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A Multi-Hazard Plan to Address Flooding and Dengue Caused by Heavy Rainfall in Malabon City

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Abstract:

This study presents a comprehensive Disaster Risk Reduction and Management (DRRM) Action Plan for Malabon City integrates strategies for mitigating the risks of flooding and dengue transmission, which are exacerbated by heavy rainfall and climate change. The city's vulnerability is primarily due to its low-lying terrain, poor drainage systems, and exposure to storm surges. This plan adopts a multi-hazard approach, combining flood control, vector control, and public health initiatives to reduce the impact of both hazards. Through community-driven interventions, infrastructure improvements, and enhanced healthcare preparedness, the plan aims to reduce the socioeconomic and health impacts of flooding and dengue outbreaks. The success of this plan depends on effective collaboration among government agencies, healthcare providers, and local communities.

Keywords **— Put your keywords here, keywords are separated by comma.**

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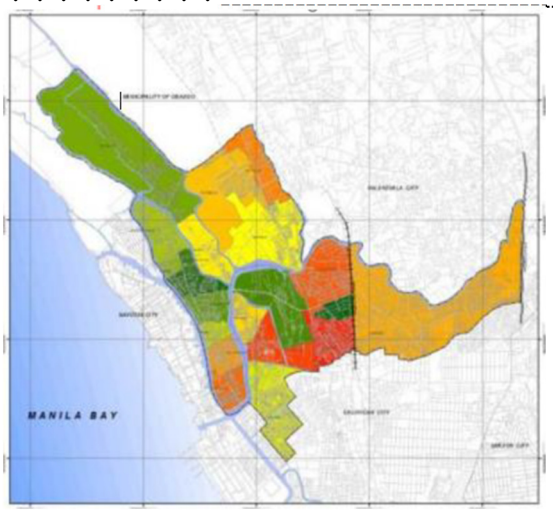
I. INTRODUCTION

Malabon City, located in Metro Manila, faces recurring flood hazards due to its geography, poor drainage, and proximity to major water bodies. These conditions, coupled with rising sea levels and increased rainfall from climate change, exacerbate the city's flood risks. Dengue fever, a major public health concern, thrives in post-flood environments where stagnant water serves as breeding grounds for Aedes mosquitoes. The city experiences frequent dengue outbreaks, particularly in flood-prone barangays. This action plan seeks to address the interconnected risks of flooding and dengue through integrated risk reduction measures, improved community preparedness, and effective healthcare responses.



II. SCOPE AND LIMITATIONS

This multi-hazard action plan focuses on mitigating flooding and dengue risks in Malabon City, particularly in flood-prone barangays like Longos, Catmon, and Tonsuya. It includes flood control measures (upgrading drainage systems, building flood barriers), vector control (community-driven mosquito control, public health education), and healthcare preparedness

(enhancing local health infrastructure and response to dengue outbreaks). The plan is designed for collaboration between local and national authorities, healthcare providers, and the community to build resilience against these interconnected hazards.

The plan's limitations include resource constraints, such as insufficient funding for infrastructure upgrades and potential resistance from some community members to adopting preventive health measures. Additionally, the unpredictable nature of extreme weather events presents challenges for timely intervention and response.

III. SITUATIONAL ANALYSIS

This analysis outlines global and local trends in disaster risk reduction, focusing on the rising impacts of climate change and the increasing frequency of hydro-meteorological hazards like typhoons, floods, and disease outbreaks such as dengue. Globally, extreme weather events have intensified due to climate change, urbanization, and population growth, with Southeast Asia experiencing the highest number of disaster-related fatalities and economic losses. Multi-hazard events, such as typhoons triggering floods and dengue outbreaks, are becoming more common and complex, creating significant challenges for disaster preparedness and management.

Locally, the Philippines is one of the most disaster-prone countries, facing frequent typhoons, severe flooding, and landslides. Malabon City, with its low-lying terrain, poor drainage systems, and proximity to major rivers, is highly vulnerable to flooding. The city's infrastructure struggles to handle the increasing volume of water, causing widespread flooding, especially in barangays like Longos, Catmon, and Tonsuya. These floods create ideal breeding grounds for Aedes mosquitoes, leading to dengue outbreaks.

Malabon's healthcare system is often overwhelmed during major flood events, with limited resources to manage the surge in dengue cases. The economic impact of flooding is severe, particularly for small businesses and low-income households, which suffer significant property damage and income loss. Despite efforts to improve disaster risk management, such as flood control and dengue prevention campaigns, challenges in coordination, infrastructure, and community participation remain.

A comprehensive, multi-hazard action plan is crucial to enhance flood control, improve healthcare infrastructure, and integrate vector control measures, reducing the vulnerability of Malabon to these interconnected hazards.

IV. RESEARCH DESIGN

The proposed Multi-Hazard Action Plan for Malabon City aims to assess and strengthen the city's readiness, response, and resilience to the combined risks of flooding and dengue transmission. A mixed-methods approach will be used, integrating quantitative surveys, qualitative focus group discussions (FGDs), and documentary analysis to gain a comprehensive understanding of the community's current preparedness levels.

Quantitative data will be gathered through structured surveys to identify measurable trends in flood risk awareness, dengue prevention practices, and disaster preparedness across different barangays. This data will highlight correlations between demographic factors, community engagement, and disaster readiness. Qualitative data will be collected through focus group discussions to explore residents' personal experiences, perceptions, and barriers to engaging in flood and dengue prevention activities. These discussions will also provide insights into local challenges in emergency response and healthcare access during flood events.

Additionally, documentary analysis of existing disaster risk management reports, health data, and historical flood and dengue records will support the research. This approach ensures that the action plan is both evidence-based and tailored to the specific needs of Malabon's communities, facilitating the development of practical, community-driven disaster resilience strategies.

V. RESULTS OF THE SURVEY

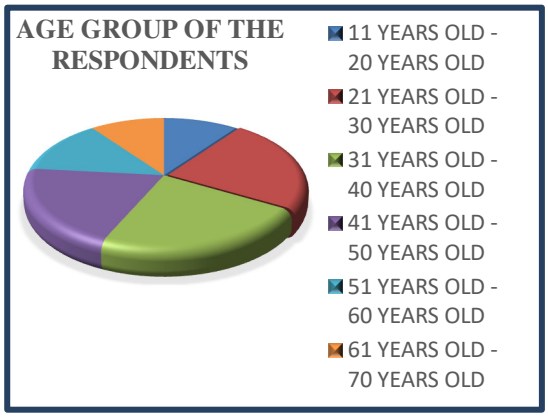


Fig. 2 Age Distribution of the Respondents

The survey collected data from 30 respondents, with the majority (80%) falling within the age range of 25 to 59 years, representing the most active working age group. This indicates that the population's primary workforce is well-represented in the study. A smaller proportion of respondents were in the 60 and above age group (13.33%), while the youngest group, aged 18-24 years, made up only 6.67% of the total respondents. This distribution suggests that while the majority of perspectives come from the adult working population, the experiences and needs of younger and older age groups may be underrepresented in the findings.

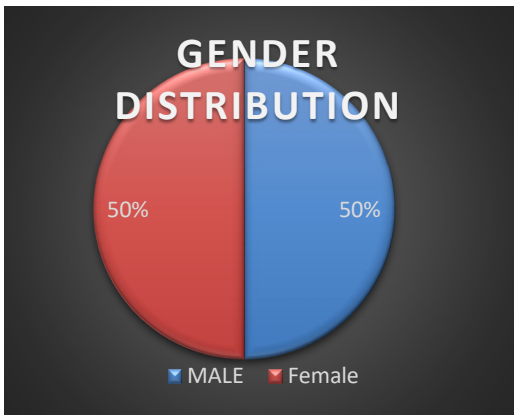


Fig. 3 Gender Distribution

The chart presents a balanced gender distribution, with equal representation of male and female respondents, each constituting 50% of the total sample. This indicates a well-rounded data set where both genders are equally represented, providing a fair perspective for analysis and ensuring that the findings are not skewed by gender imbalances. This equality in representation may contribute to more accurate and unbiased insights when analyzing the data for gender-related trends, behaviors, or preferences.

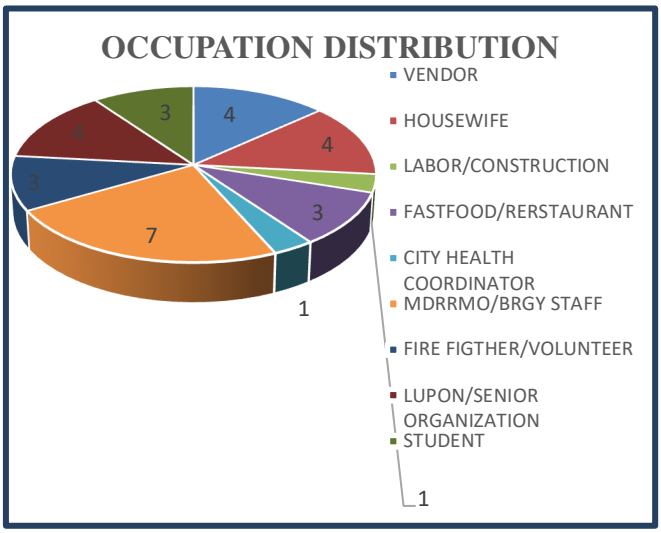


Fig. 4 Occupation of the Respondents

This shows the occupational distribution of 30 respondent reflecting a diverse range of professions. The largest group (23.33%) consists of Barangay staff, indicating strong participation from local government and emergency response personnel. Other notable groups include vendors, housewives, and members of the Senior Organization, each representing 13.33%, highlighting the involvement of small business owners, household managers, and community leaders. Occupations like labor, fast food employees, firefighters/volunteers, and students each account for 10%, showing a balanced spread across various sectors. The least represented occupation is City Health Coordinator, with only 3.33% participation, suggesting limited input from the healthcare sector. The mean number of respondents per occupation is 3.33, with the mode being MDRRMO/Barangay staff. The median of 3 respondents shows that most occupations have between 3 to 4 participants. This distribution provides a broad representation of different social and economic backgrounds, making the study inclusive. However, the underrepresentation of the healthcare sector may limit insights from that field. Overall, the diverse occupations enhance the credibility of the research by capturing multiple perspectives across sectors.

Table 1.
KNOWLEDGE AND AWARENESS

STATEMENTS	WEIGTED MEAN	INTERPRETATION
I have sufficient knowledge whether our residence is included in flood-prone areas.	4.37	Agree
Is your barangay prepared if there is sudden widespread flooding caused by heavy rainfall?	4.27	Agree
I have sufficient knowledge about the evacuation plans if our area is flooded	4.4	Agree
I have sufficient knowledge and understanding about flood preparedness	4.5	Agree
I have sufficient knowledge and understanding about Dengue.	4.3	Agree

Legend: 5 - Strongly Agree; 4 – Agree; 3 – Neither agree nor disagree, 2 – Disagree; 1 – Strongly Disagree

This response assessed the knowledge and awareness of the respondents regarding flood risks and dengue prevention. The data indicates a generally high level of awareness among the community. A majority of respondents strongly agree (mean score 4.10) that they are knowledgeable about the risks associated with floods and dengue, with flood forecasting and early warning systems being highly recognized (mean score 4.50). However, the survey reveals areas of improvement, particularly in the accessibility and understanding of disaster preparedness systems. While communication and warning systems are rated positively (mean score 4.37), the need for better feedback channels and more inclusive information dissemination is identified, with a lower score of 3.93. This suggests that while the community is aware, there are gaps in the efficiency and accessibility of disaster-related communication systems. Overall, the data highlights a solid foundation of knowledge and awareness, but stresses the importance of strengthening communication channels for better preparedness and response.

Table II
PREPAREDNESS AND EARLY WARNING SYSTEMS AND FLOOD MANAGEMENT AND RESPONSE

STATEMENTS	AVERAGE	INTERPRETATION
There is a sound and reliable early warning system for heavy rains and flooding	4.43	Agree
Drainage systems are effective in preventing flooding and clogging of canals	4.1	Agree
The emergency response team has sufficient equipment and personnel for rescue and relief operations.	4.23	Agree
The local government regularly conducts risk assessment regarding flooding	4.17	Agree
There is sufficient information and campaigns about flood preparedness	4.27	Agree
There is adequate flood control measures (e.g., flood barriers, proper drainage system) to prevent flooding.	4.17	Agree
The evacuation plan is effective and easy for residents to understand.	4.43	Agree
There is sufficient relief goods (e.g., food, medicine, water) in evacuation centers.	3.9	Neither agree nor disagree
Effective coordination between local government and agencies in flood response	4.07	Agree
Area is quickly repaired after flooding to prevent stagnant water	4.2	Agree

Legend: 5 - Strongly Agree; 4 – Agree; 3 – Neither agree nor disagree, 2 – Disagree; 1 – Strongly Disagree

This table shows that the community in Malabon has a solid understanding of flood risks and is generally prepared for flood events. Most respondents agree that local authorities have effective monitoring and forecasting systems (mean score 4.50) and communication channels for flood warnings (mean score 4.37). However, there is room for improvement in emergency response and feedback mechanisms (mean score 3.93). Regarding flood management, respondents indicated that the city has strong measures in place, including safe

spaces, elevated roads, and sanitary shelters (mean scores 4.30 and 4.40). Additionally, public awareness campaigns and resource management are highly regarded (mean score 4.40). While the community shows good preparedness, enhancing communication systems and emergency response teams would further improve flood management and resilience.

TABLE III
DENGUE PREVENTION AND CONTROL MEASURES

STATEMENTS	AVERAGE	INTERPRETATION
Regular cleaning of stagnant water and removal of possible mosquito breeding sites are carried out	4.03	Agree
The community actively participates in anti-dengue programs	4.17	Agree
There is adequate Fogging and larvicidal treatment in areas with high dengue cases	4.1	Agree
There is sufficient information from health workers about dengue prevention and its symptoms.	4.13	Agree
Proper collection and disposal of garbage to prevent the proliferation of mosquitoes.	3.67	Neither agree nor disagree
Health centers have sufficient equipment and personnel to treat dengue patients	4.13	Agree
Free or affordable dengue testing and treatment health facilities	4.07	Agree

Legend: 5 - Strongly Agree; 4 – Agree; 3 – Neither agree nor disagree, 2 – Disagree; 1 – Strongly Disagree

This table evaluates the community's engagement in dengue prevention and control measures. The results indicate that the community is generally aware of dengue risks and has a moderate level of preparedness. A significant number of respondents agree that the local government's efforts to control mosquito breeding sites and provide information on dengue prevention are effective (mean score 3.43). However, there is a need for more consistent action from residents, as the score for community participation in dengue control activities is lower (mean score 2.67).

The survey highlights that while the local government has made efforts to educate the public about dengue prevention, including providing information and resources, these efforts could be enhanced with greater community involvement. There is also room for improvement in ensuring better cleanliness of public spaces and more robust mosquito control measures to reduce the risk of outbreaks. Overall, the data reflects a positive awareness of dengue prevention but points to the need for increased community action and more comprehensive local government initiatives.

TABLE IV
COORDINATION AND COMMUNITY INVOLVEMENT AND POST-FLOOD RECOVERY AND MONITORING

STATEMENTS	AVERAGE	INTERPRETATION
There is good coordination between the local government, DOH and other agencies in responding to flooding and dengue.	4.1	Agree
There is adequate trainings and volunteer program for disaster response and dengue prevention	4.2	Agree
Ordinances and regulations regarding cleanliness and sanitation are strictly enforced	4.03	Agree
Schools, businesses and establishments actively participate in dengue prevention campaigns	4.27	Agree
There are sufficient funds for personnel for the continuous implementation of the program against flooding and dengue	3.83	Neither agree nor disagree
Post-flood clean-up activities are effective in preventing the proliferation of mosquitoes	4.2	Agree

Legend: 5 - Strongly Agree; 4 – Agree; 3 – Neither agree nor disagree, 2 – Disagree; 1 – Strongly Disagree

This table assesses the effectiveness of coordination, community involvement, and post-flood recovery efforts. The data indicates that while there is a moderate level of community involvement in disaster preparedness and recovery efforts (mean

score 2.53), the coordination between local government agencies and community members requires improvement. Respondents agree that the community is somewhat prepared, but local authorities need to strengthen coordination and resource mobilization to ensure a faster and more efficient recovery (mean score 2.43).

Regarding post-flood recovery, the respondents believe that local authorities take necessary actions, such as maintaining safe spaces and providing sanitation facilities (mean score 4.40), ensuring adequate recovery support. The monitoring of flood impacts and the creation of resource inventories to guide recovery efforts are also seen as important (mean score 4.33). However, the overall satisfaction with the pace of recovery and the involvement of local communities in these processes indicates room for improvement. Strengthening both coordination and community engagement would enhance the effectiveness of post-flood recovery and monitoring efforts.

VI. SWOC ANALYSIS

STRENGTH	WEAKNESS
There is a high level of community awareness regarding flood risks and dengue transmission, with residents acknowledging the need for preventive actions.	The drainage system is inadequate and often clogged, leading to severe flooding during heavy rainfall and typhoon events.
The local government actively participates in flood control initiatives and health campaigns, including regular clean-up drives and awareness programs.	There are insufficient financial resources and personnel to implement large-scale flood control and dengue prevention measures.
The Department of Health (DOH) collaborates with the city health department to run dengue awareness programs and provide mosquito control resources.	While there is awareness, active community participation in preventive measures such as waste management and mosquito control is inconsistent.
Malabon has established evacuation centers and disaster response teams to assist residents during floods and emergencies.	Local healthcare facilities are often overwhelmed during flood events, with limited medical supplies and staff to handle a surge in dengue cases.
Strong collaboration between local government units (LGUs), healthcare providers, and national agencies (DOH, DPWH) ensures a unified approach to disaster risk management.	Insufficient real-time data collection on flood events and dengue cases hampers timely and effective decision-making
OPPORTUNITIES	**CHALLENGES**
By investing in climate-resilient infrastructure, such as flood barriers and drainage systems, Malabon can reduce future flood risks and mitigate the impact of climate change.	Changes in local governance or policy priorities may affect the continuity and implementation of disaster risk management plans.
Implementing modern technology for flood forecasting, early warning systems, and disease surveillance can improve disaster preparedness and response efficiency.	The continued growth of Malabon's population and urban areas places pressure on existing infrastructure, making it harder to manage flooding and disease outbreaks.
Strengthening community engagement through education campaigns and volunteer programs can enhance participation in dengue prevention and flood risk management.	Competing priorities and limited financial resources may delay the implementation of key flood and dengue control measures.
Collaborating with national agencies and NGOs to improve healthcare infrastructure and resources will enable Malabon to better manage health emergencies during floods and dengue outbreaks.	The unpredictability of climate events, such as extreme rainfall or sea-level rise, complicates long-term planning and infrastructure investment.
Engaging with private companies and businesses in Malabon can provide additional funding, resources, and expertise for implementing flood control and vector management programs.	Some residents may resist government-led initiatives or fail to adopt recommended health practices, such as the removal of mosquito breeding sites or flood preparedness activities.

VII. PESTEL ANALYSIS

Political

Malabon's local government is actively involved in disaster risk management, with initiatives like flood control, dengue prevention campaigns, and evacuation plans. However, political instability, changes in leadership, or shifting policy priorities could disrupt these ongoing efforts and affect resource allocation. National policies like the Philippine Disaster Risk Reduction and Management Act (RA 10121) provide a legal framework for local actions, but the effectiveness of these policies is often hindered by challenges in coordination between national and local agencies. Inter-agency communication and resource sharing are key to ensuring smooth implementation but remain inconsistent at times.

Economic

Malabon faces significant budget constraints, which restrict the city's ability to improve infrastructure, such as updating its drainage systems or building flood barriers. Frequent and severe flooding disrupts local businesses, particularly in vulnerable areas, leading to significant economic losses. Small and medium-sized businesses in flood-prone barangays suffer from reduced productivity, property damage, and loss of income. The city's low-income households, often located in informal settlements, have limited financial capacity to recover from flood damage or the healthcare costs of dengue, further deepening socio-economic inequalities. The city's vulnerability to these disasters underscores the need for a more resilient and sustainable economic model that can withstand the impacts of extreme weather events.

Social

Community awareness of flood risks and dengue transmission is high in Malabon, but participation in preventive actions remains inconsistent. While public health campaigns raise awareness about the importance of sanitation and mosquito control, many residents still fail to take active measures to eliminate breeding sites or properly dispose of waste. Vulnerable groups, such as children, the elderly, and those with underlying health conditions, are at greater risk during floods and dengue outbreaks. They often lack the means or knowledge to protect themselves. Enhanced community engagement and education efforts are crucial to ensure that residents, especially those in informal settlements, actively participate in dengue prevention and flood preparedness measures. Social barriers like misinformation or distrust in government initiatives may hinder the success of such programs.

Technological

The integration of advanced technology into flood forecasting, real-time monitoring systems, and dengue surveillance would greatly enhance Malabon's ability to respond to disasters. Technologies such as Geographic Information Systems (GIS) for flood mapping and mobile apps for health alerts could help inform timely interventions and improve the coordination of resources during emergencies. However, Malabon faces challenges such as limited internet access in some areas, insufficient technological infrastructure, and a lack of technical expertise to fully implement these systems. Additionally, healthcare technologies like telemedicine and digital health records could improve the efficiency of medical responses during dengue outbreaks, but the required investment and training may be beyond the current capabilities of the local health system.

Environmental

Malabon is highly vulnerable to the impacts of climate change, with rising sea levels, increased rainfall, and more intense storms exacerbating the flood risks. The city's drainage systems, often clogged with waste, are insufficient to cope with the increasing volume of water during heavy rainfall, leading to prolonged flooding. Moreover, the pollution in the Tullahan and Malabon Rivers exacerbates both flooding and public health risks by contaminating water sources, making them more likely to harbor mosquito breeding sites. Malabon could benefit from nature-based solutions, such as rainwater harvesting, river rehabilitation, and reforestation programs, which can help reduce flood risks and improve water quality. However, these initiatives require sustained funding and long-term environmental management strategies that have yet to be fully implemented. Moreover, addressing environmental challenges like waste management and pollution control is critical to reducing the severity of flooding and preventing further degradation of Malabon's natural resources.

Legal

Malabon operates under national disaster risk management laws, including RA 10121, which mandates the establishment of disaster preparedness plans and funding allocations for local government units. However, enforcement of land use regulations and zoning laws remains weak, especially in

informal settlements and flood-prone areas, leading to unregulated construction and further exposure to flood risks. Moreover, despite laws that mandate mosquito control and sanitation, enforcement at the local level is often inconsistent. Strengthening legal frameworks to address unregulated development and improving the enforcement of floodplain management and environmental protection laws are necessary to mitigate risks. Similarly, stricter regulations for public health, waste management, and vector control are essential to reducing dengue transmission and ensuring the health and safety of residents.

VIII. ACTION PLAN

TABLE V
ACTION PLAN FOR GOAL 1 OBJECTIVE 1.1

Goal 1	Minimize flood-related risks through targeted infrastructure upgrades and proactive disaster mitigation practices
Objective 1.1	Collaborate with DPWH and MMDA to Upgrade floodgates and implement climate-resilient flood control systems in flood-prone barangays by 2026-2028.
Outcome	Significant reduction in flood risks and enhanced flood control infrastructure.
Programs, Projects, and Activities (PPA)	1.1.1. Assessment and Planning 1.1.2. Design and Upgrade floodgates Conduct Tree planting and Tree Growing Activities

Malabon City is highly flood-prone due to its low elevation and proximity to rivers like Malabon, Tullahan, and Tinajeros. A major incident in June 2024, when a barge damaged the Navotas Floodgate, led to severe flooding even without rain, exposing the weaknesses in the city's flood defenses. This highlighted the need for climate-resilient flood control systems.

To address this, the city plans major upgrades in collaboration with DPWH and MMDA, focusing on high-risk barangays such as Longos, Tonsuya, and Catmon. The project includes ₱8 million for design and compliance, ₱35 million for materials and equipment, ₱5 million for labor, ₱2 million for testing and quality assurance, and a ₱2 million contingency fund — totaling ₱52 million. The program is technically feasible and directly tackles Malabon's flood vulnerabilities, aiming to reduce flood severity and protect lives and property, depending on local government funding availability.

TABLE VI
ACTION PLAN FOR GOAL 1 OBJECTIVE 1.2

Goal 1	Minimize flood-related risks through targeted infrastructure upgrades and proactive disaster mitigation practices.
Objective 1.2	Upgrade, desilt, and declog at least 80% of major drainage canals and stormwater inlets citywide by 2028 to reduce flood stagnation and improve runoff capacity.
Outcome	Improved drainage systems, reduced flooding, and better stormwater management.
Programs, Projects, and Activities (PPA)	1.2.1. Launch a city-wide drainage system rehabilitation program focusing on desilting and system upgrades in priority areas

Malabon's drainage system has contributed to severe flooding during heavy rains due to blockages from waste, debris, and silt buildup. Typhoons like Ondoy (2009) and Ulysses (2020) highlighted the issue, with prolonged flooding caused by inadequate drainage maintenance. To tackle this, the city plans to upgrade, desilt, and declog 80% of major drainage systems by 2028, improving stormwater management, reducing flood duration, and preventing health risks like dengue. The total budget for the drainage upgrade is ₱5.78 million, which includes costs for site assessment (₱150,000), labor (₱1.23 million), equipment rental (₱1.2 million), waste disposal (₱1 million), materials (₱1.5 million), monitoring (₱500,000), and project management (₱350,000). This project is technically feasible and relevant, aiming to enhance Malabon's drainage efficiency and reduce flooding and health risks, though it depends on LGU funding.

TABLE VII
ACTION PLAN FOR GOAL 1 OBJECTIVE 1.3

Goal 1	Minimize flood-related risks through targeted infrastructure upgrades and proactive disaster mitigation practices.
Objective 1.3	Promote and implement nature-based solutions, such as urban gardens and green infrastructure, to enhance rainwater absorption, mitigate urban heat islands, and improve the overall resilience of vulnerable urban spaces by 2026-2027.
Outcome	Reduced flood risks and increased green space for sustainable water management.

Programs, Projects, and Activities (PPA)	1.3.1. Best Barangay Urban Green Infrastructure Contest.

This table presents a PPA matrix for Goal 1, Objective 1.3, focused on minimizing flood risks through nature-based solutions, including urban gardens, green spaces, rain gardens, permeable pavements, and water-harvesting systems by 2028. The initiative also addresses public health concerns, particularly dengue transmission, through the "Best Barangay Urban Green Infrastructure Contest." This contest, running from 2025 to 2028, will promote mosquito-repelling plants, natural filtration systems, and biological mosquito control in 21 barangays. Prizes for the contest include ₱50,000 in gift certificates for first place, ₱30,000 in seedlings for second, and ₱20,000 in planting materials for third. The project will be managed by CENRO and Barangay Captains, with funding from the LGU Environment Fund and partner organizations. The expected outcomes are reduced flood risks, increased green spaces, and fewer dengue breeding sites.

TABLE VIII
ACTION PLAN FOR GOAL 2 OBJECTIVE 2.1

Goal 2	Reduce mosquito populations through proactive and targeted environmental interventions
Objective 2.1	Intensify quarterly "Aksyon Kontra Dengue" campaigns that combine larvicide application, environmental cleanup, biological controls at least 80% of dengue-prone barangays to reduce mosquito populations and dengue cases by 30% by the end of 2027.
Outcome	Achieved significant reduction in mosquito populations and dengue cases through effective, sustainable, and community-based mosquito control interventions.
Programs, Projects, and Activities (PPA)	2.1.1. Organize quarterly "Aksyon Kontra Dengue" campaigns that combine larvicide application, environmental cleanup, biological controls in at least 80% of dengue-prone barangays to reduce mosquito populations and dengue cases by 30% by the end of 2027.

This table outlines Goal 2, Objective 2.1, aimed at reducing mosquito populations and dengue incidences through intensified quarterly "Aksyon Kontra Dengue" campaigns. The campaigns will focus on larvicide application, environmental cleanup, and biological controls like Wolbachia-infected mosquitoes and larvivorous fish. Targeting at least 80% of dengue-prone barangays, the initiative will be overseen by the City Health Office, Barangay Health Units, and the Environmental and Sanitation Office, with funding from the LGU Health Fund. The total budget is ₱234,000, covering various expenses including volunteer incentives, cleaning materials, larvicide, biological controls, community engagement, and insecticide-treated materials. The initiative is deemed feasible and effective, combining biological controls, environmental management, and community involvement for sustainable dengue reduction and improved public health.

TABLE IX
ACTION PLAN FOR GOAL 3 OBJECTIVE 3.1

Goal 3	Build informed, prepared, and resilient communities through inclusive capacity-building.
Objective 3.1	Conduct bi-annual multi-hazard drills by 2027 in schools, hospitals, businesses, and 5 vulnerable barangays, with 70% participation from vulnerable groups (elderly, children, persons with disabilities). The drills will focus on evacuation during flooding and dengue prevention, with 80% of participants demonstrating a 90% understanding of both procedures.
Outcome	Increased community preparedness for flooding and dengue outbreaks. 70% participation from vulnerable groups, and 80% of participants demonstrated understanding of evacuation procedures during floods and dengue control measures. Communities became more resilient, with reduced flood-related risks and dengue outbreaks.
Programs, Projects, and Activities (PPA)	3.1.1. Execute Integrated Flood and Dengue Preparedness Drill for Schools and Vulnerable Communities.

Malabon City aims to improve its disaster preparedness, focusing on both flooding and dengue outbreaks, with special attention to vulnerable groups like the elderly, youth, and persons with disabilities. Bi-annual multi-hazard drills will simulate scenarios such as floods and dengue surges, testing evacuation procedures, resource distribution, and communication systems. Involving schools, hospitals, and businesses, these drills will enhance

coordination, identify gaps in current plans, and ensure effective responses during actual emergencies. The initiative is designed to build community resilience and improve disaster response, making it both relevant and feasible for Malabon.

TABLE X
ACTION PLAN FOR GOAL 3 OBJECTIVE 3.2

Goal 3	Build informed, prepared, and resilient communities through inclusive capacity-building.
Objective 3.2	Launch an integrated "Ligtas Malabon" IEC campaign to raise awareness about flood and dengue risks, leveraging digital, print, and community-based channels by 2026.
Outcome	Broad public awareness and increased community engagement in flood and dengue prevention efforts.
Programs, Projects, and Activities (PPA)	3.2.1. Implement an integrated media campaign (social media, radio) reaching 10,000 households

This table details the "Ligtas Malabon" IEC campaign under Goal 3, Objective 3.2, aiming to raise flood and dengue awareness among 10,000 households (30% via social media). It includes posters, flyers, and digital content, with implementation by the Public Information Office in Q1 2026. The ₱100,000 budget covers materials (₱35K), media (₱40K), community activities (₱10K), and contingencies (₱5K), funded by the LGU IEC Fund. The goal is to enhance public awareness and community resilience

TABLE XI
ACTION PLAN FOR GOAL 3 OBJECTIVE 3.3

Goal 3	Build informed, prepared, and resilient communities through inclusive capacity-building
Objective 3.3	Launch a social media contest on platforms such as Instagram, Facebook, and TikTok to engage young people in disaster preparedness activities, encouraging them to share creative preparedness tips and disaster response plans by 2026.
Outcome	Empowered youth driving awareness and preparedness actions in their communities.
Programs, Projects, and Activities (PPA)	3.3.1. Youth-Driven Disaster Preparedness Social Media Contest

The "Youth-Driven Disaster Preparedness Social Media Contest" aims to engage Malabon's youth in promoting flood and dengue preparedness through Instagram, Facebook, and TikTok in Q1 2026. Led by CDRRMO with Barangay Youth Councils, it targets full participation across 21 barangays using #LigtasMalabon**.** ₱50,000 in prizes, funded by donations, will reward creative entries. The goal is to empower youth and strengthen community resilience

TABLE XII
ACTION PLAN FOR GOAL 4 OBJECTIVE 4.1

Goal 4	Ensure timely and efficient response to flood emergencies and dengue cases.
Objective 4.1	Upgrade the Longos, Catmon, and Tonsuya Health Centers to include the capacity to provide diagnostic testing for dengue by 2028
Outcome	Enhanced diagnostic capacity in the three health centers, improving early detection and response to dengue cases. Increased accessibility of diagnostic services for the local population.
Programs, Projects, and Activities (PPA)	4.1.1. Upgrade Longos, Catmon, and Tonsuya Health Centers to include the capacity for diagnostic testing for dengue by 2027

By 2027**,** Longos, Catmon, and Tonsuya Health Centers will be upgraded with dengue diagnostic units, funded **by** ₱8–10 million from the DOH and LGU Health Fund. Led **by** CHO and DOH**,** the project improves early detection and response, reduces hospital referrals, and strengthens Malabon's dengue control and public health capacity.

TABLE XIII
ACTION PLAN FOR GOAL 4 OBJECTIVE 4.2

Goal 4	Ensure timely and efficient response to flood emergencies and dengue cases
Objective 4.2	Ensure 100% of evacuation centers are stocked with flood and dengue-specific hygiene kits by end of 2027
Outcome	Improved preparedness for flood and dengue emergencies, ensuring evacuees' health and safety
Programs, Projects, and Activities (PPA)	4.2.1. Procure and distribute hygiene kits to 5,000 evacuees in 5 evacuation centers

By 2027**,** Malabon will provide hygiene kits to 5,000 evacuees in evacuation centers to prevent dengue and ensure sanitation. Funded with ₱2 million from LGU and donors, the project strengthens health and safety during floods.

TABLE XIV
ACTION PLAN FOR GOAL 4 OBJECTIVE 4.3

Goal 4	Ensure timely and efficient response to flood emergencies and dengue cases
Objective 4.3	Provision of additional 10 Handheld Radios by 2027 to ensure effective communication among emergency response teams, health services, and dengue control units during flood and dengue emergencies.
Outcome	Provisioned of 10 handheld radio, enhanced communication among emergency response teams and health services during disasters and dengue outbreaks in Malabon City. Improved coordination, reduced response times, and facilitated real-time information sharing. More efficient disaster management, better preparedness, and increased community trust in local authorities' ability to manage emergencies.
Programs, Projects, and Activities (PPA)	4.3.1. Provision of additional 10 Handheld Radios by 2027

Malabon will deploy 10 handheld radios to improve emergency communication during floods and dengue outbreaks, enhancing coordination, response speed, and disaster management across teams.

TABLE XV
ACTION PLAN FOR GOAL 5 OBJECTIVE 5.1

Goal 5	Facilitate the recovery of safer, healthier, and more resilient communities through integrated rebuilding, sustainable health service continuity, and data-driven recovery systems
Objective 5.1	Rehabilitate all damaged water, drainage, and health infrastructures within 12 months of major flood events.
Outcome	Rapid and effective restoration of critical infrastructures to ensure public safety and health
Programs, Projects, and Activities (PPA)	5.1.1. Drone Survey for Infrastructure Damage Assessment

Malabon will use LGU-owned drones to assess flood damage to key infrastructures within two weeks, aiding quick recovery. The ₱100,000 budget covers pilot fees, data analysis, reporting, and contingencies, ensuring a fast, cost-effective damage assessment.

TABLE XVI
ACTION PLAN FOR GOAL 5 OBJECTIVE 5.2

Goal 5	Facilitate the recovery of safer, healthier, and more resilient communities through integrated rebuilding, sustainable health service continuity, and data-driven recovery systems
Objective 5.2	Ensure continuity of health services post-disaster through reserve health worker pools and telehealth integration by 2028.
Outcome	Uninterrupted healthcare services during disaster recovery, improving health outcomes
Programs, Projects, and Activities (PPA)	5.2.1. Implement Low-cost Telemedicine System

Malabon will implement a telemedicine system for 10,000 residents post-flood, offering 24/7 remote healthcare via WhatsApp and Messenger. With a ₱400,000 budget, it funds platform setup, training for 30 health workers, and operations, ensuring continuous, affordable medical support during disasters.

IX. CONCLUSION

This Multi-Hazard action plan presents a science-based, localized strategy to address the compound risks of flooding and dengue outbreaks in Malabon City, both of which are intensified by heavy rainfall, urbanization, and climate change. Aligned with the four thematic areas of disaster risk reduction—prevention and mitigation, preparedness, response, and recovery—the plan is grounded in hazard assessments, empirical survey data, and community engagement to ensure contextual relevance and technical rigor.

Strategic interventions include climate-resilient infrastructure upgrades, drainage system rehabilitation, nature-based flood mitigation, enhanced dengue diagnostic capacity, and targeted information campaigns. Each intervention is supported by a performance-based monitoring and evaluation framework to ensure effectiveness, accountability, and continuous improvement.

By integrating scientific evidence with inclusive governance and inter-agency coordination, the plan aims to build long-term resilience and reduce Malabon City's vulnerability to hazards driven by heavy rainfall and other environmental stressors.

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