

Regulatory Impact Analysis (RIA) in Indonesia's Lake Management: Key Implications and Challenges

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Keywords: National Priority Lakes; Presidential Regulation No. 60/2021; Regulatory Impact Analysis (RIA); Renewable Energy

ABSTRACT

Lakes in Indonesia are experiencing severe ecological degradation due to utilization pressures that exceed their carrying capacity. The Government has designated 15 lakes as national priorities through Presidential Regulation (PR) Number 60 of 2021 on the Preservation of National Priority Lakes (PR 60/2021). Nevertheless, the implementation process continues to encounter multiple challenges. This study aims to evaluate the effectiveness of PR 60/2021 using the *Regulatory Impact Analysis* (RIA) framework developed by the OECD and adapted by Bappenas, focusing on five key components: problem definition, objective setting, identification of alternatives, stakeholder engagement, and cost–benefit analysis. The findings reveal a long trajectory of priority lake management efforts from 2004 until the issuance of PR 60/2021. Furthermore, the utilization of lakes for renewable energy development, primarily through hydropower and floating solar photovoltaic, has been and will be implemented across the 15 priority lakes, with projects currently in pre-construction and construction phases. The RIA indicates significant gaps between policy mandates and realities on the ground, as ongoing ecosystem degradation persists due to overexploitation beyond carrying capacity, including intensive fisheries, waste pollution, land conversion in catchment areas, and renewable energy infrastructure development that is not yet fully aligned with conservation principles. The policy alternative identified in this study, establishing a legally binding Integrated Lake Management Master Plan is considered more effective for addressing regulatory gaps and ensuring synchronization between conservation policies and development agendas, including renewable energy expansion. The RIA further emphasizes that the success of lake preservation depends on the quality of implementations, the inclusivity in policy formulation, and the effectiveness of cross-sector conflict management. Sustaining the ecological functions and economic benefits of lakes requires integrated spatial planning, conservation-based budgeting, comprehensive monitoring, and active community participation. Accordingly, lake preservation efforts should focus on: (1) strengthening PR 60/2021's operational instruments through legally binding master plans for each priority lake, (2) aligning conservation policies and renewable energy development to avoid compromising environmental and energy objectives, and (3) expanding substantive public participation, particularly by involving local and Indigenous communities as key actors in lake management.

1. INTRODUCTION

Lakes constitute a vital component of Indonesia's ecological and social systems, serving as sources of freshwater, regulators of microclimates, reservoirs of biodiversity, and economic spaces for local communities (BRIN (2023), Dewan SDA Nasional 2020; Kementerian Lingkungan Hidup 2008). The study conducted by the National Water Resources Council (2020) recorded that the number of natural lakes in Indonesia currently reaches 840 large lakes and 735 small lakes, often referred to as *telaga*, *ranu*, and *situ*. However, Dewan SDA Nasional (2020) and Hashim (2017) explain that data and studies indicate that these lakes are undergoing severe ecological degradation, ranging from sedimentation and declining water quality to the deterioration of catchment areas due to uncontrolled resource exploitation (Henny et al. 2012; Herlinawati 2019).

Among the numerous lakes in Indonesia, the government has designated 15 lakes as National Priority Lakes for the prevention and mitigation of lake ecosystem degradation, as stipulated in Presidential Regulation Number 60 of 2021 on the Preservation of National Priority Lakes (PR 60/2021). The designation of national priority lakes is based on criteria including ecological degradation, strategic economic and cultural value, and the urgency of intervention in lake hydrology. To accelerate action in these priority lakes, the National Priority Lake Rescue Unit was established to facilitate cross-ministerial and intergovernmental coordination in formulating and implementing lake restoration policies. Both the regulation and the establishment of this unit are intended to ensure that restoration interventions are implemented in a targeted, coordinated, and effective manner.

The existence and implementation of PR 60/2021 have encountered a range of complexities. First, despite being the principal legal framework for the preservation of lakes, PR 60/2021 exhibits limited emphasis on the lake restoration agenda itself. This is evident from the designation and planned use of several national priority lakes as sites for renewable energy development, such as hydropower and floating solar photovoltaic (FPV) projects. Second, in the context of renewable energy development, PR 60/2021 has not yet been fully harmonized with the broader national energy policy framework, particularly with other regulations such as Presidential Regulation No. 112 of 2022 on the Acceleration of Renewable Energy Development for Electricity Supply (PR 112/2022). Although PR 112/2022 does not explicitly designate lakes as development sites, the incentives and directives to accelerate the construction of hydropower plants and solar power plants frequently target water bodies, including priority lakes. Third, the composition of the National Priority Lake Rescue Unit established to expedite the implementation of PR 60/2021 is predominantly state-organized, with limited multi-stakeholder representation.

The utilization and planned development of renewable energy in these priority lakes face multiple challenges. For instance, hydropower development in Lake Poso has had notable impacts on both community livelihoods and ecosystem integrity. Research by Wirachandra et al. (2024) indicates that hydropower operations affect the quality and ecological balance of the lake's aquatic systems. Similarly, Litha (2022) reports that land acquisition for hydropower projects directly undermines the livelihoods of farmers residing in the vicinity of Lake Poso. Another example is the proposed floating solar photovoltaic project in Lake Singkarak, which has met with resistance from various stakeholders, particularly local communities. According to a report published by Sastra (2025),

the majority of residents opposed the project, citing perceived environmental risks that could threaten livelihoods and cause degradation to Lake Singkarak's ecosystem.

Based on the preceding discussion, it is evident that the implementation of PR 60/2021, the primary regulation for ensuring the sustainability of national priority lakes, is marked by considerable complexity. Accordingly, this study aims to examine the impacts of PR 60/2021 using a Regulatory Impact Analysis (RIA) framework. The RIA is intended to ensure that the government exercises its regulatory authority in a manner that maximizes public benefits by providing evidence-based recommendations and information to support decision-making, as outlined by the OECD (2020). As part of national regulatory governance reform, the Government of Indonesia, through the National Development Planning Agency (Bappenas) has promoted the adoption of RIA to ensure that every policy is founded on a robust analytical basis and produces tangible outcomes. Therefore, this study employs RIA to assess the impacts of PR 60/2021. The findings are expected to provide both empirical and analytical contributions for stakeholders in designing sustainable interventions that align with environmental values.

2. METHODOLOGY

This research adopts a qualitative approach by presenting a *Regulatory Impact Analysis* (RIA) of the implementation of PR 60/2021. As explained by Neuman (2014), this study is classified as descriptive research, as it seeks to portray existing social phenomena and aims to broadly describe the social environment and the relationships under examination. The study offers practical benefits, being oriented toward applying its findings to address real-world problems and provide actionable solutions. Secondary data were obtained from various relevant scholarly works, including journal articles, books, regulations, and other pertinent sources, to achieve the research objectives. Data collection was conducted between July and August 2025. The analysis in this study is grounded in the RIA framework developed by the Organisation for Economic Co-operation and Development (OECD) and previously adopted by the National Development Planning Agency (Bappenas).

Bappenas (2009) explains that a regulatory impact assessment, also referred to as regulatory impact analysis (RIA), serves as a crucial instrument to ensure higher-quality government interventions. RIA serves as a systematic mechanism for identifying and evaluating the benefits and costs of proposed regulations. It is a fundamental tool for ensuring the quality of regulatory frameworks and is now utilized by nearly all OECD member countries, the European Commission, and many transitional economies OECD (2009). Ideally, the RIA process should commence at the earliest stages of policymaking to inform policy development and clearly define both the problem and the intended objectives while the regulation remains in the proposal stage. The general principles of RIA can be grouped into five key elements: (a) commitment and support for RIA implementation; (b) RIA governance, which entails having an appropriate institutional design; (c) mainstreaming RIA through strengthened administrative capacity and accountability; (d) the use of a targeted and fit-for-purpose RIA methodology; and (e) continuous evaluation and improvement of the RIA process OECD (2020).

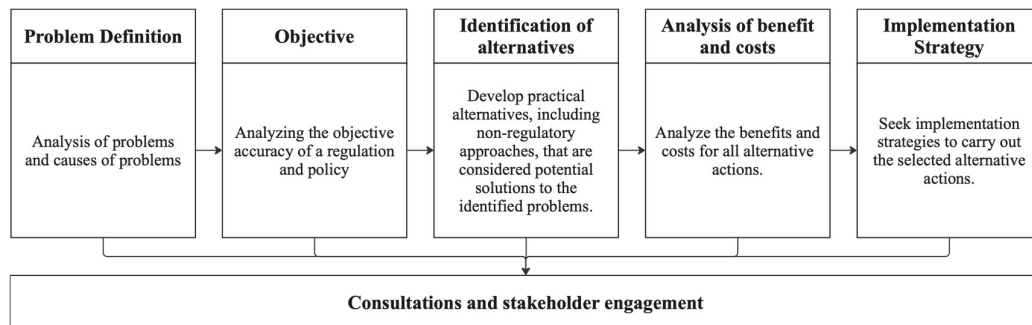


Figure 1. Basic steps in implementing RIA. Reprocessed by the Author. Sources: Bappenas (2009); OECD (2009); OECD (2020)

The application of RIA in this study does not fully adhere to all formal stages and components of a standard RIA process. Instead, a selective approach was adopted, focusing on four key aspects: problem definition, to clearly articulate the issues at hand; objectives, to establish measurable policy goals; identification of alternatives, to map out relevant solution options; and consultations and stakeholder engagement, to ensure the involvement of diverse stakeholders. This targeted approach was chosen to maximize the relevance of findings to the context of national priority lake restoration, without compromising the analytical depth required to formulate evidence-based policy recommendations.

The RIA conducted in this study represents an analytical process constrained by significant data limitations. The analysis relied exclusively on publicly accessible data and did not incorporate real-time information or primary data collected directly from the field. These constraints affect the depth of the analysis, particularly in quantifying the costs and benefits of policy options. Nevertheless, academic rigor was preserved by using legally published official data and verified information relevant to field conditions, ensuring that the depiction of the actual situation remains accurate and reliable within the study's findings.

3. RESULT AND DISCUSSION

3.1 General Overview

3.1.1 Development of Renewable Energy in National Priority Lakes

The designation of national priority lakes is based on Article 3(2) of PR 60/2021, which outlines the level of ecosystem degradation and pressures affecting ecological, economic, and socio-cultural aspects. In addition, national priority lakes hold strategic value and are formally included in planning documents or technical policy frameworks concerning water and lake management. The following is the list of the 15 national priority lakes as stipulated in PR 60/2021.

Table 1. 15 National Priority Lakes

No	Lake	Location	No	Lake	Location
1	Lake Toba	North Sumatra	9	Lake Kaskade Mahakam (Melintang, Semayang, and Jempang)	East Kalimantan
2	Lake Singkarak	West Sumatra	10	Lake Sentarum	West Kalimantan
3	Lake Maninjau	West Sumatra	11	Lake Limboto	Gorontalo
4	Lake Kerinci	Jambi	12	Lake Poso	Central Sulawesi
5	Lake Rawa Danau	Banten	13	Lake Tempe	South Sulawesi
6	Lake Rawa Pening	Central Java	14	Lake Matano	South Sulawesi
7	Lake Batur	Bali	15	Lake Sentani	Papua
8	Lake Tondano	North Sulawesi			

Article 4(c) of Presidential Regulation No. 60 of 2021 (PR 60/2021) stipulates that the preservation of lakes must be guided by policy directions that enable the utilization of national priority lakes while ensuring their long-term ecological functions and conditions. This provision affirms that the 15 national priority lakes may be utilized for various purposes, including the development of renewable energy provided such activities align with the principles of sustainability. The overarching objective is to ensure that any form of utilization does not compromise the ecological functions of the lakes and maintains environmental balance, thereby allowing their benefits to be enjoyed sustainably by both present and future generations. Among the 15 priority lakes, several have ongoing or planned renewable energy projects, primarily in the form of hydropower and floating solar photovoltaic (FPV) developments.

Table 2. Utilization of Lakes for Renewable Energy Development

Hydropower					Floating Solar Photovoltaic				
Available		Phase Status			Available		Phase Status		
Yes	No	Pre-Construction	Construction	Operation	Yes	No	Pre-Construction	Construction	Operation
9	8	0	2	7	3	12	3	0	0

Analysis of the table above indicates that the utilization of national priority lakes for renewable energy development primarily falls into two categories: hydropower and floating solar photovoltaic (FPV). Data on renewable energy development in the 15 national priority lakes in Indonesia indicate that hydropower projects are more prevalent than FPV projects. There are nine hydropower facilities located across seven lakes, three of them are located in Lake Toba. Among the nine hydropower projects, seven are already operational, whereas the two projects located in Lake Kerinci and Lake Toba are still under construction, while the remaining eight lakes have no hydropower installations. This demonstrates that the utilization of hydropower in national priority lakes has progressed significantly, with a high level of maturity from planning to implementation stages. In contrast, floating solar photovoltaic development can be considered to be at an early stage. To date, there are only three potential or planned FPV projects, all of which remain in the pre-construction phase.

3.1.2 Historical Evolution of Policies for the Management of National Priority Lakes

The evolution of policies for managing and restoring lakes in Indonesia reflects a long process involving multiple regulations, inter-ministerial agreements, and national programs. Each period has introduced different approaches and priorities ranging from conservation and development regulation to an emphasis on the restoration of critically degraded lakes. The following section presents a chronological overview of key milestones and dynamics in the management of national priority lakes from 2004 up to the issuance of PR 60/2021.

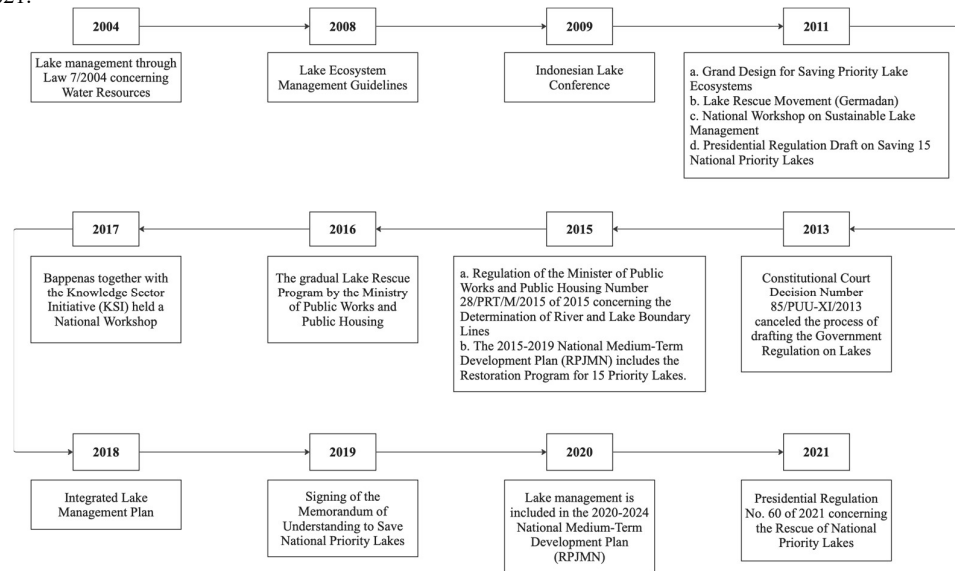
**Figure 2.** Development of National Priority Lake Management Policy

Table 3. Development of National Priority Lake Management Policy

Year	Descriptions
2004	Lake management in Indonesia was initially regulated under Law No. 7 of 2004 on Water Resources. Article 25 mandates that water resource conservation shall be implemented across various aquatic ecosystems, including lakes. Furthermore, Article 35 stipulates that the development of water resources encompasses the management and utilization of lakes, while Article 36 affirms that further provisions regarding lake development shall be regulated through Government Regulations. In addition, Article 44(1) specifies that the development of water resources for transportation purposes also includes lake management.
2008	The Guidelines for Lake Ecosystem Management, published in 2008, outline the background, objectives, and targets of lake ecosystem management, including definitions of lakes, their characteristics and functions, as well as the challenges faced by lake ecosystems. As cited from the Ministry of Environment (2008), the document also elaborates on policies, strategies, and programs for lake ecosystem management. In addition, it provides technical knowledge regarding standard criteria for lake degradation, conditions of catchment areas, lake water quality standards and their status assessments, as well as the carrying capacity for lake water pollution loads. All these elements serve as the foundational basis for implementing lake ecosystem management oriented toward maintaining ecological balance and environmental carrying capacity. The guidelines are intended to serve as a unified reference for both central and regional government agencies in implementing the sustainable utilization, protection, and conservation of lakes.
2009	According to the Ministry of Environment (2008), during the First National Conference on Indonesian Lakes (<i>Konferensi Nasional Danau Indonesia</i> – KNDI I) held in Bali in 2009, nine ministries agreed to sign the Bali Agreement on Sustainable Lake Management. This agreement designated 30 priority lakes, divided into 15 Priority I lakes and 15 Priority II lakes, with the aim of addressing various issues and degradation affecting lakes in Indonesia (Henny, Fakhruddin, Nasution, & Tjandra Chrismadha, 2012). The agreement produced seven key points: (1) lake ecosystem management; (2) utilization of lake water resources; (3) development of monitoring, evaluation, and information systems; (4) preparation of adaptation and mitigation measures; (5) capacity building, institutional development, and coordination; (6) enhancement of community participation; and (7) sustainable financing.
2011	At the Second National Conference on Indonesian Lakes (<i>Konferensi Nasional Danau Indonesia</i> – KNDI II) in 2011, the <i>Grand Design</i> for the Restoration of Ecosystems in the 15 Priority I Lakes was announced, along with the Lake Rescue Movement (<i>Gerakan Penyelamatan Danau</i> – Germadan), with Germadan Rawapening serving as the model initiative. In the same year, the <i>Nusantara Lake Conference</i> was held, resulting in the “Limboto Declaration,” followed by the <i>National Workshop on Sustainable Lake Management</i> organized by the National Development Planning Agency (Bappenas), and the drafting of the Presidential Regulation Bill (<i>Rancangan Peraturan Presiden</i> – Raperpres) on the Preservation of the 15 National Priority Lakes. The Raperpres underwent inter-ministerial discussions, and during the harmonization stage led by the Ministry of Law and Human Rights, the National Water Resources Council (<i>Dewan SDA Nasional</i>) was formally involved for the first time. The Ministry of Law and Human Rights emphasized that the coordination of water resource management falls under the duties and functions of the National Water Resources Council. Therefore, the Raperpres was required to incorporate the Council’s role in coordinating water resource management and implementing the National Water Resources Management Policy (<i>Kebijakan Nasional Pengelolaan SDA</i> – Jaknas Pengelolaan SDA), as cited from the National Water Resources Council (2020).
2013	The Government of Indonesia had previously drafted a Government Regulation Bill (<i>Rancangan Peraturan Pemerintah</i> – RPP) on Lakes as a follow-up to Law No. 7 of 2004 on Water Resources. However, this process was discontinued after the Constitutional Court, through Decision No. 85/PUU-XI/2013, annulled the Law, thereby rendering the legal basis for the regulation no longer valid.
2015	The Government of Indonesia issued Minister of Public Works and Public Housing Regulation No. 28/PRT/M/2015 on the Establishment of River Borderlines and Lake Borderlines. In addition, Presidential Regulation No. 2 of 2015 served as the legal basis for the <i>National Medium-Term Development Plan</i> (RPJMN) 2015–2019. The RPJMN document included a program for the restoration of 15 national priority lakes, which was not fully successful due to financing challenges and jurisdictional issues related to land and water management. Furthermore, the RPJMN 2015–2019 emphasized that improvements to the hydrological and water quality monitoring systems for the 15 priority lakes should focus on empowering communities in the catchment areas and around the lakes, as well as on regulating the designated lake borderlines.
2016	The Ministry of Public Works and Public Housing (PUPR) launched a phased lake restoration program, continuing to refer to the outcomes of the National Conference on Indonesian Lakes (<i>Konferensi Nasional Danau Indonesia</i> – KNDI) held in Denpasar on 13 August 2009 as cited from Trihusodo (2021). This initiative demonstrates the Ministry’s commitment to addressing the challenges faced by national priority lakes.
2017	On 9–10 May 2017, the Ministry of National Development Planning/National Development Planning Agency (<i>Kementerian PPN/Bappenas</i>), in collaboration with the Knowledge Sector Initiative (KSI), convened a National Workshop entitled “Sustainable Lake Management: Program Synergy and the Role of Stakeholders.” The workshop aimed to discuss several strategic issues, including water pollution caused by activities within and around lake ecosystem areas; holistic spatial planning for lake areas; integrated and synergistic regulations and management for sustainable lake governance; and the sustainable use of lake areas for tourism activities. The outcomes of the workshop were intended to serve as a foundation for the formulation of policies and regulations, as well as to foster synergy among stakeholders at both national and regional levels (<i>Kementerian PPN/Bappenas</i> 2017).
2018	According to the Kementerian PUPR (2019), an Integrated Lake Management document was prepared by multiple parties, which subsequently served as the basis for the Coordination Meeting on the Preservation of National Priority Lakes and the launch of the Revitalization of the Lake Preservation Movement Plan in 2019.
2019	A total of 11 ministries, together with several governors and regents, signed a memorandum of understanding on the preservation of 15 critically degraded national priority lakes at the Office of the Ministry of Environment and Forestry.

	The agreement aimed to strengthen cross-sectoral synergy between the central and regional governments for an integrated approach to lake restoration. Four main points were agreed upon: implementation of restoration efforts in accordance with the Integrated Lake Management Plan established in 2018; integration of programs into national, strategic, and spatial planning documents; multi-stakeholder cooperation to achieve healthy and sustainable lakes; and support for the formulation, implementation, monitoring, and evaluation of related policies, as cited from Herlinawati (2019).
2020	Lake management in the <i>National Medium-Term Development Plan</i> (RPJMN) 2020–2024 is integrated into the National Priority Programs, which include strengthening economic resilience, promoting regional development for equitable growth, enhancing the quality and competitiveness of human resources, and reinforcing supporting infrastructure. By 2024, the targets for revitalizing and restoring the 15 national priority lakes include damage control measures led by the Ministry of Environment and Forestry (<i>Kementerian Lingkungan Hidup dan Kehutanan</i> or KLHK). The RPJMN also emphasizes that environmental restoration is a long-term process, highly dependent on the rehabilitation of catchment areas, and is challenged by the persistently high rate of land degradation.
2021	Presidential Regulation of the Republic of Indonesia No. 60 of 2021 on the Preservation of National Priority Lakes serves as the primary regulatory framework for the central government, regional governments, and relevant stakeholders in implementing restoration efforts for the 15 national priority lakes. This regulation sets forth integrated strategies, policies, and measures to prevent further degradation, restore the quality of lake ecosystems, and ensure their sustainable utilization for environmental, social, and economic purposes.

3.2 Regulatory Impact Analysis on the Implementation of Presidential Regulation Number 60 of 2021

In the context of preserving national priority lakes, it is essential to recognize that a policy should not merely remain at the level of regulation, but must operate effectively and deliver tangible impacts on the ground. Presidential Regulation No. 60 of 2021 (PR 60/2021) serves as the primary legal foundation marking the adoption of a cross-sectoral approach to ecosystem-based lake management, integrating environmental, social, and economic dimensions.

PR 60/2021 was initially expected to strengthen inter-agency coordination, foster multi-stakeholder collaboration, and ensure the long-term sustainability of lakes as strategic resources. However, as its implementation progressed, critical questions emerged regarding the extent to which the regulation could genuinely enhance the readiness of lakes for sustainable utilization, particularly when these lakes also serve as sites for the development of renewable energy, tourism, and other economic activities that may offer benefits yet simultaneously pose challenges to ecosystem preservation.

In this study, the RIA is conducted reflectively, or *ex-post*, to comprehensively assess the actual impacts of PR 60/2021 on both the physical condition of lakes and the governance of their utilization. This RIA emphasizes the importance of evaluating how far the regulation has succeeded in building robust institutional, ecological, and social foundations to support the multi-sectoral use of lakes. Accordingly, the evaluation not only examines the policy's formal provisions but also assesses the substance and consistency of its implementation in maintaining the balance between utilization and conservation.

The primary focus of the RIA in the context of PR 60/2021 is to trace the extent of policy implementation at the field level, including identifying obstacles that arise when lakes are utilized for infrastructure purposes, particularly in energy sector projects such as hydropower and floating solar photovoltaic. The RIA is expected to provide a robust analytical framework for systematically evaluating policy effectiveness, uncovering potential overlaps of interest between sectors, and formulating policy strategies that are more adaptive to the dynamics of local needs and conditions.

The application of RIA in this study does not fully follow all formal stages and components of the RIA process. Instead, a selective approach is employed, focusing on four key aspects: (1) problem definition to clearly articulate the issues, (2) objectives to establish measurable policy goals, (3) identification of alternatives to map out relevant solution options, and (4) consultations and stakeholder engagement to ensure the involvement of a wide range of stakeholders. This focused approach is chosen to maximize the relevance of the findings to the context of preserving national priority lakes, without diminishing the analytical depth required to formulate evidence-based policy recommendations.

3.2.1 Problem Definition

The initial stage of the RIA involves formulating a problem statement that is clear and measurable. In the context of PR 60/2021, the problem refers to the gap between the ideal conditions mandated by the regulation and the realities of its implementation in the field. PR 60/2021 outlines five main strategies, ranging from integrating programs into spatial planning, budgeting, and ecosystem protection to strengthening research and data, as well as institutional empowerment and community participation. However, finding evidence indicates the presence of significant structural gaps, two of which stand out as the primary obstacles.

1. Absence of an established spatial planning framework.
2. Lake conservation is not prioritized in regional planning and budgeting documents, either in the Regional Medium-Term Development Plan (RPJMD) or the Regional Government Work Plan (RKPD).

These two issues are cross-cutting in nature and have a direct impact on the capacity of local governments to effectively implement the mandate of PR 60/2021. To understand the linkages between impacts, core problems, root causes, and systemic causes, a problem tree analysis was conducted as follows.

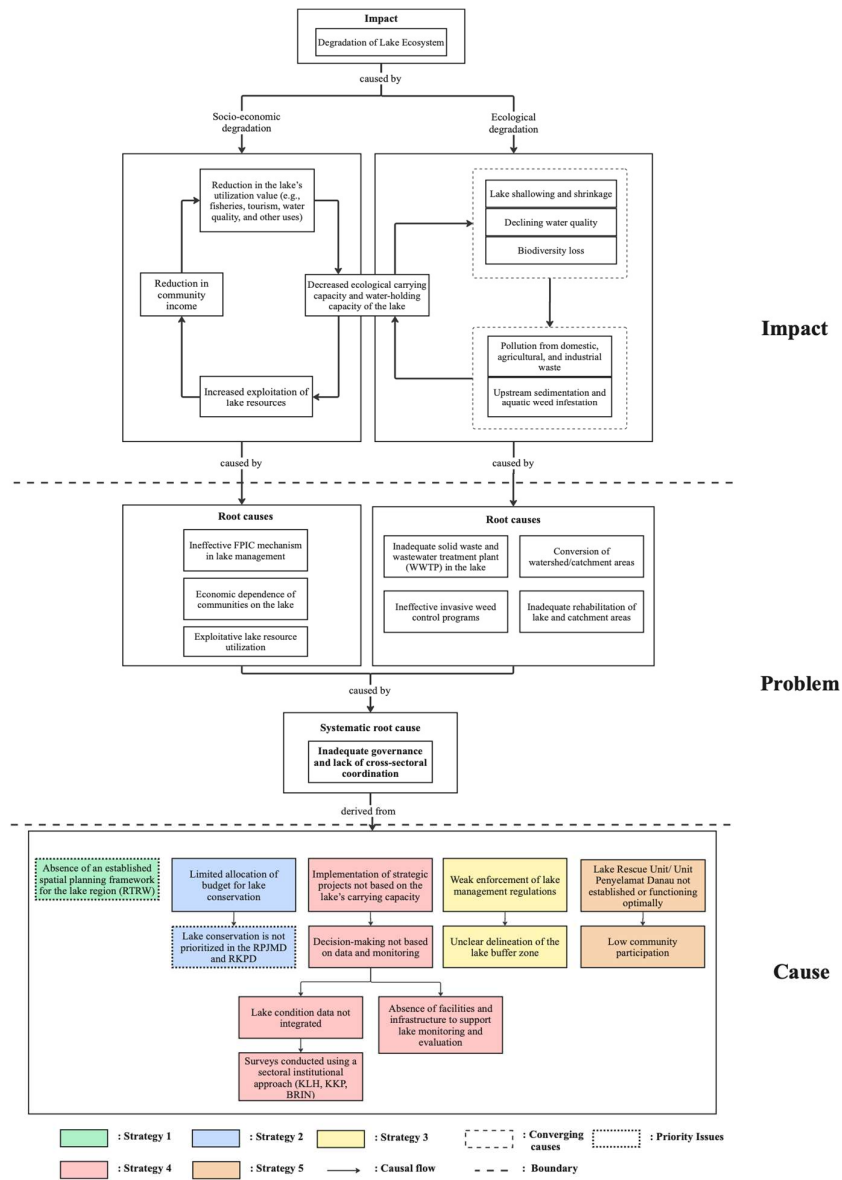


Figure 3. Tree Problem

At the *impact* level, lake ecosystem degradation is manifested through two main pathways. First, socio-economic degradation is evident from the reduced utilization value of lakes, for example, in fisheries, tourism, water quality, and other functions, which ultimately decreases community income. This condition often triggers excessive exploitation of lake resources, further intensifying pressure on the ecosystem. Second, ecological degradation is reflected in lake siltation and shrinkage, declining water quality, and the loss of biodiversity, driven by domestic, agricultural, and industrial waste pollution, upstream sedimentation, and aquatic weed infestation.

The *core problem* layer reveals that the chain of socio-economic issues stems from ineffective mechanisms for involving communities living around lakes. Even under PR 60/2021, community involvement in planning and implementation stages tends to be merely formal, often positioning communities as passive policy recipients rather than active stakeholders. This lack of meaningful engagement has, in some cases, triggered community protests or opposition to projects in lake areas. A clear example can be seen in the development of a power plant on Lake Singkarak, which sparked protests from local residents who believed the project would harm the environment and threaten the endemic bilih fish (Sastra 2025). Although the National Research and Innovation Agency (BRIN) has provided assurances that environmental management concerns would not pose a problem, public opposition to the project persisted (BRIN 2025).

Another issue underlying the socio-economic problems is the high economic dependence of local communities on lake resources, which drives exploitative utilization patterns. A notable example is Lake Maninjau, where the number of floating net cages (*Keramba Jaring Apung/KJA*) reached 17,417 units in 2021 far exceeding the lake's carrying capacity of only 6,000 KJA, as stated in the West

Sumatra Province RPJMD 2021–2026. This condition has not only accelerated the decline in water quality, shifting from mesotrophic status in 2001 to hypertrophic in 2018, but has also contributed to reduced fish production and disruptions in the tourism sector.

The *root causes* of ecological problems stem from the degradation of environmental functions in both the watershed (catchment area) and the lake body. Land conversion in catchment areas into intensive agricultural zones, settlements, and infrastructure has reduced the lake's natural capacity to retain and filter water. The case of Lake Poso illustrates how habitat alteration in the aquatic–terrestrial transition zone (ATTZ) into agricultural land, along with the construction of a hydropower plant on the Poso River, has disrupted the migratory cycles of key species such as eels and reduced biodiversity, as documented in the Poso Regency RPJMD 2021–2026. Furthermore, water quality in many priority lakes has deteriorated due to pollution from domestic, agricultural, and industrial waste, exacerbated by inadequate waste management. The Bangli Regency RPJMD 2021–2026 notes that Lake Batur suffers from pollution caused by a combination of domestic waste, chemical fertilizers, floating net cage (KJA) activities, tourism-related waste, and uncontrolled aquatic weed infestations. Sediment accumulation from erosion and excessive nutrient inflows from upstream activities has led to siltation and massive weed growth, reducing both the ecological carrying capacity and water storage capacity of the lakes.

The *root causes* of both the socio-economic and ecological degradation of national priority lakes largely stem from weak governance and insufficient cross-sectoral coordination. This condition arises not only from institutional issues at the national level but is also reflected in policies and practices at provincial and regency levels. Analysis indicates that the absence of a clear spatial planning framework for lake areas is a major contributing factor. For instance, Lake Singkarak still lacks an approved Spatial Plan (*Rencana Tata Ruang Wilayah/RTRW*), while Lake Maninjau has only a 2018 Lake Management Plan document without legal reinforcement in the RTRW, as noted in the West Sumatra Province RPJMD 2021–2026. Without a robust spatial planning framework, land use in buffer zones and catchment areas tends to be uncontrolled, leading to land conversion and environmental degradation.

Limited budget allocation for lake conservation poses a significant constraint. While some regions have incorporated lake-related issues as part of their strategic priorities in their respective RPJMD documents, such as Kerinci Regency, which references the mandate of Presidential Regulation No. 60 of 2021 conservation funding has yet to become a development priority, as reflected in the Kerinci Regency RPJMD 2022–2026. In contrast, the RPJMD of Wajo Regency (2019–2024) and Soppeng Regency (2021–2026), both managing Lake Tempe, do not include any dedicated funding allocation for lake restoration. Overall, the mainstreaming of lake conservation regulations at the regional level is summarized in the following table.

Table 4. Lake Restoration Regulations at the Regional Government Level

Lake	Spatial Planning	Planning Policy	Budget Policy
Lake Toba	- PR 81/2014 on Spatial Plan of Lake Toba Area - PR 89/2024 on Master Plan for Lake Toba National Tourism Destination (<i>Rencana Induk Destinasi Pariwisata Nasional (RIPDN)</i>) 2024–2044	- Presidential Regulation No. 89/2024 on Master Plan for Lake Toba National Tourism Destination 2024–2044 - Toba Regency Regulation No. 3/2021 on Regional Medium-Term Development Plan 2021–2026	Presidential Regulation No. 89/2024 on Master Plan for Lake Toba National Tourism Destination 2024–2044
Lake Singkarak	Spatial Plan (<i>RTRW</i>) not yet approved	- West Sumatra Provincial Regulation No. 6/2021 on Regional Medium-Term Development Plan 2021–2026 - Tanah Datar Regency Regulation No. 4/2021 on Regional Medium-Term Development Plan 2021–2026	Not available
Lake Maninjau	- No spatial plan - Lake Maninjau Management Plan Book 1 (2018)	Agam Regency Regulation No. 3/2021 on Regional Medium-Term Development Plan	Not available
Lake Kerinci	Kerinci Regency Regulation No. 3/2024 on Spatial Plan 2024–2044	Kerinci Regency Regulation No. 2/2022 on Amendment of Regency Regulation No. 4/2019 on Regional Medium-Term Development Plan 2019–2024	Not prioritized
Lake Rawa Danau	Serang Regency Regulation No. 5/2020 on Amendment of Spatial Plan 2011–2031	Serang Regency Regulation No. 7/2021 on Regional Medium-Term Development Plan 2021–2026	Not available
Lake Rawa Pening	- Central Java Provincial Regulation No. 8/2024 on Spatial Plan 2024–2044 - Semarang Regency Regulation No. 6/2023 on Spatial Plan 2023–2043	- Central Java Provincial Regulation No. 8/2024 on Spatial Plan 2024–2044 - Semarang Regency Regulation No. 6/2023 on Spatial Plan 2023–2043	- Central Java Provincial Regulation No. 8/2024 on Spatial Plan 2024–2044 - Semarang Regency Regulation No. 6/2023 on Spatial Plan 2023–2043
Lake Batur	Bali Provincial Regulation No. 2/2023 on Spatial Plan 2023–2043	Bangli Regency Regulation No. 1/2023 on Spatial Plan 2023–2043	Bangli Regency Regulation No. 1/2023 on Spatial Plan 2023–2043

	• Bangli Regency Regulation No. 1/2023 on Spatial Plan 2023–2043		
Lake Tondano	Not found	North Sulawesi Provincial Regulation No. 4/2021 on Regional Medium-Term Development Plan 2021–2026	Not available
Lake Kaskade Mahakam	• East Kalimantan Provincial Regulation No. 1/2023 on Spatial Plan 2023–2042	East Kalimantan Provincial Regulation No. 2/2019 on Regional Medium-Term Development Plan 2019–2023	Not prioritized
Lake Sentarum	• Kapuas Hulu Regency Regulation No. 1/2014 on Spatial Plan 2014–2034	Kapuas Hulu Regent Regulation No. 5/2021 on Regional Medium-Term Development Plan 2021–2026	Focus on ecotourism
Lake Limboto	• Gorontalo Provincial Regulation No. 9/2017 on Strategic Area Spatial Plan	Gorontalo Regency Regulation No. 3/2021 on Regional Medium-Term Development Plan 2021–2026	Not available
Lake Poso	• Poso Regency Regulation No. 8/2012 on Spatial Plan 2012–2032 • Poso Regency Regulation No. 5/2019 on Tourism Master Plan 2019–2034	Poso Regency Regulation No. 4/2021 on Regional Medium-Term Development Plan 2021–2026	Not available
Danau Tempe	• South Sulawesi Governor Regulation No. 39/2023 on Land Use Control around Lake Tempe • Wajo Regency Regulation No. 16/2014 on Public Order • Wajo Regency Regulation No. 12/2012 on Spatial Plan • Soppeng Regency Regulation No. 8/2012 on Spatial Plan	• Wajo Regency Regulation No. 8/2021 (amending 2019 RPJMD) • Soppeng Regency Regulation No. 2/2021 on Regional Medium-Term Development Plan 2021–2026.	Not prioritized
Lake Matano	• Luwu Timur Regency Regulation No. 7/2011 on Spatial Plan 2011–2031 • South Sulawesi Provincial Regulation No. 2/2022 on General Regional Energy Plan	Luwu Timur Regency Regulation No. 11/2021 on Regional Medium-Term Development Plan 2021–2026	Not available
Lake Sentani	• Jayapura Regent Regulation No. 74/2021 on Land Use Control around Lake Sentani	• Jayapura Regency Regulation No. 1/2018 on Regional Medium-Term Development Plan 2017–2023 • Papua Provincial Regulation No. 3/2019 on Regional Medium-Term Development Plan 2019–2023	Not available

Regulatory challenges at the local level are intensified by weak institutional capacity. The Lake Rescue Units mandated under PR 60/2021 in many regions function merely as formalities, lacking tangible operational roles. This is supported by the findings of Simatupang et al. (2022), which emphasize that without institutional strengthening and cross-sectoral integration, these units risk becoming mere symbols of commitment with no substantive impact on improving lake quality. This is evident in the case of Rawa Danau Lake in Serang Regency, where lake restoration efforts are neither explicitly integrated into local planning nor reflected in regional budgets, as outlined in the Serang Regency RPJMD 2021–2026.

The availability of data, monitoring facilities, and management systems for lakes remains fragmented and unsustainable. Monitoring efforts are predominantly sector-specific, while mechanisms for data exchange and cross-sector coordination are inadequate. This fragmentation hampers effective management, as seen in Sentani Lake, Jayapura Regency, where monitoring relies on limited spatial and water quality data without an integrated system, according to the Jayapura Regency RPJMD 2017–2022. This complexity is likely to increase due to fragmented authority following ministerial restructuring, as lake management involves not only the water body itself but also the surrounding catchment area, which requires strong inter-agency synergy. The complexity of lake management is further compounded by institutional fragmentation following the *Merah-Putih* Cabinet's ministerial restructuring, which split the former Ministry of Environment and Forestry (*KLHK*) into the Ministry of Environment (*KLH*) and the Ministry of Forestry (*Kemenhut*). Addressing these challenges requires stronger inter-agency collaboration, as effective lake management must consider not only the lake water body itself but also its broader catchment area.

This set of issues requires serious attention to ensure the sustainability of national priority lake restoration, particularly to align with the utilization of lakes across various sectors, including renewable energy development, which directly depends on lake carrying capacity. The acceleration of RE development must be designed in harmony with efforts to restore and protect lake ecosystems, so as not to exacerbate existing ecological pressures. Lake Toba serves as an example of long-term planning that has mapped lake management more holistically through the instrument of Presidential Regulation No. 89 of 2024. However, the success of this approach ultimately depends on mechanisms for community engagement, especially Indigenous communities, as primary actors with historical, social, and economic ties to the lake. Their involvement must therefore be substantively integrated into both the planning and implementation stages of policy.

3.2.2 Objective

The problems faced generally have a broad scope and high complexity, making it impossible to resolve them through a single policy or regulation. In such situations, legislation is typically designed to address only certain aspects of the issue. Therefore, RIA emphasizes that formulating clear objectives or targets is crucial so that regulatory implementation can be directed, focused, and effective in achieving the desired outcomes, as noted by Bappenas (2009). Based on the analysis conducted through problem definition of PR 60/2021 implementation, a set of objectives and targets has been formulated and articulated through several priority lake preservation strategies, which serve as the foundation for safeguarding national priority lakes.

1. **Establish Clear Policy Objectives to Address Socio-Economic and Ecological Degradation of National Priority Lakes**
As emphasized by Bappenas (2009), clarity of policy objectives forms the foundation for targeted, focused, and effective regulatory implementation. In the context of implementing PR 60/2021, these objectives should focus on controlling lake resource exploitation, restoring water quality, and protecting biodiversity, as highlighted in the West Sumatra RPJMD 2021–2026, which notes severe eutrophication in Lake Maninjau and Lake Singkarak due to excessive floating net cages (KJA), domestic waste, and unsustainable fishing practices. Clear objectives enable the formulation of measurable strategic actions, such as limiting the number of KJAs according to carrying capacity or applying protective zoning for lake buffer areas.
2. **Strengthen Mechanisms for Public Participation in Planning and Implementing Lake Management Policies**
PR 60/2021 mandates public participation; however, in practice, such engagement is often symbolic and lacks substance. For instance, the Kerinci RPJMD shows that the degradation of Lake Kerinci affects tourism and local economic sectors, yet its management has not optimally involved local communities as strategic partners. Involving indigenous communities, fishers, and local groups with socio-economic ties to the lake as policy stakeholders can reduce resistance to conservation projects and maximize the contribution of local knowledge. This model has also proven effective in promoting sustainability, as demonstrated by customary management practices in several Indonesian lake regions.
3. **Optimize Governance and Cross-Sectoral Coordination in Managing National Priority Lakes**
The implementation of PR 60/2021 still faces fragmented authority among agencies, weakening management effectiveness. The Bangli RPJMD notes that saving Lake Batur requires institutional integration, but existing institutions remain sectoral. Optimizing governance includes strengthening the Lake Rescue Unit, integrating conservation programs into regional spatial and development plans (RTRW and RPJMD), and harmonizing cross-sectoral policies such as environment, energy, fisheries, spatial planning. Binding regulations, such as establishing lake protection zoning within regional RTRWs through inter-ministerial decrees, will reinforce coordination and reduce inter-sectoral conflicts of interest.
4. **Develop a Unified Monitoring System and Database for Lake Management**
The absence of an integrated monitoring system results in fragmented lake ecosystem data and information. The Jayapura RPJMD (2017–2022) shows that the management of Lake Sentani still relies on limited spatial and water quality data without a sustainable monitoring mechanism. A unified database including spatial parameters, water quality, biodiversity, and anthropogenic pressures will facilitate early detection of ecosystem damage and support evidence based decision making. This system also enables inter-agency synergy and community participation in monitoring, thereby reducing information gaps.
5. **Align Lake Management Policies with Renewable Energy Development**
Renewable energy acceleration policies may utilize lakes for floating solar PV, hydropower, or other clean energy forms. However, without integrated regulation, renewable energy projects can exacerbate already critical ecological pressures, as observed in the case of hydropower development on the Poso River impacting eel habitats (Poso RPJMD). Policy synchronization across energy, environment, and spatial planning sectors is required to ensure that the lake carrying capacity for clean energy remains consistent with conservation principles. This approach ensures that renewable energy development not only meets national energy targets but also supports the restoration of lake ecological functions and the welfare of surrounding communities.

3.2.3 Identification of Alternative

The identification of alternatives should be undertaken once the objectives or targets of a regulation have been established. These alternatives need not be limited to the issuance of new regulations but may also involve other instruments for achieving policy goals, such as non-regulatory measures or even a “do nothing” approach, as noted in Bappenas (2009). This stage in the RIA process aligns with the perspective of Thomas R. Dye (2017), who conceptualizes and defines public policy as *“anything a government chooses to do or not to do.”* This definition emphasizes that public policy encompasses not only the actions taken by the government but also deliberate inaction, as the choice not to act can have tangible impacts and thus constitutes a form of policy.

Based on this framework, the study formulates several policy alternatives derived from an analysis of the issues and objectives related to the implementation of Government Regulation 60/2021 in the management of national priority lakes. To address the five objectives outlined in the previous section, relevant policy alternatives are proposed, as summarized in Table 5.

Table 5. Identification of Alternative

Type of Alternative	Alternative	Description
Alternatif Regulasi	Formulating an Integrated Lake Management Master Plan for Each Priority Lake	This alternative focuses on establishing a legally binding Lake Management Master Plan that comprises three key components: (1) spatial planning that regulates zoning for the lake body and its Catchment Area (DTA), (2) development and restoration directions tailored to the ecological and socio-economic characteristics of each lake, and (3) clear and sustainable funding sources. The preparation of this master plan is

		based on the current condition of the lake, taking into account all pollution sources from the catchment area to the direct use of the lake body. This document will serve as the primary instrument for integrated lake management as well as an operational reference across sectors and regions in implementing lake restoration and utilization policies. This alternative also includes the development of technical guidelines for preparing the master plan, accommodated through legally binding regulations, to ensure uniform processes, transparency, and accountability. This policy option is intended to address Objectives 1, 3, 4, and 5.
	Formulating Guidelines for the Development of a Lake Management Master Plan Enforced Through Legally Binding Regulations	This alternative complements the Lake Management Master Plan by establishing technical preparation guidelines in the form of legally binding regulations, while also addressing Objective No. 2. These guidelines include the stages of preparation, public consultation mechanisms, carrying capacity assessment methodologies, synchronization with spatial planning documents, as well as procedures for periodic evaluation and revision. The implementation of these guidelines will ensure that the master plan development process is uniform, transparent, and accountable across all regions, prevent policy overlaps, and strengthen integration across levels of government.
“Do Nothing” Alternative	No Policy Change	This alternative maintains the current policy and governance conditions without any additional interventions. While it does not require extra costs, this option carries a high risk of worsening lake ecosystem degradation, reducing community income, and weakening the environmental carrying capacity for other sectors, including tourism and renewable energy development. This alternative is included as a benchmark to assess the urgency and added value of the proposed policy interventions.

These alternatives were formulated by taking into account the established policy objectives, the characteristics of on-the-ground problems, and the principles of sustainable lake resource management.

3.2.4 Consultations and Stakeholder Engagement

Stakeholder consultation and engagement is a crucial process in the implementation of RIA. This step reflects the awareness that regulators do not possess perfect information about all parties who will be involved in or affected by a regulation, as noted in Bappenas (2009). Therefore, stakeholder consultation and engagement must be carried out systematically throughout the entire RIA process. In addition, stakeholder engagement is one of the key pillars in RIA implementation because no regulator has complete information about every party impacted by a policy. Ideally, this process should be conducted systematically at all stages of RIA from the formulation of objectives to post-implementation evaluation.

However, during the drafting of PR 60/2021, publicly available information regarding the series of consultations was relatively limited. Based on the available data and documents, government actors at both the central and local levels appeared to be the most dominant in the regulatory drafting process, while the involvement of communities, the private sector, and academia was relatively limited.

Table 6. Stakeholder Engagement in Formulation and Implementation of PR 60/2021

Stakeholder	Actors Involved	Form of Engagement	Findings
Central Government	Ministry of Public Works and Housing (PUPR), Ministry of Environment and Forestry (KLHK), National Development Planning Agency (Bappenas)	Coordination meetings, preparation of academic manuscripts	Dominates the formulation process and cross-sectoral coordination
Local Government	Provincial and District Governments with priority lakes	Technical consultations, provision of local data	Role limited to providing data and technical inputs
Communities	Not clearly identified in official documents	Not identified	Indication of very low participation
Academia/Researchers	Not clearly identified	Not identified	Research-based contributions not optimally utilized
Private Sector	Not clearly identified	Not identified	Private sector involvement not apparent

The findings indicate that consultations have been largely top-down, dominated by government actors. The lack of documented involvement from non-government stakeholders suggests that the consultation process has not been inclusive. As a result, local perspectives, scientific knowledge, and private sector innovations have not been integrated into the regulatory formulation stage. Based on these findings and considering the objectives and policy alternatives, the stakeholders to be involved in the implementation of Government Regulation 60/2021 are listed in the following table.

Table 7. Ideal Stakeholder Engagement in the Implementation of PR 60/2021

Stakeholder	Relevant Actors	Form of Engagement	Benefits of Engagement
Central Government	Ministry of Public Works and Housing (PUPR), Ministry of Environment and Forestry (KLHK), National Development Planning Agency (Bappenas), Ministry of Energy and Mineral Resources (ESDM)	Cross-sectoral coordination, policy harmonization	Ensures nationally integrated policies
Local Government	Provincial and district governments owning priority lakes	Public consultations, preparation of local action plans	Enhances policy relevance at the local level
Local & Indigenous Communities	Representatives of indigenous communities, fishers, farmers	Dialogue forums, participatory focus group discussions (FGDs)	Ensures acceptance and compliance with policies
Academia & Researchers	Universities, research institutions	Provision of scientific data, carrying capacity studies	Provides an evidence-based foundation for policymaking
Private Sector	Tourism operators, renewable energy (RE) developers, fisheries businesses	Policy dialogues, sustainable investment commitments	Encourages innovation and funding contributions
NGOs & Non-Governmental Organizations	Environmental NGOs, professional associations	Independent monitoring, advocacy	Strengthens accountability and transparency
Technical Agencies / State-Owned Enterprises (BUMN)	River Basin Organizations, Public Corporation <i>Perum Jasa Tirta</i>	Provision of operational technical input	Ensures technical feasibility of policy implementation

Broader and structured stakeholder engagement will ensure that lake management policies are inclusive, adaptive, and evidence-based. The involvement of local communities is crucial to fostering a sense of ownership, while the roles of academia, the private sector, and NGOs are essential for providing scientific data, innovation, and independent oversight. Through this approach, regulation becomes not merely a legal instrument but also a collaborative tool for achieving sustainable lake ecosystem.

3.2.5 Analysis of Benefit and Cost

Robust stakeholder consultation and engagement within the framework of RIA implementation for the preservation of priority lakes offers distinct benefits for each actor involved. However, effective implementation also entails certain costs that must be taken into account. The following benefit–cost analysis is designed to evaluate the potential impacts of adopting recommendations to enhance stakeholder consultation and engagement in the RIA process related to PR 60/2021. This analysis highlights the potential advantages (benefits) that each stakeholder group may gain, as well as the possible challenges or costs that may arise during the engagement process. The table below presents the benefit–cost considerations for implementing each type of alternative.

1. Alternative: Do nothing

The “Do Nothing” alternative, or maintaining the status quo following the issuance of PR 60/2021, is presented solely as a benchmark for assessing the urgency of policy intervention. This option entails no additional efforts to improve lake governance, strengthen cross-sectoral coordination, or integrate ecosystem protection with development agendas, including renewable energy development.

While this alternative does not incur additional short-term costs, its consequences may be cumulative and significant. Lake ecosystem degradation will persist, environmental carrying capacity will continue to decline, and pressures on water resources will intensify. Such uncertainty may also undermine public and development partner confidence in the government’s commitment to safeguarding the sustainability of natural resources. Accordingly, the “Do Nothing” option carries high risks to the ecological, social, and economic functions of lakes and is therefore best positioned as a baseline scenario in policy analysis.

Stakeholders	Cost	Benefit
Central Government	• Loss of policy implementation momentum; increased lake degradation; • Public pressure and reputational damage	No additional short-term costs
Local Government	• Loss of potential central/international support; • Higher future restoration costs	No additional short-term workload
Local & Indigenous Communities	• Long-term income decline due to ecosystem degradation; • Increased social conflicts	Status quo of short-term economic activities maintained
Academia & Researchers	• Missed opportunities to contribute to national policy; • Research with limited tangible impact	Ability to conduct research without pressure from new policy requirements

Private Sector	• Long-term losses due to reduced lake carrying capacity; • Reputational damage	Freedom to operate without technological adjustments or new investments
NGOs & Non-Governmental Organizations	• Difficulty in driving significant change; • Risk of unsustainable field programs	No need to adjust short-term strategies
Technical Agencies/State-Owned Enterprises (BUMN)	• Increased risk of inefficiency; • Conflicts of interest between projects	No additional investment required for system integration

2. Regulatory Alternative: Integrated Lake Management Master Plan

The implementation of an Integrated Lake Management Master Plan as a legally binding regulatory instrument faces several potential challenges. First, limited technical capacity and resources at the regional level may hinder local governments' ability to adjust RTRW, RPJMD, and budgeting programs in accordance with the established master framework. Second, resistance from certain stakeholders, such as communities reliant on intensive economic practices or private sector actors with exploitative business models could slow policy adoption.

In addition, gaps in data and monitoring remain, as information on water quality, biodiversity, and economic activities in lakes is neither fully integrated nor consistently maintained. Another barrier stems from potential conflicts of interest between ecosystem protection agendas and the accelerated development of renewable energy projects utilizing lake bodies, particularly when cross-sectoral coordination is ineffective. Finally, political commitment at both national and regional levels is a critical factor; without consistent support and adequate funding, the master plan risks becoming a purely normative document without tangible implementation.

Stakeholder	Status Quo	Cost	Benefit
Central Government	• PR No. 60/2021 lacks detailed operational instruments; cross-sectoral coordination remains weak; • Lake management is not integrated with spatial planning and catchment area management	• Costs of preparing a master plan (technical studies, regulatory harmonization, public consultations); • Establishment of inter-ministerial teams; capacity-building for coordination	• Availability of a binding and comprehensive national instrument; • Strengthened governance and legal certainty; • Synchronization of lake protection policies with renewable energy development; • Support for achieving the SDGs and RPJMN targets
Local Government	• Lake management implementation is partial • Lake rescue programs are often not budgeted or not prioritized; • Limited data and monitoring	• Adjustment of RTRW and RPJMD; • Allocation of APBD funds for monitoring and pollution control; staff training	• Improved quality of planning and budgeting; • Restoration of lake ecological functions with positive economic impacts (tourism, fisheries, renewable energy)
Local & Indigenous Communities	• Community involvement is largely formalistic; • Lake utilization tends toward exploitation (floating net cages/KJA exceeding carrying capacity, domestic waste, intensive agriculture)	• Adjustment of lake use patterns in accordance with carrying capacity; • Possible temporary restrictions on resource access	• Long-term protection of livelihoods; • Improved water quality; • Recognition of rights and local wisdom in management
Academia & Researchers	• Research data is fragmented; • Minimal cross-sectoral integration; • Limited data access	• Engagement in integrated research and monitoring; • Additional time and resource requirements	• Access to integrated data; • Increased research relevance in policymaking; • Opportunities for multidisciplinary collaboration
Private Sector	• Economic activities (tourism, fisheries, renewable energy) often overlook lake's carrying capacity; • Potential conflicts over water areas	• Investment in environmentally friendly technologies; • Compliance with new regulations; adjustment of business models	• Legal certainty for investment; • Incentives for sustainable practices; • Improved reputation and market opportunities

NGOs & Civil Society Organizations	• Strong advocacy role but limited to sectoral issues; • Not always involved in planning processes	• Participation in participatory processes; • Resources for independent monitoring	• Strengthened advocacy role; • Greater access to information; • Contribution to oversight of implementation
Technical Agencies / State-Owned Enterprises (BUMN)	• Technical projects remain partial; • Overlapping mandates; • Absence of a binding master guideline	• Adjustment of work programs; • Cross-agency coordination; integration of technical data	• Clarity of mandates and roles; • Reduction of project duplication; • Optimization of budgets and resources

Based on the table above, the regulatory alternative as a follow-up to PR No. 60/2021 entails significant short-term costs. However, its benefits can address key gaps in lake management and generate substantial long-term gains. Conversely, maintaining the status quo or refraining from policy changes risks compromising the achievement of long-term lake management objectives..

4. CONCLUSION

An analysis of Presidential Regulation No. 60/2021 using the Regulatory Impact Analysis (RIA) framework reveals that it serves as the main legal instrument for the preservation of 15 national priority lakes. However, its implementation remains constrained by a substantial gap between policy objectives and actual practices on the ground. Persistent issues include the absence of comprehensive spatial planning frameworks for most lakes, the low prioritisation of conservation within regional development and budgeting processes, weak coordination across sectors, and limited engagement with local communities and non-governmental stakeholders.

Finding evidence indicates that these lakes continue to experience ecological decline as pressures exceed their natural carrying capacity. Key drivers include intensive fishing practices, waste pollution, land conversion in catchment areas, and the expansion of renewable energy infrastructure, such as hydropower and floating solar photovoltaic facilities, without full alignment to conservation principles. The situation is aggravated by insufficient data availability and the absence of an integrated monitoring system, both of which constrain evidence-based policymaking.

The policy alternatives identified in this study, particularly the establishment of a legally binding Integrated Lake Management Master Plan for each priority lake, are considered more effective in addressing regulatory gaps and ensuring alignment between conservation policies and development agendas, which could include renewable energy expansion. This alternative has the potential to strengthen governance, enhance legal certainty, and foster cross-sectoral collaboration, although it will require initial investments in technical capacity, regulatory harmonization, and stronger political commitment.

The RIA assessment underscores that the effectiveness of lake rescue policies depends not only on having a regulatory framework in place but also on the quality of implementation, inclusivity in policy formulation, and the ability to manage inter-sectoral trade-offs. Success will require integrated action linking spatial planning, conservation-oriented budgeting, robust monitoring systems, and meaningful community participation to secure both ecological resilience and socio-economic benefits for local populations.

Indeed, future lake preservation should prioritise: (1) strengthening PR 60/2021 through legally binding master plans tailored to each priority lake; (2) aligning conservation policies with renewable energy development to avoid undermining environmental goals; and (3) expanding meaningful public engagement, particularly by empowering local and indigenous communities as core actors in lake stewardship. By adopting this integrated approach, Indonesia can enhance policy effectiveness, curb further ecological degradation, and ensure that national priority lakes remain sustainable, strategic assets for present and future generations.

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