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Analysis of Flood Risk Management in Torue Village Using ISO 31000:2018 for Mitigation Decision-Making

Yanuar Putra Chandra Negara[1*]; Andi Asnudin[2]; Setiyawan[3]

[1]Postgraduate Student of Civil Engineering Department, Tadulako University
[2]Civil Engineering Study Program, Faculty of Engineering, Tadulako University
[3]Civil Engineering Study Program, Faculty of Engineering, Tadulako University

Corresponding Author: Yanuar Putra Chandra Negara[1*]

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Abstract: Torue Village, Parigi Moutong Regency, Central Sulawesi, is an area repeatedly struck by river flooding and drew national attention following the mid-2022 flash flood that caused infrastructure damage, economic losses, fatalities, and lasting social trauma. This high risk stems from a combination of hydrological hazards, physical and socioeconomic vulnerabilities, and low disaster response capacity, while mitigation efforts have remained reactive and not yet grounded in systematic risk management. This study aimed to identify and analyze flood risk levels, examine the contributing factors, and formulate participatory mitigation strategies based on ISO 31000:2018. A semi-quantitative approach was employed using a Likelihood-Impact matrix corrected by a Capacity Index (CI), with primary data collected from 60 respondents and field observations at three locations. The results revealed that of the 16 risk sources identified, 2 (12.5%) were classified as Extreme, 12 (75%) as High, and 2 (12.5%) as Moderate. A CI value of 3.36 indicated low village capacity and methodologically amplified the impact scores of all risk sources through a correction factor of 1.12. Five dominant risk factor clusters were identified: hydrological hazards, settlement and land exposure, physical vulnerability, socioeconomic vulnerability, and limited institutional capacity. Sixteen mitigation strategies were formulated in alignment with ISO 31000:2018 principles, prioritized across three time horizons: short-, medium-, and long-term. The primary conclusion affirms that community capacity building represents the highest-value intervention, as it directly reduces the CI and consequently lowers risk levels across all 16 identified risk sources.

Keywords: *Disaster Mitigation, Flood Risk Management, ISO 31000:2018, Torue Village.*

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I. INTRODUCTION

Torue Village in Parigi Moutong Regency, Central Sulawesi, is an area repeatedly affected by river flooding and drew national attention following the flash flood that struck the region in mid-2022. This flood not only caused infrastructure damage and economic losses but also resulted in fatalities and deep social trauma within the community. As an area with high hydrometeorological disaster potential, Torue Village faces major challenges in flood risk management, particularly in the prevention and mitigation aspects that have not yet been systematically structured.

The increasing intensity and frequency of hydrometeorological disasters in Indonesia are driven by global climate change and environmental degradation, including land-use conversion and the degradation of watersheds (DAS) (Waskitho, 2024). According to data from the National Disaster Management Agency (BNPB), flooding has been the most frequent disaster in Indonesia over the past decade. However, mitigation efforts have often been reactive and lacking in comprehensive, risk-based strategic planning (Sudibyakto, 2018).

At the regional scale, Central Sulawesi Province is one of the regions with a high level of hydrometeorological disaster vulnerability, with flooding as the most dominant disaster type. Parigi Moutong Regency in particular is classified as an area repeatedly struck by floods caused by river overflow during the rainy season. The Regional Disaster Management Agency (BPBD) of Parigi Moutong Regency recorded 13 disaster events throughout May 2026, with flooding dominating at 10 events, or about 77 percent of all events (BPBD Parigi Moutong, 2026). This high frequency

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demonstrates that flooding is not an incidental event but a recurring threat that demands a more planned and risk-based mitigation approach.

Technical and structural approaches such as embankment construction and river normalization have been widely applied (Mahardika & Supriatna, 2025), yet studies adopting an integrated risk management perspective remain limited, particularly at the village level, which serves as the front line of initial disaster response. In this context, the international standard ISO 31000:2018 on risk management offers a systematic and holistic framework for identifying, analyzing, and treating risk with the participation of all stakeholders. The flexibility of this framework allows the integration of systematic risk management principles with the local wisdom and participatory mechanisms already alive within the Torue Village community, so that it is expected to produce more implementable and sustainable mitigation strategies.

This study aims to: (1) identify and analyze flood risk levels in Torue Village based on the ISO 31000:2018 framework; (2) examine the factors influencing flood risk in Torue Village; and (3) formulate strategies and recommendations for mitigation decision-making based on ISO 31000:2018. The findings of this study are expected to contribute to the development of disaster risk management practices in rural areas and to enhance community capacity in facing flood disasters.

II. LITERATURE REVIEW

➢ *Concept and Characteristics of River Flooding*

River flooding is defined as a condition in which the channel capacity of a river is unable to convey the incoming water discharge, causing water to overflow and inundate the surrounding floodplain (Tyas et al., 2022). This event is part of a natural hydrological process that occurs when water input from rainfall in the watershed exceeds the soil's infiltration capacity and the river's storage.

The physical characteristics of river flooding that are important in engineering analysis include peak discharge, inundation depth and extent, flow velocity, inundation duration, and event frequency. Current approaches to flood analysis no longer focus solely on physical control but integrate risk analysis by considering river morphology, land use, soil conditions, hydrology, and the exposed socioeconomic elements (Jha et al., 2022).

➢ *The Concept of Flood Risk*

Flood risk is the potential loss that may arise from a flood event within a certain period and area. In theoretical terms, the level of flood risk is influenced by four main elements: hazard, vulnerability, capacity, and exposure (UNISDR, 2009). Risk increases when hazard, exposure, and vulnerability are high, but can be reduced through interventions that enhance capacity and reduce community vulnerability and exposure (Syukur, 2021).

➢ *Disaster Risk Management and ISO 31000:2018*

Disaster risk management is a systematic approach to identifying, analyzing, evaluating, and treating disaster risk comprehensively (UNISDR, 2009). ISO 31000:2018 is a global standard that provides general guidance for applying risk management across various types of organizations, in both the public sector and local communities (Hutchins, 2018). The standard comprises three integrated components: principles, framework, and the risk management process. The risk management process in ISO 31000:2018 consists of four main stages: risk identification, risk analysis, risk evaluation, and risk mitigation or treatment. The standard emphasizes inclusiveness, the use of the best available information, and continual improvement in risk management (Hutchins, 2018).

➢ *Capacity Index as an Impact Correction Factor*

One fundamental limitation of the conventional risk matrix approach is its tendency to treat impact as a fixed value that is unresponsive to differences in community capacity. In reality, the same impact can be experienced very differently by a high-capacity community compared with a low-capacity community (Wisner & Wisner, 2004). To overcome this limitation, this study develops the Capacity Index (CI) as a methodological innovation that quantitatively integrates the dimension of community capacity into the risk matrix calculation. The CI functions as a correction factor that adjusts the impact value: a CI > 3 indicates low capacity, so the impact is amplified, whereas a CI < 3 indicates high capacity, so the impact is reduced.

➢ *Risk Matrix*

The risk matrix is an important tool used to identify, analyze, and visualize risk levels based on two main components: likelihood and impact. Risk is mapped within a matrix using a defined scale and then classified into low, moderate, high, and extreme categories to facilitate the prioritization of mitigation (Asnudin et al., 2024). The risk matrix structure used as a reference in this study is presented in Table 1.

Table 1 Risk Matrix

		IMPACT				
		Very Light (1)	**Light (2)**	**Moderate (3)**	**Heavy (4)**	**Very Heavy (5)**
	Almost Certain (5)	Moderate (5)				
	Likely (4)	Moderate (4)	Moderate (8)			
LIKELIHOOD	Possible (3)	Low (3)	Moderate (6)	Moderate (9)		
	Unlikely (2)	Low (2)	Moderate (4)	Moderate (6)	Moderate (8)	
	Rare (1)	Low (1)	Low (2)	Low (3)	Moderate (4)	Moderate (5)

Source :(Asnudin et al., 2024); (Asnudin et al., 2026)

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➢ *Community-Based Flood Mitigation*

Community-based flood mitigation is an approach that positions the community as the primary actor in disaster risk reduction efforts. This approach encompasses physical measures (embankments, drainage, reforestation) and non-physical measures (education, early warning systems, institutional strengthening). Participatory community involvement has been shown to enhance the effectiveness and sustainability of mitigation strategies (Abid et al., 2024).

III. RESEARCH METHOD

➢ *Research Design*

This study adopts a mixed-methods approach with a quantitative dominance (quan-qual). The quantitative component is used to measure and map flood risk levels numerically through a semi-quantitative model based on a Likelihood–Impact matrix corrected by the Capacity Index. The qualitative component is used to deepen the understanding of the contextual factors underlying the risk profile, including social, institutional, and community-capacity conditions (Creswell & Poth, 2016).

➢ *Research Location*

The study was conducted in Torue Village, Torue Subdistrict, Parigi Moutong Regency, Central Sulawesi Province. This location was selected because of its high vulnerability to river flash flooding, as demonstrated by the major flood event of 2022, as well as the high density of settlements and productive land along the banks of the Torue River.

➢ *Data Collection Techniques*

Data collection consisted of primary and secondary data. Primary data were obtained through closed-ended questionnaires administered via structured interviews, as well as structured field observations at three observation points. Secondary data were obtained from disaster documentation and archives, watershed maps, and comparative aerial photographs of Torue Village from 2022 and 2026.

➢ *Population and Sample*

The study involved 60 respondents divided into two groups: Group I, comprising 30 respondents (village officials, community leaders, and government agencies), and Group II, comprising 30 respondents (members of the Torue Village community). This division into two groups was intended to ensure triangulation of data sources between stakeholder perceptions and those of the general community.

➢ *Research Variables*

This study analyzes 16 risk sources grouped into five dimensions: hazard (X1–X4), exposure (X5–X7), physical vulnerability (X8–X10), socioeconomic vulnerability (X11–X13), and capacity (X14–X16). The research variables and indicators are summarized in Table 2.

Table 2 Research Variables and Indicators

Problem Statement	Variable (ISO 31000 & Risk Theory)	Indicator (Data Sought)	Reference Source
Identification & Analysis of Risk Level	Hazard	Annual flood frequency (X1); Inundation depth (X2); Inundation duration (X3); Affected area extent in Torue (X4)	(UNISDR, 2009) & Hydrological Theory
	Exposure	Number of houses on the riverbank (X5); Public infrastructure (schools/offices) (X6); Affected productive land area (X7)	(Change, 2022) & ISO 31000:2018
Factors Influencing Risk	Physical & Environmental Vulnerability	Condition of village embankments and drainage (X8); Land-use conversion/degradation in the river's upstream (X9); Quality of residents' building structures (X10)	(Wisner & Wisner, 2004)
	Socioeconomic Vulnerability	Population density in hazard-prone zones (X11); Vulnerable groups (elderly/children) (X12); Income level/economic self-reliance (X13)	(Schmidtlein et al., 2008)
	Capacity	Community mitigation knowledge (X14); Existence of an Early Warning System (X15); Village disaster-preparedness organizational structure (X16)	(Pearson & Pelling, 2015)

➢ *Data Analysis Techniques*

Data analysis was conducted in five stages. First, recapitulation and computation of the average score per questionnaire and observation item for the 16 variables. Second, calculation of the Capacity Index using the formula CI = [average(X14, X15, X16) + average(Y6–Y14)] / 2, together with a correction factor of CI/3. Third, determination of the Likelihood (L) and corrected Impact (I*) values using the formula I* = ROUND[I_raw × (CI/3)] on a 1–5 scale. Fourth, computation of the Risk Score (SR = L × I*) and its mapping to the reference risk matrix to determine the risk level (Low, Moderate, High, Extreme). Fifth, formulation of mitigation strategies based on the risk-score ranking and grouping into three implementation time horizons.

IV. RESULTS AND DISCUSSION

➢ *General Overview of Torue Village*

Torue Village is inhabited by a community with diverse socioeconomic conditions, although most residents work in the agriculture and plantation sectors. The farmland that serves as the residents' main source of livelihood is spread along the riverbanks and is therefore threatened each time a flood occurs. Flooding in Torue Village is characterized by

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inundation that can reach a depth of more than 100 cm, an average inundation duration of more than 12 hours, and a wide spatial coverage extending across the entire village and even neighboring villages. This condition is exacerbated by limited flood-control infrastructure and the low institutional capacity for disaster preparedness at the village level.

➢ *Capacity Index (CI) Calculation*

Before the final risk assessment, this study first calculated the Capacity Index as an impact correction factor. The CI integrates capacity data from the questionnaire (X14–X16) and field observations (Y6–Y14) into the formal risk matrix calculation. The CI calculation results are presented in Table 3.

Table 3 Capacity Index (CI) Calculation

Component	Data Source	Group I Score	Group II Score	Average	Weight
Questionnaire Capacity (X14, X15, X16)	Questionnaire of 60 Respondents	3.48	3.29	3.38	50%
Observation Capacity (Y6–Y14)	Observation Sheets at 3 Points	-	-	3.33	50%
CAPACITY INDEX (CI)				3.36	

Based on Table 3, the CI value obtained is 3.36. Because this value is greater than the midpoint of the scale (3.0), the flood management capacity of Torue Village is classified as low. Consequently, all impact values in the risk analysis are amplified through the correction factor CI/3 = 3.36/3 = 1.12. Thus, the village's low capacity methodologically amplifies the actual impact experienced by the community when flooding occurs.

➢ *Likelihood and Corrected Impact Values*

After the CI was calculated, the Likelihood (L) and corrected Impact (I*) values were determined for each variable. For the hazard variables (X1–X4), the L value was derived from the combined average of the two groups multiplied by the correction factor CI/3. For the exposure, vulnerability, and capacity variables, the L value was set at 4 (Likely) based on the recurring existing conditions in the field. The calculation results are presented in Table 4.

Table 4 Corrected Impact Values and Final Likelihood

No	Variable (Item)	Combined Average	Role in Matrix	Final Value (After Correction)
1	Hazard – flood frequency (X1)	3.17	Likelihood (L)	L = 4 → Likely
2	Hazard – inundation depth (X2)	2.78	Likelihood (L)	L = 3 → Possible
3	Hazard – inundation duration (X3)	1.62	Likelihood (L)	L = 2 → Unlikely
4	Hazard – affected area (X4)	3.88	Likelihood (L)	L = 4 → Likely
5	Exposure – riverbank houses (X5)	3.42	Asset Impact (Ia)	I* = 4 → Severe
6	Exposure – public infrastructure (X6)	4.07	Asset Impact (Ia)	I* = 5 → Very Severe
7	Exposure – productive land (X7)	4.07	Asset Impact (Ia)	I* = 5 → Very Severe
8	Physical vuln. – embankment/drainage (X8)	3.29	Physical Impact (If)	I* = 4 → Severe
9	Physical vuln. – land-use conversion (X9)	2.77	Physical Impact (If)	I* = 3 → Moderate
10	Physical vuln. – building quality (X10)	2.43	Physical Impact (If)	I* = 3 → Moderate
11	Socioecon. vuln. – population density (X11)	2.90	Social Impact (Is)	I* = 3 → Moderate
12	Socioecon. vuln. – vulnerable groups (X12)	2.90	Social Impact (Is)	I* = 3 → Moderate
13	Socioecon. vuln. – residents' income (X13)	3.65	Social Impact (Is)	I* = 4 → Severe
14	Capacity – mitigation knowledge (X14)	3.42	Capacity Index (CI)	I* = 4 → Severe
15	Capacity – early warning system (X15)	3.81	Capacity Index (CI)	I* = 4 → Severe
16	Capacity – disaster-preparedness org. (X16)	2.98	Capacity Index (CI)	I* = 4 → Severe

➢ *Identification and Analysis of Flood Risk Levels*

Based on the L and I* values, the final risk matrix was compiled for the 16 risk sources. The risk score was calculated using the formula SR = L × I*, then compared with the ISO 31000:2018 reference risk matrix (Asnudin et al., 2024); (Asnudin et al., 2026). The mapping results are presented in Table 5.

Table 5 Final Risk Matrix of the 16 Flood Risk Sources in Torue Village

No	Source Variable	Risk Source Description	L (1–5)	I* (1–5)	SR (L×I*)	Risk Level
1	hazard (X1)	Recurrent annual flooding (high frequency – almost every year)	4	4	**16**	
2	hazard (X2)	Extreme inundation (>100 cm) submerging settlements & assets	3	3	**9**	**Moderate**
3	hazard (X3)	Long inundation duration (>1 day) damaging health, agriculture & structures	2	2	**4**	**Moderate**
4	hazard (X4)	Wide affected area (entire village to neighboring villages)	4	4	**16**	

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5	exposure (X5)	Dense riverbank settlements (>50 houses within <50 m of the river)	4	4	**16**	
6	exposure (X6)	Public infrastructure threatened (roads, bridges, schools, health centers)	4	5	**20**	
7	exposure (X7)	Affected farmland/plantations (>10 ha of productive land lost)	4	5	**20**	
8	phys. vuln. (X8)	Damaged/inadequate embankments & drainage (control infrastructure failure)	4	4	**16**	
9	phys. vuln. (X9)	Massive upstream watershed land-use conversion (accelerated runoff & erosion)	4	3	**12**	
10	phys. vuln. (X10)	Predominance of non-permanent buildings (mostly semi-permanent/wooden houses)	4	3	**12**	
11	socioecon. vuln. (X11)	High density in flood-prone zones (population concentrated on the banks)	4	3	**12**	
12	socioecon. vuln. (X12)	Unprotected vulnerable population (elderly, toddlers, persons with disabilities predominate)	4	3	**12**	
13	socioecon. vuln. (X13)	Poverty & inability to recover (mostly poor, no emergency savings)	4	4	**16**	
14	capacity (X14)	Low flood mitigation knowledge (residents unaware of how to reduce risk)	4	4	**16**	
15	capacity (X15)	No effective Early Warning System (no siren/warning technology)	4	4	**16**	
16	capacity (X16)	Weak disaster-preparedness institutions (no village disaster team, regulation, or evacuation route)	4	3	**12**	

Based on Table 5, of the total 16 flood risk sources in Torue Village, 2 risk sources (12.5%) are at the Extreme level, 12 risk sources (75%) at the High level, and 2 risk sources (12.5%) at the Moderate level. No risk source falls into the Low category. The highest risk scores were obtained by public infrastructure (X6) and productive land (X7), each with SR = 20. This condition shows that Torue Village faces a highly critical flood risk situation requiring immediate and comprehensive mitigation measures.

➤ *Factors Influencing Flood Risk*

The analysis reveals five dominant factor clusters that shape the flood risk profile of Torue Village. First, the hydrological hazard factor is marked by high flood frequency and a wide affected area, reinforced by the hydrological conditions of the Torue River, which are influenced by upstream rainfall and degradation of vegetation cover. Second, the exposure factor is reflected in the public infrastructure and productive land that obtained Extreme risk scores, as well as the dense settlements along the riverbanks. Third, physical vulnerability is confirmed by field observations showing critical embankment and drainage conditions as well as ongoing upstream land-use conversion. Fourth, socioeconomic vulnerability is evident from the level of poverty and the inability to recover after flooding, as well as the presence of vulnerable groups without adequate protection. Fifth, the capacity factor is the most critical dimension because its value directly affects the entire impact calculation through the Capacity Index mechanism. The absence of an effective early warning system, low mitigation knowledge, and weak disaster-preparedness institutions place all three capacity components at the High risk level.

➤ *Mitigation Strategies Based on ISO 31000:2018*

Based on the analyzed risk profile, this study formulated 16 mitigation strategies prioritized according to the risk-score ranking and grouped into three implementation time horizons: short-term (0–1 year), medium-term (1–3 years), and long-term (more than 3 years). The priority mitigation strategies are presented in Table 6.

Table 6 Priority Mitigation Strategies Based on ISO 31000:2018

No	Risk Source	Risk Level (SR)	Main Mitigation Recommendation	Implementation Priority
1	Flood frequency	SR=16, High	River normalization; permanent embankments; BPBD-integrated Early Warning System	Short-Term (0–1 Year)
2	Affected Area Extent	SR=16, High	Village disaster zoning; per-hamlet risk maps; restriction of construction in flood zones	Short-Term (0–1 Year)
3	Embankment/Drainage Condition	SR=16, High	Priority rehabilitation of embankments & drainage; routine village O&M budget	Short-Term (0–1 Year)

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4	Vulnerable Groups (toddlers and elderly)	SR=12, High	Per-hamlet mapping of vulnerable groups; priority evacuation system	Short-Term (0–1 Year)
5	Community Income Level	SR=16, High	Disaster savings program; BPNT/KIS for at-risk residents; post-flood economic strengthening	Short-Term (0–1 Year)
6	Flood Mitigation Knowledge	SR=16, High	Periodic per-hamlet DRR training; risk education modules in schools & mosques	Short-Term (0–1 Year)
7	Early Warning System	SR=16, High	Installation of an Early Warning System (siren + traditional kentongan alarm + WhatsApp); routine testing every 3 months	Short-Term (0–1 Year)
8	Disaster-Preparedness Institutions	SR=12, High	Establishment & legalization of a village disaster team; village disaster regulation; official evacuation routes	Short-Term (0–1 Year)
9	Inundation Depth	SR=9, Moderate	River-channel dredging; inundation-zone mapping; village drainage audit	Medium-Term (1–3 Years)
10	Inundation Duration	SR=4, Moderate	High-capacity drainage; communal infiltration wells; >12-hour response SOP	Medium-Term (1–3 Years)
11	Riverbank Houses	SR=16, High	Gradual relocation of settlements <50 m from the river; enforcement of riverbank building permits	Medium-Term (1–3 Years)
12	Affected public infrastructure	SR=20, Extreme	Infrastructure vulnerability audit; retrofitting of bridges, roads & public-service buildings; flood-resistant standards	Medium-Term (1–3 Years)
13	Affected productive land	SR=20, Extreme	Agricultural disaster insurance; diversification with flood-tolerant crops	Medium-Term (1–3 Years)
14	Community Building Condition	SR=12, High	Flood-resistant housing program; raising floor levels; material subsidies	Medium-Term (1–3 Years)
15	Vulnerability of riverbank residents	SR=12, High	Per-neighborhood density mapping; campaign to relocate to safe zones	Medium-Term (1–3 Years)
16	Watershed land-use conversion/degradation	SR=12, High	Enforcement of spatial planning (RTRW); watershed reforestation with local government & upstream communities	Long-Term (>3 Years)

➤ *Alignment of Strategies with ISO 31000:2018 Principles*

All formulated mitigation strategies were evaluated for their alignment with the three main principles of ISO 31000:2018. The principle of inclusiveness is fulfilled through the involvement of 60 respondents from two different groups and verification by observations at three points, with strategies such as hamlet-based disaster risk reduction (DRR) training and the establishment of a village disaster-preparedness team that position the community as active subjects. The principle of best available information is fulfilled through the use of real field data combined with the Capacity Index innovation as a quantitative correction factor. The principle of continual improvement is ensured through the stratification of recommendations into three time horizons, enabling periodic evaluation in accordance with the Plan-Do-Check-Act cycle.

➤ *Discussion*

The findings of this study confirm that the flood risk profile of Torue Village is determined not only by natural hazard factors but also by the complex interaction among exposure, vulnerability, and capacity. The main methodological contribution of this study lies in the use of the Capacity Index as an impact correction factor. With a CI of 3.36, all impact values are amplified by a factor of 1.12, so that the analysis results better reflect the actual impact experienced by a low-capacity community. This approach overcomes the limitation of the conventional risk matrix, which treats impact as a fixed value (Wisner et al., 2004).

All three capacity components — mitigation knowledge (X14), early warning system (X15), and disaster-preparedness institutions (X16) — yielded High risk scores. This confirms that capacity strengthening is the intervention with the highest multiplier effect, because its impact directly lowers the CI and thereby reduces the impact value of all 16 risk sources simultaneously. This finding is consistent with the resilience-based management approach that emphasizes strengthening the community's ability to adapt to recurrent flooding (Wang et al., 2022).

V. CONCLUSION

This study concludes that Torue Village faces a highly critical flood risk. Of the 16 identified risk sources, 2 are at the Extreme level (12.5%), 12 at the High level (75%), and 2 at the Moderate level (12.5%), with the highest risk scores for public infrastructure (X6) and productive land (X7). The Capacity Index value of 3.36 indicates the village's low capacity, so that all impact values are corrected upward by a factor of 1.12.

Five dominant factor clusters shape the flood risk profile of Torue Village: hydrological hazard, exposure of

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settlements and vital infrastructure, physical vulnerability, socioeconomic vulnerability, and the village's low capacity. The study formulated 16 mitigation strategies across three time horizons, with community capacity strengthening as the intervention of highest strategic value because it directly reduces the CI and lowers risk comprehensively. Consistent implementation of all strategies is projected to significantly reduce the CI and lower risk levels to more manageable categories.

RECOMMENDATIONS

The Torue Village Government is advised to promptly establish a Village Disaster Management Team through a Village Disaster Regulation, allocate APBDes (village budget) funds for infrastructure maintenance and regular disaster risk reduction training, and prepare and disseminate a hamlet-level Flood Risk Map. The Parigi Moutong Regency Government is advised to use the results of this study as input for revising the Regional Disaster Management Plan and the Spatial Planning Plan, accelerate the installation of an integrated early warning system through the BPBD, and prioritize the rehabilitation of embankments and drainage through the Public Works Agency (Dinas PUPR).

The Torue Village community is advised to participate actively in evacuation training and simulations, to consider relocation for those residing within 50 meters of the riverbank, and to build a collective disaster savings fund at the neighborhood (RT) level. Future research is advised to revalidate the Capacity Index after at least one mitigation implementation cycle, and to replicate and adapt this ISO 31000:2018-based risk analysis model with CI correction in other villages with similar vulnerability characteristics.

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