



Waste Management Efforts in Flood Problems by The Government of Palembang: A Legal Perspective

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ABSTRACT

Urban flooding in Palembang has emerged as a critical environmental and governance challenge, where inadequate waste management systems exacerbate hydrological risks and intensify disaster vulnerability. This study aims to evaluate the legal effectiveness of waste governance in Palembang by analysing the interaction between regulatory frameworks, institutional enforcement, and community behaviour in addressing flood-related waste issues. The novelty of this research lies in integrating a socio-legal perspective that highlights enforcement gaps, institutional weaknesses, and cultural waste disposal practices, thereby positioning environmental law not only as a regulatory instrument but also as a tool for adaptive governance in disaster risk reduction. Employing a mixed-methods design, the study combines in-depth interviews with enforcement agencies and community leaders and a structured survey of 475 respondents across five sub-districts, analysed through Miles and Huberman's interactive model. The findings reveal a significant gap between legal provisions and practical implementation, stemming from weak inter-agency coordination, limited infrastructure, insufficient enforcement personnel, and entrenched socio-cultural behaviours. While formal regulations exist, their operationalisation remains fragmented, underscoring the need for strengthened institutional capacity, consistent enforcement, and community engagement to reduce waste-related flooding in Palembang and similar urban contexts.

INTRODUCTION

Urban flooding is among the most pressing and recurrent environmental threats facing Southeast Asian cities in the 21st century. Its impacts are far-reaching, encompassing damage to infrastructure, disruption of economic activity, environmental degradation, and in severe cases, the loss of lives.¹ As climate variability increases and land-use patterns shift, flooding becomes not only more frequent but also more complex to manage.² In Indonesia, these challenges are magnified by rapid urbanization, weak spatial planning, and governance deficits in waste management and environmental protection. One city that exemplifies this multidimensional vulnerability is Palembang—a provincial capital with a population exceeding 1.7 million and a growing record of urban

¹ Badan Pemeriksa Keuangan, "UU No. 24 Tahun 2007," *JDIH BPK*, April 2007, Accessed January 9, 2025. <https://peraturan.bpk.go.id/Details/39901/uu-no-24-tahun-2007>.

² Alan Boyle, "Human Rights and the Environment: Where Next?," *European Journal of International Law*, vol. 23, no. 3 (October 2012): 613–642, doi: <https://doi.org/10.1093/ejil/chs054>.

flood events.³ While infrastructural interventions such as drainage system upgrades have been initiated, the city continues to suffer from severe and localized inundations during seasonal rainfall. These recurring floods underscore the limitations of technical fixes in the absence of effective regulatory and behavioural change.⁴

Among the key non-climatic drivers of flooding in urban Indonesia is solid waste mismanagement.⁵ The correlation between ineffective waste governance and the frequency of urban flooding is well-established.⁶ Uncollected or poorly disposed waste, particularly plastic and non-biodegradable materials, frequently clogs storm drains, canals, and riverways-disrupting the natural flow of water and increasing surface runoff.⁷ In Palembang, the volume of waste generated per day exceeds 1,200 tons, most of which originates from household and market activities. However, the city's waste disposal infrastructure and workforce remain insufficient. Field data and government reports indicate that many neighbourhoods still lack adequate temporary waste collection sites (TPS), and illegal dumping into rivers persists despite regulatory prohibitions. These systemic deficiencies in waste management serve as critical bottlenecks in Palembang's urban resilience efforts.

From a governance perspective, the regulation of waste management falls under the joint responsibility of central and local governments. Law No. 18 of 2008 on Waste Management provides a comprehensive legal framework that mandates local governments to implement sustainable waste reduction and handling strategies.⁸ Additionally, Palembang City has adopted Regional Regulation No. 3 of 2015 on the Management of Household Waste and Other Similar Waste (Peraturan Daerah Kota Palembang Nomor 3 Tahun 2015 tentang Pengelolaan Sampah Rumah Tangga dan Sampah Sejenis Sampah Rumah Tangga), which operationalizes national law at the municipal level. Enforcement of these regulations is carried out by the Civil Service Police Unit (Satpol PP), in coordination with the Environmental and Sanitation Agency (Dinas Lingkungan Hidup dan Kebersihan). Yet, legal provisions alone are insufficient to drive change. Effective law enforcement requires adequate institutional capacity, inter-agency coordination, budgetary support, and-critically-public compliance. The absence or weakness of any of these elements often results in policy failure.⁹

³ International Federation of Red Cross and Red Crescent, "World Disasters Report 2010: Focus on Urban Risk," December 2017, Accessed January 9, 2025. <https://www.ifrc.org/document/world-disasters-report-2010-focus-urban-risk>.

⁴ Abhas K Jha, Robin Bloch, and Jessica Lamond, *Cities and Flooding: A Guide to Integrated Urban Flood Risk Management for the 21st Century* (Washington, 2012), Accessed January 9, 2025 <https://documents1.worldbank.org/curated/en/725851468170946234/pdf/667990PUB0Box30d0Flooding0Guidebook.pdf>.

⁵ Luís Cea and Pierfranco Costabile, "Flood Risk in Urban Areas: Modelling, Management and Adaptation to Climate Change. A Review," *Hydrology* 9, no. 3 (March 2022): 50–50, doi:10.3390/hydrology9030050.

⁶ Robert J Nicholls, "Coastal Flooding and Wetland Loss in the 21st Century: Changes under the SRES Climate and Socio-Economic Scenarios," *Global Environmental Change* 14, no. 1 (April 2004): 69–86, doi:10.1016/j.gloenvcha.2003.10.007.

⁷ Corey J. A. Bradshaw et al., "Global Evidence That Deforestation Amplifies Flood Risk and Severity in the Developing World," *Global Change Biology* 13, no. 11 (August 2007): 2379–2395, doi: <https://doi.org/10.1111/j.1365-2486.2007.01446.x>.

⁸ Leticia Blázquez, Juan A. García, and José M. Bodoque, "Stakeholder Analysis: Mapping the River Networks for Integrated Flood Risk Management," *Environmental Science & Policy* 124 (October 2021): 506–516, doi: <https://doi.org/10.1016/j.envsci.2021.07.024>.

⁹ Martin Bruwier et al., "Influence of Urban Forms on Surface Flow in Urban Pluvial Flooding," *Journal of Hydrology* 582 (March 2020): 124493–124493, doi:10.1016/j.jhydrol.2019.124493.

The challenge in Palembang is thus twofold: while legal mechanisms exist, their implementation remains fragmented and under-resourced; and while public awareness of waste-related risks is rising, behavioral change has yet to materialize at a sufficient scale. According to the Aqueduct Global Flood Analyzer, Indonesia ranks sixth globally in terms of population exposed to urban flooding, with over 640,000 people affected annually.¹⁰ In Palembang alone, 51 flood-prone areas were documented in 2019, including highly populated zones such as Jenderal Sudirman Street and Demang Lebar Daun. Despite efforts to address this, the recurrence of floods suggests that regulatory enforcement and public engagement are inadequate.

Previous studies on flood management in Indonesian cities have largely focused on technical infrastructure, spatial vulnerability mapping, or community-based adaptation strategies.¹¹ While valuable, such approaches tend to overlook the role of legal institutions as mediators between regulation and urban risk.¹² Literature on environmental law in Indonesia often remains normative, centered on the existence of regulations rather than their operational effectiveness.¹³ Moreover, studies that do consider law enforcement frequently analyze criminal law or administrative penalties in isolation, rather than as part of an integrated governance system.¹⁴ As such, a critical gap remains in understanding how legal instruments are enacted, enforced, and perceived at the local level in response to waste-induced flood risks.

This research addresses that gap by examining the implementation of legal frameworks governing waste management in Palembang City, with specific attention to their role in mitigating urban flood risks. It explores the extent to which legal mandates are translated into practice, how enforcement institutions navigate structural and resource limitations, and how local communities respond to regulatory interventions. By adopting a political-legal lens, the study situates waste governance within broader debates on environmental justice, urban vulnerability, and risk governance in developing contexts.

The novelty of this study lies in its empirical integration of legal enforcement theory with urban environmental risk analysis. Rather than merely assessing legal texts or institutional mandates, the research employs a mixed-method approach to capture both top-down and bottom-up dynamics. In-depth interviews with law enforcement officers and municipal officials are complemented by structured surveys distributed across five sub-districts in Palembang. This combination allows for a nuanced understanding of how laws are interpreted, implemented, and experienced in everyday urban practice. Furthermore, this study employs Lawrence M. Friedman's legal system theory-

¹⁰ Jörn Birkmann et al., "Adaptive Urban Governance: New Challenges for the Second Generation of Urban Adaptation Strategies to Climate Change," *Sustainability Science* 5, no. 2 (July 2010): 185–206, doi:10.1007/s11625-010-0111-3.

¹¹ Alon Tal, "The Environmental Impacts of Overpopulation," *Encyclopedia* 5, no. 2 (April 2025): 45–45, doi:10.3390/encyclopedia5020045.

¹² Dumilah Ayuningtyas et al., "Disaster Preparedness and Mitigation in Indonesia: A Narrative Review," *Iranian Journal of Public Health*, 50, no. 8 (Augustus 2021): 1536-1546. doi: <https://doi.org/10.18502/ijph.v50i8.6799>.

¹³ Mohd Amizan Mohamed et al., "Enhancing Flood Disaster Management in Klang Valley," *Jurnal Kejuruteraan* 36, no. 6 (November 2024): 2709–2715, doi: [https://doi.org/10.17576/jkukm-2024-36\(6\)-40](https://doi.org/10.17576/jkukm-2024-36(6)-40).

¹⁴ Boliang Dong et al., "Experimental and Numerical Model Studies on Flash Flood Inundation Processes over a Typical Urban Street," *Advances in Water Resources* 147 (January 2021): 103824–103824, doi: <https://doi.org/10.1016/j.advwatres.2020.103824>.

comprising legal substance, legal structure, and legal culture - as the analytical framework to examine institutional constraints and social reception. The survey instrument operationalizes this framework by focusing primarily on the cultural dimension, capturing community knowledge, attitudes, and behavioural practices regarding waste management. At the same time, qualitative interviews and regulatory analysis provide complementary insights into the substance and structure dimensions, particularly the adequacy of legal norms and the effectiveness of institutional enforcement. By integrating these three dimensions, the study offers a contextualized explanation of why waste-related flood governance in Palembang remains fragmented despite the presence of formal regulations.

This study contributes to the growing literature on environmental governance by emphasizing the operational dimension of law as a tool for urban disaster risk reduction. It argues that legal frameworks must be supported by institutional strengthening, participatory mechanisms, and sociocultural transformation in order to be effective. In the case of Palembang, strengthening waste management laws-and more importantly, ensuring their consistent and equitable enforcement-offers a promising pathway to enhancing flood resilience and environmental sustainability.

METHODS

This research adopts a mixed-method approach to explore the legal effectiveness of urban waste management policies in mitigating flood risks in Palembang, Indonesia. The integration of qualitative and quantitative techniques was chosen to ensure comprehensive insight into both institutional dynamics and public perceptions, enabling triangulation between formal regulatory frameworks and lived experiences in flood-prone urban contexts. Mixed-method research is especially suitable for complex socio-legal inquiries where legal norms must be assessed not only by textual analysis but also by examining how they operate in practice and are perceived by affected communities.¹⁵

Qualitative data were obtained through in-depth interviews with key informants, including officials from the Palembang City Civil Service Police Unit (Satpol PP), the Environmental and Sanitation Agency (Dinas Lingkungan Hidup dan Kebersihan), and community leaders from high-risk flood zones. These interviews were semi-structured and followed a thematic protocol focused on regulatory implementation, institutional barriers, and community engagement. Quantitative data were collected via structured questionnaires distributed to 475 respondents selected through stratified random sampling across five sub-districts: Ilir Barat I, Ilir Barat II, Kertapati, Ilir Timur I, and Seberang Ulu I. These areas were selected due to their historical vulnerability to flooding and varied socio-economic profiles.

The survey instrument consisted of two main parts: Section A gathered demographic information (e.g., gender, age, occupation, income level, education), while Section B assessed respondents' knowledge, attitudes, and behavioural practices concerning waste management and

¹⁵ J. W. Creswell, *Qualitative Inquiry and Research Design: Choosing Among Five Approaches* (London: SAGE Publications, 2013).

flood risks. The design of these survey items was theoretically informed by Friedman's legal system framework, particularly its cultural dimension, which encompasses public knowledge, attitudes, and practices related to law. Accordingly, the instrument included the following items: (1) community understanding of the relationship between waste and flooding problems; (2) knowledge related to waste law enforcement; (3) understanding of the location and availability of trash bins; (4) behavioural practices such as whether respondents had ever disposed of waste into rivers; and (5) public knowledge regarding institutional enforcement of waste regulations. While these items primarily operationalise the cultural dimension of Friedman's theory, insights into the substance and structure dimensions were obtained through qualitative interviews and regulatory analysis. This design ensures that the empirical measures remain consistent with the theoretical framework while accommodating the practical realities of waste governance in Palembang.¹⁶ Each item was rated using a 5-point Likert scale ranging from "Strongly Disagree" (1), to "Strongly Agree" (5). To ensure construct validity and cultural relevance, the instrument was piloted on a smaller sample (n=50) before full deployment.

Data analysis followed Miles and Huberman's interactive model which includes four interlinked stages: data collection, data reduction, data display, and conclusion verification.¹⁷ This model allows iterative synthesis and interpretation of qualitative insights while supporting convergence with quantitative findings. Quantitative data were processed using SPSS 26.0 for descriptive statistics, including frequency distributions, cross-tabulations, and percentage analyses. Ethical considerations were observed throughout the research process. Informed consent was obtained from all participants, and anonymity was maintained in reporting individual responses.

DISCUSSION

Overview of Previous Studies and Theoretical Context

As part of this discussion, previous studies have demonstrated that the increasing frequency of urban floods in developing countries is closely associated with the challenges of environmental governance, particularly in the management of municipal solid waste. Uncollected waste often obstructs drainage systems, accelerates surface runoff, and intensifies flood hazards in densely populated areas.¹⁸ In the Indonesian context, flood vulnerability has been strongly correlated with inadequate waste disposal systems, unplanned urban expansion, and lack of effective enforcement mechanisms.¹⁹

¹⁶ Bo Rothstein, "Creating Political Legitimacy," *American Behavioral Scientist* 53, no. 3 (October 12, 2009): 311–330, doi: <https://doi.org/10.1177/0002764209338795>.

¹⁷ Matthew B Miles, A Michael Huberman, and Johnny Saldaña, *Qualitative Data Analysis A Methods Sourcebook Edition*, 2014.

¹⁸ Paul H. Brunner and Johann Fellner, "Setting Priorities for Waste Management Strategies in Developing Countries," *Waste Management & Research: The Journal for a Sustainable Circular Economy* 25, no. 3 (June 2007): 234–240, doi: <https://doi.org/10.1177/0734242X07078296>.

¹⁹ Dede Sulaeman, Adi Pradana, and Hidayah Hamzah, "3 Faktor Utama Penyebab Banjir di Indonesia dan Bagaimana Mencegahnya," July 2019, Accessed February 12, 2025. https://wri-indonesia.org/id/wawasan/3-faktor-utama-penyebab-banjir-di-indonesia-dan-bagaimana-mencegahnya?__cf_chl_tk=mCfQ2oOothrjrSHyJV7NF4fAkGzovmOIGTIT3d4QmBs-1760080169-1.0.1.1-u4NblLpxH_eqtXQ6idBcrDphOefZ45f6cGaM91.xbtw.

A number of scholars have emphasized that the effectiveness of waste management systems is not solely determined by infrastructure, but by the interplay between regulation, institutional capacity, and community behavior. Kodoatie and Syarief highlight that flood risk in Indonesia is driven by a combination of hydrological and human-induced factors—ranging from sedimentation and land-use conversion to the accumulation of garbage in rivers.²⁰ Tingsanchali further advocates for integrated flood risk management, which requires alignment across planning, risk zoning, and legal implementation.²¹

The legal dimension of waste management in Indonesia is anchored in Law No. 18 of 2008, which outlines the roles of national and regional governments in reducing and handling waste. However, gaps between regulatory ambition and enforcement remain significant. As noted by Maruf, ineffective enforcement of waste regulations has allowed persistent leakage of household and urban waste into rivers.²² In urban contexts like Palembang, this waste accumulation contributes to flooding by obstructing drainage systems, ultimately exacerbating downstream marine plastic pollution. This highlights the systemic governance gaps in Indonesia's waste management regime. In urban centers like Palembang, local regulations such as Perda No. 3 of 2015 provide specific mandates for household waste handling, yet enforcement mechanisms suffer from limited personnel, weak monitoring systems, and poor inter-agency coordination.

From a theoretical standpoint, law enforcement is best understood not merely as institutional function, but as a socio-political process. Soerjono Soekanto articulates five key components of effective law enforcement: the legal framework, enforcement apparatus, infrastructure, public awareness, and cultural norms.²³ Satjipto Rahardjo adds that legal action must move beyond textualism, and instead reflect the lived realities of society and the moral imperatives of justice.²⁴ In the case of waste governance, this requires not only prosecuting violations, but fostering civic responsibility and systemic reform.²⁵

Empirical studies on environmental law enforcement in Indonesia reinforce these insights. Priyono shows that illegal electronic waste smuggling in Batam persists due to weak institutional responses and fragmented intergovernmental oversight.²⁶ Similarly, Helmi et al. identify capacity constraints as the key bottleneck in local flood governance.²⁷ In Palembang, recent assessments suggest that the majority of residents are aware of the link between waste and flooding, yet such

²⁰ Robert J. Kodoatie and Roestam Sjarief, *Pengelolaan Bencana Terpadu*, 1st ed. (Jakarta: Yarsif Watampone, 2006).

²¹ T. Tingsanchali, "Urban Flood Disaster Management," *Procedia Engineering* 32 (2012): 25–37, doi:10.1016/j.proeng.2012.01.1233.

²² Maruf Maruf, "Indonesia Response and Recent Development of Law and Policy in Addressing Marine Plastic Litter," *Journal of Indonesian Legal Studies* 4, no. 2 (November 2019): 167–188, doi: <https://doi.org/10.15294/jils.v4i2.34757>.

²³ Soerjono Soekanto, *Faktor-Faktor Yang Mempengaruhi Penegakan Hukum* (Jakarta: Rajawali, 1983).

²⁴ Satjipto Rahardjo, *Penegakan Hukum: Suatu Tinjauan Sosiologis*, 1st ed. (Yogyakarta: Genta Publishing, 2009).

²⁵ Boyle, "Human Rights and the Environment: Where Next?"

²⁶ FX.Joko Priyono, "Law Enforcement Of Electrical And Electronic Waste Smuggling In Batam, Indonesia," *Diponegoro Law Review* 2, no. 1 (April 2017): 40–40, doi:10.14710/dilrev.2.1.2017.40-56.

²⁷ Henny Helmy et al., "Community Empowerment Through Edu-Environment Application in Kebun Bunga Village, Sukarami Sub-District, Palembang," *International Journal of Professional Business Review* 8, no. 4 (April 4, 2023): 1-10, doi: <https://doi.org/10.26668/businessreview/2023.v8i4.1200>.

awareness does not consistently translate into behavioral change.²⁸ This highlights the enduring disconnect between knowledge, institutional enforcement, and civic engagement.

In summary, the existing literature suggests that improving waste management requires an integrated approach that encompasses legal regulation, institutional enforcement, and public participation. However, few studies have systematically examined how these components interact at the city level, especially in the context of flood-prone urban zones. This study contributes to the literature by evaluating the implementation of legal instruments on waste in Palembang and by identifying operational gaps in enforcement and community compliance. By bridging legal analysis and empirical data, the research offers a contextualized understanding of how environmental law functions-or fails-in dynamic urban environments.

Palembang and Legal Waste Management

Palembang is a city with a high daily waste production rate. Each resident generates approximately 0.7 kg of waste per day, which, when multiplied by the city's nearly 1.7 million inhabitants, results in an estimated 1,200 tons of waste produced daily. The Palembang City Government currently relies on a single Final Disposal Site (TPA) in Sukawinatan, whose capacity is becoming increasingly inadequate compared to the city's growing waste output. The available waste processing infrastructure remains insufficient, with only three excavators in operation and a workforce of just 60 personnel responsible for managing and maintaining the landfill.²⁹

According to the Palembang City Department of Environment and Cleanliness, the existing TPA capacity is expected to last only 20 years, utilising a landfill control system where collected waste is covered with soil to mitigate odours and environmental impacts.³⁰ The scale remains limited while recycling initiatives have been introduced—such as plastic pellets and compost production. A waste bank system has been implemented as part of the Mayor of Palembang's policy, with 28 waste banks operating across the city. The Department of Environment and Cleanliness has deployed 102 waste transportation fleets to support waste management. At the same time, 580 street sweepers are responsible for maintaining cleanliness along the city's 1.3 million meters of roadways, each covering a 500-meter radius.³¹

From a legal perspective, Article 1, Paragraph 1 of Law No. 18 of 2008 on Waste Management defines waste as solid materials resulting from daily human activities and/or natural processes. Meanwhile, Nasih describes waste as residual materials from human activities, whether organic or

²⁸ Hartiwingsih, "Faktor-Faktor Yang Mempengaruhi Proses Penegakan Hukum Pidana Lingkungan," 2006.

²⁹ Indar Tri Setiantoro, Pengolahan Sampah Kota Palembang, interview by Azhar, September 20, 2021.

³⁰ BPS Kota Palembang, *Statistik Daerah Kota Palembang 2022*, September 27, 2022, Accessed February 12, 2025. https://web-api.bps.go.id/download.php?f=/4m1HuQfkpF7phJuHLD8K0NnSEJrT2U1Yk9oQ1hhRzZteExxNTH3QzhGcXhXcW1vVUs3RTFJL2tINHixZFJXN2pBZmc4blI6U2twa2N1Y1YyVDDjNmkrSE9kSkFGTGdsQW5VOGt2bGROQVEyMXNVakRpYnpT UmpTTTkc0c2pMam1tOHEyVXdwTjJpSmZGZWcwSGxwRE4rSG5ldHRHdEVYS2pvdGtiRUVwTKvIK1FsVUZ6d2tHMTRLbVFIZStRU1lwZkZDRJR5ZERwN2NoTFlyVCs4Yng2bkJsaGRhK3ZwMXBmdHBla2pFMlo4K09iem1xdk1NeXdNbXM4a1NBT01XWHJsd nZay9OWnVicIj6cGg=&_gl=1*18hf4mg*_ga*MTkxMTg1NDM3NC4xNzU4OTYzODEw*_ga__XTTVXWHDB*czE3NTg5NjM4MTAkzEkZzAkdDE3NTg5NjM4MTAkajYwJGwwJGgw.

³¹ DLH KOTA PALEMBANG, *Laporan Kinerja Instansi Pemerintah Tahun 2023*, February 2, 2024, Accessed February 17, 2025, <https://esakip.palembang.go.id/2426/dokumen/122/2024/6660c9b61c25615b603da3cb5f9d2536.pdf>.

inorganic, that may or may not decompose and are deemed no longer valid unless appropriately managed. Effective waste management encompasses collection, transportation, regulation, recycling, and disposal to minimise negative impacts on health, the environment, and urban aesthetics while also contributing to natural resource conservation.³²

Waste management strategies vary based on the type of waste—solid, liquid, gaseous, or radioactive—each requiring specialised handling methods. Furthermore, waste management approaches differ between developed and developing countries, urban and rural areas, and residential and industrial zones. In metropolitan areas, households and institutions' responsibility for non-hazardous waste management typically falls on local governments, whereas private waste management companies usually handle commercial and industrial waste.³³

According to Article 1, Paragraph 5 of Law No. 18 of 2008 and Article 1, Paragraph 16 of Palembang City Regulation No. 3 of 2015 on Household Waste and Similar Waste Management, waste management is defined as a systematic, comprehensive, and sustainable process that includes waste reduction and handling efforts. The primary objectives of waste management are to enhance public health, maintain environmental quality, and optimise waste utilisation as a resource. Based on Article 2, Paragraph 1 of Law No. 18 of 2008, waste management covers household waste, similar household waste, and specific waste.

Household waste (Article 2, Paragraph 2) refers to waste generated from daily household activities, excluding human excreta and faecal matter. Similar household waste (Article 2, Paragraph 3) includes waste originating from commercial, industrial, social, public, and other areas that produce a sidental nature to household waste. Specific waste (Article 2, Paragraph 4) comprises waste that requires special handling, including; "a) Waste containing hazardous and toxic materials (B3); b) Waste derived from hazardous and toxic substances; c) Waste generated by natural disasters; d) Construction and demolition debris; e) Solid waste that cannot be processed using existing technology; and f) Waste that is not generated regularly." In the context of waste management in Palembang City, implementing these regulations is a fundamental framework for developing more effective and sustainable policies. A collaborative effort between local governments, communities, and industries is essential to ensure optimal waste management practices, including improving waste processing infrastructure, implementing more efficient recycling systems, and enforcing stricter regulations against improper waste management practices.

In the realm of waste management, central and regional governments are responsible for ensuring effective and environmentally conscious waste management practices, as outlined in Article 5 of Law No. 18 of 2008 on Waste Management (Law No. 18/2008). The primary responsibility for waste management lies with local governments, which oversee planning, implementation, administration, collaboration, and partnerships related to waste management. These responsibilities

³² OHS Consultant, "Strategi Pengelolaan Sampah: Panduan Praktis Untuk Masyarakat dan Pemerintah," July 2024, Accessed February 15, 2025. <https://www.ohs-consultant.com/2024/07/strategi-pengelolaan-sampah-panduan.html>.

³³ Peter Schubeler, Karl Wehrle, and Jurg Christen, *Conceptual Framework for Municipal Solid Waste Management in Low-Income Countries*, August 1996, Accessed January 21, 2025. <https://documents1.worldbank.org/curated/en/829601468315304079/pdf/400960Municipal1teOfamework01PUBLIC.pdf>.

are further regulated under Minister of Home Affairs Regulation No. 33 of 2010 on Waste Management Guidelines (Permendagri No. 33/2010).

Chapter VI of Law No. 18/2008 details waste management organisation, dividing it into household and similar waste management and specific waste management. Under Article 19 of Law No. 18/2008, household waste and similar waste management comprise waste reduction and waste handling. Waste Reduction Measures As specified in Article 20, Paragraph (1) of Law No. 18/2008, waste reduction encompasses Minimizing waste generation at the source, Recycling waste materials, and Reusing waste in an environmentally responsible manner. Meanwhile, Article 22, Paragraph (1) of Law No. 18/2008 defines waste handling as a process involving; “a) Sorting, which entails classifying and separating waste based on its type, quantity, and characteristics; b) Collection, referring to the gathering and removal of waste from its source to a temporary storage facility or integrated waste treatment plant; c) Transportation, which involves moving waste from the source and/or temporary storage to the final waste processing site; d) Processing, aimed at altering the physical, chemical, or biological properties of waste to reduce its volume and environmental impact; and e) Final disposal, which includes returning processed waste and residual waste safely to the environment”.

Local governments play a crucial role in promoting sustainable waste management systems, reducing environmental pollution, and ensuring public health and environmental protection by implementing these waste management strategies. According to Article 23, in conjunction with Article 1, Clause 12 of Law No. 18/2008 on Waste Management, the responsibility for managing specific waste falls under the jurisdiction of the Central Government, represented by the President, and is regulated through government policies. Furthermore, Articles 24(1) and 24(2) of the same law mandate that central and regional governments allocate funding for waste management sourced from state and regional budgets. In implementing waste management strategies, Article 26(1) allows local governments to collaborate with other regional administrations, which can take the form of joint waste management initiatives or partnerships as outlined in Article 26(2) of Law No. 18/2008.

Moreover, Article 27(1) of Law No. 18/2008 permits district and city governments to collaborate with private business entities to execute waste management operations. These partnerships must be formalised through legally binding contracts between local governments and business entities, as Article 27(2) stipulates. However, any business entity engaging in waste management activities must obtain official authorisation from the regional head by Article 17(1) of the law.

From a law enforcement perspective, Government Regulation No. 16/2018 concerning the Civil Service Police Unit (SatPol PP) delineates its responsibilities, which include; *(a) enforcing regional laws and regulations; (b) maintaining public order; and (c) ensuring community protection.* Consequently, SatPol PP is crucial in upholding waste management laws within regional jurisdictions. As a law enforcement agency under the authority of provincial and city governments, SatPol PP is responsible for ensuring compliance with waste disposal regulations.

In the case of Palembang City, SatPol PP enforces Regional Regulation (Perda) No. 3/2015 on

Household Waste Management. This regulation mandates that local authorities supervise and enforce waste disposal practices among residents. SatPol PP in Palembang has approximately 576 personnel dedicated to enforcing waste management regulations, ensuring that waste disposal aligns with existing local policies and environmental sustainability efforts.

In practice, waste law enforcement in Palembang also operates through judicial proceedings as stipulated under Article 32 of Regional Regulation No. 3/2015, which provides for sanctions of up to three months' imprisonment or fines of up to fifty million rupiah. These provisions represent the formal legal enforcement structure, demonstrating how institutional authority is exercised through the court system. However, implementing this mechanism remains challenging, as effective prosecution requires substantial material evidence. In operational terms, SatPol PP has been tasked with frontline monitoring, including 24-hour rotating patrols across market areas, commercial districts, and landmark sites in Palembang.³⁴

The Implementation and Challenges in Law Enforcement of Waste Management in Palembang

The Palembang community knows the correlation between waste management and flood occurrences. This is evidenced by survey data collected by researchers, as summarised in Table 1 below:

Table 1.

Understanding of Community about relations between waste and flood problems

	Percent	Cumulative Percent
Strongly disagree	1,9 %	1,9 %
Disagree	5,6 %	7,5 %
Doubt	6,7 %	14,2 %
Agree	30,2 %	44,4 %
Strongly agree	55,6 %	100 %

Source: Data processed by researchers, 2023

The findings indicate that only a tiny fraction of respondents (1.9%) strongly disagree with the relationship between waste mismanagement and flooding, while 5.6% express disagreement and 6.7% remain neutral. Conversely, a significant proportion acknowledges this link, with 30.2% agreeing and 55.6% strongly agreeing. Thus, it can be inferred that two-thirds of the respondents understand waste disposal patterns and their environmental consequences, particularly their role in exacerbating floods. However, this level of awareness does not correspond with the recurring flood incidents in Palembang. This study aims to analyse this discrepancy through a legal lens, specifically by evaluating the effectiveness of waste management policies in mitigating urban flooding.³⁵ The analysis will apply Soekanto's theory of law enforcement, which comprises five key indicators.

³⁴ Rivaldy Kesuma, Penegakan Hukum Mengenai Sampah di Kota Palembang, September 13, 2021, Palembang.

³⁵ Soerjono Soekanto, *Faktor-Faktor yang Mempengaruhi Penegakan Hukum* (Jakarta: Rajawali, 1983).

The Palembang city government has established a regulatory foundation for waste management through Local Regulation (Perda) No. 3 of 2015. This regulation assigns enforcement responsibilities to Satuan Polisi Pamong Praja (SatPol PP), ensuring residents adhere to proper waste disposal practices. However, legal frameworks alone are insufficient; their effectiveness heavily depends on complementary factors, which will be further examined using the remaining four indicators. The second factor pertains to law enforcement officers. The SatPol PP force in Palembang consists of approximately 576 personnel, which remains disproportionate to the city's population of nearly 1.7 million residents. This imbalance significantly hampers enforcement efforts, particularly when considering that SatPol PP is not solely responsible for waste regulation but also a wide range of other local ordinances. A population-to-officer ratio of approximately 1:3,400 highlights the practical challenges law enforcement faces. Given this constraint, SatPol PP's ability to effectively monitor, regulate, and enforce compliance with waste disposal laws remains limited. Consequently, these limitations contribute to the persistent issue of improper waste disposal, which worsens flood risks across Palembang.

The Palembang City SatPol PP officials interviewed in this study demonstrated a clear understanding of the provisions outlined in Local Regulation (Perda) No. 3 of 2015 on Waste Management. According to the informants, SatPol PP has implemented two primary enforcement strategies to uphold this regulation. The first strategy involves persuasive measures to raise public awareness about proper waste disposal. This initiative includes public outreach programs such as distributing pamphlets and banners to educate residents on waste regulations and penalties for non-compliance. Additionally, officers conduct direct interventions by issuing warnings and providing guidance to individuals engaged in littering. While persuasion remains a key strategy, SatPol PP also recognizes the necessity of law enforcement mechanisms to deter violations. However, effective legal action requires inter-institutional coordination, as imposing sanctions on offenders involves collaboration between SatPol PP and other relevant law enforcement agencies. This study also collected cross-sectional data from community respondents to evaluate the effectiveness of SatPol PP's enforcement efforts. One of the key questions posed to participants was whether they had witnessed SatPol PP officers actively disciplining waste-related violations. This approach aimed to assess public perception of SatPol PP's role and effectiveness in addressing urban waste management issues. The findings can be seen in Table 2 as follows:

Table 2.

Community Knowledge Related to Law Enforcements Regarding Waste

	Percent	Cumulative Percent
Strongly disagree	5,2 %	5,2 %
Disagree	12,3 %	17,5 %
Doubt	36,2 %	53,7 %
Agree	32,5 %	86,2 %
Strongly agree	13,8 %	100 %

Source: Data processed by researchers, 2023

The data presented in the table indicates that 5.2% of respondents strongly disagree, while 12.3% disagree regarding the presence of officers enforcing waste-related laws. Additionally, 36.2% of respondents expressed doubt, whereas 32.5% agreed and 13.8% strongly agreed. This data suggests that public perception is divided, with nearly equal portions of respondents having witnessed or not witnessed law enforcement efforts related to waste management.

Regarding facilities, research findings reveal that the number and capacity of waste disposal sites in Palembang City are inadequate to accommodate daily waste production, reaching up to 1,200 tons. For instance, the Sukawinatan landfill (TPA) spans an area of 25 hectares, but only 3 hectares are currently allocated for waste disposal, with garbage piles reaching 15 meters in height. Moreover, the alternative landfill, Karya Jaya TPA, has faced operational delays due to infrastructure accessibility issues despite being projected to start operations in 2021. Another significant challenge is the placement of temporary waste collection sites (TPS), which often face resistance from local communities due to their proximity to residential areas. Many TPS locations generate environmental concerns, such as unpleasant odors, increased flies, and potential health hazards.

Palembang’s transportation and waste management fleet is also insufficient to meet the demand. Ideally, 160 waste collection vehicles are required, but. Still, the city currently operates with only 40 trucks, which transport approximately 300 tons of waste daily from markets, in addition to the waste collected from residential areas. Recognizing this gap, the draft 2019 Regional Budget (APBD) of Palembang City proposed acquiring 20 additional containers, nine dump trucks, and two bulldozers. Additionally, the workforce managing waste collection is significantly below the required number. The city has only 580 janitors, whereas the optimal number needed is around 2,000. The shortage of street sweepers, with a deficit of approximately 2,144 officers to cover the required area within a 500-meter radius, further exacerbates the issue.

The waste problem is particularly severe in Seberang Ulu, where more than 20% of Palembang’s total waste originates from traditional markets, shops, and residential areas. This is primarily due to the region’s lack of adequate TPS facilities. Moreover, the persistence of waste management issues is also influenced by the behavior of residents, who demonstrate low awareness and concern for proper waste disposal. As presented in Table 3, field data highlights that the uneven distribution, insufficient number, and frequent damage to TPS facilities contribute significantly to the ongoing waste crisis in Seberang Ulu.

Table 3.
Understanding of Location for Trash Can

	Percent	Cumulative Percent
Strongly disagree	3 %	3,0 %
Disagree	10,4 %	13,4 %
Doubt	13,1 %	26,5 %
Agree	44,4 %	70,9 %
Strongly agree	29,1 %	100 %

Source: Data processed by researchers, 2023

The data in Table 3 illustrates the community's response to the importance of disposing of garbage properly. A total of 3.0% of respondents strongly disagreed, 10.4% disagreed, and 13.1% expressed doubt regarding the necessity of throwing waste in designated places. This indicates that approximately 26.5% of the respondents disagreed or were hesitant about proper waste disposal. This significant percentage highlights the persistent issue of waste scattered on streets, which eventually accumulates in drainage systems and rivers, increasing the risk of flooding. Meanwhile, 44.4% of respondents agreed with the importance of disposing of waste correctly, and 29.1% strongly agreed, making this the highest response percentage.

One of the primary challenges in waste management is community behaviour. The lack of awareness and responsibility among residents necessitates more substantial initiatives to encourage collective waste reduction efforts, such as promoting waste banks. Another fundamental issue is the public's perception of waste as a single entity without recognising the need for proper separation based on classification. Despite government initiatives to promote waste banks at the district level in Palembang, shifting public attitudes toward waste management remains challenging. Field research suggests that the waste bank program initiated by the Palembang City Department of Environment and Cleanliness has not been running effectively. This is primarily due to inadequate socialisation, guidance, and assistance from relevant agencies, making it challenging to achieve optimal results.

Beyond recycling efforts through waste banks, the government is also exploring foreign investment opportunities to convert waste into fuel. The municipal government actively seeks partnerships to transform waste-related challenges into economic opportunities. However, converting waste into diesel requires advanced technology, and attracting foreign investors is a viable strategy to mitigate the waste problem while generating additional revenue for the region.

Regarding cultural factors, the study also examines respondents' awareness and habits concerning waste disposal in rivers. To further analyse this issue, data related to the question, "Have you ever thrown waste into the river?" is presented in Table 4.

Table 4.
Respondent Ever Throw up The River

	Percent	Cumulative Percent
Strongly disagree	0,4 %	0,4 %
Disagree	0,7 %	1,1 %
Doubt	22,8 %	23,9 %
Agree	49,6 %	73,5 %
Strongly agree	26,5 %	100 %

Source: Data processed by researchers, 2023

The data regarding respondents' habits of disposing of waste in rivers reveals a concerning trend. Only 0.4% of respondents strongly disagreed with the statement about whether they had ever thrown trash into the river, while 0.7% disagreed. Meanwhile, 22.8% of respondents expressed doubt regarding their actions. However, a significant majority-49.6%-agreed that they had thrown garbage

into the river, and 26.5% strongly agreed. This means that 76.1% of respondents admitted having disposed of waste in the river at some point. The highest percentage falls within the "Agree" category, indicating that improper waste disposal in waterways remains a prevalent issue in Palembang.

This behaviour significantly contributes to the flooding problem in the city, as waste accumulation in rivers and drainage systems obstructs water flow, leading to frequent inundation during heavy rainfall. Addressing this issue requires stricter law enforcement and continuous education and awareness campaigns to change public behaviour regarding waste disposal. To further examine community participation in environmental maintenance, the study also investigates respondents' involvement in cleaning culverts and other water channels in their surroundings. The findings related to this question are presented in Table 5.

Table 5.

Respondents in Cleaning Culverts and or Other Water Flow Around the Environment

	Percent	Cumulative Percent
Strongly disagree	4,9 %	4,9 %
Disagree	16,0 %	20,9 %
Doubt	32,8 %	53,7 %
Agree	32,8 %	86,6 %
Strongly agree	13,4 %	100 %

Source: Data processed by researchers, 2023

The data regarding community participation in cleaning culverts and river flows shows a divided response. 4.9% of respondents strongly disagreed with participating in such activities, while 16.0% disagreed. Additionally, 32.8% of respondents were doubtful about their involvement. On the other hand, 32.8% agreed that they had taken part in cleaning efforts, and 13.4% strongly agreed. This indicates that almost half of the respondents have cleaned culverts and river flows around their environment.

However, the data also reveals that approximately 50% of respondents have not participated in environmental cleaning. This suggests that public awareness and active involvement in maintaining a clean environment remain below expectations. The lack of collective action in keeping drainage systems and waterways clean further exacerbates the waste problem and contributes to recurring flooding issues in Palembang. Strengthening environmental awareness programs and encouraging community-driven initiatives are crucial to fostering a more proactive approach toward waste management and flood prevention.

CLOSING

This study has examined the implementation of waste management laws in Palembang City and their implications for urban flood risk mitigation. The findings reveal a notable gap between the existence of legal instruments and their practical enforcement. While both the Department of Environment and Cleanliness (Dinas Lingkungan Hidup dan Kebersihan) and the Civil Service Police Unit (Satpol PP) have clearly defined roles within the regulatory framework, limitations in human resources, infrastructure, and inter-agency coordination have significantly undermined their operational capacity.

Weak law enforcement, insufficient transportation and waste disposal infrastructure, and persistent socio-cultural behaviors—such as illegal dumping and lack of community participation—continue to exacerbate waste accumulation in flood-prone areas. These challenges are not merely technical but institutional and behavioral, pointing to the need for a more integrated and participatory governance model. The study confirms that environmental laws, while normatively sound, often fail in implementation due to structural fragmentation and insufficient public engagement.

By applying a socio-legal analytical lens and integrating both qualitative and quantitative data, this research contributes new insights into the enforcement dynamics of local waste governance in the Global South. The novelty of this study lies in its empirical exploration of how legal mandates function (or fail) at the intersection of institutional capacity and everyday urban vulnerability. It also provides a model for evaluating enforcement gaps in other secondary cities facing similar challenges.

To improve waste governance and flood resilience in Palembang, this study recommends three interdependent strategies: (1) strengthen inter-agency collaboration through clearly defined enforcement protocols and regular coordination mechanisms; (2) expand public awareness campaigns that link waste disposal behavior to flood risks and legal consequences; and (3) upgrade waste transport and disposal infrastructure to match current and projected waste generation rates. Without addressing these multidimensional barriers, legal reform alone will be insufficient to produce lasting change. These findings also align with broader calls to enhance legal literacy and multi-level governance in environmental management across Southeast Asia.

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