A Hypothetical Community-Based Green Space Model for Barangay 20 and Barangay 275 in the Pasig River Port Area

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A Hypothetical Community-Based Green Space Model for Barangay 20 and Barangay 275 in the Pasig River Port Area

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Abstract: *The Pasig River suffers from severe pollution due to industrial waste, poor sanitation, and rapid urbanization of riverside systems. This study proposes a hypothetical community-based green space model for Barangay 20 and Barangay 275 to support river rehabilitation through a sustainable urban design. Utilizing SketchUp software, a 49,730.13 square meter model was developed, integrating parks with renewable energy such as solar lighting, a skate park, a soccer field, a water ferry terminal, shaded structures, and community vegetation zones. A written interview was conducted with a licensed engineer, evaluating the hypothetical model and the state of Pasig River and potential rehabilitations. The engineer affirmed that green space models can rehabilitate the river. The model addresses ecological and social needs, offering a framework for green infrastructure in urban river systems. This research promotes inclusive, environmentally resilient urban planning and repositions the Pasig River as a functional and valued public space.*

Keywords: Pasig River, urbanization, green space, sustainability

1. INTRODUCTION

The Pasig River, historically a vital corridor for trade and transport in Manila, is presently characterized by extreme pollution. Once declared "biologically dead" in the 1990s, the river continues to suffer from the adverse effects of industrial waste, domestic refuse, and informal settlements lacking adequate sanitation [1]. The Pasig River ranks eighth among the world's most polluted rivers [2]. This ongoing environmental crisis has prompted periodic cleanup initiatives. However, these efforts have frequently proven ineffective due to ineffective strategies and inadequate community involvement [3, 4].

Efforts to revitalize the Pasig River have primarily concentrated on the biochemical restoration of the water, including dredging and waste removal initiatives [5]. A potential resolution to this issue lies in the domain of urban planning. The role of urban planning and sustainable design is critical in constructing cities that are livable, inclusive, and environmentally resilient. In Metro Manila, where rapid urbanization often occurs with minimal regard for ecological sustainability, the degradation of essential ecological resources like the Pasig River exemplifies the long-term repercussions of inadequate planning [6]. Despite the river's historical and economic significance to Manila, neglect, encroachment, and a lack of public investment have contributed to its decline.

Urban green spaces are increasingly recognized as crucial components of sustainable urban development. Beyond their aesthetic and recreational advantages, these spaces significantly contribute to mitigating air pollution, alleviating urban heat islands, and managing stormwater runoff [7]. Green spaces can fulfill a dual role in communities bordering the Pasig River: fostering ecological restoration and improving residents' quality of life [8].

Countries such as Singapore, South Korea, and Japan have successfully rehabilitated similarly polluted rivers through comprehensive projects involving the relocation of informal settlers, the enhancement of sewage infrastructure, and the creation of riverfront parks and pedestrian zones [9]. In the Philippines, the Iloilo River Esplanade exemplifies a localized river restoration initiative that successfully integrates greenery with urban connectivity while promoting health and tourism [10].

This study introduces a hypothetical green space model targeting Barangay 20 and Barangay 275, situated along the Pasig River. Barangay 275, located in San Nicolas, has a population of 19,809, whereas Barangay 20 in Tondo comprises 45,772 residents as of 2020 [11, 12]. These barangays were selected due to their direct association with the river, including a residential community and an active river port.

Using SketchUp, the researchers developed a 1:1 scale model encompassing 49,730.13 square meters of green infrastructure. The model prioritizes sustainability, environmental resilience, and urban functionality. This proposal aims to beautify and detoxify the environment and create recreational, economic, and social value for the local population.

The primary objective of this research is to enhance the water quality of the Pasig River through an approach grounded in green infrastructure. By incorporating vegetation, permeable materials, and natural drainage solutions into a community-oriented spatial design, the model aspires to improve biofiltration processes that can help reduce urban runoff and minimize river pollution [13]. Although these interventions are hypothetical, they offer a framework for future policy development and practical implementation by local authorities and environmental organizations.

The project aspires to revitalize the river's surroundings as well, supporting long-term ecological stability.

Furthermore, a significant goal is to improve the well-being of residents in Barangay 20 and Barangay 275, exemplifying densely populated, low-income urban districts. These communities typically experience limited access to recreational areas, heightened exposure to environmental hazards, and often contend with chronic stress and poor health outcomes [14]. Introducing accessible green spaces could mitigate some of these challenges by encouraging physical activity, alleviating stress, and providing safe, inclusive spaces for social interaction and cohesion [15].

2. METHODOLOGY

This paper is a preliminary study that employs a qualitative, design-based research approach focused on the conceptual development of a community-based green space model for Barangay 20 and Barangay 275, located along the Pasig River. The methodology is comprised of: (1) the creation of a hypothetical design using SketchUp, a three-dimensional modeling software, and (2) an expert validation process facilitated through a written interview with a licensed civil engineer affiliated with Manila City specializing in urban planning and infrastructure.

2.1 Digital Design of the Hypothetical Model Using SketchUp

The design phase of the project utilized SketchUp, an architectural software tool, to visualize spatial arrangements in three dimensions. The research team developed a scaled model of the target areas, Barangay 20 and Barangay 275, with a proposed redevelopment area totaling 49,730.13 square meters. The objective was to create a landscape that integrates sustainable urban elements while accommodating the spatial constraints of riverside barangays.

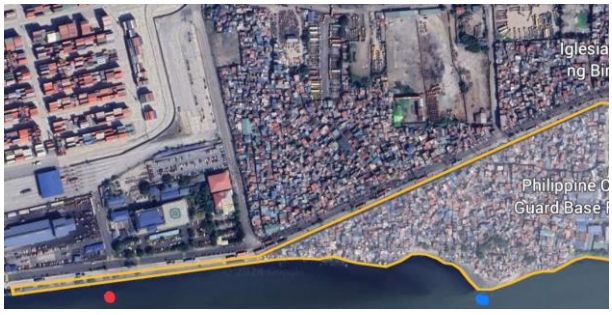

Fig. 1. Target area for the greenspace model in Barangay 20 and Barangay 275

2.2 Written Interview with a Licensed Engineer

To assess the conceptual validity and real-world feasibility of the proposed model, a written interview was conducted with a licensed civil engineer, Engineer Alan A. Gatpolintan, who is affiliated with urban rehabilitation and waterway infrastructure of Manila City. The written interview allowed the respondent to elaborate freely while addressing key insights, such as:

- The current state of the Pasig River and major obstacles to its rehabilitation.
- The potential of architectural and engineering interventions in environmental recovery.
- The effectiveness and impact of the proposed green space model.
- Recommendations for design improvements and practical enhancements.
- Considerations for community engagement, policy alignment, and long-term maintenance.

3. RESULTS AND DISCUSSIONS

The final output of this study is a hypothetical green space model designed using SketchUp, which showcases a sustainable redevelopment for Barangay 20 and Barangay 275 along the Pasig River. The design prioritizes environmental sustainability, accessibility, and community use while addressing the urban challenges typically faced by densely populated riverside communities in Metro Manila. Each component of the model was intentionally included to serve both ecological and social functions, contributing to the broader goal of river rehabilitation and community enhancement.

Economic considerations, while important, were not part of the scope. However, the eventual deployment and long-term sustainability of the proposed greenspace model are assumed to be fully funded by the local government, consistent with the framing of this study as a hypothetical green space model.

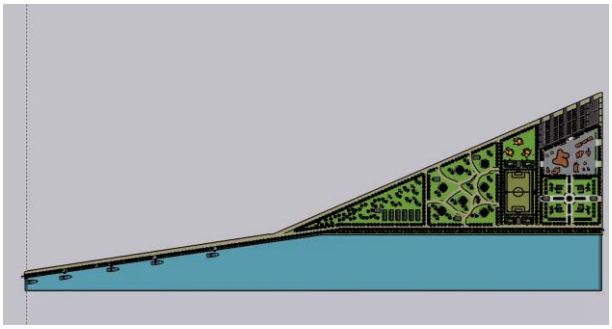

Fig. 2. Greenspace model in Barangay 20 and Barangay 275

3.1 Assessment of the Engineer and Model Refinement

The written interview with Engr. Alan A. Gatpolintan, Assistant City Engineer of Manila, provided valuable insights regarding the current condition of the Pasig River and its rehabilitation strategies. According to Engr. Gatpolintan, the river remains significantly polluted despite the existing cleanup operations. The water quality has yet to meet the standards of Class C, which would make it suitable for fisheries, recreational use, and limited industrial applications after treatment. The persistence of untreated sewage and solid waste in the river and its tributaries continues to be a principal environmental concern.

Engr. Gatpolintan identified several priority interventions rooted in civil and environmental engineering principles. These include the full sewer coverage of Metro Manila, where all septic waste is directed to treatment facilities managed by the city's water providers, such as Maynilad Water and Manila Water. He also emphasized enforcing a no-build zone within the 10-meter easement of the river, which could be repurposed as river esplanades, green spaces, roads, or bike lanes. Other recommendations included the prevention of solid waste disposal into waterways, relocation of informal settler families living along the esteros, regular dredging operations, and the revitalization of the Pasig River Ferry Service to promote public engagement and mobility.

Notably, Engr. Gatpolintan supported the implementation of green space models as part of the rehabilitation strategy, describing them as impactful when aligned with larger urban planning goals. He recommended specific improvements to the proposed model, such as prioritizing the river as the central design feature, reducing reliance on man-made lakes, incorporating shaded low-maintenance vegetation, installing shaded trees in parking areas, and integrating renewable energy technologies like solar-powered lighting.

In terms of further research, he advocated for the inclusion of a Public Information and Advocacy Program. This would involve the installation of educational signage and the development of community outreach initiatives to encourage local stewardship of the river and promote sustainable practices among residents living nearby.

The findings from this interview reveal a comprehensive perspective on the multidimensional nature of river rehabilitation. The engineer's emphasis on infrastructure, waste management, and land use regulation aligns with established best practices in urban river restoration projects worldwide. Comparable efforts, such as those seen in the Han River (South Korea), Kallang River (Singapore), and Iloilo River (Philippines), demonstrate the efficacy of integrating green infrastructure and public accessibility in urban waterways.

The endorsement of green space development within the 10-meter easement not only aligns with existing national regulations but also contributes to climate resilience, urban cooling, and community recreation. The proposal to use less maintenance plants and eco-friendly lighting addresses the operational sustainability of such projects, ensuring that post-construction upkeep is viable for local government units.

Furthermore, the call to place the river at the forefront of urban design reinforces the symbolic and practical importance of reorienting communities toward water bodies as shared assets. This view challenges the long-standing neglect of the Pasig River as a "backyard" space and suggests that the river should serve as a public frontage deserving of investment and aesthetic enhancement.

Finally, the suggestion to incorporate community education and advocacy into the design model underscores the importance of behavioral and cultural transformation. Infrastructure alone cannot ensure the long-term health of the river. Public awareness, participatory governance, and stakeholder buy-in are critical in sustaining the gains of physical rehabilitation. Integrating these social dimensions into the proposed green space model enhances its potential to become both an ecological and civic intervention.

3.2 Sketchup Model of the Green Space Model

3.2.1 Park

A central feature of the model is the integration of a park that includes several children's playgrounds and bahay kubo. The surrounding area is enhanced by planted trees, which are essential for cooling the environment, improving air quality, and providing residents with a natural retreat. These native trees offer canopy cover and promote biodiversity, while the playground encourages physical activity and provides children with safe, shaded recreational spaces. In the context of Barangay 20 and Barangay 275, where open and secure recreational areas are limited, establishing such parks could significantly enhance the psychosocial well-being and communal interaction among residents [5].

Fig. 3. Top view of the park including the bahay kubo and the playground

Fig. 4. Perspective view of the park including the bahay kubo and the playground

The model also includes public restrooms and garbage disposal services to prevent waste from entering the rivers.

Fig. 5. Public restroom

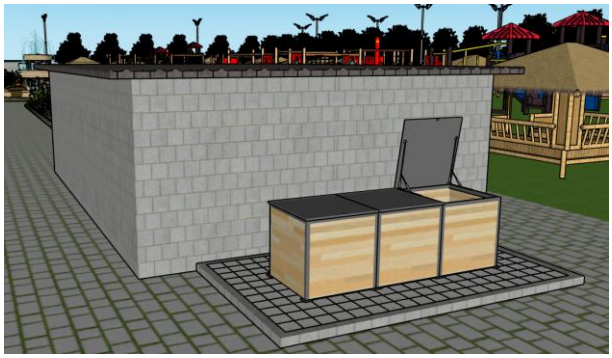

Fig. 6. Garbage disposals

3.2.2 Skatepark and Soccer Field

The proposed model incorporates a skatepark and an open soccer field to address the needs of a diverse age demographic and promote youth engagement. These facilities provide valuable sports participation opportunities, fostering active lifestyles and social inclusion. By establishing structured environments for adolescents and young adults, the design aims to mitigate the incidence of unsafe recreational activities in the community.

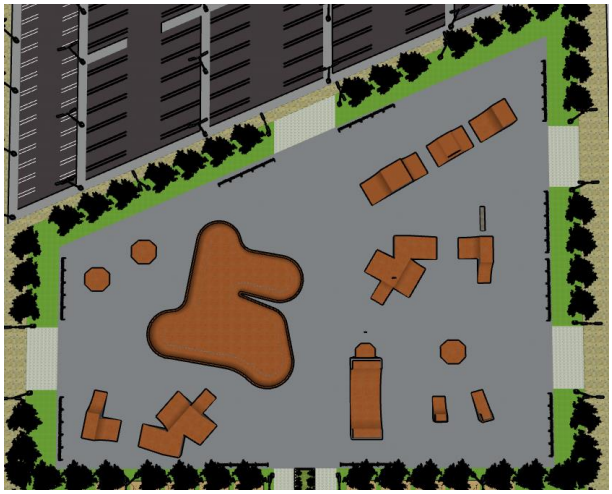

Fig. 7. Top view of the skatepark

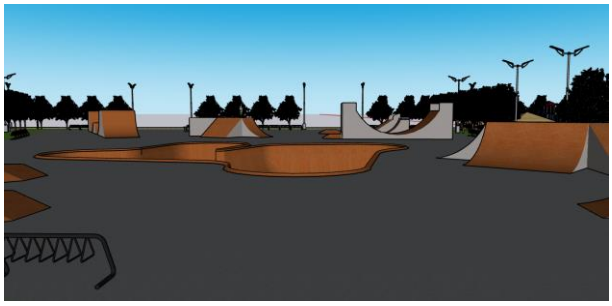

Fig. 8. Perspective view of the skatepark

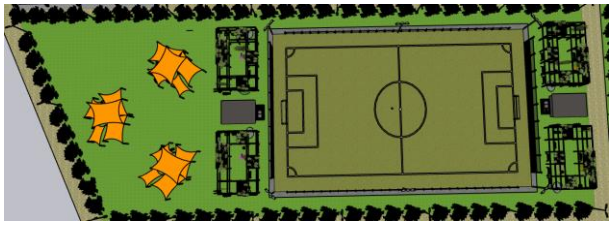

Fig. 9. Top view of the soccer field with recreational areas

Fig. 10. Perspective view of the soccer field with recreational areas

These amenities can potentially evolve into community hubs, particularly if local leagues or tournaments receive support from barangay-level governance. The objective of this is to cultivate a stronger connection between residents and the riverside, transforming it from a neglected space into a focal point for social and physical activity.

3.2.3 Parking Lot and Shaded Structures

To enhance accessibility and promote pedestrian traffic without intensifying urban congestion, the model features a designated parking area. This lot is strategically located near recreational zones and equipped with shaded trees and shelters to mitigate heat retention in paved surfaces, providing comfort for vehicles and pedestrians. The consulting engineer for this project underscored the necessity of shaded areas in vehicular zones to diminish heat buildup and improve overall user experience.

Sheds are also distributed throughout the green spaces as rest areas, particularly along walkways and in proximity to playgrounds. These structures may serve dual purposes as community gathering points or emergency shelters during inclement weather.

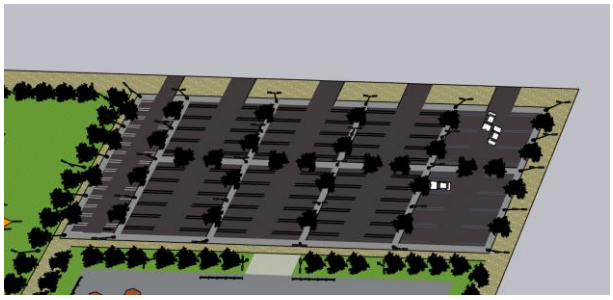

Fig. 11. Top view of the parking lot

Fig. 12. Perspective view of the parking lot

Fig. 13. Top view of the shedded areas

Fig. 14. Perspective view of the shedded areas

3.2.4 Solar Lighting and Pathway Trees

The model incorporates solar-powered lighting throughout the park, walkways, and activity zones. This strategy minimizes reliance on non-renewable energy sources and highlights a commitment to sustainable innovation. Well-illuminated paths enhance nighttime safety, encouraging residents to utilize the area even after dark.

Fig. 15. Perspective view of the pathway

The pathways are lined with low-maintenance shade trees, which provide cooling effects and visually unify the entire space. Utilizing locally adapted vegetation further supports water retention and diminishes the urban heat island effect, a practice evidenced by successful park designs in cities such as Seoul and Singapore [9].

3.2.5 Greenspace Areas

The model places significant emphasis on community-led vegetation zones, where residents can engage in gardening or urban agriculture initiatives. These spaces not only provide access to fresh vegetables but also promote environmental stewardship and social responsibility among participants. Furthermore, these zones can serve as educational resources for local schools and environmental organizations.

In addition, the design includes green buffer zones adjacent to the riverbanks. These areas act as natural filters for urban runoff, thereby reducing the influx of pollutants into the Pasig River.

The inclusion of tree parks is also inspired by rehabilitation efforts from rivers such as the Sumida in Japan and the Iloilo in the Philippines, where green corridors were shown to attract foot traffic and support ecosystem revitalization [10].

Fig. 16. Perspective view of the buffer zone with resting areas

Fig. 17. Top view of the greenspace area

Fig. 18. Perspective view of the greenspace area

3.2.6. Water Ferry Terminal

A distinctive and strategic element of the model is the inclusion of a Pasig River water ferry terminal. By reestablishing the river as a viable mode of transportation, this component aligns with the engineer's assertion that the Pasig River should be regarded as a "front yard" rather than a "backyard." The presence of a ferry terminal not only enhances mobility and alleviates road congestion but also reinstates the economic and symbolic significance of the river. It encourages both residents and visitors to perceive the river as an asset, rather than a hindrance.

Fig. 19. Perspective view of the water ferry terminal

The terminal's location within the model is seamlessly integrated with pedestrian pathways, roads, and waiting sheds to facilitate intermodal connectivity. The revival of ferry services will also aid in shifting public perceptions, contributing to the broader goal of making the river a central component of the community.

4. CONCLUSION

The Pasig River presents a significant environmental issue in Metro Manila, stemming from years of rapid urban growth, poor sanitation, and limited community involvement [4]. While past efforts to improve the river have focused mainly on technical solutions, this study introduces a design-based approach by proposing a green space model for Barangay 20 and Barangay 275. This plan aims to tackle both environmental decline and social inequality in these crowded areas.

Utilizing SketchUp as a design tool and incorporating expert advice, the model features a multi-functional green space that blends ecological restoration with community-friendly amenities. Planned elements include tree parks, playgrounds, a skatepark, a soccer field, a water ferry terminal, shaded pathways, solar lights, public restrooms, garbage disposals, and community gardening areas. These features not only enhance the area aesthetically but also provide real benefits like reducing stormwater runoff, improving air quality, supporting the ecosystem, promoting physical activity, and creating safe community spaces.

This project contributes to a larger discussion about inclusive urban development. It highlights the need to view riverside communities as active participants in rehabilitation efforts rather than just recipients. By creating accessible, functional, and eco-friendly spaces, the model encourages environmental responsibility and social fairness.

For future advancements in construction practices, the integration of environmentally sustainable materials and technologies is strongly recommended. One notable suggestion is to investigate the utilization of fly ash in soil mixtures, as it has been demonstrated to improve engineering properties while simultaneously providing a sustainable waste management solution [14]. Furthermore, machine learning models have proven effective in predicting the permeability of soil-fly ash mixtures, thereby facilitating efficient soil design in urban environments [14]. Additionally, horsetail ash, when produced at a temperature of 700 °C, has exhibited potential as a pozzolanic material due to its high silica content, rendering it another promising candidate for soil stabilization in green space construction [13].

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