River Basin Management Cycle

Training Module 2: Skills and expertise for technical development and implementation of RBM plans

26-28 February 2020, Pune

Support to Ganga Rejuvenation Project | February 2020

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Implemented by
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INDIA-EU WATER PARTNERSHIP

Prepared by
AHT GROUP AG Management & Engineering
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Objectives and Components of the Training Programme

Objective

Experts from the various target groups of the Indian government at national and state level understand the RBM Cycle, and are able to apply it in the context of the Ganga basin and other (sub)basins in India.

Components

- Training modules delivered in New Delhi, Dehradun, Lucknow and Pune.
- An e-learning platform
- Training of Trainers (ToT)

Milestones and Training Modules

Milestone	Date	Status	Locations
Rapid Training Needs Assessment (RTNA)	26 – 30 Nov 2019	Completed	New Delhi, Dehradun and Lucknow
Training Module 1: Understanding the RBM Cycle and its Steps	02 – 10 Dec 2019	Completed	New Delhi, Dehradun and Lucknow
Training Module 2: Skills and Expertise for Technical Development and Implementation of RBM Plans	26 Feb – 05 Mar 2020	Being implemented now	New Delhi and Pune
Training Module 3: Solutions through Exchange, Information Flow and Cooperation	24 – 25 April 2020	Planned	New Delhi
Training Module 4: Implementing the RBM Cycle Training (ToT)	20 – 22 April 2020	Planned	New Delhi
Training Module 5: Exchange of experience on the RBM Cycle Training	07 – 09 July 2020	Planned	New Delhi

Course Outline

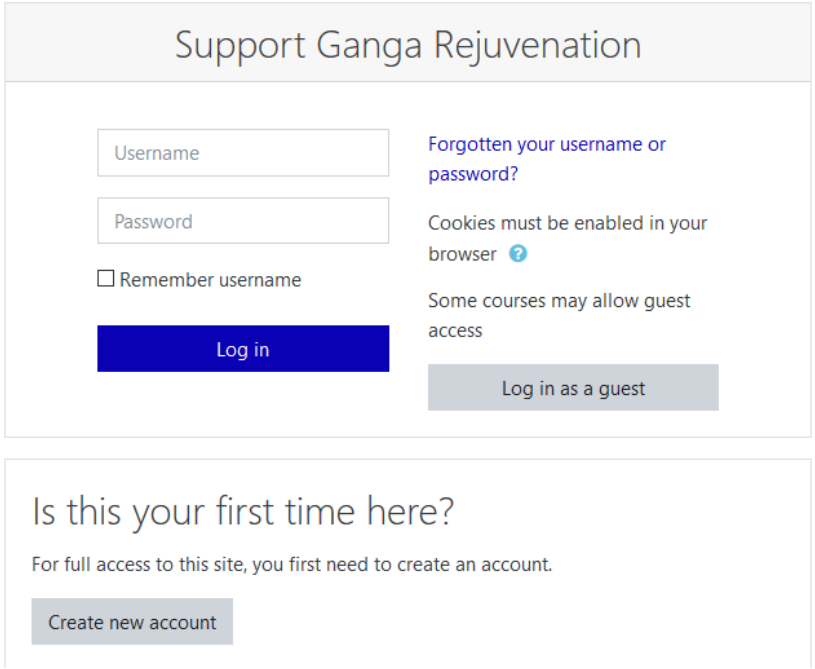
Unit	Topic
1	**Introduction to River Basin Management**
2	**Clear Governance and Coordination Structure**
	Governance (legal aspects and framework)
	Basin Coordination Structures (basin institutions and stakeholder engagement)
3	**Basin Characterisation**
	DPSIR Assessment
4	**Determining Basin Vision and Objectives**
5	**Design/ Adaptation of Monitoring Networks and Programmes**
6	**Assessment of Water Quality and Quantity**
7	**Implementation of RBM**
	River Basin Plans and Programme of Measures (PoM), Financing and Review of PoM

The e-Learning Platform

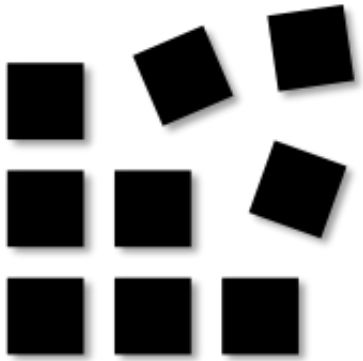
Access directly via **http://78.46.247.119**

or AHT's homepage **www.aht-group.com**

Projects → Asia → India → SGR



Your Expectations



1 Introduction to River Basin Management

Context of Water Resources Management

Sustainable Development Goals SDG 6.5 Target → "*By 2030, implement integrated water resources management at all levels, including through transboundary cooperation.*"

European Water Framework Directive (WFD) (Directive 2000/60EC) → "*Water is not a commercial product like any other, but rather a heritage which must be protected, defended and treated as such.*"

Integrated Water Resources Management Guideline (National Water Mission, 2010) → "*A process which promotes the coordinated development and the management of water, land and related resources […] to maximise the resultant economic and social welfare.*"

Elements of Water Management at Different Levels

National Level

- National water strategies and laws
- Harmonisation of investment planning
- Water sector reform including regulation

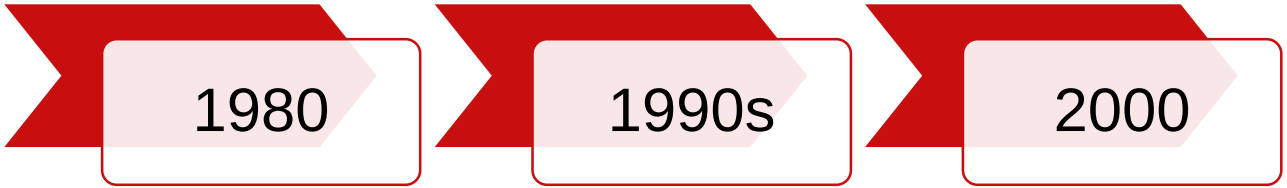
Basin Level

- Support of basin organisations
- **Data and information management, Decision-support Systems (DSS)**
- **Development of water management plans**
- **Multi-stakeholder agreements on Water Resources Management**

Local Level

- Participative management structures e.g. water user associations
- Wastewater treatment, water reuse
- Water storage, flood and rainwater management
- Water efficiency, energy efficiency

RBM in Europe: A Long Journey with the EU Water Framework Directive



Standards for drinking water, wastewater discharge and cont. surface and bathing water quality

Acknowlegded the need for broader water policies and an integrated approach

Development and adoption of the EU WFD

River Basin Management

River Basin Management Principles

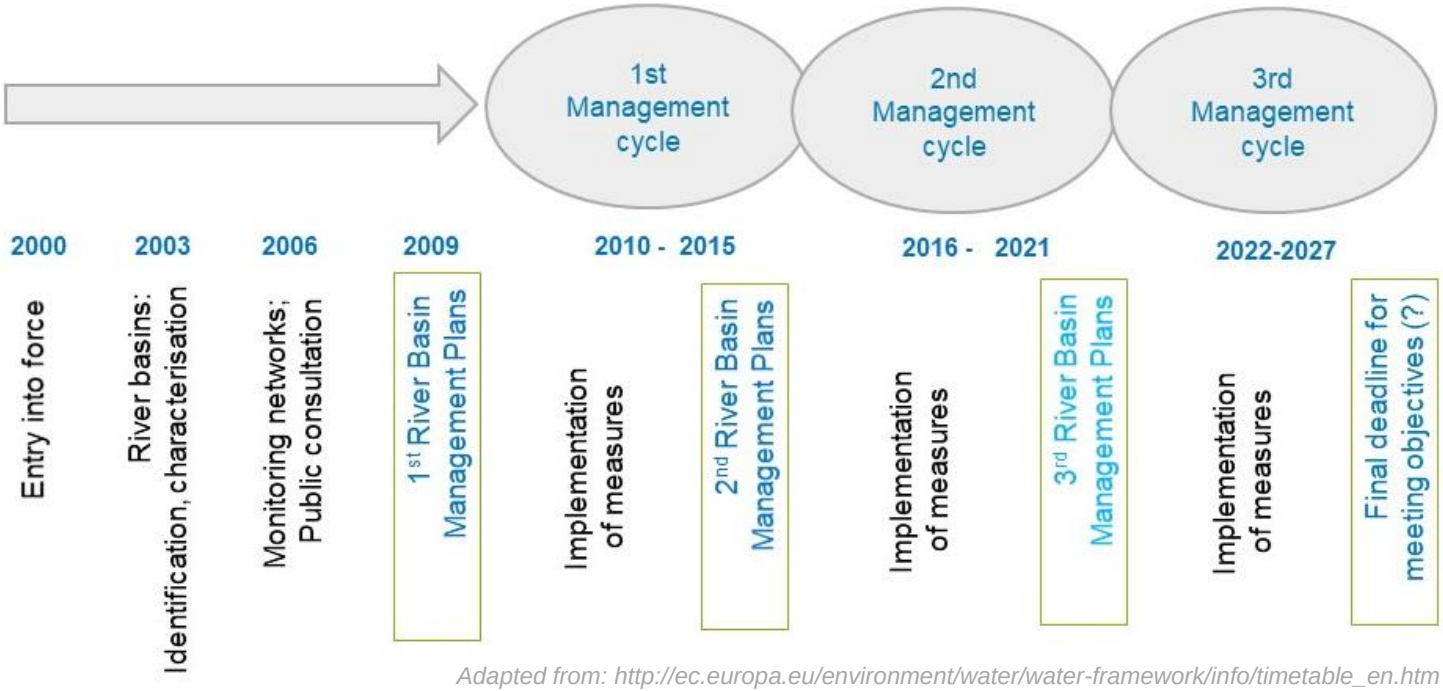
- River Basin Management (RBM) is a **practical** approach which includes **measures** necessary to achieve set goals and objectives

- In 2000, the European Union (EU) adopted the **Water Framework Directive (WFD)**

- From the requirements of the WFD, and the principles and needs of water resources management, a **River Basin Planning and Management Cycle** was developed

RBM Cycle

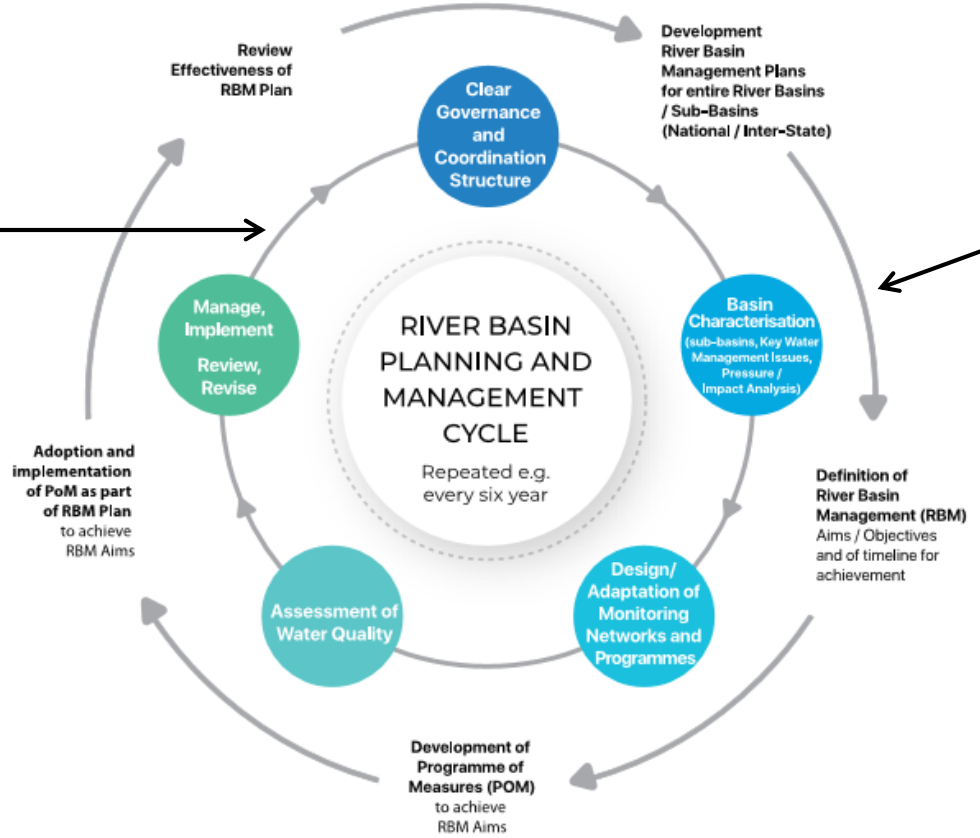
- In Europe: Years 2015, 2021,2027 → Cycle length 6 years



Adapted from: http://ec.europa.eu/environment/water/water-framework/info/timetable_en.htm

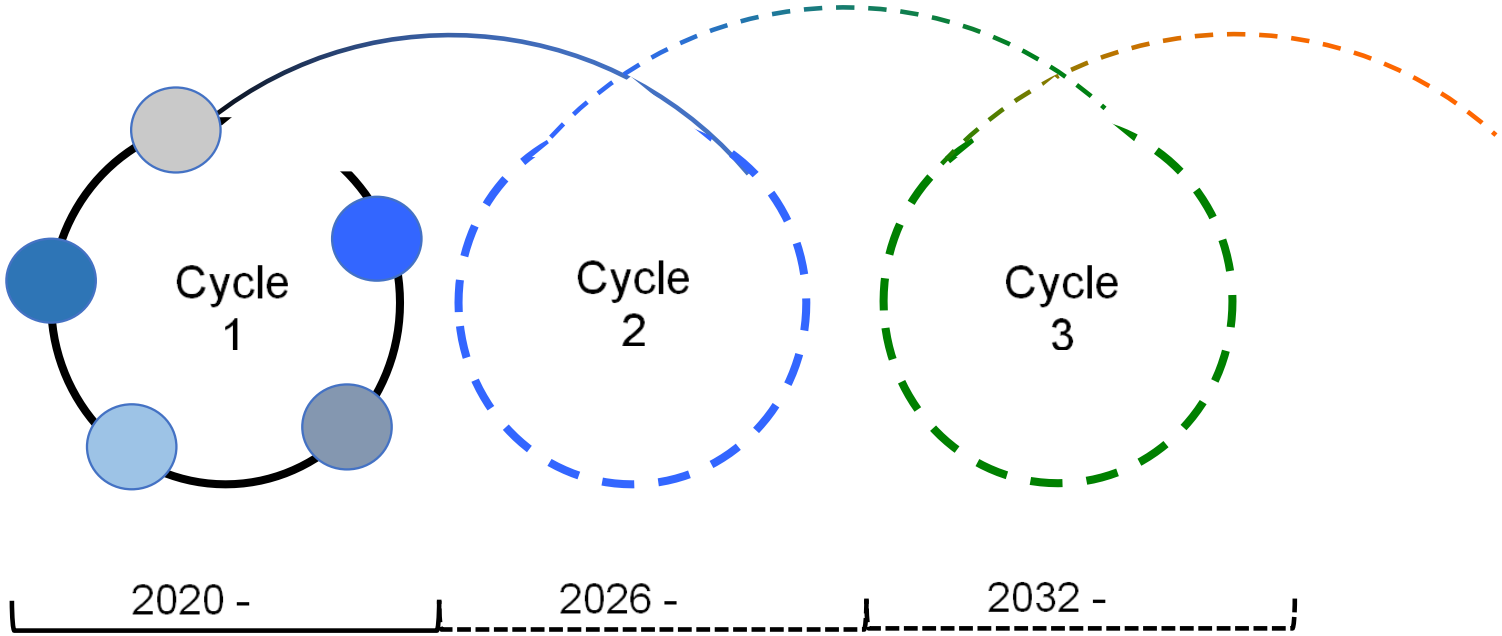
The River Basin Planning and Management Cycle

„Inner cycle“
Technical/
operational level“



„Outer cycle“
Planning and
decision making
level

The River Basin Planning and Management Cycle



- RBM process requires planning over several years and implementation cycles that are to be repeated in a certain frequency (e.g. 6 years).
- Each Cycle is a revision to adjust to new conditions in the basin and to addresses new challenges.

Didactical Approach

Didactical Approach

To achieve the objective of this training programme:

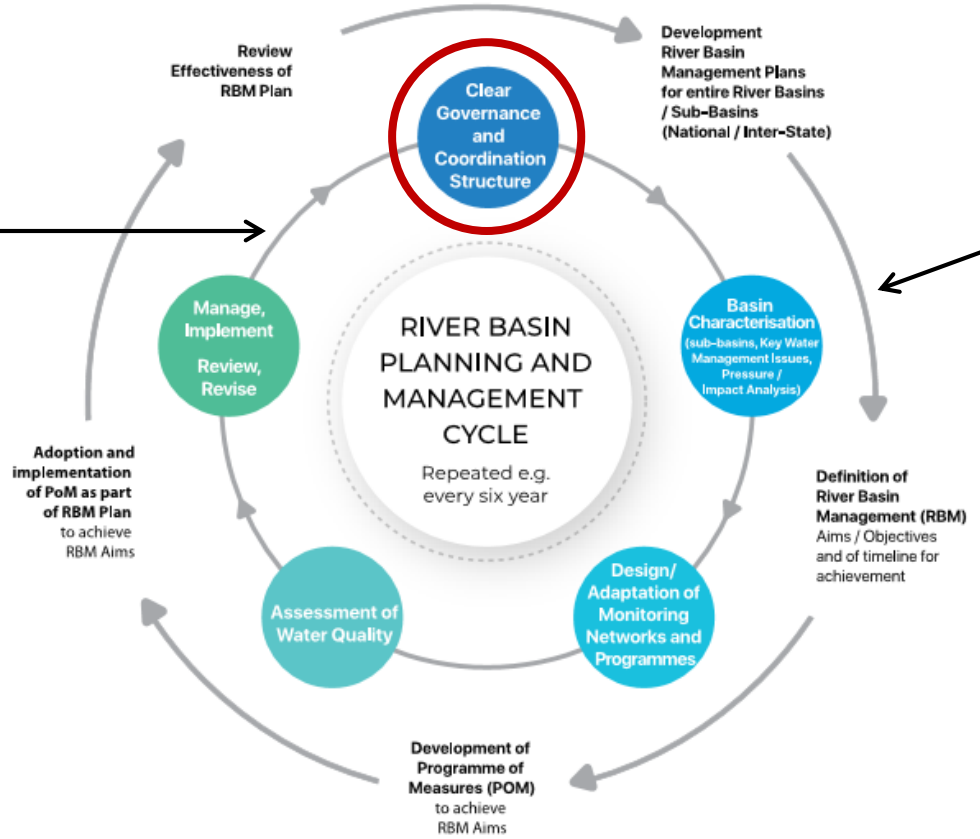
- Working groups of up to 5 people will be established
- Each working group chooses one (sub)basin in the Ganges to work on throughout the training programme
- Trainers will assist during the group works.

2 Clear Governance and Coordination Structure

2.1 Governance and Legal Framework
2.2 Basin Coordination Structures

The River Basin Planning and Management Cycle

„Inner cycle“
Technical/
operational level“



„Outer cycle“
Planning and
decision making
level

2 Clear Governance and Coordination Structure

2.1 Governance and Legal Framework
2.2 Basin Coordination Structures

What is Governance?

- **Water governance** is “the set of *administrative systems*, with a core focus on *formal institutions* (laws, official policies) and *informal institutions* (power relations and practices) as well as *organisational structures* and their *efficiency.*” (Water Governance in OECD Countries, A Multi-level Approach, OECD)
- **Water governance** refers to the range of *political*, *social*, *economic* and *administrative* systems that are in place to *develop* and *manage* water resources, and the *delivery of water services* at different levels’ (Rogers and Hall, 2003)

→ **It is a set of principles, norms, rules and procedures that:**

- Define overall objectives for water resources/basin management
- Establish norms and aspiration how and with which aim to manage water resources
- Defines rights and obligations of different actors/users
- Establishes mechanisms for continuous actor cooperation and negotiation

Water law – The basics

What is law?

- The law provides the framework within which activities can be carried out in a society.
- The law is the total of rules and regulations to arrange human relations and bring order to human conduct in a given state on a given issue

And what is water law?

- Water law is a building block of the institutional layer needed for sound water governance
- Water law is made up of all the provisions which in one way or another govern the various aspects of water management, i.e. water conservation, use and administration, the control of the harmful effects of water, water pollution and so on (Caponera, 1992).

Water Rights as the Basis for Water Law

- It is a **legal entitlement** to use water and **not a property right** in the water
- It establishes a legally enforceable expectation for the holder of the right and can exclude others from use of that water
- **Sources of water rights**: legislation/water code but also traditional and customary water uses
- It is legally enforceable so can be claimed before a court of law against the claims of the other, including the government
- By providing security and reliability of title it supports investment
- It includes
  - **Rights**: abstracting surface or ground water for different purposes, free from interference and enforceable
  - **Obligations**: return unused water, treat wastewater, pay water charges and use water in compliance with license terms (conditions of use)
- Traditionally linked to the use of land

Example: Legal foundation of the International Commission for the Protection of the Danube River (ICPDR)

ICPDR IKSD
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

- 800,000 km²
- 19 countries
- 14 of those, together with the European Union, are contracting parties of the ICPDR.
- Considered as the most international river basin in the World.

Source: ICPDR

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Example: Legal foundation of the International Commission for the Protection of the Danube River (ICPDR)

ICPDR IKSD
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

The overall legal instrument for co-operation and transboundary water management in the Danube River Basin is **The Danube River Protection Convention** (DRPC).

Its main objective is *to ensure that surface waters and groundwater within the Danube River Basin are managed and used sustainably and equitably.*

This involves:

- Ensuring sustainable water management
- Ensuring conservation, improvement and rational use of surface waters and groundwater
- Controlling pollution and reduce inputs of nutrients and hazardous substances
- Controlling floods and ice hazards

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Example: Legal foundation of the International Commission for the Protection of the Danube River (ICPDR)

ICPDR IKSD
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

- When the EU Water Framework Directive (WFD) came into force in 2000, it established a legal framework to:
  - protect and enhance the status of aquatic ecosystems,
  - prevent their deterioration,
  - and ensure the long-term, sustainable use of water resources throughout the EU.

- In response, the 15 Contracting Countries of the ICPDR, including the 5 non-EU Member States (MS), agreed to implement the WFD throughout the entire basin.

- The contracting parties made the ICPDR the facilitating platform to coordinate WFD-related work.

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Video – International Commission for the Protection of the Danube River (ICPDR)

(Duration 4:45 min)

Example: in India – Legal Framework for Basin Management in India

- **Specific Acts** as seen in the case of the Brahmaputra Board (Brahmaputra Board Act, 1980) or Damodar Valley Corporation (DVC)
- **Tribunals** are established under the Inter-State Water Disputes Act of 1956 as a result of existing inter-states river water disputes among riparian States
- **MoUs** between States as in the case of Upper Yamuna River Board
- **Gazette notification** as in the case of National Ganga River Basin Authority (NGRBA)

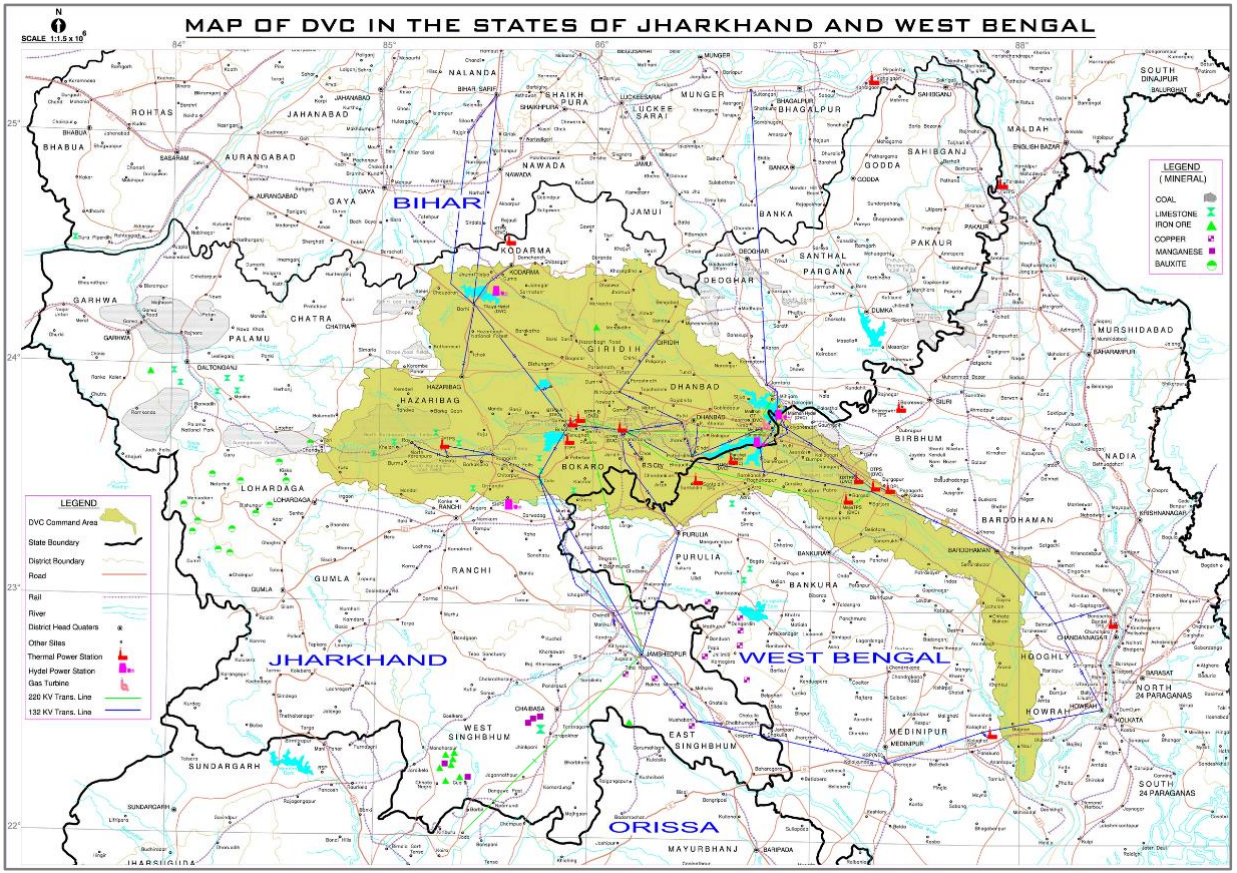
Example: in India – Legal Framework for Basin Management in India

- **2018 draft River Basin Management Bill**, under public consultation, has suggested a two-tier system of management of the River Basin Authority:
  - The Governing Council:
    - Chief Ministers of the basin States & UT.
    - State Ministers in charge of the Water Resources Departments.
    - Chairman of the Executive Board.
    - An Advisory Council assisting the Governing Council.

Example: in India – Legal Framework for Basin Management in India

- **2018 draft River Basin Management Bill**, under public consultation, has suggested a two-tier system of management of the River Basin Authority:
  - The Executive Board:
    - Chairman,
    - Administrative Secretary of the State Water Resources Departments.
    - Administrative Secretaries of various Departments.
    - Sectoral experts in sectors such as
    - Nominees from Central Water Commission (CWC), Central Ground Water Board (CGWB), Financial Advisor etc.

Example RBO in India: the Damodar Valley Corporation (DVC)



- About 25,000 km².
- Shared by two States:
  - Jharkhand,
  - West Bengal.

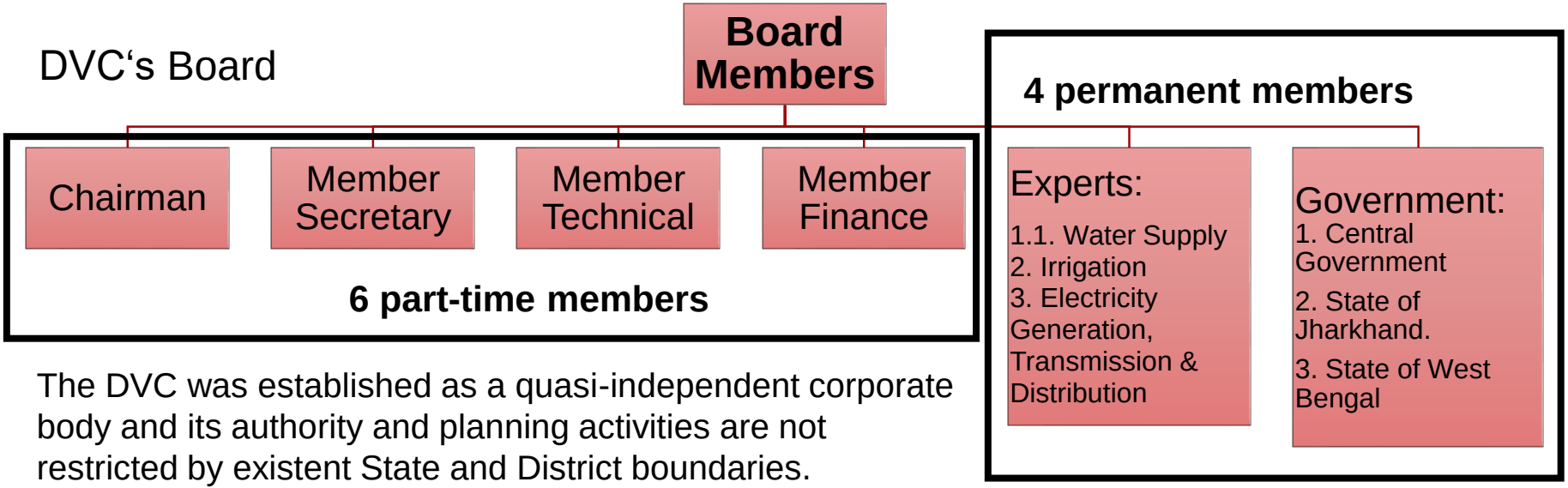
Source: https://www.dvc.gov.in/dvcwebsite_new1/dvc-map/

Example RBO in India: the Damodar Valley Corporation (DVC)

Legal background

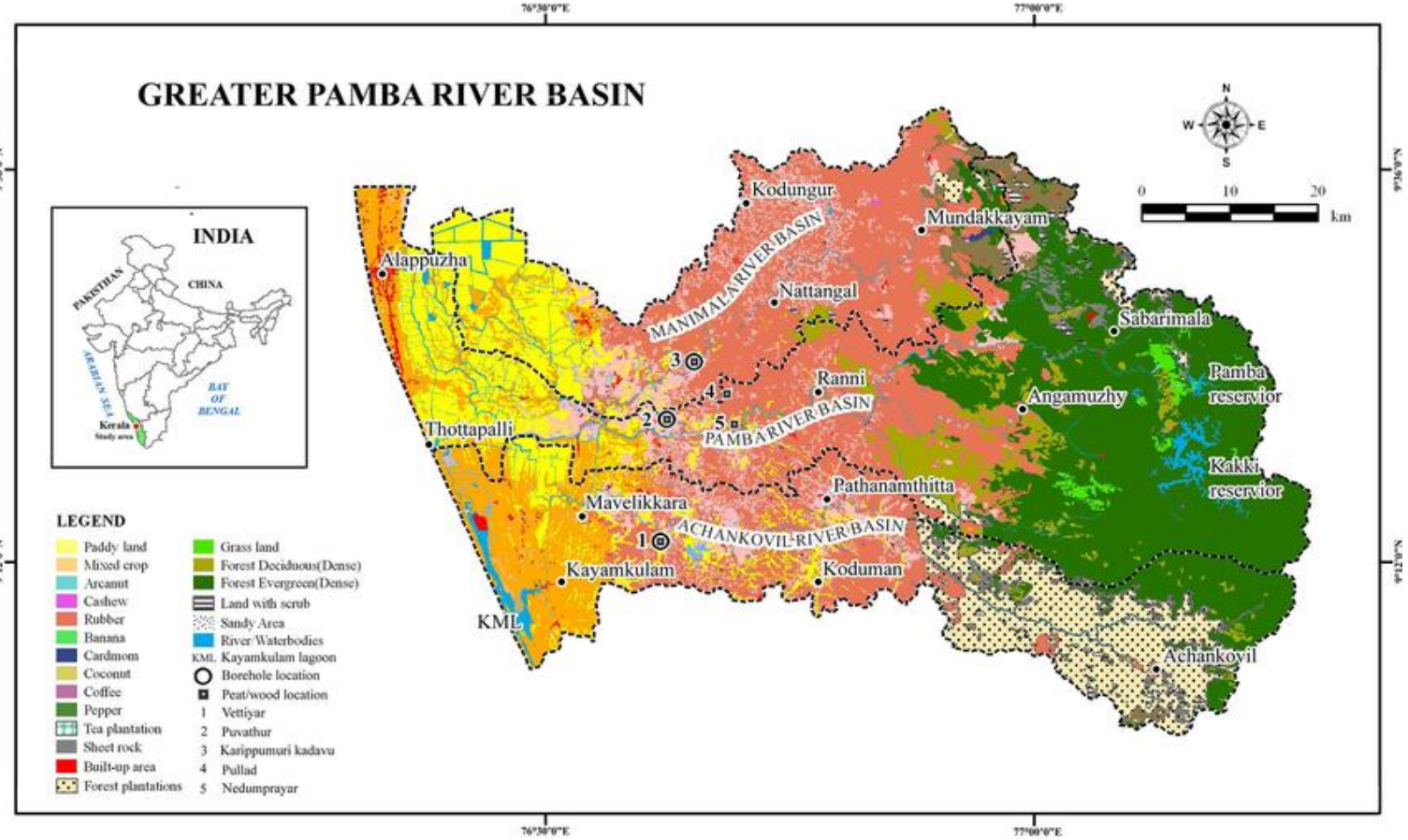
- The DVC (Amendment) Bill, 2007 was introduced in the Lok Sabha on 4th May, 2007.
- The Union Cabinet approved introduction of the DVC (Amendment) Bill 2011 on 16th June 2011 for the reconstitution of the DVC.

DVC‘s Board



The DVC was established as a quasi-independent corporate body and its authority and planning activities are not restricted by existent State and District boundaries.

Example RBO in India: the Pamba River Basin Authority



- About 2,200 km².
- Third largest river in Kerala.

Example RBO in India: the Pamba River Basin Authority

Pamba River Basin Authority Bill (2009)

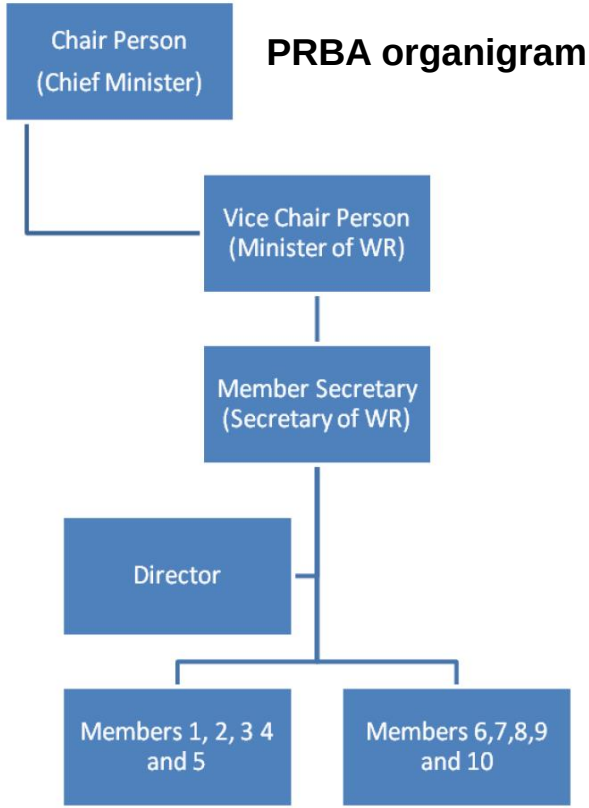
- The bill established the Pamba River Basin Authority as a statutory body for conservation of water resources in the Pamba River Basin.
- Preamble states “the government is bound to ensure the quality of water in the river and to take measures to prevent pollution and to undertake integrated planning, monitoring, management and development of water resources in the river with the **river basin as an integral unit**.”
- It has the power to impose controls or restrictions over the exploitation of natural resources or encroachments that have an impact on the water resources and the basins of the Pamba River.

Example RBO in India: the Pamba River Basin Authority

The Basin Authority is represented by stakeholders from 15 different governmental sectors as well as autonomous representatives:

- Chairman: the chief minister
- Vice-chairman: Kerala's Water Resources Minister
- Member Secretary : Water Resources secretary
- Chairman of the Kerala State Pollution Control Board
- Secretaries of various departments such as Revenue, Forest, Local Self-government, Health, Science and Technology and Environment, Finance, Power and Devaswom.
- Two water sector experts
- Two members of the House of the People, nominated by Government, representing the constituencies
- Two members of the Legislative Assembly, nominated by Government, representing the legislative constituencies
- Presidents of the District Panchayats

PRBA organigram



Pamba River Basin Authority Bill (2009)

Example RBO in India: Actual status of the Pamba River Basin Authority

- As of today, **the PRBA is not operational**. Actions on the ground were not taken to the level to which it should have been undertaken.
- According to the former Director of the PRBA, the reasons are:
  - It was not given priority by the Government
  - Lack of leadership
  - Lack of financial resource allocation
  - Apprehension by the stakeholders that this is not going to be feasible in Kerala/India
  - Frequent transfers of the officials
  - Lack of functioning of the various related departments in an integrated manner, even conflicts
- Departments members of the PRBA have undertaken their respective activities which happen to enable/facilitate the PRBA. But these activities **were not integrated**.
- A strong leadership can make a huge difference as the Chief Minister is the Chairman of PRBA.

Case of RBO in India: the River Basin Authority (RBA) in Kerala

In 2018, Kerala state government announced its plan to establish a River Management Authority for the 44 rivers in the State.

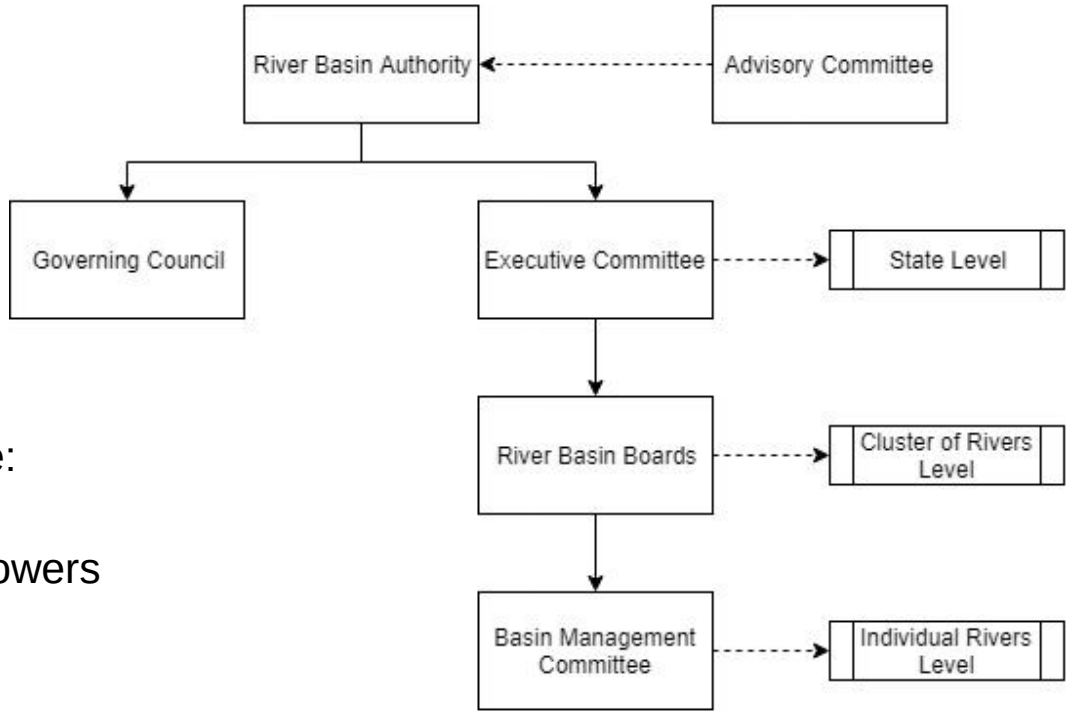
Proposed set-up of the RBA:

- Governing Council
- Executive Committee

Advised by an Advisory Committee:

- Provide technical advices
- Without any decision-making powers

RBA organigram



Source: Note from the Chief Engineer Irrigation & Administration Thiruvananthapuram, dated 25/03/2019

2 Clear Governance and Coordination Structure

2.1 Governance and Legal Framework

2.2 Basin Coordination Structures

- Institutional set-up
- Stakeholder engagement

Will be discussed in detail during Training Module 3!

3 Basin Characterisation

The River Basin Planning and Management Cycle

„Inner cycle“
Technical/
operational level“

„Outer cycle“
Planning and
decision making
level

Characterisation of the River Basin (i.e. surface water bodies)

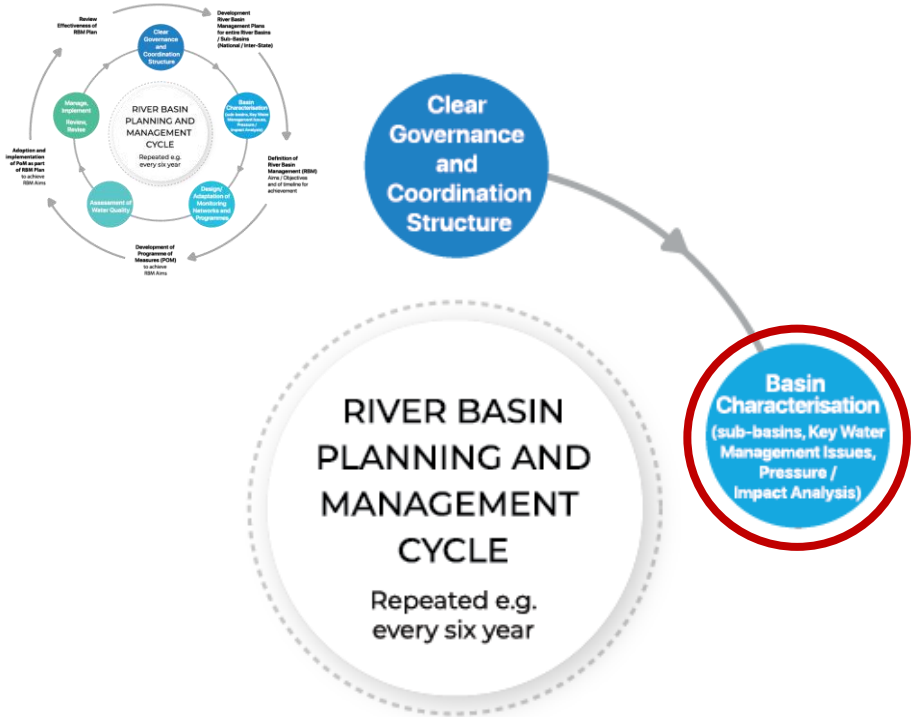
- **Step 1: Categorisation of the water body within the river basin district**
  - Ex.: river/lake/transitional water/coastal water, artificial water body, heavily modified water body)

- **Step 2: Typisation/Descriptation of the water body according to its caracteristics**
  - Ex.: ecoregion, altitude, size of the catchment, geology, flow, etc
  - For artificial and heavily modified surface water bodies the differentiation shall be undertaken in accordance with the descriptors for whichever of the surface water categories most closely resembles the heavily modified or artificial water body concerned.

- **Step 3: Produce a map with the water bodies of the river basin district**
  - For each surface water body type characterised, type-specific hydromorphological and physicochemical conditions shall be established representing the values of the hydromorphological and physicochemical quality elements.

- Type-specific conditions and type-specific biological references must be derived.

Basin Characterisation



Detailed description/ characterisation of the basin

- Identification of significant water management issues
- Pressures and impact analysis of the human activities on the surface and groundwater bodies

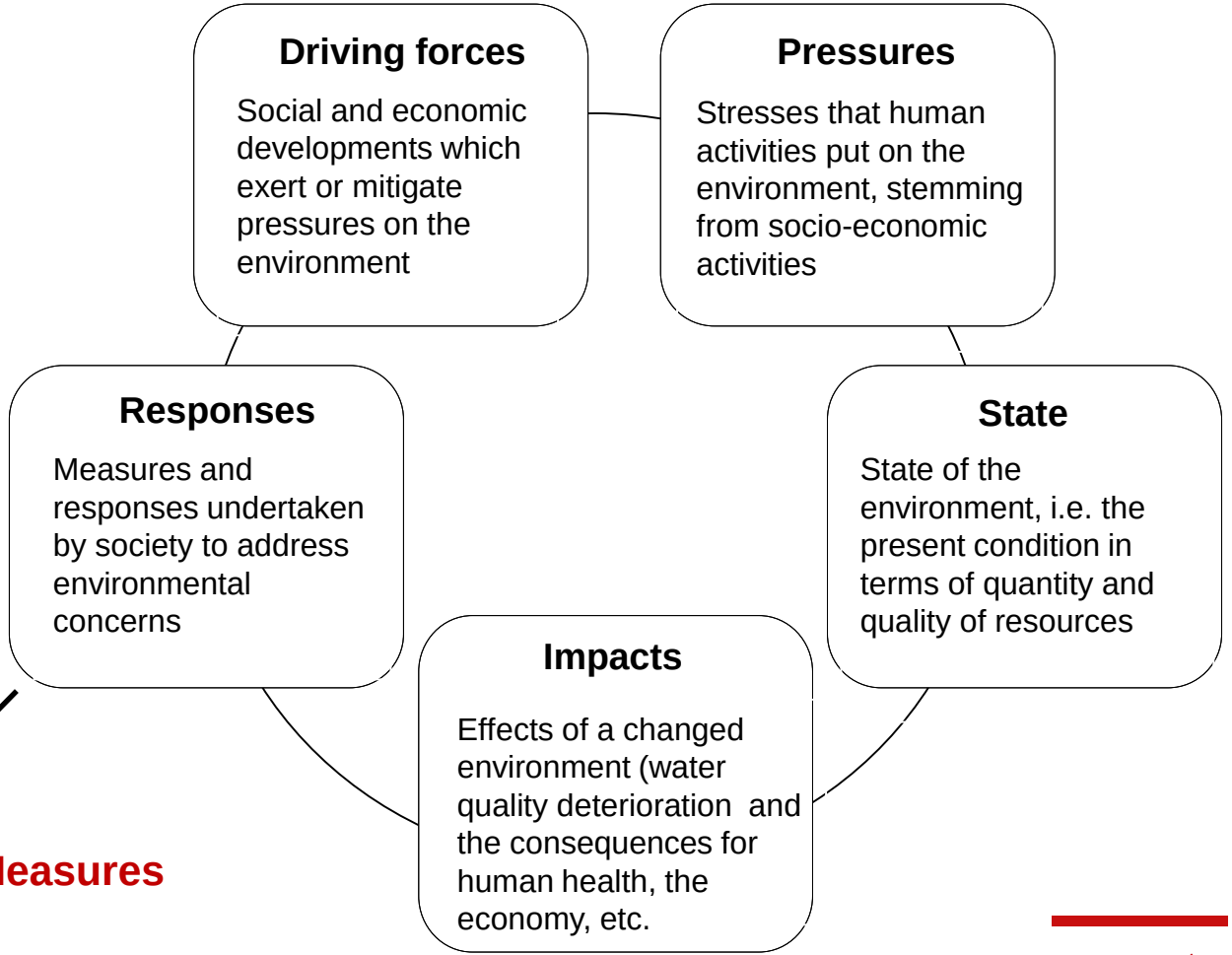
The DPSIR scheme

- The scheme was adopted by the European Environment Agency
- Identifying driving forces (**D**), pressures (**P**), states (**S**), impacts (**I**), responses (**R**)

The DPSIR Scheme

The DPSIR scheme

- The scheme was adopted by the European Environment Agency to assess Pressure and Impacts.
- Identifying driving forces (**D**), pressures (**P**), states (**S**), impacts (**I**), responses (**R**)



Programme of Measures

Example: in the Elbe basin – Basin Characterisation

International Commission for the Protection of the Elbe River
Mezinárodní komise pro ochranu Labe

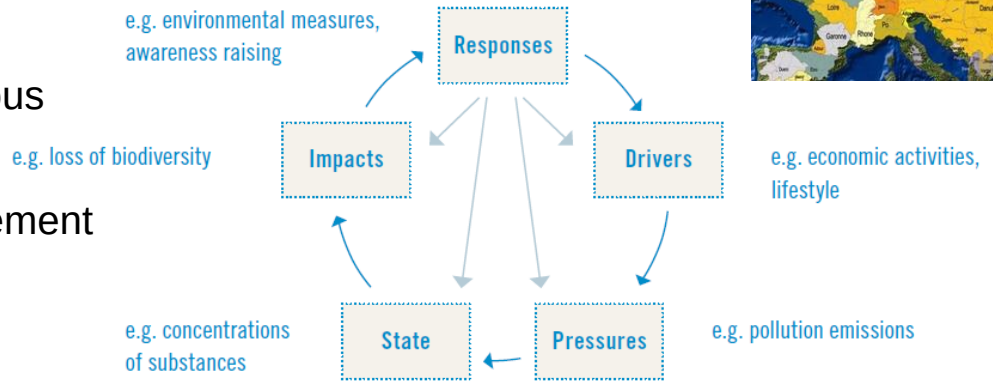
- 148,000 km²
- 4 countries (Germany, Czech Republic, Austrian and Poland).
- 99% of the area in Germany and Czech Republic.

Example: in the Elbe basin – Basin Characterisation

International Commission for the Protection of the Elbe River
Mezinárodní komise pro ochranu Labe

The Drivers-Pressures-State-Impact-Response (DPSIR) analysis and expert judgement to carry out the risk analysis (among others). 5 identified Significant Water Management Issues (SWMIs) in the Elbe Basin for the updating of the plan were identified:

- Enhancement of hydromorphology and river continuity
- Reduction of nutrients and hazardous substances
- Sustainable water quantity management
- Reducing impacts from mining
- Issues of Climate Change



All issues were addressed in the programme of measures formulating the „responses“ to heal the observed deficits.

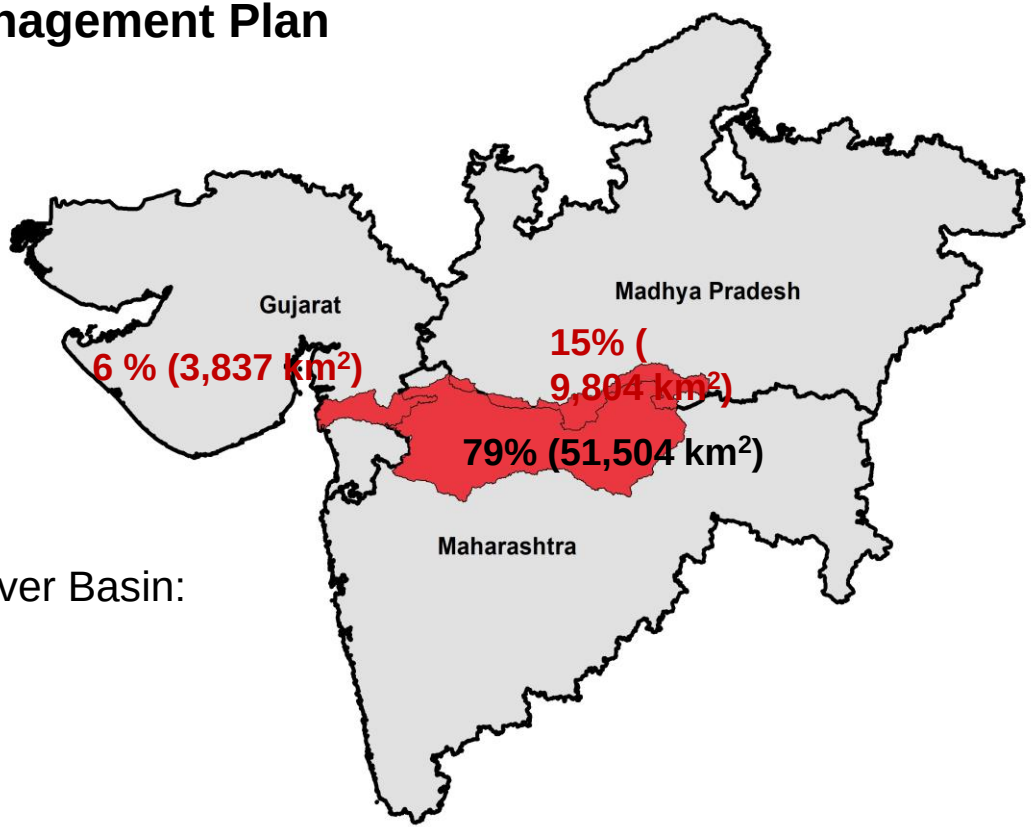
Example: in the Elbe basin – Using Flagship species to involve the public

International Commission for the Protection of the Elbe River
Mezinárodní komise pro ochranu Labe

In the Elbe River, salmon and sturgeon are flagships species at the top of the aquatic food chain. The re-introduction of these species, after having disappeared, depend on many aspects of successful RBM. An analysis for sturgeon and salmon was carried out:

- **DRIVERS:** Industrial development, transport, energy generation, agriculture, human settlements
- **PRESSURES:** Wastewater pollution, nutrient and pesticide pollutions, modification of river course, illegal fishing
- **STATE:** High nutrient load in water, straightened channels, less biodiversity in the river
- **IMPACT:** European sturgeon completely disappeared and is being introduced by artificial stocking activities.
- **RESPONSE:** Pollution reduction, restoration of habitats, improved hydropower, navigation and flood protection infrastructure to open migration routes

Example: Tapi River Basin Management Plan

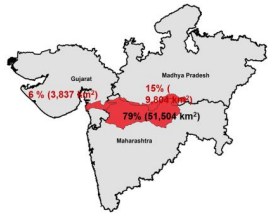


Total Catchment Area / Tapi River Basin:

65,145 km2

Example: Tapi River Basin Management Plan

- …agreed on 29 March 2019 between the three Tapi States



Point Pollution from Urban Settlements & Industries

Area Source Pollution from Agriculture

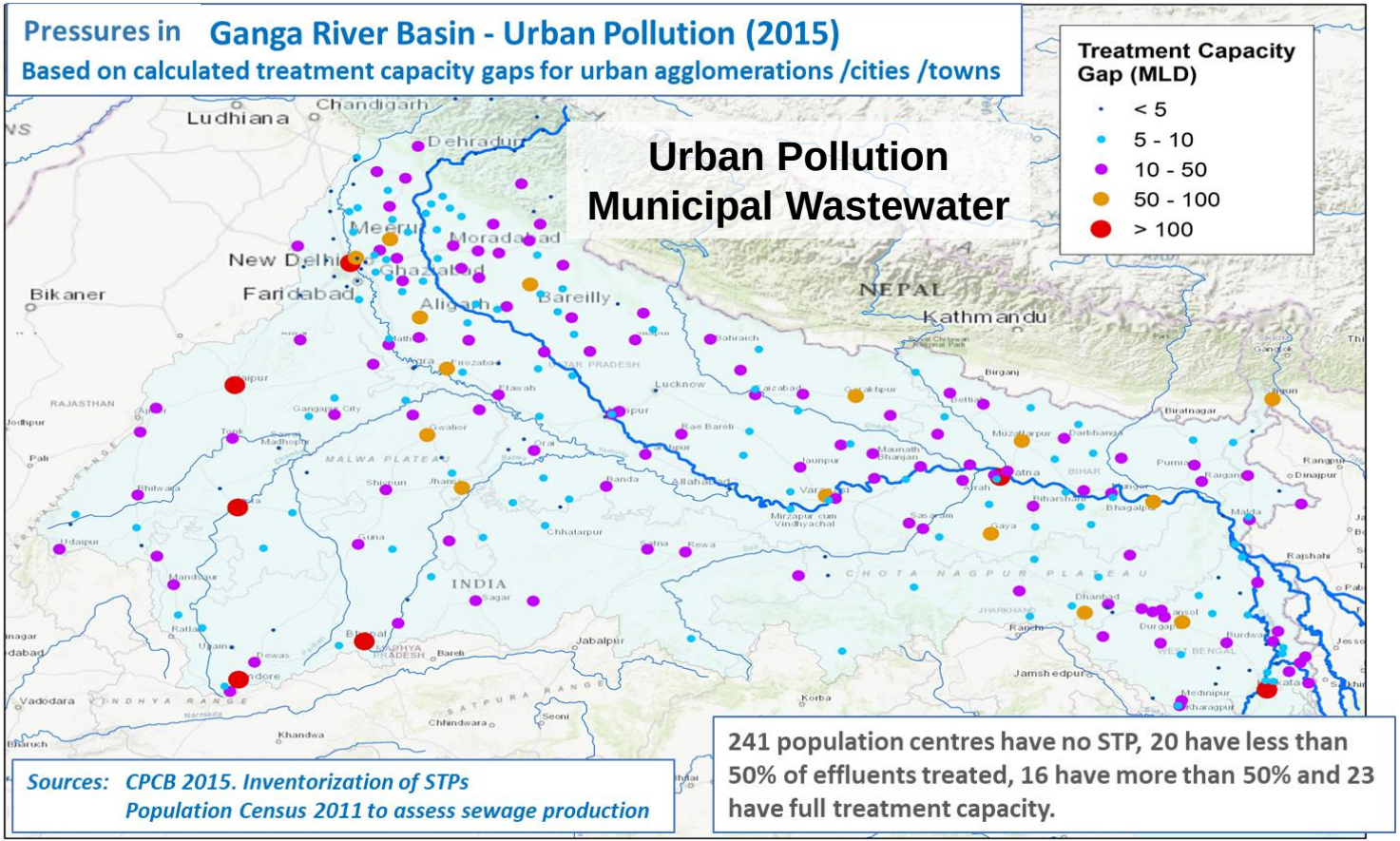
Alterations of River Hydrology/Water Quantity

Alterations of Groundwater Quality and Quantity

Alteration of Morphology / Sand Mining

- For each Key Issues:
  - Visions and management objectives.
  - Pressure/Impact Analysis and Risk Assessment including scenarios.
  - Programme of Measures.
  - Thematic maps are key to Tapi RBM Plan: easy overview on all issues on the basin –wide scale.

Example: in the Ganga basin – Hot Spots/Pressures



Example: in the Ganga basin – Real time Monitoring

Real Time Water Quality Mo

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real time monitoring ganga

Ministry of Environment, Forest and Climate Change

Central Pollution Control Board

Ministry of Water Resources, River Development & Ganga Rejuvenation

National Mission for Clean Ganga

Real Time Water Quality Monitoring of River Ganga

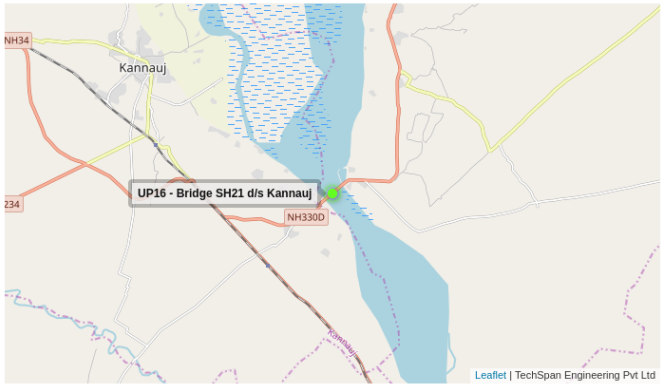
State: Uttar Pradesh UP16 - Bridge SH21 d/s Kannauj

Fit for irrigation (when meeting criteria limits of pH 6 to 8.5 & Electrical Conductivity < 2000 µm/cm)

Fit for propagation of wildlife and Fisheries (when meeting criteria limits of DO ≥ 4 mg/l, pH 6.5 to 8.5 & Free Amonia ≤ 1.2 mg/l

Fit for drinking water (raw) sourcing for conventional treatment (when meeting criteria limits of BOD ≤ 3 mg/l, DO ≥ 4 mg/l & pH 6 to 9)

Fit for Bathing (when meeting criteria limits of BOD ≤ 3 mg/l, DO ≥ 5 mg/l & pH 6.5 to 8.5)



Parameters	Criteria limit (River)	Observed Value
BOD	≤ 3 mg/l	3
DO	≥ 5 mg/l	7.75
EC	< 1000 µm/cm	
pH	6.5 - 8.5	7.91
Temperature	≤ 35°C	22.7
Ammonia	≤ 1.2 mg/l	0.82
Chloride	< 250 mg/l	
COD	< 10 mg/l	9
TSS	< 10 mg/l	9

From Training Module 2: DPSIR Exercise

Pressures analysed through group work

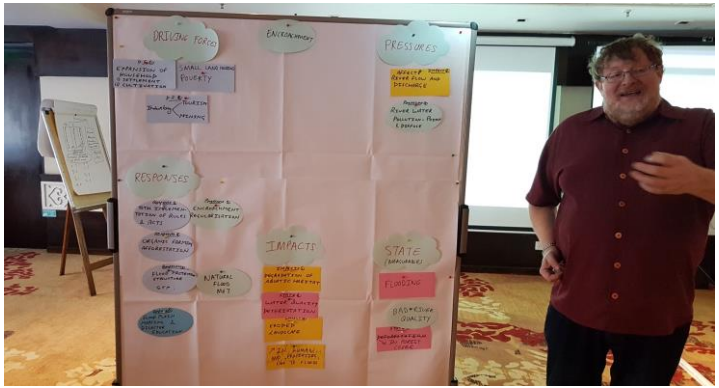
Dehradun

1. Encroachment
2. Untreated domestic wastewater
3. Inadequate solid waste management
4. Untreated industrial wastewater

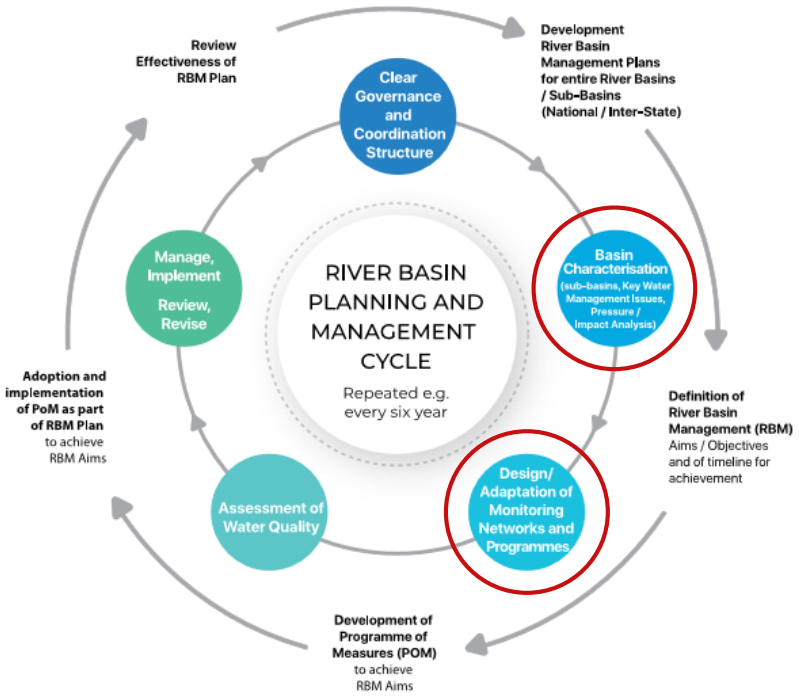
Lucknow

1. Lack of public awareness
2. Disruption of river flow/ over-abstraction
3. Untreated domestic wastewater
4. Untreated industrial wastewater

Detailed results can be found on the e-learning platform



Rationale for a Monitoring Programme



Annex II and V of the EU WFD

Characterisation

- Description of the river basin
- Identify pressures
- Assess Risk from pressures

Annex II

Monitoring

Annex V

- Develop monitoring and classification system
- Monitor to check risk assessment
- Monitor to assess status
- Monitor to assess effectiveness of measures

4 Basin Vision and Aims/ Objectives

The River Basin Planning and Management Cycle

„Inner cycle“
Technical/
operational level“

„Outer cycle“
Planning and
decision making
level

What is a Joint Vision?

A **joint vision** in basin planning is:

- A high-level statement of goals and priorities that basin planning aims to support
- Describes a desired state of the basin to be achieved
- Reflects and addresses main concerns and aspirations in a basin
- Gives a broad indication of the priorities in the basin

The Process of Defining a Joint Vision

A joint vision is typically developed in a process that:

- Brings together different users of the basin‘s resources
- Allows users and managers to think about a desired future in an aspirational manner
- Helps identifying joint values and interests (and thus overcoming differences)

The Vision process typically:

- Is *coordinated* by a designated management unit/actor (e.g. basin organisation secretariat)
- Consists of *consultations with stakeholders* at different levels (local, regional, national, transboundary)
- Develops a *series of subsequent drafts* of a vision for discussion
- Eventually *leads to agreement* of a joint vision by all those involved

A Vision Changes Over Time: Example of the Rhine River Basin

- A vision changes over time as challenges and priorities in the basin change with the state of the basin itself

→ This ensures that the vision continuously reflects the key water management issues in the basin and addresses them

1987: First Rhine River Basin Plan

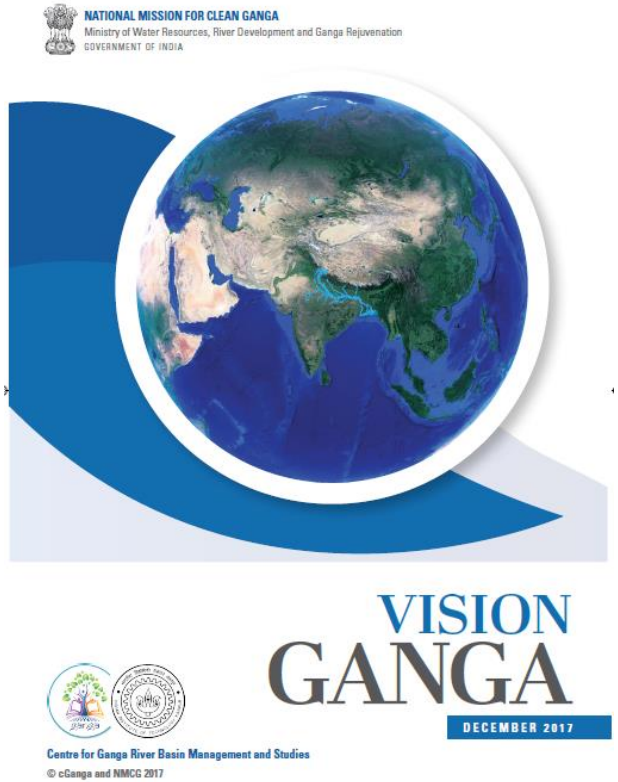
- "To improve the state of the river to such an extent that fish return to the river"
- "Guarantee the production of drinking water for the future"
- "Reduce the pollution of river sediments"

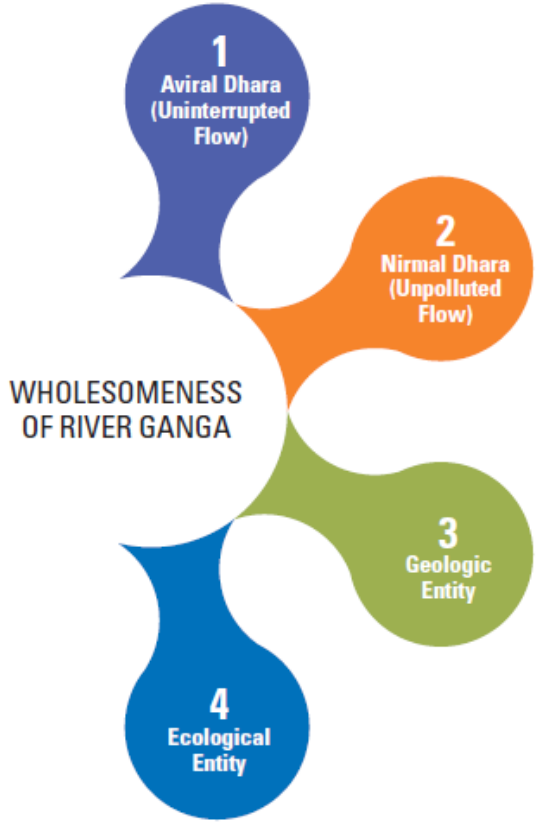
2001: Rhine Visioning Process

- "Former networks of habitats and ecological patency of the Rhine are restored"
- "Fish in the Rhine, mussels and crustaceans are suitable for human consumption"
- "The risk of flood damage is reduced by 25%"
- "Drinking water production will be possible using simple, nature-near treatment procedures"

Example: Vision Ganga 2017

- The Vision Ganga has been drafted in 2017 from the Ganga RBMP.

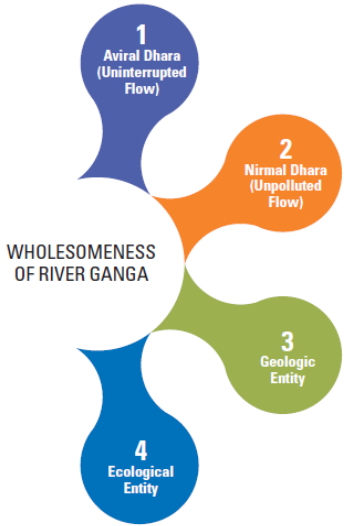




Source: NMCG (2017) Vision Ganga. Page 14.

Example: Vision Ganga 2017

[…] the "**wholesomeness of national river Ganga**", viewed from a dynamic perspective, was determined in GRMPB to be the **sanctity of the river system** imbibed in the following four points:



I. "Aviral Dhara" (Uninterrupted Flow)

"The flow of water, sediments and other natural constituents of river Ganga are continuous and adequate over the entire length of the river throughout the year."

II. "Nirmal Dhara" (Unpolluted Flow)

"The flow in the Ganga river network is bereft of manmade pollution."

Source: NMCG (2017) Vision Ganga. Page 14

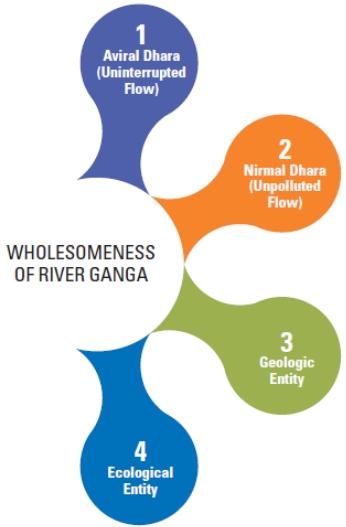
Example: Vision Ganga 2017

III. Geologic Entity

“The Ganga river system is the earth’s creations of ancient times, which may not be reparable if damaged. The geological integrity of the entire basin must therefore be protected.”

IV. Ecological Entity

“The Ganga river system is a delicately structured balance between various living species and the physical environment […]. Overexploitation and unhealthy interferences with the biophysical resources of the river system must therefore be abandoned outright.”



Source: NMCG (2017) Vision Ganga. Page 14

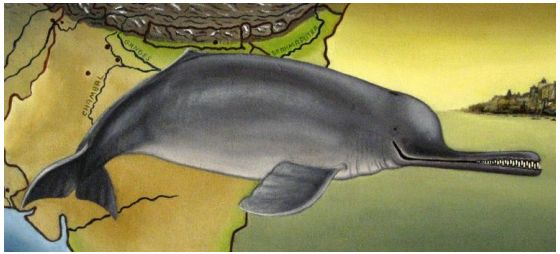
River Visions: Return of Flagship Species

Rhine salmon
Salmo salmar

(Ref: IKSR (2004) RheinLachs 2020).

Danube Sturgeon

(Ref: ICDPR (2016) Sturgeon 2020).

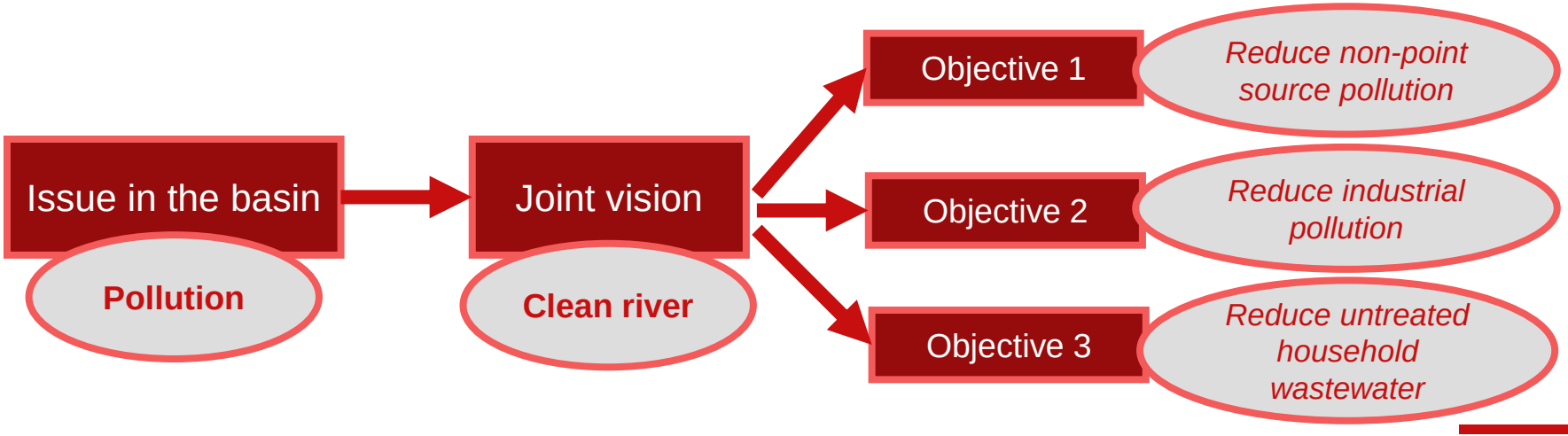


Ganga dolphin?
Platanista gangetica

(Ref: Blogspot Balams heart. Susu Gangesdelfin, 2015).

From a Vision to Specific Objectives

- A joint vision describes the desired state of a basin in very broad and strategic terms → This is insufficient to define and implement specific steps to reach this desired state
- **Specific objectives that operationalise the vision need to be defined to:**
  - Translate the vision into something more **operational**
  - Break the overall vision down into **actionable** pieces
  - Provide clear **guidance on what needs to be done** to achieve the vision

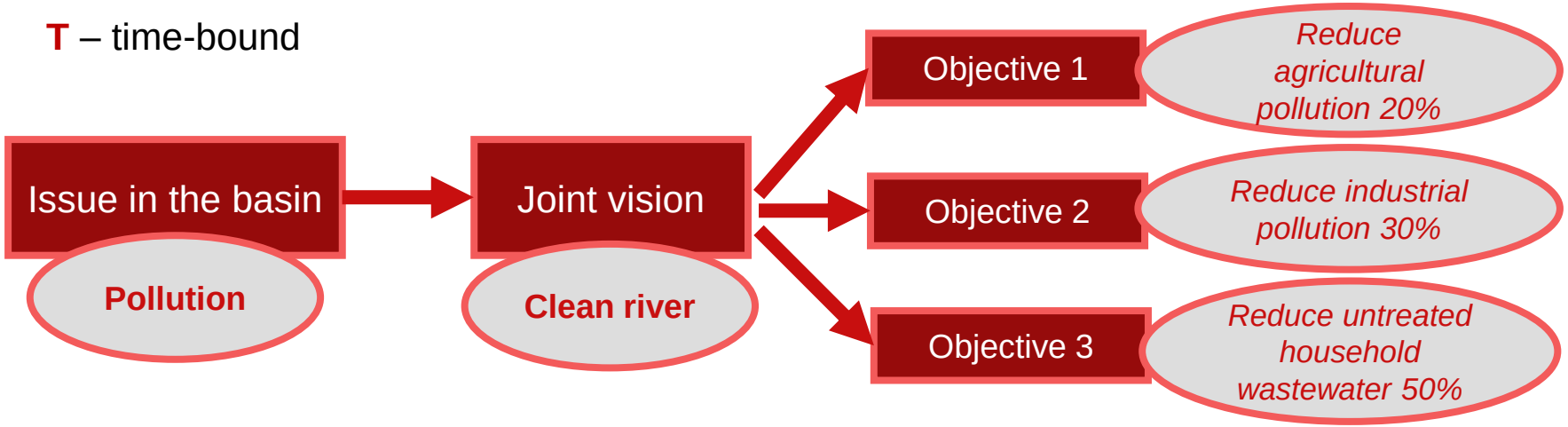


SMART Objectives

In order for objectives to be useful in the basin management plan and its implementation, they need to be SMART:

- **S** – specific
- **M** – measurable
- **A** – achievable
- **R** – relevant
- **T** – time-bound

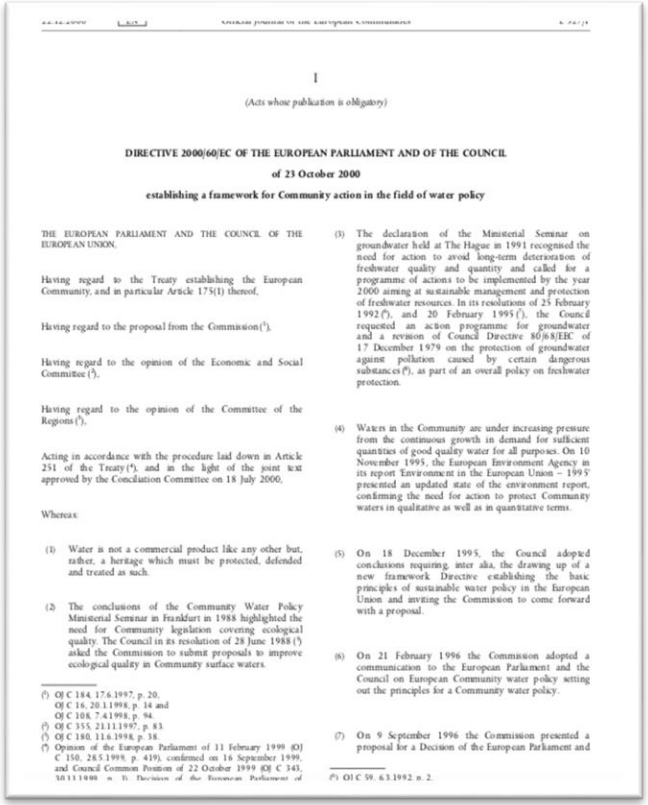
This often requires a further refinement of objectives with specific targets



Example: Environmental Objectives in the EU WFD

Art 4 of the EU WFD (2000) defines the **environmental objectives** to be achieved in all of the EU‘s water bodies as:

- Good *chemical* surface water status
- Good *ecological* water *status surface waters*
- Good *ecological* potential for *artificial and heavily modifies water bodies*
- Good *chemical* and quantitative water status of *groundwater bodies*
- *Specific aims for protected areas*



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(Acts whose publication is obligatory)

DIRECTIVE 2000/60/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 23 October 2000

establishing a framework for Community action in the field of water policy

THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION,

Having regard to the Treaty establishing the European Community, and in particular Article 175(1) thereof,

Having regard to the proposal from the Commission(1),

Having regard to the opinion of the Economic and Social Committee(2),

Having regard to the opinion of the Committee of the Regions(3),

Acting in accordance with the procedure laid down in Article 251 of the Treaty(4), and in the light of the joint text approved by the Conciliation Committee on 18 July 2000,

Whereas:

(1) Water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such.

(2) The conclusions of the Community Water Policy Ministerial Seminar in Frankfurt in 1988 highlighted the need for Community legislation covering ecological quality. The Council in its resolution of 28 June 1988 (5) asked the Commission to submit proposals to improve ecological quality in Community surface waters.

(3) The declaration of the Ministerial Seminar on groundwater held at The Hague in 1991 recognised the need for action to avoid long-term deterioration of freshwater quality and quantity and called for a programme of actions to be implemented by the year 2000 aiming at sustainable management and protection of freshwater resources. In its resolutions of 25 February 1992 (6), and 20 February 1995 (7), the Council requested an action programme for groundwater and a revision of Council Directive 80/68/EEC of 17 December 1979 on the protection of groundwater against pollution caused by certain dangerous substances (8), as part of an overall policy on freshwater protection.

(4) Waters in the Community are under increasing pressure from the continuous growth in demand for sufficient quantities of good quality water for all purposes. On 10 November 1995, the European Environment Agency in its report 'Environment in the European Union – 1995' presented an updated state of the environment report, confirming the need for action to protect Community waters in qualitative as well as in quantitative terms.

(5) On 18 December 1995, the Council adopted conclusions requiring, inter alia, the drawing up of a new framework Directive establishing the basic principles of sustainable water policy in the European Union and inviting the Commission to come forward with a proposal.

(6) On 21 February 1996 the Commission adopted a communication to the European Parliament and the Council on European Community water policy setting out the principles for a Community water policy.

(7) On 9 September 1996 the Commission presented a proposal for a Decision of the European Parliament and

(1) OJ C 184, 17.6.1997, p. 20.
OJ C 16, 20.1.1998, p. 14 and
OJ C 108, 7.4.1998, p. 94.
(2) OJ C 355, 21.11.1997, p. 83.
(3) OJ C 180, 11.6.1998, p. 38.
(4) Opinion of the European Parliament of 11 February 1999 (OJ C 150, 28.5.1999, p. 419), confirmed on 16 September 1999, and Council Common Position of 22 October 1999 (OJ C 343, 30.11.1999, p. 1). Decision of the European Parliament of

(5) OJ C 59, 6.3.1992, p. 2.

Example: in the Danube basin – Vision and Objectives

ICPDR IKSD
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

Vision:

Sustainable and equitable water management and flood risk management in the Danube River Basin

Goals of ICPDR:

- Safeguarding the Danube's Water resources for future generation
- Naturally balanced waters free from excess nutrients
- No more risk from toxic chemicals
- Healthy and sustainable river systems
- Damage-free floods

Source: ICDPR (2016) Danube Declaration. ICDPR Website „About us" Goals of ICPDR. http://www.icpdr.org/main/icpdr/about-us (02/2020)

Example: the Elbe basin – Vision and Objective

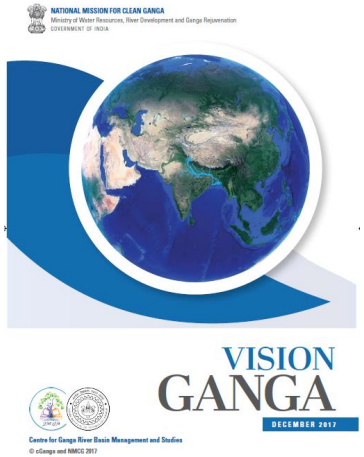
International Commission for the Protection of the Elbe River
Mezinárodní komise pro ochranu Labe

Visions and objectives for the five identified **Significant Water Management Issues (SWMI)**:

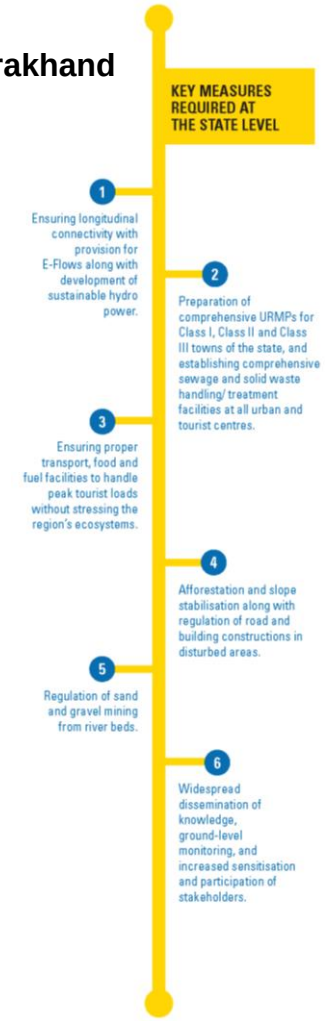
- Hydromorphological Alterations and River Continuity
- Reduction of Hazardous substances and nutrients
- Sustainable Water Quantity Management
- Reduction of contaminations related to mining activities
- Climate Change issues
- Emissions of polluting substances do not cause any deterioration of groundwater quality. Water use is appropriately balanced and does not exceed the available resources.

Example: the Ganga basin – Vision and Objectives

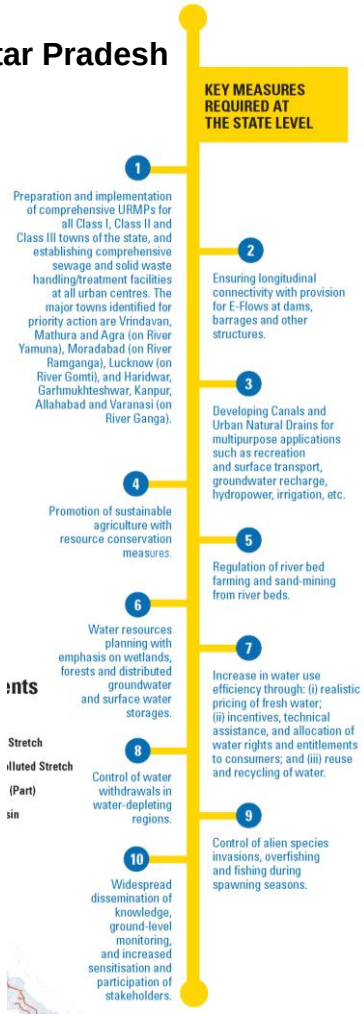
- The Vision Ganga identifies some Strate Steps and Actions.



Uttarakhand



Uttar Pradesh



Exercise: Are the Objectives of Vision Ganga SMART?

IT´S YOUR TURN

Objective of the exercise:

- Stimulate a group reflection on the objectives of Vision Ganga

Vision Ganga: *Wholesomeness and sanctity of river system, imbibed in:*

(i) Aviral Dhara (uninterrupted flow)

(ii) Nirmal Dhara (unpolluted flow)

(iii) Geologic entity

(iv) Ecological entity

S – specific
M – measurable
A – achievable
R – relevant
T – time-bound

Group-work:

- Identify **SMART** indicators related to the “Vision Ganga” and its Key Measures.

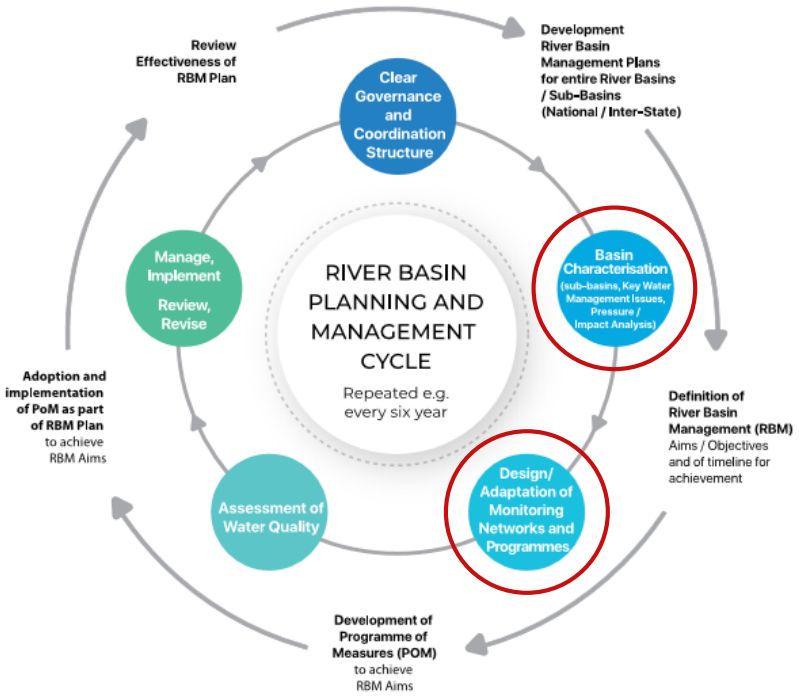
5 Monitoring Programme

The River Basin Planning and Management Cycle

„Inner cycle“
Technical/
operational level“

„Outer cycle“
Planning and
decision making
level

Rationale for a Monitoring Programme



Annex II and V of the EU WFD

Characterisation

- Description of the river basin
- Identify pressures
- Assess Risk from pressures

Annex II

Monitoring

Annex V

- Develop monitoring and classification system
- Monitor to check risk assessment
- Monitor to assess status
- Monitor to assess effectiveness of measures

Monitoring Programmes

- “Monitoring programmes are required to establish a coherent and comprehensive overview of water status within each river basin district.”

- **Monitoring information from surface and groundwater is required for:**
  - The classification of status (biological, chemical and hydromorphological/ quantity for groundwater)
  - Validating the risk assessment
  - Assessment of long-term changes from natural conditions and resulting from anthropogenic activities
  - Estimating pollutant loads
  - Identifying reasons for failure to achieve environmental objectives
  - …

Source: Guidance Document No. 7: Monitoring under the WFD, EC 2003

Relevance of Basin Characterisation and Monitoring for Policy Dialogue

- Basin characterisation and monitoring is a complex undertaking → Requires the consideration of hydrology, hydro-morphology, chemistry, and biology to assess the overall status of water resources
- All this makes the undertaking of basin characterisation and monitoring a **labour-intensive**, **time consuming** and **costly** activity → Thus, the following needs to be carefully established:
  - The scope of the characterisation
  - Division of roles and responsibilities among the various stakeholders involved
  - In addition to securing **sustainable financing mechanisms**
- Monitoring programmes (according to the WFD) are derived from/ aligned with the risk assessment (DPSIR) to achieve cost-efficient design

What is Needed for the Design and Adaptation of Monitoring Programmes

- Development of a monitoring programme and observation grid within the river basin
- Assessment of the current water quality
- Assessing options of environmental remediation
- Identify shortcomings of regulations and protection provisions
- Data to calibrate and run models

Monitoring Parameters and Methods

Many of the monitoring methods applied for basin characterisation and assessment are also used for monitoring → **Those include:**

- Hydrological parameters
- Water quality parameters
- Biological parameters

Additional methods which could be employed include:

- Telemetric Monitoring Systems
- Remote Sensing
- Geographic Information Systems (GIS)

Example: in the Elbe basin – Monitoring Networks

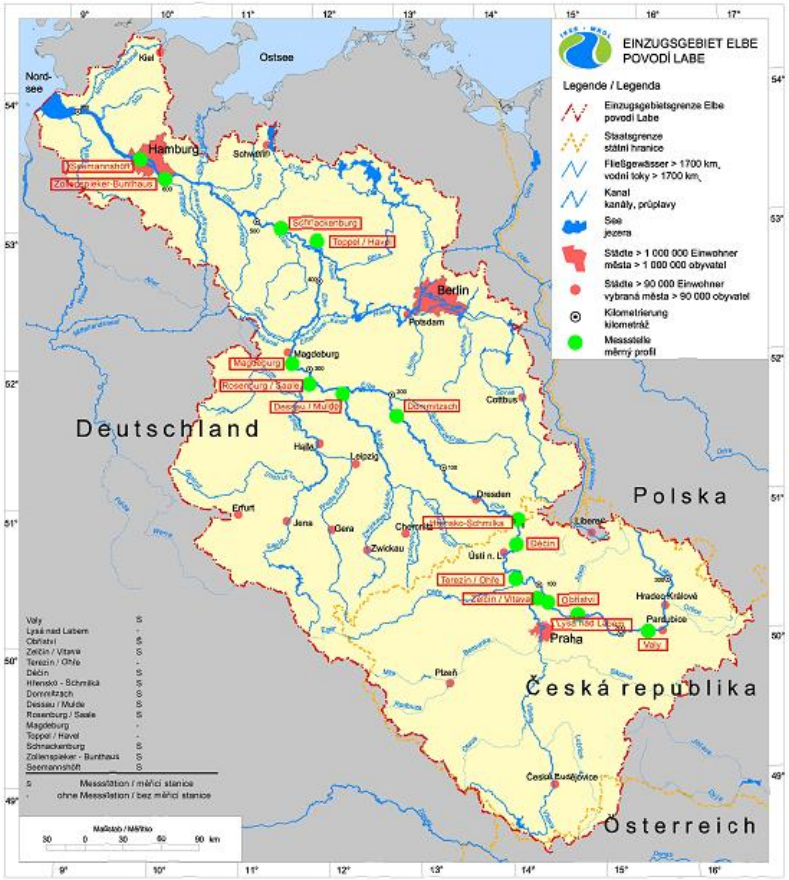
International Commission for the Protection of the Elbe River
Mezinárodní komise pro ochranu Labe

The water quality analysis in the Elbe River basin on the basis of an international **coordinated monitoring programme** had already been initiated at the beginning of the 1990s. This was the cornerstone for the complex and coordinated monitoring of the **water quality of the Elbe** and its tributaries.

- The first international monitoring programme with 63 parameters was set up for the year 1992.
- Routine tests of suspended sediments were introduced in 1996.
- The International coordinated **Elbe Monitoring Programme** 2019 currently comprises the analysis of approximately 180 parameters in the water phase and 70 parameters in suspended sediments. Approximately 10 parameters are analysed in the biological part of the monitoring programme.

Example: in the Elbe basin – Monitoring Networks

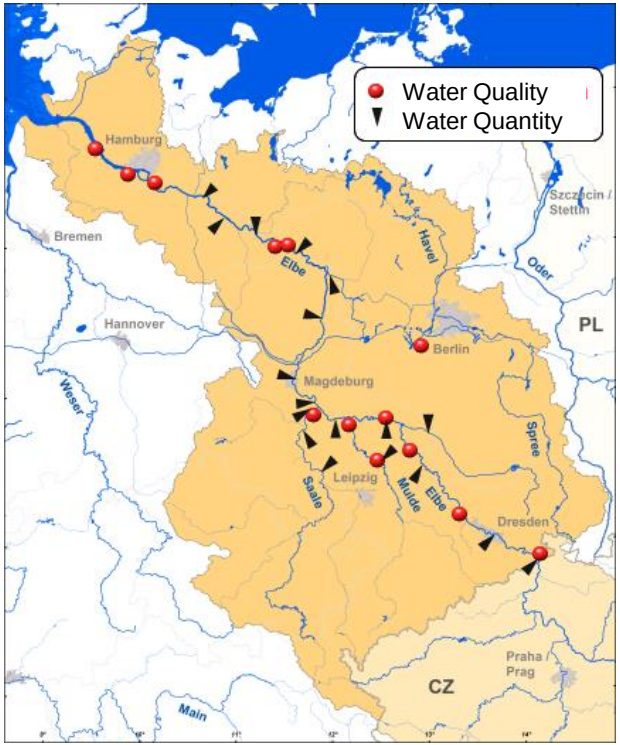
The water quality within the framework of the International **Elbe Monitoring Programme** 2019 is monitored at
9 monitoring profiles in Germany and
6 monitoring profiles in the Czech Republic (10 directly at the Elbe and
5 at tributaries).



Example: in the Elbe basin – Monitoring Networks

International Commission for the Protection of the Elbe River
Mezinárodní komise pro ochranu Labe

- The water quantity/flow within Elbe River Catchment is measured at numerous measuring stations.
- The data on all river basins and catchments (e.g. water levels and flow) are available any time in real time via internet access.



http://undine.bafg.de/elbe/pegel/elbe_pegel_auswahl.html

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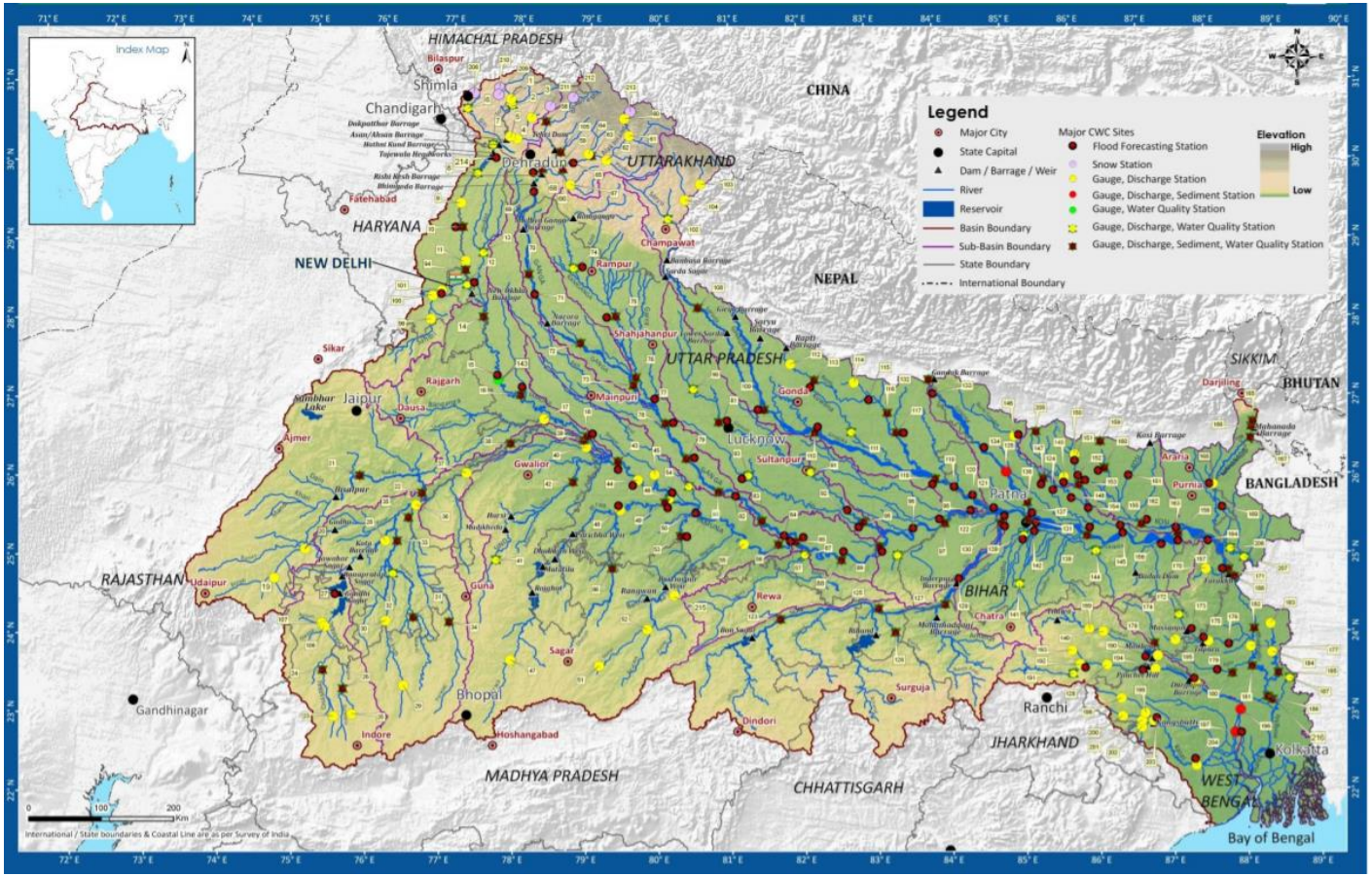
Example: in the Ganga basin – Monitoring Networks



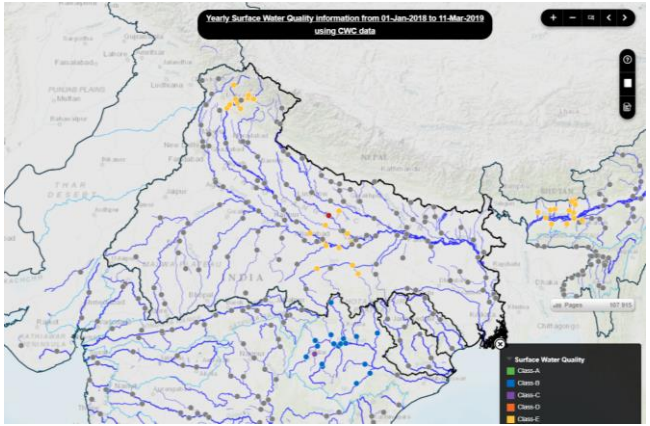
Source: Ministry of Water Resources (2014) Ganga Basin

Example: in the Ganga basin – Monitoring Networks

Example: Surface Water Quality

- 36 Real Time Water Quality Monitoring Station (RTWQMS) are operational
- Water quality monitoring is carried out 130 locations
- Dissolved Oxygen levels improved at 39 locations, Biological Oxygen Demand (BOD) decreased at 42 locations and coliform bacteria count decreased at 47 locations (2017 vs 2018 data).
- Bio-monitoring of river Ganga at various locations (Haridwar to Diamond Harbour in West Bengal) has been carried out to study the Benthic Macro Invertebrates, which reflects the biological health of river

India Water Resources Information System (WRIS)



Link: http://indiawris.gov.in/

Source: Press Information Bureau (2018) Year end Review-2018

Example: in the Ganga basin – Real time Monitoring

Real Time Water Quality Mo

52.172.40.227:8992/cr/

real time monitoring ganga

Ministry of Environment, Forest and Climate Change

Central Pollution Control Board

Ministry of Water Resources, River Development & Ganga Rejuvenation

National Mission for Clean Ganga

Real Time Water Quality Monitoring of River Ganga

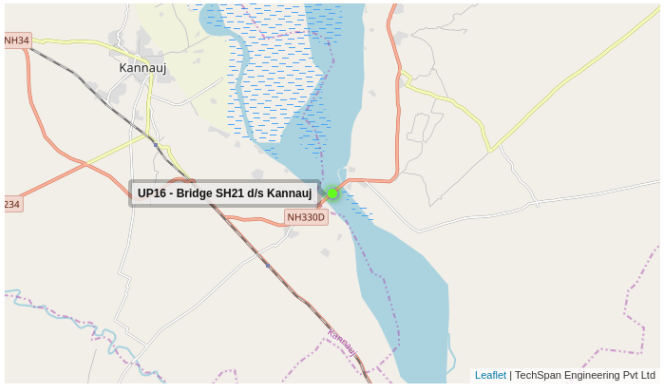
State: Uttar Pradesh UP16 - Bridge SH21 d/s Kannauj

Fit for irrigation (when meeting criteria limits of pH 6 to 8.5 & Electrical Conductivity < 2000 µm/cm)

Fit for propagation of wildlife and Fisheries (when meeting criteria limits of DO ≥ 4 mg/l, pH 6.5 to 8.5 & Free Amonia ≤ 1.2 mg/l

Fit for drinking water (raw) sourcing for conventional treatment (when meeting criteria limits of BOD ≤ 3 mg/l, DO ≥ 4 mg/l & pH 6 to 9)

Fit for Bathing (when meeting criteria limits of BOD ≤ 3 mg/l, DO ≥ 5 mg/l & pH 6.5 to 8.5)



Parameters	Criteria limit (River)	Observed Value
BOD	≤ 3 mg/l	3
DO	≥ 5 mg/l	7.75
EC	< 1000 µm/cm	
pH	6.5 - 8.5	7.91
Temperature	≤ 35°C	22.7
Ammonia	≤ 1.2 mg/l	0.82
Chloride	< 250 mg/l	
COD	< 10 mg/l	9
TSS	< 10 mg/l	9

Exercise: Assessment of existing Monitoring in the Ganga

IT´S YOUR TURN

Objective of the exercise:

- Participants exchange and discuss their perspective on existing Monitoring Networks and Programmes in the Ganga.

Assess the monitoring programme which exists for your (sub-)basin while considering the following:

- From your group point of view, does the current Monitoring Network and Programs help in your daily work, your assessment and decision-making?
- Does it need to be improved? If yes, please detail.

6 Assessment of Water Quality and Quantity

The River Basin Planning and Management Cycle

„Inner cycle“
Technical/
operational level“

„Outer cycle“
Planning and
decision making
level

The Overall Objective from Assessing Water Quality and Quantity

- Understanding the current status of water quantity and quality
- Delineate interventions by authorities
- Feed models
- Develop remediation programmes
- Verify the effectivity of the programme of measures directed to assure the adequacy of water quantity and quality
- Identification of unknown environmental pressures
- Establish a cost-effective monitoring programme

Water Quality: A Combination of Three Quality Elements

Quality elements (QE) of ecological status as defined by the Water Framework Directive

Quality element	River	Lake	Transitional water	Coastal water
Biological quality elements				
Phytoplankton	X	X	X *	X
Large algae/angiosperms			X	X
Macrophytes/phytobenthos	X	X		
Macro-invertebrates	X	X	X	X
Fish	X	X	X	
Hydromorphological quality elements				
Continuity	X **			
Hydrology	X	X		
Morphology	X	X	X	X
Tidal regime			X	X
Chemico-physical quality elements				
General chemico-physical parameters	X	X	X	X
Specific pollutants	X	X	X	X

* Not available; this parameter cannot be assessed in German transitional waters of the North Sea due to the high level of turbidity.
** An assessment method for fish ladders, downstream fish passes and sediment continuity is currently under development.

Source: German Environment Agency in accordance with the Ordinance on Surface Waters (OGewV)

Key: Assessment not required; X Assessment method available; X Assessment method currently being trialled; X Assessment method not yet available

Source: UBA (2017) Waters in Germany, page 26, table 5)

Hydromorphological Quality Elements

Various river cross-sections showing disturbances of the river hydro-morphology (left-hand side) and a graphic outline of a hypothetical river flowing into a delta (right-hand side)

Hydromorphology – Barriers to Connectivity

Hydromorphology – Channelisation

Hydromorphology: stream in „ideal“ condition

Sources: REFORM Project: How to improve hydro-morphological assessments of rivers and streams? EPA Ireland, Hydro-morphology. Article by Quinnlan, E. and Ziegler June 2018

Hydromorphological Quality Elements

- **Hydrology**

Hydrologic water balance equation

→ Forms the backbone of water resource management and can be calculated for a basin or region

$$P = ET + R + \Delta S$$

P is Precipitation, ET is Evapotranspiration, R is Runoff, ΔS is change in storage

- **River hydromorphology** considers:

— The physical character of surface waters

— Their connectivity

— Status of riverbanks and sediments

— Information about flow regimes and water quantities

→ Good hydro-morphological conditions support aquatic ecosystems; thus, it also considers structures and substrates of riverbeds and riverbanks and riparian zones

Chemico-Physical Quality Elements

- **Water Quality**

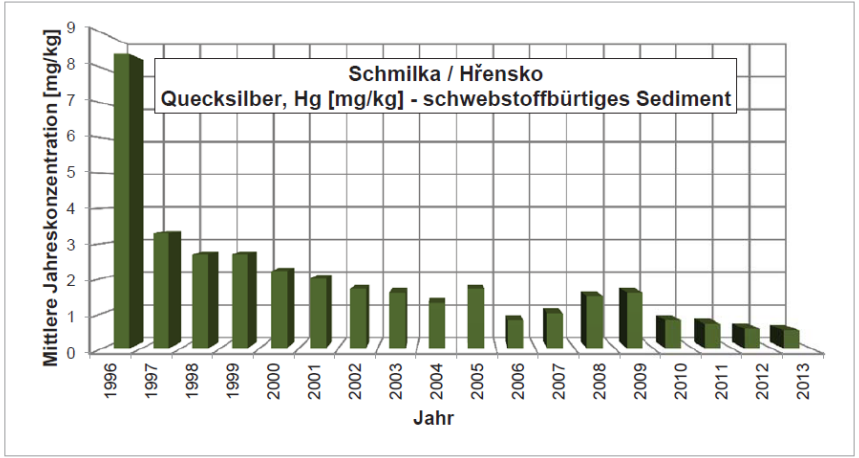
Includes:

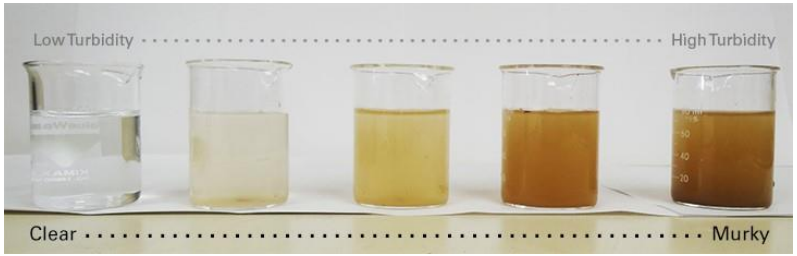
— **Physical characteristics**

e.g. temperature, turbidity

— **Chemical characteristics**

e.g. pH, EC, salt content and ions such as K+, Na+, Ca+2, Mg+2, Cl-, SO4-2, HCO3-, fluoride, silica, Persistent Organic Pollutants (POP) such as pesticides, heavy metals, or micropollutants such as pharmaceuticals or hormones





https://blogs.worldbank.org/water/how-test-water-quality-here-are-some-low-cost-low-tech-options

Example: the Danube basin – Water Quality Assessment

ICPDR IKSD
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

Joint Danube Survey (JDS)

- Until today four JDS were conducted in 2001, 2007, 2013 and 2019.
- Largest river examination of its kind with high data quality.
- The results also serve as the basis for undertaking policy initiatives.

Key Objectives of the JDS

- Production of **reliable and comparable information** on carefully selected elements of water quality for the length of the Danube River, including its major tributaries.
- **Harmonisation of water monitoring practices** and procedures in accordance with the EU Water Framework Directive (WFD) through close coordination and further training.
- Implementation of the Danube River Protection Convention.

Source: URL http://www.danubesurvey.org/

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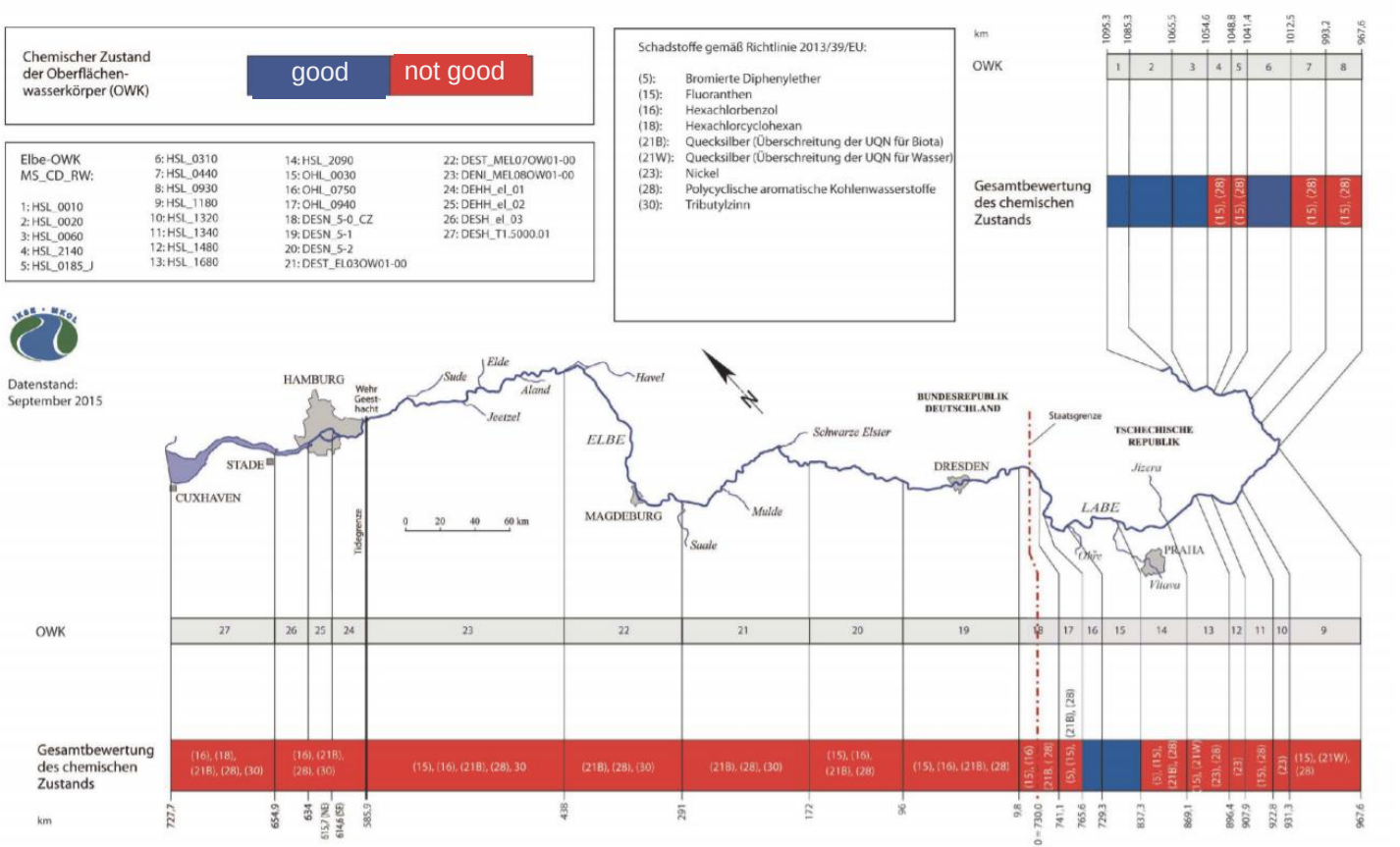
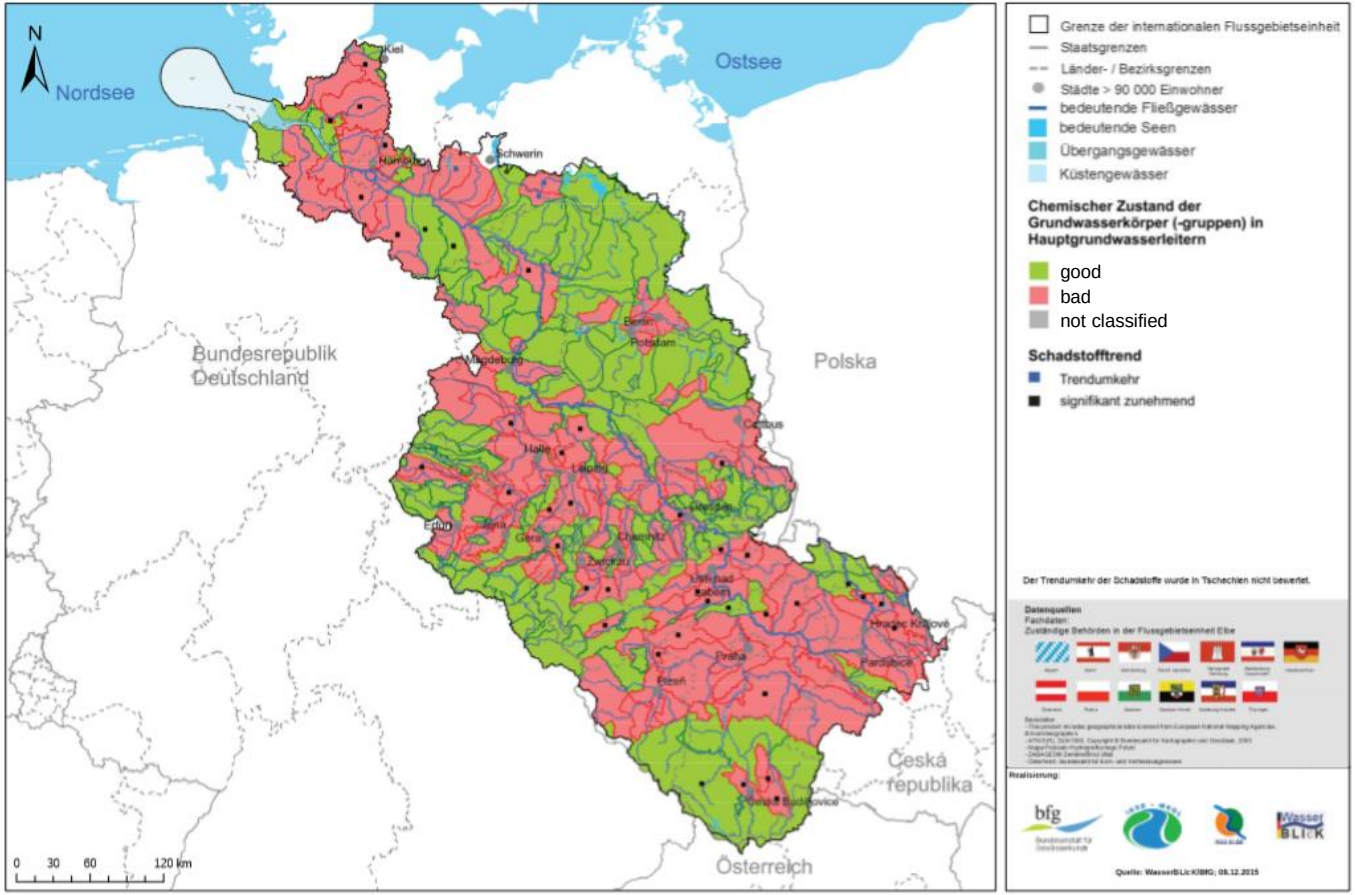
Example: the Elbe basin – Chemical Status of Surface Water of the main stream

International Commission for the Protection of the Elbe River
Mezinárodní komise pro ochranu Labe



Example: the Elbe basin – Chemical Status of the Main Groundwater Bodies



International Commission for the Protection of the Elbe River
Mezinárodní komise pro ochranu Labe

Video – Joint Danube Survey 4 of the Danube

(Duration 3:12 min)

7 Implementation of RBM

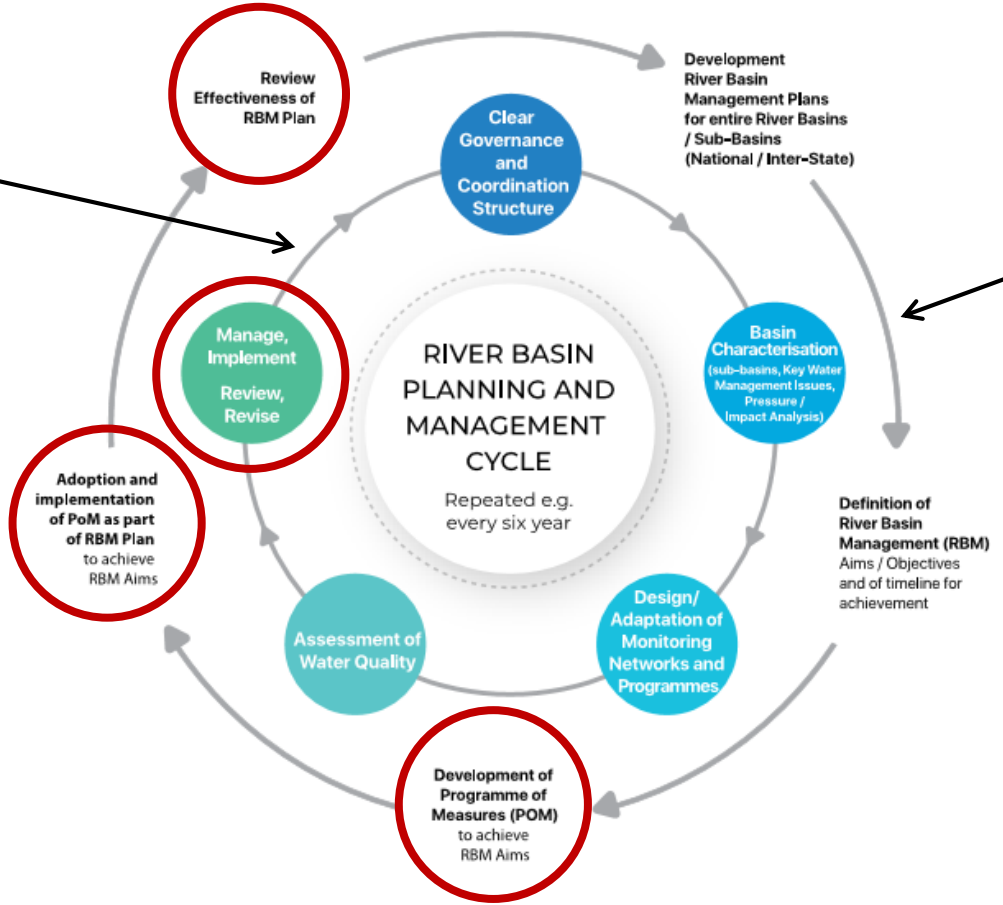
7.1 RBM Plan

7.2 Development of Programme of Measures (PoM)

7.3 Aspects for Implementing PoMs / RBM Plans

The River Basin Planning and Management Cycle

“Inner cycle”
Technical/
operational level“



“Outer cycle”
Planning and
decision making
level

7 Implementation of RBM

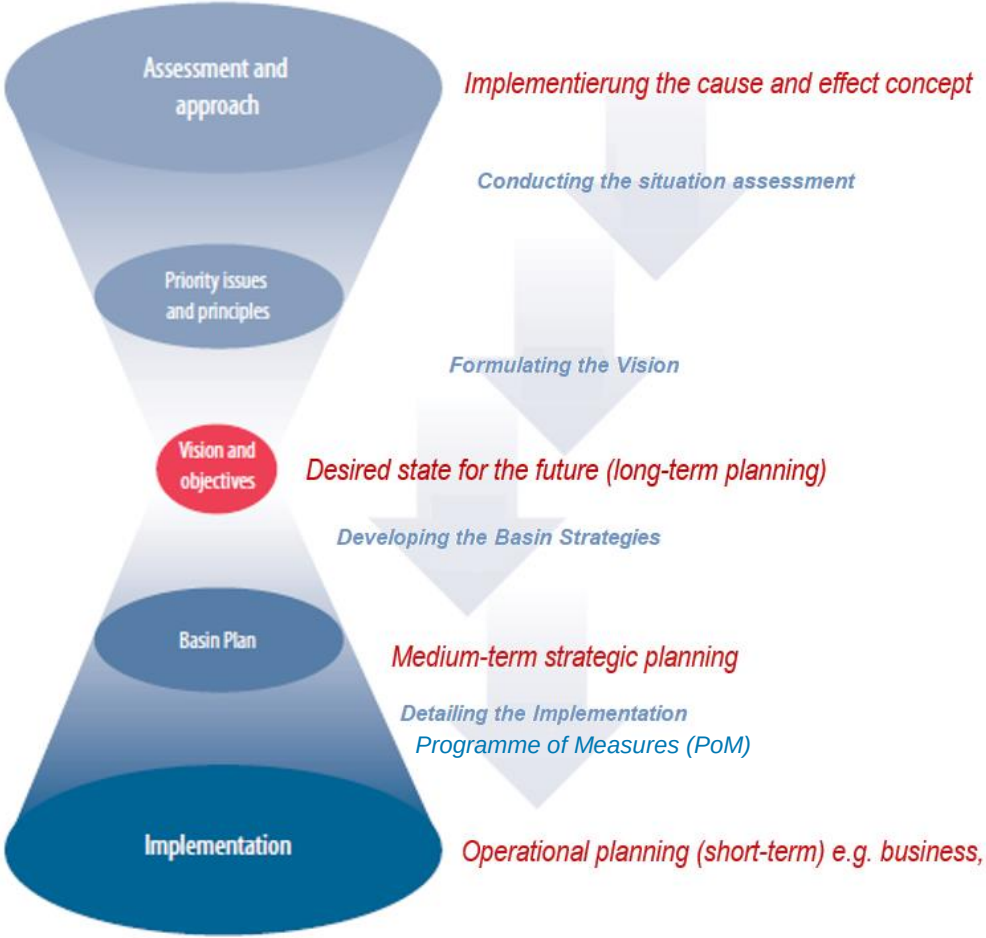
7.1 RBM Plan

7.2 Development of Programme of Measures (PoM)

7.3 Aspects for Implementing PoMs / RBM Plans

7.4 Review and Revise PoM

Moving from Vision and Objectives to a Comprehensive Plan



Adapted from Pegram et al., 2013, p. 83

Planning Basin Approaches

Steps	Rhine River	Ganga River
Problem analysis: Analysing **pressures and impacts**	Water quality, flood risk, lack of fauna/ fish	Water allocation/ abstraction, water pollution (wastewater and solid waste), dams …
Definition of long-term objectives: **vision**	Re-introduction of salmon	Aviral Dhara, Nirmal Dhara, geologic entity, ecologic entity
Definition of short-term objectives and results: **strategic planning**	Water quality targets, connectivity, flood risk management	(GRBMP 2015)
Operational planning to achieve results	River Basin Plans: Wastewater treatment, connectivity, flood retention, awareness, organisation	(GRBMP 2015)

Overview of the Planning Process

1) Definition of **joint vision**
2) Identification of **objectives**
3) Comparison of **objectives** against **state** of the basin
4) Definition of **measures** in order to move towards objectives
5) Specification of **measures** for implementation
6) Drafting of **management plan**
   - Drafting of outline
   - Consultations
   - Drafting of plan and programme of measures
   - Consultations
   - Finalisation of **plan and programme of measures**
7) **Dissemination** of plan and programme of measures

Structure and Content of a Basin Plan

The structure and content of a plan needs to be adapted to the needs of the basin and those involved in the planning and implementation process → Typically, the structure of a plan includes:

- **Description of the basin**
  - Current status
  - Future trends
  - Key water management issues
- **Basin vision/ aims and objectives**
- **Implementation plan/ Programme of Measures (PoM)**
  - Definition of measures
  - Responsibilities and resources
  - Monitoring mechanisms

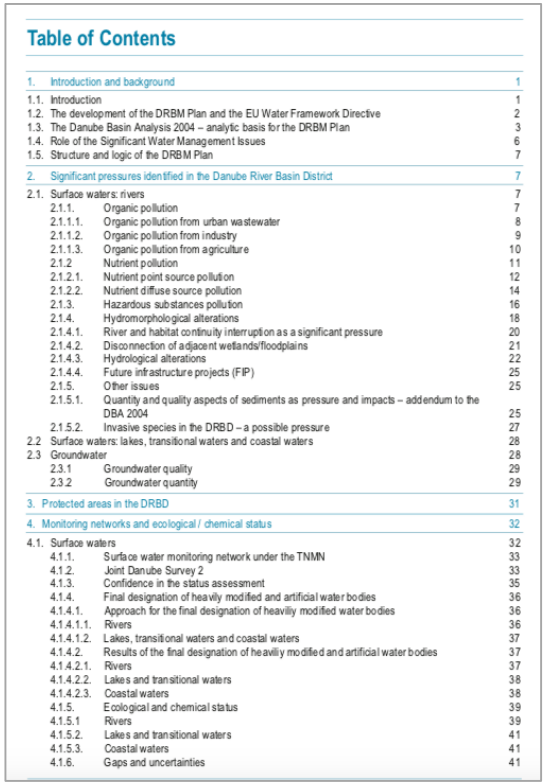
Source: ADB River Basin Planning Principles (https://www.adb.org/publications/river-basin-planning-principles)

Levels of Basin Plans

Internationally-coordinated basin plans	• International river basin commissions
Nationally-coordinated basin plans	• National river basin communities
Sub-basin plans	• Federal water or basin agencies

Examples of Structures of Basin Plans

Danube RMBP



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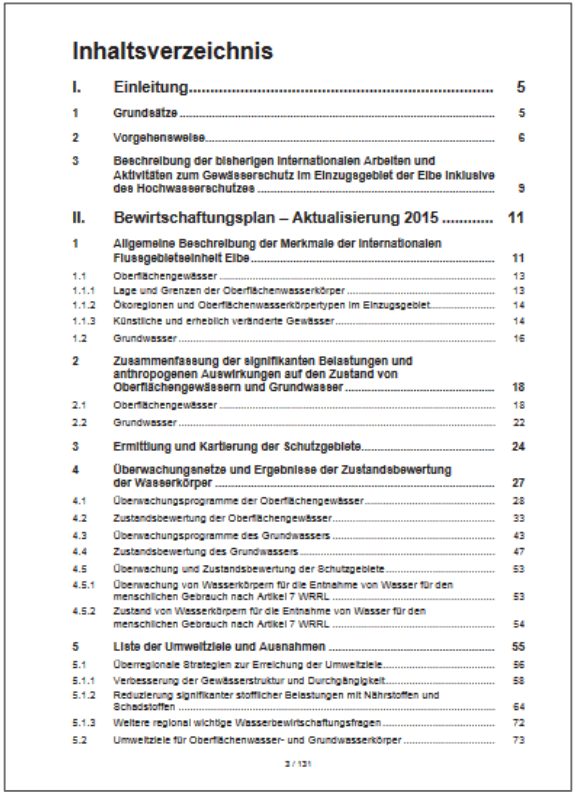
Elbe RBMP



Inhaltsverzeichnis

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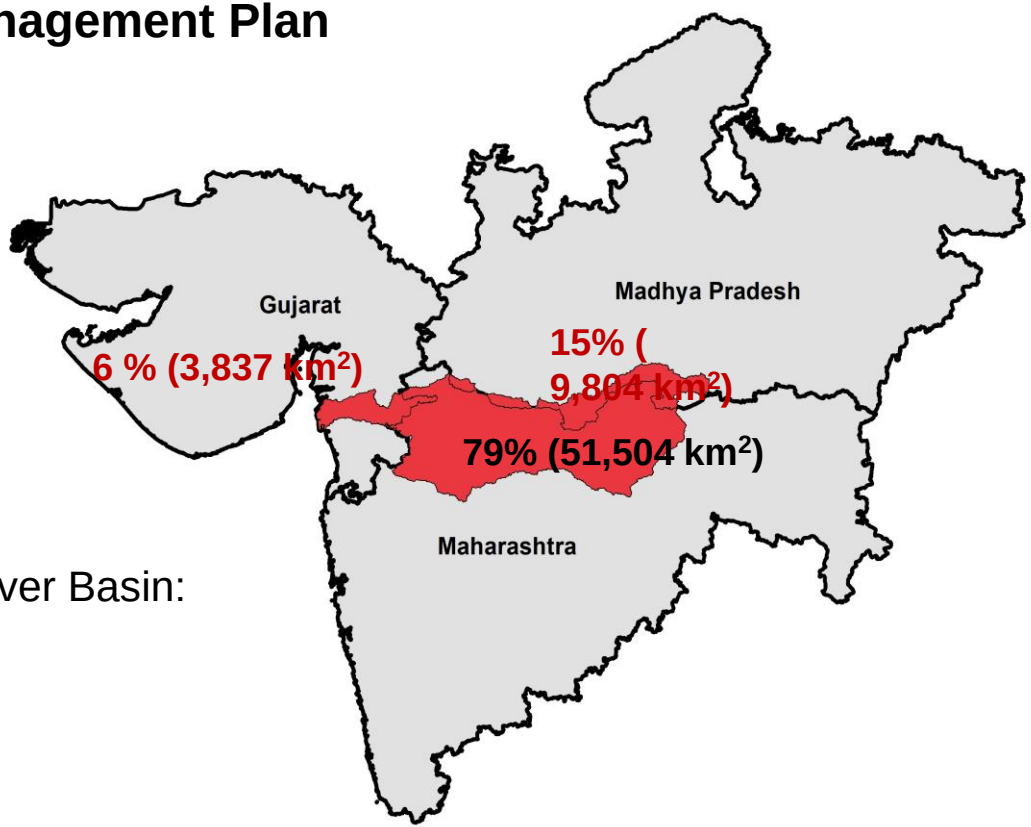
Can be found on the e-learning platform!

Example: in the Danube – The ICPDR Danube River Basin Management Plan (2015)

Pressures	Objectives	Programme of Measures 2015-2021
Pollution by organic substances	Reducing pollution by organic substances	- Access to sewer systems, at least biological treatment - Constructing sewers and treatment plants
Pollution by nutrients	Reducing pollution by nutrients	- Nutrient removal technology for 28 million people equivalents - Phosphate-free detergents - Reduction of nutrient input and losses related to farmland
Pollution by hazardous substances	Reducing pollution by hazardous substances	- Apply best available technologies and treatment in industry - Prevent accidents (Seveso III Directive)
Hydromorphological alterations	Improving the hydromorphological conditions	- Construct 146 fish migration aids until 2021 - Restoration measures for rivers - Reconnect floodplains / wetlands
	Improving groundwater	

Source: ICDPR (2015) Danube River Basin Management Plan Update 2015

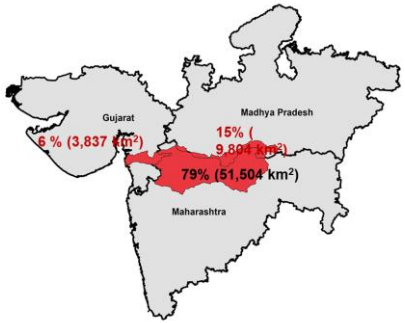
Example: Tapi River Basin Management Plan



Total Catchment Area / Tapi River Basin:

65,145 km2

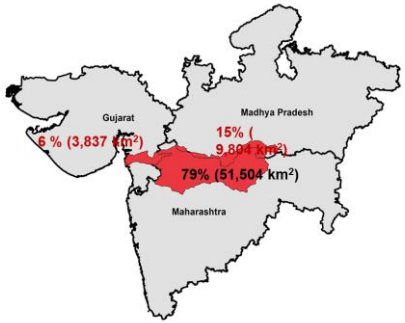
Example: Tapi River Basin Management Plan



- Ongoing activity under the India-EU Water Partnership.
- Covers the entire Tapi River Basin: beyond administrative borders
- Tapi RBM Plan will be fully aligned to RBM Cycle
  - **Blending** EU with Indian approaches
- Enabling JOINT planning and management of all issues and challenges
  - **Combination of all State information** into one **integrated** RBM Plan
  - Overview on entire Tapi basin
  - Development/implementation is steered by each State - **based on joint aims**.

  - The Tapi RBM Plan covers:
    - Surface waters and groundwater (maybe coastal waters)
    - Water Quality and Water Quantity

Example: Tapi River Basin Management Plan

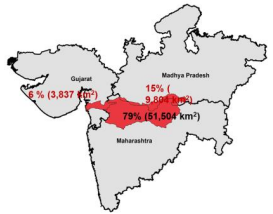


- Agreed overall Aim:
  - …ensures for sustainable water resources management in the Tapi River Basin enabling the protection of the aquatic environment as well as a sustainable socio-economic development and water supply security through appropriate measures.

  - In detail, it is aimed for:
    - to **ensure good quality of surface waters and groundwaters** through the reduction of pollution and all other relevant pressures.
    - to **ensure good/sufficient water quantity in surface waters and groundwaters** through efficient water use and all other needed measures.

Example: Tapi River Basin Management Plan

- …agreed on 29 March 2019 between the three Tapi States



Point Pollution from Urban Settlements & Industries

Area Source Pollution from Agriculture

Alterations of River Hydrology/Water Quantity

Alterations of Groundwater Quality and Quantity

Alteration of Morphology / Sand Mining

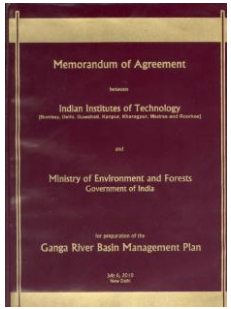
- For each Key Issues:
  - Visions and management objectives.
  - Pressure/Impact Analysis and Risk Assessment including scenarios.
  - Programme of Measures.
  - Thematic maps are key to Tapi RBM Plan: easy overview on all issues on the basin –wide scale.

Example: Ganga River Basin Management (GRBM)

Milestones and Legal foundation

National Ganga River Basin Authority (NGRBA) constituted

02/2009



06/2010

Memorandum of Agreement between 7 IITs and MoEF for preparation of GRBMP

Interim GRBMP Report

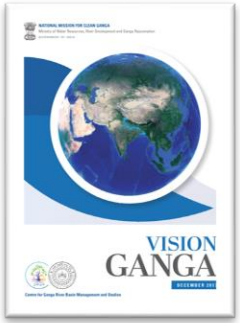
09/2013

01/2015

main plan document
8 mission reports,
73 thematic reports

River Ganga Order:
Dissolution of NGRBA
Constitution of National Ganga Council (NGC)

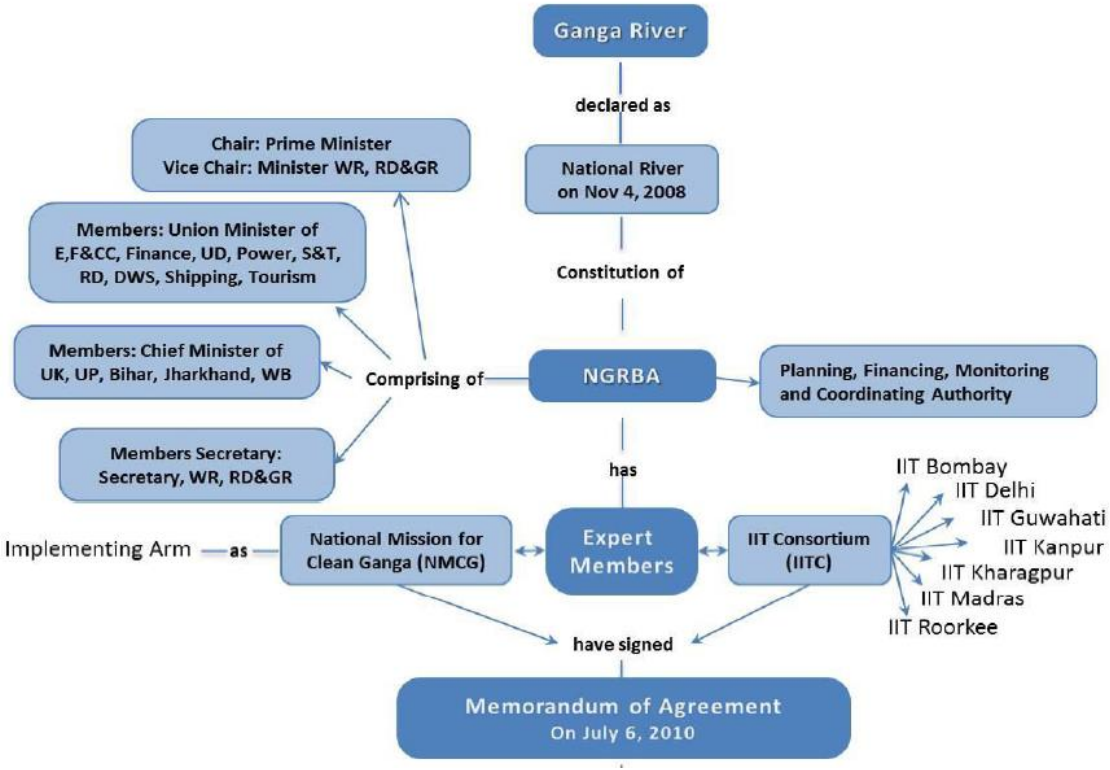
10/2016



12/2017

Vision Ganga

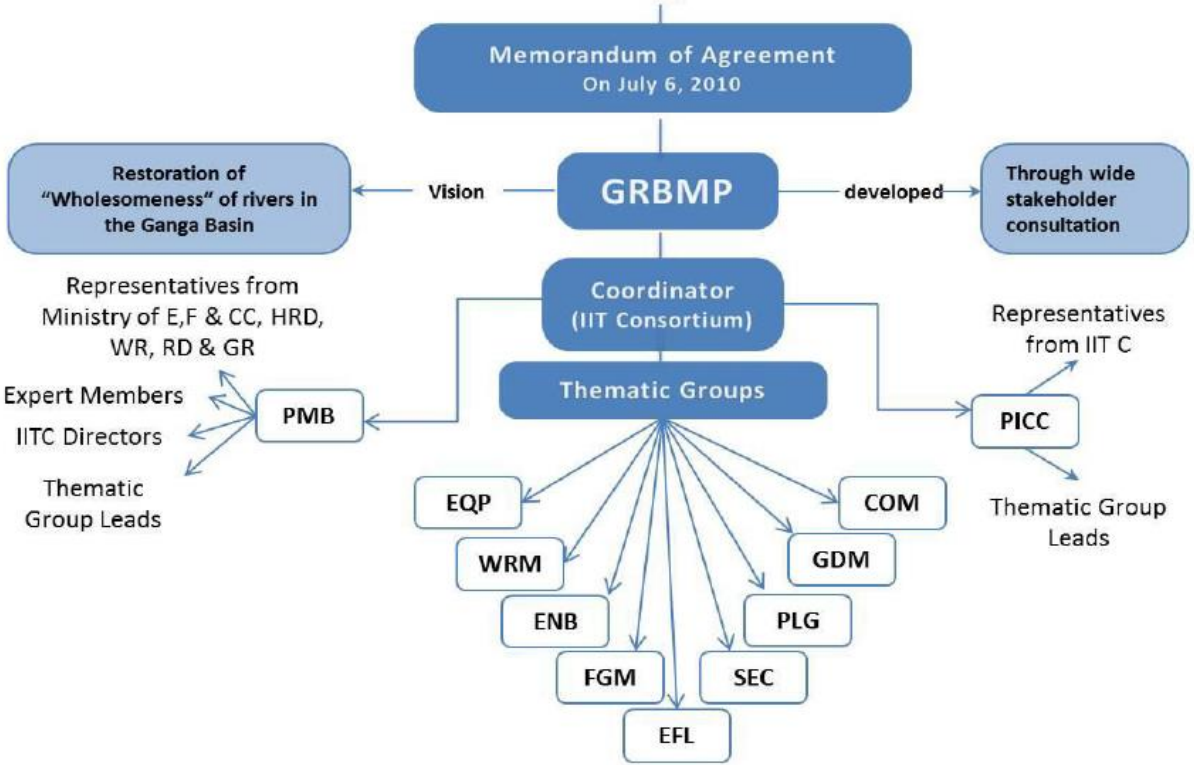
Example: Ganga River Basin Management (GRBM)
Coordination Structure



NGRBA: National Ganga River Basin Authority
NMCG: National Mission for Clean Ganga
MoEF: Ministry of Environment and Forests
MHRD: Ministry of Human Resource and Development
MoWR, RD&GR: Ministry of Water Resources, River Development and Ganga Rejuvenation
GRBMP: Ganga River Basin Management Plan
IITC: IIT Consortium
PMB: Project Management Board
PICC: Project Implementation and Coordination Committee

Source: Ganga River Basin Management Plan (GRBMP)

Example: Ganga River Basin Management (GRBM)
Coordination Structure II



NGRBA: National Ganga River Basin Authority
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GRBMP: Ganga River Basin Management Plan
IITC: IIT Consortium
PMB: Project Management Board
PICC: Project Implementation and Coordination Committee

Source: Ganga River Basin Management Plan (GRBMP)

Example: Ganga River Basin Management (GRBM)

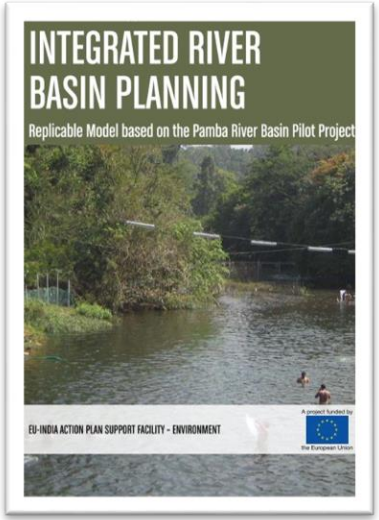
Nine themes

1. Environmental Quality and Pollution
2. Water Resources Management
3. Fluvial Geomorphology
4. Ecology and Biodiversity
5. Socio Economic and Cultural
6. Policy Law and Governance
7. Geo-Spatial Database Management
8. Communication
9. Environmental Flows

Example: Ganga River Basin Management (GRBM)

- The Ganga RBMP has done a very comprehensive **Basin Characterisation**.
- Each assessment report ends with some recommendation actions to improve the wholesomeness of the river:
  - “Aviral Dhara” (Continuous Flow”),
  - “Nirmal Dhara”(“Unpolluted Flow”),
  - Geologic Entity,
  - and Ecological Entity improve the situation.
- However these recommendation actions have not been translated yet into comprehensive Measures.

Example: the Pamba River Basin – IWRM Plan



- The EU-India Action Plan Support Facility conducted in 2010 the project “Developing a Roadmap for the Pamba river”.
- Implemented through targeted training/working sessions and consultations of a broad spectrum of stakeholder.
- It supported the newly set up Pamba River Basin Authority in devising a management plan for future priority actions.
- Objective was to evolve water management in the State to a sustainable water resources management practice that is cross sectoral, decentralized, and at the scale of the basin.
- The main actions identified in the Roadmap were:
  - the immediate need for operationalization of the Pamba River Basin Authority,
  - adequate and thorough capacity building at State and local level in IWRM practices,
  - and the development of a full IWRM Action Plan for the Pamba River.

Example: the Pamba River Basin – IWRM Plan

Development of an IWRM Action Plan

- Involvement of ca 80 representative stakeholders.
- Water resources issues identified and ranked in accordance to their importance.
- Identification of water management constraints and possible solutions.
- Preparation of an IWRM Roadmap, with identification of measures, timeline, responsible organisation and definition of monitoring indicators.

Example: the Pamba River Basin – IWRM Plan

Development of an IWRM Action Plan

Next steps	Milestones	Indicators
Form an operational body for water resources management in the Pamba River Basin	June 2011	Pamba River Authority operational - offices, staff, work plans and budgets identified.
Capacity building in IWRM	December 2011	Capacity need assessment conducted, IWRM training conducted at central and de-centralised level
Development of a communication strategy	September 2011	Communication strategy formulated and being implemented ensuring stakeholder involvement
Enforcement of existing legal framework	Immediately	Identified priority issues addressed e.g. illegal sand mining
Adjustment of existing legal water framework for the Kerala state	January 2012	Enactment of primary water legislation
Full assessment of the water resources situation (quantity & quality) in the Pamba Basin	March 2011	The quantity and quality of the resource assessed based on data from the numerous intuitions involved in monitoring.
Setting-up a sustainable monitoring and evaluation system for water resources management &	August 2011	MIS operational - databases, GIS and modelling tools Collaboration with the World
Establishment of an information system on water resources		Bank supported Hydrology II project for developing Hydrology Information System (HIS)
Initiation of elaboration and adoption of an IWRM Action Plan for the Pamba Basin	August 2011	IWRM action elaborated and endorsed by the Government
Elaboration of DPRs (Detailed Project Reports) for implementation of different actions identified	December 2012	Detailed project reports prepared for the actions identified in the IWRM plan
Elaboration of financing plan and investment strategies	December 2011	Financing strategies and development plans adopted
Implementation of the IWRM Action Plan for the Pamba River Basin	January 2012 – December 2015	Identified actions implemented.
Development of IWRM indicators to monitor the effects from implementing the IWRM plan	June 2012	Set of indicators developed to monitor that the desired effect from the reform process is being achieved. Regular evaluation reports.

Source: Project “Developing a Roadmap for the Pamba river” (EU-India Action Plan Support Facility, 2010)

7 Implementation of RBM

7.1 RBM Plan

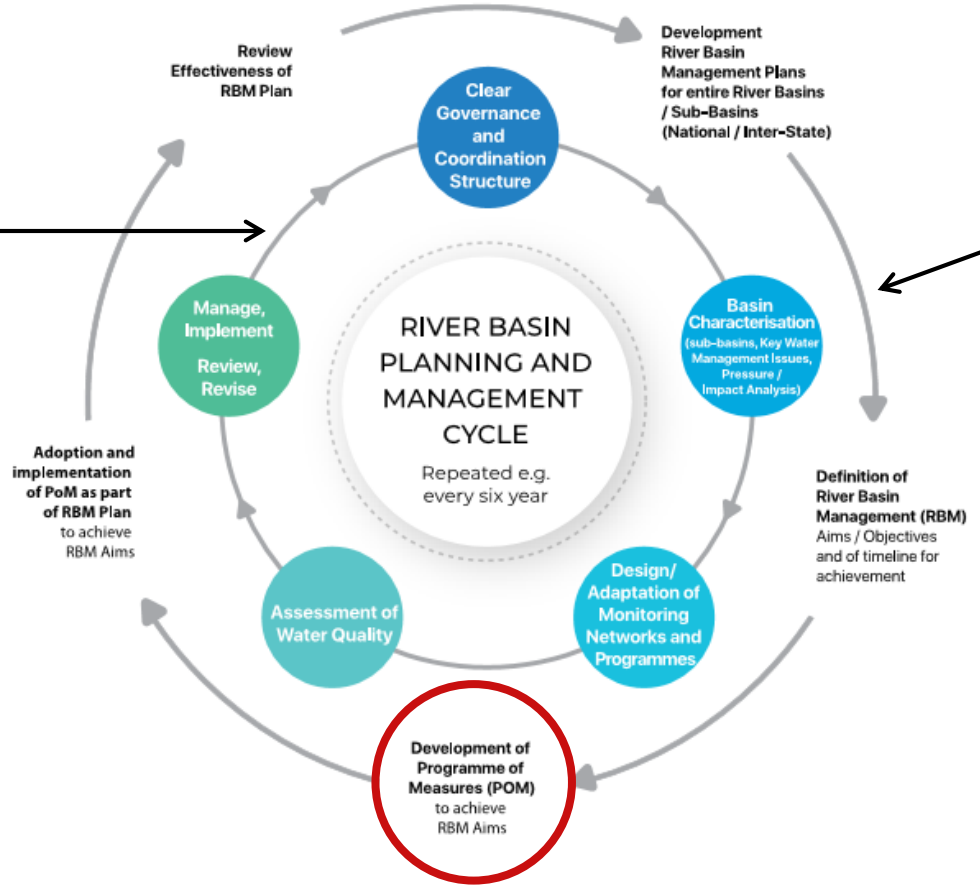
7.2 Development of Programme of Measures (PoM)

7.3 Aspects for Implementing PoMs / RBM Plans

7.4 Review and Revise PoM

The River Basin Planning and Management Cycle

„Inner cycle“
Technical/
operational level“



„Outer cycle“
Planning and
decision making
level

Programme of Measures (PoM)

- Once a joint vision and specific objectives for basin management have been defined, a PoM is needed

- **A PoM**
  - **Summarises all measures** that need to be taken to reach the vision and the objectives
  - Provides a **list of those measures in a systematic manner**
  - Provides **details on their implementation**
  - Attaches **timelines** and implementation plans to the respective measures
  - **Indicates resources needed** for implementation (financial, technical, human)

Elements of the RBMP and its PoM: The EU WFD Conceptual Approach

- Environmental quality standards
- Best available technology
- No further deterioration but restoration
- Combined approach
- Best practicable environmental option
- Enforcement of permits

Emission Cadastres as Decision Support Tool for PoM

- Build up an emission cadastre of communal/urban and industrial point sources
- Identify point sources of pollution from urban and industrial sources using COD/BOD load
- Identify priority hazardous substances to be reduced by river monitoring programmes
- Reduction of industrial emissions → Hazardous substances from chemical, pharmaceutical, cellulose fabrication, paper and metallurgic industry

Example: the Elbe basin – Action and Remediation Programmes

International Commission for
the Protection of the Elbe River
Mezinárodní komise pro
ochranu Labe

These programmes successful addressed

- solving problems municipal wastewater,
- industrial wastewater,
- reducing the diffuse loads (nutrients and herbicides) from agriculture,
- reducing the diffuse loads from landfills and polluted sites.

The Elbe Action Programme was completed with a **final report** in 2010.
These programmes were initiated before the WFD came into force.

Example: the Elbe basin – Sewage Treatment Prioritisation

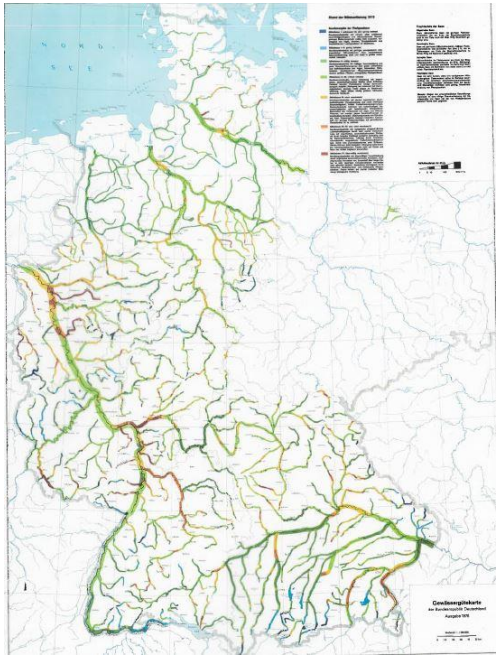
How to identify measures of highest effectivity (pollution) and efficiency (finance):

a robust and pragmatic approach from the emergency immediate action programme of the Elbe River 1990.

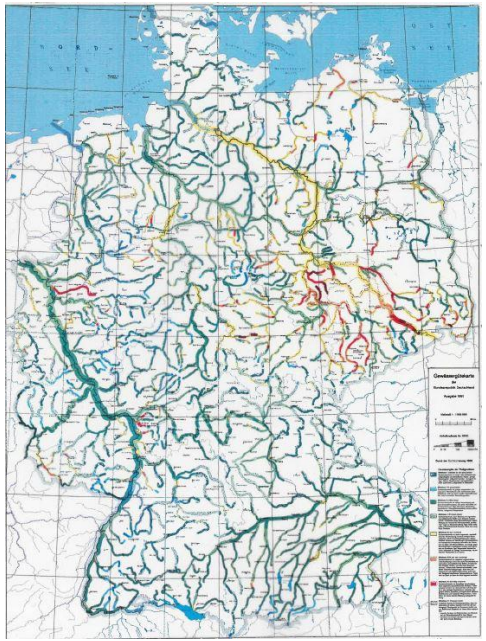
- **Urban sewage point sources**
  - The amount of sewage water load possible to reduce by treatment at source
  - Discharge points directly on the river
  - Discharge points on tributaries to the Elbe river ranked by distance to confluence with the river
- **Industrial point sources**
  - Industrial point sources which contribute more than 5% of the total load of the river measured at a defined downstream monitoring transect
  - Industrial discharge points sources discharging directly into the river
  - Industrial discharge points on tributaries to the Elbe river ranked by distance to confluence with the river

Example: Improvement of Surface Water Quality in Germany (1975-2000)

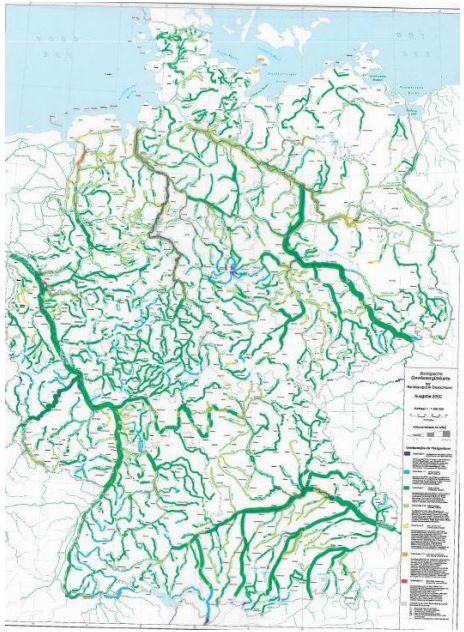
1975



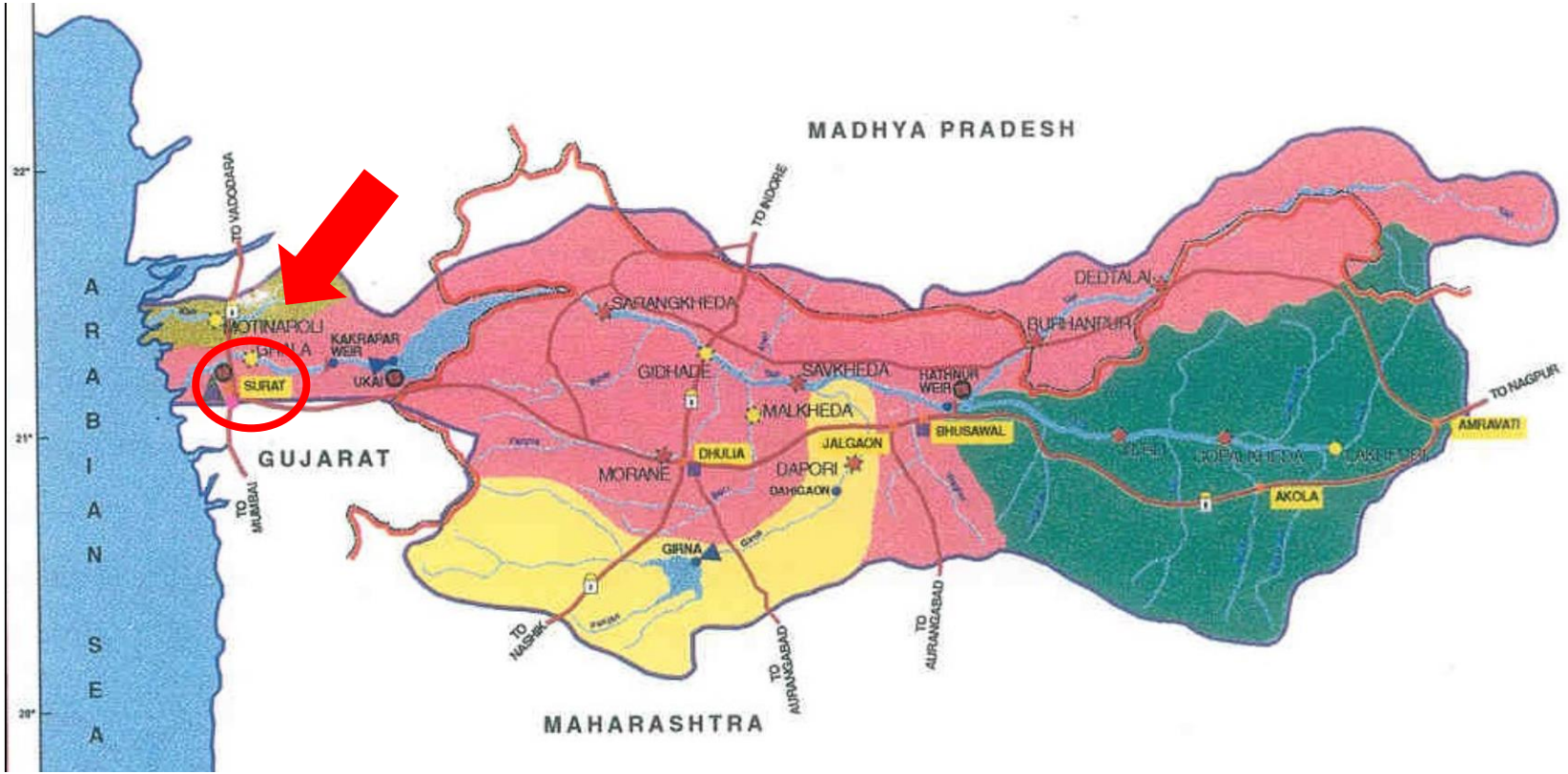
1990



2000



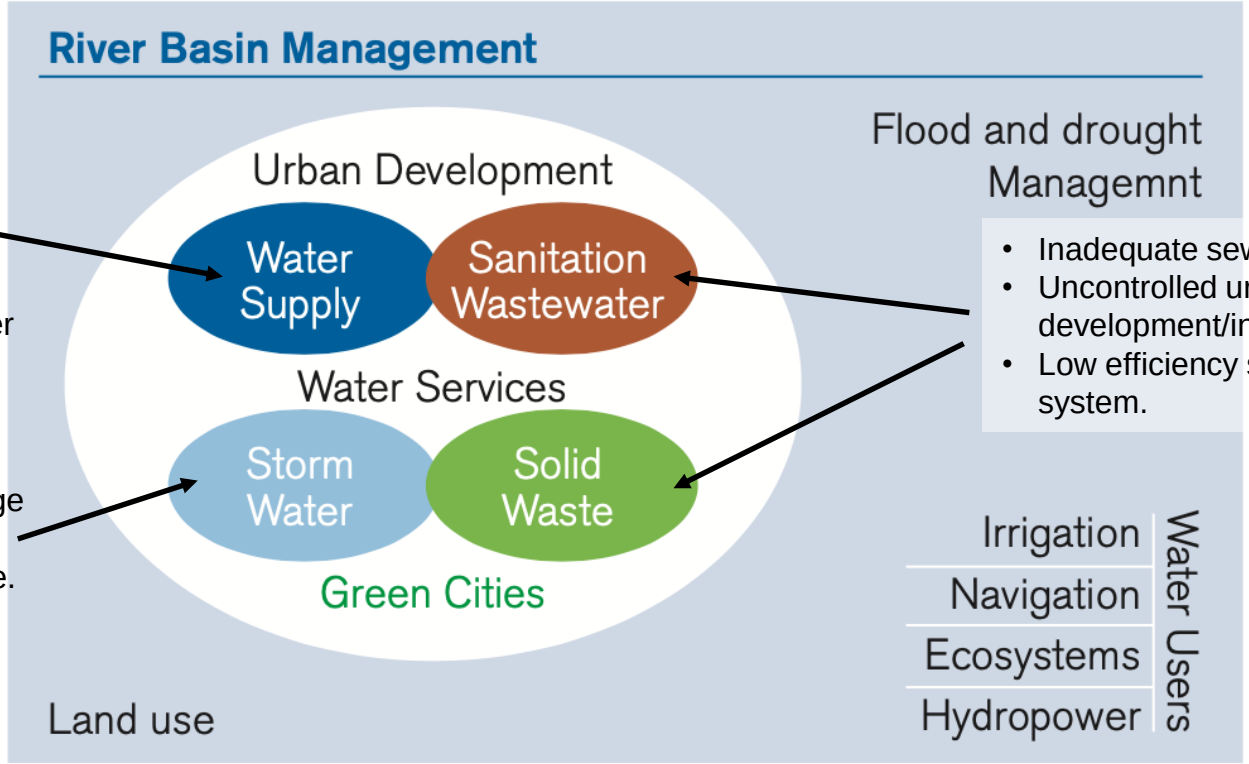
Example: Surat city



Example: Surat city – RBM, an approach for city environment

- Pressure on water resources
- Inefficient water supply systems.
- High values of Non-Revenue Water

- Recurring floods and lacking drainage systems.
- Aging infrastructure.
- Low cost recovery.

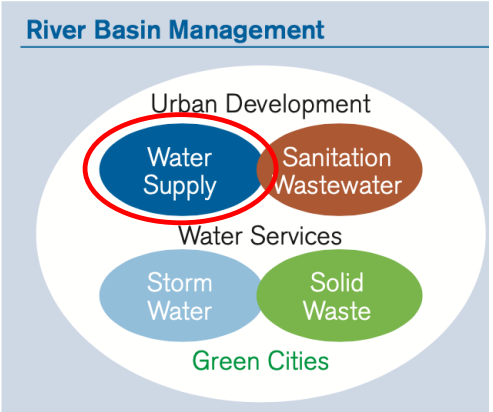


- Inadequate sewerage systems.
- Uncontrolled urban development/informal settlements.
- Low efficiency solid waste collection system.

Source: World Bank (2012) based on Porto and Tucci 2010

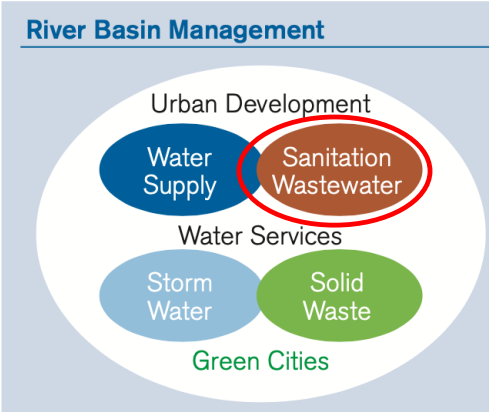
Example: Surat city – Achievements

WATER AVAILABILITY	Actions	Results
Conservation practices	Rainwater harvesting (RWH): Metropolitan Areas have notified rules under which no new building plan is approved without corresponding rainwater harvesting structure.	• 90 RWH completed till date. • 500 RWH structures to be installed by SMC in next three years.
Groundwater management	Building of a weir to increase capacity and decrease salinity intrusions from the sea into the aquifers. Study carried out suggesting management measures such as groundwater recharge	• Increased groundwater rechange and protection from salinity intrusions
Monitoring and information system	Extensive water monitoring system in water works, wastewater system and river water	• Improved decision-making and emergency management processes



Example: Surat city – Achievements

WASTEWATER	Actions	Results
Extension of sewerage system	Building of 10 new STPs in last 25 years with latest technology and sludge dewatering systems	• Capacity treated: 925 MLD • Coverage: 91 % population • 1600 km sewer network
Reuse of treated wastewater	Reuse of 35 MLD treated wastewater from STP (tertiary treatment: ultrafiltration and RO) for textile use in Pandesara industrial park	• Cost fresh water to industry: Rs. 23/KL, cost treated wastewater Rs. 18,2/KL. • Separate network for drinking and reused water in industrial area with different color-codes. • Tertiary water blended with drinking water up to 50%.



Exercise: PoM for a Sub-basin of the Ganga River

IT´S YOUR TURN

Objective of the exercise:

- Initiate the reflection on drafting PoMs for a Key Water Management Issues.

Group work in (sub-) basin:

- Choose one of the pressures of the DPSIR characterisation (TM1)
- Relate the pressure to **one of the objectives** of Ganga River Basin Management Plan
- Formulate a **set of measures** to achieve the objective in your sub-basin:
  - actions/activities to be taken,
  - timelines for implementation,
  - resources needed for implementation (financial, technical, human).

I. "Aviral Dhara" (Uninterrupted Flow)

II. "Nirmal Dhara" (Unpolluted Flow)

III. Geologic Entity

IV. Ecological Entity

7 Implementation of RBM

7.1 RBM Plan

7.2 Development of Programme of Measures (PoM)

7.3 Aspects for Implementing PoMs / RBM Plans

7.4 Review and Revise PoM

Sources of Financing for Basin Management

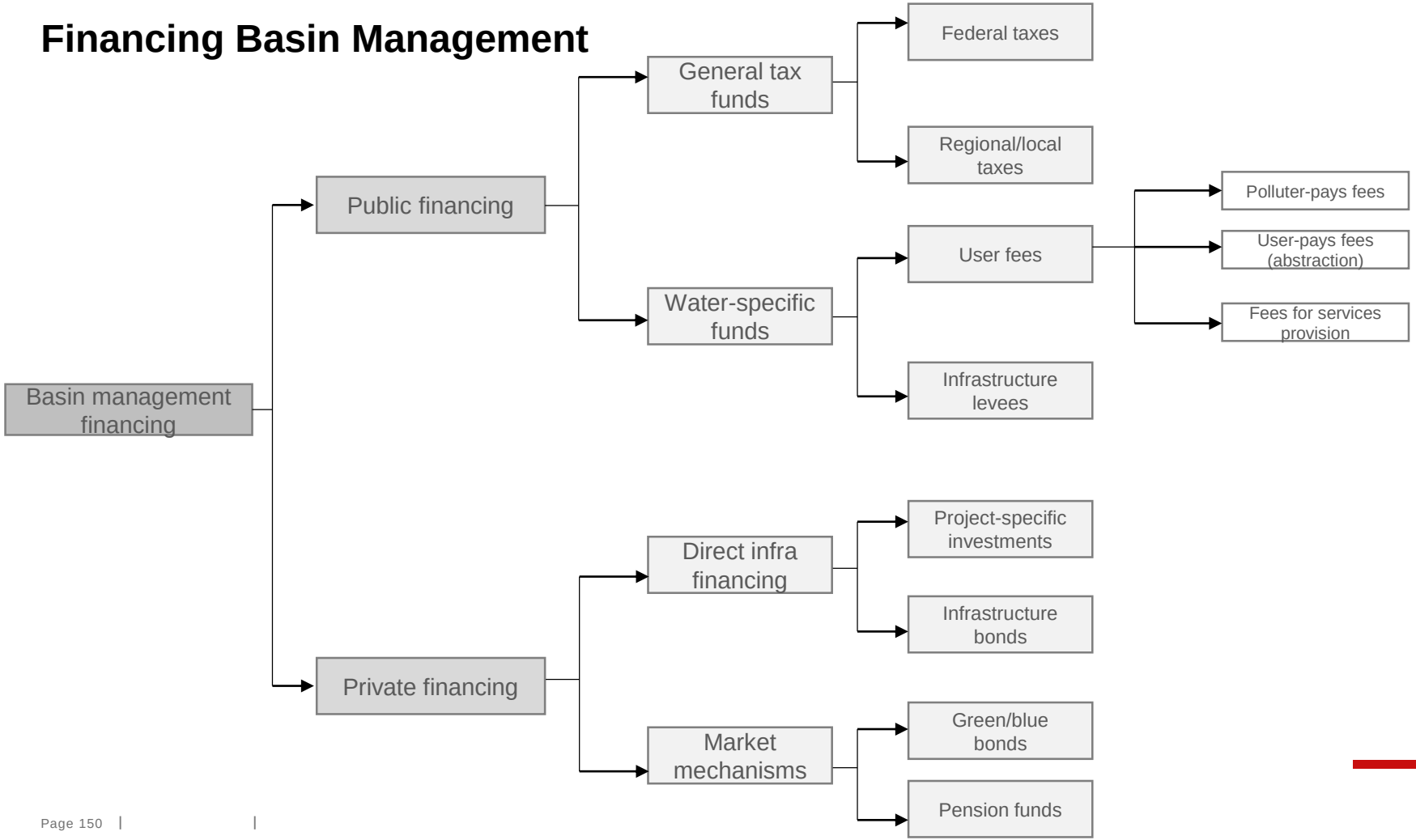
Financing can come from **different sources**, depending on:

- The political and economic situation of a country (including federal states where applicable)
- The fiscal and budgetary system of a country
- The distribution of responsibilities for water management itself and for financing it

They can **include**:

- Government budget (national – state – local)
  - Tax-funded
  - Fee-funded
  - Funded through dedicated government funds derived from e.g. wastewater and/or water abstraction charges
- Private funds/investments
- Public-private partnerships (PPP)
- International contributions e.g. Development cooperation/ Official Development Assistance (ODA) and/or dedicated funds

Financing Basin Management



Water Fees/ Charges as an Option for Financing Water Management Measures

- Charges, fees or market-based instruments such as permits provide an **incentive** for cost-effective investment in pollution clean-up
- Charges or fees will tend to be a lower cost method of achieving a given standard
- Public authorities levy fees and user-charges for services provided (e.g. effluent or refuse disposal), or where the revenue is used for a specific purpose (e.g. funding clean-up or abatement measures)
- They are collected from businesses as well as from private consumers

Similar to taxes, fees and charges are implemented with a triple objective:

- Setting a price to promote more efficient resource use and to limit the demand
- Finance government services or pay for the protection of the environmental good provided ("full cost recovery") → Revenue collection by public authorities
- Promote accountability in the public sector → Price as important source information, awareness of the costs of the public services

Source of Financing for Basin Management at Federal State Level

German Law for Wastewater Fees (“Abwasserabgaben-Gesetz” 1976, 2005, 2014)

- The wastewater fee is paid for pollution loads e.g. by wastewater treatment plants
- Per pollution unit the polluter has to pay 35.79 €
- Pollution units are 50 kg CSB, 25 kg Nitrogen, 3 kg Phosphorous, 2 kg Chlorine of AOX, heavy metals, and fish toxicity
- The fee/ charges received from polluters are reinvested in improving the quality of surface waters

Water abstraction charge (“Wasserentnahmenentgelt”)

- Charge for abstracting groundwater and surface water introduce in 13 out of 16 German federal states during the period 2008-2013
- About 4-12 cent/m^3 for groundwater, partly surface water
- ≤ 1 cent/ m^3 for cooling in power plants

Example: the Danube basin – Financing RBM

ICPDR IKSD
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

Each Danube country is responsible for **financing the projects** within its territory. Over 20 billion Euro have been invested in water treatment facilities alone. It proves to be more cost-effective to prevent environmental deterioration.

EU Member States can seek financial support from the EU through specific funds. These include:

- **European Regional Development Fund (ERDF):** Aimed at economic, social, and territorial cohesion in the EU.
- **European Social Fund (ESF):** The main EU financial instrument for investing in employment opportunities, education, help for vulnerable people, and the environment.
- **Cohesion Fund (CF):** Supports investments in TEN-T transport networks and the environment in EU Member States with below-average Gross National Income.
- **European Agricultural Fund for Rural Development (EAFRD):** Finances the Rural Development and Agri-Environmental Programs of the EU Common Agricultural Policy.
- **European Maritime and Fisheries Fund (EMFF):** Supports marine and fisheries policies in the EU.

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Example: the Danube basin – Financing RBM

ICPDR IKSD
International Commission for the Protection of the Danube River
Internationale Kommission zum Schutz der Donau

The following programs are available to **non-EU Member States**:

- **European Neighbourhood Instrument (ENI):** Provides direct support for the EU´s external policies, including environmental protection.
- **LIFE:** Entirely devoted to environmental objectives.
- **Instrument for Pre-Accession Assistance (IPA)** Provides assistance for building institutions and cross-border cooperation.
- **INTERREG Europe** Helps regional and local governments across Europe develop policies to protect the environment and improve resource efficiency.

Other **cost recovery measures** in the basin include:

- The '**polluter pays** and **user pays' principle**
- In Slovakia, farmers pay 100 % of costs for the water they use, without state subsidies. This measure aims to **reduce the overuse** of water resources.
- Hungary's regulations encourage the efficient use of water through reintroduced fees in agriculture. Farmers pay for the water they use, along with a **water resource fee** and **service costs**

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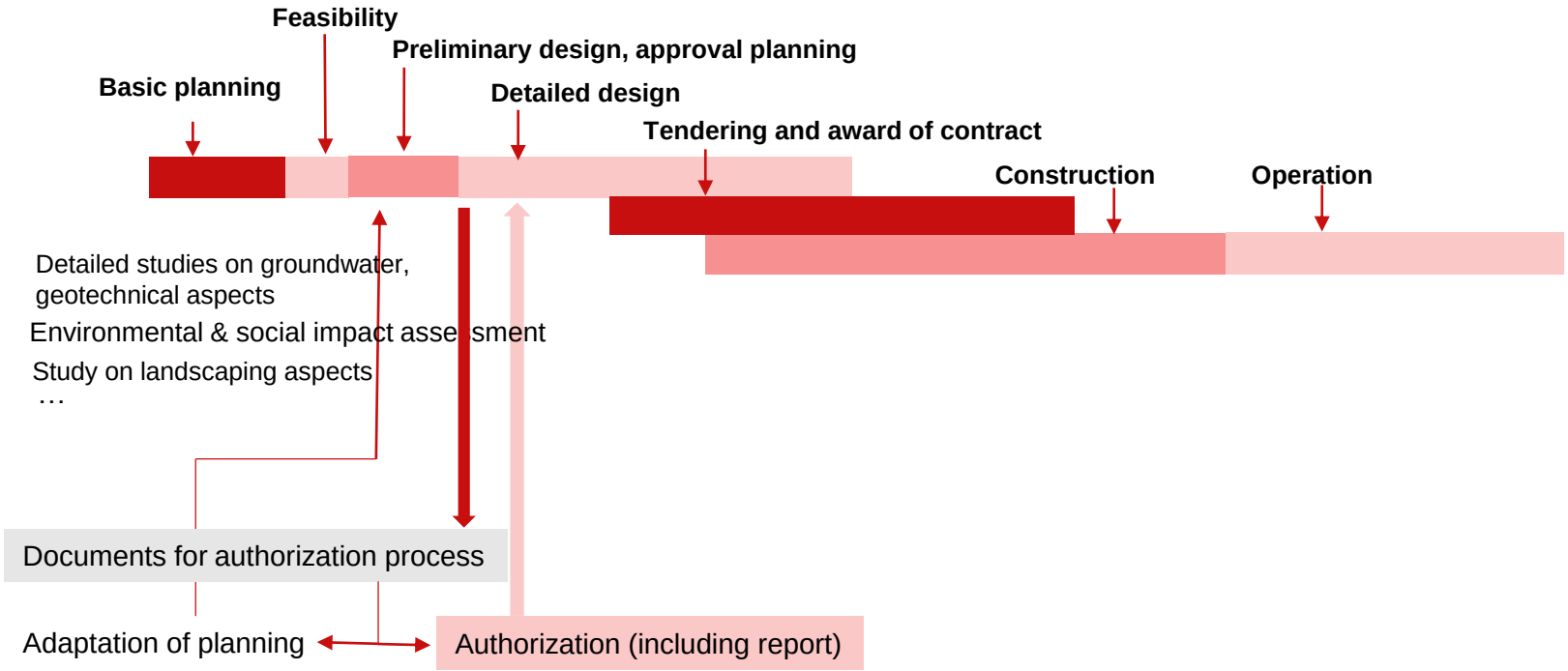
Example: the Damodar Valley Corporation (DVC) – Financing

Financing of activities

- Electricity generation: capital expenditures (CAPEX) for power generation are shared equally between the three Governments (Central, Jharkhand, West Bengal).
- Irrigation: divided between the two State Governments (Jharkhand, West Bengal) in proportion to their water withdrawal for irrigation.
- Flood control: borne by the West Bengal Government, except for an annual contribution by the Central Government.

Tasks for Planning and Constructing Public Infrastructure



Roles for Planning and Constructing Public Infrastructure

Public administration

- Steer authorisation, comment planning documents
- Prepare tendering documents
- Steer tendering and contracting
- Negotiate contracts
- Monitor costs and implementation

Engineering companies

- Bid for tender
- Basic planning
- Pre-feasibility
- Basic design, license planning
- Detailed design
- Construction control

Construction company

- Construct infrastructure
- Plan and steer construction project
- Steer sub-contractors
- Monitor costs, re-negotiate in case of changes

Environmental experts

- Prepare Environmental Impact Assessment
- Prepare studies on landscaping, biodiversity

Example: Planning Approval Documents for Flood Control Reservoir Bavaria

Flood Control Reservoir (HRB) Feldolling, Mangfall

- Explanatory report
- Plans, including property
- Inventory of construction elements
- Construction plan
- Photo documentation
- Watershed / basin plan
- Water depths, reservoir emptying, reserve water supply, inundation area
- Longitudinal cut, cross sections
- Inlet constructions
- Flood spillways
- Road adaptation
- Drainage plans
- Hydraulic verification
- Model experiment for inlet
- Performance curves
- Geotechnical report and engineering expertise report
- Hydrogeological model report
- Groundwater model report
- Accompanying landscape conservation plan
  - biotope description
  - protection of species
- Environmental impact assessment
  - Including nature protection, conflicts, groundwater
- Fauna - Flora- Habitat Guideline-Compatibility study

RBM Role Game

IT´S YOUR TURN

Objective of the exercise:

The RBM Role Game is an interactive exercise that help to:

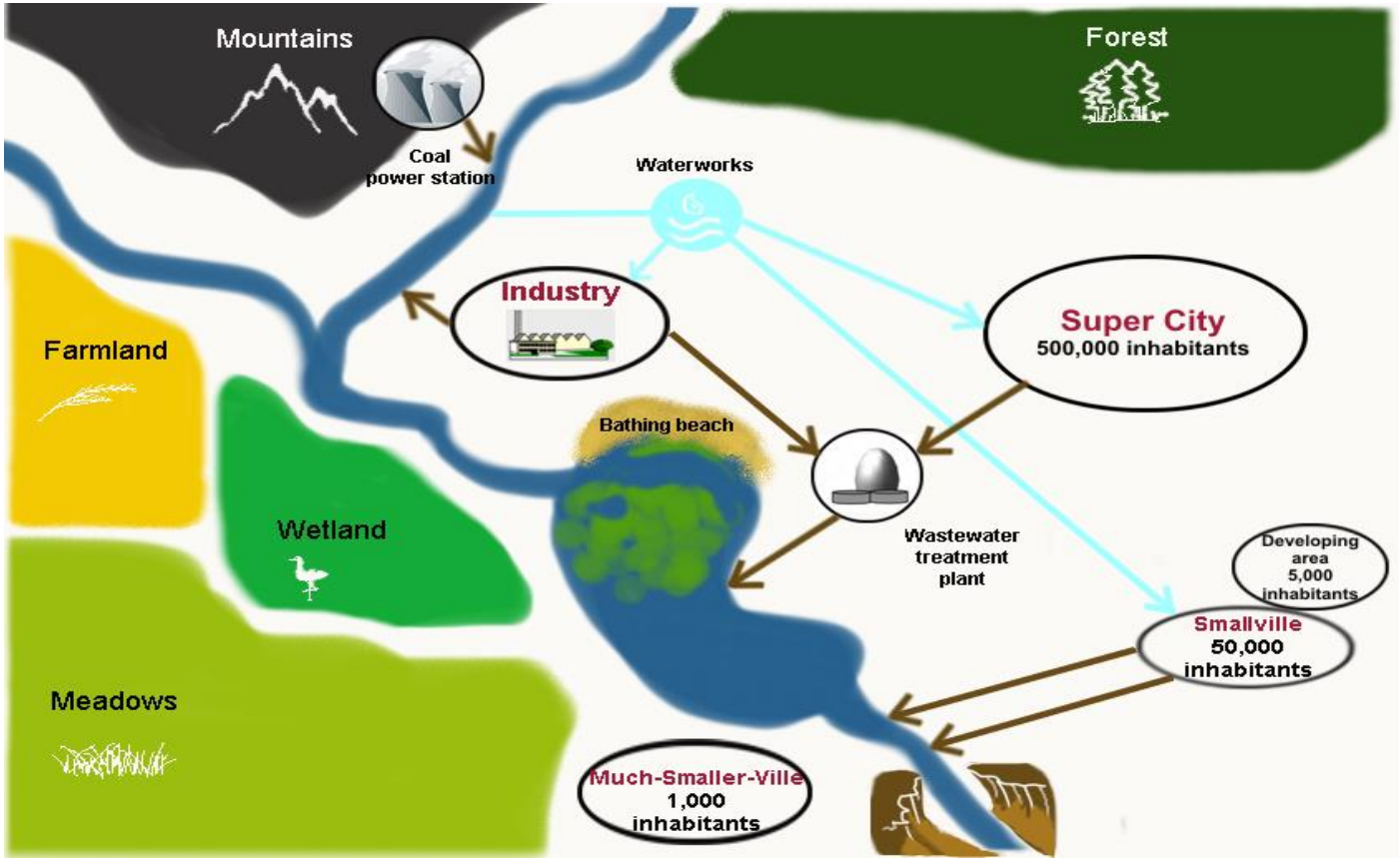
- Comprehend the different interests from stakeholders.
- Identify objectives for RBM.
- Prioritise measures to be implemented basin to achieve the objectives.

There will be 2 groups. They will have to:

- Read the information about the basin
- Each group-participant will have to take a role
- The group has to start discussion to develop the Basin Master Plan

RBM Role Game - DWA World University Challenge, 2014

IT´S YOUR TURN



RBM Role Game - DWA World University Challenge, 2014

IT´S YOUR TURN

Some facts and figures (1)

- **Water quality and quantity** of Lake Super-City is getting worse from day to day. A lot of algae is growing, O_2 concentration is low, water is getting turbid and residents are complaining about the odor, and temperature is too warm due to the cooling water from the power plant. Unfortunately, Much-Smaller-Ville will not be able to grow any further as the meadows will become a groundwater-protection-area. During drought season water scarcity is becoming more of a problem, especially for agriculture.
- **Water** supply of the “Much Smaller Ville” comes from the lake. This has to be stopped immediately because of the water quality problems. You want a sustainable drinking water system for the green province with high quality water and a buffer capacity during drought season. Water is taken directly from the river at the moment. More water is needed every year, as the number of inhabitants is increasing and the industry growing. Non-revenue water is 45%. The meadows have a very large aquifer which until now has only been used for agricultural irrigation.
- **Wastewater treatment** in the whole region has to be improved. Super City‘s wastewater treatment plant is old and only has a carbon-elimination (secondary treatment). Additionally, final clarifiers are hydraulically overloaded and flushing out suspended solids. There is no space for expansion. Smallville only has septic tanks. The outflow goes via public sewer system to the lake. Smallville is growing rapidly. Much-Smaller-Ville also uses septic tanks. There is no sewer system. Sludge of septic tanks is transported by trucks. The disposal of sewage sludge on farmland is not allowed any longer, because of high heavy metals concentrations.

RBM Role Game - DWA World University Challenge, 2014

IT´S YOUR TURN

Some facts and figures (2)

- **Industry** wants to expand, but water removal permit doesn't allow further water extraction from river and effluent concentration limits have been increased. You want to attract more industry and commerce to improve the region's financial situation and create more jobs. The existing industry has a very intensive water usage (process water and cooling water). Furthermore, all wastewater treatment technologies are end of pipe solutions. The wastewater streams are characterised by high COD, Ammonia and Phosphorus loads. All water production streams are above 25°C.
- **Waste Management** is old and has to be improved. The old landfill is full. Industry and city are looking for new alternatives. Industry and cities do operate together in waste collection.
- **Electricity** blackouts in the province are occurring more and more. Green activists always talk about waste-to-energy and biomass-to-energy. Find answers to their slogans. You are wondering whether you should still invest in the old coal power plant. The old coal power plant doesn't meet emission guidelines anymore. Too much water from the coal power plant is being led to the river, warming it up. There is a lot of wind in the mountains. However, wind alone might not be enough for the region. The effluent of the lake flows into a canyon. The geological conditions would allow the construction of a dam.

RBM Role Game - DWA World University Challenge, 2014

IT´S YOUR TURN

Your team consists of the following:

- Government official(s) of the Green Province:
  - 1 representative from the towns majors: s/he wants to improve to solid waste problem.
  - 1 representative from the Ministry of Environment: concerned by the quality of the Lake.
  - 1 representative from the Ministry of Industry: s/he wants to develop further the industries in the region.
- 1 Representative of the water supply and wastewater utility: concerned by water supply and waste water treatment.
- 1 Representative of the energy supply utility: want to improve electricity generation.
- 1 Consultant whose role is to provide innovative ideas and facilitate the discussion.

Your common vision is:

Is to make the Green Province more attractive for new residents, new industries while also promoting ecofriendly tourism.

Your tasks:

1. Read the context (10 min).
2. Each participant chooses a role (5 min)
3. Identify up to 5 objectives to carry out the Vision (10 min).
4. Identify and place on the maps up to **10 measures** to achieve the objectives (40 min).

7 Implementation of RBM

7.1 RBM Plan

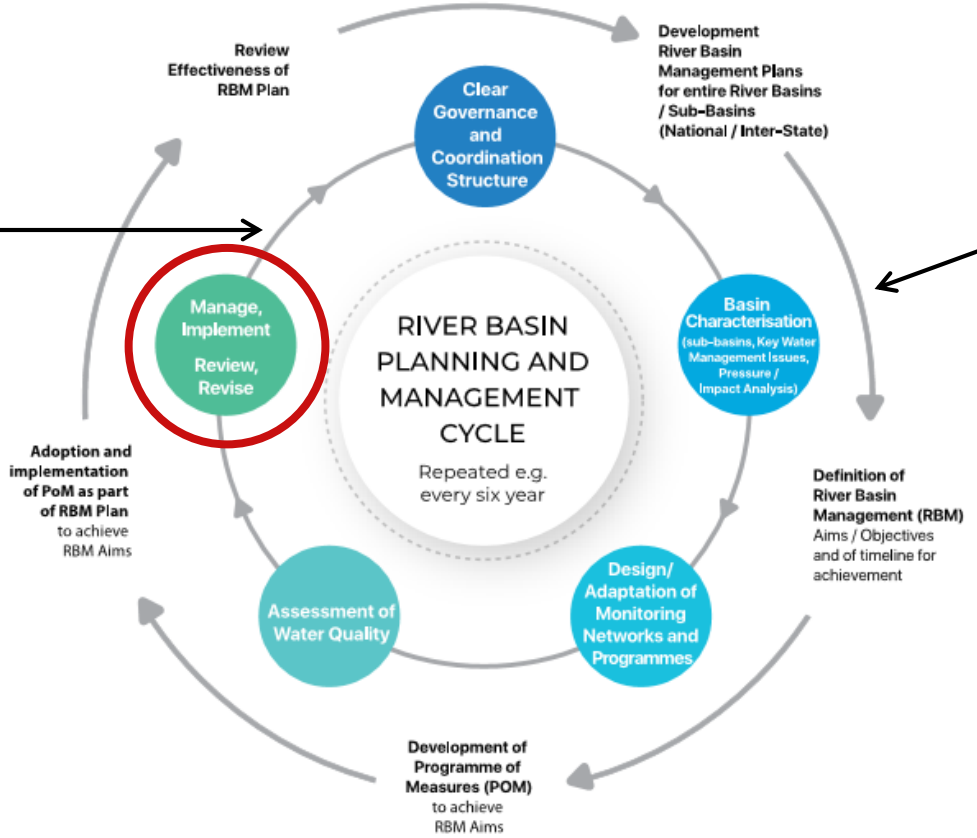
7.2 Development of Programme of Measures (PoM)

7.3 Aspects for Implementing PoMs / RBM Plans

7.4 Review and Revise PoM

The River Basin Planning and Management Cycle

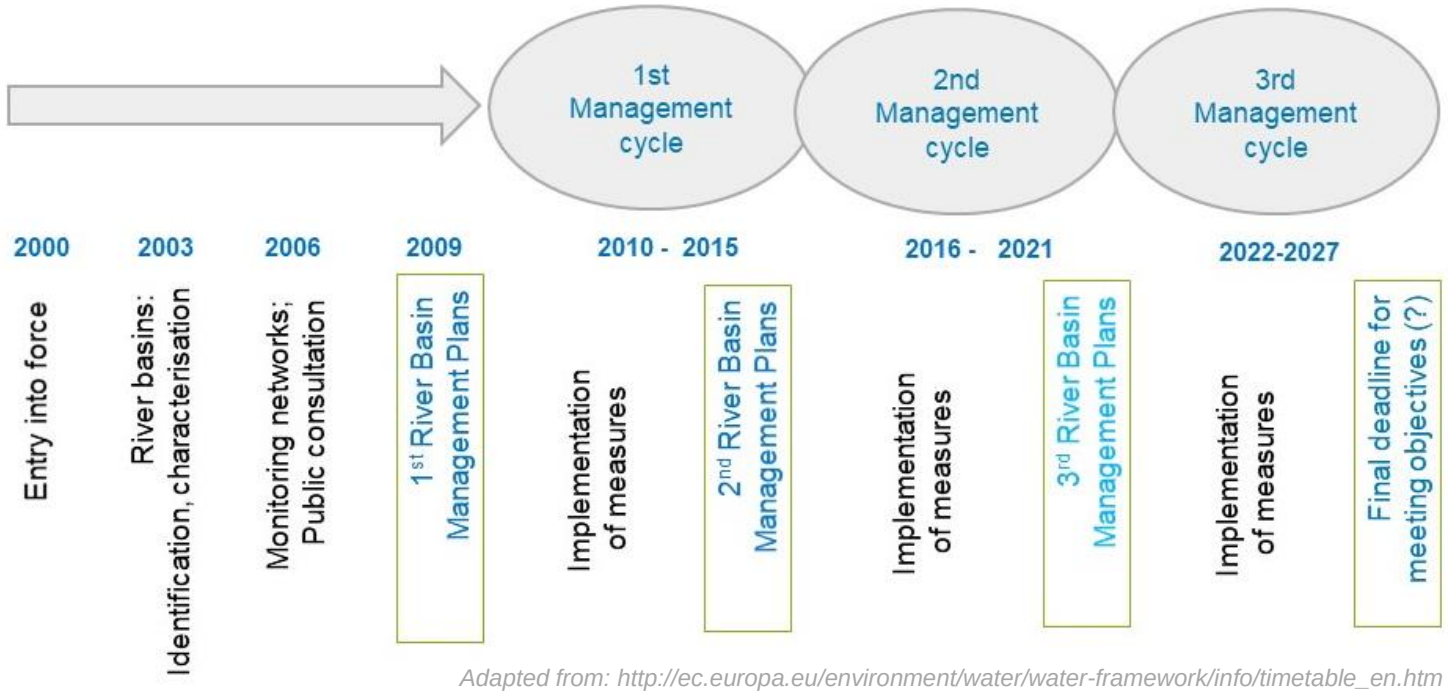
„Inner cycle“
Technical/
operational level“



„Outer cycle“
Planning and
decision making
level

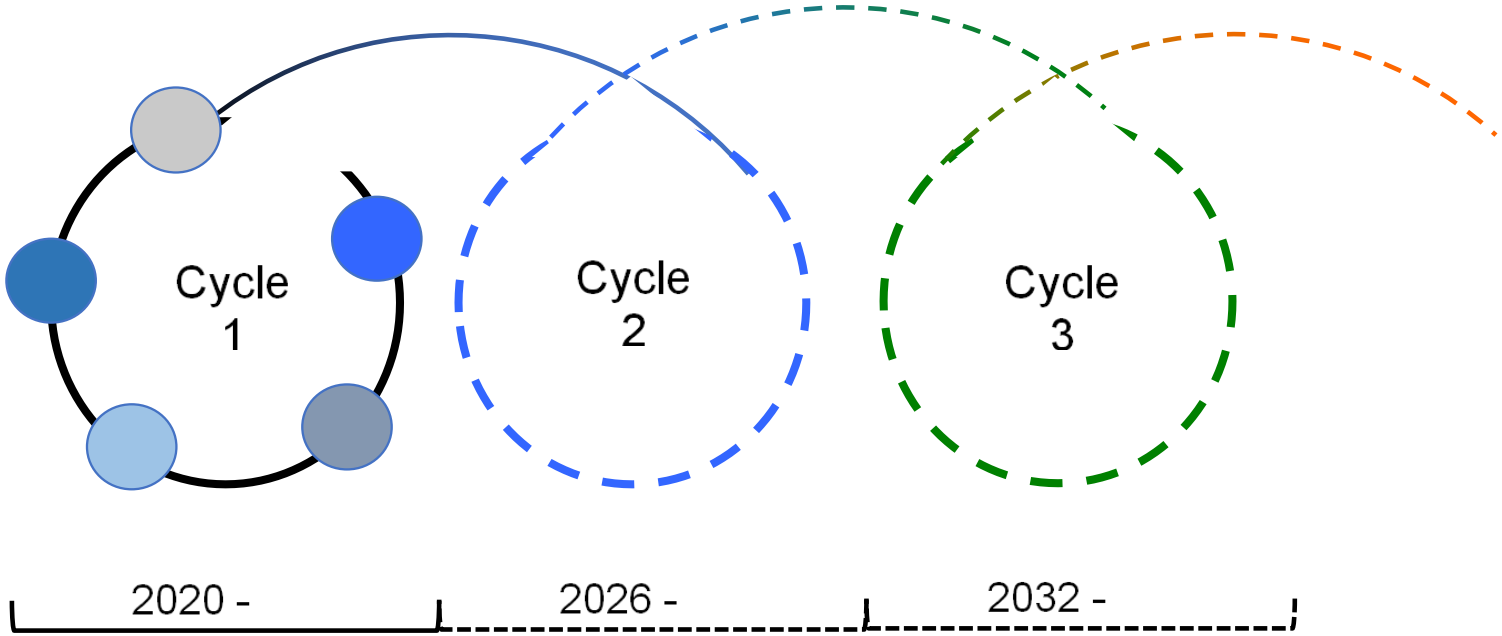
Manage, Implement, Revise, and Review the PoM

- Implementation of PoM is followed by the revision and verification of the success of the PoM within the RBMP timeline
- In Europe: Years 2015, 2021,2027 → Cycle length 6 years



Adapted from: http://ec.europa.eu/environment/water/water-framework/info/timetable_en.htm

The River Basin Planning and Management Cycle



- RBM process requires planning over several years and implementation cycles that are to be repeated in a certain frequency (e.g. 6 years).
- Each Cycle is a revision to adjust to new conditions in the basin and to addresses new challenges.


Thank you for giving us the opportunity
to share our experiences with you!

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