International Journal of Disaster Recovery and Business Continuity
Vol.5 (2014), pp.1-14
http://dx.doi.org/10.14257/ijdrbc.2014.5.01

An Analysis of the Public Perception of Floods in Manila City

Tomas U. Ganiron Jr

Graduate School, Adamson University, Manila
tomasuganironjr@gmail.com

Abstract

This descriptive study aimed to conduct an investigation in the effectiveness of flood control pump station in Lagusnilad Underpass in Lawton. For decades, Metro Manila has been battling with flood risk. The area has been inundated with flood waters several times, whether it is due to tropical weather, strong rain fall events, or rising waters. This has resulted in millions of pesos in damages, and in some instances, the same home has been affected multiple times. Many agree that Lagusnilad Underpass in Metro Manila is just not a livable area to begin with; the risk is just too great. However, abandoning the area is simply not an option. As a result, the flood risk battle ensues. Fifty respondents who are making a living nearby the location of the subject and also the everyday passers-by were selected and employed in the study. Some of the interesting insights of the study are: (a) Metro Manila was facing a serious problem specifically in flooding.(b) The pump station in Lagusnilad is very effective in controlling the flood in some areas in Metro Manila. (c) The pump station controls the rate and velocity of runoff along gutters and other surfaces in a manner that reduces the hazard to local residents and potential for damage to pavement. (d) The pump conveys runoff to natural or manmade drainage.

Keywords: *Flood control, flood risk, Lagusnilad, pump station*

1. Introduction

In the past, rainy season was welcome by every Filipino. Rain brings despite from excruciating heat of summer, cleanses away the dust and the whole environment. It's also necessary to wet the fields and water the plants. Even in the metropolis, rain is happily anticipated.

The effects of flood both beneficial and destructive have been recorded at least 5,000 years. The most familiar flood story is that in the Book of Genesis. The events upon which this Old Testament tale is based may have occurred about 3,000 BC, when the Euphrates River inundated a vast area, including Ur in Southern Mesopotamia [1, 2]. According to the Bible, the flood resulted from 40 days of continual rain, producing high water that lasted 150 days and flood depths in excess of 15 cubits (7.5 m/25 ft.) [2, 3].

The effects of flood both beneficial and destructive have been recorded at least 5,000 years. The most familiar flood story is that in the Book of Genesis. The events upon which this Old Testament tale is based may have occurred about 3,000 BC, when the Euphrates River inundated a vast area, including Ur in Southern Mesopotamia. According to the Bible, the flood resulted from 40 days of continual rain, producing high water that lasted 150 days and flood depths in excess of 15 cubits (7.5 m/25 ft.) [3].

Urbanization increases surface storm water runoff and modifies its quality. As land urbanizes, it is covered by impervious surfaces such as paved roads, parking lots and roof which prevent rainfall from infiltrating into the ground.

ISSN: 2005-4289 IJDRBC

Today, those who live in Metro Manila, rainy season means months of long suffering. While it is true that even in the city, people need rain. But when they come pouring heavy like a deluge, the problem begins. Although they make our hot days cooler, rain brings floods.

Flooding in Metro Manila has become a perennial problem that all the city dwellers rich and poor much ordure. Flood indiscriminately brings havoc to the lives of the people. Unfortunately, the efforts being made with regards to its resolution remains inadequate if not furtive [4, 20].

In accordance with this crisis, the Philippines Government built up agencies which will supervised and generate projects and activities regarding construction of roads, bridges, and buildings. One of them is the Department of Public Works and Highways (DPWH) which was named before (DPH) or Department of Public Highways [5].

DPWH with coordination of NGOs (Non-Government Organization) and NDCC (Natural Disaster Coordinating Council) help each other in solving the said crisis whenever flood, storm and typhoon may happen.

One of the major agencies handling as of now the "Flood Control Program" is the MMDA (Metropolitan Manila Development Authority) in Metro Manila and nearby provinces. They took on proper disposing of waste and garbage, which contribute much in floods [6,12].

Lagusnilad Underpass in Lawton is just one of the place that is affected by flood every year especially when rainy season comes.

The purpose of this study is to redefine the risk in Manila City. Despite efforts of the Metropolitan Manila Development Authority Program, countless flood mitigation projects, and increased education about flood loss, flood damages remain high. An evaluation of statistics of effectiveness of pumping station will be performed. With this information, the communities with the highest risk in Metro Manila will be determined.

2. Related Literature

Napinda Hydraulic Central Structure (NHCS) was designed to prevent entrance of saline and pollute water of the Pasig River to Laguna Lake with the long term aim not changing the former into a source of clean, fresh water for the domestic supply of Metro Manila [7]. Under such conditions, the NCHS should be closed. However, as long as there is no clean, freshwater lake to conserve yet, not to mention the political commitment to obtain one than the moment the lake level gets higher than that of Manila Bay, the NHCS must be kept open to allow discharge from the lake to the Bay. At present, the discharging water has to move slowly due to the impedance pose by silt and garbage from them to Pasig River.

In Manggahan Floodway (MF), the main purpose of its construction was to divert a portion of the Marikina flood flow towards to Laguna Lake in order to minimize the flooding hazard and damage of low-lying areas located along the Marikina and Pasig Rivers. Flood volumes diverted from [8, 21]. Marikina a River as well as sustained direct rainfall and tributary inflows from surrounding lakeshore watersheds may cause the significant rise of the Laguna Lake level. Its slow recession is due to the low discharge capacity of the single outlet, the Napindan Pasig River channel [7, 8].

In order not to further aggravate matters, opening the NCHS and operating the MF in reverse during this particular time should be resorted too. There are also been the perception that the storage capacity of the lake has been reduced due to the silting up of the lake bottom. However, a plan to dredge the area may not be cost effective since this will not cause any noticeable drop in water surface elevation and will not speed up recession either. Dredging the Napindan and Pasig Rivers is more effective since these are natural waterways which respond immediately to deepening and cleaning.

The other solution of this floods are the pumps which are required for main condenser circulation and water extraction, boiler feed heaters, forced and induced crafts fans, soot collectors an auxiliary condenser with circulating pumps, forced lubricating pumps and oil purifiers. Pumps needed to control the water overflow in the said place [9].

Water pumps are almost invariably of the vertical, motor driven, centrifugal type. Cogwheel or screw pumps, as well as reciprocators are commonly used for pumping equipment to control and decrease the amount of water during the rainy seasons or heavy rain. Procedure for the pumping equipment methods are based on the flow forecast, measurements inputs and other management inputs, and pursuing a sustained and vigorous program of basic and applied research related to flooding problems and solution. Furthermore, the studies will provide guidelines on the operation of the pumping station such as the NCHS and other activities related to relief and rescue, dredging of waterways and flood forecasting/warning.

Three new pumping stations built at Vistas, Balut and San Andres have been working steadily since their completion compared to the situation before the project, the maximum water depth and duration of flooding have been substantially reduced and, and the projects effect in reducing the extent of flooding has been confirmed [10, 11].

The number of households evacuated in Manila has been declining (492 household in 2012, 266 in 2013), with the exception in 2010, when typhoon caused major damage [12, 13]. The process of relocating residents took longer than the anticipated, delaying the project as a whole, but the executing agency reports that the relocation was handled in accordance with the Philippines law and did not involve any major problems. The facilities are mainly kept in good condition, but there is a maintenance problems with the garbage discarded in the canals by residents, where interferes with the operation of the operation of the pumps [12]. A systematic approach by the national and local governments is required to tackle the problem.

A flood risk assessment study for the entire Metro Manila and surrounding basin area was undertaken from February 2011 to February 2012, to prepare a comprehensive flood risk management plan for the same and to determine a set of priority structural measures, which will still undergo individual feasibility studies and detailed design prior to implementation, including nonstructural measures that will provide sustainable flood management up to a designated safety level and serve as the roadmap/vision of the government until 2035[14]. As shown in figure 1, the study area covers the entire Metro Manila and the surrounding areas, particularly, provinces of Rizal, Laguna, and parts of Bulacan, with a total area of 4,354 sq. km or 435,400 hectares, which is seven times the size of Metro Manila and two-thirds that of Singapore [12, 14]. It also encompasses the Pasig-Marikina River Basin, Malabon-Tullahan, Meycauayan, South Parañaque-Las Piñas, and the Laguna Lake Basins, including drainage basins. Administration Areas in and around the study area include 16 cities and one municipality in the National Capital Region (NCR), 63 cities/municipalities in the Calabarzon area and eight cities/municipalities in Bulacan with a population of 20,433,722 in and around the Study Area and estimated population of 17,147,658 in the study area [15].

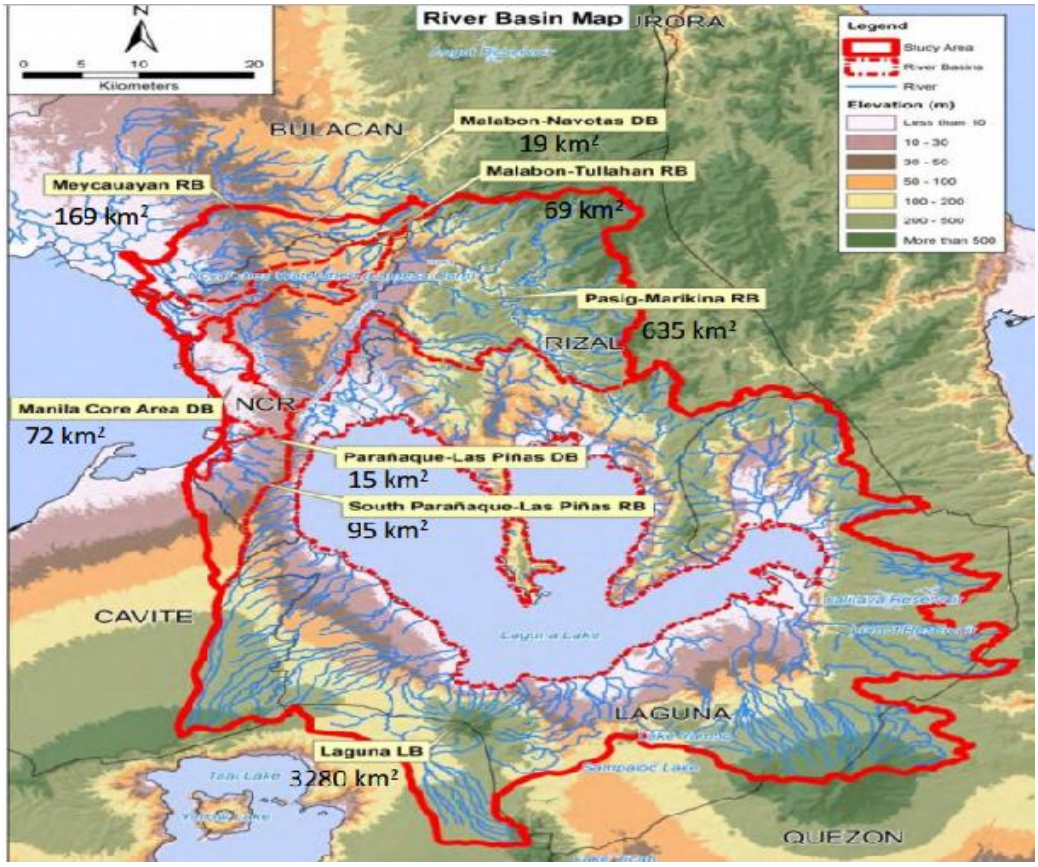
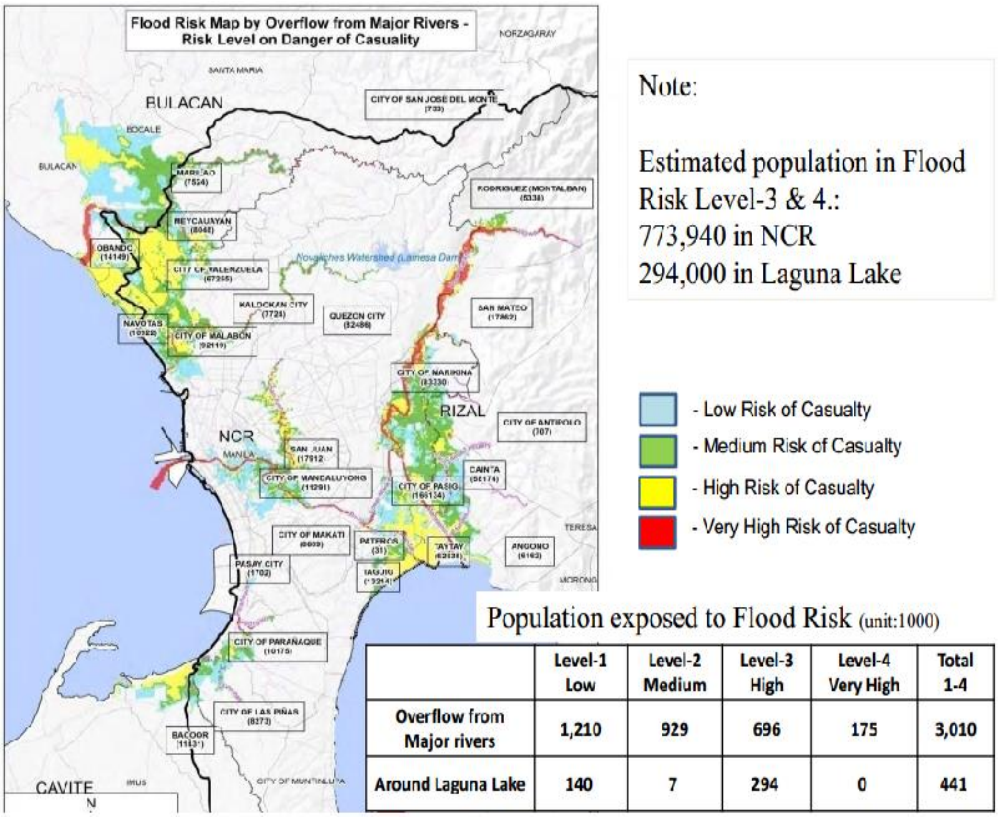


Figure 1. Boundary of Study Area and the River Basins

As shown in Figures 2 and 3, the Master Plan's optimum recommendations for structural measures in combination with nonstructural measures for the Pasig-Marikina River Basin and adjacent areas. In order to reduce the peak discharge of inflow equivalent to 3,600 m3/s under a 100-year return period from flowing downstream, a dam is proposed to be constructed in the upstream portion of Upper-Upper Marikina River in Rodriguez, Rizal (Montalban) so that only 900 m3/s discharge of outflow will go down [16]. To further reduce the peak discharge of 900 m3/s from flowing down the Upper-Upper Marikina River, the area between the Tumana Bridge and the San Mateo Bridge, and the area upstream of the San Mateo Bridge, with a combined total length of 4.0 km and maximum width of 1.5 km will be utilized as a natural retarding basin by constructing small dikes beside natural levees alongside river area management and flood plain management [14, 16]. In addition to the above, river improvements such as a combination of dike/river wall construction and excavation, dredging/excavation only, or river wall construction only will be carried out at different locations, as applicable, along the Pasig and Marikina Rivers and adjacent areas including river area management and flood plain management when needed, to ensure that the target safety level for mitigation measures will be achieved. For the other river basins, except Laguna Lake Basin, river improvements combined with river area management and flood plain management were recommended to ensure that the target safety level for mitigation measures for each will be achieved [16, 17].



Population exposed to Flood Risk (unit:1000)

	Level-1 Low	Level-2 Medium	Level-3 High	Level-4 Very High	Total 1-4
Overflow from Major rivers	1,210	929	696	175	3,010
Around Laguna Lake	140	7	294	0	441

Figure 2. Flood Risk Map on Danger of Casualty-Risk Level

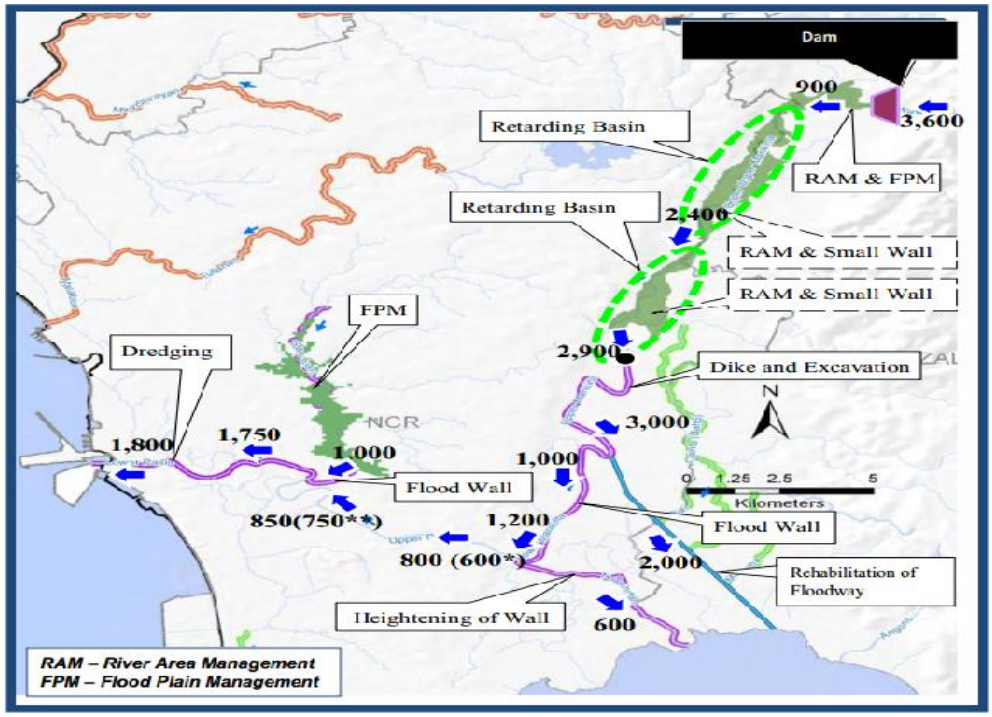


Figure 3. Mechanisms of Flood Occurrence

As shown in Figure 4, an estimated 1.6 million people will directly benefit from the mitigating structural measures for the Pasig-Marikina River Basin and adjacent areas and around P43 billion will be saved from direct damages due to floods [16, 17].

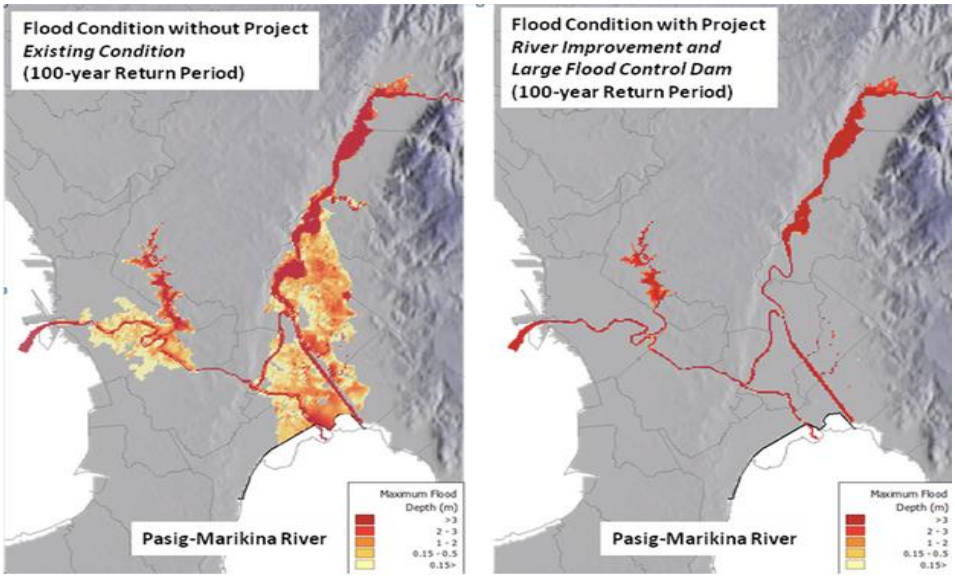


Figure 4. Project Impact

As shown in Figures 5 and 6, the following are the optimum solutions in solving the flooding situation in the Laguna lakeshore areas such as (a) Putting up a road dike around the lake with pumping stations. (b) Lakeshore land rising with road and future developments. (c) Construction of a spillway that will cut through the heavily built-up Parañaque City and another one that will go through to the Pacific Ocean. (d) Dredging works. (e) River improvements for the selected inflow rivers of the lake developments [17].

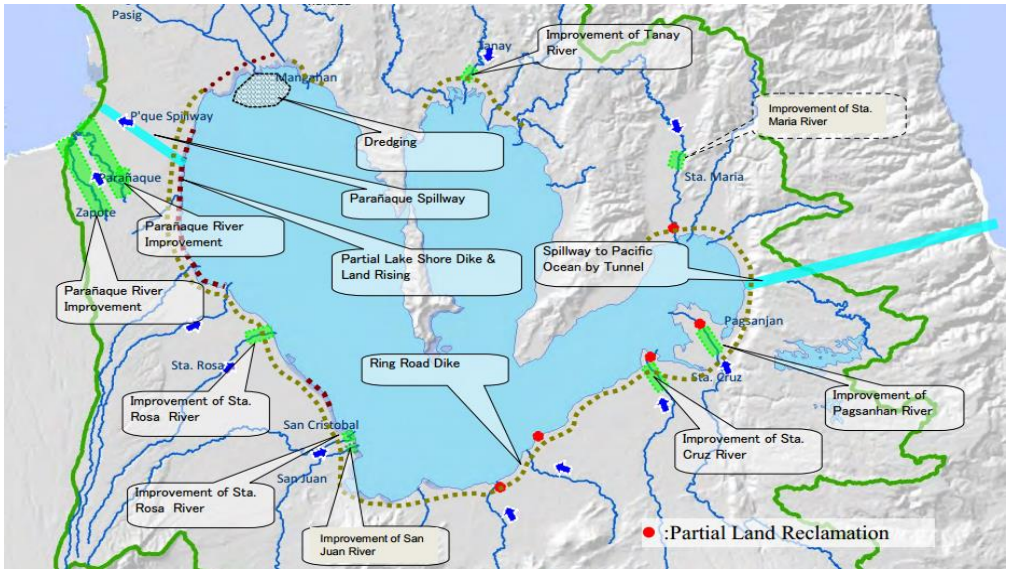
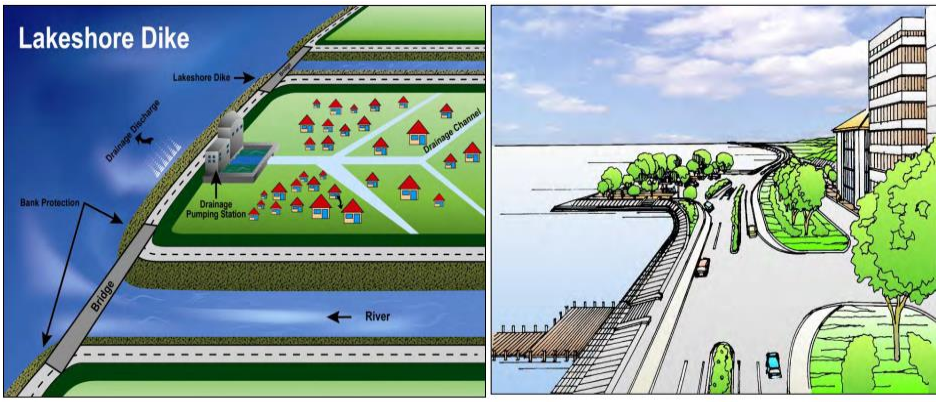


Figure 5. Laguna Lakeshore



Option-1: Image of Lakeshore Dike with Road

Option-2: Image of Raising Lakeshore Land with Road and Future Developments

Figure 6. Options for the Lakeshore Area from Taguig to Muntinlupa

As shown in Table 1, there are 11 recommended shortlisted structural mitigation measures under the Flood Management Master Plan for Metro Manila and Surrounding Areas that will serve as the roadmap of the government, which is envisioned to be implemented from today until 2035 [17-19].

Table 1. Short-listed Structural Mitigation Measures

No.	Item	Highest Flood Risk Level	Target Flood Safety (R.P.)	Total Cost (Mil. Pesos)	EIRR	Resettlement (1000 person)	Beneficiary (1000 person)	Preliminary Environmental Assess. (except negative impact of resettlement)
1 (VH)	Pasig-Marikina River Improvement (RI) + Dam	4	100-y	198,435	16.4%	331	1,593	Moderate due to some negative social impact by dam (possible)
2 (H)	Meycauayan RI	3	50-y	14,040	22.9%	35	199	Positive due to improve. Environment (recommended)
3 (H)	Malabon-Tullahan RI	3	50-y	21,635	22.3%	39	298	Positive due to improve. Environment (recommended)
4 (M)	South Parañaque – Las Piñas RI	3	30-y	17,335	12.2%	30	104	Positive due to improve. environment. (recommended)
5 (H)	East Mangahan Floodway (Cainta & Taytay RIs)	3	30-y	25,901	26.8%	25	227	Positive due to improve environment (recommended)
6 (VH)	West Laguna Lakeshore Land Raising	3	60-y	25,185	17.2%	114	114	Positive due to improvement of environment and potential of development (recommended)
7 (H)	Land Raising for Small Cities around Laguna Lakeshore	3	60-y	7,158	17.2%	8.8	8.8	Positive (same as 6) (recommended and to be studied more)
8 (H)	Improvement of the Inflow Rivers to Laguna Lake	3	30-y	637	N.A.	N.A.	N.A.	Positive due to improve. of environment (recommended and to be studied more)
9 (H)	Manila Core Area Drainage Improvement	2	10-y	27,257	19.1%	24	270	Positive due to improvement of environment (recommended)
10 (M)	West Mangahan Area Drainage Improvement	2	5-y	5,522	11.1%	3.2	25.6	Positive due to improvement of environment (recommended)
11	Valenzuela, Obando and Meycauayan (VOM) Improve.(to be studied further)	8,613 (Est. only)						
	TOTAL	**351,718**						

(1) Priority (Tentative) VH: Very High, H: High, M: Marginal
(2) Priority is set by considering 1) severity of floods or flood risk level, 2) cost and economic efficiency (EIRR≧15%), and 3) social and natural impacts and preliminary environmental assessment.

These projects were prioritized according to: (a) The severity of floods based on flood risk, flood area, duration of floods and flood damage, (b) Technical viability, (c) Social and environmental viability in preliminary level, and (d) Aerial distribution of putting priority for the flood mitigation measures for the rivers and Laguna Lake.

3. Research Methodology

The researcher employed a descriptive method of research in the study. The focus of concern of the research is the study of the effectiveness of flood control pump station in Lagusnilad Underpass in Lawton. Every year, its' residents and public is affected by floods and the problem is causing a big concern among them. Accidental sampling under the category of non-probability sampling was adapted. The researcher went through the area within the subject and conducted a survey to those who gave them a chance. Fifty respondents who are making a living nearby the location of the subject and also the everyday passers-by were selected and employed in the study. The population consists of twenty five males and twenty five females. They belonged to almost all walks of life including vendors, teachers, workers, students, ordinary housewives and businessman. A structured interview was conducted among the fifty respondents guided by a specifically prepare questionnaires. This question is the main tool in gathering pertinent data.

4. Results and Discussion

4.1. Effectiveness of Pumping Station in Lagusnilad

As shown in Figure 7, majority of the respondents with the percentage of 70% or 35 out of 50 agreed that the pump station in Lagusnilad is effective in controlling the flood in some areas in Metro Manila particularly the nearby places at the said location. Some stated that they didn't see any flood occurring during rainfall in the nearby places while some said that it is very seldom that they see flood within the area of Lagusnilad underpass as a proof for their answer. 10 of them or 20% answered no which means they are not convinced with the efficiency of the said pump station while 10% or 5 of the respondents answered maybe due to the lack of knowledge or they simply don't care about all.

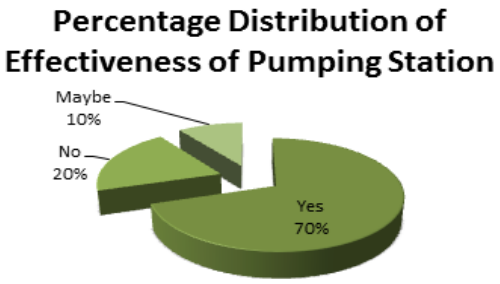


Figure 7. Effectiveness of Pumping Station in Lagusnilad

4.2. Use of Pumping Station to Resolve Problem in Flood

As shown in Table 2, 35 or 70% of the respondents are aware about the use of a pump station not only in the Lagusnilad but also in other places. 7 or 14% of them has no idea about the use of a pump station. Purification of the water which was sucked

from the streets during rainfall and supplying them to the residents nearby is the answer of 5 or 10% of the respondents. On the other hand only 6% or 3 had no idea about the pump station.

Table 2. Frequency and Percentage Distribution of the Use Pumping Station to Resolve Problem in Flood

Uses	Frequency	Percentage (%)
1. Purifies the water which was sucked from the streets during rainfall and supplies it to the residents nearby	5	10
2. Prevents overflowing of water during rainfall that may result to flooding.	35	70
3. Display for the motorist to enjoy their travel	3	6
4. No idea about the pump station	7	14
Total	50	100

4.3. Advantages of Pumping Station

As shown in Table 3, 56% or 28 out of 50 respondents know the advantage of having a pump station nearby their place. 10 or 20% said that it protects the motorist and passers-by from the flow of water during rainfall. Meanwhile, 7 or 14% stated that it serves as water storage station for the emergency need for water and 5 or 10% believes that it purifies drinking water.

It is clear that people know and need a pump station nearby their places for them not to be deeply harmed during rainy seasons.

Table 3. Frequency and Percentage Distribution of Advantages of Pumping Station

Advantages of pumping station	Frequency	Percentage (%)
1. Totally no danger of being flooded	0	0
2. Minimal occurrence of flood	28	56%
3. Purifies drinking water	5	10%
4. Lessens traffic within the area	0	0
5. Serves as water storage station for the emergency needs for water.	7	14
6. Protects the motorist and passers-by from the flow of water during rain	10	20%
Total	50	100%

4.4. Solution to the Problem of Floods

As shown in Table 4, 15 or 30% answered that constructing more pump station is more effective in reducing or minimizing flood problems especially in Metro Manila. 24% or 12 believe that the solution in flood problems is the launching of flood control programs. Constructing more drainage systems is the belief of 8 out of 50 or 16% respondents to be the answer to the critical flood problem. Meanwhile, 7 or 14% said that government has to launch more flood control projects. On the other hand, 10% or 5 suggest that constructing more dump sites is the effective way to end the flood problem.

The least number of answered variables is educating people nearby the flood prone area garnered 6% or 3 from the total number of respondents.

Table 4. Frequency and Percentage Distribution of Solution to the Problems of Floods

Solution to floods	Frequency	Percentage (%)
1. Constructing more pump station	15	30
2. Constructing more drainage system	8	16
3. Constructing more dump sites	5	10
4. Launching flood control campaign	12	24
5. Educating people nearby the flood prone area	3	6
6. Launch flood control projects	7	14
Total	50	100

4.5. Flood Problem in Metro Manila

Nowadays flood problem in Metro Manila is at its high level. Every time that it rains, it pours, because whenever a single chance of heavy or non-stop raining results to the overflowing of drainage especially in the streets that gives headache to each and every one affected. Many aspects such as livelihood, studies, health and activities were affected. Every time a heavy rain pours in many activities are delayed, some are stopped and others destroyed. Calamities were striking the country and leaves the many homeless, hopeless and in deep depression. Although the government do their best in maintaining the drainage system, it is still not enough to reduce flooding.

Unfortunately, the residents itself are one of contributing factors why this brain cracking problem occurs. Some doesn't give a damn whenever his dumped garbage can damage not only his own life but the lives of those who will be affected by it.

The pump stations are very important factor in the clean-up of the river. They are very complex, but can be simplified in a simple tour. But once people know how they work, they see a lot easier to understand. First, a number of pumps are opened. When the river got to a certain point, those pumps would open. From there the water goes into a bar screen.

This filtered the river water, cleaning out the debris. After being filtered, the water flows through the gates and into the river. When the water goes through the pump, it pushes open a check valve, or a flap, that keeps the river water out. These are the depths when the pumping stations kick in.

4.6. Significance of Constructing Pumping Station at Lagusnilad Underpass

The pump station is a part of the total urban infrastructure, and space or right of way has to be reserved for this system. Storm sewers require little space and can often be located within the street right-of –way. Major open channels, natural or manmade, require their own rights-of way, preferably under public ownership to control the drainage system serves several vital community functions: (a) It remove storm water from the streets and permits the transportation arteries to function during bad weather-when this is done efficiently, the life expectancy of street pavement is extended. (b) The pump station controls the rate and velocity of runoff along gutters and other surfaces in a manner that reduces the hazard to local residents and potential for damage to pavement. (c) The pump conveys runoff to natural or manmade drainage ways. (d) The system was designed to control the mass of pollutants arriving at receiving waterways. (e) Major open drainage ways and detention facilities offer

opportunities for multiple used such as recreation, parts, and wildlife preserves.

4.7. Minor vs. Major Runoff Events

The initial system is intended to handle the frequent runoff events and nuisance flows. It is generally designed to serve runoff peak flows and volume not exceeding the 2-or 5-year return period. The definition of the initial system includes depth and velocity limitations for roadside swales, gutters, storm sewers, and open channels during the selected design event.

The major system is made up of the initial system plus the flow-carrying capacity of streets, gutters, borrows ditches, parks, open spaces, and portions of individual lawns, as well as the major drainage ways and natural waterways. Each community needs to define what constitutes its formal, dedicated, major drainage system.

The pumping station in Lagusnilad underpass is composed of special facilities such as 2 submersible pumps, 2- 6 inches diameter and 11 meters length of pipe, 1- 33kw generator and 1 floating switch device. Every submersible pumps has ability to discharge of about 4.98 cu.m/min. depends to the elevation of the pipe from the basin.

5. Conclusions

Flood is one of the perennial problems here in the Philippines especially in Metro Manila. They are affected in many aspects such as livelihood, studies, health and activities. Every time a heavy rain pours in many activities are delayed, some are stopped others destroyed. Calamities striking the country and leave the many homeless, hopeless and in deep depression. Although the government do their best in maintaining the drainage system, it is still not enough to reduce flooding. Unfortunately, the residents itself are one of contributing factors why this brain cracking problem occurs. Some doesn't give a damn whenever his dumped garbage can damage not only his own life but the lives of those who will be affected by it.

Pump station is one of the factors in solving the flood problem in our country. This is very important factor in the clean-up of the river. They are very complex, but can be simplified in a simple tour but once know how they work, they seen a lot easier to understand. First, a number of pumps are opened. When the river got to a certain point, those pumps would open. From there the water goes into a bar screen. This filtered the river water, cleaning out the debris. After being filtered, the water flows through the gates and into the river. When the water goes through the pump, it pushes open a check valve, or a flap, that keeps the river water out. These are the depths when the pumping stations kick in.

The pump station at the Lagusnilad Underpass plays an important role in flood control such as (a) It removes storm water from the streets and permits the transportation arteries to function during bad weather-when this is done efficiently, the life expectancy of street pavement is extended. (b) The pump station controls the rate and velocity of runoff along gutters and other surfaces in a manner that reduces the hazard to local residents and potential for damage to pavement. (c) The pump conveys runoff to natural or manmade drainage ways. (d) The system was designed to control the mass of pollutants arriving at receiving waterways. (e) Major open drainage ways and detention facilities offer opportunities for multiple uses such as recreation, parts, and wildlife preserves.

The public should be aware that each user is responsible in sustaining the nature that God has entrusted to us. Users should not be careless in everything they do that can have an effect in the surroundings. Support the projects and campaigns of the government regarding the preservation of nature especially when it comes in flood prevention. Be a deliberate and functional individual start within yourself the change that you want in your place and country. To the one who has the responsibility in handling the pump station in Lagusnilad underpass in Lawton, always check the pump station. Maintain its effectiveness. Remember that the public

safety lies within their hands. Be responsible enough to maintain a good job for a better tomorrow.

6. Appendix

Figure 8. Past and Current Lagusnilad in Manila City

Figure 9. Floods in Manila City

Figure 10. New Pumping Station in Manila City

References

[1] T. U. Ganiron Jr, F. Aserios, M. Brigancia, M. Coderes and A. Yap, "The Gravitational Sub-Pumping Station along Riverside Road Intramuros Manila", BS Thesis, Civil Engineering Department, FEATI University, Manila, **(2003)**.
[2] E. Rivera, C. Guanzon, V. Opena, R. Papio and A. J. Hernandez, "Rehabilitation of the Drainage System and the Construction of Pumping Station that will serve as Flood Control in FEATI University for the Next Decades", BS Thesis, Civil Engineering Department, FEATI University, Manila, **(2002)**.
[3] T. U. Ganiron Jr, "An Empirical Investigation on End-Users' Acceptance of Compressed Lahar Sediment Blocks as Wall Panel", International Journal of ICT-aided Architecture and Civil Engineering, vol. 1, no. 1, **(2014)** June, pp. 19-30.
[4] N. Zoleta and B. Doracie, "Differential Impacts of Flood Hazards among the Street Children, the Urban Poor and Residents of Wealthy Neighborhoods in Metro Manila, Philippines", Mitigation and Adaptation Strategies for Global Change, vol. 7, no. 3, **(2002)**.
[5] G. Bankoff, "Cultures of Disaster: Society and Natural Hazard in the Philippines", Routledge, **(2012)**.
[6] E. Rivera, P. Castro and J. P. Toledo, "An Assessment of Drainage System in Metro Manila specially Espana Boulevard", BS Thesis, Civil Engineering Department, FEATI University, Manila, **(2002)**.
[7] L. Liongson, G.Tabios and P. Castro, "Pressures of Urbanization: Flood Control and Drainage in Metro Manila", UP-CIDS, **(2000)**.
[8] T. U. Ganiron Jr, C. Carreon, R. Gadingan, E. Layco and M. Melaur, "An Assessment of Flood Control in Metro Manila (Espana)", BS Thesis, Civil Engineering Department, FEATI University, Manila, **(2001**).
[9] J. Gaillard, C. Liamzon and J. Villanueva, "Natural 'Disaster: A Retrospect into the Causes of the late-2004 Typhoon Disaster in Eastern Luzon, Philippines", Environmental Hazards, vol. 7, no. 4, **(2007)**.
[10] T. U. Ganiron Jr, "Perception on the Effectivity of Flood Control Pump Station in Lagusnilad underpass in Lawton", BS Thesis, Civil Engineering Department, FEATI University, Manila, **(2004)**.
[11] J. Mullen, "Philippine Floods Cause More Chaos in Waterlogged Manila", CNN, Retrieved from http://edition.cnn.com/2013/08/21/world/asia/philippines-floods/, **(2013)** August 13.
[12] H. Hranjski, "Philippines Flooding Update: Waters Recede as Thousands Evacuated", The Weather Channel, Retrieved from http://www.weather.com/news/manila-philippines-shut-down-torrential-rains-20130819, **(2013)** August 21.
[13] H. Hranjski, "Floods Cover 60 Percent of Metro Manila", Philippine Star, Retrieved from http://www.philstar.com/headlines/2013/08/20/1112451/floods-cover-60-percent-metro-manila, **(2013)** August 20.
[14] H. Hranjski, "What's Making the Floods Worse in Manila?", Philippine Star, Retrieved from http://www.philstar.com/headlines/2013/08/23/1126031/whats-making-floods-worse-manila, **(2013)** August 20.
[15] N. Calleja, "How do you Solve a problem like Flooding on Lagusnilad?", Philippine Daily Inquirer, Retrieved from http://newsinfo.inquirer.net/472533/how-do-you-solve-a-problem-like-flooding-on-lagusnilad, **(2013)** August 22.
[16] "Floods in Metro Manila Subside; Lagusnilad still under Water", The Manila Times, Retrieved from http://manilatimes.net/floods-in-metro-manila-subside-lagusnilad-still-under-water/31777/, **(2013)** August 21.
[17] J. M. Elona, "Lagusnilad Underpass now open to Vehicles—MMDA", Philippine Daily Inquirer, Retrieved from http://newsinfo.inquirer.net/471543/lagusnilad-underpass-now-open-to-vehicles-mmda, **(2013)** August 21.
[18] J. M. Elona, "Floodwater in Manila Underpass still being pumped out", Philippine Daily Inquirer, Retrieved from http://newsinfo.inquirer.net/471455/floodwater-in-manila-underpass-still-being-pumped-out, **(2013)** August 21.
[19] D. Pata, "Monsoon floods turn Lagusnilad underpass into a Canal", GMA News, **(2013)** August 21. Retrieved from http://www.gmanetwork.com/news/photo/43180/monsoon-floods-turn-lagusnilad-underpass-into-a-canal.
[20] T. U. Ganiron Jr, "Investigation on the Use of Pleko Ceiling Board for Heat Insulator and Sound Proofing Material Applications", International Journal of Advanced Science and Technology, vol. 66, **(2014)** May, pp. 23-32.
[21] T. U. Ganiron Jr, "Size Properties of Mangoes using Image Analysis", International Journal of Bio-Science and Bio-Technology, vol. 6, no. 2, **(2014)** April, pp. 31-42.

Author

Tomas Ucol Ganiron Jr, This author obtained his Doctor of Philosophy in Construction Management at Adamson University (Philippines) in 2006, and subsequently earned his Master of Civil Engineering major in Highway and Transportation Engineering at Dela Salle University-Manila (Philippines) in 1997 and received Bachelor of Science in Civil Engineering major in Structural Engineering at University of the East (Philippines) in 1990. He is a registered Civil Engineer in the Philippines and Professional Engineer in New Zealand. His main areas of research interest are construction engineering, construction management, project management and recycled waste materials. He has been the resource person in various seminars in New Zealand (like in Auckland University of Technology, University of Auckland and University of Canterbury). He was connected with Advanced Pipeline System in New Zealand as Construction Manager wherein he supervised the sewerage and waterworks projects. He was the former Department Head of Civil Engineering in FEATI University (Manila) and former Department Head of Physics in Emilio Aguinaldo College (Manila). He is also very active in other professional groups like Railway Technical Society of Australasia and Australian Institute of Geoscientists where he became committee of Scientific Research. He has received the Outstanding Civil Engineer in the field of Education given by the Philippine Media Association Inc. (1996), ASTM Award CA Hogentogler (2008) by IPENZ in New Zealand and Outstanding Researcher (2013) in Qassim University, Buraidah City

.

