DRAINAGE SYSTEM REVITALIZATION THROUGH COMMUNITY EMPOWERMENT: FLOOD MITIGATION IN KARANG JOANG SUBDISTRICT, NORTH BALIKPAPAN

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Abstract

This community service journal article details an intervention aimed at mitigating recurrent flooding issues on Batu Ratna Road, KM 11, Balikpapan. The flooding, typically exacerbated by heavy rainfall and river overflow, would persist for 6-12 hours even after the river levels had subsided. A field survey identified that the primary cause was the reduced efficacy of the drainage system due to obstructions from poorly planned infrastructure developments, accumulation of construction materials, and overgrowth in vacant lots impeding water flow. Consequently, the mitigation efforts comprised two main activities: a community cleanup to restore drainage system functionality and an educational campaign on the importance of maintaining free-flowing drainage systems. Post-intervention observations indicated significant improvements, with heavy rains now only causing minor puddling and significantly reduced flood duration to 1-2 hours. This study underscores the effectiveness of community-based participatory approaches in addressing urban drainage issues and enhancing resilience against flooding.

Keywords: *Drainage maintenance, Drainage system revitalization, Environmental awareness, Flood mitigation*

1. Introduction

Karang Joang Village, located within the North Balikpapan Sub-district, covers an expansive land area of 93.09 km2. Among the six villages present in this region, Karang Joang stands out due to its unique challenges and potential for urban development. As per the standards set by the Indonesian National Standards, the village exhibits a high population density. This requires judicious decisions regarding land use. A reduction in horizontal land expansion and the adoption of vertical housing developments have been recommended. Such urban planning decisions are aimed at ensuring the balanced growth of the area, as underscored by the principles of urban rejuvenation documented by Pokja PPAS (Pokja PPAS, 2019). A microcosm of the broader village, the Jalan Batu Ratna area, specifically at KM 11, houses over 1000 residents. Such dense inhabitation brings its own set of urban challenges, among which flooding stands out as a primary concern.

Through surveys and local resident interviews, it became evident that flooding was a recurrent and major concern for inhabitants in the Jalan Batu Ratna region. Flooding is not just a sporadic natural phenomenon but a sustained threat undermining daily lives, infrastructure, and public health. As Hong accurately defined, flooding is the manifestation of an overflow of water that goes beyond the capacity of existing drainage systems (Hong, Adhikari, & Gourley, 2016). The urgency to address the flooding issue is compounded by the fact that Jalan Batu Ratna serves as the sole access route connecting the local community to the main public road. This critical infrastructure's susceptibility to flooding disrupts essential daily activities, limits access to emergency services, and can isolate the community during severe weather

conditions. Ensuring the road remains passable is vital not only for the routine commuting but also for the overall safety and economic stability of the area.

Several contributing factors to the flooding issues in the Jalan Batu Ratna area have been identified. Firstly, garbage accumulation due to improper waste management leads to blockages in drainage outlets, thereby reducing the efficiency of water outflow. Secondly, the area grapples with inadequate drainage systems. The combination of aging infrastructure, insufficient maintenance, and poorly designed systems renders them ineffective in handling the water volume, especially during heavy rainfall. Lastly, the rivers, which play an integral role in draining excess water, face disruptions in their natural flow. Factors like sedimentation, obstructions, and diversions hinder the smooth passage of water, adding to the flooding woes. It was considered why not to initially focus on expanding the capacity of the drainage system. The primary reason was the absence of detailed drainage system design documents, making it difficult to assess the need for capacity enhancement accurately. Given the high investment required for capacity expansion compared to revitalization, this initiative first aims to revitalize the existing infrastructure. By doing so, we can evaluate if the current drainage capacity, once optimized through cleanup and maintenance, suffices to manage the flooding issues. This approach allows for a more resource-efficient strategy, prioritizing immediate, less costly solutions while assessing the need for more extensive future investments.

The severe flooding challenges faced by Karang Joang Village resonate with the grave situation in Jakarta, Indonesia's bustling capital. The situation in Jakarta is not only a representation of the dangers of unaddressed urban flooding but also an illustration of how intertwined socio-economic and environmental factors exacerbate these challenges (Renaldi, 2022). Reference to real-life incidents, such as the devastating floods in Jakarta in 2020, serves as a grim reminder of the urgency of addressing flood-related issues. According to a study by The Center for Southeast Asian Studies (2020), urban flooding in Indonesia's capital was exacerbated by similar challenges, including garbage accumulation and poor river flow. This correlation is further underscored by the harrowing experiences of Jakarta's residents, like those in the Muara Baru neighborhood, where Suhemi's restaurant and home were threatened by rising seas and sinking land (Rinaldi, 2022). As mentioned in the article, the government's measures, like the coastal wall built in 2002, provided only temporary respite, as it was breached in 2007 due to an unprecedented flood, resulting in extensive damage and loss of life.

Much like the garbage and drainage issues in Karang Joang Village, Jakarta's flood crises can be attributed to a combination of factors. One of the key causes in Jakarta is the massive over-extraction of groundwater, due to a lack of a reliable public water supply. This has led to significant land subsidence, especially in areas like North Jakarta. With around 40 percent of the city now below sea level, Jakarta faces a heightened risk of flooding. The city's history and its transformation under Dutch colonial rule, including the construction of canals intended to regulate water flow, inadvertently compounded its flood challenges. The canals, instead of alleviating flooding, trapped sediments, preventing the natural replenishment of the delta's alluvial soil.

The distressing tale of Suhemi, whose life was disrupted by the 2007 flood, highlights the immediate impact of these larger issues on individual lives. Despite attempts to rebuild and adapt, the looming threat of another flood remains a daily concern for many Jakartans. This ever-present danger is amplified by the growing challenges of land subsidence and climate change, further straining Jakarta's already fragile environmental support system.

In conclusion, the predicaments of both Karang Joang Village and Jakarta, though on different scales, underscore the intricate web of environmental, infrastructural, and socio-economic factors that contribute to urban flooding. As exemplified in a recent study on flood risk management in Metro Manila, Philippines, and Jakarta, Indonesia, the sustainability and efficiency of flood risk management hinges on the accurate assessment of flood hazards and on the precise quantification of flood damage (Kefi, Mishra, Masago, & Fukushi, 2020). This study illustrates the deep-seated connection between flood drivers and flood damage,

highlighting the predicted rise in total flood damage by 80% in Jakarta by 2030, primarily due to an uptick in extreme rainfall events and urbanization. These findings echo the urgency of addressing the challenges faced by both regions. Addressing these challenges requires a multifaceted approach, including both short-term remedial actions and long-term strategies that prioritize sustainability and resilience.

2. Methodology

Addressing the persistent flooding challenges in Karang Joang Village requires a methodology that balances technical interventions with strong community engagement. This approach not only aims to resolve the immediate problems but also fosters a sense of ownership and responsibility among the residents, ensuring the sustainability of the initiatives.

2.1 Social Movement for Drainage System Revitalization

The primary strategy is the revitalization of the existing drainage system, guided by findings from detailed field surveys that highlighted specific blockages and inefficiencies. Given the absence of comprehensive design documents for the drainage system, this initiative prioritizes revitalization to optimize the current capacity. Residents are actively involved in this process, leveraging their local knowledge and vested interest in the well-being of their environment. This participation not only accelerates the initiative but ensures that interventions are tailored to the specific challenges of the area.

2.2 Technical Assessments and Community Training

Following the revitalization, it is crucial to assess its effectiveness in managing flood risks. This phase involves technical assessments to measure improvements in drainage performance during rainfall events. Concurrently, we conduct training workshops and awareness campaigns to educate residents on maintaining and monitoring the drainage system. These activities aim to equip the community with the knowledge to sustain the improvements and recognize potential issues early.

2.3 Post-revitalization Follow-up and Awareness

This stage focuses on embedding a proactive maintenance culture within the community. Regular community meetings and follow-ups ensure that the residents remain vigilant and committed to maintaining the drainage system's functionality. Through continuous education and engagement, we empower the community to take long-term ownership of flood prevention measures.

This methodology seeks to integrate immediate technical solutions with extensive community involvement. By emphasizing initial revitalization followed by community training and technical assessments, the approach aims to create a sustainable, replicable model for flood management in regions facing similar challenges.

3. Result

Following the implementation of our comprehensive methodology, a series of tangible results emerged, emphasizing the impact and effectiveness of community-driven initiatives. These outcomes not only highlight the physical transformations that took place within the drainage systems of the Karang Joang Subdistrict, North Balikpapan, but also the perceptible shift in the community's understanding and approach towards environmental concerns and flood management. Engaging residents in the revitalization process not only led to infrastructural enhancements but also fostered a sense of ownership and responsibility, promoting long-term sustainability. The results encompass improvements in drainage infrastructure, enhanced environmental awareness indicators, and successful community engagement sessions, all of which jointly contribute to a more informed and proactive community. Furthermore, through our dedicated efforts in this "pengabdian," we gleaned

valuable insights into the broader challenges of flood management, emphasizing the critical role of river capacity in the overall equation.

3.1 Revitalized Drainage System

In our endeavors to mitigate the flooding risk in Karang Joang Subdistrict, one of the most impactful interventions was the rejuvenation of the drainage system. Figure 1 vividly illustrates the transformation brought about by our intervention. Specifically, Figure 1 (a) showcases a drainage that was previously blocked by discarded construction materials, severely impeding the water flow. This obstruction posed a significant flooding risk, especially during periods of heavy rainfall. However, as can be seen in Figure 1 (b), after clearing the blockage and excavating a new drainage channel, the result is a newly constructed drainage system, designed to facilitate efficient water flow. The primary objective of this intervention was to optimize drainage capacity. By ensuring a consistent and unhindered flow of water towards the primary river channel, we've established a frontline defense against immediate flood threats. Now, surplus water, particularly during heavy downpours, can be efficiently and rapidly directed away from human settlements, minimizing the potential for inundation.

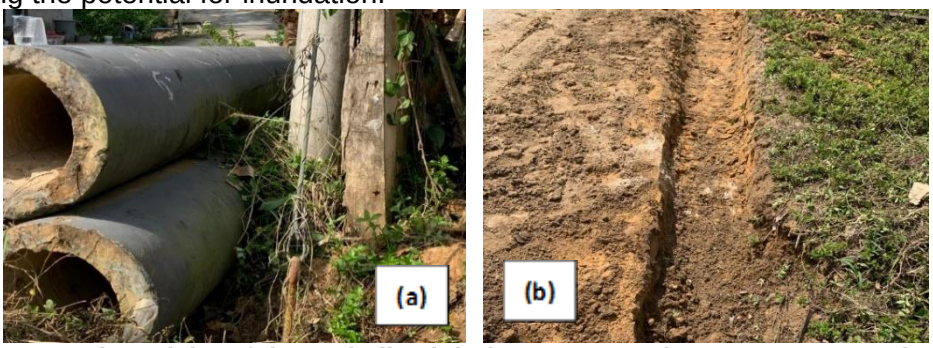

Figure 1: A sample activity of the revitalized drainage system in Karang Joang, showcasing (a) a drainage blocked; (b) the newly constructed drainage.

3.2 Enhanced Environmental Awareness

In our endeavors to mitigate the flooding risk in Karang Joang Subdistrict, one of the most impactful interventions was the rejuvenation of the drainage system. As Figure 1 demonstrates, our efforts have resulted in a noticeably revitalized drainage network. The crux of this endeavor was to optimize the drainage capacity. By ensuring a consistent and unhindered flow of water towards the primary river channel, we've established a frontline defense against immediate flood threats. Now, surplus water, particularly during heavy downpours, can be efficiently and rapidly directed away from human settlements, minimizing the potential for inundation.

Figure 2: Instructional boards and warning signs erected around Karang Joang, aimed at promoting environmental awareness and maintenance of the drainage system

3.3 Community Awareness Sessions

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Figure 3: A snapshot from one of the community awareness sessions in Karang Joang, emphasizing the importance of understanding and maintaining drainage systems

In light of the comprehensive efforts and results documented, the revitalization of the drainage system in Karang Joang Subdistrict stands as a testament to effective community involvement and proactive flood mitigation. The tangible improvements, as visualized in the documented figures, underpin the success of these endeavors. Notwithstanding these successes, it is imperative to view flood mitigation as a multifaceted challenge. The community awareness drives have unquestionably fortified the residents' knowledge, but infrastructural enhancements need to go hand in hand with these informational initiatives. The identified choke points in the main river, if unaddressed, have the potential to undermine the efficacy of the revitalized drainage system. Consequently, it is our earnest recommendation to prioritize a comprehensive study of these choke points, followed by decisive actions like dredging or structural modifications. Only by addressing both the local drainage channels and the broader river capacity can we truly safeguard the Karang Joang Village from future flood threats and ensure its sustained resilience.

4. Conclusion

The project embarked upon in the Karang Joang Subdistrict has underscored the significance of community engagement and infrastructural development in flood mitigation strategies. The successful revitalization of the drainage system, coupled with strategic community awareness initiatives, has shown considerable promise in reducing the immediate flood risks faced by the residents. Moreover, the documentation and firsthand accounts serve as a repository of both the challenges faced and the triumphs achieved.

However, our findings also spotlight the importance of adopting a holistic approach. While the drainage system's restoration has been successful, the potential bottlenecks in the main river's capacity are areas that warrant immediate attention. Addressing these choke points is paramount to ensuring the long-term sustainability of the flood mitigation measures. Thus, for Karang Joang Village and other similar areas, the journey towards complete flood resilience requires both community preparedness and infrastructural robustness.

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