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Clean Water and Sanitation Issues: Freeport Tailing Case

Nasywa Izra, Zahwa Aulia Nurul 'Aini, Keysha Valeriena Sachenka Whira Andini

International Relations Study Program, Faculty of Social and Political Sciences, Universitas Pembangunan Nasional "Veteran" Jakarta
Email: 2310412158@mahasiswa.upnvj.ac.id, 2310412124@mahasiswa.upnvj.ac.id, 2310412152@mahasiswa.upnvj.ac.id

Abstract

Access to clean water and proper sanitation is a basic human right as stated in Sustainable Development Goal 6. However, achieving this goal still faces serious challenges in areas with large-scale extractive industries, one of which is in Papua due to the management of tailings by PT Freeport Indonesia. This study aims to analyze the impact of tailings management on water quality and sanitation, particularly in the Ajkwa river basin, and its implications for the fulfillment of SDG 6 for indigenous peoples. This study uses a qualitative approach with a descriptive case study method based on secondary data obtained from government reports, company documents, scientific journals, and civil society organization publications. The results of this study show that the disposal of large amounts of tailings has caused a decline in water quality, changes in river and coastal ecosystems, and made it difficult for indigenous peoples to access clean water and safe sanitation. These conditions reflect weak environmental governance, power imbalances between the state, multinational corporations, and local communities, as well as the suboptimal implementation of sustainable development commitments. Therefore, strengthening environmental monitoring, data transparency, and meaningful engagement of indigenous peoples are crucial steps in restoring water quality and achieving SDG 6 in Papua.

Keywords: SDG 6, Mining tailings, Clean water and sanitation, PT Freeport Indonesia, Papua.

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INTRODUCTION

Essentially, all individuals have the same right to access safe and well-managed clean water, which is in line with SDG 6: clean water and sanitation. Along with the increase in world population growth and increased industrial activity, there is great pressure on the demand for clean water for all. In the context of mining, especially in developing regions such as Indonesia, one of the greatest threats to water quality comes from large-scale industrial waste, as seen in the case of PT Freeport. Based on an official report from PT Freeport Indonesia Management Fact Sheet (2024), the company produced around 69.2 million metric tons of dry tailings in 2023 alone, which requires complex technical engineering to manage safely, including the construction of a 120 km embankment in the ModADA (Modified Ajkwa Deposition Area) area.

This environmental issue is in line with SDG 6, specifically target 6.3 on improving water quality and reducing pollution, as well as target 6.6, which emphasizes the protection of rivers, swamps, and mangroves. Freeport's report shows that the company has conducted 214,032 environmental laboratory tests each year to test water quality, sediment, and tailings stability, and has formed the ModADA Management Board to monitor the chemical and structural conditions of the tailings storage area (Issues et al., 2024). Although this tailings waste is categorized as non-hazardous in Indonesian waste regulations, given the massive volume, it poses a severe environmental risk (PT Freeport Indonesia, n.d.). As part of its target 6.6, Freeport has restored approximately 953.59 hectares of mangroves since 2005 and aims to rehabilitate 500 hectares per year using geotubes, sediment traps, and bamboo barriers (Update & Division, 2024).

The issue of water on a global scale is already apparent. According to a UN report, around 80% of the world's liquid waste is disposed of without treatment, and around 3 in 10 people do not have access to safe drinking water (Nations, n.d.). This condition is exacerbated by local factors in Papua, where the Mile 50 area receives extreme rainfall of 12,143 mm per year with 329 rainy days (BMKG, 2018). If this continues, the risk of erosion and tailings movement will be faster than in dry mining areas. To manage these challenges, Freeport has allocated US$ 138.9 million per year for hydrological studies, tailings management systems, and coastal rehabilitation (PTFI, 2024). A systematic review by Freeport-McMoRan in 2021-2022 also showed that ModADA covers 219 km² of land and 220 km² of estuary area, which is considered one of the largest engineered tailings landscapes in the world (*Triennial 2021-2022 External Environmental Audit FINAL REPORT TRIENNIAL 2021-2022*, n.d.). Engineering efforts also involved planting 2,919,425 mangroves to restore 761 hectares of affected areas (PTFI, 2024). Freeport conducted research on the economic utilization of tailings land, at a cost of around Rp 4-5 billion per hectare in the MP21 zone (Pratomo, 2024), and by 2023, it had reused 137,505 tons of tailings for internal use and 1,296,428 tons for external construction materials (PTFI, 2024).

These dynamics show that in the process of achieving SDG 6 in the case of the Ajkwa River, it is not only a technical issue, but also reflects serious challenges in sustainable water management, especially in ecologically sensitive areas such as Papua. Although efforts have been made, ranging from monitoring, engineering, and restoration of ecologically sensitive areas, the risk of environmental damage continues to increase due to the massive scale of industry. Based on this context, this study will discuss clean water and sanitation issues through a case study on PT Freeport's mine waste management. This study will focus on how PT Freeport's mine waste pollutes the environment, particularly the Ajkwa River, making it difficult for indigenous communities in Papua to access clean water sources, compounded by poor sanitation conditions. Therefore, it is important to examine this issue in order to analyze the factors that cause the decline in the quality of clean water resources and formulate appropriate solutions to minimize the impact and restore the rights of indigenous peoples around the affected areas in Papua.

THEORETICAL FRAMEWORK

Environmental Governance Theory

Environmental Governance theory is grounded in the assumption that environmental problems cannot be understood merely as technical issues, but rather as the outcomes of governance processes involving state actors, the private sector, and local communities. This perspective positions institutions, regulatory frameworks, and accountability mechanisms as key determinants of the effectiveness of environmental protection. In this context, environmental quality is strongly influenced by the state's capacity to establish robust legal frameworks and to consistently enforce environmental regulations, as reflected in studies on good environmental governance in Indonesia's mining sector.

Hutagalung et al. (2025) argue that weak institutional capacity and gaps in monitoring mechanisms enable environmentally harmful practices to persist, even when formal legal instruments are in place. The discrepancy between formal rules and their implementation in practice demonstrates that environmental problems more often stem from governance failures than from the absence of regulation, as also highlighted in analyses of Papua's Strategic Environmental Assessment (KLHS) 2025–2029. In this study, Environmental Governance theory is used as an analytical lens to examine the relationship between weak law enforcement, inter-agency coordination, and the effectiveness of environmental policies in explaining the persistence of water pollution in mining areas in Papua.

Political Ecology Theory

Political Ecology theory views environmental degradation as a phenomenon that is inseparable from the power relations embedded in the governance of natural resources. This perspective critiques purely technocratic approaches to environmental management by emphasizing that ecological damage is frequently produced and reproduced through unequal political and economic structures. The state and corporations are positioned as dominant actors in shaping policy directions, while local communities are often placed in marginalized positions.

Demonstrates that communities living around extractive areas tend to have limited space for participation in policy-making processes, particularly in mining regions of Papua (JATAM, 2023). Although these communities experience the most severe social and health impacts, they are rarely meaningfully involved in decision-making mechanisms. This situation reflects unequal power relations

in which economic and political interests are frequently prioritized over environmental protection and community rights. Within the context of this study, Political Ecology theory is employed to analyze how the marginalization of indigenous communities in Papua operates structurally within environmental governance. This perspective enables the study to show that water pollution is not solely the result of technical failures, but also of unequal power relations that shape whose voices are heard and whose interests are ignored in the management of natural resources.

RESEARCH METHOD

This study uses a qualitative approach with a descriptive case study design of Freeport tailings to analyze clean water and sanitation issues in Papua. According to Creswell (2009), qualitative approaches are used to understand human and social issues by providing a comprehensive and complex description of the issues at hand. These issues are explained in detail based on the perspectives of the participants involved (Creswell, 2009). According to Yin (2009), the case study approach is an appropriate research approach for analyzing current events or issues (Yin, 2009). In real-life contexts, especially when the boundaries between the phenomenon being studied and its context cannot be clearly separated. All data sources used are secondary data obtained from scientific journals, government reports, company documents, and news articles relevant to the issues discussed. The data sources were obtained through targeted searches using Google Scholar and Google web pages to access publications and documents that were relevant and open to the public. Once all the data had been selected, all the information was quoted and grouped based on its relevance to SDG 6, environmental governance, and the impact of mining activities on clean water quality in Papua. The analysis was conducted descriptively using a thematic approach to examine information patterns, regulatory gaps, and key findings related to clean water quality management and safe sanitation in the context of Freeport's mining operations.

RESULTS AND DISCUSSION

Overview of The Freeport Mining Case in Papua

Freeport is a United States-based multinational corporation engaged in the extraction of copper, gold, and molybdenum. Operating under its parent company, Freeport-McMoRan, headquartered in Phoenix, Arizona, the company manages extensive mining operations across North America, South America, and Southeast Asia. Among its most prominent assets is the Grasberg mine in Papua, Indonesia, which is widely recognized as one of the largest and most productive mining sites in the world.

Despite its substantial economic contributions, Freeport's large-scale mining activities generate an immense volume of tailings as a byproduct of mineral extraction. These waste materials are disposed of through the Aghawagon–Otomona–Ajkwa river system, which ultimately discharges into the Arafura Sea. This method of tailings disposal has raised significant environmental concerns, as it exceeds Indonesia's water quality standards and contravenes national environmental regulations. The tailings contain toxic heavy metals and produce extremely high levels of Total Suspended Solids (TSS), far surpassing legally permitted thresholds. As a result, severe contamination of river systems and surrounding coastal ecosystems has occurred.

The environmental consequences of this pollution are experienced most acutely by local communities, particularly Indigenous Papuan populations who depend heavily on the river system for water supply, transportation, and daily subsistence activities. The deterioration of water quality poses serious health risks and undermines traditional livelihoods such as fishing and river-based agriculture. Over time, this environmental degradation has intensified broader social and economic challenges, further marginalizing communities already facing structural vulnerabilities.

Sustainable Development Goal (SDG) 6 focuses on ensuring the availability and sustainable management of clean water and sanitation for all by 2030 (Martin, 2025). Within this goal, two targets are particularly relevant to the situation in Papua. Target 6.1 emphasizes universal access to safe and affordable drinking water, while Target 6.3 aims to improve water quality by reducing pollution, eliminating waste dumping, and controlling the release of hazardous chemicals.

As a result, local communities that depend on rivers for drinking water, cooking, sanitation, and other daily activities face increasing difficulties in accessing clean and safe water (Ariyanti, 2025). This situation directly undermines the achievement of Target 6.1, which guarantees access to safe and

affordable drinking water for all (Martin, 2025). Furthermore, the continued discharge of mining waste into the environment reflects a failure to meet Target 6.3, as pollution control and sustainable waste management practices remain inadequate (Ariyanti, 2025).

Failing to achieve SDG 6 has serious long-term consequences. Ongoing water pollution threatens public health, increases social and economic inequalities, and hinders sustainable development in Papua (Ariyanti, 2025). Limited access to clean water heightens community vulnerability, while environmental damage undermines livelihoods and regional resilience.

Overall, the Freeport case demonstrates a significant gap between the objectives of SDG 6 and conditions on the ground. Both access to clean water and efforts to improve water quality have not been adequately fulfilled, resulting in ongoing environmental degradation and long-term social impacts (WWF, 2025). This situation highlights the urgent need for stronger environmental governance, responsible mining practices, and more effective implementation of global sustainability commitments to ensure water security in Papua.

Impacts on Clean Water and Sanitation

The tailings produced from PT Freeport's production activities harm the environment, especially the water quality. This is mainly due to the large volume of tailings, which is disproportionate to the technical capacity for processing them. The Minister of Energy and Mineral Resources Decree No. 175.K/37/MEM/2018 limits the maximum amount of tailings to 291,000 metric tons of dry tailings per day (Dunia Energi, 2018). Meanwhile, the waste treatment technique used is still riverine tailings disposal, whereby tailings are channeled from highlands to lowlands through rivers and deposited in the Modified Ajkwa Deposition Area (ModADA) (PT Freeport Indonesia, n.d.). The tailings contain hazardous materials such as copper, arsenic, cadmium, and mercury, which have very high Total Suspended Solids (TSS) levels (Mulia & Sari, 2018). Based on several previous studies, the TSS value at Muara Ajkwa originating from PT Freeport's waste reached 1,300 mg/L, exceeding the national quality standard of 50-400 mg/L, according to Government Regulation No. 22 of 2021 (Kamil, 2025).

The presence of large amounts of hazardous sediments can place an excessive burden on rivers and cause water pollution. Increased sediment loads slow down river flow, triggering changes in waterways and natural channels, which lead to river siltation, riverbed elevation, and river channel narrowing at several points, commonly known as geomorphological changes. In addition, tailings sediment deposited in estuaries or closed estuaries has the potential to damage local ecosystems. Exposure to heavy metals and high levels of water turbidity can inhibit light penetration, thereby suppressing the growth and reproduction of aquatic biota. This impact threatens the survival of biota that are closely related to the livelihoods of surrounding communities. Examples include a decline in the capacity of sago palms, which are a major food source, and a decline in the quality and quantity of fish populations such as stingrays, mangiwang fish, and snails. This can lead to a decline in the consumption and sale value of fish, which will have an impact on community income (New Desk, 2023). In addition, there has been damage to natural vegetation such as mangroves and swamp forests, which should stabilize the soil, protect the coastline, absorb sediment, and act as natural water filters. This has caused environmental degradation and a decline in water quality due to the decline in ecological and hydrological functions in the area.

This tailings waste has a significant impact on the indigenous peoples of Papua, whose livelihoods are highly dependent on nature. Environmental damage caused by tailings has led to the loss of their traditional food source, which comes from sago trees. In addition, river pollution has deprived indigenous peoples of access to clean water, which is a fundamental element in meeting their daily needs, ranging from consumption and sanitation to social and cultural practices, such as traditional rituals or social relations systems that use rivers and forests as a medium for living space. This condition reflects a violation of the basic right to access clean water as stipulated in SDG 6. The loss of forests and other natural areas has affected the traditional livelihoods of indigenous peoples who depend on fishing or forest products. In this situation, they are forced to switch to a money-based economic system without adequate social and economic preparation, thereby increasing their vulnerability to structural poverty. This pollution also impacts public health, as people continue to use river water and consume aquatic biota that have been contaminated with heavy metals. This can lead to skin diseases and chronic toxic effects, including the possible carcinogenic effects of arsenic in certain contexts (New Desk, 2023).

International Relations Perspective on the Freeport Case

From an International Relations perspective, Freeport is far more than just an ordinary mining company. It represents a powerful multinational corporation with significant economic and political influence. As a global actor, Freeport brings large capital, advanced technology, and extensive international networks that allow it to operate across borders and interact closely with state actors (Sihombing et al., 2022). These capabilities enable multinational corporations to shape—or even pressure—the policy decisions of host countries, particularly in determining how natural resources are governed and managed (Sihombing et al., 2022).

However, this considerable influence often clashes with principles of social and environmental responsibility. In the case of Freeport, these tensions are clearly visible in the failure to achieve Sustainable Development Goal (SDG) 6 on clean water and sanitation. Mining activities have contributed to severe river pollution and the disruption of access to clean water for Indigenous communities living around the Ajkwa–Aghawagon–Otomona river system (OHCHR, 2022). These environmental impacts demonstrate how extractive industries can undermine basic human needs and environmental sustainability when economic priorities dominate regulatory enforcement.

The Freeport case also illustrates the complexity of Indonesia–United States relations. Because Freeport is an American corporation, the issue cannot be treated as a purely domestic matter. Instead, it becomes part of broader diplomatic and economic negotiations between Indonesia and the United States. Indonesia must manage contract renegotiations and regulatory adjustments carefully to avoid damaging its strategic relationship with Washington (Shobaruddin, 2018). This creates a dilemma for the Indonesian government, on one side, it seeks to protect national sovereignty and safeguard the environment in Papua, on the other, it continues to rely on the economic contribution, employment opportunities, and foreign investment provided by Freeport, which are officially recognized as important for national growth and state revenue (Shobaruddin, 2018).

At the same time, the United States, as Freeport's home country, has an interest in protecting its corporation's overseas investments. This dynamic reinforces the role of foreign economic policy and diplomatic engagement in shaping Indonesia's domestic decision-making processes. As a result, national policies related to natural resource governance are influenced not only by domestic considerations but also by broader global political and economic interests, particularly in strategic extractive sectors such as mining (Shobaruddin, 2018).

Power asymmetry further intensifies these dynamics. As a developing country, Indonesia continues to face limitations in regulatory capacity and enforcement, particularly in environmental monitoring and ensuring compliance with mining and forestry regulations. In contrast, Freeport, as a transnational corporation, possesses significantly greater bargaining power supported by capital strength, technological superiority, and access to international legal instruments related to investment protection (Sihombing et al., 2022). This imbalance has historically allowed the company to negotiate operational conditions that favor its interests, including weaker environmental oversight and more advantageous fiscal arrangements, until Indonesia gradually sought to rebalance this relationship through divestment and contract renegotiation (Sihombing et al., 2022).

At the local level, the consequences of these unequal power relations are borne primarily by Indigenous communities. The Kamoro and Amungme peoples have experienced the degradation of river ecosystems that are central to their livelihoods, food systems, and cultural practices. Pollution of rivers has reduced access to clean water and undermined traditional subsistence activities, exacerbating social and economic vulnerability among these communities (OHCHR, 2022). These impacts highlight how environmental harm in extractive regions directly intersects with issues of Indigenous rights and human security.

At the global level, the Freeport case exposes broader weaknesses in environmental governance. Although international environmental norms exist, they are often non-binding and unevenly enforced, particularly in developing countries that depend heavily on foreign investment and export revenues. These governance gaps can be exploited by powerful multinational corporations, resulting in environmental degradation and social harm. The Freeport case thus illustrates how global economic structures and power asymmetries shape national policy outcomes and local environmental realities, especially in resource-rich regions such as Papua.

Responses of Key Actors

1) PT Freeport Indonesia

Image 1 – Environmental Management PT Freeport Indonesia



Source: ptfi.co.id

In response to environmental issues, based on an official report issued by PTFI, the company claims to have controlled the environmental impact so that it does not worsen through the application of tailings management technology. The processing system currently in use, riverine tailings disposal, is considered the most appropriate method based on the geotechnical conditions, topography, climate, seismicity, and water quality in the area. PTFI also states that the tailings produced are not hazardous or toxic materials.

In an effort to improve the environment, PTFI reports that it has planted around 3 million mangrove trees in the Ajkwa estuary since 2005, reclaimed around 1,160 hectares of tailings sedimentation area since 1999, and planted around 6 million tree seedlings in the company's area since 1992. In addition, tailings have also been used as materials for infrastructure development, such as roads, bridges, and buildings. For example, in 2021, the Ministry of Public Works and Public Housing used tailings for the construction of a national road in Merauke. From a regulatory perspective, PTFI also regularly conducts external audits, routine environmental monitoring, and complies with applicable AMDAL (Environmental Impact Assessment) permits.

2) Indonesian Government

The government's response relates to regulation and supervision. The government has established several environmental regulatory frameworks used to regulate mining activities, such as Law No. 3 of 2020 concerning amendments to Law No. 4 of 2009 concerning Mineral and Coal Mining, which regulates the obligation of mining companies to carry out environmental management and monitoring, and Minister of Energy and Mineral Resources Decree No. 175. K/37/MEM/2018, which specifically regulates the activities of PT Freeport Indonesia, including a maximum tailings volume of 291,000 metric tons per day, as well as the Environmental Impact Assessment (EIA), which forms the legal basis for mining activities, including tailings disposal, environmental monitoring, and post-mining environmental restoration. In addition to formulating policies, the government is also obliged to conduct supervision through environmental audits in accordance with applicable policies and to report the results of supervision to the public regularly.

3) Local Communities and International Actors

Local community groups and other international actors also help voice the environmental and social issues experienced by affected communities. At the national and international levels, NGOs such

as WALHI and Greenpeace are often active in conducting independent research, direct environmental monitoring, and publishing reports that criticize mining waste management practices and their impact on the environment and indigenous peoples. On the other hand, international actors are also seen to be helping to disseminate information through cross-border advocacy and litigation, such as market mechanisms, global campaigns, and transnational law. Examples include the London Mining Network (LMN) and the Global Legal Action Network (GLAN), which sued the London Metal Exchange (LME) for allowing the trading of metals resulting from environmental crimes, including copper from the Grasberg mine managed by PTFI. This can put pressure on the global market to advocate for a ban on the trade of commodities suspected of being linked to environmental damage or human rights violations (Herlinda, 2024).

Challenges in Improving Environmental Governance

1) Data Disparities and Low Data Transparency

The main problem often encountered in this case is the limited access to independent and renewable data related to the environmental impact of tailings disposal, particularly in relation to water quality and ecosystem degradation. The data currently available comes from long-term research conducted by civil society organizations, while environmental data that companies claim to collect regularly through internal audits and monitoring is not publicly accessible. This raises questions about the effectiveness of state oversight, given that companies cannot operate without government permits and approval.

2) Structural Dependency and Inconsistent Law Enforcement

The mining sector is one of the sectors that contributes to the country's Gross Domestic Product (GDP). Based on data from the Central Statistics Agency (BPS) related to GDP based on current prices according to business fields in 2024, the mining and quarrying sector contributed around 2,026 trillion rupiah, with income from metal ores around 17.05% (BPS Indonesia, 2024). This has led to economic dependence that can influence the strict enforcement of environmental regulations. This situation is called regulatory capture, where institutions that have the authority to regulate actually experience obstacles in implementing the law because they are influenced by economic and political interests, even though the regulations made by Indonesia are quite detailed in regulating mining activities, including licensing requirements and environmental quality standards. Environmental violations are often only responded to through administrative mechanisms, without accompanying strict sanctions and follow-up supervision to ensure substantial compliance. As a result, environmental problems are not quickly resolved because companies do not feel deterred by the penalties imposed.

3) Marginalization of Indigenous Peoples

Development policies are often oriented towards economic modernization without considering the social and cultural conditions of indigenous peoples who still depend on nature as their source of life. This increasingly creates ecological inequality and injustice for traditional communities, as well as hindering the achievement of sustainability goals in line with the SDGs. The government should protect Indonesia's rich cultural diversity, such as that of indigenous peoples, by providing basic facilities to support their livelihoods.

4) Complexity of Multi-Actor Governance

The environmental management process involves many actors, ranging from companies, national governments, civil society organizations, and international actors. However, actors such as NGOs and transnational advocacy networks, which often launch international campaigns and litigation to raise public awareness and put pressure on stakeholders to take action, are often hampered by their fragmented nature and lack of legal binding power. The absence of an integrated governance framework and weak coordination between actors also pose obstacles to environmental improvement.

Realistic and High-Impact Policy Recommendations

1) Comprehensive Revision of the Environmental Impact Assessment (AMDAL) and Full Implementation of FPIC

A highly effective measure to address this issue is to conduct a detailed revision of Freeport Indonesia's Environmental Impact Assessment (EIA). This is essential because the government does not have to amend the mining contract but only enforce the regulations already stipulated in the Indonesian Environmental Law (Law No. 32 of 2009). Indonesia's AMDAL uses outdated data, so its handling is no longer relevant to the actual level of ecosystem damage occurring today. Freeport has been dumping more than 200,000 tons of tailings waste every day into the Aghawagon and Ajkwa river systems, which has caused severe sediment accumulation and turned most of the rivers into artificial land (Sketsa. id, 2025). The ModADA area, which was originally around 120 km, has expanded to 230 km², indicating that there have been significant ecological changes and that AMDAL must be an important point in minimizing this issue (Danny P. Hutagalung1, Dalen Darbec Anew2, 2025). Research studies conducted between 2018 and 2021 show that indigenous peoples in Papua, including the Amungme and Kamoro tribes, were not involved in the AMDAL process, which contradicts the principle of free, prior, and informed consent (FPIC) (Mampioper, 2024). Revising the AMDAL with factual scientific data and genuine participation from indigenous communities is both realistic and required by law.

2) Strengthening Independent Monitoring of Water Quality and Sedimentation

This policy is essential because Freeport does not need to change its mining operations, only requiring independent monitoring through partnerships with universities, NGOs, and government laboratories. The daily sediment load of 200,000 tons discharged by Freeport has made the Ajkwa riverbed increasingly visible. If not addressed quickly, this situation will have a negative impact on the environment and surrounding communities (Danny P. Hutagalung1, Dalen Darbec Anew2, 2025). There are around 27 coastal villages with a population density of around 6,484 people in 3 districts that have lost access to navigable rivers, which has impacted mobility, fishing, and of course, access to water and proper sanitation for each individual. The declining fish population threatens food security for households whose communities depend on the river (Danny P. Hutagalung1, Dalen Darbec Anew2, 2025).

3) Large-Scale Utilization of Tailings for Construction Materials Based on Proven Laboratory Results

Tailings waste can be used for construction materials because it does not require changes to mining infrastructure. Laboratory studies show that tailings have sufficient material quality and are suitable for construction.

Lab results from Civil Engineering journals show that :

• Soil plasticity decreases from 28.96% to 5.42% when mixed with 15% tailings—an 81% reduction, which is ideal for road base stabilization (Mabui et al., 2021).

• The chemical composition (SiO_2 69.32%, Al_2O_3 6.86%, CaO 16.04%) is suitable for use as fine aggregate.

• Specific gravity ranges from 2.48–2.86, and weathering resistance is 2–8%, safely below the SNI limit of 10% (Lapian, 2023).

This means tailings can be used for:

– soil stabilization
– asphalt and concrete mixes
– bricks and paving blocks

This approach reduces tailings entering the river system and supports a circular economy.

4) Direct Support for Affected Communities: Clean Water Access, River Transport Recovery, and Livelihood Assistance

This policy must be implemented by the government because it can help the community meet their basic needs. Considering that 27 villages with a total population of around 6,484 are currently experiencing serious problems in accessing clean water and transportation. Boats, which are used daily to cross the Ajkwa River and other rivers, are often stuck in thick sediment. The declining number of fish and the loss of fish species can worsen food security (Danny P. Hutagalung1, Dalen Darbec Anew2, 2025). To make matters worse, many women have to travel for hours just to get clean water. The government must take notice and immediately address this issue by constructing artesian wells, deploying mobile

water treatment units, cleaning up polluted river areas, restocking lost fish species, and most importantly, providing new livelihood programs for affected communities.

CONCLUSION

This study shows that PT Freeport Indonesia's tailings management has a significant impact on water quality and sanitation sustainability in the area around the Ajkwa River, Papua. The decline in the ecological and hydrological functions of the waterways, which is the root cause of water pollution in the area, is due to the riverine tailings disposal system being unable to function effectively as a result of the excessive volume of tailings, leading to increased sediment load, high levels of Total Suspended Solids (TSS), and changes in the geomorphology of the river and estuary. This water pollution also has serious implications for the river, which is a source of life for the indigenous Papuan community. Therefore, this case indicates a violation of SDG 6 on access to clean water and proper sanitation, as it threatens the basic rights of the surrounding community, who depend on nature to meet their daily needs.

Improvements in environmental governance face a number of obstacles, such as limited data transparency, political interests, and economic dependence on the mining sector, as well as weak supervision and substantive sanctions. This confirms that the problem of pollution does not only stem from technical aspects, but also from the complexity of governance and power relations between stakeholders. Thus, the issue of PT Freeport Indonesia's tailings management reflects a structural failure to realize the principles of fair and inclusive sustainable development. Cooperation between parties is needed to address this issue with an environmental governance approach that is more accountable, participatory, and oriented towards ecological and social justice.

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