

Smart Laboratory on Clean Rivers (SLCR)

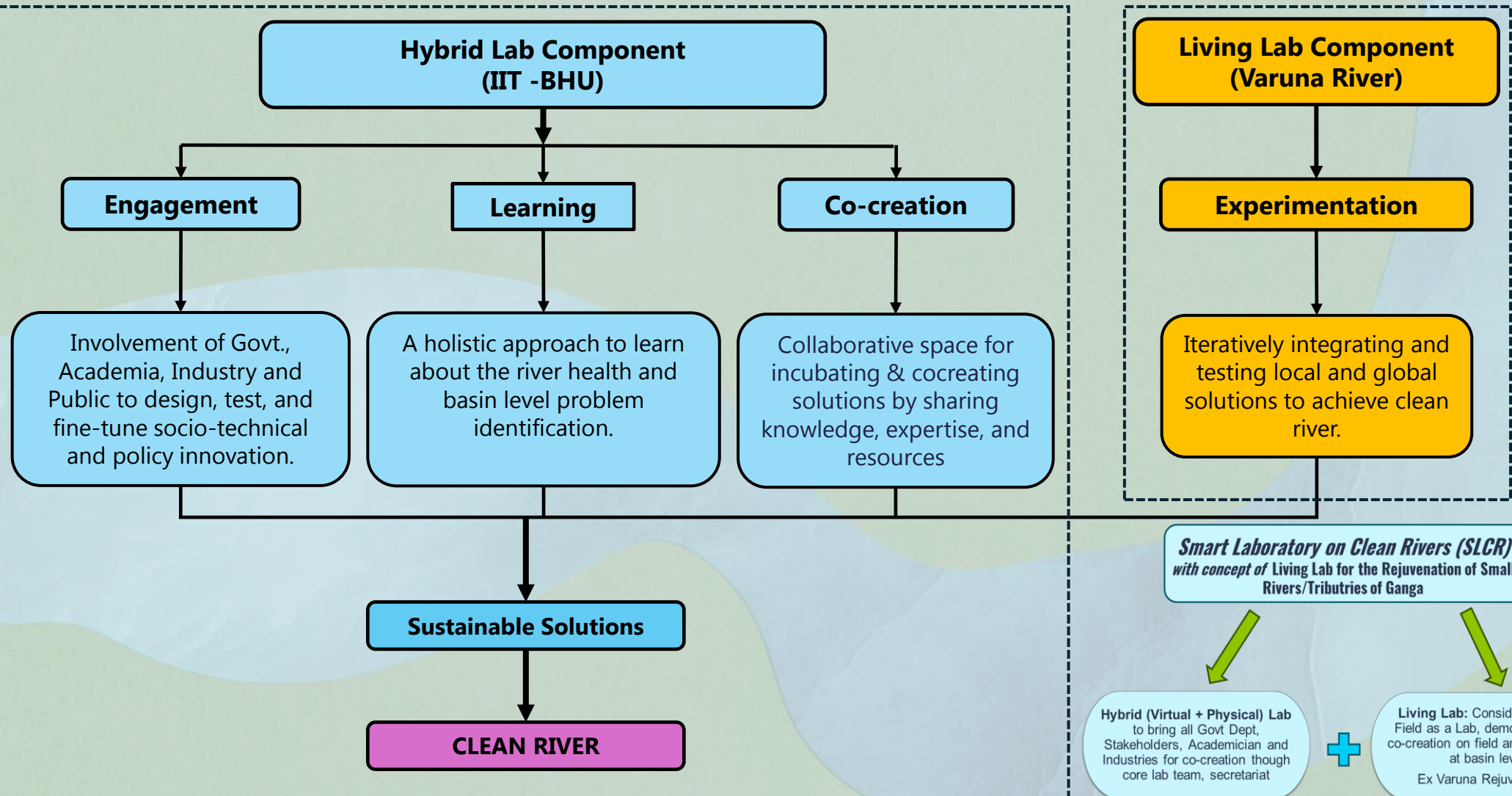
Green Strategic Partnership between India and Denmark



- Joint initiative under the leadership of the Hon'ble Prime Ministers of India and Denmark.
- Knowledge & expertise exchange through collaboration among experts and scientists.
- Co-creation of sustainable solutions through research and innovation.
- Strengthening SLCR by training enhancing capacity building & outreach.

Concept of Smart Living lab for Clean River (SLCR): Small River Rejuvenation

Smart Lab for Clean River (SLCR)



Activities at Glance under SLCR

A1

Holistic
River Plan

A2

Decision
Support System

A3

Smart
Monitoring

A4

Innovative Technologies
Wastewater treatment

A5

Sustainable
Groundwater Management

A6

Carbon-Neutral &
Water-Positive Principles

A7

Capacity building &
outreach program

A1

Holistic River Plan: River Rejuvenation Plan including Revenue Generation model.

Storm & wastewater management plan, Integration of Cultural heritage and Recreational sites

A2

Decision Support System: Development of a Hydrological and Hydrodynamic Model-based system for decision-making and planning.

A3

Smart Monitoring and data collection using emerging technologies

Fingerprint analysis for characterization of non-targeted chemical and microbial/emerging pollutants

A4

Innovative Technologies: Innovative technologies using **nature-based systems** for remediation of industrial effluents, drains and polluting tributaries/ stretches.

Refurbishing of the existing STPs to increase the hydraulic and pollutant removal capacity.

Reuse of STP treated. wastewater/ Sludge:

A5

Sustainable Groundwater Management: Small rivers receive most of their water either from rain or by the River-Aquifer (RA) exchanges. The interaction of small rivers with groundwater plays a crucial role in the overall water budgeting of the basin.

A6

Carbon-Neutral and Water-Positive Principles: any intervention that is being tested under the SLCR concept will be evaluated for its Carbon and Water footprint and how the interventions can contribute to carbon sequestration and water budget to achieve carbon neutrality and water positive environment.

A7

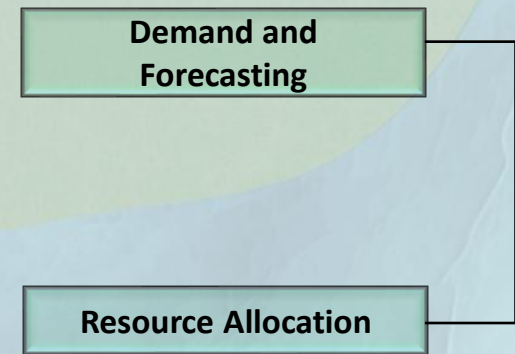
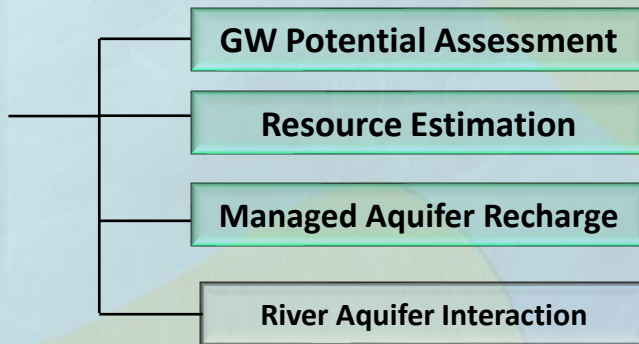
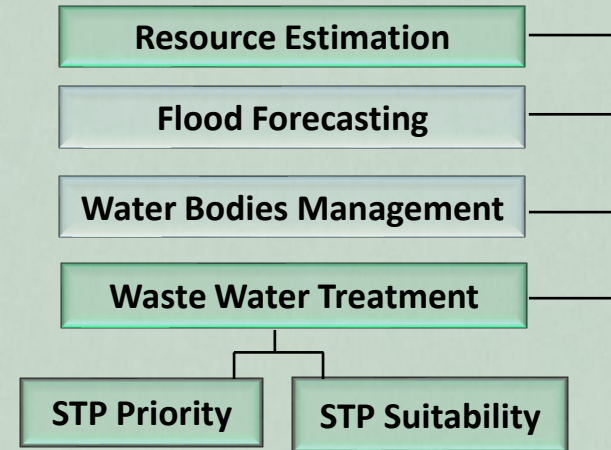
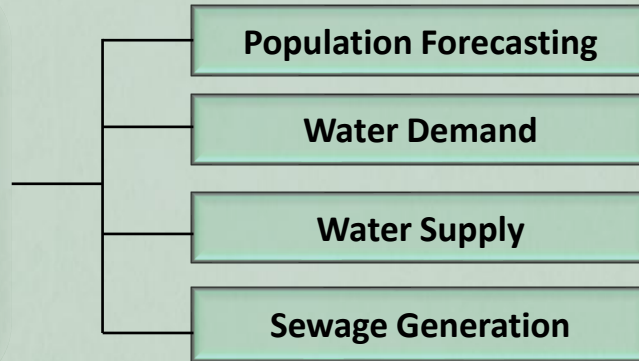
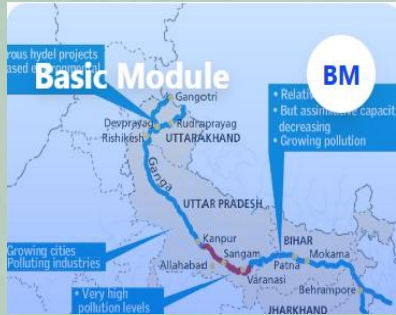
Capacity building and outreach program

Development of courses with focus on global sustainable solutions and international exposure.

SLCR – Key Project Initiatives

<u>Code</u>	<u>Project</u>	<u>Key Focus</u>
A1:P1	Holistic plan for River Varuna including River Manual	To develop a holistic plan that provides a comprehensive river management solution considering ecological, hydrological, social, economic, and cultural factors to achieve continuous and unpolluted flow in the River Varuna.
A1:P2	Integration of Cultural & Social sites along the Varuna River to develop the tourism and recreational zones.	To integrate cultural and social sites along the Varuna River to develop tourism and recreational zones, while preserving and showcasing the rich archaeological and historical heritage of the region.
A2:P1	Decision Support System for Water Management:	To understand overall water dynamics in the basin through hydrological and hydrogeological models, generation of different scenarios, forecasting based on mathematical models and data, data analytics.
A3:P1	Smart Monitoring for discharge and pollution assessment in river stretches:	To develop a robust smart monitoring system for discharge and pollution assessment in river stretches and leveraging multiple integrated technologies to complement IoT-based monitoring by adopting the output of different technologies. Identifying the optimal number of stations and locations based on multiple technologies.
A3:P2	Hydrogeological Model of Varuna Basin for Recharge Sites. Objective:	To identify recharge sites, and permissible recharge rates to enhance base flow in the Varuna River through advanced geophysical techniques (sTEM & FlowTEM) and mathematical modelling and becoming an integral part of the DSS.
A3:P3	Characterization of Emerging pollutants & Fingerprint analysis	To develop a comprehensive methodology for characterizing emerging pollutants in the Ganga River Basin, focusing on their effects, sources, distribution, and remedial measures using advanced analytical techniques like chromatography, mass spectrometry, and fingerprint analysis.

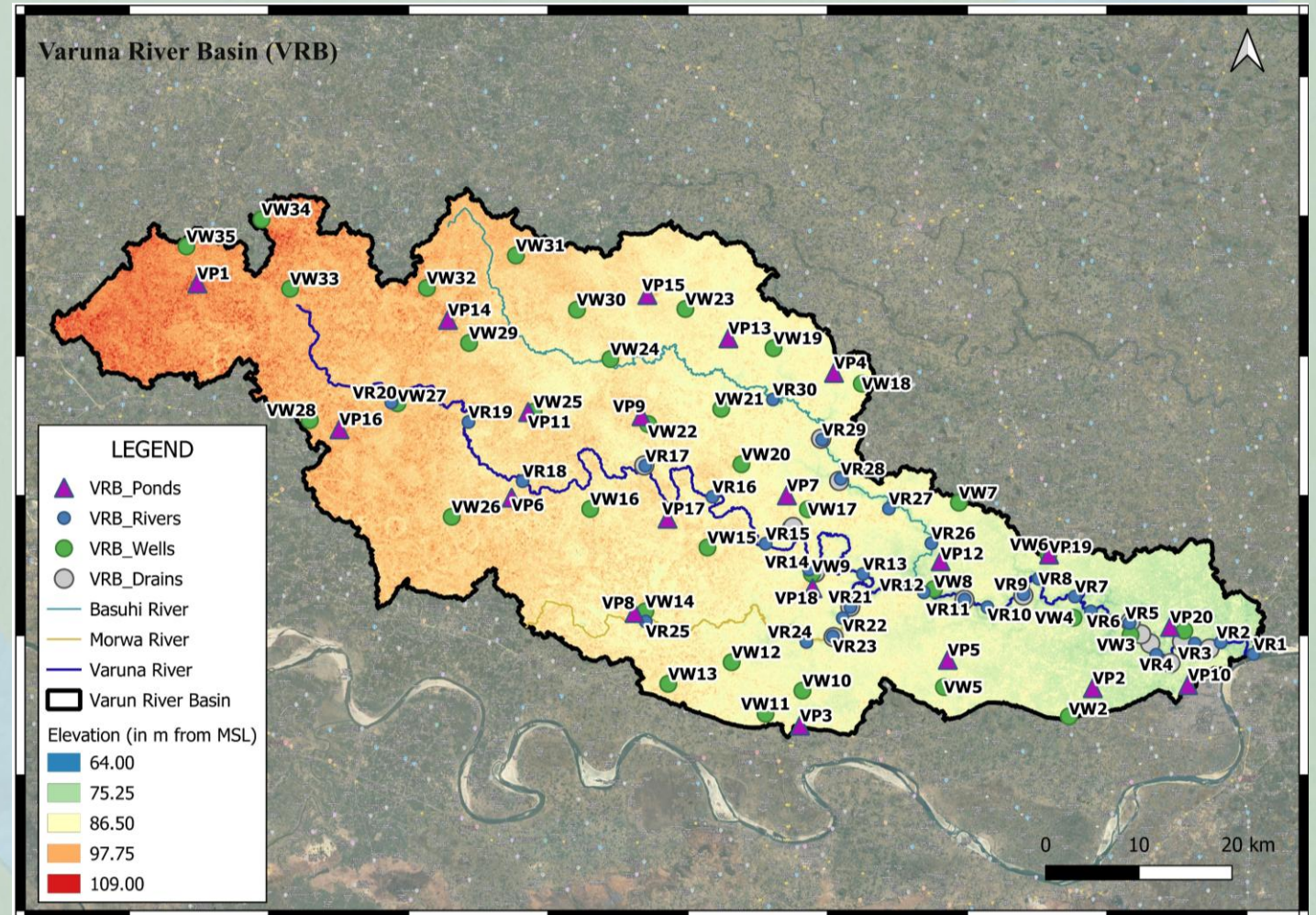
Decision Support System for Water Management



Project: Emerging Pollutants and Microbial Analysis

Why Varuna River Basin?

- Representative urban–agricultural watershed.
- Receives municipal, industrial, and agricultural inputs.
- Major tributary of the Ganga River.
- Ideal pilot basin for contaminant source apportionment



IDENTIFIED VARUNA RIVER BASIN (VRB) SAMPLING SITES

Sample
Acquisition

Sample Analysis

Contaminant
Identification

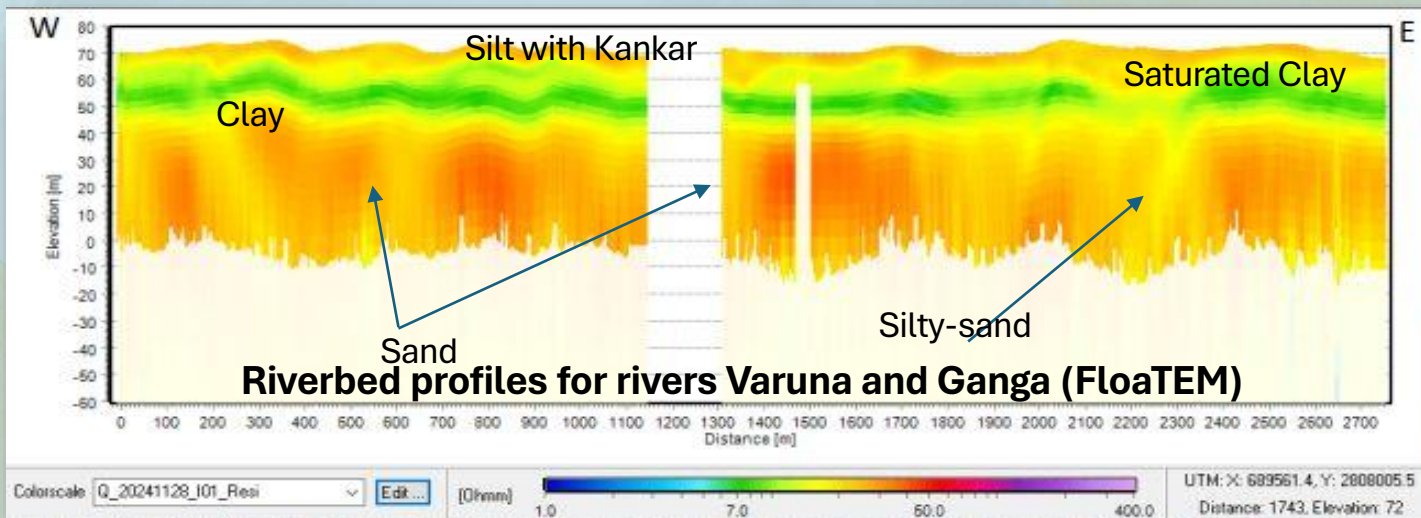
Fingerprint
Library Creation

Source
Attribution

Risk Assessment

Decision
Support

Hydrogeological Model of Varuna Basin for Recharge Sites



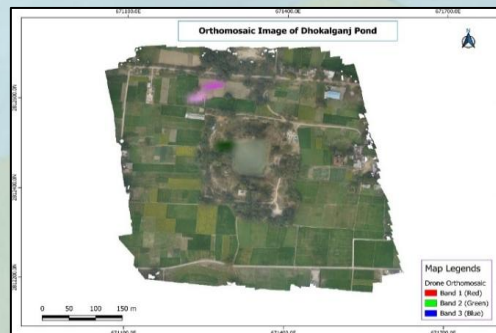
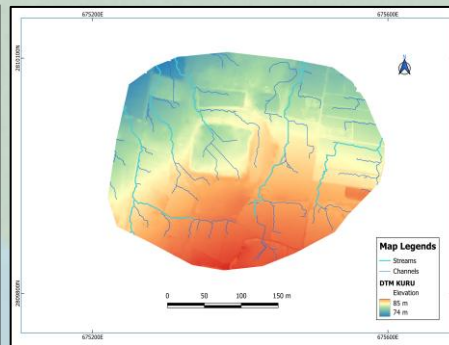
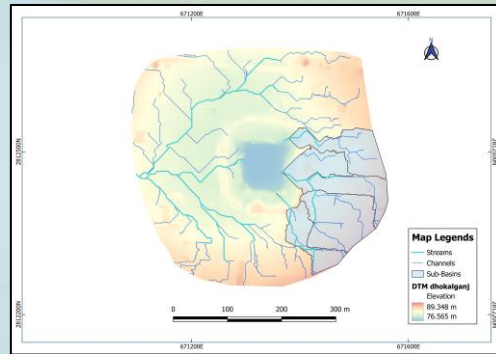
Living Lab: Sites for Pilot Demonstration

Key Requirements

- Active participation and coordination with Government Departments and Gram Panchayat.
- Statutory permissions and approvals prior to physical or on-ground interventions.

Implementation Readiness - Priority Projects

- Rooftop rainwater harvesting sites identified
- Treated-water recharge sites identified
- Amrit Sarovar – location & capacity enhancement
- Samdha Wetland – restoration site identified



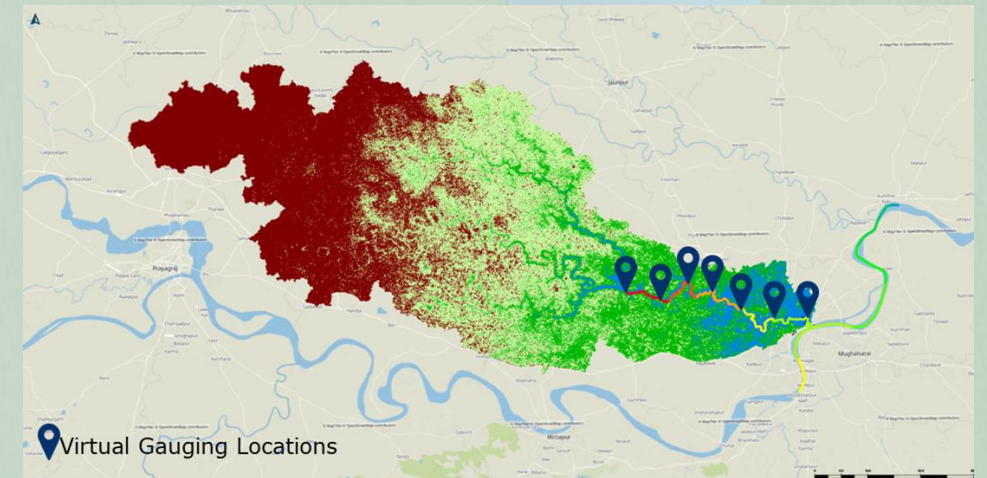
Pond in village Khewali, Hathi Bazar, Rameshwar

Varuna DSS: From Data to Decisions

- Drawing on Danish best practices in integrated water management and river restoration.
- Ramboll applies advanced tools and methodologies to support sustainable river rejuvenation.

Key Demonstrations

- Basin-scale hydrological and hydraulic models
- Decision Support Systems for water resource management
- Flood estimation and management
- Building dynamic and continuously evolving river database.
- Water quality modelling and analysis
- Groundwater recharge and resilience assessments
- Scenario-based planning for river rejuvenation



Creating Long-Term Impact

- The Smart Lab establishes a pathway for scaling proven solutions across river basins in India.

Expected Outcomes

- Improved river health and water quality
- Enhanced flood resilience
- Stronger scientific basis for investments
- Better water resource management decisions
- Capacity building and institutional strengthening
- Replicable solutions for river rejuvenation programs



MINISTRY OF FOREIGN AFFAIRS
OF DENMARK
Denmark in India



जल शक्ति मंत्रालय
MINISTRY OF
JAL SHAKTI



Thank you

