Sponsored Thesis Project Competition on

# *"RE-IMAGINING URBAN RIVERS"*

*Season- 2*

Project Title : Integrated Eco-Sensitive approach to Generated River-Related Economy, A case of Gomti Riverfront, Lucknow

Creator : Rajarshi, Faculty of Architecture and Planning, AKTU

National Institute of Urban Affairs

WATER & ENVIRONMENT VERTICAL

# INTEGRATED ECO-SENSITIVE APPROACH TO GENERATE RIVER RELATED ECONOMY– A CASE OF GOMTI RIVERFRONT, LUCKNOW

**RAJARSHI**

## ABSTRACT

The World Health Organization forecasted a possible 70% increase in the world population living in urban settings by 2050 (WHO, 2014). This will result in unplanned growth, urban sprawl and loss of green, thus adversely affecting nature and human health. Land practices and runoff management are the good ways to reduce Nonpoint Source (NPS) pollution. Blue-green Infrastructure (BGI) is a system of using blue (water) and green (nature) to address these urban and environmental challenges.

Urbanization is accompanied by land-cover change and adds to the greying of natural landscape and harming the natural hydrological cycle. Increased impervious surfaces reduce hydrologic infiltration and rainwater retention. Thus, urban areas become more susceptible to flooding. This vulnerability will be aggravated by climate change and increased erratic rainfall, leading towards threat to life and property. Flowing waters, such as rivers, are the lifeblood of most cities – providing transportation, security, electricity, irrigation, trade, and recreation.

River Gomti, the lifeline of Lucknow, is degrading rapidly and needs urgent intervention. This project aims to 'create a sustainable eco-management plan' (Ecological & Economical), with a focus on overall development. Environmental, social and economic benefits will not only increase the environmental sustainability of the waterfront, but also boost up the entire city's economy in an inclusive and integrated manner. Economic development need not come at the cost of the environment. Sustainable economic development is achievable by harmonizing all environmental considerations.

The ecocity concept is an integrative and comprehensive approach, aiming not only to the rehabilitation of the urban river according to ecological principles but also to be as an integrative part of the city itself. Therefore, the urban river is not treated as an urban river but as an urban river in harmony with the principles of an ecocity. Integration, on the other hand, involves planning of the upgrading and beautification of the urban river and its surroundings together with the planning of the other focal urban landscape elements like major centers, major historical sites and others. In this sense, the context of integration is also enriched as it now includes accessibility, connection and going beyond them includes the planning of all image makers of the city in an integrated whole.

Arresting the physical degradation of the natural resource (i.e., River Gomti) which is losing its value in terms of water front stretch that is left barren and occasionally used as an informal grazing ground, depth of the water is continually reducing which requires engineering solutions such as dredging. Apart from that, the quality of water is also deteriorating day by day which is not a good sign for a water body for long term sustainability.

Stakeholder participation must be the ideal approach as it is an important step to be involved in any planning process. The various stakeholders that have been identified in and around the site are primarily the naturally indigenous inhabitants i.e., the washermen, the fishermen and other neighboring communities including the oldest settlements of the Lucknow city near the river. Secondly, Lucknow has a huge tourist influx throughout the year as it houses a number of heritage monuments that connects with the typical tradition and culture of the place. Hence, tourists are also considered to be the stakeholders. They can participate both actively and passively in the revenue generation of the place at the same time safeguarding the ecology and the heritage which should be managed through sensitive guidelines and their strict implementation which is practicable and enforceable.

There are open and barren land used as informal grazing ground along the river stretch which is underutilized currently. These land parcels bear high land values and can be developed with new economy generation models to ensure proper and sustainable usage of the same. These may include a Horticulture or botanical garden which will be a part of the green infrastructure (environmental benefit) and it will also contribute to the beautification of the place that makes it an attraction center in itself (social benefit) and this will finally add up to the city's economy (economic benefit).

Sustainable mobility through traffic management in the surrounding areas can be another important step. Pedestrianization and encouraging green vehicular movements only in dedicated time slots in the heritage zone will lead to the reduction of the carbon emission which will not only safeguard the heritage but also act as a key step towards sustainable development.

Connections are energized by public activities and events like street festivals, sidewalk cafés, and vendors. When planning any riverside project, riverbanks, shorelines, riparian buffers, and river ecosystems are extremely significant. Geology, morphology, hydrology, and land cover are further significant factors that should be taken into account when determining how an ecosystem function. There are numerous potentials for habitat restoration, public access, stewardship, and redevelopment along the river. Integrated blue-green infrastructure, stormwater management practices, improved trail access, improved habitat corridor with increased vegetative types like meadows and transitional woodlands, as well as increased tree canopy, open space amenity, integrated design of waterfront access and softscape elements, marina access and provision of ecosystem services and more will all be included in the buffer zone.

Various projects that will be a part of integrated Ecocity would be as mentioned below.

1. **Riparian Buffer:** In order to preserve and improve biodiversity, provide ecosystem services, ecological restoration, increase the potential of habitat corridors, improve public trail access, provide open-space amenities, and educate students about the environment, a buffer zone will be created around riverside open spaces. In order to decrease concentrated flows to the water body and to maintain habitat for birds and other wildlife species that need uninterrupted access to food, shelter, and water, the riparian corridor should be unbroken. The most crucial component of a riparian corridor is a tree because they remove nutrients, stabilize the soil, change the temperature of the water, and feed aquatic

species. Riverbanks are a crucial interface for river hydrology, riparian support systems and waterfront activities for example soft edges may be developed as shallow banks with floodplain vegetation, steep banks with planted vegetation, mown and trampled earth banks with invasive vegetation.

2. **Safeguarding indigenous inhabitants:** Stakeholders and the community participation through Perpendicular connections, will extend the grid of the community into the park and natural systems, linking the urban grid to the natural forms of the waterscape and landscape. A fishing pier can be developed along with a demarcation of dedicated fishing zone to formalize the fishing activities so that the fishermen community who are dependent on these activities for their livelihood will not be displaced anywhere. Apart from them the washermen community will also retain their daily routine through formalizing the washing activity by channelizing the river water into an inland reservoir where they can wash clothes and then the water can be reused for irrigation and maintenance of riparian zone along the river.

3. **Enhancing Public Accessibility:** Even where they run alongside privately developed regions that can be expanded through land value capturing in these places, connections from buildings and districts to the rivers should be open to the public. Both temporary and long-term installations of public activities and events, such as sidewalk cafés, street festivals, and vendors, will liven up the links. Major parallel connections will be planned as one continuous space, with the landscaping defining the street's personality.

4. **Tourism Economics:** Heritage tourism to be linked with the river economy by developing an information centre for the tourists (specially first timers) and linking both the river edges through water ferries that will also add to character value of the place. These ferries can further be connected to other heritage sites in the city in the upcoming phases of the development. Pedestrianization of the heritage zone and developing a non-motorized zone withing the heritage zone can also add value to the environment and safeguarding the heritage.

5. **New economy generation:** Developing blue-green infrastructure will generate new avenues of economy and earning potential for the city. Improved waterfront urban design, creation of active and passive recreation spaces such as horticultural and botanical gardens and herbariums will attract citizens to frequent the area. A small park, boat launch, stormwater landscape or fishing pier, created at the right time and embraced by the community, can have a catalytic effect and lead to bigger things down the road. Increased footfall enhances economy but threatens the environment – hence strict guidelines will be formulated and implemented to ensure cleanliness and sustained maintenance of the proposed area.

Successful riverfront development doesn't have to start on a grand scale. Sometimes the smallest projects are the most potent.

Various projects have been highlighted are as follows:

1. Riparian Buffer
2. Safeguarding indigenous inhabitants
3. Enhancing Public Accessibility
4. Tourism Economics
5. New economy generation

Together these five identified projects (in the short- and long-term) will have a pulsar effect on the economy of the Gomti waterfront, as well as the Heritage district of Lucknow.

It will revitalize the livelihoods of the indigenous populations of the area (fishermen, washermen, cattle-grazers, etc.) as well as improve their overall quality of life. New avenues of revenue generation, as identified earlier, will provide a great uptick to the overall economy of the region.

# ACKNOWLEDGEMENT

This work would not have been possible without the support of the faculties at the Faculty of Architecture and Planning, Dr. Abdul Kalam Technical University, Lucknow. I am especially indebted to Dr. Joydeep Dutta, who guided me through the Thesis.

I am grateful to Dr. Subrajit Banerjee, for providing me this opportunity to carry out my research in this area. I am also grateful to Dr. Indrani Chakraborty, Ar. Gaurav Singh and Ar. Prabhat Rao, Ar. Anupam Anand, Mrs. Arundhatee Mishraand other faculties who constantly supported me from the inception to the completion of the Dissertation. Each of the members of my Thesis Committee has provided me with extensive personal and professional guidance and taught me a great deal about both scientific research and life in general.

I am also grateful to the **National Institute of Urban Affairs (NIUA)** for being shortlisted as the finalist in the Season-2 of the Student Thesis Competition (STC-2) with the theme of Reimagining Urban Rivers and for Sponsoring my thesis. Finally, I wish to thank my parents and ffor their love and encouragement, without whom I would never have enjoyed so many opportunities.

# TABLE OF CONTENT

# LIST OF TABLES

# LIST OF FIGURES

# LIST OF MAPS

# CHAPTER 1

## Chapter 1. Introduction

### 1.1 Background

i. Flowing waters, such as rivers, are the lifeblood of most cities – providing transportation, security, electricity, irrigation, trade, and recreation.

ii. Rivers are degrading rapidly and needs urgent intervention.

iii. Channelization of rivers, along with beautification and structured designated landscape design along the riverbanks, are parts of the development that occur in the urban centers around the world.

iv. Realizing the importance of ecological aspect, many developed countries all around the world have started to encourage and pull out their effort in developing the ecological riverfront. They have started to give back the land to the river.

v. Economic development need not come at the cost of the environment.

vi. Sustainable economic development is achievable by harmonizing all environmental considerations.

Figure 1.1 Urban River (Landscape Journal Of India, 2014)

## 1.2 Need for Study

i. Cities have been a **major part of the problem** and will have to be part of the solution as well.

ii. **Manifesting city's nature** with urban economic development

iii. To project **city holistically as** waterfront city with attractive investment opportunity to further enhance the economic growth and stability.

iv. To stablish city as one of the major tourism attraction centers

v. Making **excellent living environment**

vi. Increase the **overall living standard** of the people in the cities containing riverfront

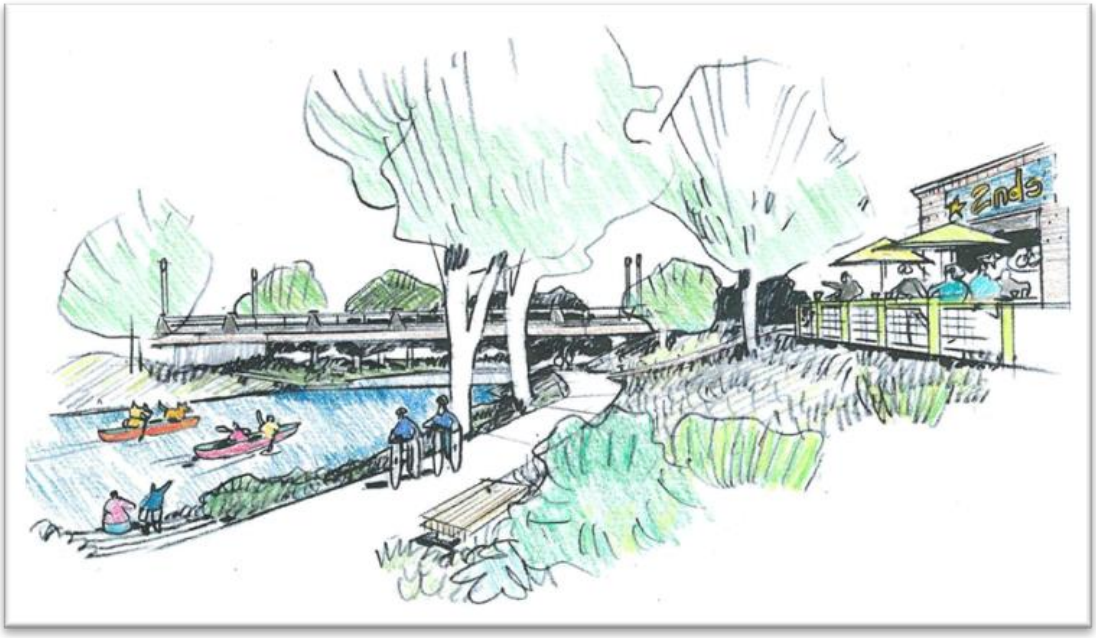



Figure 1.2 Social Spaces around river (Landscape journal of India, 2014)

## 1.3 Advantages of riverfront Development

i. **Water conservation practices:** Development of projects would ensure a proper design of projects in conserving river and maintenance of rivers flowing through large cities. Beautification of the riverfront with a natural outlook will provide the general public with an open space for leisure and recreation.

ii. **Habitat protection and restoration** Conservation of water in the river Human/Environmental connections Conservation and development of land. Conservation of flora and fauna. Maintenance of river bank.

iii. **Source of revenue** for government-government would be able to earn revenue in terms of taxes from the commercial activities in the region. The commercial activities include shops, restaurants, sport activities, transportation, boating etc. which can be leased out or giving to private players to operate.

iv. **Development of tourism in the region-** with the development of riverfront the tourism in the region can be increased by offering a variety of attractions like water sports, entertainment arenas, parks, shopping areas, etc.

v. **Economic spin-** off's-rise in the value of properties in and around the region, acting as a catalyst for redevelopment and renewal of nearby places

vi. **Employment opportunities** for nearby people and helping in development of region.

vii. With the development of riverfront there would be creation of jobs as it gives way to starting up of a host of commercial activities in that region and also indirect job creation associated with the set of activities.

viii. Encouraging **recreational activities** like walking, jogging, biking, sports activities, etc

ix. Improving **quality of life** of nearby community by revitalizing the neighborhood

## 1.4 Benefits of riverfront Development

## 1.5 Environmental Benefits

Environmentally sensitive urban riverfronts refer to concepts and projects which are sensitive to local hydrology, environmental and ecological considerations by putting primary focus on conservation, restoration and enhancement of river and associated ecosystems. Some environment benefits are:

i. Rich biodiversity

ii. Clean air

iii. Clean water

iv. Improved ground water

### 1.5.1 Economic Benefits

i. Improved livelihood opportunities

ii. Tourism growth

iii. Attractive investments (Source of Revenue)

Figure 1.3 Tourism around river (ArchDaily, 2020)

### 1.5.2 Social Benefits

Socially inclusive urban riverfronts are riverfronts with adequate considerations of the needs and aspirations of all local stakeholders, custodians and users of river and riverfronts throughout the planning, development and operational phases of such riverfronts.

i. Vibrant spaces for interactions and events

ii. Serene and scenic picnic spot

## 1.6 Aim

To create a sustainable eco-management plan' (Ecological & Economical and social), for Gomti riverfront area in Lucknow with a focus on overall development.

## 1.7 Objective

i. To assess the interaction between the city and river through articulation of environmental, social, economic and heritage profile.

ii. To study the guidelines and norms related to the riverfront development.

iii. To study and formulate various models of economy generation through riverfront projects.

iv. To propose a comprehensive plan with specific strategies for economy generation.

Figure 1.4 River Vibrant Zone (Landscape journal of India, 2014)

## 1.8 Vision

i. The river will be able to support a habitat for riverine biodiversity to thrive.
ii. The river will provide opportunity for economic development.
iii. The river will be celebrated among the citizens.

## 1.9 Scope

i. To **recommend various interventions** in terms of economy generation model for the riverfront development project in urban areas with an eco-sensitive approach.

ii. **Integrate river sensitive norms** & practices into long term planning of the city.

## 1.10 Limitation

i. The recommended projects may not be an ideal approach towards economy generation model. Hence, the research focuses to be contextual

ii. Case studies may have elements that might not be feasible in the chosen context.

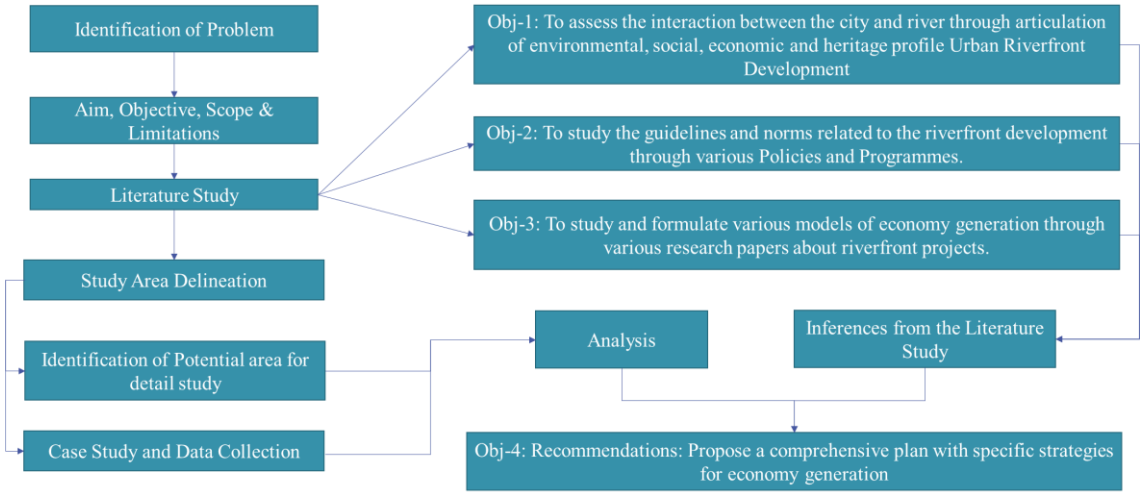
iii. Only about 2 kms stretch along the heritage area in Lucknow would be considered.

## 1.11 Research Problems

i. What is the river related **economy generation models** and how **stakeholder participation** can play a major role that can be applied with an eco-sensitive approach?

## 1.12 Methodology

Figure 1.5 Methodology (Author, 2021)



# CHAPTER 2

# Chapter 2. Literature Study

## 2.1 Definitions

i. The urban waterfront can be understood as the "part of a town that is next to an area of water such as a river or the sea" and therefore as "the interface between land and water.

ii. An official definition by the US Federal Coastal Zone Management Act, Office of Ocean and Coastal Resources (OOCR) (1972) defines the term urban river front development or port as,
   a. **"any developed area along river that is densely populated and is being used for, or has been used for, urban residential, recreational, commercial, shipping, or industrial purposes"**

iii. Definition by Gun (1998) as cited in Dong (2004) defines that
   a. **"river front development as the area in the city where land meets water, spatially, an area including 200m-300m from the interface to the water side and 1km-2km (that is about a 15min- 20min walking distance) to the land side"** (p. 7).

iv. Wu and Gao (2002) as cited in Dong (2004) present that
   a. **"It is an integrated system consisting of multiple features, of which the water forms the center, and enclosed by substantial objects"** (p. 7).

v. River front development boundaries are difficult to determine and, in some instances, planning efforts might focus on a small part of a larger indistinct river front development area.

## 2.2 Terminologies

**Table 2.1 Terminologies (NIUA, 2020)**

| | |
|---|---|
| **Basin** | The entire catchment of a water body or water course including the soil, water, vegetation and other natural resource in the area |
| **Buffer area** | An area which extends beyond the floodplain or stream |
| **Catchment area** | Is the entire land area whose runoff from rain, snow or ice drains into a water body or water course. |
| **Channelization** | A method of river engineering that widens or deepens rivers to increase the capacity for flow volume at specific sections of the river |
| **Floodplains** | The area of a river or tributary which comes under water on either side of it due to floods corresponding to its greatest flow or with a flood of frequency once in hundred (100) years |
| **Ghat** | Sloped part of river or its tributaries with artificially constructed steps or ramp to provide easy human access to river for religious or other related activities |
| **Hardscape** | All such built elements which do not allow for the infiltration of water into the ground |
| **Runoff** | Flow of water that occurs when excess stormwater, meltwater, or other sources flow over the Earth's surface |
| **Stream** | Includes river, watercourse (whether flowing or intermittently dry), inland water (whether natural or artificial) and subterranean waters |
| **Wetlands** | Distinct ecosystems where water meets land which are inundated seasonally or perennially and are characterized by uniquely adapted aquatic plants and other flora |

## 2.3 Urban Riverfront

i. Urban riverfront can be defined as a particular space of the city which is physically attached to river or water sources.

ii. According to (**Wrenn et al., 1983**), urban waterfronts could be characterized by five different ways according to a location with water.

   a. Located on the peninsula,
   b. Located on a bay,
   c. Located on bank of a river,
   d. Located on banks of intersecting rivers,
   e. Located on a large body of water.

iii. In many cities around the world, **river front development areas began as commercial centres, transportation hubs and manufacturing centres**, as a central focus for them. However, due to complex and multiple problems such as **technology change, the historic preservation movement, increased environmental awareness and urban renewal**, a dramatic change in river front development areas was brought about and **they became large spaces of unused property** in the past thirty years or so.

iv. Whereas the early examples of river front development primarily focused on leisure and retail, contemporary schemes have a broader scope, many are set up with the aim to create attractive mixed urban environments that appeal to the imagination of people and persuade them to work there, to live there, or to visit these.

v. The **first river front** development projects were **started in North American** cities, in particular **Baltimore and Boston**, in the **1960s**. Nowadays, river front development is a global trend and thousands of schemes are being carried out in large metropolises medium-sized cities and even small towns all over the world.

vi. "Urban river front developments in North America have historically suffered from a lack of vision and management in their adaptations to successive demands for new functions. Traditionally river front development and growth has been disjointed and incremental, characterized by a web of loosely related decisions and actions by dozens of political jurisdictions and hundreds of entrepreneurs ".

vii. As per **New York City Comprehensive Riverfront Plan** there are four principal functions of the riverfront development

   a. **The Natural Riverfront**, comprising beaches, wetlands, wildlife habitats, sensitive ecosystems and the water itself.
   b. **The Public Riverfront**, including parks, esplanades, piers, street ends, vistas and waterways that offer **public open spaces** and riverfront views.
   c. **The Working Riverfront**, where water dependent, maritime and industrial uses cluster or where various **transportation** and municipal facilities are dispersed
   d. **The Redeveloping Riverfront**, where the land uses have recently changed or where vacant and underutilized properties suggest potential for **beneficial change**.

## 2.4 Evolution of Urban Waterfront Development

i. Humans' social, economic, and political needs have dramatically altered the morphology of urban waterfronts.

ii. Due to the comfort and security of the food, the accessibility of transportation, and the range of farming, the waterfront has historically been the first area of choice to reside. As a result, numerous cities grew next to the waterfront. (**Morena 2011**).

iii. The settlement was first intimately entwined with the nature and scenery of the waterfront, creating a unique landscape culture between water, habitation, and human. But rather than erecting a barrier between the city and the waterfront, the industrial revolution of the 19th century moulded the waterfront as a location for massive warehouses and mills. (**Kristiánová, K., 2018**).

iv. After the demise of ancient harbour locations, many industrial events and port facilities in city centres shifted to the outside and left wide urban expanses, particularly along waterfronts (Carlino & Saiz, 2008). (Gospodini, 2001). According to (Shangi, Z. A. D., Hasan, M. T. 2019), "the barrier between city and suburb dissolved that reconnected city people with natural environment again but waterfront stay undisturbed owing to flood threat" due to rapid building and population pressure in the inner city.

v. A new technique in the construction sector promoted waterfront redevelopment to serve social and recreational needs of city dwellers and to project a positive image internationally.

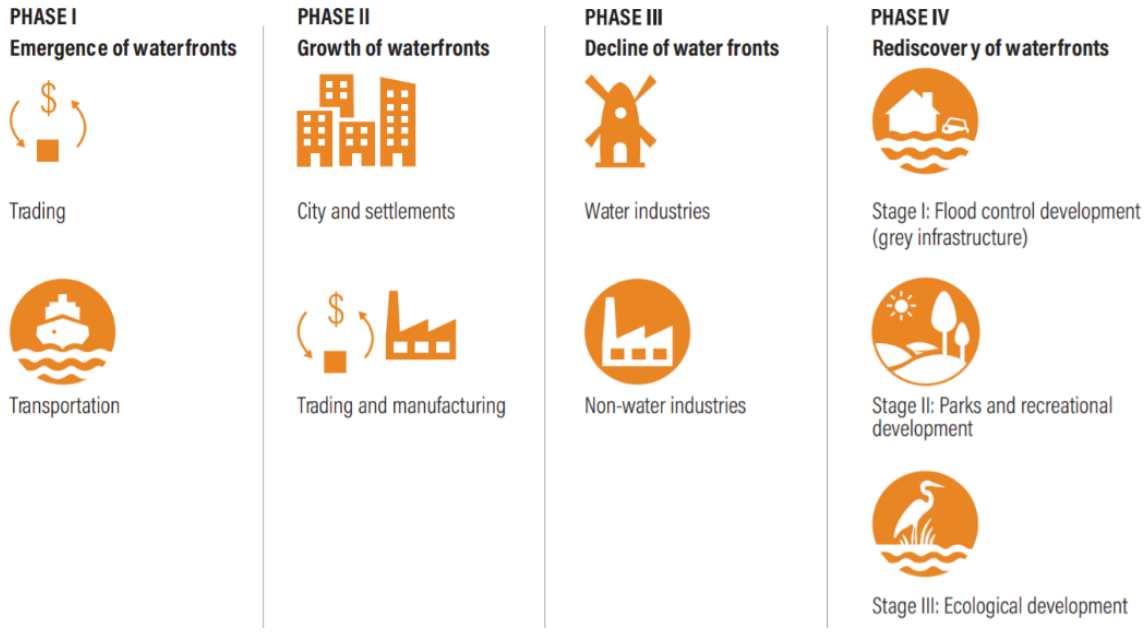



Figure 2.1 Evolution of Riverfront (NIUA, 2020)

## 2.5 Riverfront Development in India

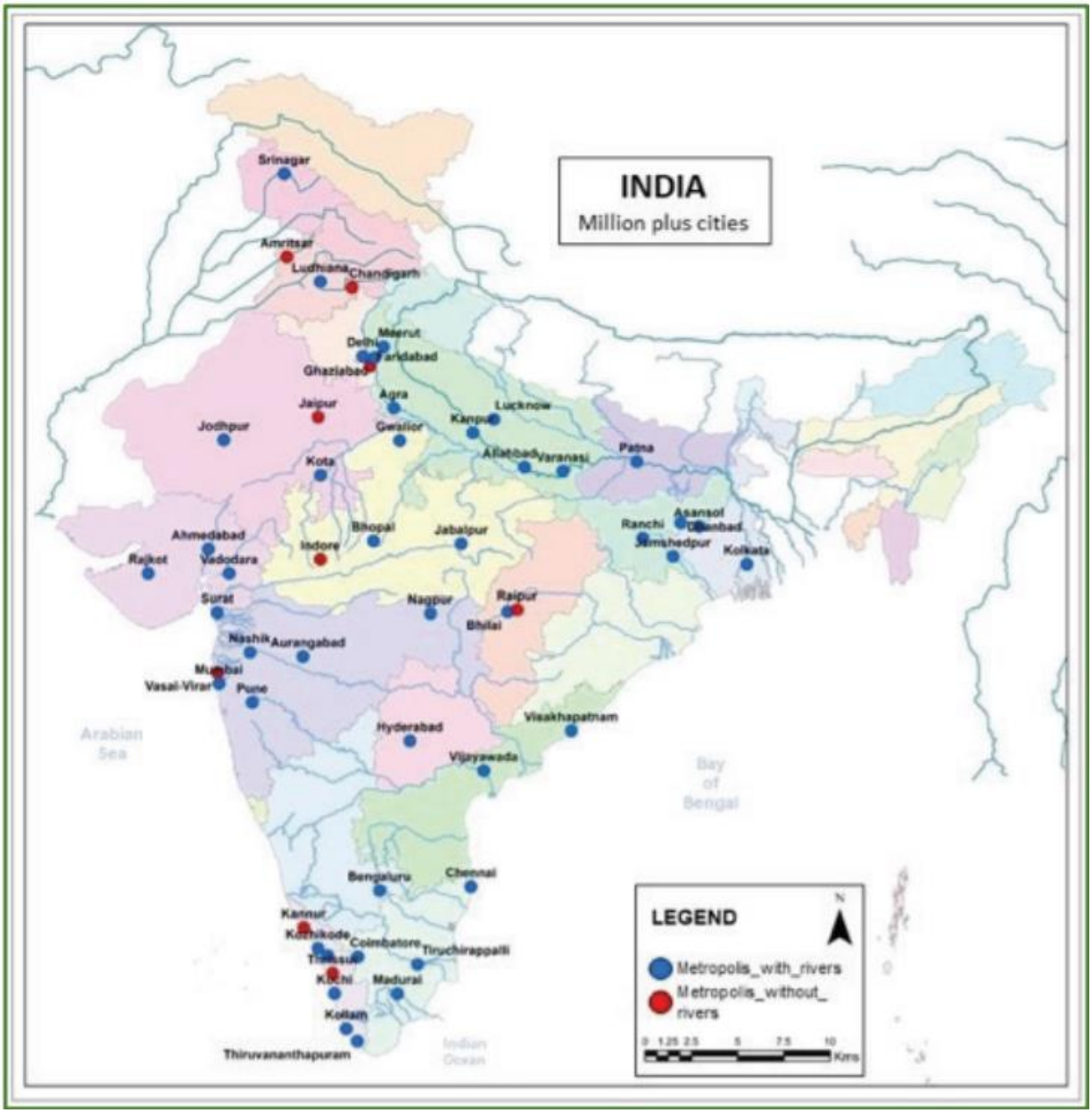
i. There is a wave of riverfront developments in India. UP governments ambitious project Gomti riverfront development in Lucknow is influenced from **first riverfront development project**, Gujarat's **Sabarmati Riverfront development**. There are several other similar riverfronts proposed on the banks of rivers in India.

ii. Riverfront developments are **cost rich projects that take few years of rigorous work for development**. It takes diversion of resources, government budget, labour, etc.

iii. **The fundamental elements of these projects include the construction of concrete wall embankments, reclamation of the river in floodplains, and commercialization of the reclaimed land.**

iv. Every riverfront project talks about the commercial beautification of the river but **none emphasizes on the betterment of its condition and ecology.** (**Anant Srivastava, April 2017**)

v. We have failed to comprehend how different species have changed as a result of diverse hydrologic variations in our rivers. Hydrologically distinct ecosystems and varied habitats have been preserved by rivers. The quantity and persistence of species are severely impacted by any significant variations in the volume, frequency, length, and timing of flow events. Venkatesh Dutta wrote in March 2018.




Map 2.1 Major Cities with Urban River in India (NIUA, 2020)

## 2.6 Role of Rivers in Indian Economy

### 2.6.1 Agriculture

Indian economy is considered to be an agro-based economy. Thus, to fulfill the need for agricultural activities, there is a high demand for water supply. Moreover, the area around the rivers is more fertile. Thus, it gives a better possibility to the farmers to maximize their yield.

### 2.6.2 Industrial Development

One of the biggest blessings of rivers is the development of dams and hydropower projects on them. They are used for generating hydroelectricity and irrigation purposes.

Apart from these the industrial waste of Delhi and its nearby areas are thrown into the river Yamuna which helps the industries of this area flourish.

Vast number of construction sites require river sand extracted from river banks, such as the river Sone in Bihar. So, rivers are quite essential for the development of big industries.

### 2.6.3 Inland Navigation

Rivers also act as a means of transport. Waterways are the best alternative as far as pollution is considered. Moreover, waterways are much cheaper than the former two.

### 2.6.4 Fishing

The livelihood opportunities provided by this sector have been instrumental in sustaining incomes of over 28 million people in India, especially the marginalized and vulnerable communities, and has promoted meaningful socio-economic development.

The Economic Survey states that in the total agricultural exports, the marine products' share is close to 19%, the highest of all.

### 2.6.5 Boosting Tourism

The amount of employment that these rivers generate for local communities is enormous. Lakes also provide ample space for sports like boating and water zorbing, etc.

In the past one and a half years, the tourism sector has suffered the most because of the two severe waves of the COVID-19 and lockdown. With the efforts like Aatm Nirbhar Bharat (self-reliant India), it is expected that when the COVID restrictions will ease, people will prefer to go to local tourist spots rather than to a foreign place.

### 2.6.6 Conclusion

People should also acknowledge the significance of rivers in the Indian economy and must do every bit from their respective ends. Or else the future generations would not be able to utilize the economic benefits of rivers.

## 2.7 Existing Policies and Regulations with influence on Riverfront Development

Some of the acts and policies by various authorities that are related to and in a way applicable to the study area that the dissertation focuses upon.

The purpose of each Act/Policy has been defined and the applicability of that particular act has been

Table 2.2 Acts Applicable to study area

| Act/ Rules | Purpose | Applicability | Authority |
|---|---|---|---|
| **Jal Jeevan Mission (URBAN), 2021** | This mission takes an integrated approach and recognizes that rejuvenation of water bodies and sustainable aquifer management will be critical to augment sustainable fresh water supply. | Urban green spaces and sponge cities will mitigate flood impact and **support development of urban water assets** (surface and groundwater) through circular practices for recycle and recharge of treated wastewaters. | Ministry of Housing and Urban Affairs, urban local bodies |
| **River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016** | For effective abatement of pollution and rejuvenation, protection and management of the River Ganga, **maintain ecological flows** through its entire length, impose restrictions as required on industries and processes abutting River Ganga and to make provision for inspection of premises, plants, machinery, etc., to assess their impact on the river. | This Order shall apply to the states comprising the River **Ganga Basin and its tributary** rivers and streams and will guide during plan, implementation and evaluation phases. | Ministry of Jal Shakti, State Ganga Basin Authorities |
| **National Water Policy, 2012** | The National Water Policy, 2012 is envisioned as a framework law that can support essential legislation on water governance at State and Union level. This law enshrines the value that water be considered as element that sustains life and ecology and not merely as a scarce resource that has to be divided among various competing uses. | Section 8: '**Conservation of River Corridors**, and Infrastructure' details the value of urban rivers.<br>Section 8.2: Encroachments and **diversion** of water bodies and drainage channels must not be allowed.<br>Wherever encroachment has occurred, **restoration** to the extent feasible should be undertaken and maintained properly. | Government of India, State governments, Ministry of Jal Shakti, Ministry of Housing and Urban Affairs |

| Act/ Rules | Purpose | Applicability | Authority |
|---|---|---|---|
| **Environment (Protection) Act, 1986** | To protect and improve overall environment. | As all environmental notifications, rules and schedules are issued under this umbrella act. | MoEFCC<br>CPCB, SPCB |
| **Land Acquisition Act, 1894 (as amended)** | Sets out rules for acquisition of land by government. | Applicable in case of acquisition of land. | Revenue Department, State Government |
| **Water Prevention and Control of Pollution) Act, 1974** | To control water pollution by controlling discharge of pollutants as per the prescribed standards. | This act will be applicable during construction phase and may be applicable during operational phase. | State Pollution Control Boards |
| **National Forest Policy, 1988** | To maintain ecological stability through preservation and restoration of biological diversity. | This policy will be applicable if any eco-sensitive feature exists in and around the project. | Forest Department, State Government and Ministry of Environment, Forests and Climate Change |
| **Wildlife (Protection) Act, 1972** | To protect wildlife in sanctuaries and national parks. | This act is applicable if any sanctuary/ national park exists within 10 km radius of project site.<br>This act will be applicable, if there are any points of protected wildlife crossings in proximity to project locations like River Dolphin, which is a schedule-I animal. | Chief Conservator Wildlife, Wildlife Wing, State Forest Department, Ministry of Environment, Forests and Climate Change |

## 2.8 Principles (Guidelines) for Riverfront Development

### 2.8.1 Riverfront development planning is often guided by following priorities:

i. Balanced land use

ii. Respect for limited resources

iii. Improved public access

iv. Safeguards for environmental quality

### 2.8.2 The general principles for riverfront development are set out below:

*2.8.2.1 Interconnected, linear riverfront development with broad public access*

i. Encouraging the use of the greenway as a daily commuter path and recreational amenity.

ii. Demonstrating the connection between access, greenway development and market demand.

iii. Creating a coherent, visually pleasing order to the water's edge

*2.8.2.2 Protection and enhancement of the natural environment*

i. Documenting the ecological state of the riverfronts in order to preserve this environmentally diverse natural habitat.

ii. Preventing and, where possible, eliminating inappropriate uses and practices from the rivers' edge.

iii. Protecting existing natural areas from development.

*2.8.2.3 Reclaim the city's identity as one of the best water cities*

i. Raising public expectations of what the city's riverfront offers.

ii. Attracting people, investment and the best aspects of urban living to the riverfront.

# CHAPTER 3

# Chapter 3. CASE STUDIES

## 3.1 Mutha Riverfront Pune

**Riverside restoration – city planner's viewpoint: case of Mutha riverfront, Pune, India**

S. Barve & S. Sen

Department of Architecture and Regional Planning, IIT Kharagpur, India

### 3.1.1 Aim of the study: The study provides a set of planning and design principles that will allow communities to reclaim urban river edges in the most ecologically sound and economically viable manner.

i. The total length of the river within the city is 10 km with an average width of 150 to 225 meters and an average depth of around 2 to 3 meters (CDP Pune)

ii. The Mutha riverfront is multi-functional with majority of the premises being residential, commercial and institutional buildings along with some heritage structures.


Map 3.1 Zoning for Development (Sen, 2011)

### 3.1.2 Criterions for study area delineation

i. Two major transportation corridors running parallel on both sides of the river as the limit.

ii. Commutable distance from the riverfront varying from 200m. to 1200 m.

iii. Population Density ranging from 8000 to 90,000 persons per sq. km.

iv. Catchment area of Major nallahs/creeks meeting the river.

i. River stretch divided into **4 stretches** depending on the land use characteristics and functions of that area.

ii. **Stretch 1 & 2 -** in the fringe and middle zone of the city respectively.

iii. **Stretch 3 & 4 -** located within the central area of the city

iv. These four stretches are again divided into **13 sub-zones** marked as A–M.

### 3.1.3 Proposals and Recommendations

The proposals and recommendations for Mutha riverfront development indifferent parts are as follows.

### 3.1.4 Characteristics of the river stretch

i. In order to accommodate the existing demand for housing in Pune available vacant land in the **stretch-1** should be allocated for residential use.

ii. Vacant lands along the river in **stretch-2** have the maximum potential for recreational and commercial development.

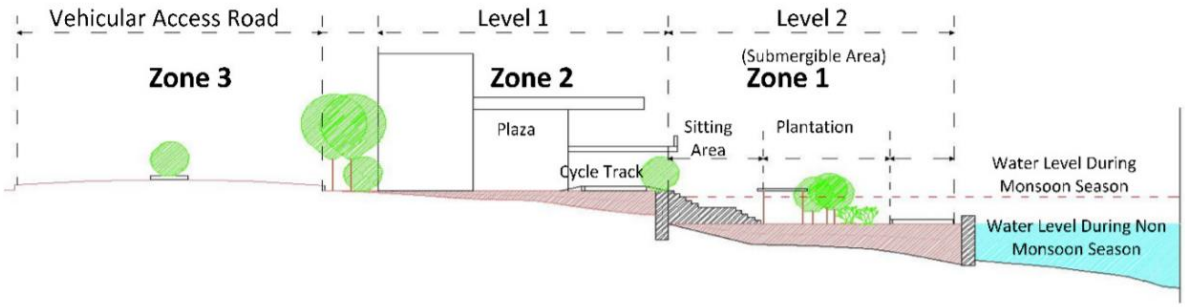
iii. Stretch-3 and stretch-4 zones are located within the central and core area of the city where not much of the vacant land is available on the river side.

### 3.1.5 Recommendations and development control guidelines for existing development.

- **Zone-1**, which is the strip near the riverbed, is subject to periodic flooding. Hence **no permanent structure** should be allowed to construct. Only design elements which could withstand periodic flooding during monsoon may be permitted to build.

- **Zone-2**, the area of land between the retaining wall and the vehicular access road, has the maximum potential for development and hence built structures including **sports center, restaurants, plazas, community halls** are proposed in this zone.

- **Zone-3**, which defines the boundary of riverfront area may be used for **vehicle parking areas**. All the controls follow the topography of river section.




Map 3.2 Section along river (Sen, 2011)

### 3.1.6 Proposal for improvement of transportation network.

i. The riverfront offers a good opportunity for laying a road network along the river that would connect various areas within the city.

ii. Existing 2.5 km long riverside road in Stretch-2 should be continued along most of the part of the riverfront that will **provide a good access to riverfront** activities.

iii. All other **major roads should be widened** and improved to accommodate enhanced concentration of recreational and associated commercial facilities providing sufficient space for parking of two wheelers and cars in this stretch.

### 3.1.7 Rectification Strategies

i. **Additional STPs and Pumping stations** at the meeting point of creeks/nallas.

ii. **Stream Channelization** of the river and major nallas.

iii. **Silt removal** from time to time and gradient correction.

iv. **Slum relocation** was also advocated to a nearby location.

v. **Provision of garbage disposal units**.

vi. **Financial Assessment of project** – Net Present Value (NPV) indicated project will be profitable. (Through selling of developed govt. property and implementation of projects with external assistance.

### 3.1.8 Conclusion

i. For better bonding between the river and city it is necessary to open up riverfront and make it accessible to public.

ii. On the other hand due care should be taken to prevent the river environment from degrading through excessive public use.

iii. This can be achieved by optimal land use planning for the riverfront areas and implementing the activities that are most suitable for the delicate balance of the river environment.

## 3.2 A case study of Godavari riverfront development, Nanded city

Moxa Rajeshbhai Patel, Prof. Himanshu J. Padhya, Prof. Zarana H. Gandhi

Faculty of Civil Engineering, 1Sarvajanik College of Engineering & Technology, Surat, India

3.2.1 **Aim of the study:** To connect the city to the river, make it more accessible and usable by the residents. The study attempts to assess the masterplan of Godavari riverfront.


Map 3.3 Godavari Riverfront

### 3.2.2 **(Moxa Rajeshbhai Patel, 2020)**

i. Godavari river is the second longest river in India after the river Ganges.

ii. Kumbh Mela is a mass Hindu pilgrimage in which millions of pilgrims gather on banks of Godavari in Nashik city to bathe in a sacred river.

iii. It is most popular for the Takhat Sachkhand Shri Hazur Abchalnagar Sahib Gurudwara (Sachkhand Gurudwara), one of the five Takhats of the Sikh religion.

iv. The master plan divided the 5 kms on north and south bank into five zones each.

v. These zones identified the assets and constraints for each zone to generate a proposed set of components, which were unique and yet tied in the complete waterfront together.

### 3.2.3 Key components of the project include:

i. Ghats, Pathways and promenades and buildings for social infrastructure

ii. Revival of natural drainage systems and Solid waste management

iii. Parks, gardens, street plantation

iv. Facilities like, Lighting, Street furniture, artwork, sculptures

v. Reorganizing cremation activity

Map 3.4 Godavari Riverfront, Nanded City (Moxa Rajeshbhai Patel, 2020)

## 3.3 Case Study-3

## 3.4 Analysis prospect of sustainable riverfront development in Historical region around khan river, Indore

Neelam Kushwah and Ashad Mehmood

Associate Professor, IPS Academy, (Indore, Madhya Pradesh, India)

3.4.1 **Aim of the study:** The purpose of this article is to investigate ways to enhance river redevelopment, execute it, and construct a vibrant and appealing riverfront area along the Khan River in Indore. It doesn't hold freshwater but instead has become polluted over the period of time carries sewage due to pollution.

i. Length of River Khan in urban area 21 kms

### 3.4.2 Issues Identified

3.4.2.1 Khan River Industrial pollution:

A number of light industrial units directly discharge untreated toxic effluent into Khan River.

3.4.2.2 Pollution by waste disposal:

There is no appropriate waste disposal system on the bank of the Kahn River. Different types of waste are disposed of into the river

3.4.2.3 Illegal activities:

Concrete structure builds and Tin-shed after filling up a vast stretch of Khan River

Encroachment still continues on the bank of Khan River posting a hazard to the river upstream

### 3.4.3 The Project Emphasized upon:

i. Protected the **quality of water** and the environment.
ii. Waterfronts are the part of the present **urban fabri**c.
iii. The **historic uniqueness** gives attractiveness.
iv. **Mixed-use** is the priority.
v. **Public access** is a requirement.
vi. Planning in **public-private** companies speeds the course.
vii. **Public contribution** is an element of sustainability.
viii. Waterfronts is **long term** projects.
ix. Regeneration is a **continuing** process.
x. Waterfronts revenue from global interacting

### 3.4.4 Proposal

i. **River Network:** To make it easier for people to walk and sit and chat with one another, there should be a wide pedestrian pathway (30–40') along the riverside.
ii. **Embankment and Road along Khan River:** For the purpose of enhancing traffic flow and protecting the riverside. The road should be 300 feet away from the bank of the river.

iii. **Parks and Open Spaces**: The proposed sites for parks measuring 2.5 acres and 7.5 acres should remain open to the public for leisurely visits.

iv. **Shops:** There should be a few modest shops along the river, but no big box stores or department stores.

v. **Vehicles:** The areas surrounding footpaths are off-limits to motorised vehicles.

vi. **Picnic spot:** Using some specific initiatives, make the area more appealing.

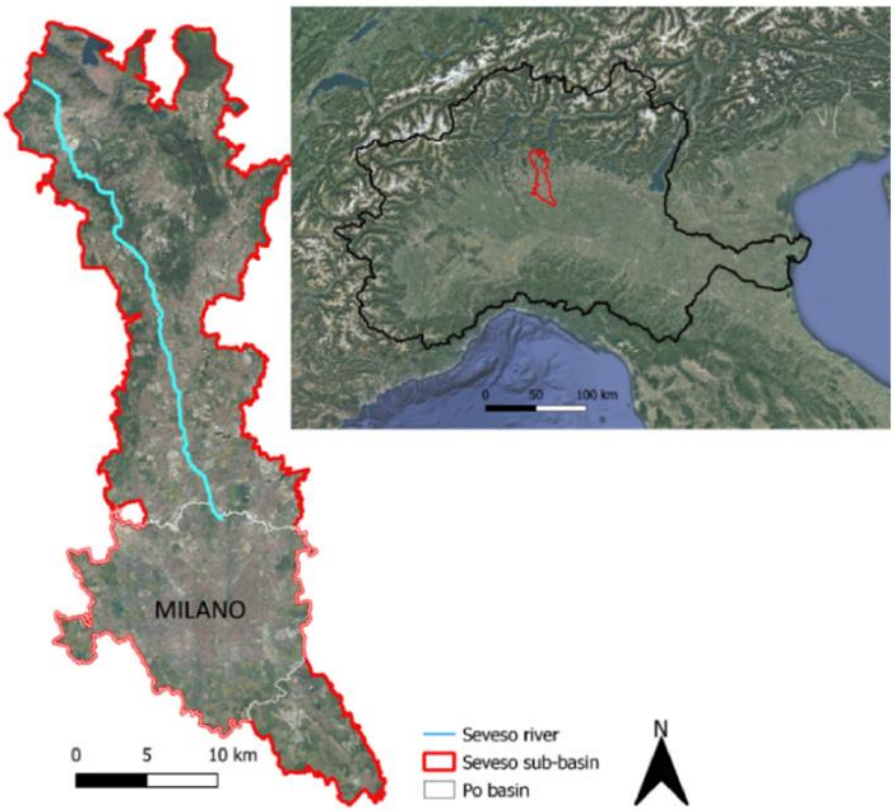
### 3.4.5 Conclusion:

The results showed that Indore does not presently have satisfactory regulations and guidelines to control riverfront development.

## 3.5 Case Study – 3 Soveso Riverfront, Milan, Italy

FRANCO RAIMONDI et all.

Politecnico di Milano, Italy




Map 3.5 Soveso River, Milan (RAIMONDI, 2020)

3.5.1 **Aim of the study:** To assess some effects arising from the applications of river restoration and sustainable urban drainage techniques.

- **Project idea:** Redevelopment of the river environment in the north of Milan, precisely a stretch of about **2 km of the Seveso River** within the Parco Nord, between the municipalities of Milan, Cormano and Bresso.
- The area presents itself as one of the most critical of the basin as regards the flood risk, due to the percentage of waterproofed surface.
- In particular, soil sealing has drastically reduced the percentage of rainwater infiltration and the concentration time by increasing the surface runoff.
- To **reduce the risk of flooding**, they have relied on channelization, artificialization of the riverbed and the riverbanksand flood detention basins.
- These solutions have not always led to satisfactory results and have often only **moved the problem downstream** and contributed to **worsening of the water quality and the river ecosystem**.

### 3.5.2 Recommendations

3.5.2.1 De-waterproofing of the car parks:

i. Coating of parking surfaces with techniques that facilitate the infiltration of rainwater determines a reduction of the polluting load especially related to suspended solids and in some cases also to some heavy metals being trapped in the previous asphalt without soil contamination.

ii. Moreover, it is well known that pervious pavements have the capability to delay runoff reducing peak discharge.

3.5.2.2 Insertion of scrapers, boulders and brushes:

i. This will increase the turbulence locally and contribute to lowering the water temperature and improving oxygenation, aspects useful for removing of excess nutrients. It also has a positive effect in improving coarse particulate organic matter retention too.

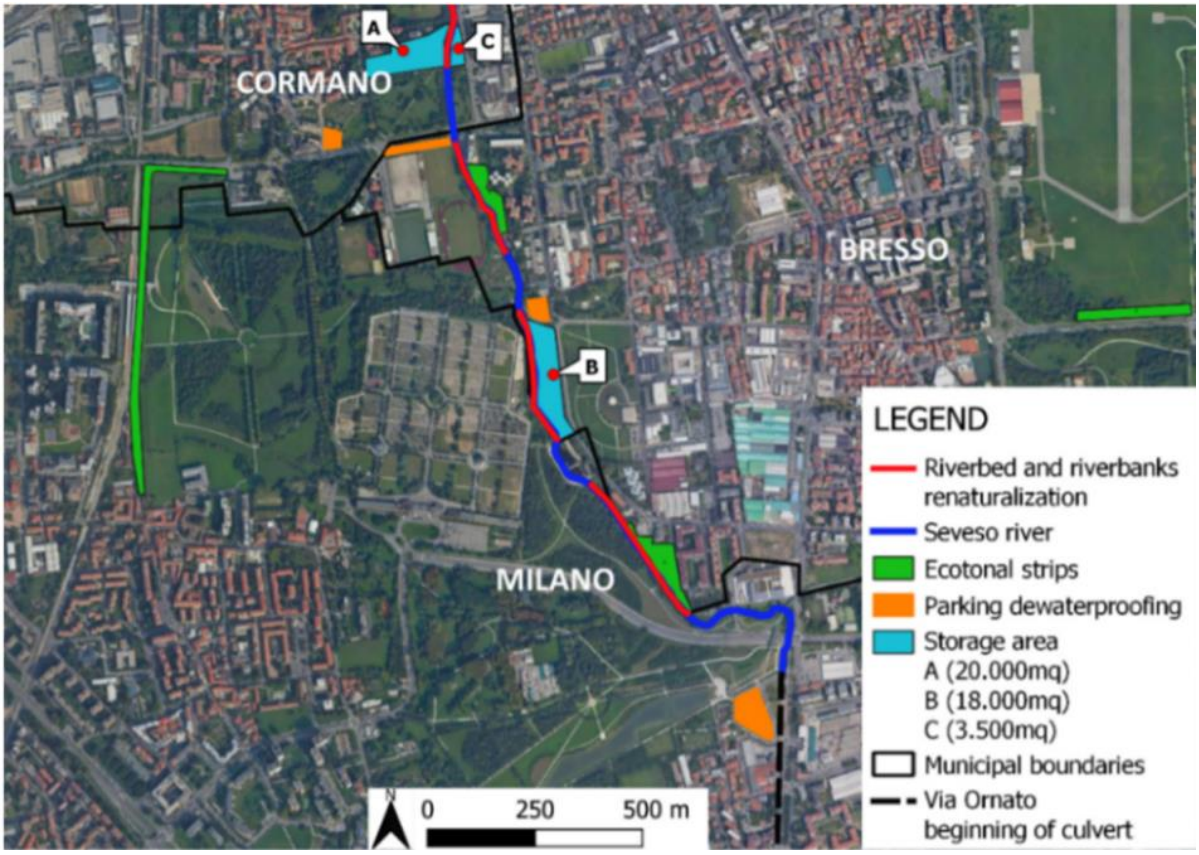
ii. In addition, these solutions, if well designed, allow the current to be conveyed to the center of the riverbed during lean periods, avoiding the formation of stagnant pools and therefore of poorly hygienic conditions.

3.5.2.3 Introduction of ecotonal strips on the roads:

i. Allows pre-treatment of rainwater while beyond riverbanks they contribute to **stabilize** and offer refuge and **sustenance** for the numerous species of **birds and small mammals** that live in the park, partially giving back to the river the role of ecological rod which belongs to it.

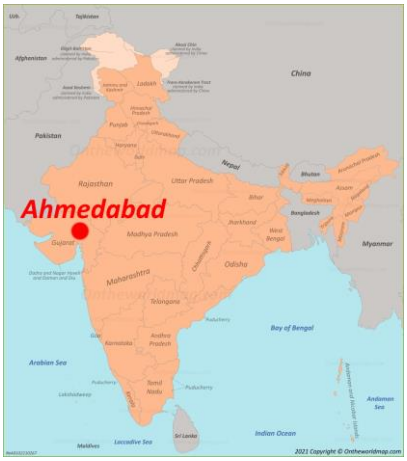
### 3.5.3 Conclusion

Coating of parking surfaces with techniques that facilitate the infiltration of rainwater determines a reduction of the polluting load especially related to suspended solids and in some cases also to some heavy metals being trapped in the pervious asphalt without soil contamination.

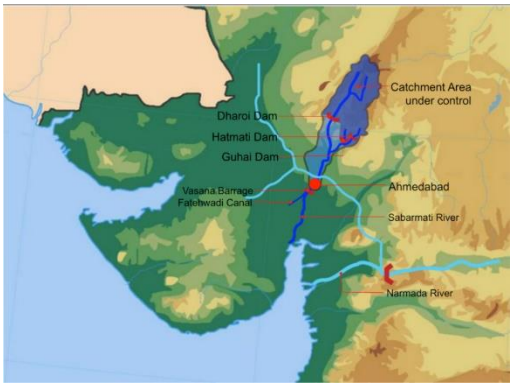



Map 3.6 Soveso Riverfront, Milan (RAIMONDI, 2020)

## 3.6 Case Study-4 Sabarmati Riverfront, Ahmedabad




Map 3.7 Location of Ahmedabad in India Map (mapworld, 2014)




Map 3.8 Sabarmati River (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.1 (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.2 Why Ahmedabad


Figure 3.1 Issues with Sabarmati Riverfront

i. Due to increase in urban pressures, carrying capacity of existing sewage system falling short and its diversion into storm water system releasing sewage into the river.

ii. **Illegal sewage** connections in the storm water drains.

iii. **Open defecation** from the near by human settlements spread over the entire length.

iv. Discharge of **industrial effluent**

v. Illegal construction/**encroachment** of huts/slum on the river bed.

### 3.6.3 Proposed Land use of Sabarmati Riverfront

Table 3.1 Landuse Classification of Sabarmati Riverfront (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

| Sr. No. | Sanctioned Land Use | Area Sq. m | Area | % |
|---|---|---|---|---|
| 1 | Road | 4,44,378 | 44 | 22 |
| 2 | Garden | 2,74,585 | 27 | 14 |
| 3 | Open Space | 3,71,198 | 37 | 18 |
| 4 | Public Purpose | 2,88,875 | 29 | 14 |
| 5 | Lower Promenade | 2,66,462 | 27 | 13 |
| 6 | Multi Purpose for sale | 2,94,083 | 29 | 14 |
| 7 | Sports | 72,503 | 7 | 4 |
| 8 | Residual(Utilities, Residential, Commercial, General, Education) | 15,787 | 2 | 1 |
| | | 20,27,871 | 202 | 100 |

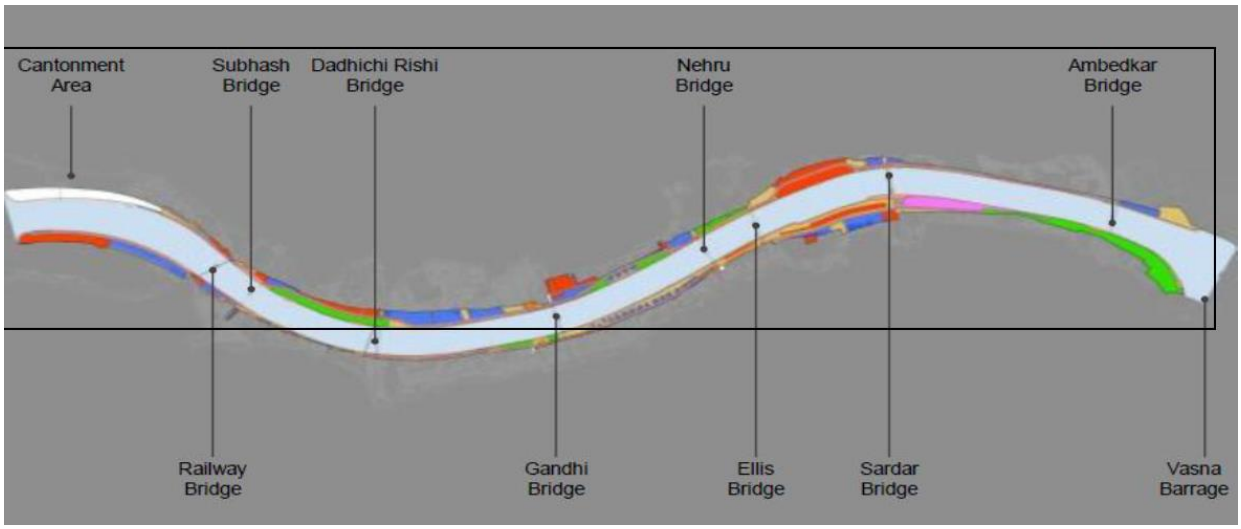
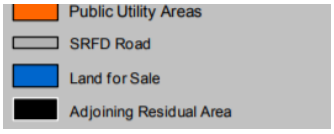



Figure 3.2 Landuse map of Sabarmati Riverfront (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)



The proposed development is of mix land use that includes commercial, recreational and residential developments within the both side of river bank from **Gandhi Bridge to Sardar Bridge.**

### 3.6.4 Key objectives of the project were:

At the outset, the project was envisioned as a multidimensional environmental improvement, social uplifting, and urban rejuvenation project. were to:

i. Make the riverfront **accessible** to the public.
ii. Stop the flow of sewage, and keep the river clean and **pollution free**.
iii. Provide a site for the permanent **re-housing** of informal settlements along the riverbed.
iv. **Reduce the risk of erosion** and overflow to flood-prone neighborhoods.
v. Create **vibrant riverfront** with parks, promenades and ghats (steps leading to the river) to enjoy the water.
vi. Provide Ahmedabad with new cultural, trade and social **amenities**.
vii. **Generate resources** for paying project costs.
viii. **Enhance connections** between the east and west sides of Ahmedabad.
ix. Create a **stronger identity** for Ahmedabad.
x. **Revitalize riverfront** neighborhoods, and rejuvenate Ahmedabad.

### 3.6.5 "Ravivari" - Gujari Bazar - Sunday Market

i. It is an age-old Sunday market, where 40% of traders were women and half of them describe themselves as Dalits. It was unhygienic and also there is a risk of flood in monsoon.

Figure 3.3 Ravivari Market (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

Figure 3.4 Ravivari Market at Sabarmati Riverfront (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.6 Dhobi Ghat

i. Around 172 Dhobis were using both the bank of the river for washing activities.On the eastern bank of the river near Vasna Barrage is constructed as dhobi ghat spread over approx. 9400 sq.mt area has utility area of about 600 sq.mt.

ii. There are seven blocks in modern Dhobi Ghat, and each block has 24 units with well-developed water supply and drainage system with a water meter for inlet wa tering.

Figure 3.5 Dhobi Ghat along Sabarmati Riverfront (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.7 Event Area

- Earlier the dry river bed was used to host events like circus and cricket etc.
- However, a mega city like Ahmedabad requires a proper event management ground facility.

- An area of 60.00 aq.mt, spread between Sardar Bridge and Ellis Bridge on the west bank has been designed for hosting events such as the Kite Festival, the Marathon, the Cyclotron and Garib Kalyan Mela are organized.

Figure 3.6 Event area along Sabarmati Riverfront (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.8 Urban Forestry

i. Between Vasna Barrage and Ambedkar Bridge, the unique afforestation project is situated over 1 lakh sq.mt area. The natural forestry is being developed with different plant species from Gujarat, including certain very rare species.

Figure 3.7 Urban Forestry along Sabarmati Riverfront (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.9 Sewage System

i. Earlier the sewage from 36 drainage points directly falls into the river that makes the water dirty, mosquito ridden and unhealthy environment.

ii. Now, there is an extreme change in the environment around the river because all sewage goes to a pumping station for transformation it to river quality.

Figure 3.8 Sewarage System (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.10 Promenade

This project's two-level, continuous path for pedestrians and bikes created just above the water's surface on both sides of the riverbank is a major component. Therefore, there won't be any private ownership of riverbanks, and the entire stretch is public property.

Figure 3.9 Promenade along the Riverfront (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.11 Public Garden/ Flower Garden

For parks and garden space 27% of project land is developed. There are three gardens.

- Garden of 60000 sq.mt between Subhash Bridge and Dadhichi Bridge;
- Garden of 25000 sq.mt at Usmanpura between Gandhi Bridge and Nehru Bridge on West bank.
- Flower garden of 40000 sq.mt near event area on west bank of the river.

Figure 3.10 Public Garden (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.12 Water Recreation

- Various water sports are provided in the project on both sides of the river bank. Boating facilities are available on both side of the river bank in different places. For the future plan, there will be a zip line, Amphibian bus, Sabarmati Darshan through ferry and adventure water sports.

Figure 3.11 Water Recreation (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.13 Project Benefits and Impacts

i. Now it is possible to **retain surface water** in the river all year around.

ii. The ground **strata are recharged** with storage of 12.5 million cubic meter river water.

iii. More than 250 MLD **sewage is diverted** from the river and pollution is eliminated.

iv. The river is protected from the scour and **stopped the erosion** of the river banks with Diaphragm walls.

v. 202 ha. **land is available by retaining wall** on both sides for further development for the city and flood protection.

vi. The embankments provided with wide walkways, green space with tree plantation and many other facilities.

vii. Rehabilitation of resettlement of 10000 slum dwellers in great pukka houses.

viii. **Traditional users** of a river like washer men and unorganized vendors are now provided with organized facilities.

ix. **Easy access** to the river water through Ghats, Stairs/ Ramps.

Figure 3.12 Double Promanade at Sabarmati Riverfront (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

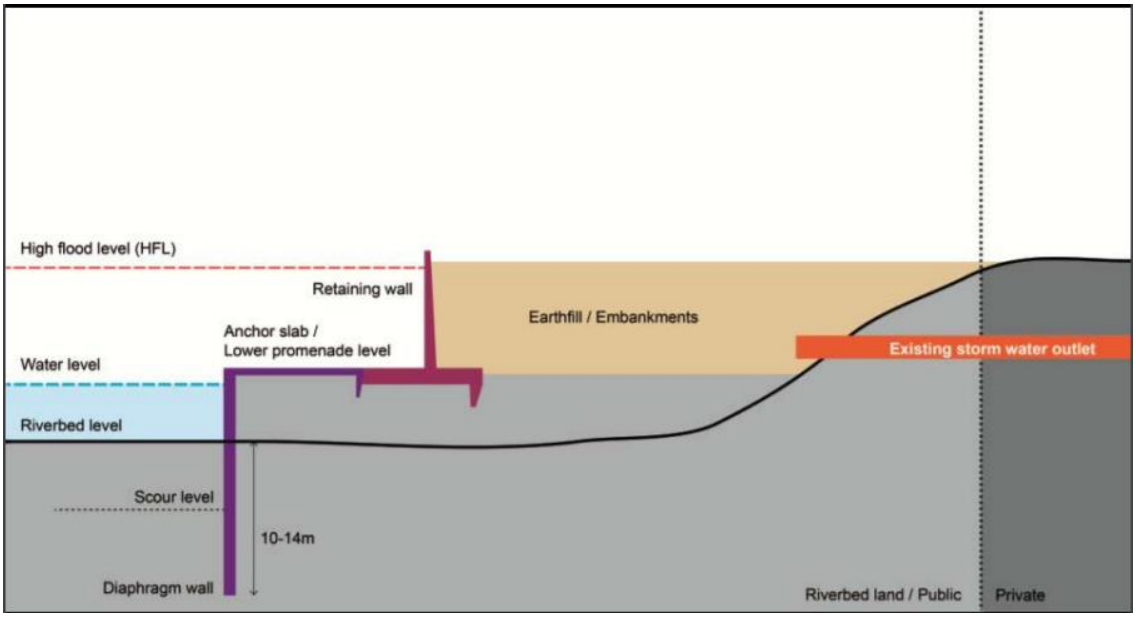



Figure 3.13 Section of Sabarmati Riverfront (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth, 2015)

### 3.6.14 The project is basically divided into four stages:

3.6.14.1 Stage 1 – Laying the Groundwork (1999-2003)

**3.6.14.2** While the scoping of the project was undertaken, the project team pursued the issue of land transfer clearance from the Irrigation Department for Reclamation. This land transfer was critical without which the project could not proceed further. Although the application for the land transfer was made in February 1999, it was only in 2003 that the land transfer process was finally completed due to delays with valuation. Stage 1 included:

- **Irrigation clearance** (June 1999)
- **Land Transfer** (February 1999 – April 2003
- **Soil testing** report (2000)
- **Structure design** (2000)
- **Proof checking** for structure design (2000)
- **Infrastructure design** (2001)
- Finance **feasibility study** (2001)
- **EIA Report** – CEPT and GEC (2002)
- Selection of construction technologies (**Value Engineering**)

**Stage 2 – Launch (2003):**

The project was formally launched by the Chief Minister of State in 2003. However, the Commissioner of Ahmedabad decided to move the project further northward for unclear reasons. This would have placed the entire project outside the city, undermining its role in urban revitalization. The hasty change for approval undermined various members of the board. Before the idea of moving the project northward could materialize, however, the Commissioner was transferred, saving the project.

**Stage 3 – Pilot Projects and Key Infrastructure (2004 – 2010):**

In 2004, the **construction of the pilot project** was initiated to finalize technology for constructing the retaining walls. After this pilot process was completed, **contractors were selected** from several rounds of proposals and construction was initiated in 2007.

**Stage 4 – Significant Completion and Use (2011 – Present):**

**Major infrastructure improvements** were undertaken from 2007 to 2009 including the construction of underground interceptor sewer lines along both banks and **diaphragm walls**. Given that the construction posed little threat to the informal settlements in the vicinity, no significant relocation was undertaken at this time.

Relocation commenced beginning in 2010 for the development of the upper level promenade and streets. From 2011 onward, sections of the riverfront development started to open to the public. To date, a majority of the lower promenade and two public parks have been opened, and the alternative site for the Ravivaari has been opened as has the Dhobighat. Several elements have not been constructed, such as a city level exhibition and conference facility and a large Ferris Wheel.

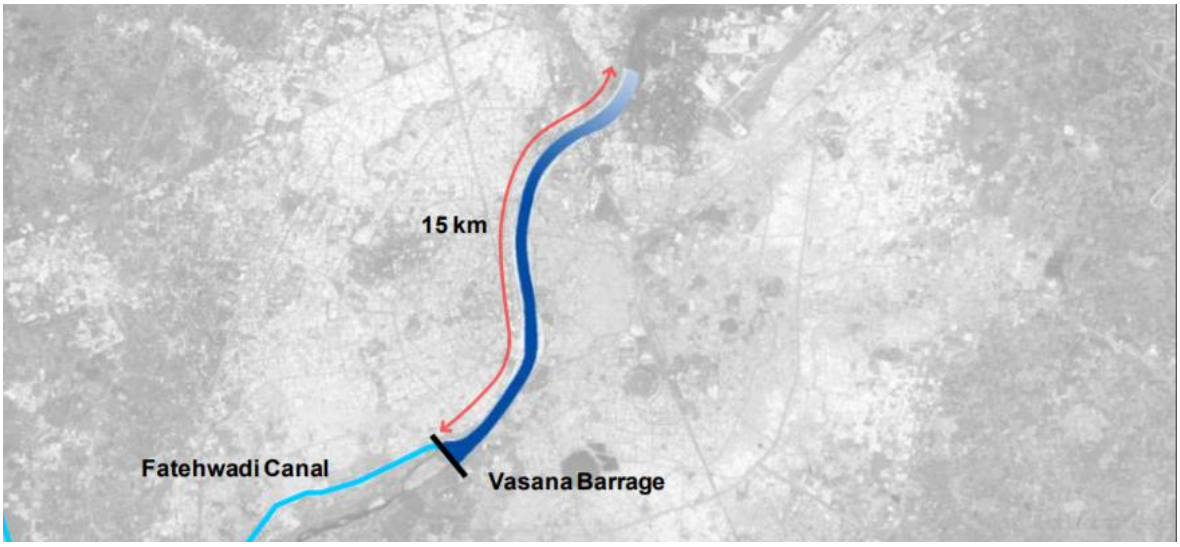



Figure 3.14 Sabarmati Riverfront During construction (Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth. 2015)

## 3.7 Summary

Table 3.2 Summary of Case Studies

| Case study | Author, Year | Aim | Recommendations | Inference |
|---|---|---|---|---|
| Mutha riverfront, Pune | S. Barve & S. Sen 2011 | The study provides a set of planning and design principles that will allow communities to reclaim urban river edges in the most ecologically sound and economically viable manner. | 1.Division of Riverfront in 4 sectors<br>2.Land use proposals on identified vacant lands.<br>3.Development control guidelines for existing development.<br>4.Improvement of transport network<br>5.Rectification strategies. | • Categorization of river zones<br>• Methods for gathering information |
| Godavari riverfront, Nanded | Moxa Rajeshbhai Patel et al, 2020 | To connect the city to the river, make it more accessible and usable by the residents. | 1.Ghats, Pathways and promenades<br>2.Natural drainage systems revival and SWM<br>3.Reorganizing crematorium | • Identifying the components related to riverfront development |
| Khan riverfront, Indore | Neelam Kushwah and Ashad Mehmood, 2017 | To study how to improve and implement the redevelopment of river and create energetic and attractive riverfront | 1.Pedestrian Network<br>2.Embankment and Road<br>3.Parks and Open Spaces<br>4.Small shops<br>5.Picnic spot | • Identifying the methods of redevelopment of riverfront |
| Soveso Riverfront | Franco Raimondi et al 2020 | To assess some effects arising from the applications of river restoration and sustainable urban drainage techniques. | 1.De-waterproofing of the car parks<br>2.Insertion of scrapers, boulders and brushes<br>3.Introduction of Ecotonal buffers | • Innovative ad-hoc methods can be used and implemented. |
| Sabarmati riverfront development | SRFDCL | Envisioned as multidimensional (environmental improvement, social uplifting, and urban rejuvenation) project | 1.Ravivaari<br>2.Dhobi ghat<br>3.Event Area (Public Space)<br>4.Promenade | • Logistics of the stages for development |

## 3.8 Conclusions / Analysis (Learnings from the case studies)

The riverfront development can be clubbed into the following four components based upon the type of interventions proposed.

1. Physical interventions which is Ecologically sensitive and Economically vaible
2. The new development along the riverside
3. Connectivity and Identity
4. Resettlement/Rehousing of the informal settlements.

3.8.1.1 Derived Thesis Topic

**Comprehensive Eco-Management plan with specific strategies for economy generation, Gomti riverfront, Lucknow**

# CHAPTER 4

# Chapter 4. Analysis and Key Issues

## 4.1 Lucknow

Lucknow city is surrounded by its rural towns and villages like the orchard town of Malihabad, historic Kakori, Mohanlalganj, Gosainganj, Chinhat, Itaunja. On its eastern side lies Barabanki District, on the western side is Unnao District, on the southern side Raebareli District, and on the northern side the Sitapur and Hardoi districts. The Gomti River, the chief geographical feature, meanders through the city, dividing it into the Trans-Gomti and Cis-Gomti regions. Lucknow city is located in the seismic zone III.

Lucknow has a warm humid subtropical climate with cool, dry winters from December to February and dry, hot summers from April to June. The rainy season is from mid-June to mid-September, when Lucknow gets an average rainfall of 896.2mm (35.28 in) from the south-west monsoon winds, and occasionally frontal rainfall will occur in January. In winter, the maximum temperature is around 25°C (77F) and the minimum is in the 2-to-3-degree Celsius range. Fog is quite common from late December to late January. Summers are extremely hot with temperatures rising to the 40 to 45°C range.

## 4.2 Geography

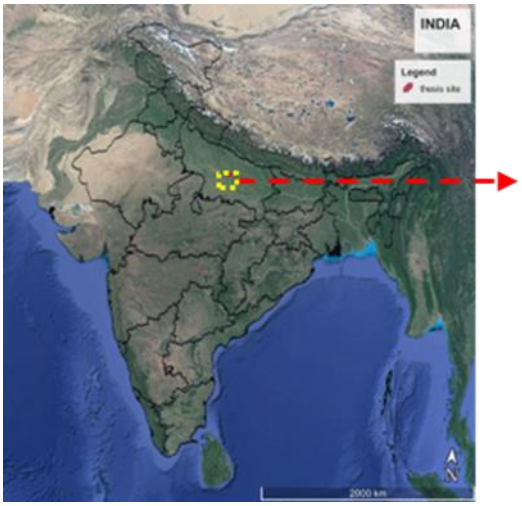
Lucknow, the capital of Uttar Pradesh is situated 23 Mts. above sea level. It is situated on 26°30'- 27°10' North latitude and 80°30'- 81°13' East longitude. Lucknow covers an area of 2528 km2. It is surrounded on the eastern side by District Barabanki, on the western side by district Unnao, on the southern side by Raebareli and on the northern side by Sitapur and Hardoi districts. City is located on the north-western shore of Gomti river, which flows through the city. Some of the tributaries of this river are Kukrail, Loni,

Beta etc. Sai river flow from the south of the city and in the east enters district Raebareli.

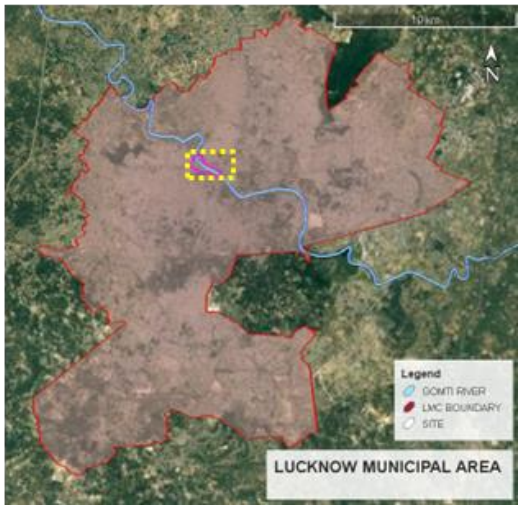
Lucknow is accessible from every part of India through Air, Rail and Road. It is directly connected with New Delhi, Patna, Calcutta, Mumbai, Varanasi, Bangalore, Thiruvananthapuram and other major cities by Chaudhary Charan Singh airport.

## 4.3 Site

The chosen project site presents multiple opportunities for an inclusive integrated redevelopment. However, the absence of immediate planning interventions would threaten to irreversibly damage the heritage of the area.




Map 4.1 India Map




Map 4.2 India Map

### 4.3.1 Justification for site Selection

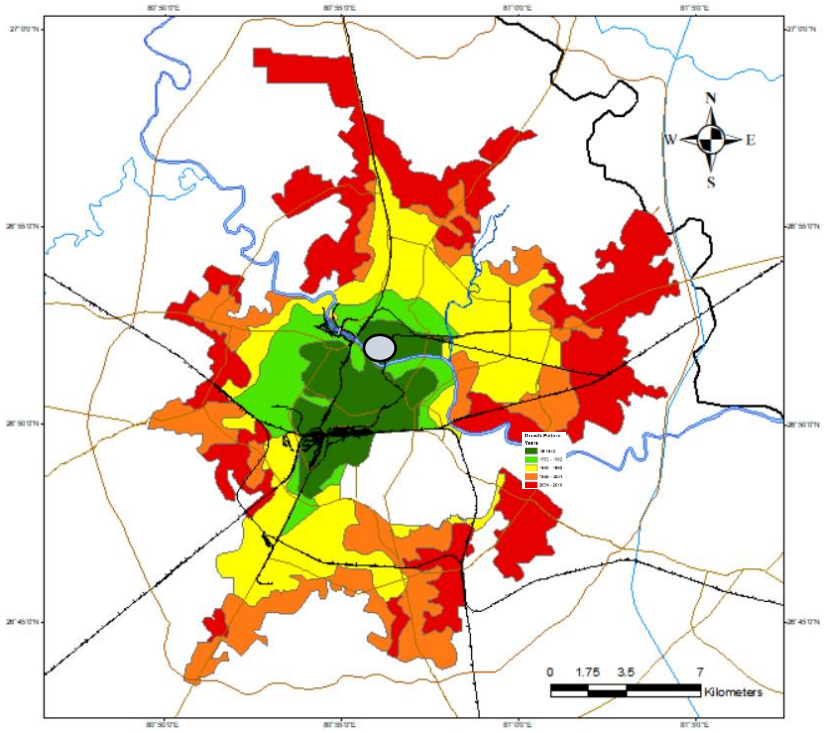
**i.** The site, contains very special character in itself as it is located along the heritage zone of Lucknow, which suggests that probably this was where the oldest settlements along the river had started.

**ii.** Not much attention is given to this stretch and least action being taken to revive this river stretch which has a strong potential to be linked to the heritage zone which shall act as a major tourist attraction and can contribute to a good percentage of revenue generation through tourism.

**iii.** This is the part that has the maximum opportunity with barren land parcels left underutilized which houses a number of informal activities which are being practised along the river.

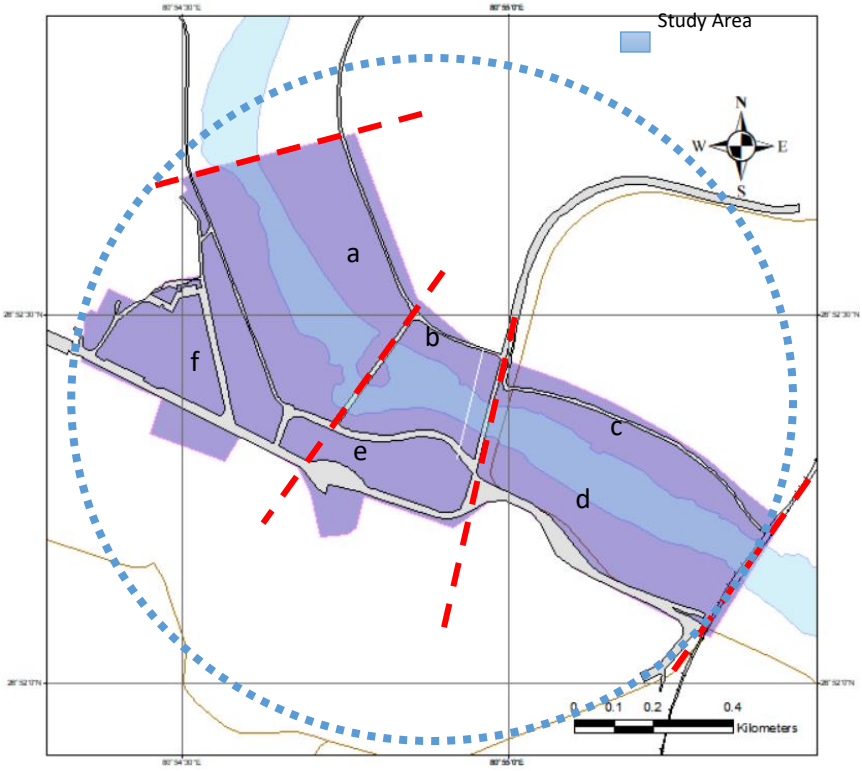
iv. The Indigenous Inhabitants can be made stakeholders with formalization of their informal activities along the river edge. These will include the fishermen, Washermen, Boatmen, Cattle herders, etc.

v. Open dumping sies and open defecation is creating unhygienic living conditions for residents.

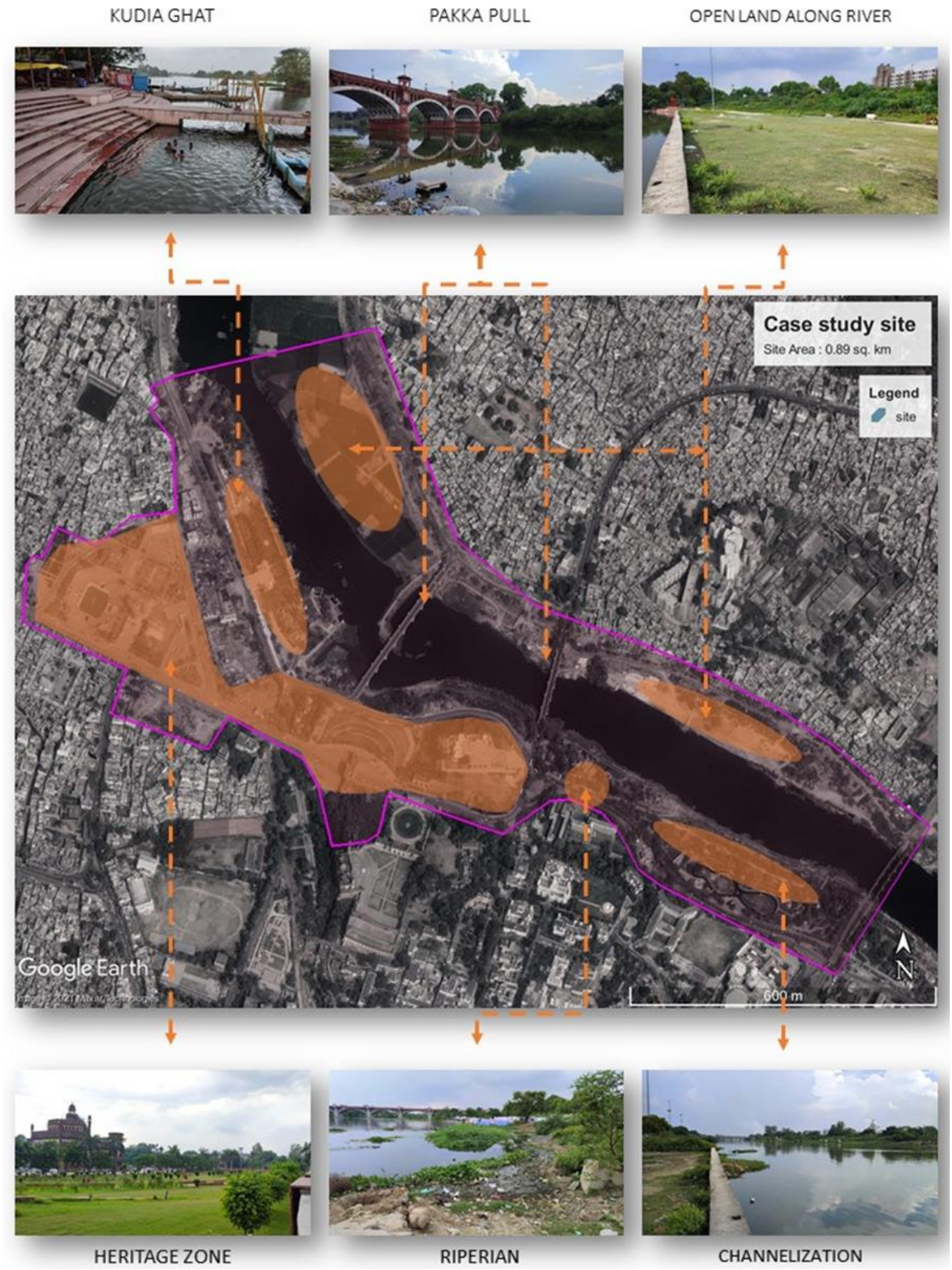



Map 4.2 Growth Pattern of Lucknow (City Development Plan, 2014)

Map 4.4 Study Area




Study Area

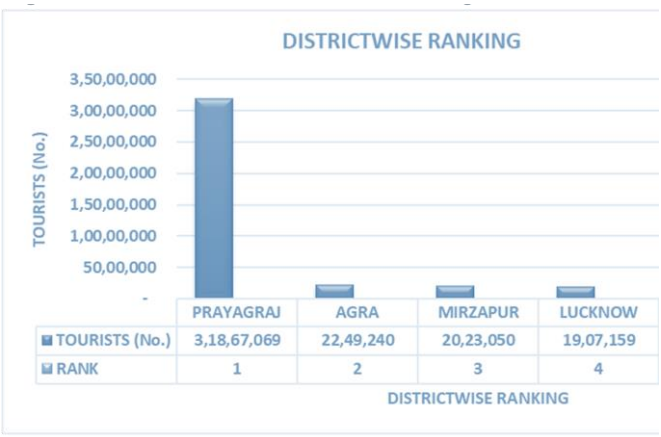



*The above map is the blow-up of the case study site with a magenta outline which accommodates an area of about 0.89 Sq. Km. Relevant site pictures taken recently has been attached to each of the land parcel to identify the issues and find potential solutions.*

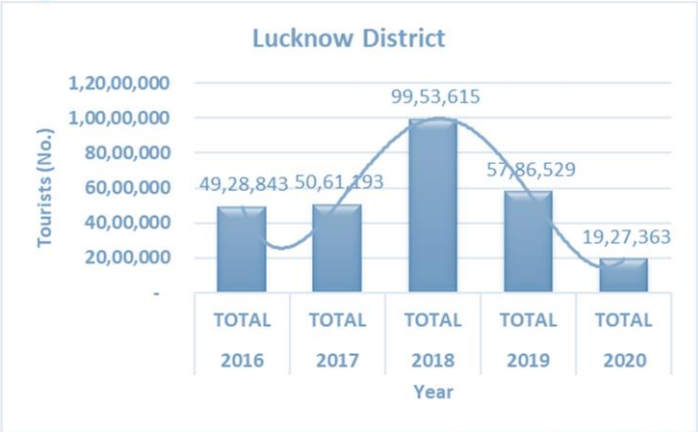
## 4.4 Tourism

i. Tourism is the only industry which is privately driven leading to job opportunities created in every nook and corner of the country.
ii. With a multiplier of 1.9236, direct and indirect contribution of tourism to Gross value added (GVA) was estimated at 5.35% in 2015–16.
iii. The direct and indirect share of tourism employment to the total employment comes out to be about 12.38%.

Figure 4.2 Tourist Places in Lucknow (uptourism, 2020)




Graph 4.1 District wise total tourist footfall ranking in UP (uptourism, 2020)




*Source: uptourism, 2021*

Graph 4.2 Annual Tourist Visit Statistics in Lucknow (uptourism, 2020)

**Inference: Average Annual tourist footfall based on past 5 years is 41 lakhs.**

Table 4.1 State wise Domestic Tourist Ranking in 2020 (uptourism, 2020)

| Rank | State/UT | Domestic Tourist Visits in 2020 | |
|---|---|---|---|
| | | Number (crore) | Share(%) |
| 1 | Tamil Nadu | 14,06,51,241.00 | 23.0 |
| 2 | Uttar Pradesh | 8,61,22,293.00 | 14.1 |
| 3 | Karnataka | 7,74,53,339.00 | 12.7 |
| 4 | Andhra Pradesh | 7,08,28,590.00 | 11.6 |
| 5 | Telengana | 3,99,97,001.00 | 6.6 |
| 6 | Maharashtra | 3,92,34,591.00 | 6.4 |
| 7 | West Bengal | 2,88,41,732.00 | 4.7 |
| 8 | Madhya Pradesh | 2,35,19,632.00 | 3.9 |
| 9 | Gujrat | 1,94,64,517.00 | 3.2 |
| 10 | Punjab | 1,66,92,197.00 | 2.7 |

*Source: India Tourism Statistics, 2021*

**Inference: UP is 2nd most visited tourist destination by domestic tourists**

Table 4.2 State wise Foreign Tourist Ranking in 2020
(uptourism, 2020)

| Rank | State/UT | Foreign Tourist Visits in 2020 | |
|---|---|---|---|
| | | Number | Percentage Share (%) |
| 1 | Maharashtra | 12,62,409.00 | 17.6 |
| 2 | Tamil Nadu | 12,28,323.00 | 17.1 |
| 3 | Uttar Pradesh | 8,90,932.00 | 12.4 |
| 4 | Delhi | 6,81,230.00 | 9.5 |
| 5 | West Bengal | 4,63,285.00 | 6.5 |
| 6 | Rajasthan | 4,46,457.00 | 6.2 |
| 7 | Punjab | 3,59,114.00 | 5.0 |
| 8 | Kerala | 3,40,755.00 | 4.8 |
| 9 | Bihar | 3,08,080.00 | 4.3 |
| 10 | Goa | 3,02,751.00 | 4.2 |

**Inference: UP is 3rd most visited tourist destination by foreign tourists**

## 4.5 Indigenous Occupation Informal Interview…

### 4.5.1 Fishermen

i. Fishermen: One of the Stakeholders

ii. There was a massive flood in Gomti river in 1960s and later in 1970s after which the government finally decided to resettle the riverside inhabitants just 100-200 metres to the landward side in 1974.

**iii.** 52 plots of 600sq.ft (20'x30') each were allotted to families who were resettled to the landward side apart from the families who were provided monetary benefits.

**iv.** Some of the fishermen also own boats which is the side activity**.**

Figure 4.3 Author with a Fisherman

Mathura prasad
(Fisherman), Author

4.5.1.1 Problems And Issues Identify:

i. Reduction of water flow : Resulted in reduction of the fish flowing upstream and hence the livelihood of the fishermen have been threatened.

ii. Construction of new Hardinge bridge : Introduction of ford to reduce the flow of river for the construction of new bridge in the recent 5-6 years.

iii. Inconvenience of Occupation : the decline of their work is the They now have to travel 2-3 kms downstream to hunt for fishes which takes them longer to catch fish

iv. Loss of income : Sometimes they have to return empty handed due to no fish or they have gone so far that they cannot row back home and choose public transport to get back.

v. The boating activity can be improved and has the opportunity to be turned into a potential future tourist attraction

### 4.5.2 Washermen

i. Washermen – Another Stakeholder Group

ii. Non-residents but, Livelihood is dependent.

iii. They travel 0-1, 2-4 or even 5-6 kms to reach the river bank to wash clothes

iv. They bring clothes from nearby private hospitals, or from Rakabganj cloth market in old Lucknow.

v. Bring about 50-100 clothes to wash every day.

vi. Average Earning is 400-500 per day

4.5.2.1 PROBLMS AND ISSUES IDENTIFIED:

Washermen (Hori Lal, Sonu, Barati Lal), Author, 2021

Figure 4.4 Author with Washermen (Author, 2021)

i. Creation of ford due to which the river flow has reduced

ii. Fish market nearby dumps the leftovers along the river which creates unhygienic conditions.

iii. Cattle herders sometimes bring buffaloes which is disturbing

iv. There are dedicated permanent space provided by the govt. for washermen along the river near kudia ghat (South bank) but the washermen are scared to go as there is HT cable passing just above it.

v. Other place near Dubagga (upstream) houses permanent washing facility provided by the govt. which is away from the river bank and has water pumps for washing.


Figure 4.5 Detail of Various Sites of Existing community (Author, 2022)

### 4.5.3 Semi-Structured Interviews with the tourists.

i. Tourists – Another Stakeholder Group

ii. Mostly domestic Tourist

iii. Visit for a day Mostly.

iv. Would like to visit the riverfront and spend 2-3 hours in boating and other activities around the river bank.

v. Are willing to spend some money for the activities around riverbank.

vi. Could be included in the tourism package for a day also.

vii. A Tourist Information centre should be developed so as to orient the tourists and brief them about things.

viii. Decentralization of TIC could also be done.

ix. Parks and garden spaces can be increased around the riverbank so that it attracts more visitors.

x. Better connectivity from the heritage zone to be made.

xi. Will benefit the locals by generating employment opportunities.

Figure 4.6 Tourist group from Lucknow (Author, 2022)

Tourist (Abhay), Author, 2022

Tourist (Amir), Author, 2022

Figure 4.7 Tourists at Bara Imambara (Author, 2022)

Bara Imambada, Author, 2022 Tourist (Asif & Amit), Author, 2022

Figure 4.8 Domestic Tourists at Lucknow

### 4.5.4 Interviews with the Tourist Guides.

i. Tourist Guides –Stakeholder Group

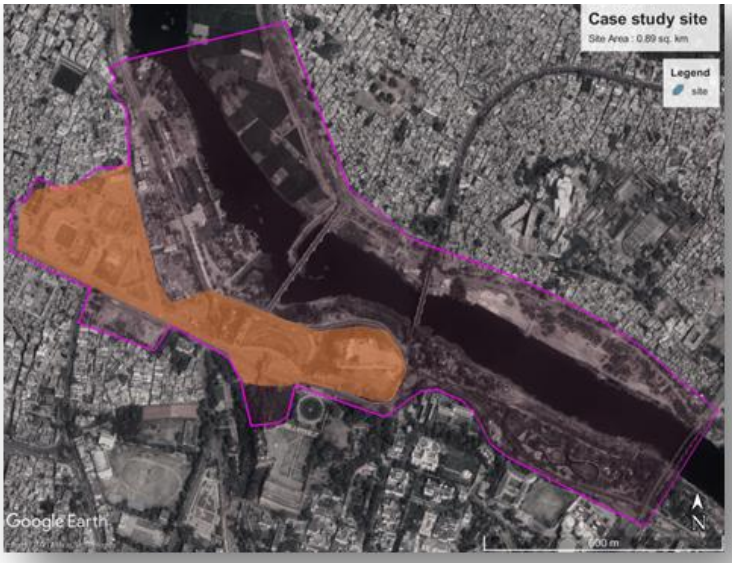
ii. Non-residents but, Livelihood is dependent.

iii. They travel 0-1, 2-4 or even 5-6 kms to reach the the heritage area at Husainabad complex.

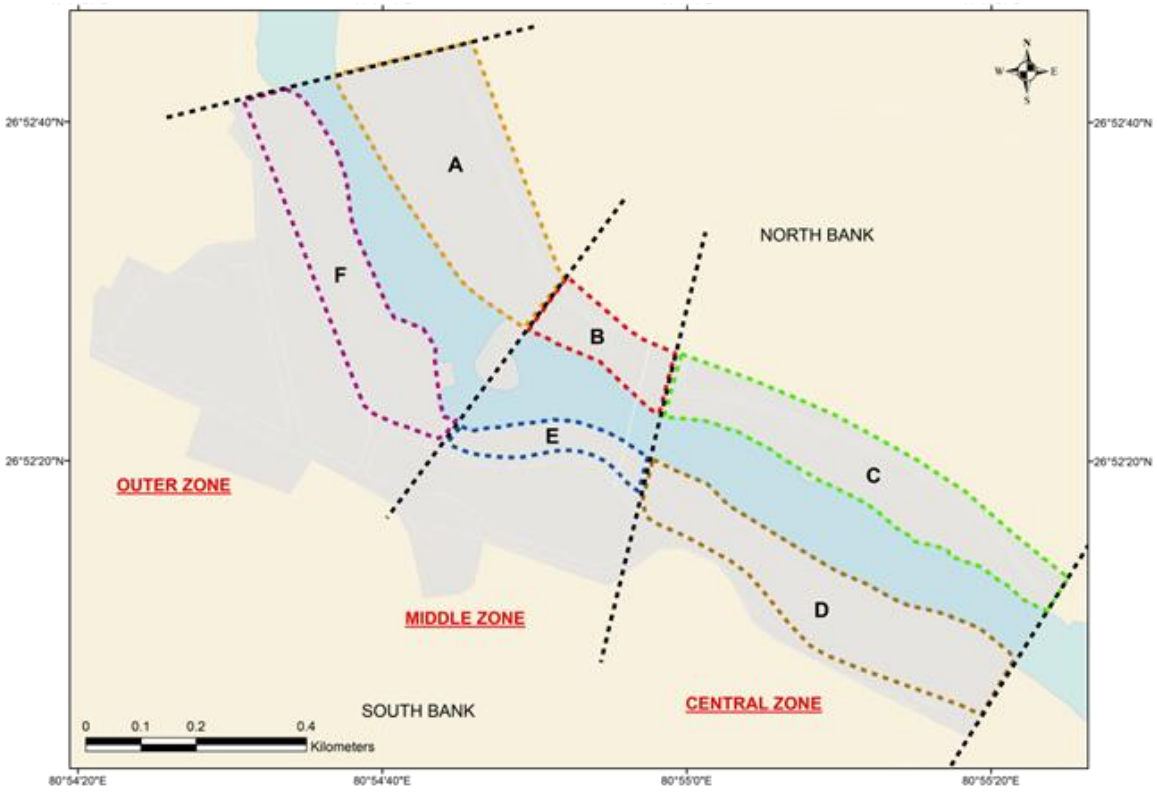
iv. They travel to work here for minimum wages but are satisfied during thwe months of October to March.

v. Average Earning is 400-500 per day as some of them also manage to earn on their own apart from the fixed guide charges.

Map 4.5 Study area with Highlighted Heritage zone

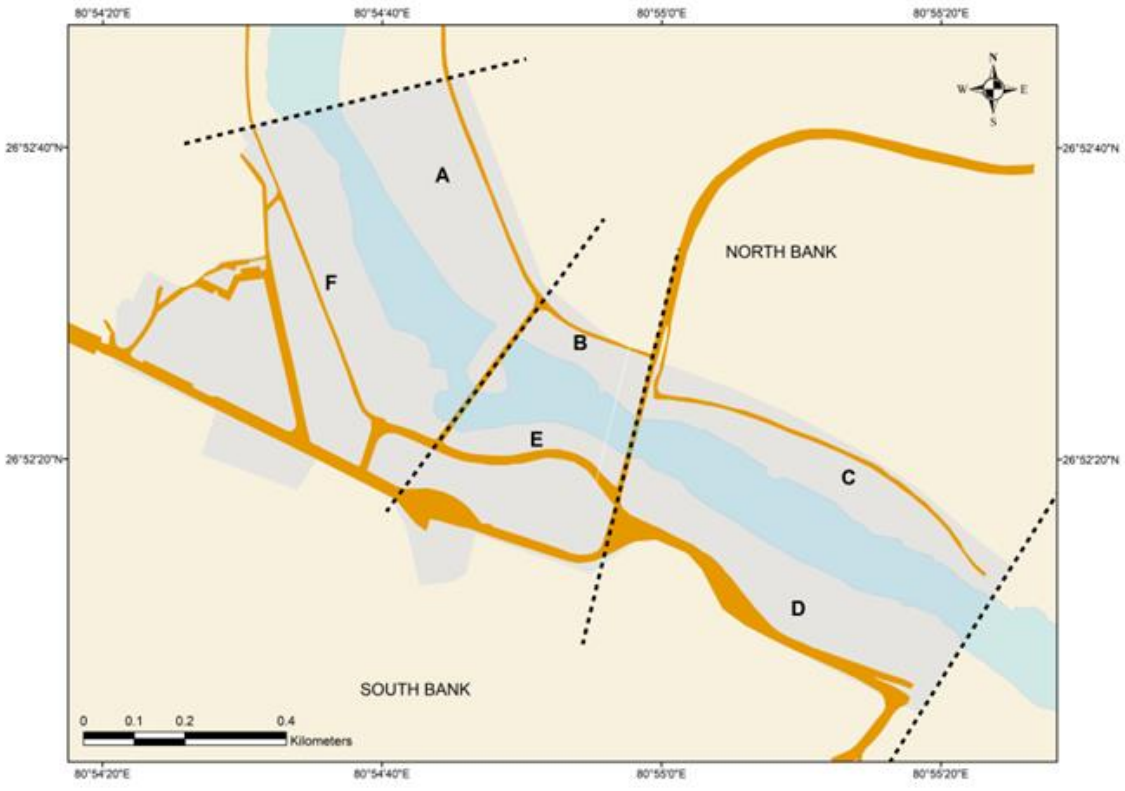


Map 4.7 Map Showing the sub-division of zones in the study area




Division of Study area into Sub Zones Author, 2022

Map 4.6 Study area with Road Network




Route Map of Husainabad Complex and Study Area Author, 2022

# CHAPTER 5

# Chapter 5. PROPOSALS AND WAY FORWARD

## 5.1 Way Forward

### 5.1.1 Three aspects of the Development:

i. **Ecological**
ii. **Economic**
iii. **Social**


Figure 5.1 Integrated Development including major aspects

### 5.1.2 Potential Interventions based on the Analysis and the site study:

i. Riparian Buffer : Ecotonal Strips
ii. Safeguarding indigenous inhabitants : Formalizing Activities
iii. Enhancing Public Accessibility : Social spaces
iv. Tourism Economics : Recreation
v. New economy generation : Herbariums/Botanical Gardens

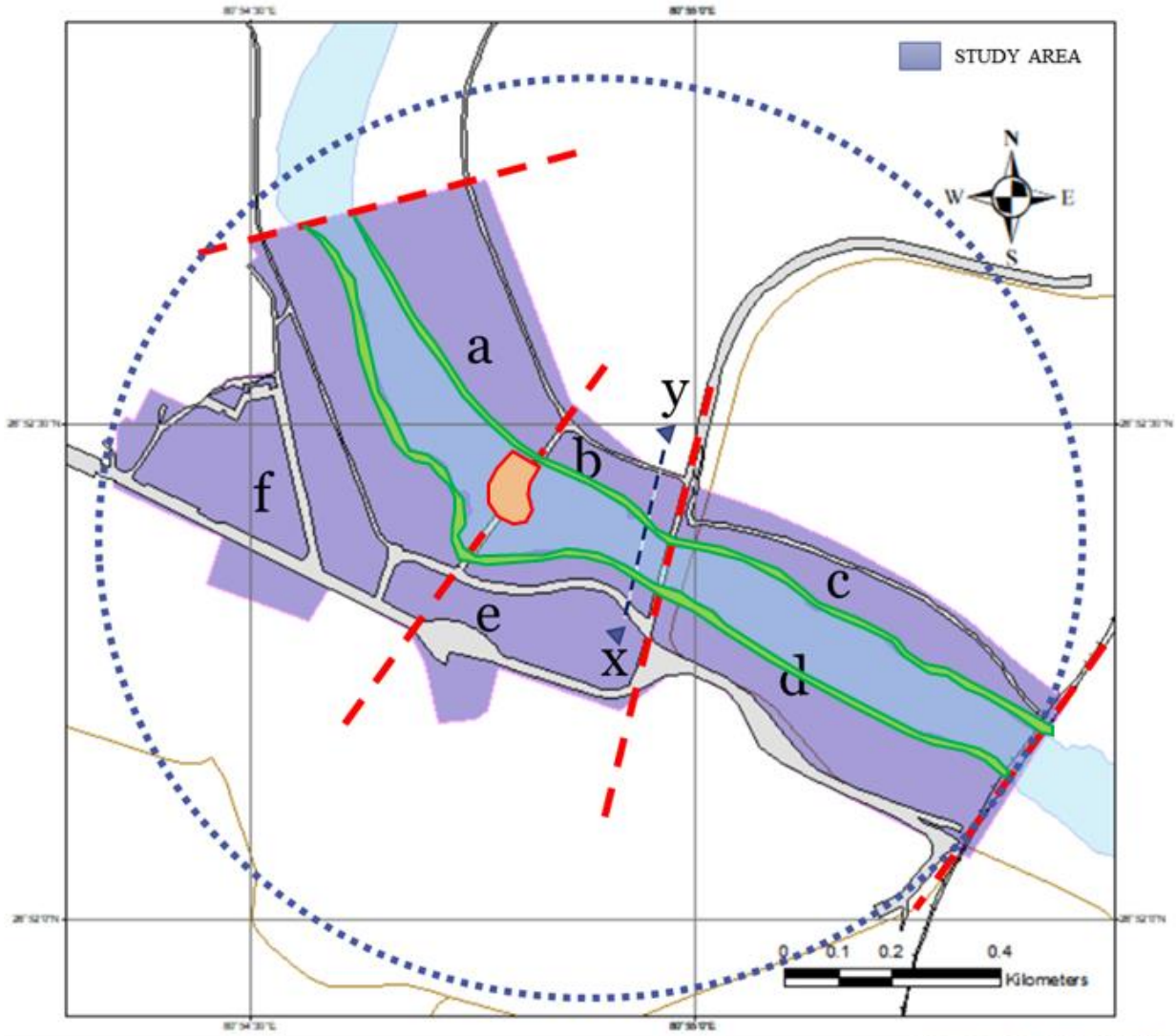
Together these five identified projects (in the short- and long-term) will have a pulsar effect on the economy of the Gomti riverfront, as well as the Heritage district of Lucknow.

It will revitalize the livelihoods of the indigenous populations of the area (fishermen, washermen, cattle-grazers, etc.) as well as improve their overall quality of life. New avenues of revenue generation, as identified, will provide a great uptick to the overall economy of the region.

## 5.2 Proposals

### 5.2.1 Physical interventions:

i. Dredging by sustainable modern techniques; create a water edge development.
ii. Reduce the expanse of the temporary fords created around the pillars of the new bridge; Clear the water Hyacinth and clean the stagnant floating garbage.
iii. Create a riparian buffer with ecotonal strips
iv. Pedestrianize the entire stretch along both sides of the river create necessary parking areas and provide innovative night lighting.




Map 5.1 Map Showing Major Physical Interventions (Author, 2022)

Ford Clearance | Cleaning Water Hyacinth

Figure 5.2 Physical Interventions to be done at site

No-Vehicular Zone

Dredging

Figure 5.3 Steps to make River and surrounding Healthy

### 5.2.2 New economy generation by increasing footfall & revenue

i. Tap the tourist potential creating a tourist awareness/information centre, and engaging them in recreational activities like boating, etc.

ii. A water ride-based amusement park and a botanical garden (herbarium) along the river bank on the barren chunks of land (see fig...)

iii. Urban design and landscaping with pavilions, gazebos and food stalls to ensure revenue generation from tourists and local visitors.

Figure 5.4 New Economy Generation strategies in the riverfront


Water Sports

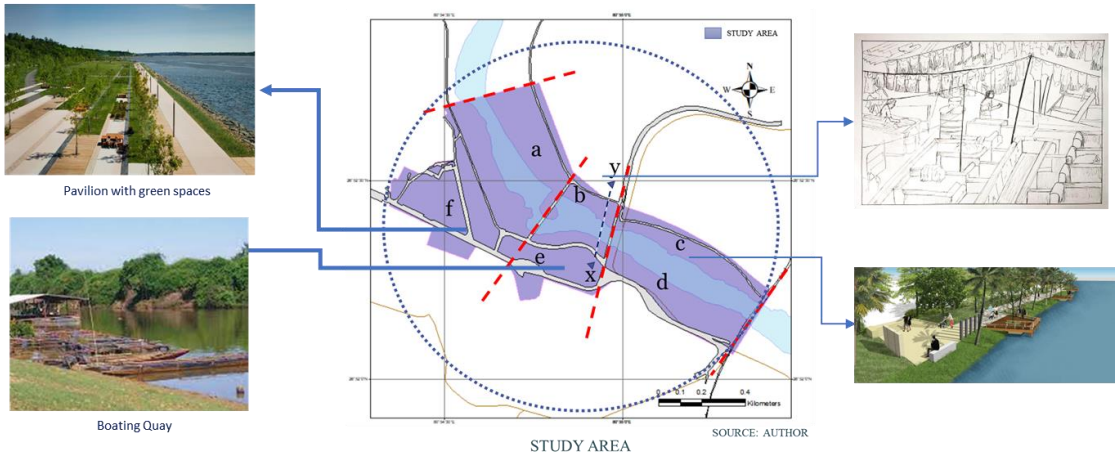
Botanical Garden/ Herbarium

### 5.2.3 Safeguarding Indigenous occupations:

i. Fishermen: Upgrade and improve the physical conditions of their zone of operation, with platforms and pavilions (North bank)

ii. Boatmen: Create a safe & user-friendly quay and ticket booth to encourage and promote the boating activities for the tourists.

iii. Washermen: Create a backwater channel on the north bank with a STP, to ensure that washing activity gets necessary water supply, but waste water is not dumped back.




STUDY AREA

### 5.2.4 Tourist Guides:

Creating an opportunity for local guides to expand their domain of income, by including riverside tourism as a part of their existing heritage circuit

Map 5.2 Map Showing Final details of Design interventions along the river

PAVILION WITH GREEN SPACE

KUDIA GHAT

HERITAGE ZONE

HERITAGE ZONE

BOTANICAL GARDEN

Map 5.4 Interventions proposed on the south bank of the Gomti river

TOURIST INFORMATION CENTRE

DHOBHI GHAT

NEW HARDINGE BRIDGE

DECK ALONG RIVER

HERBARIUM AND GARDEN

Map 5.3 Interventions proposed on the North Bank of the Gomti river

# Chapter 6. Bibliography

(2014). Retrieved from mapworld.
(2020). Retrieved from ArchDaily.
Author. (2021).
Author. (2022).
(2014). *City Development Plan.* Lucknow: Lucknow Municipal Corporation.
Comission, U. P. (2016). Tourism.
(2021). *Comprehensive Riverfront Management Plan.* NIUA.
*Landscape journal of India.* (2014).
*Landscape Journal Of India.* (2014).
Moxa Rajeshbhai Patel, P. H. (2020). A case study of Godavari riverfront development, Nanded city .
NIUA. (2020). *Comprehensive Riverfront Management Plan.*
(2015). *Sabarmati Riverfront, A Catalyst for Ahmedabad's Economic Growth.*
Sen, S. B. (2011). Riverside Restoration-city planner's viewpoint: case of Mutha Riverfront, Pune, India.
Tourism, U. (2020). UP tourism Report.
Tourism, U. (2021). *Tourist Report.* UP Tourism.
uptourism. (2020). Retrieved from UP Tourism.