A major Program of Work to Support Strategic Basin Planning by Government of India with a duration of about about 2 years.

Project Background:

- The Ganga River is the most populated river basin in the world.
- The ecological health of the Ganga River and some of its tributaries have deteriorated significantly.
- MoWR, RD&GR is now adopting a river basin approach for water resources assessment, planning and management with special attention on IWRM and promoting conjunctive use of surface and ground water.
- There is a wide diversity of stakeholders ranging from domestic to agriculture to industries with large number of institutions and spread over 11 states.
- The World Bank have awarded the contract to M/s Deltares for Strategic Basin Planning for Ganga River Basin in India.

The High level objectives are:

Objective # 1

To **strengthen the capability** of relevant Central and State Government Agencies to undertake comprehensive evidence-based *Strategic Basin Planning* for the Ganga River Basin

Objective # 2

To develop, document and disseminate (through detailed analytical work and stakeholder engagement) a set of **"plausible scenarios"** that balance significantly improving the health of the river and maintaining an acceptable level of economic productivity

Objective # 3

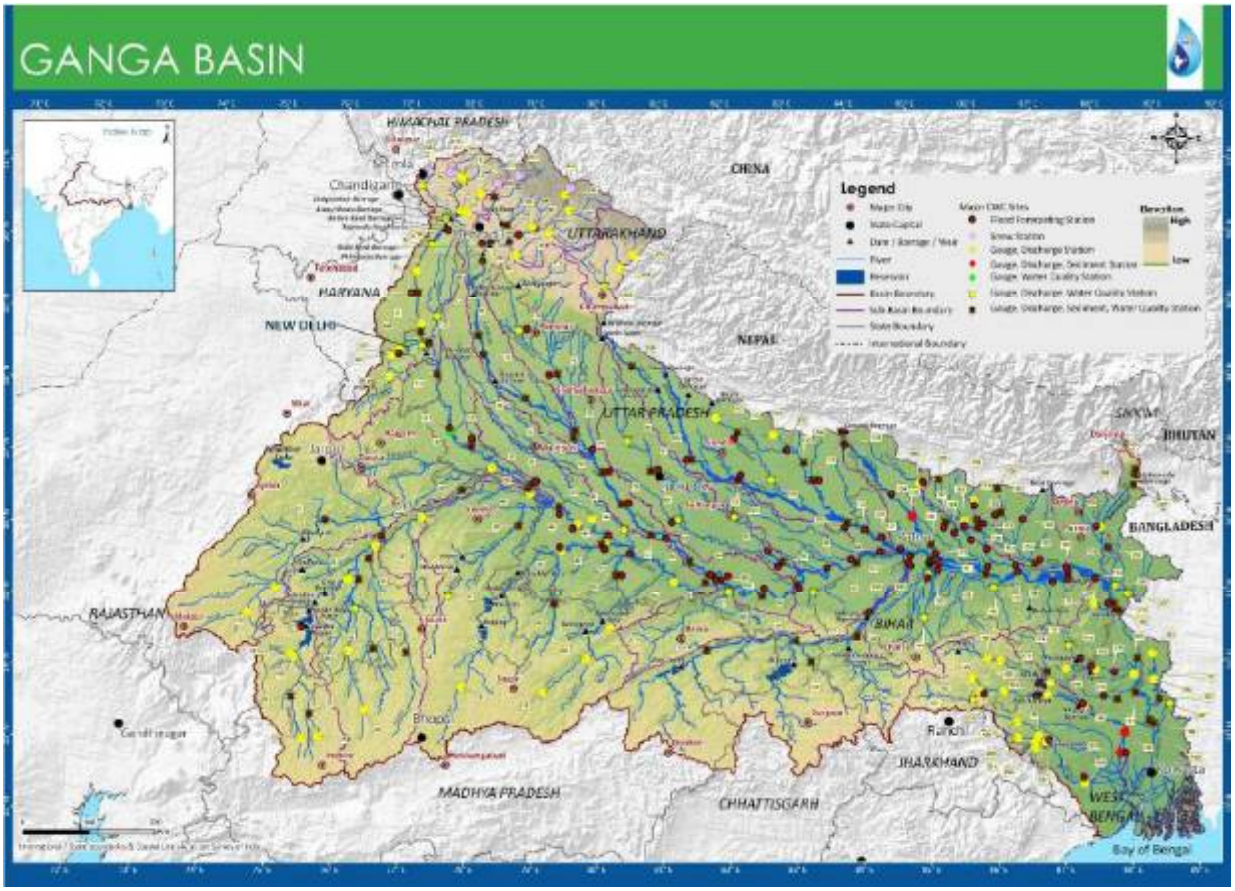
To build stronger and more accessible ***Information and Knowledgebase*** **to guide ongoing dialogue around and management of the Ganga River basin**

Objective # 4

To establish ongoing **multi-stakeholder engagement** processes in the basin to support Strategic Basin Planning

These objectives will be achieved by:

- robust water resources planning model
- multi-scale environmental flow assessment
- scenarios that explore alternative options
- surface-groundwater interactions across the basin
- multi-stakeholder consultation process (inside and outside of government)
- wide access to the models and analyses and quality documentation



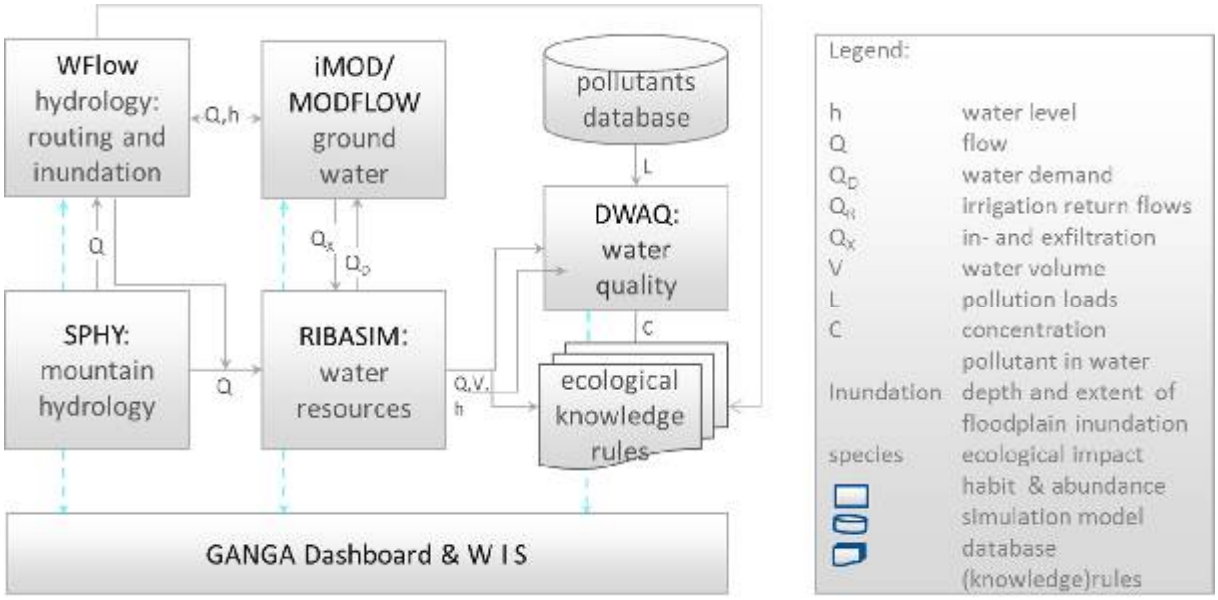
	Interactions	
Upstream	⟷	Downstream
Surface Water	⟷	Ground water
People	⟷	Ecosystem/Environment
Water quantity	⟷	Water quality
Urban	⟷	Rural
Central	⟷	States
Long term	⟷	Short term
Floods	⟷	Droughts




Methods

To meet the specified requirements for the river basin modelling, a framework based on the following individual sub-models will be set-up, tested and applied for the Ganga basin:

1. Distributed catchment hydrological models for the simulation of rainfall runoff and sub-surface flows on a daily time step and fine spatial resolution (WFLOW – SPHY);
2. 3D geo-hydrological model to simulate the groundwater dynamics, the interaction with the surface water such as the Ganga River and the impact of groundwater extraction (iMOD-MODFLOW);
3. A water management tool to simulate the Ganga River Basin, the operation of its water resources infrastructure, water demand and allocation (RIBASIM);
4. A catchment water quality model to quantify catchment loads and pollutant concentrations as well as an ecology module with knowledge rules to assess the impact on the ecology of the river and its floodplains and the ecosystem services (e.g. River Basin Explorer);
5. The Ganga Water Information System (WIS) and dashboard to store and manage all data and model results in a geo-database and to allow dedicated querying of model results; and
6. Delft-FEWS as a connector between the models and the information system.



Aim of the models:

- To support decision making with respect to strategic basin planning
- Compare situations with and without certain developments / measures
- No detailed modelling of the whole water system
- Only include what is relevant for strategic planning

Model	Originator	Description	License status
WFLOW	**Deltares**	**Surface water hydrology**	**Open source**
SPHY	**FutureWater**	**Mountain hydrology**	**Open source**
RIBASIM	**Deltares**	**Water resources**	**Free**
MODFLOW	**USGS**	**Groundwater flow**	**Open source**
iMOD	**Deltares**	**Graphical user interface for and an accelerated version of MODFLOW**	**Open source**
Delft-FEWS	**Deltares**	**Data, workflow and visualization platform**	**Free**
River Basin Explorer	**Deltares**	**Water quality, ecology and ecosystem services**	**Free**

Collaborative modeling approach

The collaborative modelling process commenced during the inception/conceptualization phase with the meeting of stakeholders at different basin-wide and state-level meetings and workshops. At these meetings the stakeholder responses to the project and its set-up were solicited, also in addition to their initial ideas on the most important water-related issues confronting the basin.

These initial ideas were subsequently complemented with information received from questionnaires that were sent to a wide range of state-level stakeholder organizations. Several questions in this questionnaire related to the perceived issues, their impacts and their causes.

Based on the input received through the meetings, workshops and questionnaires, the project team identified issues that play a role in the different states. To validate and further elaborate these findings for input into the technical modelling process, another series of workshops will be organized in the period July-October 2016:

In the wake of these workshops, the modelling team will use the additional information gleaned and decisions taken to further develop the hydrological, allocation, and water quality models, which will then be collaboratively validated and used for the assessment of packages of measures and scenarios during in the later phases of the project.

Phasing of the Project

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