastes		
Rehabilitation of the pumping station	Generation of solid wastes, i.e. biodegradable and non-biodegradable wastes from activities of construction workers.	Implement solid waste management plan Optimize recycling of wastes – segregate biodegradable and non-biodegradable waste		
	Waste oil	Send to hazardous waste recycling facility	Not significant	Improper disposal to waterways and contamination.

Project Activity	Impact	Mitigation	Significance of Impact	Risk to Bank and Remedy
				Waste tracking to ensure proper disposal.
	Fugitive dust generation	Implement dust abatement and control procedures Water roads to reduce dust	Not significant	Community complaints over inadequate watering. Contractor reporting on dust abatement.
	Noise hazard to workers	Ensure use of hearing protection where required. Signage to indicate noise risk	Not significant	Ensure contractors uphold safety standards. Safety audits.
	Noise disturbance to communities	Implement noise abatement procedures where practicable Inform communities of noise and hours of operation. No night operations.	Not significant. Noise disturbance will be significant at some points during construction, but limited due to short duration	Community complaints over excessive noise. Noise monitoring.
	Generation of wastewater	Use of existing sanitary facilities at each pumping station. Sewage waste pumped from septic tank and disposed in a sewage treatment facility. Alternative use of chemical toilets.	Not significant	Improper sewage disposal and discharge to waterways. Ensure adequacy of pump station sanitary facilities relative to worker numbers.
	Occupational safety hazard to workers – risk of injury or death	Enforce use of personal protective equipment (PPE) Safety training in equipment use and risk First aid stations Signage	Not significant	Risk of worker debilitating injury or fatality. Ensure contractors uphold safety standards. Safety audits.
	Involuntary resettlement of ISFs	Implementation of RAPs – total estimated households to be resettled between 1500 and 2500	Not significant	Delays in implementation of RAP. Raised community expectations.
	Impact on livelihood (economic displacement of	Livelihood interventions	Not significant	Delays in implementation of of

Project Activity	Impact	Mitigation	Significance of Impact	Risk to Bank and Remedy
	marginal fisherfolks, water hyacinth weavers and waste pickers)			capacity building programs.
	Legacy issues on *Oplan Likas*	Due diligence and follow-up	Significant	Potential grievances from perceived inequity between pre- and post- cut off date PAPs. Due diligence and action plan to redress compensation inequity
	Compensation/entitlement Discrepancies	Due diligence and follow-up	Not significant	Grievances over inequity in compensation. Project should standardize rates.
	Community safety issues due to increased traffic and vehicle use on roads, particularly young children.	Project will develop a traffic safety plan. Signage and flag persons. Proper coordination with barangay. Education campaign in community to explain traffic risks.	Not significant	Injury or death in community.

IMPACTS OF DREDGING AND WATERWAY CLEARING

RESUSPENSION OF SEDIMENTS

240. The Project will involve the dredging of sediments in the waterways to achieve higher runoff from the catchment into the outlets of the receiving waterways. The dredging of sediments from the waterways will result to resuspension of sediments which can cause a 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 have a limited effect and change to water quality.

241. The effect will occur intermittently but repeatedly over the life of the project since dredging works will be undertaken during the construction phase as well as during the maintenance and

operation of the flood control project. There will be temporary effect of resuspension of sediments on water quality during dredging but this is reversible through periodic dredging and removal of silt in the waterways.

242. On the long term, the periodic dredging and removal of silt during project implementation is expected to reduce the volume of sediments and improve the water quality of the waterways.

GENERATION AND DISPOSAL OF DREDGED MATERIALS

243. Dredging of sediments in the waterways will increase the capacity of the waterway channel to avoid flooding, particularly during high rainfall or typhoon. Dredging activity will result in the generation of dredged materials that requires proper disposal.

244. The disposal of dredged materials removed from waterways will cause a negative impact to the environment since these contain organic materials and contaminants such as heavy metals. Dredged materials possibly contain contaminants and 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 are likely contaminated with these heavy metals as well. Because of the presence of these contaminants, the dredging materials are not considered as ordinary wastes but are hazardous waste materials that require proper management and disposal systems to avoid adverse effects to human health and the environment.

245. The effect of dredged materials will be assessed through tests on sediment quality. When regular sediment quality tests show the presence of hazardous elements, the disposal methods of the dredged materials will conform to the hazardous waste disposal requirements of the Government (RA6969).

REMOVAL OF WATER HYACINTH

246. The waterway clearing operations will involve the removal of water hyacinth which proliferate in some waterways in Metro Manila. The removal of these water hyacinth will have a negative impact on the aquatic ecosystem of the waterways. Adverse impacts will occur on fisheries and other aquatic resources because of the deterioration of habitat of fish.

247. The removal of water hyacinth will occur intermittently and sporadically over the life of the Project. 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 at Pasig River tributaries.

248. In areas near the Laguna Lake, the removal of water hyacinth will have an impact on the communities that gather water hyacinth stalks for small-scale cottage industry projects. However, this is not considered to be significant because of the small number of water hyacinth cottage industry projects in Metro Manila, compared to the available water hyacinth that can still be harvested in Laguna Lake and Pasig River.

249. The impact of removal of water hyacinth is considered significant because of the lack of proper disposal proceders for the anticipated large volume of collected water hyacinth waste.

ODOR

250. 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.

251. The impact of foul odor during dredging to communities will be more intense during the dry summer months and will affect areas where there are dense settlements near the waterways.

252. Due to the isolated frequency causing the effect, the low magnitude of the effect and the high confidence in the cause-effect relationship, odor due to dredging activities is not expected to be a significant.

OCCUPATIONAL HEALTH AND SAFETY

253. Dredging activities may result to accidents and pose risks to the health and safety of workers operating the dredging equipment and machinery. Hazards may come from unsafe dredging methods, lack of personnel safety gadgets, and direct exposure to waste materials.

254. With the implementation of occupational health and safety measures in the ECOP, the impact of occupational hazards will not be significant.

Table 39: Summary of Environmental and Social Impacts during Dredging and Waterway Clearing

Project Activity	Impact	Mitigation	Significance of Impact	Risk to Bank
Dredging and waterway clearing	Resuspension of sediments	Take sediment samples prior to initiation of dredging, assess toxicity Assess dredging risk for resuspension and need of controls	Not significant if material is not toxic. Reassess following testing	Contamination of waterways. Ensure sediment sampling and toxicity tests prior to commencement of dredging.
	Generation and disposal of dredged materials	Take sediment samples prior to initiation of dredging, assess toxicity Determine disposal options based on toxicity limits	Significant due to volume of dredged material and presence of possible contaminants, currently unknown	Improper disposal of dredged material either marine or terrestrial. Ensure sediment sampling and toxicity tests prior to initiation of dredging. Implement waste tracking procedures.
	Removal of water hyacinth	Mechanically remove	Possible significant	Improper disposal of

		water hyacinth Assess other control methods e.g. biological Ensure proper disposal and assess options other than landfill or compost	due to volume of water hyacinth generated and need of a disposal location.	water hyacinth and creation of nuisance to communities. Examine other initiatives for hyacinth control in Philippines and regionally.
	Odor due to exposure of dredged sediments to air during storage and disposal	Limit storage time of dredged materials at pump stations	Not significant	Community complaints due to odor and stench of contaminated sediments. Waste tracking.
	Occupational safety hazard to workers – risk of injury or death	Enforce use of personal protective equipment (PPE) Safety training in equipment use and risk, particularly dredge barges and vessels First aid and signage	Not significant	Risk of worker debilitating injury or fatality. Ensure contractors uphold safety standards. Safety audits.

IMPACTS DURING OPERATION

GENERATION OF NOISE

255. The operation of pumps and equipment at the pumping station will generate high noise levels that will result to negative impacts to workers at the pumping stations and to communities near the pumping stations.

256. Effect of noise to workers has severe and long-term effects on the sense of hearing. Noise levels are intense inside the pumping station building where the pumps and motors are housed.

257. The impact of noise to workers during operation is significant but hearing protection and noise control measures will be implemented to reduce occupational hazards from long-term and periodic exposure of workers inside the pumping station. Mitigating measures to reduce noise and protect workers will be implemented as part of ESMP.

258. The effect of noise nuisance to communities adjacent to the pumping station is considered low because noise is generally confined within the pumping station building and residual noise is dissipated with distance. Noise monitoring will be considered both within the pumping station and in nearby communities.

GENERATION OF SOLID WASTES

259. 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 of the existing pumping stations is the accumulation and disposal of solid wastes trapped at the flood control gates. The accumulation of solid wastes at the pumping station will have a negative impact to the environment without regular collection and appropriate disposal methods.

260. Maintenance of the pumping station will generate wastes consisting of wires and lighting fixtures. The wires are considered as recyclable waste materials while the lighting fixtures, particularly the CFLs, are considered as hazardous wastes because of the mercury content in the lamps. The generation of CFLs will cause negative impacts to the environment and therefore requires appropriate disposal to prevent adverse impacts to biophysical conditions.

261. The workers at the pumping stations will also 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.

262. A large volume of solid wastes will be generated at the pumping stations that require appropriate disposal. With the implementation of waste tracking and verification of waste disposal, this impact will be minimized.

IMPACTS TO VULNERABLE PEOPLES

263. The Project will reduce livelihood opportunities for vulnerable peoples, notably restrictions in access to waterways or reductions in abilities to harvest water hyacinth or collect trash. In addition, prolonged exposure to floodwaters can lead to increased disease incidence, in particular leptospirosis infections to hyacinth harvesters.

264. To minimize these impacts, the Project will implement the following mitigation measures:

- Access will be provided to waterways in the vicinity of pumping stations
- Alternative job opporuntities for waste pickers will be provided including a transition process from informal to formal employment, if applicable
- Employment in the Bantay Ilog patrol boats will be offered
- Access to hyacinth waste collection sites will be provided to hyacinth collectors
- Boats will be provided to hyacinth collectors on an as needed basis.

GENERATION OF WASTEWATER FROM WORKERS

265. Wastewater from the sanitation requirements of workers at the pumping station and from leachate from collected solid wastes at the flood gates will pose negative impacts to water quality of the receiving body of water. The impact will be confined within the pumping station area but will occur continually over the life of the project. On the average, there are about 10 to 15

workers in each pumping station which generates about 1-2 m3/day of sewage. Leachate from the collected solid wastes is minimal.

266. Due to the low magnitude of the wastewater and the provision of wastewater treatment methods within pumping stations, the generation of wastewater from the operation of the pumping station is not expected to be significant.

OCCUPATIONAL HAZARDS

267. The operation of pumps, motors, generator sets, conveyors, trashrakes 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.

268. Occupational hazards will rarely occur with implementation of occupational health and safety measures. The impact of occupational hazards is not significant because occupational health and safety measures can be implemented as part of the ESMP.

Table 40: Summary of Environmental and Social Impacts during Operations

Project Activity	Impact	Mitigation	Significance of Impact	Risk to Bank
Operation of pumping station	Noise	Install noise abatement equipment and controls where required. Provide hearing protection to workers	Not significant	Noise complaints from adjacent communities. Noise monitoring. Ensure compliance with noise limits e.g. World Bank, IFC
	Noise disturbance to communities	Implement noise abatement procedures where practicable Inform communities of noise and hours of operation. No night operations.	Not significant	Community complaints over excessive noise. Noise monitoring. Ensure compliance with noise limits e.g. World Bank, IFC.
	Generation of solid wastes	Implement solid waste management plan Optimize recycling of wastes	Not significant	Improper waste disposal. Community safety issue. Maintain inventory of waste generated. Implement waste tracking procedures including manifests.
	Impacts on livelihood of vulnerable peoples,	The Project will undertake measures to minimize impacts		The social management plan

Project Activity	Impact	Mitigation	Significance of Impact	Risk to Bank
	notably waste pickers, fisherfolk and hyacinth harvesters	to vulnerable peoples as follows: Waste pickers – opporutnities for formal employment will be provided including transition preparation from informal to formal work arrangements Hyacinth harvesters – access will be provided to harvest sites or access to hyacinths that are removed from waterways. Additionally boats will be provided to minimize their exposure to contaminated water Fisher folk – alternative entry and exit sites will be provided. Alternative employment in Bantay Ilog patrol boats to minimize waste could be provided.		should incorporate measures as described to minimize Project impacts to vulnerable peoples Follow-up and monitoring should be assured that these measures are fully implemented
	Generation of wastewater	Use of existing sanitary facilities at each pumping station. Sewage waste pumped from septic tank and disposed in a sewage treatment facility.	Not significant	Improper sewage disposal and discharge to waterways. Ensure adequacy of pump station sanitary facilities relative to worker numbers.
	Occupational safety hazard to workers – risk of injury or death	Enforce use of personal protective equipment (PPE) Safety training in equipment use and risk First aid stations Signage	Not significant	Risk of worker debilitating injury or fatality. Ensure contractors uphold safety standards. Safety audits.

KEY IMPACTS OF THE FIVE SUBPROJECTS

Key Impacts of the Five Subprojects

269. 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.

270. **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.

271. 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.

272. **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.

273. **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. 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.

274. **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 increased dust, odor, and noise nuisance in the residential area across the pumping station site.

275. **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 IMPACTS

276. Based on the analysis of the anticipated positive and negative impacts of the Project, there are also induced impacts that will result. In general, these induced impacts are associated with potential residual effects of improved flood management.

INDUCED IMPACTS TO COMMUNITY

277. The induced impacts are expected to be positve. Floods disturb the normal course of life and pose a real threat to both human life and property. As a result of flood mitigation measures, there will be positive effects to the local communities because of reduced incidence and impact of annual flooding. There are other anticipated induced positve 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.

278. The areas protected by flood control measures will seem to be safe and inhabitants may be convinced that such areas as now protected against damage from floods. Population growth, economic development and intensification of land use and settlement in Metro Manila and other previously identified flood-prone areas may be induced by the project. Land values in these areas will likely increase and more businesses and financial opportunities may develop because transit of person and goods will not be affected anymore by flooding. These changes in the community is also attributed by the reduced cost for insurance, business disruption losses, and other land use benefits.

INDUCED IMPACTS ON RESETTLEMENT

279. With the weakness in the implementation of land use plans in Metro Manila and surrounding areas, people may decide to resettle on previously identified flood-prone areas. After completion of any resettlement due to the Project, land use management and control in these areas is needed to maintain the areas and avoid houses from being built again in these zones. This will require better regulations for flood prone areas and enforcement of land use plans by the LGUs as part of the overall flood risk management program.

INDUCED IMPACTS FROM PUMPING STATION OPERATION

280. There may be some risk of induced flooding due to improper operation of the pumping stations such as insufficient opening or closing of the flood gates. However, this induced impact is considered to be minimal and manageable by MMDA's observation of flood gate levels and implementation of pumping station operating procedures.

CUMULATIVE IMPACTS

281. Aside from the Metro Manila Flood Management Project, there are other related projects that are ongoing or proposed which when considered together will result in cumulative impacts. The scope of this ESIA involves the assessment of the potential environmental effects of Phase 1 of the 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 mneasuresto be undertaken by the Government and other project proponents to provide collaborative solutions to minimizing cumulative negative impacts, if any.

282. In the context of regional master planning, cumulative effects will be evaluated on Valuable Ecological Components (VECs). The VECs will be defined based on assessment of impacts and consultations with stakeholders during implementation of Phase 1. Examples of VECs are the following:

    a. Public safety and health
    b. Changes in water quality
    c. Sediment quality
    d. Solid waste management
    e. Land use changes.

283. A draft TOR for the conduct of the CIA is presented in the ESMF of the Project.

ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN

284. The proposed interventions in drainage areas will create various impacts, both positive and negative. An environmental and social management plan (ESMP) as presented in **Annex C** has been developed to mitigate project impacts during construction and operations.

285. Construction impacts are addressed by standardized Environmental Codes of Practice, including erosion and sediment control, air and water quality management, noise and vibration, solid waste management, occupational health and safety and vehicular traffic management. (see **Annex D**).

ENVIRONMENTAL CODES OF PRACTICE (ECOPS)

EROSION AND SEDIMENT CONTROL

286. Excavation of soil for the civil works at the pumping stations and at resettlement sites might trigger localized erosion at the project area. To address this concern, the following measures will be implemented:

- Planning the sites for the temporary facilities and stormwater drainage facilities to prevent channelling of water flows and erosive velocities;
- Reduction of the length of exposure of an area through sequencing site-clearing and rehabilitation works;
- Construct diversion banks and channels to prevent runoff from flowing through the exposed areas;
- Site vehicle washing facilities to remove the soil and mud from vehicles and machinery before leaving the site; and
- Decreasing flow velocities through stone paving to control erosion.

CONTROL OF FUGITIVE DUST EMISSIONS

287. Generation of dust cannot be avoided in construction works. This will affect air quality and may impact the surrounding communities and environment. To prevent or minimize the generation of dust, the following measures will be implemented:

- Avoiding excavation activities during periods of strong winds;
- Protecting stockpiles by covering them with geotextile fabrics or using mulching materials;
- Use of water trucks for dust suppression;
- Implementing vehicle speed limits near the site;
- Using tarpaulins to cover the loads and limiting the loads of haul trucks to avoid spillage; and,
- Using the existing road networks so that the soil and mud are not tracked onto the roads.

WATER QUALITY

288. Water quality of adjacent water bodies to the pumping stations and at resettlement sites will be impacted because of the wastewater generated from construction works. In order to address this, the following measures will be applied:

- Construction of buffer zones along the river banks;
- Placing stockpiles of potential water pollutants away from local watercourses or drainage;
- Diverting of storm-water runoff into an oil and water separator before being discharged into the waterway particularly at the pumping stations;
- Construction of a washdown area where mud can be removed from a vehicle as it drains to a sediment basin;
- Preparation of Emergency Spills Contingency Plan as part of the specific environmental management plan (SEMP); and
- Conduct of awareness training of construction site personnel with regards to preventing water pollution.

NOISE AND VIBRATION

289. Noise and vibration are caused by the heavy equipment during construction and pumps during the operations stage. It may bring nuisance impacts to adjacent communities and health hazard to workers at the pumping stations. In order to limit or mitigate the impacts of noise and vibration, the following measures will be taken:

- Monitoring of vibrations at the nearest vibration-sensitive receptor;
- Modify the construction activities with low vibrations;
- Selection of equipment to minimize noise during construction, including silencers, mufflers or noise abatement structures;
- Limiting of hours of operation;
- Provision of ear protection equipment for workers of the pumping stations;
- Monitor and apply effective noise abatement measures for equipment and other techniques;
- Scheduling of construction activities during the daytime; and
- Consultation with local community to address concerns.

SOLID WASTE MANAGEMENT

290. Solid wastes from construction (spoils and oily wastes) will be generated by the project. The project will incorporate the following to manage solid waste generation and disposal:

- Issuance of a waste segregation (biodegradable and non-biodegradable) guidelines for all construction and operations personnel;
- Provision of solid waste handling and storage facilities, such as dumpsters, trash cans in common areas and strategic locations in the facility;
- Implement a paper usage reduction program in the administration office of the pumping stations by re-using paper for other similar purposes;

- Non-biodegradable wastes, such as paper, plastics, and metals, shall be sorted accordingly and sold to waste service providers; and
- Residual and other general solid wastes shall be placed in appropriate bins and shall be disposed in accordance to the schedule of the City's solid waste collection system.
- Use of a waste manifest for tracking of all waste shipments to an authorized disposal facility.

OCCUPATIONAL HEALTH AND SAFETY

291. MMDA/DPWH and its designated construction contractors will implement occupational health and safety policies during construction and operations. This will not just reduce the likelihood of injuries/fatalities but also protect valuable equipment and properties against damages. The following health and safety guidelines will be applied to the project:

- All management, technical, and non-technical personnel shall undergo specialized safety training courses to familiarize themselves to the operations and maintenance of the pumping station including its auxiliaries;
- Emergency response plan shall be updated regularly, and emergency drills shall be performed regularly to improve personnel's response technique and time;
- Safety adits shall be conducted by MMDA management, with possible assistance from various safety consultants;
- Personnel shall undergo scheduled annual health check-ups;
- Safety signage, adequate illumination, anti-skid steps and guard rails, fire extinguishers, first-aid kits, and other safety features shall be established throughout the pumping stations;
- Personal protective equipment (PPE), which includes safety boots, hard hats, gloves, reflective vests, ear plugs and safety goggles (where applicable) shall be mandatory for construction workers (during rehabilitation phase) and MMDA/DPWH personnel (during operations phase).

VEHICULAR TRAFFIC MANAGEMENT

292. The ingress of heavy equipment and vehicles to the pumping stations pose a safety hazard. To manage the traffic, contractors may implement the following measures:

- Coordination with the Barangay LGU;
- Provision of safety barriers, warning signs and lights, traffic marshals within the vicinity of project sites, and adequate parking spaces;
- All deliveries of construction materials and heavy equipment, either inbound or outbound of pumping stations, may be done during off-peak hours and at designated delivery hubs located near the project area to prevent blockage of traffic flow along public roads; and
- Assistance of security personnel in directing traffic of vehicles coming in and out of the pumping stations.
- Consultation with communities to discuss traffic management measures.

293. To avoid traffic congestion, possible alternative routes will be established through a traffic management plan, in coordination with the barangay and City LGU. Directional signage and traffic marshals will be placed at strategic locations where heavy traffic normally occurs.

SOCIAL MANAGEMENT PLAN

294. To mitigate the social risks of the project, the following are the elements of the Social Management Plan:
    - Formulation and adoption of a resettlement policy framework (RPF)
    - Financing of land acquisition and housing construction, site development, community infrastructure, rental support, capacity building, livelihood assistance, and resettlement monitoring and evaluation as part of Component 3 of the project
    - Establishment of a functional Grievance Redress System
    - Development of a communication and participation framework.

295. To meet the requirement of WB OP 4.12, the RPF will provide the following set of entitlements (**Table 41**) to various PAPs based on the gaps analysis between national legislation and WB OP 4.12.

Table 41: Entitlements of Project –Affected People

PAP Category	Impact	Entitlement
Resident owner of informal structure	Loss of dwelling, potential loss of access to work place.	• Compensation at full replacement cost for lost structures/assets based on market value of materials and labor labor (for those who will opt for cash compensation only). • Inclusion in social (amortized) rehousing schemes; or provision of subsidized housing rental unit for those unable to afford a mortgage. • Rental subsidy / voucher for up to 24 months while waiting for the availability of the units in resettlement site; or staging area. (*This entitlement may be extended to meet the completion date of resettlement housing.)* • Transition allowance for moving costs to resettlement site. • Moving assistance – trucks for personal belongings; vans for women and children. • Free access to skills training and related livelihood restoration programs for up to two family members, of which at least one is female, to be specified in the RAP.
Absentee owner of informal structure	Loss of rental property, loss of rental income.	• Compensation at full replacement cost for lost structures/assets based on market value of materials and labor.
Renter or sharer of informal	Loss of dwelling, potential loss of	• Inclusion in social rehousing schemes. • Rental subsidy / voucher for up to 24 months while

PAP Category	Impact	Entitlement
structure	access to work place.	waiting for the availability of the units in resettlement site • Transition allowance for moving costs to new rental unit. • Moving assistance – trucks for personal belongings; vans for women and children • Free access to skills training and related livelihood restoration programs for 2 family members to be specified in the RAP.
Owner of private land – market sale	Loss of property & assets	• Willing seller-willing buyer arrangement, negotiated on the basis of land market price and replacement cost of assets.
Owner of private land - expropriation	Loss of property & assets	• Compensation as determined by the court of law. • Remedial measures for any gaps between court ruling and appraised value.
Private owner Trees	Removal of trees / loss of assets	• Compensation based on timber value for non-fruit-bearing trees. • Compensation for fruit-bearing trees equivalent to cost of replacement root stock and lost income from sale of fruit based on agro-economic expert.
Owner of standing Crops	Loss of income.	• Compensation based on market value of crop evaluated by agro-economic expert.
Titled owners' structures and immovable assets	Loss of fixed assets.	• Compensation at replacement cost.
Renters of private land	Loss of land use; loss of income.	• Land owner to reimburse unused portion of lease payments made; assistance to shift to another site. • Given a minimum of 3 months' notice, compensated for rents paid in advance as well as for any structures or improvements made by the lease holder.
Informal users of private land	Loss of dwellings and structures; loss of income from	• Resettlement and assistance as provided for loss of dwellings. • Compensation for crops if used for agricultural purposes

PAP Category	Impact	Entitlement
	land-based activities.	or allowing harvest existing crops, where possible. • Assistance to shift to another site if used for commercial purposes.
Vulnerable People	Resettlement could affect social support networks and physical conditions of project-affected children, pregnant women, elderly, person with disabilities.	• Welfare agency support will be provided to ensure that vulnerable people are assisted as needed in resettlement transition.
Female-headed households	Resettlement may pose additional hardships for female household heads, especially those who are very poor or without sufficient social network support.	• Such households will be identified in baseline surveys with follow-up on specific issues in consultations. Welfare agents will assist with any additional measures needed to ensure a smooth transition in resettlement for female household heads and children.

296. The resettlement issue will be addressed by a resttlement action plan (RAP). Livelihood restoration will form a part of the RAP or remedial measures of the Due Diligence Report that MMDA/DPWH will prepare as a requirement of the RPF for each subproject (pumping station) that will have project-affected persons. Each RAP must, based on census and socio-economic profiling, be able to clearly identify the number of PAPs and the extent by which they are impacted by the project. The RAP must also ensure that livelihood interventions are well-budgeted with clear implementation structure and timeline for proposed activities.

COMMUNICATION AND PARTICIPATION FRAMEWORK

297. Information, education and communication (IEC) programs will target the barangay officials and affected residents. The following are the major topics to be discussed:

- ESIA process status;
- ESIA findings;
- The compensation for the identified affected areas in construction area (if any);
- The potential consequential impacts on the residents on the community affected; and
- The benefits of the project on their socio-cultural, economic and bio-physical environment of the affected residents as they address flooding & solid waste management issues.

298. Strategy methods will be in groups, individuals, or sectors. The IEC materials and strategies that will be used should be simplified and can be understood by all stakeholders. The materials will be illustrated in the local language. The topics will be focus on the ESIA process and the activities to be implemented during rehabilitation works and operation. The following information to be discussed includes:

- The project description – a graphic illustration about the operations of the flood mitigating infrastructures;
- Dredging activities and the disposal plan;
- Solid waste disposal and management;
- Location map that indicates exact location of activities;
- Answers to FAQs of the project;
- The identified impacts and mitigations (written in local language) on the health and safety measures related to pumping station upgrading, dredging and, solid waste management on current behavior in relation to the project.

299. MMDA will lead the role in making strategic partnerships with all the major stakeholders, such as local government and residents directly affected by the subprojects. Plans are underway to hire consultants to help prepare the framework that will contain assessment of communication and participation issues and challenges that need to be addressed, the stakeholders to be reached to help ensure project success, the overall media landscape that needs to be navigated as the project goes through the entire cycle from preparation to implementation, the key messages, communication channels, and action plans outlining in detail the series or sequence of activities that will be undertaken based on the communications framework.

PROPOSED MITIGATION MEASURES

300. **Annex C** presents the proposed environmental and social managment plan for each pumping station to address Project impacts. The mitigating and enhancement measures are listed along with the responsible parties and guarantees involved.

301. **Table 42** presents the matrix of environmental monitoring plan (EmoP), which is a set of environmental parameters that must be checked regularly to ensure the projects' sustainability and efficiency. The EMoP will allow the MMDA to monitor ESMP implementatoon and perform corrective measures whenever needed.

Table 42: Matrix of the Environmental Monitoring Plan

Concern	Parameter to be Monitored	Sampling & Measurement Plan			Lead Person	Annual Estimated Cost
		Method	Frequency	Location		
A. Rehabilitation of the Pump Stations						
A1. Solid waste generation	Weight or volume of wastes generated	Weighing/log-book recording	Daily	Construction areas	MMDA	Minimal
A2. Siltation of channels	Turbidity, sediments	Grab sampling and laboratory analysis	Monthly	Channels	MMDA	P 5,000 per month
A3. Air quality	Dust and noise	Air Sampling	Whenever necessary	Project Site	MMDA	P 10,000 per event per station
A4. Employment	Number of locally-employed personnel	Log-book/ database registration	Daily	Administration office of the project site	MMDA	Minimal
A5. Occupational health and safety	No. of work-related illnesses/injuries; No. of safety man-hours	Log-book/ database registration	Daily	Administration office of the project site	MMDA	Minimal
A6. Public perception/ acceptability	No. of valid complaints	Consultations with local officials and residents	Upon official request /summon of the local barangay office	Host barangay	MMDA	Minimal
B. Operations of of Pump Stations & Dredging Activities						
B1. Solid waste generation	Weight or volume of wastes generated	Weighing/log-book recording	Daily/weekly	Project Sites	MMDA	Minimal
B2. Hazardous waste generation (used oil etc.)	Liter (liquid)	Weighing/log-book recording	Weekly	Liquid waste storage	MMDA	Part of operations
B3. Noise	Decibel levels on selected equipment	Digital sound level meter	When necessary	Pumping station	MMDA	P2,000 per station
B4. Ambient Air Quality	NO_x, SO_x, PM_{10}, TSP	Air sampler	At least annual	Project Site	MMDA	P10,000 per station per event
B5.Occupational health and safety	No. of work-related illnesses/injuries; no. of safety man-hours	Log-book/ database registration	Daily	Administration office of the project	MMDA	Minimal
B6.Public perception/ acceptability	No. of valid complaints	Consultations with local officials and residents	At least twice a year	Adjacent barangays	MMDA	Minimal

GRIEVANCE REDRESS MECHANISM

302. A Grievance Redress Mechanism (GRM) will be established to ensure that complainants are able to file complaints and raise grievances related to the project. A grievance may include social-related issues, environment-related complaints during construction and implementation, and technical issues of the project.

303. The GRM will use the existing and well-established complaints handling system or Public Complaints Unit of the MMDA. Any aggrieved party may raise the complaint through the MMDA's website (www.mmda.gov.ph), MMDA social media accounts on Facebook and Twitter (@MMDA), or lodge the complaint personally through the Public Complaints Desk located at the ground floor of the MMDA Office in Makati City. All complaints received through the MMDA website, social media accounts and at the Public Complaints Desk are referred to the concerned unit for immediate action, investigation and resolution of the complaint. The action on the complaint is recorded and monitored by the Public Information Office of MMDA using real-time flow of information of complaints and follow-up.

304. At the site of each pumping station, the station manager will be in-charge of the overall process of resolving a particular grievance. Once a complaint has been received at the site, the station manager is expected to closely coordinate with the complainant and the barangay immediately. In addition, the local community will be informed about the availability of the complaint services of the project so that complaints could be resolved on site in a relatively short period of time.

CONCLUSIONS

305. 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.

306. MMFIP Phase 1 will not result to significant adverse environmental impacts and that the impacts are primarily confined within the site of the existing pumping stations and at the waterways. Environmental mitigation measures have been designed as outlined in the ESMP and ECOP to address any adverse impacts of project implementation.

307. The following Project impacts are considered significant and will require ongoing due diligence measures to ensure that they can be minimized:

- Disposal of dredged waste materials from waterways. Toxicity testing will be required and a waste management plan implemented to ensure proper disposal
- Generation of waste water hyacinth – the large volumes of waste will require adequate disposal
- Legacy issues associated with Oplan Likas – will require implementation of due diligence and a follow-up action

308. 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 or any other Supervising Agency, should implement a supervision and oversight program to assure adoption of these mitigation measures.

REFERENCES

309. The following are the reports reviewed and the websites visited for the preparation of this ESIA:

1. Master Plan for Flood Management in Metro Manila and Surrounding Areas, DPWH through World Bank, April 2013
2. EMB Memorandum Circular No. 2014-005
3. Metro Manila Development Authority presentations, 2015
4. www.aarconbuilders.com
5. www.abs-cbn.com
6. www.mmda.gov.ph
7. www.dpwh.gov.ph
8. Pasig River Rehabilitation Commission presentations, 2009
9. Earthquake risk analysis of Metro Manila by Saldivar-Sali, article published in manila Bulletin, October 1991
10. DENR-EMB 2011 Metro Manila Air Quality Status Report Department of Environment Natural Resources, Environmental Management Bureau (DENR-EMB)
11. Philippine Atmospheric Geophysical and Astronomical Services, Climate Change in the Philippines Report, February 2011
12. Noble, B.F. 2010. Introduction to Environmental Impact Assessment. A Guide to Principles and Practice. Oxford University Press.
13. Social Impact Assessment Report for the Metro Manila Flood Management Program Phase 1, World Bank 2015
14. Master Plan for Flood Management in Metro Manila and surrounding areas by Dr. Anton Heinsbroek (Deltares), mission report in November 2012

ANNEXES

A. Environmental and Social Safeguards Screening Matrices

B. Analysis of Environmental and Social Impacts

C. ESMPs for the Pumping Stations

D. Environmental Code of Practice (ECOPs)

E. Due diligence report for wastes disposal (solid and hazardous wastes)

F. Environmental due diligence of resettlement sites

G. Results of water quality, sediment quality, and noise sampling

ANNEX A: Environmental and Social Safeguards Screening Matrices

Project:

Metro Manila Flood Management Project – Phase 1

Annex A: Environmental and Social Safeguards Screening Matrix - Metro Manila Flood Management Project Phase 1

Notes:

This matrix is to be used together with the Environmental Code of Practice (ECOP). The ECOP is intended to cover all the typical and repeating impacts and mitigation measures in the rehabilitation of pumping stations. This screening matrix identifies other impacts not covered by the ECOPs, but may potentially occur in some pumping stations / sites.

When considering the activities and location of a pumping station, fill up the following matrix based on the on site conditions and activities in the proposed pumping station site. Having multiple issues in one site does not necessarily mean that the site is unsuitable (specifically for new pumping stations). They do indicate a real risk of causing undesirable adverse environmental and social effects, and that more substantial environmental and/or social safeguards instruments may be required to adequately avoid, mitigate or manage potential effects.

Table A1: Environmental & Social Screening Matrix for Vitas Pumping Station

	Screening / Criteria	Y/N	If Yes	Comments
1	Will dredging of waterways be done?	Y	Prepare a dredging management plan which includes sampling of dredge material for presence of toxic and hazardous content. Disposal options for the dredge material will depend on the analysis of the sludge.	Refer to Schedule 3 of RA 6969 for threshold levels of toxic and hazardous content of sludge/dredge material. Based on TCLP test.
2	Will there be expansion of the pumping station structure or installation of new additional structures?	Y	Consult with WB safeguards staff if an EIA is needed.	ECOPS and ESMP will apply. Depending on the magnitude of the works, an EIA may be required.
3	Will substantial solid waste be generated from the pumping station operations	Y	Ensure that the transport and disposal of the solid waste is compliant with RA 9003.	Includes aquatic weeds (e.g. water hyacinth)
4	Will the pumping station dispose of solid waste in a site other than the following: Navotas Sanitary landfill Montalban Solid Waste Disposal Facility	Y	Conduct a due diligence audit of the disposal site and ensure the following. Only disposal sites with proper design and leachate treatment will be considered.	
5	Will there be dismantling of equipment containing PCBs (e.g. tranformers)	N	Prepare a PCB management plan.	Contact DENR-EMB (Mr. Edwin Navaluna)
6	Will the project affect any Physical Cultural Resources or sites of historical and cultural significance within the impact area?	N	Prepare a PCR management Plan	
7	Will there be lands to be acquired for this rehabilitation work, temporarily or permanently?	N	Refer to the RPF	
8	Will there be properties and other assets that will be affected or damaged?	N	Refer to the RPF	
9	Will there be people that need to resettle to give way to the rehabilitation?	Y	Refer to the RPF. Prepare a RAP.	Preparation of RAP is underway. Results will be included in the ESMP
10	Will there be economic displacement due to the rehabilitation work?	Y	Refer to the ESMF/RPF	
11	Has there been resettlement of PAPs carried out under a GoP program (e.g. Oplan Likas) in the vicinity of the Pumping station?	Y	Refer to the RPF	

Table A2: Environmental & Social Screening Matrix for Balut Pumping Station

	Screening / Criteria	Y/N	If Yes	Comments
1	Will dredging of waterways be done?	Y	Prepare a dredging management plan which includes sampling of dredge material for presence of toxic and hazardous content. Disposal options for the dredge material will depend on the analysis of the sludge.	Refer to Schedule 3 of RA 6969 for threshold levels of toxic and hazardous content of sludge/dredge material. Based on TCLP test.
2	Will there be expansion of the pumping station structure or installation of new additional structures?	Y	Consult with WB safeguards staff if an EIA is needed.	ECOPS and ESMP will apply. Depending on the magnitude of the works, an EIA may be required.
3	Will substantial solid waste be generated from the pumping station operations	Y	Ensure that the transport and disposal of the solid waste is compliant with RA 9003.	Includes aquatic weeds (e.g. water hyacinth)
3	Will the pumping station dispose of solid waste in a site other than the following: Navotas Sanitary landfill Montalban Solid Waste Disposal Facility	Y	Conduct a due diligence audit of the disposal site and ensure the following. Only disposal sites with proper design and leachate treatment will be considered.	
4	Will there be dismantling of equipment containing PCBs (e.g. tranformers)	N	Prepare a PCB management plan.	Contact DENR-EMB (Mr. Edwin Navaluna)
5	Will the project affect any Physical Cultural Resources or sites of historical and cultural significance within the impact area?	N	Prepare a PCR management Plan	
6	Will there be lands to be acquired for this rehabilitation work, temporarily or permanently?	N	Refer to the RPF	
7	Will there be properties and other assets that will be affected or damaged?	N	Refer to the RPF	
8	Will there be people that need to resettle to give way to the rehabilitation?	N	Refer to the RPF. Prepare a RAP.	
9	Will there be economic displacement due to the rehabilitation work?	N	Refer to the ESMF/RPF	
10	Has there been resettlement of PAPs carried out under a GoP program (e.g. Oplan Likas) in the vicinity of the Pumping station?	N	Refer to the RPF	

Table A3: Environmental & Social Screening Matrix for Paco Pumping Station

	Screening / Criteria	Y/N	If Yes	Comments
1	Will dredging of waterways be done?	Y	Prepare a dredging management plan which includes sampling of dredge material for presence of toxic and hazardous content. Disposal options for the dredge material will depend on the analysis of the sludge.	Refer to Schedule 3 of RA 6969 for threshold levels of toxic and hazardous content of sludge/dredge material. Based on TCLP test.
2	Will there be expansion of the pumping station structure or installation of new additional structures?	Y	Consult with WB safeguards staff if an EIA is needed.	ECOPS and ESMP will apply. Depending on the magnitude of the works, an EIA may be required.
3	Will substantial solid waste be generated from the pumping station operations	Y	Ensure that the transport and disposal of the solid waste is compliant with RA 9003.	Includes aquatic weeds (e.g. water hyacinth)
3	Will the pumping station dispose of solid waste in a site other than the following: Navotas Sanitary landfill Montalban Solid Waste Disposal Facility	Y	Conduct a due diligence audit of the disposal site and ensure the following. Only disposal sites with proper design and leachate treatment will be considered.	
4	Will there be dismantling of equipment containing PCBs (e.g. tranformers)	N	Prepare a PCB management plan.	Contact DENR-EMB (Mr. Edwin Navaluna)
5	Will the project affect any Physical Cultural Resources or sites of historical and cultural significance within the impact area?	N	Prepare a PCR management Plan	Possible for Chance-Find since site is near several cultural and heritage sites.
6	Will there be lands to be acquired for this rehabilitation work, temporarily or permanently?	N	Refer to the RPF	
7	Will there be properties and other assets that will be affected or damaged?	N	Refer to the RPF	
8	Will there be people that need to resettle to give way to the rehabilitation?	N	Refer to the RPF. Prepare a RAP.	
9	Will there be economic displacement due to the rehabilitation work?	N	Refer to the ESMF/RPF	
10	Has there been resettlement of PAPs carried out under a GoP program (e.g. Oplan Likas) in the vicinity of the Pumping station?	Y	Refer to the RPF	

Table A4: Environmental & Social Screening Matrix for Tripa de Gallina Pumping Station

	Screening / Criteria	Y/N	If Yes	Comments
1	Will dredging of waterways be done?	Y	Prepare a dredging management plan which includes sampling of dredge material for presence of toxic and hazardous content. Disposal options for the dredge material will depend on the analysis of the sludge.	Refer to Schedule 3 of RA 6969 for threshold levels of toxic and hazardous content of sludge/dredge material. Based on TCLP test.
2	Will there be expansion of the pumping station structure or installation of new additional structures?	Y	Consult with WB safeguards staff if an EIA is needed.	ECOPS and ESMP will apply. Depending on the magnitude of the works, an EIA may be required.
3	Will substantial solid waste be generated from the pumping station operations	Y	Ensure that the transport and disposal of the solid waste is compliant with RA 9003.	Includes aquatic weeds (e.g. water hyacinth)
3	Will the pumping station dispose of solid waste in a site other than the following: Navotas Sanitary landfill Montalban Solid Waste Disposal Facility	Y	Conduct a due diligence audit of the disposal site and ensure the following. Only disposal sites with proper design and leachate treatment will be considered.	
4	Will there be dismantling of equipment containing PCBs (e.g. tranformers)	N	Prepare a PCB management plan.	Contact DENR-EMB (Mr. Edwin Navaluna)
5	Will the project affect any Physical Cultural Resources or sites of historical and cultural significance within the impact area?	N	Prepare a PCR management Plan	
6	Will there be lands to be acquired for this rehabilitation work, temporarily or permanently?	N	Refer to the RPF	
7	Will there be properties and other assets that will be affected or damaged?	N	Refer to the RPF	
8	Will there be people that need to resettle to give way to the rehabilitation?	N	Refer to the RPF. Prepare a RAP.	
9	Will there be economic displacement due to the rehabilitation work?	N	Refer to the ESMF/RPF	
10	Has there been resettlement of PAPs carried out under a GoP program (e.g. Oplan Likas) in the vicinity of the Pumping station?	N	Refer to the RPF	

Table A5: Environmental & Social Screening Matrix for Labasan Pumping Station

Screening / Criteria		Y/N	If Yes	Comments
1	Will dredging of waterways be done?	Y	Prepare a dredging management plan which includes sampling of dredge material for presence of toxic and hazardous content. Disposal options for the dredge material will depend on the analysis of the sludge.	Refer to Schedule 3 of RA 6969 for threshold levels of toxic and hazardous content of sludge/dredge material. Based on TCLP test.
2	Will there be expansion of the pumping station structure or installation of new additional structures?	Y	Consult with WB safeguards staff if an EIA is needed.	ECOPS and ESMP will apply. Depending on the magnitude of the works, an EIA may be required.
3	Will substantial solid waste be generated from the pumping station operations	Y	Ensure that the transport and disposal of the solid waste is compliant with RA 9003.	Includes aquatic weeds (e.g. water hyacinth)
4	Will the pumping station dispose of solid waste in a site other than the following?: Navotas Sanitary landfill Montalban Solid Waste Disposal Facility	Y	Conduct a due diligence audit of the disposal site and ensure the following. Only disposal sites with proper design and leachate treatment will be considered.	
5	Will there be dismantling of equipment containing PCBs (e.g. tranformers)	N	Prepare a PCB management plan.	Contact DENR-EMB (Mr. Edwin Navaluna)
6	Will the project affect any Physical Cultural Resources or sites of historical and cultural significance within the impact area?	N	Prepare a PCR management Plan	
7	Will there be lands to be acquired for this rehabilitation work, temporarily or permanently?	N	Refer to the RPF	
8	Will there be properties and other assets that will be affected or damaged?	N	Refer to the RPF	
9	Will there be people that need to resettle to give way to the rehabilitation?	N	Refer to the RPF. Prepare a RAP.	
10	Will there be economic displacement due to the rehabilitation work?	N	Refer to the ESMF/RPF	
11	Has there been resettlement of PAPs carried out under a GoP program (e.g. Oplan Likas) in the vicinity of the Pumping station?	N	Refer to the RPF	

ANNEX B: Analysis of Environmental and Social Impacts

Project:

Metro Manila Flood Management Project – Phase 1

Annex B: Analysis of Environmental and Social Impacts

Table B1: Impacts During Construction Works

Impact	Criteria Rating	Criteria Rating Rationale
Generation of construction wastes	Impact Balance: Negative	Demolition and removal of equipment and facilities will result to the generation of wastes consisting of old equipment, scrap metal, piping, wiring, lighting fixtures, waste concrete and other construction spoils. The majority are considered as recyclable waste materials but the activity will still produce residual waste materials which requires appropriate disposal to prevent adverse impacts. Compact fluorescent lamps (CFLs) will be generated during the replacement of lighting fixtures. These are considered as hazardous wastes because they contain mercury which if improperly disposed will cause negative impacts to health of community and the environment. Solid waste will also be generated from the installation of equipment and facilities. These wastes generally consist of scrap metal, piping, wiring, waste concrete, and other construction spoils. These materials are inert but should be disposed properly to avoid negative impacts to land and waterways. The presence of construction workers at the site will also 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. Recycling and proper waste disposal procedures need to be enforced.
	Spatial Boundary: Footprint	Solid waste generation will be confined to the pumping station site.
	Duration: Short-term	Solid waste from demolition of equipment and structures and rehabilitation of facilities will only occur during construction.
	Frequency: Isolated	The event is confined to activity on demolition of facility and removal / replacement of equipment.
	Reversibility: Reversible	Residual effect is short-term and reversible.
	Magnitude: Low	Limited effects expected as construction wastes will be collected.
	Probability: High	The residual effect will occur if mitigating measures are not properly implemented.
	Confidence: Low	Data on the quantity of solid waste that will be generated from demolition and rehabilitation activities is not certain.

Impact	Criteria Rating	Criteria Rating Rationale
Generation of waste oil	Impact Balance: Negative	Waste oil and lubricants from the dismantling of motors, pumps and other auxiliary equipment may result to negative impacts to land and waterways when disposed inadvertently.
	Spatial Boundary: Footprint	Waste oil generation will be confined to the working area.
	Duration: Short-term	Waste oil will occur during the extent of construction.
	Frequency: Isolated	Waste oil will only be generated specific to the activity during construction.
	Reversibility: Reversible	Waste oil can be collected, sold to and recycled by third party waste oil recycling companies.
	Magnitude: Low	Generation of waste oil and lubricants is limited in quantity since most of these will be contained in dismantled motors and pumps. Most of the waste oil will be generated from accidental spill or leaks from the dismantled equipment. This will result to limited effect on the environment.
	Probability: High	Accidental spill of waste oil will occur if mitigating measures are not properly implemented.
	Confidence: High	There is full understanding of the cause-effect relationship of waste oil generation. Waste oil is considered as hazardous wastes and there are Government requirements for the management and disposal of waste oil as outlined in Republic Act 6969.
Generation of Dust	Impact Balance: Negative	Airborne dust from movement of construction vehicles will have a negative impact to health of communities along the access roads to the site. Dust from the construction works for the rehabilitation of pumping station buildings and construction of new structures will have a negative impact to workers and communities directly adjacent to the pumping stations. Specifically, the following construction works are anticipated to cause dust generation. • **Vitas PS:** Dust will be generated from the rehabilitation of the pumping station building, construction of additional storage tanks and rehabilitation of warehouse. • **Balut PS**: Dust will generally occur from the construction works for the rehabilitation of the pumping station building and perimeter fence. • **Tripa de Gallina PS:** Rehabilitation of the pumping station building, construction and installation of primary trashscreens including horizontal and vertical conveyors will be additional infrastructures that will result to dust generation. • **Labasan PS:** Source of dust will be from the rehabilitation of the pumping station building.

Impact	Criteria Rating	Criteria Rating Rationale
	Spatial Boundary: Direct impact area	Dust from construction activities will be confined to pumping station area and along access roads.
	Duration: Short-term	Dust will occur during the construction.
	Frequency: Isolated	Dust will only be generated during construction
	Reversibility: Reversible	The residual effect of dust is limited and reversible.
	Magnitude: Low	Limited effects expected as watering and other dust control measures will be done to limit dust.
	Probability: High	The residual effect is likely to occur during construction without appropriate implementation of dust control measures.
	Confidence: High	Confidence is based on a full understanding of cause-effect relationships pertinent to the construction works involved and the sources of dust during project implementation. Air quality standards for protecting occupational and community health are prescribed.
Noise	Impact Balance: Negative	Noise from the operation of construction equipment such as pumps, generators, and compressors as well as from movement of trucks will have a negative impact to workers and to the nearest residential houses to the pumping stations. Noise nuisance will also affect communities during movement of vehicles transporting materials and equipment to the pumping stations.
	Spatial Boundary: Direct impact area	Noise will be confined to pumping station area and along access roads. Noise from the construction works at the pumping station could reach approximately 100-meter radius of the source.
	Duration: Short-term	Event occurs during the extent of construction.
	Frequency: Isolated	Noise will only be generated during construction.
	Reversibility: Reversible	The residual effect of noise during construction is limited and reversible.
	Magnitude: Low	Noise levels of 75dBA up to 90 dBA may be detected from the operation of the construction equipment and vehicles. Noise from construction works will directly affect workers but will have limited effect to surrounding communities since noise dissipates with distance from the source.
	Probability: High	Noise is likely to occur.
	Confidence: High	Confidence is based on understanding of the cause-effect of noise on the health of workers and surrounding communities. Allowable noise standards to ensure occupational and community health and safety is prescribed.

Impact	Criteria Rating	Criteria Rating Rationale
Generation of wastewater	Impact Balance: Negative	Wastewater coming from the sanitation requirements of construction workers will cause a negative impact to the environment.
	Spatial Boundary: Footprint	Generation of wastewater will be confined within the sites of the pumping stations.
	Duration: Short-term	Impact will occur during the extent of construction.
	Frequency: Isolated	Wastewater will be confined to the project construction activities.
	Reversibility: Reversible	The residual effect is limited and reversible.
	Magnitude: Low	The impact of wastewater generation is detectable and results to limited effect on the environment since there will be no construction camps and that the workers will be using the existing toilets with septic tanks at the pumping stations.
	Probability: High	Wastewater generation during construction is likely to occur.
	Confidence: High	There is full understanding of the cause-effect relationship of wastewater generation during the construction works.
	Significance: Not significant	The impact of wastewater generation during construction is not significant since there will be no construction camps and that wastewater can be managed through the existing toilets with septic tanks at the pumping stations.
Occupational hazards	Impact Balance: Negative	Construction activities may result to negative impact to workers due to accidents and mechanical, electrical, tripping and fall hazards at the workplace.
	Spatial Boundary: Footprint	Occupational hazards will be confined to project area.
	Duration: Short-term	Impact will occur during the extent of construction.
	Frequency: Accidental	Occupational hazards will rarely occur with implementation of occupational health and safety measures.
	Reversibility: Reversible	Residual effect is limited and reversible.
	Magnitude: Medium	Effect of occupational hazards will be moderate.
	Probability: High	There is likelihood of occupational hazards.
	Confidence: High	There is reasonable understanding of the cause-effect relationship of occupational hazards during rehabilitation of the pumping station equipment and facility.

Table B2: Impacts During Dredging and Waterway Clearing

Impact	Criteria Rating	Criteria Rating Rationale
Resuspension of sediments	Impact Balance: Negative	Dredging of sediments from the waterways will result to resuspension of sediments which cause a negative impact on the water quality and aquatic life remaining in the rivers. There exists a potential negative impact of resuspension of sediments during dredging. The resuspension of sediments during dredging will contribute to further deterioration of water quality of the rivers served by these pumping stations which are tributaries of Class C waters classified to support fishing and recreational activities. Although, the current state of the water quality of these waterways does not conform to the Class C water criteria and can no longer support aquatic life, the resuspension of sediments will have a negative impact on water quality.
	Spatial Boundary: Footprint	Resuspension of sediments will directly affect the waterway being dredged.
	Duration: Short-term	The impact will occur during dredging works only.
	Frequency: Periodic	Resuspension of sediments from dredging activities will occur intermittently but repeatedly over the life of the project.
	Reversibility: Reversible	The residual effect of resuspension of sediments on water quality during dredging is reversible through periodic dredging and removal of silt in the waterways.
	Magnitude: Medium	The resuspension of sediments is detectable and can be immediately observed during dredging activities even with the highly turbid water in the waterways.
	Probability: High	Resuspension of sediments is highly probable during dredging works.
	Confidence: High	The residual effect of resuspension of sediments on water quality during dredging is known but is expected to improve with the implementation of the project.
	Significance: Not significant	The resuspension of sediments during dredging does not contribute to significant impact to the environment and the river's ecosystem since this will occur on a short-term and temporary basis. The periodic dredging and removal of silt during project implementation is expected to reduce the volume of sediments and improve the water quality of the waterways.
Generation and disposal of dredged materials	Impact Balance: Negative	Dredged materials removed from waterways during dredging will cause a negative impact to the environment since these contain organic materials and contaminants such as heavy metals. Because of the contaminated nature of the dredged materials, these are considered as hazardous waste materials that require proper management and disposal to avoid adverse effects to human health and the environment.
	Spatial Boundary: Footprint	The generation of dredged materials will occur within the project area.

Impact	Criteria Rating	Criteria Rating Rationale
	Duration: Short-term	The impact will occur during dredging works only.
	Frequency: Isolated	The generation of dredged materials will occur intermittently but repeatedly over the life of the project.
	Reversibility: Reversible	N/A
	Magnitude: Medium	The impact of dredged materials is detectable from estimates of the volume of silt/sediments to be removed from the waterways.
	Probability: High	The generation of dredged materials is highly probable.
	Confidence: High	The residual effect of dredged materials is known through tests on sediment quality. When regular sediment quality tests show the presence of hazardous elements, the disposal methods of the dredged materials should conform to the hazardous waste disposal requirements of the Government (RA6969).
Removal of water hyacinth	Impact Balance: Negative	The removal of water hyacinth in the waterways served by the Paco and Labasan pumping stations will have a positive impact on the aquatic ecosystem of the waterways. This effect requires further investigation.. The removal of the water hyacinth will also result to negative impact to the environment because of the generation of organic waste materials that requires appropriate disposal.
	Spatial Boundary: Direct impact area	The removal of water hyacinth will directly affect the Estero de Paco at the Paco PS and the attenuation pond at the Labasan PS. These waterways are within the direct impact area of the project.
	Duration: Short-term	The removal of water hyacinth will occur during the extent of activity.
	Frequency: Occasional	The removal of water hyacinth will occur intermittently and sporadically over the life of the project since water hyacinth is expected to continue to grow because of the natural conditions and the ability of these species to propagate in the presence of nutrients in the waters.
	Reversibility: Reversible	The residual effect is short term and reversible.

Impact	Criteria Rating	Criteria Rating Rationale
	Magnitude: Medium	The change is detectable and results in limited effect on the environment and social component. As compared to the limited quantity of water hyacinth at the Paco PS, the presence of water hyacinth at the Labasan attenuation pond is larger and will result to a loss of about 6.4ha of water hyacinth area. In terms of disposal of collected water hyacinth, the magnitude is considered moderate at the Labasan PS because of the estimated quantity of water hyacinth that needs to be disposed properly.
	Probability: High	The effect of removal of water hyacinth is highly probable.
	Confidence: High	The cause-effect relationship of the residual effect of water hyacinth removal to the environment and the community as a result of project implementation is known.
Odor	Impact Balance: Negative	Foul odor emitted from the dredging of decomposing organic materials in the river water and bottom sediments will have a negative impact to people living near the banks of the waterways. The impact of foul odor during dredging to communities living along waterways served by the Vitas, Balut, and Tripa de Gallina pumping stations is more intense due to the proximity of dense settlements near the waterways and the generally poor water quality and anaerobic decomposition in the sediments that results in odor emission.
	Spatial Boundary: Direct impact area	Emission of foul odor will affect the communities in the direct impact area.
	Duration: Short-term	The effect of odor will occur during the dredging activities only.
	Frequency: Isolated	The generation of foul odor will occur to specified dredging activity but will be intense when dredging is done during the dry summer months.
	Reversibility: Reversible	The residual effect of odor is short term and reversible.
	Magnitude: Low	The impact of odor is detectable and results in limited effect on the social component.
	Probability: High	The residual effect of odor is likely to occur.
	Confidence: High	There is confidence on the cause-effect of odor to people in the impact area.
	Significance: Not significant	Due to the isolated frequency causing the residual effect, the low magnitude of the residual effect and the high confidence in the cause-effect relationship, odor due to dredging activities is not expected to be a significant residual effect.
Occupational hazards	Impact Balance: Negative	Dredging activities may result to accidents and pose risks to the health and safety of workers operating the dredging equipment and machinery. Hazards may come from unsafe dredging methods, lack of personnel safety gadgets, and direct exposure to waste materials.

Impact	Criteria Rating	Criteria Rating Rationale
	Spatial Boundary: Footprint	Occupational hazards will be confined to project area.
	Duration: Short-term	Impact will occur during the extent of dredging activity.
	Frequency: Isolated	Occupational hazards will rarely occur with implementation of occupational health and safety measures.
	Reversibility: Reversible	N/A
	Magnitude: Medium	Effect of occupational hazards is severe moderate.
	Probability: High	There is likelihood of occupational hazards.
	Confidence: High	There is reasonable understanding of the cause-effect relationship of occupational hazards during dredging operations.

Table B3: Impacts During Operation

Impact	Criteria Rating	Criteria Rating Rationale
Noise	Impact Balance: Negative	The operation of pumps and equipment at the pumping station will generate noise levels that will result to negative impacts to workers at the pumping stations and to communities near the pumping stations.
	Spatial Boundary: Footprint	Impact of noise will be confined to pumping station sites.
	Duration: Long-term	Impact will occur during the regular operation of pumps and motors at the pumping stations.
	Frequency: Periodic	The generation of noise occurs intermittently but repeatedly during the life of the project.
	Reversibility: Reversible	Residual effect is short term and reversible.
	Magnitude: High	Effect of noise to workers is high and results in severe effect and long-term effect on the sense of hearing.
	Magnitude: Low	The effect of noise nuisance to communities adjacent to the pumping station is low because noise is generally confined within the pumping station building and residual noise can be dissipated with distance.
	Probability: High	The generation of noise from pumping station operation is likely to occur.
	Confidence: High	There is reasonable understanding of the cause-effect relationship of noise hazards during pumping station operations. Allowable noise levels in the workplace is established according to the OSHS.
Generation of solid wastes	Impact Balance: Negative	The operation of trash racks at each pumping station will result to the collection of solid wastes entrapped at the flood control gates. The accumulation of solid wastes at the pumping station will have a negative impact to the environment without regular collection and appropriate disposal methods. Maintenance of the pumping station will generate wastes consisting of wiring and lighting fixtures. Wiring is considered as recyclable waste materials while the lighting fixtures, particularly the CFLs, are considered as hazardous wastes because of the mercury content in the lamps. The wastes require appropriate disposal to prevent adverse impacts to biophysical conditions. The workers at the pumping stations will also 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.
	Spatial Boundary: Footprint	Solid waste generation will be confined to the pumping station site.

Impact	Criteria Rating	Criteria Rating Rationale
	Duration: Long-term	Impact will occur during the regular operation and maintenance of the pumping stations.
	Frequency: Continuous	The generation of solid waste occurs continually over the life of the project.
	Reversibility: Reversible	Residual effect is reversible with the implementation of mitigation measures.
	Magnitude: Low	Limited effects expected as solid wastes will be collected.
	Probability: High	The residual effect will occur if mitigating measures are not properly implemented.
	Confidence: High	There is confidence based on the availability and monitoring data on the quantity of solid waste generated from the regular operation of the pumping stations and an understanding of the cause-effect relationship of solid waste generation.
Generation of wastewater	Impact Balance: Negative	Wastewater from the sanitation requirements of workers at the pumping station and from leachate from collected solid wastes at the flood gates will pose negative impacts to water quality of the receiving body of water.
	Spatial Boundary: Footprint	The impact of wastewater from the pumping station is confined within the project area.
	Duration: Long-term	Wastewater generation will be an ongoing event during the operation of the pumping station.
	Frequency: Continuous	The impact will occur continually over the life of the project.
	Reversibility: Reversible	The impact of wastewater generation is reversible through appropriate wastewater treatment methods.
	Magnitude: Low	The change is detectable but results in a limited effect on the environment due to the low volume of projected wastewater.
	Probability: High	The generation of wastewater from workers and leachate from collected solid wastes is highly probable.
	Confidence: High	Confidence is based on a full understanding of cause-effect relationships of wastewater to the environment. There are regulations prescribing the allowable standards for effluent discharges into surface waters.
Occupational hazards	Impact Balance: Negative	Occupational hazards from operation of pumps, motors, and other dangerous mechanical equipment may result to accidents and pose risks to the health and safety of workers. Hazards may also come from lack of guard rails and fences in open channels, lack of personnel safety gadgets, and direct exposure to waste materials.
	Spatial Boundary: Footprint	Occupational hazards will be confined to project area.

Impact	Criteria Rating	Criteria Rating Rationale
	Duration: Long-term	Impact will occur during the regular operation of the pumping station.
	Frequency: Accidental	Occupational hazards will rarely occur with implementation of occupational health and safety measures.
	Reversibility: Reversible	Residual effect is limited and reversible.
	Magnitude: Medium	Effect of occupational hazards will be moderate.
	Probability: High	There is likelihood of occupational hazards.
	Confidence: High	There is reasonable understanding of the cause-effect relationship of occupational hazards during operation of the pumping stations.

Table B4: Social Impacts

Impact	Criteria Rating	Criteria Rating Rationale
Involuntary resettlement: land acquisition for new pump stations and waterway clearing	Impact Balance: Negative	Involuntary resettlement from land acquisition and the clearing of the waterway will have a negative impact to ISF. The range of resettled households for the Project is estimated between 1500 and 2500.
	Spatial Boundary: Footprint	The affected area will generally be confined within the area of the project footprint.
	Duration: Short-term	Involuntary resettlement will be short-term and will occur during the initial phase of project implementation.
	Frequency: Isolated	The event is confined to land acquisition and the specific clearing of waterway.
	Reversibility: Reversible	Not applicable.
	Magnitude: Low	The change is detectable and results in limited effect on the social component.
	Probability: High	Resettlement of affected households is highly probable.
	Confidence: High	There is confidence on the cause and effect of resettlement on the affected households. The current regulations protecting the rights of people in case of involuntary resettlement caused by a project is also known and can be addressed in the RAP.
Legacy issue from past Government resettlement programs	Impact Balance: Negative	*Oplan Likas* aimed to relocate 104,219 households away from danger areas (including waterways) over 5 years from 2011-2016). Some 67 per cent of the 36,049 ISFs being resettled (as of April 2015) were at off-city locations. The Project will assess whether resettlement has reduced income streams or access to basic services and support remedial measures to bring resettlement outcomes in line with GOP policies and the general objectives of WB OP 4.12.
	Spatial Boundary: Regional	67% of resettled ISFs have been in off-city locations
	Duration: Periodic	Done between 2011 and 2016
	Frequency: Isolated	As above
	Reversibility: N/A	Not applicable
	Magnitude: High	High due to large number of households resettled, particularly to off-city locations
	Probability: High	High
	Confidence: High	High: retrospective due diligence will be undertaken to assess gaps in meeting the specific requirements of OP 4.12.

Impact	Criteria Rating	Criteria Rating Rationale
Effects of discrepancy between WB and Government entitlements for PAPs	Impact Balance: Negative	Differences in scale of compensation between the GOP and WB could lead to increased social tension in communities where compensation has previously been paid and will be paid as part of the Project. Compensation will address a) replacement costs for land and assets b) location (preferably in-city) c) transitional allowances and d) human development costs
	Spatial Boundary: National	Metro-Manila and neighboring communities
	Duration: Long-term	Over the life of the Project
	Frequency: Continuous	This will be assessed over the life of the Project.
	Reversibility: N/A	Not applicable.
	Magnitude: High	Project scale
	Probability: High	Compensation costs are known for GOP and WB
	Confidence: High	Where costs differ, the more stringent entitlement cost will apply.
Traffic and restriction to access	Impact Balance: Negative	Traffic and temporary restriction of community access in the vicinity of the sites of the pumping stations will occur and cause a negative impact to the people during the movement of large vehicles to transport equipment and materials to the sites.
	Spatial Boundary: Footprint	Traffic and restriction of access will occur within the direct impact area of the pumping stations.
	Duration: Short-term	The movement of large vehicles will mostly occur during the construction phase but will sometimes occur during project operation.
	Frequency: Isolated	The event is confined during the construction phase but will also occur intermittently during the operational phase due to the transport of accumulated and collected wastes out of the pumping stations to the disposal sites at least twice a year.
	Reversibility: Reversible	The residual effect of traffic and access restriction is reversible.
	Magnitude: Low	The change is detectable and results in limited effect on the social component. Vehicle movement is not expected to be large.
	Probability: High	The impact of traffic and access restriction is likely to occur.
	Confidence: High	The anticipated frequency of vehicle movement into and outside of the pumping stations during the construction phase and when the project operates is not significant. There is reasonable understanding of the cause and effect to the community of traffic and restriction access which can be mitigated in the ECOP during construction as well as by the ESMP during the operational phase.

Impact	Criteria Rating	Criteria Rating Rationale
Community hazards and traffic accidents	Impact Balance: Negative	Community hazards and accidents from the movement of vehicles along narrow roads leading to the pumping stations may compromise safety of the people.
	Spatial Boundary: Footprint	The impact to community safety will occur within the direct impact area of the project. Access roads are a major concern.
	Duration: Short-term	The community hazards from movement of vehicles to the sites will mostly occur during the construction phase but will continue to occur during project operation.
	Frequency: Isolated	The event is confined during the construction phase but will also occur intermittently during the operational phase due to the transport of accumulated and collected wastes out of the pumping stations to the disposal sites at least twice a year.
	Reversibility: Reversible	The residual effect of community hazards is reversible.
	Magnitude: Low	The change is detectable and results in limited effect on the social component.
	Probability: High	The impact on community safety due to vehicle movement along access roads is likely to occur without appropriate implementation of traffic control measures.
	Confidence: High	The anticipated frequency of vehicle movement into and outside of the pumping stations during the construction phase and when the project operates is not significant. There is reasonable understanding of the cause and effect to community safety which can be mitigated in the ECOP during construction as well as by the ESMP during the operational phase.

ANNEX C: Environmental and Social Management Plans for Each Pumping Station

Project:

Metro Manila Flood Management Project – Phase 1

Annex C: Environmental and Social Management Plans

Each succeeding section of the environmental and social management plans (1) lists key impacts specific to each pumping station, and (2) delineates mitigation and enhancement measures, responsibilities, costs, and instruments/references corresponding to each environmental and social impact.

The ESMP is for the use of contractors upon undertaking of the various rehabilitation projects.

Key Impacts Specific to Vitas Pumping Station

DISPLACEMENT OF ISFS

- The rehabilitation of the Vitas Pumping Station and clearing of the waterway of Estero de Vitas will affect 50 ISFs who are current living on the banks of the estero and underneath the bridges at Raxabago St. and Capulong St. In compliance with the WB OP 4.12, an appropriate resettlement plan will be prepared for the affected households.

IMPACT ON COMMUNITY HEALTH AND SAFETY DUE TO TRANSPORT OF MATERIALS

- Access to the Vitas Pumping Station is through the Raxabago St. and then a narrow road that is parallel to the Estero de Vitas. A number of informal settlers live on the banks of the estero. This narrow access road and the presence of households along the road may result to adverse impacts on community health and safety from the movement of large hauling trucks and equipment. Extra caution must be exercised when passing through this narrow road. A resettlement plan will be prepared for these informal settlers.

Table C1: Environmental and Social Management Plan for Vitas Pumping Station

Environmental and Social Management Plan for Vitas Pumping Station					
Activity and Environmental Aspects	**Environmental and Social Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
Rehabilitation and Upgrading of Vitas Pumping Station	Generation of construction wastes	• Implementation of Solid Waste Management Plan (SWMP) • Segregation of solid waste according to recyclables and non-recyclables • Repair or re-use of available construction materials and equipment • Hauling of discarded/recyclable items by licensed haulers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Solid Waste)
	Generation of waste oil from equipment dismantling	• Segregation of hazardous wastes from regular wastes • Storage of hazardous items in sealed, sturdy, and properly marked containers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Hazardous Waste)

Environmental and Social Management Plan for Vitas Pumping Station					
Activity and Environmental Aspects	**Environmental and Social Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		• Hauling of hazardous items by accredited haulers/treaters			
	Generation of dust	• Regular watering of construction sites that have high dust concentration • Avoid long exposure of excavated soil and sand piles to strong winds by applying canvass covers • Regular clean-up and housekeeping of construction areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Dust Generation)
	Generation of noise	• If piling is necessary, perform monitoring for nearby concrete structures that may be affected • Notify nearby residents about the activities of using heavy equipment	MMDA Contractor	Part of construction costs	Refer to: ECOP (Noise and Vibration)
	Generation of wastewater from workers	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e., portable comfort rooms)	MMDA Contractor	Part of construction costs	Refer to: ECOP (Water Pollution)
	Occupational hazards	• All personnel are required to wear proper PPEs • All works must be supervised by trained and competent engineers and workers • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Workers Safety)
Dredging activities along Estero de Vitas	Re-suspension of sediments	• Provision of designated disposal sites	MMDA Contractor	To be determined	Refer to: ECOP (Dredged Materials)
	Generation and disposal of dredged materials	• Provision of designated disposal sites	MMDA Contractor	To be determined	Refer to: ECOP (Dredged Materials)
	Odor	• Immediate transportation of dredged materials to disposal sites	MMDA Contractor	To be determined	Refer to ECOP (Dredged Materials)

Environmental and Social Management Plan for Vitas Pumping Station					
Activity and Environmental Aspects	**Environmental and Social Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		• Coordination with barangays			
	Occupational hazards	• All personnel are required to wear proper PPEs • All works must be supervised by trained and competent engineers and workers • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Workers Safety)
Operation of the Pumps	Generation of noise	• Regular maintenance and monitoring of equipment	MMDA Contractor	Part of maintenance cost	Refer to: ECOP (Noise and Vibration)
	Generation of solid wastes	• Implementation of Solid Waste Management Plan (SWMP) • Segregation of solid waste according to recyclables and non-recyclables • Repair or re-use of available construction materials and equipment • Hauling of discarded/recyclable items by licensed haulers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Solid Waste)
	Generation of wastewater from workers	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e., portable comfort rooms)	MMDA Contractor	Part of construction costs	Refer to: ECOP (Water Pollution)
	Occupational hazards	• All personnel are required to wear proper PPEs • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of maintenance cost	Refer to: ECOP (Workers Safety)
Social Impacts	Involuntary Resettlement	• Implementation of Resettlement Action Plan (RAP)	MMDA Contractor	To be determined	
	Traffic and access restriction	• Avoid deliveries during rush hour • Strategic routing to avoid sensitive	MMDA Contractor	To be determined	Refer to ECOP (Traffic Management)

Environmental and Social Management Plan for Vitas Pumping Station					
Activity and Environmental Aspects	**Environmental and Social Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		areas such as schools and hospitals			
	Community hazards	• Coordination with barangays	MMDA Contractor	To be determined	Refer to ECOP (Communication with local communities)

Key Impacts Specific to Balut Pumping Station

- The Balut Pumping Station is located in Buendia St. corner Nepa St. in Barangay 137, The 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 is readily deposited , solid waste entrapment and accumulation at the Balut pumping station is not a major concern.

- A potential impact of the Balut pumping station is the noise and dust from construction activities as well as the odor emanating from the cleaning of the retention pond at the site. Affected communities include the residential houses infront of the site along Buendia St. and the Paez Integrated School on the northwest.

Table C2: Environmental and Social Management Plan for Balut Pumping Station

Environmental and Social Management Plan for Balut Pumping Station					
Activity and Environmental Aspects	**Environmental and Social Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
Rehabilitation and Upgrading of Balut Pumping Station	Generation of construction wastes	• Implementation of Solid Waste Management Plan (SWMP) • Segregation of solid waste according to recyclables and non-recyclables • Repair or re-use of available construction materials and equipment • Hauling of discarded/recyclable items by licensed haulers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Solid Waste)
	Generation of waste oil from equipment dismantling	• Segregation of hazardous wastes from regular wastes • Storage of hazardous items in sealed, sturdy, and properly marked containers • Hauling of hazardous items by accredited haulers/treaters	MMDA Contractor	Part of construction costs	Refer to: ECOP (Hazardous Waste)
	Generation of dust	• Regular watering of construction sites that have high dust concentration • Avoid long exposure of excavated	MMDA Contractor	Part of construction costs	Refer to: ECOP (Dust Generation)

Environmental and Social Management Plan for Balut Pumping Station					
Activity and Environmental Aspects	**Environmental and Social Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		soil and sand piles to strong winds by applying canvass covers • Regular clean-up and housekeeping of construction areas			
	Generation of noise	• If piling is necessary, perform monitoring for nearby concrete structures that may be affected • Notify nearby residents about the activities of using heavy equipment	MMDA Contractor	Part of construction costs	Refer to: ECOP (Noise and Vibration)
	Generation of wastewater from workers	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e., portable comfort rooms)	MMDA Contractor	Part of construction costs	Refer to: ECOP (Water Pollution)
	Occupational hazards	• All personnel are required to wear proper PPEs • All works must be supervised by trained and competent engineers and workers • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Workers Safety)
Dredging activities within pump station basin	Re-suspension of sediments	• Provision of designated disposal sites	MMDA Contractor	To be determined	Refer to: ECOP (Dredged Materials)
	Generation and disposal of dredged materials	• Provision of designated disposal sites	MMDA Contractor	To be determined	Refer to: ECOP (Dredged Materials)
	Odor	• Immediate transportation of dredged materials to disposal sites • Coordination with barangays	MMDA Contractor	To be determined	Refer to ECOP (Dredged Materials)
	Occupational hazards	• All personnel are required to wear proper PPEs • All works must be supervised by trained and competent engineers and workers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Workers Safety)

Environmental and Social Management Plan for Balut Pumping Station					
Activity and Environmental Aspects	**Environmental and Social Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		• First aid stations, safety equipment and signage shall be made available on working areas			
Operation of the Pumps	Generation of noise	• Regular maintenance and monitoring of equipment	MMDA Contractor	Part of maintenance cost	Refer to: ECOP (Noise and Vibration)
	Generation of solid wastes	• Implementation of Solid Waste Management Plan (SWMP) • Segregation of solid waste according to recyclables and non-recyclables • Repair or re-use of available construction materials and equipment • Hauling of discarded/recyclable items by licensed haulers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Solid Waste)
	Generation of wastewater from workers	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e., portable comfort rooms)	MMDA Contractor	Part of construction costs	Refer to: ECOP (Water Pollution)
	Occupational hazards	• All personnel are required to wear proper PPEs • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of maintenance cost	Refer to: ECOP (Workers Safety)
Social Impacts	Involuntary Resettlement	• Implementation of Resettlement Action Plan (RAP)	MMDA Contractor	To be determined	
	Traffic and access restriction	• Avoid deliveries during rush hour • Strategic routing to avoid sensitive areas such as schools and hospitals	MMDA Contractor	To be determined	Refer to ECOP (Traffic Management)
	Community hazards	• Coordination with barangays	MMDA Contractor	To be determined	Refer to ECOP (Communication with local communities)

Key Impacts Specific to Paco Pumping Station

- Paco 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.

Table C3: Environmental and Social Management Plan for Paco Pumping Station

Environmental and Social Management Plan for Paco Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
Rehabilitation and Upgrading of Paco Pumping Station	Generation of construction wastes	• Implementation of Solid Waste Management Plan (SWMP) • Segregation of solid waste according to recyclables and non-recyclables • Repair or re-use of available construction materials and equipment • Hauling of discarded/recyclable items by licensed haulers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Solid Waste)
	Generation of waste oil from equipment dismantling	• Segregation of hazardous wastes from regular wastes • Storage of hazardous items on sealed, sturdy, and properly marked containers • Hauling of hazardous items by accredited haulers/treaters	MMDA Contractor	Part of construction costs	Refer to: ECOP (Hazardous Waste)
	Generation of dust	• Regular watering of construction sites that have high dust concentration • Avoid long exposure of excavated soil and sand piles to strong winds by applying canvass covers • Regular clean-up and housekeeping of construction areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Dust Generation)
	Generation of noise	• If piling is necessary, perform monitoring for nearby concrete structures that may be affected	MMDA Contractor	Part of construction costs	Refer to: ECOP (Noise and Vibration)

Environmental and Social Management Plan for Paco Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		• Notify nearby residents about the activities of using heavy equipment • For hauling trucks, comply with road weight limit standards to avoid ground vibration			
	Generation of wastewater from workers	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e., portable comfort rooms)	MMDA Contractor	Part of construction costs	Refer to: ECOP (Water Pollution)
	Occupational hazards	• All personnel are required to wear proper PPEs • All works must be supervised by trained and competent engineers and workers • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Workers Safety)
Dredging activities along Estero de Paco	Re-suspension of sediments	• Provision of designated disposal sites	MMDA Contractor	To be determined	Refer to: ECOP (Dredged Materials)
	Generation and disposal of dredged materials	• Provision of designated disposal sites	MMDA Contractor	To be determined	Refer to: ECOP (Dredged Materials)
	Removal of water hyacinth	• Provision of designated disposal sites • Hauling of removed water hyacinth by licensed haulers • Coordinate with NGOs or charitable organizations that may be interested in using water hyacinth as part of their livelihood programs	MMDA Contractor	To be determined	Refer to ECOP (Solid Waste)
	Odor	• Immediate transportation of dredged materials to disposal sites • Coordination with barangays	MMDA Contractor	To be determined	Refer to ECOP (Dredged Materials)
	Occupational hazards	• All personnel are required to wear proper PPEs	MMDA Contractor	Part of construction	Refer to: ECOP (Workers Safety)

Environmental and Social Management Plan for Paco Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		• All works must be supervised by trained and competent engineers and workers • First aid stations, safety equipment and signage shall be made available on working areas		costs	
Operation of the Pumps	Generation of noise	• Regular maintenance and monitoring of equipment	MMDA Contractor	Part of maintenance cost	Refer to: ECOP (Noise and Vibration)
	Generation of solid wastes	• Implementation of Solid Waste Management Plan (SWMP) • Segregation of solid waste according to recyclables and non-recyclables • Repair or re-use of available construction materials and equipment • Hauling of discarded/recyclable items by licensed haulers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Solid Waste)
	Generation of wastewater from workers	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e., portable comfort rooms)	MMDA Contractor	Part of construction costs	Refer to: ECOP (Water Pollution)
	Occupational hazards	• All personnel are required to wear proper PPEs • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of maintenance cost	Refer to: ECOP (Workers Safety)
Social Impacts	Involuntary Resettlement	• Implementation of Resettlement Action Plan (RAP)	MMDA Contractor	To be determined	
	Traffic and access restriction	• Coordination with land owner regarding use of road on the way to pumping station • Avoid deliveries during rush hour • Strategic routing to avoid sensitive areas such as schools and hospitals	MMDA Contractor	To be determined	Refer to ECOP (Traffic Management)

Environmental and Social Management Plan for Paco Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
	Community hazards	• Coordination with barangays	MMDA Contractor	To be determined	Refer to ECOP (Communication with local communities)

Key Impacts Specific to Tripa de Gallina Pumping Station

GENERATION OF DREDGED MATERIALS AND SOLID WASTES

- The key environmental impacts from the rehabilitation of the Tripa de Gallina pumping station are due to the generation of dredged materials and solid wastes which requires proper transport and management to authorized disposal sites. The pumping station serves a large catchment area whch includes Makati City, Pasay City, Taguig City, and Paranaque City. 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.

IMPACTS OF ODOR, DUST AND NOISE

- 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 that includes the possibility of increased dust and odor and noise nuisance in the residential area across the pumping station site.

Table C4: Environmental and Social Management Plan for Tripa de Gallina Pumping Station

Environmental and Social Management Plan for Tripa de Gallina Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
Rehabilitation and Upgrading of Tripa de Gallina Pumping Station	Generation of construction wastes	• Implementation of Solid Waste Management Plan (SWMP) • Segregation of solid waste according to recyclables and non-recyclables • Repair or re-use of available construction materials and equipment • Hauling of discarded/recyclable items by licensed haulers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Solid Waste)
	Generation of waste oil from equipment dismantling	• Segregation of hazardous wastes from regular wastes • Storage of hazardous items on sealed, sturdy, and properly	MMDA Contractor	Part of construction costs	Refer to: ECOP (Hazardous Waste)

Environmental and Social Management Plan for Tripa de Gallina Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		marked containers • Hauling of hazardous items by accredited haulers/treaters			
	Generation of dust	• Regular watering of construction sites that have high dust concentration • Avoid long exposure of excavated soil and sand piles to strong winds by applying canvass covers • Regular clean-up and housekeeping of construction areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Dust Generation)
	Generation of noise	• If piling is necessary, perform monitoring for nearby concrete structures that may be affected • Notify nearby residents about the activities of using heavy equipment • For hauling trucks, comply with road weight limit standards to avoid ground vibration	MMDA Contractor	Part of construction costs	Refer to: ECOP (Noise and Vibration)
	Generation of wastewater from workers	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e., portable comfort rooms)	MMDA Contractor	Part of construction costs	Refer to: ECOP (Water Pollution)
	Occupational hazards	• All personnel are required to wear proper PPEs • All works must be supervised by trained and competent engineers and workers • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Workers Safety)
Dredging activities along Estero de Tripa de Gallina	Re-suspension of sediments	• Provision of designated disposal sites	MMDA Contractor	To be determined	Refer to: ECOP (Dredged Materials)
	Generation and	• Provision of designated disposal	MMDA	To be	Refer to: ECOP (Dredged

Environmental and Social Management Plan for Tripa de Gallina Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
	disposal of dredged materials	sites	Contractor	determined	Materials)
	Odor	• Immediate transportation of dredged materials to disposal sites • Coordination with barangays	MMDA Contractor	To be determined	Refer to ECOP (Dredged Materials)
	Occupational hazards	• All personnel are required to wear proper PPEs • All works must be supervised by trained and competent engineers and workers • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Workers Safety)
Operation of the Pumps	Generation of noise	• Regular maintenance and monitoring of equipment	MMDA Contractor	Part of maintenance cost	Refer to: ECOP (Noise and Vibration)
	Generation of solid wastes	• Implementation of Solid Waste Management Plan (SWMP) • Segregation of solid waste according to recyclables and non-recyclables • Repair or re-use of available construction materials and equipment • Hauling of discarded/recyclable items by licensed haulers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Solid Waste)
	Generation of wastewater from workers	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e., portable comfort rooms)	MMDA Contractor	Part of construction costs	Refer to: ECOP (Water Pollution)
	Occupational hazards	• All personnel are required to wear proper PPEs • First aid stations, safety equipment and signage shall be made available	MMDA Contractor	Part of maintenance cost	Refer to: ECOP (Workers Safety)

Environmental and Social Management Plan for Tripa de Gallina Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		on working areas			
Social Impacts	Involuntary Resettlement	• Implementation of Resettlement Action Plan (RAP)	MMDA Contractor	To be determined	
	Traffic and access restriction	• Avoid deliveries during rush hour • Strategic routing to avoid sensitive areas such as schools and hospitals	MMDA Contractor	To be determined	Refer to ECOP (Traffic Management)
	Community hazards	• Coordination with barangays	MMDA Contractor	To be determined	Refer to ECOP (Communication with local communities)

Key Impacts Specific to Labasan Pumping Station

PRESENCE OF WATER HYACINTH

- The Labasan pumping station is located in the Laguna lakeshore area 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 attentuation pond of the Labasan pumping station, is characterized with a proliferation of water hyacinth. which clogs the waterways and affects the efficient operation of the Labasan pumping station.

- The mechanical removal of the water hyacinth will form part of the waterway clearing and dredging activities at the Labasan pumping station. This will require proper disposal of the water hyacinth.

In terms of socio-economic impacts of water hyacinth, there are lakeshore communities that gather the water hyacinth stems for small-scale cottage industry for baskets and matting and papermaking projects. Even with the clearing or removal of water hyacinth at the Labasan attenuation pond, this small-scale industry will not be severely affected because of the presence of water hyacinth in other Laguna lakeshore areas.

Table C5: Environmental and Social Management Plan for Labasan Pumping Station

Environmental and Social Management Plan for Labasan Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
Rehabilitation and Upgrading of Labasan Pumping Station	Generation of construction wastes	• Implementation of Solid Waste Management Plan (SWMP) • Segregation of solid waste according to recyclables and non-recyclables • Repair or re-use of available construction materials and equipment • Hauling of discarded/recyclable items by licensed haulers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Solid Waste)
	Generation of waste oil from equipment dismantling	• Segregation of hazardous wastes from regular wastes • Storage of hazardous items on sealed, sturdy, and properly marked containers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Hazardous Waste)

Environmental and Social Management Plan for Labasan Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		• Hauling of hazardous items by accredited haulers/treaters			
	Generation of dust	• Regular watering of construction sites that have high dust concentration • Avoid long exposure of excavated soil and sand piles to strong winds by applying canvass covers • Regular clean-up and housekeeping of construction areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Dust Generation)
	Generation of noise	• If piling is necessary, perform monitoring for nearby concrete structures that may be affected • Notify nearby residents about the activities of using heavy equipment • For hauling trucks, comply with road weight limit standards to avoid ground vibration	MMDA Contractor	Part of construction costs	Refer to: ECOP (Noise and Vibration)
	Generation of wastewater from workers	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e., portable comfort rooms)	MMDA Contractor	Part of construction costs	Refer to: ECOP (Water Pollution)
	Occupational hazards	• All personnel are required to wear proper PPEs • All works must be supervised by trained and competent engineers and workers • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Workers Safety)
Dredging activities within Labasan Pumping Station basin	Re-suspension of sediments	• Provision of designated disposal sites	MMDA Contractor	To be determined	Refer to: ECOP (Dredged Materials)
	Generation and disposal of dredged materials	• Provision of designated disposal sites	MMDA Contractor	To be determined	Refer to: ECOP (Dredged Materials)
	Removal of water hyacinth	• Provision of designated disposal sites • Hauling of removed water hyacinth by	MMDA Contractor	To be determined	Refer to ECOP (Solid Waste)

Environmental and Social Management Plan for Labasan Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
		licensed haulers • Coordinate with NGOs or charitable organizations that may be interested in using water hyacinth as part of their livelihood programs			
	Odor	• Immediate transportation of dredged materials to disposal sites • Coordination with barangays	MMDA Contractor	To be determined	Refer to ECOP (Dredged Materials)
	Occupational hazards	• All personnel are required to wear proper PPEs • All works must be supervised by trained and competent engineers and workers • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of construction costs	Refer to: ECOP (Workers Safety)
Operation of the Pumps	Generation of noise	• Regular maintenance and monitoring of the infrastructures	MMDA Contractor	Part of maintenance cost	Refer to: ECOP (Noise and Vibration)
	Generation of solid wastes	• Implementation of Solid Waste Management Plan (SWMP) • Segregation of solid waste according to recyclables and non-recyclables • Repair or re-use of available construction materials and equipment • Hauling of discarded/recyclable items by licensed haulers	MMDA Contractor	Part of construction costs	Refer to: ECOP (Solid Waste)
	Generation of wastewater from workers	• Follow basic housekeeping policies • Provision of sanitation facilities (i.e., portable comfort rooms)	MMDA Contractor	Part of construction costs	Refer to: ECOP (Water Pollution)
	Occupational hazards	• All personnel are required to wear proper PPEs • First aid stations, safety equipment and signage shall be made available on working areas	MMDA Contractor	Part of maintenance cost	Refer to: ECOP (Workers Safety)

Environmental and Social Management Plan for Labasan Pumping Station					
Activity and Environmental Aspects	**Environmental Impacts**	**Mitigation and Enhancement Measures**	**Responsibility**	**Cost**	**Instruments/ Reference**
Social Impacts	Involuntary Resettlement	• Implementation of Resettlement Action Plan (RAP)	MMDA Contractor	To be determined	
	Traffic and access restriction	• Avoid deliveries during rush hour • Strategic routing to avoid sensitive areas such as schools and hospitals	MMDA Contractor	To be determined	Refer to ECOP (Traffic Management)
	Community hazards	• Coordination with barangays	MMDA Contractor	To be determined	Refer to ECOP (Communication with local communities)

ANNEX D: Environmental Codes of Practice (ECOPs) for the Rehabilitation of the Pumping Stations

Project:

Metro Manila Flood Management Project – Phase 1

Annex D: Environmental Codes of Practice in the Rehabilitation of Pumping Stations

1.1 Intent of ECOPs

These Environmental Codes of Practice (ECOPs) have been prepared to define methods and/or procedures to be followed by consultants, designers and contractors for the avoidance or mitigation of adverse environmental and social impacts that may arise out of the rehabilitation and modernization of pumping stations under the MMFMP1. The definitions of terms used in the ECOP are set out below.

1.2 Definition of Terms

MMDA	Metropolitan Manila Development Authority. The entity that engages the principal consultant to design and/or supervise the rehabilitation/modernization of pumping stations in Metro Manila
Project	Shall include development, new construction, upgrading, and rehabilitation. reconstruction and maintenance of pumping stations.
Consultant	The firm or design team engaged by the MMDA to undertake the investigation, the design or the construction supervision of the project.
Designer	The person, group or groups that undertake the various phases of project preparation and/or construction supervision.
Engineer	A licensed member of the Philippine Regulatory Commission
Contractor	The firm engaged by the MMDA to construct the project or direct the labor team if construction is to be carried out directly by the client.
DENR	Department of Environment and Natural Resources
DPWH	Department of Public Works and Highways
EIA	Means the comprehensive study or detailed environmental impact assessment.
EMB	Environmental Management Bureau

1.3 Objectives of the ECOPS

The objective of these ECOPs are to cover the typical impacts associate with the rehabilitation and modernization of pumping stations in the context of Metro Manila. It will ensure that all people involved in development project planning, design, construction and maintenance are aware of the need for the ECOP, and implement the systems for the prevention or mitigation of adverse environmental and social effects of activities related to rehabilitation of pumping stations. The ECOP shall be followed for the planning, design and construction of all pumping station rehabilitation works. The ECOP will establish guidelines for managing and minimizing potential environmental (including social) impacts of rehabilitation and modernization of pumping stations, by outlining principles and minimum standards which shall be taken into account in the planning, design, and construction phases.

1.4 Implementation

These ECOPs have been introduced in the MMFMP1 Project to simplify the implementation of safeguards in the rehabilitation of pumping stations.

There are three implementation mechanisms for the ECOP:

1) Use of the ECOP is specified in the Bidding documents through the Terms of Reference for the design of works. The relevant design directives stated in the ECOP should also be incorporated in the Terms of Reference;
2) Use of the ECOP is specified in the specifications for the construction of physical works. The relevant suggested specifications stated in the ECOP should also be incorporated in the specifications.
3) Approvals by the MMDA and World Bank are granted with the condition that works proceed under the provisions of the ECOP

1.5 Monitoring

MMDA personnel and the PMO of the project will monitor the implementation of the ECOP through regular supervision of works. The ECOP will also be monitored through normal contract administration procedures.

1.6 Main Environmental and Social Issues typical of Pumping Station Rehabilitation and Modernization

- Dredge material generation
- Solid Waste
- Dust generation
- Air pollution
- Impacts from noise and vibration
- Water pollution
- Drainage and sedimentation
- Management of stockpiles
- Chemical and hazardous wastes
- Traffic management
- Interruption of utility services
- Restoration of affected areas
- Worker and public safety
- Communication with local communities
- Chance finds

1.7 Codes of Practice

Table D: Environmental Codes of Practice (ECOP)

Environmental Codes of Practice (ECOP)		
ENVIRONMENTAL & SOCIAL ISSUES	**SPECIFIC MITIGATION MEASURE**	**COMMENTS**
1. Dust generation	• The Contractor is responsible for compliance with relevant Philippine legislation with respect to ambient air quality. • The Contractor shall ensure that the generation of dust is minimized and is not perceived as a nuisance by local residents and shall implement a dust control program to maintain a safe working environment and minimize disturbances for surrounding residential areas/dwellings. • The Contractor shall implement dust suppression measures (e.g. use water spraying vehicles) as required and appropriate. • Material loads shall be suitably covered and secured during transportation to prevent the scattering of soil, sand, materials, or dust. • Exposed soil and material stockpiles shall be protected against wind erosion and the location of stockpiles shall take into consideration the prevailing wind directions and locations of sensitive receptors.	May occur when structures are demolished.
2. Air pollution	• All vehicles must comply with Philippine regulations controlling allowable emission limits of exhaust gases. • Vehicles in the Philippines must undergo a regular emissions check. • There should be no burning of waste or materials on site. • Generators must have an air permit from the DENR	May occur when structures are demolished.
3. Impacts from noise and vibration	• The contractor is responsible for compliance with the relevant Philippine legislation with respect to noise and vibration. • When needed, measures to reduce noise to acceptable levels must be implemented and could include silencers, mufflers, acoustically dampened panels or placement of noisy machines in acoustically protected areas.	
4. Water pollution	• The Contractor must be responsible for compliance with the relevant Philippine legislation relevant to wastewater discharges into watercourses. • Portable or constructed toilets must be provided on site for construction workers.	Applies specifically to temporary workers quarters.

Environmental Codes of Practice (ECOP)		
ENVIRONMENTAL & SOCIAL ISSUES	**SPECIFIC MITIGATION MEASURE**	**COMMENTS**
	Wastewater from toilets as well as kitchens, showers, sinks, etc. shall be discharged into a tank for removal from the site or discharged into municipal sewerage systems; there should be no direct discharges to any waterbody. • Wastewater over permissable values set by relevant Philippine effluent standards/regulations (DAO 35) must be collected in a tank and removed from site by licensed waste transporter and collector. • At completion of construction works, water collection tanks and septic tanks shall be covered and effectively sealed off.	
5. Solid waste	• Before construction, a solid waste control procedure (storage, provision of bins, site clean-up schedule, bin clean-out schedule, etc.) must be prepared by Contractors and it must be carefully followed during construction activities. • Before construction, all necessary waste disposal permits or licenses must be obtained. Arrangements with a solid waste transporter should be obtained. • Measures shall be taken to reduce the potential for litter and negligent behavior with regard to the disposal of all refuse. At all places of work, the Contractor shall provide litter bins, containers and refuse collection facilities. • Solid waste may be temporarily stored on site in a designated area approved by the Construction Supervision Consultant and relevant local authorities prior to collection and disposal through a licensed waste collector. • Waste storage containers shall be covered, tip-proof, weatherproof and scavenger proof. • No burning, on-site burying or dumping of solid waste shall occur. • Recyclable materials such as wooden plates for trench works, steel, scaffolding material, site holding, packaging material, etc shall be collected and separated on-site from other waste sources for reuse, for use as fill, or for sale. • If not removed off site, solid waste or construction debris shall be disposed of only at sites identified and approved by the Construction Supervision Consultant and included in the solid waste plan. Under no circumstances shall the contractor dispose of any material in watercourses.	

Environmental Codes of Practice (ECOP)		
ENVIRONMENTAL & SOCIAL ISSUES	**SPECIFIC MITIGATION MEASURE**	**COMMENTS**
6. Chemical or hazardous wastes	• Chemical waste of any kind shall be disposed of at an approved appropriate landfill site and in accordance with local legislative requirements. The Contractor shall obtain needed disposal certificates. • The removal of asbestos-containing materials or other toxic substances shall be performed and disposed of by specially trained and certified workers. • Used oil and grease shall be removed from site and sold to an approved used oil recycling company. • Used oil, lubricants, cleaning materials, etc. from the maintenance of vehicles and machinery shall be collected in holding tanks and removed from site by a specialized oil recycling company for disposal at an approved hazardous waste site. • Used oil or oil-contaminated materials that could potentially contain PCBs shall be securely stored to avoid any leakage or affecting workers. The Chemicals Section of the Environmental Management Bureau of the DENR, must be contacted for further guidance. • Relevant agencies shall be promptly informed of any accidental spill or incident. • Store chemicals appropriately and with appropriate labeling • Appropriate communication and training programs should be put in place to prepare workers to recognize and respond to workplace chemical hazards Prepare and initiate a remedial action following any spill or incident. In this case, the contractor shall provide a report explaining the reasons for the spill or incident, remedial action taken, consequences/damage from the spill, and proposed corrective actions.	The decommissioning of equipment/machines may generate toxic / hazardous compounds such as lubricants/ petroleum products, etc.
7. Management of dredge material / sludge	• Dredging plan should be established including time schedule, method statement to meet the requirements of traffic safety, public health and environmental sanitation. In order to ensure dredging that is consistent with environmental regulations, key decision makers (local authority, DPWH, DENR, LGU, etc.) must be involved and concur in each key decision point in the process leading to preparation and implementation of a plan. • Characteristics of sludge/sediment should be determined by sampling and	As per Schedule 3 of RA 6969, the standard test for toxicity is the Toxicity Characteristic Leaching Potential (TCLP).

Environmental Codes of Practice (ECOP)		
ENVIRONMENTAL & SOCIAL ISSUES	**SPECIFIC MITIGATION MEASURE**	**COMMENTS**
	analysis. Sludge that is heavily contaminated would require measures that go beyond the scope of these ECOPs. • Ensure that dredged material management plans incorporate environmental considerations in the identification of short-term and long-term disposal alternatives, consider methods to reduce dredging, and maximize the beneficial use of dredged materials. • Dredging work should be conducted when water flow is high to allow the dredged materials can be separated into the sediment and the supernatant water (i.e., spoil) by settling. • Leachate from dredged materials should not be allowed to enter watercourses without appropriate filtering or treatment. • Collected dredged materials have to be processed, as per Philippine regulations on waste collection, to ensure safe and environmentally secure transportation, storage, treatment and management • Those involved in handling of sludge should be specialized and have previous experience in sludge handling. Guidelines for certification of sludge handling is in DENR's regulations (RA 6969) on management of hazardous substances • Sanitary landfills site should meet technical requirements, based on level of potential contamination.	
8. Traffic management	• Before construction, carry out consultations with local government and community and with traffic police. • Significant increases in number of vehicle trips must be covered in a construction plan previously approved. Routing, especially of heavy vehicles, needs to take into account sensitive sites such as schools, hospitals, and markets. • Installation of lighting at night must be done if this is necessary to ensure safe traffic circulation. • Place signs around the construction areas to facilitate traffic movement, provide directions to various components of the works, and provide safety advice and warning.	This is applicable to this project when transporting the heavy machinery to replace the existing pump motors.

Environmental Codes of Practice (ECOP)		
ENVIRONMENTAL & SOCIAL ISSUES	**SPECIFIC MITIGATION MEASURE**	**COMMENTS**
	• Employing safe traffic control measures, including road/rivers/canal signs and flag persons to warn of dangerous conditions. • Avoid material transportation for construction during rush hour. • Passageways for pedestrians and vehicles within and outside construction areas should be segregated and provide for easy, safe, and appropriate access. Signpost shall be installed appropriately in both water-ways and roads where necessary.	
9. Restoration of affected areas	• Cleared areas such as disposal areas, site facilities, workers' camps, stockpiles areas, working platforms and any areas temporarily occupied during construction of the project works shall be restored using landscaping, adequate drainage and revegetation. • Start revegetation at the earliest opportunity. Appropriate local native species of vegetation shall be selected for the planting and restoration of the natural landforms. • Spoil heaps and excavated slopes shall be re-profiled to stable batters, and grassed to prevent erosion; • All affected areas shall be landscaped and any necessary remedial works shall be undertaken without delay, including green-spacing, roads, bridges and other existing works • Trees shall be planted at exposed land and on slopes to prevent or reduce land collapse and keep stability of slopes • Soil contaminated with chemicals or hazardous substances shall be removed and transported and buried in waste disposal areas. • Restore all damaged road and bridges caused by project activities	

Environmental Codes of Practice (ECOP)		
ENVIRONMENTAL & SOCIAL ISSUES	**SPECIFIC MITIGATION MEASURE**	**COMMENTS**
10. Worker and public Safety	• Contractor shall comply with all Philippine regulations and World Bank EHS guidelines regarding worker safety. • Prepare and implement action plan to cope with risk and emergency • Preparation of emergency aid service at construction site • Training workers on occupational safety regulations • Ensure that ear pieces are provided to and used by workers who must use noisy machines, for noise control and workers protection. • During demolition of existing infrastructure, workers and the general public must be protected from falling debris by measures such as chutes, traffic control, and use of restricted access zones. • Install fences, barriers, dangerous warning/prohibition site around the construction area which showing potential danger to public people • The contractor shall provide safety measures as installation of fences, barriers warning signs, lighting system against traffic accidents as well as other risk to people and sensitive areas. • If previous assessments indicate there could be unexploded ordnance (UXO), clearance must be done by qualified personnel and as per detailed plans approved by the Construction Engineer.	Unexploded ordinances have been unearthed in some areas of Manila dating back to WW2 when Manila was carpet-bombed.
11. Communication with local communities	• Maintain open communications with the local government and concerned communities; the contractor shall coordinate with local authorities (leaders of baranggays or puroks) for agreed schedules of construction activities at areas nearby sensitive places or at sensitive times (e.g., religious festival days). • Copies of these ECOPs and of other relevant environmental safeguard documents shall be made available to local communities and to workers at the site. • Disseminate project information to affected parties (for example local authority, enterprises and affected households, etc) through community meetings before construction commencement; • Provide a community relations contact from whom interested parties can receive information on site activities, project status and project implementation results; • Provide all information, especially technical findings, in a language that is	

Environmental Codes of Practice (ECOP)		
ENVIRONMENTAL & SOCIAL ISSUES	**SPECIFIC MITIGATION MEASURE**	**COMMENTS**
	understandable to the general public and in a form of useful to interested citizens and elected officials through the preparation of fact sheets and news release, when major findings become available during project phase; • Monitor community concerns and information requirements as the project progresses; • Respond to telephone inquiries and written correspondence in a timely and accurate manner; • Inform local residents about construction and work schedules, interruption of services, traffic detour routes and provisional bus routes, blasting and demolition, as appropriate; • Notification boards shall be erected at all construction sites providing information about the project, as well as contact information about the site managers, environmental staff, health and safety staff, telephone numbers and other contact information so that any affected people can have the channel to voice their concerns and suggestions.	
12. Chance find procedures	If the Contractor discovers archeological sites, historical sites, remains and objects, including graveyards and/or individual graves during excavation or construction, the Contractor shall: • Stop the construction activities in the area of the chance find; • Delineate the discovered site or area; • Secure the site to prevent any damage or loss of removable objects. In cases of removable antiquities or sensitive remains, a night guard shall be arranged until the responsible local authorities or the National Museum takes over; • Notify the Construction Supervision Consultant who in turn will notify responsible local or national authorities in charge of the Cultural Property (within 24 hours or less); • Relevant local or national authorities would be in charge of protecting and preserving the site before deciding on subsequent appropriate procedures. This	The National Museum is in charge of chance finds in the Philippines.

Environmental Codes of Practice (ECOP)		
ENVIRONMENTAL & SOCIAL ISSUES	**SPECIFIC MITIGATION MEASURE**	**COMMENTS**
	would require a preliminary evaluation of the findings to be performed. The significance and importance of the findings should be assessed according to the various criteria relevant to cultural heritage; those include the aesthetic, historic, scientific or research, social and economic values; • Decisions on how to handle the finding shall be taken by the responsible authorities. This could include changes in the layout (such as when finding an irremovable remain of cultural or archeological importance) conservation, preservation, restoration and salvage; • If the cultural sites and/or relics are of high value and site preservation is recommended by the professionals and required by the cultural relics authority, the Project's Owner will need to make necessary design changes to accommodate the request and preserve the site; • Decisions concerning the management of the finding shall be communicated in writing to relevant authorities; • Construction works could resume only after permission is granted from the responsible local authorities concerning safeguard of the heritage.	

ANNEX E: Environmental Due Diligence for the Disposal Sites of Solid & Hazardous Wastes

Project:

Metro Manila Flood Management Project – Phase 1

Annex E: Environmental Due Diligence of Waste Disposal Sites

Navotas Sanitary Landfill

Tanza, Navotas
Resource Person: Operation Manager (Phil Eco)

I. Operation

1. The Navotas Sanitary Landfill is owned and operated by Phil Ecology Systems Corporation (Phil Eco) and serves the City of Manila, along with other cities such as Navotas and Malabon. The sanitary landfill has been operational since 2006. **Figure 1** shows the map of the Navotas Sanitary Landfill.

2. Located in Bgy. Tanza, the area dedicated for the landfill is about 39.67 ha. Phase I, Phase II, and Phase II of the landfill are 11.3, 13.67, and 15.0 hectares, respectively. Phases I and II (11 cells) have already been used, while Phase III, composed of 9 cells, is currently in commission. Although Phases I and II have already been filled, it still has not reached its full vertical capacity of 25m. In fact, the operators only fills up to 10m to give the waste time to settle naturally. Depending on the availability of other sanitary landfills, it is estimated that it will take more or less 15 years to fill the Navotas landfill.

3. Since the area is surrounded by the Manila Bay in the west and by fishponds in the north, east, and south, waste is transported to the landfill via barge that travels from Estero de Vitas in Manila to the sanitary landfill. About five barges deliver to the landfill every day, with one out of the five barges containing soil cover. Solid waste delivered to the landfill amounts to about 8,000 cu.m. every day.

4. With regard to facilities on site, the Navotas Sanitary Landfill has a leachate treatment facility and a gas collection system. The leachate treatment facility consists of two ponds – one for untreated leachate and another for treated leachate. A lining, such as those used for the sanitary landfill, was installed within the pond to contain the leachate. Leachate goes through a series of treatment processes (pond system). Once processed, the treated leachate is released in another pond for it to evaporate. The site also has its own gas collection system. A series of pipes from the landfill leads to a facility serves as the gas collection system. Once collected, flares are set off in the facility to ignite the gas.

5. The company also installed a vermicomposting facility in their collection station along Estero de Vitas. Furthermore, the company is currently installing a materials recovery facility (MRF), also in their facility in Estero de Vitas.

6. Bulldozers, backhoes, and trucks are present on-site. The maintenance of these vehicles are also done on-site. Waste from maintenance activities, such as oil and grease, are transported off the island. Moreover, the motor pool has lining under the cement to ensure that the waste chemicals do not seep through the ground.

7. Whenever hazardous waste is received in Estero de Vitas, Phil Eco sends back this waste to the sender.

Figure 1: Map of Navotas Sanitary Landfill

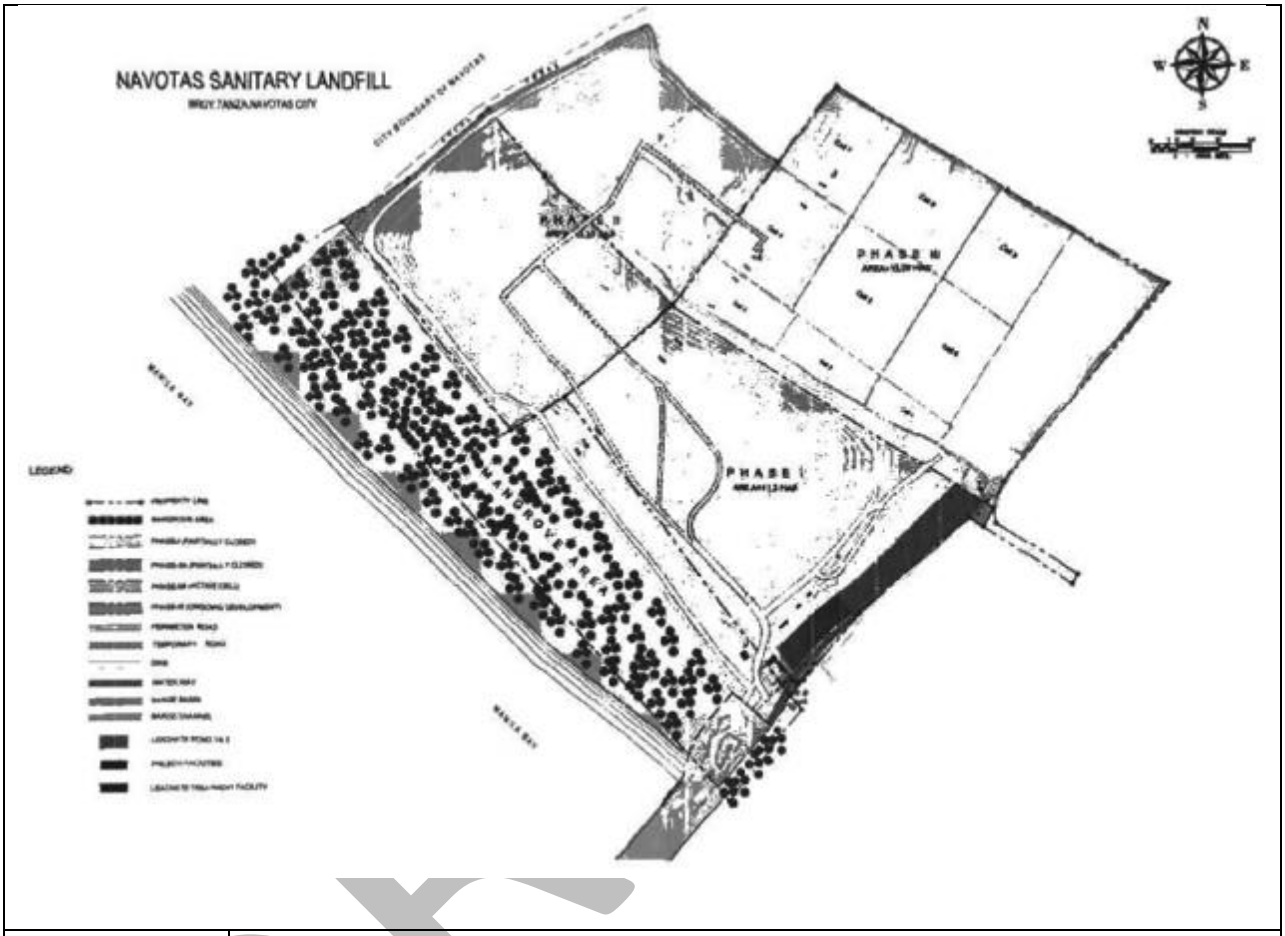


FIGURE NO.	FIGURE TITLE.
1-1	**Site Plan of Navotas Sanitary Landfill**

II. Workers' Safety and Welfare

8. There are about 30 employees under Phil Eco and 40 employees under sub-contractors. It takes three shifts per day to maintain the 24-hour operation of the landfill. Barracks and bathrooms are provided for the workers, who live on site.

9. Safety is a priority for the company, especially since there are people living on-site. Each worker is provided with his own personal protective equipment (PPE). Furthermore, there is a certified safety officer on-site. Workers have also received training on occupational safety. In case of fire, there are fire extinguishers and a fire truck on the island.

10. To avoid untoward incidents, liquor ban on the site is strictly enforced. A designated smoking area was assigned to avoid fires in the landfill.

11. There have not been any reported cases of incidents of fires and explosions on the landfill.

III. Environmental Compliance

12. A multi-partite monitoring team composed of the LGU, MMDA, and fisherfolk, to name a few, visits the site quarterly.

13. Surface water and water from two deep wells on site are monitored quarterly. The water quality parameters monitored are:
    - pH
    - Temperature
    - Biological Oxygen Demand (BOD)
    - Chemical Oxygen Demand (COD)
    - Total Dissolved Solids (TDS), and
    - Total Suspended Solids (TSS).

14. Air quality is monitored twice a year. The parameters monitored to assess air quality are:
    - Total Suspended Particles (TSP)
    - Hydrogen sulfides (H_2S)
    - Carbon dioxide (CO_2), and
    - Total Volatile Organic Compounds (TVOC).

15. Seen in **Figure 2** are the Environmental Compliance Certificates (ECC) for each phase of the landfill.

Figure 2: Environmental Compliance Certificates of the Navotas Sanitary Landfill

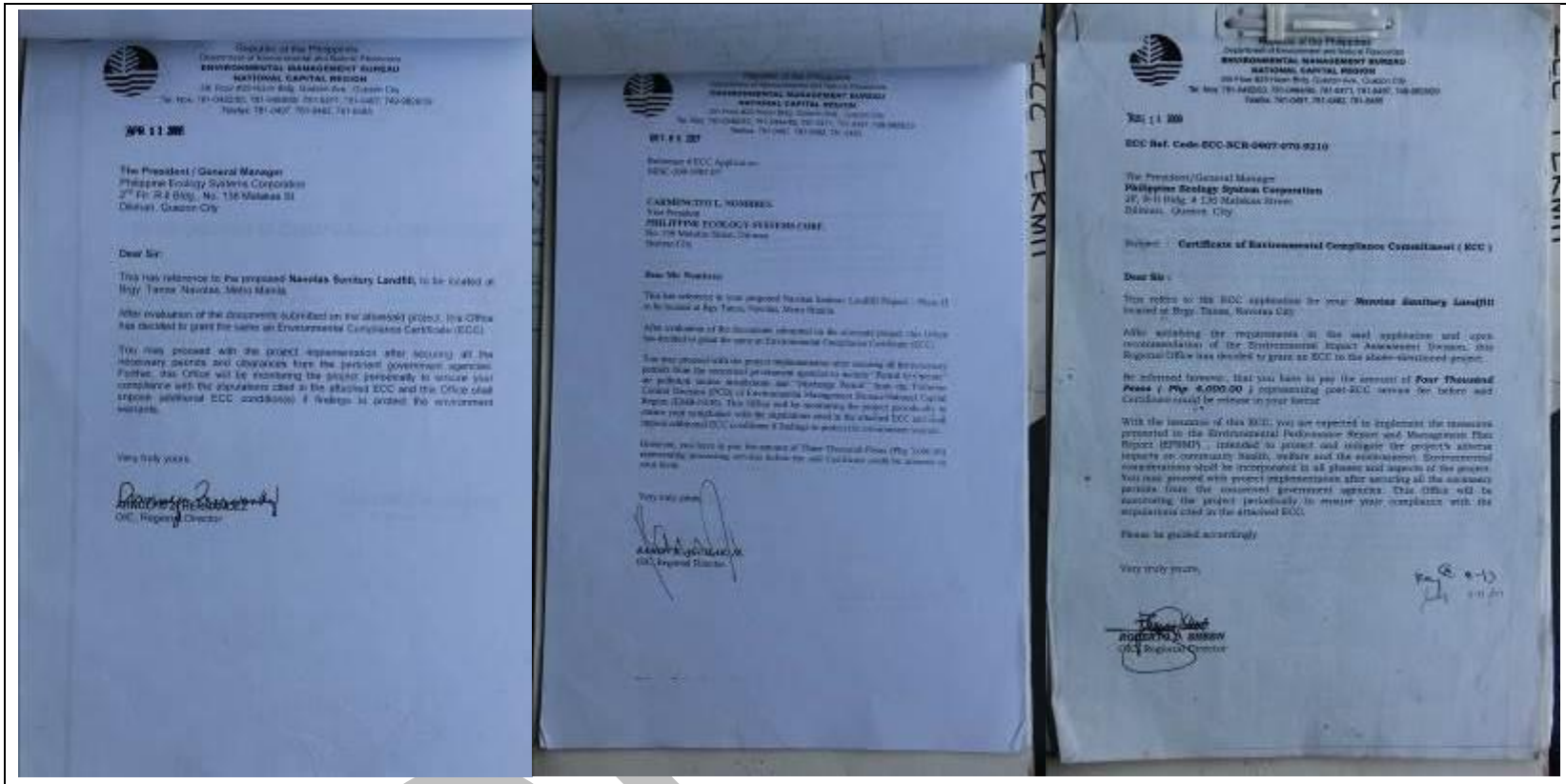


FIGURE NO.	FIGURE TITLE.
1-2	**Environmental Compliance Certificates of the Navotas Sanitary Landfill**

Montalban Solid Waste Disposal Facility

Bgy San Isidro, Rodriguez, Rizal
Resource Person: Head Supervisor (ISWIMS)

I. Operation

1. The facility is owned and operated by International Solid Waste Integrated Management Specialist (ISWIMS), Inc. It was first opened in 2002. The facility serves most of Metro Manila. Among LGUs served are Makati, Mandaluyong, Pasay, Taguig, San Juan, Valenzuela, Muntinlupa, Pateros, Rodriguez, and Quezon City.

2. The landfill is divided into four bases: Base I (14 ha), Base II (10 ha), Base III (9 ha), and Base IV (50 ha). Bases I-III (33 ha) is projected to be filled by the end of 2015. Base IV is currently being developed, and will be in commission by the start of 2016. The facility is designed to hold as high as 100m of solid waste. The total amount of solid waste that Base IV can accommodate is about 50,000,000 cu.m. **Figure 3** shows the map of Montalban Solid Waste Disposal Facility.

3. Since the bases are not used simultaneously, soil cover is never an issue. Soil from the next development is used on the current operational landfill, and so on.

4. About 400-500 dump trucks enter the site every day. The volume of waste dumped in the facility per day is around 15,000-16,000 cu.m., or 4.5 MT. Assuming that Base IV can contain up to 50,000,000 cu.m. of waste, the area may be filled in about eight to nine years.

5. Based outside the property are informal settler families (ISFs). According to the source, there were only a few ISFs when the landfill started operation. The number of ISFs grew because of migration from Payatas dumpsite. As a result, waste pickers are prevalent in the landfill. The management of the landfill allows waste pickers to go to the landfill. In fact, the waste pickers were given shifts; they work in to shifts per day, from 6am to 12pm, then from 12pm to 6pm. Waste pickers are not allowed to be on the dump when there is incoming waste.

6. As was mentioned, ISFs are present outside the landfill. Within the landfill are creeks and several drainage canals; some are runoff canals while others are concrete, riprap, and cross-pipes. These drainage canals allow rainwater to flow out of the landfill.

7. There are facilities in the compound that facilitate further segregation of solid waste and leachate treatment. Plastic and paper, among other combustible materials, are extracted in the Refuse-Derived Fuel (RDF) Processing Plant and converts these wastes into pellets that can be used as fuel. **Figure 4** shows the RDF. The compound also has a Sequencing Batch Reactor (SBR) Facility that treats leachate. The process flows of the SBR and RDF are shown in **Figure 5** and **Figure 6**, respectively. Furthermore, a Materials Recovery Facility (MRF) is currently being installed in the compound.

8. The facility also has an ongoing Memorandum of Agreement (MOA) with the Montalban Methane Power Corporation (MMPC), which is located a few meters from the solid waste disposal facility. The MMPC installed pipes within the landfill that collects methane, which converts the gas into energy in the nearby plant.

9. ISWIMS procured their own heavy vehicles (i.e. backhoes, bulldozers, trucks). The merchants, such as Komatsu and Caterpillar, visit the site to conduct maintenance services on the vehicles. Maintenance is done in the motor pool.

10. With regard to hazardous wastes, the management of the landfill sends back whatever waste they cannot accommodate.

Figure 3: Map of Montalban Solid Waste Disposal Facility

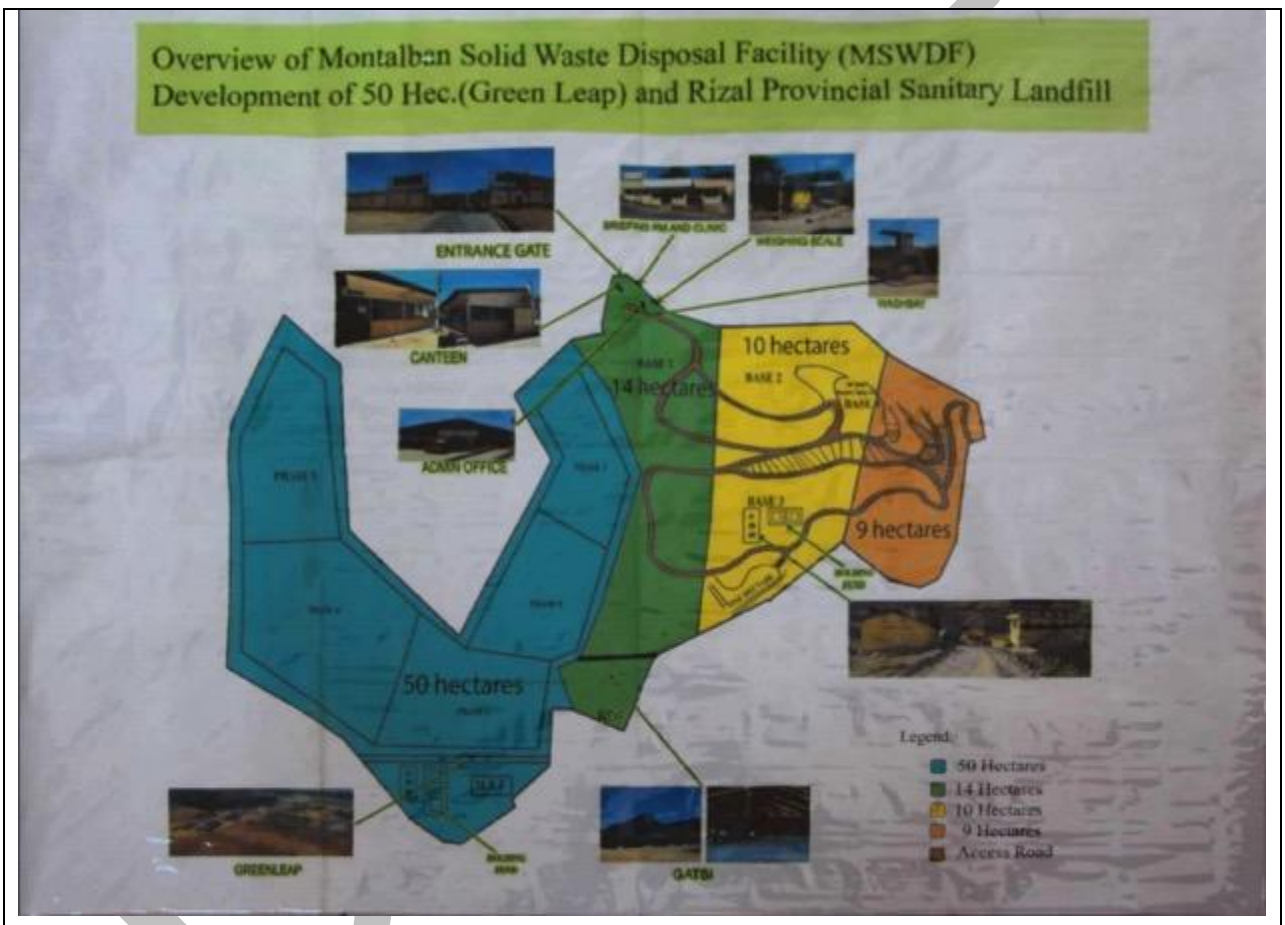


FIGURE NO.	FIGURE TITLE.
3	**Map of Montalban Solid Waste Disposal Facility**

Figure 4: Refuse-Derived Fuel (RDF) Processing Plant

FIGURE NO.	FIGURE TITLE.
4	**Refuse-Derived Fuel (RDF) Processing Plant**

Figure 5: Process Flow Diagram of Sequential Batch Reactor (SBR) Facility

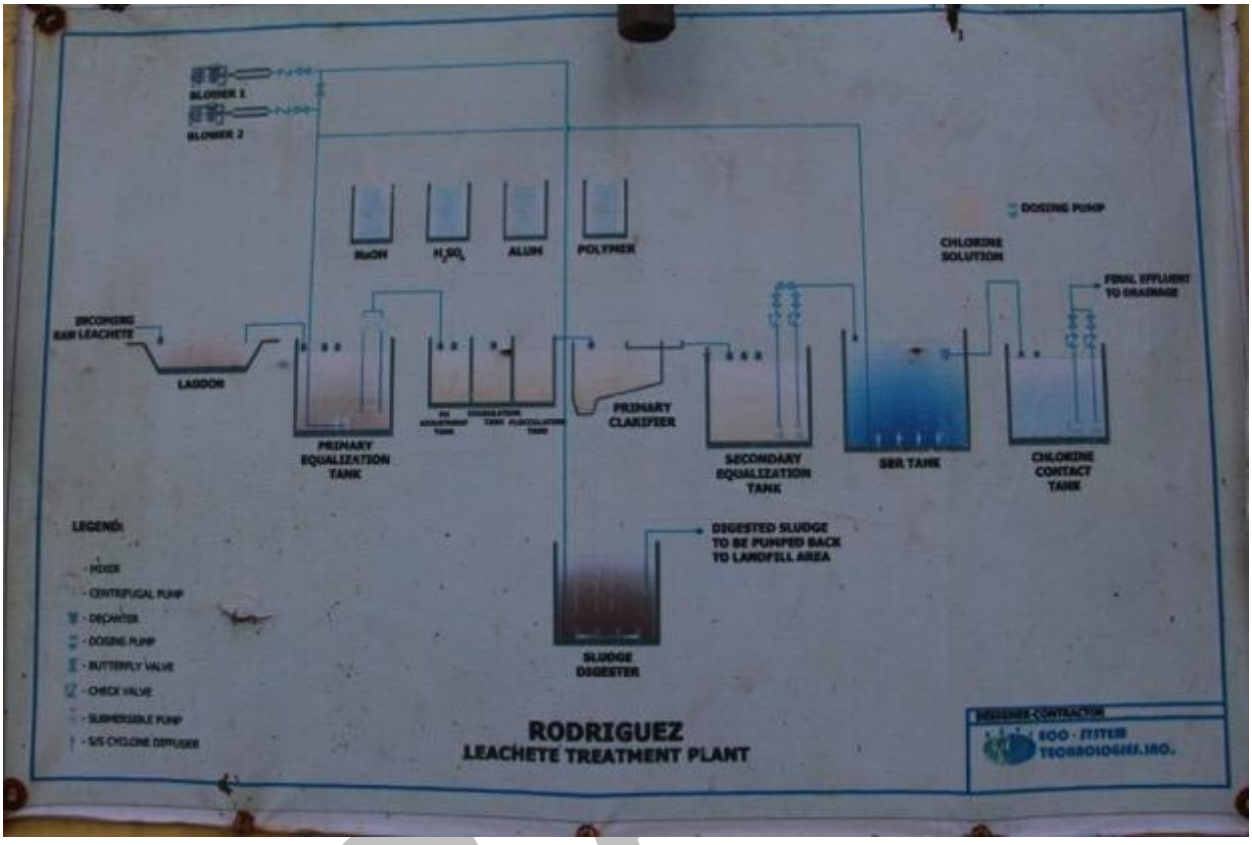


FIGURE NO.	FIGURE TITLE.
5	**Process Flow Diagram of Sequential Batch Reactor (SBR) Facility**

Figure 6: Process Flow Diagram of Refuse-Derived Fuel (RDF) Processing Plant

FIGURE NO.	FIGURE TITLE.
6	**Process Flow Diagram of Refuse-Derived Fuel (RDF) Processing Plant**

II. Workers' Safety and Welfare

11. There are about 240 employees who work in the landfill. Three shifts per day are conducted to complete the 24-hour operation.

12. PPEs, such as masks and boots are provided for workers. Raincoats are also provided whenever needed.

13. In case of fires, fire-fighting equipment such as fire extinguishers, water tanks, and fire trucks are in the vicinity. There have been reported fires in the area, but only because of dry grass that was perhaps ignited.

14. Security personnel are deployed in the area. There are people from the local police and the provincial security division to ensure the safety of workers.

III. Compliance

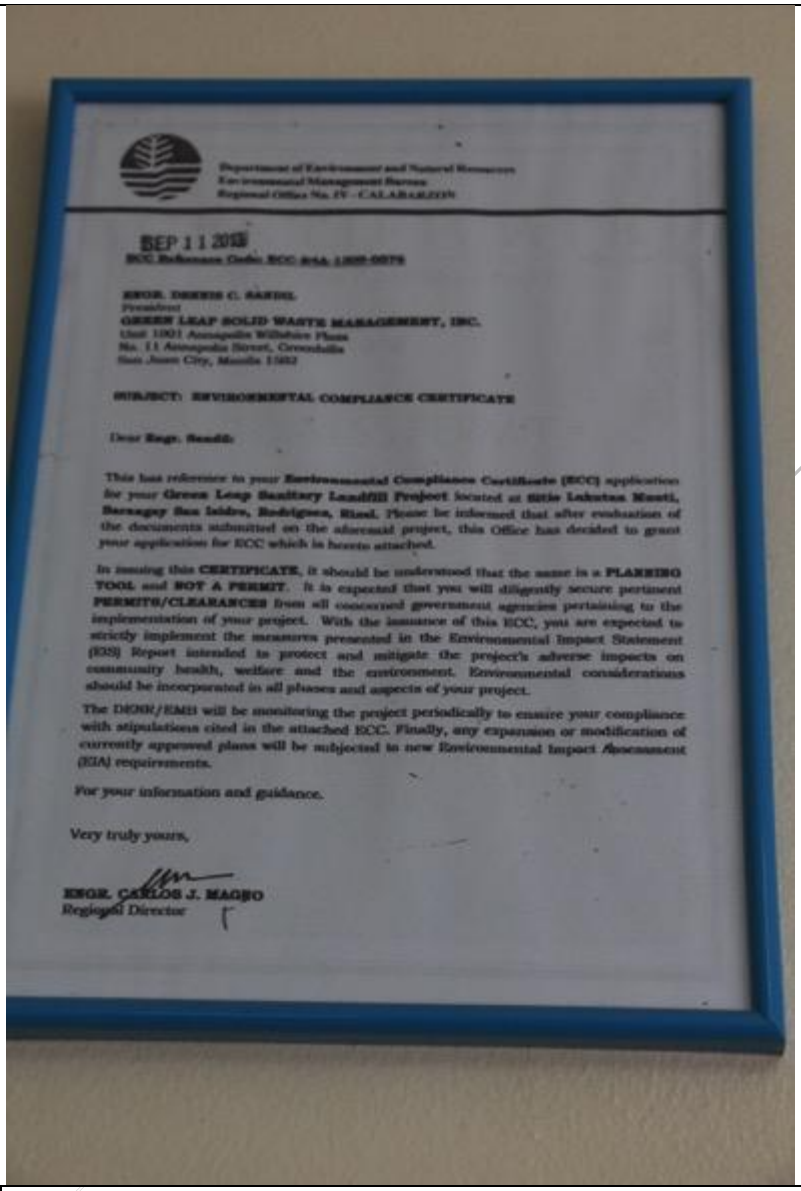
15. According to the source, the company has no problems with compliance. Their ECCs can be seen in **Figure 7**.

16. A multi-partite monitoring team visits the site quarterly.

17. Furthermore, environmental monitoring is conducted. Water and leachate monitoring is conducted quarterly. The parameters monitored are:
    - pH
    - Color
    - Biological Oxygen Demand (BOD)
    - Chemical Oxygen Demand (COD)
    - Oil and grease
    - Cyanide
    - Hexavalent chromium
    - Mercury
    - Lead
    - Arsenic
    - Cadmium

18. Air and noise quality is monitored twice a year. The parameters monitored are:
    - Nitrogen dioxide (NO_2)
    - Sulfur dioxide (SO_2)
    - Particulate Matter (PM_{10})
    - Total Suspended Particles (TSP)
    - Noise

Figure 7: Environmental Compliance Certificates of the Montalban Solid Waste Disposal Facility



Department of Environment and Natural Resources
Environmental Management Bureau
Regional Office No. IV - CALABARZON

SEP 11 2013

ECC Reference Code: ECC-R4A-1309-0079

ENGR. DENNIS C. SANIDL
President
GREEN LEAP SOLID WASTE MANAGEMENT, INC.
Unit 1001 Annapolis Wilshire Plaza
No. 11 Annapolis Street, Greenhills
San Juan City, Manila 1502

SUBJECT: ENVIRONMENTAL COMPLIANCE CERTIFICATE

Dear Engr. Sanidl:

This has reference to your **Environmental Compliance Certificate (ECC)** application for your **Green Leap Sanitary Landfill Project** located at **Sitio Lakatan Manti, Barangay San Isidro, Rodriguez, Rizal.** Please be informed that after evaluation of the documents submitted on the aforesaid project, this Office has decided to grant your application for ECC which is hereto attached.

In issuing this **CERTIFICATE**, it should be understood that the same is a **PLANNING TOOL** and **NOT A PERMIT**. It is expected that you will diligently secure pertinent **PERMITS/CLEARANCES** from all concerned government agencies pertaining to the implementation of your project. With the issuance of this ECC, you are expected to strictly implement the measures presented in the Environmental Impact Statement (EIS) Report intended to protect and mitigate the project's adverse impacts on community health, welfare and the environment. Environmental considerations should be incorporated in all phases and aspects of your project.

The DENR/EMB will be monitoring the project periodically to ensure your compliance with stipulations cited in the attached ECC. Finally, any expansion or modification of currently approved plans will be subjected to new Environmental Impact Assessment (EIA) requirements.

For your information and guidance.

Very truly yours,

ENGR. CARLOS J. MAGBO
Regional Director

FIGURE NO.	FIGURE TITLE.
7	**Environmental Compliance Certificate of the Montalban Solid Waste Disposal Facility**

Clark Sanitary Landfill – Hazardous Waste Disposal Facility

Source: Metro Clark Waste Manegement Corporation website: http://mcwm.net/

The sanitary landfill (SLF) is located in Sub Zone D, Clark Special Economic Zone, Sitio Kalangitan and is managed by Metro Clark Waste Management Corporation (MCWM). It is built based on internationally accepted standards, which exceed the standards stipulated in RA 9003. The SLF has a 70-ha landfill facility that can contain up to 20,000,000 tons. It also has a 10-ha recycling facility, 5-has of infrastructure, and a 15-ha environmental buffer zone.

It is assured that no leachate from the landfill can seep into the soil or groundwater. High-density polyetheline (HDPE) plastic liners are used as protection layers. Furthermore, HDPE was used to built the pipe system that brings the leachate to the Leachate Treatment Plant.

Aside from domestic, household, and residual waste, the SLF also accepts industrial and commercial non-hazardous waste. Moreover, the SLF also accommodates treated **hazardous** waste such as:

- K301 Solidified Wastes and Polymerized Wastes: wastes whose hazardous substances are physically immobilized by consolidation to reduce the surface area of the wastes in order to meet the waste acceptance criteria.
- K302 Chemically fixed Waste Waste whose hazardous substances chemically immobilized through chemical bonds to an immobile matrix or chemical conversion to meet the waste acceptance criteria.
- K303 Encapsulated Waste Waste whose hazardous substances are physically immobilized by enveloping the waste in a porous, impermeable material In order to store hazardous wastes until such time that a proper disposal facility is available.

The Multi Partite Monitoring Team (MMT) was established to ensure transparency in the conduct of the audit of the operation of Metro Clark Waste Management Corporation. The MMT is composed of representatives from DENR-EMB, CDC, Province of Tarlac, Municipalities of Bamban and Capas, Barangays Cutcut, Anupul and NGO. The MCWMC has a valid environmental compliance certificate and a discharge permit issued by EMB Region 3.

ANNEX F: Environmental Due Diligence of Resettlement Sites

Project:

Metro Manila Flood Management Project – Phase 1

Annex F: Environmental Due Diligence of Resettlement Sites

ANNEX G: Results of water quality, sediment quality and noise sampling

Project:

Metro Manila Flood Management Project – Phase 1

Annex G: Results of water quality and sediment quality sampling

Results of Analyses

The World Bank
26th Floor, One Global Place, 5th Avenue cor. 25th Street
Bonifacio Global City, Taguig City

PAB ACCREDITED TESTING LABORATORY PNS ISO/IEC 17025:2005 LA-2008-119B

PAB ACCREDITED TESTING LABORATORY PNS ISO/IEC 17025:2005 LA-2008-118B

SN: F00030763.004

Date Received: 12/02/2015

Lab No.:P00059514

Project Name: N/S

Attention: Mr. Kevin Bartolome

Test Description	Results	Units	Test Methods	Date Analyzed	By	Ref*
Sample No.: P00059514-01			**DateSampled: 12-02-15 08:21**			
Sample ID: ESTERO DE SUNOG DE APOG, BALUT, TONDO			**Matrix: Surface Water**			
-Metals-						
Arsenic	< 0.01	mg/L	SDDC, Spectrophotometry	12/08/15	EDC	
Cadmium	< 0.006	mg/L	Flame AAS	12/08/15	MBC	
Chromium	< 0.02	mg/L	Flame AAS	12/05/15	PPG	
Lead	< 0.05	mg/L	Flame AAS	12/07/15	MBC	
Mercury	0.002	mg/L	Manual Cold Vapor AAS	01/07/16	-	
-Microbiology-						
Total Coliforms	1,700,000	MPN/100mL	Multiple Tube Fermentation Technique	12/03/15	CBS	
-Wet Chemistry-						
pH, onsite @ 27.1°C	6.9	-	Electrometric Method	12/02/15	-	
Biological Oxygen Demand	53	mg/L	Azide Modification Winkler (SM 5210B)	12/03/15	MLJ	
Chemical Oxygen Demand	153	mg/L	Open Reflux Method (SM5220B)	12/03/15	JGDD	
Total Suspended Solids	34	mg/L	Gravimetry (SM2540 D)	12/04/15	MCT	
Oil & Grease	< 0.3	mg/L	Pet. Ether Extraction (DENR-EMB Modified)	12/04/15	RCYL	
Nitrate - N	0.09	mg/L	Colorimetry - Brucine	12/04/15	JEC	
Phosphate - P	1.8	mg/L	Stannous Chloride Method (SM4500-P D)	12/03/15	JEC	
>>> end of result set for Sample No.:P00059514-01 <<<						
Sample No.: P00059514-02			**DateSampled: 12-02-15 08:31**			
Sample ID: BALUT PUMPING STN. POND			**Matrix: Surface Water**			
-Metals-						
Arsenic	< 0.01	mg/L	SDDC, Spectrophotometry	12/08/15	EDC	
Cadmium	< 0.006	mg/L	Flame AAS	12/08/15	MBC	
Chromium	< 0.02	mg/L	Flame AAS	12/05/15	PPG	
Lead	< 0.05	mg/L	Flame AAS	12/07/15	MBC	
Mercury	0.006	mg/L	Manual Cold Vapor AAS	01/07/16	-	
-Microbiology-						
Total Coliforms	9,200,000	MPN/100mL	Multiple Tube Fermentation Technique	12/03/15	CBS	
-Wet Chemistry-						
pH, onsite @ 21.1°C	6.9	-	Electrometric Method	12/02/15	-	
Biological Oxygen Demand	70	mg/L	Azide Modification Winkler (SM 5210B)	12/03/15	MLJ	
Chemical Oxygen Demand	153	mg/L	Open Reflux Method (SM5220B)	12/03/15	JGDD	
Total Suspended Solids	29	mg/L	Gravimetry (SM2540 D)	12/04/15	MCT	
Oil & Grease	< 0.3	mg/L	Pet. Ether Extraction (DENR-EMB Modified)	12/04/15	RCYL	
Nitrate - N	0.09	mg/L	Colorimetry - Brucine	12/04/15	JEC	
Phosphate - P	2.1	mg/L	Stannous Chloride Method (SM4500-P D)	12/03/15	JEC	
>>> end of result set for Sample No.:P00059514-02 <<<						
Sample No.: P00059514-03			**DateSampled: 12-02-15 11:37**			
Sample ID: PACO PUMPING STN. INLET			**Matrix: Surface Water**			
-Metals-						
Arsenic	< 0.01	mg/L	SDDC, Spectrophotometry	12/08/15	EDC	
Cadmium	< 0.006	mg/L	Flame AAS	12/08/15	MBC	
Chromium	< 0.02	mg/L	Flame AAS	12/05/15	PPG	
Lead	< 0.05	mg/L	Flame AAS	12/07/15	MBC	
Mercury	0.002	mg/L	Manual Cold Vapor AAS	01/07/16	-	

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CRL Environmental Corporation

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- **Laboratory:** Bldg. 2, Berthaphil Compound 1, Berthaphil Inc. Industrial Park
  Jose Abad Santos Ave., CFZ Pampanga, Philippines
  Tel: (6345) 599-3943 * (6345) 499-6529 * (632) 552-5100 * Fax: (6345) 599-3963

Test Description	Results	Units	Test Methods	Date Analyzed	By	Ref*
-Microbiology-						
Total Coliforms	940,000	MPN/100mL	Multiple Tube Fermentation Technique	12/03/15	CBS	
-Wet Chemistry-						
pH, onsite @ 28.3°C	7.0	-	Electrometric Method	12/02/15	-	
Biological Oxygen Demand	27	mg/L	Azide Modification Winkler (SM 5210B)	12/03/15	MLJ	
Chemical Oxygen Demand	76	mg/L	Open Reflux Method (SM5220B)	12/03/15	JGDD	
Total Suspended Solids	24	mg/L	Gravimetry (SM2540 D)	12/05/15	MCT	
Oil & Grease	< 0.3	mg/L	Pet. Ether Extraction (DENR-EMB Modified)	12/04/15	RCYL	
Nitrate - N	0.08	mg/L	Colorimetry - Brucine	12/04/15	JEC	
Phosphate - P	1.6	mg/L	Stannous Chloride Method (SM4500-P D)	12/03/15	JEC	

>>> end of result set for Sample No.:P00059514-03 <<<

Sample No.: P00059514-04 **DateSampled: 12-02-15 11:32**
Sample ID: PACO PUMPING STN. OUTLET **Matrix: Surface Water**

-Metals-					
Arsenic	< 0.01	mg/L	SDDC, Spectrophotometry	12/08/15	EDC
Cadmium	< 0.006	mg/L	Flame AAS	12/08/15	MBC
Chromium	< 0.02	mg/L	Flame AAS	12/05/15	PPG
Lead	< 0.05	mg/L	Flame AAS	12/07/15	MBC
Mercury	0.0007	mg/L	Manual Cold Vapor AAS	01/07/16	-
-Microbiology-					
Total Coliforms	940,000	MPN/100mL	Multiple Tube Fermentation Technique	12/03/15	CBS
-Wet Chemistry-					
pH, onsite @ 28.6°C	6.9	-	Electrometric Method	12/02/15	-
Biological Oxygen Demand	18	mg/L	Azide Modification Winkler (SM 5210B)	12/03/15	MLJ
Chemical Oxygen Demand	74	mg/L	Open Reflux Method (SM5220B)	12/03/15	JGDD
Total Suspended Solids	56	mg/L	Gravimetry (SM2540 D)	12/05/15	MCT
Oil & Grease	0.4	mg/L	Pet. Ether Extraction (DENR-EMB Modified)	12/07/15	RCYL
Nitrate - N	0.06	mg/L	Colorimetry - Brucine	12/04/15	JEC
Phosphate - P	1.2	mg/L	Stannous Chloride Method (SM4500-P D)	12/03/15	JEC

>>> end of result set for Sample No.:P00059514-04 <<<

Sample No.: P00059514-05 **DateSampled: 12-02-15 09:40**
Sample ID: VITAS PUMPING STN. INLET **Matrix: Surface Water**

-Metals-					
Arsenic	< 0.01	mg/L	SDDC, Spectrophotometry	12/08/15	EDC
Cadmium	< 0.006	mg/L	Flame AAS	12/08/15	MBC
Chromium	< 0.02	mg/L	Flame AAS	12/05/15	PPG
Lead	< 0.05	mg/L	Flame AAS	12/07/15	MBC
Mercury	0.0008	mg/L	Manual Cold Vapor AAS	01/07/16	-
-Microbiology-					
Total Coliforms	1,600,000	MPN/100mL	Multiple Tube Fermentation Technique	12/03/15	CBS
-Wet Chemistry-					
pH, onsite @ 27.7°C	7.1	-	Electrometric Method	12/02/15	-
Biological Oxygen Demand	33	mg/L	Azide Modification Winkler (SM 5210B)	12/03/15	MLJ
Chemical Oxygen Demand	68	mg/L	Open Reflux Method (SM5220B)	12/03/15	JGDD
Total Suspended Solids	18	mg/L	Gravimetry (SM2540 D)	12/05/15	MCT
Oil & Grease	2.8	mg/L	Pet. Ether Extraction (DENR-EMB Modified)	12/07/15	RCYL
Nitrate - N	0.1	mg/L	Colorimetry - Brucine	12/04/15	JEC
Phosphate - P	1.8	mg/L	Stannous Chloride Method (SM4500-P D)	12/03/15	JEC

>>> end of result set for Sample No.:P00059514-05 <<<

Sample No.: P00059514-06 **DateSampled: 12-02-15 09:33**
Sample ID: VITAS PUMPING STN. OUTLET **Matrix: Surface Water**

-Metals-					
Arsenic	< 0.01	mg/L	SDDC, Spectrophotometry	12/08/15	EDC
Cadmium	< 0.006	mg/L	Flame AAS	12/08/15	MBC
Chromium	< 0.02	mg/L	Flame AAS	12/05/15	PPG
Lead	< 0.05	mg/L	Flame AAS	12/07/15	MBC
Mercury	0.004	mg/L	Manual Cold Vapor AAS	01/07/16	-
-Microbiology-					

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■ **Laboratory:** Bldg. 2, Berthaphil Compound 1, Berthaphil Inc. Industrial Park
Jose Abad Santos Ave., CFZ Pampanga, Philippines
Tel: (6345) 599-3943 * (6345) 499-6529 * (632) 552-5100 * Fax: (6345) 599-3963

Test Description	Results	Units	Test Methods	Date Analyzed	By	Ref*
-Microbiology-						
Total Coliforms	2,400,000	MPN/100mL	Multiple Tube Fermentation Technique	12/03/15	GTY	
-Wet Chemistry-						
pH, onsite @ 27.6ºC	6.9	-	Electrometric Method	12/02/15	-	
Biological Oxygen Demand	47	mg/L	Azide Modification Winkler (SM 5210B)	12/03/15	MLJ	
Chemical Oxygen Demand	99	mg/L	Open Reflux Method (SM5220B)	12/03/15	JGDD	
Total Suspended Solids	18	mg/L	Gravimetry (SM2540 D)	12/05/15	MCT	
Oil & Grease	1.8	mg/L	Pet. Ether Extraction (DENR-EMB Modified)	12/07/15	RCYL	
Nitrate - N	0.1	mg/L	Colorimetry - Brucine	12/04/15	JEC	
Phosphate - P	1.6	mg/L	Stannous Chloride Method (SM4500-P D)	12/03/15	JEC	

>>> end of result set for Sample No.:P00059514-06 <<<

Sample No.: P00059514-07 **DateSampled: 12-02-15 14:18**

Sample ID: TRIPA DE GALLINA PUMPING STN. INLET **Matrix: Surface Water**

-Metals-					
Arsenic	< 0.01	mg/L	SDDC, Spectrophotometry	12/08/15	EDC
Cadmium	< 0.006	mg/L	Flame AAS	12/08/15	MBC
Chromium	< 0.02	mg/L	Flame AAS	12/05/15	PPG
Lead	< 0.05	mg/L	Flame AAS	12/07/15	MBC
Mercury	0.0006	mg/L	Manual Cold Vapor AAS	01/07/16	-
-Microbiology-					
Total Coliforms	3,500,000	MPN/100mL	Multiple Tube Fermentation Technique	12/03/15	CBS
-Wet Chemistry-					
pH, onsite @ 29.1ºC	7.1	-	Electrometric Method	12/02/15	-
Biological Oxygen Demand	44	mg/L	Azide Modification Winkler (SM 5210B)	12/03/15	MLJ
Chemical Oxygen Demand	107	mg/L	Open Reflux Method (SM5220B)	12/03/15	JGDD
Total Suspended Solids	65	mg/L	Gravimetry (SM2540 D)	12/05/15	MCT
Oil & Grease	3.2	mg/L	Pet. Ether Extraction (DENR-EMB Modified)	12/07/15	RCYL
Nitrate - N	0.06	mg/L	Colorimetry - Brucine	12/04/15	JEC
Phosphate - P	2.3	mg/L	Stannous Chloride Method (SM4500-P D)	12/03/15	JEC

>>> end of result set for Sample No.:P00059514-07 <<<

Sample No.: P00059514-08 **DateSampled: 12-02-15 14:25**

Sample ID: TRIPA DE GALLINA PUMPING STN. OUTLET **Matrix: Surface Water**

-Metals-					
Arsenic	< 0.01	mg/L	SDDC, Spectrophotometry	12/08/15	EDC
Cadmium	< 0.006	mg/L	Flame AAS	12/08/15	MBC
Chromium	< 0.02	mg/L	Flame AAS	12/05/15	PPG
Lead	< 0.05	mg/L	Flame AAS	12/07/15	MBC
Mercury	< 0.0006	mg/L	Manual Cold Vapor AAS	01/07/16	-
-Microbiology-					
Total Coliforms	16,000,000	MPN/100mL	Multiple Tube Fermentation Technique	12/03/15	CBS
-Wet Chemistry-					
pH, onsite @ 28.9ºC	7.1	-	Electrometric Method	12/02/15	-
Biological Oxygen Demand	39	mg/L	Azide Modification Winkler (SM 5210B)	12/03/15	MLJ
Chemical Oxygen Demand	94	mg/L	Open Reflux Method (SM5220B)	12/03/15	JGDD
Total Suspended Solids	57	mg/L	Gravimetry (SM2540 D)	12/05/15	MCT
Oil & Grease	4.3	mg/L	Pet. Ether Extraction (DENR-EMB Modified)	12/07/15	RCYL
Nitrate - N	0.1	mg/L	Colorimetry - Brucine	12/04/15	JEC
Phosphate - P	2.3	mg/L	Stannous Chloride Method (SM4500-P D)	12/03/15	JEC

>>> end of result set for Sample No.:P00059514-08 <<<

Sample No.: P00059514-09 **DateSampled: 12-02-15 16:06**

Sample ID: LABASAN PUMPING STN. INLET **Matrix: Surface Water**

-Metals-					
Arsenic	< 0.01	mg/L	SDDC, Spectrophotometry	12/08/15	EDC
Cadmium	< 0.006	mg/L	Flame AAS	12/08/15	MBC
Chromium	< 0.02	mg/L	Flame AAS	12/05/15	PPG
Lead	< 0.05	mg/L	Flame AAS	12/07/15	MBC
Mercury	0.001	mg/L	Manual Cold Vapor AAS	01/07/16	-
-Microbiology-					

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  Jose Abad Santos Ave., CFZ Pampanga, Philippines
  Tel: (6345) 599-3943 * (6345) 499-6529 * (632) 552-5100 * Fax: (6345) 599-3963

Test Description	Results	Units	Test Methods	Date Analyzed	By	Ref*
-Microbiology-						
Total Coliforms	160,000	MPN/100mL	Multiple Tube Fermentation Technique	12/03/15	CBS	
-Wet Chemistry-						
pH, onsite @ 26.9°C	6.7	-	Electrometric Method	12/02/15	-	
Biological Oxygen Demand	29	mg/L	Azide Modification Winkler (SM 5210B)	12/03/15	MLJ	
Chemical Oxygen Demand	68	mg/L	Open Reflux Method (SM5220B)	12/03/15	JGDD	
Total Suspended Solids	20	mg/L	Gravimetry (SM2540 D)	12/05/15	MCT	
Oil & Grease	< 0.3	mg/L	Pet. Ether Extraction (DENR-EMB Modified)	12/07/15	RCYL	
Nitrate - N	0.09	mg/L	Colorimetry - Brucine	12/04/15	JEC	
Phosphate - P	3.5	mg/L	Stannous Chloride Method (SM4500-P D)	12/03/15	JEC	

>>> end of result set for Sample No.:P00059514-09 <<<

Sample No.: P00059514-10 **DateSampled: 12-02-15 16:12**

Sample ID: LABASAN PUMPING STN. OUTLET **Matrix: Surface Water**

-Metals-						
Arsenic	< 0.01	mg/L	SDDC, Spectrophotometry	12/08/15	EDC	
Cadmium	< 0.006	mg/L	Flame AAS	12/08/15	MBC	
Chromium	< 0.02	mg/L	Flame AAS	12/05/15	PPG	
Lead	< 0.05	mg/L	Flame AAS	12/07/15	MBC	
Mercury	0.001	mg/L	Manual Cold Vapor AAS	01/07/16	-	
-Microbiology-						
Total Coliforms	160,000	MPN/100mL	Multiple Tube Fermentation Technique	12/03/15	CBS	
-Wet Chemistry-						
pH, onsite @ 26.8°C	6.7	-	Electrometric Method	12/02/15	-	
Biological Oxygen Demand	21	mg/L	Azide Modification Winkler (SM 5210B)	12/03/15	MLJ	
Chemical Oxygen Demand	55	mg/L	Open Reflux Method (SM5220B)	12/03/15	JGDD	
Total Suspended Solids	22	mg/L	Gravimetry (SM2540 D)	12/05/15	MCT	
Oil & Grease	1.2	mg/L	Pet. Ether Extraction (DENR-EMB Modified)	12/07/15	RCYL	
Nitrate - N	0.1	mg/L	Colorimetry - Brucine	12/04/15	JEC	
Phosphate - P	3.3	mg/L	Stannous Chloride Method (SM4500-P D)	12/03/15	JEC	

>>> end of result set for Sample No.:P00059514-10 <<<

>>> end of result set for Lab No.:P00059514; Total no. of samples analyzed: 10 <<<

N/S = Not Supplied

MPN = Most Probable Number

Shimadzu Analytical Methods, Atomic Absorption Spectrophotometry (AAS)

Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 22nd Edition.

Test Methods for Evaluating Solid Wastes, Vol 1A, USEPA, Third Edition

Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020

Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 21st Edition.

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Results of Analyses

The World Bank
26th Floor, One Global Place, 5th Avenue cor. 25th Street
Bonifacio Global City, Taguig City

PAB ACCREDITED TESTING LABORATORY PNS ISO/IEC 17025:2005 LA-2008-119B

SN: F00030763.005
Date Received: 12/02/2015
Lab No.:P00059514

Project Name: N/S

Attention: Mr. Kevin Bartolome

Test Description	Results	Units	MDL	REG LIMIT	Test Methods	Date Analyzed	By	Ref*
Sample No.: P00059514-11					**DateSampled: 12-02-15 08:40**			
Sample ID: BALUT PUMPING STN. POND SEDIMENTS					**Matrix: TCLP Extract**			
-Metals-								
Arsenic	0.002	mg/L	0.001^	1.0	Gaseous Hydride AAS	12/10/15	MBC	83
Barium	ND	mg/L	0.08	70	Flame AAS	12/15/15	MBC	83
Cadmium	ND	mg/L	0.006	0.3	Flame AAS	12/15/15	MBC	83
Chromium	ND	mg/L	0.02	5.0	Flame AAS	12/14/15	PPG	83
Lead	ND	mg/L	0.05	1.0	Flame AAS	12/15/15	MBC	83
Selenium	ND	mg/L	0.001^	1.0	Gaseous Hydride AAS	12/28/15	MBC	83
Silver	ND	mg/L	0.01	5.0	Flame AAS	12/14/15	PPG	83
Mercury	0.01	mg/L	0.0006^	0.1	Manual Cold Vapor AAS	01/18/16	-	83
>>> end of result set for Sample No.:P00059514-11 <<<								
Sample No.: P00059514-12					**DateSampled: 12-02-15 11:43**			
Sample ID: PACO PUMPING STN. INLET SEDIMENTS					**Matrix: TCLP Extract**			
-Metals-								
Arsenic	0.001	mg/L	0.001^	1.0	Gaseous Hydride AAS	12/10/15	MBC	83
Barium	ND	mg/L	0.08	70	Flame AAS	12/15/15	MBC	83
Cadmium	ND	mg/L	0.006	0.3	Flame AAS	12/15/15	MBC	83
Chromium	ND	mg/L	0.02	5.0	Flame AAS	12/14/15	PPG	83
Lead	ND	mg/L	0.05	1.0	Flame AAS	12/15/15	MBC	83
Selenium	ND	mg/L	0.001^	1.0	Gaseous Hydride AAS	12/28/15	MBC	83
Silver	ND	mg/L	0.01	5.0	Flame AAS	12/14/15	PPG	83
Mercury	0.002	mg/L	0.0006^	0.1	Manual Cold Vapor AAS	01/18/16	-	83
>>> end of result set for Sample No.:P00059514-12 <<<								
Sample No.: P00059514-13					**DateSampled: 12-02-15 09:45**			
Sample ID: VITAS PUMPING STN. INLET SEDIMENTS					**Matrix: TCLP Extract**			
-Metals-								
Arsenic	0.006	mg/L	0.001^	1.0	Gaseous Hydride AAS	12/10/15	MBC	83
Barium	ND	mg/L	0.08	70	Flame AAS	12/15/15	MBC	83
Cadmium	ND	mg/L	0.006	0.3	Flame AAS	12/15/15	MBC	83
Chromium	ND	mg/L	0.02	5.0	Flame AAS	12/14/15	PPG	83
Lead	ND	mg/L	0.05	1.0	Flame AAS	12/15/15	MBC	83
Selenium	ND	mg/L	0.001^	1.0	Gaseous Hydride AAS	12/28/15	MBC	83
Silver	ND	mg/L	0.01	5.0	Flame AAS	12/14/15	PPG	83
Mercury	0.002	mg/L	0.0006^	0.1	Manual Cold Vapor AAS	01/18/16	-	83
>>> end of result set for Sample No.:P00059514-13 <<<								
Sample No.: P00059514-14					**DateSampled: 12-02-15 14:25**			
Sample ID: TRIPA DE GALLINA PUMPING STN. SEDIMENTS					**Matrix: TCLP Extract**			
-Metals-								
Arsenic	0.007	mg/L	0.001^	1.0	Gaseous Hydride AAS	12/10/15	MBC	83
Barium	ND	mg/L	0.08	70	Flame AAS	12/15/15	MBC	83
Cadmium	ND	mg/L	0.006	0.3	Flame AAS	12/15/15	MBC	83
Chromium	ND	mg/L	0.02	5.0	Flame AAS	12/14/15	PPG	83
Lead	ND	mg/L	0.05	1.0	Flame AAS	12/15/15	MBC	83
Selenium	ND	mg/L	0.001^	1.0	Gaseous Hydride AAS	12/28/15	MBC	83
Silver	ND	mg/L	0.01	5.0	Flame AAS	12/14/15	PPG	83
Mercury	0.001	mg/L	0.0006^	0.1	Manual Cold Vapor AAS	01/18/16	-	83
>>> end of result set for Sample No.:P00059514-14 <<<								

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>>> end of result set for Lab No.:P00059514; Total no. of samples analyzed: 4 <<<

^Reporting Limit/s

N/S = Not Supplied

MDL = Method Detection Limit/s

ND = Not Detected (Below MDL / Reporting Limit/s)

Shimadzu Analytical Methods, Atomic Absorption Spectrophotometry (AAS)

Test Methods for Evaluating Solid Wastes, Vol 1A, USEPA, Third Edition

Standard Methods for the Examination of Water and Wastewater, APHA, AWWA, WEF, 21st Edition.

*** Regulatory Limit Reference**

[83] DENR Administrative Order No. 2013 - 22, Revised Procedures and Standards for the Management of Hazardous Wastes (Revising DAO 2004 - 36)

FN>>>>00116994>>>>

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