

A Zonal Urban Design Framework for Sustainable Waterfront Development in Sri Lankan Cities: The Case of Moratuwa

Nesura Bulathsinghala*, Shakisna Ravichandran^a, Ahmed Jinan^a, Jeeva Wijesundara^a
Sri Lanka Institute of Information Technology, Malabe, Sri Lanka

Abstract

Sri Lanka's urban waterfronts, though rich in ecological and cultural value, remain underutilized and fragmented due to unplanned urbanization, environmental degradation, and limited public access. Moratuwa, despite its strategic coastal and riverine setting, exemplifies this issue with socially disconnected, economically stagnant, and environmentally vulnerable waterfronts.

The objective of this research is to develop a Zonal Urban Design Framework that transforms Moratuwa's waterfronts into sustainable, vibrant, and inclusive urban spaces while creating a replicable model for other Sri Lankan cities.

The study employs a qualitative case study approach, combining contextual analysis, land-use mapping, site observations, stakeholder interviews, and secondary data review. A SWOT analysis was conducted to identify opportunities and constraints, followed by zonal mapping to classify character zones. Drawing from global waterfront development approaches and urban design theories, tailored strategies were proposed for each zone, culminating in a comprehensive urban design framework.

The research concludes that a zonal, context-sensitive approach offers a viable pathway to sustainable waterfront development. By integrating ecological preservation, community participation, economic revitalization, and inclusive public space design, Moratuwa can be reimagined as a model waterfront city. This framework not only addresses local challenges but also holds replicable potential for waterfront development in other Sri Lankan cities.

Keywords: Waterfront Urbanism, Inclusive Public Spaces, Coastal Revitalization, Sustainable Urban Design, Moratuwa City Development.

* Corresponding Author: Nesura Bulathsinghala; E-mail: nb.tharaka@gmail.com

Introduction

Background

Sri Lanka's coastal urban expansion, particularly in the highly urbanized Western Province where Moratuwa is located, is characterized by rapid, often disorganized growth and subsequent inefficient land use (UDA, 2021; UN-Habitat, 2024). This urban sprawl is consuming peri-urban and ecologically sensitive lands, and is compounded by the significant backlog in formulating and updating development plans by the apex authority (GlobalABC, 2022). This pattern, coupled with the degradation of natural assets like coastal wetlands and mangroves, severely escalates the nation's vulnerability to climate change impacts, notably sea level rise and increased intensity of riverine and flash flooding (Liyanage & Weerakoon, 2023; UN Sri Lanka, 2023). Sri Lanka remains consistently ranked among the top countries at risk from extreme weather events (UN Sri Lanka, 2023).

Moratuwa provides a critical case study of these combined challenges. Despite its strategic location, its valuable waterfronts are profoundly underutilized: they are environmentally degraded, socially disconnected, and economically stagnant (UDA, 2021). Environmental compromise is evident through poor solid waste management (SWM) practices and blocked drainage, which contaminate vital waterways and deplete fragile mangrove habitats (Premadasa et al., 2021). Institutionally, development is often restricted by complex land ownership patterns (UDA, 2021) and the lack of integrated, human-centered urban mobility planning (Jayalath & Kulatunga, 2025). The inherent socio-economic, environmental, and institutional complexity of Moratuwa necessitates solutions tailored to local conditions, as generic global urban models are proving insufficient (UN-Habitat, 2024).

This research addresses the clear gap: the absence of a tailored, context-specific framework capable of transforming Sri Lanka's underutilized waterfronts into resilient public assets.

Moratuwa

The Moratuwa Municipal Council (MMC) is a key administrative body within the Colombo District, positioned strategically within Sri Lanka's Western Province. As a town, Moratuwa benefits from its geographical location along the Galle Road and the railway line, which serve as vital transportation arteries linking the Western and Southern Provinces (UDA, 2021). The National Physical Structure Plan-2030 designates Moratuwa within the high-density urban zone, and the Spatial Structural Plan-2050 places it within an emerging economic corridor. The Western Megapolis Structure Plan envisions Moratuwa as a second-order urban center, highlighting its role in the urban hierarchy. These planning initiatives emphasize the town's significant role in the broader urban framework, underlining the need for its development within high-density and economically productive zones (UDA, 2021).

Geographically, Moratuwa occupies a distinct position, surrounded by natural features that enhance its potential for urban development. located in the Western Province of Sri Lanka. It lies at coordinates Latitude: 6° 46' 60.00" N and Longitude: 79° 53' 60.00" E, covering an area of approximately 23.4 km². Dehiwala-Mt bounds it. Lavinia Municipal Council to the North, the Indian Ocean to the West, and the Bolgoda River to the South and to the East. At sea level, Moratuwa plays a crucial role in the Colombo metropolitan region. Moratuwa is well-connected to Colombo through road and rail networks, making it a key transit point for commuters and goods traveling between the southern parts of Sri Lanka and the capital. There are a total of 29 wards and 42 GN divisions in the Moratuwa MC Area (UDA, 2021).



The selected 1 km radius project boundary around the Station Cross Road junction as the epicenter offers a strategic foundation for our urban design research.



The project's study area was meticulously defined to encompass 1.38 square kilometers of Moratuwa's critical urban landscape, ensuring the resulting urban design model addresses the full spectrum of local challenges. The boundary selection criteria were multifaceted: first, it strategically includes both the Old Galle Road and the New Galle Road to directly confront the issue of urban commercial sprawl along these vital transport arteries. Second, it is essential that the design addresses environmental and waterfront issues, so the boundary incorporates all major water bodies—the Bolgoda River, the Lunawa Lagoon, and the coastal beach—capturing the underutilized and environmentally compromised edges. Third, to ensure integrated mobility planning, the area includes the main railway line, the bus stand, and the adjacent underutilized railway and coastal edge lands. Finally, the selection deliberately covers areas that are isolated from the railway and features a representative mix of residential, commercial, and industrial zones, creating a comprehensive and realistic testing ground for a replicable zonal design framework that tackles connectivity, environmental resilience, and waterfront revitalization simultaneously.

Urban Design Vision & Goals

The proposed urban design framework is anchored by the comprehensive Vision: "A vibrant waterfront community that embraces nature, fosters a sense of belonging, and ensures inclusivity and safety." To realize this vision, the framework sets six interconnected goals aimed at holistic transformation. These goals prioritize Waterfront Development (1) to unlock the area's potential, immediately followed by the need to Restore Environmental Health (2), recognizing the necessity of ecological resilience. Economically, the framework aims to Boost the Economy and Livelihood (3) by leveraging the revitalized waterfront. Social goals emphasize creating a Safe, Crime-Free Environment (4) and ensuring Housing for All (5), directly addressing social equity and security. Finally, a critical goal is the implementation of Human-Centered Transportation (6), shifting focus from vehicle-centric planning to prioritizing pedestrians and community connectivity. Together, these goals form a sustainable and inclusive roadmap for transforming Moratuwa's underutilized coastal area.



Figure 5 - Project Vision & Goals

Literature Review

The development of a Zonal Urban Design Framework for sustainable waterfront development in Moratuwa requires a synthesis of key urban design theories. This literature review outlines the theoretical underpinnings that inform the zonal framework.

The Context of Moratuwa: Challenges and Opportunities

The Moratuwa waterfront, particularly along Bolgoda Lake, is a unique urban landscape with significant potential, but also critical constraints. The lake is a biodiversity hotspot, but its ecological integrity is threatened by unplanned urbanization, encroachment, and pollution (Rathnayake et al., 2019). The existing built environment is characterized by a mix of fragmented, underutilized residential and commercial areas, alongside a traditional fishing community whose livelihoods are at risk from both environmental degradation and competing land uses. The city also faces urban challenges like traffic congestion and a lack of quality public spaces. The Moratuwa Development Plan 2019-2030 recognizes these issues by proposing a 12-meter water reservation and a 36-meter managed development zone to protect the waterfront's ecological integrity (Urban Development Authority, 2019). These site-specific conditions and existing planning regulations necessitate a tailored approach.

Foundational Theories and Typology of Waterfront Development

The theoretical foundation of contemporary waterfront urbanism represents a paradigm shift from a purely industrial function to an integrated, mixed-use model (Marshall, 2014). Early planning theories, separating land uses, are ill-equipped for complex post-industrial waterfronts (Lin & Tseng, 2016), necessitating modern approaches that emphasize dynamic "places." The literature identifies diverse strategies. The Economic & Tourism-First Development model prioritizes financial growth via large infrastructure, though balancing it with public access is essential to prevent social inequity (Chang & Yu, 2011). Conversely, Limited Development with Conservation Focus is vital for ecologically sensitive zones, prioritizing environmental remediation and passive recreation (Crosbie, 2012). Other key models include Public-Space Oriented Waterfront Development (Roberts & Sykes, 2000), which creates high-quality public spaces, and the Mixed-Use Development Approach, which blends uses for vibrant, self-sufficient neighborhoods (Rouse, 2011). Specialized approaches further include Fishery-Oriented Development, which supports traditional livelihoods by upgrading harbor infrastructure (ADB, 2015), and Transport-Oriented Waterfront Development (WTOD), which leverages multimodal transport for improved connectivity (Papa & Moroni, 2019). Finally, Community-Led, Incremental Development offers a socially inclusive alternative to top-down master planning (Lee, 2008).

Urban Design Theories Applicable to Moratuwa

Urban design provides the theoretical foundation for transforming Moratuwa's waterfront. Urban Waterfront Regeneration, as championed by figures like Peter Hall, focuses on revitalizing underutilized waterfronts to reconnect cities with their water bodies (Hall, 2014). This involves creating a mix of commercial, residential, and recreational uses. While this can lead to economic revitalization and enhanced community access, if not carefully managed, it risks gentrification and the

displacement of existing residents (Roberts & Sykes, 2000). For Moratuwa, this theory is directly applicable to underutilized residential and commercial land, as highlighted in the provided text.

Another crucial theory is the Waterfront as Public Realm, advocated by Joan Busquets, which emphasizes designing waterfronts as extensions of the public realm. This approach promotes accessibility, social interaction, and cultural integration, ensuring that spaces remain inclusive and accessible (Busquets, 2013). This is essential for Moratuwa's coastal belt and Bolgoda River banks, as it fosters a sense of shared community and prevents privatization.

Ecological Urbanism, championed by Mohsen Mostafavi, provides a critical framework for integrating ecological principles into the urban fabric (Mostafavi, 2010). This theory is highly relevant to Moratuwa's Bolgoda Lake, a key ecological asset. It highlights the importance of balancing development with ecological sustainability by preserving natural resources through green spaces and sustainable stormwater management (Rathnayake et al., 2019). Furthermore, Cluster Theory, put forth by Michael Porter, emphasizes enhancing collaboration among industries within a specific geographic area (Porter, 2000). For Moratuwa, this theory can guide the development of hubs that connect the fishing community, tourism, and related industries to drive innovation and competitiveness.

Other relevant theories include Circular Economy (Walter Stahel), which guides waste management and resource conservation in industries like timber and fisheries (Stahel, 2010), and Eyes on the Street (Jane Jacobs), which promotes natural surveillance through mixed-use development to enhance safety and social interaction in public spaces (Jacobs, 1961). Defensible Space Theory (Oscar Newman) can be applied through landscaping and building orientation to foster a sense of ownership and security within different residential and community zones (Newman, 1972). Finally, Human-Centered Transportation Design (Jan Gehl) is crucial for Moratuwa's waterfront, as it prioritizes pedestrian and cycling paths over vehicle traffic, contributing to a more livable and walkable urban environment (Gehl, 2010).

The Interconnected Urban Fabric and the Need for a Zonal Framework

While the literature provides a rich array of development approaches and theories, it becomes clear that no single model is sufficient for the complexity of the Moratuwa waterfront. A one-size-fits-all master plan would fail, and a successful model must extend beyond the waterfront land itself, integrating with the broader urban fabric, including the urban core, transportation systems, and security measures. The critical gap identified is the need for a Zonal Urban Design Framework. This framework allows the strategic application of different development approaches to specific, designated zones. For instance, a Limited Development with Conservation Focus is essential for protecting the ecologically sensitive areas of Bolgoda Lake, while a Fishery-Oriented Development approach is crucial for supporting the traditional livelihoods of the fishing community. Conversely, the more urbanized sections of the waterfront are better suited for a Mixed-Use Development Approach to create new, vibrant residential and commercial hubs. This flexible, context-sensitive zoned approach moves beyond the limitations of a single, uniform plan, ensuring that each intervention holistically contributes to the overarching vision of a vibrant waterfront community that embraces nature, fosters a sense of belonging, and ensures inclusivity and safety for all residents.

Methodology

Research Methodology

The research followed a phased methodology, commencing with a Contextual Analysis aimed at identifying the project area's strengths, weaknesses, opportunities, and threats. This analysis was comprehensively informed by both primary and secondary data. The primary data collection involved several direct, on-site, and community-focused methods to capture the current reality of Moratuwa's waterfronts. This included the use of current land-use maps and intensive site observations to physically document the environment, specifically noting encroachments, illegal solid waste dumping sites, blocked drainage patterns, and the condition of existing mangrove habitats and underutilized coastal lands. Furthermore, extensive structured and semi-structured interviews were conducted with key stakeholders, such as Moratuwa Municipal Council officials, local fishing community leaders, and affected residents, to gather qualitative data on socio-economic barriers, public amenity needs, and local knowledge regarding historical flood events. Additionally, surveys were deployed to quantify public demand for specific facilities, such as recreational spaces and mixed-use housing. Secondary data supplemented this by incorporating official development proposals (e.g., UDA plans) and relevant academic literature, providing the necessary macro-planning context and international best practices for waterfront revitalization. The findings from this dual-data analysis were then utilized for zonal mapping to identify existing character zones and determine the most applicable waterfront development approaches. This ultimately led to a framework that matches each approach to specific site characteristics and design requirements, which was subsequently applied to the Moratuwa case study to create a finalized urban design proposal.

Contextual Analysis

The research began with a critical Contextual Analysis, using a dual data approach to understand Moratuwa's conditions and opportunities. Primary data was collected via on-site observations and land-use mapping along the waterfronts, documenting environmental degradation and public access obstruction. Semi-structured interviews provided insights on governance gaps and community priorities, like improved waste management and housing. Land-use surveys revealed conflicts (industrial discharge, informal housing encroachment). This field-based data was corroborated by secondary data (*Moratuwa Development Plan*, academic literature), situating local problems within the regional context of urban sprawl and coastal vulnerability.

The synthesis revealed crucial, intertwined social and physical challenges. Socially, diverse communities, including fishing families, face housing shortages, insecure tenure, and limited amenities. Informal settlements are highly vulnerable to flooding and poor sanitation. The local identity, tied to carpentry and fisheries industries, requires modernization support. Physically, Moratuwa's unique, ecologically rich landscape is severely threatened by pollution, reclamation, and unregulated construction. Infrastructure deficiencies (drainage, waste systems) compound its innate climate vulnerability to coastal erosion and the urban heat island effect.

The extensive data synthesis culminated in a comprehensive SWOT analysis. Strengths included Moratuwa's strategic location; Weaknesses centered on land encroachment

and poor waste management; Opportunities lay in planned projects and conservation; and Threats involved climate change and social inequality. This empirically grounded synthesis provided a holistic understanding of Moratuwa's urbanity. This understanding became the direct foundation for the subsequent zoning strategies, ensuring the developed Zonal Urban Design Framework is directly responsive to Moratuwa's challenges and potential for resilient development.

SWOT

After the extensive contextual Analysis, we were able to identify Strengths, weaknesses, Opportunities, and Threats in Moratuwa Urbanity, and it is summarized in Table 1

Table 13 - SWOT Analysis

<u>Strengths</u> • 19% of the land area of 23.4 sq km of the Moratuwa MC is water-based resources. • Bolgoda Lake, being considered as the Largest freshwater lake in the country falls in the Moratuwa MC area. • Existence of wetlands enriched with a high rate of biodiversity. • Existence of the right environmental conditions for the growth of Mangroves in the environment of Bolgoda Lake, Lagoon, and the Beach. • The Moratuwa MC belongs to the Greater Colombo Tourism Resort Zone which is the 4th most tourist-attractive zone of the country. • Moratuwa MC is bounded by picturesque water bodies. • The traditional Furniture Industry in the Moratuwa Moratuwa MC area. • The Galle Road is one of the seven corridors that provides main access to the City of Colombo. • The Moratuwa railway station functioning as the Center of four other domestic railway stations	<u>Weaknesses</u> • Haphazard land encroachment, filling, and unauthorized constructions in environmentally sensitive areas. • Discharge of industrial effluents into water bodies and surrounding areas. • Non-declaration of Lunawa Lagoon area as an environment protection zone. • Depletion of mangrove habitat in Bolgoda Lake, Lunawa Lagoon and in the beach areas. • Inaccessibility to surrounding water bodies (Bolgoda Lake & Moratuwella Beach) due to haphazard physical developments & unauthorized illegal settlements. • Lack of sufficient open spaces for the residents of the Moratuwa MC. • Lack of public car parking facilities in the city. • Shortage of houses and existence of underserved settlements. • Lack of proper maintenance of infrastructure. • Lack of public garbage collection points and lack of actions against littering .
<u>Opportunities</u> • Declaration of Bolgoda Lake and its surroundings as a Conservation Area under the Act no 47 of 1980. • The Magapolis Western Region Master Plan in 2016 recommends to develop the Moratuwa within the tourism resort zone for long-term development as a tourist city.	<u>Threats</u> • Rising sea levels as a result of global warming. • Height restrictions imposed by the Department of Civil Aviation. • High Urban heat and lack of shaded spaces. • Drug addiction and illegal activities in certain areas.

• Proposed Multimodal Transport Center Project and the extension of the proposed Marine-Drive Road up to Moratuwa town. Proposed Light Rail Transit project by the Megapolis Transport Plan. • Proposed Housing Schemes at Dandeniya, Samarakoonwatta, Pittaniya and Batarywatta. • Development initiatives can encourage youth involvement in carpentry and fisheries through targeted training programs, preserving local skills and boosting the regional economy. • Job fairs and career counseling can provide diverse employment opportunities for young people, reducing the risk of substance abuse and promoting socio-economic stability.	
--	--

Zonal Mapping and Characteristics

Based on observations and thorough analysis, zoning categories were proposed to reflect the functional and spatial characteristics of the site. These zones help identify varying levels of economic activity, residential density, and industrial presence, providing a framework for sustainable development and urban planning.

Observed Zoning:

- High-Density Economic Zone: Scattered mainly along Old Galle Road and New Galle Road.
- Mid-Density Economic Zone: Found along both sides of Old Galle Road towards Panadura.
- Slums and Illegal Settlements: Located in the coastal area facing the Indian Ocean to the west.
- Compact Lot Neighborhood – Residential Zone 1: Mainly adjacent to the slums along the coast, with some near Bolgoda Lake.
- Moderate Lot Neighborhood – Residential Zone 2: Scattered throughout the site, concentrated towards the northeast facing Rathmalana.
- Expansive Lot Neighborhood – Residential Zone 3: Primarily concentrated near Lunawa River and in Panadura, around Bolgoda River.
- Timber Workshops/Factories: Concentrated near Bolgoda River (north and west) and Kandalana area.
- Following Map highlights the Zones observed within the focused area.

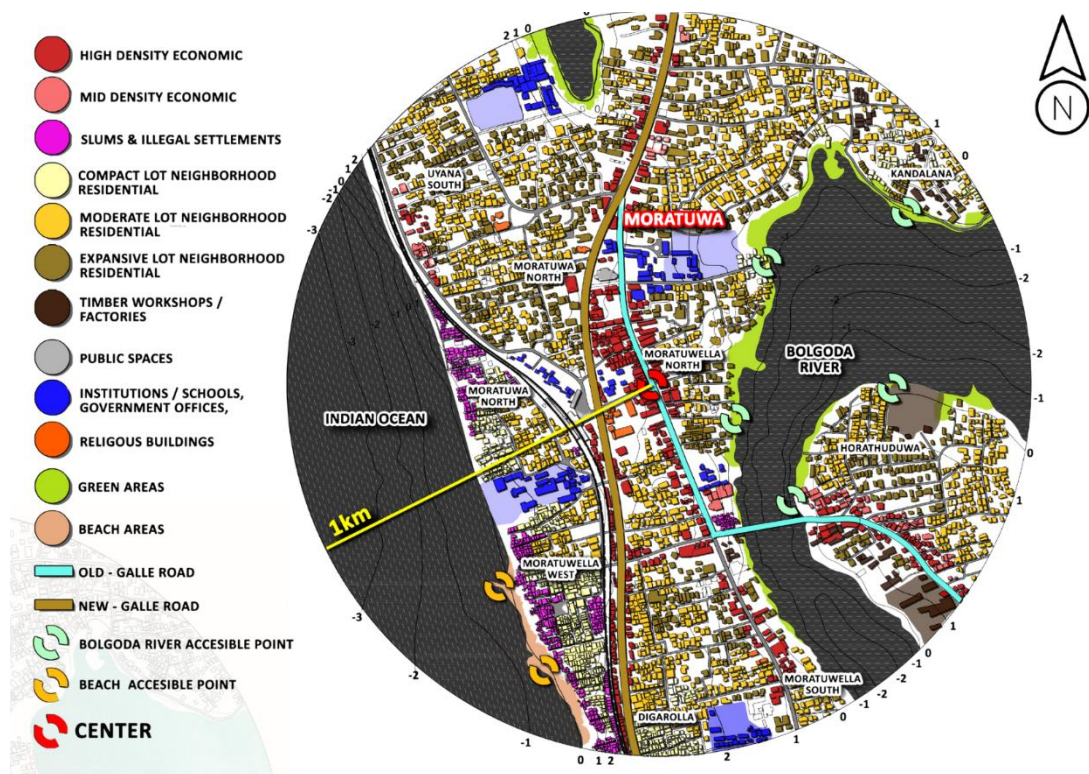


Figure 6 – Land Map of the Focused Area and Observed Zones
Source – Author

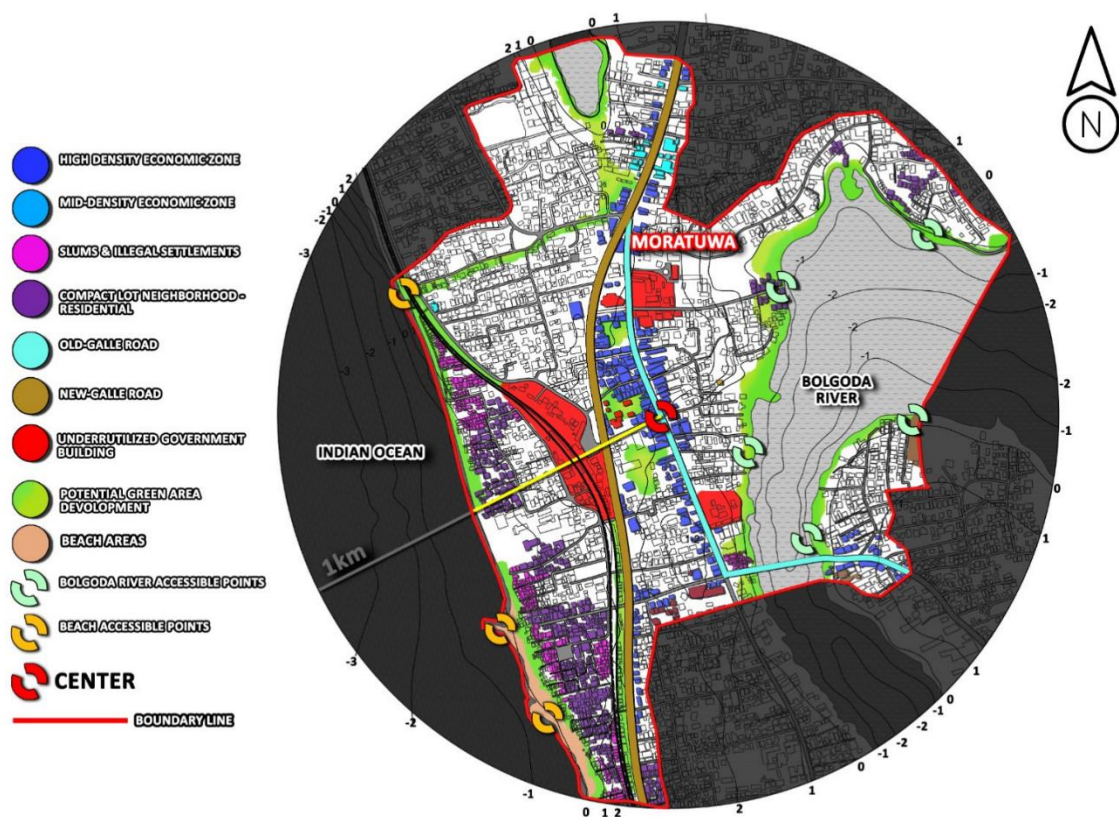


Figure 7 – Potential Development Areas Identified within the project boundary
Source – Author

After analysing Land use, and identifying underutilized lands we were able to identify Potential Development Land areas in the focused area (see figure – 5)

The Zonal Urban Design Framework

Framework Principles

The framework's primary principle is zonal planning, dividing the waterfront into distinct areas with unique, tailored development strategies. Contextual relevance assesses a zone's specific ecological, social, and economic conditions to ensure responsive planning. Holistic integration ensures development is not isolated, connecting it with crucial factors like transportation and the urban core. Finally, adaptability and specificity make the framework a flexible guide, providing a menu of design interventions for systematic, responsive solutions.

Identify applicable key Waterfront City Development Approaches

The proposed framework for Moratuwa draws strength from a literature review of proven waterfront development approaches, adapting them to the project area's unique complexities. The selection is justified by each approach's capacity to meet the needs of Moratuwa's distinct character zones. Approaches focusing on the socio-economic and built environment include the Mixed-Use Development Approach, which creates integrated settings blending residential, commercial, and recreational spaces to enhance vibrancy and surveillance (Keyvanfar et al., 2020). Waterfront Neighborhood Development focuses on balancing residential uses and public spaces in underutilized areas (Hamin & Nistari, 2020). For economic stimulation, the Economic & Tourism-First Development strategy prioritizes commercial hubs but requires balance with local access to prevent social inequity (Keyvanfar et al., 2020). The Public-Space Oriented Waterfront Development is fundamental for fostering an inclusive urban realm through high-quality parks and promenades (Hamin & Nistari, 2020).

Connectivity and mobility are addressed by the Transport-Oriented Waterfront Development (WTOD), a pioneering strategy that integrates water transport with other modes to leverage the waterways' allure. WTOD is recognized for improving connectivity, reducing traffic congestion, and enhancing community well-being (Kaur & Shokeen, 2021).

Crucially, environmental sustainability and livelihood necessitate targeted approaches. Environment Revitalization Focused Development prioritizes restoring ecosystems and improving water quality, directly addressing urban regeneration in the context of climate disruption (Jabareen, 2021). For sensitive zones, Limited Development with Conservation Focus is essential, emphasizing remediation and passive recreational uses to protect habitat and water quality (Waterfront Development, 2025). Finally, Fishery-Oriented Development focuses on upgrading infrastructure for the local fishing community, harmonizing their dynamic interface with the coastal environment to support traditional livelihoods (Balsman & Shoup, 2021). This comprehensive suite allows the framework to be effectively tailored to Moratuwa's diverse functional and environmental zones.

Framework

This framework (Table - 2) serves as a strategic guide for urban planners, architects, and policymakers in developing waterfront Cities.

Table 14 - Proposed Framework

Waterfront Development Approach	Indicators (Applicable Zone characteristics)	Specific design interventions
Waterfront Neighborhood Development (D1)	Areas with existing or potential for residential use, proximity to public transit, and a need for community revitalization. Often located in former industrial or underutilized residential zones, High demand for housing near the waterfront, Existing community fabric that can be enhanced, Adequate land area to accommodate residential and mixed-use development.	• Mixed-density residential zoning: Incorporate a variety of housing types (e.g., apartments, townhouses, single-family homes) to cater to diverse incomes. • Maintain publicly accessible waterfront areas by creating reservations • Always try to create neighborhood street layouts as visual and access corridors to the waterfront. • Pedestrian-friendly & Cycling-Friendly streetscapes: Design wide sidewalks, tree-lined streets, and reduce vehicle speeds. • Small-scale commercial nodes: Integrate neighborhood-serving retail, cafes, and services within a walkable distance. • Shared green spaces: Create community gardens, pocket parks, and courtyards within residential blocks.
Economic & Tourism-First Development (D2)	Existing Economic Zones Prime waterfront locations with high visibility, easy access for tourists, and existing or planned transportation infrastructure (e.g., main roads, Railway Stations, bus stands, Transport hubs, Water taxi services, airports). Strategic location with potential for high returns on investment. Strong market demand for tourism and entertainment facilities. Infrastructure capacity to support high visitor volumes.	• High-density commercial zoning: Allow for the development of hotels, resorts, convention centers, and large-scale entertainment venues. • Iconic architectural landmarks: Design signature buildings that serve as tourist attractions and define the skyline. • Integrated retail and hospitality hubs: Create self-contained complexes that blend shopping, dining, and accommodation. • Themed promenades and event spaces: Design areas specifically for festivals, performances, and public events that draw visitors.

Limited Development with Conservation Focus: (D3)	Ecologically sensitive areas such as wetlands, mangroves, or coastal habitats with high biodiversity. Zones that serve as natural flood buffers or have historical environmental significance. Presence of sensitive ecosystems or critical habitats. High risk of environmental degradation from development. Need for a natural flood barrier or climate resilience.	• Strict zoning for no-build or low-impact structures: Restrict development to passive recreational uses like boardwalks and bird-watching decks. • Environmental remediation systems: Implement projects to clean polluted water, restore degraded habitats, and plant native vegetation. • Informational and educational signage: Install interpretive signs to educate the public about the area's ecology and importance. • Naturalized recreational trails: Create permeable paths and trails that follow the natural contours of the landscape. Non-motorized boat journeys in suitable zones.
Community-Led, Incremental Development (D4)	Areas with a strong, organized community and a tradition of local governance. Often in informal settlements or neighborhoods with a clear sense of identity but a lack of formal infrastructure. Existing strong social capital and community cohesion. Need for socially inclusive development that respects local culture. Desire to empower residents in the planning process.	• Flexible zoning codes: Implement zoning that allows for small-scale, gradual changes over time without a rigid master plan. • Community workshops and co-design platforms: Use public participation tools to allow residents to propose and implement small-scale projects. • Phased infrastructure upgrades: Introduce improvements like water lines, sanitation, and street lighting incrementally as community resources become available. • Support for small-scale, local businesses: Improve small-scale livelihood empowerment centers, provide grants or micro-loans for residents to open small businesses that serve the community's needs. • Slums threatening the development can be relocated to nearby locations without completely severing their connection with the context.

WaterTransport-Oriented Development WTOD (D5)	Existing or Potential Areas at the intersection of water and land transport corridors, such as ferry terminals, bus stations, or future light rail stops. Zones with significant traffic congestion and a need for enhanced connectivity. High-traffic volume and a need for congestion relief. Strategic location that can serve as a regional hub. Opportunity to connect different parts of the city.	• Multimodal transport Strategy: Create integrated stations that seamlessly connect ferries, buses, bicycles, and pedestrian pathways. • High-density, mixed-use zoning around transport nodes: Cluster residential and commercial buildings near the transport hub to maximize efficiency and walkability. • Pedestrian plazas and public waiting areas: Design high-quality public spaces that serve as gathering points and encourage social interaction. • Park-and-ride facilities: Implement facilities that allow commuters to transfer from private vehicles to public transport, reducing traffic in the core waterfront area.
Environment Revitalization Focused Development (D6)	Areas with a history of industrial pollution, contaminated soil, or degraded water quality. Zones with brownfields or former industrial sites that require extensive remediation before development. Presence of significant environmental hazards or pollution. (Coastal erosion, Sea-level rise, Flood-prone areas) Legal or regulatory mandate for environmental cleanup. Need for a demonstration project in sustainable urban regeneration.	• Bioremediation and soil-cleansing projects: Use natural processes or engineered systems to decontaminate land and water. • Green infrastructure systems: Implement bioswales, rain gardens, and permeable pavements to manage stormwater runoff and filter pollutants. • Habitat restoration programs: Reintroduce native plant and animal species to rebuild damaged ecosystems. (eg: Mangrove Restoration) • Respond to coastal erosion • Adaptive reuse of industrial structures: Repurpose old factory buildings or warehouses for new, sustainable uses (e.g., community centers, art galleries).
Fishery-Oriented Development (D7)	Zones with a historical or current fishing community, existing harbor facilities, or a strong cultural connection to the fishing industry. Presence of an active fishing community or a need to preserve cultural heritage. Existing or potential harbor facilities for upgrade. Economic viability of supporting the fishing industry.	• Upgraded harbor infrastructure: Modernize docks, fish markets, and storage facilities to support the local fishing fleet. • Dedicated fishing-related commercial zones: Create areas for bait shops, gear repair, and seafood restaurants. • Public Fish market development with smart water & waste management systems and Hygiene practices.

		• Public-private partnerships: Establish collaborations between the local community and government to manage resources and facilities. • Educational and cultural centers: Design spaces that celebrate the fishing heritage and educate visitors about the local culture and industry. • Dual Harbor Integration to connect the fishery and tourism industries.
Public-Space Oriented Waterfront Development (D8)	Any waterfront zone that needs to be more inclusive and accessible. Particularly effective in areas that have been privatized or lack communal gathering places. Lack of existing high-quality public space in a given area. Need to create a destination for social interaction and recreation. High potential for public use and community engagement.	• Continuous public promenades: Create uninterrupted walkways along the waterfront for jogging, cycling, and leisure. • Multi-functional plazas and parks: Design large, flexible spaces for public events, markets, and informal gatherings. • Accessible infrastructure: Ensure all public spaces are accessible to people of all ages and abilities, including ramps, wide paths, and universal design principles. • High-quality public amenities: Provide clean restrooms, seating, lighting, and shaded areas to enhance comfort and usability.
Mixed-Use Development Approach (D9)	Urban or peri-urban zones with high potential for growth, a need for diversified economic activity, and a desire to create a lively, round-the-clock environment. Proximity to main Streets Proximity to key amenities or transport hubs. Opportunity for economic diversification and job creation. Desire to create a self-sufficient and lively neighborhood.	• Vertical integration of uses: Design buildings/shop houses with retail on the ground floor, offices on the middle floors, and residential units above. • Compact, walkable blocks: Create small-scale blocks that encourage walking and reduce reliance on cars. • Diverse architectural styles: Employ a variety of building designs to create visual interest and avoid a monolithic feel. • Active ground floors: Ensure that the ground level of buildings is engaging and transparent, with windows and doors that open to the street to enhance natural surveillance.

The framework application involves three steps: first, dividing the boundary into distinct zones based on characteristics (ecological sensitivity, community needs, infrastructure); second, matching zone traits to framework indicators to select the most suitable development approach for each area; and finally, implementing tailored design interventions. This process, which rejects a one-size-fits-all approach, ensures responsive and sustainable development. Following these steps, an urban sketch design map was created, detailing the selected development approach and proposing compatible new proposals for every specific zone.

Urban Design Proposal

Applying the framework involved selecting specific development approaches for each zone based on the land-use map. The following figure illustrates the land-use map with a matrix annotating these selected development approaches for each zone.

These proposals were then crafted by considering the chosen waterfront development for each zone. The goal was to support the project's six overarching goals and achieve its vision: "A vibrant waterfront community that embraces nature, fosters a sense of belonging, and ensures inclusivity and safety."

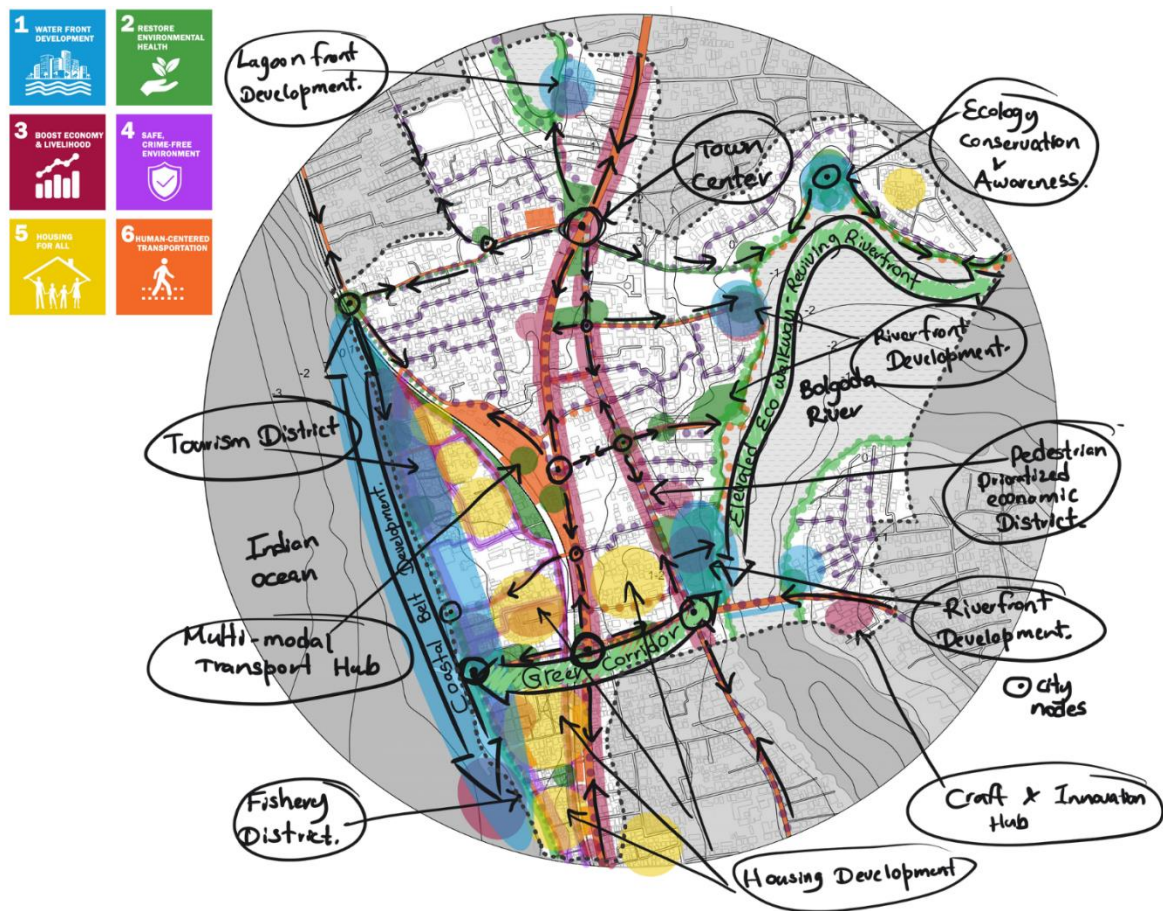


Figure 8 - Urban Sketch Design



Figure 9 - Urban Design Proposals

Conclusion

This research successfully addressed the critical void in Sri Lankan urban planning by developing a tailored, zonal urban design framework for transforming underutilized waterfronts, using Moratuwa as a detailed, high-density coastal case study. The initial contextual analysis provided a robust foundation, confirming that Moratuwa's waterfronts are profoundly underutilized due to a complex, compounding set of issues. These include uncontrolled urban commercial sprawl along vital corridors (Old and New Galle Roads), severe environmental degradation from poor solid waste management (SWM) and blocked drainage, and institutional issues like restricted public access resulting from concentrated private land ownership. Furthermore, the analysis highlighted Moratuwa's acute vulnerability to climate change impacts, such as sea level rise and flooding, which is exacerbated by the lack of natural buffers (mangroves).

The research successfully answered its central question by demonstrating how a zonal framework can provide a viable and replicable model for transformation. The design methodology ensured the solution is holistic and context-specific: by meticulously defining a 1.38 km^2 project area that incorporates the commercial core, all major water bodies (Bolgoda River, Lunawa Lagoon, and the beach), and the railway/bus transport nodes, the framework ensured a comprehensive scope. The framework's Vision—a vibrant, inclusive, and safe waterfront community—is directly supported by six interconnected goals that prioritize Restoring Environmental Health, implementing Human-Centered Transportation (WTOD), and Boosting the Economy. The rigorous methodology, which synthesized primary data (site observations, community interviews) and a literature review of proven development approaches (e.g., Conservation-Focus, Fishery-Oriented Development), allowed for the creation of a zonal design proposal that is meticulously matched to specific site characteristics.

Ultimately, this research provides the Moratuwa Municipal Council and the Urban Development Authority with a context-specific, replicable zonal model capable of guiding resilient development. By mapping proven international approaches to localized needs, the framework offers a pragmatic strategy to transition Sri Lanka's undervalued coastal edges into sustainable, resilient, and inclusive public assets.

References:

Journal articles:

- ADB. (2015). Final Report SRI: Northern Province Sustainable Fisheries Development Project - PPTA.
- Balsman, A., & Shoup, K. (2021). *Opportunities for Urban Fishing: Developing Urban Fishing Programs to Recruit and Retain Urban Anglers*. North American Journal of Fisheries Management, 41(4), 1081-1094.
- Busquets, J. (2013). The Urban Project: The Urban Project as a Tool for Transformation.
- Chang, T. C., & Yu, W. (2011). Tourism and development in developing economies: a policy implication perspective. Sustainability, 12(4), 1618.
- Crosbie, M. (2012). "Limited Development with Conservation Focus." Progressive Architecture, 93(10), 40-45.
- Gehl, J. (2010). Cities for People. Island Press.
- GlobalABC. (2022). *Sri Lanka Sustainable Housing and Construction Roadmap 2020–2050*. Global Alliance for Buildings and Construction.
- Hall, P. (2014). Good Cities, Better Lives: How Europe Discovered the Lost Art of Urban Planning. Routledge.

- Hamin, H., & Nistari, S. (2020). *Waterfront Development and Urban Sustainability: A Literature Review*. Sustainability, 12(5), 1836.
- Jabareen, Y. (2021). *Planning for Urban Resilience: Lessons from the Literature and Practice*. Sustainable Cities and Society, 75, 103351.
- Jacobs, J. (1961). *The Death and Life of Great American Cities*. Random House.
- Jayalath, J. A. C. D., & Kulatunga, U. (2025). Sustainable Urban Mobility in Sri Lanka: The Imperative for an Inherent Human-Centered Approach for Holistic Development. *Proceedings of The 13th World Construction Symposium*.
- Kaur, R., & Shokeen, S. (2021). *Water Transport Oriented Development (WTOD): A Sustainable Approach for Urban Planning*. Journal of Architecture and Urbanism, 45(1), 1-12.
- Keyvanfar, Ali, et al. "A Sustainable Historic Waterfront Revitalization Decision Support Tool for Attracting Tourists." Sustainability, vol. 10, no. 2, 1 Feb. 2018, p. 215, www.mdpi.com/2071-1050/10/2/215#cite, <https://doi.org/10.3390/su10020215>. Accessed 29 Mar. 202.
- Lee, K. (2008). Community-led development and its rationale. Community-Led Development, 20(3), 15-28.
- Lin, T. S., & Tseng, M. L. (2016). Post-industrial waterfront regeneration: A systematic review and research agenda. Journal of Urban Planning and Development, 142(3).
- Liyanage, K. T. W., & Weerakoon, W. M. M. S. B. (2023). Vulnerability Assessment of the Coastal Zone of Sri Lanka to Sea-Level Rise Scenario: a GIS Based Study. *Sri Lankan Journal of Applied Sciences*, 2(1), 81–90.
- Marshall, S. (2014). *Urban waterfronts in the age of globalization*. Routledge.
- "Matara Sustainable Urban Development - Cities Development Initiative for Asia." Cities Development Initiative for Asia - Investing in Asia's Urban Future, 11 Dec. 2020, cdia.asia/project/matara-sustainable-urban-development/. Accessed 2 Aug. 2025.
- Mbata, Raymond. *Sustainable Waterfront Development: Balancing Environmental Concerns and Community Growth*. 2024.
- Mostafavi, M. (2010). *Ecological Urbanism*. Lars Müller Publishers.
- Newman, O. (1972). *Defensible Space: Crime Prevention Through Urban Design*. Macmillan.
- Papa, R., & Moroni, V. (2019). Transport-oriented development for a sustainable urban regeneration. IOP Conference Series: Earth and Environmental Science, 360(1), 012015.
- Porter, M. E. (2000). Location, clusters, and the new economics of competition. Journal of Urban Economics, 47(3), 329-346.
- Premadasa, H. A. A., Bandara, N. J. G. J., & Ariyaratne, R. T. (2021). Techniques for Better Management of Municipal Solid Waste Strategies: A Case Study of Moratuwa Municipality, Sri Lanka. *Proceedings of the 11th Annual International Conference on Industrial Engineering and Operations Management (IEOM)*.
- Rathnayake, M. K. D., et al. (2019). The water quality and microplastic contamination in the Bolgoda Lake mangrove ecosystem, Sri Lanka. Journal of Environmental Science and Technology, 12(4).
- Rathnayake, M. K. D., et al. (2019). The water quality and microplastic contamination in the Bolgoda Lake mangrove ecosystem, Sri Lanka. Journal of Environmental Science and Technology, 12(4).
- Roberts, P., & Sykes, H. (Eds.). (2000). *Urban Regeneration: A Handbook*. SAGE Publications.

Rouse, W. (2011). Mixed-Use Development: A Review of Professional Literature.

Stahel, W. (2010). The performance economy revisited. *Sustainable Development*, 18(4), 189-201.

UDA (Urban Development Authority). (2021). *Moratuwa Development Plan 2021–2030*. Urban Development Authority – Sri Lanka.

UN-Habitat. (2024). *Climate Change & Urban Environment Strategy for Asia-Pacific 2024-2030*. United Nations Human Settlements Programme.

UN Sri Lanka. (2023). *Climate Change Fact Sheet*. United Nations Resident Coordinator's Office in Sri Lanka.

“Urban Justice Theory | Remaking Industrial.” *Remaking Industrial*, 2016, www.remakingindustriallandscapes.com/inclusive-city-building.

Urban Development Authority. (2019). *Moratuwa Development Plan 2019-2030*.

Waterfront Development: A Vision for Tomorrow's Cities. (2025). *Journal of Urban Planning and Management*, 50(2), 150-165.