



National Mission for Clean Ganga

Ministry of Jal Shakti
Department of Water Resources, River Development & Ganga Rejuvenation
Government of India

A Draft prepared by cGanga and Indore Municipal Corporation



VISION KANH

A Sustainable Restoration Pathway

FEBRUARY 2020



cGanga
Centre for Ganga River Basin Management and Studies

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IMC
Indore Municipal Corporation

VISION KANH

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National Mission for Clean Ganga (NMCG)

NMCG is the implementation wing of National Ganga Council which was setup in October 2016 under the River Ganga Authority order 2016. Initially NMCG was registered as a society on 12th August 2011 under the Societies Registration Act 1860. It acted as implementation arm of National Ganga River Basin Authority (NGRBA) which was constituted under the provisions of the Environment (Protection) Act (EPA) 1986. NGRBA has since been dissolved with effect from the 7th October 2016, consequent to constitution of National Council for Restoration, Protection and Management of River Ganga (referred to as National Ganga Council).

www.nmcg.in

Centre for Ganga River Basin Management and Studies (cGanga)

cGanga is a think tank formed under the aegis of NMCG, and one of its stated objectives is to make India a world leader in river and water science. The Centre is headquartered at IIT Kanpur and has representation from most leading science and technological institutes of the country. cGanga's mandate is to serve as think-tank in implementation and dynamic evolution of Ganga River Basin Management Plan (GRBMP) prepared by the Consortium of 7 IITs. In addition to this it is also responsible for introducing new technologies, innovations and solutions into India.

www.cganga.org

Indore Municipal Corporation (IMC)

Indore Municipal Corporation (IMC) is the governing body of the city of Indore in the Indian state of Madhya Pradesh. It consists of democratically elected members and is headed by a mayor. IMC administers the city's infrastructure and public services including healthcare, educational services etc. At present, the Indore municipal area is divided into 19 zones and 85 wards of various sizes and population. As per the provision of Madhya Pradesh Municipal Corporation Act, 1956, IMC has a chairman (Mayor), councilors elected by direct election from 85 wards of Indore, 2 members of Parliament, and 5 members of State Legislative Assembly representing constituencies within the municipal area. In recent years IMC has launched Indore Smart City project as a major initiative to upgrade the Governance, Transportation, Energy & Waste Management, Water Management, Finance, Health & Education, Infrastructure and Heritage of Indore.

www.imcindore.org

Acknowledgment

The Vision Document for **Sustainable Restoration of River Kanh** was the synthesis of the diverse efforts of cGanga, Indore Municipal Corporation, and many enthusiastic individuals and organisations involved in adapting the essential ingredients of the Ganga River Basin Management Plan and River Restoration Vision to the specific ground realities and socio-cultural milieu of the Kanh river basin. Their commitments and help are gratefully acknowledged along with those of many people who contributed to the photographs and images for this document.

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PREFACE

NATIONAL RIVER Ganga has been at the centre of the government's multi-decadal efforts to restore and conserve degraded Indian rivers. The Ganga River Basin Management Plan (GRBMP) submitted to the National Mission for Clean Ganga (NMCG), Government of India in the year 2015 by a Consortium of 7 IITs ("Indian Institute of Technology"s) set a clear direction and action-framework for this purpose, but progress on its implementation was tardy, partly due to the GRBMP recommendations being broad-based strategic measures to some extent. Therefore, after the Centre for Ganga River Basin Management and Studies ("cGanga") was created through a Memorandum of Understanding between MoWR, RD&GR (now Ministry of Jal Shakti), Government of India and IIT Kanpur in April 2016, cGanga conducted many field and in-house studies as well as workshops and consultations with stakeholders, executive bodies, monitoring agencies and experts on various components of GRBMP and its implementation. Based on these activities over the past few years, a clearer understanding emerged on some of the major implementation challenges of GRBMP, especially the difficulty in restoring a very large and complex river system like River Ganga. This led to a more refined and detailed strategic implementation procedure that combines robust scientific method with a Socio-economically, culturally and administratively aligned policy framework.

The revised strategy that evolved was essentially a bottom-up approach to Ganga river conservation where relatively small, low-order streams that comprise the main source streams of the Ganga

river system were brought into focus for restorative action because they could be restored and conserved independently and cohesively in the entire Ganga basin, thereby leading to a cascading impact on River Ganga as a whole. This approach was embodied in the Concise Manual and Guide for River Restoration presented by cGanga and NMCG during the India Water Impact Summit (IWIS) in 2019. Adopting the strategy outlined in the manual, the present Vision Document for River Kanh lays down the restoration needs and strategy for the river given its socio-cultural and ecological status – both historical and modern – and the urban and rural socio-economic needs of present times. The document does not lay down the nuts and bolts of the restoration plan but is a first step at defining them by taking cognizance of the physical, social and management status of the Kanh river.

This document was prepared by dedicated members of cGanga through the gathering of information, analyses and discussions with various agencies and individuals. Key stakeholders, experts and community representatives of the Kanh river basin also interacted with cGanga members and gave their valuable inputs unreservedly on many aspects of the document. This document is, therefore, the outcome of a joint effort of Team cGanga with dedicated members of the Kanh river basin.

VINOD TARE

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Aerial view of Kanha river, Indore

A

INTRODUCTION

INDIA'S NATIONAL river – River Ganga – and her river network are spread over the vast alluvial plains of North and East India with the Himalayan mountain ranges at its northern and north-eastern boundary, the Aravalli mountains at the north-west, and the Vindhya and Satpura ranges towards its south-west. Though River Ganga is conventionally considered to begin at the confluence of Rivers Bhagirathi and Alaknanda at Devprayag in the state of Uttarakhand, it is variously held to include also one or more of its head-streams above the confluence – the Bhagirathi river, or both the Bhagirathi and Alaknanda rivers, or her six major head-streams (the Alaknanda, Dhaulī Ganga, Nandakini, Pindar, Mandakini

and Bhagirathi rivers) in Uttarakhand. However, a more comprehensive scientific and spiritual view of River Ganga is to include all her source streams as being integral to River Ganga since they all contribute their flows not only to the main stem but also to the river ecosystem (**Figure 1**). Thus, even small, low-order streams in the Ganga river basin may be of much significance as far as her overall status is concerned. Hence, River Ganga may be considered to include thousands of streams originating from various locations in the basin, and, if they have degraded, then the restoration and conservation of even small streams is vital for the restoration and conservation of River Ganga.

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B

INDIVIDUALITY OF RIVERS

RIVERS, LARGE and small, have their own individual characteristics. Ancient Indian scriptures also allude to different rivers having different significances thus:

त्रिभिः सारस्वतं तोयं सप्ताहेन तु यामुनम् ।
सद्यः पुनाति गांगेय दर्शनादेव नामर्दम् ॥
(मतस्य पुराण, १८५/१०-११)

(सरस्वती नदी में तीन दिन स्नान करने से, यमुना में सात दिन स्नान करने से एवं गंगा में केवल एक स्नान से पवित्रता प्राप्ति होती है परन्तु नर्मदा के दर्शन मात्र से मनुष्य पवित्र हो जाता है।)

[Bathing for three days in River Saraswati, seven days in River Yamuna, and only one day in River Ganga bestows sacredness, but human beings become sacred merely by the auspicious sight of River Narmada
- Matsya Purana, 185/10-11]

What the above verse suggests is that all rivers may be important and sacred for humans, but different rivers should be approached differently and treated differently because each river has its own unique characteristics in terms

of topography, catchment properties, geomorphology, hydrology, hydraulics, water quality and ecology. Thus, the restoration and conservation of a large river like River Ganga must be addressed with similar differentiation for her different component streams.

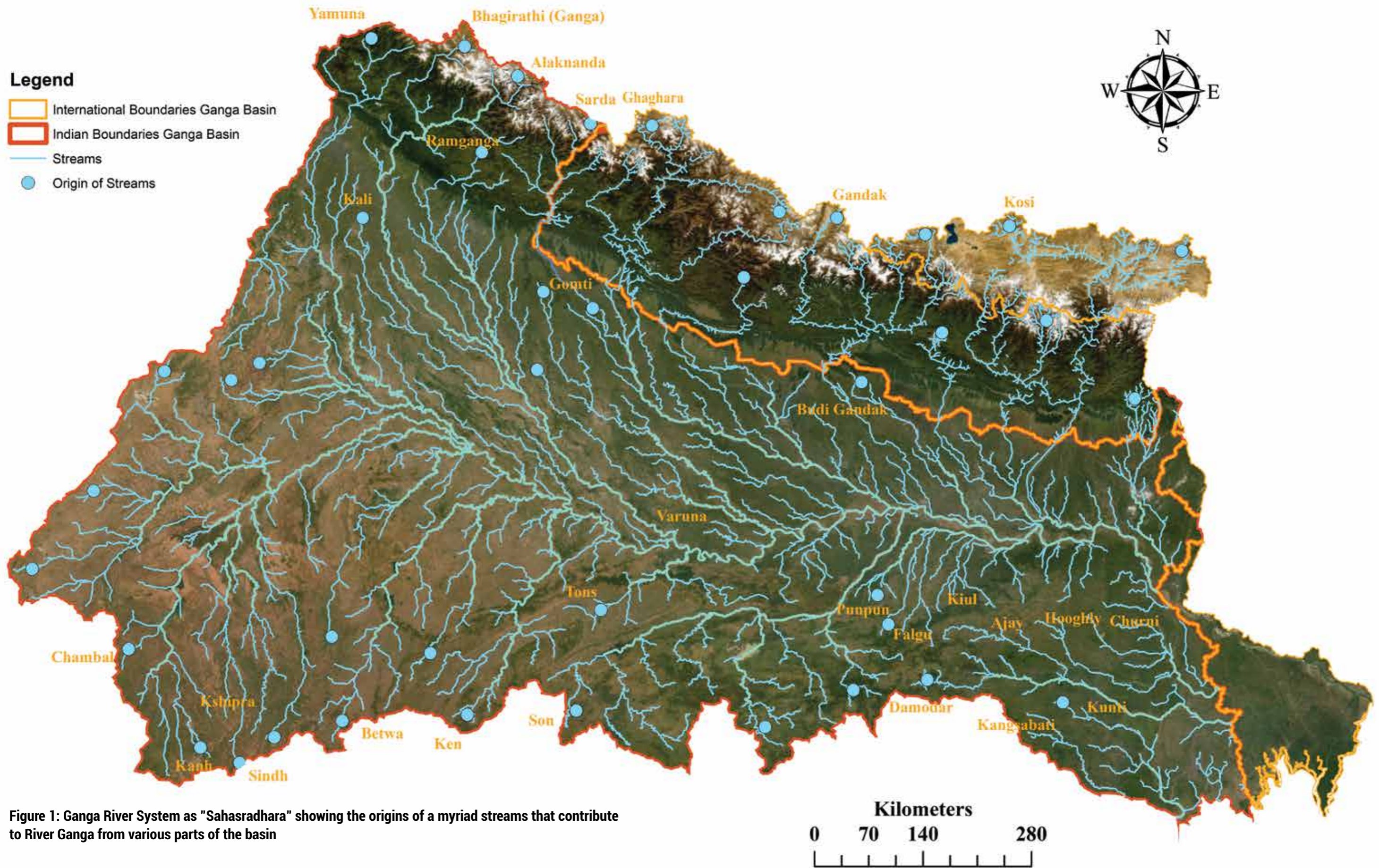


Figure 1: Ganga River System as "Sahasradhara" showing the origins of a myriad streams that contribute to River Ganga from various parts of the basin

C

WHY PRIORITIZE RIVER KANH'S RESTORATION

IN A follow-up to the Ganga River Basin Management Plan-2015 (GRBMP), cGanga had reviewed the implementation challenges of GRBMP and concluded that the tardy implementation is at least partly due to the complexity of the Ganga basin over the vast landscape. Hence, a strategic approach had been evolved by cGanga and NMCG for its systematic implementation by fully restoring and conserving small low-order tributaries through comprehensive measures while the main Ganga river and her major tributaries are revived through broader landscape-scale measures [cGanga and NMCG, 2019].

In keeping with the above approach, the Kanh river in Madhya Pradesh, (see Figure 2) a relatively low order but important river

flowing through Indore city and joining River Kshipra near Ujjain, is an ideal candidate for restoring and conserving as a living river. The city of Indore in Madhya Pradesh is known for its throbbing economic life, general cleanliness, shared urban spaces, historical heritages, religious shrines, and other visible signs of healthy urban life. If any natural factor constrains the growth and prosperity of Indore, it is the limitation of water and water bodies. For though the city has been growing rapidly over the decades, its limited water resources has led to unsustainable groundwater withdrawals, falling water table, and shrinkage or drying up of its rivers and water bodies. Thus, Indore's main the heart of the city – River Kanh – has changed over time from a seemingly perennial

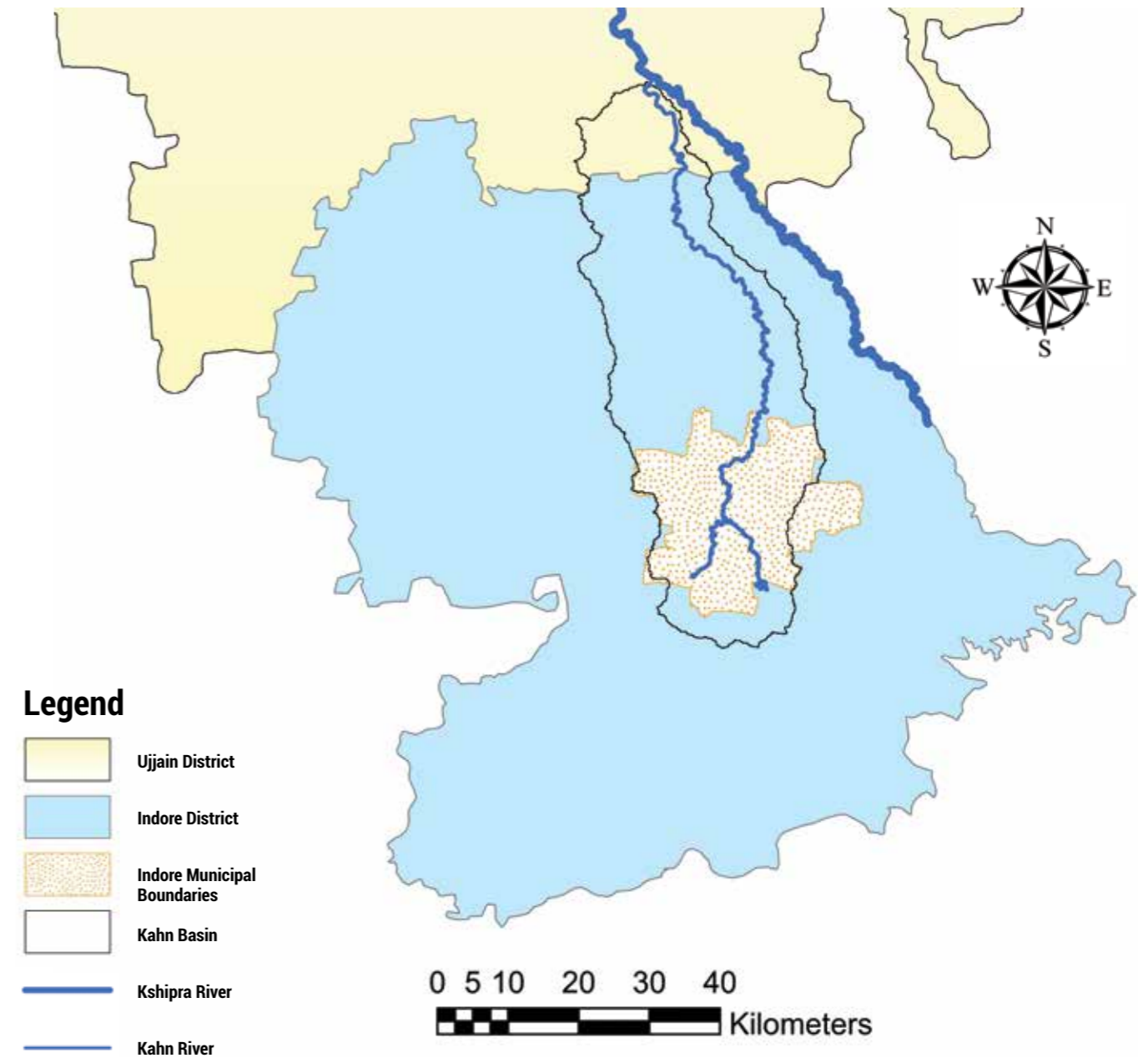


Figure 2: Location map of Kanh river basin in Indore and Ujjain Districts

river to a discharge drain for the city's municipal wastewater and monsoon stormwater. There are thus considerable hydrological, ecological, civic and aesthetic

advantages in reviving and conserving River Kanh including its immense benefits for the Ganga river system.

Presently the Kanh river carries

Project diverting River Kanh to the Kshipra River downstream of Ujjain during Simhastha 2016. River Kanh deprived of its right to union with Kshipra at Sangam due to this diversion.



mostly municipal wastewater in the dry season and wastewater plus intermittent stormwater runoff in the monsoon season. While dry season flows are not much more than a trickle, monsoon flows can still be high and flood the riparian areas. But the polluted waters of River Kanh are a major drawback for aquatic biota and for the city's hygienic

and aesthetic needs. Besides, they adversely affect the downstream reaches of the river as well as River Kshipra – which it joins at the Triveni Sangam near Ujjain. Due to this reason its flows had been temporarily diverted through a sewer diversion project and released into the Kshipra downstream of Ujjain during the Simhastha in

2016. The diversion, however, was only a temporary measure that did not alter its long-term adverse effect on River Kshipra's water quality and biodiversity. It is natural, then, that restoration of River Kanh needs to be taken up urgently to benefit the city, the rivers and water bodies in the region, and River Ganga as a whole.

"The diversion of River Kanh to bypass the Triveni Sangam during Simhastha 2016 was only a temporary measure that did not alter its long-term adverse effect on River Kshipra's water quality and biodiversity"

D

HISTORICAL AND HYDROLOGICAL SIGNIFICANCE OF RIVER KANH

INDORE CITY developed along the banks of River Kanh in the nineteenth century. The Kanh river was considered to be as pious as the larger rivers in the region – Rivers Narmada and Kshipra. Hence the Holkar rulers visited the city regularly during Shravana fairs. In central India, Simhastha (Kumbh) is generally organized at

the Triveni Sangam (three-river confluence) of Rivers Kshipra, Kanh and the invisible Saraswati, since it was begun in the 18th century by the Maratha ruler Ranoji Sindhe. Skandapurana, the largest of all Mahapuranas, in its multiple verses, mentions the sacredness and importance of the confluence of the holy Rivers Kshipra and Kanh, e.g.:

क्षातासंगमसंयुक्ता यत्र शिप्रा पयस्विनी ॥
तत्र भुक्तिश्च मुक्तिश्च धनधान्यसमागमः ॥

(जिस स्थान पर कान्ह नदी का संगम शिप्रा के साथ होता है उस स्थान पर भोजन, मोक्ष एवं धन धान्य का भी समागम होता है अर्थात उस स्थान पर ये सभी प्रचुर मात्रा में मिलते हैं)

[The location of Rivers Kshipra and Kanh's confluence is notable for the profusion of food, wealth and salvation.]



Congregation of pilgrims near Triveni Sangam, Ujjain during Simhastha 2016

and

तीर्थमन्यतरं व्यास क्षातासंगमसंभवम् ।
यत्र तु स्नानमात्रेण महापापैः प्रमुच्यते ॥

(स्कन्दपुराण के अवन्तिखंड में महर्षि व्यास जी ने तीर्थों में क्षाता (कान्ह/ख्याता) के शिप्रा एवं सरस्वती नदी के संगम स्थान कि महत्ता को बताते हुए कहा है कि इस संगम स्थान पर स्नान करने से महापापों से भी मुक्ति मिलती है)

[As per Maharshi Vyas taking a dip at the confluence of Rivers Kanh Kshipra and Saraswati at Triveni Sangam will cleanse people even from great sins.]



Kanh river at Krishna Pura, Indore

Traditionally, Kanh River waters have helped maintain the region's aquatic environment, soil moisture and microclimate, provided for irrigation and domestic needs, recharged groundwater, and enriched the Kshipra river

The Kanh river is not only of great historical and religious significance, its hydrological importance is also notable. It drains a considerable tract of land in Indore district, thereby removing surplus biomass, inert materials and wastes. Traditionally, Kanh

River waters have helped maintain the region's aquatic environment, soil moisture and microclimate, provided for irrigation and domestic needs, recharged groundwater, and enriched the Kshipra river at Ujjain with its flow. If the Kanh river is fully restored, then it can not only meet all these needs but also other needs of river resources by Indore city and its neighbourhood, such as recreation and waterway transport.

SUITABILITY OF RIVER KANH'S RESTORATION IN THE GANGA BASIN

E

RIVER KANH originates at Asrawad Khurd near the south-eastern boundary of Indore and flows over a length of about 26 km through the city, traversing about 80 km overall until it reaches its confluence with the Kshipra. There are several other smaller rivers (such as the Chandrabhaga and Saraswati) and natural drains joining the Kanh river in Indore, besides several lakes and ponds in the district. The Sirpur Lake, for instance, is a paradise for bird watchers for native as well as migratory birds. The lakes are, however, far-flung and not directly hydraulically connected to the Kanh river. But the stream network and nearby ponds can be hydraulically connected to provide an integrated aquatic system to augment the city's water availability, aesthetic

appeal and biodiversity richness to add to the Kshipra river's many native fish species such as catfish, barbs and Indian major carps.

The Kanh river is ideally suited for revival on a priority basis. Its main advantages for taking up restoration work are indicated below:

● **LOW ORDER STREAM:**

The Kanh river is a third order stream that joins the fourth order Kshipra river, which later joins the Chambal river, which discharges into River Yamuna, a major tributary of National River Ganga (**Figure 3**). Thus, while being part of the Ganga River System, the Kanh river is not heavily affected by a network of lower order streams, and its restoration can be carried out comprehensively and cohesively for the entire river.

The stream network and nearby ponds can be hydraulically connected to provide an integrated aquatic system to augment the city's water availability, aesthetic appeal and biodiversity richness

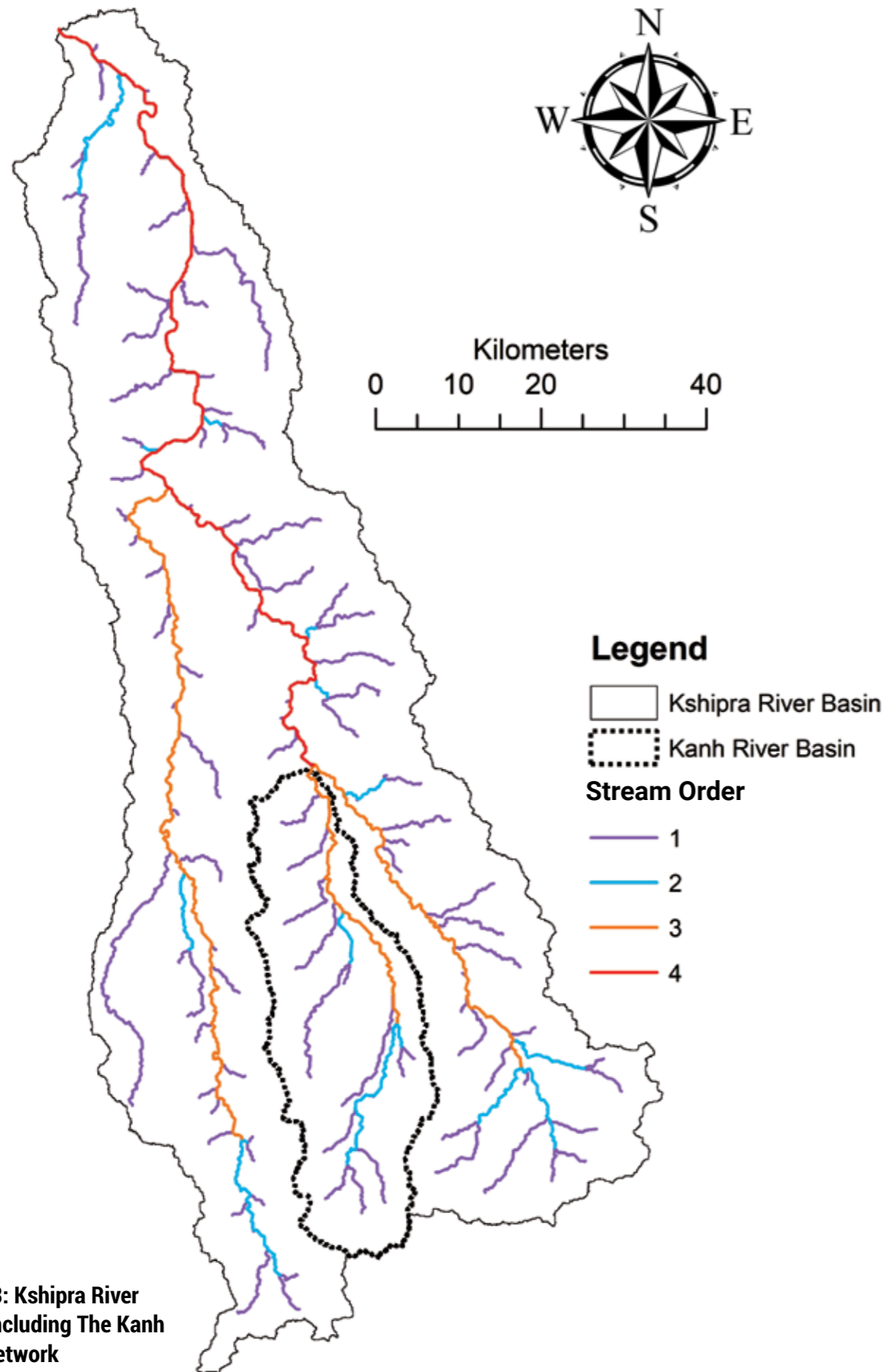


Figure 3: Kshipra River Basin including The Kanh River Network

● **PERENNIAL STREAM:**

Available information indicates that the Kanh river was historically a perennial river, though presently it may not be so if one excludes anthropogenic discharges. However, through inter-basin transfer of water from River Narmada, 495 MLD water is pumped from the water treatment plant near Jalud (situated at a distance of about 50 km from Indore) to meet Indore's municipal water demand. Treated, partially treated and untreated wastewater generated in Indore municipal area then goes into the Kanh river, which effectively makes it perennial even if the lean season flows are small and polluted. If the municipal wastewater are adequately treated and fed into the river, then a minimum assured discharge of unpolluted water can be maintained in the Kanh river during lean periods for its ecosystem to come alive.

● **URBAN LOCATION:**

The restoration of Kanh river as a healthy freshwater stream can be a boon for the city of Indore – for the hygienic, aesthetic and ecological benefits that it can bestow. The significant economic and cultural benefits of restoring the river can ensure the enthusiastic support of citizens and stakeholders

of the river basin to make it economically viable and a resounding success.

● **PROMINENCE:**

River Kanh is not only the largest river of Indore and a historically important river in the region, it also flows centrally through the length of Indore city in a more or less South to North direction. Its basin, with an area of 820 sq km., includes a diversity of Land Cover and Land Use patterns such as large agricultural areas, urban conglomeration, rural settlements, industrial and institutional areas, scrublands and rocky terrain. Runoff and wastewater from these areas contribute variously to the flow of the river to give it a composite texture.

If the municipal wastewater are adequately treated and fed into the river, then a minimum assured discharge of unpolluted water can be maintained in the Kanh river during lean periods for its ecosystem to come alive



Aerial view of River Saraswati (left) and Kanh (right) in Indore city

F

BASIC INFORMATION ABOUT RIVER KANH AND ITS HYDROLOGY

RIVER KANH runs for a length of about 80 km, of which 26 km length lies in Indore city and the balance 54 km is in rural setting as shown in (Figure 4). The river channel is at most about 30 m wide in its entire stretch, but its floodplains may have been encroached upon in some places. There are 33 major slums on either side of the river, which together with other urban developments may have partly shrunk the needed river space. Several large and small drains join River Kanh, as evident from (Figure 5)

and Table 1. The natural flow and hydraulic capacities of many of the drains have been affected by heavy silt and sludge deposits that require frequent de-silting. This is partly because the stormwater drains are now used primarily as wastewater drains or as combined sewers carrying both municipal wastewater and stormwater. However, it is also possible that increased soil erosion and solid wastes (such as construction wastes) are entering these drains, thereby causing siltation due to low flow velocities.

There are 33 major slums on either side of the river, which together with other urban developments may have partly shrunk the needed river space

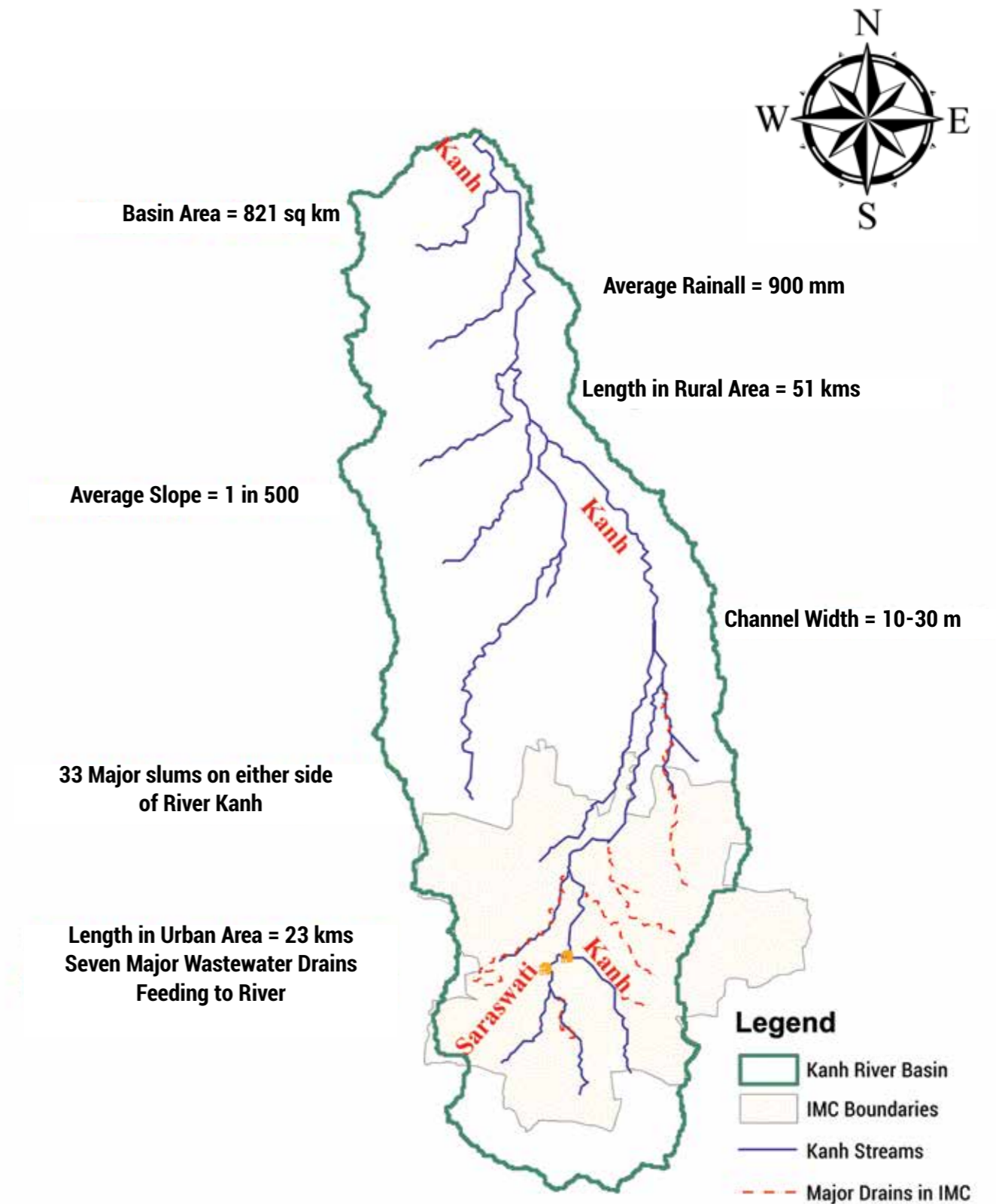


Figure 4: Hydrological Features and Setting of Kanh River

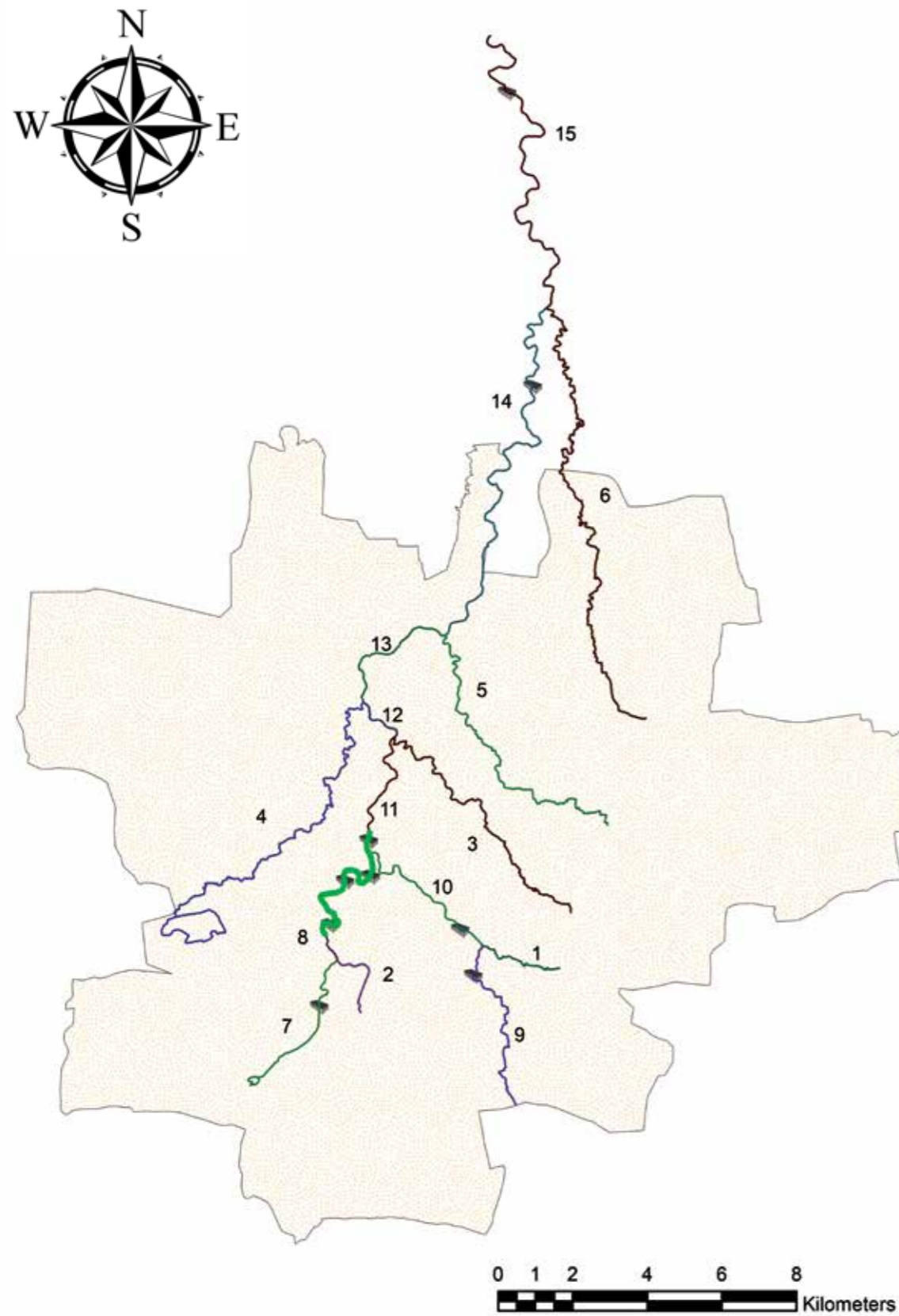


Figure 5: Kanh River's Incoming Natural Drains and Proposed Riverfront Development

Table 1: Sizes of Natural Drains of the Kanh River Network

S.No.	River/Drain	Length (in m)	Avg. Width (in m)
1	Azad Nagar Drain	1694	4.83
2	Pimpliyapala Drain	1690	2.09
3	Palasia Drain	7487	4.82
4	Piliyakhal Drain	10791	4.63
5	Khajrana Drain	4858	6.83
6	Tulsi Nagar Drain	10108	2.88
7	Saraswati River	3867	7.26
8	Saraswati River	5251	15.59
9	Kanh River	5017	5.46
10	Kanh River	4799	14.78
11	Kanh River	3283	18.29
12	Kanh River	2104	10.73
13	Kanh River	2324	23.53
14	Kanh River	9788	19.86
15	Kanh River	51735	27.41



Check dam at Sirpur Lake, Indore



G

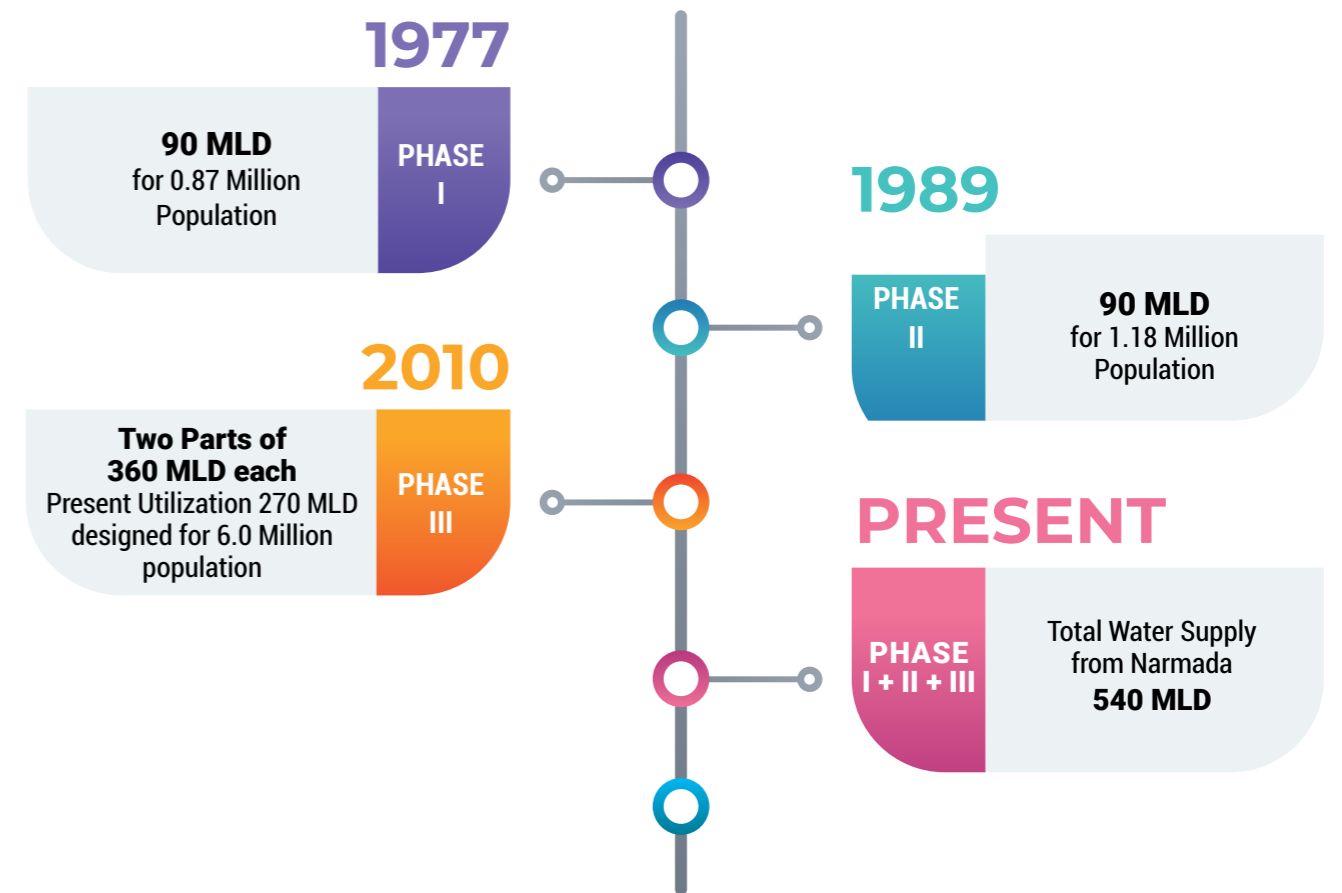
THE WATER QUESTION IN KANH BASIN

WATER IS the primary critical resource in the Kanh River Basin. With anthropogenic usage having exceeded freshwater renewal capacity of the basin, Indore city's water demand is largely met by water sourced from the Narmada river as well as unsustainable groundwater withdrawals. Freshwater sources have thus been shrinking over time, including the Kanh river system. However, transfer of water from the Narmada river basin to the Kanh basin has resulted in considerable additional wastewater production

in the latter basin, especially of municipal sewage, as indicated in **Figure 6 (a)** and **(b)**. It may be noted, however, that the wastewater produced is not used in any form, but is partly treated before being discharged out of the basin through the Kanh river. Given the polluted nature of the wastewater and its limited residence time in the basin, it is obvious that the wastewater does more harm than good, besides being an expenditure burden for the city authorities to treat and safely dispose. A radically different approach to the holistic management of this surplus wastewater, however, can restore the entire cityscape and its water bodies, especially River Kanh, into vibrant urban ecosystems with vast aesthetic, ecological and economic benefits accruing from them.

Indore city's water demand is largely met by water sourced from the Narmada river as well as unsustainable groundwater withdrawals

NARMADA WATER SUPPLY TO INDORE & ENROUTE VILLAGES



ISSUES AND CONCERNS

- High cost of conveyance (29 INR/cu.m)
- Water Sources for future population
- Water pollution
- Integrated Water Resources Management?

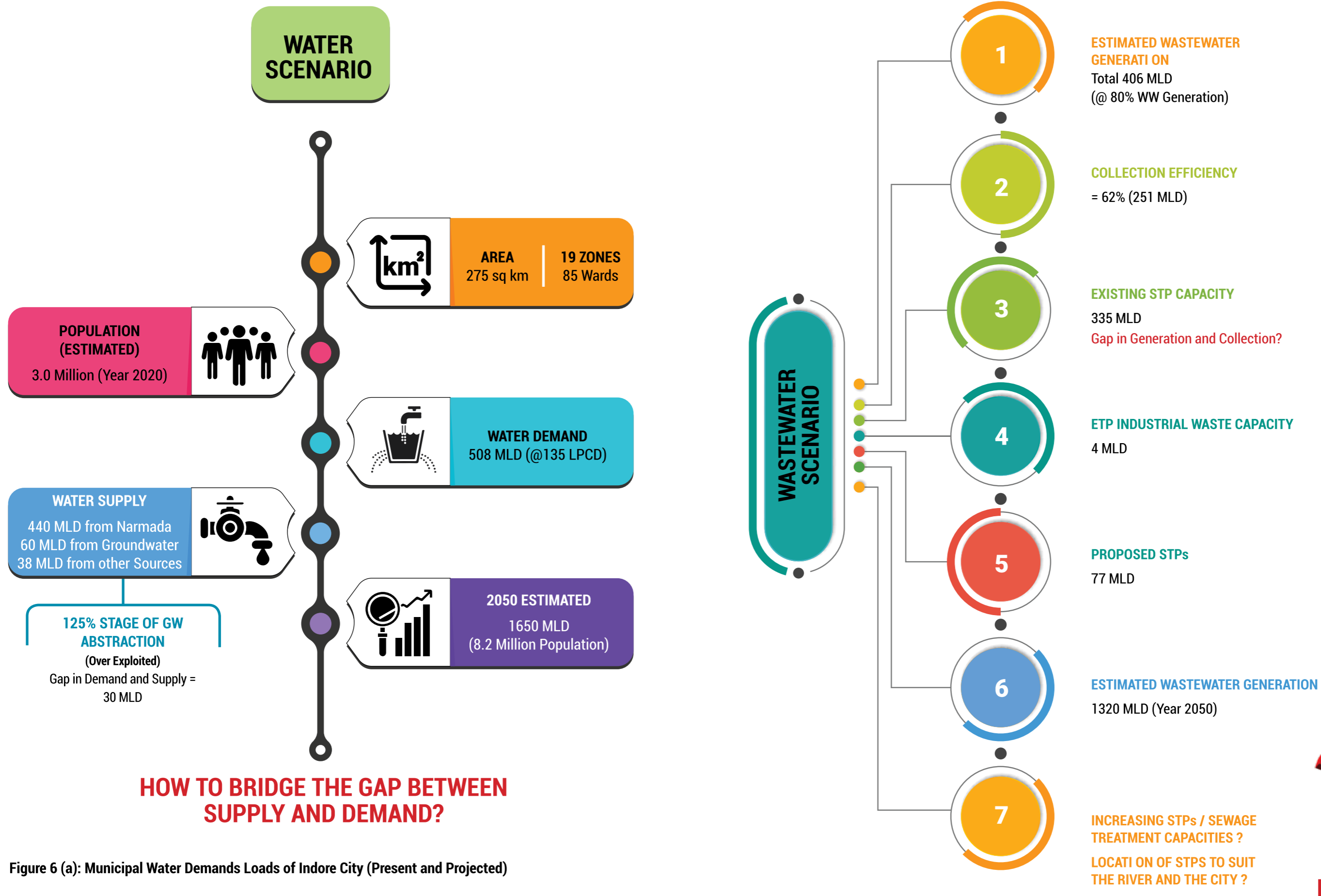


Figure 6 (a): Municipal Water Demands Loads of Indore City (Present and Projected)



RESTORATION STRATEGY FOR KANH RIVER

THE ESSENTIAL restoration strategy involving utilization of municipal wastewater to maintain flows in the river has been already described in the Concise River Restoration Manual (cGanga and NMCG, 2019), and is repeated here for completeness. The restoration measures needed comprise comprehensive action not only for the river but also for the floodplains and, in fact, the entire catchment or watershed. Thus, attention should be paid on all aspects, namely:

- **INPUT WATER QUALITY:** A Four-Stage Water Quality Improvement Cycle is proposed as shown in (Figure 7) for municipal (and, where possible, industrial, commercial and agricultural return) flow management so that the freshwater body receiving the water is not only ecologically and aesthetically satisfying, but is also a reliable source of water for human use. Thus, while

Primary (and, where possible, Secondary) Treatment of municipal sewage ensures significant removal of organic and inorganic contaminants, phyto-remediation of the ensuing wastewater in Wetlands (natural or constructed) removes further organics, nutrients, and other pollutants, thereby preventing any harm to the river while also fulfilling suitability of the river water for human needs.

- **WATER SAVING OR INCREASED WATER AVAILABILITY**
The Four-Stage Water Quality Improvement Cycle proposed above effectively results in recycling of anthropogenic water use at the local ecosystem level. The net water losses in such recycling will be only some evaporation and conveyance losses, apart from losses due to human water usage.
- **INTEGRITY OF THE RIVER SYSTEM**
The river channel and banks need



Figure 7: The Four-Layer water Treatment Cycle for Municipal Water Use and Freshwater Regeneration



Artist's conception of River Front Development at Krishna Pura, Indore

Both aquatic and terrestrial flora and fauna are essential for healthy rivers and their catchments. Natural vegetation, in particular, helps catchments in recharging groundwater and soil moisture as well as in runoff purification

complete protection from human actions such as sand mining, constructions, and other interventions. Simultaneously, the floodplains and incoming drains (and, in fact, the entire catchment or watershed) need safeguards against encroachments, structural impairments, denudations, and blockages of natural drainage paths.

● WATER RESOURCE INTEGRATION

While the primary focus is on the river as a freshwater body, water bodies seldom exist in nature in functional isolation, but are hydraulically and hydrologically linked to other water bodies in the neighbourhood. Thus

ensuring the sustenance of and connectivity with other water bodies (including groundwater) in the region is of importance.

● RIVER-RELATED INFRASTRUCTURE

Some structural interventions may be necessary to ensure the functioning of the river as a secure perennial river without obstructing terrestrial activities. Thus, for instance, weirs may be needed in river stretches with steep gradients to provide the necessary flow depths or flow velocities needed for river biota; or, embankments may be needed in regions that are susceptible to flooding during heavy

storms; or bridges may be needed to secure river crossings for human and terrestrial animals.

● RESTORING/ DEVELOPING AQUATIC AND TERRESTRIAL BIOTA

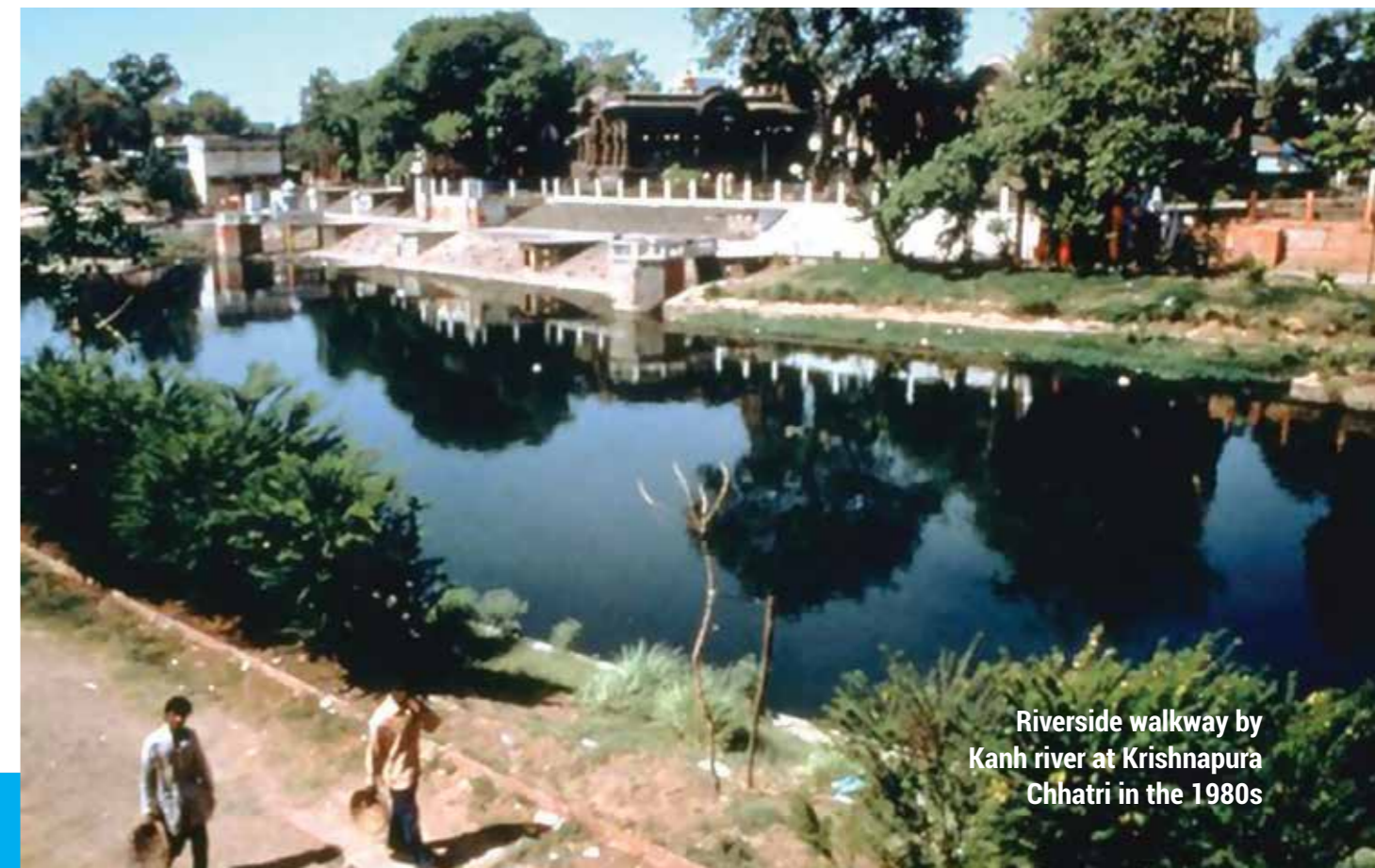
Both aquatic and terrestrial flora and fauna are essential for healthy rivers and their catchments. Natural vegetation, in particular, helps catchments in recharging groundwater and soil moisture as well as in runoff purification. Hence efforts may be desirable to generate and maintain adequate natural vegetal cover in the basin. Likewise, adequate levels of aquatic flora and fauna should be maintained in the river and water bodies by controlling over-exploitation of biotic products and seeding with suitable species where needed.

● CONTINUOUS RECORDS

A complete inventory should be

kept of all changes made and/or observed in the river and its basin (including key monitoring indicators) during the restoration-conservation period. These records will not only help assess the progress and success of the efforts, but can also help in overcoming unexpected obstacles in the progress as well as in implementing similar programmes in other river basins.

It is of importance to note that in recent years the Indore Municipal Corporation (IMC) has planned many decentralized STPs as shown in (Figure 8), which would be of advantage in transporting the STP-treated flows to nearby wetlands and rivers/ drains instead of expensive transportation to large downstream STP-treated waters towards the head-end of River Kanh. Table 2 below presents the list of small Decentralized STPs planned by IMC.



Riverside walkway by Kanh river at Krishnapura Chhatra in the 1980s

Table 2: Proposed Decentralized STPs in Indore

LOCATION	CAPACITY
Prateek Setu	8 MLD
Radhaswami Ground	6 MLD
Zoo, IMC Open Ground	35 MLD
Hukmakhedi Talab	6 MLD
Nahar Bhandara	11 MLD
Ahirkhedi	1 MLD
Bada Bangarda	3 MLD
Kanadiya	6 MLD
Arandiya	8 MLD
Shakkarkhedi	5 MLD
Talawali Chanda	1 MLD



Delivery of Kanh river caged in sewer line downstream of Ujjain during Simhastha 2016

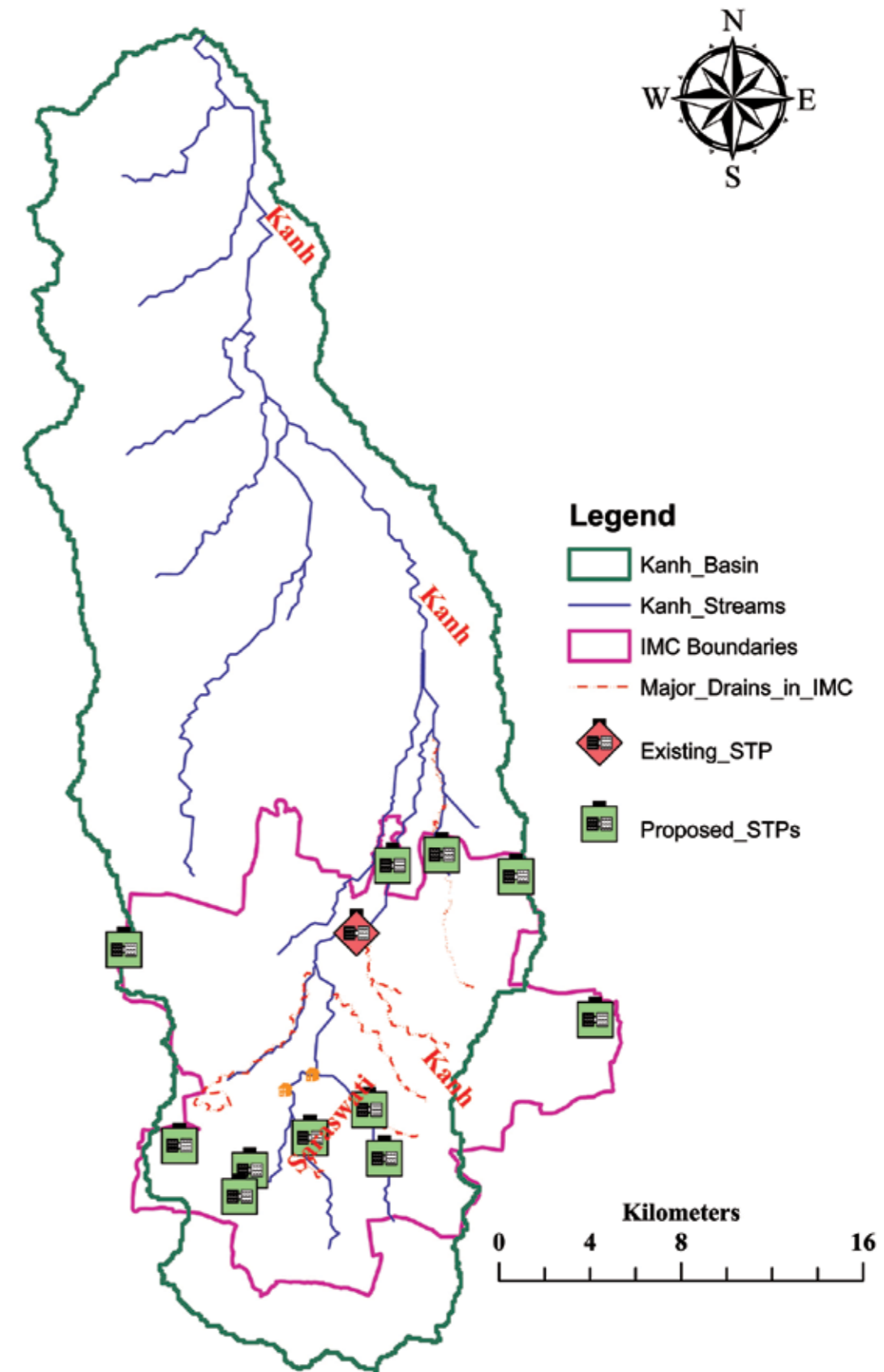


Figure 8: Location of Existing and Proposed STPs in IMC

I

RESTORATION STAGES & TARGETS

THE RESTORATION goals may not be achieved immediately in completeness. As enunciated in the Concise River Restoration

Manual (cGanga and NMCG, 2019), the restoration targets and milestones may be set out in stages as shown in **(Figure 8)**:

It may be noted that, in general, floodplains are sometimes given little importance in restoration processes. But floodplains are important in multiple ways, and they should be considered as integral to the natural river space. Hence a floodplain of 25-year to 50-year return floods should generally have natural vegetal cover and be free from constructions and

risk-prone structures, except for essential items such as River-related Infrastructure, Bathing Ghats, Water/ Wastewater Treatment Plants, Riverside Recreational and Civic Facilities, etc. In case pre-existing structures occupy the floodplains, the attempt should be to initially target a risk-free floodway of at least 5 to 10 year return floods.

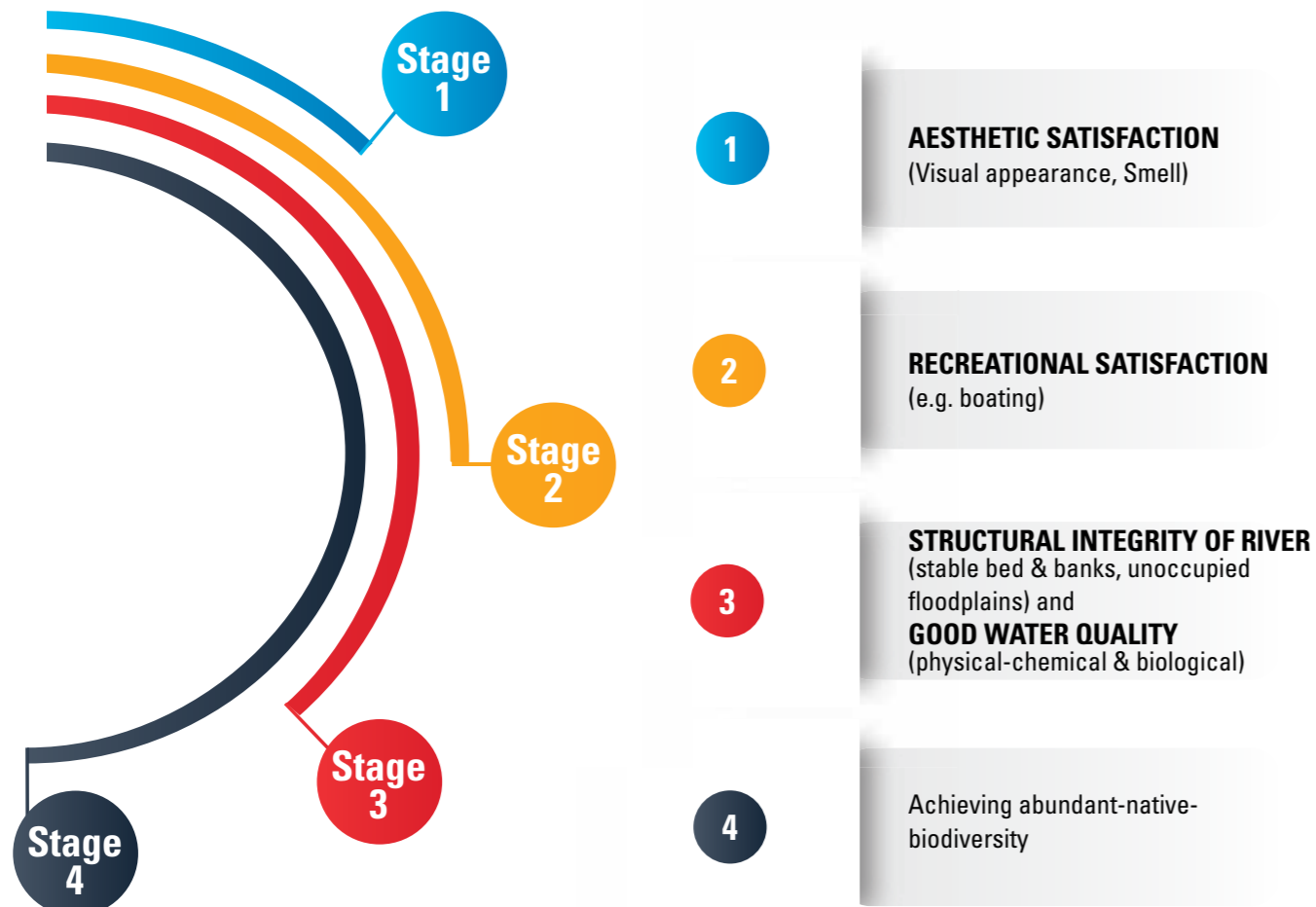


Figure 8: Restoration milestones that may be achieved in stages



Aerial view of proposed River Front Development at Krishnapura Chhatri, Indore

J GOVERNANCE

THE GOVERNANCE of River Kanh's Restoration and Conservation process must be cohesively managed by a dedicated Kanh River Basin Organization (or equivalent body). The principles to be adopted by the KRBO are as listed in the Concise River Restoration Manual (cGanga and NMCG, 2019), namely:

- KRBO as Custodian for the river – this is its main task.
- Stakeholder-based participatory representation in KRBO
- Conformity with State and Federal Laws
- Specialized and continuous knowledge updating
- Open access information bank about the river

Hence the KRBO itself should comprise largely of prominent local persons and stakeholders besides government representatives and subject experts. The role of stakeholders has been further discussed in the above manual and is not repeated here in detail. **(Figure 9)** illustrates the role of stakeholders in River Kanh's restoration, and a suggestive list of

stakeholders who may be involved in KRBO is presented.

POLITICAL STAKEHOLDERS

- Member of Parliament (MP)
- Members of Legislative Assembly (MLAs)
- Mayor
- Councillors of Wards

ACADEMICIANS & RESEARCHERS

- cGanga
- IIT Indore
- IIM Indore
- SGSITS Indore
- Others

BUREAUCRATS & TECHNOCRATS

- Ministry of Jal Shakti (NMCG, CWC, CGWB, NWM, NWDA)
- MoEF&CC (CPCB, FRI, WII)
- Ministry of Tourism
- MoHUA
- Ministry of Finance
- CPCB, MPPCB, CWC
- District Collector/District Magistrate, Commissioner (IMC), CEO (ISCDL)
- MPPCB, PHED, MPWRD
- Narmada Control Authority
- EPCO



- Agriculture Department & Agriculture Engineering Department
- Horticulture Department
- Panchayat & Rural Development Department, Others

URBAN LOCAL BODIES

- Indore Municipal Corporation (IMC)
- Indore Development Authority (IDA)
- Indore Smart City Development Ltd (ISCDL)
- Others

PUBLIC/PRIVATE

- Consultants, contractors & vendors
- Resident Welfare Association
- Market Associations/ Commercial Condominiums
- Prominent Citizens

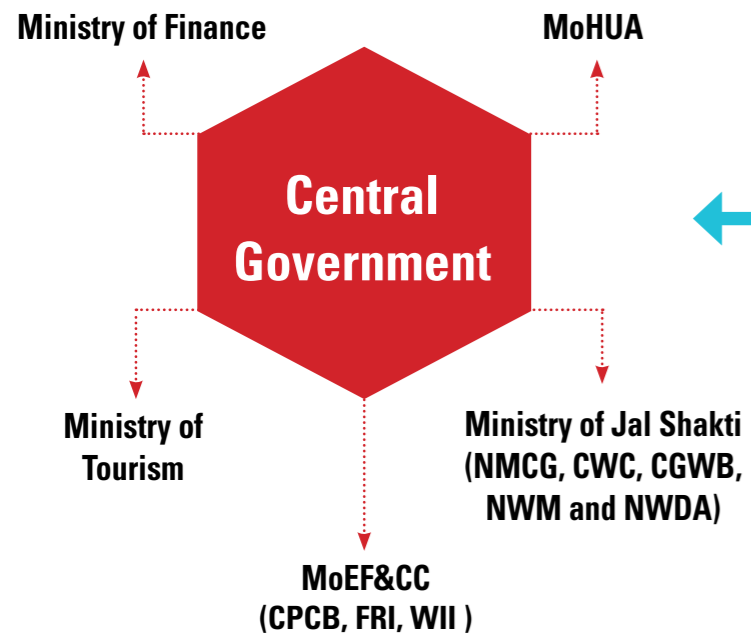
- NGOs/CSOs & activists
- News Media
- Faith leaders
- Common People

INTERNATIONAL GROUPS & BUSINESSES

The main objectives of KRBO should be as detailed in the Concise River Restoration Manual [cGanga and NMCG, 2019], namely: (i) Recovering and sustaining the health of River Kanh, (ii) Ensuring that measures are taken conforming to the local ecology and environment, (iii) Maximizing the benefits from River Kanh, and (iv) Minimizing damages or losses caused by the river. To meet these objectives consistently KRBO may develop suitable metrics to measure the progress in meeting the objectives.

IMPLEMENTATION CHALLENGE: DE-ALIGNED INTERESTS COORDINATION

THE MAJOR IMPLEMENTATION CHALLENGE OF RIVER BASIN PLANS IS THE DIVERGENCE OF INTERESTS AND OUTLOOK OF DIFFERENT ACTORS AND THE SHORT AND VARIABLE RESIDENCE TIME OF THE AGENTS OF IMPLEMENTATION. HOW CAN THIS PROBLEM BE OVERCOME? APPROACH RIVER BASIN MANAGEMENT AS AN EMBEDDED CYCLIC PROCESS



Politicians, Bureaucrats & Technocrats

Academics & Researchers

- cGanga
- IIT Indore
- IIM Indore
- SGSITS
- CEPRD
- DAVV

LEGAL



- MPWRD
- EPCO
- PHED
- Narmada Control Authority
- Agriculture Department & Agriculture-Engineering Department
- Horticulture Department
- Panchayat & Rural Development Department
- Forest Department
- Tourism Department

State Government

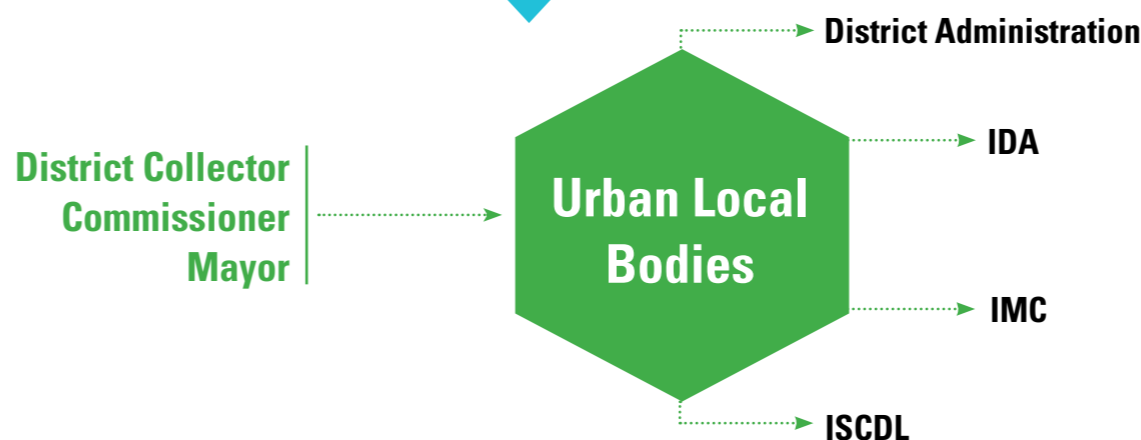
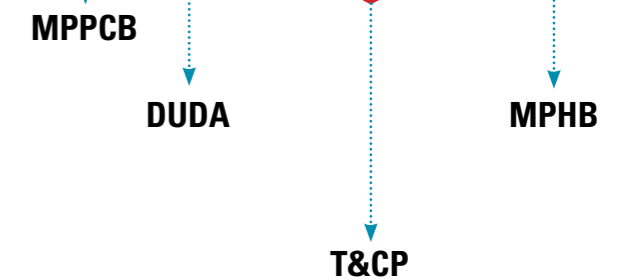
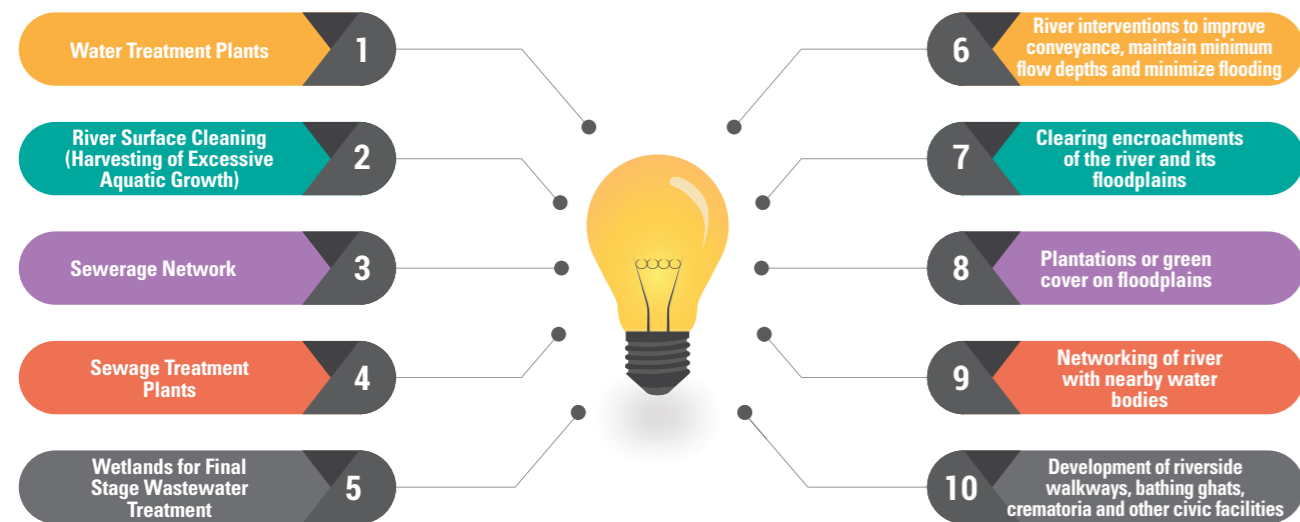


Figure 9: Stakeholders for Restoration and Conservation of Kanh River

POTENTIAL EXPENSES, BENEFITS AND REVENUES LIKELY TO BE INCURRED FOR KANH RIVER'S RESTORATION AND CONSERVATION



THERE ARE SEVERAL HEADS OF EXPENDITURE LIKELY TO BE INCURRED FOR THE RESTORATION PROJECT. THE EXACT EXPENSES CAN ONLY BE ESTIMATED AFTER FINALISATION OF THE PROJECT DETAILS, BUT THE MAJOR ITEMS THAT CAN BE ENVISAGED AT THE OUTSET ARE LISTED BELOW:

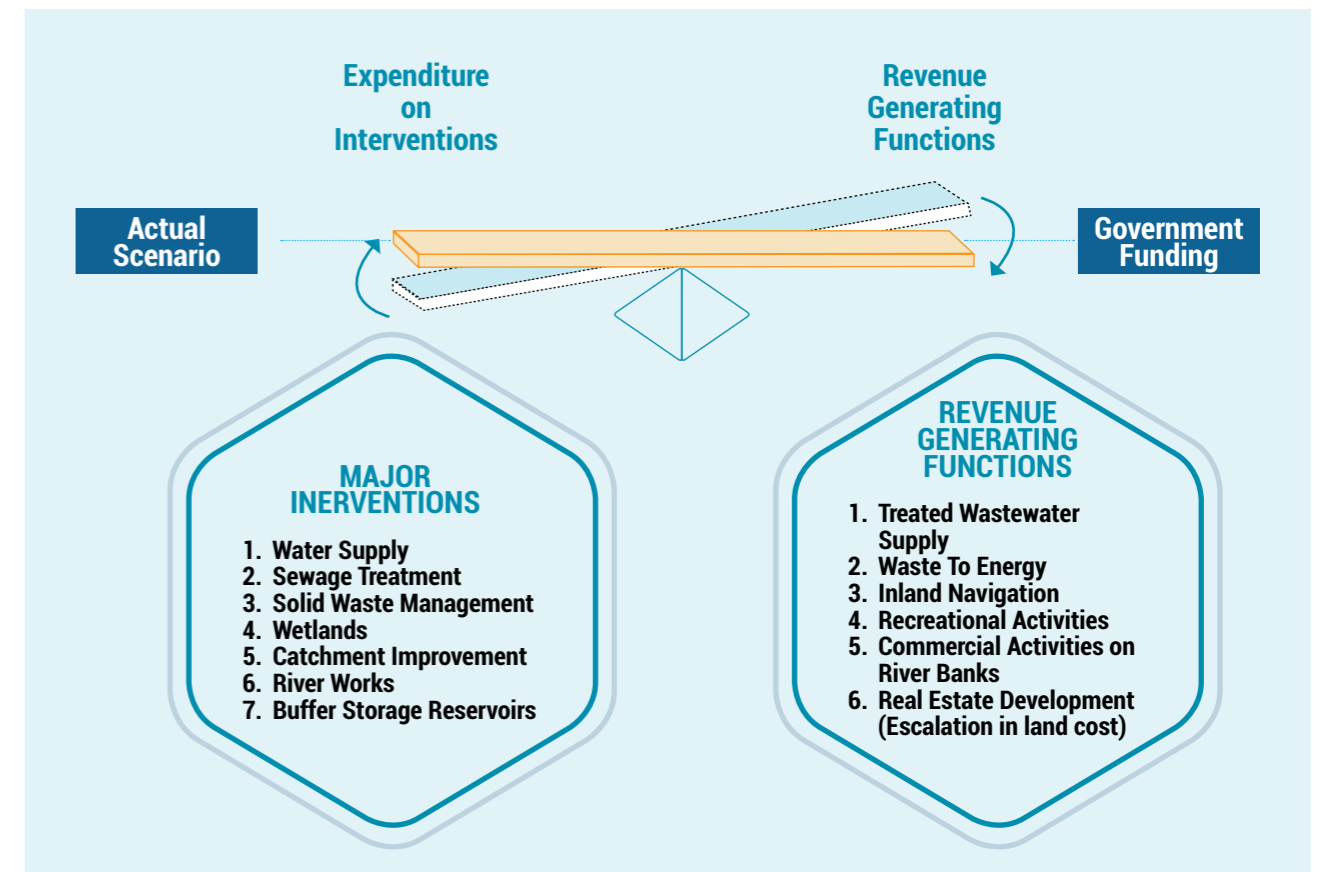


THE CITY of Indore has many public attributes such as green open spaces and water bodies that are aesthetically, culturally and spiritually vital for urban life. But the rapid growth of Indore has also resulted in increased built-up areas that squeeze the available public spaces and vital ecological niches. These issues can be significantly redressed - economically, culturally and ecologically - by the restoration of Kanh River. The foreseeable benefits of reviving

River Kanh and other water bodies proposed herein are summarized in Table 3. The actual benefits likely to accrue will depend on the detailed project plan. Taking into account all these benefits along with increased municipal water availability, the scheme proposed herein can be expected to be an all-round success. It should be noted that the increased water availability itself can result in considerable saving in transporting water from the distant Narmada river.

Table 3: Potential Benefits of Kanh River Restoration

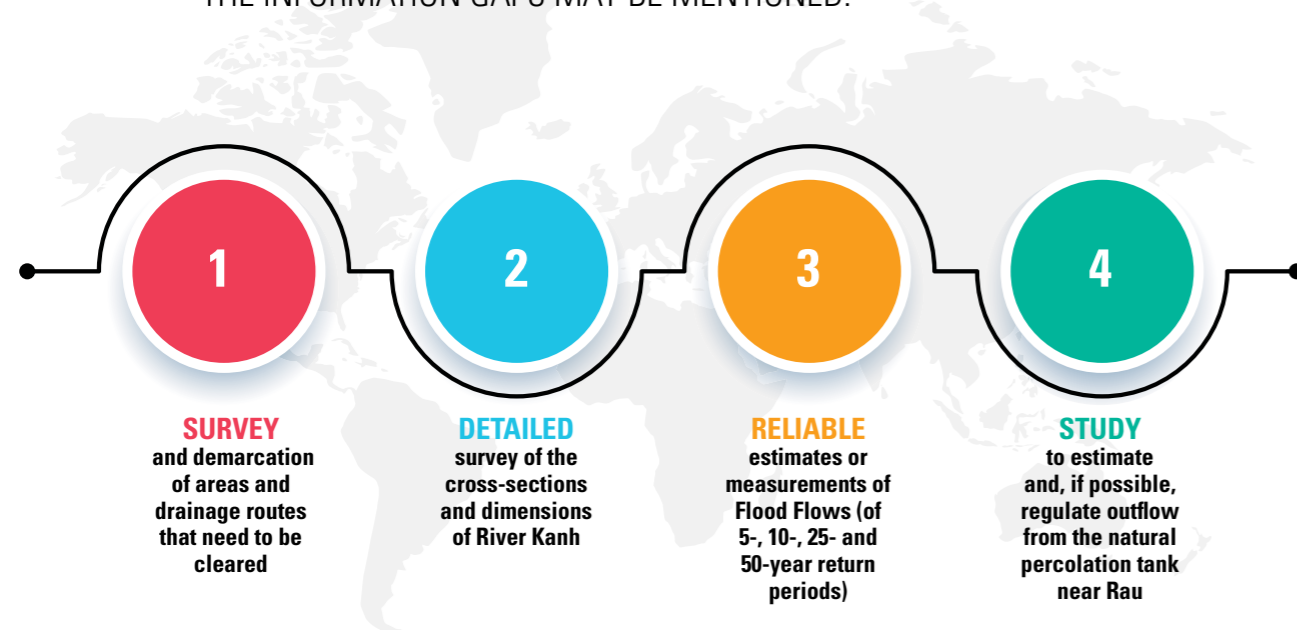
SR NO.	BENEFIT
1	Increased and Better Quality Freshwater Availability
2	Fuel, organic fertilizers, and other value-added products from harvested wetland biomass.
3	Readily available recreational activities like boating, fishing, and birding.
4	Navigation and Waterway Transport,
5	Modern recreational activities like Open Gyms, Bicycle-riding zones, Sports activity zones, Kids play-zones, Water sports zones, Water jet landings/ports, Amphitheatres, Art Installations, etc.
6	Bee keeping; Flower farming; Fisheries and Commercial Fishing
7	Agriculture/Region specific commercial farming
8	Pop-up plazas; Shopping Malls, Commercial establishments
9	Jal Vidhya Mandir, Crematoria Usage



L

KNOWLEDGE AND INFORMATION GAPS

THERE ARE EVIDENTLY MANY GREY AREAS WHICH CAN ONLY BE CLEARED UP AFTER PROJECT FORMULATION AND STUDIES. A FEW SUCH TASKS TO CLOSE THE INFORMATION GAPS MAY BE MENTIONED:



MONITORING, FEEDBACK, EVALUATION & COURSE CORRECTION

M

RIVERS ARE among the most complex ecosystems of nature, and in spite of the best efforts there may be

temporary setbacks due to inadequate understanding of a specific river's characteristics. Moreover, both the restoration

plans and their implementation may also have unnoticed flaws that can cause such setbacks. Hence a system of rigorous monitoring, feedback, performance evaluation and course correction (if needed) is essential. The basic tasks to be carried out here are as follows [cGanga and NMCG, 2019]:

- Monitoring of STPs, Wetlands & Drains by Specialized Agencies
- Performance Feedback from Stakeholders
- Performance Evaluation by Experts
- Overall Evaluation by RBO
- Corrective Measures for future to be appropriately devised by RBO

N

CONCLUSION

THE KANH River of Indore is not a very large river, but it is an important river for the Ganga River and a famous and prominent river of Madhya Pradesh. Holistic restoration of River Kanh with Indore city's municipal wastewater treated in STPs and followed by wetland phytoremediation will provide all-round benefits for anthropogenic and ecological needs of the region and become a trend-setter in India. It is, therefore, hoped that stakeholders of the Kanh river basin will actively involve themselves in this sunrise venture.

REFERENCES

cGANGA AND NMCG (2019), "River Restoration and Conservation: A Concise Manual and Guide."
 IMC (2017), "Detailed Project Report on Indore Water Supply - Vol I"
 IMC (2017), "Detailed Project Report on Indore Sewerage System - Vol I"
 CGWB (2013), "District Ground Water Information Booklet for Indore District"



Iconic Heritages of Indore in the proximity of River Kanh

