



Draft Strategic Guidelines

MAINSTREAMING Urban River Management into Master Plans



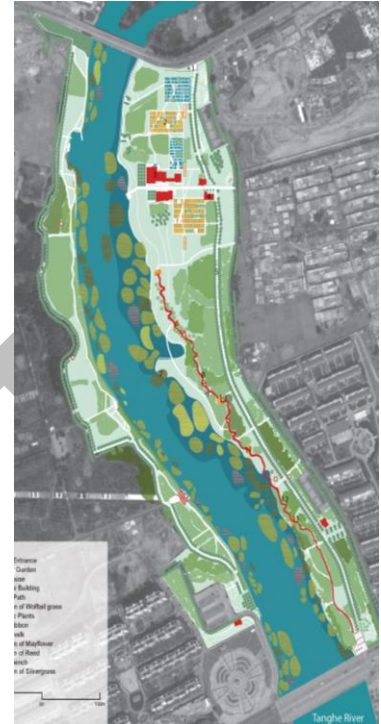
Draft Strategic Guidelines



Vancouver's River Dist., Canada



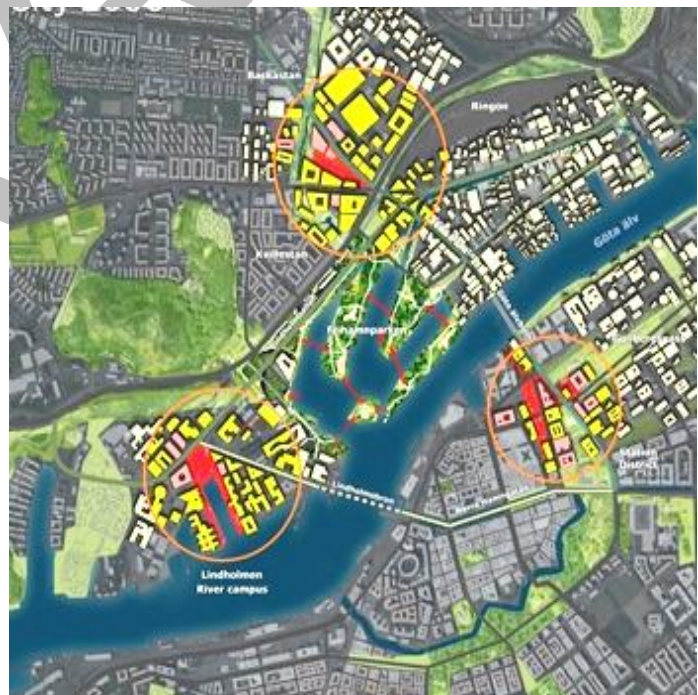
Busan River City, South Korea



Qinhuangdao, China



Södertälje, Sweden, Europe



River City, Gothenburg, Sweden, Europe

River-centric Urban Planning

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Acronyms

CETP	: Common Effluent Treatment Plant
CGANGA	: Centre for Ganga River Basin Management and Studies
CSP	: City Sanitation Plan
DCR	: Development Control Regulations
DEWATS	: Decentralized Waste Water Treatment System
FAR	: Floor Area Ratio
GC	: Ground Coverage
HFL	: High Flood Line
HIZ	: High Impact Zone
IWRM	: Integrated Water Resource Management
JNNURM	: Jawaharlal Nehru National Urban Renewal Mission
LAP	: Local Area Plan
MIP	: Medium Impact Zone
MoEFCC	: Ministry of Environment, Forest and Climate Change
MoHUA	: Ministry of Housing and Urban Affairs
MoUD	: Ministry of Urban Development (former)
MP	: Master Plan
NDMA	: National Disaster Management Authority
NDZ	: No Development Zone
NIUA	: National Institute of Urban Affairs
NMCG	: National Mission for Clean Ganga
RAY	: Rajiv Awas Yojana
RRZ	: River Regulation Zone
STP	: Sewage Treatment Plant
TCPO	: Town and Country Planning Organization
UDPFI	: Urban Development Plans Formulation and Implementation
URDPFI	: Urban and Regional Development Plans Formulation and Implementation
URMP	: Urban River Management Plan
WTP	: Water Treatment Plant
WWTP	: Waste Water Treatment Plant
ZDP	: Zonal Development Plan

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Foreword

Cities and rivers have an intrinsic relationship. Traditionally, the rivers have been at the centre of various cultural, religious, livelihood-related, and recreational avenues in cities. However, over the years, in the pursuit for economic development cities, cities have exploited rivers indiscriminately. Today many of our rivers are in a highly vulnerable condition.

With the rapid urbanization in cities all around the world, rivers are extensively becoming the dumping grounds for waste and waste water discharge. Over exploitation, in terms of excessive water extraction for city use and use of riverfronts for destructive anthropogenic activities is a common scenario. As a result of these heavy disturbances throughout the urbanization process, urban rivers have become intensively influenced areas of human and ecological interaction.

As the local governments struggle to keep up with the high levels of urbanization, this over dependence of cities on their rivers is posing a serious threat to the naturally existing ecosystems. To further deteriorate the situation, the significant value of rivers has been ignored by the policy makers and development experts. It is clearly understood that cities need to bring their rivers to the heart of urban planning. The challenge is to incorporate river management strategies within the core of planning agenda for cities, while preparation of their development plans. Master Plans, being one such document shaping the development of a city, shall thus mainstream river management parameters within its planning framework.

This document, is a guide to help city planning authorities in mainstreaming Urban River Management practices into their existing Master Plans, or while preparation of their upcoming plans. The document analyses the current planning frameworks for urban rivers across the globe. It draws a comparative of the river treatment in the Master Plans of various river towns. It finally arrives at a river-sensitive approach to urban planning, with the help of different master plan tools. While the central focus is on the Ganga basin towns, the document also applies to other Indian river towns.



Chapter 1. **An Introduction to Urban Rivers**

Chapter 1. An Introduction to Urban Rivers

Through the ages, rivers have been the center for human existence. A vast number of earliest and most prominent ancient cities evolved as river cultures. These have been the most common centers for human growth owing to easy availability of water source for drinking and other purposes, food resource, transportation and other basic necessities for human existence. For instance, through the history many civilizations settled along the Euphrates- the Tigris Rivers in Mesopotamia, the Nile in Egypt, the Ganga in India, the Indus in Pakistan, and the Huang-Ho in China. And the practice continues till date. Some of the current examples of urban rivers include the Thames in London, the Seine in Paris, the Tiber in Rome, the Vltava in Prague, the Danube in Budapest, the Hudson in New York, the Yarra in Melbourne, among many others.

This inter-relationship between rivers and cities forms a multi-disciplinary perspective in the development sector. The rivers have been guiding the growth of cities along their banks. At the same time, the development within a city reshapes its rivers, their urban landscapes and alters the river ecology. Moreover, the cities are heavily dependent on their rivers for various infrastructural and developmental needs. In this process the cities have clearly harnessed, modified, and engineered their rivers, altering ecologies and creating new landscapes, while moving towards urbanization.

Moreover, even though the basic need of river systems for the human settlements have been established worldwide, the critical challenge lies in the consistent failure of economies and societies to value rivers for their full spectrum of benefits. The rivers have primarily been regarded as sources of water and pollution sinks. They have been developed and managed for centuries, harnessed for navigation, energy and water supply. However, they provide a far broader set of benefits for people and economies. These benefits include, but exceed, the value of the water flowing down them. For example:

- River floodplains can reduce the risk of flooding within cities – an increasing concern in the face of climate change
- Rivers support the majority of freshwater fisheries. This low cost protein from freshwater fish supports vulnerable rural communities, enhances food security and boosts regional economies.
- Rivers deliver the sediment that maintains deltas, some of the most important agricultural regions in the world and home to a large number of people

It has been observed globally that the water resources are not managed in a way that harnesses as well as protects their complete ecosystem values. A wide range of river benefits still remain unknown, poorly measured or undervalued. These hidden values are usually not measured or prioritized until any crisis situation arises. This pattern of neglect has witnessed long term consequences. For example, the poor management of water

supplies continues to threaten the vitality and viability of communities, cities and countries today.

As a result, the river development projects are often undertaken without long-range, strategic planning or any assessment of trade-offs. Compounding the inevitable outcomes arising from such a lack of comprehensive planning, the river ecosystems and the natural resources are challenged by dramatic declines. Furthermore, partly due to river management majorly focused on narrow or short-term objectives, the infrastructure services related to the river system are taken care of, but the ecosystem services at large are heavily ignored.

In light of the above, the essence lies in understanding the behaviour of rivers vis-à-vis its urban connect. Doing so will require a paradigm shift in the framework for assigning values and managing the river systems in general. To catalyse these desired changes in the value systems, a re-framing of the policy and management structure is also desired.

This chapter titled '*An Introduction to Urban Rivers*' tries to view the river as a component of the urban setting, identifying the factors of association of the river and the city environment. The base has been set by introducing the benefits and challenges of rivers within city extents. The current scenario of river health in Indian cities, informs the need for river restoration within the urban context. The concept of river management is also introduced by elaborating upon the key terms referred under the concept.

1.1. Role of Urban Rivers

Urban rivers have always been recognized for their role in serving as water resources, protection of nature, fisheries, and provision of recreational areas with considerable contributions to landscape. In addition to these roles, rivers also have certain other definite environmental, social, cultural and economic values.

Urban rivers serve as a complex balance of social-economic-ecological systems, serving the cultural and religious beliefs, the recreational needs, the livelihood dependencies as well as the ecological services of the riverine ecosystem. In particular, rivers and their associated ecosystems provide a broad range of services, including clean surface and ground water, habitat for riparian flora and fauna, fisheries, and the regulation of flood flows. Other riverine ecosystem services include carbon and nutrient sequestration, fiber production, and biodiversity protection.

Many rivers are central to the spiritual identities and religious beliefs of different communities. As per the WWF Reportⁱ on Valuing Rivers, 2018, "*Specific rivers feature prominently in their country's cultural identities and histories, such as the Mississippi in the*

United States, the Magdalena in Colombia, the Nile in Egypt and the Irrawaddy in Myanmar. The Yellow River is known as China's 'mother river', although that name is also sometimes applied to the Yangtze. Many rivers are considered sacred to various religions, such as the Ganges River and the River Jordan". These value systems are to be protected and restored among the growing anthropogenic influences.

The recreational function served by the rivers are also gaining importance, owing to the lack of sufficient open spaces within the cities today. The World Health Organization recommended the availability of a minimum of 9 sqm of green space per individual with an ideal UGS value of 50 sqm per capitaⁱⁱ. However, many Indian cities fall far behind. Urban rivers provide the essential open spaces which serve as lung spaces for city residents. When developed appropriately, they also serve as urban recreational spots providing an opportunity for citizens to connect to these natural landscapes.

It is important to understand here that each river city has a unique relationship as well as historical significance and functional requirement with its river. These rivers in various cases have also been providing the resources and services necessary for development of cities. The figure below explains the various functions served by healthy urban river ecosystems.

Figure 1 Role of Urban Rivers



Some other additional indirect benefits of urban river systems include the following.



Landscapes with water are perceived as more restorative than those without. Water bodies have been found to be particularly significant in **IMPROVING MENTAL HEALTH AND WELLBEING** of people (by increasing happiness levels). They provide attractive, stimulating features that have the ability to restore attentiveness and inspire creativity. Views of water and the sound of water have been shown to alleviate stress more effectively than other types of natural setting.

Urban rivers **ENSURE SOCIAL COHESION AND CITIZEN CONNECT**. The improved community participation at lively open spaces having active involvement of citizens, is likely to increase the social connections between people living in the area. A sense of ownership of these community spaces further ensures upkeep of these facilities by the community itself.



Rivers in an urban area also provide some indirect **ECONOMIC BENEFITS**.
Improved sales – high quality environments lead to an increase in money spent in the local businesses and also encourage businesses to settle in that area
Employment – settlement of businesses in an attractive area can increase the local employment rate

Source: Compiled by NIUA, 2019

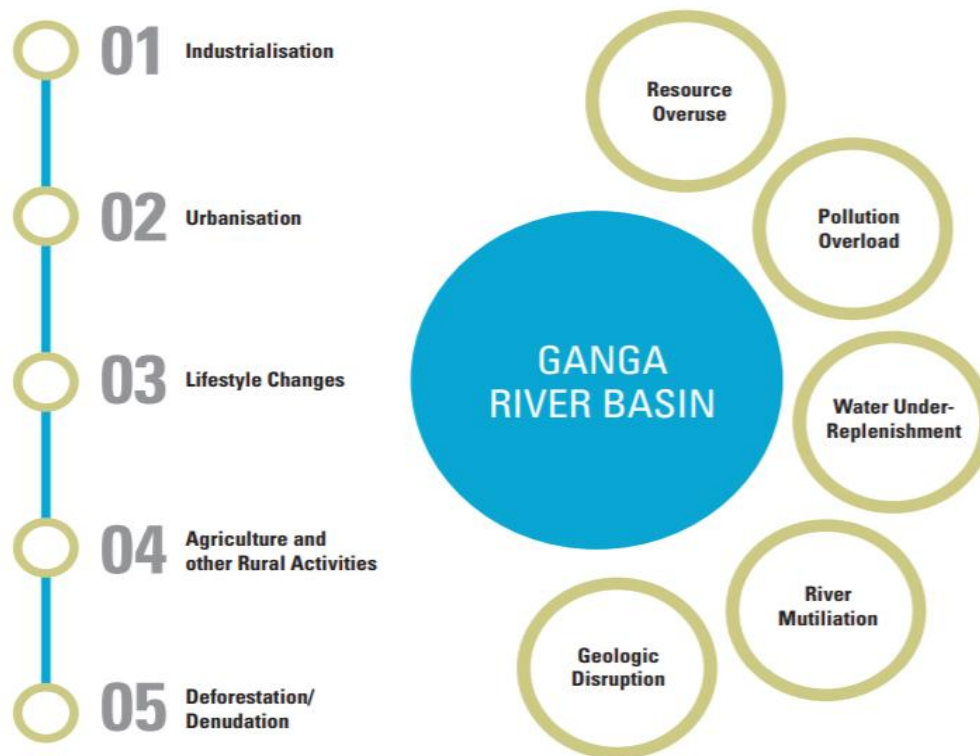
1.2. Urban challenges having a bearing on River Management

It is widely known that the social and economic benefits of intensive urban growth is paralleled with varying degrees of environmental issues. Some of the serious concerns of urban areas are related to water challenges, be it water availability for urban use or the health of the natural water ecosystems. These negative impacts of rapid urbanization in cities on its rivers are multifaceted, going far beyond the usually publicized concern of water pollution, extending to biological and structural changes in the natural state of the water channels. As the urban centres have expanded in number and size, the negative impacts on river ecosystems have become more severe and widespread.

With the rapid expansion of towns and cities population, the physical characteristics of the urban space have been completely altered. The natural river channels have been altered by straightening and creation of embankments for flood protection and to maximize the use of land for housing, industry and agricultural use. These rivers within cities are highly stressed as a result of their interaction with the influencing factors within the city extent. The stresses make these rivers less resilient to the effects of climate change. The changes have often lead to loss of ecological value of these rivers, created problems of flood management, changes in the natural drainage pattern, waste water management issues, loss of natural bio-diversity as well as loss of quality open spaces.

As per the *Vision Gangaⁱⁱⁱ* document by cGanga and NMCG, the five major degradation factors and their anthropogenic causes have been listed in the figure below.

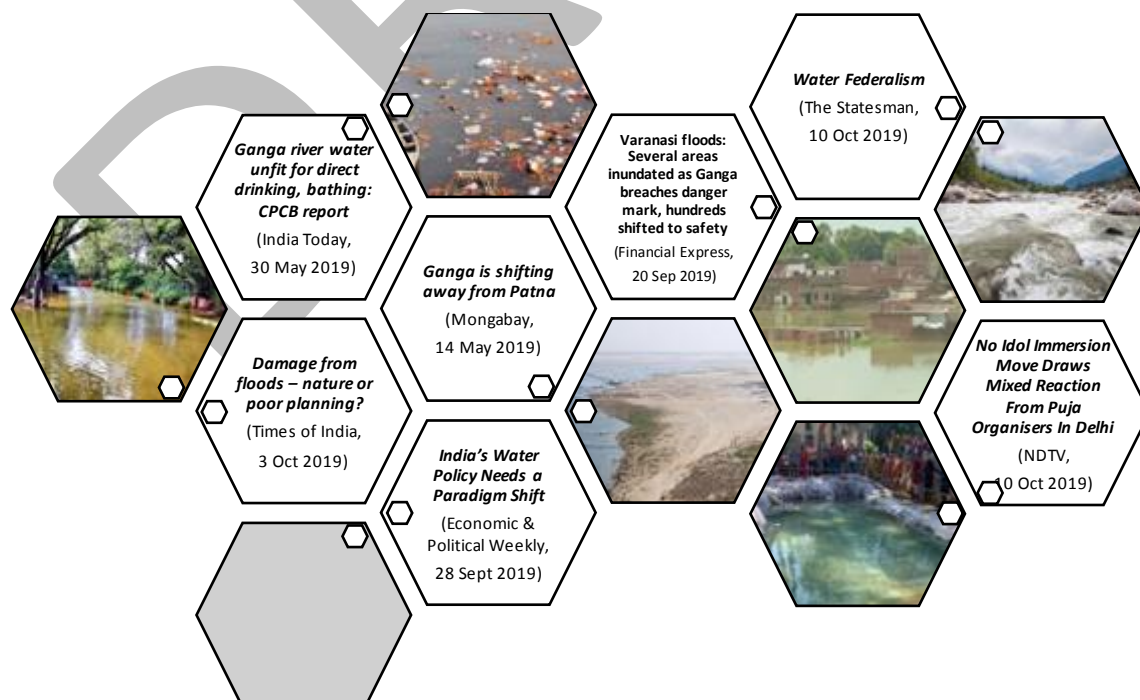
Figure 2. Five major degradation factors and their anthropogenic causes



Source: Vision Ganga, December 2017, cGanga and NMCG

These anthropogenic factors affect current health of the river and its associated network. Figure below showcases some of the recent news highlights, wherein the above referred ecological stress is clearly evident.

Figure 3. Recent news highlights, showing ecological stress



Source: Compiled by NIUA, 2019

The typical problems faced by urban rivers are related to untreated domestic, industrial and agricultural discharges flowing directly into the streams, development within the natural catchment basin, change of the natural river profile as a result of anthropogenic activities, extraction of river water to meet the city demands which further alters the natural flow, and pollution from other anthropogenic sources. These are well elaborated in the diagram below, from a 2013 publication, *Rivers by Design*^{iv}.

Figure 4 Typical problems faced by rivers within the city boundaries

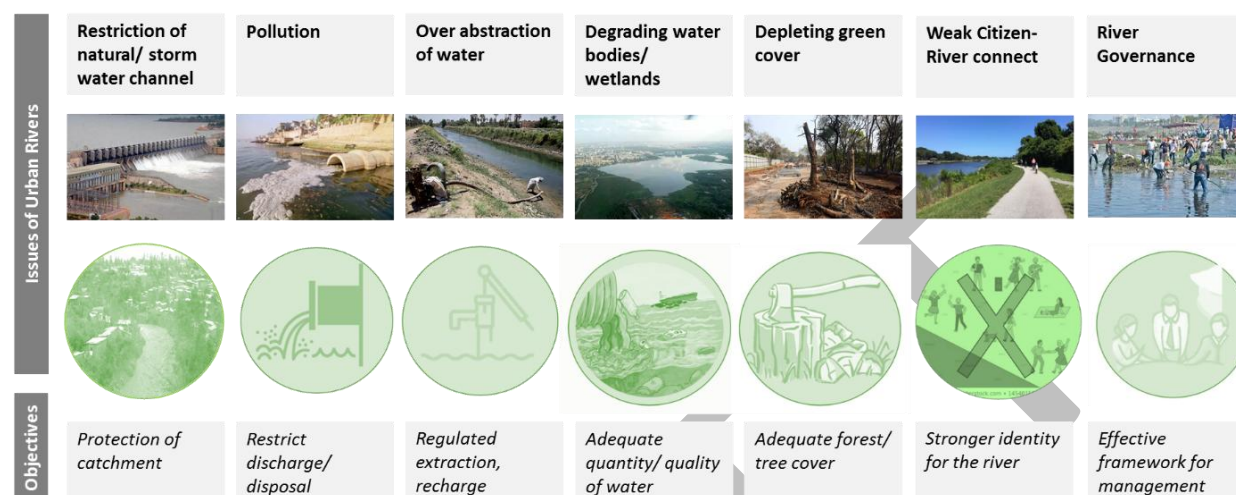


1. Poor Drainage – rain now falls onto hard surfaces such as roofs, paving and roads and drains quickly into the river system increasing storm flows and runoff increasing the potential for flooding. This can also quickly enter sewerage systems risking overload and flooding.
2. Development within the floodplain – housing, industry, infrastructure and agriculture can lead to greater flood risk, loss of habitats and biodiversity.
3. River profile – raising river banks, culverting and straightening were used to try and reduce flooding and drain land. They might have solved a local problem but they often put pressure on the water course and downstream land.
4. Water supplies – abstracting water from rivers, canals, reservoirs, lakes or underground aquifers to provide public water supply for agriculture and industry. Over abstraction can lead to problems such as drying-out of water courses and wetlands and sinking water tables.
5. Pollution – waste dumping, chemicals from industry, sediment, pesticides and fertilizers from agriculture and drainage from roads containing oil are all contributors to river pollution, leading to loss of water quality and biodiversity.

Source: *Rivers by Design*, Rethinking development and river restoration, Restoring Europe's Rivers, 2013

In order to meet the increasing water challenges, the urban planning framework needs to be relooked with an intent to manage the urban water systems. The core areas of concern for river health in an urban setup include the following key challenges.

Figure 5. Key challenges of urban rivers



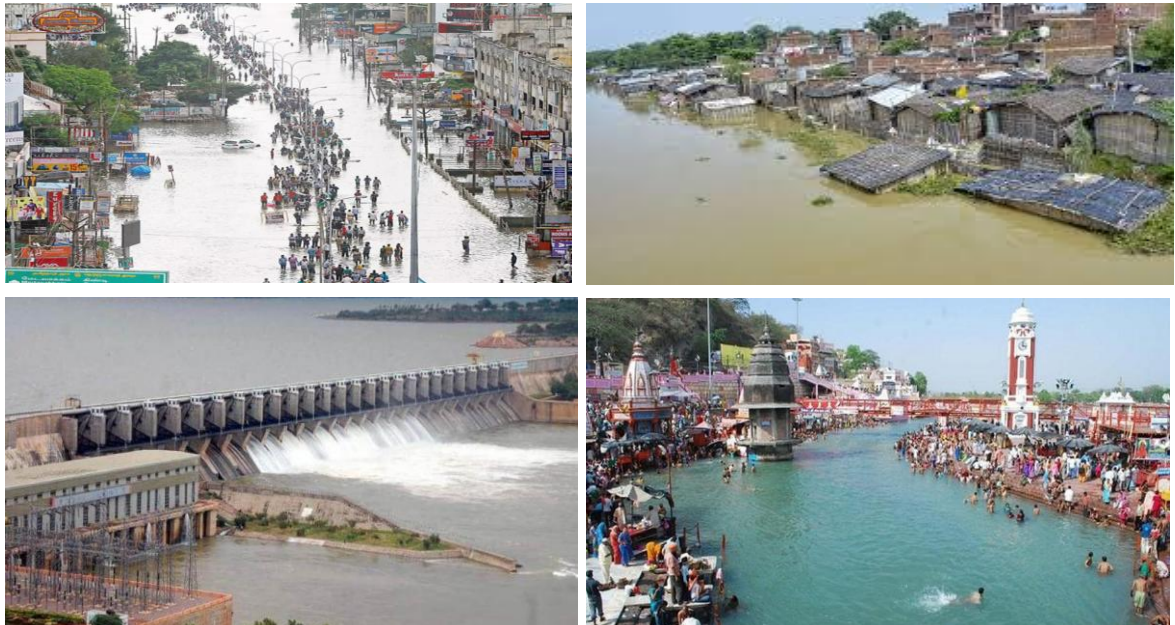
Source : Prepared by the Author, 2019

Restriction of natural/ storm water channels: The River needs its space to perform its various functions, one of which is acting as a sponge to prevent flooding. However, in many Ganga towns unplanned development and encroachment along riverbanks have severely restricted natural channels. Furthermore, channelization and excessive concretization further confine the river because of which the entire geomorphology and ecology of the river gets disturbed. This impermeabilization of the landscape in cities leads to surface flooding, excess runoff and fluvial flooding. The water quality is also damaged by the excessive runoff washing pollutants off roads and causing spills from combined sewer outflows.



Appropriate measures are to be identified within the city plans, aiming towards protection of the entire catchment area for the natural/storm water channels, redevelopment/ relocation of any existing structure within the floodplain area, as well as introduction of blue-green spaces for conserving the ecological balance of the entire zone.

Figure 6. Restriction of natural water channels within urban areas



Pollution: As per *The United Nations World Water Development Report 2017; Wastewater- the Untapped Resource*, globally it is likely that over 80% of wastewater is released to the environment without adequate treatment. The same is witnessed in the Asia and the Pacific region, wherein an estimated 80–90% of all wastewater produced is released untreated, polluting ground and surface water resources. The sectors highly contributing to the pollution

load include waste generated from municipal & urban areas, industrial effluents and agricultural runoffs. This discharge of untreated wastewater directly into the water bodies explains the rapid growth of deoxygenated dead zones.

Pollution is also unarguably the most severe concern in Ganga towns. Pollution from various sources—domestic and industrial sewage; agricultural runoffs; solid waste dumping; among others— are taking a toll on the rivers. In many cases, large stretches of the rivers are literally flowing sewers. As the cities heavily depend on these rivers, river pollution poses serious health issues. More importantly, the entire riparian ecosystem is heavily affected, sometimes threatening its very existence.

Appropriate measures are to be identified within the city plans, aiming towards restricting discharge/ disposal of untreated wastewater in the water channels/ water bodies. Wastewater has to be collected through a network leading towards a treatment plant.

Figure 7. Excessive Pollution of Urban Rivers





Over-abstraction of water: As the rate of urbanization in cities grows, the stress on water resources to meet the rising demand also increases. In peri-urban areas, agriculture water demand aggravates the situation. As a result, rivers and aquifers are fast depleting, causing changes in hydro-morphology and natural hydrological regimes of water channels.

Central Water Commission (CWC), an apex organization of Ministry of Jal Shakti, Department of Water Resources, River Development and Ganga Rejuvenation, Government of India reported that per capita surface water availability in 1951, 1991, 2001 and 2010 was 5200 m³, 2309 m³, 1902 m³ and 1588 m³ respectively. There have been continuous decreasing trends in per capita surface water availability and if it continues, in near future India will become 'water stressed' (<1000 m³)^v.



Degrading stagnant waterbodies/ wetlands: Urban water bodies (stagnant) and wetlands are a very important avenue to stabilize the groundwater levels, in addition to providing various social and environmental benefits. They serve as an important source for groundwater recharge, augmenting groundwater levels, and thereby reducing the stress on river water resources. However, in several Ganga towns, water bodies are in a dilapidated state—resulting from encroachment, and pollution.

Economic and urban development has been further leading to environmental degradation of wetlands/ water bodies. Loss of catchment basins, change in quality of water, as well as loss of natural flora and fauna raise concern about the impacts of rapid urbanization over these vulnerable ecosystems.



Depleting green cover: Green cover is very important from a river management point of view. On riverbanks, it serves as an erosion control mechanism. In other areas, it helps augment groundwater levels, and provide a habitat for biodiversity to thrive. Unfortunately, the cities today have been trapped within a vicious green-grey debate. The general trend is that as cities become more urbanized, there is a decrease in the green cover.



desired condition.

Weak citizen-river connect: Traditionally, the river was at the centre of various societal practices—cultural, religious, livelihood-related, and recreational. While this is still prevalent in some Ganga towns, somehow many towns (especially the larger cities) have lost their connect with the river. Re-igniting this connect is very important so that citizens will voluntarily take on some of the responsibility for maintaining the rivers in the

River governance: River governance encompasses several aspects—accountability of different stakeholders/ assigning roles & responsibilities, coordination between agencies, citizen engagement, monitoring and evaluation, and finances, among others. These have to be clearly mapped out for any planning to achieve its ultimate objective. Most Ganga towns lack a holistic mechanism for river governance. Some aspects of these can easily be taken up at the Master Plan level.



The challenges of urban rivers are diverse in nature, as explained above, involving environmental, economic, technical, political as well as social impacts. These call for a shift in the way urban water systems are managed by the city administration.

1.3. Current Scenario of River Health in Indian Cities

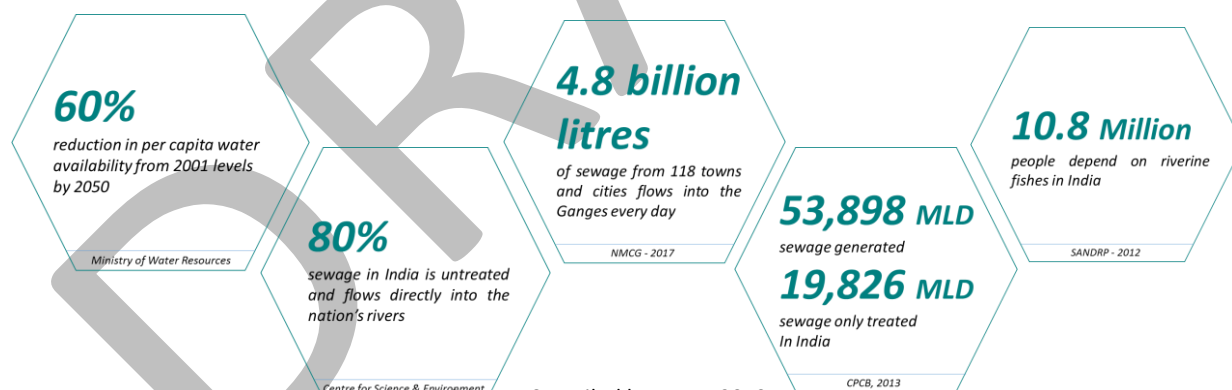
As mentioned above, humans have been settling near rivers since medieval times to use resources as potable water, to power mills, for transportation and waste disposal. In urban areas, rivers continue to be channelized to accommodate for development and flood prevention. As human conurbations have expanded, rivers at their centres have come under more pressure and lost the ability to function naturally. According to the Composite Water Management Index (CWMI) report released by the Niti Aayog in 2018^{vi}, the country's water demand is projected to be twice the available supply by 2030, implying severe water scarcity for hundreds of millions of people. The present situation is also not ideal. “5 of the world’s 20 largest cities under water stress are in India, with Delhi being second on the list”, as quoted by Composite Water Management Index (CWMI) report released by the Niti Aayog in 2019^{vii}. The severity of the situation can be understood from mention in the same

report, regarding a loss of 6% in the GDP by 2050 only due to the water crisis, if this scenario continues.

This supply shortage is primarily marked due to non-availability of clean water sources. As per World Economic Forum 2019, 'It's estimated that around 70% of surface water in India is unfit for consumption. Every day, almost 40 million litres of wastewater enters rivers and other water bodies with only a tiny fraction adequately treated'. As per India Rivers Week Assessment "70 per cent of our rivers are facing existential threats. Over 60 per cent of sewage generated in India is dumped untreated in rivers and water bodies. As per latest official assessment the number of polluted river stretches in country has increased to 352 from 302 two years ago. Similarly, the number of critically polluted stretches has gone up to 45 from 34 in two years". Another major concern highlighted above is the urban flooding scenario. As per World Bank statistics, 'By 2050 nearly 20% of the world's population will be at the risk of floods".

Some major statistics highlighting the seriousness of concern regarding the current health of urban rivers, are highlighted in the figure below.

Figure 8. Concerns regarding Urban River Health



Source: Compiled by NIUA, 2019

1.4. Defining Urban River Management

Different degrees of river restoration mechanisms are required every scale of planning and development interventions (like at the basin, city, local area level) to address the above-mentioned river related issues. However, the concept of Urban River Management is limited to the urban extent.

Various terms related to Urban River Management have been already defined by organizations having expertise in this sector.

- As mentioned in Rivers by Design, Rethinking Development and River Restoration, **“River restoration aims to improve the quality and function of rivers and to restore them to support healthy and thriving ecosystems”**.
- **“River restoration is the re-establishment of natural physical processes (e.g. variation of flow and sediment movement), features (e.g. sediment sizes and river shape) and physical habitats of a river system (including submerged, bank and floodplain areas).”** - International Union for Conservation of Nature ‘River Restoration and Biodiversity’
- WWF describes Integrated **River Basin Management** as **“the process of coordinating conservation, management and development of water, land and related resources across sectors within a given river basin, in order to maximize the economic and social benefits derived from water resources in an equitable manner while preserving and, where necessary, restoring freshwater ecosystems”^{viii}**.
- As per the Urban Rivers: Re-making Rivers, Cities and Space in Europe and North America, by Stéphane Castonguay and Matthew Evenden^{ix}, **urban rivers** are defined in a descriptive sense as **“rivers that flow through cities”**, and in an analytical sense as **“those rivers that have been folded into the process of urbanization, whether flowing through urban centers or not”**. **“Urban Rivers examine both the role of rivers in the process of urbanization and the impact of urbanization on rivers”**. **“The term urban rivers is most often associated today with the goals of ecological restoration. In a range of contexts, environmentalists have called for the reintegration of rivers into urban life through pollution abatement, parks development, and pathway construction. In part an aesthetic vision, the idea of the urban river also highlights the particular features of riverine transformation that cities have imposed, including changed patterns of sediment deposition and erosion, hydrology and ecology, owing to heightened pollution levels, paved catchments, and canalized stream channels.”**

For the purpose of this document, the term Urban River Management shall mean the following.

URBAN RIVER MANAGEMENT can be understood as the process of conservation, development and restoration of the river resources within the administrative extent of a city. It aims at achieving a careful balance between the ecological, infrastructural, social, recreational and economic functions of a river within the city.

It should ensure that within the city boundary, the river behaves as Environmentally Sensitive, Economically Viable and Socially Inclusive.

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Chapter 2. **Planning for River**

Chapter 2. Planning for River Management

Looking at the current scenario of growth, India is at the threshold of facing complex urban planning and development challenges. With the continuously growing population, India is expected to surpass China's population by 2025. A major portion of this increase would be in existing mega cities, posing greatest challenges to India's urban future, as reflected in a research compilation titled 'GIS based three-dimensional 3D volumetric analysis in Urban planning' dated 2015^x. This calls for effective planning measures to manage the massive urbanization.

More importantly, all the eco-sensitive areas, especially the rivers within cities, are facing serious concerns as elaborated in the chapter above. To deal with these issues, an effective planning mechanism specifically focused on river management is required. Apart from that, the threat of any catastrophe/ natural calamities surrounding the natural resources, also calls for prior preparedness to deal with such situations. The risk of such events multiplies within the urban areas, due to rapid population rise and urbanization.

With that background, this chapter titled '*Planning for River Management*' tries to establish a base for the river-sensitive planning approaches. The chapter explains the link with the Urban River Management Plan (URMP), elaborates the urban planning framework in India, gives a snapshot of the river-sensitive approach to planning followed within the country while justifying the scales at which this is adopted. Lastly, the chapter tries to build-up on the gap between the river management and urban planning exercise within cities. The case is presented by a comparative analysis of the river treatment by Master Plans of various towns. Thus establishing the need for mainstreaming river management within the city planning exercise.

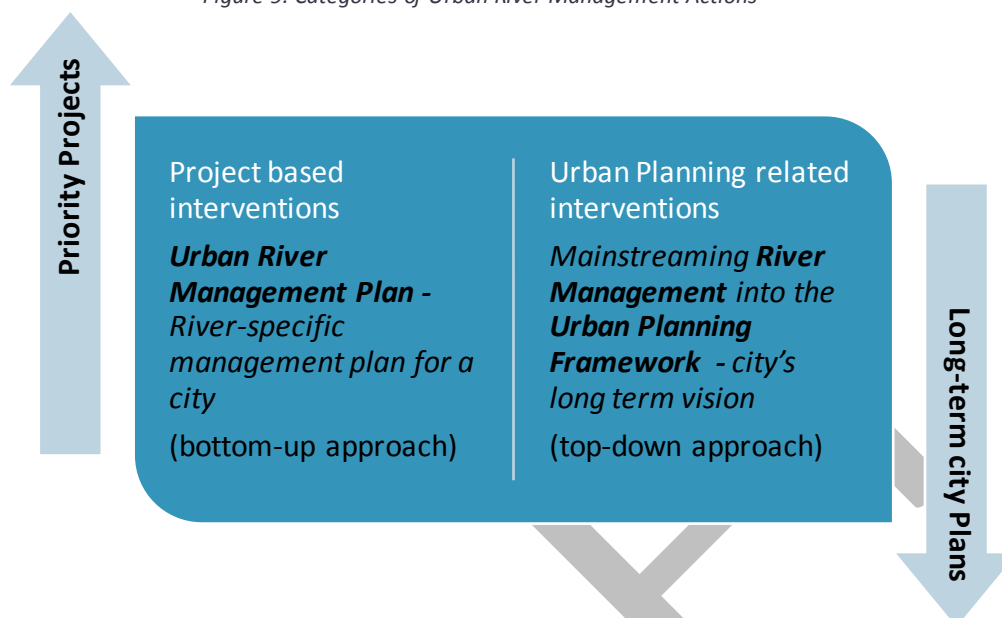
2.1. Linking to the URMP

River Management within cities has to be addressed by two broad categories of actions. Following a top-down approach, it has to be integrated with the already existing planning and development framework of the cities, in the form of urban planning related interventions. Also, specific priority interventions and projects can be identified by the city officials to improve the state of the rivers flowing through these cities, in the form of project based interventions, from a bottom-up approach. Both the approaches have to function hand-in-hand, leveraging opportunities on each other. These two categories are as follows:

- A. **Urban planning-related** using various planning instruments. It is expected that these actions/recommendations would be adopted in the town's Development/Master Plan or any other long-term plan for the city.

- B. **Project-based interventions** for river management. It is expected that towns will initiate the relevant projects that are required to enhance the river outlook in the town.

Figure 9. Categories of Urban River Management Actions



Source: Compiled by NIUA, 2019

The first category explained above, is related to mainstreaming sustainable river health management into a city's larger long-term vision. To address this, river management has to be imbibed within the current city plans and the national level policies. The present planning framework has a number of plans at varying scales and with specific needs, like the 'Regional Plan', 'Master Plan', 'City Sanitation Plan', 'City Development Plan', 'River Basin Management Plan', 'Sanitation Safety Plan' (by World Health Organization), 'City Disaster Management Plan' for Municipal Corporations and 'District Disaster Management Plan' for smaller towns, among many others, which need to follow a river-sensitive approach.

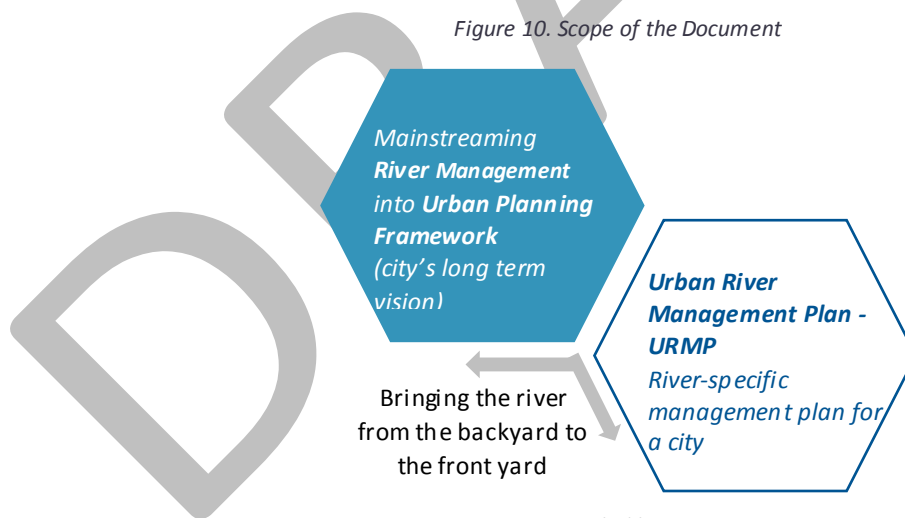
The second is associated with developing a dedicated river-specific management plan for a city. For this, the Urban River Management Plan (URMP)^{xi} framework, as explained in the box below, defines various project-based interventions that can be identified by the cities for enhancing the three core elements of river management: River Health, Social Cohesion and Economic Value.

As per the “Vision Ganga” document released by NMCG in 2017, one of the key objectives of the Ganga River Management Plan is to ensure that “all existing, ongoing and planned anthropogenic activities in the basin shall be reviewed or scrutinized in a transparent, inclusive manner (with consensus of all affected people and stakeholders) for the overall health of the basin”. With this intent in mind, the National Mission for Clean Ganga (NMCG) and the National Institute of Urban Affairs (NIUA) have developed a common Urban River Management Plan (URMP)¹ framework for all Ganga towns.

The **Urban River Management Plan (URMP)** is a planning framework developed for helping the cities along the Ganga River plan for interventions systematically and holistically, to revive and maintain the rivers in their areas in a sustainable manner. Its overall objective being to assist Ganga towns improve the state of the river in their stretch. It is embedded in the central idea that maintaining healthy rivers in the Ganga towns is crucial to enhance liveability in the towns.

This document focusses on making the city’s long-term plans, river-centric in their approach. It talks about river-sensitive city planning. Separate guidelines on the ‘Urban River Management Plan’ have been prepared for river-specific project based interventions.

Figure 10. Scope of the Document



Source: Compiled by NIUA, 2019

2.2. Urban Planning Framework in India

The contemporary planning practices in India are as old as the early 1900s. One of the initial significant achievements in this regard was seen in the form of the Model Town and Regional Planning and Development Law in 1962, drafted by the TCPO, which formed the basis for enactment of Town and Country Planning Acts by various states. The broad provisions under these included the preparation of a land use map, preparation of

development plans and detailed schemes. However, till then the urban local authorities were still not efficient in respect to the Constitution (Seventy-Fourth) Amendment Act 1992.

The first national level planning guidelines were framed in 1996 by the Institute of Town Planners, in consonance with the provisions of 74th CAA. These 'Urban Development Plans Formulation and Implementation' (UDPFI)^{xii} guidelines emerged as an outcome of the recommendations from a *National Workshop on Master Plan Approach: Its Efficacy and Alternatives* that was held in 1995, which examined the entire process of urban development planning and implementation.

As per the present framework, urban planning and development at national level is dealt by the Ministry of Housing and Urban Affairs (MoHUA) and the Planning Commission of India, in the form of policies, legislations, and development programs laid down by them. At the state and city level, the Town Planning Departments are responsible for preparation and implementation of the Master Plans or Development Plans among various other planning documents^{xiii}. The Master Plans are legal documents that drive the process of planning and development for cities in India. This urban planning process remains almost the same throughout the country, strictly following guidelines as per the Urban Development Plans Formulation and Implementation (UDPFI). Further with changing times, the towns and cities became more dynamic in nature, showing unprecedented changes in terms of infrastructure and other requirements. To meet these, as well as to cater to the emerging concepts of inclusive planning, sustainable development, disaster management and others, the revised Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines^{xiv} were conceptualised and framed in 2015.

2.3. Hierarchy of Plans

As per the Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines 2015, the urban and regional planning framework has been divided into the following two:

- i. *Core Area Planning*, and
- ii. *Specific and Investment Planning*

The Core Area Planning comprises of plans at 4 different scales with independent objectives: a long-term *Perspective Plan* with a vision and policy orientation, a long-term *Regional Plan* with optimization of resources shared at a regional level for development, a long-term comprehensive *Development Plan* specific to development within urban and peri-urban limits, and a short-term *Local Area Plan* within the framework of Development Plan.

The Specific and Investment Planning is categorized into 3 short term specific approaches to plan preparation: a *Special Purpose Plan* for special areas with specific development requirements within the framework of Development Plan, an *Annual Plan* for physical/ fiscal

resource mapping and performance indicators of Development/ Local Area Plan, and *Project/ Research* to focus on execution and implementation.

Figure 11. Relationship of Planning System



Source: Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines 2015

Perspective Plan: This is usually developed at a State level, and focuses on the spatio-economic policies, strategies, and programmes towards the development of the State. The plan is based on state resource mapping, analysis, and assessment of potential resources. The scope of this plan covers the social, economic, environmental and spatial development goals, policies and priorities relating to the activities that have spatial and financial implications.

Regional Plan: Regional plans are developed to ensure consistent and seamless treatment of the planning philosophy for a region, whose specific areas may be under the jurisdiction/purview of different planning Acts/Statutes. These include Town and Country Planning Act, Municipal Laws, Urban/Metropolitan Planning/ Development Act, Improvement Trust Act, Industrial Development Act, Cantonment Board Act, Major Ports Act etc. Often these laws are mutually exclusive, which may lead to planning conflicts and sub-utilization of land. The Regional Plan helps avoid such issues.

Development Plan/ Master Plan: Development plan is a statutory plan prepared (under relevant Act) within the framework of an approved perspective plan. The approved development plan allows the local authority to implement development of the land area specified under the plan with the help of local area plans and projects. The term “Development Plan” is used differently in States. Some States use it for an integrated multi-sector plan, such as the District Development Plan. Some states call it a Master Plan. Here, both the plans, Development plans and Master plans have the same functions and impose similar controls, with variation in the use of nomenclatures by States.

Local Area Plan: The purpose of Local Area Plans is to facilitate micro-planning to help decentralization and improve implementation of Development Plans/Master Plans.

Special Purpose Plan: Special Purpose Plan are prepared for specific development sectors depending on its economic and environmental importance. These plans need to be within the framework of the Regional Plan, Development/ Master Plan or Local Area Plan in the jurisdiction of the local authority.

Annual Plan: An Annual Plan contains the details of the new and ongoing projects that the local authority intends to implement during each financial year for necessary financial resource mobilization and monitoring its performance. The annual plan is to be prepared by the local authority in each financial year to identify the new projects, which the authority will undertake for implementation during the year, taking into account the physical and fiscal performance of the preceding year, the priorities, the policies and proposals contained in the approved Regional Plan, Development Plan or Local Area Plan.

Projects/Research: Conceived within the framework of the Perspective plan, Development/ Master plan or any of the plans in the planning system, projects are the working layouts with all supporting infrastructure and documents including cost, source of fund and recovery providing all necessary details for execution including finance, development, administrative and management.

The details of this planning system at various scales, with examples of plans and their scope, is elaborated below.

Figure 12. Urban Planning Framework

Planning System	Scope and purpose of the plan	Time	Various plans; indicative list							
Core area of planning										
Perspective Plan	To develop vision and provide a policy framework for urban & regional development and further detailing	20-30 years	Long Term Perspective Vision document	Concept plan	Mission statement	-	-	-	-	-
Regional Plan	To identify the region and regional resources for development within which settlement (urban and rural) plan to be prepared and regulated by DPC	20 years	Regional Plan (Mobility 1)	Sub-regional plan	-	-	-	-	-	-
Development Plan/ Master Plan	To prepare a Comprehensive Development Plan for urban areas, Peri-urban areas under control of Development Authority/ Metropolitan Planning Committee	20-30 years (review every 5 years)	District Development Plan (Mobility 1)	City/ Metropolitan Development Plan (Mobility 2)	Master Plan City Utility (30 years)	Revised Development Plan	-	-	-	-
Local Area Plan	To detail the sub-city landuse plan and integration with urban infrastructure, mobility and services.	5-20 years (review every 5 years)	Town Planning Schemes	Zonal Plan/ Sub-city plan	Ward Committee Plan	Coastal Zone Mgmt Plan	Urban Redevelopment Plan	-	-	-
Specific and investment planning										
Special Purpose Plan	To identify the needs of the special areas which require special plan within the framework of the development plan	5-20 years (within city utilities 30 year plan)	City Development Plan (as per JNNURM)	Comprehensive Mobility Plan (as per JNNURM)	City Sanitation Plan (as per JNNURM)	Disaster Management Plan (as per NDMA)	Slum Redevelopment Plan (as per RAY)	Tourism Master Plan	Environmental Conservation Plan	Heritage Conservation Plan
Annual Plan	To translate Development Plan in the context of annual physical & fiscal resource requirement. To monitor plan implementation with performance milestones.	1 year	Investment plan	Audit and monitoring plan	-	-	-	-	-	-
Project/ Research	To focus on project related investments, costing and returns & for the studies required prior to or post plan formulation. This should be a continuous process to support planning and implementation at all stages and promotes innovation in practice	5-20 year	Pre-feasibility & feasibility study	Detailed Project Report	Schemes & Sub-projects	Surveys & Studies	Project such as: Riverfront development projects	-	-	-

Source: Urban and Regional Development Plans Formulation and Implementation (URDPFI) Guidelines 2015

2.4. Master Plan synergies with Urban River Management

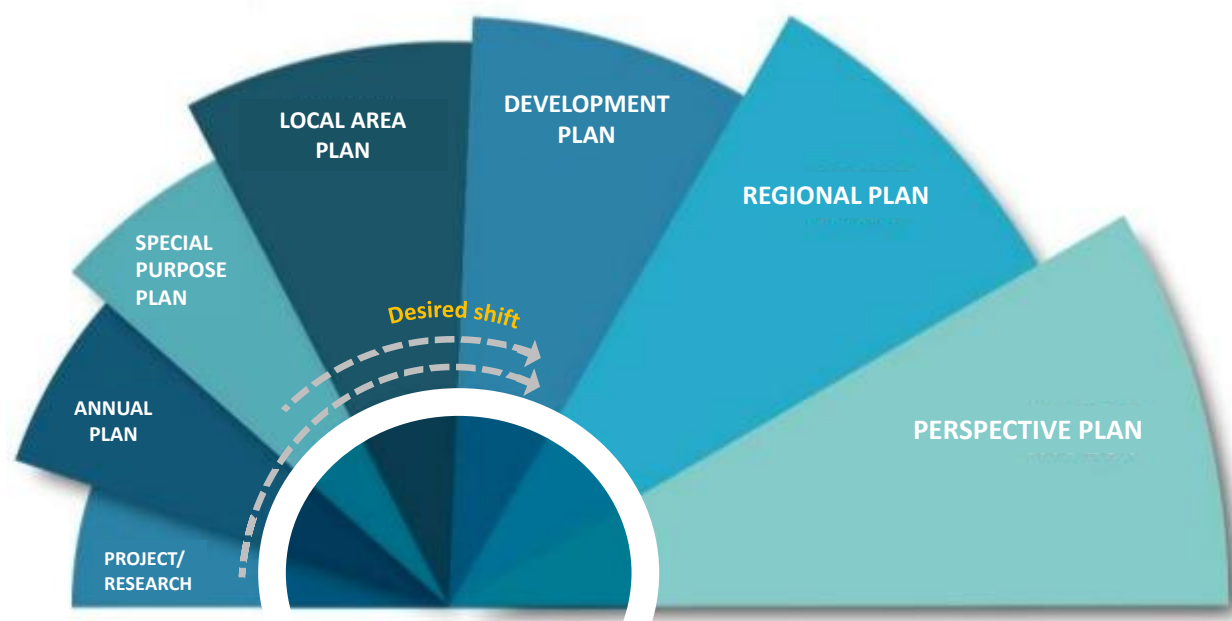
Among the various scales and hierarchy of plans in the Indian system, river-sensitive approach to urban planning is most appropriately applicable and severely lacking in the Master Plans of cities across the country. These statutory documents can ensure implementation of pan-city interventions when dealing with the issues of urban rivers, that are usually spread across the entire extent of the city.

As clearly reflected above, the Master Plan is a statutory instrument aimed at controlling, directing and promoting rational development of urban areas, while achieving maximum economic, social and aesthetic benefits. It indicates proposals for allocating the use of land for various purposes such as residential, industrial, commercial, recreational, public and semi-public, etc; identifies areas required to be preserved/ conserved; maps a phased-out strategy for development; defines the area specific zoning and sub-division regulations, development control norms and building bye-laws which are the instruments to access, use and control of land; among its other functions.

More importantly Master Plans are prepared by organizations reporting to the state and rivers are a state subject. Thus the Urban River Management has a natural complementarity with the Master Plan of cities. Moreover, the Master Plans have an enforcement mandate and a statutory backing, making the authorities accountable for their actions. These plans are also capable of resolving social/ economic/ cultural/ environmental conflicts, that is essential for restoring the wholesomeness of rivers within cities. It is thus envisaged, that the planning related interventions of the URMP can piggyback on the existing city Master Plans, for a holistic approach in dealing with urban rivers.

The figure below shows this hierarchy of plans and the desired shift in river-sensitive approach, from special purpose plans and projects (as the usual present practice) to city level planning through Development/ Master Plans.

Figure 13 Planning System addressing Urban River Management



Source: Compiled by NIUA, 2019

2.5. Comprehensive Planning for Urban Rivers

As elaborated in Chapter 1, the need for planning and restoration of rivers emerges when a river ecosystem has been degraded to an extent that the river can no longer provide the ecosystem services required out of it. In such cases, river restoration/ management policies, strategies and plans need to be developed with a clear understanding of the freshwater ecosystem as well as the dependent system (that draws its services from the river).

Addressing the present issues of Indian rivers requires a more strategic planning approach with restoration activities. The restoration process can require interventions and co-ordination at numerous spatial, functional and administrative scales, for instance the Integrated Water Resource Management (IWRM), Integrated River Basin Management/ watershed planning, river-sensitive urban planning, special purpose plans for disaster/ flood management/ river drought, and projects for river management like riverfront projects/ ghat development projects, etc. In India however, river management is usually dealt at the following two scales, the river basin comprising of the entire catchment, or the river channel along with its immediate surroundings.

Planning for river basin

A river is more appropriately characterized by its entire catchment area, rather than any administrative boundaries. Various River Basin Management Plans are already being prepared in India as well, to outline a broad strategy for revitalising the entire catchment basin of the rivers and their tributaries, as advocated by the national missions and priorities.

Like the Indian *National Water Policy (2012)* prescribes that “*Integrated Water Resources Management (IWRM) taking river basin/sub-basin as a unit, should be the main principle for planning, development and management of water resources*”. Similarly, one of the goals of the *National Water Mission (2008)* is “*promotion of basin level integrated water resources management*”, which is also achieved through river basin management plans. Some such plans like the Ganga River Basin Management Plan, prepared under the National Mission for Clean Ganga, intend to take comprehensive measures for restoration of the wholesomeness of the entire basin ecosystem with due regard to the competing water uses across different administrations within the river basin.

Projects for river management

River management projects, mostly in the form riverfront development, landscape/recreation, installation of Sewage Treatment Plants (STPs), ghat development, etc. are most commonly adopted by the river cities. Some examples include the Dravyawati Riverfront project (Jaipur), Sabarmati Riverfront project (Ahmedabad), Yamuna Biodiversity park (Delhi), etc. Even under the Namami Gange Programme of the Ministry of Water Resources, a variety of activities for revitalization of river Ganga have been taken up, including treatment of municipal sewage, treatment of industrial effluent, drain bio-remediation, river surface cleaning, rural sanitation, river front development, construction of ghats and crematoria, afforestation & biodiversity conservation, etc. However, the aim of these projects is usually limited to developing a beautiful, healthy and usable river bank for the city inhabitants. While these projects are essential for the development of a healthy river infrastructure, they alone are not self-sufficient for a holistic urban river management.

River-sensitive Urban Planning

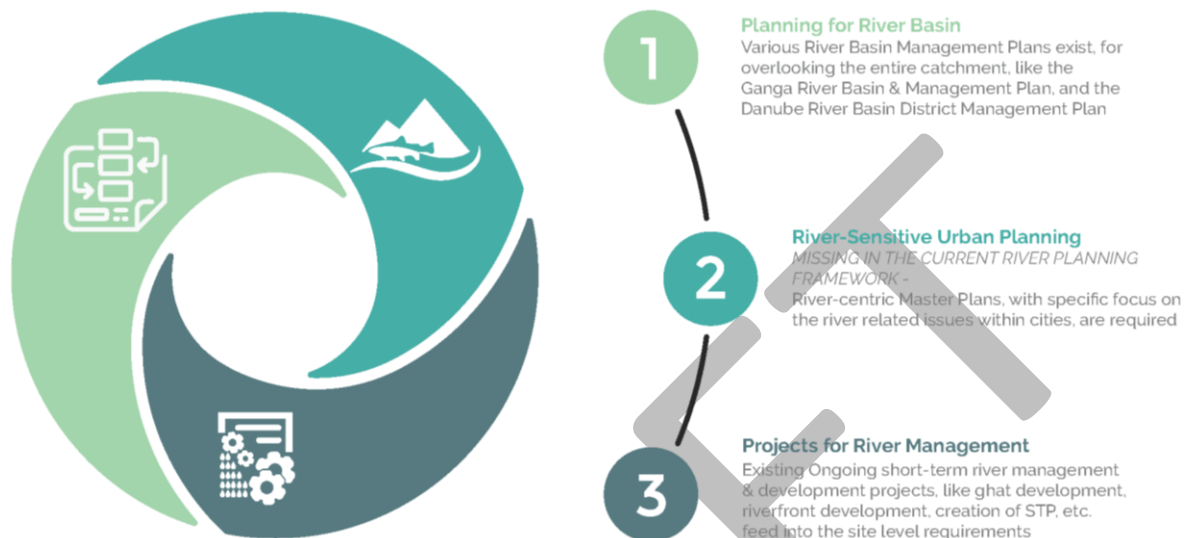
Between the above two levels of river management, there is a relatively unaddressed space. This is related to river-sensitive city planning, usually defined by the city’s administrative boundaries, which essentially treats the river as an asset and ensures that the developmental activities within the city are not detrimental to the river. Hence, the city planning needs to take cognizance of the river and its interaction with the city.

It is also pertinent to mention here that any river flowing through a city cannot be looked in isolation, without its contextual setting and its linkages the urban area. The city-river connect is a very strong relationship build across generations, and cannot be neglected while dealing with any form of city planning, infrastructure development or management related to the area. The dependency of the city and its inhabitants on the river ecosystem has to be accurately projected for coming up with an efficiently functioning infrastructure system. More importantly, the dependency also has to be mapped out, for bringing forth the best possible development interventions without altering the natural ecological character of the area. Thus, even while dealing with river-projects, the concept of river

management has to be interwoven within the city planning stage itself. This is a relatively weaker link in the Indian context of urban river management.

The figure below mentions these three interwoven scales of river-sensitive urban planning.

Figure 14. Levels of Planning for River Management



Source: Compiled by NIUA, 2019

2.6. Review of Existing Master Plans

Master Plans are visionary documents, which provide the perspective for development that shall come up within a city in the next 20-30 years. When working with river cities, it becomes crucial to strengthen this planning link for a holistic (considering ecological, economic, social parameters) approach to river-sensitive urban planning.

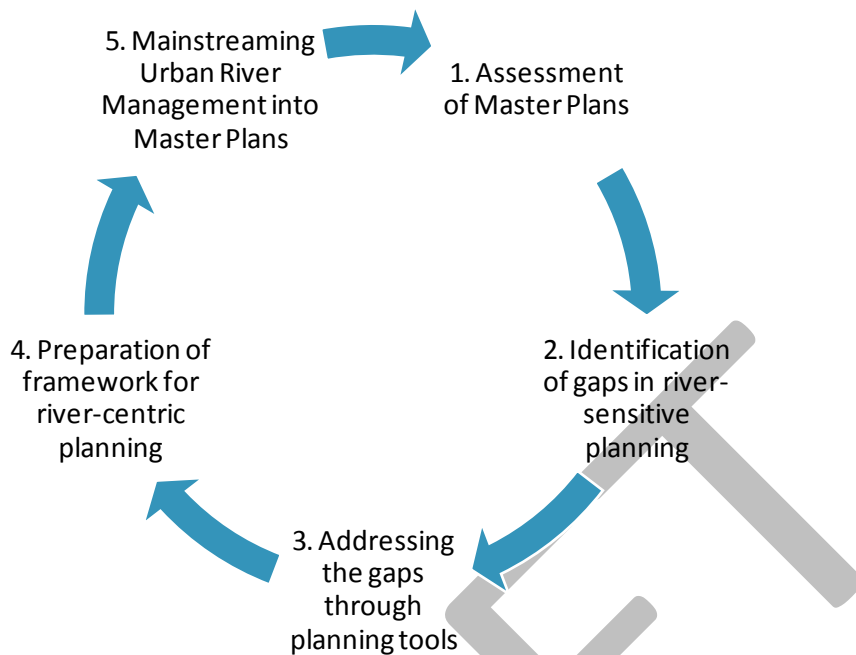
2.6.1. Methodology Adopted

The Master Plans for various river towns have been studied to understand the current status of river-sensitive planning within cities. These Master Plans have been scrutinised with a perspective to understand how they deal with the rivers flowing through these cities.

Following this process, the plans for towns falling on the main stem of river Ganga have been compared against other national as well as international river towns. These have been assessed to identify the key gap areas within the existing Master Plans. These gap parameters are expected to feed into the existing urban planning framework, for a holistic and efficient river-sensitive planning approach.

The figure below shows the methodology followed, as a part of these strategic guidelines.

Figure 15 Methodology followed for river-centric planning



Source: Compiled by NIUA, 2019

Each Master Plan addresses certain river related parameters, either by merely mentioning it or by devising detailed strategies for it. Also, certain parameters are completely neglected while proposing the development strategies for a river city. An attempt has been made to compare selected river towns on this basis. These towns have been graded purely from the perspective of river consideration within their planning document.

The analysis of Master Plans also showcases certain best practices in the form of river-sensitive approaches undertaken as proposed recommendations/ strategies/ projects, after a clear assessment, reflection as well as projection of the ecosystem requirements within the city.

2.6.2. Towns selected for assessment of Master Plans

The availability of a Master Plan or Development Plan or any other plan of similar scale and purpose, has been considered as the main criteria behind the selection of towns. Based on the availability of a Master Plan, various Ganga basin towns, i.e. out of the 97 towns falling on the main stem of river Ganga, in the Upper, Middle and Lower basin stretches, have been identified. Apart from these, other major national and international river towns have also been shortlisted based on the river-sensitive approach followed by their city plans.

As per the information available online over the websites for Town & Country Planning Organizations of Indian states, the towns having a statutory Master Plan within the 4 Ganga basin states, i.e. Uttarakhand, Uttar Pradesh, Jharkhand and West Bengal, have been

enlisted in Annexure-I. The 4 states mentioned above exclude Bihar, as no data regarding the availability of Master Plans for the cities in Bihar has been listed online. Also, the list of 97 towns falling on the main Ganga river stem is enclosed as Annexure-II. It is found that out of these 97 Ganga basin towns, only 17 have prepared their Master Plans (as per the information listed on their TCPO websites). These towns are enlisted in the figure below.

Figure 16 List of Ganga basin towns having Master Plans/ Development Plans

S.No.	STATE	Ganga basin towns with Master Plans/ Development Plans
1	Uttarakhand (6 towns)	Haridwar
2		Rishikesh
3		Chamoli - Gopeshwar
4		Srinagar
5		Gaucher
6		Badrinath
7	Uttar Pradesh (6 towns)	Prayagraj (Allahabad)
8		Bithoor
9		Garhmukteshwar
10		Kanpur
11		Shuklaganj/ Gangaghat
12		Varanasi
13	Bihar (1 town)	Patna
		*No information about Master Plans of Bihar is available on TCPO website
14	Jharkhand (2 towns)	Sahibganj
15		Rajmahal
16	West Bengal (2 towns)	Haldia
17		Kolkata

Source: Compiled by NIUA, 2019 (as per information from the TCPO websites of states across India, refer Annexure I)

Moreover out of the 17 towns listed above, the Master Plan documents for only 8 towns highlighted above are accessible online. These 8 Ganga basin towns have been considered for this analysis.

1. Patna Master Plan, 2031
2. Kanpur Master Plan, 2021
3. Allahabad Master Plan, 2021
4. Haridwar Master Plan, 2025
5. Vision 2025, Perspective Plan, Kolkata Metropolitan Area
6. Landuse & Development Control Plan 2021, Haldia
7. Sahibganj Master Plan, 2040

8. Rajmahal Master Plan, 2040

Master Plans for other major river towns listed below, were also assessed.

9. Dehradun Master Plan, 2025
10. Master Plan for Delhi, 2021
11. Agra Master Plan, 2021
12. Comprehensive Development Plan Ahmedabad, 2021
13. MP for Chennai Metro. Area, 2026

Also international best practices, showcasing river-sensitive Master Plans, were identified.

14. New Orleans Master Plan, 2030
15. Ulaanbaatar Master Plan, 2030
16. Municipal Development Plan, City of Calgary

As enlisted above, a total of 16 Master Plans have been elaborated with means undertaken to manage rivers within these cities. Apart from these Master Plans, various other best practices, and literature documents have also been considered for mapping out the ideal river-sensitive city plans.

2.6.3. Parameters of River Management addressed within Master Plans

The river management related elements, presently existing within the Master Plans of river towns have been analysed. These parameters of river management commonly addressed within various Master Plans have been clearly identified, based on this study. However, these parameters are limited to the basic functions served by urban rivers. For convenience in understanding, these 11 parameters have been categorized within three broad subheads - *General Parameters*, *Planning Parameters* and *Ecological Parameters*.

General Parameters - Any Master Plan starts with a well-defined vision and specific objectives, with a clear intent to successfully achieve the desired goal. These objectives are usually built on the background, historical setting and the current statistics of the city. These details have to be established at the beginning of these planning documents, forming the scope and basis for the proposed development model. For river cities, this visionary exercise shall be cognizant of the health of the entire river ecosystem. This means that the *General Parameters* forming a part of the Master Plans, such as the following, intend to strengthen the city's connect with their rivers:

1. MP Vision/ Objectives vis-à-vis river management
2. River Background (regional linkages, historical setting and current statistics)

However, talking about the current Master Plans, this approach to start the entire planning exercise in a river-sensitive manner is still far from reality, for most of the river cities.

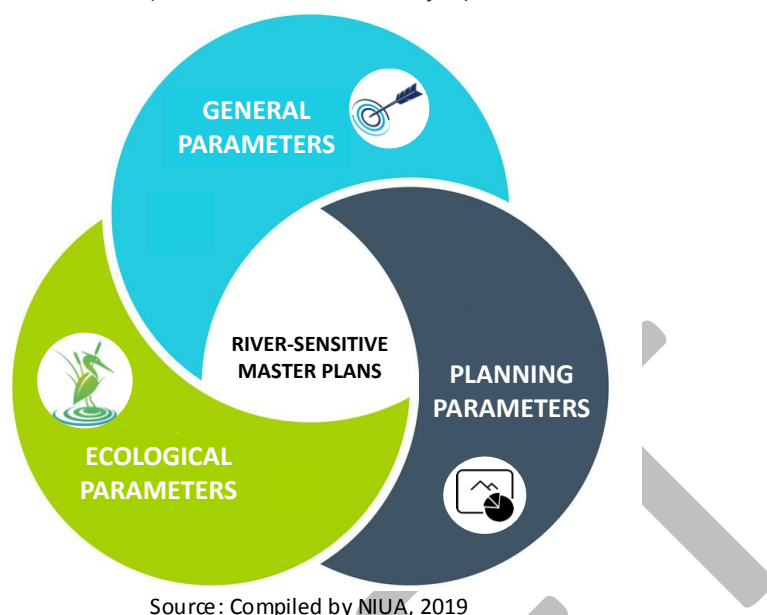
Planning Parameters - As defined in sections above, the domain of Master Plans is primarily associated with (but not limited to) assigning/ allocating suitable land use, steering the proposed development, imposing specific restrictions and regulations, defining the norms for standardised development and recommending suitable strategies for the desired development. For all river towns these urban planning parameters, that define the manner in which any area is developed, shall definitely involve a consciousness towards the river and its floodplain ecology. All planning and development interventions within a city shall be proposed, without disturbing and in-fact strengthening the ecosystem balance of the river zone. For this, an elaborate assessment of the current planning framework is required, while building upon the river-specific needs through the planning tools of a Master Plan. The *Planning Parameters* within various Master Plans, that have a bearing over the river health are as below:

1. River Zone Delineation
2. Urban flooding
3. Landuse, use zone, use premise
4. Development Control Norms/ Zoning Regulations
5. Ground water augmentation
6. River water extraction for city use
7. River pollutants and pollution level
8. River navigation - Inland waterways

Ecological Parameters - The health of a river stream is primarily defined by its ecosystem. Any river system, no matter how beautifully developed, will not thrive without its ecological flow. Moreover, other factors such as conservation of eco-rich habitats and biodiversity rich areas are equally important determinants for urban river health management. However, river ecology is not a widely studied aspect within the Master Plans. Infact, most of these planning documents are even silent about the environmental parameters related to the rivers flowing within the cities. Some of the ecological parameters attempted by Master Plans of international river towns include the following:

1. Identification & Protection of eco-sensitive areas
2. Ecological flow
3. Biodiversity rich habitats

Figure 17 Typology of Urban River Management parameters addressed within the Master Plans of cities
(based on case studies identified)



Source : Compiled by NIUA, 2019

2.6.4. Comparison of River Consideration in Master Plans

The matrix below, reflects upon the river-consideration within each of the above-mentioned Master Plans. While some plans begin by defining a river-sensitive vision, others earmark the permissible activities along the river.

Relative scoring, on the basis of the 11 identified common parameters, give an idea about where each Master Plan stands against the others. The scoring is standardized based on the following two criteria:

- 0.5 score for parameters mentioned within the Master Plan without any detailed analysis or recommendation.
- 1.0 score for parameters mentioned within the Master Plan with detailed strategies or recommendations to address the concern

Figure 18 Analysis of Master Plans addressing parameters of Urban River Management

Comparison of river consideration in the Master Plans		General Parameters		Planning Parameters							Environmental Parameters		
Parameters for Urban River Management		River-sensitive Vision/ Objectives	River Background	River Zone Delineation	Urban Flooding	Land Use, Use Zone, Use Premise	Development Control Regulations	Ground water Augmentation	River Water Extraction for City Use	River Pollutants and Pollution level	River Navigation	River Ecology/ Environmental Services	Relative Scoring (11 components)*
Selected Master Plans	Ganga Towns												
	Dehradun Master Plan, 2025												3
	Haridwar Master Plan, 2025												3.5
	Allahabad Master Plan, 2021												6.5
	Kanpur Master Plan, 2021												2.5
	Patna Master Plan, 2031												4
	Land use & Development Control Plan Kolkata MA												2.5
	Land use & Development Control Plan 2021, Haldia												2
	Sahibganj Master Plan, 2040												0.5
Rajmahal Master Plan, 2040												0.5	
Indian River Cities													
	Master Plan for Delhi, 2021												3.5
	Agra Master Plan, 2021												3.5
	Comprehensive Development Plan Ahmedabad, 2021												3
International River Cities													
	MP for Chennai Metropolitan Area, 2026												8.5
	New Orleans Master Plan, 2030												8.5
	Ulaanbaatar Master Plan, 2030												6.5
	Municipal Development Plan, Calgary												7

Source : Compiled by NIUA, 2019

To further give clear examples of a river-sensitive approach to planning, the details of environmental approach undertaken by each of these Master Plans are available in Annexure-III. These examples can be referred while preparing strategies for other river towns, wherever suitable.

2.6.5. Gap Areas in River-Sensitive Urban Planning

Based on the above assessment, a severe gap is observed in adopting a river-sensitive approach within the Master Plans for most of the Ganga Basin towns. Also when it comes to addressing their rivers, most of the city Master Plans look at land use allocation and aspects related to the basic infrastructural needs served by rivers within cities, such as water extraction, ground water augmentation and water pollution. It is pertinent to mention here that certain important parameters like floodplain delineation, urban flooding and development control regulations are left unaddressed in most of the Master Plans. It is also clearly evident that none of the Indian Master Plans considered above reflect upon conservation of river ecology, which is of prime consideration while managing the river health. Parameters like ecological flow of the river, identification & protection of eco-sensitive areas, biodiversity mapping, and other factors governing the river's environmental health are not addressed in any manner within these planning documents.

The key gap areas in river-sensitive urban planning include:

- Lack of a concrete vision for the river
- No proper delineation of the river zone
- Insufficient Development Control Regulations, specific to the river zone
- Inadequate coverage of river ecology and ecosystem services related aspects

These are the core gap areas in terms of a river-sensitive approach within Master Plans. These huge gaps draw our attention towards initiatives for mainstreaming River Management parameters within city's Master Plans.

The above analysis also highlights that the Master Plans for certain cities like Chennai, New Orleans, Ulaanbaatar and Calgary are relatively river-friendly. Their examples can be adopted while envisaging a river-sensitive urban planning approach.



Chapter 3. Enabling

River-Sensitive Master Planning

Chapter 3. Enabling River-sensitive Master Planning

As elaborated in Chapter 1, cities have a long and complex relationship with their rivers. Beginning with their dependence on these ecosystems for water sources and pollution sinks, they soon drifted into the process of over-exploitation and ignorance towards the river health. The inherent complexity of constant environmental changes along these urban rivers requires a complete change in perspective, which goes far beyond the binary conceptualizations of river city-interactions.

Moreover, these harmful impacts of urbanization on rivers are wide-ranging and multifaceted, going far beyond the historical concerns of water pollution. As the urban centres further expand in number and size, these negative impacts on freshwater ecosystems become more severe and widespread. Picking up from the chapters above, some of the core concerns of urbanization affecting these urban water resources include the following.

Figure 19 Concerns of urbanization affecting these urban water resources



To address the above issues, urban river management has to be brought to the heart of city planning. It has to be seamlessly built within the whole natural planning process. It also means that we need to have city plans which will ensure that the rivers never reach an undesirable state.

The Master Plans, as explained in Chapter 2, are standard instruments of planning used by the planning and development authorities across the country. They are statutory in nature, prepared (under relevant act) within the framework of an approved perspective plan. The URDPFI clearly defines its key objective as to provide necessary guidelines and intended actions in the form of recommendations, strategies and physical proposals for various policies given in the perspective/ regional plan, depending upon the economic and social needs and aspiration of the people, available resources and priorities.

The main intent of Master Plans is to promote growth and guide/ regulate development within cities. It is an instrument for land and infrastructure allocation and development,

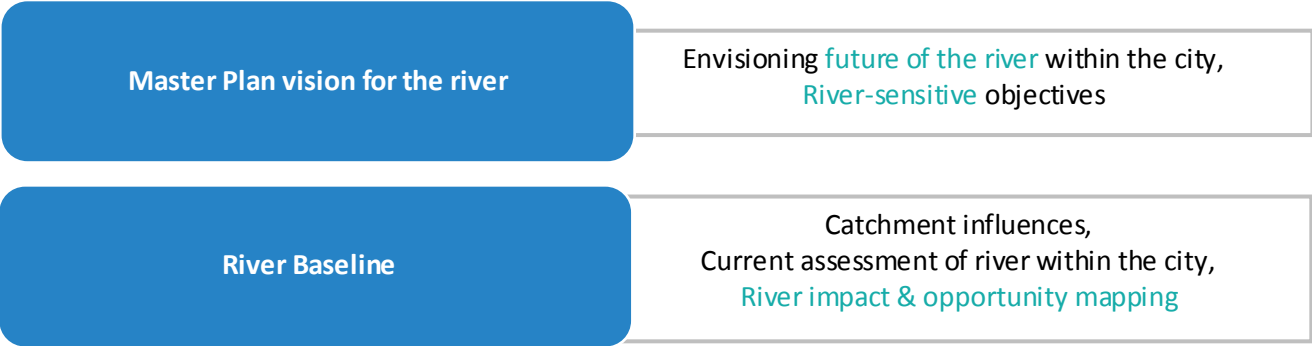
while performing the economic, social and ecological functions efficiently. It also identifies areas for conservation/ preservation and areas with optimum development potential within cities. River cities have to ensure that this planning document is envisioned with environmental improvement, social upliftment, and urban rejuvenation of the waterfront as per the specific city needs.

3.1. River focus through Planning Tools

The Master Plan for river cities has to be conceptualised with a focus on the river specific needs. In an attempt to do so, this planning document, through its various Planning Tools, needs to take cognizance of the rivers with a holistic approach to imbue river-centric perspective within each section of the city plan. It shall clearly outline provisions for *river-space* while allocation of various land uses, regulate of its development and access, make provision for river-related infrastructure, identify projects for development and their phasing, to maintain the river health within the city space. The entire Master Planning process needs to adopt a river-sensitive approach.

Planning Essentials

The process of preparation of any Master Plan is initiated by framing the vision & objectives, as well as forming a current baseline for the urban area. These form the building blocks for the entire planning exercise. It is thus envisaged, that the Master Plan for any river city shall start by setting out a broad vision which highlights how the city views its connect with the river in the plan period. It shall be followed by setting out certain river-sensitive planning objectives, establishing the catchment influences and evaluating the current stature of the river within the city. These essential elements of the planning exercise shall follow a river-sensitive approach.



After fixing the above-mentioned planning essentials, the following Master Plan tools can be used as instruments to mainstream sustainable river health management into the city's larger long-term vision.

Taking river consideration within the following seven tools, will ensure the requisite river-sensitive development within the city.

The details of each of these planning essentials as well as master plan tools, along with case examples showing how these have been successfully adopted to the needs of different river cities, are elaborated in the section below.

Master Plan Tools

Figure 20 Master Plan Tools, for a river-sensitive plan



Source : Compiled by NIUA, 2019

3.1.1. Master Plan Vision for the river

Developing a vision statement and specific objectives stipulating the direction of growth is essential for any policy framework, to clearly identify the resource potential and required innovations that can be adopted for the thrust areas of development. Master Plan is a long-term envisioning process, with a broad view to cater to the emerging needs within its spatial extent. These long term Urban Development Plans formulate an overarching vision for the next 20-30 years, enlist the broad objectives aligned towards achieving it, provide a policy framework for urban & regional development with the same perspective, and detail-out implementable strategies to achieve the desired results.

The Master Plans for river cities shall commence by envisioning the future city-river connect. Relevant objectives in relation to management of water quality, provision of public access to the river to strengthen the citizen-river connect, protection of cultural values associated with the river, exploitation of the river-tourism potential, management of risks associated with natural hazards, as well as conservation of the natural ecosystem shall also be framed and incorporated within the planning process.

Some specific examples of river-sensitive vision and objectives, formulated for planning of various cities, are referred below.

Example: Master Plan, New Orleans, 2030

Vision Statement:

1. *LIVABILITY – Enhanced quality of life for everyone that preserves the city’s character*
2. *OPPORTUNITY – Expanding opportunity and ensuring equitable chance to share benefits*
3. *SUSTAINABILITY – A more resilient city*
By 2030, New Orleans can become a city that celebrates its relationship to water and uses water-management strategies to provide amenities to neighbourhoods wherever possible



Source: <https://www.planetizen.com/files/plans/New%20Orleans%20Plan%20Vol%202%20Implementation.pdf>

Example: Los Angeles River Master Plan 2020 (Draft)

Vision Statement:

The Reimagined River - Fifty-one miles of connected open space that includes clean water, native habitat, parks, multiuse trails, art, and cultural resources to improve health, equity, access, mobility, and economic opportunity for the diverse communities of LA County, while providing flood risk management.

Objectives:

Goal 1 - Reduce flood risk and improve resiliency.

Goal 2 - Provide equitable, inclusive, and safe parks, open space, and trails.

Goal 3 - Support healthy, connected ecosystems.

Goal 4 - Enhance opportunities for equitable access to the river corridor.

Goal 5 - Embrace and enhance opportunities for local arts and culture.

Goal 6 - Address potential adverse impacts to housing affordability and people experiencing homelessness (along the river).

Goal 7 - Foster opportunities for continued community engagement, development & education.

Goal 8 - Improve local water supply reliability.

Goal 9 - Promote healthy, safe, clean water.

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3.1.2. Forming the River Baseline

For framing the Master Plans of any city, its contextual setting within the region shall be clearly established by analysing the regional linkages and dependencies. All relevant regional policies and strategies shall feed directly into the planning interventions proposed within the Master Plans. Specifically in the case of river cities, the influence region is not limited to the administrative boundaries. The entire catchment basin has an influence over the river within the city boundaries. The impact of upstream pollution, sharing of water resource across administrative setups, flow across cities and basin water resource management, in addition to various other factors shall be considered while analysing the influences over the river town.

Once the regional context is established, the growth and development potential as well as the site needs as per the current ground conditions, need to be explicitly recognized in order to prepare appropriate policies, strategies and specific projects for spatial planning. For a river-sensitive approach, the current status of the river within its surroundings (ecological as well as spatial aspects), its historical citing and contextual setting within the city have to be mapped out. Accordingly an elaborate spatial earmarking of the critical and potential areas, in the form of impact and opportunity mapping, shall be carried out to feed directly into the planning exercise.

The contents of the river baseline shall include (but not be limited to) the following categories:

- *Topography*: (contours; slopes; geographic boundaries; river zone; soil; climate; floodplain; groundwater; etc.)
- *Demography*: (population density; location of unauthorized/slum settlements; demographic profile; etc.)
- *Physical infrastructure*: (sewerage infrastructure; drainage network; sewered and non-sewered areas; on-site sanitation systems; community/public toilets; solid waste collection centres; water supply systems; etc.)
- *Spatial planning*: (planning zones; administrative boundaries; land use; use zones/use premise; stakeholder mapping; etc.)
- *Environmental assets*: (water bodies; forests; wetlands; parks; protected areas/ecosensitive zones; etc.)
- *Social aspects*: (religious and cultural establishments, especially along the river; crematoria; dhobi Ghats; boating locations; etc.)

Some specific examples showing an analysis of the river setting within the city, are shared below.

Example: The River South Greenway Master Plan

Existing Condition Maps – Current Assessment

Identification and analysis of existing conditions resulted in an understanding of issues, challenges and specific planning recommendations within the River South Greenway Master Plan study area. For analysis purposes, existing conditions were organized into sixteen maps including:

1. General Types of Property Ownership
2. Generalized Existing Land Use
3. Existing Zoning
4. Flood Hazard Areas
5. Blueprint Denver
6. Neighborhood Features
7. Mobility
8. Recreation Features
9. Existing In-River Recreation Features
10. Aquatic Habitats
11. Vegetation Habitat
12. Sanitary Sewer Infrastructure
13. Storm Sewer Infrastructure
14. Notable Channel Features
15. Barriers
16. Landfills

Opportunity Maps

Analysis of existing conditions leads to the identification of opportunities. Opportunities maps for access, land, land use – water/ recreation and habitat were completed and provided a valuable tool when developing the Vision Plan Map and determining planning proposals.

For analysis purposes, existing conditions were organized into four opportunities maps including:

1. Access Opportunities
2. Land Opportunities
3. Land Use Opportunities
4. Water Recreation and Habitat Opportunities

Source: <https://www.thegreenwayfoundation.org/uploads/3/9/1/5/39157543/riso.pdf>

3.1.3. Localizing national policies

Policies set the framework for directing development, in-line with the overall vision and objectives of the planning document. Strong planning policies ensure controlled development that is carefully designed and cited without modifying the existing landscape, while ensuring that the local needs are well addressed. The policies in-turn give way to specific strategies and project proposals to be identified for different areas.

Several national and state level policies have direct implications on river management aspects. Some of these *allied policies/ supporting policies* are the *National Policy on Faecal Sludge and Septage Management*, 2017 (for sanitation management); *Swachh Bharat Abhiyaan*, 2014 (for both wastewater and solid waste management); *Jal Shakti Abhiyaan*, 2019 (for water bodies rejuvenation, water conservation, afforestation, and groundwater recharge); *Draft National Forest Policy*, 2018 (for forest management); *National Water Policy*, 2012 (which has considerable river-related clauses); *National Water Mission*, 2011 (for climate-change related implications), *Street Vendors Act*, 2014, *Draft National River Policy 2011*, among others. The state level interventions include the river regulation zone (RRZ) policy by states, state water policies, Inter-State River Water Disputes (Amendment) Bill (2019), state Policy on Rain Water Harvesting, among others. The Master Plan should devise specific localized strategies for a customized implementation of these policies at a city scale.

Guidelines like the *Guidelines for repair, renovation and restoration of water bodies with external assistance and domestic support - Ministry of Water Resources (2009)*, *Guidelines for the national lake conservation plan - Ministry of Environment and Forests (2008)*, *Model bill to regulate and control the development of groundwater - Ministry of Water Resources (1996)*, that have direct implications on river management, shall also be contextualised to the local needs.

Example: National Water Policy (2012), MoWR, GOI

Conservation of River Corridors, Water Bodies and Infrastructure

- Conservation of rivers, river corridors, water bodies and infrastructure should be undertaken in a scientifically planned manner through community participation. The storage capacities of water bodies and water courses and/or associated wetlands, the flood plains, ecological buffer and areas required for specific aesthetic recreational and/or social needs may be managed to the extent possible in an integrated manner to balance the flooding, environment and social issues as per prevalent laws through planned development of urban areas, in particular.
- Encroachments and diversion of water bodies (like rivers, lakes, tanks, ponds, etc.) and drainage channels (irrigated area as well as urban area drainage) must not be allowed, and wherever it has taken place, it should be restored to the extent feasible and maintained properly.
- Urban settlements, encroachments and any developmental activities in the protected upstream areas of reservoirs/water bodies, key aquifer recharge areas that pose a potential threat of contamination, pollution, reduced recharge and those endanger wild and human life should be strictly regulated.
- Environmental needs of Himalayan regions, aquatic eco-system, wet lands and embanked flood plains need to be recognized and taken into consideration while planning.
- Sources of water and water bodies should not be allowed to get polluted. System of third party periodic inspection should be evolved and stringent punitive actions be taken against the persons responsible for pollution.
- Quality conservation and improvements are even more important for groundwaters, since cleaning up is very difficult. It needs to be ensured that industrial effluents, local cess pools, residues of fertilizers and chemicals, etc., do not reach the ground water.
- The water resources infrastructure should be maintained properly to continue to get the intended benefits. A suitable percentage of the costs of infrastructure development may be set aside along with collected water charges, for repair and maintenance. Contract for construction of projects should have inbuilt provision for longer periods of proper maintenance and handing over back the infrastructure in good condition.
- Legally empowered dam safety services need to be ensured in the States as well as at the Centre. Appropriate safety measures, including downstream flood management, for each dam should be undertaken on top priority.

Source: http://mowr.gov.in/sites/default/files/NWP2012Eng6495132651_1.pdf

3.1.4. Town-specific Strategies

The URDPFI Guidelines, 2015 state that *“The objective of a development plan is to provide further necessary details and intended actions in the form of strategies and physical proposals for various policies given in the perspective plan and regional plan depending upon the economic and social needs and aspiration of the people, available resources and priorities”*. The policies are thus contextualised to town-specific needs in the form of Master Plan strategies, that form a means for implementing the Plan. In this case, specific river-focussed strategies catering to different objectives have to be identified to form a part of the city’s planning document, which in-turn pave way for further area-specific project proposals. Examples of such strategies include citizen engagement strategy, blue-green continuum strategy, strategy for urban forestry, etc.

Some specific examples showing town-specific strategies identified for a river city, are shared below.

Example: Structure Plan for Bangalore Metropolitan Region, 2041

Strategies for Water Resource Management

- **Effective protection and rejuvenation of surface water bodies to be ensured** - All water features like rivers, reservoirs, lakes, seasonal stream beds and wetlands should be protected, maintained and enhanced in capacity. This is critical from the long-term ecological well-being of the region as also to address the infrastructural needs for development. All lakes and tanks in the BMR should be actively rejuvenated. This should include existing lakes as well as ones that have been degraded / lost due to bad management in the past.
- **Water-demand based land use to be encouraged** - Strict control on Groundwater extraction to be enforced - There should be strict monitoring and control on groundwater extraction. Individual drilling, extraction and use should be stopped and community extraction and supply should be regulated.
- **Integrated Watershed Management to be encouraged** - Physical planning at the local area should necessarily integrate watershed management so as to address both development and environmental issues in a balanced manner.

Strategies for Environmentally Sensitive Areas

- **Protection framework for Environmentally Sensitive Areas to be enhanced** - Developments of any nature should be strictly monitored and controlled in and around designated environmentally sensitive areas such that further deterioration of the areas is arrested.

Source: <http://bmrda.karnataka.gov.in/Documents/Revised%20Structure%20Plan%20Report-ilovepdf-compressed.pdf>

Example: New York City Comprehensive Waterfront Plan – Vision 2020

Department of City Planning, Vision 2020, presents strategies for implementing many of the long-term goals of PlaNYC, plan for a greener, greater New York City; to improve water quality and ensure that each neighborhood has access to the recreational space.

Citywide Strategies

The City's recommendations for our waterfront and waterways spring from eight broad goals

Goal 1 - Expand public access to the waterfront and waterways on public and private property for all New Yorkers and visitors alike

Strategy 1 - Create new publicly accessible waterfront spaces

Strategy 2 - Create a more connected waterfront

Strategy 3 - Ensure public open spaces are high quality, support diverse uses, and are well-funded

Goal 2 - Enliven the waterfront with a range of attractive uses integrated with adjacent upland communities

Strategy 1 - Spur reinvestment in the waterfront

Strategy 2 - Incentivize the cleanup and redevelopment of waterfront brownfield sites

Strategy 3 - Increase knowledge of historic resources on the waterfront and promote preservation and adaptive reuse

Goal 3 - Support economic development activity on the working waterfront

Strategy 1 - Maintain the robust activity in the Port of New York and New Jersey and at the Brooklyn and Staten Island marine terminal facilities

Strategy 2 - Promote the region's marine highways to move domestic and international goods within the city and throughout the region

Strategy 3 - Pursue a long-term dredged material management strategy to make New York City's waterways navigable for all forms of transport

Strategy 4 - Analyze and promote policies to strengthen maritime support services and spur reinvestment in waterfront industrial areas

Strategy 5 - Promote environmentally sustainable practices, which will enhance not only waterfront industrial businesses but adjacent residential communities as well

Goal 4 - Improve water quality through measures that benefit natural habitats, support public recreation, and enhance waterfront and upland communities

Strategy 1 - Build new cost-effective grey infrastructure and optimize existing systems to meet goals for water quality throughout the city

Strategy 2 - Maximize the use of green infrastructure and other source controls to capture rainfall on impervious surfaces, helping reduce combined sewer overflows and other discharges

Strategy 3 - Restore natural systems to improve ecological productivity, reduce pollution, and provide habitat, recreation, and climate-adaptation services

Strategy 4 - Improve monitoring and public awareness of water quality

Goal 5 - Restore degraded natural waterfront areas, and protect wetlands and shoreline habitats

Strategy 1 - Acquire and augment protection of wetland and other shoreline habitat

Strategy 2 - Increase scientific understanding, public awareness, and stewardship of the natural waterfront

Strategy 3 - Promote ecological restoration that enhances the robustness and resilience of local and regional ecosystems

Goal 6 - Enhance the public experience of the waterways that surround New York—our Blue Network

Strategy 1 - Promote water recreation in suitable locations with access points, docks, and on-shore facilities

Strategy 2 - Clarify and enhance regulatory and organizational mechanisms to ensure safety of water recreation and reduce potential conflicts among various users of the waterways

Strategy 3 - Increase waterborne public transportation

Strategy 4 - Increase New York City's preparedness for waterborne emergency evacuation

Strategy 5 - Increase public knowledge and awareness of the waterfront and waterways

Strategy 6 - Explore renewable energy opportunities on our waterfront and in our waterways

Goal 7 - Improve governmental regulation, coordination, and oversight of the waterfront and waterways

Strategy 1 - Improve predictability and efficiency of the permitting process for in-water construction

Strategy 2 - With input from stakeholders, establish design guidelines for in-water infrastructure, such as piers, docks, and bulkheads

Strategy 3 - Ensure that the City adequately maintains City-owned waterfront infrastructure

Strategy 4 - Pursue regional coordination and partnerships on issues of regional significance

Goal 8 - Identify and pursue strategies to increase the city's resilience to climate change and sea level rise

Strategy 1 - Conduct a citywide strategic planning process for climate resilience

Strategy 2 - Develop a better understanding of the city's vulnerability to flooding and storm surge and examine a range of physical strategies to increase the city's resilience

Strategy 3 - Explore regulatory and policy changes to improve resilience of new and existing buildings to coastal flooding and storm surges

Strategy 4 - Work with the Federal Emergency Management Agency (FEMA) and the insurance industry to encourage the consideration of more accurate data on current and future risks of flooding and storm surges

Strategy 5 - Assist with local resiliency planning

Strategy 6 - Integrate climate change projections into NYC's emergency planning and preparedness efforts

Source: https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/vision-2020-cwp/vision2020/vision2020_nyc_cwp.pdf

Example: Urban River Landscapes, By Bülent Cengiz, 2013

General strategies for an ecologically sound riverfront design

These principles set the stage for success of planning.

1. Ecological targets and economic development targets should be mutually beneficial
2. Protect and restore the characteristics and functions of natural rivers
3. Regenerate the riverfront as a human realm
4. Compromises are necessary to achieve multiple objectives
5. Obtain broad participation in the process of planning and designing riverfront

Planning strategies

Some important aspects such as regional development patterns, natural and cultural history, flood control, public access, recreation and education should be taken into account in planning the revitalization of a riverfront. These principles must be incorporated into master plans and conducted by zoning and building codes, engineering standards and site plans and designs

1. Demonstrate characteristics of the city's unique relationship with the river in the riverfront design
2. Know the river ecosystem and plan for a scale larger than the riverfront
3. Because rivers are dynamic, minimize new floodplain development
4. Provide public access, connections, and recreational opportunities
5. Celebrate the river's environmental and cultural history through public education programs, riverfront signage and events

Design strategies

These principles set the stage for design success.

1. Protect features and functions of natural river
2. Buffer sensitive natural areas
3. Restore riparian and in-stream habitats
4. Use nonstructural alternatives to manage water resources
5. Reduce hardscapes
6. Manage storm-water on site and use nonstructural approaches
7. Balance recreational and public access targets with river protection
8. Incorporate information about a river's natural resources and cultural history into the design of riverfront features, public art, and interpretive signs

Source: <https://www.intechopen.com/books/advances-in-landscape-architecture/urban-river-landscapes>

3.1.5. Assigning land use

The (Draft) National Land Utilization Policy, 2013 states that *“land is required for development of essential infrastructure and for urbanization, while at the same time there is also a need to protect land under environmentally sensitive zones and land which provides ecosystem services”*. Land, being a limited and important natural resource, thus must be utilized vigilantly. Land assembly and development mechanisms are required to be undertaken for achieving optimum economic, social and ecological use of urban land. When it comes to river cities, spatial planning of the waterfront can directly help protect the ecological, amenity, economic and cultural values.

Moreover in some states, Master Plan is essentially a statutory land use plan, approved and adopted by the local authority, with precise and definite proposals notifying the manner in which land parcels are affected. These Plans have enough control over land through various associated techniques like land acquisition, land pooling, land reservations, TDRs, guided land developments, etc. They can direct the physical development of a city. The URDPFI Guidelines, 2015 state that *“Care should be taken regarding inter-relation of various activities and land uses with each other. Land use to be planned most solicitously”*. The manner of utilization of land, including its allocation to ensure the best possible use of each land parcel, is also controlled by the Master Plans. These planning documents ensure an efficient allocation of infrastructure provisions and space standards within the city as per the projected requirements. For all the river cities, this allocation of land within the river’s zone of influence is of utmost importance, without disturbing the natural ecology of the area.

Land use allocation has traditionally been one of the core functions of the Master Plan. The basic idea is to allocate different **land use types** within the town to allow for systematic urban development. Each land use category can be further sub-divided into **land use zones**. The land use zone can be further divided into **land use premises**. Land use premise can be permitted across different land use zones. Finally, each use premise there are a certain **use activities** that can be permitted.

For proper management of the land adjacent to the river, a complete exercise of delineation of the river influence zone has to be undertaken. Appropriate land uses and use zones have to be assigned for this delineated area within the Master Plan, with a focus on maintaining the eco-sensitive nature of the area. Specific protective and eco-sensitive areas can be earmarked for conservation. A clear identification of permissible and restricted activities is also required, for imposing controlled use of the river space without disturbing its natural character. In addition, the definitions and parameters for delineation of the river space, as well as allocation of various uses zones with use restrictions (permitted, conditionally permitted or prohibited) have to also be clearly specified within the planning document.

Example: Regulation of Human Activities Along Rivers and Lakes - A Background Document for the Proposed Notification on RIVER REGULATION ZONE, National Institute of Ecology, 2002

The report has been prepared for the National River Conservation Directorate, Ministry of Environment and Forests, Government of India to develop a criteria for zoning of rivers and their floodplains, and also regulate activities within those zones.

The report identifies the following criteria for recognizing different river zones:

- Climatic, Geomorphic and Hydrological Criteria
- Urbanization/Human use
- Potential for Restoration
- State of Degradation
- Ecological Criteria
- Socio-cultural Criteria

Delineation of River Regulation Zone

The criteria described above will lead to an elaborate system of zones for the numerous large, medium and small rivers in India. Four River Regulation Zones have been proposed with the following major features:

- **RRZ I** – River channels and their floodplains in ecologically sensitive and fragile watershed areas, Areas mostly in foothills (medium elevations), areas of pristine/outstanding beauty, heritage sites, areas rich in genetic diversity or important for biodiversity, particularly rare/endangered species.
- **RRZ II** - River channels and their floodplains in the hills (>300 m altitude); generally low human population density; high flow velocity; river regulation relatively low
- **RRZ III** – River channels and their floodplains at lower elevation (<300 m); within municipal limits (high population densities) where floodplain has already been heavily reduced and infrastructure facilities are well developed (e.g., temples, ghats, road, various residential, commercial or recreational buildings, boat jetties, fish landing facility, etc.); River stretches generally heavily regulated or channelized; water quality much degraded and restoration most difficult (low potential)
- **RRZ IV**- River channels and their floodplains at lower elevation (<300 m) in suburban and rural areas where infrastructure development has not occurred or is only moderate, and where land is primarily under agriculture and grazing; Areas with low degradation but high potential for restoration.

Use Activities/ Permissibility

Unless Exempted (as listed below), following activities shall be regulated to the extent indicated in each of the four Zones identified earlier for the purpose.

RRZ I

- Total prohibition of all polluting activities including permanent or temporary construction (Residential, Commercial, Religious, Recreational),
- Total prohibition of agrochemical based cultivation,
- Total prohibition of disposal of all kinds of solid wastes (including religious offerings and idol immersion)

RRZ II

- Total prohibition on permanent/ temporary construction on floodplain/ slope facing river
- Total prohibition on mining/quarrying on hills
- Total prohibition on use of fertilizers and pesticides for agriculture Total prohibition on solid waste disposal
- Regulation of forage removal/grazing on hill slopes
- Regulation of gravel/sand mining

RRZ III

- No further extension of any infrastructure that may necessitate reduction in the remaining floodplain or affect the course of the river channel
- Total prohibition of disposal of all kinds of solid wastes
- Total prohibition of groundwater extraction within 500m of the river channel and limited (regulated) extraction beyond that area.

RRZ IV

- Total prohibition of all polluting activities including permanent or temporary construction (Residential, Commercial, Religious, Recreational)
- Total prohibition of agrochemical based cultivation
- Total prohibition of disposal of all kinds of solid wastes
- Total prohibition of groundwater extraction within 500m of the river channel
- Total ban on drainage and reclamation of existing wetlands
- Regulation of gravel and sand mining – stretches & amounts to be identified and notified
- Regulation of grazing and forage removal

The aerial extent of the zoning has also been defined by mentioning:

Various activities must be regulated within a distance of 500 m from floodplain boundary

Source: <https://cdn.downtoearth.org.in/dto/userfiles/images/RR7-Background-Report-Dec2002.pdf>

Example: Draft River Conservation Zone (Regulation of Harmful Activities) Rules, 2012

Floodplain zoning

The following lateral zonation of river banks has been defined:

- **No Development Zone** - The competent authority shall determine a NDZ on either bank for each river which shall not be less than the “Active Flood Plain” of the river.
- **High & Medium Impact Zones** - The competent authority shall identify and designate suitable distance/s, from the NDZ, on either bank keeping local topographical conditions in mind, to be called as High impact and Medium impact zones (HIZ and MIZ). In plains where river topography is relatively flat, these distances shall not be less than 1 and 3 Km respectively from the NDZ.

“Active Flood Plain” as defined by High Flood Line (HFL) which in entrenched /embanked stretches of a river stretch shall be the available space (including the river channel/s) in the valley of entrenched stretch or between two embankments or between existing roads on either side along a river acting as an embankment. In other stretches of the river HFL / active flood plain shall be the 100 year flood line.

Source: <https://cdn.downtoearth.org.in/dte/userfiles/images/river-rules-2012.pdf>

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3.1.6. Development Control Regulations

Development Control Regulations are intended to limit the type and extent of development in a given area. Regulations like height restrictions, FAR, minimum setbacks, ground coverage, etc. are a part of the Master Plans in the form of building bye-laws or architectural controls. For river cities, once the flood zone is earmarked, specific development controls shall be identified for the sub-zones falling within the eco-sensitive area. There can be different considerations for restrictions within that particular zone. For example, in an area liable to flooding in a 25-year frequency flood, residential buildings could be permitted with certain stipulation of construction on stilts (columns), minimum plinth levels, prohibition for construction of basements and minimum levels of approach roads, only double story buildings in urban areas, utilization of ground floors for schools and other non-residential purposes.

Some examples showing developmental regulations imposed within the river zones, are as follows.

Example: Draft Bihar Building Bye-Laws, 2013

Construction near river front

- No construction or re-construction of any building, within the radius of 200 metres, or such other higher distance as prescribed from time to time by the State Government, from the outer boundary of the riverfront of Ganges shall be permitted except for repair and renovation work of heritage buildings.
- No construction or re-construction of any building shall be allowed, within the radius of 100 metres, or such distances as prescribed by the State Government, from the outer boundary of the riverfront of any river other than the Ganges river. The State Government shall notify a list of such rivers.
- Notwithstanding the above provision, any Planning Authority or Government Body shall be able to undertake development and beautification work of riverfront, ghats or any other planned development on reclaimed lands with the approval of the Government.

Source: http://www.bshb.in/download/Bihar_State_Urban_Bye_Laws.pdf

Example: Draft Development Control and Promotion Regulations -2015, for Pune Municipal Corporation

Construction within flood line of river

- *Area between the river bank and blue flood line (Flood line towards the river bank) shall be prohibited zone for any construction except parking, open vegetable market, garden, lawns, open space, cremation and burial ground, or like uses, provided the land is feasible for utilization.*
- *The construction in the area between blue flood line and red flood line may be permitted above the red flood line level.*
- *If the area between the river bank and blue flood line or red flood line forms the part of the entire plot in developable zone i.e. residential, commercial, public-semi-public, industrial, then, FSI of this part of land may be allowed to be utilised on remaining land.*
- *The blue and red flood line shall be as marked by the Irrigation Department or any other Government institutions dealing with the subject.*

Source: [https://pmc.gov.in/Draft_Plan_Old_Village/28\(4\)/DCPR%20PUNE%20-%202015%20-%20vol%20-%201.pdf](https://pmc.gov.in/Draft_Plan_Old_Village/28(4)/DCPR%20PUNE%20-%202015%20-%20vol%20-%201.pdf)

Example: Development Control and Promotion Regulations -2015, for Nashik Municipal Corporation

Construction within flood line of river Godavari, Waghadi, Nasardi and Waldevi

- *Area between the river bank and blue flood line (Flood line towards the river bank) shall be prohibited zone for any construction except parking, open vegetable market with otta type construction, garden, open space, cremation and burial ground, public toilet or like uses, provided the land is feasible for utilization.*
Provided further that development and redevelopment of the existing properties within river bank and blue flood line, in core area, marked on development plan, may be permitted at a height of 0.45 m. above red flood line level.
Provided further that development of property falling within the river bank and blue flood line, in non-core area, shall be allowed to be developed subject to flood protection measures to be undertaken by the owner to the satisfaction of Municipal Commissioner in consultation with Irrigation Department.
- *Area between blue flood line and red flood line shall be restrictive zone for the purposes of construction. The construction within this area may be permitted at a height of 0.45 m. above the red flood line level.*
- *If the area between the river bank and blue flood line or red flood line forms the part of the entire plot in developable zone i.e. residential, commercial, public-semi-public, industrial, future urbanizable zone, then, FSI of this part of land may be allowed to be utilised on remaining land*

Source: http://nashikcorporation.in/public/upload/download/SDCR_under_section_26.pdf

3.1.7. Norms and Standards

Norms are used as a tool to ensure consistency in planning. Norms for standardised development within the river zone can help facilitate restricted and regulated growth within the area. Standards, from a river point of view, are tools to ensure the quality of the riverine resources do not suffer because of urban development activities. Standards could be quantitative or qualitative value. For example, there are norms for minimum buffers within river zones, minimum required environmental flow, permissible extent of channelization, etc. Also, there are standards for river water quality, groundwater quality, richness of riparian biodiversity, among others.

Examples of river related norms and standards, which can be mandated through Master Plans are as below.

Example: Environmental flow (E-Flow) in river Yamuna

E- Flow Standards

- The Hon'ble Supreme Court had in W.P. (C) 537 of 1992 directed on 14 May 1999, that "a minimum flow of 10 cumecs (353 cusec) must be allowed to flow throughout the river Yamuna".
- In view of the above it has been estimated that the E Flow in river Yamuna downstream of the barrage at Hathnikund should be no less than 2500 cusec (around 70% of the average minimum virgin flow of 3500 cusec reported at Hathnikund barrage during the leanest month of January). And the corresponding flow downstream of the barrage at Okhla in Delhi should be no less than 1500 cusec. These may be designated as the lower '**river safety**' thresholds at the respective barrages.

Source: <https://yamuna-revival.nic.in/wp-content/uploads/2019/02/E-flow-Principal Committee.pdf>

Example: Guidelines for Preparation of Project Reports under National River Conservation Plan and National Ganga River Basin Authority

Water Quality Standards for Rivers

- Water Quality Standards for rivers as per CPCB classification of Designated Best Use criteria of rivers for bathing are as given below:

Water Quality Standards for Rivers

Parameters	Standards
pH	6.5 to 8.5
BOD	3 (mg/l) or less
DO	5 mg/l or more
Faecal coliform	
Desirable	500 (MPN/100 ml)
Max. permissible	2500 (MPN/100 ml)

Effluent Standards

- Effluent standards have been made more stringent, for critical stretches of River Ganga, by the Ministry of Environment, Government of India

Effluent standards prescribed by NRCD, Ministry of Environment, GOI

Parameters	Units	Effluent Standards for discharge into water bodies		Effluent Standards for discharge on land
		Existing Standards	Standards revised on 3.2.10 (Annexure 3)	
pH		5.5-9.0		
BOD	mg/l	30	*20	100
TSS	mg/l	50	*30	200
Fecal coliforms	MPN/100 ml	Desirable– 1,000 Permissible– 10,000		Desirable – 1,000 Permissible – 10,000

*or lower depending on the assimilative capacity of the effluent receiving water body

Source:

https://nrcd.nic.in/writereaddata/FileUpload/Guidelines_for_Report_Preparation_under_NRCP_NGR_A_Dec%202010.pdf

3.1.8. Recommendations

The Master Plan is also very well placed to make recommendations on current and emerging aspects that need to be addressed. For example, climate change is likely to alter river flows, thereby disturbing the ecology that depends upon on it. Similarly, in view of depleting rivers and groundwater, it is becoming increasingly evident that water demand management is the only way forward for large urban areas to meet their water demand. In river cities, specific recommendations for the floodplains shall be framed, with a focus on conservation of the natural river environment. The Master Plan has the authority to provide tangible recommendations and directions to various agencies to take action in this regard.

Certain examples of broad river-related recommendations are highlighted here.

Example: Revitalize the River Los Angeles River Revitalization Master Plan, April 2007

Preconditions for Revitalization

Goal: Enhance Flood Storage

Recommendation 1 - Identify opportunities for peak flood storage outside the channel to reduce flow velocities in the River to sub-critical (less than 12 feet per second) levels. This will support the maintenance and re-establishment of vegetation.

Recommendation 2 - Identify opportunities for selective acquisition of additional rights-of-way to expand the River's floodplain.

Near-Term Improvements

Goal: Enhance Water Quality

Recommendation 1 - Emphasize multiple-benefit landscape treatments and "green infrastructure" improvements.

Recommendation 2 - Implement water quality treatment at multiple scales to maximize efficiency.

Recommendation 3 - Create landscape-based water quality treatment at major confluences of the River to treat pollutants carried by tributaries.

Recommendation 4 - Develop "treatment terraces" within the channel to treat stormwater flows that "daylight" or surface in the River.

Recommendation 5 - Create landscape-based "green strips" at the top of Riverbanks and in adjacent linear parkland and streets to treat stormwater runoff from streets.

Near-Term Improvements

Goal: Enable Safe Public Access

Recommendation 1 - Provide opportunities for safe access to the water, ensure that people can quickly exit the channel, and establish a flood warning system in the event of high flow conditions.

Recommendation 2 - Provide opportunities for temporary pools and lakes for water-based recreation by installing inflatable rubber dams.

Recommendation 3 - Create a variety of public spaces, including small pocket parks, natural areas, and urban plazas and civic spaces in “reclaimed” areas of the channel.

Recommendation 4 - Ensure public safety by using alternate “greening” techniques in areas where the concrete remains necessary for flood damage prevention.

Recommendation 5 - Continue development of non-motorized transportation and recreation elements including bike and pedestrian paths and multiuse trails in the River and tributary rights-of-way

Long-Term Vision

Goal: Restore a Functional Riparian Ecosystem

Recommendation 1 - Create a continuous functional riparian corridor that provides habitat for birds, mammals, amphibians, reptiles, invertebrates, and fish within the channel bottom.

Recommendation 2 - Connect this corridor to other significant habitat and migration routes along the tributaries and into the mountains.

Recommendation 3 - Improve water quality and provide fish passages, ladders, and riffle pools that would support desirable fish species, including steelhead trout if feasible.

Recommendation 4 - Bio-engineer the River’s edge where feasible to create and restore wildlife habitat along the upper reaches of the River

Source: <https://boe.lacity.org/lariverrmp/CommunityOutreach/pdf/05Chapter4-RevitalizetheRiver42407.pdf>

3.1.9. Creating the grounds for Project Development

Projects are specifically derived implementable measures with identifiable targets, which are conceived within the framework of the existing plans. Master Plans in the form of projects, shall identify the implementation, administrative, management and funding mechanisms, at the same time providing all the necessary inputs for their execution. These projects shall be specifically designed as per the local requirements.

Specific riverfront development projects like ghat development, cleaning projects, development of eco-recreational sites, eco-tourism infrastructure can be identified as model projects within the Master Plan for development of river cities.

Example showcasing a project proposed along a river is as below. Such projects can be identified within the Master Plans, with their action plan for implementation, while leaving scope for detailed DPRs to plan for the project.

Example: Development Control and Promotion Regulations -2015, for Nashik Municipal Corporation

Development of Cycle Track Along River & Nalla

A cycle track shall be developed in green belt areas earmarked on Development Plan along the rivers. Also, cycle track proposal is shown on canal land in the Development Plan. A distance of 6 m. from the edge of minor water course (nalla) is to be left as marginal distance for construction of any building. A 3 m. strip of land from the edge of such water course out of this 6 m distance to be left, shall be available for use as cycle track for general public. The compound wall shall be constructed excluding this distance of 3 m. strip for cycle track. The owner shall be entitled for FSI of this strip of land for cycle track, in-situ. This 3m wide strip shall be handed over to Municipal Corporation for which, owner shall be entitled for TDR or in-situ FSI equivalent to 35% of the area of 3m. wide strip. This regulation shall be applicable for development of land along nallas. Where development is already taken place and it is not possible to make provision for such 3 m. wide cycle track, then Municipal Commissioner shall be empowered to decide not to apply this regulation for particular stretch of nalla. In such cases, normal marginal distances under these regulations shall apply.

Source: http://nashikcorporation.in/public/upload/download/SDCR_under_section_26.pdf

3.1.10. Projecting the Requirements

Master Plans are long term perspective plans with 20-30 years as the plan period. To plan for this tenure, a clear estimate of the present gap and projected requirements (based on the past trends, induced growth and development objectives) for all the city activities, infrastructure and land is required as the basic input. This essentially involves estimating the population as well as its spatial, infrastructural, development, and other requirements. Projecting the trends is thus a pre-requisite for developing the above-mentioned planning tools.

3.2. How can Master Plans address specific Urban River Challenges

Each of the above planning tools can address the river related issues within a city, in a specific manner. This section elaborates upon the challenges of urban rivers, highlighting what needs to be addressed under each issue, and what the Master Plan can do about it (within the scope of the Master Plan).

3.2.1. Issue: Restriction of natural water/storm water channel

A Master Plan extensively guides the physical development of any area. It shall thus cater to the need for development of the river channel and its surroundings, by planning for the zone in a way that clearly ensures minimum disturbance of the water channel and conserves the natural ecology.

What needs to be addressed?

- To minimize restriction of natural water channel/ urban drainage pattern
- To prevent encroachment for protection of the catchment area
- To manage physical processes of the river (sediment dynamics, flow, etc.) for a healthy habitat

What can the Master Plan do about it?

Localizing National Policies	<ul style="list-style-type: none"> • Water Policy and Action Plan for India 2020: An Alternative (November 2002), Alternative Futures
Town Specific Strategies	<ul style="list-style-type: none"> • for <i>floodplain zoning</i> • for protection of catchment (bio-remediation practices for water channel and land management for buffer area) • <i>Planting strategy</i> for riparian green buffer along all water channels/ drains (focused on environmental protection, erosion control and pollution control)* • <i>Relocation Strategy</i> for existing encroachments within the river zone* • <i>Redevelopment Strategy</i> for low density development in flood fringe areas
Assigning Land use Categories	
Land Allocation	<ul style="list-style-type: none"> • <i>River zone delineation</i> (floodplain mapping)
Land use	<ul style="list-style-type: none"> • for all existing natural water channels/ drains
Use Zone/ Use Premise	<ul style="list-style-type: none"> • <i>Compatible eco-sensitive land uses</i> - for the entire river zone*
Use Activities	<ul style="list-style-type: none"> • <i>Eco-sensitive activities</i> permissibility controls within the river zone and drainage basin

Development Control Regulations	<ul style="list-style-type: none"> • Development regulations based on distance from the river edge and drains (sp. FAR, density norms)
Norms & Standards	<ul style="list-style-type: none"> • for minimum buffer requirements along the water channels
Recommendations/ Regulations	<ul style="list-style-type: none"> • regarding covering/ encroachment of water channels • for protecting and integrating critical ecological areas such as wetlands, floodplains and riparian corridors into existing development areas
Creating the grounds for project development	<ul style="list-style-type: none"> • for construction of embankments as per requirement
NOTE: *Shall be covered as an overall policy/ strategy catering to various issues	

Pre-requisites

- ☐ Projections for future population growth within the river zone

3.2.2. Issue: Pollution

Master Plans have the ability to guide the city infrastructure and other facilities. Accordingly, it shall impose and implement strategies for preventing water pollution from any source.

What needs to be addressed?

- To **prevent discharge of untreated waste water** (domestic/ industrial/ agricultural) in the water channels
- To **restrict disposal of solid waste** (domestic/industrial/bio-medical/hazardous/social or religious) in water channels

What can the Master Plan do about it?

Localizing National Policies	<ul style="list-style-type: none"> • National Policy on Faecal Sludge and Septage Management, 2017 (for sanitation management) • Swachh Bharat Abhiyaan, 2014 (for both wastewater and solid waste management) • The water (prevention and control of pollution) act - Ministry of Environment and Forests (1974)
Town Specific Strategies	<ul style="list-style-type: none"> • for connecting all major settlements with STP network • for alternative decentralized waste water solutions to ensure 100% city coverage • for CETP network for all industries • <i>Planting Strategy</i> for riparian green buffer along all water channels/ drains* • for implementing Polluter Pays Principle to restrict polluting activities • for minimizing the impact of activities (informal settlements, dhobhi ghats, agriculture, HH industries, tourism, religious) within the river zone • for promoting <i>organic agriculture</i> through incentives* • <i>Reuse Strategy</i> for planned reuse of treated waste water • <i>Recycling Strategy</i> for reducing solid waste • <i>Bio-drainage Strategy</i> for linking drainage with ecology and green networks

	<ul style="list-style-type: none"> • <i>Green Infrastructure Strategy</i> for sustainable infrastructure provision*
Assigning Land use Categories	
Land Allocation	<ul style="list-style-type: none"> • for waste water treatment facilities (at source and all drain outfalls) • for solid waste disposal/ treatment facilities away from the river • dedicated areas for religious, agricultural, tourism activities (affecting the river)
Land use	<ul style="list-style-type: none"> • for all existing natural water channels/ drains
Use Zone/ Use Premise	<ul style="list-style-type: none"> • for physical infrastructure facilities
Use Activities	<ul style="list-style-type: none"> • Identification of <i>non-permissible use</i> (polluting activities) within the river zone and drainage basin
Norms & Standards	<ul style="list-style-type: none"> • for STP/CETP capacity requirement based on population • for quality of discharge into the river • for minimum buffer requirements along the water channels for minimum distance of solid waste disposal facilities from the river
Recommendations/ Regulations	<ul style="list-style-type: none"> • regarding dumping of solid waste (religious, hazardous, others) in water channels • regarding discharge of untreated waste water in water channels
Creating the grounds for project development	<ul style="list-style-type: none"> • Action plan for construction of STPs and CETPs

NOTE: *Shall be covered as an overall policy/ strategy catering to various issues

Pre-requisites

- Projections for future waste water and solid waste generation

3.2.3. Issue: Over abstraction of water

Due to huge volumes of water abstraction from surface and ground water sources, the hydro-morphology and natural hydrological regimes of water channels continue to be altered. Master Plans need to put in place policies guarding regulated extraction of fresh water from these vulnerable sources, while reducing the expected water demand as well as promoting reuse of waste water.

What needs to be addressed?

- To ensure **regulated extraction** of water from surface and ground water sources
- To **promote reuse and recycle** of water for limiting potable water requirement
- To **promote ground water recharge** for augmenting water extraction

What can the Master Plan do about it?

Localizing National Policies	<ul style="list-style-type: none"> • Jal Shakti Abhiyaan, 2019 (for water bodies rejuvenation, water conservation, afforestation, and groundwater recharge) • National Water Policy, 2012 (which has considerable river-related clauses) • National Water Mission, 2011 (for climate-change related implications) • The water (prevention and control of pollution) cess (amendment) act - Ministry of Environment and Forests (2003)
Town Specific Strategies	<ul style="list-style-type: none"> • for water allocation and regulated extraction • for <i>Water Demand Management</i> (reduction of water demand, shift

	<ul style="list-style-type: none"> from fresh water sources to reused/ recycled water) to minimize <i>Non-Revenue water losses</i> (leakage, theft) <i>Rainwater Harvesting Strategy</i> for minimizing potable component of water demand <i>Reuse & Recycle Strategy</i> for minimizing potable water need
Assigning Land use Categories	
Land Allocation	<ul style="list-style-type: none"> for water supply infrastructure (borewells/ ranneywells/ tubewells, WTP) for open areas, to act as ground water recharge zones
Land use	<ul style="list-style-type: none"> for physical infrastructure facilities
Use Zone/ Use Premise	
Use Activities	<ul style="list-style-type: none"> Permissible activities within the recharge zones
Development Control Regulations	<ul style="list-style-type: none"> Development regulations for the recharge zones/ rainwater harvesting structures in complexes & buildings
Norms & Standards	<ul style="list-style-type: none"> for quantum of per capita water demand and supply; demand efficiency water charges for construction of waste water treatment, reuse, recycle and harvesting structures for construction of water supply system (borewells/ ranneywells/ tubewells, WTP, network)
Recommendations/ Regulations	<ul style="list-style-type: none"> regarding unaccounted groundwater extraction incentives to promote reuse
Creating the grounds for project development	<ul style="list-style-type: none"> Rainwater harvesting structures in public complexes

NOTE: *Shall be covered as an overall policy/ strategy catering to various issues

Pre-requisites

- ☐ Projections for future water demand

3.2.4. Issue: Degrading water bodies/ wetlands

The alarming rate at which city's wetlands are vanishing/ degrading highlights some dire consequences over the dependent ecosystems. Thus the Master Plans need to ensure an effective policy framework for water resource management within cities.

What needs to be addressed?

- To secure adequate quantity of water in natural depressions/ water bodies
- To maintain and improve the quality of water natural depressions/ water bodies

What can the Master Plan do about it?

Localizing National Policies	<ul style="list-style-type: none"> Guidelines for repair, renovation and restoration of water bodies with external assistance and domestic support - Ministry of Water Resources (2009), Guidelines for the national lake conservation plan - Ministry of Environment and Forests (2008) Model bill to regulate and control the development of groundwater - Ministry of Water Resources (1996) Wetlands Conservation Management Rules (2017)
Town Specific Strategies	<ul style="list-style-type: none"> for revival of all urban water bodies

	<ul style="list-style-type: none"> • <i>Planting strategy</i> for riparian green buffer along all water bodies * • <i>Relocation Strategy</i> for existing encroachments within the water body catchment* • <i>Strategy for watershed management*</i>
Assigning Land use Categories	
Land Allocation	<ul style="list-style-type: none"> • for all natural depressions and its entire catchment area (buffer zone) • for constructed wetlands/ water bodies, wherever required • for water bodies/ wetlands
Land use	
Use Zone/ Use Premise	
Use Activities	<ul style="list-style-type: none"> • Permissible activities within the water body and its catchment areas
Development Control Regulations	<ul style="list-style-type: none"> • Development regulations for the catchment area based on distance from the water body
Norms & Standards	<ul style="list-style-type: none"> • for catchment specifying minimum buffer requirements along the water body
Recommendations/ Regulations	<ul style="list-style-type: none"> • for protecting and integrating critical ecological areas such as wetlands, floodplains and riparian corridors into development areas
Creating the grounds for project development	<ul style="list-style-type: none"> • Developing/ rejuvenating the water bodies and their catchment (with riparian landscaping and bio-remediation practices)
NOTE: *Shall be covered as an overall policy/ strategy catering to various issues	

3.2.5. Issue: Depleting Green Cover

The green/ open areas within a city play an important role in the ground water recharge and enrichment of biodiversity. Buffer areas near water channels with native riparian species specifically serve the protection of the entire watershed and erosion control within the area. Master Plans shall thus ensure that limited activities are permissible within these conservation zones.

What needs to be addressed?

- To create a **riparian zone** with native species along the water channel for erosion control and protection of watershed
- To maintain **adequate forest/ tree cover** for ground water recharge

What can the Master Plan do about it?

Localizing National Policies	<ul style="list-style-type: none"> • <i>Draft National Forest Policy, 2018</i> (for forest management)
Town Specific Strategies	<ul style="list-style-type: none"> • <i>Green Buffers</i> along all water bodies and water channels • <i>Greenway/ corridor plans</i> as eco-friendly recreational developments along the major water channels • <i>Strategy for afforestation</i> in the river zone with native riparian species* • <i>Green Infrastructure Strategy</i> for sustainable infrastructure provision and its efficient integration with greens* • <i>Compensatory Afforestation Rules</i> for depleting green cover
Assigning Land use Categories	
Land Allocation	<ul style="list-style-type: none"> • for green covers (as conservation areas, restricted/ reserved areas)
Land use	<ul style="list-style-type: none"> • for recreational areas
Use Zone/ Use Premise	

Use Activities	<ul style="list-style-type: none"> • Permissible activities within varying typology of recreational areas
Development Control Regulations	<ul style="list-style-type: none"> • Development regulations for the catchment area based on distance from the water body
Norms & Standards	<ul style="list-style-type: none"> • for minimum per capita tree cover • for adequate provision of open spaces
Recommendations/ Regulations	<ul style="list-style-type: none"> • regarding unchecked uprooting of trees to ensure maximum conservation of existing trees • regarding encroachment of conservation/ restricted/ reserved areas
Creating the grounds for project development	<ul style="list-style-type: none"> • Public landscaping practices for developing/maintaining the green areas with native species • Native riparian landscaping practices along the river and drainage channels
NOTE: *Shall be covered as an overall policy/ strategy catering to various issues	

Pre-requisites

- ☐ Projections for future green cover requirements

3.2.6. Issue: Weak Citizen-River Connect

Any riverfront development shall ensure that the natural ecology of the river is intact to serve its purpose efficiently. Any development shall not come at the cost of the environment. This can only be possible if the waterfront development ensures that the human use of water being planned for is compatible with the environment's own needs. The Master Plans of river cities shall provide for riverfront development strategies that conserve the natural ecology of the area.

What needs to be addressed?

- To design and develop a **riverfront catering to the needs of the citizens** in a sustainable manner
- To make the riverfront **accessible** to the public
- To create a **stronger identity for the river (enhance the Blue network)**

What can the Master Plan do about it?

Localizing National Policies	<ul style="list-style-type: none"> • <i>National Tourism Policy, 2002</i> (promoting river based eco-tourism)
Town Specific Strategies	<ul style="list-style-type: none"> • to strengthen economy based on river tourism potential • to develop the river's historical connect with the city • <i>Green Linkages/ corridors</i> inter-connecting the natural systems • <i>Green Infrastructure Strategy</i> for sustainable infrastructure provision*
Assigning Land use Categories	
Land Allocation	<ul style="list-style-type: none"> • Dedicated areas for eco-sensitive religious (designated ghat areas), tourism (water sports) and public recreation activities
Land use	<ul style="list-style-type: none"> • <i>Compatible eco-sensitive land uses</i> - for the entire river zone* • for recreational areas
Use Zone/ Use Premise	
Use Activities	<ul style="list-style-type: none"> • <i>Eco-sensitive activities</i> permissibility controls within the river zone and drainage basin

Norms & Standards	<ul style="list-style-type: none"> • for development of river tourism activities
Recommendations/ Regulations	<ul style="list-style-type: none"> • for protecting water edge activities from intrusion and encroachment that diminishes the natural landscape setting • Regulating footfall within the river zone for tourism and religious activities • for minimizing the impacts of anthropogenic activities like bathing ghats, fishing, navigation, etc.
Creating the grounds for project development	<ul style="list-style-type: none"> • Eco-parks along river banks • Development of tourism & religious infrastructure • Urban Riverfront Development <ul style="list-style-type: none"> ○ Riparian landscaping and bio-remediation practices ○ Design for public plazas, seating and landscape features along the riverbank in a manner sensitive to, and respectful of the existing natural habitat

NOTE: *Shall be covered as an overall policy/ strategy catering to various issues

Pre-requisites

- Projections regarding footfall for tourism and religious activities along the river

3.2.7. Issue: River Governance

The Master Plans play a major role in planning for urban river management wherein it talks about assigning key responsibilities of development, and also the monitoring, implementing, phasing and financing structures for each proposal therein.

What needs to be addressed?

- To establish an effective **framework for water resource management** in a city in an integrated, sustainable manner
- To affix the **roles and responsibilities** for management of an urban waterfront
- To identify resources for **project implementation, management and funding**

What can the Master Plan do about it?

Localizing National Policies	<ul style="list-style-type: none"> • <i>Natural Hazard Prevention Policy</i> for flood hazard mitigation • MoWR, River Development and Ganga Rejuvenation (National Mission of Clean Ganga) Order 9/10/2018, S.O.5195(E) (to maintain e-flows)
Town Specific Strategies	<ul style="list-style-type: none"> • <i>Strategy for watershed management</i>* • <i>Public Engagement Strategy</i> for water resource sensitization • Phasing of project proposals • Prioritization of projects and costing • Allocation of <i>roles and responsibilities</i> of key stakeholders • to improve <i>Administrative and Legal Framework</i> for water resource management • <i>Emergency preparedness planning</i> - to increase preparedness for waterborne emergency situations • to improve access to the public waterfront areas • <i>Blue-Green Strategy</i> to interconnect the water and recreational infrastructure • <i>Regional Strategy for allocation and management</i> of shared water resources (using water credits and other concepts) • <i>E-flow Strategy</i> for maintaining environmental flow in the river*

	<ul style="list-style-type: none">• <i>Adaptive re-use Strategy</i> (means to adopt historically existing river-edge resources for contemporary uses)
Norms & Standards	<ul style="list-style-type: none">• for calculating the requisite ecological flow
Recommendations/ Regulations	<ul style="list-style-type: none">• for strengthening the existing framework of implementation and monitoring• for promoting transparency in implementation• for authorizing agencies/ committees with implementation capacities• regarding <i>funding possibilities</i>
Creating the grounds for project development	<ul style="list-style-type: none">• Project prioritizing/ phasing,• Administrative & legal/• implementation/ monitoring/ financial framework

NOTE: *Shall be covered as an overall policy/ strategy catering to various issues

Pre-requisites

- ☐ Projections estimating the required project funding as per the projected needs

The figure below, shows the entire process to adopt river-centric planning within Master Plans, with specific examples for implementing it.



3.3. Re-framing the Master Plans – A way forward

These strategic guidelines are expected to lead the path towards re-building our current Master Plans and the aspects dealt by them. They touch upon various aspects required to be understood for a holistic river-centric development, starting with an introduction to the issues dealt by rivers in an urban scenario, elaborating upon the planning framework in India along with the hierarchy of plans, establishing the need for bringing in a river-sensitive approach within the cities' Master Plans through the assessment of gaps within the current plans, and identification of effective planning tools that shall address the component of river management within the Master Plans. The main intent behind these guidelines is to ensure that every planning and development exercise should also take into account, the needs of the local river within the influence area. For this, the document also clearly maps out the procedure for incorporating a river-sensitive approach, while developing a new Master Plan or revising the existing ones.

The 7 planning tools that could support in arriving at this river-sensitive approach in planning, as identified in Chapter 3 of this document, are the core elements for preparing our desired plans. For example, the kind of strategies that can be framed by cities or the regulations that a city can impose on the activities along the rivers, have been identified. Each river city, with the help of this guidance document, is expected to come up with the possible solutions under the required planning tools, to address the river needs within their Master Plans. The Master Plan solutions to deal with the issues under each planning tool has to be based on the present needs of the city.

As a way forward, all river cities that are coming up with their new Master Plans are expected to ensure that these parameters are incorporated within their plans to address their river needs. Also for the cities with an ongoing Master Plan tenure, an immediate analysis of the extent to which these parameters have been considered within the plan is desired. Thereafter, a revision of the current plan shall ensure that all these river focused parameters are taken up by the Master Plan, as per the local river needs.

The state town and country planning organisations shall identify the river cities which need to adopt these guidelines. The city Planning and Development Authorities, who have the core responsibility for preparation and implementation of their Master Plans, have the task of preparing a river-centric Master Plan. The plan shall clearly identify the city agencies responsible for its implementation.

River being a public entity and the dependency of various livelihoods on the rivers, makes it important to consider the local river needs. The planning exercise shall involve stakeholder consultation for incorporating strategies that improve this citizen-river connect.



Chapter 4.

Annexures & References

Chapter 4. Annexures and References

ANNEXURE-I

List of towns having Master Plans/ Development Plans, as per the state's Town & Country Planning Websites

Uttarakhand	
1	Doonghati
2	Dehradun
3	Haridwar
4	Chameli-Gopeshwar
5	Gaucher
6	New Tehri
7	Srinagar
8	Rishikesh
9	Badrinath
10	Paudi
11	Bageshwar
12	Rudrapur
13	Kashipur
14	Bajpur
15	Kichcha
16	Ramnagar
17	Kausani Lwesal
18	Nainital
19	Bhimtal
20	Roorkee
21	Gairsend
Uttar Pradesh	
1	Kanpur
2	Bithoor
3	Akbarpur-Mati
4	Lucknow Development Area
5	Unnao-Shuklaganj Development Area
6	Raebareli Development Area
7	Varanasi
8	Varanasi Part -B {Ramnagar-Mugalsarai}
9	Agra
10	Fatehpur -Sikri
11	Mathura-Vrindavan (Ka)

12	Mathura-Vrindavan (Kha) {Kosikala, Nandgaon, Chata, Chaumuha}
13	Mathura-Vrindavan (Ga) {Govardhan-Radhakund}
14	Firozabad-Shikohabad Development Area
15	Aligarh Development Area
16	Allahabad Development Area
17	Bareilly Development Area
18	Meerut Development Area
19	Baghpat-Baraut-Khekada Development Area
20	Ghaziabad
21	Loni
22	Muradnagar
23	Modinagar
24	Bulandhsahar
25	Sikandarabad
26	New Sikandarabad
27	Jahangirabad
28	Kurja Development Area
29	Hapur
30	Garhmukteshwar-Brijghat
31	Pilkhuwa
32	Moradabad Development Area
33	Rampur Development Area
34	Jhansi Development Area
35	Orai Development Area
36	Ayodhya-Faizabad Development Area
37	Gorakhpur Development Area
38	Azamgarh Development Area
39	Saharanpur Development Area
40	Muzaffarnagar
41	Khatauli
42	Banda Development Area
43	Basti Development Area
Jharkhand	
1	Basukinath Nagar Panchayat
2	Bishrampur Nagar Parishad
3	Bundu Nagar Panchayat
4	Chaibasa Nagar Parishad
5	Chakradharpur Nagar Parishad
6	Chakulia Nagar Panchayat

7	Chatra Nagar Parishad
8	Dumka Nagar Parishad
9	Garhwa Nagar Parishad
10	Giridih Nagar Parishad
11	Godda Nagar Panchayat
12	Gumla Nagar Parishad
13	Hazaribagh Municipal Corporation
14	Hussainabad Nagar Panchayat
15	Chas Municipal Corporation
16	Chhatarpur Nagar Panchayat
17	Chirkunda Nagar Parishad
18	Deoghar Nagar Nigam
19	Jamtara Nagar Panchayat
20	Adityapur Municipal Corporation
21	Jamshedpur NAC
22	Jhumritilaiya Nagar Parishad
23	Khunti Nagar Panchayat
24	Koderma Nagar Panchayat
25	Latehar Nagar Panchayat
26	Lohardaga Nagar Parishad
27	Madhupur Nagar Parishad
28	Manjhiaon Nagar Panchayat
29	Medininagar Nagar Parishad
30	Pakur Nagar Parishad
31	Rajmahal Nagar Panchayat
32	Sahibganj Nagar Parishad
33	Saraikela Nagar Panchayat
34	Simdega Nagar Parishad
35	Kapali Nagar Parishad
36	Mihijam Nagar Parishad
37	Nagar Uttari Nagar Panchayat
38	Phusro Nagar Parishad
39	Ramgarh Nagar Parishad
40	Jugsalai Municipality
41	Mango NAC
42	Ranchi Municipal Corporation
43	Dhanbad Municipal Corporation

West Bengal	
1	Kolkata
2	Siliguri
3	Jalpaiguri
4	Naxalbari
5	Haldia
6	Asansol
7	Durgapur
8	Srinikatan Santiniketan Planning Area
9	Burdwan
10	Digha-Shankarpur Planning Area
11	Midnapur-Kharagpur Planning Area
12	Gangasagar-Bakkhali Planning Area
13	Jaigaon
14	Tarapith-Rampurhat
15	Furfura Sharif
16	Bakreswar
17	Patharchapuri
18	Mukutmanipur

ANNEXURE-II

Ganga Basin Towns

List of towns on the main stem of Ganga River

STATE	NO. OF TOWNS
Uttarakhand	16
Uttar Pradesh	21
Bihar	18
Jharkhand	2
West Bengal	40
Total Basin Towns	97

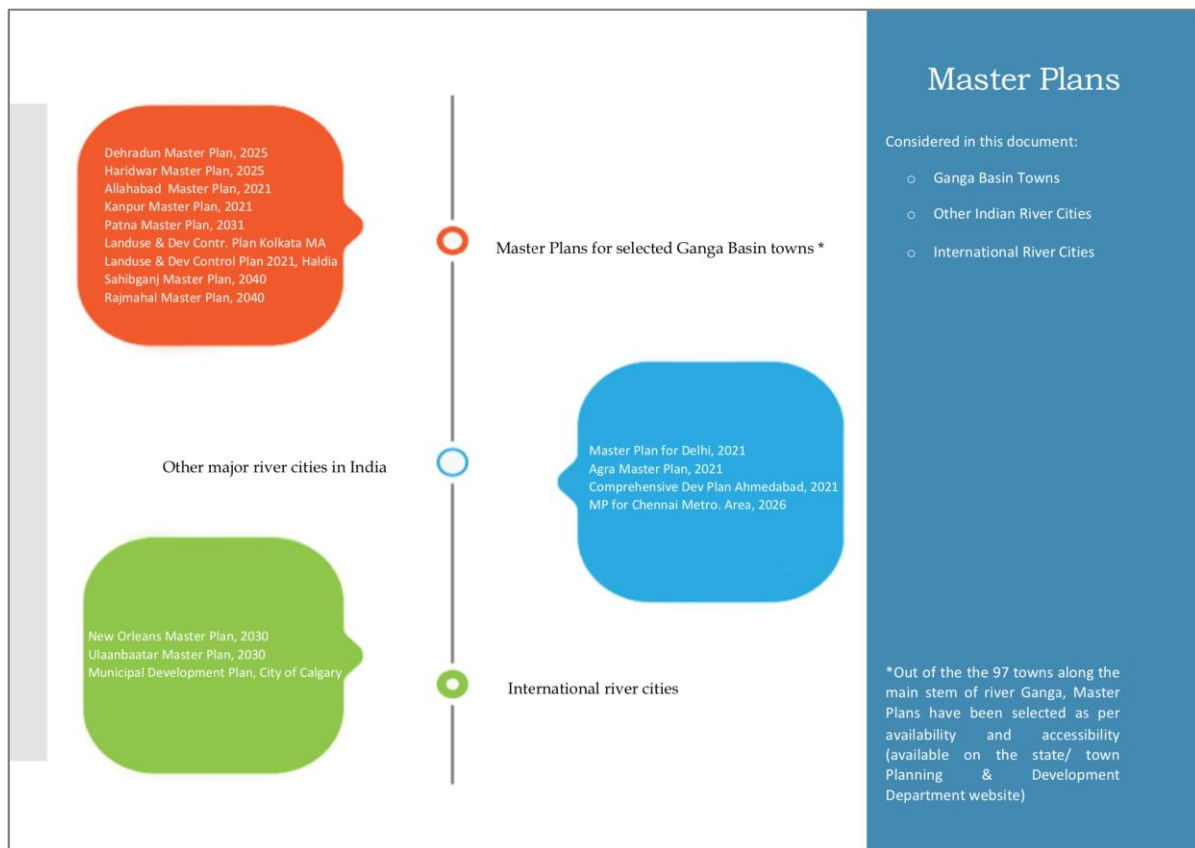
S. NO.	STATE	TOWN
1	Uttarakhand	Haridwar
2		Rishikesh
3		Muni Ki Reti - Dhaulwala
4		Tapovan
5		Chamoli - Gopeshwar
6		Srinagar
7		Uttarkashi (Budkot)
8		Joshimath
9		Rudraprayag
10		Gaucher
11		Karnaprayag
12		Devprayag
13		Nandprayag
14		Kirtinagar
15		Badrinath
16		Gangotri Dham
1	Uttar Pradesh	Prayagraj (Allahabad)
2		Anoopsahar
3		Babrula
4		Ballia
5		Bijnor
6		Bithoor
7		Chunar
8		Farrukkabad
9		Garhmukteshwar
10		Ghazipur
11		Hastinapur
12		Jhansi
13		Kannauj

14		Kanpur
15		Mirzapur
16		Pt. Deen Dayal Upadhyaya (Mughal Sarai)
17		Narora
18		Ramnagar
19		Saidpur
20		Shuklaganj/ Gangaghat
21		Varanasi
1	Bihar	Patna
2		Bhagalpur
3		Begusarai
4		Munger
5		Chapra
6		Danapur
7		Hajipur
8		Buxar
9		Jamalpur
10		Barauni
11		Barh
12		Mokameh
13		Sultanganj
14		Fatuah
15		Bakhtiyarpur
16		Barahiya
17		Sonepur
18		Kahelgaon
1	Jharkhand	Sahibganj
2		Rajmahal
1	West Bengal	Baidyabati
2		Bally
3		Bansberia
4		Baranagar
5		Barrackpore
6		Behrampur
7		Bhadreshwar
8		Bhatpara
9		Budge Budge
10		Chakdah
11		Chamdani
12		Chandannagar
13		Dhulian
14		Diamond Harbour
15		Garulia

16	Gayespur
17	Haldia
18	Halishahar
19	Howrah
20	Hugli-Chinsurah
21	Jangipur
22	Jiaganj-Azimganj
23	Kalyani
24	Kamarhati
25	Kanchrapara
26	Katwa
27	Khardah
28	Kolkata
29	Konnagar
30	Maheshtala
31	Murshidabad
32	Nabadwip
33	Naihati
34	Panihati
35	Rishra
36	Santipur
37	Serampore
38	Titagarh
39	Uluberia
40	Uttarpara

ANNEXURE-III

Comparison and contrast of Master Plans of selected towns



Upper Ganga Basin | Uttarakhand

Dehradun Master Plan 2025

Ganga & Yamuna River

River Background

- Plan identifies the rivers flowing through the city
- Mention about historical construction of streams for irrigation
- Encroachment of river & drains identified as an issue
- Regional river-tourism context provided

Land use, use zone, use premise

- Plan earmarks existing land use as 'Green Belt/ Nallahs/ River'
- Land zone for rivers, drains, watersheds identified in the plan
- Land allocated for plantation along water bodies to avoid erosion, prevent encroachment and serve as recreational & recharge areas (10m along major rivers and watersheds, 5m along other drains)
- Proposal for construction of bridges over the rivers

Ground water augmentation

- Proposal for rainwater harvesting in recharge areas and all plots above 125sqm

River water extraction for city use

- Mention of water supply/ demand/ wastage quantum
- Mentions the need for a proposal to supply sufficient water

River pollutants

- Sewage disposal areas identified

Activities permissible in 'Water Enclosure'

Permissible use-

- River, stream & drain
- Riverbank parks & plantation
- Artificial reservoirs

Permissible use with permission from development authority-

- Max. 25sqm. construction in artificial reservoirs

Highlights of the Plan

Parameters reflected in Master Plan



Upper Ganga Basin | Uttarakhand

Haridwar Master Plan 2025

Ganga River

Parameters reflected in Master Plan

River Background

- Promulgated as a religious/ cultural centre of Ganga ghat

Land use, use zone, use premise

- Plan earmarks existing and proposed land use as 'agriculture/green area', with 'River/stream/drain' use zones
- Categories of activities identified within the river zone – 'Permissible'/'approval of authority'/'forbidden'
- Specifically residential, heavy/ harmful industries, objectionable activities not permissible
- Tourism spots identified along the banks

Ground water augmentation

- Proposal for development of traditional water sources and afforestation of watershed areas for revival. Water catchment for preventing soil erosion and decay of green cover, due to intense rainwater surface flow
- Provision for Rain Water Harvesting in all uses above 250sqm

River water extraction for city use

- Quantum of water requirement and supply mentioned

River pollution

- Mention about pollution due to encroachment
- Introduction to the sewerage system

River navigation

- Tourism potential of the river identified

Development regulations within the river zone -

- Proposal for development and restriction of encroachment on riverbanks, and their use as open areas for festivals as well as environment catalysts
- Recommendation for using relatively sloping land and lower terrain near river/ drains, as parks/ play areas/ planted greens, and relatively higher terrain as residential
- Controlling of irregular mining activities near river/ drains, and proposal for dense plantation in the areas
- Plantation in sloping areas, and 10 to 20m along drains devoid of full development with afforestation activities promoted
- Allocation of land for plantation
- All construction except roads completely restricted in areas near river. Min. 50m along the banks of river, and 10m along other drains to be used for afforestation

Highlights of the Plan



Middle Ganga Basin | Uttar Pradesh

Kanpur Master Plan 2021

Ganga & Pandu River

Land use, use zone, use premise

- Plan earmarks existing land use as 'river & drains'
- River edge development to include development for eco-friendly tourism and activities
- Development of green area along rivers
- Zoning Regulations – areas shall be earmarked as
 - Special/ heritage zone
 - Rainwater Harvesting

Ground water augmentation

- Emphasis on promoting rain water harvesting

River pollution

- Various sources of pollution have been identified
- Emphasis on the pollution issue (pollution levels higher than determined standards)


Zoning Regulations

- Special/ heritage zone
 - Can include riverfront development or environmentally sensitive areas to avoid their deformation
 - Earmarking such areas and identifying permissible activities
- Rainwater Harvesting
 - Existing use of any water bodies above 1acre falling within any proposed landuse, to remain unchanged.
 - Enlisting such areas with their details and protection proposal

Execution of water harvesting plans

- Mention of dipping ground water levels
- Layouts for plans over 20acres to incorporate reservoir/ water bodies of approx. 5% land for ground water recharge, within parks and open areas
- Min. area of such water bodies to be 1acre and depth 6m, and layout to be provided with building/ floor plans.
- Construction of check dams to store rain water during peak season, for naturally increasing ground water levels.

Highlights of the Plan



Parameters reflected in Master Plan



Highlights of the Plan



Lower Ganga Basin | Bihar

Patna Master Plan 2031

Ganga, Sone, Gandak & Punpun River

Parameters reflected in Master Plan

River Background
Plan identifies the rivers flowing through the city, along with details of their area

Urban flooding

- Flood levels/ flood mapping/ vulnerability assessment, & integrated drainage plan have been incorporated
- Need for bunds/ embankments, storm water canals mentioned

Land use, use zone, use premise

- Plan earmarks existing land use as 'River/ Flood Plain'
- Plan earmarks proposed land use as
 - 'Special Reservations Zone (Bio Conservation Zone)'
 - 'Natural Heritage'
- Permitted & prohibited uses have been enlisted

Development Control Regulations
No landfill within 100mt. of navigable river

River water extraction

- Supply for part of the town, and irrigation for agricultural zones
- Surface water resources are under-utilized for drinking, due to high investment cost

River navigation
Inland waterway route, terminal, traffic, transport highlighted

Proposed Land use

- Special Reservations Zone (Bio Conservation Zone)** - Lagoons and area along river, used for enhancing aesthetic value of river and for river front development/ public recreational activities
- Natural Heritage** – River areas

Use Zones/ Permissible activities – Bio-Conservation Zone

- Uses Permitted - Boating, Picnic huts, Camping sites, Special Training camps, higher order Educational/ technical/ research institutes (conditional)
Uses Prohibited – any development between the River/Canal/Stream and the embankment
- Uses Permitted - River side green areas, Water Treatment Plant, Sewage Treatment Plant, Solid waste Treatment Plant, solid waste dumping grounds (conditional)
Uses Prohibited - not related to Environmentally Sensitive Use Zone
- Uses Permitted - Riverfront Developments

Highlights of the Plan



Lower Ganga Basin | West Bengal

Land Use & Development Control Plan, Kolkata

Ganga River

Parameters reflected in Master Plan

River-sensitive Objectives
Development Policy states efforts to be made for -

- Development of river-front with pedestrian plaza and other conforming facilities along the river-bank
- Preserving wetlands, tanks, ponds, water bodies, wherever possible

Ground water augmentation

- Regulations stating no canal, pond, water body or wetland shall be filled up (unless allowed by authority taking in view drainage/ ecology & environment/ pisciculture/ fire fighting)

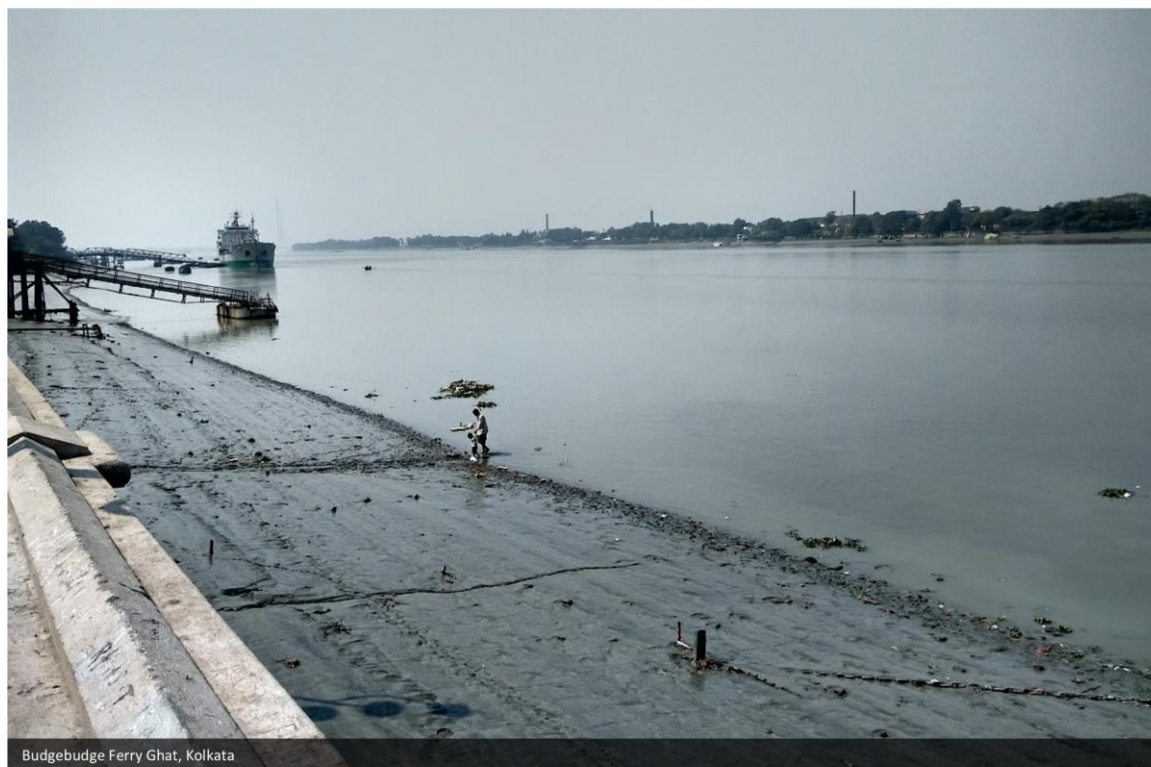
Development Control Regulations:
Prohibited buildings in Development Control Zone 'RF' (Riverfront):

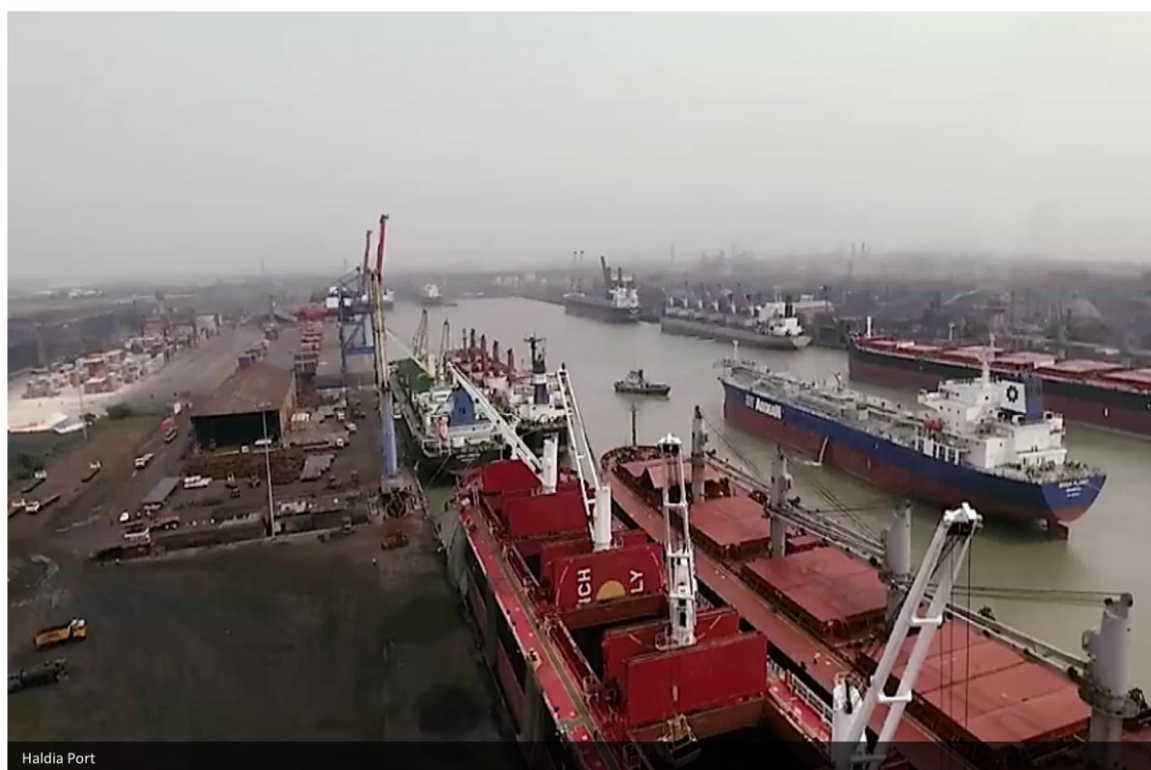
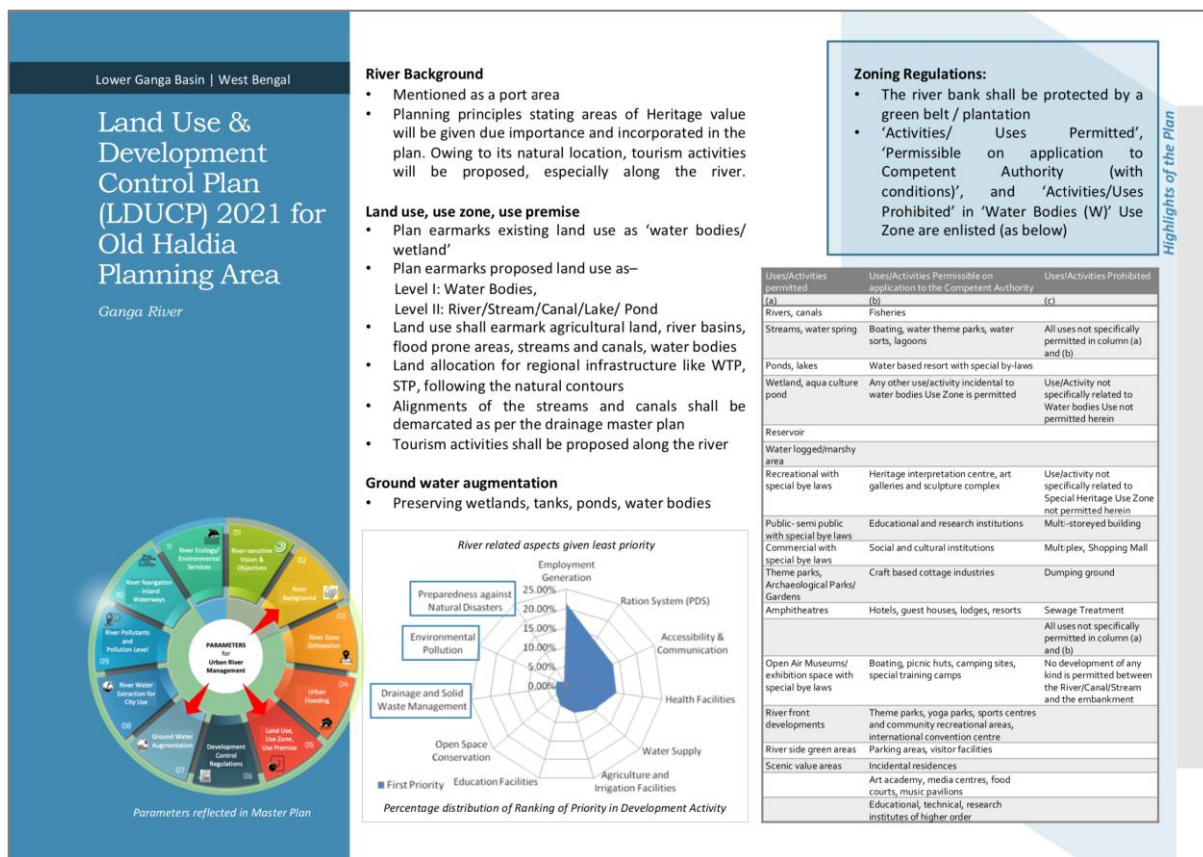
- Existing/ new industrial building or extension
- Hazardous building
- New/ extension of existing buildings – residential, business, educational, institutional, mercantile (wholesale), mixed use, storage
- New/ extension of existing assembly buildings, excluding clubs, restaurants, eating houses, passenger stations, transport terminals, crematoria, bathing ghats
- Khatahs (where cattle are kept)

Building restrictions for development Control Zone 'RF':

- Max. permissible height – 5.00m (without stilts) or 6.50m (including stilts).
- Min. height of stilt – 3.00m and stilted portion not allowed to be walled up or covered along the sides.
- Buildings alongside the river shall not be more than 20.00m long, with a clear linear gap of 50.00m between two buildings
- Max. permissible covered area – 200.00 sqm.

Highlights of the Plan






Delhi

Master Plan Delhi 2021

Yamuna River



Parameters reflected in Master Plan

River Background
Plan identifies the rivers flowing through the city, along with details of their area

Land use, use zone, use premise

- Plan earmarks existing and proposed land use as 'Green Belt & Water Body', with 'River & Water Body' use zone
- Landscaping drains and waterfront as interconnected parkways

Ground water augmentation

- Mention of recharge & annual rainwater harvesting potential
- Proposal for Integrated Water Resource Management - 'zero run-off drainage', 'regulated flood plain reservoirs', balancing ponds/ retention ponds/ sediment traps, for storing monsoon overflow with segregated wastewater disposal system
- Proposal to use treated wastewater for ground water augmentation

River water extraction

- Mention of river water allocation/ ranney wells in Yamuna flood plains, transit losses, inter-State river water allocation
- Proposal for increase in raw water allocation

River pollution

- Details of BOD/ total coliform levels
- Drain outfalls identified
- Pollution control measures and eco-sensitive land use controls

Focal points of the plan
Rejuvenation of Yamuna through-

- adequate flow by release of water,
- refurbishment of trunk sewers,
- treatment of drains,
- sewering of unsewered areas,
- treatment of industrial effluents,
- recycling of treated effluents,
- removal of coliforms at STPs

Yamuna Action Plan
Recommendations of a committee formed to draw up an Action plan for the cleaning / rejuvenation of the Yamuna River-

- Min. flow to be ensured by Riparian states by releasing adequate water
- Refurbishment of Trunk Sewerage System, that is in highly dilapidated condition and has been silted
- Treatment of the flows from major drains falling in the river, by laying internal sewerage system/ installation of decentralized treatment plants
- Laying of Sewer Lines in the un-sewered areas of the city
- Clearing slum clusters from riverbed
- Treatment of Industrial Effluent before discharge into the drains/river, through better capacity utilisation and laying of conveyance system wherever required
- Re-use of Treated Effluent
- Coliform removal at STPs to permissible levels in treated wastewater

Highlights of the Plan



Uttar Pradesh

Agra Master Plan 2021

Yamuna River

Parameters reflected in Master Plan

Land use, use zone, use premise
The plan proposes -

- Parks, recharge zones and tourism activities in open areas adjacent the river
- Plantation within 3m on both sides of the major drains

Ground water augmentation

- Proposal for adequate Sewage/ Water Treatment plants with new/ improved technologies
- Proposal for barrage upstream of river
- Proposal for water harvesting, reducing wastage while transmission/ distribution

River water extraction
Mention of details regarding quantum of water supply

River pollution
Details of treated and untreated sewage/ drainage discharge in the river

Specific proposal for water harvesting

- Identification & protection of existing natural water bodies, permitting no other land use
- Area around water bodies to be developed as tourist zones, wherever possible
- Water reservoir (min. 1 acre and 6m deep) on almost 5% area, for all plans over 20 acres, with parks/ open areas
- For all plans less than 20 acres, provision of recharge well/ tank, as per determined standard of the park/ green belt
- Zoological/ Hydro-zoological survey to propose ground water recharge
- Permanent structures not more than 5% of the park area. Footpaths/ tracks of permeable/ semi-permeable perforated blocks
- Less water consuming plants for roads, parks and open areas
- Permeable pavements along roads for ground water recharge
- Proposal for rooftop rain water and recharge structures in all existing/ to be constructed official complexes.
- Recharge through percolation pits catching water from terraces/ open areas of all uses having an area above 1000sqm.


Highlights of the Plan



Gujarat

Ahmedabad Comprehensive Development Plan 2021

Sabarmati River



Parameters reflected in Master Plan

Urban flooding
Plan identifies the flood risk areas

Land use, use zone, use premise
The plan provides guidance on Special Planned Area Development -

- Sabarmati Riverfront Development (SPD-1) - special area zone, planned and developed, contains various uses along with adequate provision of open spaces, parks and gardens. Located in 11.5kms stretch along river covering about 200 Ha of land
- FSI as applicable
- Permissible Uses as per SRFD Master plan

Development Control Regulations

- Regulations regarding min clearance from the water body
- No development in area designated for water body, pond and talab in Development Plan excluding riverfront
- Special regulations pertaining to ground coverage, margins, height of building, use of building etc. that will prevail over General Development Regulations.

Ground water augmentation
Rain water harvesting proposal, through rain water disposal (channelling rain water discharge from a building-unit to a public storm water drain) and mandating rain water harvesting/ storage as per building sizes.

Minimum Distance from Water body

- Minimum clearance of 30mts between boundary of the bank where there is no embankment and any development work or part thereof
- Minimum clearances of 15mts between embankment of a river and any building or part thereof or any other clearance as may be prescribed under any other general or specific orders of Government and appropriate Authority whichever is more


Highlights of the Plan



Tamil Nadu

Master Plan for Chennai Metropolitan Area 2026

Coom & Adyar River



Parameters reflected in Master Plan

River Background
Plan identifies the rivers flowing through the city, along with details of their area

River Zone Delineation

- Floodplain zoning and restrictions

Urban flooding

- Details of past occurrences
- Contour details
- Flood risk mapping and strategies to reduce damage
- Drainage Master Plan proposed

Land use, use zone, use premise

- Greens along riverbanks

Development Regulations

- Restricted developments in Aquifer Recharge area

Ground water augmentation

- Desilting, improvements and conservation of lakes
- Details of ground water levels and quality

River pollution

- Waterway basin-wise sewage generation, no. of outfalls details

Floodplain zoning

- Follow GoI notification, declaring the coastal stretches of seas, bays, estuaries, creeks, rivers and back-waters upto 500m from the High Tide Line (HTL) as Coastal Regulation Zone (CRZ)
- Restrictions on both sides in case of rivers, creeks and backwaters
 - To be kept clear of all activities
 - Suitable trees and plants to be planted
 - Free from artificial development
 - Pollution from industrial and town wastes must be avoided

CRZ	Permissibility
CRZ-I	Ecologically sensitive areas between high and low tide line, natural gas exploration and salt extraction permitted
CRZ II	Areas up to shoreline of the coast, unauthorized structures not allowed
CRZ III	Rural and urban areas outside CRZ-I and CRZ-II, only agriculture-related activities and public facilities permitted
CRZ IV	Aquatic areas up to territorial limits

Highlights of the Plan



MAINSTREAMING Urban River Management into Master Plans

Strategic Guidelines for River Towns

Louisiana

New Orleans Master Plan 2030

Mississippi River

Parameters reflected in Master Plan

River-sensitive Vision
River-centric vision for city development

River Background
Reinventing city's Crescent Plan to reinforce the river's critical role

Urban flood management
Planning for flood protection, stabilization of neighborhoods (disaster risk, climate change mitigation strategies)

Landuse, use zone, use premise

- Eco-friendly uses proposed
- New public parks and recreation areas developed

Development Control Regulations
No structures permissible except those necessary to support specific conservation aims or low-impact amenities

Ground water augmentation

- Feasibility of river as a potential for managing groundwater
- Conservation/ storm-water management techniques

River water extraction for city use
Water supply, WTP that purify river water, capacity information

River pollution
Details of sewage and drainage system

River navigation
Potential of new ferry connections for fast/ efficient mass transit

River Ecology/ Environmental Services
Reduce the city's carbon footprint - reducing leakage of treated water and overreliance on pumped drainage

Vision for New Orleans, 2030

- A city that celebrates its relationship to water and uses water-management strategies to provide amenities to neighborhoods wherever possible

Landuse, use zone, use premise

- Natural Area** - Increase, retain and preserve ecologically sensitive habitats by conserving, improving, and/or restoring for aesthetic value, biodiversity, natural disaster resilience, natural resource and wildlife conservation, and nature-oriented recreation
- Celebrate the city's relationship to water**- linked by green-blue corridors (landscaped canals, rain gardens, restored wetlands) that improve public understanding of water systems, spur adjacent private economic investment
- Reclaim river and lake waterfronts for lively public spaces
 - Crescent Park - linear park, along riverfront with paths to discourage run-off, and adaptive reuse of wharves
 - Lafitte Greenway - pedestrian/ bicycle urban trail, with landscaping, bio-swales, storm-water retention features

Establish Riverfront Advisory Committee

Highlights of the Plan



Mongolia

Ulaanbaatar Master Plan 2030

Tuul River

Parameters reflected in Master Plan

River Background
Plan identifies the rivers flowing through the city

River-sensitive Vision and Priorities

- Vision - City is Environmentally Friendly
- Objectives - safe, healthy, green city, resilient to climate change
- Strategies - Establish sustainable environmental management

River Zone Delineation
Designates rivers as special protection areas and renew the existing protection area boundaries

Urban Flooding

- Flood control areas should be identified
- Infrastructure to store/ redirect flood waters, where required

Land use, use zone, use premise

- Green/Open Space - areas for recreation, ecological conservation and to enjoy nature
- Establish waterfront open space along rivers and streams, with connected parks/ green space for residents and tourists.

Ground water augmentation
Ground water sources mapped

River water extraction for city use

- Drinking water sources - groundwater aquifers and river water
- New infrastructure will be constructed to provide water

River pollution

- Existing waste water treatment plant should be improved using state-of-the-art technologies and additional plants should be established to meet the demand

Highlights of the Plan

- Ulaanbaatar city Green Belt – at the edges to contain size of city and limit development in high flood risk areas, areas in the city's drinking water catchment and restricted area (natural preservation areas, water resource protection areas). Include existing strictly restricted areas.
- Implement river enhancement projects



Alberta

Municipal Development Plan, Calgary, 2009 (60 yr. plan)

Bow & Elbow River

Parameters reflected in Master Plan

River-sensitive Objectives

Protect, conserve/enhance water quality/ quantity by assigning land use and framework that protects the watershed

River Background

- Identifies rivers flowing through the city, with watershed details
- Proximity to riverfront adds value to open space system

Urban flooding

- Regulating land uses/ development within Flood Hazard Areas
- Flood hazard mapping (using 100 year flood event)

Land use, use zone, use premise

- Maintain and enhance the riverfront as an active, liveable, pedestrian/bicycle-oriented amenity
- Maintain/ improve public access to major water bodies/ rivers
- Open space typology - Rivers and creeks; River valleys
- Riverfront Areas - development of park and pathway system, with public plazas/ seating/ landscape features along the riverbank sensitive to existing natural habitat

Ground water augmentation

Protect Watersheds-drains, springs, wetlands, ponds, streams, lakes

River water extraction for city use

Provision, alignment, capacity of water distribution mains

River pollution

Provision, alignment, capacity of sewer/ stormwater mains/ trunks

River Ecology/ Environmental services

- Network - rich with wildlife habitat, and natural vegetation
- Protect biodiversity in river valleys, ravines, coulees, wetlands
- Riparian Strategy - Sustaining Healthy Rivers and Communities

Protecting aquatic and riparian habitats

- Ensure "no net loss" principles of significant wetland habitat and preserve existing wetlands as a priority over reconstruction.
- Protect aquatic habitats through preservation, restoration and creation of wetland bank sites.
- Protect riparian areas to meet habitat, water quality and public access through environmental reserve dedications and design alternatives.
- Encourage and enable protection of source water and groundwater recharge areas.

Top priorities to reducing flood impact-

- Appropriate land use and development regulations;
- Mitigate the potential impact or obstruction of floodwaters;
- Enhance Calgary's flood resiliency by employing a comprehensive approach to flood risk reduction measures
- Align policies and regulations to meet the minimum standards
- All buildings located in the floodway, flood fringe or overland flow area must be designed to prevent:
 - damage by floodwaters;
 - damage by elevated groundwater;
 - incremental increase of upstream river water levels.

Highlights of the Plan

Bow Bridge, Calgary

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National Institute of Urban Affairs



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