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Azadi Ka Amrit Mahotsav

7th India Water Impact Summit 2022

Valuing Water | Transforming Ganga

15-17, December 2022 | Dr Ambedkar International Centre, New Delhi

Restoration and Conservation of Small Rivers in a Large Basin

"Mapping and Convergence of 5Ps"
(People, Policies, Plans, Programmes & Projects)

बड़े बेसिन में छोटी नदियों की बहाली और संरक्षण:

"5P का मानचित्रण और अभिसरण"
(लोग, नीतियां, योजनाएं, कार्यक्रम एवं परियोजनाएं)

Lead Organisers

cGanga
Centre for Ganga River Basin Management and Studies
Indian Institute of Technology Kanpur

सत्यमेव जयते
NITI Aayog
National Institution for Transforming India

NMCG
National Mission for Clean Ganga
Ministry of Jal Shakti, Government of India

ABOUT THE ORGANISERS

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NITI Aayog

National Institution For Transforming India

The NITI Aayog serves as the apex public policy think tank of the Government of India, and the nodal agency tasked with catalyzing economic development, and fostering cooperative federalism through the involvement of State Governments of India in the economic policy-making process using a bottom-up approach.

www.niti.gov.in

NMCG
National Mission for Clean Ganga
Ministry of Jal Shakti, Government of India

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 Rejuvenation, Protection and Management of River Ganga (referred to as National Ganga Council).

www.nmcg.in

cGanga
CENTRE FOR GANGA RIVER BASIN MANAGEMENT AND STUDIES
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cGanga is a think tank and a center of excellence 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 center 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 and innovations as well as novel policy, governance and financial solutions for the water sector in India.

www.cganga.org

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"5P का मानचित्रण और अभिसरण"

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GLIMPSES OF IWIS 2012-2021

1st IWIS 2012: Water Innovation in India.

2nd IWIS 2017: Exploring Potential of Stipulations Made in Ganga River Basin Management Plan - 2015.

3rd IWIS 2018: Showcasing and Enhancing Impact of National and International Efforts on Ganga River Restoration and Conservation.

4th IWIS 2019: Realizing Vision Ganga Through Jal Jeevan Mission.

5th IWIS 2020: Comprehensive Analysis and Holistic Management of Local Rivers and Waterbodies: Arth Ganga: River Conservation Synchronized Development.

6th IWIS 2021: River Resources Allocation: Planning and Management at the Regional Level.

सत्यमेव जयते

जल शक्ति मंत्री
भारत सरकार

Minister for Jal Shakti
Government of India

MESSAGE

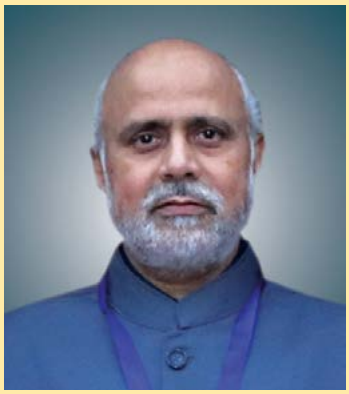
The 7th IWIS (India Water Impact Summit 2022), being organized jointly by the National Mission for Clean Ganga (NMCG) and the Centre for Ganga River Basin Management and Studies (cGanga) in New Delhi on the theme of *Restoration and Conservation of Small Rivers in a Large Basin "Mapping and Convergence of 5Ps" (People, Policies, Plans, Programmes & Projects)*", where many national and international experts, stakeholders and investors will deliberate upon river conservation, is immensely welcome. Our country faces many unsolved problems, but we have the ability to turn adversity into opportunity and avoid the pitfalls of other nations in managing our rivers and aquatic systems. A persistent problem in India in recent decades is that of water shortages (droughts) and water surpluses (floods) occurring periodically in various parts of the country that have affected our progress. Added to this problem are high levels of pollution and shrinking of our rivers and water bodies, which have limited the access of many ordinary Indians to clean water. Our irrigation, municipal and industrial water needs have also grown, calling for extra challenges to meet them. Our government has been successfully carrying out the *Swachh Bharat* Programme to ensure a healthier and Open-Defecation Free (ODF) India in mission mode. We have also launched the ambitious programme of providing universal piped water supply to all rural households by the year 2024 under the *Har Ghar Jal* programme and the *Jal Jeevan Mission* to preserve and augment our freshwater sources. All these missions, essential for securing our well being and future and making our country *Atmanirbhar*, are closely linked with our many large and small rivers which make the present IWIS especially relevant.

I am pleased to note that the 7th IWIS will not only focus on the *Convergence of People, Policies, Plans, Programmes and Projects*, but also present emerging technologies, enable greater interaction between investors and stakeholders in water recycling and sludge management, and promote international cooperation with India for water and river management. I wish the organizers of IWIS-2022 every success in this venture, and hope that it strengthens our developmental programmes with valuable inputs emerging from the Summit.

07 December 2022

Gajendra Singh Shekhawat

PREFACE



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On behalf of the Centre for Ganga River Basin Management and Studies (cGanga) led by IIT Kanpur, National Mission for Clean Ganga (NMCG), Ministry of Jal Shakti, and the NITI Aayog, we warmly welcome all participants from India and abroad to the 7th India Water Impact Summit (IWIS-2022). The *Namami Gange* programme, being implemented by NMCG, is an integrated mission for the restoration and conservation of River Ganga and its tributaries. Towards this goal, a strategic comprehensive Ganga River Basin Management Plan (GRBMP-2015) was developed by a consortium of 7 IITs, which is being further evolved by cGanga led by IIT Kanpur. cGanga acts in the capacity of a comprehensive think-tank to NMCG in its stated goals and objectives vis-à-vis the Ganga River Basin. Namami Gange aims to restore the wholesomeness of the river by ensuring Aviral Dhara and Nirmal Dhara, and maintaining its geomorphological and ecological integrity. Integrated River Basin Management (IRBM) approach is followed in *Namami Gange* with multi-sectoral and multi-agency interventions such as: (i) for pollution abatement (*Nirmal Ganga*), (ii) for improving river flows (*Aviral Ganga*) and ecology, (iii) to strengthen people's river connect (*Jan Ganga*), and (iv) to facilitate diversified research, scientific mapping, and evidence-based policy formulation (*Gyan Ganga*).

India Water Impact Summit, which was started as a one-time event a decade ago, has now become an annual event organized jointly by NMCG and cGanga. In the 7th Edition of IWIS, we are delighted that NITI Aayog has extended its support in organizing the event. At the outset, a brief overview of the past six Summits is outlined here to throw light on the theme of the present IWIS. The first Summit, held in 2012 during the preparation of the Ganga River Basin Management Plan (GRBMP) by the IIT Consortium, was an aggregate of the then prevailing activities on India's water resource management. The 2nd Summit, held in 2017, attempted to establish a new multi-disciplinary, multi-stakeholder forum to bring together policy makers at national and regional levels, technology and engineering firms, finance and investment specialists, and interested civil society members to brainstorm on pressing issues of India's water environment. The 3rd Summit, held in 2018, reviewed the manifold efforts undertaken by government agencies to meet Namami Gange's goals of rejuvenation and conservation of India's National River Ganga, especially in the most critical Ganga Basin States – Bihar, Delhi, Uttarakhand, Uttar Pradesh, and

The convergence of five P's, namely, People, Policies, Plans, Programmes and Projects, may be considered crucial to address the issue of divergent impacts of different activities carried out by different agencies in the "Samarth Ganga" framework to achieve Sustainable Development Goals (SDGs)

West Bengal. The 4th IWIS in 2019 went further to explore ways and means of integrating science and policy for Integrated Water Resource Management, to assess and prepare for major water impacts in urban and rural areas of India, and developing new and innovative financing mechanisms through the Water Finance Forum initiated in IWIS-2017. The ideas and suggestions that emerged from these four Summits led us to seek comprehensive means to integrate river conservation into India's developmental path in the 5th IWIS (IWIS-2020) from the perspective of *Arth Ganga*, an ancient Indian concept. IWIS-2020 also intensified efforts to financially strengthen water management and river conservation in India through synergy between planners, executors, financiers, investors and regulatory bodies.

A more focused assessment was attempted in IWIS-2021 to evaluate the different types of river resources, their usefulness for ecosystem services for human benefit, and the adverse effects of over-extraction and misuse of these resources on the ecosystem services. This exploration was aimed to help chalk out feasible pathways for sustainable river resource planning and management over the long term to meet the concerns of diverse stakeholders and to aid planners, policymakers and financiers.

In the backdrop of the afore-mentioned six Summits, it has become apparent to attempt to resolve the issue of divergent impacts of different activities carried out by different agencies and governments for developmental or social purposes. The convergence of five P's, namely, People, Policies, Plans, Programmes and Projects, may be considered crucial for this purpose in the "Samarth Ganga" framework to achieve Sustainable Development Goals (SDGs). Thus, the thrust of deliberations in the Seventh Edition of India Water Impact Summit (7th IWIS) is to understand, elaborate, delineate potential causes of divergence, and formulate strategies for convergence through collation of views expressed in the Summit. In this context, while many aspects of river management are at play, a select few that are key to initiate and assess the success of river restoration programmes are scheduled to be covered in IWIS-2022, viz.: (i) Setting the goal to determine health status of rivers. (ii) Establishing norms for bio-physical status of rivers, determining the present condition in different stretches starting from origin to destination. (iii) Formulation and execution of river monitoring programmes. and (iv) information/ data collation, utilisation and dissemination strategy.

The plenary sessions of IWIS-2022, to be addressed by eminent national

The Summit
will deliberate on Restoration and Conservation of Small Rivers in a Large Basin with focus on select aspects of "Mapping and Convergence of 5P's"

and international representatives, are aimed to elucidate both the overarching problems and the successful pathways in river management. The three main issues to be covered in these sessions will therefore address the key themes, namely, (i) Restoration and Conservation of Small Rivers in a Large Basin – Mapping and Convergence of 5P's (People, Policies, Plans, Programmes & Projects); (ii) Lessons from Various River Related Programmes; and (iii) Bottlenecks and Course Correction – Lessons from Various River Related Programmes. These plenary talks are expected to provide useful guidelines in all future river-related activities in the country.

As in past Summits, the present Summit will cover the overall scientific, technological and policy issues in Track A. The first session of this track is designed to help formulate clear and definable goals for the health status of rivers, without which neither the state of a river nor the impact of river-related activities and restoration efforts can be properly evaluated. The second session of Track A will deliberate on the need for and the means to establish the health status of different stretches of rivers and setting milestones to mark their improvements. This setting of standards will naturally be useful to evaluate the progress of river restoration efforts over time. Hence, comprehensive river monitoring programmes will be needed to scientifically evaluate river health status. Foolproof formulation of such river monitoring programmes will therefore need to be discussed and chalked out in the third session of Track A. It may be noted that both evaluation of river health and the efficacy of river restoration and conservation activities may often depend not only on one's own data collection, but also on data from secondary sources. Hence the need for collation, utilization and dissemination of river-related data to make them truly useful for various river-related purposes will be considered in the fourth session of Track A.

Financial resources are essential for sustained efforts in river management. Track B of IWIS-2022 will explore the economics and ways and means of financing the comprehensive management of sludge from wastewater treatment plants, and the water recycling and trading market in India.

New technologies and applications being developed worldwide have the potential to significantly improve India's river and water management scenario. Track C, running in parallel with the other two tracks, will introduce various new, innovative solutions to India's water and wastewater management needs. Two special sessions in Track E, namely Session E1 – Decentralised Waste-water Management for Sustainability of Sewerage Assets, and Session E2 – Impact of Land use on Rejuvenation of Small Rivers in Track E related to implementation issues are additional features of the 7th edition of IWIS.

Finally, we wish to thank our strategic partners, panelists, speakers, staff and volunteers who have had full faith in our objectives and ability, and have worked hard to make this Summit a success. We hope that you find IWIS-2022 to be as constructive and exciting as the previous six Summits. We look forward to your valued participation.

7TH INDIA WATER IMPACT SUMMIT 2022

Restoration and Conservation of Small Rivers in a Large Basin

"Mapping and Convergence of 5Ps"

(People, Policies, Plans, Programmes & Projects)

In the Fifth Edition of India Water Impact Summit (IWIS) held in December 2020 the focus was on understanding the meaning, concept and nuances of the "Arth Ganga" proposition made by the Hon'ble Prime Minister in the First Ganga Council meeting held in December 2018 in Kanpur. "Arth Ganga", a Sanskrit word implies "meaning or spirit of rivers" as well as relates to "economics of rivers". The word "Ganga" is referred in the larger context of all rivers, and not just limited to the bio-physical entity ordinarily known as river Ganga; as the holy river symbolizes the culture of rivers not only in India but also world over, particularly in the Indian region. The deliberations clearly revealed that development and river restoration and conservation are to be seen as two faces of a coin in the spirit of "Arth Ganga".

Assessment of river resources and preserving the requisite portion for rivers to be able to perform many of their crucial processes and functions, referred as "Samarth Ganga", are prerequisites for conservation of rivers. Allocation of remaining river resources for various developmental/anthropocentric needs is to be done judiciously. These aspects were deliberated in detail in the Sixth Edition of IWIS held during December 2021. Deriving from this and extending the propositions made in the strategic Ganga River Basin Management Plan (GRBMP) released in 2015 by the Consortium of IITs (IITC), team cGanga (Centre for Ganga River Basin Management and Studies led by IIT Kanpur) subsequently developed the framework for "Samarth Ganga" meaning Able Rivers.

Samarth Ganga

Framework for a River to Perform Its Processes and Functions

1.0 Samarth Ganga – What, Why & How?

King Bhagirath's determined efforts for the salvation of his ancestors led to the mighty Ganga's descent on earth – so it is believed. But the once formidable River Ganga's ability

Five main pillars for Samarth Ganga are: (1) Nirmal Ganga (i.e. Unpolluted Ganga), (2) Aviral Ganga (i.e. Continuously Flowing Ganga), (3) Ganga-Gyan (i.e. Ganga Knowledge), (4) Jan-Ganga (i.e. People-Connected Ganga), and (5) Arth-Ganga (i.e. Value Ganga)

to perform its many valuable tasks in the basin has declined significantly in recent times due to a host of manmade reasons. Scientifically judged, the changes in the river have affected its flow capacity – whether of water or of silt/ sediments, the availability of essential elements and other conditions needed by riverine organisms, and its ability to absorb the surging volumes of water during heavy monsoon rains. Such deficiencies are, in fact, common for most rivers of our country.

For sustainable use and conservation of river resources, it must be understood that rivers need to be restored close to their original or pristine conditions, because river processes and functions occur naturally in and by the river in an able river. Today, it is not only in India but in the whole world that most rivers have become dependent on public attitudes and governments for their existence, whether it be for carrying out conservation works or for allocating financial resources for such works. But, if a river becomes able, then it can make many needed functional adjustments and improvements on its own, and funds can be used for various works needed to maintain sustainability of the basin. Hence, both from cultural and scientific points of view, definite measures should be taken to ensure that rivers can maintain their abilities.

We may consider five main pillars (refer Figure 1) to be needed for Samarth Ganga. As shown in the following picture, these pillars are: (1) Nirmal Ganga (i.e. Unpolluted Ganga), (2) Aviral Ganga (i.e. Continuously Flowing Ganga), (3) Ganga-Gyan (i.e. Ganga Knowledge), (4) Jan-Ganga (i.e. People-Connected Ganga), and (5) Arth-Ganga (i.e. Value Ganga). To make Ganga "Samarth", while it is necessary to make it unpolluted and continuously flowing, it is equally necessary to make people aware of both ancient knowledge and the latest science related to Ganga and other rivers. Because, to impart ability to Ganga to reinvigorate her, it is not only the government and the administration, but common citizens too must strive to achieve and sustain Ganga's ability. Here an attempt is made to explain Samarth Ganga (Able Ganga) and its fifth important pillar, Arth-Ganga (Value-Ganga). Once Ganga becomes able, Ganga will also be capable of raising funds from its own river and basin resources, which together with people's participation, can sustain it indefinitely.

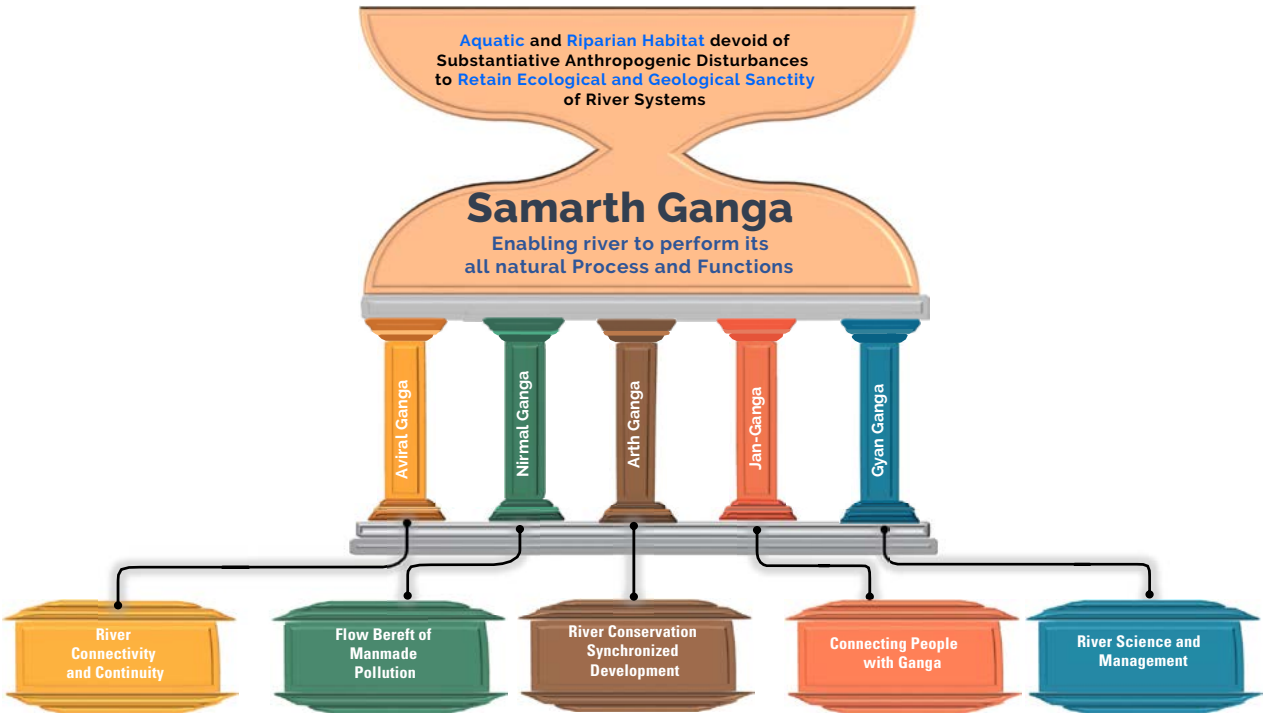


Figure 1: Framework for a River to Perform its Processes and Functions – "Samarth Ganga"

2.0 "Arth Ganga" – The Central Pillar

The degradation of River Ganga, symbol of purity in people's minds since ancient times, have greatly influenced the nation's perception. This negative impact, and the wish to see River Ganga unpolluted and uninterrupted once again, was the backdrop of the strategic Ganga River Basin Management Plan – 2015 (GRBMP) prepared by the Consortium of seven premier technical institutes of India, IITs (cGanga and NMCG, 2015).

Ancient traditional knowledge provides valuable insights and useful support to the deliberations that go into a scientific approach to Ganga River Restoration and Conservation. The conservation imperative is viewed in terms of the present-day need to revive the river to enable healthy progress of the nation. In other words, the development of the nation is implicit in the GRBMP, viewed as sustainable development. Or development that benefits both the nation (or society) and its ecosystems in the long run. This sense of sustainable development is also implicit in the notion of "Arth Ganga" voiced by our Prime Minister, Shri Narendra Modi, in the National Ganga Council meeting held in December 2019. It is worthwhile, therefore, to explore ways and means to develop and apply the concept of Arth Ganga in the context of "development with river conservation".

2.1 Arth Ganga – The Concept

Arth Ganga signifies the overall valuation of a river, that is the river's tangible values – physical or economic (goods such as water, sediment, nutrients, biodiversity, etc., and services such as flood drainage, navigation, etc.) and intangible values (unquantifiable benefits such as aesthetic, mystical, spiritual, and other timeless qualities). These tangible and intangible values together comprise the absolute value of the river – which reveals the true meaning of Arth Ganga. Among the above two types of values, only tangible values can be quantified in terms of human use or economics. It may be noted, however, that in their totality the tangible values are also a reflection of the intangible values; Any healthy river can have the highest levels of both tangible and intangible values, whereas when a river deteriorates both these values drop significantly. Thus, the tangible and intangible values are significantly related, and their maximum values cannot be achieved without river conservation.

The focus of deliberations on Arth Ganga in the 5th India Water Impact Summit (IWIS-2020) held in December 2020 was on tangible, economically quantifiable values of waterbodies of the Ganga Basin and other river basins. Additionally, emphasis was on discussing and understanding the implementation aspects of the concept of Arth Ganga and communicate that understanding to all concerned.

To understand the importance of rivers and waterbodies in the above perspective some immediate questions naturally arise, viz.:

1. Is there any established method of economic valuation of goods and services (tangible value) received from all rivers and waterbodies in the River Basin area? If not, then how can this task be completed in a precise and scientific manner?
2. (a) How can the intangible values of rivers be estimated? Can this be done by taking advantage of the knowledge, wisdom and dialogue with masses of eminent artists (such as painters, writers and poets, playwrights, stage artists and movies), religious Gurus (teachers), and social elders and dignitaries?
   (b) How can the share of intangible values be included in the evaluation of rivers and river conservation?

2.2 River Conservation and Development

Anthropogenic activities in the Ganga River Basin – as well as other River Basins of India – have been changing gradually ever since industrialization began, and the changes have both accelerated and multiplied with India's rapid development. These changes have often had significant adverse effects on rivers and waterbodies, which vary in different parts of the basin depending on their biophysical environment and the nature of the activities carried out. The need to conserve our rivers and waterbodies is, therefore, essential both to sustain the pace of development and to maintain healthy river functioning to ensure their benefits stably over the long term. Thus, it is imperative that river conservation and development need to be seen as two faces of a coin, which is aptly and simply communicated by the phrase "Arth Ganga" as depicted in Figure 2.

Figure 2: River Conservation and Development as Two Faces a Coin

2.3 Arth Ganga and Sustainable River Conservation

There is an in-principal consensus on the need to conserve rivers. In such circumstances, the human and economic resources needed to conserve rivers must come from different sections of society. Evidently, unlimited resources cannot be spent unless comparable gains are achieved from river conservation. In other words, the value addition to society and the nation from investments in river conservation (in terms of economic gains) alone can make river conservation works sustainable and long-term. The practical meaning of Arth Ganga can be understood from this fact.

3.0 Arth-Ganga: Application of the concept

3.1 Important Developmental Activities

Rapid urbanization and human habitat development, hydropower projects, agriculture (including irrigation), engineering measures for flood control, tourism, and commercial river navigation are some of the modern human activities that affect river systems most. Due to non-integration of river conservation with these activities, the potential tangible and intangible values of the river systems have reduced. Most of these activities have not necessarily been evaluated in terms of their effects on rivers or river conservation, and therefore the extent of their impacts on rivers and waterbodies is uncertain (except for the impact of industrial pollution on waterbodies where some studies and estimates have been made). Keeping this in mind, the 5th India Water Impact Summit (IWIS-2020) was focused on synchronising these developmental activities with river conservation as depicted in Figure 3. Following the discussions in the Summit, the special issues which need to be resolved are as follows:

1. Identifying important development sectors in a river basin that are closely linked to river conservation and river values.
2. Identifying alternative developmental options for each of these sectors.
3. Identifying the linkages of developmental options with river conservation.
4. Identifying potential bottlenecks in adopting alternative developmental options in sync with river conservation.

3.2 Goods and Services from Rivers

Many goods and services for human needs are available from healthy rivers such as water for domestic, institutional, and industrial use, water and nutrients for agriculture, sand for construction, fish and other biotic products,

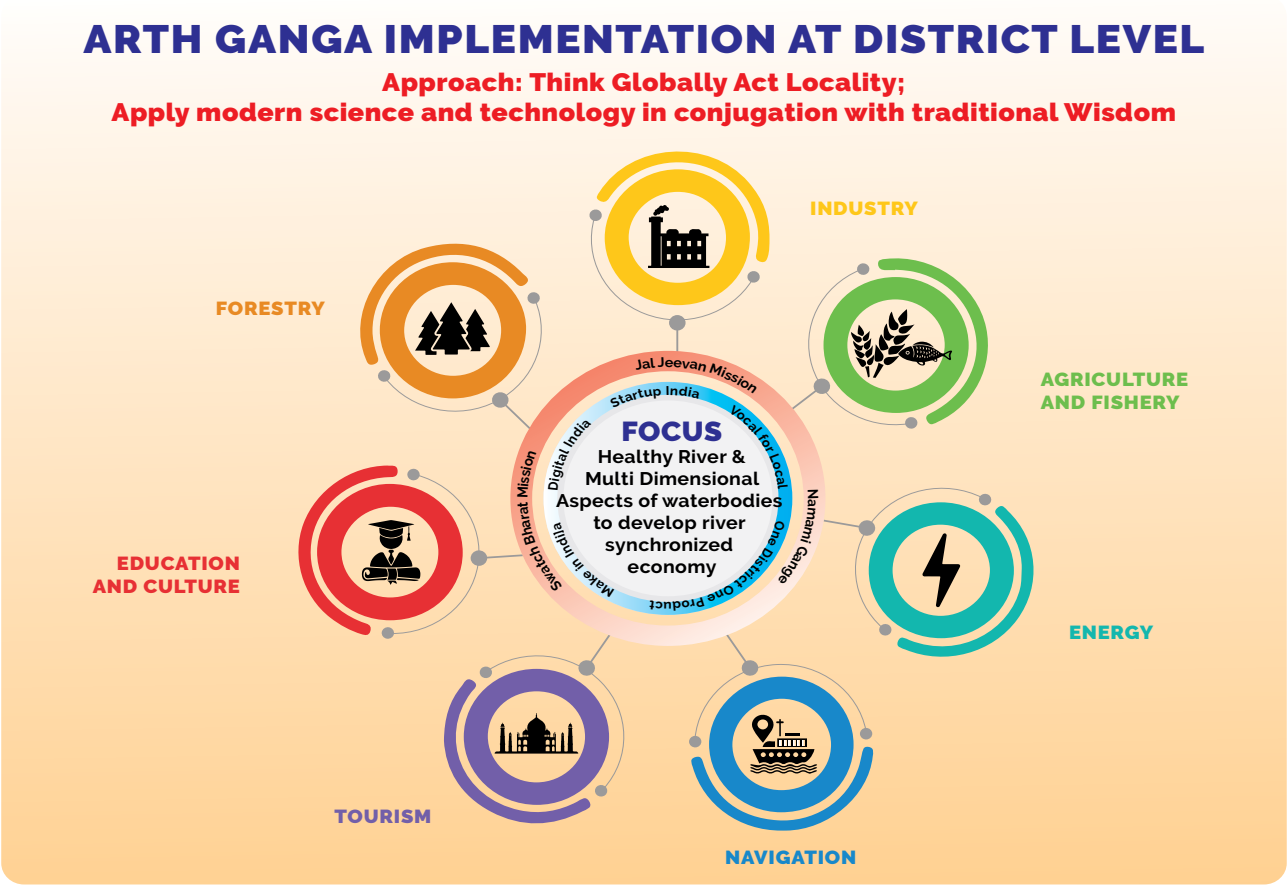


Figure 3: Arth Ganga Concept Realization from the Development Potential Inherent in Healthy River System through Implementation Across the Geographical Scale of District Administrative Boundaries

navigation and transport, tourism, recreation, hydropower, drainage of flood waters from basin, groundwater recharge, aquatic, amphibian and avian biodiversity, rejuvenation of floodplains by periodic flooding, water purification, and waste removal. The economic value of such goods and services of rivers needs to be quantified to make a judicious choice of developmental options. While economic valuation of these goods and services of river ecosystems is essential, until such valuation is done, provisional measures or qualitative assessment of their improvements/ depreciations need to be carried out from time to time to assess the overall progress in river conservation in keeping with the goal of Arth Ganga.

3.3 Whole River System

Due to intense developmental activities in their catchments, many small rivers and waterbodies of the River system have degraded or undergone very negative changes. These small rivers, in turn, have affected the larger rivers into which they flow, setting off a cascading effect for the entire river system. Hence, Arth Ganga's River conservation objective can only be achieved by a bottom-up approach of reviving and conserving small rivers and not vice versa of directly conserving the main-stem river. The conservation of small rivers and associated waterbodies will make it easier to conserve the main stem of the river. Integration of river conservation and development should therefore be coordinated at various geographical and administrative levels to conserve the entire river system. Various elements of developmental activities that need to be included in river conservation are schematically illustrated in river and water centric economic development framework presented in Figure 4.

4.0 Water Management Framework

The term "Arth" in the concept of Arth-Ganga refers to the total (tangible and intangible) value of goods and services obtained from rivers, and Ganga represents all rivers. Now, in the context of river conservation, it is necessary

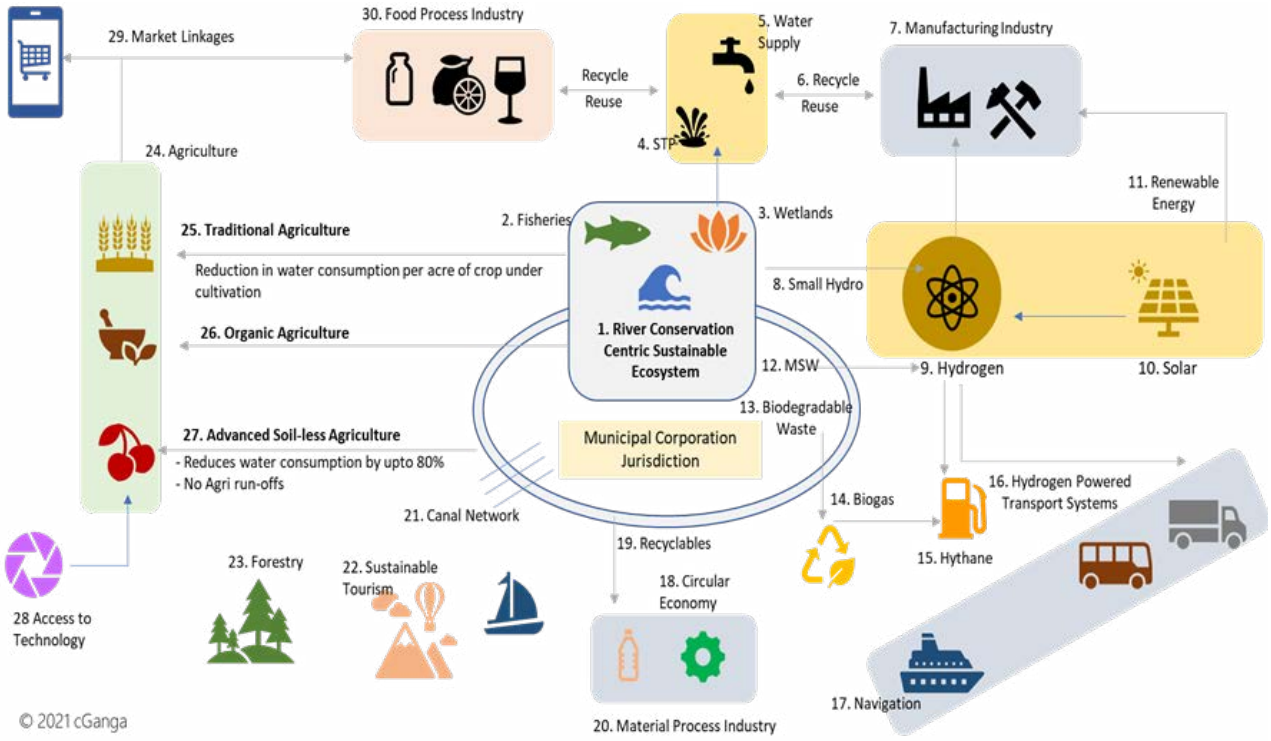


Figure 4: River and Water Centric Economic Development Framework

to identify all water resources in the basin area that have an impact on the river directly or indirectly. To understand river conservation comprehensively, it is necessary to consider water movement across the boundary by means of which water flows in or out of a given area. If river restoration and conservation works are planned only within administrative boundaries, then water flows need to be considered across the administrative boundaries, which may not match with river basin boundaries. Instead, an administrative boundary may be only part of a large river basin, or it may be the combined watershed areas of more than one small river.

Through the complete accounting of water within the administrative limits, information about its various uses can be compiled, which will help in making reliable estimates of the actual availability and status of water (water budget). If the amount of water coming and/or going from/to outside the administrative limits is estimated, as well as the amount of water needed for human use, then the actual water use, water demand and water availability will be known.

The 'actual water requirement/expenditure' refers to that part of water that goes out of its 'local cycle' either naturally or through human use. However, this part of the water in some form can be helpful in completing the hydrological cycle elsewhere. Minus this water that has left, the remaining water will be 'Available Water' which can be used in different ways. To properly understand all these components of the hydrological cycle, it is necessary to prepare a water budget, by doing which water management can be strengthened at the local level.

4.1 Water Storage

The difference between the quantum of water coming into an area from outside and that going out of the area over a certain period is the change in water storage for that area. Such storage can be in surface waterbodies (manmade reservoirs, lakes, ponds, swamps, etc.) or in groundwater aquifers and soils. Figure 5 illustrates the water inflows and outflows and storages in a typical geographical area. Water in canals and rivers is constantly flowing, due to which they have not been considered as waterbody storage.

Some of the assumptions and limitations of water budget and water storage in an area can be as follows:

1. In any area surface water may flow in or out by rivers, streams, and canals, namely:

- A river brings water from outside into a geographical area and flows out of the area again; in this case the water loss from the area can be calculated by measuring the water flow at both its entry and exit points in the area (water flowing out through the river).
- If a river comes from outside and discharges into a surface waterbody or any other river of the area, then the inflowing water can be calculated by estimating the flow at the point of entry in its area.
- If a river originates from a surface waterbody or from any major river of the area, then the outgoing water can be calculated by estimating the water flowing out from the area at its exit point.

2. It may be noted that aquifer boundaries seldom match with river basin boundaries, and hence flows into or out of river basins and groundwater bodies may not correlate. Since groundwater flows are relatively slow compared to surface flows (such as streamflow and surface runoff), change in groundwater storage over short periods are generally ignored. Groundwater leakages have also been considered negligible in the calculation.
3. The water balance is typically computed as the difference between precipitation (as gain or input) and evaporation and transpiration (as loss or output) minus the storage (as surplus).

Figure 5 presents typical variation in some of the components of water balance computation for a given geographical area.

4.2 Water Bodies

Computation of water balance components for different waterbodies is essential for calculating the water budget of any region. These entities may be of the following types:

- **Rivers and Streams:** Rivers, whether they flow into an area from outside, originate in the area and flow out, or originate within the area and join any other water source of the area, estimation/ calculation of their water flows at different places is necessary. This will help in estimating the water budget correctly. First, the different types of rivers in the area need to be identified, after which their flow paths, sizes, types, their water uses for human and animal should

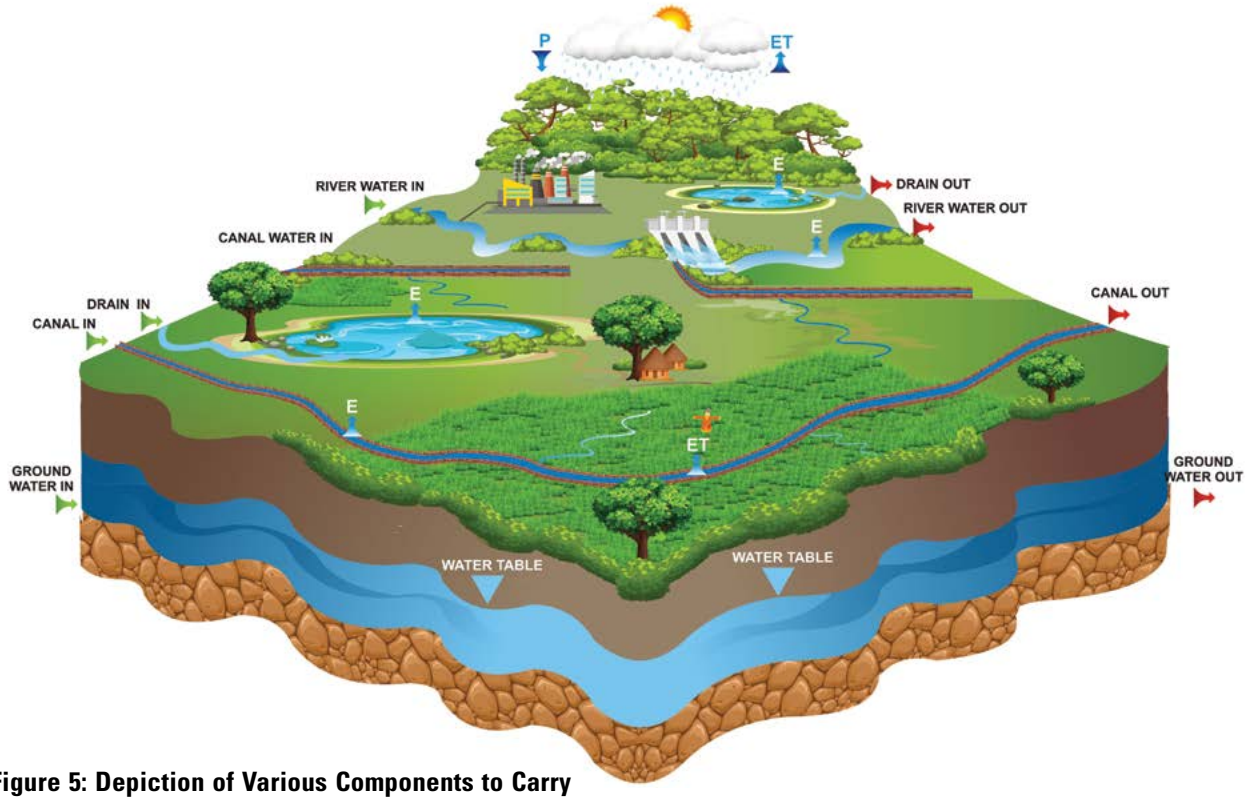


Figure 5: Depiction of Various Components to Carry Out Water Balance in a Geographical Area

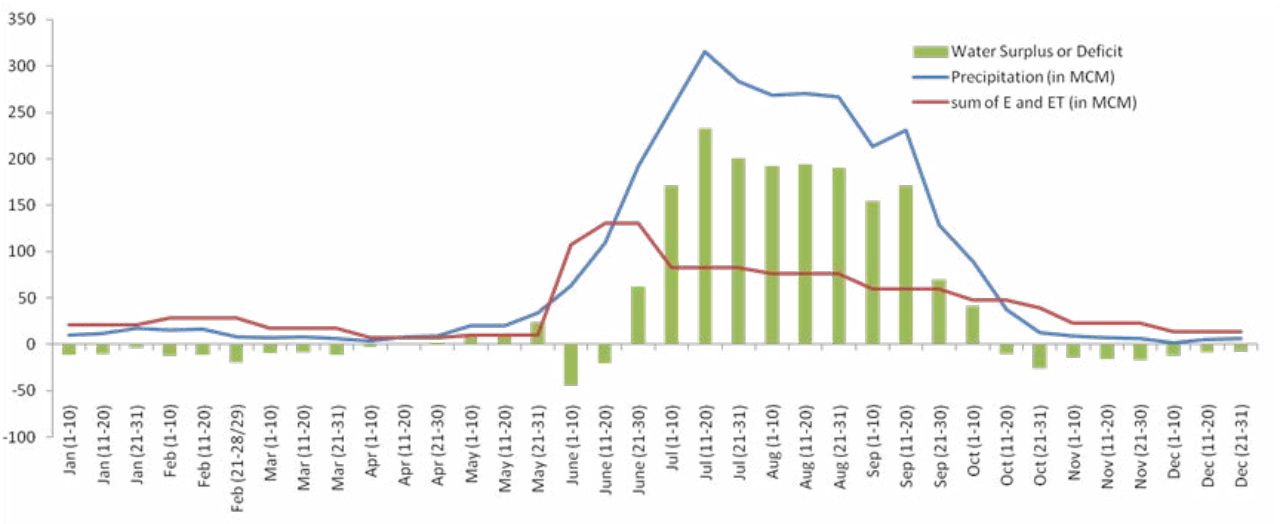


Figure 6: Typical Variation in Some of the Components of Water Balance Computation for a Given Geographical Area

be correctly estimated. As far as possible all this information should be preserved in a digital medium like GIS.

- **Canals:** Like rivers, it is necessary to study the water coming in through different types of canals, and its effects on those sources and their biodiversity. For water budget computations, information about water flows in the canals, their periods, and different uses of the water in the area can prove helpful.
- **Surface Water Storage:** Information about the status of surface water storage, whether in natural or artificial reservoirs, sources, the water coming in every year, and the change in storage conditions with annual rainfall, etc., are essential for water budgeting. In any critical situation, this water storage is helpful in water supply, so it is necessary that its correct information is available so that its proper usage can be determined in keeping with various components in the water budget.
- **Groundwater:** Estimation of groundwater source and groundwater level, its lowest possible level in the year, possible level at the time of scanty rainfall, etc. – based on the available data and with actual measurements – should be used in the water budget computations as per needs.
- **Wetlands:** Wetlands and wetland ecosystems play a significant part in water and water budget, because while preparing water budget, not only the water availability for human use must be considered, but it should also be combined with the water needs of aquatic life and other terrestrial organisms.

Through the above steps, correct information about the water status, usage, and availability of water for other uses in all water sources of an area fulfils the needs for water budget. Proper maintenance of water resources is also very important and such information should also be compiled as much as possible. It is also very important to store all the information in a proper format in digital medium.

4.3 Water Resource Network

All waterbodies in a basin are hydrologically interconnected, and hence – in principle – they constitute a single water resource system or a water resource network. Each waterbody in the network has its own importance and functions, and it is necessary that the water status of the waterbodies in the network should be adequate for it to fulfil its natural functions which may have been otherwise affected by human actions. Hence, to ensure the water adequacy of the waterbodies, they should be interconnected as much as possible. Such interconnections of local waterbodies within a water resource system not only ensures healthy waterbodies but also enables their maximum anthropogenic use.

4.4 Water Quality and its Management

While calculating the local water budget, it is necessary to know the physical and chemical qualities of water along with the quantity of water, so that the available quantity of water of the right quality can be determined for use as per requirements. For example, it is not necessary that the quality of water used in agriculture and

industry should also be the same as of potable water; in such a situation if the quantity of potable water available is limited, then such sources should be considered only for drinking water supplies, while comparatively low-quality water can be used for other purposes. Similarly, if there be many sources of low-quality water, then the quality of water can be made usable through proper treatment process as per requirements. Therefore, it is necessary that from time to time the water quality of various sources are assessed/ studied, directly or indirectly.

4.5 Aquatic Biodiversity – Monitoring and Upkeep

An indirect but useful estimation of water quality in waterbodies can be done based on the population and status of aquatic organisms and micro-organisms in a waterbody. A flourishing biodiversity is necessarily an indication of the water quality being fit life. Hence the actual condition of any water source can be gauged from the status of aquatic organisms that populate it. Thus, an indirect but useful assessment of a waterbody's water quality can be done through biomonitoring of the waterbody, and detailed biomonitoring can even indicate possible uses of the water such as for municipal water supplies, or for recreation, industrial or agricultural usages. Biomonitoring would also yield useful information on biodiversity resources of waterbodies and help in maximizing their benefits (e.g., optimum fishery production).

5. Closing the Loop at Appropriate Geographical Scale for Sustainable Development

Along with conservation of rivers and waterbodies, steady and sustainable development is possible only when the principles of symbiosis and participation are fully integrated. Just as every life has a cycle and during the completion of that cycle, the organism adapts and interacts with various other organisms, similarly the cycle of the elements of developmental activities is also completed when water conservation as well as economic growth through local employment are also integrated as much as possible. It is not possible to complete the cycle of all elements at the local level, but activities at the local level can play an important role in completing their cycle. Those activities whose loop cannot be closed locally can contribute to the next appropriate higher level of the cycle, thus completing the cycle on a larger scale. The continuity of this cycle becomes equally probable if any element/ component is likely to be completed at a short distance from the point of origin/ manufacture to the point of its maximum possible use. On this principle, efforts are being made in India like 'Make in India', 'Vocal for Local', and 'One District One Product'. Such possible cycle in water conservation is shown in the Figure 7.

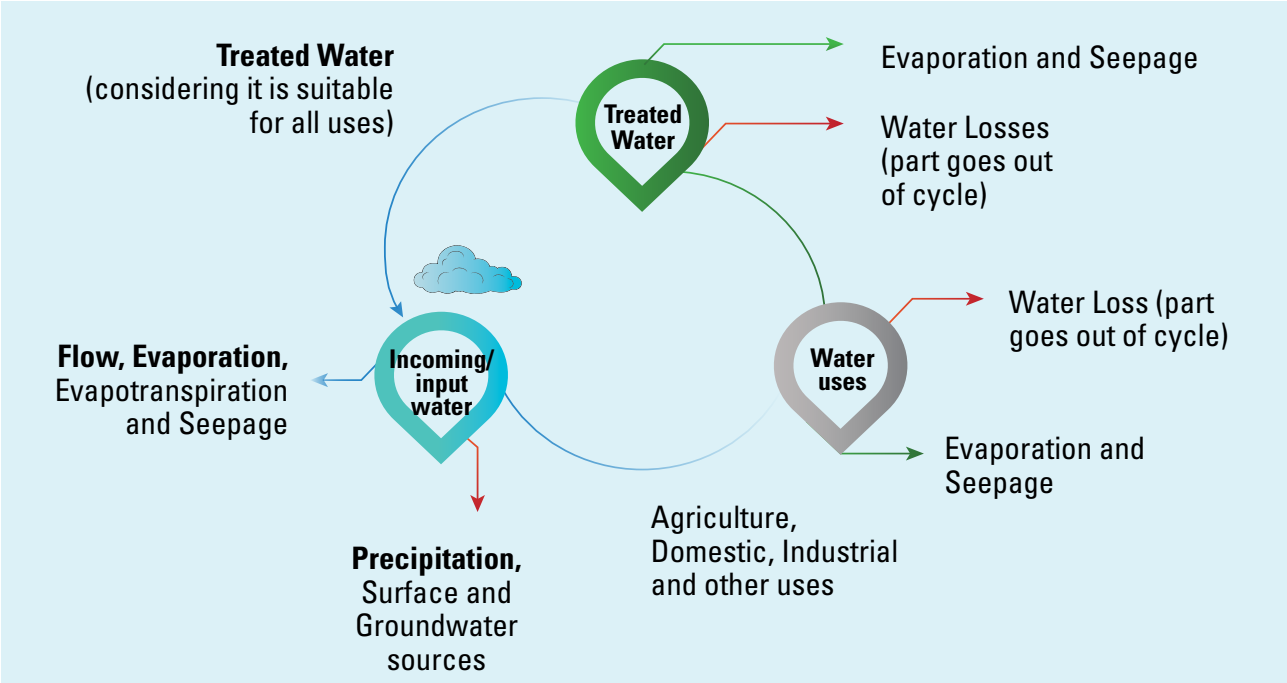


Figure 7: Local Water Cycle

Efforts should
be made as much as possible to close the cycles of various water related products at the local level, which is necessary for sustainable development

As shown in the above example, the total utilization of treated water locally, and the part of used water that cannot be recycled as water again or that part is neither in the form of wastewater nor evaporation and effluent need to be included to complete the water cycle in some form. At any local level, per capita water loss can be calculated by calculating the inflow of water at the local level and its drainage. This water loss can be called the water requirement of that locality.

Just as some other cycles, such as purification, evaporation, emissions, agriculture, and human use, etc., contribute to the completion of the water cycle, other cycles can also be completed at the local and regional levels. For example, in solid waste management, the energy generated can be used domestically, commercially or in transportation. Efforts should be made to complete any cycle at the local level as much as possible; however, there may be instances in which the by-products or waste products in various cycles can play an important role in completing other cycles.

6. Creating an Enabling Environment

Governments and local administrations can make significant contributions to synchronize development with river conservation and execute projects on the ground for this purpose. The success of such efforts however depends also on the cooperation of stakeholders. Hence there is a need to create an enabling environment so that all stakeholders are readily co-opted and involved in these ventures. Some of the following steps may be considered to fulfil this task.

6.1 Education and Culture

Ground-level knowledge of the people are vital in the diagnosis of any problem. Understanding of water and its related issues have existed in Indian culture since ancient times, but due to changes in cultures over time some important knowledge which are very relevant in present times have been neglected. Some such knowledge from traditional wisdom has been cited in various reports released by cGanga. In addition, there have been changes with changing times which may have been impractical to check immediately. To counter such adverse changes, the use of science and technology is necessary to reduce as much as possible the deterioration in the quality and quantity of water and its sources. As has also been mentioned in GRBMP, traditional knowledge (which is a part of culture) and modern science need to be combined harmoniously to advance in the field of rivers and water management. It is necessary that such traditional knowledge should be disseminated among common people so that they feel connected with Arth Ganga or similar other innovations in the water sector. Beneficial results can also be obtained by incorporating ancient knowledge in modern education system. Some of the following points in this sequence can be included in the action plan.

- At every stage of primary, secondary, and higher education, water resource knowledge of the past, present and possible future situation should be introduced, water related problems, their causes and appropriate solutions should be explained to students based on practical knowledge. In this sequence, group discussions, debates, contests, etc. among students can also be helpful.
- Historical/ archaeological knowledge related to water available at various sources should also be included in the syllabus (experimental/practical form) as far as possible.
- Students of appropriate levels should be involved in the monitoring of water resources. By doing this, their understanding of hydrology and related ecosystem will be increased.
- To explain various topics of water-related science, it should be demonstrated practically by visiting water sources. The cultural importance of water and rivers should be explained.

- It is necessary for all above-mentioned tasks that teachers should be educated and sensitized on the subject. Such institutions of the country, which have extensive knowledge and information about rivers and water, should provide the required help and guidance in this matter.

6.2 Social and Political

To achieve the goals defined above, the contribution of social and political leadership is very important to promote and propagate essential education and culture. It should be the responsibility of religious leaders, politicians, and other respected social leaders of the country that such policies can be made that create awareness of water conservation and conservation-synchronized development among the public. Leading faith and social dignitaries, along with promoting these policies, should also contribute to the change in the policies as per appropriate suggestions received from the common citizen. The success of any society is based on mutual coordination, so understanding and explaining water-synchronized development can be done in a simple way with social and political support. Experiments such as local river basin management organizations and river/ water resource management suggested by cGanga may prove to be helpful in this. Apart from this, some of the following steps can also be of help.

- To explain to common citizens the possible direct and indirect effects of water on life. The severity of water crises can be explained by giving examples of tragedies like the Corona epidemic at the present time.
- Water budget should be made at the local level so that the priority of related works can be decided according to the existing hydrological situation from local to state and nation levels.
- Ensure participation of local people in any new water and river-related projects, not only to solve problems reliably but also to connect the local populace to their neighbouring waterbodies.
- Hydrological and cultural complexes and museums in every district should be built by connecting all religious leaders to it, and maximum possible information about regional water history and the current status of water and aquatic ecosystems can be shared with common citizens.
- Economic aspects related to water should be apprised through various means and possible employment opportunities should be increased in the water sector, which can prove helpful in water/ river-synchronised development.

6.3 Science and Technology

With changing times, nature has also changed due to anthropogenic impacts, and scientific understanding needs to constantly increase to availing the multiple benefits of nature continuously. At the same time, it is also important that our present understanding does not cause misfortune or problems for the future; hence pursuing evidence-based scientific knowledge and technology is necessary. In this context, cGanga also tries to use ancient concepts and understanding and traditional knowledge with in all its studies. In doing so, we can develop better technology with proper use of science which can be important in ensuring the sustainability of water-synchronized development. When developing and using technology, it must be kept in mind that all the important aspects of conservation and development have been thoroughly investigated and possible impacts have been well analyzed. This science and technology should be understandable and accessible to all stakeholders, which can also facilitate the way to achieve the goals of synchronizing development with river conservation. Some suggestions may be as follows:

- Balanced use of a combination of natural and modern scientific treatment processes – such as the four-stage treatment cycle suggested by cGanga – can effectively improve water treatment and reuse.
- Efforts should be made as much as possible to close the cycles of various water-related products at the local level, which is necessary for sustainable development.
- Water requirement, purification requirement and effective mechanism should be developed according to the water-impacting industries and water-dependent industries.
- There is a need to explain science to the common citizen by combining it with culture, ancient knowledge, social understanding, and practical uses.

6.4 Novel and Noble solutions

For grasping the meaning of Arth Ganga in its fullness, it is necessary to understand how the means to achieve it can be made smooth and

Impact Bonds

will play the most significant role in ecosystem financing in decades to come, particularly those that are outcome based, bring in a range of investors who are ready to provide necessary capital for conservation or developmental activities

continuous. For this, the need is to find optimal, new, and comparatively best solutions and promoting them depending on the specific time, context, and location. It is not always possible to have sustainable solutions only by finding a new solution, but if the solution is innovative and is superior to other available solutions, and it does not appear to have any possible side-effects, then the goal of Arth-Ganga can be achieved by making it sustainable. For this to happen, knowledge, science, culture, and society – as well as regional economic aspects – should be considered as far as possible. At every level, whether it be local (urban or rural), state, or nation level administration, suitable solutions should be worked out only by comparative analysis.

- Individuals and institutions should be encouraged to find innovative solutions in the field of environment and water conservation.
- Impact of suggested solutions on water conservation/ purification and/or large-scale water requirements testing must be accepted.

6.5 Economic Framework

In designing the economic framework of an eco-system, the policy must revolve around a single tenet, that is the value inherent in any eco-system is not unlimited and that when humans extract this value for consumptive purposes or in a manner that compromises any intangible values, it cannot be done so using the zero-sum framework. Human gains cannot come at the expense of nature's loss. Thus, the overall economic framework must include the following key aspects:

- Defining and continuously evolving the finite capacity of goods and services that the eco-system can provide.
- Defining the scope and limits of economic development activities that can take-place in the eco-system.
- Defining how those activities will be governed, monitored, measured, and approved.
- Defining how those activities will be funded including funding from public and private sources.
- Defining how the economic activities deriving benefits from the eco-system pay for ongoing maintenance and upkeep of the eco-system.
- And most importantly, defining the mechanism by which the funds generated for conservation must be channelled back into the eco-system for conservation purposes. The funds cannot and must not be pooled into a central melting pot to cross subsidise other activities.

Integrating a Sustainable Development Approach in Economic Development in and around Eco-Systems

Much of the demand on nature comes from eroding forest cover to make space for urbanization or industrialization. In the context of river systems, this leads to over-exploitation of surface and sub-surface waters as well as increased pollution loads entering the waters. It is a difficult balancing act for Governments to provide livelihood opportunities to communities living in rural or bio-diversity rich areas. Standard developmental practices have been linear in their approach almost always degrading the environment. However, with greater awareness, recognition and acceptance of environmental sustenance, the narrative to integrate Sustainable Development practices has never been stronger than it is now.

Implementation of such approaches must always be bottom up as local applications enable a faster roll-out and activation of a feedback loop. With time our collective knowledge of managing complex eco-systems will increase as we will be able to generate the necessary data which will provide the requisite evidence to support decision-making.

When designing the economic and financial framework, two key models can be used. These are:

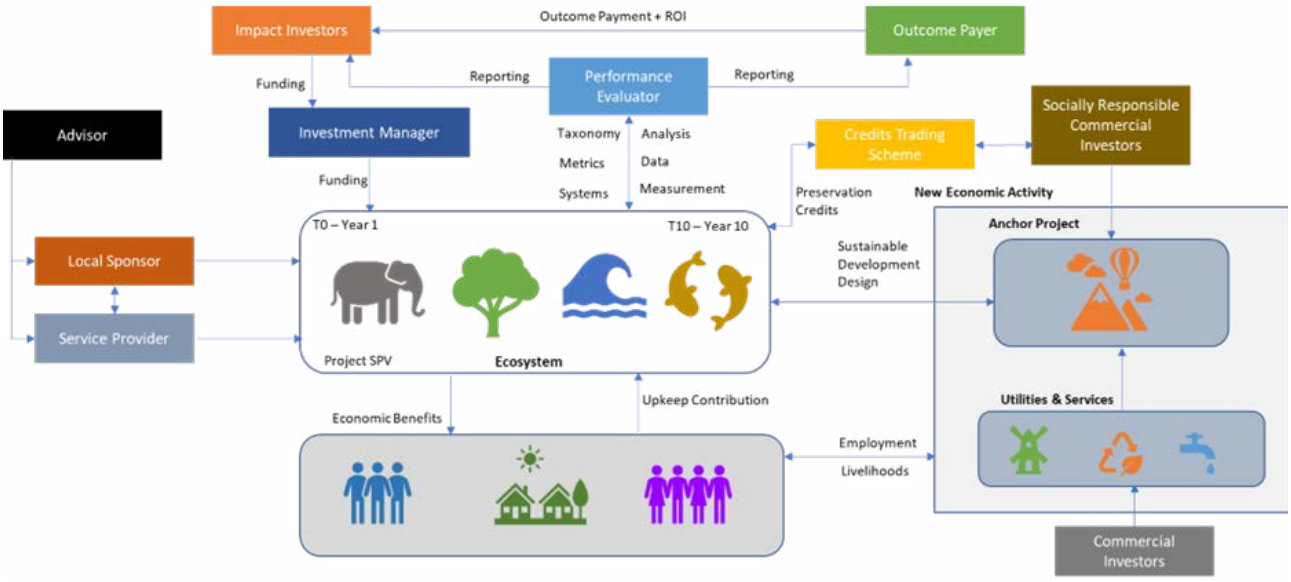


Figure 8: Schematic Representation of Stakeholder Interaction as well as a Range of Financial Instruments Including Preservation Credits, Impact Bonds and Standard Equity/Debt mechanisms

a) Consumptive Approach

Any goods or services provided by the eco-system should be replenished and the cost to do so must be derived from a "consumption tariff" which may be derived via several instruments such as a fee, tax, cess, or a capacity charge.

b) Preservation Approach

Provision of goods or services by eco-systems that are marked super-essential or critical must also be compensated for by a "preservation tariff" which again may be derived via specific instruments such as "preservation credits". These credits must be made available to local stakeholders such a communities and preservation authorities who may monetise the instruments to generate the necessary finance.

The following illustration (Figure 8) depicts stakeholder interaction as well as a range of financial instruments including preservation credits, impact bonds and standard equity/debt mechanisms.

6.6 Financing Framework

With the guiding economic framework in place, establishing the financing framework requires establishing a dedicated central authority that plays a dual role of a regulator as well as an economic development agency. This authority must be empowered with either a Central government backstop and/or an endowment fund that acts as a guarantor to enabling all downstream financing of projects.

On establishment of the guarantee-framework, the various instruments, platforms, and structures that can be used to finance the projects are:

a) Impact Bonds:

These will play the most significant role in eco-system financing in decades to come. Impact Bonds, particularly those that are outcome based, bring in a range of investors who are ready to provide necessary capital today for conservation or developmental activities. The investors can redeem these at the end of the term and receive a yield that provides financial as well as environmental returns.

b) Pooled risk and financing facilities

Building knowledge and critical mass of projects will only be possible for agencies that have large areas under their coverage. Smaller entities will struggle to find talent and attract large institutional investors who need minimum placement thresholds to make their investments. Thus, pooling risks into aggregate vehicles will provide a vehicle that enables risk-issuers to tap into capital markets that provide cheaper financing. The pooled facility will also build knowhow over a period that will make implementing the financing structures progressively more efficient.

c) Insurance and Guarantee wrappers

For projects where revenue models aren't clearly defined or the benefits are more intangible in nature, establishment of insurance

and guarantee instruments in form of wrappers or back-stops become very critical. A strong government backing also sends a signal of commitment to market.

d) Conservation Credits Trading Markets

The most effective way to bring citizen and stakeholder participation is to establish a Credits trading market that enable holders of the instruments to monetise them via a variety of investors. Credits' schemes can be developed around whole eco-systems or narrow resource/ area categories. Examples include:

- Carbon Trading scheme for carbon sinks and other initiatives
- Water Quality and Quantity trading schemes
- Preservation credits trading schemes

e) Waste Commodity Exchange

A major downside of consumption is generation of immense volumes of waste that has been going to landfills or rivers/oceans in an unsustainable manner. The onset of circular economy models allows to accord an economic value to waste. Establishment of trading platforms will make the markets more efficient and transparent that support more capital investment that can go towards waste management industry.

f) And traditional debt and equity financing instruments that will support standard project activities.

6.7 Summary of Economic and Financial Framework: A 10-points Action Approach

1. All economic activity should be done keeping in mind river, water, and eco-system conservation
2. Circular Economy Integral to the framework
3. Hydrogen and renewables become the central energy sources
4. Technology, Knowhow, Finance and Market-Linkages must be delivered centrally
5. Anchor Economic Project with ancillary sub-projects
6. Incentivising water conservation through centralised trading credits
7. Harmonisation of policies
8. Data driven monitoring and subsequent investment release
9. Integrating all government schemes
10. Innovative financial instruments

The most important challenge in River Basin Management is bringing convergence amongst Five Elements i.e., "People, Policies, Plans, Programmes and Projects"

7. Involvement of Stakeholders in the Realization of Arth Ganga

7.1 Awareness Creation

The regeneration and conservation of rivers and waterbodies to avail their goods and services over time should be coordinated with India's developmental priorities and programs. Hence, the integration of river conservation with development is very important in India's governance policies. Such policies should not only be for the Central and State governments, but also to ensure meaningful participation of Local Governance Bodies, local communities, and the common citizens to participate meaningfully in the work of river conservation, since they are all stakeholders of all rivers and waterbodies in different ways. As already mentioned in GRBMP, this work calls for raising the awareness of stakeholders.

7.2 Jurisdiction

After analysing various points and possibilities in this document, it can be said that to achieve the goals and tasks outlined above in full, it is important to keep in mind that fundamentally new thinking in defining the national developmental journey is must. And the approach should be included so that the evaluation of environmental factors – that are often overlooked in long-term development – are also considered. For sustained development, the role of various stakeholders such as local body governments and even small stakeholders like common citizens – which till now have been only in terms of restrictions and controls – should also be included in policy formulation and planning. Since sensitization is meant to develop a passion for river conservation, all small and big stakeholders must participate diligently in the same way as people looking after their own home gardens or voluntary work ("shramdaan") in public gardens. This requires that all small stakeholders be empowered. In other words, it may be said that the policies should be changed in such a way that there is decentralization of power with adequate empowerment and substantial participation in river conservation of stakeholders. It is only in this manner that

the continuance of benefits derived from rivers and the realization of Arth Ganga in its full sense can be assured. An important question that needs to be addressed here is: How can various stakeholders be empowered to actively participate and cooperate in river conservation?

8. Conclusion: Monitoring, Evaluation and Feedback to make Arth Ganga possible and sustainable

It is not always possible to define a clear path from the beginning. However, once a comprehensive framework of action has been established, barriers to progress in short-term and medium-term goals can be overcome at various stages through continuous monitoring, evaluation and feedback of the achievements and failures. When each development plan or initiative is coupled with such monitoring, evaluation, and feedback mechanism by stakeholders, achieving the goal of Arth Ganga will be early and certain.

In the above context, it is important to resolve some of the questions below:

1. What monitoring and evaluation mechanism should be adopted to develop the synchronization of development with river conservation?
2. What policies and programs should be adopted to integrate development with river conservation at national, state, and local levels?

The Summit Focus

The past many decades of anthropocentric activities reveal that humans have tremendous potential to adversely impact river-systems while the long-term sustenance of developmental activities/projects, which are directly or indirectly influenced by and/or impacted by river systems, is much dependent on the existence of healthy rivers. Thus, it is imperative that human-river interactions are understood and managed in a holistic manner adopting the "Samarth Ganga" framework to achieve Sustainable Development Goals (SDGs).

Experience of managing large river basins with focus on ensuring sustenance of rivers reveals that the state of the health of large rivers (higher order rivers) is much dependent on the condition of tributaries, smaller rivers (lower order rivers; commonly referred as rivulets, streams, or drains). Many factors, particularly influencing the health of the rivers and having interplay amongst themselves, need to be identified, studied, and managed to attain the overarching goal of "Samarth Ganga" in restoration and conservation of small rivers in larger river basins like Brahmaputra, Ganga, Mahanadi, Narmada, Godavari, Krishna, Cauvery, etc. Such factors could be broadly viewed as consisting of Five Elements or Five P's, namely, People, Policies, Plans, Programmes and Projects (refer Figure 9). The single most important challenge in River Basin Management is bringing convergence amongst these Five Elements. Thus, the thrust of deliberations in the Seventh Edition of India Water Impact Summit (7th IWIS) is to understand, elaborate, delineate potential causes of divergence, and formulate strategy for convergence through collation of views expressed in Plenary Sessions, Panel Discussions, International Forums, and informal discussions through intense engagement with the most influential players.

Policies should

not be restricted to the Central and State governments, but also ensure meaningful participation of Local Governance Bodies, local communities, and the common citizens to participate meaningfully in the work of river conservation

While many aspects are at play, a select few that are key to initiate and monitor the progress of river restoration programmes include (i) setting the goal to determine healthy status of the river, (ii) establishing norms for bio-physical status of rivers, determining the present condition in different stretches starting from origin to destination, (iii) formulation and execution of river monitoring programmes, (iv) information/data collation, utilisation and dissemination strategy, (v) setting mile stones and assessment of river restoration/cleaning programme(s), and (vi) circular economy, finance, policy and governance aspects of water, sewage, sludge and solid waste management.

In the past 3 to 8 years many mega initiatives such as Swachh Bharat Mission, Namami Gange Programme, Jal Jeevan Mission, Atal Bhujal Yojana, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Digital India, etc. that directly or indirectly relate to restoration and conservation of river systems were launched. Similar initiatives are also taken by many state governments to restore and conserve river systems including efforts through MGNREGA. It is essential that various

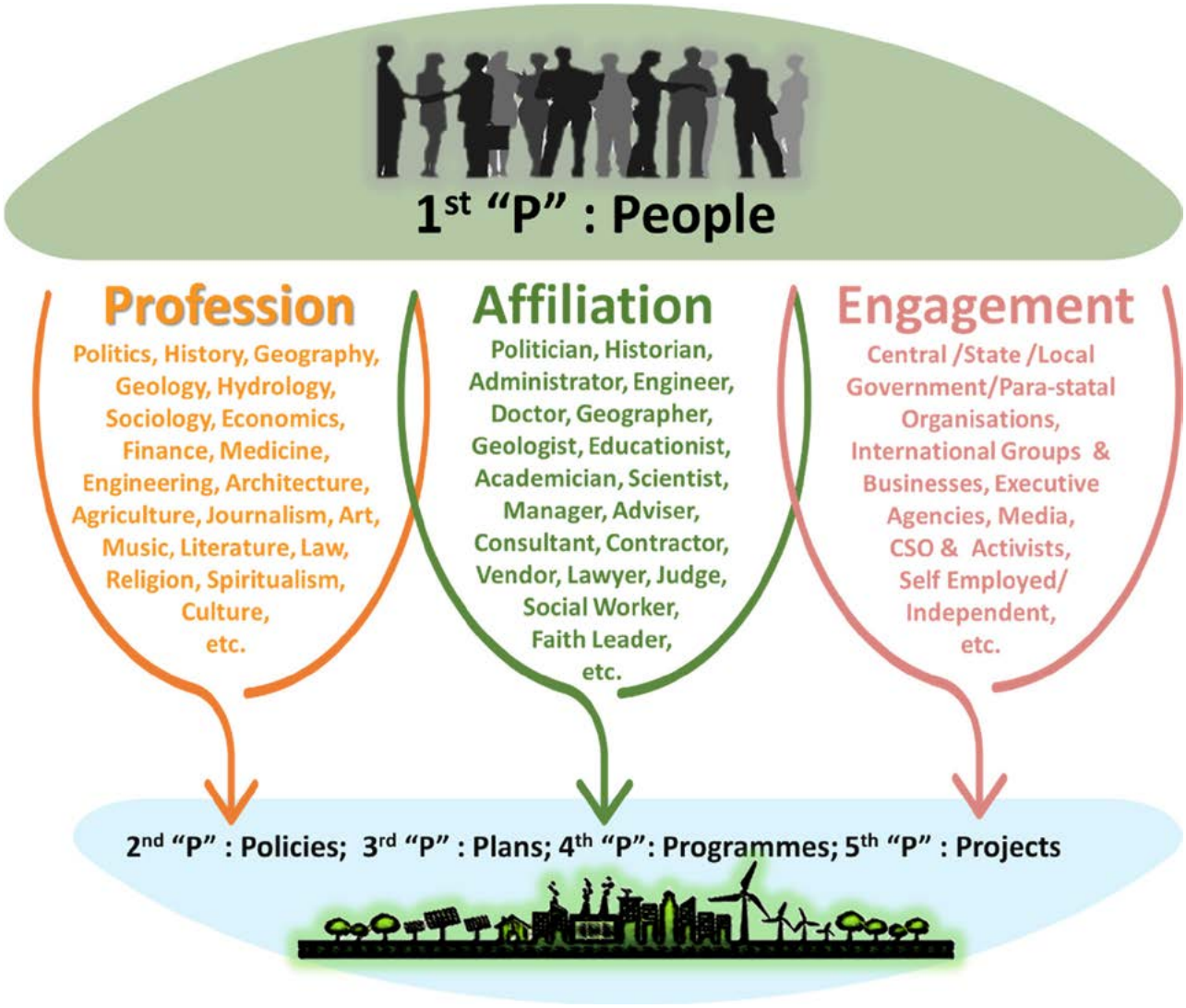


Figure 9: Five Elements or Five P's (People, Policies, Plans, Programmes and Projects) Common to Many Factors Influencing the Health of the Rivers and Having Interplay amongst Themselves

activities carried out by multiple agencies of central, state, and local governments as well as of international groups are scanned through the lens of a larger vision of river restoration and conservation to feed into the UN SDGs. It is imperative to understand the bottlenecks in bringing convergence of actions on ground through many projects formulated via various sectorial programmes to achieve the vision of "Samarth Ganga".

Managing the interplay amongst five key elements (5P's: People, Policies, Plans, Programmes & Projects; refer to adjacent illustration) appears to be the most crucial challenge. This year, the Summit will deliberate on Restoration and Conservation of Small Rivers in a Large Basin with focus on select aspects of "Mapping and Convergence of 5P's". The Summit will give an insight into the potential causes for divergence and strategy to achieve convergence.

The Summit consists of four Plenary Sessions, four Technical Sessions in Track A on Science, Technology & Policy, two sessions in Track B on Economics and Finance, five sessions in Track C on Technology and Innovation, one International Session in Track D, and two sessions in Track E on Implementation aspects related to specific issues.

PLENARY SESSIONS

SESSION P1: INAUGURAL SESSION

Day 1: Thursday, December 15, 2022; 14:30 – 16:00 hrs

Restoration and Conservation of Small Rivers in a Large Basin - "Mapping and Convergence of 5P's (People, Policies, Plans, Programmes & Projects)"

Large rivers, being major sources of various river services, are often in the limelight, but small rivers seldom receive the same degree of attention for restoration and conservation. Yet, small rivers and streams that merge with large rivers directly or via higher-order rivers, are vital components of the larger rivers themselves. Hence their revitalization and conservation are crucial for the entire river network. Given their relatively small scales, the conservation of small rivers may not require large-scale multi-institutional involvement but may be efficiently carried out with the active involvement of local governance bodies, communities, and people.

This session will present a brief on background and purpose of IWIS, introduce the theme of the present summit, and there will be opportunity to listen to the words of wisdom from the dignitaries on the dais that consists of representatives from the government including Hon'ble Ministers of the Central Government.

SESSION P2

Day 2: Friday, December 16, 2022; 11:30 – 13:00 hrs

Lessons from Various River Related Programmes

Numerous river-related programmes are carried out by national and state governments which may be prima facie designed with other goals such as infrastructure (roads, bridges, power plants, etc.) and social development (water supply, sanitation, housing, healthcare, rural environment, etc.), but they have significant impacts on river systems. Hence, along with programmes that are directly related to rivers – such as inland navigation, surface irrigation, fisheries, hydropower, etc. – they all affect our rivers in multiple ways. A comprehensive review of such impacts can provide valuable lessons in how to minimize river stresses and ensure synchronicity of development with river conservation.

This session will engage in discussions with senior government officials who are leading major initiatives that are focused on restoration and conservation of river systems and transform water supply and sanitation infrastructure in the country. The intent is to initiate a dialogue that may eventually pave way for SWOT analysis of the current approach to make suitable changes to achieve higher and speedy improvements towards attaining Sustainable Development Goals.

PLENARY SESSIONS

SESSION P3

Day 3: Saturday, December 17, 2022; 11:30 – 13:00 hrs

Bottlenecks and Course Correction in River Related Programmes

Multiple river-related programmes carried out by national and state governments and their subordinate institutions may often overlap or intersect insofar as they affect rivers. The lack of synergy in such cases calls for a continuous or periodic assessment of the bottlenecks in their coordination and the means to overcome them through a convergence in policies and practices of different river-related programmes. Co-involvement of programme implementation agencies, independent experts, knowledge bodies, and community and people's representatives in such assessments are essential along with independent third-party monitoring.

This session will engage in discussions with senior government officials and experts who have experience of implementing various programmes, that are dependent on healthy river systems and at the same time impact river systems, to identify bottlenecks and pave way for course correction in achieving the larger goal of river synchronized development (Arth Ganga).

SESSION P4

Day 3: Saturday, December 17, 2022; 16:30 – 18:00 hrs

Valedictory Session

TRACK A: SCIENCE, TECHNOLOGY & POLICY

SESSION A1

Day 1: Thursday, December 15, 2022; 11:30 – 13:00 hrs

Setting the Goal to Determine Health Status of the River

Rivers and streams are among the most endangered ecosystems worldwide. Rivers have economic, social, cultural, aesthetic and ecological values, as well as intrinsic values that are not dependent on people's will. These values of rivers are based on their health. World over, the rivers are over exploited for their functions and are under severe pressure due to various disruptive anthropogenic activities. Numerous stressors such as nutrient enrichment, pollutants, sedimentation, and alterations in stream hydrology and habitat are the major factors of concern for ecological integrity, sustainability and ecosystem health. For evaluation of the actual state and measure the rate of changes in the rivers and streams, the periodic assessment of its health is essential. The focus of this summit is to pave path for expediting mapping, integration and assessment of different scenarios/ aspects of river health.

Currently, most countries in the world plan for a management approach to sustain the prime natural resources like rivers and streams. At the same time, it is equally important to evaluate how socio-economic development programmes such as water supply, sanitation, agriculture and horticulture, animal husbandry, navigation, recreational, tourism, rural and urban development, hydropower, or even education and culture, etc. are dependent on river systems influence river restoration and conservation efforts.

The most important question, therefore, that needs to be answered is whether River Restoration and Conservation (RRC) should be at higher pedestal in comparison to the other socio-economic development programmes such as water supply, sanitation, agriculture and horticulture, animal husbandry, navigation, recreational, tourism, rural and urban development, hydropower, or education and culture, etc. even though in terms of financial layout and direct social impacts some of these may be of higher priority.

Presently some of the mega programmes that impact river systems and aim at socio-economic upliftment such as Swachh Bharat Mission, Jal Jeevan Mission, Atal Mission for Rejuvenation and Urban Transformation (AMRUT), MGNREGA are executed employing sectoral planning with much less emphasis on comprehensive micro level project preparations that focuses on restoration and conservation of rivers.

As such suboptimal results, and at times even adverse impacts, are seen that raises questions regarding sustainability of actions on ground.

Another important question, therefore, that needs to be answered is how to facilitate and identify agencies that could be assigned the responsibility of preparing comprehensive Detailed Project Report (DPR) for identifying and coordinating activities for optimal utilization of resources deployed through various programmes of the central, state and local governments as well as contributions from NGOs and bilateral and multilateral cooperations. Should the organisations/ programmes engaged in river cleaning take up this on priority?

Also, River Health Assessment (RHA), though has been under consideration for River Action Plans, is rarely a requirement for planning and implementation of projects designed with primary focus on RRC. The river health concept and a national river health assessment system is absent in India. This is perhaps because of lack of (i) suitable assessment methods, (ii) identification of indicators/ variables, and (iii) development of selected indices of river health assessment for evaluating the effectiveness of river cleanup or river restoration and conservation programmes. RHA involves all critical components of a riverine system including aquatic flora and fauna, riparian

vegetation, geo-morphological features, physical form of the channel, hydrology, water quality, habitat, etc. However, it is impractical to routinely monitor all the variables under these components. Monitoring of some of the critical indicators under these components is a prerequisite to provide a holistic indication of the system health. As a part of the river health assessment, many variables/ indicators are involved, and could be broadly grouped under five major subject matters as depicted in Figure 10.

Figure 10: Depiction of Many Variables/Indicators Related to River Health Assessment (RHA) under Four Broad Categories

An important issue, therefore, that needs to be addressed is what criteria be adopted for River Restoration and Conservation (RRC) that is effective, simple, relatively easy to monitor, and understood by all stakeholders. It is proposed that restoration and maintenance of indigenous aquatic life and riparian vegetation akin to pre industrial and urbanization era (reference condition) reflecting the bio-physical status of healthy rivers in different stretches (from origin to destination) be adopted as a guiding principle for RRC.

TRACK A: SCIENCE, TECHNOLOGY & POLICY

SESSION A2

Day 2: Friday, December 16, 2022; 09:30 – 11:00 hrs

Establishing Present Condition and Norms for Bio-physical Status of Healthy Rivers in Different Stretches (from Origin to Destination) and setting the Milestones

By and large, for most of the river clean-up programmes worldwide, and particularly in India since the beginning of Ganga Action Plan, much of the emphasis has been on assessment of certain water quality parameters focusing on the ingress of domestic and industrial discharges and disposals. Accordingly, the status of river has been judged based on CPCB established guidelines for Designated Best Use Water Quality Criteria stated in Table 1. In many forums appropriateness of such guidelines for assessment of river cleanup measures have been questioned and an alternative measure such as River Health has been strongly advocated.

Table 1: Designated Best Use Water Quality Criteria

Designated Best Use	Class of Water	Criteria
Drinking Water Source without Conventional Treatment but after Disinfection	A	➢ Total Coliforms Organism MPN/100ml shall be 50 or less; ➢ pH between 6.5 and 8.5 ➢ Dissolved Oxygen 6 mg/l or more ➢ Biochemical Oxygen Demand 5 days 20°C: 2 mg/l or less
Outdoor Bathing (Organised)	B	➢ Total Coliforms Organism MPN/100ml shall be 500 or less ➢ pH between 6.5 and 8.5 ➢ Dissolved Oxygen 5 mg/l or more ➢ Biochemical Oxygen Demand 5 days 20°C: 3 mg/l or less
Drinking Water Source after Conventional Treatment and Disinfection	C	➢ Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 ➢ Dissolved Oxygen 4 mg/l or more ➢ Biochemical Oxygen Demand 5 days 20°C: 3 mg/l or less
Propagation of Wild Life and Fisheries	D	➢ pH between 6.5 to 8.5 ➢ Dissolved Oxygen 4 mg/l or more ➢ Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste Disposal	E	➢ pH between 6.0 to 8.5 ➢ Maximum Electrical Conductivity at 25°C: 2250 micro mhos/cm ➢ Maximum Sodium Absorption Ratio: 26 ➢ Boron Max: 2 mg/l

The questions, therefore, that need to be answered are: (i) whether Designated Best Use Water Quality Criteria is appropriate for assessing RRC efforts, (ii) is RH an appropriate measure to assess RRC efforts? and (iii) whether any appropriate guidelines/norms exist for River Health Assessment?

The most important prerequisite for preparing road map for RRC programme then is to establish current as well as pre-industrial and urbanization era (i.e., near pristine or reference condition) bio-physical status of different river stretches from the origin of a river to its destination. As indicated in Figure 10, the biophysical status of a river is determined by variables/indicators that could be broadly categorized as: (i) Geomorpholocal, (ii) Hydraulic, (iii) hydrological, (iv) water quality, and (v) biological.

The focus of deliberations in this session will be to develop roadmap for achieving abovementioned tasks.

The important tasks that need to be accomplished are: (i) identification of the most representative variables/ indicators under each of the above mentioned broad categories; (ii) preparing guidelines for assessing the health of rivers based on these variables/indicators; (iii) developing criteria for spatio-temporal frequency with which such variables/indicators need to be monitored; (iv) establishing present condition as well as norms for Bio-physical Status of healthy rivers in different stretches (from Origin to Destination); and (v) setting the milestones for river rejuvenation programmes.

SESSION A3

Day 3: Saturday, December 17, 2022; 09:30 – 11:00 hrs

Formulation and Execution of River Monitoring Programmes

The overarching goal in River Health Assessment is to account for Goods & Services including Ecosystem Services and take an informed/evidence-based decision to maintain river status that strikes a balance between River Conservation & Development as shown in Figure 11. One of the purposes of RHA is to determine challenges in river restoration and conservation programmes as depicted in Figure 12.

Figure 11: Balancing River Conservation and Development

Figure 12: Assessment and Restoration Challenges

The salient aspects that need to be addressed in river health assessment are: (i) why to monitor, (ii) what to monitor, (iii) how to monitor, (iv) who will monitor, (v) value for the resources utilized in monitoring, and (vi) capacity building for monitoring. Table 2 provides an indicative list of variables that may reflect on bio-physical status of a river.

Table 2: Indicative List of Variables that may Reflect Bio-physical Status of a River

Category	Parameters
Hydraulic	River Longitudinal Profile; River Cross Section; Gauge; Discharge; River Bed and Banks Material & Condition; Sediment Load
Hydrology	Topography; Weather Parameters; Land Use & Land Cover
Water Quality	Temperature; pH; Electrical Conductivity; Solids (Dissolved, Suspended, Fixed, Volatile Fractions); DO; BOD; COD; TOC; Ammonical Nitrogen; Total Kjeldahl Nitrogen; Nitrite Nitrogen; Nitrate Nitrogen; Phosphorous (ortho and poly phosphate); Metals; Insecticides; Pesticides; Emerging Contaminants; Coliforms; Other Indicators of Pathogens
Geomorphology	Bed Slope; Lateral and Longitudinal Connectivity; Bank Stability; Riffle-pool Sequence; Channel Shifting; Channel Sinuosity; Channel Capacity; Efficiency Hydraulic Radius; Bedform Wavelength; Texture of Floodplain Sediment; Bedform Amplitude; Channel Multiplicity; Braid Intensity
Biological Profile	Microorganisms; Micro-invertebrates; Macro-invertebrates; Vertebrates; Keystone Species

Collation of information as per the indicative list of variables of River Health in five broad categories for different stretches requires mobilization of substantial resources from local, regional and national/international level. Engagement and coordination with numerous stakeholders are essential. A novel combination of simple river side community-based methods to those requiring advanced facilities may have to be evolved keeping in background the existing institutional framework and getting value for the resources utilised. This session will focus on evolving and piloting methodology for river monitoring in light of the background information provided in this document alongwith schematic illustration provided in Figure 13 that could be adopted for Establishing Present Condition and Norms for Bio-physical Status of Healthy Rivers in Different Stretches (from Origin to Destination) and setting the Milestones for RRC programmes.

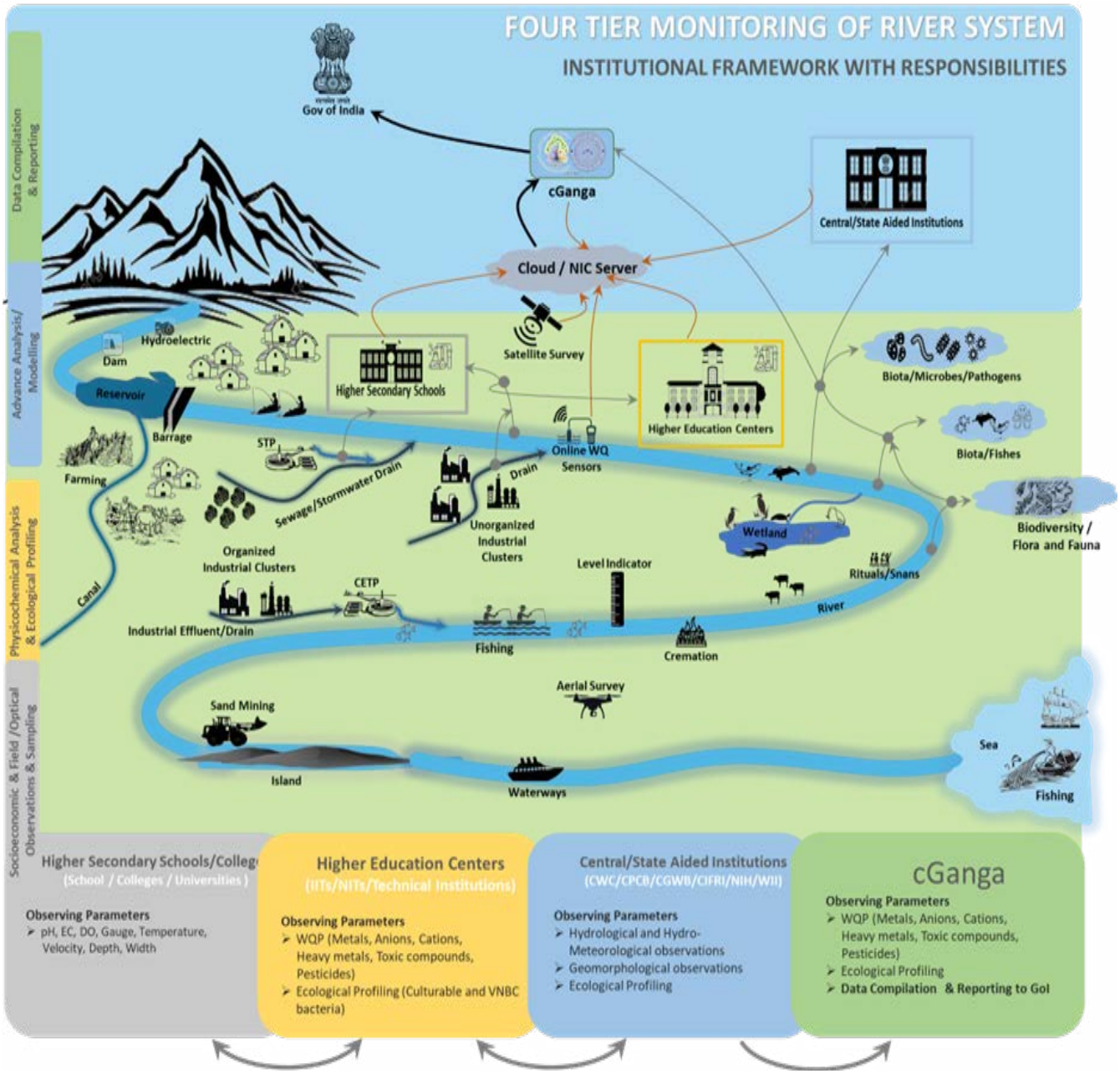


Figure 13: Illustration of a Multitier River Monitoring System

TRACK A: SCIENCE, TECHNOLOGY & POLICY

SESSION A4

Day 3: Saturday, December 16, 2022; 09:30 – 11:00 hrs

Information/Data Collation, Utilization and Dissemination Strategy

As of now there is scarcity of information about the present condition as well as desired state of a huge number of small river systems in India. This information is a prerequisite for direction and extent of efforts that need to be channelized for restoration and conservation of rivers, and setting the milestones to assess the progress and benefits. A nationwide programme needs to be evolved for gathering information on a regular basis in a sustainable manner so that inventory of such information is available for setting the bench marks (reference) and assessing the progress of activities carried out under various programmes. Historically some of the information is gathered and available with various organisations, institutions, and individuals.

Therefore, mapping of who is doing what, where are they getting resources from, what information is available irrespective of shared or not shared, what are the gaps in gathering information relevant to assessment of present condition as well as desired state of river systems in India is a significant task. What needs to be done, who all could be engaged, and from where the resources should flow in for this task?

Once such information is collated, a systemic plan of action needs to be developed and executed to fill the gap in information. Only then a comprehensive micro level plan of action could be made so that a cost-effective execution of stretch wise restoration and conservation works, drawing resources from many river-related programmes, for all small or big rivers could be done.

This session is intended to pave way for formulating road map for executing aforementioned tasks.

Several issues need to be resolved regarding preparation of a systemic plan of action that needs to be developed and executed to fill the gap in information. Since the outcome of such exercise is a crucial input for many river-related programmes but does not specifically fall in the domain of any one organization, the issues that need to be addressed include; (i) Which programme/organization should coordinate such tasks; (ii) How the requisite resources be generated/allocated; and (iii) What institutional framework be created to execute?

TRACK B: ECONOMICS AND FINANCE

SESSION B1

Day 2: Friday, December 16, 2022; 14:30 – 16:00 hrs

Economics and Finance of Sewage Treatment Plant Sludges

As the deployment of number of sewage treatment plants in the country increases, so will the quantity of sludge produced. The sludge handling should become an integral part of waste-water treatment facility, there are however thousands of STPs in the country that do not have sludge treatment on-site.

- For older facilities how does the retrofit model work in the case and how will these get financed.
- With increase in urbanization, how will the cities cope up with increase in sludge quantity. Do they need to set up dedicated sludge treatment centers. If so, what are the requisite conditions under which they will be financed?
- What are the different outputs of each technology type?
- What are the CapEx/OpEx costs and payback for each technology class?
- What is the commercial model for the output of each technology class?
- How will the markets be created for each category of output?
- What are the PPP models for sludge management?
- How relevant is BOOT model for each of the techno-commercial models?
- What level of funding does the government need to bring in?
- What financial models and instruments can be used for sludge treatment?

Instrument and Facility Case Study

cGanga has initiated a number of strategic pilot projects to treat and process sludge. A facility is being set up to finance these projects with cooperation of municipal administrations and green-investors from around the world.

RELEASE OF REPORTS:

1. Strategy for Management of STP Sluges in India
2. Status Report on Management of STP Sludges in India

TRACK B: ECONOMICS AND FINANCE

SESSION B2

Day 2: Friday, December 16, 2022; 16:30 – 18:00 hrs

Economics and Financing of Water Recycling and Water Trading Market

For the water market to become more robust, it is important to establish not only the pricing but an efficient trading market.

- What are the necessary conditions to establish waste-water trading schemes?
- How will the pricing and trades be regulated?
- There are many operating conditions where waste-water production may not be co-located with water consumers. The market for recycled water will vary for each of the conditions:
  - o Water produced in – households, commercial establishments and, industries
  - o Water consumed in – agriculture, horticulture, commercial establishments including golf-courses, public parks and, industries
- Which technology classes enable better interconnection between production and consumption locations as it is not easy to treat wastewater at the site of production.
- What part can rivers and wetlands play in creation of reservoir capacity for recycled water markets?
- How to bring wastewater as an integral part of water-resilience strategy for cities.
- What tools enable a more efficient water trading?
- What financial models are there for enabling creation of wastewater trading markets?

Instrument and Facility Case Study

cGanga is developing a pilot scheme for trading between industrial off-takers and waste-water generators.

TRACK C: TECHNOLOGY AND INNOVATION

SESSION C1-C5

C-1: Day 1: 11:30 – 13:00 hrs
C-3 and C-5 Day 2 & Day 3: 14:30 - 16:00 hrs
C-2 and C-4: Day 1 & Day 2: 16:30 – 18:00 hrs

Innovation plays a key role in the Namami Gange programme. The programme is being used as a platform to both attract technologies from around the world as well as indigenously develop new innovations.

The Environment Technology Verification (ETV) framework developed by cGanga, IIT Kanpur in association with NMCG, Ministry of Jal Shakti, GoI is a unique mechanism to streamline and accelerate the introduction of innovative technologies in the water sector for restoration and conservation of rivers. ETV process provides a single window access to solution providers to bring their innovation to market. Currently over 30 technology companies from 12 countries are enrolled in the ETV process.

A brief on introduction, need, approach and current status are illustrated in Figure 14. ETV is to be viewed as a facilitation mechanism for improving and adopting novel solutions in India, and then down streaming to similar markets. The criteria for adopting in ETV is presented in Figure 15. As illustrated it is not meant for selection or rejection of a solution.

Schematic representation of the outline of ETV Programme, key benefits, process, and eco-system support are presented in Figures 16 to 19.

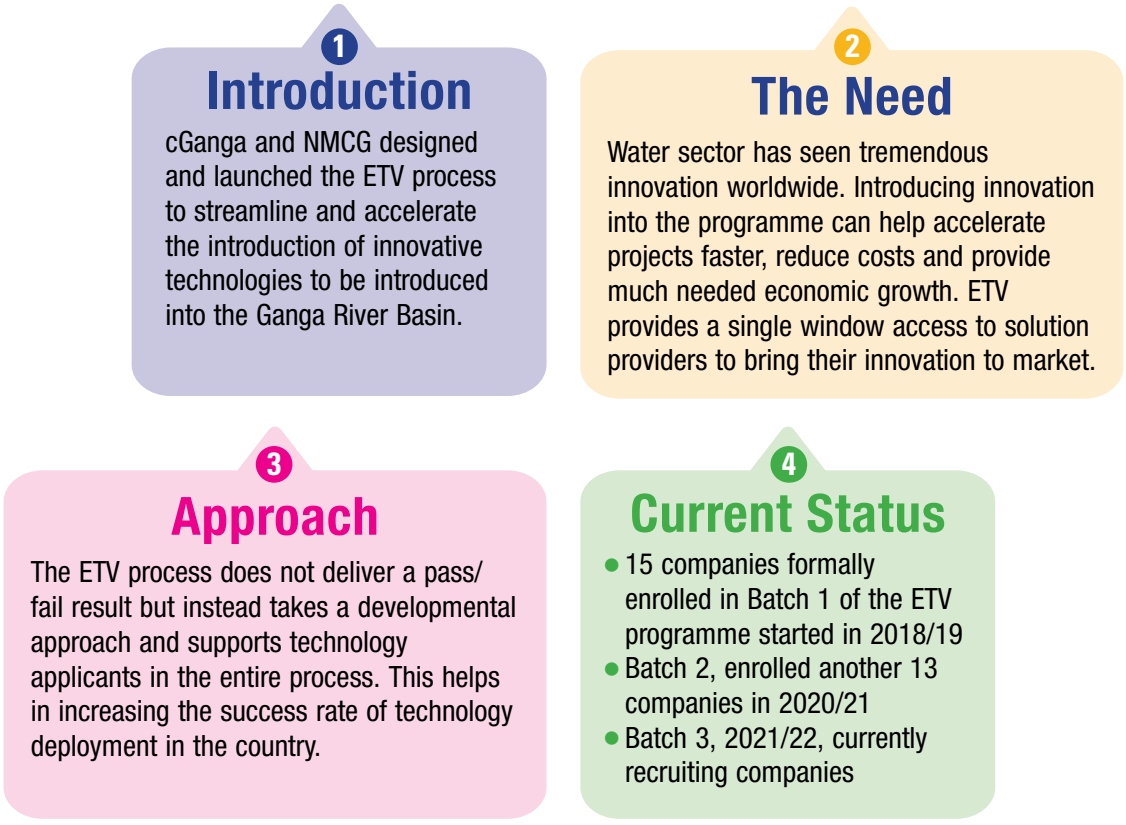


Figure 14: Vision and Status of Developing Environmental Technology Verification (ETV) Process

Figure 15: Criteria for Environmental Technology Verification (ETV)

CURRENT SEGMENTS

The ETV programme shall address issues in a range of segments. For the 2019-2021 phase, the segments are:

Decentralised Systems

- Municipal wastewater treatment
- Industrial effluents treatment
- Bio-remediation systems
- Drinking water supply systems

Data and Information (Digital)

- Data Generation – remote sensing, sensors etc
- Data management and handling
- Data analytics – AI, ML etc

Ancillary Services

- Solid Waste Management
- Sustainable Agriculture
- Sustainable Hydropower
- Energy Recovery / Hydrogen
- Water Resource Management etc
- Inland waterways

GOVERNANCE

- ETV evaluation process is managed by a panel made up of a permanent committee and additional expert members
- The permanent committee is made up of representatives from: cGanga | NMCG | NEERI
- Expert members are selected from eminent institutions and industry. The selection is based on the topic / technology class

PROCESS

The panel reviews the technology applicant and assessment is made on five criteria:

1. State of Technology Readiness Level (TRL)
2. State of Commercialisation (in India) Readiness Level (CRL)
3. Value for money
4. Overall impact
5. KPIs / Criteria for successful evaluation of the pilot

- KPIs are mutually defined as what constitutes success
- The project cost is underwritten by the Government which is re-imbursed on successful execution of the pilot. See ETV Funding and Commercial Framework section for more details

Figure 16: ETV Programme

Pilot Project

Getting access to a pilot project is one of the biggest benefits of the ETV programme. It is either very difficult for new technology proponents to secure projects as they are always asked to show reference site in the country of application (India in this case.)

Developmental Role

Unlike many of the other ETV assessment processes and programmes in India and globally, this process is more developmental. It doesn't deliver a pass or fail certificate but really helps the companies in identifying the gaps in their proposition and supports them in plugging those gaps.

Highly Subsidised Technical Assessment

In most cases a technical assessment exercise can cost significant sums to the technology company. In this case the Government of India massively subsidises the assessment cost.

Project Cost Re-imbursement or Conversion to Service Contract

At the end of successful technology demonstration, the technology company has the option to recoup the funding through cost re-imbursement or through conversion of the project into a service contract. Either ways this commitment makes it easier for the companies to secure funding for the pilot.

Access to Eco-System and Additional Support

The programme supports companies by providing access to a range of experts, grant and funding programmes, potential technology partners and other Government and private sector support initiatives.

Acceleration

This is one of the fastest technology acceleration processes in the environment sector shortening the commercial cycles for the technology companies.

Figure 17: ETV Key Benefits

ETV Enrolment

- Applicants put in an expression of interest
- If the solution is deemed innovative and addresses critical challenges in the Ganga River Basin, then the applicant will be invited to the ETV programme.
- The applicant is required to complete the administrative registration process including payment of a fee.

Identification/ Selection of a Pilot Project and Preparation/ Submission of Pre-Feasibility Report (PFR)

- A pilot project is identified.
- Applicants are required to complete a feasibility report around a project with details on each of the six criteria.
- The report is to be submitted to cGanga and any feedback and comments are provided at this stage.

Preliminary Assessment

- cGanga panel shall review the PFR and provide its feedback to the applicant and its consortium.
- This helps the applicant in fine-tuning their proposition.

Panel Presentation

- The applicant is invited to present to an independent panel of reviewers.
- If the panel is satisfied with the presentation, it will make its formal recommendation to the Government.
- The applicant has the option of nominating an observer on the panel. This makes the process open, transparent and fair.

Confirmation letter from Govt/ NMCG

- Upon receiving the formal recommendation from the panel, NMCG shall proceed on to formally approving the project.
- The letter of support will contain details of cost-re-imbursement (if requested by applicant) and confirmation of licenses / permits /approvals.

Project Development Agreement

- All stakeholders sign a project development agreement.
- cGanga will be the project monitoring agency for all projects implemented under the ETV process.

Figure18: ETV Process

Figure 19: ETV Eco-system Support

The provision of sessions in this track gives opportunities to companies from around the world to showcase their cutting-edge technologies and innovations that have the potential of making a significant positive impact in the river basin. The 2022 Summit will focus on technologies in these areas:

- Digital Water
- Waste to Hydrogen
- Data and Information
- Waste to Biogas
- Decentralized Wastewater treatment
- Carbon Capture in STPs
- Sustainable Agriculture
- Drinking Water Systems
- Sustainable Hydropower
- Energy Efficiency Systems
- Green Hydrogen
- Inland-water Navigation Systems

This edition of IWIS, like the previous ones, will introduce new solutions as well as solutions that were introduced earlier and have made changes based on the feed back given by the ETV Expert Panel as mentioned in Table 3.

Table 3: Tentative list of presentations scheduled in the 7th Edition of IWIS

S No.	Technology Area	Company	Presence
1	Bio-Remediation	DRYLET	Virtual
2	Juvenile Water (fresh water everywhere)	ZANDER	Virtual
3	STP's on Ships	ENVIRONOR	Physical
4	Nationwide water quality monitoring dashboard	Piquant	Physical
5	Predictive AI for digital Water	Ketos Inc	Physical
6	Pipe Assessment using digital	VAPAR	Virtual
7	Air Lift Pumps	Flonergia	Physical
8	STP	BIO Pipe	Physical
9	Digital Twins in O&M	Water360	Virtual
10	Sludge to Manure	Bioswing Stetter	Physical
11	Membranes	Evove	Virtual
12	Waste Water Treatment	Smart Ops	Virtual/Physical
13	Waste Water Treatment	KBK Environ Infrastructures	Physical
14	Forward Osmosis Technology	Waterwhelm	Virtual
15	The Digitization and Fractionalization of the Reserve	Redpill Group	Virtual
16	Climate Tech	CI Metrics	Physical
17	Green Cremation	Green Revolution Foundation	Physical
18	Soilless Agriculture	Hindustan Agri Business	Physical
19	Gauge and Discharge Measurements	AuM Systems	Physical
20	Presentation	City of Glassgow College	Virtual
21	Presentation	Birmingham City University	Virtual

TRACK D: INTERNATIONAL COLLABORATION

SESSION D1

Day 1: Thursday, December 15, 2022; 16:30 – 18:00 hrs

cGanga has signed MOUs with many national and international organizations to work towards river restoration and conservation goal. This session is aimed at engaging with high level diplomats of various countries to deliberate on how to derive much higher output in field through various bilateral and multilateral cooperations by bringing in convergence with mega level water related programmes of the Central and State Governments to expedite development in sync with visionary goal of river restoration and conservation to attain UN SDGs.

This session with Ambassadors and senior diplomats of more than 20 countries on the topic of "Achieving Global Water Security through Shared Knowledge", which cGanga shall also implement through a unique River twinning initiative that is explained further as follows.

International Partnerships and engagement with diplomats

- Part A: India – EU Partnership: Dialogue with EUD and EU-Member States [35 mins]
- Part B: India – Global Partnership: Dialogue with various G20 Nations [35 mins]
- Part C: India – Global South Partnership: Dialogue with other developing countries [20 mins]

A new global partnership initiative on river science and economic development

Rivers are supporters of life, and the world needs to unite as one to accelerate the development of best practices that help rejuvenate, restore and conserve biologically diverse riverine ecosystems. To that effect cGanga is contemplating a new global initiative that will bring nations together to create and disseminate new knowledge on river conservation and sustainable development approaches.

Twinning of river systems will form the bedrock of these partnerships and we have more than 15 such twinning alliances under initiation. These include:

In Europe	**In Asia**	**In the Americas**
Ganga – Danube	Ganga – Mekong	Ganga – Mississippi
Ganga – Rhine	Ganga – Kallang	Ganga – Mackenzie
Ganga – Sava	Ganga – Tigris	Ganga – Black River
	Ganga – Nakdonggang and others…	Ganga – Rio Grande
In United Kingdom		Ganga – Amazon
Ganga – Thames	**In Africa**	Ganga – La Plata and others...
Ganga – Tame (Midlands)	Ganga – Niger Ganga – Orange	
Ganga – Clyde (Scotland) and others…	Ganga – Volta and others...	**In Australia**
		Ganga – Murray darling

In this approach the name "Ganga" is not a reference to the one bio-physical entity but a synonym for all rivers in India and across the world.

The approach takes its guidance from the Sanskrit phrase "Vasudhaiva Kutumbakam", which means that the world is one family and its inspiration from the Hon. Prime Minister of India Shri Narendra Modi's speech in which he said "that shared knowledge helps us overcome all circumstances". This new initiative is based on both creating and sharing that new knowledge to help increase resilience and strengthen capacity of water resources globally.

The session is also expected to have senior representation from National Mission for Clean Ganga, Ministry of Jal Shakti, Ministry of Environment, Forests & Climate Change, NITI Aayog and cGanga. The recommendations will be submitted to the G20 Secretariat for further deliberations at the international level.

TRACK E: IMPLEMENTATION CHALLENGES

SESSION E1

Day 2: Friday, December 16, 2022; 09:30 – 11:00 hrs

Decentralised Wastewater Management for Sustainability of Sewerage Assets

In rural or peri-urban areas the conventional centralized wastewater management have generally failed to address the needs of communities for collection and disposal of domestic wastewater and faecal sludges. There are opportunities for implementing wastewater management systems based on a decentralized approach that may offer opportunities for wastewater re-use, identification of total generated sludge and resource recovery as well as improvements in local environmental health conditions. Decentralized approaches will offer increased opportunities for better planning and decision-making. This session will include various initiatives on Decentralized Waste Water Treatment Systems and success stories/practices, and support Urban Local Bodies (ULBs) for better management of wastewater.

SESSION E2

Day 3: Saturday, December 17, 2022; 09:30 – 11:00 hrs

Impact of Land use on Rejuvenation of Small Rivers

The flow of river is generally contributed by the various rivulets; therefore, the health of the smallest stream has a ripple effect on the next order stream until it finds its way to large river. The small rivers not only carry water to large river but also bring rich variety of aquatic biodiversity. To preserve the riverine ecosystem, the preservation, conservation, and rejuvenation of springs, nallahs and other streams is significantly important. With the growing urbanization and haphazard development and land use planning, the survival of small rivers is at a high risk. Hence, it is important to draft policies, interventions, and strategies to safeguard the small rivers from destruction due to poor land use planning and development.

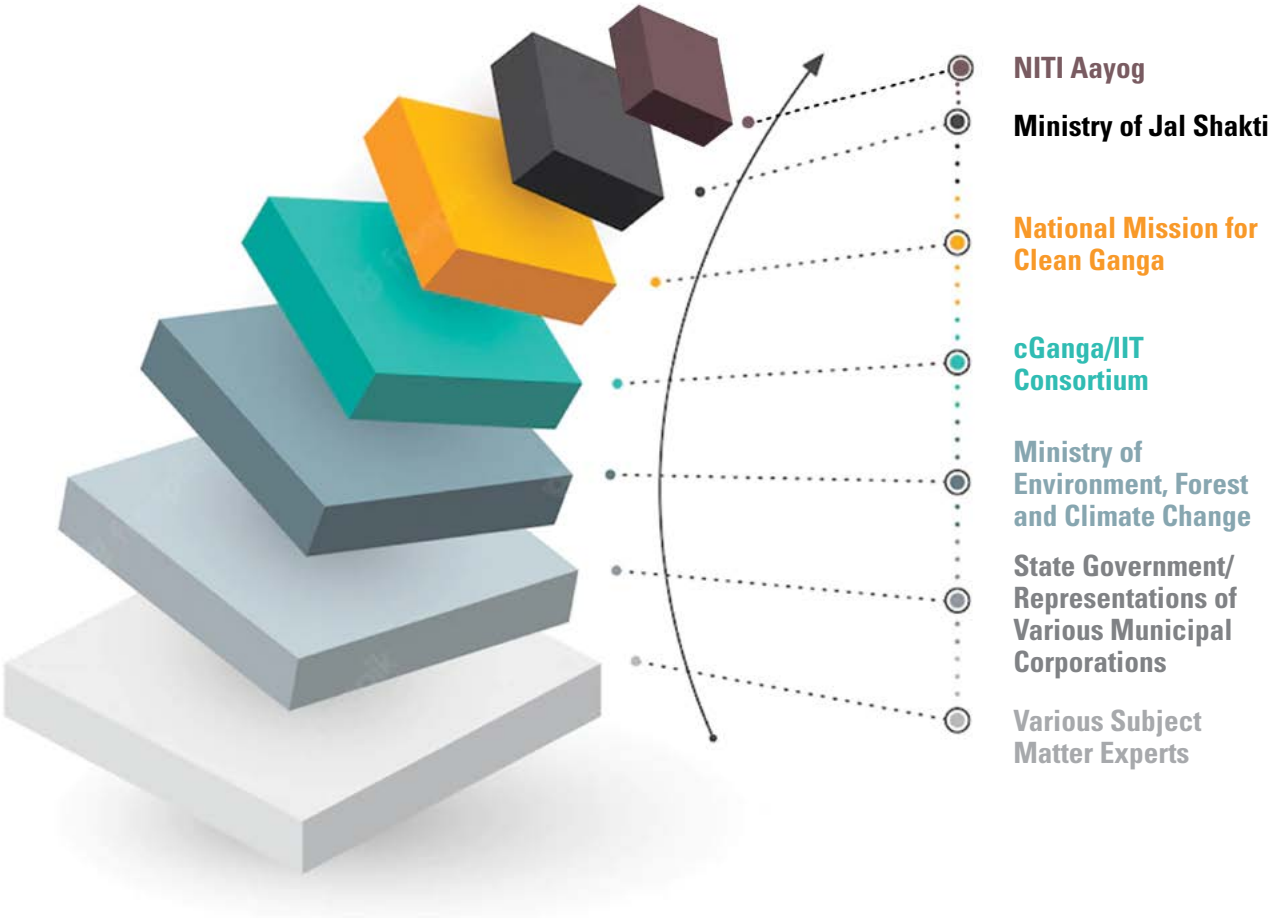
SUMMIT TIMETABLE

Time	Day 1 Thursday, December 15	Day 2 Friday, December 16	Day 3 Saturday, December 17
09:30 – 11:00 hrs	Pre-Summit Session and Meet & Greet	**TS 2: Track A: Science & Policy** **Session A2:** Establishing Present Condition and Norms for Bio-physical Status of Healthy Rivers in Different Stretches (from Origin to Destination) and setting the Milestones **Venue: Conference Room 1**	**TS 6: Track A: Science & Policy** **Session A3:** Formulation and Execution of River Monitoring Programmes **Venue: Conference Room 1**
	Venue: Lobby/ Atrium	**TS 3: Track E: Implementation Challenges** **Session E1:** Decentralized Wastewater Management for Sustainability of Sewerage Assets **Venue: Conference Room 2**	**TS 7: Track E: Implementation Challenges** **Session E2:** Impact of Land use on Rejuvenation of Small Rivers **Venue: Conference Room 2**
11:00 – 11:30 hrs	**BREAK**		
11:30 – 13:00 hrs	**TS 1: Track A: Science and Policy** **Session A1:** Setting the Goal to Determine Healthy Status of the River **Venue: Conference Room 1** **Track C: Technology & Innovation** **Session C1:** Hybrid model for International companies **Venue: Conference Room 3**	**Plenary Session** **Session P2:** Lessons from Various River Related Programmes **Venue: Bhim Hall**	**Plenary Session** **Session P3:** Bottlenecks and Course Correction in River Related Programmes **Venue: Bhim Hall**
13:00 – 14:30 hrs	**LUNCH BREAK**		
14:30 – 16:00 hrs	**Plenary Session** **Session P1:** Inaugural Followed by Opening of Exhibition **Venue: Bhim Hall**	**TS 4: Track B: Economics & Finance** **Session B1:** Economics and Finance of Sewage Treatment Plant Sludges **Venue: Conference Room 1** **Track C: Technology & Innovation** **Session C3:** Physical / Hybrid Model **Venue: Conference Room 3**	**TS 8: Track A** **Session A4:** Information/ Data Collation, Utilization and Dissemination Strategy **Venue: Conference Room 1** **Track C: Technology & Innovation** **Session C5:** Physical / Hybrid Model **Venue: Conference Room 3**
16:00 – 16:30 hrs	**BREAK**		
16:30 – 18:00	**Track C: Technology & Innovation** **Session C2:** Hybrid model for International companies **Venue: Conference Room 3** **Track D: International Session** **Session D1:** International Collaboration Theme: Ambassadors' Meet **Venue: Conference Room 1**	**Track C: Technology & Innovation** **Session C4:** Physical / Hybrid Model **Venue: Conference Room 3** **TS 5: Track B: Economics & Finance** **Session B2:** Economics and Financing of Water Recycling and Water Trading Market **Venue: Conference Room 1**	**P4: Plenary Session** Valedictory **Venue: Bhim Hall**
9:30 – 11:30 hrs	**# Day 2 will host India Water Leaders' Council parallel to Sessions A2 & E1 with special invitees** **Venue: Conference Room 3**		
19:30 – 22:00 hrs	**Reception Dinner: December 16, 2022**		

BY INVITATION ONLY

PARTICIPATION

Indian Government and State Governments



International

• A number of Country Delegations and International Experts

ENGAGE WITH US

A. Engagement Models during the Summit

The Summit is a great multi-disciplinary platform to showcase your efforts, solutions, knowledge through a range of strategic engagement plans. These are:

Strategic Partnerships

This engagement mode is for Government departments at all levels (central, state, municipal), public sector entities, multilateral institutions, NGOs, and foundations who wish to deepen their strategic engagement with India for the River Restoration and Conservation programmes. It could entail releasing a special report, initiating a project, highlighting select areas of work or other initiatives.

Sponsorship

For private sector companies or entities wanting brand recognition, the Summit offers a multitude of opportunities including but not limited to hosting networking events, display of special solutions and other showcases. Please get in touch with the Summit team for more details.

Technology and Innovation Showcase

Companies or organizations that have developed solutions, which have the potential of high impact in Indian River Basins, can get an opportunity to present to stakeholders, potential Indian partners and investors.

Knowledge Partners

Professional Service Firms and Knowledge-oriented institutions are invited to partner with cGanga and NMCG to prepare and launch a number of special reports during the Summit as well as curate and organize the various Summit sessions.

B. Ongoing Engagement Models

There are various ongoing engagement models that enable partners to find various touch points with the Ganga River Basin. These are:

1

Working Groups and Task Forces

Interested parties can channel their novel ideas through dedicated task forces and workinggroups. These groups have in-depth deliberations which are summarised in the form of white-papers submitted to Government and various stakeholders. The working groups are a sub-set of5 major task forces: (i) Science & Research (ii) Engineering & Operations (iii) Technology,Innovation, Entrepreneurship & Skills (iv) Policy, Law & Governance (v) Finance & Investments

2

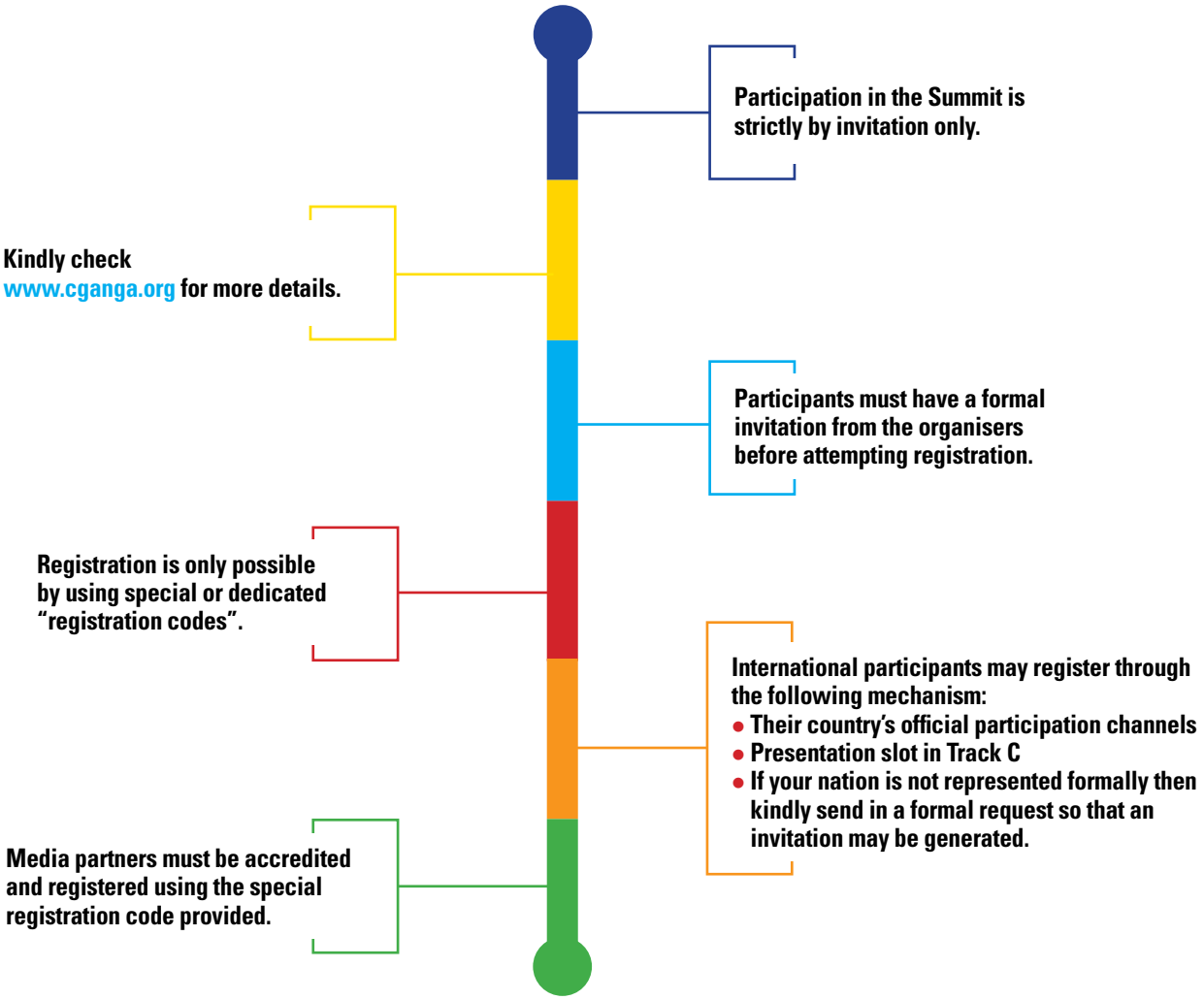
Pilots / Demonstration Projects

Companies interested in introducing their solutions into the River Restoration and Conservationprogrammes can do so through pilot/demonstration projects. They must however first gothrough the Environment Technology Verification (ETV) process. This allows stakeholders toassess the technologies and ascertain value for money.

3

International Chapters and Roadshows

cGanga and NMCG regularly conduct international roadshows to increase the outreach andawareness. Additionally, countries can establish their own local country chapters to channel theircollective innovations and interests into India.



REGISTRATION FOR YOUR PARTICIPATION IN IWIS

- All invitations to the IWIS shall be issued during 15-30th November. If you have not received the invitation, then please get in touch with the Summit organizers.
- To register you must have a special registration code either provided by your Government Department, Organization, Delegation Leader or through your direct participation in the Summit.
- Use the "registration code" that you received to complete the registration process.
- The links to the registration process shall be made available from 25th November.

CONTACT DETAILS

General Enquiries and Submissions of Participation Requests:
iwis@cganga.org

For Indian Government Related Queries:
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For International Participation and Summit Partnerships:
Mr Sanmit Ahuja
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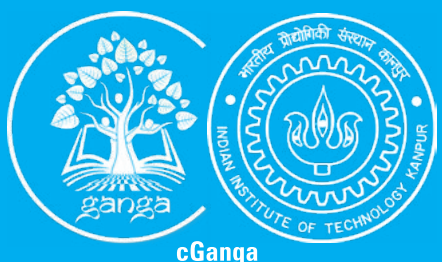
FOR MEDIA ENQUIRIES:
media@cganga.org



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