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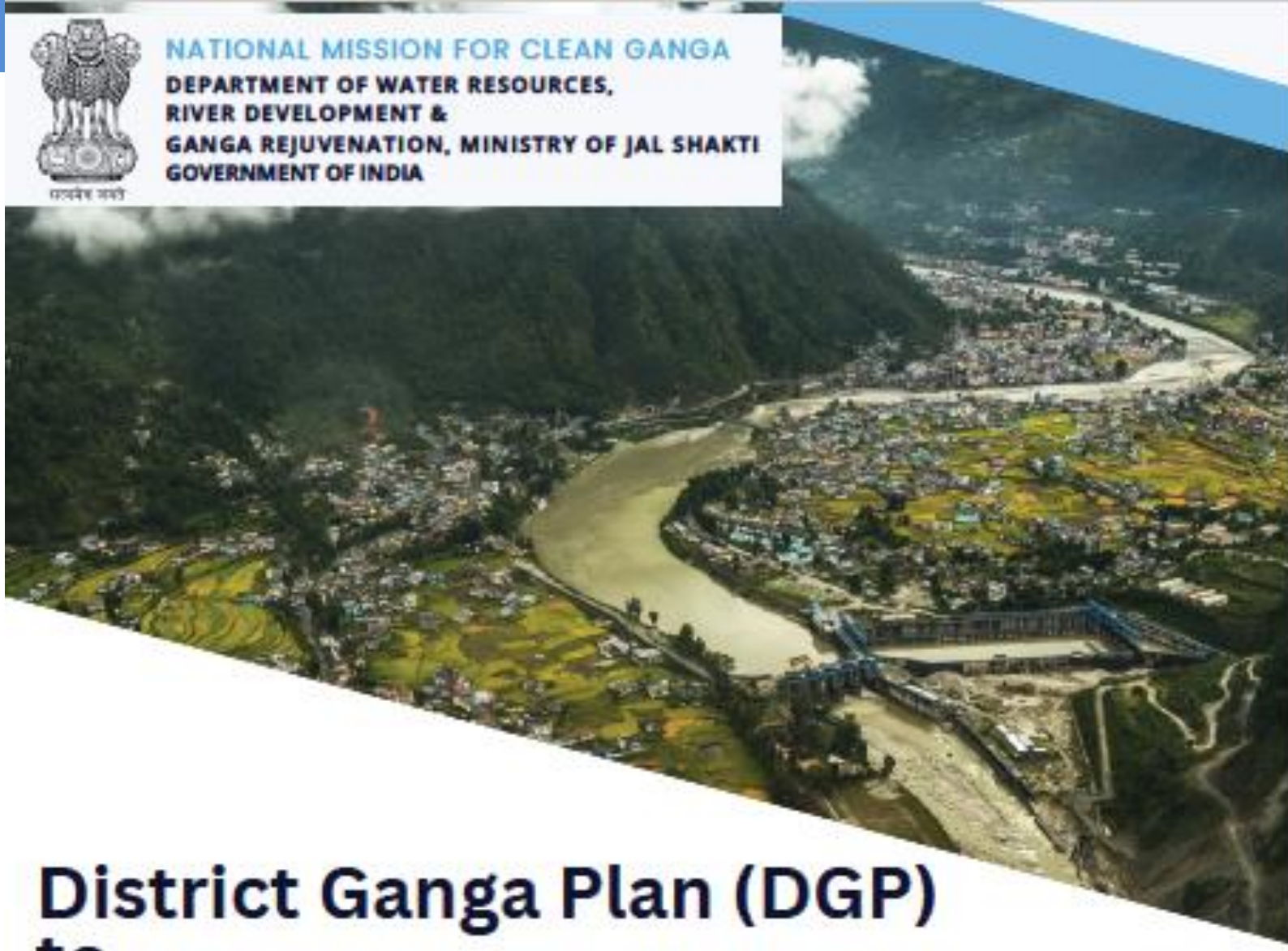

District Ganga Plan (DGP) to District River Management Plan (DRMP) – Comprehensive Manual

Prepared by

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

National Mission for Clean Ganga (NMCG)

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

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

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Acknowledgment

This "District Ganga Plan (DGP) to District River Management Plan (DRMP) – Comprehensive Manual" report is a collective effort of many experts, institutions and organisations, in particular team cGanga, IIT Kanpur & NMCG, Jal Shakti Ministry, GoI.

Suggested Citation

cGanga & NMCG, 2025, District Ganga Plan (DGP) to District River Management Plan (DRMP) – Comprehensive Manual

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District Ganga Plan (DGP) to District River Management Plan (DRMP) – Comprehensive Manual

A Unified Template, Illustrated Framework, and Consolidated Methodology for All Indian Districts

November 2025

cGanga

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


पूजा सामग्री के
अनुज विक्रेता

Preface

India stands at a critical juncture in its approach to water and ecological management. Over the past decade, significant progress has been made in understanding rivers, drains, wetlands, aquifers, and the broader hydrological systems that support life and livelihoods across the country. The District Ganga Plans (DGPs), prepared under national river rejuvenation efforts, have generated an invaluable diagnostic foundation—mapping pollution sources, documenting river stretches, identifying wetlands, and capturing key environmental and socio-economic characteristics of each district.

Yet, as the pressures on water systems intensify—driven by rapid urbanization, agricultural expansion, industrial growth, declining groundwater, soil degradation, and climate variability—it has become increasingly clear that diagnostics alone are not enough. Districts now require actionable, integrated, and cyclic water management strategies that go far beyond assessment and reporting. They require a unified operational roadmap that connects rivers with drains, wetlands with floodplains, aquifers with soils, reservoirs with tributaries, and communities with governance systems.

This report—District Ganga Plan (DGP) to District River Management Plan (DRMP): A Unified Template, Illustrated Framework, and Consolidated Methodology for All Indian Districts—is designed to provide exactly that. It transforms the DGP framework into a comprehensive, district-neutral DRMP architecture that can be adopted by any district in India, whether located in the Tarai–Bhabar zone with shallow aquifers, in the alluvial plains with deep groundwater systems, in multi-tributary foothills, or in reservoir-linked regions. The DRMP reimagines water planning as a holistic, ecological, and governance-driven exercise—integrated across hydrology, agriculture, industry, ecology, and community stewardship.

The manual consolidates a wide range of components: a complete DRMP upgradation template, a full illustrated version with schematics and conceptual diagrams, a detailed 12-component DRMP structure, and a 5–10 year implementation roadmap. It is structured to support district administrations, technical agencies, planners, engineers, and practitioners in transitioning from fragmented water management practices to an integrated district-wide hydrological system.

By embedding principles of perennialisation, wetland rejuvenation, biosolids utilization, soil carbon enhancement, industrial compliance, groundwater recharge, and nature-based solutions, the DRMP empowers districts to build resilient, self-sustaining water ecosystems that can withstand environmental and developmental pressures.

This document is offered as a practical, adaptable, and forward-looking guide—one that aspires to strengthen governance, improve ecological outcomes, enhance water security, and contribute to the long-term health of India's rivers and landscapes. It is our hope that this unified framework will support district administrations in operationalizing integrated water management and inspire a new generation of planning that places ecology and hydrology at its core.

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District Ganga Plan (DGP) to District River Management Plan (DRMP) – Comprehensive Manual:

A Unified Template, Illustrated Framework, and Consolidated Methodology for All Indian Districts

1. Introduction

India's water systems—rivers, wetlands, drains, aquifers, floodplains, soils, and reservoirs—form a single, living hydrological and ecological continuum. While District Ganga Plans (DGPs) created under national river rejuvenation initiatives provide valuable diagnostics, they are not designed as actionable, integrated, cyclic, district-level management plans.

The challenges facing Indian districts—whether in the Tarai–Bhabar zones with shallow aquifers and extensive tributary networks, or in the plains with deep groundwater and sprawling urban drainage—require a new governance architecture. This is the intent of the District River Management Plan (DRMP).

The DRMP transforms a DGP from a static diagnostic report into an implementation-ready, district-integrated, basin-aware, ecologically balanced water management roadmap, fit for local administrative execution.

This master manual combines:

- A complete DRMP Upgradation Template
- A full Illustrated Version with diagrams, tables, schematics
- A Consolidated Analytical Framework applicable to plains, Tarai, industrial and agrarian districts
- A unified 12-component DRMP architecture
- A 5–10 year implementation roadmap.

It is district-neutral, meaning any district—Tarai, plains, hilly foothills, multi-tributary, reservoir-dependent, urban-industrial, or rural-agricultural—can adopt this template directly.

2. Why DGPs Must Evolve into DRMPs

DGPs have served important functions:

- Mapping drains, wetlands, floodplains
- Listing pollution sources
- Summarising STPs and industrial loads
- Identifying groundwater blocks
- Capturing land-use and agriculture patterns
- Documenting stakeholder consultations

However, they stop at diagnostics. They do not provide:

- Urban and rural water system integration
- Closed-loop water cycles
- Wetland rejuvenation strategies
- Aquatic biomass management
- Reservoir–river coordination
- Block-wise projectisation
- Monitoring frameworks
- Nature-based solutions integration
- Cyclic (5-year) revision protocols

Moreover, different categories of districts—foothill-fed Tarai, river-fed plains, multi-tributary districts, reservoir-linked districts—face distinct challenges that DGPs do not address. The DRMP brings all district types into a common, holistic planning framework.

The DRMP is needed because water management is no longer a matter of isolated STPs or drains, but of whole system planning integrating hydrology, ecology, agriculture, industry, and governance.

3. DRMP Philosophy

The DRMP is built on four foundational pillars, universal across all district types (Tarai, plains, peri-urban, agricultural, or industrial corridors). These pillars shift planning from sectoral fragmentation to holistic stewardship.

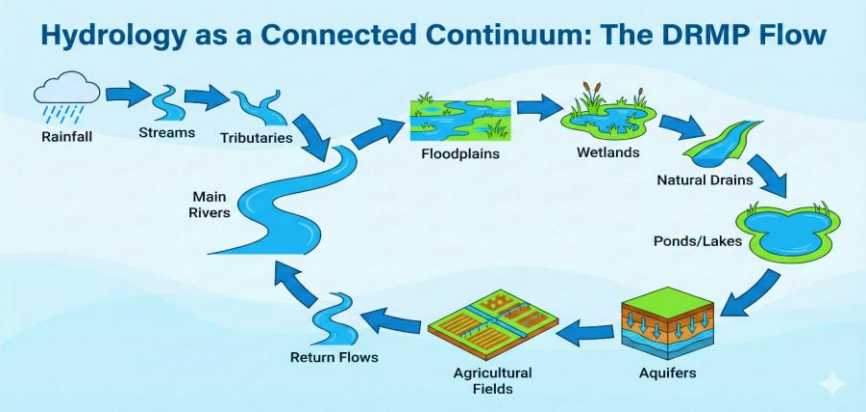
3.1 Administrative Integration

The DRMP unifies all district systems—urban water, rural sanitation, drainage, wetlands, agriculture, groundwater, industries, reservoirs, and community assets—into one plan under the leadership of the District Magistrate, supported by a strengthened District Ganga Committee (DGC).

3.2 Hydrological Integration

Every DRMP treats hydrology as a connected continuum:

Rainfall → Streams → Tributaries → Main Rivers → Floodplains → Wetlands → Natural Drains → Ponds/Lakes → Aquifers → Agricultural Fields → Return Flows → River



This integration applies equally to:

- Plains with deep aquifers
- Tarai–Bhabar zones with shallow aquifers and high infiltration
- Reservoir-dependent basins
- Multi-tributary districts
- River belts with seasonal fluctuations

3.3 Ecological Integration

Natural systems—wetlands, aquatic vegetation, soil carbon, riparian habitats—are treated as core infrastructure. The DRMP incorporates:

- Aquatic biomass harvesting
- Encroachment removal
- Wetland buffers
- Biodiversity restoration
- River corridor greening
- Soil regeneration
- Seasonal flow patterns

These measures stabilise ecosystems, reduce flood risk, and create livelihoods.

3.4 Technical Integration

DRMPs combine:

- Decentralised treatment
- Natural polishing via wetlands
- Drain restoration and perennialisation
- Agricultural nutrient management
- Industrial cluster-level interventions
- Biosolids & biochar application
- Groundwater recharge
- Smart monitoring dashboards

This technology + ecology fusion is tailored for districts ranging from Tarai foothills to western plains.

4. District-Neutral DRMP Upgradation Template

This template converts any DGP into a complete DRMP.

4.1 STEP 1 — Baseline Consolidation

Each district compiles:

- River/tributary layers
- Drain networks (major/minor; flow direction; pollution loads)
- STP/FSTP performance
- Wetland inventory
- Floodplain mapping
- Industrial and MSME clusters
- Solid waste infrastructure
- Agriculture (cropping, fertilizer/pesticide intensity)
- Groundwater (quantity + quality)
- Reservoirs and storage changes
- Encroachment locations
- Socio-economic and demographic patterns

This baseline accounts for all district types:

- Deep aquifer plains
- Shallow aquifer Tarai–Bhabar zones
- Reservoir-linked hydrology
- Tributary-dense districts
- Urban–industrial clusters

4.2 STEP 2 — Gap Analysis (DGP → DRMP)

Districts typically exhibit the following gaps:

Hydrological Gaps

- Lack of tributary–drain–river connectivity
- Absence of perennialisation strategies
- No reservoir–river linkage
- No aquifer–river exchange modelling (critical in Tarai districts)

Ecological Gaps

- Wetlands mapped but not restored
- Floodplain pressures not addressed
- Biomass not managed

Administrative Gaps

- Siloed departments
- Missing URMP + RRMP integration
- No district-level water loop planning

Agriculture Gaps

- High nutrient load runoff
- Lack of soil carbon strategies
- Unregulated pesticide and fertilizer cycles

Industrial Gaps

- Limited CETP integration
- No industrial drain segregation
- No cluster-level mapping

Drainage Gaps

- Hyper-fragmented drainage in many districts
- No drain prioritisation plan
- No drain interception strategy

Monitoring Gaps

- No DRIS dashboard
- No quarterly reporting
- No annual river report cards

4.3 STEP 3 — Integrated DRMP Vision

A suggested unified DRMP vision:

"To restore the district's hydrological, ecological, groundwater, soil, and socio-economic systems through integrated, circular water management; protection and rejuvenation of rivers and wetlands; sustainable agriculture; industrial compliance; groundwater stability; and community-driven stewardship using a decentralized and nature-based approach."

This applies equally to:

- Plains with declining groundwater
- Tarai districts with shallow aquifers and heavy agricultural inputs
- Tributary-rich districts with industrial pressure
- Reservoir-dependent districts where live storage is shrinking

4.4 STEP 4 — DRMP Cluster Architecture

Seven Mandatory Clusters

1. Urban Water Loop (URMP)
2. Rural Water, Sanitation & Agriculture (RRMP)
3. Wetlands & Floodplains
4. Industrial Wastewater & Hazardous Waste
5. Groundwater Security
6. Basin Linkages & Ecological Flows
7. Monitoring, Data & Governance

Special Cluster for Tarai Districts: Tarai–Bhabar Hydrology Considerations

- Shallow aquifer vulnerability
- High infiltration zones
- Reservoir-fed tributaries
- Agricultural leaching control
- Multi-tributary integration
- Seasonal groundwater–river exchange

4.5 STEP 5 — Project Matrix (50–80 Projects)

Projects should include:

- d-STPs and polishing wetlands
- Drain interception
- Wetland restoration
- Industrial clusters and CETP upgrades
- Reservoir desiltation
- Groundwater recharge
- Soil carbon enhancement
- Nutrient management
- Compost and biochar centres
- Encroachment removal
- Stormwater and flood mitigation
- Biodiversity corridors
- Monitoring instrumentation

4.6 STEP 6 — Block-Wise DRMP Plans

Blocks are categorised according to:

- Urban/industrial
- Rural/agricultural
- Floodplain
- Tarai shallow aquifer zones
- Bhabar infiltration belts
- Reservoir catchments

Each block receives:

- 3–10 focused interventions
- Budget, timeline, agencies, convergence options

5. Illustrated Hydro-Ecological Framework

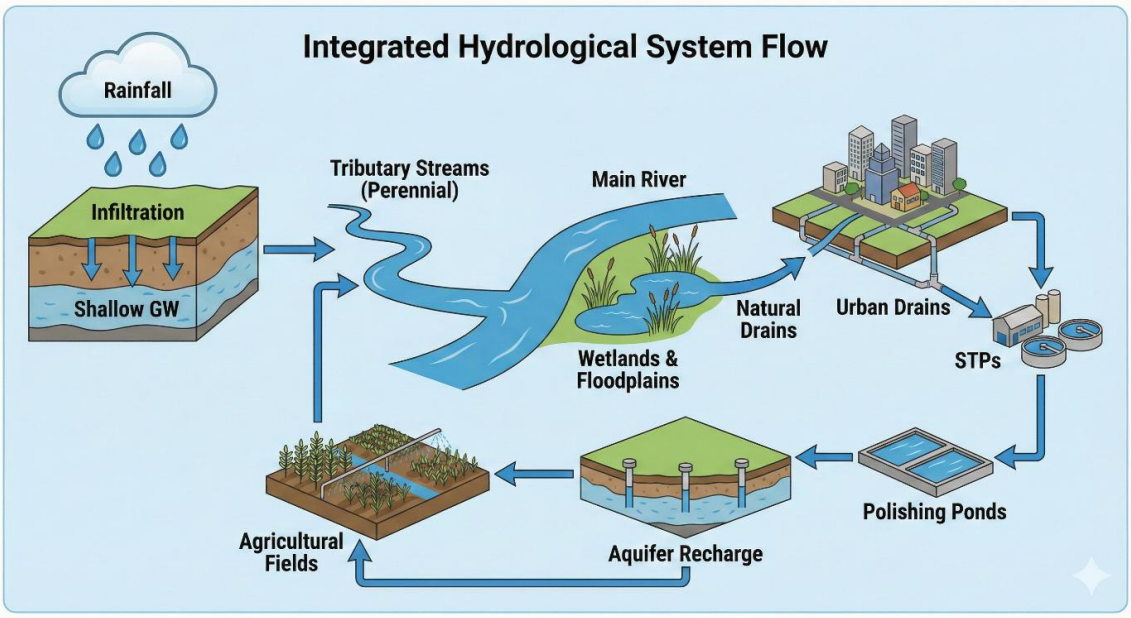
This section presents a list of items to provide clarity to practitioners, administrators, and engineers preparing DRMPs in districts with varying hydrological profiles—plains, Tarai, multi-tributary, reservoir-fed, and industrial corridors.

The list is conceptual and can be developed into GIS layers, CAD diagrams, or DPR schematics.

5.1 Hydrological System Diagram

District hydrology must be understood as a connected system of flowing components instead of isolated components.

Rainfall → Infiltration → Shallow GW → Tributary Streams (Perennial) → Main River → Wetlands & Floodplains → Natural Drains → Urban Drains → STPs → Polishing Ponds → Aquifer Recharge → Agricultural Fields (Return Flow → Tributaries)



This integrates:

- Tarai shallow aquifer behaviour
- Bhabar high-permeability belt
- Tributary-fed river systems
- Reservoir-fed catchments
- Plains drainage and aquifer recharge
- Urban/rural wastewater recycling

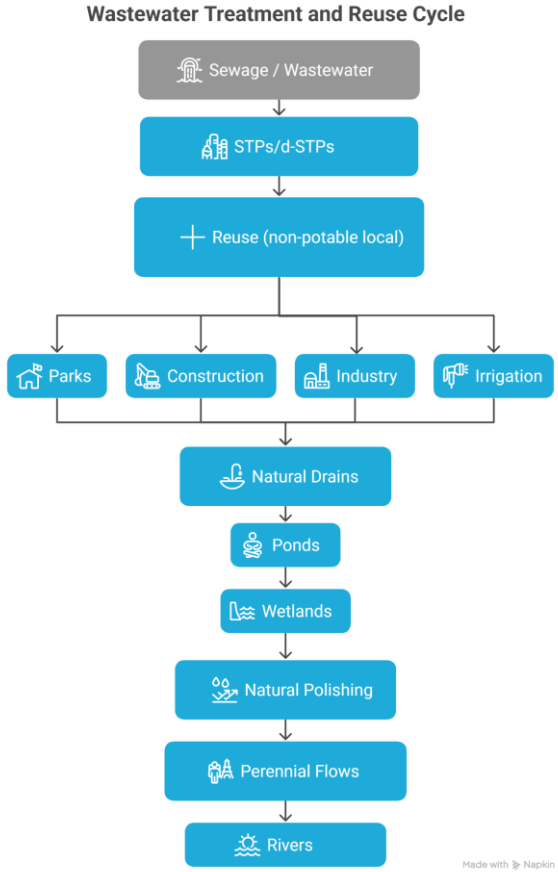
5.2 District Types in the DRMP Framework

Each district falls into one or more hydrological categories: (i) Hill Districts; (ii) Tarai–Bhabar Districts (Multi-Tributary Systems/Reservoir-Linked Districts/Shallow Aquifer Systems); (iii)Plains Districts; (iv) Downstream/Delta. A robust DRMP must be capable of accommodating:

- Shallow aquifers (Tarai)
- Reservoir desiltation needs
- Multi-tributary drainage
- Urban-industrial clusters
- Agricultural return flows

5.3 Closed-Loop Water Cycle for DRMP

The DRMP philosophy emphasizes circular water systems:



Key principles:

1. Wastewater is treated locally, not transported long distances.
2. Water bodies act as storage + polishing + ecological buffers.
3. Perennial flow restoration stabilizes rivers and aquifers.
4. Reuse is localized and demand-based.

5.4 Drainage–Wetland Rejuvenation Schematic

STP/Decentralised STP

↓

Natural Drain/Wetland (Natural/Constructed)/Pond/Lake

↓

Floodplain Wetland

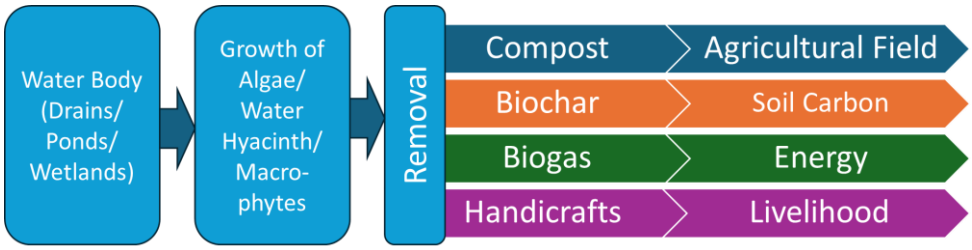
↓

River Main Channel

This structure ensures:

- Dilution during dry seasons
- Natural nutrient uptake
- Stabilized oxygen levels
- Aquatic biomass removal
- Improved hydrological flows

5.5 Aquatic Biomass Management Diagram



This is essential because:

- Nutrient elimination in Indian conditions is impossible.
- Regular biomass harvesting prevents eutrophication.
- Biomass becomes a resource for livelihood generation.

5.6 Reservoir–River System Diagram (Important for Tarai and reservoir-linked districts)

Catchment Hills → Runoff → Sediments → Reservoir → Irrigation Canal System→ Downstream Tributaries → River → Floodplain Wetlands → Aquifer Recharge

This conceptual flow scheme helps districts manage:

- Reservoir siltation
- Reduced live storage
- Tributary flow stabilization
- Wetland replenishment

6. Wetlands, Drains & Agriculture Modules

Wetlands, drains, and agriculture form the ecological–hydrological core of district water systems. Their management determines river health, groundwater balance, flood regulation, and nutrient cycling.

6.1 Wetland Typology for DRMP

Three wetland categories must be included in DRMP mapping:

Category A — Riverine Floodplain Wetlands

- Adjacent to main rivers and tributaries
- Provide flood buffering
- Recharge shallow aquifers
- Act as biodiversity hotspots

Category B — Urban Ponds & Lakes

- Receive stormwater and treated wastewater
- Act as local reuse nodes
- Serve recreation and cultural needs

Category C — Reservoir-Linked Wetlands

- Located in Tarai/reservoir fringe zones
- Extremely productive ecologically
- Require biomass management
- Are critical for agriculture and groundwater recharge

6.2 Wetland Restoration Framework

A district's DRMP must include:

Step 1: Delineation

- GIS boundary
- Catchment
- Inflow/outflow
- Encroachment mapping

Step 2: Physical Restoration

- De-silting
- Channel clearance
- Bund strengthening
- Sluice gate installation

Step 3: Ecological Restoration

- Native species plantation
- Buffer zone
- Avifauna habitat
- Aquatic vegetation management

Step 4: Hydrological Restoration

- Directed treated water flow
- Monsoon flood routing
- Summer base flow maintenance

Step 5: Biomass Harvesting Cycle

- Weekly/biweekly removal
- Composting or biochar
- Employment generation

6.3 Agriculture–Water Integration

Agriculture influences river health through:

- Irrigation withdrawals
- Fertilizer/pesticide runoff
- Soil erosion
- Groundwater extraction
- Return flows into drains

The DRMP requires:

1. Nutrient load reduction (balanced fertilizer plans)
2. Soil carbon enhancement
3. Vegetated buffer strips along drains
4. On-farm water conservation (trenchers, micro-irrigation)
5. Runoff control
6. Promotion of low-chemical farming

Agriculture modules must support both shallow aquifer Tarai districts and deep aquifer plains districts.

7. Illustrated Tables

This section compiles provides templates for various tables to be prepared in DRMP preparation.

7.1 Table — River Priority Classification

Priority	Condition	Typical Features	DRMP Required Action
I	Critical	Industrial pollution, low DO	Immediate interception, CETPs
II	High	Urban sewage + industry	d-STPs, drain treatment
III	Moderate	Sewage/urban runoff	Wetland-fed polishing
IV	Good	Rural/forest-fed	Preservation, biodiversity

7.2 Table — Wetland Restoration Checklist

Parameter	Requirement	Notes
Boundary mapping	Mandatory	Geo-referencing
Catchment inflow/outflow	Mandatory	Drain linkage
Depth profile	Recommended	For desilting
Biomass density	Critical	Determines harvesting cycle
Encroachment	Critical	Priority removal areas

7.3 Table — Aquifer–River Interaction Assessment

Aquifer Type	Interaction	DRMP Strategy
Shallow (Tarai)	High connectivity	Pesticide control, infiltration buffers
Deep Artesian	Moderate	Controlled recharge
Alluvial Plains	Seasonal exchange	Wetland recharge
Hard Rock	Low	Percolation tanks

7.4 Table — Drain Categorisation

Category	Characteristics	Action
A	High pollution drains	Interception + treatment
B	Medium pollution	Constructed wetlands
C	Clean drains	Preservation
D	Monsoon drains	Flood routing only

7.5 Table — Reservoir Assessment

Parameter	Requirement
Live storage trend	Essential
Siltation rate	Essential
Catchment erosion hotspots	Essential
Wetland linkage	Highly recommended

8. Comparative Hydrological Diagnostic Framework

This section provides a unified, district-neutral comparative framework for understanding how diverse Indian districts behave hydrologically, ecologically, and administratively. It supports DRMP preparation across:

- Plains districts
- Tarai–Bhabar districts
- Multi-tributary districts
- Reservoir-linked districts
- Urban–industrial clusters
- Rural–agricultural landscapes

8.1 River System Diagnostics

Districts generally fall into one of three categories:

Category A — Mainstem-dominant districts

- One major river with few tributaries
- Typical of plains districts
- DGP data is simple but often urban-biased

Category B — Multi-tributary districts

- Several major tributaries join the main river
- Hydrology highly complex
- Requires district-scale tributary integration
- Common in Tarai, foothills, and some middle-Ganga zones

Category C — Reservoir-influenced districts

- Reservoirs influence flows, wetlands, and groundwater
- Require storage loss analysis and desiltation strategies

Observed Diagnostic Needs

Across all categories, a DRMP must:

- Integrate surface water flows
- Map tributary interactions
- Identify priority river stretches
- Assess seasonal flow variability
- Include floodplain behaviour

Tarai-type districts, plains districts, and reservoir zones require different intensity of mapping, but under DRMP they all follow one unified assessment method.

8.2 Drainage Systems Diagnostic

Drainage is often the most critical DRMP element, because drains directly impact river pollution.

District Drainage Patterns Observed

1. Urban drains discharging untreated sewage
2. Rural drains carrying agricultural runoff
3. Hyper-fragmented drain networks in Tarai regions
4. Industrial drains directly entering tributaries
5. Flood-flow drains active only in monsoon

Common DRMP Findings Across Districts

- DGPs identify drains but rarely treat them as *hydrological systems*.
- Most districts lack drain prioritisation (Category A/B/C).
- Very few districts map drain–wetland linkages.
- Constructed wetlands are not part of existing plans.

DRMP Requirements

- A complete district-level drainage map
- Pollution source tracking
- Interception points
- Treatment nodes (d-STPs, wetlands)
- Reuse opportunities
- Seasonal flow data
- Drain rationalisation strategy

This applies equally to urban-industrial plains districts and high-drain-density Tarai districts.

8.3 Groundwater Diagnostic

Indian districts vary widely:

Three Broad Groundwater Contexts

Category	Characteristics	DRMP Focus
Shallow Aquifers (Tarai)	High connectivity, risk of contamination	Pesticide control, buffer creation
Deep Alluvial	Moderate interaction	Recharge + surface integration
Declining Plains	Over-extraction	Reuse → recharge → regulation

Key DRMP Observations

- DGPs describe groundwater but do not propose block-wise recharge strategies.
- Aquifer–river exchanges are rarely analysed.
- No district provides groundwater quality cycles or seasonal contamination maps.

A DRMP integrates:

- Shallow aquifer vulnerability
- Natural recharge structures
- Managed aquifer recharge (MAR)
- Groundwater–drain connectivity
- Irrigation water budgeting

Applicable across both Tarai and plains contexts.

8.4 Industrial Pollution Diagnostics

Industrial districts typically have following issues:

- CETP underperformance
- Industrial drains improperly connected
- Hazardous waste leakage
- Mixed industrial–sewage drains
- Unregulated MSME clusters
- Absence of real-time monitoring

DRMP Solutions

- Industrial drain separation
- Cluster-level CETP augmentation
- Chemical load reduction
- In situ treatment modules
- Real-time monitoring stations
- Sludge management plans

These apply to both plains industrial cities and Tarai districts with large industrial estates.

8.5 Wetland Systems Diagnostic

Common issues:

- Wetland loss and encroachment
- Inadequate inflow/outflow
- Seasonal drying
- Lack of biomass management
- High nutrient loading
- Absence of wetland governance bodies

DRMP Approach

- Wetland boundary and buffer demarcation
- Ecological restoration
- Hydrological recharging with treated water

- Biomass harvesting
- Integration with drains and rivers
- Wetland-based treatment nodes

This framework fits all district categories—Tarai floodplain wetlands, urban ponds, reservoir peripheries, and plains community tanks.

8.6 Agriculture–Water Diagnostic

Agriculture is the largest water user.

Observations:

- Excessive fertilizer and pesticide use
- Runoff entering drains
- Soil carbon decline
- Groundwater mining
- Poor irrigation efficiency

DRMP integrates:

- Soil-nutrient balance mapping
- Pesticide reduction strategies
- Micro-irrigation
- Vegetated buffer strips
- Runoff control channels
- Compost/biochar inputs from aquatic biomass

This applies to high-input Tarai districts, sugarcane belts, rice-wheat plains, and mixed agricultural systems.

8.7 Cross-District Diagnostic Synthesis

A consolidated view across diverse districts reveals that all districts—whether Tarai hydrological systems, alluvial plains, industrial corridors, or agricultural belts—share seven fundamental challenges:

1. Lack of integrated hydrological planning
2. Fragmented drain systems
3. Weak wastewater reuse cycles
4. Wetland degradation
5. Industrial non-compliance
6. Groundwater stress or vulnerability
7. Missing monitoring systems

The DRMP remedies all seven.

9. Integrated Gap Analysis Model (DGP vs DRMP)

This section synthesizes the gaps seen across multiple districts into a unified DRMP-compliant gap assessment model.

9.1 Universal Gaps in Existing DGPs

Existing DGPs, across states, share systematic limitations:

1. Structural Gaps

- Diagnostics without implementation planning
- No convergence across departments
- No district-level water loop strategy

2. Hydrological Gaps

- No analysis of tributary–drain–river relationships
- Missing perennialisation planning
- Inadequate aquifer integration
- No reservoir linkage planning

3. Ecological Gaps

- Wetlands documented but not restored
- No systematic biomass management
- No biodiversity integration

4. Agriculture Gaps

- Lack of nutrient cycle assessments
- Runoff unaddressed
- No chemical input management plan

5. Industrial Gaps

- Industrial drains untreated
- CETP gaps unaddressed
- Hazardous waste untracked

6. Drainage Gaps

- Linear mapping without hydrological logic
- No prioritisation (high/medium/low drains)
- No drain interception framework

7. Monitoring Gaps

- No DRIS
- No quarterly report cards
- No digital flow stations

9.2 DRMP Gap-Filling Requirements

Each gap corresponds to a required DRMP intervention:

DGP Gap	DRMP Inclusion
No URMP–RRMP integration	**Unified district water plan**
Missing perennial flows	**Treated water routing plan**
Wetland loss	**Wetland rejuvenation program**
Excess nutrient inflow	**Biomass management plans**
Industrial pollution	**CETP + drain segregation**
Agricultural runoff	**Soil–nutrient balance plan**
Groundwater decline	**MAR and recharge strategy**
Missing monitoring	**DRIS digital dashboard**

9.3 Gap Synthesis for All District Types

A district-neutral synthesis applicable to plains, Tarai, and mixed systems:

Hydro-ecological gaps:

- Fragmented surface water systems
- Weak recharge and groundwater balance
- Non-perennial hydrological cycles
- Wetland disconnection

Water quality gaps:

- Sewage discharge
- Agricultural runoff
- Industrial hotspots
- Solid waste pollution

Institutional gaps:

- Weak data sharing
- Overlapping mandates
- No convergence platform

Planning gaps:

- No DPR pipelines
- No costed project bundles
- No 5-year planning cycles

Implementation gaps:

- Lack of real-time data
- Poor enforcement mechanisms
- Underfunded O&M systems

10. DRMP Design: Complete, Integrated Framework

This is the core section describing the full DRMP architecture, combining hydrology, ecology, engineering, governance, and community engagement.

The DRMP consists of 12 integrated components applicable to all district types. Tarai considerations are integrated naturally into each component where relevant.

10.1 Component 1 — Hydrological Integration

A complete DRMP begins with understanding:

- Rivers and tributaries
- Drainage density and flow
- Wetlands and floodplains
- Canal systems
- Reservoir influence
- Aquifer layers and permeability

For Tarai–Bhabar districts, additional elements include shallow aquifer recharge, seasonal groundwater–river interactions, and hillside inflow.

10.2 Component 2 — River System Management

This includes:

- Priority river stretches
- Pollution source mapping
- Riparian buffer creation
- Biodiversity integration
- E-flow alignment
- Seasonal flow management

Multi-tributary districts require tributary-by-tributary action plans.

10.3 Component 3 — Urban Water Loop (URMP)

Key elements:

- Decentralised STPs (d-STPs)
- Drain interception
- Polishing ponds/wetlands
- Perennial flow strategy for urban drains
- Local reuse (parks, construction, industry)
- Stormwater integration

10.4 Component 4 — Rural Water & Agriculture (RRMP)

Includes:

- Greywater systems
- Village-level soak pits
- Runoff channels

- On-farm trenching
- Vegetated buffer strips
- Livestock waste management
- Fertilizer–pesticide optimisation
- Soil carbon enhancement
- Nature-based recharge solutions

Applicable to both Tarai high-input agriculture and plains systems.

10.5 Component 5 — Drainage Management

Includes:

- Drain mapping
- Pollution load assessment
- Hydrological segmentation
- Drain rationalisation strategies
- Multi-season flow modelling
- Treatment nodes (d-STPs, wetlands, in-stream wetlands)
- Biomass harvesting cycles

Particularly important for drain-dense Tarai districts and urban-industrial districts.

10.6 Component 6 — Wetlands & Floodplains

DRMP mandates:

- Wetland boundary demarcation
- Catchment delineation
- Hydrological restoration
- Seasonal water balance
- Buffer creation
- Native vegetation
- Biomass management
- Floodplain zoning

These apply to riverine wetlands, reservoir-edge wetlands, and urban ponds.

10.7 Component 7 — Industrial Wastewater Management

Components:

- CETP capacity upgradation
- Hazardous waste management
- Industrial drain segregation
- In-situ and ex-situ treatment
- Real-time monitoring sensors
- Cluster-level plans
- Compliance enforcement

This applies across industrial plains districts, MSME clusters, and Tarai industrial estates.

10.8 Component 8 — Groundwater Management

Includes:

- Managed Aquifer Recharge (MAR)
- Percolation tanks, trenches
- Rooftop harvesting
- Aquifer vulnerability mapping
- Groundwater demand management
- Irrigation efficiency programs
- Groundwater quality monitoring

Tarai districts also require pesticide leaching control and shallow aquifer safeguards.

10.9 Component 9 — Reservoir & Storage Management

Includes:

- Storage trend analysis
- Siltation studies
- Catchment erosion control
- Reservoir–wetland linkage
- Flow regulation
- Wetland-supported recharge
- Live storage recovery plans

Applicable wherever reservoirs influence district hydrology.

10.10 Component 10 — Ecology & Biomass

Includes:

- Aquatic vegetation management
- Algae/hyacinth harvesting
- Compost/biochar production
- Riparian biodiversity corridors
- Riverbank vegetation
- Habitat restoration

This creates ecological stability and livelihood opportunities.

10.11 Component 11 — Monitoring & Digital Governance

DRMP requires:

- DRIS (District River Information System)
- River/tributary flow sensors
- Water quality monitors
- Drain sensors
- Wetland dashboard

- Groundwater loggers
- Quarterly report cards
- Grievance platforms

Open public dashboards enhance accountability.

10.12 Component 12 — Cyclic DRMP Planning

DRMP follows an administrative and ecological cycle:

Understanding → Communication → Negotiation → Planning →Implementation → Monitoring → Feedback → Revision (every 5 years)

This ensures adaptive governance suitable for rapidly changing hydrological and industrial conditions.

11. Complete DRMP Architecture

This section presents the fully integrated DRMP structure that any district—Tarai, plains, multi-tributary, reservoir-fed, or industrial—can adopt directly. All components are designed to work together holistically.

The DRMP is organized into 12 interconnected components which form the backbone of a district-wide hydrological, ecological, and governance strategy.

11.1 Overview of DRMP Components

The DRMP contains:

1. Hydrological Integration
2. River System Management
3. Urban Water Loop (URMP)
4. Rural Water & Agriculture (RRMP)
5. Drainage Management & Perennialisation
6. Wetlands & Floodplains
7. Industrial Waste & Effluent Management
8. Groundwater Security
9. Reservoir & Storage Systems
10. Ecology, Biodiversity & Biomass
11. Monitoring, Governance & DRIS
12. Cyclic Planning & 5-year Revisions

This structure ensures that all aspects of district water management—physical, ecological, industrial, institutional, and social—are included in one unified plan.

11.2 Component-by-Component DRMP Blueprint

Below is the fully integrated blueprint for each component.

11.2.1 Component 1 — Hydrological Integration

A DRMP begins with a hydrological foundation:

- Comprehensive mapping of rivers, tributaries, drains, wetlands, floodplains, ponds, and reservoirs
- Assessment of surface–subsurface interactions
- Identification of seasonal flow variations
- Understanding Tarai/Bhabar infiltration zones and shallow aquifer behaviours where applicable
- Integration of hill inflows, foothill streams, and groundwater discharge zones

A complete hydrological assessment is required before any project design.

11.2.2 Component 2 — River System Management

A DRMP river strategy includes:

- Segmentation of river stretches
- Water quality classification
- Pollution load identification
- Ecological flow assessment
- Riparian buffer creation
- Channel restoration
- Riverbank stabilization
- Convergence with flood management plans

This ensures rivers improve as they flow through the district.

11.2.3 Component 3 — Urban Water Loop (URMP)

Urban water systems require:

- Decentralised STPs aligned to drain clusters
- Interception of sewage at key nodes
- Wetland or pond polishing to reduce treatment loads
- Local reuse for non-potable functions
- Stormwater network integration
- Master water budgeting for each urban area
- Use of natural drains as living ecological corridors

Perennialisation of urban drains using treated water is central to DRMP planning.

11.2.4 Component 4 — Rural Water & Agriculture (RRMP)

Rural water and agriculture planning includes:

- Greywater management units in each large village
- Livestock waste processing (biogas, compost)
- Vegetated drain buffers to reduce nutrient runoff
- Soil-nutrient balance mapping
- Promotion of balanced fertilizer use
- Pesticide reduction strategies
- Farm pond creation and rehabilitation
- On-farm water conservation systems
- Natural recharge measures
- Low-chemical agriculture models

These interventions reduce pollution and improve water security.

11.2.5 Component 5 — Drainage Management & Perennialisation

A complete DRMP requires a drainage blueprint:

- Classification of drains into A/B/C/D
- Pollution load measurement
- Seasonal mapping of flow
- Drain restructuring for hydrological coherence
- Interception and treatment at key nodes
- Vegetated and constructed wetlands
- Active biomass removal
- Linking drains to wetlands and ponds
- Summer base flow creation using treated wastewater

Drainage is treated as a hydrological asset, not a waste channel.

11.2.6 Component 6 — Wetlands & Floodplains

Wetlands restoration is essential to DRMP outcomes:

- Mapping all wetlands and floodplains
- Restoring connectivity to drains, tributaries, and rivers
- De-silting and depth profile optimization
- Re-establishing natural inflow and outflow
- Buffer zone creation (50–300 m depending on category)
- Native vegetation plantations
- Ecological conservation plans
- Biomass harvesting to prevent nutrient overload
- Wetland-based treatment systems for wastewater polishing

Floodplains are protected and used as natural buffers.

11.2.7 Component 7 — Industrial Wastewater & Hazardous Waste Management

Industrial management includes:

- Mapping industrial zones and effluent pathways
- Upgradation of CETPs/ETPs
- Industrial drain segregation
- Pre-treatment compliance by units
- Real-time monitoring systems
- Sludge handling and management
- Hazardous waste tracking
- Industrial stormwater containment

This ensures industries no longer pollute district water bodies.

11.2.8 Component 8 — Groundwater Security

Groundwater stabilization includes:

- Aquifer mapping
- Managed Aquifer Recharge (MAR) structures
- Rooftop rainwater harvesting
- Recharge trenches, percolation tanks, check dams
- Regulation of groundwater extraction
- Irrigation efficiency programs
- Integration with treated wastewater reuse
- Groundwater quality monitoring

Districts with shallow aquifers must also manage pesticide leaching, fertilizer infiltration, and nutrient flows.

11.2.9 Component 9 — Reservoir & Storage System Management

In districts where reservoirs influence hydrology:

- Assess live storage decline
- Map catchment erosion sources
- Plan de-siltation strategies
- Integrate reservoir inflow/outflow with tributaries
- Evaluate impacts on wetlands and village ponds
- Manage seasonal releases to stabilize rivers
- Prevent nutrient accumulation and weed proliferation

Reservoirs are managed as part of the hydrological ecosystem, not isolated assets.

11.2.10 Component 10 — Ecology, Biodiversity & Biomass

A DRMP integrates ecological stability with livelihoods:

- Aquatic biomass harvesting (algae, hyacinth)
- Mechanized and manual harvesting cycles
- Community-led wetland maintenance
- Compost, vermicompost, and biochar micro-enterprises
- Riparian forestation
- Biodiversity enrichments (fish habitats, bird nesting)
- Pollution-tolerant & native species management
- Seasonal ecological health monitoring

Healthy ecosystems support healthy rivers.

11.2.11 Component 11 — Monitoring, Governance & DRIS

Monitoring ensures accountability:

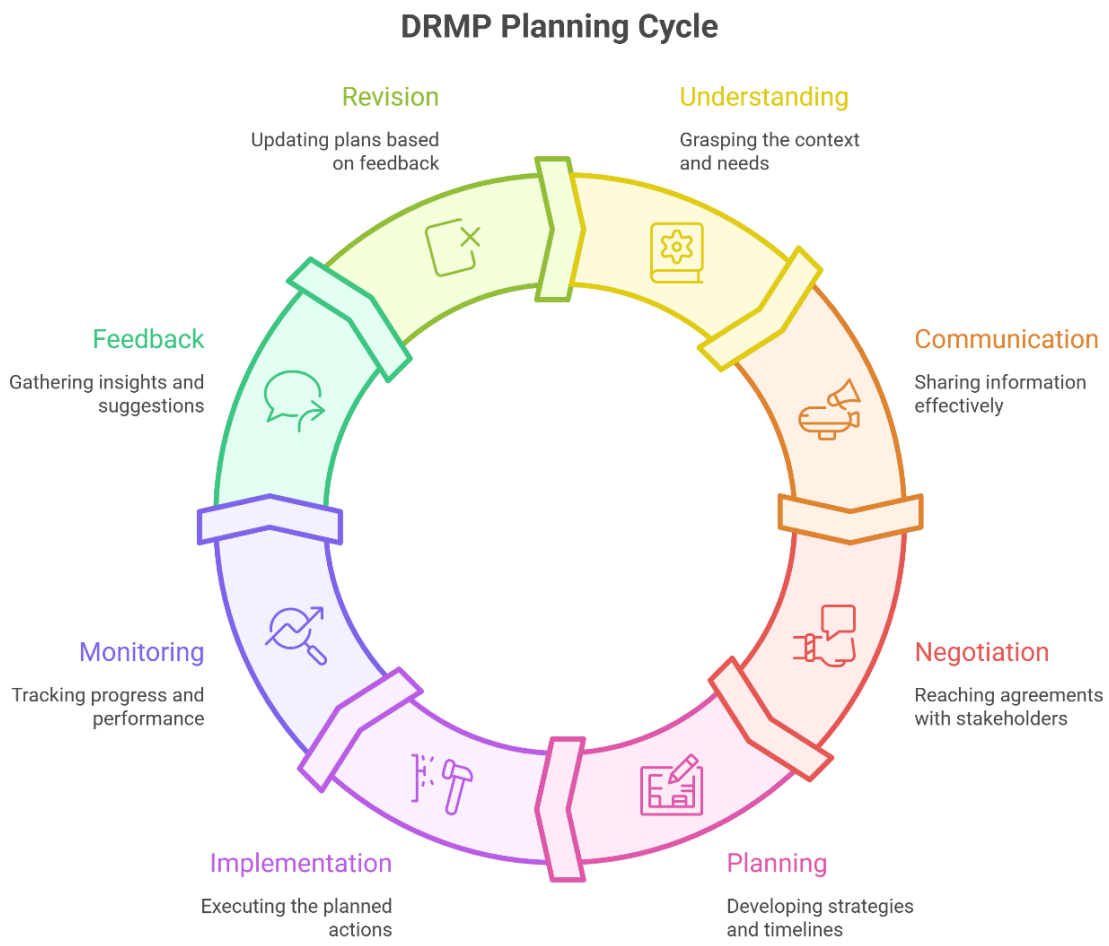
- DRIS (District River Information System)
- GIS-based dashboards
- Smart flow meters and water quality sensors
- Citizen reporting apps
- River report cards every quarter
- Annual district water report
- Integration with rainfall, groundwater, and discharge data
- Multidepartment data sharing protocols

Good governance underpins successful DRMP implementation.

11.2.12 Component 12 — Cyclic DRMP Planning & 5-Year Revision

DRMP follows a continuous cycle:

Understanding → Communication → Negotiation → Planning → Implementation → Monitoring → Feedback → Revision (Every 5 Years)



This ensures the DRMP remains adaptive to:

- Climate variability
- Industrial expansion
- Population growth
- Irrigation load changes
- Ecological shifts
- Technological advancements

Periodic updates keep the DRMP relevant and effective.

12. Implementation Roadmap (5–10 Years)

This roadmap provides a practical sequence of actions for DRMP delivery.

12.1 Phase 1 (0–2 Years): Foundation & Diagnostics

Key Actions:

- Establish DRMP Secretariat (within DM office)
- Launch DRIS setup
- Complete hydrological and ecological mapping
- Identify all drains, tributaries, wetlands, aquifers

- Prepare preliminary project list (50–80 items)
- Initiate encroachment mapping
- Start STP audits
- Launch agriculture nutrient assessment
- Begin community engagement network (“Jal Mitra” groups)

12.2 Phase 2 (2–4 Years): Core Infrastructure Deployment

Actions:

- Build decentralised STPs
- Construct polishing ponds and wetlands
- Intercept and treat high pollution drains
- Restore priority wetlands
- Begin reservoir desiltation (if applicable)
- Implement groundwater recharge projects
- Establish compost and biochar units
- Start industrial drain segregation
- Roll out rural greywater systems
- Create vegetated buffer strips along drains

12.3 Phase 3 (4–6 Years): Expansion & Consolidation

Actions:

- Expand reuse networks
- Connect more drains to wetlands
- Scale low-chemical agriculture models
- Complete major recharge structures
- Formalize wetland management groups
- Institutionalize STP–wetland–drain feedback loops
- Expand real-time monitoring systems
- Implement riverfront ecological corridors

12.4 Phase 4 (6–10 Years): Maturity & Cyclic Governance

Actions:

- Achieve near-zero untreated discharge
- Restore wetland networks fully
- Stabilize groundwater levels
- Complete reservoir improvements
- Mainstream wastewater reuse
- Launch DRMP 2.0 revision cycle
- Publish public annual “State of the District’s Rivers” reports
- Transition to climate-adaptive governance

Standard DRMP Templates for All Districts

Following are typical templates required for DRMP preparation.

Table 1: DRMP Project Matrix Template (50–80 Projects)

Cluster	Code	Project Title	Location	Description	Lead Agency	Partners	Timeline	Budget	Priority
1	U1.1	Decentralised STP Node	Urban ward	d-STP + Polishing	Jal Nigam	ULB, Forest	3 yrs	₹	High

Table 2: Drain Assessment & Rationalisation Template

Drain No.	Length	Catchment	Flow (Dry/Wet)	Pollution Source	Required Action	Treatment Node

Table 3: Wetland Restoration Template

Wetland Name	Type	Area	Catchment	Inflow	Outflow	Issues	Restoration Actions	Biomass Plan	Monitoring

Table 4: Groundwater Recharge & MAR Template

Block	Aquifer Type	Depth	Recharge Potential	Proposed MAR	Cost	Timeline

Table 5: Reservoir Assessment Template

Reservoir	Original Storage	Current Storage	Siltation (%)	Catchment Issues	Restoration Actions

Table 6: Agriculture–Water Template

Block	Dominant Crops	Fertilizer Use	Pesticide Use	Runoff Risk	Soil Carbon	Required Action

Table 7: DRIS Monitoring Template

Node	Parameter	Frequency	Device	Responsible Agency

13. Conclusion

This District-Neutral DRMP Master Document (Sections 1–12) represents a fully integrated, professionally structured, hydrologically and ecologically robust framework suitable for:

- Plains districts
- Tarai–Bhabar districts
- Multi-tributary districts
- Reservoir-dependent districts
- Urban-industrial clusters
- Rural-agricultural dominated districts

The document merges the entire template, illustrations, consolidation, and implementation roadmap into a single coherent manual, ready for adoption by any district administration.

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