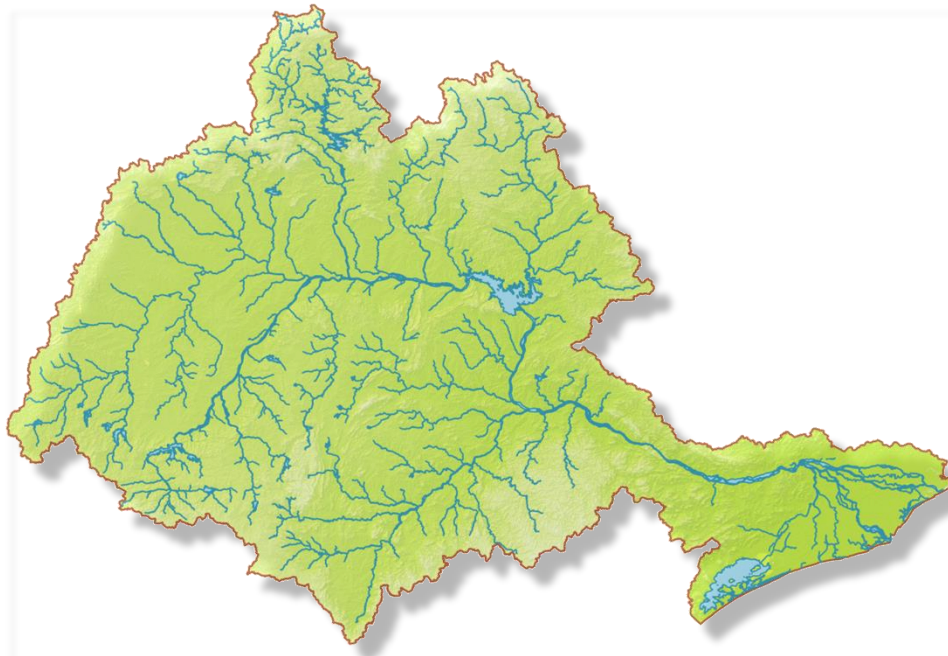




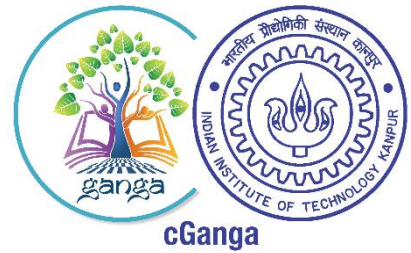
National River Conservation Directorate
Ministry of Jal Shakti,
Department of Water Resources,
River Development & Ganga Rejuvenation
Government of India

Legal Constraints

Mahanadi River Basin



March 2025



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Legal Constraints

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National River Conservation Directorate (NRCD)

The National River Conservation Directorate, functioning under the Department of Water Resources, River Development & Ganga Rejuvenation, and Ministry of Jal Shakti providing financial assistance to the State Government for conservation of rivers under the Centrally Sponsored Schemes of 'National River Conservation Plan (NRCP)'. National River Conservation Plan to the State Governments/ local bodies to set up infrastructure for pollution abatement of rivers in identified polluted river stretches based on proposals received from the State Governments/ local bodies.

www.nrcd.nic.in

Centres for Mahanadi River Basin Management Studies (cMahanadi)

The Centre for Mahanadi River Basin Management Studies (cMahanadi) is a Brain Trust dedicated to River Science and River Basin Management. Established in 2024 by NIT Raipur and NIT Rourkela, under the supervision of cGanga at IIT Kanpur, the centre serves as a knowledge wing of the National River Conservation Directorate (NRCD). cMahanadi is committed to restoring and conserving the Mahanadi River and its resources through the collation of information and knowledge, research and development, planning, monitoring, education, advocacy, and stakeholder engagement.

www.cmahanadi.org

Centre for Ganga River Basin Management and Studies (cGanga)

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.

www.cganga.org

Acknowledgment

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Disclaimer

This report is a preliminary version prepared as part of the ongoing Condition Assessment and Management Plan (CAMP) project. The analyses, interpretations and data presented in the report are subject to further validation and revision. Certain datasets or assessments may contain provisional or incomplete information, which will be updated and refined in the final version of the report after comprehensive review and verification.

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Preface

In an era of unprecedented environmental change, understanding our rivers and their ecosystems has never been more critical. This report aims to provide a comprehensive overview of our rivers, highlighting their importance, current health, and the challenges they face. As we explore the various facets of river systems, we aim to equip readers with the knowledge necessary to appreciate and protect these vital waterways.

Throughout the following pages, you will find an in-depth analysis of the principles and practices that support healthy river ecosystems. Our team of experts has meticulously compiled data, case studies, and testimonials to illustrate the significant impact of rivers on both natural environments and human communities. By sharing these insights, we hope to inspire and empower our readers to engage in river conservation efforts.

This report is not merely a collection of statistics and theories; it is a call to action. We urge all stakeholders to recognize the value of our rivers and to take proactive steps to ensure their preservation. Whether you are an environmental professional, a policy maker, or simply someone who cares about our planet, this guide is designed to support you in your efforts to protect our rivers.

We extend our heartfelt gratitude to the numerous contributors who have generously shared their stories and expertise. Their invaluable input has enriched this report, making it a beacon of knowledge and a practical resource for all who read it. It is our hope that this report will serve as a catalyst for positive environmental action, fostering a culture of stewardship that benefits both current and future generations.

As you delve into this overview of our rivers, we invite you to embrace the opportunities and challenges that lie ahead. Together, we can ensure that our rivers continue to thrive and sustain life for generations to come.

Centre for Mahanadi River Basin
Management Studies (cMahanadi)
NIT Raipur & NIT Rourkela

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Abbreviations and Acronyms

Abbreviation	Full Form
BAU	Business As Usual
cGanga	Centre for Ganga River Basin Management and Studies
cMahanadi	Centre for Mahanadi River Basin Management and Studies
CWC	Central Water Commission
DRC	Dispute Resolution Committee
GRBMP	Ganga River Basin Management Plan
ISRWD Act	Inter-State River Water Disputes Act
IWAI	Inland Waterways Authority of India
LARR Act	Land Acquisition and Rehabilitation and Resettlement Act, 2013
MAF	Million Acre-Feet
MWDT	Mahanadi Water Disputes Tribunal
NCDS	National Committee on Dam Safety
NDSA	National Dam Safety Authority
NMCG	National Mission for Clean Ganga
NRCD	National River Conservation Directorate
NRCP	National River Conservation Plan
PIB	Press Information Bureau
RBO	River Basin Organization
RR	Rehabilitation and Resettlement
SCDS	State Committees on Dam Safety
SDSO	State Dam Safety Organizations
SIA	Social Impact Assessment
SRI	System of Rice Intensification
WCF	Water Conflicts Forum

1. Preamble

The Mahanadi River Basin, a critical geographical and hydrological entity in East-Central India, serves as a vital resource for multiple riparian states. Its intricate network of rivers, tributaries, and associated ecosystems underpins the ecological balance, economic development, and cultural heritage of the region. Understanding the fundamental characteristics of this basin is paramount to appreciating the complexities of its legal and institutional governance.

Geographical Extent and Riparian States

The Mahanadi River originates at an elevation of 442 meters above mean sea level near Pharisya village in the Dhamtari district of Chhattisgarh. While its primary beneficiaries are the riparian states of Chhattisgarh and Odisha, its extensive basin also extends into Maharashtra and Jharkhand. This multi-state presence inherently introduces complexities in water resource management and allocation.

The main stem of the Mahanadi River spans a total length of 851 kilometers, with a significant portion, 357 kilometers, flowing through Chhattisgarh, and the remaining 494 kilometers traversing Odisha. The overall basin area encompasses 141,589 square kilometers. Of this, Chhattisgarh accounts for the largest share, covering 73,214 square kilometers, or 51.71% of the total area, while Odisha contributes 65,847 square kilometers, representing 46.51% of the basin. The remaining smaller portions lie within Maharashtra and Jharkhand.

The river system is further defined by its numerous tributaries. Upstream of the Hirakud dam, major tributaries such as the Seonath, Hasdeo, Mand, Ib, and Jonk converge with the Mahanadi. Downstream of the Hirakud dam, the Ong and Tel rivers contribute to the basin's flow. For analytical purposes, the basin is broadly categorized into three distinct reaches: the Upper Mahanadi and Middle Mahanadi, which are predominantly located in Chhattisgarh, and the Lower Mahanadi, which extends across Odisha. The geographical spread of the Mahanadi basin is also reflected in its political footprint, extending over 27 parliamentary constituencies. This includes 13 constituencies in Odisha, 11 in Chhattisgarh, and one each in Jharkhand, Maharashtra, and Madhya Pradesh, underscoring the broad political implications of any water-related dispute within the basin.

1.1. General Importance

The Mahanadi River Basin is indispensable for the ecological, economic, and socio-cultural well-being of the region. Ecologically, it is crucial for sustaining diverse ecosystems, supporting various plant and animal life. However, this vital ecosystem faces extensive decline due to unchecked mining activities, industrial practices, and rapid urbanization.

Economically, the river is a cornerstone for regional development. It provides extensive irrigation networks vital for agriculture and is a significant source of hydroelectric power generation. The basin's rich mineral resources, particularly coal, have attracted substantial industrial investments, further underscoring its economic significance.

Socio-culturally, the Mahanadi is revered as the "lifeline" for the people of Odisha and Chhattisgarh, holding profound religious and cultural importance. Its waters are considered sacred and are integral to numerous rituals, festivals such as Boita Bandana and Kartika Purnima, and temple traditions, with many Shiv temples situated along its banks. The river also sustains traditional fishing practices, which are now threatened by environmental changes.

A critical observation concerning the Mahanadi basin is the apparent contradiction between its current status and the escalating disputes. The basin is frequently described as "not yet a closed basin," implying that its utilisable water resources have not been fully allocated, thus presenting "ample opportunity" for integrated development and management. However, this optimistic assessment stands in stark contrast to the documented realities within the basin. There is extensive pollution, a discernible decreasing trend in the average annual flow, and significant localized water scarcity, particularly in its tributaries. This situation reveals a critical paradox: while the basin theoretically possesses sufficient water resources, ongoing unsustainable practices, including unchecked industrialization, unregulated construction of barrages, and widespread pollution, are actively eroding this potential. The window of opportunity for sustainable management is rapidly narrowing due to uncoordinated and environmentally detrimental development. This suggests that the current inter-state dispute is not merely a contest over water allocation but, more fundamentally, a struggle to prevent future, more severe water stress that will inevitably arise from present mismanagement. The implications are profound, indicating a race against time before the basin reaches a point of irreversible degradation, akin to other over-exploited river systems.

1.2. Water Availability and Use

The hydrological characteristics of the Mahanadi basin dictate the availability and patterns of water use across its riparian states.

1.2.1. Water Availability

The basin receives an average annual rainfall of 1291 millimeters, which translates to a substantial 182 Billion Cubic Meters (BCM) of water resources annually. The average annual surface water availability is estimated at 66.8 BCM. Chhattisgarh, being the upper riparian state, contributes approximately 36.9 BCM (55%) of this surface water, while Odisha contributes 29.9 BCM (45%). The total utilisable average surface water in the basin is estimated to be about 50 BCM, with Chhattisgarh's share standing at 27.5 BCM and Odisha's at 22.5 BCM.

In addition to surface water, the basin possesses a total replenishable groundwater resource of about 13.6 BCM. This groundwater is typically apportioned on a 50:50 basis between Chhattisgarh and Odisha, with each state receiving an estimated 6.8 BCM. Consequently, the total utilisable water in the Mahanadi basin, combining both surface and groundwater, is approximately 63.6 BCM. Of this, Chhattisgarh accounts for 34.3 BCM and Odisha for 29.3 BCM. The current per capita water availability in the basin is 1432 cubic meters per person, which is notably higher than the national average of 900 cubic meters per person.

However, a critical observation is the reducing trend in the average annual flow of the river and significant inter-annual variations in runoff. This trend suggests that while current per capita availability appears favorable, the long-term water availability may decrease, necessitating the adoption of more dynamic water allocation mechanisms to adapt to changing hydrological realities.

1.2.2. Water Use

Water resources in the Mahanadi basin are utilized across various sectors, with agriculture and industry being the most prominent.

1.2.2.1. Irrigation

Agriculture stands as the largest consumer of water in the basin, with an estimated gross irrigated area of around 3.32 million hectares. This area constitutes 39.4% of the total gross cultivated area in the basin. Approximately 2.134 million hectares (64%) are irrigated using surface water sources, while the remainder relies on groundwater. The estimated surface water use for irrigation is 13.72 BCM, with Chhattisgarh utilizing 5.481 BCM and Odisha 8.234 BCM. Groundwater use for irrigation is estimated at 5.10 BCM. Cumulatively, the total irrigation

water use is roughly 18.82 BCM, accounting for about 30% of the total utilisable water in the basin. Notably, surface water irrigation use increased by 24% between 2001-02 and 2014-15. The current per hectare irrigation water use is approximately 5665 cubic meters. A concern within the basin is that farmers located at the tail-end of canal-irrigated areas are often denied adequate water, compelling them to rely more on groundwater, which can lead to an overall increase in water consumption.

1.2.2.2. Industrial Use

The total water allocated to large industries in the Mahanadi basin is approximately 2.074 BCM, with Chhattisgarh accounting for 1.130 BCM and Odisha for 0.944 BCM. In volumetric terms, industrial water use is currently less than 3.3% of the total utilisable water. However, there is a growing emphasis on industrialization, particularly in water-intensive sectors such as thermal power plants, iron and steel plants, mining, and cement production. This focus is projected to significantly increase industrial water demand. Evidence suggests that new barrages and pick-up weirs constructed in Chhattisgarh are primarily designed to serve industries, with a combined capacity exceeding 1 BCM, supplying water to over 45 power plants. Furthermore, there is an observed trend of irrigation water being increasingly diverted for industrial purposes in both states.

1.2.2.3. Domestic and Livestock Needs

The population of the Mahanadi basin in 2018 was approximately 44.42 million. Current domestic water needs are estimated at 0.95 BCM, with 0.5 BCM for Chhattisgarh and 0.45 BCM for Odisha, based on per capita requirements of 55 liters per capita per day (lpcd) for rural areas and 70 lpcd for urban areas. Projections indicate that domestic water demand will rise to 1.23 BCM by 2030 and 1.9 BCM by 2050. The livestock population in the basin was about 17.7 million in 2012, with a current water requirement of 0.54 BCM, a figure projected to remain relatively constant until 2050.

Table 1: Water Use Projection under Business as Usual (BAU) Scenario (Mahanadi Basin)

Sector	Current (2018) water use (BCM)	Projected water use in 2030 (BCM)	Projected water use in 2050 (BCM)
	CG	OD	Total
Domestic	0.50	0.45	0.95
Livestock	0.27	0.27	0.54
Agriculture	8.03	10.78	18.81
Industries	1.13	0.94	2.07
Total Use/Allocation	9.93	12.44	22.37
Utilisable Water	34.30	29.30	63.60
Overall Water Balance	24.37	16.86	41.23

(Source: Joy, K. J., Neha Bhadbhade, Sarita Bhagat and Abraham Samuel (2021) Mahanadi Basin: An Alternative Approach to Inter-state Water Sharing and Management – An Approach Paper. Forum for Policy Dialogue on Water Conflicts in India, Pune)

Table 2: Water Use Projection under Alternative Approach-Based Scenario (Mahanadi Basin)

Uses	2030 (BCM)	2050 (BCM)
	CG	OD
Water for life	1.13	0.94
Water for livestock	0.28	0.28
Water for the ecosystem	8.39	6.97
Water for agriculture livelihoods	16.50	15.60
Water for adaptation to change	3.50	2.86
Water for industrial water use	2.50	1.58
Total Use/Allocation	32.30	28.23
Utilisable water	34.30	29.30
Overall Water Balance	2.00	1.07

(Source: Joy, K. J., Neha Bhadbhade, Sarita Bhagat and Abraham Samuel (2021) Mahanadi Basin: An Alternative Approach to Inter-state Water Sharing and Management – An Approach Paper. Forum for Policy Dialogue on Water Conflicts in India, Pune)

2. Understanding Legal Constraints

The governance of inter-state river basins in India operates within a complex legal framework, characterized by constitutional mandates, statutory instruments, and judicial interpretations. This section explores these foundational elements, providing the necessary context to understand the specific legal constraints and challenges encountered in the Mahanadi Basin.

Constitutional Framework for Water Governance in India

The Constitution of India delineates a nuanced system of power sharing between the Union (Central) Government and the State Governments, particularly articulated in the Seventh Schedule. This division of legislative authority is central to water governance.

The Union List (List I) grants Parliament exclusive legislative authority over subjects such as Defence and Foreign Affairs. Crucially, Entry 56 of this list empowers the Centre to regulate and develop inter-state rivers and river valleys, provided such intervention is declared by Parliament to be expedient in the public interest. This provision forms the bedrock of central government's authority over shared river resources.

Conversely, the State List (List II) reserves exclusive legislative authority for state legislatures over subjects like Public Order, Police, and Health. Explicitly, Entry 17 of List II places "Water, including water supplies, irrigation and canals, drainage and embankments, water storage, and water power" under state jurisdiction. However, this state power is expressly made subject to Entry 56 of List I, creating a potential for concurrent or overriding central authority. Additionally, Entry 14 (Agriculture) and Entry 18 (Land improvement) of the State List also implicitly involve water-related concerns.

The Concurrent List (List III) contains subjects where both Parliament and State legislatures can legislate. In cases of conflict, the Centre's power generally prevails. Notably, the Concurrent List does not contain any explicit water-related entry.

Beyond legislative powers, Article 262 of the Constitution specifically addresses the adjudication of disputes concerning inter-state rivers or river valleys, granting Parliament the explicit right to adjudicate such matters. Furthermore, Article 262(2) empowers Parliament to enact laws that preclude judicial intervention, including by the Supreme Court or any other court, in disputes referred to specialized tribunals. This principle has historical roots in Sections 130-134 of the Government of India Act, 1935, which similarly barred court jurisdiction in water disputes.

This constitutional arrangement reveals an enduring tension between federalism and centralization in water governance. Water is primarily a State subject under Entry 17 of List II, granting states significant autonomy over their water resources. Yet, Entry 56 of List I and

Article 262 provide the Union Government with substantial powers over inter-state rivers. This central authority is further reinforced by the Supreme Court's "centralizing approach" in landmark cases such as *In Re: Networking of Rivers* and *M.C. Mehta v. Union of India*, where the judiciary has often prioritized broader environmental implications or national interests, sometimes bypassing an exhaustive constitutional analysis regarding explicit legislative jurisdictions. This approach has effectively strengthened central oversight, even in areas like groundwater management, which traditionally fall under state purview.

The inherent tension in India's water federalism arises from this dual structure: states assert their autonomy over water within their boundaries, while the Centre seeks integrated management of inter-state rivers, often through legislative declarations or judicial interpretations. This ambiguity in jurisdictional boundaries frequently fuels disputes, leading to a "tug-of-war" between central and state authorities and posing significant challenges to the principle of cooperative federalism. The Mahanadi dispute, with Odisha's allegations against Chhattisgarh's "illegal" barrages and the Centre's delayed intervention in forming a tribunal, perfectly exemplifies this constitutional friction. The states' desire for independent control over water resources clashes with the central government's mandate for national-level regulation, creating a complex legal and political landscape for river basin management.

Inter-State River Water Disputes Act, 1956 (ISRWD Act) and its Amendments

The Inter-State River Water Disputes Act, 1956 (ISRWD Act), serves as the principal legal framework in India for addressing conflicts related to the use, distribution, and control of waters from inter-state rivers and river valleys. Its enactment aimed to provide a structured mechanism for adjudicating such disputes, thereby preventing protracted legal battles in ordinary courts.

The Act, under Section 2(c), explicitly defines a 'water dispute' as any disagreement or difference between two or more State Governments concerning: (i) the use, allocation, or management of waters from inter-State rivers or river valleys; or (ii) the interpretation or implementation of agreements governing the use, distribution, or control of such inter-State water resources.

The adjudicatory process under the ISRWD Act 1956 is initiated when a State Government perceives that a water dispute has arisen or is likely to arise, prejudicially affecting its interests. Such a dispute can be triggered by executive action or legislation by another State, the failure of another State to exercise its powers, or the non-implementation of an existing agreement. The aggrieved State Government may then formally request the Central Government to refer the dispute to a Tribunal for adjudication.

Upon receiving a complaint, the Central Government first attempts to settle the dispute through negotiations. If these negotiations fail within a period not exceeding one year from the date of the request, the Central Government is mandated to constitute a Water Disputes Tribunal by notification in the Official Gazette. The Tribunal comprises a Chairman and two other members, who are nominated by the Chief Justice of India from among persons who are Judges of the Supreme Court or a High Court. The Central Government may also appoint two or more persons as assessors, in consultation with the Tribunal, to provide expert advice during the proceedings.

Once constituted, the Central Government formally refers the water dispute and any connected or relevant matters to the Tribunal for adjudication. The Tribunal investigates the matters, forwards a report setting out its findings, and gives its decision within a period of three years, which can be extended for a further period not exceeding two years for unavoidable reasons. If any party (Central Government or State Government) requires explanation or guidance on the Tribunal's decision, they may refer the matter back to the Tribunal within three months, and the Tribunal may provide a further report within one year (extendable).

A crucial aspect of the Act is that the decision of the Tribunal, once published by the Central Government in the Official Gazette, is final and binding on the parties to the dispute and is to be given effect to by them. Furthermore, Section 6(2) of the Act stipulates that the published decision shall have the same force as an order or decree of the Supreme Court. To facilitate implementation, Section 6A empowers the Central Government to frame schemes for giving effect to the Tribunal's decision, which may include establishing authorities for implementation, defining their powers, and creating funds. The Tribunal itself possesses powers akin to those of a civil court under the Code of Civil Procedure, 1908, including summoning witnesses, requiring document production, and directing investigations.

A significant provision is Section 11, which explicitly bars the jurisdiction of the Supreme Court and other courts over any water dispute referred to a Tribunal under this Act. This provision was intended to establish tribunals as the sole adjudicatory bodies for inter-state water disputes. The Tribunal is dissolved by the Central Government after it has forwarded its report and when no further reference is deemed necessary.

Despite its comprehensive design, the ISRWD Act 1956 has faced considerable criticism for its practical shortcomings. A primary issue is excessive delays in dispute resolution. While the Act mandates negotiation attempts, these can be indefinite, and even after the Central Government determines negotiation failure, the constitution of a tribunal

and subsequent adjudication can take years, if not decades. Cases like the Cauvery and Krishna Water Disputes exemplify these prolonged processes. This is compounded by the fact that prior to the 2002 amendment, there was no fixed timeline for tribunal formation.

Another critical problem is the weak enforcement mechanism. Although Tribunal decisions are legally binding and carry the force of a Supreme Court decree (Section 6), states have frequently ignored or delayed compliance, as seen in the Sutlej-Yamuna Link Canal dispute. The absence of explicit penalties for non-compliance often leads to states refusing to follow rulings.

The most profound challenge relates to jurisdictional ambiguity and judicial intervention. Despite the clear prohibition in Section 11 against Supreme Court jurisdiction, states and private entities have approached the Supreme Court for relief, leading to conflicting rulings and effectively diluting the Tribunal's exclusive authority. This creates an illusion of exclusivity in the Tribunal's jurisdiction, undermined by the reality of judicial drift. The Supreme Court, in the Cauvery dispute, rejected the bar under Section 11 for appeals made under Article 136 of the Constitution, effectively reshaping the rules of engagement. This precedent means that while the Mahanadi Water Disputes Tribunal (MWDT) is established under the ISRWD Act, its decisions are not truly "final" in a practical sense, as they can be challenged in the Supreme Court. This judicial interpretation undermines the legislative intent of the ISRWD Act, prolongs disputes, and encourages states to pursue litigation even after a tribunal award, contributing to the "sluggish and unsatisfying" nature of tribunal proceedings.

The Inter-State River Water Disputes (Amendment) Act, 2002, sought to address some of these concerns. It introduced fixed timelines, requiring the Central Government to constitute a Tribunal within one year of a complaint (Section 4(1)) and mandating the Tribunal to deliver its decision within three years, extendable by two (Section 5). It also formally mandated that Tribunal decisions, once published, carry the same force as a Supreme Court order or decree (Section 6(2)). However, procedural delays persist due to political reluctance in declaring disputes non-negotiable. Without clear enforcement mechanisms, states continue to delay implementation or seek repeated clarifications, leading to prolonged uncertainty. Furthermore, the Act lacks an explicit definition for 'inter-state river', contributing to jurisdictional ambiguity. Legal experts like Fali S. Nariman, Ramaswamy Iyer, and Harish Salve have critically highlighted the structural flaws, emphasizing irregular sittings, infrequent hearings, procedural inconsistencies, and the lack of timely finality in tribunal decisions.

Recognizing these persistent challenges, the Interstate River Water Dispute (Amendment) Bill, 2019, was introduced to bring about significant reforms. It proposed a mandatory Dispute Resolution Committee (DRC) for negotiation and amicable resolution as a first step before adjudication. This explicit incorporation of negotiation aimed to promote timely resolution, acknowledging that a party-led and party-focused political process might be more effective initially. The Bill also sought to replace the existing ad-hoc, dispute-specific tribunals with a single Inter-State Water Disputes Tribunal with multiple benches, aiming to streamline administrative processes, reduce delays, and cut expenses. It imposed definitive timelines, mandating decisions within three years (with one two-year extension) and clarifications within six months. The Bill also maintained that Tribunal decisions, once published, would have the same legal status as Supreme Court orders and mandated the Central Government to frame schemes for implementation. Additionally, it proposed that the Central Government appoint a specialized agency to maintain a national data bank on river basins.

However, this progressive vision for legislative reform was met with a significant setback: the Bill lapsed following the dissolution of the 17th Lok Sabha. This legislative intent to address the ISRWD Act's shortcomings is consistently undermined, either by judicial interpretations that create ambiguity or by political processes that prevent comprehensive reform. The failure to enact such a comprehensive bill means that India continues to rely on fragmented and often adversarial legal frameworks. This perpetuates the challenges seen in the Mahanadi basin, where integrated planning and cooperative governance are critically needed but lack a robust statutory foundation. The policy vacuum allows for continued uncoordinated development and exacerbation of disputes, leaving the existing, flawed framework in place and perpetuating the cycle of prolonged water disputes.

3. Other Relevant Legal Frameworks

Beyond the ISRWD Act, several other legal frameworks indirectly or directly influence the management of inter-state river basins in India, each contributing to the complex web of governance and potential legal constraints.

The River Boards Act, 1956, was enacted with the objective of facilitating the regulation and development of inter-state rivers and river valleys. It explicitly provides for the establishment of River Boards, intended primarily to assist the Central Government in various dimensions of inter-state river governance. Section 5 of the Act outlines the composition of these Boards, stipulating a Chairman and other members appointed by the Central Government, possessing special knowledge and experience in fields such as irrigation, electrical engineering, and flood control. Despite its declared objective, the Act explicitly confines the role of these Boards to advisory functions, significantly limiting their ability to influence state-level actions. Consequently, no River Board has been constituted under this Act since its inception, even though bodies performing similar functions exist outside its statutory framework, such as the Brahmaputra Board, Bansagar Control Board, and Betwa River Board. The non-implementation of the River Boards Act signifies a persistent failure to establish a proactive, cooperative, and basin-wide governance mechanism outside of contentious tribunals. This institutional void forces disputes into an adversarial adjudicatory model, rather than fostering collaborative management. The Mahanadi dispute, with its calls for a Joint Control Board or a Mahanadi River Board, highlights a recurring demand for a mechanism that the existing, unused Act could have provided, but failed to. This failure is attributed to states' reluctance and the Act's inability to foresee shifts in India's political landscape, particularly the rise of strong coalition politics and more empowered states in the 1990s, which led to a less assertive central government.

The River Basin Management Bill, 2019, though it ultimately lapsed, represented a significant legislative attempt to create a structured approach for the management and development of inter-state rivers and river basins. The Bill proposed the establishment of a centralized River Basin Authority with a two-tiered governance structure: a Governing Council (comprising Chief Ministers and Water Resources Ministers from basin states) and an Executive Board (consisting of a Chairman, bureaucrats, and subject-matter experts). Its core function was the preparation and implementation of comprehensive River Basin Master Plans, guided by principles of sustainable utilization, integrated management, demand management, cooperative governance, and conjunctive use of surface and groundwater. The Bill aimed to repeal the unused River Boards Act, 1956. The failure to enact such a comprehensive bill

means that India continues to rely on fragmented and often adversarial legal frameworks. This perpetuates the challenges seen in the Mahanadi basin, where integrated planning and cooperative governance are critically needed but lack a robust statutory foundation. The policy vacuum allows for continued uncoordinated development and exacerbation of disputes. The Dam Safety Act, 2021, is a recent and important piece of legislation designed to ensure the safety of dams through surveillance, inspection, operation, and maintenance mechanisms. It establishes robust institutional structures at both Central and State government levels, including the National Committee on Dam Safety (NCDS), the National Dam Safety Authority (NDSA), State Committees on Dam Safety (SCDS), and State Dam Safety Organizations (SDSO). The NCDS and NDSA consolidate the Union Government's decision-making power, including the authority to resolve disputes between SDSOs and dam owners or states. While its primary goal is dam safety, its centralized institutional structure gives the Union significant control over dam operations, even on inter-state rivers. This could potentially conflict with state autonomy over water resources. This Act, while beneficial for safety, introduces another layer of central oversight that could be perceived by states as an infringement on their water jurisdiction, potentially leading to new forms of inter-state or Centre-state disputes, particularly if dam operations (e.g., releases, impoundment levels) are seen to favor one state over another. The Mahanadi basin has numerous dams and barrages, making this Act highly relevant to its future governance and potential for conflict.

The National Waterways Act, 2016, facilitates the development and regulation of inland waterways for shipping and navigation. It declares certain waterways, including the Mahanadi (designated as National Waterway 73), as national waterways, thereby enabling their centralized control and coordinated development. This Act integrates these national waterways under the regulatory purview of the Inland Waterways Authority of India (IWAI) Act, 1985. The centralized control over designated waterways for navigation potentially conflicts with state control over water for irrigation or hydropower. This Act introduces a new potential source of inter-state water disputes. If navigation requirements (e.g., maintaining minimum depths, regulating flows) conflict with existing or planned water uses by riparian states (e.g., for agriculture or industry), it could create new legal challenges and exacerbate existing tensions, particularly in a basin like Mahanadi that is already water-stressed in certain areas and seasons.

The Inland Waterways Authority of India Act, 1985, established the Inland Waterways Authority of India (IWAI) as an autonomous body responsible for developing and regulating inland waterways for efficient shipping and navigation. IWAI manages assets, undertakes

surveys, executes infrastructure projects, promotes safe navigation, and coordinates inland water transport systems. Its centralized management of waterways can lead to conflicts with state-level jurisdiction over water resources, especially concerning irrigation and hydroelectric projects.

Pollution Control Laws, primarily the Water (Prevention and Control of Pollution) Act, 1974, and the Environment (Protection) Act, 1986, constitute a crucial legal framework for inter-state rivers. These statutes prohibit water pollution and empower pollution control boards to take action against polluters. The Environment (Protection) Act, 1986, also grants the Central Government umbrella power to establish new institutions, such as the Central Ground Water Authority. Despite these laws, pollution remains a "very serious concern" in the Mahanadi basin due to rapid industrial development, mining, and chemicalized agriculture. Issues like heavy metal pollution, salinity, fluoride, iron, and arsenic are prevalent. This highlights a significant gap: while laws exist, their enforcement and integration into inter-state water dispute adjudication are weak. The legal framework for water disputes primarily focuses on quantity (allocation) rather than quality and ecological health, which are critical for sustainable basin management. This allows continued environmental degradation, exacerbating socio-economic impacts on riparian communities and potentially leading to future disputes over water usability.

Finally, the Land Acquisition and Rehabilitation and Resettlement Act, 2013 (LARR Act), established a comprehensive legal framework for land acquisition, ensuring fair compensation, rehabilitation, and resettlement for affected landowners and communities. It replaced the Land Acquisition Act, 1894, addressing historical concerns regarding arbitrary acquisition and inadequate compensation. The Act mandates a Social Impact Assessment (SIA) before any land acquisition and applies to land acquired for public purposes, including infrastructure projects like dams. While the LARR Act aims to mitigate social conflicts arising from large projects, its effectiveness in preventing disputes is contingent on robust implementation and enforcement. Any future large-scale water projects in the Mahanadi basin would inevitably fall under LARR Act provisions, and their successful implementation would be crucial to avoid the social and legal challenges seen in the Narmada basin. The Act's provisions, if not diligently followed, can become a new source of legal challenge and public agitation, even if the primary water allocation dispute is resolved.

Inter-State Disputes

The Mahanadi River Water Dispute, primarily between Odisha and Chhattisgarh, represents a significant inter-state conflict with deep roots in historical agreements, industrialization drives, and the inherent challenges of managing a shared natural resource.

Root Causes of the Mahanadi Water Dispute (Odisha vs. Chhattisgarh)

The fundamental issue at the heart of the Mahanadi River Water Dispute is the uneven distribution of water resources between Odisha, the downstream state, and Chhattisgarh, the upstream state. This imbalance is exacerbated by the competing and often conflicting demands from both the agricultural and industrial sectors in each state.

Odisha alleges that Chhattisgarh has "illegitimately" constructed numerous dams and barrages across the Mahanadi and its tributaries (Sahu, 2025). These upstream constructions, according to Odisha, severely affect the water inflow into the Hirakud Reservoir, particularly during the non-monsoon seasons, leading to water crises and environmental degradation in the lower basin. Odisha has gone as far as to term Chhattisgarh's water projects "illegal" and claimed they were built without Odisha's knowledge (Source: Down to Earth: 15 May 2018, <https://www.downtoearth.org.in/water/-maha-dispute-over-the-mahanadi-60542>).

A central point of contention is the prioritization of water use. Odisha contends that Chhattisgarh's projects are not primarily for the welfare of farmers but rather to serve the interests of industrialists, highlighting the rapid industrialization in both states that places immense pressure on the Mahanadi River. This assertion points to a disguised conflict, where farmers are used as a shield for industrial interests. Both states publicly claim their actions are for farmers' welfare, but evidence suggests that water-guzzling industries consume the major share of the river's resources. The conflict is strategically framed as an inter-state dispute to divert attention from and camouflage the increasing intra-state sectoral conflicts and the significant diversion of water to industries within each state. This implies that any resolution focusing solely on inter-state water allocation without addressing the underlying industrial demand and its associated environmental costs will be superficial and ultimately unsustainable. The dispute, therefore, is less about an absolute water scarcity for traditional uses and more about the deliberate diversion of water for new, high-demand industrial applications.

4. Historical Timeline of the Dispute

The Mahanadi water dispute has a long and complex history, marked by intermittent agreements and escalating conflicts.

The initial controversy emerged between 1953 and 1957, involving Odisha and Madhya Pradesh (Chhattisgarh's predecessor state) over the construction of the Hirakud Dam. This early disagreement set a precedent for future inter-state tensions.

In 1983, another significant disagreement surfaced with the signing of an agreement concerning a Joint inter-state irrigation and power project. As part of this agreement, a Joint Control Board was proposed to manage the project and ensure even water distribution, but this proposal was "kept in cold storage" and never effectively implemented. Following the successful completion of the Hirakud Dam Project, Madhya Pradesh proceeded to build numerous irrigation projects that, according to Odisha, obstructed the continuous flow of water to the Hirakud Reservoir, laying the groundwork for future disputes.

By 2008, the growing dissatisfaction among farmers in Odisha became evident when they protested against the increasing diversion of water to industries at the Hirakud Dam. They symbolically formed a 'Chasi Rekha' (line of farmers) to mark a boundary beyond which industrial units would not be permitted to draw water.

The current phase of the dispute escalated in July 2016, when Odisha formally objected to Chhattisgarh's ongoing construction of dams and barrages on the Mahanadi. This led to Odisha filing a formal complaint with the Ministry of Water Resources on November 19, 2016, under Section 3 of the Inter-State River Water Disputes (ISRWD) Act, requesting the constitution of a Tribunal for adjudication.

In response, the Central Government formed a Negotiation Committee, which, by May 2017, concluded that the dispute could not be resolved through negotiation, citing Odisha's non-participation in the meetings. Subsequently, Odisha filed Original Suit No. 1/2017 before the Supreme Court. Acting on the Supreme Court's direction on January 23, 2018, the Central Government officially constituted the Mahanadi Water Disputes Tribunal (MWDT) via a Gazette Notification on March 12, 2018. The matter was formally referred to the Tribunal in April 2018.

The Tribunal's proceedings have faced interruptions. The period from March 2020 to June 2021 was officially declared a non-functional period due to the COVID-19 pandemic. The Central Government later decided that the effective date of the MWDT's constitution would be December 14, 2019, based on Supreme Court directions in similar matters. Consequently, the initial three-year period for the Tribunal's report submission, which would have expired

on April 13, 2024, was extended by two years until April 13, 2026. Recent hearings in August and September 2023 saw various interim applications disposed of and time granted for filing appendices. In December 2024, a new chairperson, Justice Bela M Trivedi, was appointed for the MWDT. As of July 2025, there are indications of a potential shift towards amicable settlement, with Odisha's Chief Minister proposing a joint negotiation committee to his Chhattisgarh counterpart, a proposal currently under active consideration.

4.1. Role of Industrialization and Barrage Construction

The rapid industrialization in both Chhattisgarh and Odisha, heavily reliant on the Mahanadi's water resources, plays a central role in the ongoing dispute. Chhattisgarh justifies its barrage constructions by claiming they are necessary to control floodwaters and primarily serve irrigation purposes for its farmers. However, Odisha counters that these projects are largely designed to benefit industrialists, contributing to the aggressive industrial expansion in both states.

Both states have made massive investments in the power and steel sectors. Chhattisgarh has signed Memorandums of Understanding (MoUs) for establishing power plants with a capacity of 49,000 MW, while Odisha has similar agreements for 60,000 MW potential. These ambitious projects necessitate significant water withdrawals from the Mahanadi. Chhattisgarh has constructed nearly 50 masonry check dams in different tributaries and two major hydro projects on the main stream of the Mahanadi. Such extensive constructions are recognized to result in ecological imbalances in both states.

Despite claims of farmer welfare, industries are observed to consume the major share of the river water. This prioritization of industrial needs is further evidenced by the privatization of other rivers in Chhattisgarh, such as Kelo, Kurkut, Shabri, Kharun, and Maand, which have been handed over to private companies for monetary gain. This trend indicates that the "development" narrative, while politically appealing, is a primary cause of the dispute. The pursuit of rapid industrialization by both riparian states, often through unilateral construction of water infrastructure, directly conflicts with the principles of equitable sharing and environmental sustainability. It leads to ecological degradation and significant downstream impacts. This highlights a fundamental policy choice that prioritizes industrial growth over the holistic health of the river basin and the livelihoods of dependent communities.

Moreover, both states continue to treat the Mahanadi as a water-surplus river to attract investments, despite the reality that it is now a water-deficit basin experiencing severe

stress. This misrepresentation of the river's hydrological status further exacerbates the conflict by encouraging unsustainable water extraction practices.

4.2. Downstream Impact and Water Allocation Contentions

The upstream actions of Chhattisgarh have profound and measurable consequences for the downstream state of Odisha, forming a central part of the Mahanadi water dispute. Odisha alleges that the barrages constructed upstream significantly reduce water inflow into the Hirakud Reservoir, particularly during non-monsoon seasons. This reduction in flow leads to acute water crises and environmental degradation in the lower basin areas.

The construction of dams and barrages physically dislocates the natural seasonal flow patterns of the river, which are critical for the health of the floodplain ecology. This hydrological alteration directly impacts the livelihoods of communities dependent on the river: farmers, often marginalized, face severe challenges due to reduced water availability for agriculture, and fishing communities experience diminishing fish stocks. Downstream areas also contend with seasonal water shortages and poor water quality, a direct result of upstream practices and industrial discharge.

The environmental degradation is extensive. Industrialization and mining activities contribute significantly to water pollution, introducing fly ash, heavy metals, salinity, fluoride, iron, and arsenic into the river system. This contamination renders water unfit for drinking and irrigation, and has transformed some tributaries into "dead rivers". The reduced flow and pollution also disturb vital river basin environments, including wetlands like the Hirakud and Chilika Lake, and disrupt aquatic ecosystems, leading to biodiversity loss. Unrestrained water withdrawal further exacerbates the susceptibility of ecosystems and intensifies climate-related events such as droughts and floods. The safety of the Hirakud dam itself is also reported to be at a critical stage due to these cumulative impacts.

The lack of coordination on water flow data and flood management between the states is particularly detrimental for downstream populations. This highlights the inherent challenge of managing a shared river basin where unilateral actions by an upstream state have significant, often negative, externalities on downstream states. The dispute is not just about water quantity but also about the quality and ecological health of the shared resource, which directly impacts the human right to water and livelihoods. The absence of transparent data sharing further exacerbates mistrust and hinders any cooperative management efforts.

Table 3: Political Perspectives in Mahanadi Water Conflict

(Source: Newspaper articles from *The Hindu*, *Times of India*, *Amar Ujala*, *The Indian Express*.)

Political Actor	Key Assertion/Position/Strategy	Target of Criticism/Focus	Impact/Role in Conflict
Odisha (BJD/BJP Government)	Emphasizes regional rights and autonomy; accuses Centre and Chhattisgarh of injustice; alleges unilateral water project construction in upstream areas reduces water flow; claims water is meant for industries.	Federal and Chhattisgarh Government.	Uses dispute to assert regional identity, autonomy, and highlight resource abuse; defends as the victim of water rights; contributes to political rivalry.
Chhattisgarh (BJP/Congress Government)	Emphasizes state development through water projects; claims legal and fair use of river water for state and regional development; claims water is meant for agriculture.	Odisha's failure to regulate Mahanadi water; Odisha's opposition to developmental needs; Odisha amplifying issue for political profit.	Justifies upstream constructions; asserts territorial sovereignty; contributes to political rivalry.
Central Government (BJP)	Formed Tribunal after Supreme Court direction; constituted Negotiation Committee (failed); extended Tribunal's report submission deadline.	Accused by Odisha of delay in Tribunal formation and partiality towards Chhattisgarh.	Faces challenges in resolving the issue; accused of party favoritism and political bias in intervention, data sharing, and environmental clearance.
Opposition Parties (Centre)	Criticized the ruling BJP Government for not establishing a Water Tribunal earlier.	Ruling Government (BJP).	Contributes to political pressure on the Central

			Government.
Opposition Parties (Odisha)	Alleged previous BJD Government for non-seriousness; accused BJD of using the issue for vote bank politics; called for all-party meetings.	Previous BJD Government; Centre and Chhattisgarh.	Highlights internal political divisions; attempts to gain political expansion and bureaucratic help; asserts regional identity.
Civil Society Organizations (e.g., Mahanadi Bachao Andolan)	Organized protests (e.g., 'Jal Satyagraha', 'Save Mahanadi Campaign'); demanded transparency and accountability; urged formation of Mahanadi River Board.	Chhattisgarh Government's "illegal activities"; BJP-led Central and Chhattisgarh Government's collusion; political leaders using issue for vote bank politics.	Played a noteworthy role in motivating riparian community rights; emphasized environmental and socio-cultural needs; created public awareness; pushed for legal and institutional solutions.
Regional Sentiments	Misused to proclaim state identity and claim for political space.	Other states; Central Government.	Fuels political overtone; complicates amicable resolution; used by political leaders to harvest electoral gains.

5. Inter-state Water Agreements

Historical inter-state water agreements concerning the Mahanadi River have played a significant role in shaping the current dispute, often highlighting the gap between formal accords and their practical implementation.

Historical Inter-state Water Agreements

One notable historical agreement dates back to April 27, 1983, when significant deliberations took place in Bhubaneswar. This meeting involved the Chief Ministers of Madhya Pradesh (which later became Chhattisgarh) and Orissa (now Odisha), along with the Minister of State for Irrigation & Power, Orissa, and various officials from both states.

During these deliberations, several agreements were reached concerning various projects within the Mahanadi basin. These included projects such as the IB Project (Orissa), Sapnai Project (Madhya Pradesh), and a series of Joint Projects like Kurnala, Upper Jonk, Lower Jonk, Sahajbahal, and Lower Kolab. A key outcome of these discussions was the consent by both Madhya Pradesh and Odisha to establish a Joint Control Board. The intended purpose of this board was to assess the progress of survey, investigation, planning, execution, and operation of Joint Inter-State Irrigation and/or Power Projects. It was also tasked with discussing and deciding on any issues arising from these projects, and crucially, making assessments regarding the even distribution of Mahanadi water. This agreement was made in the context of both states having consented to the Hirakud Dam project, being fully aware of its extensive 83,000 square kilometer catchment area.

5.1. Effectiveness and Points of Contention

Despite the formal agreement in 1983, its effectiveness was severely limited by a critical failure in implementation. The proposal for the Joint Control Board, intended to ensure even distribution and resolve issues, was "kept in the cold storage for years together". This non-implementation represents a significant failure in establishing and sustaining a cooperative mechanism for basin management.

Following the successful completion of the Hirakud Dam Project, Madhya Pradesh (now Chhattisgarh) proceeded to build many irrigation projects that, from Odisha's perspective, obstructed the continuous flow of water to the Hirakud Reservoir. This unilateral development, despite the earlier agreement, became a new source of contention.

A major shift in project goals also contributed to the dispute. While the original intent of dam construction, such as the Hirakud Dam, was often for agriculture and flood control, the underlying objective gradually shifted to providing water to industrial units. This change

in priority, favoring industrial needs over agricultural ones, generated conflict with farmers and downstream interests.

The subsequent construction of numerous check dams and hydro projects by Chhattisgarh, often without Odisha's knowledge or explicit consent, became a primary trigger for the current dispute. This highlights a fundamental lack of coordination and transparency. The absence of coordination on water flow data and flood management between the states is explicitly described as "deadly for people downstream". Furthermore, both governments are accused of using "old and fragmented data" for water flow and balance analysis, hindering accurate assessments and coordinated planning.

The gap between formal agreement and practical implementation is a recurring theme in the Mahanadi dispute. The 1983 agreement established a framework for cooperation and a Joint Control Board, but this board was never effectively operationalized. This failure to implement the agreed-upon mechanism created an institutional vacuum that allowed uncoordinated development and fostered mistrust between the states, ultimately leading to the current adversarial legal battle. This situation implies that future agreements must embed stronger enforcement and monitoring provisions, and cultivate genuine cooperation that extends beyond mere signatures on paper.

6. Committees and Commissions

The Mahanadi River Basin has seen the establishment and proposal of various committees, commissions, and authorities aimed at managing its water resources and resolving disputes. Their roles, compositions, functions, and effectiveness offer critical insights into the challenges of inter-state water governance.

6.1. Specific Committees/Commissions/Authorities Established for Mahanadi Basin

Several bodies have been involved in attempts to manage or resolve the Mahanadi water dispute:

6.1.1. Negotiation Committee

Following Odisha's complaint under the ISRWD Act, 1956, the Central Government constituted a Negotiation Committee to attempt an amicable settlement of the dispute. This committee was chaired by the Member (WP&P) of the Central Water Commission and included 11 other members representing Odisha, Chhattisgarh, Madhya Pradesh, Maharashtra, Jharkhand, and various Union Ministries such as Agriculture, Environment, Forests and Climate Change, and Water Resources. Its functions were to assess water availability and

utilization, examine existing agreements, and consider the claims of all riparian states. However, the committee submitted its report in May 2017, concluding that the dispute could not be resolved through negotiation, primarily due to "no participation from complainant State i.e. State of Odisha in the meetings". This outcome highlights the limits of negotiation without trust. The ISRWD Act mandates negotiation before tribunal formation, but the failure of the Negotiation Committee due to Odisha's non-participation demonstrates that formal mechanisms are ineffective if there is a fundamental lack of trust or political will to engage. Odisha's refusal to participate suggests a deep-seated mistrust in the negotiation process or a strategic preference for adjudication, which ultimately led to further delays and the escalation of the dispute to the Supreme Court. This implies that building trust and creating a conducive atmosphere for dialogue is a prerequisite for effective negotiation, even more so than the formal mechanism itself.

6.1.2. Special Committee (post-Sept 2016 meeting)

After a high-level meeting on September 17, 2016, involving the Union Minister for Water Resources, River Development & Ganga Rejuvenation and the Chief Ministers of Odisha and Chhattisgarh, a Special Committee was formed. Chaired by Dr. Amarjit Singh, OSD, MOWR, RD&GR, its specific function was to list out water resources projects in Odisha and Chhattisgarh that were under construction without the approval of the Technical Advisory Committee (TAC) of the Ministry of Water Resources, RD&GR. While its establishment aimed to address concerns about unauthorized constructions, the subsequent escalation of the dispute to the Supreme Court and Tribunal indicates that this committee did not succeed in resolving the core issues.

6.1.3. Expert Committee (post-Sept 2016 meeting)

Alongside the Special Committee, an Expert Committee was also proposed following the September 17, 2016 meeting. This committee was to comprise representatives from the Central Water Commission (CWC) and the Governments of Odisha and Chhattisgarh. Although its functions were not explicitly detailed beyond its composition, its formation was intended to bring technical expertise to the table. However, like the Special Committee, its efforts were insufficient to prevent the dispute from escalating to formal adjudication.

Joint Control Board (proposed in 1983 agreement)

As discussed in the previous section, the 1983 deliberations between Madhya Pradesh (now Chhattisgarh) and Odisha included an agreement to establish a Joint Control Board. This board was intended to assess the progress of joint irrigation and power projects, discuss and decide on arising issues, and make assessments regarding the even distribution of Mahanadi

water. Despite this formal agreement, the Joint Control Board was "kept in the cold storage for years together" and was never implemented, rendering it ineffective in fostering inter-state cooperation.

6.2. Mahanadi Water Disputes Tribunal (MWDT)

The Mahanadi Water Disputes Tribunal (MWDT) represents the most significant formal adjudicatory body established for the Mahanadi dispute.

Constitution: The MWDT was formally constituted by the Central Government via Notification No 1114 (E) dated March 12, 2018. This action followed a direct order from the Supreme Court, which intervened after Odisha filed Original Suit No. 1/2017. The effective date of the Tribunal's constitution was later decided to be December 14, 2019, a decision made by the Central Government with regard to Supreme Court directions in similar matters.

Composition: The Tribunal initially comprised three members: Justice A.M. Khanwilkar as Chairman (a sitting Judge of the Supreme Court of India), Justice Ravi Ranjan (Judge, Patna High Court) as a Member, and Justice Indermeet Kaur Kochhar (Judge, Delhi High Court) as another Member. Additionally, two assessors were appointed to provide expert assistance to both the states and the Tribunal. In a recent development, Justice Bela M Trivedi took over as chairperson in December 2024.

Functions: The primary function of the MWDT is the adjudication of water disputes concerning the Mahanadi river and its basin between the riparian states of Odisha and Chhattisgarh.

Current Status: The matter is currently "under adjudication" or "sub-judice" before the Tribunal. Its proceedings involve data submissions, arguments, and inspections from both states.

Extensions: The initial three-year period for the Tribunal to submit its report and decision, calculated from its effective constitution date of December 14, 2019 (and thus expiring on April 13, 2024), was extended by two years. This extension, granted until April 13, 2026, was attributed to unavoidable reasons, including a non-functional period from March 2020 to June 2021 due to the COVID-19 pandemic.

Interim Applications/Orders: Odisha filed Interim Application (I.A.) No. 1/2018 seeking interim reliefs, such as the demand for Chhattisgarh to release 1.74 million acre-feet (MAF) of water during the non-monsoon season. This application was later disposed of, with the Tribunal granting liberty to Odisha to file a fresh application or revive the present one if circumstances warrant. Other I.A.s from both states have been filed and subsequently disposed of, often with similar provisions for renewal. The Tribunal has also sought time for

parties to study assessors' reports (e.g., on basin delineation) and file appendices. Notably, the Tribunal has deferred hearings multiple times to encourage amicable settlement talks between Odisha and Chhattisgarh.

Effectiveness: The Tribunal's proceedings have been described as "sluggish and unsatisfying". It has been noted that the Tribunal was "largely inactive in recent years" until the appointment of the new chairperson. Furthermore, observations from legal experts suggest that no inter-state water dispute in India has been resolved entirely through tribunal proceedings, and the likelihood of a tribunal-led solution remains slim even if it extends for another decade.

The MWDT's experience illustrates the adjudicatory bottleneck and the political imperative that often characterize inter-state water disputes. The Tribunal's formation, compelled by Supreme Court intervention, highlights the failure of initial negotiation attempts. Despite its formal establishment, the Tribunal's proceedings have been slow and required extensions, indicating the inherent complexities and political nature of these disputes. The Tribunal's active encouragement of out-of-court settlements by deferring hearings suggests a recognition that purely legalistic adjudication might not be the most effective or sustainable path for resolution. This implies a need for a hybrid approach that integrates legal, technical, and political solutions, rather than relying solely on judicial pronouncements.

7. Previous Reports and Studies

Various reports and studies have shed light on the environmental impacts, water resource assessments, and potential alternative approaches for the Mahanadi Basin. These provide crucial data and analytical frameworks for understanding the dispute's complexities.

Environmental Impacts and Assessments

The Mahanadi Basin faces significant environmental challenges, primarily stemming from pollution, hydrological alteration, and the impacts of industrialization. These issues have led to considerable biodiversity disruption.

Pollution: The basin is severely affected by pollution from multiple sources. Rapid urbanization, industrialization (particularly from thermal power plants, iron and steel industries, mining, and cement factories), and chemicalized agriculture contribute to a tremendous increase in the pollution load. Urban waste disposal, including sewage, trade effluents, and biomedical waste, further exacerbates the problem. The types of pollutants are diverse, ranging from heavy metals, salinity, and fluoride to iron, arsenic, grit, debris, suspended solids, pathogens, organic wastes, nutrients, and various known chemicals.

Many areas within the basin, particularly its tributaries like the Kelo, Ib, Bheden, and Lilari, are extremely polluted. The Lilari River, a tributary of the Ib in Jharsaguda district, has become "practically a dead river" due to pollution. The impacts are far-reaching, leading to unhealthy living conditions, a range of health hazards (including chest pain, cough, skin diseases, infant mortality, diarrhea, gastro-enteritis, cholera, typhoid, viral hepatitis, and malaria), rendering water unfit for drinking and irrigation, and adversely affecting aquatic and terrestrial organisms. Economically, pollution has severely impacted the fishery market and tourism revenue, with fishing in polluted tributaries like the Kelo and Ib being "almost finished". Specific industrial discharge figures highlight the scale of the problem, with Sambalpur discharging 736 KLD, Cuttack 2,780 KLD, and Paradeep 5,280 KLD from larger industrial units. This situation reveals the silent crisis of water quality. While the inter-state dispute predominantly focuses on water quantity (allocation), numerous reports consistently highlight severe water quality degradation due to industrialization and urbanization. The "right to water" for riparian communities is fundamentally undermined if the available water is polluted and unfit for use. This implies that the Tribunal and any future management plans must integrate water quality and pollution abatement as core components, not as secondary considerations, to ensure truly sustainable and equitable water access.

Hydrological Alteration: The Mahanadi's natural flow regime has been significantly altered. There is a discernible decreasing trend in the average annual flow and high inter-annual variations in runoff. Upstream barrages and diversion weirs, such as the Arpa-Bhaisajhar, Pairy-Mahanadi Intra State Link Project, and Tandula Reservoir Augmentation Scheme, reduce inflows into the Hirakud reservoir, impacting non-monsoon storage. These structures also trap sediment, which can restructure the sediment regime and potentially lead to deltas sinking. Climate change further compounds these hydrological changes. While studies present conflicting views on its impact on overall flows (some predict increases, others reductions), there is a general consensus that climate change will likely escalate extreme events, leading to more frequent floods and droughts. This illustrates the compounding effect of infrastructure and climate change. Human interventions, through dams and barrages, are physically altering the river's natural flow patterns. This is exacerbated by climate change, which introduces significant uncertainty and intensifies extreme hydrological events. This implies that static water allocation models are insufficient; adaptive management strategies that account for dynamic changes and build climate resilience are essential for the long-term sustainability of the basin.

Biodiversity Disruption: The combined effects of reduced water flow and severe pollution significantly disturb river basin environments, including vital wetlands like the Hirakud Reservoir and Chilika Lake, and other aquatic ecosystems. This disruption directly impacts biodiversity, leading to diminishing fish stocks and, in some polluted tributaries, the near cessation of fishing activities.

Industrialization: The increasing demand for water from industries is a major driver of the inter-state conflict. Many new barrages and pick-up weirs constructed in Chhattisgarh are exclusively for industrial use. There is also a concerning trend of irrigation water being increasingly diverted for industrial purposes.

7.1. Other Relevant Studies and their Findings

Several organizations and committees have conducted studies and engaged with the Mahanadi basin, offering valuable perspectives on its challenges and potential solutions.

The Water Conflicts Forum (WCF) has been actively involved in the Mahanadi basin for over a decade. Their work has focused on various aspects, including the Hirakud dam, inter-sectoral water allocations (specifically between agriculture and industry), environmental flows, and groundwater management. WCF has undertaken a thematic exploration of water use, providing estimates for the gross irrigated area and the utilization of both surface and groundwater. They have also estimated the industrial water allocation within the basin. A key aspect of WCF's engagement has been facilitating knowledge-based dialogues with civil society organizations (CSOs) in the basin, fostering a common stance against the politicization of water sharing. Based on their extensive research and dialogues, WCF has proposed an "alternative approach" to dispute resolution and river basin management. This approach is grounded in principles of equity, environmental sustainability, institutional restructuring, stakeholder participation, and improving water use efficiency.

The Jeyaseelan Committee Report (2007), compiled by a High-Level Technical Committee, specifically studied various aspects of water usage for the Hirakud Reservoir. A significant finding of this report was the observation of a decreasing trend in rainfall, particularly in the post-Hirakud project phase, and its potential impact on inflow to the reservoir. This underscores the importance of independent scientific assessment and data transparency. The Jeyaseelan Committee and WCF reports highlight critical environmental trends, such as decreasing rainfall and escalating pollution, and emphasize the urgent need for reliable data. The Mahanadi dispute is characterized by a "non-sharing of hydrological data" and a "lack of data-sharing transparency" between states. This indicates that objective, scientific assessments and transparent data sharing are fundamental prerequisites for

resolving complex water disputes. Without agreed-upon data and independent verification, states can manipulate information for political gain, hindering any progress towards a fair and sustainable resolution. The absence of such transparency also undermines trust, often forcing the dispute into adversarial legal channels rather than collaborative problem-solving.

Other studies mentioned include those by Gosain and Rao (2003, cited in Asokan and Dutta, 2008) and Asokan and Dutta (2008), which suggest climate change could lead to an increase in Mahanadi River flow (28% and 26.8% respectively), albeit with an escalation in September runoff and a reversal in April, indicating potential for increasing floods and droughts. Conversely, a study by Ghosh et al. (2016) presents a contradictory view, suggesting climate change could reduce annual water flows by at least 10%. Patil, Kulkarni, and Bhawe (2017) also indicate a decreasing trend of rainfall in the catchment. Amarasinghe, Shah, and Anand (2007) provide insights into environmental flow requirements for Indian basins, estimating 20% to 27% of renewable water resources for the Mahanadi basin.

8. Landmark Judgements

Judicial interventions have played a pivotal role in the Mahanadi dispute, particularly through the constitution and proceedings of the Mahanadi Water Disputes Tribunal (MWDT), and the broader interaction between the courts and the tribunal process.

Mahanadi Water Disputes Tribunal (MWDT): Constitution, Proceedings, Current Status, Interim Applications, Orders, Extensions

The Mahanadi Water Disputes Tribunal (MWDT) was established as the primary adjudicatory body for the inter-state water dispute over the Mahanadi River.

Constitution: The MWDT was formally constituted by the Central Government through Notification No 1114 (E) on March 12, 2018. This action was a direct consequence of a Supreme Court direction, which had intervened after the State of Odisha filed Original Suit No. 1/2017. The Central Government later specified that the effective date of the Tribunal's constitution would be December 14, 2019, a decision made in line with Supreme Court directives in similar matters. The Tribunal's composition includes a Chairman, initially Justice A.M. Khanwilkar (a Supreme Court Judge), and two Members, Justice Ravi Ranjan (Patna High Court) and Justice Indermeet Kaur Kochhar (Delhi High Court). Two assessors were also appointed to assist the states and the Tribunal with expert advice. In December 2024, Justice Bela M Trivedi assumed the role of chairperson.

Proceedings and Current Status: The matter remains "under adjudication" or "sub-judice" before the Tribunal. The proceedings involve the submission of data, presentation of arguments, and inspections conducted in both states. However, the Tribunal's proceedings

have been characterized as "sluggish and unsatisfying". It was noted that the Tribunal had been "largely inactive in recent years" until the appointment of the new chairperson.

Interim Applications and Orders: The State of Odisha filed Interim Application (I.A.) No. 1/2018 seeking interim reliefs, including a demand for Chhattisgarh to release 1.74 million acre-feet (MAF) of water during the non-monsoon season. This application was subsequently disposed of by the Tribunal, with liberty granted to Odisha to file a fresh application or revive the present one if the situation warranted it in the future. Other I.A.s filed by both states have also been addressed and disposed of, often with similar provisions for renewal. The Tribunal has also requested time for the parties to examine assessors' reports (e.g., on basin delineation) and to file remaining appendices. The Tribunal has notably deferred hearings on multiple occasions to encourage amicable settlement talks between Odisha and Chhattisgarh. The limited scope of interim reliefs in protracted disputes is evident in the MWDT's approach. Odisha sought immediate interim reliefs, such as a specific water release, but the Tribunal chose to dispose of these applications, allowing for re-filing at a later stage. The observation that there have been "no interim orders from the tribunal side to maintain the minimum flow of water" further highlights this. This indicates a reluctance by the Tribunal to issue strong interim orders that could significantly alter the status quo, likely to avoid prejudicing the final adjudication or escalating political tensions. The absence of such immediate orders means that the downstream state (Odisha) continues to experience the alleged impacts of upstream actions during the prolonged adjudication process, undermining the urgent relief sought by affected communities and emphasizing the procedural inefficiencies and the gap between legal processes and urgent on-ground needs.

Extensions: The initial three-year period for the Tribunal to submit its report and decision, which commenced from its effective constitution date of December 14, 2019, and was set to expire on April 13, 2024, was extended by two years. This extension, pushing the deadline to April 13, 2026, was granted due to "unavoidable reasons," including a declared non-functional period from March 2020 to June 2021 due to the COVID-19 pandemic.

This situation exemplifies the chronic problem of delays in tribunal adjudication. The ISRWD Act, despite its fixed timelines (three years, extendable by two) , consistently faces extensions. The delay in the MWDT's effective start date and the subsequent extension, even if for "unavoidable reasons" like a pandemic, compound the already inherent delays in interstate water disputes. This leads to a prolonged wait for resolution, undermining the very purpose of timely adjudication and perpetuating uncertainty for riparian states and their dependent communities.

9. Significant Judicial Interventions and Legal Challenges

The interaction between the Supreme Court, High Courts, and the tribunal process in the Mahanadi dispute illustrates the complex legal landscape governing inter-state river water conflicts in India.

Supreme Court's Role: The Supreme Court played a crucial role in the formal initiation of the MWDT. Odisha filed Original Suit No. 1/2017 before the Supreme Court, which subsequently directed the Central Government to constitute the MWDT. This highlights the Supreme Court's function as a catalyst, not an adjudicator, for water disputes. Despite Article 262(2) and Section 11 of the ISRWD Act explicitly barring court jurisdiction in water disputes referred to a tribunal, Odisha approached the Supreme Court, and the Court, rather than directly adjudicating the dispute, compelled the executive to fulfill its statutory duty of forming a tribunal. However, the Supreme Court then "abstained from adjudicating the matter directly and did not wish to make an interim role". This strategic approach by the Supreme Court avoids direct constitutional conflict while still ensuring that the dispute progresses towards a resolution mechanism. However, it does not inherently solve the underlying issues of tribunal efficiency or the finality of its decisions. The Court's non-intervention on interim reliefs further shifts the burden of immediate problem-solving onto the Tribunal.

High Courts: Unlike the Narmada River Basin, which details specific Indira Sagar-Madhya Pradesh High Court Judgments, the provided information on the Mahanadi dispute does not extensively mention High Court interventions or judgments. This suggests a limited role for High Courts in the core inter-state water-sharing conflict once the dispute is formally escalated to the Supreme Court (for tribunal formation) or the Tribunal itself. While High Courts may intervene in intra-state aspects of river projects (such as rehabilitation and resettlement issues, as seen in Narmada), the inter-state nature of the Mahanadi dispute, once formally escalated, primarily falls under the Supreme Court's original jurisdiction (to compel tribunal formation) or the Tribunal's exclusive adjudicatory domain, effectively limiting the High Courts' direct role in the core water-sharing conflict.

Interaction with Tribunal Process: The MWDT has shown a pragmatic approach by frequently deferring its hearings to encourage amicable settlement talks between Odisha and Chhattisgarh. This signifies the Tribunal as a forum for negotiation, not just adjudication. Odisha's Advocate General has publicly acknowledged that no inter-state water dispute in India has been resolved entirely through tribunal proceedings, advocating instead for amicable resolution through dialogue. This suggests a recognition by the Tribunal itself that purely legalistic adjudication might not be the most effective or sustainable path for resolving

complex inter-state water disputes, especially given their deep political undertones. This approach implies a move towards a more facilitative role for tribunals, encouraging dialogue and consensus-building, rather than strictly imposing a definitive award. The success of this approach, however, remains contingent on genuine political will from the disputing states.

9.1. Legal Constraints among Authorities (Legal Challenges across departments)

The governance of the Mahanadi River Basin is characterized by a complex interplay of legal constraints arising from jurisdictional overlaps, conflicting priorities, a pervasive lack of coordination, and significant accountability issues among various authorities at both central and state levels. These challenges collectively hinder effective and integrated river basin management.

9.2. Jurisdictional Overlaps

The constitutional division of powers creates inherent jurisdictional overlaps in water governance. While water is primarily a State subject, the Union Government retains significant powers over inter-state rivers and navigation, as exemplified by the National Waterways Act, 2016, which designates the Mahanadi as National Waterway 73. This dual authority can lead to conflicts, as central mandates for navigation might clash with state priorities for irrigation or hydropower.

Further overlaps arise between environmental and developmental mandates. Environmental clearances, typically issued by the Ministry of Environment and Forests, are often conditional or, in practice, overlooked when state development authorities (such as state irrigation departments or industrial promotion bodies) push for rapid construction. This creates a situation where environmental safeguards may be compromised in favor of developmental expediency.

Moreover, the management of surface water and groundwater is frequently treated as separate domains, despite their inherent hydrological interconnectedness. This compartmentalized approach creates ambiguities and inefficiencies in comprehensive water resource management. The peril of compartmentalized governance in an integrated ecosystem is profound. The Mahanadi basin functions as an integrated ecosystem, yet its governance is fragmented across numerous central and state authorities, each operating under distinct mandates. This fragmentation leads to situations where decisions made by one authority, such as granting industrial clearances, can have severe, uncoordinated impacts on another's domain, including water quality or agricultural supply, ultimately leading to exacerbated conflicts and unsustainable outcomes. The absence of a unified, basin-wide authority, such as

the River Basin Authority proposed in the lapsed 2019 Bill , exacerbates these overlaps, rendering holistic management practically impossible.

9.3. Conflicting Priorities

A significant legal constraint stems from the conflicting priorities among authorities. Both Odisha and Chhattisgarh prioritize rapid industrialization, particularly in the power, steel, and mining sectors, for economic growth. This pursuit of economic development often occurs at the expense of the river's ecological health and the water needs of the agricultural sector. Water is increasingly diverted for industrial use, leading to protests from farmers who face water deficits for their livelihoods.

Governments frequently focus on short-term gains, such as immediate industrial investment and electoral advantages derived from water disputes, rather than committing to long-term sustainable water management. This highlights the politicization of priorities. The conflict in Mahanadi is deeply influenced by "party favouritism and political bias" and electoral strategies. State governments prioritize industrial growth and frame it as "development" , even when it leads to ecological decline and farmer protests. This indicates that the conflicting priorities are not merely technical or economic but are profoundly political. The electoral cycle and regional identity politics often overshadow rational, sustainable resource management, leading to policy choices that exacerbate water stress and disputes. Overcoming these constraints requires not just legal or institutional reform, but also a fundamental shift in political culture towards genuine cooperative federalism.

9.4. Lack of Coordination

The Mahanadi basin's governance is plagued by a pervasive lack of coordination. The historical failure of the 1983 Joint Control Board to be implemented and the subsequent failure of the Negotiation Committee due to Odisha's non-participation underscore a persistent absence of effective inter-state coordination mechanisms.

A critical aspect of this coordination failure is the data sharing deficit. There is a documented "non-sharing of hydrological data" and a "lack of data-sharing transparency" between states and with federal institutions, which fosters mistrust and hinders objective assessments. This leads to fragmented data analysis, where governments use "old and fragmented data" for water flow and balance analysis, further impeding accurate assessments and coordinated planning. Ultimately, the current institutional structures fail to enable integrated and participatory governance of water resources at the basin level. The trust deficit acts as a significant barrier to coordination. The failure of joint committees and the lack of data sharing point to a deep-seated mistrust between Odisha and Chhattisgarh. This lack of

trust is a fundamental impediment to effective coordination. Without shared, transparent data and a genuine willingness to collaborate, any institutional mechanism, such as a River Board, will struggle to function effectively. This implies that building inter-state trust through transparent processes and shared scientific understanding is as crucial as establishing formal coordination bodies.

9.5. Accountability Issues

Despite the existence of legal provisions and tribunal awards, there is a recurring problem of non-compliance and weak enforcement, leading to significant accountability issues.

In the Mahanadi basin, the unregulated construction of water projects by upstream states affects river ecology, and federal institutions have "failed to control the issue". The Union Ministry of Environment's approval for Chhattisgarh to proceed with ecologically destructive projects raises serious questions of accountability. Furthermore, there is a noted lack of concern from irrigation departments in addressing farmers' complaints about water mismanagement and the need for canal repairs. This points to a significant enforcement gap in India's water governance framework. Even when legal or institutional mechanisms exist, the absence of robust penalties or political will to enforce decisions renders them ineffective. This undermines the rule of law in water management and perpetuates conflicts, as states can operate with perceived impunity.

10. Summary and Recommendations

The comprehensive analysis of the Mahanadi River Basin's legal and institutional landscape reveals a complex and challenging environment for water resource management. While the basin holds significant ecological, economic, and socio-cultural importance, it is currently embroiled in an inter-state dispute rooted in historical grievances, competing developmental priorities, and systemic governance deficiencies.

10.1. Summary of Key Legal and Institutional Challenges in Mahanadi Basin

The Mahanadi basin faces a multifaceted array of legal and institutional challenges:

Fragmented Legal Framework: The reliance on the Inter-State River Water Disputes Act, 1956, despite its amendments, is problematic due to inherent procedural inefficiencies, prolonged delays in adjudication, and weak enforcement mechanisms for tribunal awards.

Judicial Overreach/Ambiguity: The Supreme Court's appellate jurisdiction under Article 136 creates a degree of uncertainty regarding the finality and binding nature of tribunal

awards, inadvertently incentivizing prolonged litigation and undermining the specialized adjudicatory process.

Institutional Voids: The historical non-implementation of the River Boards Act, 1956, and the recent lapsing of the progressive River Basin Management Bill, 2019, have left a critical void in establishing proactive, cooperative, and basin-wide governance mechanisms. This absence forces disputes into adversarial legal channels rather than fostering collaborative management.

Politicization of Disputes: The Mahanadi conflict is heavily influenced by inter-party-political rivalries and electoral strategies in both Odisha and Chhattisgarh. This political maneuvering often overshadows genuine environmental concerns and the socio-economic well-being of riparian communities, turning water into a tool for political gain.

Conflicting Developmental Priorities: The aggressive pursuit of rapid industrialization by riparian states, particularly in water-intensive sectors, leads to significant water diversion and pollution. This creates direct conflicts between industrial and agricultural water needs, exacerbating inter-sectoral and inter-state tensions.

Environmental Degradation: The basin is suffering from severe water pollution, significant hydrological alterations due to upstream constructions, and consequent biodiversity disruption. These critical environmental concerns are often treated as secondary or residual considerations in dispute resolution mechanisms, which primarily focus on water quantity allocation.

Lack of Transparency and Trust: A pervasive absence of transparent hydrological data sharing and a deep-seated mistrust between the disputing states hinder amicable negotiations and coordinated management efforts. This trust deficit is a fundamental barrier to effective cooperation.

Enforcement Deficit: There is a notable weakness in accountability and a lack of effective penalties for non-compliance with legal decisions and tribunal awards. This enforcement gap undermines the binding nature of legal pronouncements and allows states to operate with perceived impunity, perpetuating conflicts.

10.2. Recommendations for Strengthening Cooperative Federalism and Dispute Resolution

To overcome these entrenched legal and institutional constraints, a multi-pronged approach focusing on legislative reform, enhanced negotiation, and a shift towards cooperative federalism is essential.

Revive and Enact the Inter-State River Water Disputes (Amendment) Bill, 2019:

The provisions outlined in this lapsed Bill, particularly the establishment of a Dispute Resolution Committee (DRC) for mandatory negotiation and a single, permanent Inter-State Water Disputes Tribunal with multiple benches, are crucial for streamlining dispute resolution and reducing delays. Parliament should prioritize reintroducing and enacting this Bill, potentially incorporating lessons learned from the ongoing MWDT experience to refine its mechanisms. This would provide a more robust and efficient legal framework for inter-state water disputes.

Strengthen Negotiation and Mediation Mechanisms: Adjudication, by its nature, is adversarial and time-consuming. The failure of the Negotiation Committee in the Mahanadi dispute due to Odisha's non-participation underscores that formal mechanisms alone are insufficient without a foundation of trust. It is recommended to implement mandatory, time-bound negotiation and mediation stages before resorting to formal adjudication. This could involve the appointment of neutral expert facilitators and the creation of clear incentives for states to reach amicable settlements. A concerted effort to build inter-state trust through joint scientific studies, transparent data sharing initiatives, and regular inter-state dialogue forums, independent of immediate political pressures, is paramount.

Clarify Supreme Court's Jurisdictional Scope: The ambiguity arising from the Supreme Court's intervention under Article 136, which allows appeals against Tribunal awards, undermines the intended finality of these awards and encourage prolonged litigation. Legislative clarification through amendments to the ISRWD Act is needed to reinforce the spirit of Article 262(2) and Section 11, which bars court jurisdiction in referred disputes. Alternatively, a definitive Supreme Court ruling that respects this legislative intent, limiting judicial review to exceptional constitutional questions rather than re-adjudication of facts, would bring much-needed certainty and prevent endless appeals.

Establish a Permanent River Basin Organization (RBO) for Mahanadi: The historical non-implementation of the River Boards Act, 1956, and the recognized need for a "broad-based river basin organisation with active stakeholder participation" highlight a critical institutional gap. Given that the Mahanadi is "not yet a closed basin", there is a unique opportunity to establish a multi-stakeholder Mahanadi River Basin Authority. This body should be legally mandated with clear powers for integrated planning, data collection, monitoring, and proactive conflict prevention. It should operate on principles of subsidiarity, ensuring decisions are made at the most appropriate level, and include representatives from

all riparian states, the central government, technical experts, and civil society organizations to foster inclusive governance.

Recommendations for Integrated Water Resource Management and Environmental Protection: Beyond dispute resolution, sustainable management of the Mahanadi Basin requires a fundamental shift towards an integrated approach that prioritizes ecological health and long-term sustainability.

Adopt an Integrated Basin Management Approach: The current fragmented management of water resources (e.g., treating surface and groundwater separately, focusing on quantity over quality) and the conflicting priorities (e.g., industrial growth versus agricultural needs) are unsustainable. It is recommended to develop a comprehensive Mahanadi Basin Master Plan based on an "alternative approach". This plan should explicitly prioritize water for basic human needs ("water for life"), ecosystem health ("water for the ecosystem"), and sustaining livelihoods ("water for agriculture livelihoods"), followed by allocations for adaptation to climate change and then industrial uses. This master plan must holistically encompass the management of both surface and groundwater, address water quality and pollution abatement, and implement effective sediment management strategies.

Prioritize Environmental Flows and Water Quality: Environmental flow (e-flow) and water quality are often treated as residual considerations in water allocations, leading to severe ecological degradation in the Mahanadi basin. It is crucial to mandate environmental flow as a high-order priority allocation, reserving a significant portion of utilisable water (e.g., 24% as suggested) for maintaining the river's ecological health. Furthermore, stringent water quality standards must be enforced throughout the basin, with regular monitoring and punitive measures for polluters. Pollution control boards need enhanced powers and resources, and their actions should be integrated into basin-wide planning.

Enhance Data Transparency and Joint Monitoring: The lack of transparent hydrological data sharing and the use of fragmented data exacerbate mistrust and hinder effective management. A joint, independent technical body, possibly under the proposed RBO, should be established to collect, verify, and disseminate real-time hydrological and water quality data across all riparian states. This transparency is fundamental for building trust and enabling evidence-based decision-making.

Promote Water Use Efficiency and Demand Management: Given the reducing trend in annual flow and increasing demands, particularly from industries, aggressive promotion of water-saving technologies and practices is vital. This includes encouraging System of Rice Intensification (SRI) in agriculture, implementing water-efficient industrial processes (e.g., air

cooling in thermal power plants, recycling wastewater), and promoting responsible domestic water use. Demand-side management strategies should be integrated into water policies to reduce overall water footprint.

Integrate Social and Environmental Impact Assessments: All future water resource development projects, including barrages and industrial expansions, must undergo rigorous and transparent Social Impact Assessments (SIAs) and Environmental Impact Assessments (EIAs). These assessments should be comprehensive, consider cumulative impacts, involve genuine public consultation, and be subject to independent review. Compliance with R&R provisions, as mandated by the LARR Act, 2013, must be strictly enforced to mitigate social costs and prevent new disputes.

Foster Public and Stakeholder Participation: The "top-down" nature of current dispute resolution mechanisms has proven ineffective. Future governance frameworks must be democratic, decentralized, and participatory, involving civil society organizations, academic institutions, local communities, farmers, and fisherfolk in decision-making processes, from planning to implementation and monitoring. This ensures that diverse needs and local knowledge are integrated, fostering ownership and more equitable outcomes.

Develop Adaptive Management Strategies: Given the uncertainties introduced by climate change and dynamic socio-economic shifts, a static, one-time solution from a tribunal is insufficient. The Mahanadi basin requires an adaptive management approach that allows for periodic review and modification of water allocation plans based on improved understanding of bio-physical and social systems, new information, and evolving needs. This approach should be embedded in the Tribunal's mandate and the RBO's operational framework.

By implementing these recommendations, India can move beyond the current adversarial and fragmented approach to inter-state water disputes, fostering a more cooperative, integrated, and sustainable management of the Mahanadi River Basin for the benefit of all its dependent communities and ecosystems.

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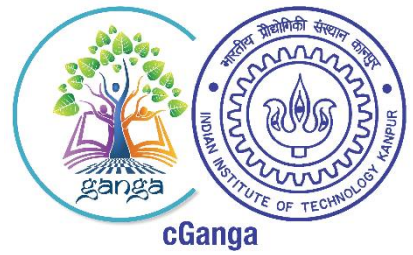
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