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A Multi-Hazard Mitigation Plan for Rain-Induced Landslides and Waterborne Diseases in Mabini, Batangas

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Abstract:

This study explores the compounded hazards of rain-induced landslides and waterborne diseases in Mabini, Batangas, an area particularly vulnerable to extreme weather events, including typhoons and monsoon rains. Given its mountainous terrain, Mabini is at significant risk for both landslides and the outbreak of waterborne diseases like leptospirosis, cholera, and dysentery, which become more prevalent during and after rainfall events. The study investigates the local infrastructure, evaluates disaster risk management (DRM) strategies, and proposes a detailed action plan aimed at improving disaster preparedness, response strategies, and community resilience. Recommendations focus on enhancing slope stabilization, improving flood control, bolstering early warning systems, and strengthening community-based disaster management (CBDRRM) strategies.

Keywords: **Mabini, Batangas, Rain-induced Landslides, Waterborne Diseases, Multi-hazard, Mitigation Plan**

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I. INTRODUCTION

The Philippines is located in the Pacific Typhoon Belt and is frequently hit by typhoons, floods, and landslides. Mabini, Batangas, which lies within this region, is particularly vulnerable to these hazards, especially during the rainy season when the risk of rain-induced landslides and waterborne diseases increases. This study provides a comprehensive analysis of these risks and offers mitigation strategies tailored to the unique challenges faced by the municipality.

Mabini's geographical characteristics—steep hillsides, high rainfall, and proximity to the sea—make it highly susceptible to landslides, especially during the typhoon season. The combination of saturated soils and steep slopes triggers landslides that cause significant destruction. The effects of these landslides are compounded by the contamination of local water sources, leading to outbreaks of waterborne diseases. This study investigates these risks and the current mitigation measures, emphasizing the need for improved infrastructure and public health interventions.

II. SCOPE AND LIMITATION

The plan addresses the dual threats of rain-induced landslides and waterborne diseases in Mabini, Batangas, focusing on assessing and mitigating risks from contaminated water sources and landslide-prone areas. It aims to evaluate health risks from outbreaks like leptospirosis, cholera, and

dysentery, and examine local infrastructure vulnerabilities. The plan emphasizes developing early warning systems, promoting sanitation education, and enhancing disaster preparedness. Key stakeholders, including LGUs, DRRM councils, health authorities, and the community, are involved in implementation.

However, the plan faces limitations, including limited resources for infrastructure projects, insufficient data on past events, logistical challenges during typhoons, weather unpredictability, and potential community resistance. Political inefficiencies, inter-agency coordination issues, and environmental constraints like steep terrain also hinder effective execution.

III. SITUATIONAL ANALYSIS

Rain-induced landslides and waterborne diseases are global issues, especially in regions with mountainous terrain and frequent rainfall. The study references examples from other countries, such as Nepal and Colombia, where landslides triggered by heavy rains have destroyed infrastructure and led to public health crises. These events underscore the importance of integrated disaster management strategies that address both physical destruction and public health risks.

In Mabini, many barangays are identified as being at high risk for landslides due to steep slopes and soil instability. These hazards, often exacerbated by human activities such as deforestation and road construction, threaten local communities. The study also assesses the prevalence of waterborne diseases in Mabini, focusing on the contamination of water sources by floodwaters. The research evaluates the municipality's health infrastructure and identifies gaps in sanitation, water supply, and disease prevention measures.

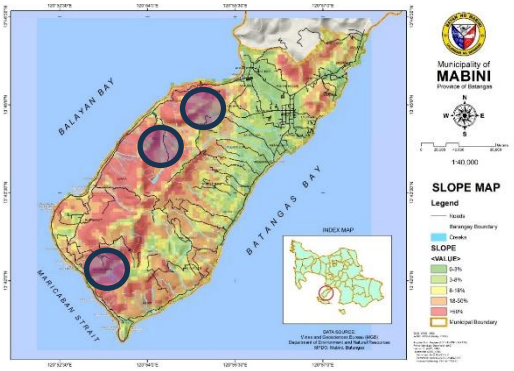

Fig. 1 Slope Map of Municipality of Mabini, Batangas. *Barangay San Jose, Solo and San Teodoro were identified as landslide-prone due to their steep slopes (18%-50% and above) which are considered prone to erosion and landslides.*

IV. METHODOLOGIES OF THE PLAN

The study used descriptive, correlational, and comparative research designs to gather data on community awareness in Barangays San Jose, San Teodoro, and Solo regarding the impact of heavy rainfall, landslides, and waterborne diseases. The data collected through questionnaires and interviews aimed to inform recommendations for improving Mabini's disaster risk management and community resilience.

V. RESULTS FROM SURVEY

Table I
Demographic Profile of Respondents in terms of Anticipated Hazards that Might Happen.

Anticipated Hazards	Frequency	%	Rank
Flooding	25	83.33	2
Volcano Eruption	9	30	6
Tsunamis	8	26.67	7
Wildfire	3	10	10
Earthquakes	15	50	5
Terrorism	5	16.67	9
Chemical Spillage	3	10	10
Large Scale Disease	18	60	4
Landslides	22	73.33	3
Typhoon	27	90	1
Storm surge	6	20	8

Table I shows that the most anticipated hazards in Mabini, Batangas are typhoons (90%) and flooding (83.33%), followed by landslides (73.33%) and large-scale diseases (60%). Earthquakes (50%) also raise concern, while hazards like volcano eruptions (30%), tsunamis (26.67%), and terrorism (16.67%) are less anticipated. The data highlights the community's primary concerns of typhoons, flooding, and landslides, with waterborne diseases linked to flooding being a significant worry. These concerns reflect the region's vulnerability to extreme weather and its impact on health risks.

Table II
Survey on Rain-Induced Landslides

	WM	VI
I believe that areas in Mabini, Batangas are often affected by landslides when heavy rain occurs.	3.57	Strongly Agree
The roads and infrastructure in Mabini are insufficient to prevent landslides caused by heavy rain.	3.40	Strongly Agree
The Mabini community is sufficiently knowledgeable about the risks of landslides and how to prevent them.	2.50	Agree
There are programs or initiatives by the local government of Mabini to provide education and training to the community about the risks of landslides.	2.47	Disagree
The community actively participates in initiatives to prevent landslides and ensure the safety of residents.	2.83	Agree
Composite Mean	**2.95**	**Agree**

Table II shows that residents of Mabini, Batangas are highly aware of the area's susceptibility to rain-induced landslides (WM = 3.57), but are concerned about inadequate infrastructure to prevent such hazards (WM = 3.40). While there is general understanding of the risks (WM = 2.50), public knowledge and local government programs (WM = 2.47) could be improved. Community participation in safety efforts is evident (WM = 2.83), though greater involvement and proactive measures are needed. Overall, the composite mean of 2.95 suggests the need for better infrastructure, enhanced education, and stronger community engagement to mitigate landslide risks.

Table III
Survey on Waterborne Diseases

	WM	VI
The water quality in Mabini is often affected after heavy rains or flooding.	3.43	Strongly Agree
There have been cases of waterborne diseases in Mabini after heavy rainfall.	2.67	Agree
The Mabini community is sufficiently knowledgeable and prepared to avoid diseases caused by contaminated water.	2.67	Agree
Authorities often provide information on how to prevent diseases caused by contaminated water.	2.67	Agree
Local governments have measures to ensure the cleanliness of water sources after floods.	3.03	Agree
Composite Mean	**2.89**	**Agree**

Table III highlights community concerns in Mabini, Batangas regarding waterborne diseases linked to heavy rains and flooding. Respondents strongly agree (WM = 3.43) that extreme weather affects water quality, increasing the risk of diseases like cholera and dysentery. While the community acknowledges these risks (WM = 2.67), they feel somewhat prepared (WM = 2.67) and recognize the need for further education on disease prevention. Local efforts to inform the public (WM = 2.67) are noted, but more targeted education is required. Additionally, respondents agree (WM = 3.03) that the local government works to ensure water cleanliness post-flood, but ongoing improvements are needed. The composite mean of 2.93 indicates that while measures are in place, there is room for improvement in education, government action, and preparedness to address waterborne diseases.

Table IV
Survey on Disaster Risk Management and Community Resilience

	WM	VI
Disaster risk management programs in Mabini are sufficient to prevent disasters caused by rain, landslides, and floods.	2.70	Agree
The Mabini community is prepared and has the necessary equipment to respond to disasters such as landslides and flooding.	2.63	Agree
Local governments have prepared plans to expedite the community's recovery from disasters.	2.20	Disagree
Community members are actively involved in disaster preparedness and risk reduction efforts.	2.53	Agree
Local governments address the gaps in equipment and infrastructure to make the community more disaster ready.	2.43	Disagree
Composite Mean	**2.50**	**Agree**

Table IV reveals that while the community in Mabini, Batangas generally views disaster risk management initiatives as somewhat adequate (WM = 2.70), there is room for improvement. Respondents feel the community is moderately prepared for disasters like landslides and flooding (WM = 2.63), but stronger preparation is needed. There is dissatisfaction with local government recovery plans (WM = 2.20), indicating perceived deficiencies. Although community involvement in disaster preparedness is recognized (WM = 2.53), it is seen as insufficient. Respondents also express concerns about inadequate equipment and infrastructure (WM = 2.43). The composite mean of 2.50 suggests that while some disaster management programs exist, significant improvements are needed in recovery, resources, and infrastructure to enhance community resilience. Enhancing disaster response strategies, public education, and resource allocation would greatly improve the region's ability to handle future crises.

VI. SWOC ANALYSIS

Table V
SWOC ANALYSIS

Strength	Weakness
The location of Mabini, Batangas offers protection from rough seas and strong winds, with natural barriers like mountains and hills.	Landslides, flooding, and storm surges pose significant risks to communities and infrastructure, particularly in coastal areas.
Residents are well-informed about disaster risks due to ongoing community education programs, guiding them during	The local government struggles with a lack of resources such as vehicles, medical supplies, and personnel during large-scale

evacuations and safety protocols.	emergencies, particularly in smaller barangays.
Proximity to Metro Manila, beautiful beaches, and diving spots in Anilao boost the local economy, positioning Mabini as a key player in eco-tourism and adventure tourism.	While some areas may have good communication systems, remote or mountainous barangays often lack timely disaster alerts or even basic cellphone coverage, hindering effective response.
Opportunities	**Challenges**
Enhanced coordination with national agencies like OCD and PHIVOLCS could improve disaster relief, infrastructure support, and early warning systems.	In large-scale disasters, transportation routes can be cut off, delaying the arrival of relief supplies and external aid, hindering the recovery process.
Incorporating disaster-resilient building techniques and improving public infrastructure can help mitigate the effects of disasters and facilitate faster recovery.	Rising sea levels and stronger storms increase the vulnerability of coastal areas, leading to coastal erosion, flooding, and loss of land and marine ecosystems.
Using mobile apps, social media, geo-tagging, and mapping technologies could improve real-time disaster alerts, information dissemination, and pinpointing vulnerable areas.	Unregulated development and overcrowding in tourist areas strain local resources and harm delicate ecosystems, including coral reefs, marine life, and waste management systems.

VII. PESTEL

PESTEL analysis assessed Mabini, Batangas' factors that affects their susceptibility to rain-induced landslides and waterborne diseases.

1. Political: Mabini, Batangas operates under a decentralized local government system with autonomy for local governance. The municipal leadership consists of elected officials, including a mayor, vice mayor, and councilors. Political policies focus on sustainable development, with a notable emphasis on tourism and environmental conservation, especially in areas like Anilao. The local government implements policies like the "pay-to-dive" fee system, ensuring tourism revenue contributes to ecological management and community development. Additionally, Mabini aligns with regional development plans under CALABARZON, integrating local policies with broader programs. Local politics also address coastal challenges like disaster management and climate change adaptation.

2. Economic: Mabini's economy is driven by tourism, agriculture, and aquaculture, with a strong focus on the Anilao diving sector. The area is a major tourist destination, generating substantial revenue through resorts, dive shops, and hospitality services. Agriculture, including coconut, rice, and vegetables, supports the local economy, along with fish farming. Enhanced transport infrastructure like the Southern Tagalog Arterial Road has bolstered accessibility, facilitating trade and tourism. The economy benefits from both local and international visitors, contributing to employment and economic growth.

3. Social: Mabini's growing population is primarily driven by migration, especially young workers seeking employment in the tourism sector. This growth has led to housing shortages and increased demand for healthcare and education. The local community actively participates in community-based tourism (CBT), preserving culture and heritage while benefiting from tourism. The Batangas State University has partnered with local communities to promote sustainable tourism. While healthcare services are available, there are challenges due to limited resources, as seen during the COVID-19 pandemic.

4. Technological: Mabini embraces technology to promote tourism, with businesses using social media for marketing and online booking. Environmental technologies, like underwater drones and satellite imaging, help monitor coral reefs and marine ecosystems. The "Project CLICK" initiative aims to improve digital literacy by providing tablets to students. Despite strong internet connectivity in main areas, rural parts still struggle with slow or no service. Local businesses have had to invest in internet infrastructure to cater to digital nomads and divers.

5. Environmental: Mabini's tropical climate supports diverse ecosystems, including mangroves, seagrass beds, and coral reefs. However, these ecosystems face threats from overfishing, waste disposal, and unsupervised tourism. The municipality has established 13 Marine Protected Areas (MPAs) and enforces no-fishing zones to conserve biodiversity. Mabini is vulnerable to typhoons, with Typhoon Rolly causing significant damage in 2020. Efforts to promote eco-tourism include encouraging resorts to adopt sustainable practices and reducing plastic waste.

6. Legal: Local and national laws protect Mabini's natural resources, such as the National Integrated Protected Areas System (NIPAS) Act, which designates coastal areas as protected zones. The Tourism Act, Coastal Zone Management Act, and Environmental Impact Statement System regulate tourism and development. Local ordinances, such as those prohibiting tree cutting near watersheds and managing waste, support environmental protection. The municipality has created marine sanctuaries, enforces fishing bans, and promotes reforestation projects to safeguard aquatic and terrestrial resources. Climate change adaptation and disaster risk reduction strategies are embedded in local development programs.

VIII. ACTION PLAN

8.1 Disaster Prevention and Mitigation

Table VI
Action Plan for Goal 1 Objective 1.1

Goal 1	Strengthening community and institutional preparedness for natural hazards including rain-induced landslides and waterborne diseases.
Objective 1.1	To raise awareness about disaster risks and preventive measures thru conduct of community meetings and distributing informational materials achieving a 50% increase in resident awareness as measured by post-awareness surveys within the next 6 months.
Outcome	Increased community awareness of disaster risks and preventive actions, evidenced by a 50% improvement in survey results. Engagement through forums and distributed IEC materials will contribute to enhanced disaster preparedness and community resilience.
Programs, Projects, and Activities (PPA)	1.1.1 Regular Conduct of barangay-level disaster awareness forums 1.1.2 Production and distribution of visual IEC materials 1.1.3 Launch a social media awareness campaign

The initiatives focus on enhancing disaster preparedness and awareness in Mabini, Batangas. The first initiative (PPA 1.1.1) aims to increase community knowledge through disaster awareness forums, with a target of a 50% awareness increase within six months, monitored via pre- and post-forum surveys. The second initiative (PPA 1.1.2) involves distributing informational materials and holding community meetings to achieve the same goal of a 50% increase in awareness, tracking engagement with 4,484 households. The third initiative (PPA 1.1.3) leverages social media for a campaign to boost disaster preparedness, focusing on increasing awareness by 50%, with a target completion date of October 2025 for all efforts. Together, these initiatives are designed to enhance community resilience by increasing disaster awareness through direct engagement and digital outreach.

Table VII
Action Plan for Goal 1 Objective 1.2

Goal 1	Strengthening community and institutional preparedness for natural hazards including rain-induced landslides and waterborne diseases.
Objective 1.2	To develop at least two disaster preparedness plans and establish corresponding planning committees with active involvement from residents, businesses, and the local government, ensuring stakeholder-driven preparedness within 9 months.
Outcome	Two disaster preparedness plans, co-developed by residents, businesses, and LGUs, are finalized and implemented within 9 months. Two stakeholder planning committees are established with clearly defined roles, conducting inclusive engagements, validation sessions, and training activities to sustain preparedness and community resilience.
Programs, Projects, and Activities (PPA)	1.2.1 Organizing community disaster planning workshops 1.2.2 Drafting Barangay-based Disaster Preparedness Plans 1.2.3 Forming Stakeholder Preparedness Committees

This part outlines key programs focused on enhancing disaster preparedness and recovery in the community. PPA 1.2.1 details a program aimed at developing disaster preparedness plans through community workshops, tracking attendance and feedback, and engaging stakeholders to ensure plan creation by December 2025. PPA 1.2.2 describes a program focused on co-developing disaster preparedness plans with active participation from residents, businesses, and local governments, with plans to be finalized within 9 months. Lastly, PPA 12.3 emphasizes the formation of stakeholder preparedness committees to ensure that disaster plans reflect the needs of all parties, with the goal of completing the plans within 9 months. These initiatives collectively aim to strengthen community resilience through structured planning, training, and inclusive engagement.

Table VIII
Action Plan for Goal 1 Objective 1.3

Goal 1	Strengthening community and institutional preparedness for natural hazards including rain-induced landslides and waterborne diseases.
Objective 1.3	To improve early warning systems by upgrading or installing early warning systems in at least 3 barangays ensuring timely evacuation and safety during natural hazards within 12 months.
Outcome	Functional early warning systems are installed or upgraded in 3 barangays within 12 months. These systems deliver timely and clear alerts, enabling residents to evacuate safely and promptly during natural hazards. Community response time improves significantly, and effectiveness is monitored through drills, feedback, and system testing, ensuring continued operational readiness.
Programs, Projects, and Activities (PPA)	1.3.1 Site assessment and risk mapping 1.3.2 Procurement, installation and system operation training of early warning devices 1.3.3 Community orientation on evacuation alerts

This focus on improving early warning systems and community preparedness in disaster management. PPA 1.3.1 involves conducting site assessments and risk mapping in 3 barangays, with the goal of identifying hazards and preparing the community for potential threats. PPA 1.3.2 focuses on the procurement, installation, and operation training of early warning systems, ensuring functional devices like sirens and signage are set up by September 2026. PPA 1.3.3 emphasizes community orientation on evacuation alerts, targeting 3 barangays to provide essential training on evacuation procedures, with activities scheduled to conclude by October 2025. These initiatives aim to enhance disaster preparedness and response by engaging communities and ensuring that the systems in place are operational and well-understood.

8.2 Disaster Preparedness

Table IX
Action Plan for Goal 2 Objective 2.1

Goal 2	Improve the effectiveness and speed of disaster response operations to minimize damage and loss of life.
Objective 2.1	To form a coordinated response system and formalize agreements involving key agencies through regular coordination meetings that will improve disaster response efficiency within the next 6 months.
Outcome	A coordinated disaster response system is established within 6 months, supported by formal agreements among key agencies. Monthly coordination meetings foster collaboration and efficient communication, resulting in a unified disaster response plan. This system enhances decision-making, optimizes resource deployment, and improves response time, thereby minimizing damage and saving lives.
Programs, Projects, and Activities (PPA)	2.1.1 Develop formal disaster response agreements 2.1.2 Create disaster response simulation drills schedule 2.1.3 Coordinate with neighboring LGUs for cross-border response

This section emphases on improving disaster response effectiveness and coordination. PPA 2.1.1 seeks to establish formal disaster response agreements between local government units (LGUs) and key agencies, ensuring a cohesive response plan that enhances decision-making and resource allocation, with the agreements set to be completed by October 2025. PPA 2.1.2 outlines the scheduling of disaster response simulation drills to assess readiness and boost coordination, with quarterly drills planned and annual evaluations conducted. Finally, PPA 2.1.3 aims to strengthen cross-border disaster response by coordinating with neighboring LGUs, enhancing collaborative efforts through regular meetings and joint exercises, with the first drill set for October 2025.

Table X
Action Plan for Goal 2 Objective 2.2

Goal 2	Improve the effectiveness and speed of disaster response operations to minimize damage and loss of life.
Objective 2.2	To equip local disaster response teams with necessary equipment, vehicles, and medical supplies to handle emergencies like landslides, and waterborne diseases by securing funding or donations for equipment within the next 12 months.
Outcome	Within 12 months, local disaster response teams are fully equipped with essential vehicles, tools, and medical supplies to manage emergencies such as landslides and waterborne diseases.
Programs, Projects, and Activities (PPA)	2.2.1 Acquire disaster response equipment (vehicles, communication tools) 2.2.2 Procurement/ Donations for medicines and medical supplies 2.2.3 Train responders on equipment usage and maintenance

This section is centered on strengthening the capabilities of local disaster response teams. PPA 2.2.1 focuses on procuring vital disaster response equipment, such as vehicles, communication tools, and medical supplies, ensuring that teams are fully prepared to address emergencies like landslides and waterborne diseases, with the procurement process to be completed by July 2026. PPA 2.2.2 aims to secure procurement and donations for medical supplies, guaranteeing that local health units are well-equipped to handle disasters, with agreements expected by October 2025. Finally, PPA 2.2.3 highlights the importance of training responders on the proper use and maintenance of the new equipment, with the first training session set for July 2026. These efforts aim to ensure that local responders are adequately equipped, trained, and prepared to manage disaster situations efficiently.

Table XI
Action Plan for Goal 2 Objective 2.3

Goal 2	Improve the effectiveness and speed of disaster response operations to minimize damage and loss of life.
Objective 2.3	To establish at least 2 temporary shelter sites with complete water and sanitation services in collaboration with NGOs and local agencies within the next 12 months.
Outcome	Within 12 months, a minimum of two temporary shelter sites are established in coordination with NGOs and local agencies. Each shelter is fully functional, equipped with clean water, sanitation facilities, and access to basic health and hygiene resources.
Programs, Projects, and Activities (PPA)	2.3.1 Establish temporary shelter sites with water and sanitation services 2.3.2 Coordinate with health units for medical support and distribution of hygiene kits

PPA 2.3.1 and 2.3.2 focus on establishing temporary shelter sites and enhancing support services for disaster-affected individuals. PPA 2.3.1 aims to set up at least two temporary shelter sites with full water and sanitation services, in collaboration with NGOs and local agencies, within 12 months. These shelters will provide essential services to affected populations. PPA 2.3.2 works on coordinating with health units to provide medical support and distribute hygiene kits to those in the shelters. The target is to establish these services in a timely manner, ensuring that families receive the necessary healthcare and hygiene resources after a disaster.

8.3 Disaster Response

Table XII
Action Plan for Goal 3 Objective 3.1

Goal 3	Enhance the effectiveness and coordination of disaster response efforts to minimize the impacts of natural hazards**,** specifically rain-induced landslides, and waterborne diseases.

Objective 3.1	To conduct training of at least 80% of disaster response teams in handling multi-hazard scenarios through conduct of joint training with experts within the next 6 months.
Outcome	Within six months, at least 80% of local disaster responders will be trained in managing multi-hazard emergencies through joint drills and technical workshops with key agencies.
Programs, Projects, and Activities (PPA)	3.1.1 Conduct multi-hazard drills with responders 3.1.2 Formulate a joint disaster response team for cross-border incidents

This plan emphasizes on enhancing disaster response capabilities and coordination. PPA 3.1.1 emphasizes training at least 80% of local disaster response teams in managing multi-hazard scenarios, through joint training with experts, set to be completed within six months. PPA 3.1.2 ensures the rapid deployment of health teams within three months of a disaster, with the focus on preparing them for health threats such as cholera and typhoid after flooding and landslides. Both initiatives aim to strengthen local preparedness through training and readiness, ensuring that teams are well-equipped to respond to various disaster situations.

Table XIII
Action Plan for Goal 3 Objective 3.2

Goal 3	Expand health information access of residents by taking advantage of existing technological practices.
Objective 3.2	To ensure rapid deployment readiness within the next 3 months of rapid-response health teams to address possible health threat such as cholera, typhoid, and diarrhea that are common after flooding and landslides.
Outcome	Within the next three months, health teams are fully equipped, trained, and mobilized to respond immediately to potential outbreaks of waterborne diseases such as cholera, typhoid, and diarrhea in flood- and landslide-prone areas.
Programs, Projects, and Activities (PPA)	3.2.1 Ensure rapid deployment of medical resources 3.2.2 Conduct rapid response training for health teams

This section highlights on strengthening disaster response capabilities by improving medical readiness and coordination. PPA 3.2.1 guarantees the swift deployment of medical resources by overseeing the distribution and availability of supplies, with an emphasis on preparing medical teams for emergencies such as cholera, typhoid, and diarrhea after disasters. PPA 3.2.2 highlights the need for rapid-response training for health teams, ensuring they are well-equipped and trained to manage waterborne disease outbreaks in flood-prone areas. Together, these initiatives aim to optimize medical responses and ensure quick, coordinated action during disaster situations.

Table XIV
Action Plan for Goal 3 Objective 3.3

Goal 3	Expand health information access of residents by taking advantage of existing technological practices.
Objective 3.3	To improve roads and drainage systems of at least 3 landslide prone areas to reduce the impact of flooding and landslides in critical areas within the next 12 months.
Outcome	Within the next 12 months, targeted infrastructure upgrades—including improved roads, enhanced drainage, and slope stabilization—are completed in at least 3 landslide-prone areas.
Programs, Projects, and Activities (PPA)	3.3.1 Improvement of drainage systems in flood-prone areas 3.3.2 Repair flood-damaged roads 3.3.3 Enhance slope protection in landslide-prone areas

PPA 3.3.1, 3.3.2, and 3.3.3 focus on improving infrastructure and reducing disaster risks, specifically in flood-prone and landslide areas. PPA 3.3.1 aims to enhance drainage systems to reduce flooding risks, with progress tracked and completed by April 2026. PPA 3.3.2 focuses on repairing roads damaged by flooding to ensure accessibility for emergency services, with repairs completed by April 2026. PPA 3.3.3 addresses slope protection in landslide-prone areas, aiming for improved infrastructure like roads, drainage, and slope stabilization within 12 months to mitigate the impact of flooding and landslides

8.4 Disaster Recovery and Rehabilitation

Table XV
Action Plan for Goal 4 Objective 4.1

Goal 4	Facilitate rapid recovery and long-term rehabilitation to restore the community to a resilient state after a disaster.
Objective 4.1	To develop a comprehensive recovery plan that includes rebuilding infrastructure, restoring access to clean water, and providing medical care within 3 months.
Outcome	Within 3 months post-disaster, a comprehensive recovery plan is created and implemented, targeting infrastructure restoration, clean water access, and provision of essential medical services.
Programs, Projects, and Activities (PPA)	4.1.1 Develop a comprehensive recovery plan 4.1.2 Immediate restorations of critical infrastructure and clean water access 4.1.3 Provide medical care and rehabilitation services

This part centers on post-disaster recovery and rehabilitation. PPA 4.1.1 involves developing a comprehensive recovery plan that includes rebuilding infrastructure, restoring access to clean water, and providing medical care within three months post-disaster. PPA 4.1.2 emphasizes the immediate restoration of critical infrastructure and clean water access, with a target of 50% of affected areas restored by October 2025. PPA 4.1.3 focuses on providing medical care and rehabilitation

services to affected individuals, ensuring that medical support and rehabilitation efforts are available within the recovery period.

Table XVI
Action Plan for Goal 4 Objective 4.2

Goal 4	Facilitate rapid recovery and long-term rehabilitation to restore the community to a resilient state after a disaster.
Objective 4.2	To provide financial assistance and psychosocial support to affected families and barangays within 1-month post disaster.
Outcome	Within one month following a disaster, affected families received immediate financial aid and psychosocial support.
Programs, Projects, and Activities (PPA)	4.2.1 Provide financial assistance to affected families 4.2.2 Offer psychosocial support services 4.2.3 Distribute food packs and basic necessities

PPA included are focused on providing essential assistance and support to families affected by disasters. PPA 4.2.1 aims to provide financial aid to affected families within one month of a disaster, with a target of distributing PHP 10,000 per family to approximately 500 families, for a total of PHP 5,000,000, by the end of October 2025. PPA 4.2.2 emphasizes offering psychosocial support services to affected individuals, ensuring that families receive necessary mental health support, with services beginning within one month post-disaster. PPA 4.2.3 involves distributing food packs and basic necessities to the affected families, targeting 500 families, with a budget of PHP 750,000. All activities are to be completed within one month post-disaster, ensuring prompt support for recovery.

Table XVII
Action Plan for Goal 4 Objective 4.3

Goal 4	Facilitate rapid recovery and long-term rehabilitation to restore the community to a resilient state after a disaster.
Objective 4.3	To implement at least 2 projects related to sustainable recovery practices, including environmental restoration and the protection of marine ecosystems within 12 months.
Outcome	Within 12 months, a minimum of three sustainable recovery projects—covering environmental restoration and marine ecosystem protection—are implemented through community engagement and multi-stakeholder collaboration.
Programs, Projects, and Activities (PPA)	4.3.1 Implement environmental restoration projects 4.3.2 Raise awareness on environmental recovery 4.3.3 Create sustainable community-driven recovery practices

This plan focuses on implementing sustainable recovery practices with a focus on environmental restoration and marine ecosystem protection. PPA 4.3.1 aims to execute environmental restoration projects such as reforestation and soil conservation in three areas, with progress monitored through reports and photos, to be completed by July 2026. PPA 4.3.2 focuses on supporting marine ecosystem protection through community engagement and the implementation of marine conservation projects, with the target outcome being the successful restoration of critical ecosystems within 12 months. PPA 4.3.3 emphasizes the collaboration between communities and stakeholders to develop and implement sustainable recovery practices, aiming to ensure long-term environmental sustainability following a disaster.

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REFERENCES

[1] Cheng, R. R. and Kim, T. J. (2019). Building community-based resilience in the municipality of San Francisco, Cebu, Republic of the Philippines.

[2] Comprehensive Development Plan (2016). The comprehensive development plan (CDP) for Mabini, Batangas 2016–2025. Local Government of Mabini, Batangas.

[3] Comprehensive Land Use Plan. (2018). Comprehensive Land Use Plan 2018–2027. Local Government of Mabini, Batangas.

[4] Congress Of the Philippines (2010). Philippine Disaster Reduction and Management Act. https://www.officialgazette.gov.ph/2010/05/27/republic-act-no-10121/.

[5] Department of Health (2013). Health Response to Typhoon Yolanda (Haiyan). Retrieved from http://www.doh.gov.ph.

[6] Department of Science and Technology (2022). The Risks of Flooding: Protect yourself from floodwater diseases | Philippine Council for Health Research and Development. Dost.gov.ph. https://www.pchrd.dost.gov.ph/news_and_updates/the-risks-of-flooding-protect-yourself-from-floodwater-diseases/

[7] Era, M., Vallar, E., Osman, A. J., Borg, R. P., Axisa, G. B., Ayerbe, I. A., Gonzalez-Pardo, M. M., & Ranguelov, B. (2022). A Baseline Assessment of the Multi-Hazard Early Warning Systems in the Province of Batangas, Philippines. International Journal on Advanced Science, Engineering and Information Technology, 12(2), 621. https://doi.org/10.18517/ijaseit.12.2.15003

[8] Guevara, F. (2020). Typhoon Vicky: Addressing the Needs of the Affected Communities. Philippine Daily Inquirer. Retrieved from https://www.inquirer.net.
[9] Manlapig, L. (2009). Impact of Typhoon Ondoy (Ketsana) on Public Health. Philippine Journal of Health. Retrieved from https://www.pmh.gov.ph.
[10] Mabini Municipal Disaster Risk Reduction Management Plan. (2022). Mabini Municipal Disaster Risk Reduction Management Plan 2022-2025. Local Government of Mabini.
[11] Office of Civil Defense (2020). National Disaster Risk Reduction and Management Plan (NDRRMP) 2020 – 2030. Policy Development and Planning Service (PDPS), Camp Aguinaldo, Quezon City. Retrieved from https://ndrrmc.gov.ph/attachments/article/4147/NDRRMP-Pre-Publication-Copy-v2.pdf.
[12] Perez, F., Jimenez, A., & Sanchez, M. (2018). Impact of landslides on waterborne diseases in Colombia: A case study. International Journal of Disaster Risk Reduction, 25, 52-64. https://doi.org/10.1016/j.ijdrr.2017.11.011

