



**Guidance Note for
Environmentally Sensitive, Climate
Adaptive and Socially Inclusive Urban
Riverfront Planning and Development**









FOREWORD

Cities in India have historically developed near major water bodies such as rivers to ensure water access and accrue additional benefits of proximity to these natural resources.

India's rivers and their many tributaries have been the source of physical and spiritual sustenance of Indian civilization for eons. Rivers hold immense cultural and religious significance in India and the cities and locales on riverbanks are typically important cultural centers. Flowing rivers support agriculture, industry, trade and urbanization in India and are critical for a robust economy to thrive. In addition, rivers also support a plethora of flora and fauna along their courses such as fish, birds and larger species.

Despite India's reverence for rivers these natural resources are facing urgent and rapid challenges which have brought them and their ecologies to the brink of collapse. Constantly increasing demand on the finite water available in the river, pollution from urban areas, industries and agricultural runoff are some of the key stressors for rivers today in India. In addition, the deep connection that humans had forged with rivers, with a multitude of religious and cultural practices and community and individual rituals are lost today. Cities and towns are turning their backs to rivers, which are now too polluted, with too little water or too flooded.

The picture of degradation of rivers and riverfront is ubiquitous as there is a constant struggle to achieve a balance between urban development and environmental sustainability. Added to the developmental challenges comes the growing uncertainty and risk wrought by climate change. To manage risks brought about by unprecedented and unmanaged urbanization, increasing population and growing climatic whiplash, it is critical that restoration and conservation of rivers, local water bodies and

other related ecosystems become a co-equal goal in a city's development. There needs to be a revolution in planning to improve how we make policy and investment decisions and implement solutions. The climate challenge is not only urgent—it is also pervasive across virtually all sectors of the economy.

National Mission for Clean Ganga (NMCG) has been prompted to develop a balanced approach to urban riverfront development (URFD), where ecological, environmental and social concerns are addressed harmoniously along with development to accrue multiple benefits to people and riverine ecosystems and also generate economic dividend for cities. This guidance note on URFD is to provide a broad framework in order to plan and develop environmentally sensitive, climate adaptive and socially inclusive approach to urban riverfront projects. It can be considered as a primer for multiple stakeholders including urban local bodies, service providers, project financing organizations etc. who are involved in planning and/ or developing any urban riverfront projects.

Governments, development agencies, service providers, subject matter experts and civil societies are needed to collaborate to strengthen knowledge and capacity for managing the complex process of urban riverfront development especially at a time when climate risks and water challenges are becoming prevalent and are resulting into serious social, financial and environmental losses.

Save water, Save rivers, Save earth, Save humankind!

Shri Rajiv Ranjan Mishra
Director General

National Mission for Clean Ganga
Department of Water Resources, River
Development and Ganga Rejuvenation
Ministry of Jal Shakti

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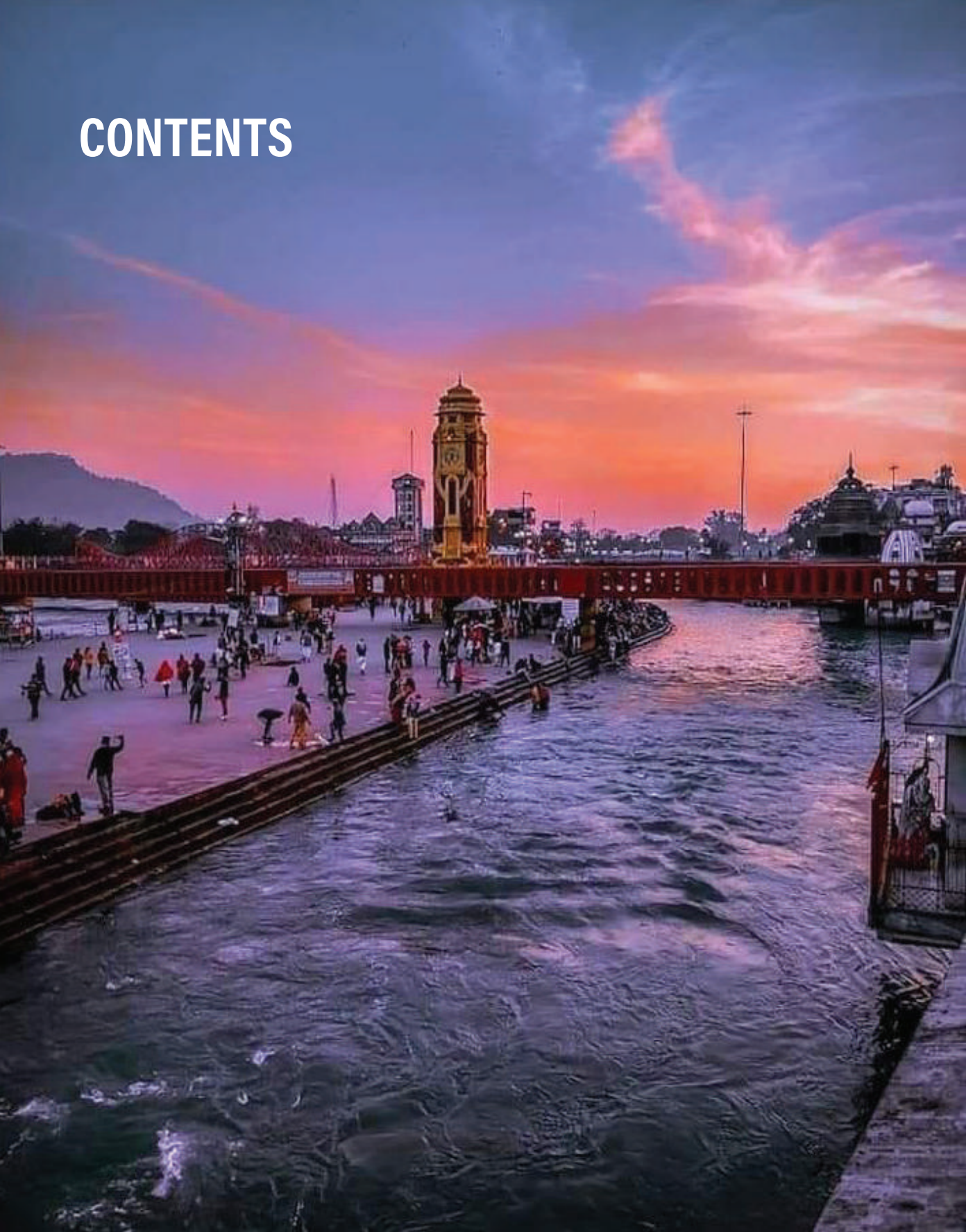


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CONTENTS



SUMMARY	7
CHAPTER I: INTRODUCTION	12
Historical Context and Significance	15
Urban Riverfronts Today	17
Principles of Ecologically Sound Riverfront	19
How urbanization affects streams	19
Guiding Principles	19
CHAPTER II: EXISTING PLANNING AND REGULATORY FRAMEWORKS	24
Existing Environmental and Social Regulatory Framework: Policies and Regulations with influence on Riverfront Development	24
Interrelation between URMP and URFD.....	26
CHAPTER III: APPRAISAL FRAMEWORK	30
[A] Project Screening Report (PSR)	30
A.1 Type of Proposed URFD Project	30
A.2 Interrelation between Existing Plan(s) and URFD Proposal.....	32
A.3 Site Selection	32
A.4 Connections.....	38
A.5 Financial Plan.....	41
A.6 Development of Key Performance Indicators.....	41
[B] Detailed Project Report (DPR)	42
B.1 Hydrological Assessment	43
B.2 Climate Change Scenario	46
B.3 Environmental Impact Assessment (EIA).....	49
B.4 Social Impact Assessment.....	54
B.5 Design Strategy.....	60
[C] Planning and Institutional Strategy	63
CHAPTER IV: GUIDANCE FRAMEWORK.....	68
[A] Implementation of Management/ Action Plans	69
[B] Change Management.....	69
[C] Monitoring and Evaluation	72
[D] Training.....	72
[E] Information Disclosure	72
[F] Grievance Redressal	73
CHAPTER V: OPERATION AND MAINTENANCE FRAMEWORK	76
[A] Financing Operations & Maintenance in URFDs	76
Appendix A: TASK CHECKLIST	86
Bibliography	92

SUMMARY

Urban Riverfront Development (URFD) and planning in India currently focuses on the built environment (construction, landscaping and beautification) and the potential economic benefits to be derived from these projects. There are limited considerations of the social, hydrological, environmental and ecological impacts of these projects as well as impact on the project itself. Also, erratic climatic events like flood and drought has direct impact on riverfront projects. Discounting these aspects of riverfront planning and development has time and again led to failed outcomes, hydrological/ ecological/ environmental stresses and disasters like floods with loss of life and property.

With this context, National Mission for Clean Ganga (NMCG) has requested World Resources Institute India (WRI India) to develop a guidance note integrating water, ecology, environment and climate resilience related considerations within the existing framework of urban riverfront planning and development. Responding to NMCG's request, WRI India has developed this high-level guidance note by bringing in relevant hydrological, ecological, environmental, social and climate resilience considerations.

This document is a primer for all stakeholders who wish to implement urban riverfront projects; to be able to plan and develop projects which are environmentally sensitive, climate adaptive and socially inclusive. The document, as envisaged, has three broad objectives as presented below.



Appraisal tool to support decision-making on urban riverfront development based on environmental and social indicators



Informs project proponent, decision makers and other stakeholders about **environmentally sensitive, climate adaptive and socially inclusive** riverfront developments



Guidance to various service providers on design and planning and implementation of ecological URFD

A BROAD STRUCTURE OF THE GUIDANCE NOTE IS AS FOLLOWS:

CHAPTER I is an introduction into the history of urban rivers and their present condition in urban India.

CHAPTER II outlines the existing environmental and social regulatory framework and the interrelationship between Urban River Management Plan (URMP) and URFD.

CHAPTERS III AND IV detail the protocols for appraisal, implementation process and governance for riverfront developments. These two chapters also include a range of case studies which are provided to demonstrate how cities across the world have worked to integrate a variety of ecological and social measures in URFDs.

CHAPTERS V outlines mechanisms to ensure smooth Operations & Maintenance (O&M) in URFD projects and financing mechanisms that can be used.

APPENDIX A presents a checklist to help all stakeholders follow various steps as suggested in Chapter III, IV and V.

1 Appraisal framework



Project Screening High-level Plan Report

Type of URFD

Existing Plans

Site Selection

Connections

Financial Plan

Key Performance Indicators



Detailed Project Report Detailed action and management plans

Hydrological Assessment

Climate Change scenario

Environmental Impact Assessment
Ecological and environmental setting

Social Impact Assessment
Socio-economic analysis
Stakeholder identification and mapping
Participation and outreach plan

Design Strategy



Planning and Institutional Strategy Planning Mechanisms

2 Guidance Note for Implementation



Implementation of Management/ Action Plans

Approved Construction
Design and Plans

Environmental and Social
Management Plans

Land Acquisition and
Resettlement Action Plan

Indigenous Peoples Plan

Hydrological Impact
Management Plan

Biodiversity
Management Plan



Change Management

Project Reviews

Stakeholder Engagement
Register



Monitoring and Evaluation

Bi-annual Audits

Correction/prevention plans

Performance Improvement



Training

Roles, Responsibilities
and duties

Compliance training

Impacts of Procedural
Lapses



Information Disclosure

Information Dissemination

Comments Period

Feedback



Grievance Redressal

Grievance receipt and
acknowledgement

Investigation

Response

3 Operations, Maintenance and Financing



Operations



Maintenance



Financing



An aerial photograph of a wide river with a paved bank. Several boats with green and white canopies are docked at the bank. People are walking and standing on the paved area. The background shows a line of trees and a clear sky. A large blue curved banner is overlaid on the top right of the image.

CHAPTER I

INTRODUCTION

CHAPTER I: INTRODUCTION

Historically, human settlements have clustered along riverbanks and developed into large urban centres when supplemented by plentiful resources (food and water), trade and commerce. The industrial era with its growing urban populations and economic activity saw urban rivers change from freshwater sources to polluted water streams carrying industrial and human wastes away from urban centres. In the 20th century, a resurgence of urban riverfront development came about as commercial, retail and residential use, along with vibrant public spaces, competed to establish themselves on prime riverfront properties.

Climate change driven extreme weather events place built infrastructure, property and human lives at risk. As extreme events increase in frequency, urban areas are looking beyond economic benefits and renewing their relationship with water systems to make cities

resilient, such as in Rotterdam (Mackenzie 2010) and to improve the quality of life of citizens such as in Cheonggyecheon, Seoul (Landscape Performance Series n.d.). Urban design and planning strategies and water management policies are integrating concepts such as water-sensitive cities, sponge cities and blue-green infrastructure, allowing cities to respond better to urban hydrological cycles and extreme weather events.

Living beside and building along riverfronts remains fraught with various challenges such as the risk of loss of life and property due to floods and spread of insects and disease due to contaminated water. In India and other developing countries, such risks are disproportionately borne by economically weaker sections of society who reside in such areas due to the lower costs of land in these unimproved areas. Development plans often

Figure 1 | Evolution of waterfront development

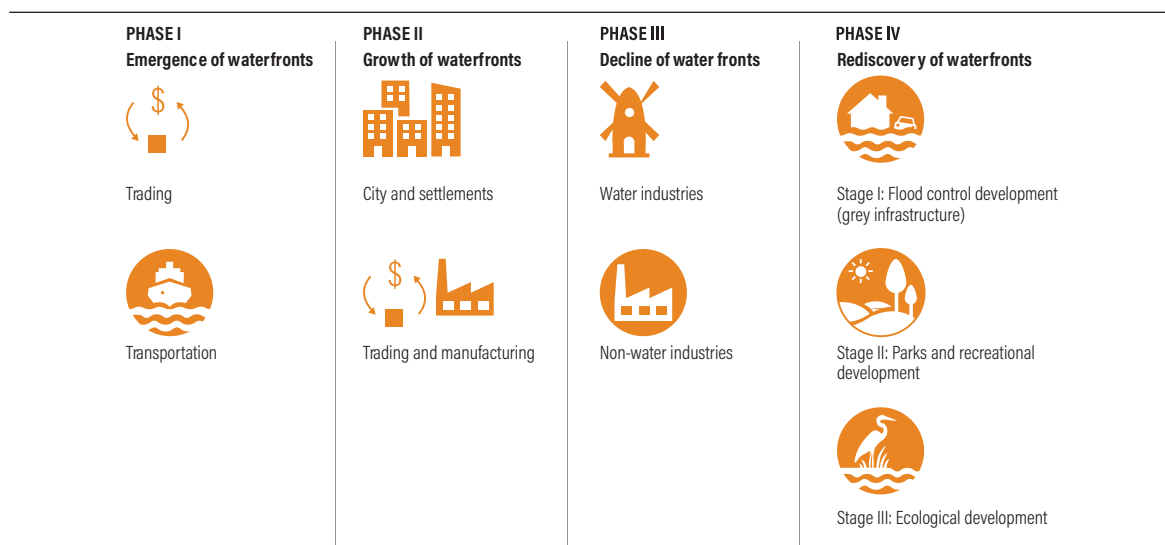


Image adapted from (Redzuan and Latip 2016)

Box 1 | Urban riverfronts must respond to key challenges of current times

The environment in terms of river catchment and upstream areas have rapidly changing land-use profiles; this has drastic impacts on sediment loads and runoff volumes entering water bodies as well as local biodiversity. Climate change driven weather variability impacts the extent and frequency of extreme events such as floods and drought leading to infrastructure damage and loss and disruption of services. Finally, changing population and demographic patterns impact the socio-cultural connections and associations that communities have with rivers, often leading to the loss of river custodian communities. These three interacting themes lead to higher stress on urban river ecosystems with increased pollution, extreme events and lack of care of the river.

To manage for the uncertainty brought about by climate change, existing planning concepts need to be transformed so that climate risk can be mainstreamed, and adaptation practices can be integrated into urban and regional planning. Improved data analytics and forecasting tools must be developed which can ensure robust decision making for climate uncertainty. Participation of communities, particularly of vulnerable and most impacted groups in the planning process must be ensured so that the benefits of climate adaptive planning can percolate to such groups (GCA 2019).

With the emerging global focus on environment, climate and social issues this document asserts that there are 3 primary concerns that must be addressed in combination as new urban riverfront development projects are conceptualised and implemented to respond to critical and rapid changes.

Thus, this guidance note has been developed to support project proponents to develop environmentally sensitive, climate adaptive and socially inclusive urban riverfronts.



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



Climate adaptive urban riverfronts are riverfronts which have adequate planning/ design buffers to deal with future climatic variabilities by limiting and/ or mitigating any social, ecological and capital loss as well as damage to natural and built assets.



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

do not factor in the socio-economic impacts of displacement of these existing residents.

Urban riverfront development projects focus primarily on the built environment (construction, landscaping and beautification) and the potential economic benefits to be derived from these projects. There is limited consideration of the social, hydrological, environmental and ecological concerns of these projects. Discounting these aspects of riverfront development has time and again led to severe hydrological/ ecological/ environmental impacts as well as disasters like urban floods and loss of life and property.

Additionally, riverine ecosystems provide many benefits such as groundwater recharge, microclimate control, increasing biodiversity and controlling floods where intact floodplains and wetlands are present. Further, healthy urban rivers can also support fishing, recreational activities and water activity-based tourism as livelihood options for citizens.

India, with its many urban rivers and culturally important sites such as the ghats (like Varanasi on River Ganga), is well poised to demonstrate the benefits of water and eco-sensitive urban riverfront developments. Urban riverfront development projects along various rivers

Box 2 | **How to use this document**

This guidance note on environmentally sensitive, climate adaptive and socially inclusive urban riverfront planning and development has been developed as a primer for urban local bodies which are contemplating the rejuvenation and restoration of their urban rivers. This note intends to offer key points that project proponents should consider before embarking on and during the project implementation phase.

As the local context of each URFD project site is different, this document is not intended to provide pre-defined solutions on methods and technologies that can be undertaken to develop URFDs. Also, various solutions are described as part of case studies but this document is technology agnostic and does not prefer any specific technological solution. Rather this document provides a checklist of relevant and critical aspects, tasks and activities that a project proponent (URFD authority) must consider while developing an environmentally sensitive, climate adaptive and socially inclusive URFD project.

This document also provides a range of global and national case studies of riverfront developments; examples of both good practices and unsuccessful implementation and provides a project framework that future riverfront developments in India can follow.

This document has drawn extensively from an existing publication *Ecological Riverfront Design: Restoring Rivers, Connecting Communities* to develop the framing and approach to be followed to develop ecological URFDs.

However, this document goes beyond the theory and conceptual frameworks of the above-mentioned primary publication and provides an India-specific, documented, high-level guidance note by bringing in relevant

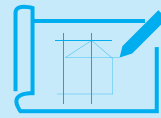
hydrological, ecological, environmental, social and climate resilience aspects that need to be considered during planning, development and operational phases of riverfront development projects. This document is a primer for all stakeholders who wish to implement urban riverfront projects; to be able to plan and develop projects which are environmentally sensitive, climate adaptive and socially inclusive.

This guidebook is an **addendum to any existing reports and guidelines** on urban riverfront developments and is designed to include a broad framework on an **environmentally sensitive, climate adaptive and socially inclusive** approach to riverfront projects.

This document **does not include** guidelines on architectural detailing, technical details and heritage conservation practices.



Architectural detailing



Technical aspects



Heritage conservation practices

are already attracting significant investments (Mumbai alone is investing INR 685 million to develop the Mithi Riverfront (Das 2017)).

A balanced approach to urban riverfront development (URFD), where ecological, environmental and water concerns are addressed harmoniously along with development can accrue multiple benefits to people and riverine ecosystems and also generate economic dividend for cities.

Historical Context and Significance

Urban centres in the Indian sub-continent have a long and intertwined history with river valleys and river basins. Beginning with the ancient Indus Valley civilization to later periods such as the Maurya, Chola and Mughal eras, cities have grown and flourished along the banks of rivers

and in the fertile deltas of river basins. Indian tradition holds all Indian rivers sacred and considers them as the purifier, life giver, symbol of fertility and destroyer of evils.

Being close to rivers brought easy access to water for domestic, agricultural and fishing purposes. The added access to waterways for navigation, trade and commerce allowed these settlements to connect with each other and enabled the growth of large urban centres (Gupta 2017). Alongside the tangible impacts brought about due to the proximity to rivers, a deep cultural significance for rivers emerged in India where rivers came to be associated with community and individual rituals. These cultural practices mirrored natural rhythms such as the hydrological cycle of the river, the change of seasons and the associated flowering/ fruiting of trees which dictate

agricultural sowing and harvest times.

Since industrial times rapid urban population growth in cities across the world and in India has changed the intimate relationship cities and citizens had with urban rivers (Otto, McCormick and Leccese 2004).

Improved road, rail and air transport services and advancements in science and technology removed dependence on local resources like rivers. Water was sourced and transported from distant rivers and reservoirs to meet urban needs in many cities and this trend continues today (IIHS 2014).

Rapid increase in urban population has led to greater extraction of surface water from the river

as well as groundwater (that supports base flow in rivers). Additionally, dumping of municipal and construction waste on the riverbanks adds to pollution levels. Industrial pollution, wastewater and fecal sludge, agrochemical runoffs and waste had turned many urban rivers into settling drains or cesspools.

Across India, rivers continue to be revered and their cultural significance is embedded into festivals and rituals, but the deep connections engendered by daily access and use of local rivers for domestic and economic purposes has dwindled. This has in turn led to a reduction of local activities that enabled river protection and rejuvenation.

While in India river restoration still focusses on

Figure 2 | Ghat of Varanasi



Image Credit: Sheldon Kirshner

Figure 3 | Ghats in Patna City



Image Credit: WRI India

river cleaning and aesthetic appeal, the concept of clean rivers on a global level has shifted towards the creation of healthier rivers which are able to sustain a wider diversity of fish, birds, and other wildlife. An ecologically improved and healthy river draws the public to the water's edge for various recreation activities such as to walk, bike, boat, fish, and observe wildlife. People returning to the river and the increased and deeper connection with water leads them to express a stronger interest to protect and restore natural areas and wildlife habitats along rivers and elsewhere in the catchment (Otto, McCormick and Leccese 2004).

Urban Riverfronts Today

Urban riverfront development in India is thus far limited to commanding and controlling river waters and exploiting its floodplains for the use and convenience of people as well as for commercial gains realized from real-estate development. The modern concept of urban riverfront development in India has originated with Sabarmati riverfront development in Ahmedabad, which involved a grey infrastructure-based development for a stretch of around 10 km (AMC n.d.). Following this, several other urban riverfront

Figure 4 | Stormwater infiltration changes over undeveloped and developed areas

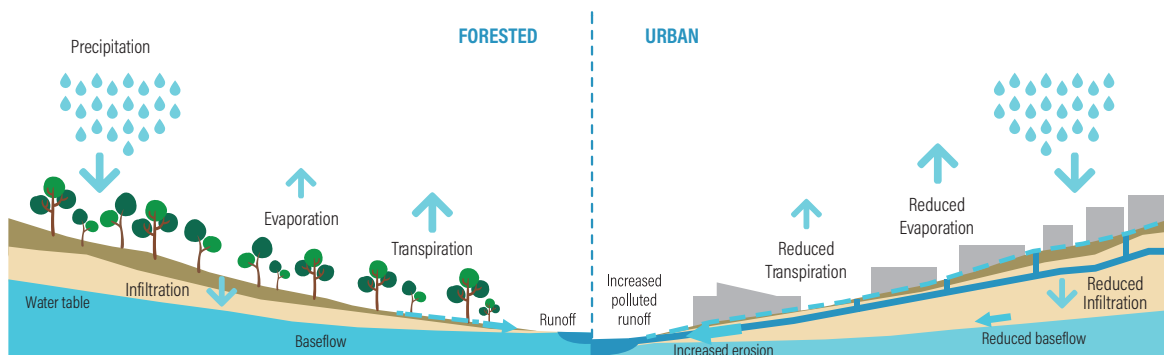


Image Credit: Melbourne Water

1. Stormwater is usually water from ice/snow or water from a nearby stream, river or runoff surface.
2. Natural sediment such as soil and forests absorb most of the stormwater. In developed areas such as in cities, unmanaged stormwater can create 2 types of problems: flooding and water pollution.
3. Water pollution is due to contaminants on the impervious surface of the materials used to construct parking lots, roads and buildings that prevents stormwater from being absorbed into the ground. Therefore, generating more runoff than natural sediment and introducing pollutants to the water. Flooding is due to objects being transported to drains and blocking them.
4. To combat stormwater, a storm drain is installed at various points in cities. It is designed to drain excessive stormwater from impervious surfaces.

development projects have been approved. This list includes Godavari riverfront development in Maharashtra, Patna riverfront development in Bihar, Dravyavathi riverfront development in Rajasthan, Gomti riverfront development in Lucknow, etc., besides similar development proposals for other rivers across India.

But as more studies indicate the wide range of benefits of urban riverfront development projects, river management practices have shifted towards river protection and restoration of degraded areas. Cities today increasingly recognize the value of ecological services provided by natural river (courses) such as flood control, groundwater recharge, etc. Natural river functions (e.g., flood storage, water purification and supply, wildlife habitat, and safe fishing and recreation) once

they are lost or degraded are extremely costly to replace. Incorporating river protection measures in URFDs can significantly reduce the costs of recreating these ecological services.

Urban riverfronts today must fulfil a range of services from recreation to economic activity and ecological functions. Urban rejuvenation along riverfronts when done right is a powerful tool for cities to renew core city areas and revitalize commercial and business districts. Furthermore, there is great insistence for greater proximity to the river, as citizens increasingly want to view biodiversity, engage in recreation activities and learn of the cultural and natural history of rivers. The pressures to rejuvenate urban rivers is paralleled with rapid development across the watershed which compromises water quality as

increased runoff and untreated sewage enters water courses. Urban riverfront developments must protect and improve of river health as a co-equal goal with economic and area revitalization efforts (Otto, McCormick and Leccese 2004).

Principles of Ecologically Sound Riverfront

This section below is derived extensively from “Ecological Riverfront Design: Restoring Rivers, Connecting Communities by Betsy Otto, K McCormick, and M Leccese of the American Planning Association”.

How urbanization affects streams

Changes in stream hydrology resulting from urbanization include the following (Caraco 2000):

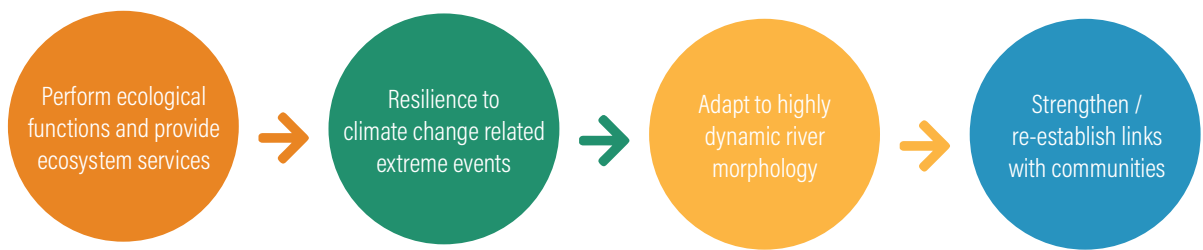
- Increased peak discharges compared to predevelopment levels
- Increased volume of urban runoff produced by each storm
- Decreased time needed for runoff to reach the stream, particularly if extensive drainage improvements are made

- Increased frequency and severity of flooding
- Reduced streamflow during prolonged periods of dry weather due to reduced level of infiltration in the watershed
- Greater runoff velocity during storms due to the combined effects of higher peak discharges, rapid time of concentration, and the smoother hydraulic surfaces that occur as a result of development.

The following principles can be considered as guiding pillars or anchors to evolve guidance for urban river front development. These principles are for the fundamental purpose of creating environmentally sound river front developments and lists the critical functions that the urban river front should perform in the context of intense and rapid urbanisation and climate change scenarios.

Guiding Principles

To translate these guiding principles into planning and design strategies and actions on ground the planning objectives and design objectives mentioned below will be useful.



Planning objectives based on the guiding principles

Plan for a larger scale	Plan for a scale larger than the riverfront to include immediate micro watershed and integrating streams/rivulets flowing into the river
Use development regulations	Ensure spatial connectivity with city's open spaces
Connect to green network	Provide for public access, connections, and recreational uses
Enable public access	Manage river resources which are directly accessed by communities through participatory stewardships
Participatory stewardship	Plan for a scale larger than the riverfront to include immediate micro watershed and integrating streams/rivulets flowing into the river
Formal management authority	Establish and formalise management bodies within the urban local body and community/neighbourhood

Design objectives based on the guiding principles

Unique characteristics	Demonstrate characteristics of the city's unique relationship to the river in the riverfront design
Pollution removal	Design for filter strip and gross pollutant traps at the city side of RFD
Low impact design	Adopt low impact design and construction measures like bio-engineering and landscape interventions to restore natural riparian
Non-structural alternatives	Use nonstructural alternatives to manage water resources
Reduce hardscape	Reduce hardscape within the RFD area
Manage stormwater	Manage stormwater on site and use nonstructural approach such as retention ponds, swales and wetlands
Inundation sinks	Design for inundation sinks to carry or hold any inundation from the river
Use development regulations	Ensure spatial connectivity with city's open spaces
Ghat design	Design ghats which are not continuously built along the banks at intervals
Natural and cultural history	Incorporate information about a river's natural resources and cultural history into the design of riverfront features, public art, and interpretive signs
Restrict river channelisation	Do not channelise the river at the RFD stretch by continuously running walls

In the context of this guidance note, a few scientific terms have been used throughout the document. The definitions of such scientific terms are presented below. These definitions have been primarily drawn from River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016.

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



CHAPTER II

EXISTING PLANNING AND REGULATORY FRAMEWORKS



CHAPTER II: EXISTING PLANNING AND REGULATORY FRAMEWORKS

Existing Environmental and Social Regulatory Framework: Policies and Regulations with influence on Riverfront Development

Currently, river management is not empowered by an Act or Policy that focuses on it exclusively. Having said that, there are several acts and policies aimed at regulating and managing many of the environmental and social components of a river system. Water quality, environment,

biodiversity and disaster risks are aspects addressed through specific acts and policies. The following table presents few key environmental and social regulations applicable to urban riverfront development projects (MoEF&CC n.d.). Please note that this list may not present ALL relevant and applicable national and state-specific environmental and social regulations that may be applicable to a URFD project. The URFD project proponent and consulting service providers must undertake a detailed compliance assessment of relevant and applicable environmental and social regulations.

Act/ Rules	Purpose	Applicability	Authority
Jal Jeevan Mission (URBAN), 2021	This mission's primary objective is to provide universal coverage of water supply across 4,378 statutory towns in accordance with United Nations Sustainable Development Goal 6. This mission takes an integrated approach and recognizes that rejuvenation of water bodies and sustainable aquifer management will be critical to augment sustainable fresh water supply.	Urban green spaces and sponge cities will mitigate flood impact and support development of urban water assets (surface and groundwater) through circular practices for recycle and recharge of treated wastewaters.	Ministry of Housing and Urban Affairs, urban local bodies
River Ganga (Rejuvenation, Protection and Management) Authorities Order, 2016	This order is for the purpose of effective abatement of pollution and rejuvenation, protection and management of the River Ganga, maintain ecological flows through its entire length, impose restrictions as required on industries and processes abutting River Ganga and to make provision for inspection of premises, plants, machinery, etc., to assess their impact on the river.	This Order shall apply to the states comprising the River Ganga Basin and its tributary rivers and streams and will guide during plan, implementation and evaluation phases.	Ministry of Jal Shakti, State Ganga Basin Authorities
National Water Policy, 2012	The National Water Policy, 2012 is envisioned as a framework law that can support essential legislation on water governance at State and Union level. This law enshrines the value that water be considered as element that sustains life and ecology and not merely as a scarce resource that has to be divided among various competing uses.	Section 8 about 'Conservation of River Corridors, Water Bodies and Infrastructure' details the value of urban rivers. Section 8.2 elaborates: 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. Wherever encroachment has occurred, restoration to the extent feasible should be undertaken and maintained properly.	Government of India, State governments, Ministry of Jal Shakti, Ministry of Housing and Urban Affairs

Act/ Rules	Purpose	Applicability	Authority
Environment (Protection) Act, 1986	To protect and improve overall environment.	As all environmental notifications, rules and schedules are issued under this umbrella act.	Ministry of Environment, Forests and Climate Change, DoE, State Govt. Central Pollution Control Board, State Pollution Control Boards
Coastal Regulation Zone (CRZ) Notification 1991 (2011)	Protection of fragile coastal belts.	If project location is located along coastal belt.	
Land Acquisition Act, 1894 (as amended)	Sets out rules for acquisition of land by government.	Applicable in case of acquisition of land.	Revenue Department, State Government
Environmental Impact Assessment Notification 14th Sep-2006 (as amended)	Mandatory environmental clearance to a certain category of new development activities following environmental impact assessment.	Applicable in case built up area of the project is more than 20,000 sq.m and the total construction area is more than 1,50,000 sq.m	State Pollution Control Boards, State Environment Impact Assessment Authority
Wildlife (Protection) Act, 1972	To protect wildlife in sanctuaries and national parks.	This act is applicable if any sanctuary/ national park exists within 10 km radius of project site. This act will be applicable, if there are any points of protected wildlife crossings in proximity to project locations like River Dolphin, which is a schedule-I animal.	Chief Conservator Wildlife, Wildlife Wing, State Forest Department, Ministry of Environment, Forests and Climate Change
Air (Prevention and Control of Pollution) Act, 1981	To control air pollution by controlling emission of air pollutants as per the prescribed standards.	This act will be applicable during construction phase and may be applicable during operational phase (for e.g., if the project has any diesel generator set of more than 15 kVa capacity or a crematorium).	State Pollution Control Boards
Water Prevention and Control of Pollution) Act, 1974	To control water pollution by controlling discharge of pollutants as per the prescribed standards.	This act will be applicable during construction phase and may be applicable during operational phase.	State Pollution Control Boards
The Noise Pollution (Regulation and Control) Rules, 2000	The standards for noise for day and night have been promulgated by the MoEF&CC for various land uses.	This act will be applicable during construction phase.	State Pollution Control Boards
Central Motor Vehicle Act, 1988	To check vehicular air and noise pollution.	This act will be applicable during construction phase and may be applicable during operational phase.	Motor Vehicle Department
National Forest Policy, 1988	To maintain ecological stability through preservation and restoration of biological diversity.	This policy will be applicable if any eco-sensitive feature exists in and around the project.	Forest Department, State Government and Ministry of Environment, Forests and Climate Change

In addition, there are a few empowered agencies that can provide or have provided directions for urban riverfront development projects. Few of them are presented below:

National River Conservation Directorate (NRCD), under MoEF&CC - the objective of NRCD is to improve the water quality of the rivers, which are the major water sources in the country, through the implementation of pollution abatement works (NRCD 2014).

National Green Tribunal (NGT) – a special judicial entity equipped with the necessary expertise to handle environmental disputes involving multi-disciplinary issues. They also have power to issue orders in cases where legalities and regulations are compromised or are not abided by individuals or entities including government agencies (NGT 2016).

City and Regional Land use plans and Building regulations are local-level development management mechanisms, under the purview of Development Authorities and the respective State-level Town Planning Departments along with the urban local bodies. These land use regulations, building regulations and activity regulations have the greatest role in influencing the condition of the river and its watershed in the long-term.

This tool allows the formulation of building coverage regulations, create zoning regulations through participatory planning which can reduce surface runoff, increase percolation, etc.

Projects under SPVs and National Missions such as HRIDAY, PRASAD, SMART CITY, AMRUT, etc., are development plans and projects which target towns, cities and tourist hubs/corridors and religious hubs. If the

location of these proposed projects are along or near a river, these projects will need to look at riverfront development guidelines to inform their project proposals to avoid any conflict (HRIDAY n.d.); (AMRUT n.d.); (Ministry of Tourism 2016).

Therefore, concerned authorities in charge of preparing and implementing these other mission-based projects such as HRIDAY, SMART CITY, AMRUT, etc., near riverfronts should ensure that there is no conflict.

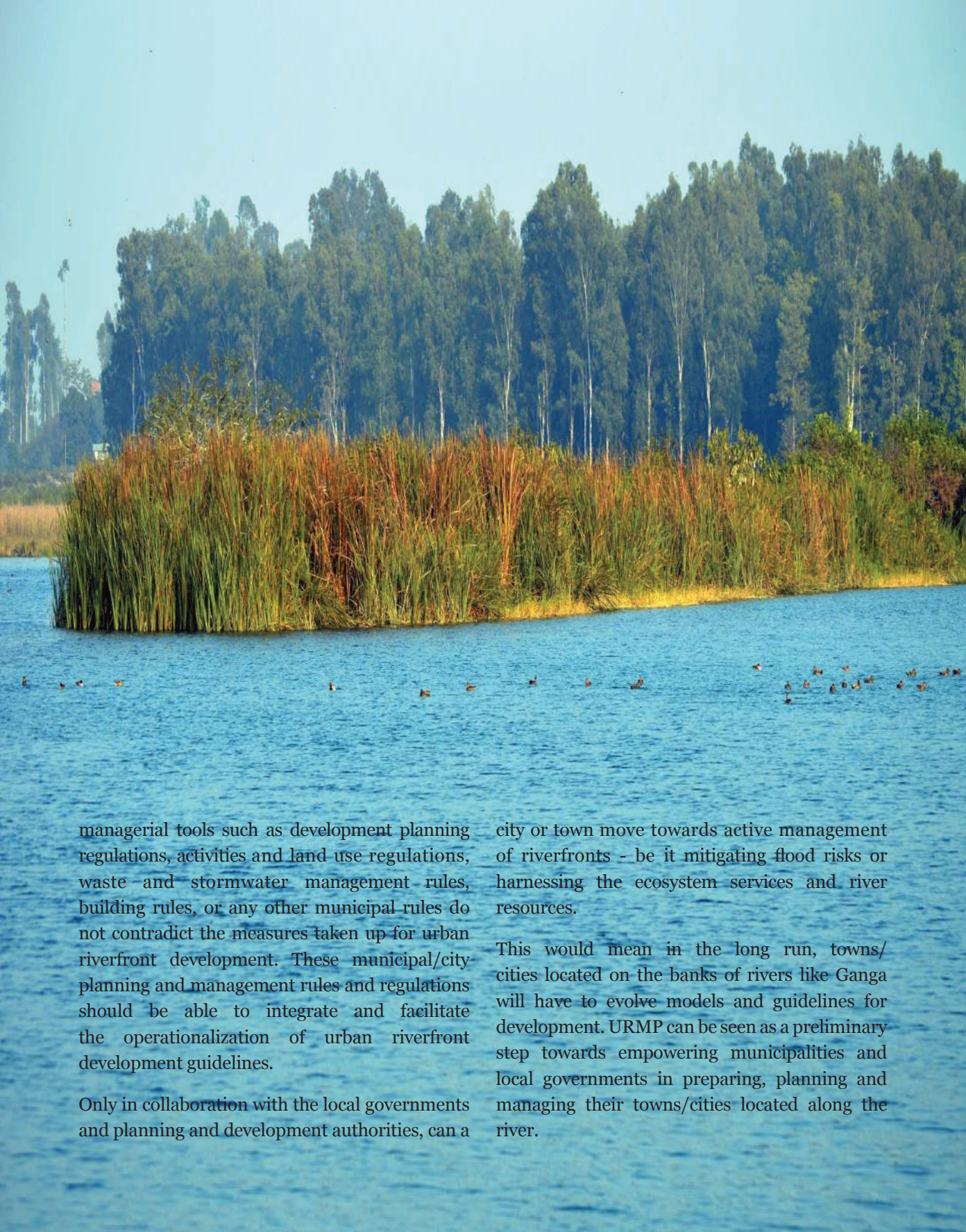
Interrelation between URMP and URFD

Urban River Management Plan (URMP) (NGRBA 2010), which is a city specific comprehensive planning document meant for better management of urban rivers (as well as water bodies and associated ecosystems), should ideally inform Urban Riverfront Development proposals. This is because URMP provides the following plans and information which are critical considerations for URFD projects:

- Runoff from urban watershed
- Waste and effluent discharge from the city to the river
- Access, use and management of riverine and riparian edges and buffers; have direct environmental and social impact on the health of the river and its ecology

Regulatory or management measures for the river therefore cannot be limited to the river, or its immediate edge/buffer but has to extend to the source, especially the watershed of immediate impact and gradually the entire basin itself.

It is also important that administrative and



managerial tools such as development planning regulations, activities and land use regulations, waste and stormwater management rules, building rules, or any other municipal rules do not contradict the measures taken up for urban riverfront development. These municipal/city planning and management rules and regulations should be able to integrate and facilitate the operationalization of urban riverfront development guidelines.

Only in collaboration with the local governments and planning and development authorities, can a

city or town move towards active management of riverfronts - be it mitigating flood risks or harnessing the ecosystem services and river resources.

This would mean in the long run, towns/cities located on the banks of rivers like Ganga will have to evolve models and guidelines for development. URMP can be seen as a preliminary step towards empowering municipalities and local governments in preparing, planning and managing their towns/cities located along the river.



CHAPTER III

APPRAISAL FRAMEWORK



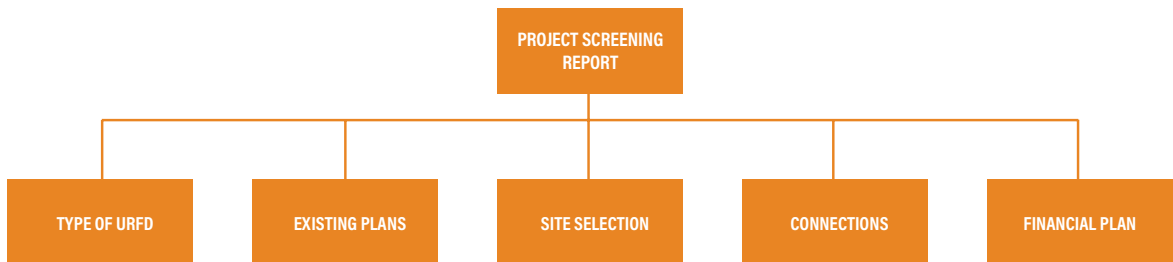
CHAPTER III: APPRAISAL FRAMEWORK

A new urban riverfront planning and development appraisal framework is being proposed for appraisal of urban riverfront development (URFD) proposal and to make sure the proposed project and associated investment is environmentally sensitive, climate adaptive and socially inclusive. A set of project reports should be the basis of phased evaluation, approval or rejection of a URFD proposal. The guidelines for preparation of the project reports are discussed in the subsequent section. The project proponent should prepare

a Project Screening Report (PSR) first followed by a Detailed Project Report (DPR) if the project proponent receives an (conditional/unconditional) approval on the PSR.

[A] Project Screening Report (PSR)

A Project Screening Report (PSR) is the initial high-level project report that a project proponent should prepare for preliminary approval prior to the development of a detailed project report. No expensive primary data collection and consulting services is required for the development of the PSR report. A PSR should contain the following information:



A.1 Type of Proposed URFD Project

Every urban riverfront development (URFD) project is different and requires planning solutions appropriate to its unique conditions. Accurately classifying these unique conditions is an essential first step. Factors to consider are:

- Energy environment of the floodplain; and
- Development intensity

Energy Environment of the Floodplain

Energy environment of the floodplain (Knighton 1984) reflects the interrelation between a river stream's ability to do work (as estimated using specific stream-power) and the erosional resistance of the floodplain (as estimated from sediment size). There is an inverse relationship between the erodibility of a river and sediment size. The classification is as follows:

- High and Medium Energy Floodplain - those floodplains are comprised largely of non-cohesive alluvium (gravel to fine sand)

Figure 5 | Ganga flowing in upper Himalayan range



Image Credit: Asdelhi95, Wikimedia Commons

- Low Energy Floodplain – those floodplains are comprised largely of cohesive alluvium (silt and clay).

Figure 6 | Slow flowing river/ streams in Sunderbans



Image Credit: Jitendra Katha

Development Intensity of the URFD

The development intensity of a riverfront corridor can be classified according to the degree or percentage of impervious cover—hard surfaces such as buildings, streets, parking lots, and sidewalks—found within the corridor. A basic classification system might be:

- ultra-urban (80 to 100 percent impervious cover)
- urban (40 to 79 percent impervious cover), and
- suburban (10 to 39 percent impervious cover) (Center for Watershed Protection 2003).

An URFD may fall under a straightforward classification or have a mix of classifications (for e.g., densely developed downtown-commercial riverbanks to stretches of more naturalized riverbanks in suburban-residential areas).

A.2 Interrelation between Existing Plan(s) and URFD Proposal

Existing city level master plans and land use plans should be examined to identify opportunities for spatial integration of open green spaces with the riverfront and riparian zones. Any proposed URFD spatial plans should be informed by the city level master plan and land use plans. Local area spatial development plans should be developed to include the spatial and visual re-linking of riverfront areas with the city public spaces and to create a network of green landscape infrastructure that is sensitive and incremental to the existing baseline of socio-economic and environmental values.

Additionally, the basin level management plan (if it exists) provides a comprehensive background on the environmental, ecological, hydro-geological,

morphological, socio-economic and socio-cultural conditions and context of the river basinⁱⁱ. It is important for the URFD project proponent to review and incorporate the suggestions and directions as mentioned in the respective basin level management plan within URFD plan.

A.3 Site Selection

In case of large rivers (such as the Ganga) which are managed through multi-layered institutional mechanisms, it is critical to examine the choice of a site for URFD. Where URFD proposals are developed on sites which are ecologically sensitive, vulnerable or the proposal is not socio-economically or socio-culturally viable, then the return on investment on the RFD project will be limited. To ascertain that a site is suited for an URFD project it is suggested that the following general guidelines be followed during site selection:

- **Preserve natural geomorphology of riverbanks:** URFD proposals (master plan or design) should not extensively affect or damage existing geomorphic features of the riverbanks. Geomorphic features and the active floodplain can be mapped using high-level remote sensing technologyⁱⁱⁱ. Morphological features may include; river islands, floodplains, estuarine wetlands, etc.
- River features are not only evidence of how a river behaves, it is also a self-regulating mechanism of the river to manage its course. Destruction of these natural and dynamic formations of the river within its floodplain will make the riverbanks and settlements alongside much more vulnerable to inundation/flood risks and erosion. Urban riverfronts have to be sensitive to the river features, both geomorphic and ecological.

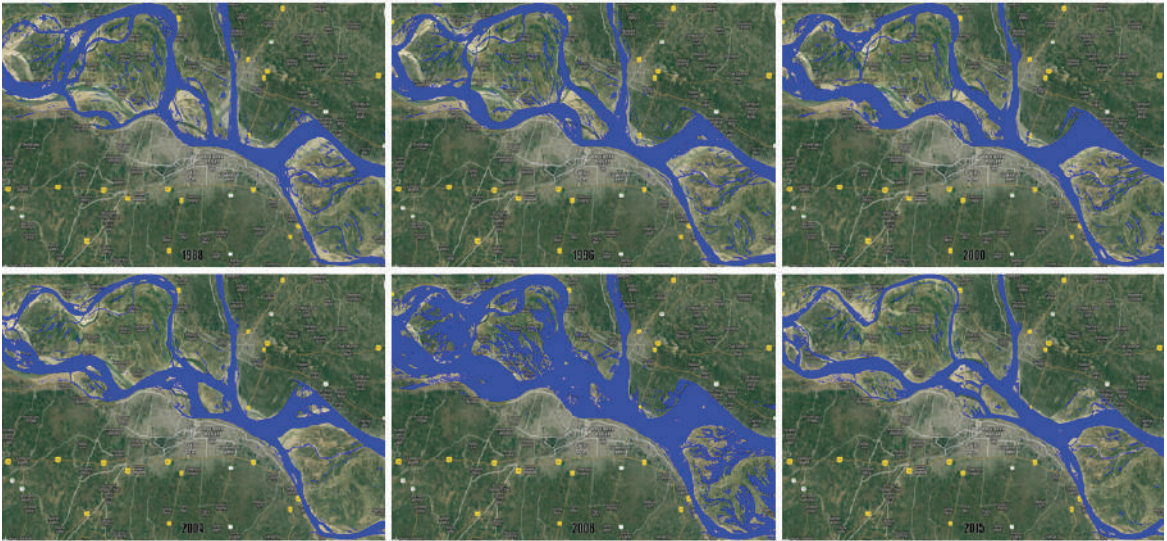
Figure 7 | Use of remote sensing to map river morphological features and change over time - Patna, India

Image Credit: WRI India

Box 3 | Altering river geomorphology: issues with concretization of natural waterways - Los Angeles River

Channelization of the 51-mile Los Angeles River and its tributary streams was carried out by the U.S. Army Corps of Engineers in 1938 to quickly remove stormwaters from urban areas and direct them to the ocean (Otto, McCormick and Leccese 2004). Since then the city of Los Angeles has continued to reduce its natural and cultural connections and dependence on the river. Industrial development grew along the channelized river but from the 1980s industrial decline has left large expanses of brownfield sites along the river.

Figure 8 | Concretisation of the Los Angeles River in 1938 (Masters 2017)

Image Credit: Nathan Masters

Today, studies indicate that the excessive hardscape and concrete-lined riverbanks have resulted in poor water quality caused by urban runoff and the destruction of native habitat. The original rationale for the concrete channel system was to move stormwater out to the ocean as quickly as possible after rainfall events. This objective is being re-evaluated now given the region's dependence on imported water, depletion of groundwater and the impacts of stormwater pollution on state beaches. The series of plans to renew the Los Angeles River centre around naturalizing the river course by removing the concrete channel and approximating a natural river channel.

- Preservation of floodplain:** The floodplain is the space of the river which allows for the accommodation of variabilities in river dynamics; such as increased volume of water, debris load, etc. The floodplain is also a critical belt and hosts riparian biodiversity which is fundamental to ecological functions such as nutrient assimilation, water quality regulations, inundation regulation, etc. Urban riverfront master plans should be planned and designed to include the floodplain extents such that no new permanent-built constructions are allowed within the floodplain; and all new permanent-built constructions should be

allowed only beyond the floodplain. Where space is limited (as is often the scenario in urban areas), the permanent structures constructed may be elevated above the high flood level to minimize the impact on floodplain ecology and environment. Where floodplains have been altered, these should be revived to natural conditions (if not consumed by the city) through landscaping and bio-engineering interventions. Any spatial interventions to provide access to the river in the floodplain should be limited to temporary structures on stilts, or floating members using natural materials like coir, wood, rubble/boulders.

Figure 9 | Characteristics of a river floodplain

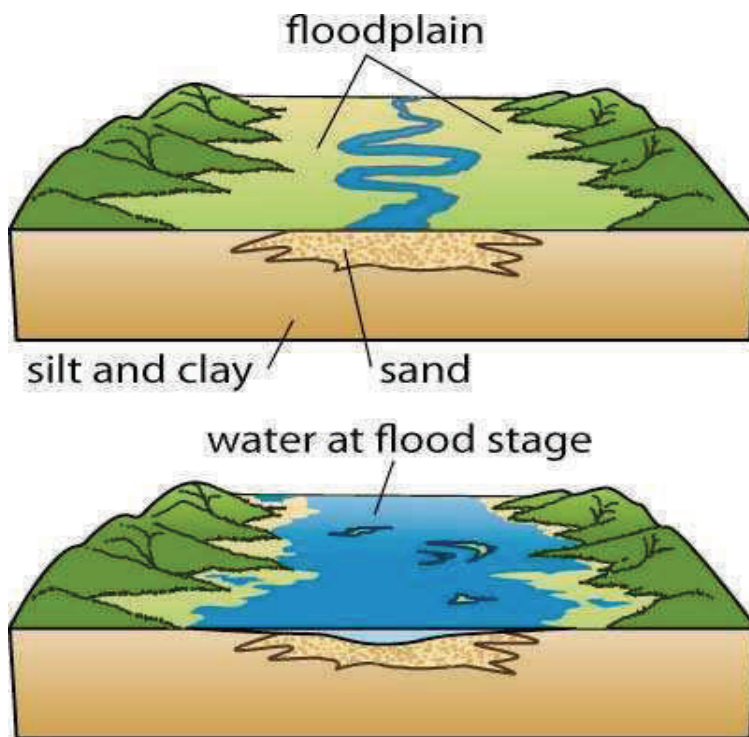


Image Credit: Elizabeth Morales

URFD proposals should necessarily include blue green infrastructure (ecological design elements and nature-based solutions) integrated with minimal grey infrastructure (built-up development). Areas which are highly vulnerable to erosion with unstable landform and edge conditions are also locations along the river which require special attention.

Spatial analysis tools such as remote sensing and GIS mapping are robust planning tools that can help categorize floodplains depending on return period (for example:

delineation of 50 year floodplain or 100 year floodplain). This detailed definition can empower policy makers to take informed decisions regarding safe permanent and temporary uses along urban rivers. The Delhi Development Authority (DDA) in collaboration with School of Planning and Architecture, Delhi and CSIR-National Environmental Engineering Research Institute (CSIR-NEERI) has mapped the floodplains of River Yamuna. A biodiversity park has been approved and is being implemented in Zone O which is identified as protected riverine ecology (NGT 2020).

Box 4 | Bioengineering as an ecological river restoration tool - Sammamish River Trail

The Sammamish River in Redmond, Washington State, USA is considered a critical component for flood management for the urban and rural communities along the river. In the 1960s the natural river course was converted into a concrete channel for quick diversion of stormwaters away from inhabited areas. Increased urbanization in this watershed has increased the risk of flooding as development has occurred closer to the water course and pressures on grey stormwater infrastructure has also increased. The river was also an important migratory path and breeding ground for various fauna such as salmon and trout (Knutson and Wood 2009) whose numbers had reduced following the channelization of the river.

Rather than rely upon the Army Corps' traditional approach to controlling the river, in the 1990s project planners sought to let the river be a river as part of river restoration. The river restoration master plan had two major objectives - to create a more natural waterway that is accommodating to people and wildlife and continues to provide flood control and protection to the neighbouring communities. The project combined bioengineering, in-stream habitat construction, and weed removal. The floodplain was enlarged by 50 feet through sculpted riverbank "benches" planted with native vegetation. The river's meanders and curves have been revived by adding boulders, root wads, and gravel bars to the once-uniform channel. The bank was graded into a series of earth benches. The top of the bank was moved back from the river about 50 feet at its maximum point. These benches were planted with native vegetation and provide the potential for different habitat zones. They also are helping to maintain the river's flood-flow capacity.

The restored riverfront has become the centrepiece of a new 16-mile trail that connects to a regional greenway system. Salmon, steelhead, native trout, and upland riparian species have returned to the river and its banks (Holt 2002).

- **Managing grey (built up) infrastructure in and around the URFD:** Dams, embankments, bridges and culverts are structures that alter the characteristic of a river including ecological/environmental flows, ecology, inundation extents and morphology of the river. Apart from the health of the river, the immediate precincts upstream and downstream of dams are also vulnerable to natural disasters. It is important to identify, map and describe (including potential risks and qualitative impacts of such structures) such existing and proposed structures (up-stream 20 km and downstream 10 km) as part of the PSR.

In cases where development (settlements, or roads) has already taken over in downstream reaches rehabilitation measures for older/original floodplains must be prioritized. The

rehabilitation efforts must be supported with bio-engineered measures and water diversion mechanisms which can operate or carry water that inundates beyond the floodplain.

- **Locations with polluting land uses:** It is important to identify, map and describe (including photo-documentation) treated and untreated wastewater (domestic and industrial) discharge points and solid waste dumping locations. In cases where such points exist within the river precincts/riverfront, additional measures to mitigate pollution risks have to be taken. Suggested measures include: placement of bio-retention ponds, reed-beds, bio-engineered swales, gross pollutant traps, filter strips, etc., at the edge of such land uses. The suggested measures can reduce the intensity of pollution in such cases.

Box 5 | Pollution mitigation for river restoration – Sligo Creek, Maryland, Washington DC

In Montgomery County, Maryland, near Washington, D.C, the 13.3-square-mile Sligo Creek watershed, in poor condition before 1990, has benefitted from a reconstruction effort. More than 60 percent of the watershed had paved or impervious surfaces. The creek was polluted by combined sewer overflows (CSOs) during storms. As a result, only a few fish species— none of them native—survived in Sligo Creek.

From 1991 to 1994, Sligo Creek received one of the nation’s most extensive watershed wide restoration efforts—one that combined grey and green infrastructure interventions.

The water quality in the creek and its tributaries were improved by separating storm and sanitary sewers to eliminate CSOs and through revegetation, bank stabilization, and reconfiguration of in-stream flows.

Upstream, three connected ponds were built to detain runoff for up to 36 hours after rainfall events, which allowed pollutants and sediments to settle and not be carried downstream in runoff.

The downstream channel was completely rebuilt with 19 native shrub species reintroduced to the riparian zone. Volunteers then reintroduced native fish to the streams.

By 1996, fish species had increased from three to 16, including native and pollution-sensitive fish. Fish deformities, lesions, and tumours dropped 75 percent. New greenway trails provide access to this revitalized resource (Thompson 1996).

Box 6 | Pollution mitigation for river restoration - Dravyavati Riverfront Development, Rajasthan, India

The Dravyavati River originates in the Aravalli Hills in India, flows through the city of Jaipur for about 47 kilometres collecting stormwater and wastewater and connects with the Dhund River further downstream. The river faced typical urban stresses, such as encroachments, water pollution and solid waste dumping as the city urbanized and in 2012 there was a significant flood event leading to high loss of life and property. The flood event caused a major rethink of the river's presence and importance in the city and plans to rejuvenate the river and resume the waterfront were undertaken by the TATA Project Limited on behalf of the government.

To maintain a pristine riverfront and continuous flow of water, a significant challenge was to intercept and treat the sewage and industrial effluents that were entering the river. To achieve this outcome 5 sewage treatment plants have been constructed along the length of the river to treat up to 170 million litres of wastewater per day (TATA Projects 2018).

Figure 10 | Before and after pictures of Dravyavati River, Jaipur



Image Credit: Tata Projects

A.4 Connections

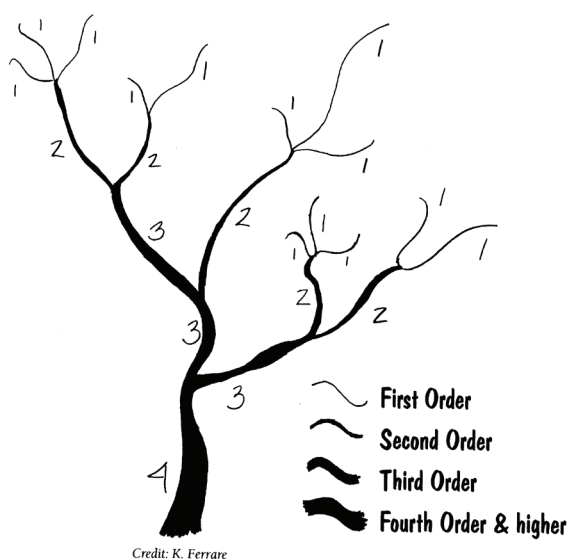
Rivers are complex networks with physical and functional connections to subsidiary streams and tributaries that flow into as well as distribute its water. The relation between rivers and settlements primarily develop due to access to natural resources, cultural drivers, and to increase the value of neighbouring properties. To leverage benefits of an urban river through an URFD the natural and spatial connections and links have to be strengthened.

- Connection of river with tributaries, distributaries, lower order streams and immediate micro-watershed:** Physical disconnection or disruption of the functional links between the main river and any streams (tributaries flowing into it or distributaries flowing out of it) or any lower order natural streams should be avoided. The immediate micro watershed along the river is also an extremely important connection of the river with its larger system

and hence the URFD should necessarily avoid (impermeable) hardscapes to ensure that the surface and sub-surface flows are self-regulated.

- Connection of city's green open spaces with the riverfront:** Riverfront development is an opportunity for creating well connected, universally accessible public spaces for citizens. Derelict river edges can be rejuvenated under such projects thereby ensuring that these spaces are converted into vibrant and thriving urban districts. Spatially and physically connecting to a city's popular and important public spaces and parklands increases accessibility to and footfall in riverfront districts. Connecting open green spaces with the riverfront also provide safe corridors for biodiversity movement which can help restore fragmented and degenerated natural habitats (parks/sacred groves, etc.) existing within a development/city.

Figure 11 | Stream order



Stream order classifies streams according to their size and position in the watershed. When two first-order streams intersect, the downslope stream is assigned an order of two. When two second-order streams intersect, the downslope stream is assigned an order of three, and so on. This most common method of ordering is known as the Strahler Method.

Figure 12 | Connecting city to river



SCATTERED OPEN SPACE + EXISTING WATER

Parks are fragmented across the current development area.

CONNECTING RIVER-TO-CITY

Major greenbelts create an open space network that connects city-to-park and park-to-river. Bicycle trails and urban runoff collect along the corridors and filter out to the river.



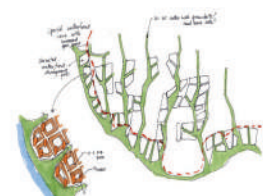
Initial Sketches - "Green Fingers"



Drainage



Open Space Structure



Greenbelt Development

CITY//PARK HYBRIDIZED

THE EXISTING OPEN SPACE NETWORK WAS DISCONNECTED AND SCATTERED THROUGHOUT THE CITY

Source/Image Credit: SWA Group, Laguna Beach, CA (ASLA Professional Awards 2013)
<https://www.asla.org/2013awards/212.html>

- **Connection of city's pedestrian and cycling paths with the riverfront:** Creating cycling and pedestrian connectivity to riverfronts, is the most direct way to make riverfronts accessible. Additionally, river-front cycling paths and walkways that are shaded will attract more people to the riverfront. While providing such increased accessibility, it is also important to provide ancillary infrastructure. It is also commonly observed

in many cases of riverfront development that cycle-traffic can cause disturbance to the public space and therefore cycling access will have to be regulated. It is also important to ensure that cycle paths do not dominate or obstruct the view to the riverfront or affect the riparian habitat. Pedestrian and cycle paths should not be constructed on the floodplain unless the floodplain is already lost to development.

Box 7 | Connecting green and pedestrian corridors with riverfront - Sammamish River, Redmond, Washington

The Sammamish River in Redmond, Washington, is typical of many urban and suburban streams. The river lost much of its riparian area and native vegetation when the U.S. Army Corps of Engineers straightened and reconstructed the river into a deep trapezoidal channel in the 1960s. Straitjacketing the river destroyed habitat and dealt a blow to its once-abundant salmon. In the 1990s, a stretch of river was refurbished.

Using a multidisciplinary approach, community groups and other stakeholders came together to revitalize Redmond's waterfront. Among the groups involved were project designers, Parametrix, the City of Redmond, King County, public agencies, and the citizens of Redmond.

Behind City Hall engineers recreated the river's meanders and curves, and added boulders, root wads, and gravel bars to the once-uniform channel. Tying these restoration projects together is Redmond's new riverwalk, a thoroughfare for joggers, bikers, and shoppers.

The Sammamish River Trail links the communities of the Sammamish Valley with the King County trail system. The county hired JGM-Landscape Architects to develop a master plan that includes trails, fishing opportunities, planting buffers, and wildlife habitat enhancement. Currently underway is a water conservation demonstration garden where residents can learn low-water use and environmentally friendly gardening techniques as part of public stewardship of the river's ecology.

Figure 13 | Pedestrian access to spaces within a 5-minute walk of the riverfront

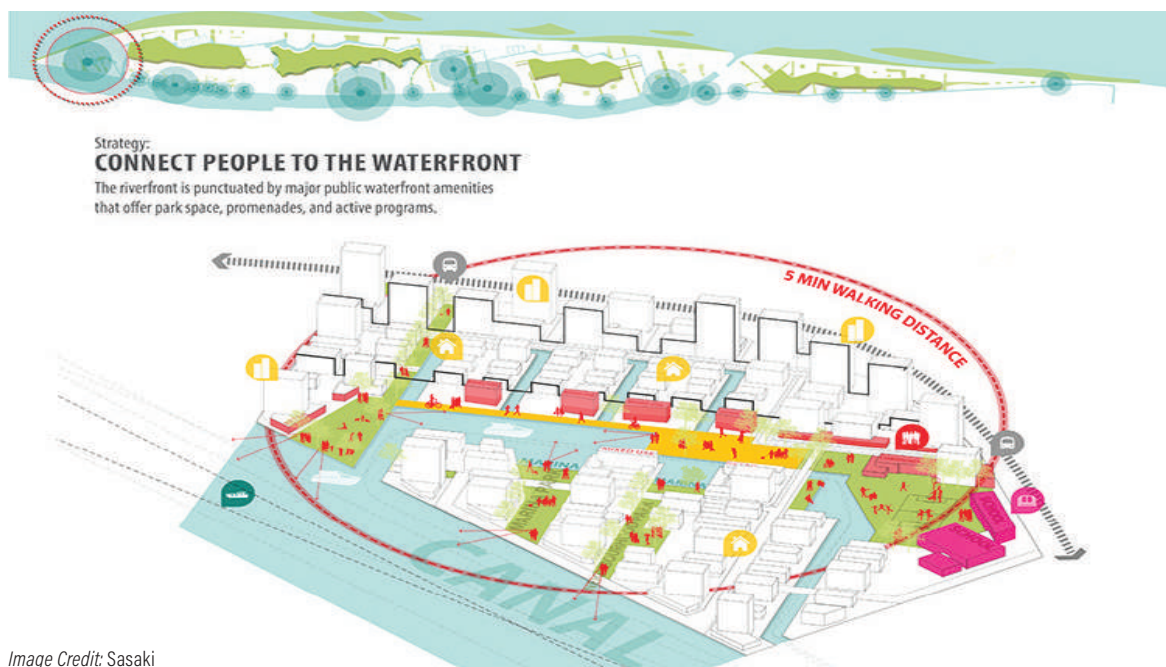


Image Credit: Sasaki

Figure 14 | Trinity River Park in Dallas, Texas



Source/Image Credit: Michael Van Valkenburgh Associates Inc.

A.5 Financial Plan

In addition to multi-stakeholder collaboration, a financial plan must be part of the planning strategy for URFDs. The financial plan must include an outlay for pre-design studies, design and implementation phases and for operations and maintenance, and monitoring and evaluation works that will have to be undertaken post-implementation. The financial plan can propose drawing upon national and state level funds from river rejuvenation programs.

A.6 Development of Key Performance Indicators

As part of the PSR it is recommended to develop a series of Key Performance Indicators (KPI) which can be used to evaluate whether certain required outputs and outcomes have been

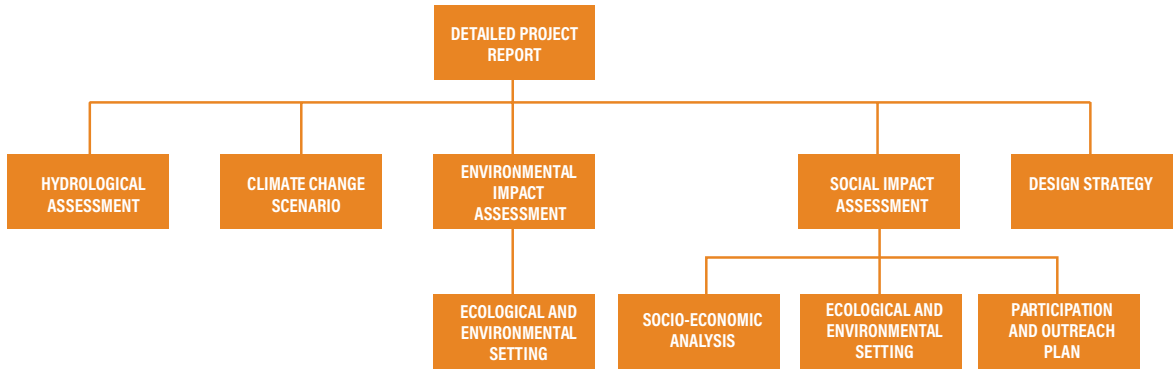
achieved through the subject URFD project. Below is an indicative list of possible KPIs that can be considered. This is not an exhaustive list and project proponents are urged to create KPIs to address the unique context of their location and community. Once relevant KPIs are considered for a project, the project proponent must establish benchmarks for the same, so that change over time (pre and post-project impacts) can be monitored.

- Safety, security and access indicators:
 - a. Projected increase in public access to river
 - b. Degree of equitable and inclusive connectivity – pedestrian and non-motorized transport network to connect urban areas with the proposed riverfront

- c. Degree of access to differently abled and vulnerable groups (children, elderly, etc. Inventory of elements enhancing accessibility (ramps, directional pavers, etc.)
 - i. Inventory of elements enhancing accessibility (ramps, directional pavers, etc.)
 - ii. Inventory of safety elements (lighting, lifeguard booth, etc.)
- Enhancement of the public realm indicators:
 - a. Measure increase in area of enhanced public space from pre-project state. (enhanced public space can refer to new plaza space, park space, river walk, etc., that has been created)
 - b. Type and number of amenities and services to enhance public space (drinking water, toilets, etc. Ideally number of amenities should be as per global standards of services stated; such as minimum of 1 toilet cubicle per 550 women or female children; minimum of 1 toilet cubicle per 1100 men (ASEAN 2016))
- Ecological functions indicators:
 - a. Number of natural infrastructure interventions included which provides
 - i. Treatment capacity of X million litre per day
 - ii. Storage capacity of Y million litres for certain range of rainfall event
 - b. Pollution abatement numbers
 - i. Pollution reduced by X% from pre-project stage
 - ii. Water quality of output from nature-based systems meets Pollution Control Board standards
- for discharge into water body
- c. Increased biodiversity
 - i. Increase in number of species in comparison to pre-project stage
 - ii. Increase in total number of individuals per species in comparison to pre-project stage
- d. Micro-climate changes
 - i. Reduction in daytime/night-time temperature in comparison to surrounding areas
- Economic benefit indicators:
 - a. Projected increase in tourist footfalls to the site and associated revenue generation
 - b. Projected revenue generation from site amenities
 - c. Projected increase in informal (vendors, artisans, fisherfolk) livelihood generation
 - d. Projected increase in surrounding (beyond designated floodplain) land value generation and tax revenue collection

[B] Detailed Project Report (DPR)

A Detailed Project Report (DPR) should be undertaken if the PSR is approved by the appropriate stakeholders and decision-makers. This is a follow-on detailed study which should be carried out by collecting primary data, modelling, stakeholder consultation, etc. A DPR report should contain the following information:



B.1 Hydrological Assessment

The hydrological setting of every river system is anchored on intrinsic or extrinsic (anthropogenic) aspects. While rivers in pristine conditions and away from any human interventions would have only intrinsic aspects governing their hydrological settings, most rivers round the world are considerably influenced by extrinsic anthropogenic aspects.

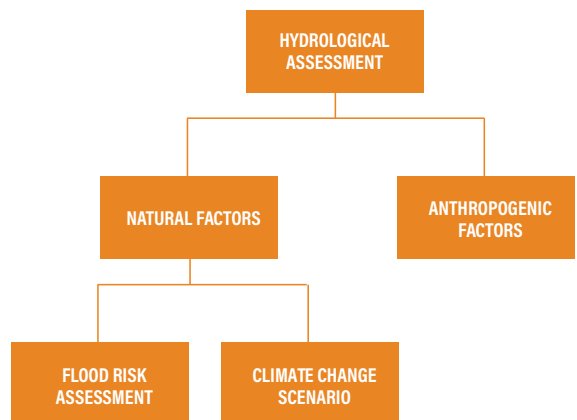
The key intrinsic factors that determine the hydrological setting of any stretch or part of the river is: origin and source of water, the terrain and landform through which the river flows, the geographic region that it is located in. Within the river, the hydrological setting changes when the river moves from upstream reaches to midstream reaches and it is considerably different downstream and near its sinks (usually deltas/estuaries before flowing into the sea/ocean).

Therefore, to determine and understand the hydrological setting of a river or a segment of a river, following aspects and related parameters and indicators can be examined and studied:

- Water quantity: incident rainfall in the basin and runoff generated, time of concentration together determine the rate of flow and volume of water in the river at any given time (river hydrograph analysis)

- Hydrodynamics: river features created by the flow of river and the geomorphology of the valley
- Source of water: glacial, rain-fed, lake, sub-surface streams (groundwater)
- Variability of inundation during peak and lean flows
- Saline water intrusion extent in the estuary (in lower reaches of river segment), the inundation extents during high tide and low tide events of the sea

In addition, the following generic list of natural and man-made problems which are normally encountered in river hydrology should be evaluated as per the guideline mentioned by Central Water Commission, Government of India (CWC 2009).



Natural Problems

- Frequent changes in river course.
- Avulsion of one river into another (beheading).
- Heavy shoal formation causing diversion of the main current towards the banks.
- Development of natural cut-off in meandering rivers. This, sometimes, changes the meandering pattern.
- Heavy landslides in the catchment causing sudden and steep rise in silt load.
- Heavy aggradation of the riverbed. This causes high flood levels resulting in overtopping of banks/embankments even during floods of relatively moderate intensity.
- Heavy erosion of banks by hill streams due to flash floods.
- River instability due to changes in bed slopes as a result of seismic activity.
- Changes in river channels due to changes in rainfall pattern.
- Erratic behaviour of rivers in deltaic areas where they have numerous spill channels.
- Erratic behaviour of braided rivers.
- Morphological changes in a river due to changes in its base flow (too little or too much water).

Anthropogenic Problems (primarily forward-looking risk identification study)

- Degradation of riverbed downstream due to any future dam or barrage construction.
- Effects of constriction of river width due to any future barrage/bridge construction.

- Effects of any future flood embankment project on the regime of rivers.
- Effects of extraction of sand and boulders from the riverbeds and banks.
- Effects of spurs and bed bars of different types on river behaviour.
- Effects of inter-basin transfers of water on the regime of river.
- Effects of riverbed cultivation and construction by farmers in a river reach.
- Effects of dredging/channelization of riverbed.
- Effects of any current and future RFD and ghat development on the regime of river.
- Effects of growing urbanization on the regime of river.

Flood Risk Assessment

Also, it is extremely critical to undertake a flood risk assessment study to determine the following:

- High Flood Level (HFL) for a return period of 100, 50 and 30 years, Danger Level (DL), Warning Level (WL) and annual normal flood level
- 100-year-old floodplain extent
- 50-year-old floodplain extent
- 30-year-old floodplain extent

Large permanent structures should not be built within the 100-year floodplain because they increase the amount of impervious surface, exacerbate runoff problems, and increase the risk of costly flood damage (Otto, McCormick and Leccese 2004).

Box 8 | Flood protection - Patna Riverfront, Bihar, India

The riverfront in the city of Patna, India has a dense urban edge, in that habitation (formal and informal), education institutions and government offices are placed along the river edge with nominal elevation from the river level. The river too has annual flooding events and the high flood level is significantly higher than the surrounding inhabited areas, making all these human activity zones vulnerable to flooding. To mitigate this risk the riverfront development project has constructed an embankment wall along the project to reduce the risk of flood events which can damage habitation and official spaces (VOYANTS 2014).

Figure 15 | Embankment walls along riverfront to protect built spaces in the city



Image Credit: WRI India

B.2 Climate Change Scenario

Climate change poses a high risk to urban infrastructure and services as extreme weather events (particularly floods) can potentially overwhelm engineered systems. Furthermore, capacity of urban local bodies

has to be strengthened to comprehend and plan for climate uncertainty and adapt/ adjust planning and construction codes so that new build and retrofit of existing systems can be done so as to mitigate forecasted climate extremes (GCA 2019).

Box 9 | Sponge City Program in China

Urban areas are vulnerable to extreme weather events; hydrological assessments of urban water bodies (lakes, streams and rivers) can help in the mapping of at-risk areas by understanding the flow quality of urban waters. Cities can no longer depend exclusively on grey infrastructure solutions to mitigate against climate change driven extreme events. Rather, climate proofing using flexible tools and mechanisms (such as blue-green or natural infrastructure) and capacity and resilience building is critical for cities to adapt and maintain their economic prominence.

The Sponge City Concept (SPC) developed in China is a resilience building measure and water management tool for cities to mitigate effects of environmental changes and natural disasters. The objective of the SPC is that stormwater generated from rainfall events is absorbed, stored, infiltrated and cleaned using natural and/or manmade facilities and the rainfall and stormwater is transformed into a water resource that may be utilized during times of drought (MHURD 2014).

The SPC aims to shift the traditional thinking and approach around stormwater management which focuses on the quick discharge of runoff to avoid flooding and inundation. Instead SPC looks to capture and utilize stormwater to the maximum extent possible as a critical water management practice. Under the SPC sustainable urban design and low-impact development is required so that a city builds resilience (and blue-green infrastructure) to adapt to climate change driven extreme events and provides ecological function (Chan, et al. 2018). The SPC concept is similar to some stormwater management concepts in developed countries such as low-impact development (LID), green infrastructure (GI), and water-sensitive urban design (WSUD) (Li, et al. 2016).

Figure 16 | Sponge city concept



Image Credit: Scoopnest

Climate change is already bringing about distinct changes to river hydrology across India (Singh and Kumar 2018); (Sharannya, Mudbhatkal and Mahesha 2018). Shifting rainfall patterns, hotter and drier summers and shorter and wetter monsoons are dumping more water in a shorter duration of time onto Indian rivers. In addition, research in the Himalayan regions indicate a significant increase in glacial melt rates which are likely to increase Indo-Gangetic river levels for a short period before dwindling down.

In this scenario the development of riverfront areas into key urban locations is fraught with uncertainty whether the riverfront will have viable water available throughout the year. It is, therefore, recommended that 100-year return period scenario of the flood risk assessment study as mentioned under hydrology section should be adopted in the feasibility study. Also, to have usable riverfront developments year-round, these developments must include flexible spaces which can accommodate a varied range of activities and functions.

Figure 17 | **Sponge city in China**



Image Credit: Business Insider

Box 10 | Restoring and creating floodplains to allow river flooding during extreme wet period - Room for the River Program, Netherlands

The Netherlands is a country at high flood risk due to its location at the delta of three river systems - the Rhine, Meuse and Scheldt which flow into the ocean through this country. Furthermore, much of the country lies below sea level and is protected from flooding by the presence of levees, sea walls and coastal dunes. (Dutch Water Sector 2019). Over the past century, rivers in the Netherlands have been increasingly constrained and confined with higher dykes, and former floodplain zones have also decreased as new land uses have taken over these spaces. Higher volumes of water are expected in these rivers as a consequence of increased precipitation and frequent flood events due to climate change (Mott MacDonald 2019).

Since 2007, the Dutch government has implemented a programme to improve flood protection to vulnerable, low-lying areas by allowing rivers space to expand naturally (flood) when carrying high water volumes. A range of measures are implemented as part of this programme, including restoring/reclaiming natural floodplains, deepening river channels, removing barriers to the flow of flood waters (such as dykes and bridge bases), areas to slow, retain and absorb flood waters and restoration of riparian wetlands to act as natural sponges (CEDA n.d.); (ruimtevoorderivier 2016). A mix of 9 different solutions have been implemented at 34 locations on the Rivers IJssel, Rhine, Lek and Waal, with a budget of 2.3 billion euros.

The project necessitated collaborative working between national and local levels of government, various utilities, local businesses and communities. About 150 homes and 40 businesses had to be relocated in this project to make room for the rivers (UN-IHE 2013).

Examples of such floodplain restoration works and making room for rivers are also present in various other countries, with some notable emerging examples in the US, which has been facing a cascade of flood events. Typically having faced successive flood events where flood protection infrastructure such as levees have failed or been damaged, there is a shift towards reconnecting the floodplains with rivers and removal of levees and other flood barriers (Shader 2019).

The Army Corps in the US are widely responsible for construction, maintenance and repairs to flood protection infrastructure. Following recurring flooding on the Maquoketa River in Iowa which damaged a levee, the Army Corps in collaboration with the Iowa Department of Natural Resources secured 300 acres of floodplain land. This land was transferred to the Green Island Wildlife Management for restoration and protection of the floodplain to reduce the impacts of floods. Similarly, following the 2011 floods in the Missouri River, a flooded landowner chose to setback a levee instead of rebuilding it in its original location (Shader 2019).

Figure 18 | Menu of flood mitigation measures as described in the 'Room for the River' program

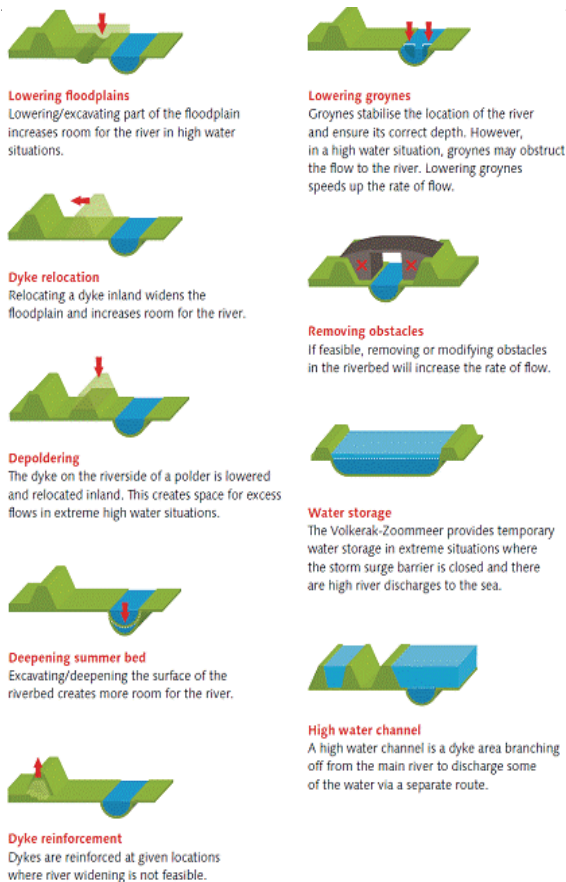


Image Credit: ruimtevoorderivier 2016

B.3 Environmental Impact Assessment (EIA)

Environmental Impact Assessment is a process that evaluates a project's:

- potential environmental risks and impacts in its area of influence; examines project alternatives;
- identifies ways of improving project selection, siting, planning, design, and implementation by preventing, minimizing, mitigating, or compensating for adverse environmental impacts; and
- enhancing positive impacts; and includes the process of mitigating and managing adverse environmental impacts throughout project implementation.

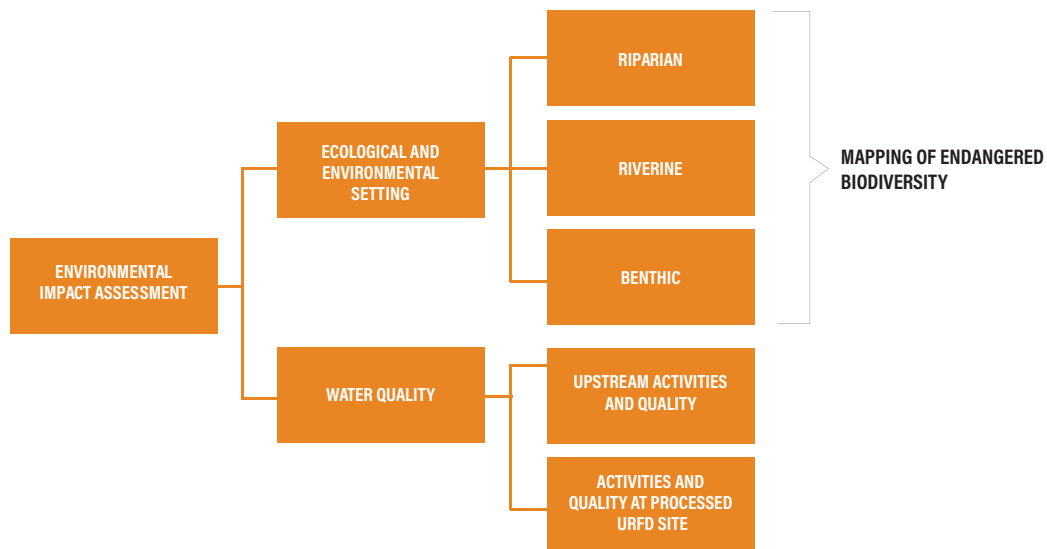
URFD project proponent should apply a precautionary approach to natural resource management to ensure opportunities for environmentally sustainable development.

Based on the findings of the EIA, an **Environment Management Action Plan (EMP)** should be developed to ensure environmentally sustainable development of the proposed URFD both during the construction as well as during operational phases. The EMP is site and time specific including necessary responsibility matrix.

Figure 19 | Secondary channel and island developed as part of the Room for the River program near Nijmegen



Image Credit: ruimtevoordewaal.nl



Ecological and Environmental Setting

The ecological and environmental setting of a river across its width and length varies considerably. Across the width of the river, three broad ecosystem zones exist:

- **Riparian:** This is the belt that forms the interface between the water line and the land. Wetlands and most of the river features can be found here. The biodiversity here is typically diverse, while at the same time sensitive to the conditions and activities in the floodplain and lands adjoining it. Amphibian and aquatic life flourish here. Floral diversity includes wetland species. This is also an important edge for terrestrial biodiversity which access the river for water, fishing, etc.
- **Riverine:** This is the water flowing belt, which is dominated by aquatic biodiversity. Floral biodiversity here is much lower than the riparian zone. Most of these species form the higher order in the food web/chain.

This makes them highly dependent on the species in the lower order of the food web.

- **Benthic:** Benthic species are the small invertebrate species which occupy the floor of a stream/river. The microorganisms in this layer are critical to the health of the water body as their biological and chemical actions directly prevent the build-up of carbon in bottom sediments and deoxygenation of bottom waters. These species also act to sequester and move contaminants and excess nutrients from groundwater and sediments as well as controlling emissions of greenhouse gases (such as carbon dioxide and methane). The integrity of the freshwater supply depends on how various benthic species make their living and contribute to complex food webs (Covich, Palmer and Crowl 1999).

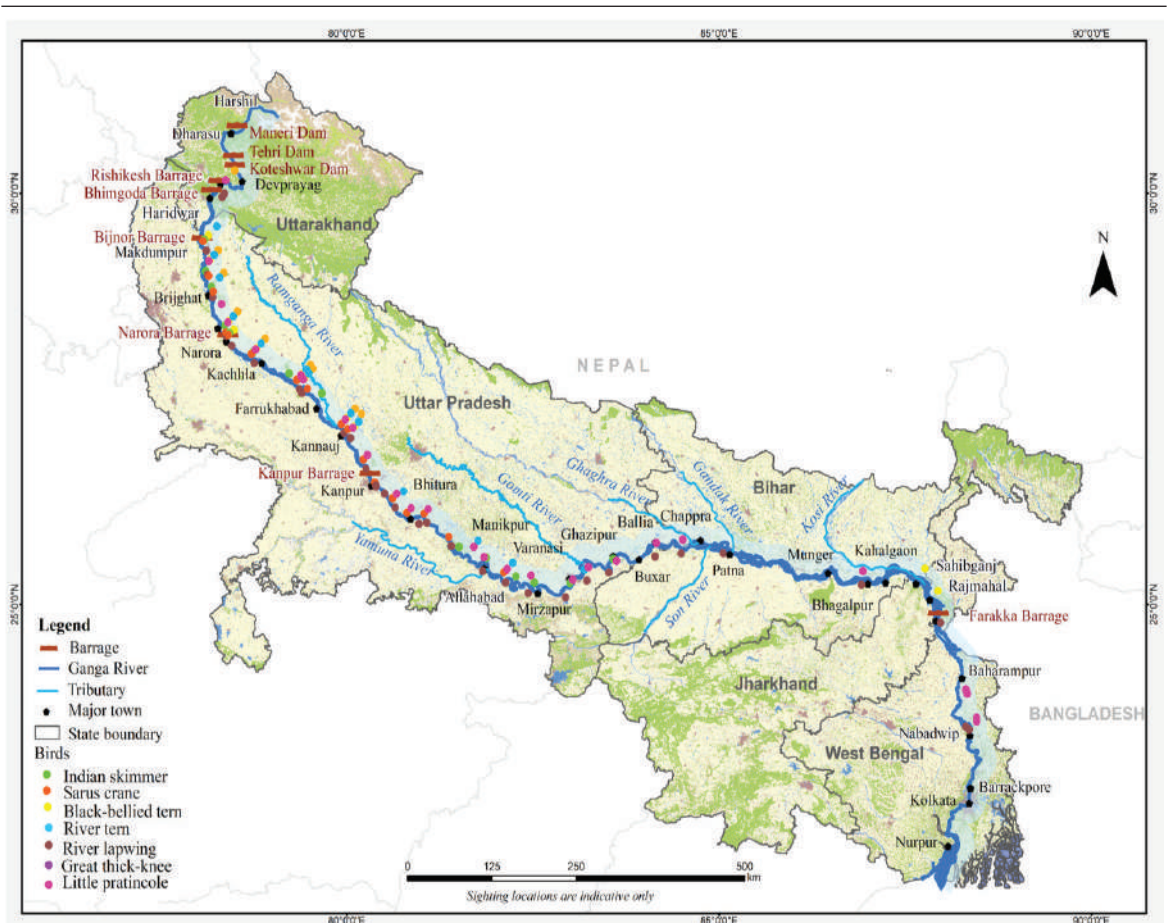
In all these ecosystem types, the biodiversity within these habitats are critical in keeping the food cycle and thereby nutrient and energy cycle intact and healthy. And the biodiversity

in each of these ecosystem types thrive in its unique ecological settings as elaborated above. Biodiversity and habitat conditions or ecological and environmental settings are therefore co-dependent on each other and together determine the health and functional capacity of the river. Studies have shown that “habitat diversity and water quality become severely compromised when as little as 10 percent of a floodplain is paved or covered with an impervious surface. A floodplain that is more than 50 percent paved will result in a waterway with little wildlife habitat and few natural

features” (MacBroom 1998).

The DPR for proposed URFDs should include information on the biodiversity and its status (current and baseline). It should also ensure that the design proposal does not affect/impact the floral and faunal diversity. The objective of this activity is to protect natural habitats including the forest areas and wildlife which in turn protects and enhances the environment enabling long-term sustainable development. URFD project should support the protection, maintenance, and rehabilitation of natural habitats and biodiversity.

Figure 20 | Bird species map along river Ganga



Locations with endangered biodiversity: While the river and riparian habitat host aquatic and wetland biodiversity, some segments of a river may be habitat to certain species which are endangered/threatened/rare.

Therefore, URFDs in such stretches should pay greater attention in spatially and physically controlling access to the river^{iv}. These stretches should be visually accessible and viewable from land for ease of monitoring. Such riverfronts

will require provisioning of noise buffers such as through placement of vegetated buffer strips along the river edge. Community stewardship and awareness plays an important role in managing locations with endangered biodiversity. URFD areas can have information and display kiosks, viewing decks above ground (non-permanent structures within the vegetation buffers) to provide an opportunity for people to (re)connect with nature without disturbing any endangered species.

Box 11 | Design elements for the protection of Gangetic river dolphins - Patna Riverfront, Bihar, India

The Patna riverfront development on the Ganga river is a critical example of an urban river project incorporating design details for preservation of key fauna in the river. The Gangetic river dolphin is an iconic species in the river and is present across the river stretch near the city of Patna. No wildlife sanctuary is in the vicinity and an environmental impact assessment was not mandatory, but the project recognizing the presence and importance of the river dolphins introduced design elements considering these species. There are 3 specific interventions that were considered –

1. Gabion wall being constructed to preserve the river edge would use fine wire mesh (of 4 inches size) to prevent incidents of dolphins being stranded in these spaces.
2. Space between ghats would be retained in their natural form and no exotic plant species would be introduced, allowing aquatic and amphibious flora to grow in this riparian zone.
3. During project implementation, care was taken to minimize sound pollution in the river due to heavy equipment. Boats used in the river for project construction and implementation used propeller guards to prevent injury to river dolphins (VOYANTS 2014).

Figure 21 | Gabion wall and riparian flora



Image Credit: WRI India

Quality of Water in the stretch of the river where URFD is proposed: Water quality of a river varies across its course depending on uses and activities in its catchment areas. It is important to map discharge of (treated, partially treated and untreated) municipal and industrial effluents and disposal of solid waste. Further water quality (physical and chemical) in and around (especially up to 5 km upstream of) the proposed URFD project must be evaluated. In conditions where the quality of water is not up to bathing quality, physical access to the river should be controlled and necessary information about the quality of water should be provided at the riverfront. Also, a deteriorated riverfront

environment from contaminated/ polluted water and floodplain will attract lower footfall at any URFD development project. It is important to remediate contaminated/ polluted river water and floodplain (i.e., improve visuals and odour) prior to opening of an URFD project to public.

Similarly, any activities (like washing, cattle bathing, open burning of dead bodies) that could further deteriorate the quality of the water should be suspended. In case any such activities are intrinsic to some communities and is not feasible to ban them completely, a stakeholder consultation process should be initiated to achieve a balance between the needs of communities and the quality of water.

Box 12 | Ecological restoration - Taehwa River, South Korea

The Taehwa River flows through the metropolitan city of Ulsan, located in the southeast of the Korean Peninsula. Originally a farming and fishing community, in 1962 it was designated as a special industrial zone. Its status changed again in 1997 when it was designated a metropolitan city. As the area developed over the years, low levels of environmental awareness and insufficient flows resulted in high levels of river contamination from poorly treated industrial wastewater and domestic sewage. The river water quality deteriorated significantly, resulting in a large fish kill in 1992 and again in 2000. Exacerbating the dire situation, unplanned riverbank developments added to the environmental deterioration of the river and its surroundings. The Taehwa River recorded its worst biological oxygen demand (BOD) level in 1996 at 11.3 ppm. Awareness of the severe river pollution was raised to national levels in 2000 when massive fish kills were televised across the country (Lee 2015).

Through implementation of Phase I and II of the Taehwa River Master Plan, 2005-2014, water quality in the river improved significantly. The basic concept of the Taehwa Master Plan was 4-fold: “Safe and clean river”, “Ecologically healthy river”, “Familiar and close river”, and “Historical and future river”, each with its own focus activities, and undertaken through the organization and participation of local stakeholders (UNESCAP & KOICA 2011).

Water quality improvement activities included:

1. The removal of debris, contaminated sediment and sludge.
2. Concrete structures along the riverfront were replaced with natural revetments for flood protection, and green lawns and walking paths were introduced in formerly deserted areas along the riverbanks.
3. To further encourage people to engage with the river, observatory towers and a tourist pavilion were constructed.

Improved water quality due to the riverbank redevelopment efforts paid off when, in 2012, the river was selected as one of South Korea’s twelve eco-tourism sites.

B.4 Social Impact Assessment

Social Impact Assessment (SIA) should be carried out to make URFD project responsive to social development concerns. SIA can also help enhance project benefits towards poor and vulnerable communities while minimizing or mitigating concerns, risks and adverse impacts. Furthermore, during the project other social issues may emerge such as influx of labour during construction, a systematic assessment provides the basis to prepare a Social Management Plan for the implementation phase.

The main objectives of SIA are:

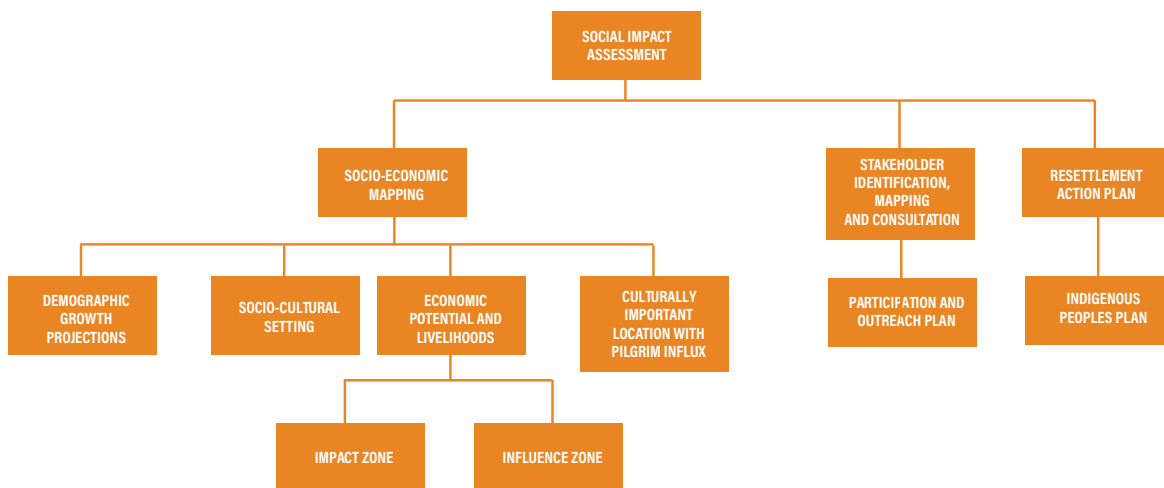
- to carry out a socio-economic, cultural and political/institutional analysis to identify the project stakeholders and social issues associated with the project;
- to assess the extent of asset loss and undertake the census of potential project affected people;
- to develop a Resettlement Action Plan (RAP) in consultation with the affected people and project authorities;

Socio-Economic Mapping

Demographic Growth Projections

A riverfront project must consider the number of local residents, daily and annual visitors that are expected to enter and use the URFD, as well as account for any variations on festivals, holidays and other culturally significant days. To estimate daily footfall into the URFD, the demography of the urban area, and specifically of the impact and influence zones must be surveyed. In addition, the growth projections for the impact and influence zones and tourist footfall must also be estimated to be able to develop the URFD appropriately which can accommodate the estimated influx of people.

Demography and growth projections for the entire urban area can be considered as per census data or any other estimates developed as part of other master plans or regional plans. For the impact and influence zones as well as tourist footfalls, surveys must be conducted to understand the various user groups in the URFD. The demographic survey should include socio-economic data, gender, age, time spent on the riverfront, activity on the riverfront,



amenities used, etc. Such data can reveal insights into the users accessing the riverfront and indicate amenities and services they might need. Further such studies can indicate if there are any communities living within at-risk areas such as floodplains and their vulnerability to extreme weather events. This data can be useful to support relocation/ rehabilitation plans as part of the URFD.

Socio-cultural Setting

The socio-cultural setting is a key element to understand the existing and projected usage that a riverfront development will have. As part of the feasibility study, a survey of time periods (specific days or months) of cultural significance on the riverfront must be developed. The socio-cultural setting will also include the estimated footfall onto the riverfront during these times – divided into local citizens and tourists accessing the site on these special event days.

Economic Potential and Livelihoods

Riverfronts have historically been sources of revenue generation for riverside dwellers due to the abundance of natural resources available in these locations. But with growing pollution levels and decreased dependence on rivers for basic needs such as drinking water and food these livelihood options have dwindled. Now riverfront areas are usually disconnected from the city due to the presence of industrial enclaves or dump yards (which add to river pollution loads). In addition, low income communities inhabit these areas as these are the open spaces available to such communities to set up informal habitations.

Rejuvenated riverfronts, though, have the potential to support new livelihood options

including traditional practices such as fishing and new ones like river-based tourism (boating, etc.). In addition, clean and vibrant riverfront districts are prime locations for businesses such as restaurants and cafes which can generate revenues for the city. The impacts of a riverfront development when done well can extend beyond the actual site and is likely to influence a wider region in proximity to the riverfront.

To establish the extent of economic and livelihood generation potential a study of the of the riverfront site must be conducted. This assessment must provide an overview of 2 areas, the impact zone or the actual riverfront development site and the influence zone the area in proximity to the riverfront development where changes might happen due to increased foot traffic to the riverfront development site.

Impact Zone

- Existing traditional water-based activities (types of activities and number of people employed in this) which can be rejuvenated to add to the cultural value of the site as well as enable people to reengage with their crafts
- Potential of seasonal fishing markets based on the biodiversity that can be safely harvested from the river.
- Extent of river-based tourism activities such as boating and water sports which can be deployed with minimal impact on natural flora and fauna
- Map other urban amenities such as walking tracks, bike paths which can be extended to the riverfront development to connect the site to the city and increase footfall to the site.

Influence Zone

- Identify service industry activities such as restaurants and cafes, hotels, etc., which can provide additional amenities to the users of the riverfront development. Such existing uses must be mapped to integrate them appropriately with the riverfront development plan. Also, recommendations to city codes to support the development of additional mixed uses in the influence zone of the riverfront development must be included.

Culturally Important Location with Pilgrim Influx

River and river precincts are culturally significant landscapes in India, with many important and high footprint religious and cultural nodes located along riverbanks. For example, the River Ganga hosts major cultural and religiously significant nodes, especially in the upper and middle segment of the river. Such nodes have temples, ghats, gathering grounds and other semi-public spaces with very high footfall, especially during festivals and special occasions. Seasonal influxes are managed by the municipality and city administration (e.g., Kumbh mela) with specific management plans. The day to day influx of pilgrims, cultural activities and access to the river also have to be managed effectively to protect the river and its habitat and at the same time provide a safe and enriching experience to visitors (pilgrims and tourists). A well designed URFD that integrates architectural, aesthetic and spatial markers/features can enrich the experience while protecting the ecology of the river. Therefore, such URFD

proposals should consider:

- Control of access with respect to footprint
- Ghats that are designed for ease of access with spatial micro-zoning for activities on the ghats so that movement of people towards the ghats is not obstructed
- Well-designed gathering spaces in the landward side with capacity to hold people waiting to access the river or river ghats.

Stakeholder Identification, Mapping and Consultation

A stakeholder is “a person, group, or organization that has a direct or indirect stake in a project/organization because it can affect or be affected by the Project/organization’s actions, objectives, and policies”. Stakeholders thus vary in terms of degree of interest, influence and control they have over the project.

“Stakeholder Analysis” is the process of identifying the individuals or groups that are likely to affect, or be affected by, a proposed project and categorizing them on the degree of impact they may face. This information is then used to formulate interventions so that the interests of stakeholders are addressed in the project plan, policy, program, or other action.

The importance of such an analysis is to strengthen the understanding of the socio-political environment surrounding the project. It allows for the:

- Identification of the interests, concerns and potential risks surrounding the stakeholders, as well as conflicts of interests (if any).
- Identification of relations between stakeholders that may enable “coalitions” for project sponsorship, ownership and

co-operation as well as the mechanisms which may have a role in influencing other stakeholders.

- Key groups/ individuals to be pinpointed who need to be informed about the project during the execution phase.
- Identifying stakeholders (those who are likely to have an adverse impact on the project) and employing effective strategy to mitigate their concerns.
- Generation of information essential to the planning, implementation and monitoring of the project.
- Development of a framework for participatory planning and implementation of various project activities.

The identification of stakeholders and their inclusion in the decision-making process is thus essential to the process of prioritising, analysing and addressing issues. The project proponent can develop management systems and strategies to address the concerns/ expectations of various stakeholders. Finally, such an analysis can also reveal stakeholders who can be potential allies, collaborators and champions for the URFD project, and these capacities can be leveraged during the design, implementation and Operations & Maintenance (O&M) phases.

“Stakeholder mapping” is a process of examining the relative influence that different individuals and groups have over a project as well as the influence of the project over them. The purpose of a stakeholder mapping is to:

- Identify each stakeholder group;
- Study their profile and the nature of the

stakes;

- Understand each group’s specific issues, concerns as well as expectations from the project that each group retains.
- Gauge their influence on the Project.

On the basis of such an understanding, the stakeholders are categorised into High Influence/ Priority, Medium Influence/ Priority and Low Influence/ Priority. The stakeholders who are categorized as high influence are those who have a high influence on the project or are likely to be heavily impacted by the project activities and are thus high up on the priority list for engagement and consultation. Similarly, the stakeholders categorized as medium influence are those who have a moderate influence on the project or even though they are to be impacted by the project, it is unlikely to be substantial and is thus neither high nor low in the list for engagement. On the other hand, the stakeholders with low influences are those who have a minimal influence on the decision-making process or are to be minimally impacted by the project and are thus low in the engagement list.

	High	Medium	Low
Influence			
Priority			

Suggested method to estimate stakeholder engagement profile

Stakeholder mapping is a critical component to develop an URFD so that a wide range of users and impacted groups can be identified, and their inputs can be taken during the planning stage. Mapping of a stakeholders of the development (including, but not limited to) must look at:

- Official stakeholders such as government agencies, implementation groups.

- Stakeholder groups such as business associations, NGOs, community groups, educational institutions.
- Residents in the impact and influence zones (particularly any groups which may have to be relocated).
- Other stakeholders such as students, design and landscape specialists, environmentalists, etc.

Participation and Outreach Plan

A riverfront development will be a key addition to a city and has the potential to be a vibrant space generating high levels of direct and indirect economic opportunities for citizens and businesses. A key component to develop a successful riverfront is to engage deeply and meaningfully with the local community and stakeholders to understand their requirements and integrate their feedback into final riverfront development proposals. URFD planning and design must include the participation of all identified stakeholders. While a complex process to bring in multiple views and perspectives, particularly of non-subject experts, integrating the voice of actual users and implementers of the project will ensure the long-term success of such developments.

The stakeholder participation process must have 2 essential components:

- Development of a participation plan using various participatory mechanisms to ensure that a diverse set of people and stakeholders can express their views during the planning process and of the proposal.
 - i. Public engagement through series of public meetings, design charettes,

feedback forms and surveys.

- ii. Ensure diverse attendance of participants by hosting such sessions in public community spaces (such as schools or colleges), at varying times and days.
- Engaging various stakeholders to be partners in the participatory process to ensure a sense of ownership for the riverfront development project.
 - i. Partnering with educational institutions to have them support participatory meetings (both by use of their premises and use of their resources in terms of teachers and students).
 - ii. On-boarding local business and resident welfare associations to maintain their long-term support for riverfront developments.

Efforts should be extended beyond identifying traditional stakeholder groups and reach out to neighbourhoods that historically may not have used the riverfront. URFD will be more vibrant, inclusive, and successful when local officials and developers, as well as planning staff participate in stakeholder meetings to ensure that everyone works toward the same vision and that all important considerations are made known.

The URFD project proponent will be required to formulate a stakeholder engagement plan (SEP) and Grievance Redressal Mechanism (GRM) for the project. The plans will be aimed at:

- Identifying and engaging with stakeholders through the life cycle of the project.
- Identifying and addressing key social concerns and requirements.

- Building relations and support with the stakeholders, especially the local community and Panchayat members.
- Receiving, recording and addressing any grievance/complaints received from the stakeholders in a timely manner.

Box 13 | Community outreach and participation in river restoration in Seoul, South Korea

The Han River is the lifeline of the city of Seoul and it is over 1 km wide along the section traversing the centre core of the city, dividing the older (north) section of the city from the new (south) CBD. The city of Seoul is one of the most densely occupied cities in Asia, and the need for corresponding infrastructure had given rise to the ubiquitous highways along both sides of the Han River and 18 bridges for motor vehicles and trains. As the city encroaches ever nearer to both banks of the Han River, public accessibility and the condition along these banks become more compromised. The city has embarked on a series of recovery programs to return much of the banks and islets on the river to a more natural state for public use and recreation, though the existing highways and traffic congestion will also remain (Hee and Low 2009).

With the latest 2008 draft master plan and Hangang (River) Renaissance Project, Seoul municipality aims to regain the friendly relationship between humans and nature and to recover the uninterrupted linkage between all sections of the city. It also seeks to create a new brand for the city by continually rediscovering the hidden value of Han River.

Among the more prominent projects initiated by the government are the redevelopment of Seoul Forest, Seongyudo Island and designating Bamseom Island as a nature conservation area. These projects are implemented in partnership with private companies and only after in-depth consultations with Seoul citizens (Hee and Low 2009).

As a positive result of this consultative approach, urban transformations along Han River have avoided the earlier pitfalls and citizen protests and engaged her citizens through family-oriented and meaningful public spaces along the waterfront.

Due to these consultations, the projects were well rated by the public and were in direct response to the needs of Seoul citizens. Being public in nature, these spaces also serve to bridge the inland developments with Han River through appropriate developments along the riverbanks. The programmatic functions were also influenced by the feedback from the public hence securing the critical mass of users to enliven the place and ensure the sustainability of the development (Hee and Low 2009).

Resettlement Action Plan (RAP)

A URFD project may result in land acquisition and/ or relocation or loss of shelter for non-titleholders and/ or loss of assets or access to assets and/ or loss of income sources or means of livelihood. A study should be undertaken to

avoid or minimize involuntary resettlement where feasible, exploring all viable alternative project designs. It also intends to assist displaced person by improving their former living standards, community participation in planning and implementing resettlement and to provide assistance to affected people, regardless of the

legality of title of land. An understanding of the issues related to social, economic and cultural factors of the affected people is critical in the formulation of an appropriate rehabilitation plan. A Resettlement Action Plan (RAP) should be prepared in consultation with the Project Affected People (PAP) to ensure that no one is worse off than before the project. Restoration of (at least) pre-project levels of income is an important part of rehabilitating socio-economic and cultural systems in affected communities.

Indigenous Peoples Plan (IPP)

This plan aims to protect the dignity, right and cultural uniqueness of indigenous people impacted by URFD projects and to ensure that they do not suffer due to development and they receive social and economic benefits. This plan will be prepared in consultation with the community and project authorities.

B.5 Design Strategy

Riverfront developments must be imagined as key public space additions to a city and must be open and accessible to all citizens. Furthermore, as a public space in a city riverfront spaces should also include elements and features that enhance the public realm by creating a space that is attractive to a wide range of users.

Equitable Access

Equitable access should be ensured for persons across all income categories, age ranges and for differently abled persons.

- To ensure that all people are welcome to such a public space it must be ensured that access is free for all persons.
- To ensure that persons across various age ranges and different abilities can access riverfront spaces, the public space should be universally accessible and include design

features such as ramps and slopes to allow for ease of movement.

- Signage should include multiple languages and iconography to provide information for users with varied linguistic abilities.
- At a city scale, URFD projects must be accessible from other locations via multiple public transit and para-transit connections. Thus, access points to URFDs must be included in the transit network of the city

Addressing and Managing the Built Environment

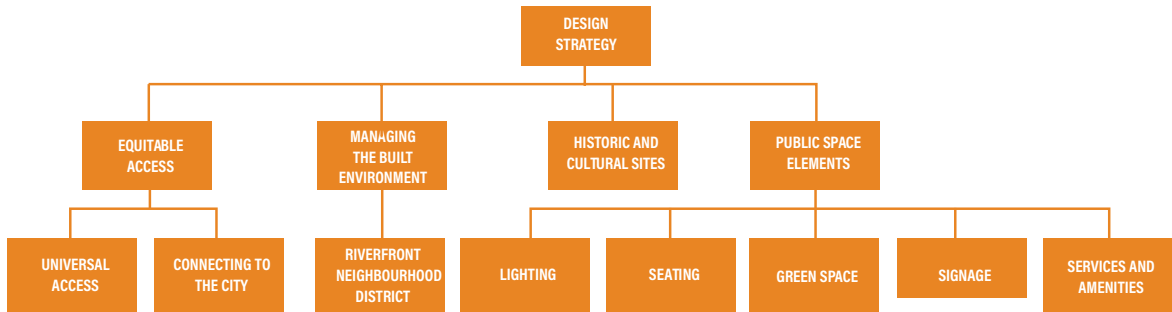
The built environment in a riverfront development must integrate with and respond to the existing natural landscape and built form on site. In addition, the built elements on site must also enhance the experience for users by providing visual/ aesthetic appeal and/or comfort.

Riverfront Neighbourhood and District

In addition to the riverfront development site, the design plans and proposals must also include interventions (at least minor) in the adjoining neighbourhoods and riverfront district. The interventions can be limited to improving pedestrian thoroughfare access in these localities to access the riverfront easily and provide signage towards the river. Vehicular access to the riverfront can be limited to specific locations only to reduce congestion in riverfront districts.

Historic/ Cultural Aspects

Most existing riverfronts in India have historic or cultural significance and are the sites for various cultural practices which require access to the river. In such cases the URFD must integrate these existing uses and enhance these sites by providing a greater level of comfort for uses (such as shaded areas, benches, etc.) and increased services and amenities (toilets, changing rooms, drinking water, etc.).



Public Space Elements

Public space elements are crucial to develop usable and accessible public spaces such as URFDs. These elements must include lighting design and fixtures, seating elements, green space, signage and services and amenities at the very least. These elements must be designed as per existing safety norms and also to meet the forecasted use on site. Furthermore, public space elements must be designed and located taking into account possible flooding and high-water levels so that there is no or minimal damage to these elements. URFD authorities can opt for low-impact design for public space elements and choose locally available or manufactured products for public space elements.

Above and beyond this URFD authorities can choose to implement additional elements such as public sculptures, artwork, etc., which can enhance the public space and improve the experience of users in the space.

Lighting

Lighting design on a riverfront is critical as appropriate lighting will improve safety and enhance the environment of the site for evening and night-time use. Lighting must include measures for ambient light, safety light and

work light. Use of lighting fixtures must be considered in tandem with trees and other high features which might cause obstructions. It would be useful to include multiple types of lighting fixtures which can provide lighting at various heights. Provision of solar lights might be considered to reduce dependence on the grid and reduce variable supply issues. Lighting design must also account for varying water levels (high flood level, etc.) and place fixtures in such locations to minimize chances of damage from rising water levels.

Seating

The riverfront is both a usable and leisure space and can attract users carrying out either or both functions. Providing appropriate seating can enhance the time spent by users on the riverfront. Seating should be designed and located to provide unobstructed views of the river. Seating at varying heights and different configurations would accommodate a wide range of user groups across various ages. Care must be taken that seating elements themselves do not obstruct movement paths and views for users.

Green spaces

Including green spaces in URFDs will improve visual aesthetics and comfort (shade). Using

a range of local and native tree/ plant species can improve the micro-climate by helping to regulate temperature, humidity on a micro scale. URFDs should integrate existing trees into the

design. Furthermore, green spaces can also be developed to provide ecological services such as erosion control, water quality improvement, bio-diversity refuge, etc.

Box 14 | Public space - Dravyavati Riverfront, Rajasthan, India

The Dravyavati Riverfront project was undertaken in the city of Jaipur, India after a significant flooding event in 2012 which led to high loss of life and property. The river suffered from typical issues which all many urban streams in India, such as encroachments and habitation built onto the river's floodplains, sewage and industrial outflows into the river and dumping of solid waste. The 2012 flood was a wake-up call to the local government and citizenry to review and revive their relationship with the river. The project undertaken since 2015 on behalf of the government by TATA Project Limited rejuvenated the river and created an extensive and high-quality public space for the city of Jaipur.

The public space added to the city is a total of 100,000 sq. m area distributed along the river in multiple sections. A wetland zone in the river rejuvenation stretch was developed as a bird park, creating a habitat for local and migratory birds. This site was formerly the Ram Sagar Dam which had been damaged in a flood event (TATA Projects 2018).

A landscape park has been developed which hosts a range of public space elements, such as walking tracks, cycle paths, pavilions, viewing areas and a marketplace. In addition, public space amenities such as food kiosks and drinking water points are also present. Finally, a botanical garden has also been created housing over 40,000 plants of around 1000 species (TATA Projects 2018).

Figure 22 | Scenes from along the Dravyavati Riverfront project in Jaipur

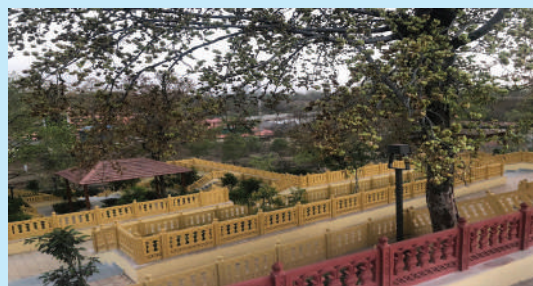


Image Credit: NMCG

Signage

Signage is a key component of successful public space design as it helps users identify services and amenities on site and provides any historic/cultural/ecological information on the riverfront as well. Signage should be developed in multiple languages and in simple iconography to allow a range of users (of varying linguistic ability) to be able to access information.

Services and Amenities

URFDs are developed with the aim to increase riverfront footfalls. These sites should also improve services to the increased number of users to the location. Service and amenities in URFDs should include (but are not limited to):

- Drinking water.
- Toilets, washrooms and changing rooms.
- Waste bins (segregated).
- Cycle stands.

- Lifeguard booth.
- Food kiosks.

[C] Planning and Institutional Strategy

Many URFDs are driven by national river conservation plans which see riverfront development as a critical part of river rejuvenation. But eventually the maintenance and upkeep of URFDs falls to the urban local bodies where the development is located. The URFD planning strategy should include a mechanism for collaboration across agencies and a financial plan to ensure ease of implementation and O&M. For continued O&M works, the O&M agency and a revenue generation stream must be identified. Some of the services and amenities provided at URFDs (such as convention centres, auditoriums etc.) can be paid services.

Institutional collaboration must be ensured so that design, planning and implementation of the URFD can happen in a seamless manner.

Box 15 | New institutions to finance and implement urban riverfront developments - Copenhagen City and Port Development Corporation, Denmark

Copenhagen, like many global cities faces challenges of upgrading older and stressed urban infrastructure and yet has to deal with contestation against tax increases and cesses. The city developed a new type of institution (a public asset corporation) as an alternative to existing public authorities, which could function independently, yet be publicly accountable, cost efficient and revenue maximizing, while maintaining a long-term, holistic view of projects undertaken. The Copenhagen City and Port Development Corporation (CCPDC) was set up by national law (Noring 2019) to manage port and other harbourfront (re)developments (Noring 2019).

The CCPDC is a publicly owned, privately managed organization which brings together the lean business efficiency of a corporation with the public accountability of a government agency. The CCPDC is designed to be able to bypass public sector regulations such as tendering and is able to create subsidiaries, joint-ventures and use other corporate mechanisms to increase revenues. This allows the agency flexibility to choose or discard project options and opportunities, financing mechanisms (PPP, TIF, etc.) with only maximum revenue generation as a goal and are not hindered by other socio-political concerns (Noring 2019).

Further URFDs are by their location often cut off from the rest of the city. Working in partnership across agencies can help build connections and access to the URFD, for example local transport agencies can support the URFD with dedicated

bus, auto services to some of the riverfront locations. Similarly working in partnership with water resources departments can ensure that water flows in URFDs are maintained.

Box 16 | Constitution of the National Mission for Clean Ganga to implement river improvement projects, India

The Ganga river is one of the most iconic rivers in the world and in India is revered as a holy river with various legends, myths and cultural narratives associated with it. In addition, the river basin accounts for approximately 26% of the country's land mass (NMCG 2019) and houses about 600 million inhabitants (The World Bank 2015). Decades of development, urban and industrial growth and the associated changes in land use in the river basin brought about significant pollution and changes to water flows in the Ganga River.

To enable pollution abatement and conservation of the river, under the powers of the Environment (Protection) Act, 1986, the Central Government constituted the National Ganga River Basin Authority (NGRBA) in 2009. The NGRBA in 2011 set up the National Mission for Clean Ganga^{vi} (NMCG) as the implementation agency to undertake on-ground project work in conjunction with relevant local bodies (MoEF 2009) to achieve the mandate of NGRBA.

NMCG maintains a basin-level perspective (through live data monitoring) and oversight of on-going and proposed projects and is able to assess the impacts of interventions in a local and river basin scale. This is a single agency with the charge of pollution abatement and maintaining river health by managing environmental flows. It is able to undertake a range of interventions to support development and deployment of technologies, processes and community engagement to achieve these outcomes. Projects approved by the NMCG are eligible to access a range of funding such as from the World Bank project or the Clean Ganga Fund. Furthermore, NMCG itself has discretionary powers to undertake disbursement of funds for Ganga rejuvenation projects through management of an endowment or trust (NMCG 2019).





CHAPTER IV

GUIDANCE FRAMEWORK



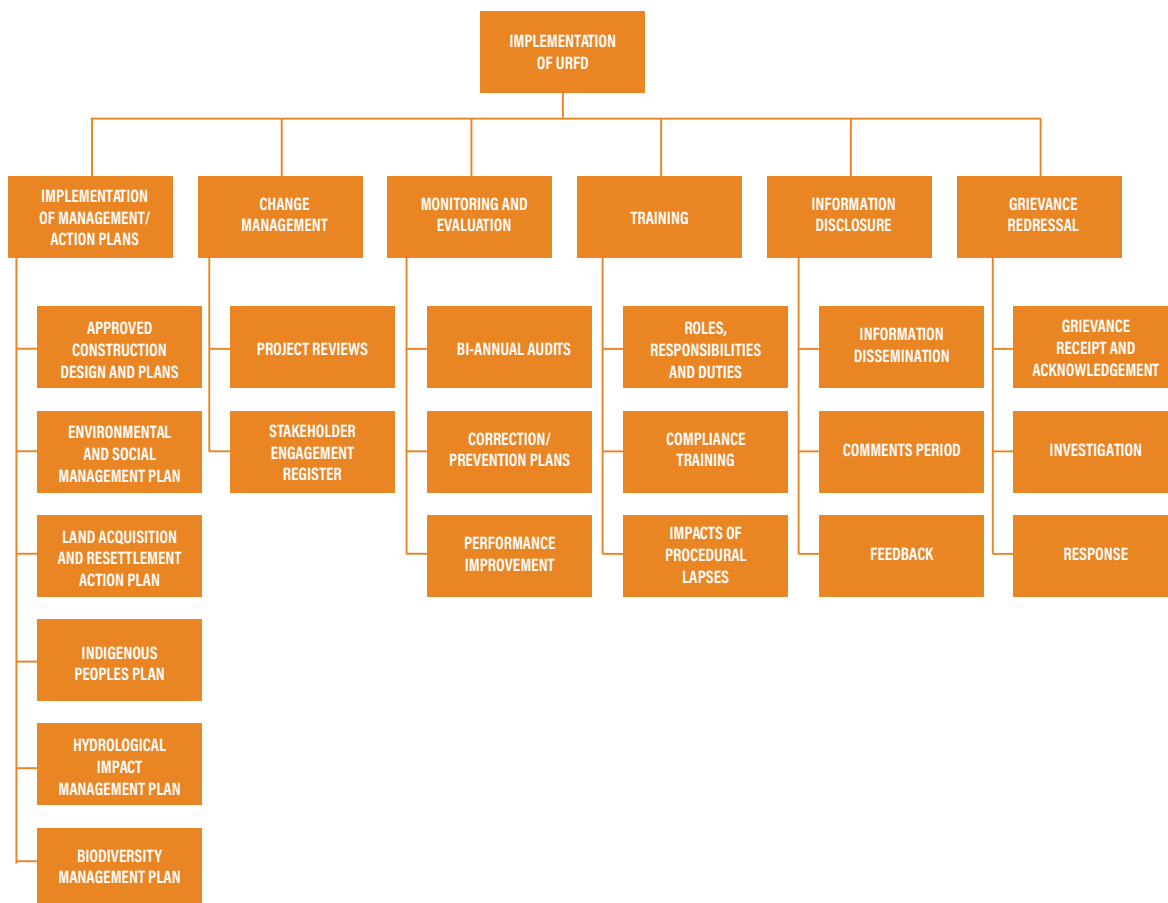
CHAPTER IV: GUIDANCE FRAMEWORK

This section provides a guidance overview that should be adopted during implementation and operational phases of URFD project. This guidance is intended to provide a generic overview to ensure the effective implementation and adaptation of the following plans for URFDs:

- Management/ Action Plans
- Change Management
- Monitoring and Evaluation
- Training
- Information Disclosure

- Grievance Redressal

This guidance overview is currently generic in nature and is not inclusive of all the state and national compliance requirements as well as requirements obligated by financial institutions that are supporting the Project. A project specific plan shall provide a transparent translation into action of the Project’s approved design plans, impact management plans, applicable federal and state legislations and permitting conditions, project lenders’ requirements and other environmental and social commitments and obligations.



[A] Implementation of Management/ Action Plans

These are core documents and supporting processes which allow the identification and understanding of requirements, commitments, risks and impacts, set out the various controls and measures needed to manage risks and objectives, and drive continual improvement. Following is a minimum list of plans that need to be consulted during implementation of URFD.

- Approved Construction Design and Plans
- Environmental and Social Management Plan
- Land Acquisition and Resettlement Action Plan
- Indigenous Peoples Plan (if any)
- Hydrological Impact Management Plan
- Biodiversity Management Plan

These documents should be accompanied with procedures and/ or flowcharts that define implementation processes and controls (including standard procedures or flowcharts, detailed work instructions, manufacturers' operating / maintenance instruction manuals, etc.) to ensure effective implementation.

Wherever feasible, these documents will be retained in electronic format to facilitate efficient control and distribution. All these documents should be clearly identifiable. Each update or revision should be authorised by the appropriate authority prior to distribution. Documents are to be organised in a disciplined manner, clearly identified with respect to type of record and range/period covered.

[B] Change Management

Management Plans are intended to be 'live' documents as the site-specific conditions can change with time. In case of any change of site-specific conditions, the project implementation team should initiate a review of management plans. The project lead should seek for external third-party consulting help for any change in approved management plan. In addition, the project lead should voluntarily initiate a review of all management plans on an annual basis to update the plans, if needed (note: some plans may specify a different minimum frequency of updating). In case of any such change in management plans, the revised plans/ the proposed changes should be approved by project lead, project lender as well as regulators and stakeholders as deemed appropriate.

Additionally, the on-going process of stakeholder engagement may generate additional commitments (often 'promises' or 'undertakings' to individuals or stakeholder groups) that may not be reflected or identified in the approved management plans. These commitments should be recorded throughout the implementation phase in a live document like Stakeholder Engagement Register, which facilitates tracking across all the various commitments made to stakeholder groups (affected communities, local government, lenders, NGOs, or other organisations) over the life of the Project. The Register should set out timeframes for action and assign responsibility for fulfilling such commitments to the appropriate individuals, business units or, in some cases, the implementing third party (e.g. the contractor, an NGO or local government agency).

Box 17 | Community engagement

Community Engagement and Participatory initiatives often lose traction in the long term, due to lack of ownership and stewardship among users and direct beneficiaries (communities). This is attributed to the gaps in the modus operandi of community participation and engagement employed in most of the current community engagement practices.

The model for Community Engagement by TREE Craze Foundation (TCF)^{vii} under its program CERRE (Community Engagement for River Rejuvenation and Environment) suggests an institutional framework for the non-formal, non-government entities, namely CBOs, NGOs, academic organizations as well as citizens to work together. The key components are anchored around a River Trust Model which can be initiated and operationalized through a pilot. Some of the components of this River Trust Model are:

- River Trust which includes a hierarchy of local chapters and regional chapters which are based on hydrological boundaries.
- Public Participation and Stakeholder Strategy Plan.
- Working groups which includes focus groups.
- Action Plans for sub-programs.
- Knowledge materials: Toolkits, guidelines and a Charter for the River Trusts. The model is designed to achieve the following objectives:
 1. Two directional flow of information between government and communities
 2. Awareness
 3. Empowered citizens
 4. Transparency
 5. Ownership
 6. Collaboration and partnerships to work together
 7. Bridging gaps between participating stakeholders and decision makers

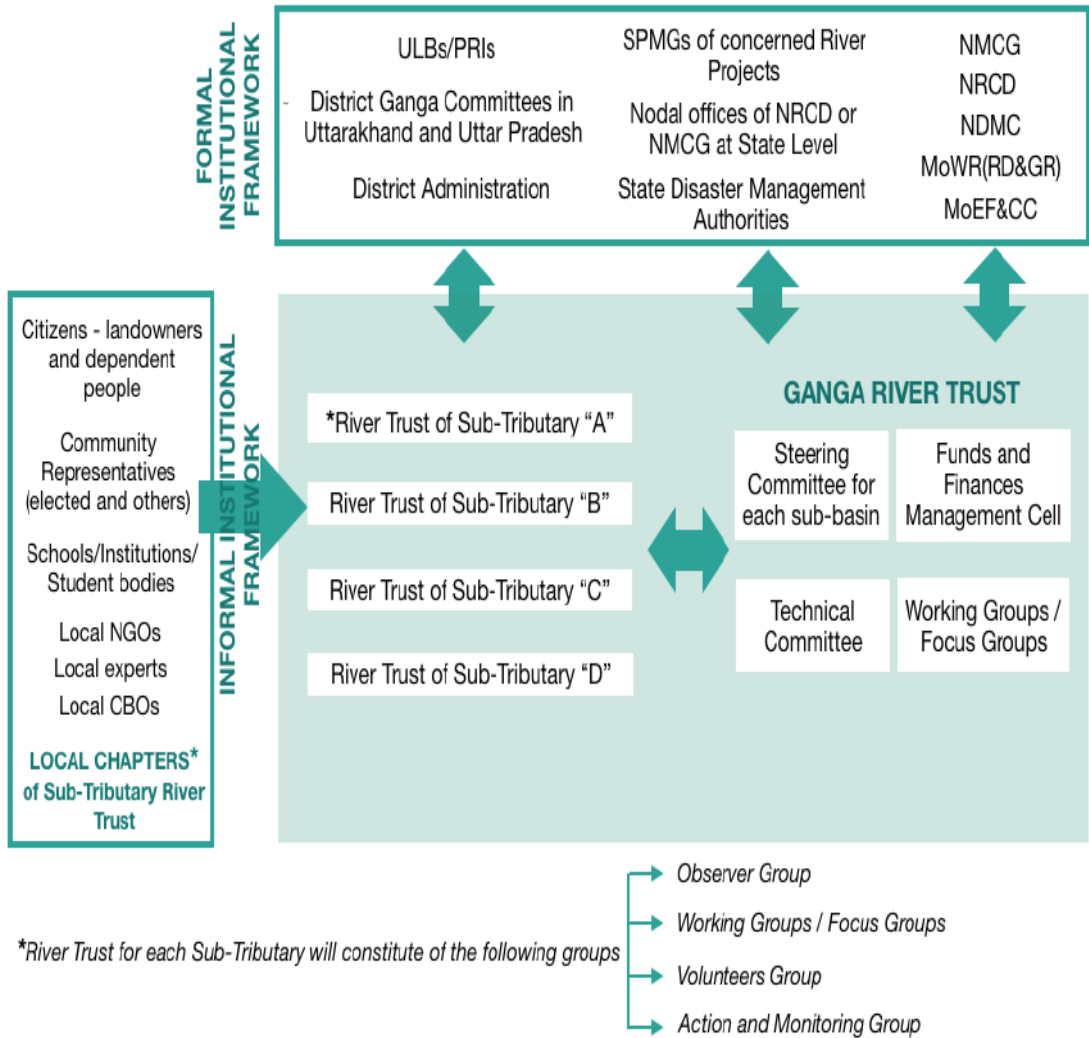
This model by TCF for community engagement enables an institutional arrangement which can anchor, host, manage, initiate and hand-hold community members and other stakeholder and decision makers. River Management Trusts or River Trust at local and sub-basin level supported by a Steering Committee and Working Groups for each local river trust is the most successful institutional model worldwide. Given the scale of rivers, types, and the population impacted in a country like India, it is preferred to have local river trusts for each sub-tributary or tributary of the river, each of which is represented at the larger body which would be the River Trust for a given River.

The ultimate objective of CERRE program is to empower the citizens to own, run and manage their local river trusts and together build the network of local and regional river trusts to enable local and basin level goals for river rejuvenation.

The model for non-formal institutional framework under CERRE programme of TCF is illustrated below:

The box to the bottom left of the above illustration shows the composition of local chapters. No formal, governmental institutions are part of the river trusts. This distinction is absent in almost all entities formed for implementing projects and programmes, but this distinction is important to ensure that citizen and community voice is truly and independently represented. This is an important and unique feature of the model for community engagement proposed by TCF.

Figure 23 | TREE Craze Foundation (Information Brochure on CERRE Programme)



*River Trust for each Sub-Tributary will constitute of the following groups

*Local Chapters will be created for each of the major ULB or Gram Panchayat within the area of the Sub-Tributary River Trust.

[C] Monitoring and Evaluation

Monitoring and Evaluation (M&E) are critical for effective implementation of management/ action plans. M&E records consists of documents, reports, photos, forms / templates, recordings, data, etc., that demonstrate the implementation of management plans stating results achieved or providing evidence of activities performed.

The project proponent should set up a M&E team which should report to the project lead. The M&E team should have an overarching responsibility for the management, monitoring, inspection, and reporting of management plans. The team should ensure that the project implementation team should have the right knowledge, skills and experience necessary to perform their work as per the approved management plans. The M&E team should:

- Conduct bi-annual audits on effective implementation of management plans.
- Report corrective and/or preventive actions in coordination with the project execution team.
- Drive the continuous performance improvement in relation to implementation of management plans.
- Reporting of KPIs on regular basis as detailed in PSR (Chapter III: Section A6).

[D] Training

All Project personnel, whether internal or external (with specific assigned tasks), are required to be professional and competent. As appropriate, individual competencies will be demonstrated through professional qualifications and/or on the basis of adequate personal experience, training and/or instruction.

It is imperative that all project execution staff and contractor personnel know and understand:

- Their respective roles, responsibilities and specific duties in relation to implementation of management plans.
- The importance of compliance to project management plans, to the requirements of the various regulations and to the project lender's requirements.
- The potential consequences of procedural failures or deviations from planned arrangements, especially with regard to potential environmental degradation or stakeholder disappointment.

Training should occur at all levels throughout the implementation phase of the project. Project specific training program should be developed by incorporating various requirements under management/ action plans, regulatory and permit requirements as well as any specific requirements from the project lead. The training materials should be reviewed and updated on an annual basis to accommodate any change in circumstances. It is important to maintain up-to-date training records as well as to ensure sufficient qualified capacity to deliver these training programs.

[E] Information Disclosure

Implementation of URFD projects are expected to have social and environmental impacts on the community. Therefore, inquiries, concerns and complaints are expected to arise during the implementation phase. The project proponent's response and its approach to manage such issues can have significant implications on the success of such projects. The project proponent should ensure that all stakeholders are well

informed about the project throughout its implementation lifecycle. Stakeholders will have the opportunity to express their opinion about the project including complaints.

The project proponent should use all effective communication tools with all stakeholders such as face to face meetings, informational meetings, visits in the communities, presentations and focus group meetings. The project proponent should ensure effective and timely communication with all stakeholders, including the media and provide information on progress of operation phase as well as to respond to concerns related to the Project. Stakeholder engagement program shall define the communication with key interest groups and the frequency of such meetings.

[F] Grievance Redressal

A grievance can be defined as an actual or perceived problem that might give grounds for complaint. As a general policy, the project proponent should work proactively towards preventing grievances through the implementation of impact mitigation measures and community liaison. These activities should be designed to anticipate and address potential issues before they become grievances.

Anyone should be able to submit a grievance to the Project if they believe the project is having a detrimental impact on the community, the environment, or on their quality of life during the implementation phase. They may also

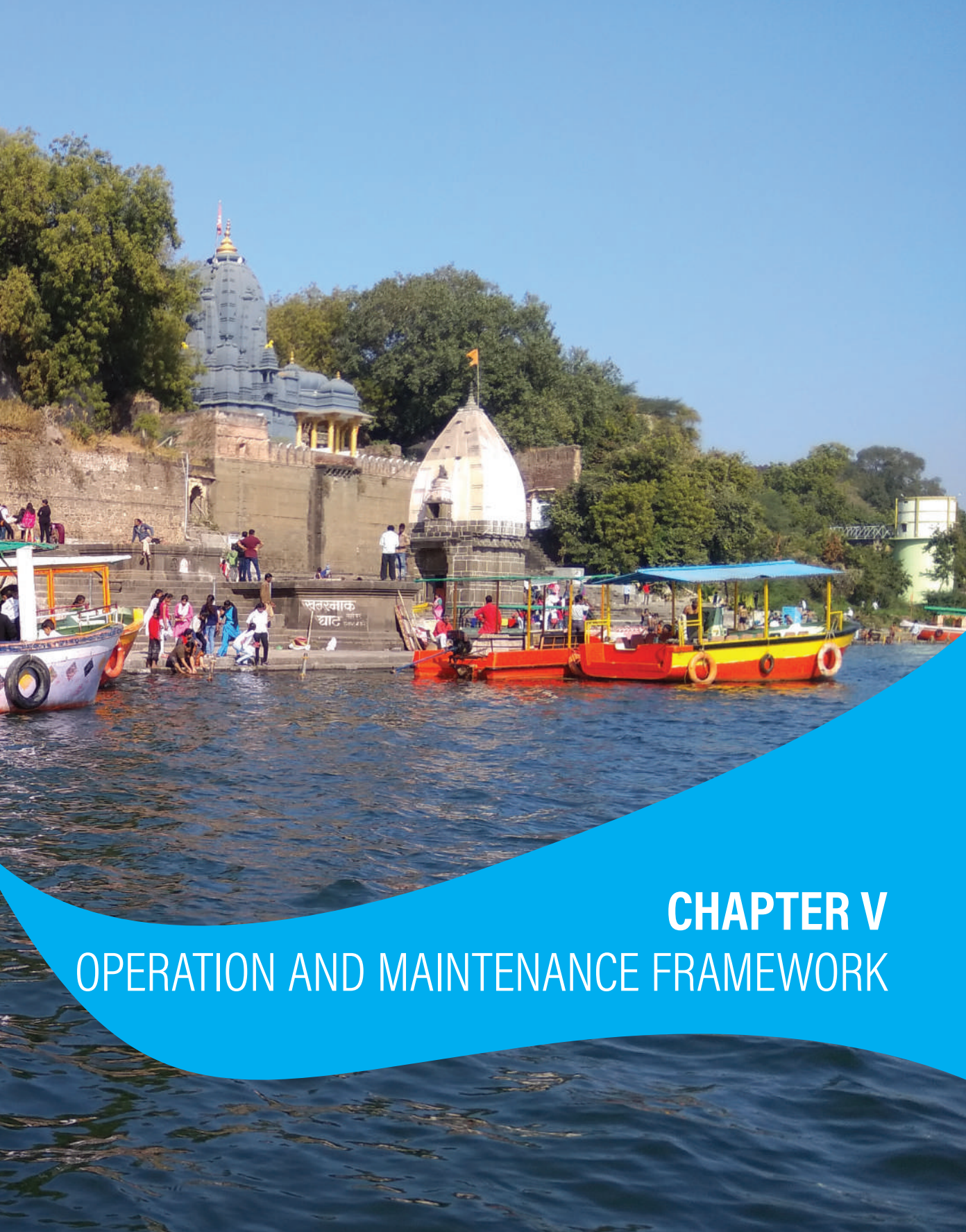
submit comments and suggestions to the project team.

Any comments or concerns can be brought to the attention of the project team verbally or in writing (by post or e-mail) or by filling in a grievance form. Grievance forms can then be submitted to the relevant project personnel whose contact details should be provided clearly.

All grievances should be acknowledged within 10 days. The response to a comment should be provided within 21 working days, unless there are exceptional circumstances. Grievances should be categorized based on validity and risk level. Where further investigations are required, project team and qualified external authorities, as appropriate, should assist with the process. The grievance redressal mechanism should record the manner in which any review has been carried out, the results of the review, any changes to activities that will be undertaken to address the grievance and how the issue will be managed to meet appropriate environmental and social outcomes. Grievance information should record the following in the form of a grievance log:

- Stakeholder name and contact details
- Details of the nature of the grievance
- Date received, responded to and closed out
- How it was submitted, acknowledged, responded to and closed out.





CHAPTER V

OPERATION AND MAINTENANCE FRAMEWORK

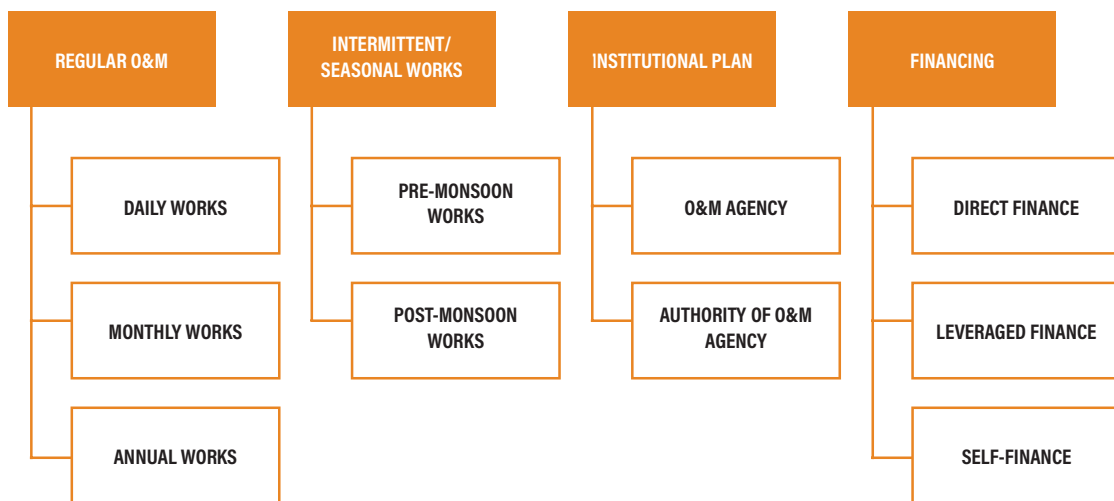
CHAPTER V: OPERATION AND MAINTENANCE FRAMEWORK

Urban riverfronts have the potential to bring in tourists and new users which can help revitalize riverfronts and adjacent neighbourhoods and improve revenues in these areas. The presence of more people along the riverfront, though, will require adequate services and amenities and measures to mitigate the environmental impacts of increased foot traffic in these districts.

Operations and Maintenance (O&M) will be a critical component of a successful urban

riverfront project. Ideally an O&M plan must be developed during the design and planning stages so that design and construction support ease of O&M works at a later stage and protocols are established early on in the project.

The O&M plan must clearly designate the authority which will be in charge and establish protocols of regular (daily, monthly and annual) works. In addition, there must be a clear set of guidelines on pre and post flooding works that must be undertaken to ensure the longevity of the riverfront development.



[A] Financing Operations & Maintenance in URFDs

Alongside a pre-defined O&M plan, adequate and long-term funding must be allocated for O&M efforts in URFD project. These funds must be allocated/ disbursed to the agency in charge of project management. There are multiple avenues from which funding can be ascertained and these can be divided into 3 categories:

- Direct Finance
- Leveraged Finance
- Self-financing

A.1 DIRECT FINANCE

Direct finance will include all such funds which are granted directly to urban local bodies (ULBs) by state or national governments or are leveraged by ULBs through

grants or loans to build urban infrastructure. For projects such as URFDs urban local bodies can add the capital and O&M expenses as another item in their budget estimates along with water and sanitation, roads and public health. The URFD would be considered as another work undertaken by the ULB for the public good. Funds for these works could be secured from:

- **ULB budget:** money allocated by the local government for the URFD in their annual budget and the URFD is taken up as a public amenity similar to public roads or water supply and sewerage systems.
- **Grant or seed money:** provided by initiatives such as Namami Gange/ SMART Cities/

AMRUT/ NRC.

- **Loans:** from infrastructure banks or development agencies.

A significant challenge associated with direct finance is that while beneficial to support capital expenses it is difficult to ensure on-going funding for O&M works. Particularly as ULB budgets are already constrained with on-going activities which might have priority and O&M costs typically increase with increasing age of infrastructure. Grant or seed money also does not provide for robust funding streams for long-term O&M works. And finally, with loans there is an additional expense of repayment that must be borne.

Box 18 | Funding river rehabilitation works - Qinhuai River, Nanjing, People's Republic of China

Nanjing is a historically important city in China, having also been a former capital city and 34 kilometres of the Qinhuai River flows through the city. In the 2000s the city faced major water related stresses brought about by rapid urbanization and increased rural to urban migration. The region went from 50% rural population in 1990 to a mere 27% rural by 2003. Increased domestic and industrial demand in a region of inconsistent rainfall led to cycles of urban flooding and stagnation and water scarcity. In addition, the region's water sources (rivers and lakes) including the Qinhuai River were severely polluted, with areas within the river wetland diverted for garbage dumps and squatter settlements (Vollmer 2009).

Eventually, the focus of urban development arrived at river improvement and rejuvenation with about USD 90 million (from 1985 to 2009) spent on grey infrastructure (upgrade drainage and sewage treatment), which led to significantly improved water quality by 2002. Moving beyond pure infrastructure improvements, the city also looked to mitigate floods and improve urban health and approached the ADB for financing to achieve these objectives. The ADB agreed to fund USD 100 million in the proposed USD 236 million project. The ADB funds were targeted towards various outcomes and 3 components are of particular interest. The primary objective was for wetland rehabilitation of 33 hectares of degraded and occupied wetland zone to create a wetland park. The project also included a component for the resettlement of the occupiers within the wetland area. Also included was a component on strengthening local institutions, particularly to improve environmental management and monitoring. Preliminary assessment of the proposed plan suggests net benefits of about USD 112 million can be accrued from the wetland park alone. (Vollmer 2009)

Box 19 | Riverfront development on River Ganga - Patna, India

The World Bank has been a long-time supporter of the Ganga rejuvenation project and is providing financial support of about USD 1 billion (2011-2021) for improvements, interventions and capacity building for authorities in areas across the Ganga Basin (The World Bank 2011). As part of the overall project, the World Bank also provided funding for the Ganga Riverfront Development project at Patna in 2013. The project management and funds disbursement for this project was undertaken by Bihar Urban Infrastructure Development Corporation Ltd. (BUIDCo), which is the nodal agency in Bihar under the NGRBA (Tripathi 2013).

This project had a 26-month timeline to develop 20 ghats in 4 distinct urban districts and a continuous promenade along the riverfront as well as implement landscaping, electrical works and public amenities in the space. With the World Bank's presence in this project the bidding procedure was conducted through the Bank's guidelines (BUIDCo 2013). The cost sharing of the proposed USD 43 million project (Malhotra 2016) was worked out as 70% from NGRBA (Central agency) and 30% from the state. Of the Centre's share 90% of the amount was provided by the World Bank, which was 63% of the total project amount (Tripathi 2013).

Box 20 | Financing using funds from Corporate Social Responsibility

Alongside usual funding sources of loans or budget line items, another potential source of funds in India can be from the Corporate Social Responsibility (CSR) funds as provided by corporations in India. As per the Corporate Social Responsibility Policy (2014) to improve corporate citizenship, companies are required by law to channel at least 2% of net profits of 3 previous fiscal years towards works of social or environmental benefits, institute a CSR Committee which will oversee the disbursement of funds and maintain oversight of and report project status (Finance Department 2019).

In 2014 the CSR Policy was modified which now allows corporations to directly provide funds towards the Clean Ganga Fund instead of towards specific projects where the corporation would have to maintain oversight. Instead, by contributing to the Clean Ganga Fund, corporations are still able to meet their obligations under the CSR Policy, yet do not need to maintain records of how the funds were used within the project itself (Government of India 2014).

A.2 LEVERAGED FINANCE

Given the growing challenges that ULBs face to secure financing for projects and for O&M, a range of innovative financial mechanisms have been attempted across cities. While most of these mechanisms are new to India, a few of them have been used to support infrastructure works such

as city road improvements and water supply and sewerage projects. URFDs could look to these innovative mechanisms to leverage funds for O&M works. The financial tools are as follows:

- **Municipal Bonds/ Green Infrastructure Bonds:** wherein financially viable ULBs are able to tap into market capital by issuing

Box 21 | Pioneering green bond to fund green infrastructure project - DC Water Environmental Impact Bond, Washington

In September 2016, DC Water and Sewer Authority (DC Water) issued the US's first Environmental Impact Bond (EIB) of USD 25 million to fund the initial project (construction of green infrastructure for Rock Creek Project A). This was part of the total USD 2.6 billion program to control stormwater runoff and improve water quality of the rivers and streams in the district (Goldman Sachs, 2016). The amount raised through this 30 year tax exempt bond (with a mandatory tender^x period of 5 years) will be used specifically to construct green infrastructure which uses nature based technologies to reduce storm surges and decrease combined sewer outflows in the current context of frequent and extreme rainfall events (US EPA 2017) (North and Gong 2017).

This innovative bond uses a Pay for Success model and allows for performance based risk/ reward sharing between DC Water (see table below) and the investors and helps raise the investment needed for capital costs in the project.

There are 2 principal benefits to the use of green bonds such as DC Water's EIB:

The risks associated with the performance of the project are shared between DC Water and the investors; thus, when there is low performance the investors will provide additional payments allowing DC Waters to recover some of its costs.

By connecting performance with outcome (runoff reduction) as well as infrastructure built or deployed, the focus to build and maintain higher outcomes is incentivized.

The risk sharing mechanism in this EIB is set up as a special (potential) pay-out to investors at the end of the mandatory tender period but is contingent on performance outcomes. If the new infrastructure (nature-based technologies) functions efficiently (reduces stormwater runoff by more than 41.3% of existing flows) then the utility pays to the investors. But when the system function is low (stormwater reduction less than 18.6%) then investors pay the utility^x.

Performance Tier	Outcome Ranges	Contingent Payment
1	Runoff Reduction >41.3%	DC Water will make an Outcome Payment to Investors of \$3.3 million.
2	18.6%>= Runoff Reduction < = 41.3%	No Contingent payment due.
3	18.6%>= Runoff Reduction < = 41.3%	Investors will make Risk Share Payment to DC Water of \$3.3 million.

Basically, the risk sharing mechanism denotes that the utility, DC Water's, payment obligation to investors is contingent on the functioning of the systems installed. Other than the risk sharing payment, the EIB functions like any other investment bond and offers a 3.43% return, payable semi-annually for the first five years^x (US EPA 2017).

bonds (Vaidya and Vaidya 2010).

- **Tax Credit Programs:** allows ULBs to raise capital by accepting contributions from private entities, usually businesses, and providing tax credits/ tax breaks to these entities in return^{viii}.

Business Improvement Districts/ Community Benefit Districts: are demarcated regions where businesses agree to a higher tax rate from which infrastructure improvements or community projects can be undertaken (Shah, et al. 2015). When local residents also agree to such a revised

Box 22 | Masala bonds and the potential for infrastructure funding in India

Financing needs for emerging economies such as India are wide and varied but regulatory and institutional barriers impact the flow of funds in these markets. In addition, while there may be global interest in participating in these economies, the markets function on local currency only which limits the participation of global players. To overcome the challenges of currency exchange risks and yet allow local/ national companies the opportunity to tap into global investment mechanisms the International Finance Corporation (IFC) worked closely with Indian agencies to develop a debt instrument in local currency^{xii}. This was termed as Masala Bonds and are essentially off-shore Rupee Denominated Bonds which can be traded on global markets and the monies raised can be invested in projects in India (Shi 2017).

The first Masala Bonds were offered by IFC on the London Stock Exchange in 2014 for a total amount of USD 1 billion (INR 62 billion). As of 2016 Masala Bonds of about USD 95 billion had been issued by various Indian and foreign entities^{xiii} at the London Stock Exchange (Challa and Kanakadurga 2016). An Indian entity incorporated under the Companies Act is eligible to issue Masala Bonds in global markets. Monies raised through Masala Bonds can be used for a wide range of purposes except for certain limiting activities as delineated by the Reserve Bank of India (RBI). The following activities are prohibited for Masala Bonds (MEA 2016):

- Purchase of land or real estate activities (except for affordable housing and integrated township projects).
- Investment in capital markets.
- Lending to other entities.
- Any activity prohibited by the foreign direct investment guidelines.

Masala bonds protect bond issuers from global currency fluctuations as the bonds are issued and returns are offered on the local currency^{xiv}. For investors, Masala Bonds are attractive as they offer a higher rate of return of about 5% to 7% as compared to about 2% to 3% returns in the US (MEA 2016).

While corporate, banking and public sector units can easily access overseas bond markets using Masala Bonds, there is still some question on the mechanism through which government entities (though incorporated) can access this market. These were raised on the issuance of Masala Bonds on the London Stock Exchange by the Kerala Infrastructure Investment Fund Board in April 2019. Though this issuance was approved by the RBI as the first state level body to issue such bonds there remains the question of how sovereign guarantee would be applied (Shikha and Gulati 2019).

tax rate these districts are called CBDs. Such tools might be particularly relevant to URFDs to ensure community participation and a sense of stewardship as the money from the community/ local businesses will be used to manage the project and O&M.

A.3 SELF-FINANCING

In addition, ULBs implementing URFDs can look

to self-financing mechanisms for such projects to remove dependence from the fluctuations of ULB budgets and/ or external funding sources. Assets on the project site can be used to generate revenues under self-financing mechanisms. Some possible self-financing mechanisms include rents on spaces such as convention centres, auditoriums, etc., and advertising charges.

Box 23 | Municipal bonds and SMART Cities

Urban infrastructure needs in India are enormous, with a projected need of USD 4.5 trillion until 2040 (PTI 2018) as both older and emerging cities require either new systems or substantial infrastructure upgrades. Budgetary allocations will not meet this huge requirement if Indian cities are to provide equitable, high-quality infrastructure for all citizens. To meet this financing gap, urban local bodies and financing agencies have explored a variety of alternate mechanisms to raise funds to meet capex and opex costs for urban infrastructure. Municipal bonds might be a crucial tool to support urban local bodies to raise investments.

A municipal bond is a debt instrument which urban local bodies, special purpose vehicles, parastatals can use to raise financing for infrastructure projects such as road construction, water supply and sanitation, schools, health centres, etc. Through this mechanism the issuer (urban local body) is obligated to pay to the investors the principle and interest amount after a fixed tenure. This instrument also benefits investors as municipal bonds typically have higher rates of returns, are low-risk and have attractive tax savings associated with them (ICAI 2018)

Though this mechanism was first used in 1997 by the Bangalore Municipal Corporation, the municipal bond market has remained sluggish in India (Kapoor and Pati 2017). The recent initiatives around SMART Cities and AMRUT have led to more interest among urban local bodies and utilities to explore the municipal bond market to raise funds. In addition, relaxation of various regulations by the Securities and Exchange Board of India in 2019 may also spur the municipal bond market in India (PTI 2019).

Box 24 | Value creation through river rejuvenation and redevelopment - Dravyavati Riverfront, Rajasthan

The Dravyavati River (Amainshah Nallah) flows about 48 kilometres through the city of Jaipur, is a rain-fed stream, which until the river rejuvenation project had become a wastewater stream. The deteriorating water quality, diminished biodiversity and ecosystem, resultant health hazards and a disastrous flood event (in 2012) were key triggers for the city authorities to plan a river rejuvenation scheme. The project was awarded by Jaipur Development Authority (JDA) to Tata Projects Limited (TPL-SUCG Consortium) to develop a rejuvenation plan, implementation of the area development plan on a turn-key basis and manage operation and maintenance for a 10-year period (Anand 2018). The project is estimated to be about Rs 1676 crore including construction cost of Rs 1470 crore and 10 years' maintenance of Rs. 206 crore (Kumar 2018).

The TPL-SUCG Consortium also proposed a Business Plan for value creation and monetization of the improved and reclaimed lands post-redevelopment. This was to showcase to the JDA the added benefits (monetary and other tangible benefits) the city could accrue from the river rejuvenation project (Anand 2018). The plan estimated that up to 85 hectares of reclaimed land could come into the ownership of government authorities. In addition, the value of existing government land (about 53 hectares) would also be enhanced. In total, these added lands and enhanced areas could potentially add a value of approximately INR 1,900 crore (~USD 275 million considering an exchange rate of INR 70 against 1 USD) to government coffers (Jaipur Development Authority n.d.).

This study does not include adjoining private lands which would also see increments in their property values which could flow to government authorities in the form of property tax.

Box 25 | Trust Fund mechanism for river rejuvenation - Clean Ganga Fund, India

The Clean Ganga Fund (CGF) was established in 2014 in India, as approved by the Union Cabinet, under the direction of the Prime Minister. The fund is designed to be managed by a Trust led by the Finance Minister. This trust and fund mechanism allows for the creation of a large corpus of money which can be used at the direction and discretion of the Trustees. The eligible actions that can be undertaken from this fund includes a range of pollution abatement projects (including mitigation of point and non-point sources of pollution, setting of sewage treatment plants in urban areas along the river, etc.). Further, the fund allows actions on conservation of biodiversity, community engagement and awareness, research and development, monitoring and reporting of water quality (Press Information Bureau 2014).

This type of fund gives project proponents the flexibility to tap into unencumbered finances to undertake a range of projects for river rejuvenation and redevelopment. Further, the fund structure provides for on-going donations from both private individuals and corporations (national and foreign), thus maintaining a robust and growing funds pool that project proponents can tap into. Finally, funds as part of corporate social responsibility can be placed in this fund directly to add to the fund pool (NMCG 2017).

Corporates can also choose to use their CSR funds for specific projects instead of contributing to the CGF, such as piloting of new technology, ghat adoption, tree plantations, awareness drives, research, etc.







APPENDIX A TASK CHECKLIST

APPENDIX A: TASK CHECKLIST

The tasks to be undertaken (and their order) are described as a questionnaire below which can be used as a checklist for approvals, implementation, management and evaluation of the environmentally sensitive, climate adaptive and socially inclusive urban riverfront planning and development.

Table - Questionnaire

S.No.	Task	Yes	No	Comment
1	Has a Project Screening Report (PSR) been prepared which includes:			
a	Urban riverfront development (URFD) typology, based on			
i	Energy environment of river			
ii	Energy environment of river			
b	Study of existing plans and proposed URFD			
c	Site selection analysis based on			
i	Natural geomorphology of riverbanks			
ii	Floodplains extent			
iii	Grey (built up) infrastructure in and around the URFD			
iv	Locations with polluting land uses			
d	Urban and riverine connections			
i	Connections to upper and lower order streams, tributaries and distributaries			
ii	Connections to urban green spaces			
iii	Connections to pedestrian and NMT pathways for accessing the URFD			
e	Financial plan			
f	Review of URMP, other projects/programmes, Development Controls and other zoning regulations applicable in the project area			

S.No.	Task	Yes	No	Comment
2	Has a Detailed Project Report (DPR) been developed which includes			
a	Hydrological Assessment			
b	Environmental Impact Assessment			
c	Social Impact Assessment			
d	Design Strategy			
3	Has a Planning and Institutional Strategy been developed for the URFD?			
IMPLEMENTATION ACTIVITIES				
4	Have the following management/ action plans been developed?			
a	Approved Construction Design and Plans			
b	Environmental and Social Management Plan			
c	Land Acquisition and Resettlement Action Plan			
d	Indigenous Peoples Plan, if any			
e	Hydrological Impact Management Plan			
f	Biodiversity Management Plan			
5	How are changes and feedback being managed?			
a	External consultant approves changes to existing plan			
b	Has an annual review of all management plans been undertaken?			
c	Is there a stakeholder register allowing input of feedback from various stakeholders?			
d	Have stakeholder inputs resulted in changes to the plan or project commitments and have these been used to update the management plans?			

S.No.	Task	Yes	No	Comment
6	Has a monitoring and evaluation team been set up as part of the URFD project?			
a	Has a bi-annual M&E report been generated with corrective actions indicated?			
b	Have the corrective actions been implemented on the URFD project site?			
c	Has the M&E report been used to update the management plans?			
7	Have all URFD personnel undergone an orientation training session with focus on roles and responsibilities; compliance requirements; and consequences of procedural lapses?			
8	Is there a portal/ platform for regular information dissemination and disclosure for the URFD? Does the platform support user/ stakeholder feedback?			
9	Is there a dedicated team and a platform/ mechanism for grievances to be submitted with regards to the URFD?			
a	What is the rate at which grievances are addressed and resolved?			
b	What are the steps undertaken to ensure transparency to address the issue shared with the complainant?			







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ENDNOTES

ⁱ Ecological Riverfront Design: Restoring Rivers, Connecting Communities. (Planning Advisory Service Report Number 518-519. 2004 <https://www.csu.edu/cerc/documents/EcologicalRiverfrontDesign.pdf>) by Betsy Otto, Kathleen McCormick, and Michael Leccese; Publisher: American Planning Association.

ⁱⁱ Such a management plan exists for the River Ganga basin and this plan also provides directions for developing, managing and reviving the river through the guiding objectives.

ⁱⁱⁱ Geomorphic features for River Ganga are mapped along its entire stretch and this mapping data is available with IIT consortium and can be made available by the National nodal agency (NMCG). Similar mapping of geomorphic features along with active floodplain and valley margin mapping/delineation are available for most of the major rivers in the country.

^{iv} Access control to the river will include interventions such as limiting ghats or paths leading to the river, boating activities, shipping, etc.

^v CPCB prescribes bathing water quality (CPCB n.d.) in ghat areas where people will access the water for cultural and recreational purposes. Another notification from US EPA also prescribes minimum measures of water quality parameters for various uses including recreational use (US-EPA 2012) which the project proponent can choose to follow.

^{vi} The NGRBA was dissolved in 2016 and replaced with the National Council for Rejuvenation, Protection and Management of River Ganga (referred as National Ganga Council) (NMCG 2019).

^{vii} TREE Craze Foundation TREE Craze Foundation (TREE stands for Tree, Rivers, Ecology, and Environment), a section-8 not-for-profit company, committed to the cause of Trees, Rivers, Ecosystems & Environment. It acknowledges the power of communities and is striving to charge up the communities to own up their rivers and act for them leveraging international best practices.

^{viii} Pennsylvania Department of Community and Economic Development. Waterfront development tax credit program. <https://dced.pa.gov/programs/waterfront-development-tax-credit-program-wdte/>

^{ix} Mandatory tender period refers to the minimum period of time that the bond has to be held or amount locked in before the investor can seek to recover their investment.

^x The utility recovers the risk share payment by holding back the requisite amount (USD 3.3 million) from investors final payout (North and Gong 2017).

^{xi} At the end of the mandatory tender period the rate of return can be revised based on existing market dynamics for the rest of the bond tenure.

^{xii} Samurai bonds in Japan and dim-sum bonds in China were developed on similar lines to the Masala bonds on India (Shi 2017).

^{xiii} Masala bond issuers include Housing Development Finance Corporation, National Thermal Power Corporation, province of British Columbia, Canada and European Bank for Reconstruction and Development (EBRD) in 2016 (Challa and Kanakadurga 2016).

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