

INTEGRATED APPROACHES FOR LAKE CONSERVATION IN URBAN ENVIRONMENTS

Ar. Dewashree Misra

Department of Interior Design

Kalinga University, Nava Raipur Atal Nagar, Chhattisgarh

dewashree.misra@kalingauniversity.ac.in

Abstract

Urbanization and industrialization pose significant threats to water bodies and biodiversity worldwide, with unregulated development leading to widespread degradation of surface water bodies. This paper advocates for the inclusion of lakes and surrounding watersheds as integral components of development plans, highlighting their crucial role in supporting both human communities and ecosystems. By serving as vital life support systems through water recharge, storage, and regulation of hydrological processes, lakes contribute to maintaining local microclimates and supporting biodiversity.

This research aims to assess the impact of land use in catchment areas on lakes, identify sources of pollution, analyze existing infrastructure, and propose conservation measures for lake protection and enhancement. The study emphasizes the importance of integrated planning approaches for sustainable development, considering both the ecological significance and socio-economic value of lakes. While specific recommendations for water quality improvement, vegetation restoration, and shoreline development are limited by available scientific data, the research provides a framework for prioritizing lakes and guiding future project implementation. This paper contributes to the refinement of project definitions and execution strategies, assisting policymakers in making informed decisions for the preservation and sustainable management of urban water bodies.

Keywords: Urbanization, Industrialization, Lakes, Watershed management, Sustainable development.

Introduction

Lakes constitute essential components of metropolitan environments, despite their often modest dimensions. They play pivotal roles in ecological and economic spheres by supplying drinking water, replenishing groundwater, mitigating floods, fostering biodiversity, and supporting livelihoods. Various sectors of the economy, including agriculture, domestic, and industrial, benefit from ready access to lake water. However, urban lakes and wetlands in India are currently facing severe environmental challenges, as they have been consistently neglected and degraded due to unplanned rapid urbanization. Consequently, these water bodies are increasingly surrounded by sewage and debris, and impermeable

surfaces dominate their surroundings, leading to the influx of pollutants instead of water. Once vibrant centers of urban life, metropolitan lakes now pose hazards, exacerbating floods and exacerbating droughts due to their dwindling presence. The prevailing water crisis in Indian cities underscores the critical importance of urban lakes and wetlands. Despite the existence of various policies and acts aimed at their preservation and restoration, urban water bodies have witnessed significant deterioration in recent years.

Historically, lakes have been integral to human civilization, but contemporary urbanization has altered their usage patterns. The disappearance of numerous lakes, either through extinction or spatial reduction, underscores the urgency of addressing this issue. This paper explores the impact of urbanization on lakes in global cities, revealing a trend of lake depletion and encroachment by urban development. It highlights the pressing need for concerted efforts to conserve and restore urban lakes, emphasizing the importance of adopting sustainable management practices and enforcing existing regulations. Through a comprehensive analysis of the challenges facing urban lakes and wetlands, this study provides insights into potential strategies for their preservation and underscores their indispensable role in ensuring the environmental sustainability of metropolitan areas.



Aim of Study:-

Study the preservation of lakes to create and enhance healthy everyday environments and ecosystems for the public, incorporating an integrated planning approach and policy frameworks.

Objectives:-

Describe the lake area and its surrounding catchment region.

- Focus on the land use patterns of the surrounding areas.
- Investigate the potential for development and conservation of the lake and its site.
- Assess existing and future infrastructure facilities in and around lake areas and their catchment regions.
- Propose a preservation plan incorporating an integrated planning approach to safeguard and improve the lakefront environment.
- Evaluate criteria and indicators for the lake preservation plan.

Defining Lakes:

Lakes are collectively identified as depressions on land filled with water. However, there is no universally agreed-upon definition. According to the International Glossary of Hydrology, a lake is defined as an "inland body of water of considerable size" (UNESCO and WMO, 1992). Kuusisto (1985) provides a more detailed description, stating that lakes are "depressions or hollows filled with water."

These bodies of water typically exhibit a consistent surface level, except for temporary fluctuations caused by factors such as wind or ice. The ratio of inflow to volume is such that most of the suspended material entering the lake settles as bottom sediments.

Under the National Lake Conservation Program of the Ministry of Environment and Forests, lakes are characterized as "standing water bodies with a minimum depth of 3 meters, generally covering an area of more than 10 hectares, and having minimal or no aquatic vegetation" (Ministry of Environment and Forests, 2010).

The purpose of defining lakes is to establish their identity, which plays a significant role in their preservation. However, this specific definition of lakes can lead to their exploitation. Due to various environmental and climatic factors, the criteria used to define a lake may change over time, creating loopholes for their utilization for various purposes.

CLASSIFICATION OF LAKES IN INDIA

India has no particular characterization of lakes, so broad order measures are utilized to bunch lakes. These incorporate lakes recognized in light of:

- The executive's measures, for example, lakes assigned under National Lake Conservation Plan, Ramsar Sites and so on
- Fleeting lakes, for example, lakes Ganga-Brahmaputra bowl for example Beels and Jheels
- Useful Criteria, for example, lakes for water system, water supply and hydrology and so on
- Immunological rules for example new water lakes, salty water lakes and so forth

- Geological area like Himalayan lakes, Coastal lakes, peninsular lakes, etc.

URBAN LAKES

Metropolitan water bodies are integral to Indian culture, serving as reservoirs of water for domestic and agricultural purposes, facilitating groundwater replenishment. The utilization of frozen nitrogen aids in the deactivation of phosphates, effectively removing toxins and treating wastewater. Additionally, these water bodies function as urban recreational spaces, contributing to the maintenance of the microclimate within the vicinity.

Uniqueness OF Urban Lakes

Lakes represent fascinating and vital ecosystems for both humans and the environment. They serve as reservoirs for surface water, forming just one component of the hydrological cycle, and maintain intricate connections with other water sources such as precipitation and groundwater. Within lakes, a diverse array of organisms thrive, including bacteria, fungi, algae, plants, small fish, mollusks, crustaceans, insects, larger fish, amphibians, reptiles, birds, and mammals. Acting as natural water harvesting systems, lakes play a crucial role in providing water for various purposes. Without lakes, water would swiftly drain away from urban areas, particularly due to the steep topography of the land. Many human communities residing near lakes heavily depend on Lake Biodiversity and associated resources for their water, food, and livelihoods. Particularly, lower-income groups rely on freshwater biodiversity to fulfill their basic needs.

URBAN LAKES CHARACTERISTICS

Metropolitan lakes are characterized after functional models:

- Metropolitan lakes have surface area of 10 square miles or less.
- They will quite often be shallow with a normal profundity of 20feet or less
- Metropolitan lakes have a waste area of at minimum proportion of 10:1 which implies that their watershed apply a solid impact on the lake.
- These metropolitan lake should be overseen for entertainment, water supply, flood control or other direct human use.

DEFINITIONS

Integrated Planning: An approach that incorporates spatial development and investment initiatives with due consideration for environmental factors.

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Integrated Development: Refers to the spatial and functional integration of development areas and their inhabitants.

Catchment Area: In geology, the region from which rainfall drains into a stream or lake. A catchment area encompasses the land that channels water to a common location. Watersheds vary in size, ranging from areas draining into small streams to those draining into larger water bodies.

Watershed Area: Refers to the region or boundary of land that separates water flowing into different basins, rivers, or seas. It essentially represents an area drained by a river, stream system, or other watercourse.

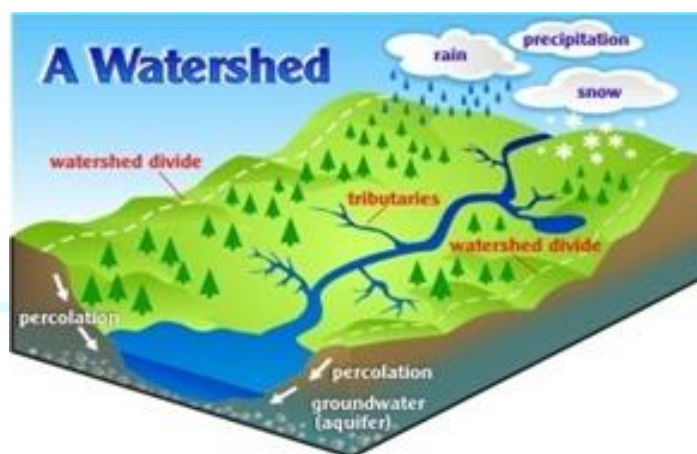


Figure.2.1:- watershed area
Source: - Source:-www.watershed.org

Catchment Factors: The catchment area is a significant determinant of the volume or probability of flooding. Considerations for catchment factors include geography, size, shape, soil type, and land use. Catchment geography and shape influence the time it takes for rainfall to reach the water body.

Topography: The geographical features determine the speed at which runoff will reach a water body. Rainfall in steep, mountainous regions will reach streams faster than in flat or gently sloping areas.

Shape: The shape of the catchment area contributes to the speed at which runoff reaches a water body. A long, narrow catchment will take longer to drain than a round one.

Size: The size of the catchment area determines the amount of water reaching the water body; larger catchments have a greater potential for flooding.

Soil Type: Soil type plays a role in determining the amount of water reaching the water body.

Land Use: Land use can influence the amount of water reaching the water body, similar to top clayey soils. For instance, precipitation on rooftops, pavements, and roads is collected by streams with minimal absorption into the groundwater.

CHALLENGES FACING URBAN WATER BODIES

Over the past two decades, urban water bodies in India have suffered from uncontrolled urbanization, leading to various risks including pollution, encroachment, eutrophication, illegal mining activities, unregulated tourist activities, and social exploitation.

Pollution: The rapid increase in urban population without corresponding expansion of city infrastructure, such as proper waste disposal facilities, has resulted in widespread contamination of urban water bodies. These bodies of water are now used for disposing of untreated local sewage and solid waste, often turning them into de facto landfills.

Encroachment: Another significant threat to urban water bodies, especially in metropolitan areas, is encroachment. As urbanization intensifies and land becomes increasingly scarce, even small parcels of land in urban areas hold high economic value. Consequently, these water bodies are no longer valued for their ecological benefits but rather as real estate opportunities. Encroachment through dumping of solid waste, sewage discharge, and construction of new structures like railway stations and roads has severely encroached upon these wetlands.

Unregulated Tourism Activities: Unplanned tourism activities without proper planning and regulation pose yet another major threat to urban water bodies. Disruption of wildlife, pollution, alterations in local lifestyles, and loss of cultural heritage are some of the impacts of tourism on the local environment. The common practice of disposing of waste into nearby water bodies has become increasingly prevalent in recent times, contributing to the degradation of many water bodies, particularly in high-altitude lakes.

Social Exploitation: Local communities often misuse urban water bodies for religious and cultural practices, such as immersion of idols. These activities serve as a significant source of pollution in lakes.

Urbanization: Urbanization and industrialization are essential for the rapid economic growth of a country, with every state and city transitioning from rural to urban areas and metros. However, development activities carry the risk of environmental damage, exacerbated by both necessity and greed. Processes such as manufacturing, processing, transportation, and consumption not only deplete natural resources but also place strain on the ecological environment.

Urban Sprawl:-

Urbanization happens either in outspread bearing around water bodies and a grounded city or straightly along the expressways. The scattered improvement along parkways or environmental factors the city and in provincial field is regularly alluded as spread. Profoundly. A portion of the reasons for the spread incorporate contamination development, economy and vicinity to assets and essential conveniences.

Key Issues leading to degradation of lakes

Anthropogenic stress: Numerous lakes and lakes have been lost during the time spent different anthropogenic activities and populace pressures prompting impromptu urbanization and extension. Rest of the enduring lakes are decreased to cesspools because of direct release of modern effluents and unregulated unloading of strong squanders.

Deficiency in proper management: The quantity of lakes has been steadily diminishing in light of the fact that a portion of the tanks have been changed over into private territories and some have been involved by state offices for public purposes like transport stands, arenas and private formats and so forth A large portion of the live Lakes have silted up because of defective land the board in the catchment and unpredictable mud lifting from the lake beds thusly their waste seizing limit has been decreased extensively separated from delivering the squanderer turbid.

Social composition of land ownership: Expanding populace and developing economies prompting impromptu turn of events and more noteworthy tension ashore assets. Lakes are regularly considered primary focuses for improvement especially in metropolitan regions because of tension of human exercises like urbanization, industrialization and so forth Because of these exercises the vast majority of the metropolitan lakes are getting corrupted past the place of recuperation.

Spread of well irrigation: As the populace expands, the interest for water keeps on expanding. Exhaust wells are burrowed unpredictably. In the event that the water collecting isn't done to re-energize ground water the titanic interest in bore wells is basically washed away.

Lack of governmental commitment: Inadequate firm scholastic exploration focused on wetlands in understanding the significance and pith of protection and the board, attributable to monetary limitations and absence of framework and required aptitude. Additionally the adjustment of the establishment instrument and their debilitating over the course of the years is an issue.

Absence of information bank: Census of lakes and ID and appraisal of their concerns both in the metropolitan and rustic regions isn't accessible. Absence of admittance to logical information and logical standards for limiting structure action around the lakes.

Man has utilized the lake assets simultaneously abused similar lake assets is apparent all through the mankind's set of experiences. The exercises in the catchment are more towards change of the waste example, tapping the streams and expansion of the dirtied water. The metropolitan lakes because of sewage and strong garbage removals have prompted eutrophication and harmfulness in the lake waters.

Policies frame work in India

Legal Framework:

India has enacted various laws, rules, and regulations pertaining to water resources, climate, forests, agriculture, fisheries, and social sectors, directly or indirectly linked with lake management. The Indian Constitution explicitly mandates the state's responsibility to preserve the environment. Article 48-A of the directive principles states: "The state shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country." Article 51-A (g) imposes a fundamental duty on every citizen "to protect and improve the natural environment including forests, lakes, rivers, and wildlife and to show compassion for living creatures." The constitution empowers panchayats and urban local bodies with relevant functions and responsibilities concerning lake conservation.

Initiatives by the Central Government:

Several acts and notifications issued by the Ministry of Environment and Forests provide the legal framework for the protection of lakes and reservoirs. These address environmental protection, pollution control, specific natural resources protection acts, hazardous waste management, and the establishment of the National Green Tribunal.

Constitutional Provisions and Legislative Regulations:

The protection of the environment and sustainable development were explicitly incorporated into the constitution through the Constitution Amendment Act of 1976. Article 48-A of the directive principles of state policy declares: "The state shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country." Central obligations, as envisaged in Article 51-A, impose similar duties on every citizen to protect and improve the natural environment, including forests, lakes, rivers, and wildlife, and to display compassion for living beings. The water (prevention and control of pollution) act 1974

This Act, 1974 suggests that least complex the country specialists can authorize water contamination guideline. Article 252 engages parliament to sanction legitimate rules on the country subjects for 2 or additional states, wherein the country governing bodies have agreed to such regulation. Under this Act, the country sheets had been vested with the administrative power and had been engaged to set up and placed into impact emanating norms for production lines releasing contamination into our waterways.

The Water (Prevention and Control of Pollution) Cess Act of 1977

Fundamental goal of this Act is to fulfill the expenses of the head and realm water sheets. Financial motivators are accommodated the control of contaminations via differential toll of duty structure. The nearby government and positive specific businesses are expected to pay the cess for water consumption. The deals gathering thus are thusly utilized for Implementation of Water (Prevention and control of contamination) Act, 1977.

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The Indian Forest Act of 1927

The above act is a consolidation of Indian forest Act of 1878 and its revisions, with minor changes that has sanctioned in preindependent India. The demonstration for the most part manages 4 classes of woods, viz, held woodlands, town backwoods, included timberlands and nongovernment (non-public) backwoods. They expressed Act applies to the lakes which comes under any of the above noted four classifications of lush region.

The Forest (Conservation) Act of 1980

Under this demonstration, the focal government has authorized the forest Act, 1980 to save you quick deforestation and ecological debasement. as per this Act, sooner than a realm government "de-holds" a saved forest, utilizes lush region land for non-timberland capacities, allocates forest land to a non-public office, or clears forest land for the thought process of reforestation, it needs to take the endorsement of the focal specialists.

The Environment (Protection) Act, 1986 (EPA)

Under this demonstration, "climate" comprises of water, air and land and the between relationship which exists among and among water, air and land, and individuals, different living animals, verdure, miniature life form and resources fragment three of the EPA States that the basic specialists will have the solidarity to go to all such lengths as it consider neccicity or convenient to safeguard and working on the nature of the climate and halting controlling and subsiding ecological toxins.

National Environmental Policy, 2004

The National Environmental Policy (NEP, 2004) is a reaction to the public obligation to a clean ecological, ordered in the Constitution in Article 48A and 51A. Fortified by legal understanding of Article 21. The fundamental targets of NEP 2004 is

- Protection of Critical Environmental Resources
- Intra generational Equity: Livelihood Security for the Poor

NATIONAL LAKE CONSERVATION PLAN: SAFEGUARDING AND MANAGING INDIA'S LAKES FOR SUSTAINABLE DEVELOPMENT

Under the National Lake Conservation Plan (NLCP), initiated by the Ministry of Environment and Forests, a nationwide effort has been underway to safeguard and manage polluted and degraded lakes in urban areas, while also assisting rural governments in the sustainable management and preservation of lakes. This plan aims to prioritize lakes based on scientific criteria.

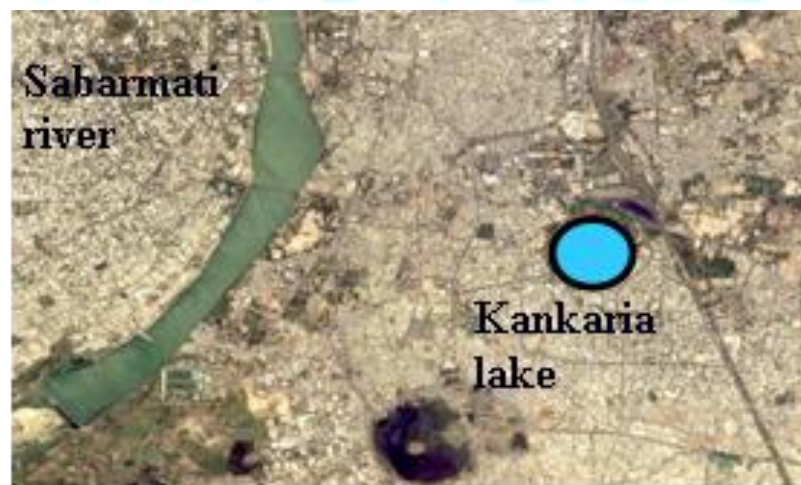
The primary objectives of the National Lake Conservation Plan include:

- Prevention of pollution from both point and non-point sources.
- Treatment and enhancement of the catchment area.
- Removal of sediment from water bodies and control of aquatic weeds.
- Conducting research and development studies on flora and fauna activities and associated ecological aspects.
- Implementation of various activities tailored to the specific conditions of each lake, such as an integrated development approach, taking into account interactions with human populations.

CASE STUDY-KANKARIA LAKE FRONT DEVELOPMENT (SPATIAL FACTOR)

The Kankaria Lake has been an indivisible piece of the distinguishing proof of Ahmedabad thinking about that its premise. Be that as it may, the weighty site guests at the lakeside road, disarranged casual exercises, indiscriminate utilization of the appropriate of way and the absence of adequate gets to the lake the front stayed away from the whole usage of every one of its true capacities.

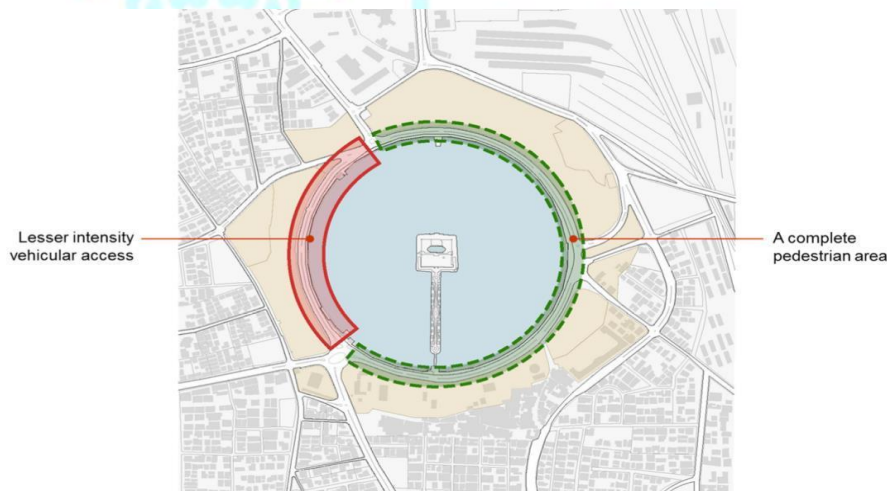
Started via the Ahmedabad Municipal association, the essential objective of the test changed into to make an exorbitant public space with productive and durable foundation that could encourage completely new games as well as aiding cutting edge day sport.

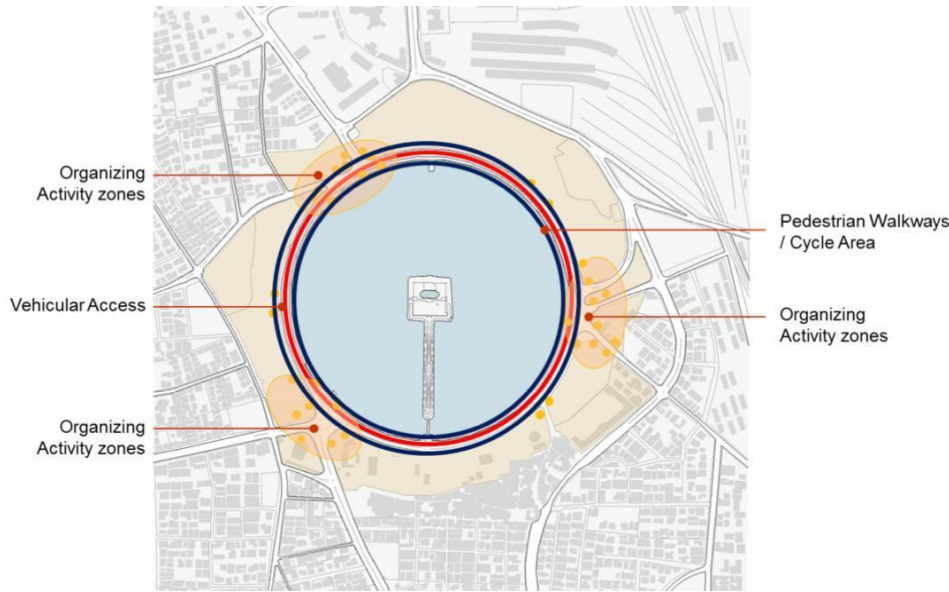


Underutilized land around lakes

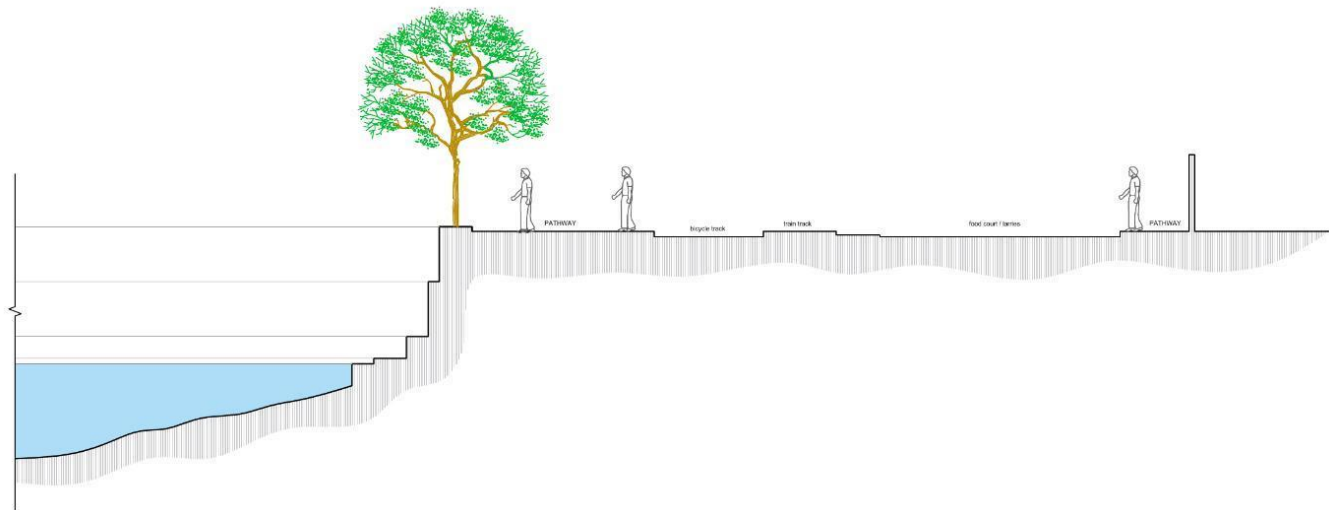
PURPOSE OF DEVELOPMENT

The heavy traffic on Lake Feature Street, disorganized informal activities, careless use of the right of way, and inadequate access to the lakefront have hindered the full utilization of its true potential. Spearheaded by the Ahmedabad Municipal Corporation, the initiative aims to transform the lakefront area located in the heart of Ahmedabad into a vibrant recreational urban space. Its primary objective is to develop sustainable and green infrastructure that promotes not only new activities but also supports existing ones.





ZONING OF LAKE BOUNDARIES



PEDESTRIAN WAY SECTION

The strategies encompassed creating extensive pedestrian zones adjacent to the lake edge, expanding an outer ring road by reinforcing the existing road network, establishing approximately 6 kilometers of access roads including new entry points to the lakefront, enhancing recreational capacity by upgrading public amenities, preserving heritage structures, and promoting inclusive development in the area. The project transforms the previously congested lakeside road into an appealing pedestrian promenade adorned with linear gardens, food courts, and designated parking areas. The design of the promenade features a continuous 2-kilometer-long pedestrian zone along the lake's edge, complemented by street furniture such as wooden benches, lighting fixtures, seating arrangements, and waste bins, creating a

seamless buffer between the pedestrian area and the cycle track. Among the various recreational activities provided, the most popular one is the miniature train ride encircling the lake. The design emphasizes aesthetic detailing for the walkways, carriageways, and on-street parking, facilitates access ramps to the lake's ghats, and provides centralized facilities for the community. General Steps in conservation of lakes.

1.investigation studies	Water quality analysis Inflow characteristics Contours and surroundings Weather Data Sedimentation analysis Socio-economic study of the surroundings.
2.Design of Engineering Measure	Watershed/catchment treatment Provision of silt traps Improvement of inlets points Wetland treatment
2. In-Lake Treatment	Dredging and de-silting Shoreline treatment
3.Shoreline Management	Declare lake area as protected Community toilets, sewage treatment plant Solid waste Management Peripheral Roads and green Belts, Fencing Electrification Promote Eco-Tourism Food Court, Children’s Park, Water Boat Jetty
4. People’s Participation	Active participation from local community, citizen groups, conservation, organizations, NGOs, and media.
5. Role of Regulatory	Inter-Agency Regulatory Body-LDA, Pollution Control Board, Forest Dept. City Corp.Development Authority Evolve effective wetland programs

Source: - National Lake Conservation Plan

CONCLUSION

Actual preparation and lake the executives have been fragmented in various offices and disciplines. This has been adverse to water bodies in metropolitan regions. Metropolitan lakes have been viewed as all the time as less important as metropolitan land use so preservation to metropolitan use gets need above water body assurance. Landuse the executives is a perplexing issue wherein various objectives, partner and measures should be thought of. The review will attempt to draw out the issues and recommend rules

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for accomplishing better outcomes and reserve funds lakes as significant piece of metropolitan environments. Protection plan through coordinated arranging approach should be made in such manner that they help to save these water bodies and upgrade their utility and not damage their reality. The methodology towards metropolitan arranging needs an adjustment of strategies and acts.

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