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# Insights to Peri-Urban Dynamics' Effects on Water Bodies in the Fringe Settlements in Ibadan, Nigeria

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**Abstract**

Peri-urban dynamics have increasingly impacted water bodies in fringe settlements in Ibadan, Nigeria. This study explore the insights into the effects of these dynamics on water bodies in Eleyele, Adetokun, Alafara and Ologuneru areas in Ibadan. These peri-urban areas are experiencing rapid urbanization and population growth, leading to increased pressure on water resources. Despite the presence of Eleyele Water Works Dam, the settlements often lack proper water infrastructure, leading to over-extraction of groundwater and contamination of surface water bodies. A mixed-methods approach was utilized to comprehensively explore the effects of peri-urban dynamics of water bodies in the study area. The combination of qualitative and quantitative data provided a more holistic understanding of the topic. Findings established that flooding, indiscriminate waste disposal, sand lifting, reduction in strength of the water body of streams and rivers as a result of informal developments, remains reoccurring environmental challenges in the studied communities. Furthermore, the growing demand for water in these peri-urban areas puts additional pressure on already limited water resources. As a result, the water bodies in these fringe settlements are facing depletion and degradation, impacting the availability of clean and safe water for both human consumption and agricultural use. Poor water quality also poses health risks to the residents, leading to the spread of waterborne diseases. Understanding the insights into peri-urban dynamics and their effects on water bodies in the study area is crucial for sustainable water resource management and urban planning. Addressing these issues requires integrated approaches that consider land use planning, water resource management, and community engagement. Effective policies and interventions are needed to mitigate the negative impacts of peri-urban dynamics on water bodies and ensure access to clean and safe water for the residents of these areas.

**Keywords:** Land Use Changes, Fringe Settlements, Peri-Urban Dynamics, Water Body Degradation

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## 1.0 Introduction

Peri-urban dynamics refer to the interactions and processes that occur at the urban-rural interface, where urban and rural environments blend together (Barbosa, 2022). Fringe settlements are areas located at the outskirts of cities or towns, often characterized by rapid urbanization, informal housing, and limited access to basic services (Sikarwar, 2023). In these fringe settlements, water bodies such as rivers, streams, wetlands, and ponds play a crucial role in providing water for domestic use, agriculture, and other activities (Sareen, 2023).

The effects of peri-urban dynamics on water bodies in fringe settlements can be significant and multifaceted. Rapid urbanization in these areas can lead to increased pollution from untreated sewage, industrial discharges, and solid waste, which can contaminate water bodies and degrade water quality. (Ravetz, 2013). As populations in fringe settlements grow, the demand for water also increases, leading to over-extraction of water from rivers and aquifers, which can deplete water resources and impact the ecosystems that depend on them. (Maryati, 2015).

Land use changes associated with peri-urban dynamics, such as deforestation, soil erosion, and infrastructure development, can also contribute to water pollution and degradation. Deforestation can lead to increased sedimentation in water bodies, reducing water quality and affecting aquatic life. (Iddrisu, 2023). Similarly, impervious surfaces like roads, buildings, and parking lots can increase surface runoff and lead to higher levels of pollutants being carried into water bodies, further compromising water quality. (Czekajlo, 2021).

Insights into peri-urban dynamics' effects on water bodies in fringe settlements highlight the need for integrated and sustainable water management strategies. Addressing water pollution and degradation in these areas requires a multi-faceted approach that considers the social, economic, and environmental dimensions of water resources. (Salem, 2024).

Community engagement and participation are crucial in addressing water challenges in fringe settlements. Empowering local communities to be involved in water management decision-making processes can help ensure that solutions are context-specific, culturally appropriate, and sustainable in the long term. (Rajendra, 2024).

Incorporating nature-based solutions, such as restoring riparian buffers, implementing green infrastructure, and promoting sustainable agricultural practices, can help improve water quality and enhance the resilience of water bodies in fringe settlements. These approaches not only mitigate pollution and degradation but also provide additional benefits such as flood control, carbon sequestration, and habitat restoration. (Csorba, 2022).

Effective policies and regulations are essential for managing water resources in peri-urban areas. Governments and local authorities play a key role in setting and enforcing standards for water quality, regulating land use activities, and promoting sustainable water use practices. Collaboration between different sectors, including government agencies, non-profit organizations, research institutions, and community groups, is essential to address the complex and interconnected challenges of water management in fringe settlements. (Haldar, 2024).

Investing in infrastructure for water supply, sanitation, and wastewater treatment is essential to ensure access to safe and clean water for residents of fringe settlements. Building and maintaining reliable water infrastructure can help reduce pollution, improve water quality, and enhance the overall health and well-being of communities living in peri-urban areas. (Yakubu, 2021).

Peri-urban dynamics have significant effects on water bodies in fringe settlements, posing challenges to water quality, quantity, and ecosystem health. Addressing these challenges requires a holistic approach that considers the social, economic, and environmental dimensions of water management. By engaging local communities, adopting nature-based solutions, implementing effective policies, and investing in infrastructure, we can promote sustainable water management practices and ensure the long-term health and resilience of water bodies in fringe settlements. (Razzoli, 2016).

## 2.0 Literature Review

The dynamics of peri-urban areas play a crucial role in the management and sustainability of water bodies in fringe settlements. (Jampani, 2020). As urban areas expand into rural regions, these peri-urban spaces experience unique challenges that can have significant impacts on water bodies. (Gomes, 2021). Understanding the insights

 

into peri-urban dynamics and their effects on water bodies in fringe settlements is essential for effective planning and management strategies. (Roldan-Arias, 2023).

Several studies have highlighted the complex relationship between peri-urban dynamics and water bodies in fringe settlements. (Ravetz, 2013), (Rajendra, 2024). As cities expand, peri-urban areas are often at the forefront of urbanization, leading to increased pressure on water resources. The conversion of agricultural land to urban areas in peri-urban regions can result in changes to the hydrological cycle, impacting the quality and quantity of water in adjacent water bodies. (Ramirez-Agudelo, 2020).

One of the key insights into peri-urban dynamics' effects on water bodies is the impact of land use changes. The conversion of land for residential, commercial, or industrial purposes can lead to increased runoff, pollution, and sedimentation in water bodies. (McConville, 2014). Studies have shown that peri-urban areas experience higher levels of pollutants such as nutrients, heavy metals, and organic matter compared to rural areas, which can degrade water quality and harm aquatic ecosystems. (Narain, 2022).

Population growth in peri-urban areas can exert pressure on water resources, leading to over-extraction and competition for water. (Butsch, 2020). The demand for water for domestic, agricultural, and industrial purposes in fringe settlements can strain water bodies, especially during dry seasons. Understanding population dynamics in peri-urban areas is crucial for sustainable water management practices to ensure the long-term availability of water resources. (Barbosa, 2022)

The development of infrastructure in peri-urban areas can have both positive and negative impacts on water bodies. (Mondal, 2021). While improved infrastructure such as sewage treatment plants and stormwater management systems can help prevent pollution and mitigate flood risks, inadequate infrastructure and unplanned development can lead to environmental degradation. (Committee for International Cooperation in National Research in Demography, 2007). Poorly planned infrastructure can result in the discharge of untreated wastewater into water bodies, affecting water quality and public health. (Salvia, 2020).

Climate change adds another layer of complexity to peri-urban dynamics and their effects on water bodies in fringe settlements. (Matthew, 2022). Changes in rainfall patterns, increased frequency of extreme weather events, and rising temperatures can exacerbate water scarcity and pollution in peri-urban areas. Understanding the implications of climate change on water resources is essential for developing adaptive strategies to minimize the impacts on water bodies. (Sumardjo., 2023).

Effective water management in peri-urban areas requires active community participation and stakeholder engagement. (Purba, 2022). Engaging local residents, businesses, and government agencies in decision-making processes can lead to more inclusive and sustainable water management practices. Building partnerships between different stakeholders can help address conflicts over water use, promote water conservation, and foster resilience in peri-urban water systems.

Policy and planning interventions are critical for addressing the challenges posed by peri-urban dynamics on water bodies in fringe settlements. Integrating water management considerations into land use planning, zoning regulations, and environmental policies can help minimize the negative impacts of urban expansion on water resources. (Adewoyin, 2024). Adopting an ecosystem-based approach to water management can promote the sustainable use of water bodies in peri-urban areas while protecting biodiversity and ecological functions.

Gaining insights into peri-urban dynamics and their effects on water bodies in fringe settlements is essential for sustainable water management in rapidly changing landscapes. By understanding the complex interactions between urbanization, land use changes, population growth, infrastructure development, climate change, community participation, and policy interventions, we can develop holistic strategies to protect and preserve water resources in peri-urban areas. (Falegan, 2024). Collaborative efforts involving researchers, policymakers, practitioners, and local communities are essential to address the challenges and opportunities presented by peri-urban dynamics on water bodies in fringe settlements.

## 3.0 Research Methodology

This research adopted a mixed-methods approach to explore the insights into peri-urban dynamics and their effects on water bodies in fringe settlements. The study combined qualitative and quantitative methods to

 

provide a comprehensive understanding of the complex interactions between urbanization, land use changes, population dynamics, infrastructure development, and water management practices in peri-urban areas.

Data collection methods employed were both qualitative and quantitative. Key informant interviews with local residents, community leaders, government officials, and water management experts were used to gather insights on peri-urban dynamics and water body management practices. Also focus group discussions with stakeholders involved in water resource management and those residents in riverine areas were carried out to explore perceptions, knowledge, and practices related to water bodies in the fringe settlements. Field observations were carried out to document land use changes, water quality, infrastructure conditions, and community interactions in peri-urban areas.

A purposive sampling strategy was used to select peri-urban fringe settlements namely, Eleyele, Adetokun, Alafara and Ologuneru. The Eleyele, Adetokun communities falls within Ibadan Northwest Local Government Council while Alafara and Ologuneru are within Ido Local Council, Ibadan, Oyo State, Nigeria. Eleyele has a sizeable water body warranting a lake dam by the Oyo State Water Corporation. Adetokun, Alafara and Ologuneru have rivers and streams traversing each settlement. The selected study sites consisting of 346 returned administered samples, Eleyele 70, Adetokun 148, Alafara 86, and Ologuneru 42.

Data analysis employed involved coding and categorizing qualitative data from interviews, focus groups, and observations were carried out to identify themes related to peri-urban dynamics and their effects on water bodies. A narrative synthesis integrating qualitative findings was used to develop a coherent narrative on the relationships between urbanization, water resource management, and peri-urban dynamics.

For quantitative data analysis, it was descriptive statistics analysis of survey data used to summarize perceptions, and practices of water management in peri-urban areas. GIS-based analysis used to visualize and interpret the spatial distribution of land use changes, population growth, and water quality parameters in the fringe settlements. Inferential statistical analyses employed to assess relationships between variables such as land use types, infrastructure development, and water quality indicators.

The research adhered to ethical guidelines, ensuring confidentiality, voluntary participation, and informed consent of study participants. These data collection procedures were employed to safeguarding the privacy and rights of individuals involved in the study. Approval from relevant ethical review boards was sought before conducting research activities involving human subjects.

Findings from the study were limited to the specific selected peri-urban areas for investigation and are not fully generalizable to all peri-urban dynamics affecting water bodies in these fringe settlements. Access to certain data, such as historical land use records, water quality monitoring data, and infrastructure development plans, posed some challenges in the comprehensive analysis of peri-urban dynamics' effects on water bodies.

## 4.0 Discussion

A discourse on insights to peri-urban dynamics and effects on water body in the study area captures the findings from both the qualitative and quantitative data obtained through the survey. The key informants' interview, reconnaissance and or observatory visit to the study area were analysed as qualitative data while the respondents perceptions obtained through questionnaire quantitative data are the result of findings on the environmental induced variables such as flooding, sand lifting activities, indiscriminate waste disposal and changes in drainage pattern/reduction in water body strength, all as components of water body effects in the study area.

Presence of natural water body in the study area of Eleyele, Eleyele Lake Water Dam, Alaguntan stream in Adetokun, and Aba Ela River in Alafara area provides a comparative advantages in the peri-urban interface. Eleyele Lake Water Dam provides water transportation system. This, was discovered through observatory schedule visit and its operational details from key informants' interview including the community leaders and government officials overseeing Eleyele Lake Water transportation system. The commuters across the water, uses speed boat and canoe to daily conveys from communities - Idunnu, and ObaIdo to Eleyele from where they board buses, taxis, tricycles and motorcycles to the inner city. The Eleyele Lake Water area is a boundary between Akinyele, Ido and Ibadan North West Local Government Areas.

 

From the account of participants' interviewed, the water transportation system run operations daily, from 6am to 9pm. Eleyele water lake dam is 240m long across the dam. The lake is 125 m above sea level with an average depth of 6.0 m. (Ayoade, 2022). The management of the water transportation is under the arrangement between the Community Residents Association and the Oyo State Ministry of Rural Development and Mineral Resources.

It is part of the regulations that; boat should be placed at both ends of the 240metres wide lake water, overloading prohibited, 15 passengers with 4 children as maximum, use of life jackets is a must, throwing of refuse or sacrifice into the water body is forbidden, resolution of conflicts between the operators and passengers to be solved by the community. Figure 4.1 has the commuters on Eleyele lake water and Figure 4.2 shows the riverine communities of Idunnu and Obaido.

**Figure 4.1. Water Transportation**
**Source: Fieldwork 2023**

**Figure 4.2 Riverine Communities of Idunnu and Oba-Ido along Eleyele Lake Water Bank**
**Source: Fieldwork 2023**

 

Table 4.1 summarizes the different environmental and climate change induced degradation perceived by residents in the peri-urban communities. In terms of flooding, majority (49.1%) of the respondents were indifferent while 18.2% were rarely affected by flood occurrence in recent years. Furthermore, about 33.0% of the respondents in the study area agreed to being affected by flood; but, on different scale. With this finding, it was established that, flooding remains a reoccurring environmental and health challenge in the peri-urban communities in recent years. It is important to note that some of the factors contributing to flooding in the study area is associated with the rapid/uncontrolled development activities and the encroachment of setbacks of water-bodies in the community. Owning to this reality, majority (76.3%) of the respondents in the study area observed a reduction in the size/strength of water bodies, as well as changes in the drainage pattern of the sampled communities. Only a minute proportion accounting for 10.1% rarely observed any changes in the drainage pattern and decrease in the level of water body in the study area.

In similar manner, majority of the respondents were neither satisfied nor dissatisfied (neutral) with the process of soil/sand lifting in the study area. As observed from Table 4.1, 32.7% of the sampled respondents had an indifferent perception regarding the process of soil lifting activity in the study area. On the other hand, 21.4% of the respondents were observed to be satisfied while 27.5% were slightly satisfied. Respondents who were rarely satisfied accounted for 18.5% only. The proportion of respondents who were rarely satisfied was further observed to be higher in Eleyele community (27.1) compared to the other sampled communities of Alafara (24.4%), Adetokun (14.2%) and Ologuneru (7.1%).

Another type of environmental degradation experienced by respondents in the study was associated with the increase in volume of waste generated and the indiscriminate disposal of waste. As observed, 86.1% of the respondents perceived that there was an increase in the volume of waste generated in the study area. However, in terms of waste disposal, less than a quarter (24.0%) of the respondents observed a proper method of disposing waste.

Table 4.1: Residents' Perceived Environmental Degradation in the Study Area

| Increased Waste Production | Residential communities | | | | Total |
|---|---|---|---|---|---|
| | Eleyele | Adetokun | Alafara | Ologuneru | |
| | *Freq. (%)* | *Freq. (%)* | *Freq. (%)* | *Freq. (%)* | *Freq. (%)* |
| **Rarely** | 6 (8.6) | 25 (16.9) | 7 (8.1) | 2 (4.8) | 40 (11.6) |
| **Slightly** | 31 (44.3) | 52 (35.1) | 36 (41.9) | 14 (33.3) | 133 (38.4) |
| **Neutral** | 3 (4.3) | 3 (2.0) | 1 (1.2) | 1 (2.4) | 8 (2.3) |
| **Strongly** | 23 (32.9) | 60 (40.5) | 35 (40.7) | 22 (52.4) | 140 (40.5) |
| **Very strongly** | 7 (10.0) | 8 (5.4) | 7 (8.1) | 3 (7.1) | 25 (7.2) |
| **Total** | **70 (100.0)** | **148 (100.0)** | **86 (100.0)** | **42 (100.0)** | **346 (100.0)** |
| **Affected by Flooding in Recent years** | | | | | |
| **Rarely** | 13 (18.6) | 24 (16.2) | 19 (22.1) | 7 (16.7) | 63 (18.2) |
| **Slightly** | 10 (14.3) | 27 (18.2) | 16 (18.6) | 4 (9.5) | 57 (16.5) |
| **Neutral** | 38 (54.3) | 77 (52.0) | 30 (34.9) | 25 (59.5) | 170 (49.1) |
| **Strongly** | 7 (10.0) | 17 (11.5) | 17 (19.8) | 3 (7.1) | 44 (12.7) |
| **Very strongly** | 2 (2.9) | 3 (2.0) | 4 (4.7) | 3 (7.1) | 12 (3.5) |
| **Total** | **70 (100.0)** | **148 (100.0)** | **86 (100.0)** | **42 (100.0)** | **346 (100.0)** |
| **Indiscriminate Refuse Disposal** | | | | | |
| **Rarely** | 17 (24.3) | 25 (16.9) | 29 (33.7) | 12 (28.6) | 83 (24.0) |
| **Slightly** | 20 (28.6) | 58 (39.2) | 26 (30.2) | 22 (52.4) | 126 (36.4) |
| **Neutral** | 12 (17.1) | 21 (14.2) | 7 (8.1) | 2 (4.8) | 42 (12.1) |
| **Strongly** | 19 (27.1) | 40 (27.0) | 21 (24.4) | 6 (14.3) | 86 (24.9) |
| **Very strongly** | 2 (2.9) | 4 (2.7) | 3 (3.5) | - | 9 (2.6) |
| **Total** | **70 (100.0)** | **148 (100.0)** | **86 (100.0)** | **42 (100.0)** | **346 (100.0)** |
| **Satisfaction with soil/sand lifting activities** | | | | | |
| **Rarely** | 19 (27.1) | 21 (14.2) | 21 (24.4) | 3 (7.1) | 64 (18.5) |
| **Slightly** | 18 (25.7) | 49 933.1) | 18 (20.9) | 10 (23.8) | 95 (27.5) |
| **Neutral** | 24 (34.3) | 46 (31.1) | 28 (32.6) | 15 (35.7) | 113 (32.7) |
| **Strongly** | 7 (10.0) | 19 (12.8) | 17 (19.8) | 9 (21.4) | 52 (15.0) |
| **Very strongly** | 2 (2.9) | 13 (8.8) | 2 (2.3) | 5 (11.9) | 22 (6.4) |
| **Total** | **70 (100.0)** | **148 (100.0)** | **86 (100.0)** | **42 (100.0)** | **346 (100.0)** |
| **Reduction in water body strength and changes in drainage pattern** | | | | | |
| **Rarely** | 9 (12.9) | 12 (8.1) | 12 (14.0) | 2 (4.8) | 35 (10.1) |
| **Slightly** | 20 (28.6) | 29 (19.6) | 33 (38.4) | 10 (23.8) | 92 (26.6) |
| **Neutral** | 6 (8.6) | 33 (22.3) | 2 (2.3) | 6 (14.3) | 47 (13.6) |
| **Strongly** | 27 (38.6) | 59 (39.9) | 30 (34.9) | 20 (47.6) | 136 (39.3) |
| **Very strongly** | 8 (11.4) | 15 (10.1) | 9 (10.5) | 4 (9.5) | 36 (10.4) |
| **Total** | **70 (100.0)** | **148 (100.0)** | **86 (100.0)** | **42 (100.0)** | **346 (100.0)** |

**Source: Fieldwork 2023**

 

An analysis of observatory schedule findings is contained in the Figure 4.4 depicting a reduction and total dries off of River Ela in Aba Ela area and soil lifting/informal housing developments at Alafara, in the study area. Also Figure 4.3 is the pie-chart expression of the respondents' perception about reduction in water body level of the natural streams and rivers in the area.

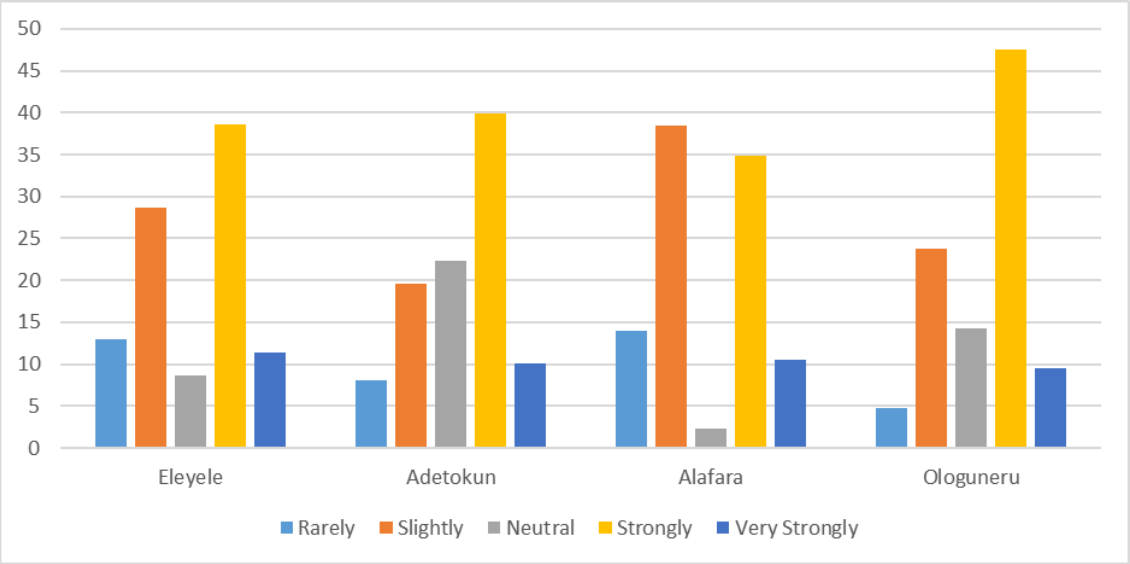


**Figure 4.3 Reduction in Water Body Level**
**Source: Fieldwork 2023**

**Figure 4.4 River Ela Water Dries Off due to Growth in Development in the Study Area**
**Source: Fieldwork 2023**

 

**Figure 4.5: Land Degradation in Alafara as a Result of Informal Developments**
**Source: Fieldwork 2023**

## 5.0 Conclusion

The study on insights into peri-urban dynamics' effects on water bodies in fringe settlements has shed light on the complex interactions between urbanization, land use changes, population growth, infrastructure development, and water management practices in the study area. (Nuissl, 2021). The research findings have highlighted the significant impacts of peri-urban dynamics on water bodies, including changes in water quality, quantity, and ecological integrity. Understanding these dynamics is crucial for addressing the challenges posed by rapid urbanization on water resources in fringe settlements.

Integrated planning approach that will considers water management practices alongside urban development strategies in peri-urban areas is hereby recommended. Coordinate land use planning, infrastructure development, and water resource management to ensure sustainable and resilient peri-urban growth. A community engagement to foster participation in water management decision-making processes, empower the local residents, businesses, and institutions to contribute to water conservation efforts and sustainable practices in peri-urban fringe settlements is desirable. (Furlong, 2017).

Establishment of robust monitoring and evaluation mechanisms to track changes in water quality, quantity, and biodiversity in peri-urban water bodies. Implement regular water quality sampling, data collection, and analysis to inform evidence-based decision-making. Provision of capacity building initiatives for local stakeholders, including training programs, workshops, and educational campaigns on water conservation, pollution prevention, and sustainable water use practices in peri-urban areas. (UN Environmental Programme, 2024).

An integration of green infrastructure solutions, such as rain gardens, permeable pavement, and constructed wetlands, to enhance water filtration, retention, and infiltration in peri-urban landscapes. Promote nature-based approaches to water management to mitigate the impacts of urbanization on water bodies. (Fang, 2023).

Also the need to formulate and enforce policies that regulate land use changes, water pollution, and water extraction in peri-urban areas. Implement zoning regulations, environmental standards, and incentives for sustainable development practices that protect water bodies in fringe settlements.

Support ongoing research initiatives and knowledge sharing platforms to exchange best practices, lessons learned, and innovative solutions for managing peri-urban dynamics' effects on water bodies. Collaborate with academic institutions, government agencies, and civil society organizations to advance the understanding of water resource challenges in peri-urban areas. (Browder, 2019).

 

In conclusion, addressing the effects of peri-urban dynamics on water bodies in fringe settlements requires a holistic and collaborative approach that integrates environmental, social, and economic considerations. By implementing the recommendations outlined above, stakeholders can work together to safeguard water resources, enhance community resilience, and promote sustainable development in peri-urban areas facing rapid urbanization pressures.

The research findings will contribute to the existing literature on peri-urban dynamics and water body management in fringe settlements. Recommendations based on the study results will inform policymakers, urban planners, water management authorities, and community stakeholders on effective strategies to address the challenges posed by peri-urban growth on water bodies. The insights gained from the research will support the development of sustainable water management practices and enhance resilience in peri-urban areas facing dynamic urbanization pressures.

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