



Flood Mitigation in East Bintan District by the Bintan Regency Regional Disaster Management Agency in 2025: Case Study Kijang Kota Urban Village

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Abstract

Flooding remains a recurring disaster in Kecamatan Bintan Timur, particularly Kijang Kota Urban Village, requiring sustained mitigation involving government institutions and communities. This study aims to analyze flood mitigation implementation by the Regional Disaster Management Agency (BPBD) of Bintan Regency using William Nick Carter's non-structural mitigation framework. A qualitative descriptive approach was employed, with data collected through interviews, observation, and documentation involving BPBD, the Public Works and Spatial Planning Agency, TAGANA, and local residents. Data were analyzed through data reduction, data presentation, and conclusion drawing based on six indicators: legal framework, institutional development, community awareness, training and education, incentives, and early warning systems. The findings indicate that mitigation has been implemented through regulatory instruments, institutional coordination, community education, disaster simulations, capacity-building programs, and early warning communication networks. Community awareness has improved, although participation remains uneven, while training activities are constrained by limited funding. Specific incentives have not been established for mitigation actors. Early warning mechanisms using digital applications, WhatsApp groups, and local communication networks have supported information dissemination but require stronger digital literacy. The study concludes that mitigation is functioning but requires institutional strengthening and sustained community participation.

Keywords : flood mitigation, BPBD, non-structural mitigation, community preparedness, early warning system.



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INTRODUCTION

Flood is one of the hydrometeorological disasters that repeatedly affects communities and generates social, economic, environmental, and infrastructure impacts. High rainfall, tidal flooding, inadequate drainage capacity, and changes in land use contribute to the persistence of flood hazards in many regions. Flood risk management requires preventive measures that address both physical hazards and the capacity of communities to respond to disaster threats. Ni'matussyahara et al. (2022) emphasize that flood risk management is directed toward minimizing potential damage through systematic risk reduction efforts.

Disaster management is not limited to emergency response after a disaster occurs, but also includes preventive and preparedness measures before the hazard develops into a disaster. Harijoko et al. (2021) explain that disaster management in Indonesia requires an integrated approach to disaster risk reduction involving government institutions and communities. The government holds an important position in establishing policies, coordinating institutions, developing preparedness programs, and strengthening community capacity. Rahim et al. (2023) also identify the role of local government as an important component in flood disaster management through regulatory and administrative arrangements.

Flood mitigation requires coordination among institutions because flood risks often cross administrative, sectoral, and community boundaries. Armando and Arif (2023) describe integrated and collaborative flood mitigation as an approach that involves cooperation among government institutions, communities, and other relevant actors. Institutional collaboration can improve the distribution of

responsibilities, information, resources, and emergency responses. Such collaboration becomes more important in areas where flood events are recurrent and require continuous risk reduction measures.

Community institutions also have an important function in strengthening disaster mitigation at the local level. Buchari (2020) shows that community-based institutions can organize residents, increase awareness, and strengthen their capacity to face disaster risks. Community participation allows mitigation programs to reach households and local groups that are directly exposed to hazards. This approach places communities not only as recipients of government assistance but also as active actors in disaster risk reduction.

The coastal characteristics of an area can further increase the complexity of flood mitigation because hydrological conditions may interact with tidal processes and human activities. Dewi Diana Pramata et al. (2024) discuss resource management and disaster mitigation in coastal areas through approaches that combine environmental management, community involvement, and educational activities. Coastal communities require mitigation strategies that consider local environmental characteristics and the patterns of hazards affecting settlements. Kharimah et al. (2021) similarly emphasize the importance of flood mitigation measures in reducing disaster risks and supporting community security.

William Nick Carter's disaster mitigation framework provides a basis for examining non-structural mitigation through several complementary components. Carter (1991) places legal frameworks, institutional arrangements, public awareness, training and education, incentives, and early warning systems among important elements of disaster management. These components address the administrative, social, educational, motivational, and informational dimensions of disaster risk reduction. The framework is relevant for examining whether mitigation activities have been supported by formal regulations, institutional coordination, community preparedness, capacity development, incentives, and mechanisms for delivering warnings.

The implementation of flood mitigation by local disaster management agencies remains important because formal policies do not automatically guarantee effective risk reduction at the community level. Nurillah et al. (2022) demonstrate that flood disaster mitigation by a regional disaster management agency involves managerial and operational efforts to reduce risks before, during, and after flood events. The effectiveness of mitigation is influenced by institutional capacity, coordination, preparedness, community participation, and the availability of supporting resources. These conditions indicate the need to examine mitigation practices based on specific indicators rather than assessing disaster management only from the occurrence or absence of flood events.

Kijang Kota, Kecamatan Bintan Timur, Kabupaten Bintan, represents an important setting for examining the implementation of flood mitigation because the area experiences recurring flood problems associated with rainfall, tidal conditions, and drainage limitations. The persistence of flooding indicates that mitigation requires more than emergency assistance and must include sustained preventive and preparedness measures at institutional and community levels. Empirical investigation through interviews and field-based information is important for identifying how mitigation policies and programs are implemented by responsible actors, with interviews serving as a recognized method for obtaining information directly from research participants (Fadhallah, 2021). This study therefore examines the implementation of flood mitigation by BPBD Kabupaten Bintan in Kecamatan Bintan Timur, particularly Kelurahan Kijang Kota, using William Nick Carter's non-structural mitigation indicators as the analytical framework.

RESEARCH METHODS

This study employed a qualitative approach with a descriptive method to obtain an in-depth understanding of flood mitigation implementation by the Regional Disaster Management Agency (BPBD) of Bintan Regency in East Bintan District, particularly Kijang Kota Urban Village. Data were collected through interviews, observation, and documentation to identify program implementation, institutional coordination, community involvement, and constraints in flood mitigation activities. Interviews were conducted to obtain direct information from research informants regarding mitigation practices in the field, while documentation was used as supporting evidence for the research findings (Fadhallah, 2021).

The research was conducted at the BPBD of Bintan Regency, with the study focusing on flood mitigation implementation in East Bintan District, particularly Kijang Kota Urban Village. The research

informants consisted of personnel from the BPBD of Bintan Regency as the main informants, as well as representatives of the Public Works and Spatial Planning Agency (PUPR), Disaster Preparedness Cadres (TAGANA), and residents of Kijang Kota Urban Village as supporting informants. Data analysis was conducted through data reduction, data presentation, and conclusion drawing, followed by analysis using six non-structural disaster mitigation indicators developed by William Nick Carter: legal framework, institutional development, public awareness, training and education, incentives, and early warning systems.

RESULTS AND DISCUSSION

Legal Framework and Institutional Arrangement in Flood Mitigation

The implementation of flood mitigation in East Bintan District is supported by a regulatory framework that establishes the authority, procedures, and responsibilities of the Regional Disaster Management Agency (BPBD) of Bintan Regency. The findings indicate that BPBD refers to Law Number 24 of 2007 on Disaster Management, Government Regulation Number 21 of 2008, Regional Regulation of Bintan Regency Number 4 of 2022, and Regent Regulation of Bintan Number 42 of 2022 in conducting mitigation activities. These regulations are operationalized through disaster management documents, including the Disaster Risk Assessment (KRB), Disaster Management Plan (RPB), Flood Contingency Plan, and Standard Operating Procedures (SOP). Triyana (2013) emphasizes that disaster management in Indonesia requires a clear regulatory foundation because legal arrangements determine institutional authority and the implementation of disaster management programs.

Table 1. Regulatory and Operational Basis for Flood Mitigation

Regulatory/Operational Instrument	Function in Flood Mitigation
Law No. 24 of 2007	National legal foundation for disaster management
Government Regulation No. 21 of 2008	Regulation of disaster management implementation
Regional Regulation of Bintan Regency No. 4 of 2022	Regional basis for disaster management
Regent Regulation of Bintan No. 42 of 2022	Regional administrative and operational arrangements
Disaster Risk Assessment (KRB)	Identification and assessment of disaster risks
Disaster Management Plan (RPB)	Planning for disaster risk reduction
Flood Contingency Plan	Preparation for flood emergency conditions
Standard Operating Procedures (SOP)	Operational guidance for disaster response

The regulatory framework is reflected in operational procedures for receiving flood reports, assessing field conditions, recording affected areas, and coordinating responses among relevant institutions. The research findings show that flood reports from residents are followed by field verification and data collection by BPBD personnel, indicating that formal procedures have been translated into operational activities. Sri Heryati (2021) identifies local government as a central actor in disaster management because regional institutions possess administrative responsibilities for implementing disaster risk reduction programs. The regulatory structure observed in Bintan provides an institutional basis for consistent action, although the effectiveness of implementation remains dependent on coordination and institutional capacity.

Table 2. Institutional Roles in Flood Mitigation

Institution/Actor	Main Role
BPBD Kabupaten Bintan	Coordination and disaster management
Dinas PUPR	Infrastructure and flood-control support
Dinas Sosial/TAGANA	Social assistance and initial assessment
TNI/Polri	Security and field support
Kecamatan	Local administrative coordination
Kelurahan	Community-level coordination

RT/RW	Local information distribution
Community	Preparedness and participation

Institutional arrangement constitutes the second major component of the mitigation system because flood management requires division of responsibilities among actors with different technical and administrative capacities. BPBD functions as the principal coordinator, while the Public Works and Spatial Planning Agency supports infrastructure-related measures, TAGANA assists with initial assessment and social disaster management, and TNI/Polri provide field support. Ierdiana et al. (2025) demonstrate that government coordination between disaster management agencies and public works institutions is important in implementing flood mitigation, particularly when mitigation involves both administrative and infrastructural dimensions. Similar institutional coordination is evident in Bintan through the use of the Disaster Management Plan, Disaster Risk Reduction Forum, and formal assignment documents that provide a basis for inter-agency cooperation.

The institutional mechanism operates through field assessment, communication, and distribution of responsibilities according to the conditions identified by BPBD. The findings indicate that coordination is activated according to the needs of affected communities, with BPBD organizing the response and other institutions providing sector-specific support. Kahana et al. (2025) shows that institutional strategy within BPBD is closely related to organizational structure, programs, resource management, and coordination capacity in disaster management. The arrangement in Bintan has established the basic institutional structure required for flood mitigation, but sustained coordination remains necessary to strengthen implementation at the local level.

Community Awareness and Training and Education in Flood Mitigation

Community awareness is a central component of non-structural flood mitigation because disaster preparedness depends on the ability of residents to recognize risks and respond to early threats. The findings indicate that BPBD Kabupaten Bintan has implemented socialization, disaster education, counseling, simulations, and community-based programs such as Desa Tangguh Bencana (DESTANA), Sekolah Aman Bencana (SAB), and Keluarga Tangguh Bencana (KATANA). Information is also distributed through mass media, social media, pamphlets, and communication with BMKG concerning weather conditions and potential hazards. Sari et al. (2020) demonstrate that disaster education can strengthen public understanding of flood mitigation when educational activities are adapted to local conditions and community characteristics.

Table 3. Community Awareness Programs for Flood Mitigation

Community Program	Main Activity	Intended Outcome
DESTANA	Community-based disaster preparedness	Strengthened village preparedness
SAB	Disaster education in schools	Increased student preparedness
KATANA	Family-level disaster education	Improved household preparedness
Socialization	Delivery of flood mitigation information	Increased risk awareness
Counseling	Explanation of disaster risks and responses	Improved community knowledge
Simulation	Practical disaster response exercises	Improved emergency preparedness
Social media	Distribution of disaster information	Wider information access
Pamphlets	Dissemination of mitigation information	Accessible public information

The findings further indicate that residents in Kijang Kota possess practical knowledge concerning recurring flood characteristics in their residential environment. Some residents reportedly secure valuable belongings before flooding occurs and recognize rainfall intensity, river overflow, and

tidal conditions as factors associated with flood events. Community participation, however, is not evenly distributed because some residents do not actively participate in socialization and disaster simulation activities. Sari et al. (2024) underline that motivation and community participation are important factors in strengthening flood risk reduction, particularly at the local level.

Table 4. Community Awareness Findings in Kijang Kota

Observed Aspect	Research Finding	Condition
Knowledge of flood characteristics	Residents recognize recurring flood patterns	Relatively adequate
Protection of valuable belongings	Some residents secure belongings before flooding	Implemented
Recognition of rainfall risk	Residents identify high rainfall as a flood factor	Adequate
Recognition of tidal risk	Residents identify tidal flooding as a local threat	Adequate
Participation in socialization	Not all residents participate actively	Not evenly distributed
Participation in simulations	Participation remains limited among some residents	Needs strengthening
Community preparedness	Preparedness exists but varies between residents	Moderate

Training and education constitute another component of mitigation because knowledge must be accompanied by practical capacity to perform appropriate actions during emergencies. BPBD Kabupaten Bintan conducts capacity-building activities through online training, disaster simulations, emergency response exercises, and KATANA activities involving community members. Training for BPBD personnel is directed toward improving knowledge of disaster management, while simulations provide opportunities to practice evacuation procedures, emergency coordination, and role distribution. Sari et al. (2020) support the use of disaster education as an instrument for strengthening community preparedness and understanding of flood mitigation.

The implementation of training remains constrained by limited financial resources, which affects the frequency and intensity of direct field-based training activities. Some capacity-building activities are conducted through online platforms such as Zoom Meeting, allowing knowledge transfer to continue while providing less opportunity for direct practical exercises. Practical simulations remain important because disaster preparedness involves technical skills, coordination, decision-making, and rapid response rather than theoretical knowledge alone. The findings indicate that BPBD Kabupaten Bintan has established training and educational activities, but their implementation requires greater continuity and practical orientation to strengthen the preparedness of personnel and communities.

Incentives and Early Warning Systems in Flood Mitigation

Incentives represent an element of non-structural mitigation intended to encourage participation and strengthen motivation among actors involved in disaster risk reduction. The findings show that BPBD Kabupaten Bintan has not established specific incentives for residents or personnel directly involved in flood mitigation activities in Kijang Kota. Government support is instead directed toward institutional strengthening through budget allocation, mitigation programs, operational facilities, and post-disaster assistance. Sari et al. (2024) indicate that community motivation and participation constitute important elements in strengthening flood risk reduction, particularly when communities are encouraged to engage actively in mitigation activities.

Table 5. Forms of Government Support Related to Flood Mitigation

Support Aspect	Implementation Finding	Main Orientation
Budget allocation	Funding provided for disaster management programs	Institutional support
Mitigation programs	Prevention and preparedness activities implemented	Risk reduction
Operational facilities	Supporting equipment provided for disaster operations	Operational capacity
Rehabilitation	Assistance provided according to disaster damage	Post-disaster recovery
Reconstruction	Support provided for affected communities	Recovery
Capacity strengthening	Activities conducted for institutions and communities	Preparedness
Direct incentives	No specific incentive scheme identified	Needs strengthening

The absence of direct incentives indicates that participation in mitigation activities is primarily based on institutional responsibility and social awareness rather than material or formal recognition. Government assistance is more visible through rehabilitation and reconstruction programs for affected communities, while preventive participation does not yet receive a specific incentive mechanism. This condition limits the motivational function of the incentive component within Carter's non-structural mitigation framework. The findings indicate that incentive development could be directed toward recognition, community-based support, or other mechanisms that encourage sustained participation in prevention and preparedness activities.

Table 6. Incentive Conditions in Flood Mitigation

Indicator	Existing Condition	Assessment
Incentive for community participation	No specific incentive	Not optimal
Incentive for mitigation personnel	No specific incentive identified	Not optimal
Post-disaster assistance	Rehabilitation and reconstruction support available	Implemented
Institutional budget	Available for mitigation activities	Implemented
Community motivation	Primarily based on social and institutional responsibility	Requires strengthening
Recognition for active participation	No specific mechanism identified	Requires development

Early warning systems constitute a critical component of flood mitigation because timely information enables residents and institutions to prepare before hazardous conditions escalate. BPBD Kabupaten Bintan utilizes disaster-related applications, WhatsApp communication groups, coordination with village and neighborhood authorities, volunteers, and TAGANA to disseminate information concerning potential flood events. Communication through RT/RW networks provides an additional mechanism for transferring information from government institutions to households at the community level. Waluyo and Putra (2024) emphasize the importance of technology-based early warning systems for accelerating the transmission of flood information and supporting anticipatory action.

Table 7. Early Warning Mechanisms Used in Flood Mitigation

Early Warning Mechanism	Main Users/Actors	Function
Disaster application	BPBD and community	Disaster information dissemination
WhatsApp groups	Government, RT/RW, volunteers, residents	Rapid information distribution
RT/RW communication network	Local community authorities	Community-level warning
TAGANA coordination	Disaster volunteers and institutions	Information and field coordination
Government communication	BPBD and local government	Administrative warning dissemination
Weather information	BPBD and related agencies	Identification of potential hazards

The findings show that the early warning mechanism combines digital technology with community-based communication rather than depending on a single technological platform. WhatsApp groups and local government networks remain important because they are familiar to residents and can distribute information rapidly through existing social structures. Sagita and Tantri (2024) highlight the importance of disaster communication conducted by BPBD in increasing the role of younger community groups, indicating that communication strategy affects the accessibility and effectiveness of disaster information. The early warning system in Kijang Kota has therefore been implemented at an operational level, although continued socialization and improvement of digital literacy are required to increase community utilization of available disaster information systems

CONCLUSION

Flood mitigation implementation by BPBD Kabupaten Bintan in Kecamatan Bintan Timur, particularly Kijang Kota Urban Village, has been implemented through the six non-structural mitigation indicators of William Nick Carter, comprising legal framework, institutional development, community awareness, training and education, incentives, and early warning systems. The legal framework has provided formal guidance through regulations, disaster management plans, contingency plans, and SOPs, while institutional development has been supported by coordination among BPBD, PUPRP, TAGANA, TNI/Polri, local government, and community actors. Community awareness has been strengthened through socialization, education, simulation, DESTANA, SAB, and KATANA programs, although community participation remains uneven. Training and education have improved preparedness among personnel and residents, but limited budget availability affects the intensity of practical training activities.

The incentive component remains less developed because specific incentives for communities and mitigation personnel have not been identified, with government support concentrated on programs, operational facilities, rehabilitation, and reconstruction. The early warning system has been implemented through disaster applications, WhatsApp communication groups, RT/RW networks, volunteers, and coordination among relevant institutions. The system has supported rapid information dissemination, although digital literacy and community utilization of disaster applications require further improvement. Flood mitigation in Kijang Kota therefore shows a functional non-structural framework, while stronger community participation, continuous practical training, incentive mechanisms, and early warning capacity remain important areas for institutional improvement.

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