



Periyar River Basin: Legal constraints



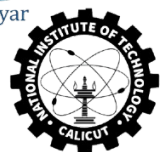
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Periyar River Basin: Legal constraints

1. Overview of Periyar River Basin

The Periyar River, also known as the “lifeline of Kerala,” is the longest river in the state, measuring 260.7 km in length. The total drainage area of the Periyar river basin is 5216 sq.km, of which 119 sq.km lies in Tamil Nadu. The area belonging to Tamil Nadu in the Periyar basin is drained by the tributary Nirar, which is diverted to Tamil Nadu as a part of inter-state Parambikulam-Aliyar Project (Madhusoodanan and Sreeja, 2010). Periyar River drains parts of Kerala’s Idukki, Ernakulam and Thrissur districts, as well as Tamil Nadu’s Coimbatore district. The Periyar River basin is situated between latitudes 9°15’30"N and 10°21’00"N and longitudes 76°08’38"E and 77°24’32"E, featuring an average basin slope of 22.60%. The basin receives an average annual rainfall of 3200 mm.

It originates in the forested region near Sivagiri Peak, situated about 80 kilometres south of Devikulam, at an elevation of 2,438 meters above mean sea level (MSL). From its source, the river flows through steep mountainous terrain and is joined by the Mullayar River approximately 16 kilometres downstream. Following this confluence, the Periyar turns westward and flows for about 16 kilometres through a sandy bed. After meandering for another 13 kilometres, the river reaches Vandiperiyar, passing through a second narrow gorge before being joined by the Perumthura River. Further downstream, six smaller tributaries merge with the Periyar before it is joined by the significant Edamala tributary. The river continues its course past Malayattoor, eventually reaching Aluva (Alwaye), where it bifurcates into two branches. The northern branch merges with the Chalakudy River at Punthenvelikkara and then expands into a broad estuarine body at Munambam. The southern branch diverges into several distributaries that drain into the Vembanad Lake via Varapuzha (India WRIS; Joseph, 2004).

Hydrological monitoring of the Periyar is conducted by the Central Water Commission (CWC) through two observation stations located at Neeleswaram and Vandiperiyar, which are crucial for assessing the river’s flow characteristics and seasonal variations (India WRIS).

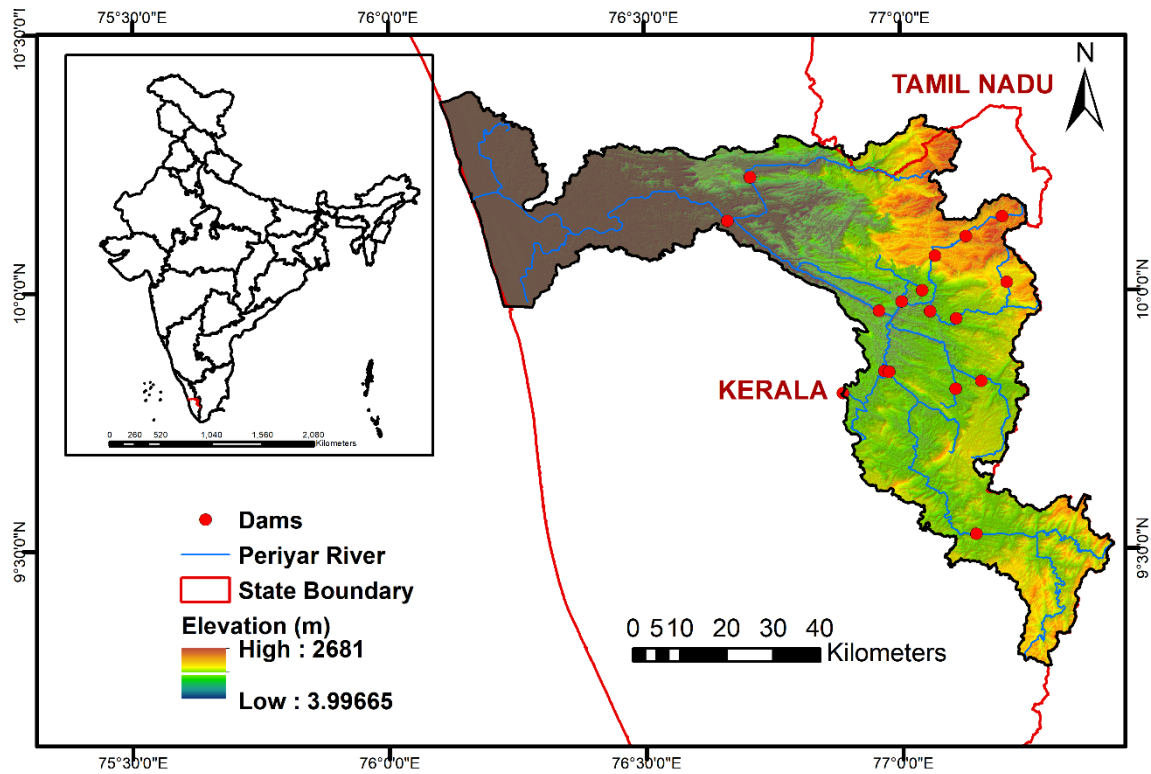


Figure 1: Periyar River Basin

The river houses a number of dams used for irrigation, hydroelectric power generation, and drinking water supply. The Mullaperiyar Dam and Idukki Dam are two prominent structures in the river basin. The Mullaperiyar Dam, built in 1895 as an inter-state dam, diverts water from the Periyar to the Vaigai basin in Tamil Nadu (Madhusoodhanan and Sreeja, 2010). The Idukki Dam, along with Cheruthoni and Kulamavu, was built as part of the largest hydroelectric project in Kerala and stands as the second-biggest concrete arch dam globally. It generates 780 MW of power a day and stores water for the dry summer period. Other dams in the Periyar basin include Kulamavu Saddle 1 & 2, Idamalayar, Kundala, Mattupetty, Ponmudi, Anayirankal, Lower Periyar, Kallarkutty, Sengulam, and Erattayar.

The Periyar River has long faced environmental degradation stemming from extensive human interventions. Activities such as pollution, unregulated sand mining, encroachments, and large-scale infrastructure development, including dams and hydroelectric projects, have disrupted the river's ecological integrity, leading to altered flow regimes, habitat fragmentation, erosion, and biodiversity loss (Kerala State Planning Board, 2022). In response, both state and central governments have introduced various regulatory and conservation measures, including the Periyar River Basin Conservation Project and the establishment of the Periyar Tiger Conservation Foundation. Despite these efforts, significant challenges persist in securing the long-term sustainability of the river.

At the heart of these challenges lie complex legal and institutional constraints that affect the governance of the Periyar Basin. These include overlapping jurisdictional responsibilities, lack of river basin management authority, limited enforcement of environmental regulations, and the absence of a comprehensive legal framework tailored to river basin management. Furthermore, the interstate nature of the Periyar River, originating in Kerala and supplying water to Tamil Nadu through the Mullaperiyar Dam, has added a layer of legal and political complexity, giving rise to prolonged disputes over water sharing, dam safety, and ecological risk.

This document explores these legal constraints in detail, analysing how they shape the governance of the Periyar River Basin and highlighting the need for integrated, ecologically sound, and legally robust frameworks to ensure its sustainable management.

2. Understanding Legal Constraints

Legal constraints in river basin management arise from a complex interplay of factors influencing water governance, environmental sustainability, and inter-state relations. In the Periyar Basin, these challenges are intensified by disputes between Kerala and Tamil Nadu, particularly centered on the 1886 Mullaperiyar Dam agreement. These constraints often pose significant challenges to the effective and equitable management of river systems. The key areas of legal complexity include the following:

2.1. Inter-State Disputes

Water Sharing Agreements: Disputes frequently emerge over historical treaties and agreements related to water allocation between states. Such conflicts often result in prolonged legal battles, with states asserting competing claims over shared river resources. The Periyar river, though originating entirely within Kerala, is subject to one of India's longest running inter-state water disputes due to the Mullaperiyar Dam agreement of 1886 (and subsequent renewals). Tamil Nadu's rights to divert water to the Vaigai Basin have been a source of contention, with Kerala advocating for safety concerns and ecological flow requirements, while Tamil Nadu prioritizes irrigation and drinking water needs.

Jurisdictional Challenges: The division of powers between state and central governments can complicate governance. In federal systems like India, interstate rivers are subject to central legislation, yet states retain substantial control over local water management. The operational

control of the Mullaperiyar Dam lies with Tamil Nadu, creating a complex governance arrangement in which Kerala has limited operational authority over a major dam within its own territory. This dual authority often leads to jurisdictional ambiguities and conflict.

2.2. Environmental Regulations

Legislative Gaps: While overarching environmental laws such as the Environment (Protection) Act, 1986, are intended to safeguard river ecosystems, enforcement has been insufficient to prevent issues such as pollution from industrial effluents in the Eloor–Edayar stretch and unregulated sand mining in the lower reaches. Regulatory mechanisms often fail to assess the cumulative ecological impacts of infrastructure and development projects.

Legal Personhood for Rivers: Some jurisdictions have begun recognizing rivers as legal entities with rights, promoting a shift from anthropocentric to eco-centric governance. Although innovative, this approach faces significant legal, administrative, and cultural challenges regarding its implementation and acceptance. For a river system like the Periyar, implementation of such measures would likely encounter considerable resistance from industrial, agricultural, and inter-state water use stakeholders.

2.3. Governance and Institutional Frameworks

Fragmented Governance: River basins are typically managed by multiple agencies with overlapping mandates, leading to institutional inefficiencies and policy conflicts. Management of the Periyar basin is divided among multiple agencies Kerala State Electricity Board (KSEB) for hydropower, Kerala Water Authority (KWA) for municipal supply, Pollution Control Board for water quality, and the Irrigation Department for local diversions. Currently, there is no single integrated authority for coordinated basin-wide management. The absence of an integrated governance structure often hampers the development and execution of holistic management strategies.

Public Trust Doctrine: This legal principle asserts that certain natural resources are held in trust by the state for public benefit. In Kerala, the High Court has applied this doctrine to protect rivers, notably in cases related to illegal sand mining, although its enforcement may conflict with developmental or private interests.

2.4. Water Rights and Allocation

Equitable Utilization: Legal frameworks often emphasize the equitable distribution of water among users. However, operationalizing the principle of equity remains contentious, especially in regions with pronounced socio-economic disparities and competing water demands.

Rights of Indigenous Communities: Indigenous and tribal communities in the upper catchment of Periyar have historically depended on the Periyar for subsistence farming, fishing, and cultural practices and also hold customary rights to water, which are not always acknowledged within formal legal structures. The exclusion of these rights can exacerbate social tensions and lead to demands for legal reform and inclusion.

2.5. Climate Change Impacts

Existing legal frameworks are often ill-equipped to address the dynamic impacts of climate change on water availability and quality. New legal instruments and adaptive governance models are required to accommodate shifting hydrological regimes and ensure long-term resilience.

These legal constraints underscore the need for comprehensive reforms that promote ecological sustainability, ensure equitable resource distribution, and foster collaborative governance among stakeholders at all levels.

3. Inter State Disputes

The primary inter-state dispute in the Periyar basin centres on the Mullaperiyar Dam. The conflict between Kerala and Tamil Nadu involves the dam's structural safety, its operational control, and the historical agreements governing its use.

3.1. Mullaperiyar Dam

The Mullaperiyar Dam, located in the Idukki district of Kerala across the Periyar River, is a significant example of 19th-century hydraulic engineering and a pivotal point of interstate discourse in India. The dam was originally constructed to divert the west-flowing waters of the Periyar River eastward, enabling irrigation in the drought-prone districts of Madurai and Ramanathapuram in the then Madras State (now Tamil Nadu) (Pennycuick, 1897; Thatheyus e al., 2013).

History and Construction: The concept of diverting the waters of the Periyar River was first proposed in 1798 by Muthu Arula Pillai, the Prime Minister of the Ramnad Raja. Over the following decades, several British engineers conducted feasibility assessments. Among the earliest were Mr. Parish in 1807, and Captain J.L. Caldwell of the Royal Engineers in 1808, whose mission specifically explored the feasibility of conveying water to Madurai via a tunnel through the Western Ghats (Mohanakrishnan, 2012; Thatheyus et al., 2013).

An early attempt to construct an earthen dam in 1850 was abandoned due to labor disputes. In 1861, Captain J.G. Ryves, R.E., submitted proposals for a similar structure, which were further revised in 1867. However, the project faced persistent delays owing to financial constraints and the famine of 1876–77, which diverted attention and resources away from large-scale infrastructure projects. The final project, as proposed by Colonel Pennycuick, involved the construction of a masonry dam, the creation of a large reservoir, and the excavation of a tunnel through the watershed to facilitate the eastward diversion of water. The scheme was formally sanctioned in 1884, and construction began in 1887 under the direction of the British Army Engineering Corps, with Colonel Pennycuick personally overseeing the execution (Mohanakrishnan, 2012; Thatheyus et al., 2013).

Construction followed the signing of the 1886 Mullaperiyar Lease Agreement, the terms of which are detailed in Section 4.1. The lease stipulated an annual rent of five rupees per acre, amounting to ₹40,000 per year, payable to the Travancore government, which was adjusted against the annual tribute owed to the British. It also conferred full and exclusive rights to the Secretary of State for India to construct, operate, and maintain all irrigation-related infrastructure within the leased area. The Maharaja of Travancore, reportedly signing the agreement under duress after over two decades of resistance, is believed to have remarked, “I am signing this agreement with my blood!”, a reflection of the deep political sensitivity and perceived imbalance of the arrangement (Thatheyus et al., 2013).

Construction began in 1887 under Pennycuick’s leadership. The site, located in the dense and malaria-prone forests of the Western Ghats at an elevation of 850 m with an average annual rainfall of 2000mm, posed immense logistical and environmental challenges. Heavy monsoon rains, disease outbreaks, labour shortages, and the difficulty of transporting construction materials over 76 miles of rugged terrain severely hampered progress.

The substantial discharge of the Periyar River made foundation work particularly difficult, and initial structures were repeatedly damaged or destroyed by floods. Despite the withdrawal of government funding during construction, Pennycuick reportedly used his personal funds to ensure the completion of the project (Thatheyus et al., 2013). The final masonry dam was completed in 1895, and although it was originally designed for a 50-year lifespan, the structure continues to function over a century later, supported by multiple phases of retrofitting (Madhusoodhanan et al., 2010; Thatheyus et al., 2013).

Major Structural and Functional Features: The Mullaperiyar Dam is a masonry gravity dam, notable for being the first dam in India constructed using surki concrete, a traditional mixture of lime and brick powder. The dam is built in a “V”-shaped gorge in the Western Ghats, exhibiting a composite heterogeneous structure composed of the following:

- The dam is constructed using uncoursed rubble masonry on both the upstream and downstream faces, bonded with lime surkhi mortar. The mortar mix consists of two parts lime, one part surkhi, and three parts sand.
- Hearting of lime surkhi concrete, which constitutes over 60% of the dam’s volume, made in the ratio of 3.125 parts stone to 1 part mortar.
- 10-meter-wide reinforced concrete backing added to the downstream side during the 1980s for structural strengthening.

The major features of the dam are given in *Table 1*, *Table 2*, *Table 3*, and *Table 4*.

Table 1: Main Dam Dimensions (Khan et al., 2022; Thatheyus et al., 2013).

Parameter	Value
Length (m)	366
Top of dam including parapet (m)	48.16
Height of dam from deepest foundation (m)	53.64
Top width of dam with parapet (m)	6.4
Downstream slope	0.9276:1
Upstream Slope	1:20

Table 2: Baby Dam Dimensions (Khan et al., 2022; Thatheyus et al., 2013).

Parameter	Value
Location	Left Bank Saddle
Type	Composite gravity structure
Top of dam (m)	48.17
Length of dam (m)	73.15

Height of dam (m)	16.15
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Spillway: Originally designed with 10 vents of dimensions 10.97 m x 4.88 m, it was later enhanced with 3 additional vents of 12.16 m x 4.88 m to increase discharge capacity. The details are given in *Table 3*.

Table 3: Spill Way Properties (Khan et al., 2022; Thatheyus et al., 2013).

Parameter	Value
Location	Right Saddle
Crest level (m)	41.45
Number of original vents	10 (10.97 m × 4.88 m)
Number of additional vents	3 (12.16 m × 4.88 m)
Total control gates	13

Reservoir and Water Diversion: The dam creates a reservoir with a gross storage capacity of 15.662 TMC (thousand million cubic feet). The Full Reservoir Level (FRL) was originally set at 152 feet (46.33 meters), while the sluice for water diversion to Tamil Nadu is located at an elevation of 106.5 feet, well below the crest level. The details are given in *Table 4*.

Table 4: Details of the Reservoir (Khan et al., 2022; Thatheyus et al., 2013).

Parameter	Value
Catchment area (sq. km)	624
Full Reservoir Level (FRL)	46.33 m (152 ft)
Maximum Water Level (MWL)	47.24 m (155 ft)
Gross Storage Capacity	15.662 TMC
Gross storage at 104 ft	5.092 TMC
Gross storage at 136 ft	11.210 TMC
Gross storage at 155 ft	16.617 TMC
Utilizable storage above sluice level	9.176 TMC
Probable Maximum Flood	306399 cusecs
Recorded Maximum Flood (cusecs)	298519 cusecs

The Periyar Lake, formed by the Mullaperiyar Reservoir, is a renowned wildlife and ecotourism destination, popularly known as Thekkady Lake. The reservoir plays a dual role as it serves Tamil Nadu's irrigation and power needs while also supporting Kerala's conservation and tourism objectives.

3.2. Origin of the Dispute

The Mullaperiyar Dam has been at the center of a longstanding and complex dispute between the states of Kerala and Tamil Nadu. The conflict has evolved over time, shaped by questions surrounding the legal scope of water usage, the safety of the dam, and the rights and responsibilities defined under the original lease agreement of 1886.

Early Dispute Over Water Usage (1990): The first recorded disagreement between the former princely state of Travancore and the then Madras Presidency arose around the year 1900. The Government of Madras proposed using water from the Mullaperiyar Dam for generating hydroelectric power. Travancore strongly opposed the proposal, asserting that the 1886 lease agreement allowed the use of the dam's waters exclusively for irrigation purposes (Sreejith 2020). In response to this disagreement, the Periyar Arbitration Tribunal was constituted to adjudicate the matter. The tribunal ruled in favour of Travancore, declaring that the lessee, that is, the Madras Government, had no right to utilize the water for purposes other than irrigation (Sreejith 2020). Despite this ruling, subsequent political and administrative negotiations resulted in the expansion of rights for the state of Tamil Nadu, ultimately enabling it to use the water for both irrigation and power generation.

Escalation of Dam Safety Concerns (1925–1998): The safety of the dam became a point of public debate as early as 1925, following a report in *The Times of India* that suggested the structure had sustained damage during the 1924 floods and was at risk. These claims raised alarm, particularly in Travancore, but were later addressed by Superintending Engineer C.T. Mullings, whose inspection report concluded that the dam remained structurally sound, thus temporarily easing concerns (Sreejith 2020).

In 1962, following the heavy floods of 1961, the *Times of India* again raised alarms regarding the structural safety of the Mullaperiyar Dam. The article highlighted that the dam was constructed using lime surki mortar and lacked adequate provisions for inspection and maintenance, particularly due to the absence of a scouring sluice, which made it impossible to fully drain the reservoir. This report triggered widespread public concern regarding the dam's safety (Madhusoodhanan et al., 2010; Thatheyus et al., 2013).

From the time of the dam's initial impoundment, seepage and wetness had been observed on the downstream face. To address this, remedial measures were implemented during two major phases:

1930–1935 and 1961–1965. These included guniting of the upstream face, a process by which concrete is applied to irregular or vertical surfaces, and grouting of the dam body, which involves filling cracks and crevices in masonry with mortar. These operations collectively consumed approximately 543 tons of cement. Despite these interventions, seepage continued, contributing to a sustained sense of insecurity among communities residing in the downstream areas. The issue remained a focal point in Kerala's long-standing concerns about the dam's structural integrity and safety (Thatheyus et al., 2013).

When Kerala raised concerns about the safety of the Mullaperiyar Dam with the Central Water and Power Commission (CWPC) in 1964, an inspection was conducted along with engineers from both states. As a result, it was decided to lower the Maximum Water Level (MWL) from 155 feet to 152 feet. Later, in 1978, the Central Water Commission (CWC) directed that the MWL be further reduced to 145 feet (Madhusoodhanan et al., 2010; Madhusoodhanan et al. 2015, Ram Mohan and Krittika, 2015; Thatheyus et al., 2013).

The safety concerns gained public attention in 1979 when the Kerala press reported major leaks in the dam. The sense of insecurity was further heightened by the Machhu II dam failure in Gujarat in August 1979. On November 25, 1979, the Chairman of the Central Water Commission (CWC) Dr. K.C Thomas held discussions in Thiruvananthapuram with officials from Kerala's Irrigation and Electricity Department and Tamil Nadu's Public Works Department (PWD). It was decided to undertake emergency, medium-term, and long-term strengthening measures. Lowering the reservoir level to 136ft was one of the emergency measures (Madhusoodhanan et al., 2010; Sreejith 2020; Thatheyus et al., 2013).

- Emergency: Reduce water level to 136 ft.
- Medium-term: Structural reinforcement through cable anchoring (1991).
- Long-term: Concrete backing of the dam's downstream face (completed in 1994).

Exploring the possibility of constructing a new dam was suggested as an alternative to long-term measures which was dropped in further discussions.

A subsequent meeting was held under the CWC Chairman on April 29, 1980, in New Delhi, where it was concluded that after implementing emergency and medium-term measures, the reservoir level could be restored to 145 feet. On March 25, 1986, the CWC forwarded a "Memorandum on Rehabilitation of Mullaperiyar Dam" to Tamil Nadu, outlining peak flood estimates, additional spillway vents, and strengthening measures such as concrete backing on the dam's downstream

face. It was suggested that upon completion of these measures, the dam could safely store water up to the original FRL of 152 feet (Madhusoodhanan et al., 2010; Thatheyus et al., 2013).

Meanwhile, Tamil Nadu implemented several prescribed measures. The emergency step of fully raising the spillway shutters to lower the reservoir level to 136 feet was carried out in 1979. In 1981, a reinforced concrete capping was provided along the entire length of the main dam. As part of the medium-term measures, the cable anchoring was strengthened in 1991. In 1994, the long-term measure of reinforcing the dam with concrete backing on the downstream face was completed. The enhancement of spillway capacity, another emergency measure to improve water level control, was completed in 1997 (Madhusoodhanan et al., 2010; Thatheyus et al., 2013). However, an additional measure suggested by the CWC to strengthen the baby dam was not implemented due to objections from Kerala. Meanwhile, public protests in Tamil Nadu intensified, demanding an increase in the dam's water level. Despite these demands, Kerala refused to raise the level beyond 136 feet from 1980 onwards. At the same time, Tamil Nadu increased its water withdrawals from the dam by installing additional infrastructure to meet the irrigation needs of newly cultivated lands (Thatheyus et al., 2013).

Legal Complexities Post-Independence (1947–1956): Following India's independence, the status of pre-existing agreements such as the 1886 Mullaperiyar lease came under scrutiny. Kerala contended that the lease had lapsed under Section 7(1)(b) of the Indian Independence Act, 1947, which declared that all treaties and agreements with princely states would stand terminated upon the lapse of British suzerainty. Kerala supported this claim by referring to a bulletin issued by the Maharaja of Travancore on 18 July 1947, which stated a general denouncement of all existing agreements, including the Mullaperiyar lease. The state also argued that the Dewan of Travancore had explicitly denounced the lease in his communications with the Viceroy.

The Supreme Court ruled that the 1886 lease agreement was a non-political arrangement and therefore remained valid after independence. It found no clear evidence that the Maharaja of Travancore had officially cancelled the agreement after August 15, 1947. The Court also noted that an informal standstill agreement between Travancore and the Dominion of India helped maintain existing arrangements. Additionally, it held that the removal of Section 177 of the Government of India Act, 1935, did not affect the validity of the original lease.

Further complications arose with the implementation of the States Reorganization Act in 1956, which redefined state boundaries and reconstituted Travancore-Cochin into the new state of Kerala. Kerala, supported by the Mullaperiyar Environmental Protection Forum (MEPF), argued that the 1886 agreement had become invalid since it was not adapted or revised by the specified date under Section 108 of the Act. However, the Supreme Court dismissed this contention as well. It ruled that Section 108 applied only to political agreements, not to commercial or administrative arrangements such as the 1886 lease. The Court reaffirmed that the lease remained valid and binding. Furthermore, it held that under Article 295(2) of the Indian Constitution, the newly formed State of Kerala had inherited all legal obligations and rights from its predecessor, Travancore, thus continuing the enforceability of the original lease agreement (Ram Mohan and Kritika, 2015; Thatheyus et al., 2013).

Supplemental Agreements (1959–1979): By 1959, Tamil Nadu had begun using the Mullaperiyar waters for hydroelectric power generation, despite the original lease being silent on such usage. To regularize this expanded use and address related administrative matters, Kerala and Tamil Nadu entered into two supplemental agreements in 1970. These agreements granted Kerala fishing rights in the reservoir, fixed an annual lease rent to be paid by Tamil Nadu, formally recognized Tamil Nadu's right to generate hydroelectric power from the dam, and leased an additional 42.7 acres of land to Tamil Nadu for related infrastructure. Crucially, these supplemental agreements explicitly stated that the 1886 agreement would remain in force, thereby reaffirming its validity and continued application (Madhusoodhanan et al., 2010; Madhusoodhanan et al. 2015, Ram Mohan and Kritika, 2015; Thatheyus et al., 2013).

Commencement of Constitutional Litigation (1998–2006): With Tamil Nadu asserting completion of strengthening measures, it sought to raise the water level to 152 ft, leading to multiple petitions in the Kerala and Tamil Nadu High Courts. To prevent conflicting rulings, these cases were transferred to the Supreme Court of India. The Supreme Court, through its order dated April 28, 2000, directed the Union Minister for Water Resources (WR) to facilitate discussions between the Chief Ministers of Kerala and Tamil Nadu for an amicable resolution, but no agreement was reached. As a result, an Expert Committee was constituted under the chairmanship of B. K. Mittal, a member of the Central Water Commission, to assess the safety of the dam and appropriate water storage levels. The committee's March 2001 report recommended raising the water level from 136 feet to 142 feet following the successful implementation of strengthening measures, with further raising of water level to 152 ft. would be considered after balance

strengthening measures are implemented. On 27 February 2006, the Supreme Court issued its final verdict allowing the water level to be raised to 142 feet and stated that it could be further increased to 152 feet once all strengthening measures were completed (Madhusoodhanan et al., 2010; Thatheyus et al., 2013).

Second Supreme Court Litigation and Empowered Committee (2006–2014): In March 2006, the Kerala Legislative Assembly enacted the Kerala Irrigation and Water Conservation (Amendment) Act, which empowered the Kerala Dam Safety Authority to evaluate the structural integrity of dams within the state and recommend their suspension or decommissioning if public safety warranted it. Under this provision, the Authority designated 136 feet as the maximum safe water level for the Mullaperiyar Dam (Sreejith, 2021; Thatheyus et al., 2013).

Tamil Nadu strongly opposed the 2006 Kerala legislation and filed a case in the Supreme Court on March 31, 2006, asking for the law to be struck down as unconstitutional. The case was heard by a Constitution Bench, with senior advocates Harish Salve representing Kerala and Pararasan representing Tamil Nadu. Kerala argued that if the Periyar River was considered an interstate river, the matter should be handled by a separate tribunal and not by the Supreme Court. If it was entirely within Kerala, then the Kerala Dam Safety Authority's powers were valid. Kerala also said the Supreme Court had no authority over agreements made before independence, such as the 1886 lease. It claimed the 1970 agreement only leased the dam area and not the water, and since Kerala received no benefit from the project, it had the right to revise or cancel the agreement. Kerala further opposed the proposed increase in the storage level to 142 feet, citing that this would submerge large forest areas inhabited by protected wildlife species. The state also suggested that, instead of storing water in the Mullaperiyar Dam, it could be diverted to the Idukki reservoir through an alternate route, since Tamil Nadu had operational control only over the dam structure, not the downstream distribution (Thatheyus et al., 2013).

Following these arguments, the Supreme Court in September 2006 directed Kerala and Tamil Nadu to resolve the issue either bilaterally or with the assistance of the central government. Talks began on September 25, 2006. During these discussions, Tamil Nadu's Minister for Public Works, Duraimurugan, insisted on raising the dam's water level to ensure irrigation for a larger area of farmland. Kerala's Minister for Water Resources, N. K. Premachandran, opposed the move, arguing that it would endanger the lives of approximately 3.5 million people living downstream. Despite multiple rounds of negotiations, no agreement was reached, and the issue escalated in

December 2006 when Tamil Nadu withdrew from talks convened by the Union Minister of Water Resources.

In the meantime, Kerala commissioned independent studies to assess the safety of the dam. A team from the Indian Institute of Technology (IIT) Delhi in 2008 concluded that the dam was hydrologically unsafe, while scientists from IIT Roorkee reported that the dam stood in a region prone to seismic activity. Kerala formally proposed the construction of a new dam on August 14, 2007, and received permission from the Ministry of Environment and Forests on September 16, 2009, to conduct a preliminary survey. Tamil Nadu opposed the idea of a new dam and approached both the Government of India and the Supreme Court. However, its appeal was dismissed on October 21, 2009. On November 10, 2009, a three-judge bench of the Supreme Court recommended that the matter be heard by a five-judge Constitution Bench due to the significant constitutional questions it raised (Sreejith, 2021; Thatheyus et al., 2013).

On February 18, 2010, the Supreme Court constituted a high-level Empowered Committee to examine issues related to the safety of the dam, the permissible water storage level, and the constitutionality of the Kerala Dam Safety Act. The Court directed both states to nominate a representative to the committee, which could be either a technical expert or a retired judge. The committee was headed by former Chief Justice of India, A. S. Anand, and tasked with a comprehensive assessment of all relevant matters concerning the Mullaperiyar Dam (Ram Mohan and Krittiaka; 2015; Sreejith, 2021; Thatheyus et al., 2013).

Initially, Tamil Nadu Chief Minister M. Karunanidhi opposed the Empowered Committee and sought political mediation. Kerala appointed former Supreme Court judge K. T. Thomas as its representative and reiterated that Kerala had the right to construct, own, operate, and maintain a new dam while remaining open to sharing water with Tamil Nadu under a fresh agreement. Although Tamil Nadu later refused to cooperate with the committee, the Supreme Court dismissed its objection, leading to the eventual nomination of retired judge A. R. Lakshmanan as Tamil Nadu's representative (Thatheyus et al., 2013).

The Empowered Committee conducted a site visit to the Mullaperiyar Dam on December 21, 2010, and recommended that an underwater inspection of the dam wall be carried out. In response, a joint team from the Central Water and Power Research Station (CWPRS) and the Central Soil and Materials Research Station (CSMRS), led by Dr. Rajpal Singh, visited the site on December 5,

2011. The inspection team included professional divers from Orissa, led by Ratnakar Dalai. Meanwhile, Abbas, a farmers' leader from Tamil Nadu, opposed the visit of the National Tiger Reserve Authority team led by Rajesh Gopal, suggesting it was a distraction from the core issues. Kerala objected to the active involvement of the Central Water Commission in the Empowered Committee's functioning. To facilitate coordination, a supporting Coordination Committee was formed, chaired by representatives from the CWPRS and the Central Water Commission, and tasked with reviewing the safety reports Kerala had prepared with assistance from IIT experts (Sreejith 2021; Thatheyus et al., 2013).

Tamil Nadu subsequently filed an application in the Supreme Court requesting an order to prevent Kerala from proceeding with the construction of a new dam. The state also sought permission to carry out repair work on the existing dam to enhance safety. The Supreme Court extended the tenure of the Empowered Committee by six months from April 30, 2011. On August 24, 2011, the five-judge Constitution Bench further extended the committee's term until February 29, 2012, allowing it additional time to complete its investigation and submit a final report.

The committee submitted its report on April 23, 2012. The Empowered Committee concluded that the Mullaperiyar Dam was safe from hydrological, structural, and seismic standpoints, supporting the restoration of the Full Reservoir Level to 142 feet. For a long-term solution, the committee proposed two alternatives. The first was for Kerala to construct a new dam at its own cost, while continuing to honour Tamil Nadu's water rights through the existing dam until the new structure was completed. This would involve a new agreement and oversight by an independent committee led by a Central Government representative. The second option was for Tamil Nadu to build a new tunnel to divert water, allowing the existing dam to function as a diversion weir at a lower height of around 120 feet. This tunnel-based option was considered quicker and more cost-effective, with added safety benefits during emergencies (Sreejith 2021; Thatheyus et al., 2013).

A Constitution Bench of the Supreme Court heard the case in July-August 2013, completing arguments on August 21, 2013. The final judgment (*State of Tamil Nadu v. State of Kerala & Another*, (2014) 12 SCC 696) on May 7, 2014, declared the Kerala Irrigation and Water Conservation (Amendment) Act, 2006, unconstitutional and directed the Union Government to establish a three-member Supervisory Committee to oversee the dam's safety, particularly upon restoring the Full Reservoir Level (FRL) to 142 feet (Supreme Court of India, 2014).

Recent Developments and Unresolved Issues (2014–Present): Russel Joy, a public-spirited citizen and advocate, played a pivotal role in bringing national attention to the long-standing safety concerns surrounding the Mullaperiyar Dam through a public interest litigation. In *Writ Petition (Civil) No. 878 of 2017*, filed under Article 32 of the Constitution of India, he approached the Hon'ble Supreme Court, seeking urgent judicial intervention to uphold public safety and environmental protection. In his petition, Russel Joy specifically requested:

- The appointment of an international expert agency to independently assess the structural lifespan of the Mullaperiyar Dam;
- A judicially defined timeline for the dam's decommissioning based on technical evaluations;
- A direction to the State of Tamil Nadu to create a financial provision for potential compensation and environmental restoration in the event of dam failure.

He argued that the dam, constructed in 1895 using lime surki mortar, had significantly exceeded its originally envisioned lifespan of 50 years, allegedly specified by its British engineer, John Pennycuik. Highlighting the dam's advanced age, evolving engineering standards, and the high population density in the downstream areas of Kerala, he contended that continued operation of the structure posed a grave risk to human life, thus infringing upon the fundamental right to life under Article 21 of the Constitution.

While the Supreme Court, in its earlier decision in *State of Tamil Nadu v. State of Kerala & Another*, (2014) 12 SCC 696, had affirmed the dam's safety from a structural and hydrological standpoint, it took serious note of the persistent fear among downstream residents. On 11 January 2018, the Court issued a significant order (AIR 2018 SC (Supp) 127; (2018) 3 SCC 179), directing the following:

- The Government of India was instructed to establish a dedicated sub-committee under Section 9 of the Disaster Management Act, 2005, to ensure high-level preparedness and monitoring of any potential disaster linked to the dam;
- The States of Kerala and Tamil Nadu were directed to constitute their respective state-level sub-committees under Section 21 of the same Act;
- A comprehensive disaster management plan was to be formulated for the Mullaperiyar Dam, distinct from structural evaluations, to address preparedness, mitigation, and emergency response.

In its judgment, the Court underscored that even in the absence of immediate structural concerns, the psychological impact and legitimate apprehensions of the affected communities could not be

ignored. It affirmed that the right to live free from fear is intrinsic to Article 21 and emphasized the State's constitutional duty to adopt visible, confidence-building measures, rather than relying on abstract (Ministry of Water Resources, 2024).

Kerala repeatedly expressed fears about the structural stability of the 125-year-old Mullaperiyar Dam, particularly during monsoon seasons. Writ Petition (Civil) No. 880 of 2020, filed by Dr. Joe Joseph and others against the State of Tamil Nadu and others, was brought before the Supreme Court of India under Article 32 of the Constitution. The petition highlighted serious concerns regarding the safety of the Mullaperiyar Dam and alleged that the Supervisory Committee, constituted as per the Supreme Court's 2014 judgment, had failed to effectively discharge its duties. The petitioners sought the Court's intervention to ensure the implementation of critical safety measures, including a scientifically defined Rule Curve for reservoir operations, a proper gate operation schedule, and a comprehensive instrumentation plan to monitor the dam's structural health.

In response to these concerns, the Supreme Court, in its order dated 16 March 2021, directed the Supervisory Committee to examine and address the three core issues: the instrumentation plan of the dam, the Rule Curve, and the gate operation schedule or reservoir operation plan. Tamil Nadu submitted its reports on all three matters, in consultation with the Central Water Commission. These submissions were reviewed during a meeting with the State of Kerala on 9 July 2021. While the reports were generally found acceptable, Kerala formally expressed its dissent, continuing to raise safety-related objections.

The petition further urged that the provisions of the Dam Safety Act 2021 be applied to the Mullaperiyar Dam and sought the involvement of the National Dam Safety Authority. Recognizing the ongoing concerns, the Supreme Court issued an important interim order on 8 April 2022. The Court ruled that the Dam Safety Act would indeed apply to the Mullaperiyar Dam and, until the National Dam Safety Authority became fully operational, reconstituted the Supervisory Committee to include two technical experts, one each from Kerala and Tamil Nadu. This reconstituted committee was empowered to oversee all aspects of dam safety, including inspection, maintenance, surveillance, and emergency response planning (Ministry of Water Resources, 2024).

Table 5: Milestone in the development of the dam and the associated disputes.

No	Period	Milestone
1	1798	Muthu Arula Pillai proposed the dam
2	1861	Captain Ryves report in favour of the project
3	1867	Captain Payne made a survey
4	1870	Revision of the Project by Col. Pennycuick
5	1884	Sanctioning the project
6	1886	Periyar Lease Deed signed
7	1887	Beginning of dam construction
8	1895	Completion of second masonry dam
9	1932	Amendment of the Lease Deed for power
10	1947	Formal agreement by Kerala and Tamil Nadu on Lease Deed
11	1959	Power generation started by Madras state
12	1965	Hydel Power Project
13	1970	New agreement on power generation
14	11 May 1962	Questioning the safety of the dam
15	1964	Joint inspection for assessing safety of the dam
16	1964	CWC inspection - MWL to 152 ft
17	1978	CWC directed to keep MWL to 145 ft
18	1979	MWL reduced to 136 ft
19	1980	CWC increased MWL to 145 ft
20	1986	CWC increased MWL to 152 ft
21	27 Feb 2006	Supreme Court verdict to keep the water level at 142 ft
22	March 2006	Kerala Irrigation and Water Conservation Amendment Act
23	25 Sep 2006	Talks between Kerala and Tamil Nadu initiated
24	2008	Experts from IIT, New Delhi evaluated the safety of the dam
25	14 Aug 2007	Kerala proposed the new dam
26	18 Feb 2010	High-level Empowered Committee constituted by the Supreme Court
27	2012	Empowered Committee Report Submission stating the dam is hydrologically, structurally, and seismically safe
28	2014	Supreme Court Declares Kerala Irrigation and Water Conservation (Amendment) Act, 2006 Unconstitutional and the Full Reservoir Level (FRL) as 142 feet.
29	2018	The sub-committee formation under the Disaster Management Act, 2005
30	2021	Court order to Imply Dam Safety Act to the Mullaperiyar

The Supreme Court's actions in this case marked a significant step in strengthening institutional mechanisms for dam safety, particularly in light of persistent public fears about the aging structure and the dam's operation during heavy monsoons. The matter remains under the Court's ongoing supervision. Despite this progress, the long-standing core dispute persists. Tamil Nadu advocates

for strengthening the existing dam and operates under the finalized plans. Meanwhile, Kerala continues to raise safety concerns and insists on constructing a new dam. The Supreme Court's supervisory framework (including both the Supervisory Committee and Disaster Management sub-committees) remains active and continues to guide these technical and operational issues.

4. Inter-state Water Agreements

Water-sharing agreements between states are fundamental to ensuring equitable resource distribution and fostering inter-state cooperation. The Mullaperiyar Dam has long been a focal point of such arrangements between Kerala and Tamil Nadu, with its origins tracing back to the 1886 lease indenture signed between the Maharaja of Travancore and the British administration. This historic agreement enabled the diversion of water from the Periyar River to support irrigation in the rain-shadow regions of what is now Tamil Nadu.

Over time, differences emerged between the two states regarding the terms of water usage, financial compensation, and additional rights, prompting several rounds of negotiations. These efforts culminated in 1970, when two supplemental agreements were signed. These agreements not only reaffirmed the core principles of the 1886 deed but also introduced key revisions, most notably, granting Tamil Nadu the right to generate hydroelectric power from the diverted waters, enhancing financial terms for Kerala, and updating lease provisions.

4.1. The 1886 Mullaperiyar Lease Agreement

The Mullaperiyar Lease Agreement, signed on October 29, 1886, represents a landmark accord between the Kingdom of Travancore and the British Government of India, formalized for the construction and operation of the Periyar Irrigation Works. The agreement was executed after nearly 24 years of protracted negotiations, reflecting the strategic importance of the Periyar River and its potential to support agricultural development in the arid regions of the Madras Presidency (present-day Tamil Nadu).

The indenture was signed on behalf of the Kingdom of Travancore by Dewan V. Ram Iyengar, under the authority of Maharaja Visakham Thirunal Rama Varma, and by J.C. Hannington, the State Secretary of the Madras Presidency, on behalf of the British Secretary of State for India. The lease was made retrospectively effective from January 1, 1886. The Maharaja of Travancore, who reportedly signed the agreement under pressure after resisting it for more than two decades, is

believed to have remarked, “I am signing this agreement with my blood.” This statement reflects the political sensitivity and perceived unfairness of the arrangement.

Under the terms of the agreement:

- A total of 8,000 acres of land was leased to the British Government for the project, with an additional 100 acres provided subsequently.
- The lease was granted for a period of 999 years, with a provision for renewal for another 999 years.
- An annual rent of five rupees per acre was stipulated, amounting to ₹40,000 per annum, payable to the Travancore State. This sum was to be deducted from the annual tribute owed by Travancore to the British Government.
- The agreement conferred full rights, authority, and exclusive control to the Secretary of State for India over the construction, maintenance, and operation of irrigation works, including the dam, reservoirs, tunnels, canals, and associated infrastructure within the leased area.

This lease facilitated the diversion of water from the west-flowing Periyar River, located in present-day Kerala, to the Vaigai basin in Tamil Nadu for irrigation purposes.

4.2. The 1970 Supplemental Agreements

In 1970, the original 1886 Mullaperiyar Lease Agreement was formally amended through a supplementary agreement executed between the States of Kerala and Tamil Nadu. A key provision of this amendment was the ratification of the Periyar Hydroelectric Project, with retrospective effect from 1954, thereby regularizing Tamil Nadu’s power generation activities from the Mullaperiyar waters.

While the amendment upheld the lease period of 999 years as stipulated in the 1886 agreement, it explicitly removed the clause permitting a further 999-year extension, thereby limiting the lease to a single 999-year term. The revised agreement also introduced significant financial and administrative revisions, including:

- **Revision of Lease Rent:** The annual lease rent was increased from ₹5 to ₹30 per acre, resulting in a total payment of approximately ₹0.26 million per annum for 8,692.97 acres leased by Tamil Nadu.
- **Royalty for Power Generation:** Tamil Nadu was required to pay a royalty of ₹0.767 million per annum to Kerala for the hydroelectric power generated from the diverted Periyar waters.

- **Provision for Periodic Review:** The lease agreement incorporated a new clause for review of the lease rent every 30 years, allowing for adjustments in response to changing economic and administrative considerations.
- **Surrender of Fishing Rights:** As part of the revised terms, Tamil Nadu relinquished fishing rights over the Mullaperiyar reservoir, which were transferred to Kerala.

In addition to the annual lease rent and royalty payments, Kerala benefits from the presence of the Periyar Lake, which has become a prominent site for wildlife tourism, contributing to the state's ecological and economic value.

5. Committees and commissions

The Periyar River basin, a critical water resource in South India, has been the subject of numerous issues, ranging from inter-state water sharing and dam safety to severe environmental pollution. To address these multifaceted challenges, various committees and commissions have been established over the years, often under the direct mandate of India's judiciary. These bodies play a crucial role in studying issues, mediating disputes, and recommending or overseeing remedial measures, reflecting the persistent efforts to balance developmental needs with environmental protection and public safety in the basin. Multiple committees and commissions have been constituted to address specific issues within the Periyar basin, primarily focusing on the Mullaperiyar Dam dispute and, more recently, on the escalating problem of river pollution.

5.1. Expert Committee under Member (D&R), CWC (June 2000)

Formed following a Supreme Court directive on April 28, 2000, this committee was tasked with studying the safety of the Mullaperiyar Dam in light of strengthening measures undertaken by Tamil Nadu and advising on raising the reservoir's water level beyond 136 ft. Its March 2001 report opined that the water level could be raised from 136 ft to 142 ft without endangering dam safety, with further raising to 152 ft to be considered after balance strengthening measures were implemented.

5.2. Kerala Legislature's Environment Committee (2007 and 2008):

This committee published reports specifically on Periyar River pollution. These reports highlighted industrial and domestic pollution sources, ecological impacts, and recommended measures for pollution control and sustainable river management.

5.3. Committee for Monitoring Seepage (Suggested by CWC, April 28, 2008)

The Central Water Commission (CWC) proposed a nine-member committee, headed by a CWC Chief Engineer and including representatives from both Kerala and Tamil Nadu, to monitor seepage as a critical indicator of the Mullaperiyar Dam's integrity. However, a consensus on such a monitoring mechanism could not be achieved between the states.

5.4. Government of Kerala constituted Expert Committee (May 2009)

This committee suggested mapping of the underwater area, installing a highly sensitive computer-operated seismograph, and constructing a new dam downstream of the existing Mullaperiyar Dam. The committee also opined that the existing dam had deteriorated to such an extent that no rectification work could salvage it to a safe condition.

5.5. Empowered Committee on Mullaperiyar Dam (April 30, 2010)

Constituted by the Union Government following a Supreme Court directive on February 18, 2010, this high-level, five-member committee was chaired by former Chief Justice of India, Justice A. S. Anand. Its mandate was comprehensive, encompassing all issues related to the dam's safety and storage level, including legal and constitutional dimensions of the dispute. The committee submitted its report on April 23, 2012, concluding that the Mullaperiyar Dam is hydrologically safe and suggesting that Kerala's proposal to build a new dam required reconsideration. It also presented alternative solutions, such as strengthening the existing dam. The Supreme Court extended the term of this committee by a further six months from October 30, 2010.

5.6. Committee appointed by the Kerala State Pollution Control Board (March 2014)

The KSPCB formed this committee to study the fish kill issue in the Periyar River and report its findings to the Government. Dr. S. Bijoy Nandan was entrusted with the study. The study found that the Eloor-Edayar stretch was severely polluted, with restricted water flow due to the Pathalam bund closure causing pollutant accumulation and low dissolved oxygen levels. Toxic sludge deposits in the riverbed created “dead zones,” severely impacting aquatic life. To address these issues, the committee recommended establishing a Periyar River Monitoring Authority to oversee river health and coordinating pollution control efforts, along with implementing effluent treatment facilities for small and medium industries in the Aluva-Kalamassery area to prevent further discharge of untreated industrial waste.

5.7. Supervisory Committee on Mullaperiyar Dam (Constituted July 1, 2014)

Approved on June 18, 2014, and officially constituted on July 1, 2014, this three-member committee was established by the Union Government as directed by the Supreme Court. It is tasked with overseeing all matters concerning the Mullaperiyar Dam, including supervising the restoration of the Full Reservoir Level (FRL) to 142 ft. Its mandate includes periodic inspections, especially before and during monsoon, to keep a close watch on dam safety and recommend necessary measures to be carried out by Tamil Nadu. The committee is empowered to issue directions to both states in emergent situations. Its office is located in Kumily, Kerala, with Tamil Nadu bearing all its expenses.

5.8. Joint Biodiversity Management Committee (Formed 2017)

This collaborative body unites local authorities along the Periyar River, focusing on biodiversity conservation, controlling invasive species like water hyacinth, and promoting sustainable resource use under the Biological Diversity Act, 2002.

5.9. Sub-Committee under the National Disaster Management Authority (NDMA) (March 12, 2018)

Formed as per a Supreme Court judgment dated January 11, 2018, this sub-committee operates under the National Executive Committee of NDMA. Chaired by the Secretary, Ministry of Water Resources (MoWR), its purpose is to monitor measures for ensuring high-level preparedness to face any disaster related to the Mullaperiyar Dam. The Supreme Court explicitly stated that the formation of this sub-committee does not imply any doubt about the dam's safety or lifespan.

Supervised Committee constituted by the National Green Tribunal (2018): This five-member committee, including officials from CPCB, NEERI, SEIAA, and the District Magistrate's representative, conducted detailed studies of river water and sediments in the polluted stretch of the Periyar River. It found no significant heavy metal or chemical pollution in the river.

5.10. Special Committee by the Kerala State Pollution Control Board (January 21, 2019)

Ordered by the National Green Tribunal, this committee was established by the Pollution Control Board to prepare an action plan for the remediation of pollution in the Periyar River, utilizing available funds.

5.11. High-Level Monitoring Committee (Chief Secretary, Kerala) (May 27, 2022)

The National Green Tribunal (NGT) directed the Chief Secretary of Kerala to immediately constitute this committee, comprising four Additional Chief Secretaries (Environment, Local Self-government, Irrigation/Water Resource, and Finance), with the Environment ACS as coordinator. This committee was tasked with restoring the water quality of the Periyar River, ensuring that all concerned industries adopt Zero Liquid Discharge (ZLD), and taking remedial action against defaulting entities. A one-year timeline was set for completing action plans, and the NGT emphasized maintaining a minimum environmental flow of 15-20%.

5.12. Kerala High Court–Constituted Expert Committee on Pollution (June 2024)

Responding to petitions over a mass fish-kill in the Periyar, the Kerala High Court formed this expert committee. Led by the State Environment Secretary and including representatives from CPCB and KSPCB, it was tasked with inspecting the river (particularly the Eloor–Edayar industrial belt) and recommending measures to curb toxic effluents.

5.13. Kerala High Court–Constituted Committee on Fish Kill Incidents (June 2024)

Also formed by the High Court in June 2024, this committee comprises officers from the State and Central Pollution Control Boards to investigate fish kill incidents in the Periyar River and recommend preventive strategies.

5.14. High Level Committee (Kerala High Court, prior to March 2025)

The Kerala High Court had previously constituted a High-Level Committee to address ongoing pollution issues in the Periyar River. The Court emphasized that all requirements of this committee must be promptly addressed by relevant government departments, local bodies, the Kerala Pollution Control Board, and industries. Its report in January 2025 detailed recommendations for industrial effluent standards, online monitoring, and urban sewage controls.

5.15. New "Permanent Supervisory" (Monitoring) Committee (NDSA Chief) (January 2025)

The Union Government formally transferred Mullaperiyar's safety oversight to the National Dam Safety Authority (NDSA) and dissolved the 2014 Supreme Court committee. This new seven-member panel is chaired by the NDSA Chief and includes additional chief secretaries of Kerala and Tamil Nadu, senior irrigation officials, and technical experts. It has a mandate to cover all safety and maintenance issues for the dam.

5.16. State Level and District Level Monitoring Committees (Kerala Government, March 2025)

The Kerala government constituted a two-level monitoring system to tackle pollution in the Periyar. The State Level Committee, chaired by the Chief Secretary, includes representatives from various departments. District-level committees, headed by district collectors in Ernakulam, Idukki, and Thrissur, focus on localized pollution issues. However, the Kerala High Court found these new committees "unnecessary" given its existing High-Level Committee and directed them not to commence operations without further court order, emphasizing the need for a more "powerful Authority".

5.17. Apex Committee (Integrated River Basin Management Plan) (2025)

As part of the Integrated River Basin Conservation and Management Plan notified by the Kerala Government, an Apex Committee chaired by the Chief Minister and several subordinate committees have been constituted. These bodies are tasked with preparing and implementing multi-year action plans for each basin and ensuring compliance with prior court and PCB directives.

The proliferation of committees and commissions in the Periyar basin underscores the persistent and complex challenges related to water resource management and environmental degradation. Historically, the focus has been on the Mullaperiyar Dam, with various expert and empowered committees repeatedly affirming its safety (at least up to 142 ft FRL) despite Kerala's consistent apprehensions and attempts to legislate water levels. These judicial pronouncements and committee findings have consistently prioritized technical assessments over political or speculative concerns, largely supporting Tamil Nadu's right to utilize the dam's waters as per existing agreements. More recently, judicial intervention, particularly from the National Green Tribunal and the Kerala High Court, has shifted attention to the severe pollution of the Periyar River, leading to the formation of committees aimed at assessing pollution sources, enforcing environmental norms like Zero Liquid Discharge (ZLD), and proposing comprehensive remediation plans. The judiciary has frequently expressed dissatisfaction with the pace of implementation, emphasizing the need for robust, permanent authorities with executive powers to ensure compliance and effective long-term conservation, rather than just ad-hoc monitoring bodies. This evolution reflects an ongoing struggle to transition from reactive dispute resolution to proactive and integrated management of the Periyar River basin.

6. Reports and Studies

The prolonged dispute over the Mullaperiyar Dam has generated a wealth of significant reports and studies, creating a complex narrative centered not on water allocation, but on the structural integrity of an over-century-old dam. The conflict's origins are rooted in the 1886 Periyar Lake Lease Agreement, a colonial-era document whose continued validity has been a central point of legal contention. The technical debate over the dam's safety gained prominence after 1979, prompting a series of assessments from various expert bodies. This has led to a "battle of reports" involving initial studies by the Central Water Commission (CWC), contrasting findings from institutions like the Indian Institutes of Technology (IITs) commissioned by the State of Kerala, and extensive investigations by a high-powered Empowered Committee (EC) appointed by the Supreme Court in 2010. The detailed findings and technical specifics of these pivotal reports, which form the evidentiary backbone of the legal and political dispute, will be further elaborated in the subsequent sections.

6.1. Studies on Foundational Agreements

The foundational agreements governing the Mullaperiyar Dam are the 1886 Periyar Lake Lease Agreement and the supplemental agreements of 1970. These documents establish the legal basis for the dam's construction, operation, and water diversion rights. The validity and interpretation of these agreements have been central to the dispute and consistently upheld by the Supreme Court. For a detailed description of the terms of these agreements, see Section 4.

6.2. Reports on Dam Safety and Structure

The structural safety of the Mullaperiyar Dam has been the subject of multiple expert assessments with conflicting conclusions, forming the technical core of the dispute. For a detailed historical account of the events leading to these studies and the resulting legal actions, see Section 3.2.

The primary technical reports and their key findings are summarized below:

- **Central Water Commission (CWC) Reports:** Initial reviews by the CWC led to recommendations for strengthening measures. The CWC concluded that upon completion of these measures, the water level could be safely raised to 142 ft, and eventually to 152 ft.
- **IIT Delhi and IIT Roorkee Studies (Commissioned by Kerala):** These studies contradicted the CWC's findings. IIT Delhi concluded the dam was hydrologically unsafe for the Probable Maximum Flood (PMF), while IIT Roorkee found it structurally unsafe

to withstand potential earthquakes in the region. Based on these findings, both studies recommended urgent strengthening and rehabilitation measures for the dam, the implementation of advanced flood management protocols, and continuous structural monitoring to ensure long-term safety.

- **Empowered Committee (EC) Report (2012):** Appointed by the Supreme Court, the EC conducted a comprehensive investigation and concluded the dam was hydrologically, seismically, and structurally safe. It found that lime leaching and seepage were within acceptable limits and that the dam could withstand the PMF and relevant seismic events, supporting the raising of the water level to 142 ft.

Dam Break and Consequence Analysis: Studies projecting the impact of a potential dam failure highlight the catastrophic risk for downstream populations. A breach could release approximately 316.5 million cubic meters of water, overwhelm the Idukki reservoir and threaten a cascading failure with devastating consequences for central Kerala (George et al., 2022; Binny, 2018). These conflicting technical assessments underscore the gap between official safety assurances, as affirmed by the Empowered Committee and the Supreme Court, and the persistent public anxiety in downstream regions.

6.3. Reports on Hydrology and Environment

The Periyar river basin, an integral part of Kerala's geography, is the site of the Mullaperiyar Dam, a structure whose hydrological and environmental impacts have been intensely debated. The Periyar River, the longest in Kerala at 244 km, originates in the Sivagiri hills of the Western Ghats and flows through the Idukki and Ernakulam districts before reaching the Arabian Sea (Government of Kerala, 2011a; Thatheyus et al., 2013).

Rainfall patterns and water yield in the basin are significant. The dam area is situated in a high rainfall zone, receiving a mean annual rainfall of 2420 mm (based on data from 1916-1976) (Government of Kerala, 2011a). The region is predominantly influenced by the South-West monsoon from June to August. The 75% dependable runoff from the dam's catchment is approximately 21 TMC (thousand million cubic feet), based on data from 1910-2005. Despite varying water levels, approximately 93% of this dependable yield (around 19.5 TMC out of 21 TMC) is reportedly diverted to Tamil Nadu even with the reduced Full Reservoir Level (FRL) of 136 ft (Government of Kerala, 2011a).

Regarding water flow and flood management, studies have presented differing conclusions on the dam's hydrological safety and the Probable Maximum Flood (PMF). The Central Water Commission (CWC), in 1986, estimated the PMF at 2.12 lakh cusecs (6003 cumecs) (Mohan et al., 2015). However, Kerala contested this, asserting that the observed flood in 1943 was 2.98 lakh cusecs, suggesting the CWC's estimation was an underestimation (Thatheyus et al., 2013; Mohan et al., 2015; Pushkaran Jayanthi). Studies commissioned by Kerala from the Indian Institute of Technology (IIT) Delhi explicitly concluded that the Mullaperiyar Dam was hydrologically unsafe for passing the PMF (Government of Kerala, 2011a; Ministry of Water Resources, 2015), determining the PMF value to be higher at 8676 cumecs (3.064 lakh cusecs). In contrast, the Empowered Committee (EC), in its 2012 report, aligned with the CWC's assessment, finding the dam hydrologically safe and accepting the 2.12 lakh cusecs (6003 cumecs) PMF. The EC determined that the spillway could safely pass this flood, even at an FRL of 142 ft, with a transient Maximum Water Level (MWL) reaching 153.47 ft (or 154.10 ft if one gate was inoperative) (Empowered Committee, 2012; Mohan et al., 2015). The EC also deemed Kerala's dam-break flood projections as "conjectural" due to a lack of computational basis (Supreme Court Reports, 2014).

The Periyar river basin is also ecologically sensitive, home to the Periyar Tiger Reserve, recognized as a biodiversity hotspot and Kerala's oldest sanctuary (Mohan et al., 2015). Environmental organizations like the Mullaperiyar Environmental Protection Forum (MEPF), supported by Kerala, have raised concerns that raising the dam's water level beyond 136 ft would adversely affect the biodiversity, including large herbivores, carnivores, and amphibians, by submerging vital habitats like grassy areas, marshlands, swamps, and forests. They also pointed to the primitive construction techniques and structural stress of the over 100-year-old dam as threats. Conversely, Tamil Nadu argued that only a minimal area of 11.2 km² (1.44% of the total reserve) would be submerged, and that a higher water level would, in fact, benefit the wildlife by promoting greenery and a healthier ecological environment (Mohan et al., 2015). The Supreme Court, in its 2006 judgment, sided with Tamil Nadu's perspective, concluding that raising the water level would "not affect the flora and fauna" and would even lead to "improvement in the environment," making elephants and tigers "happier". This finding was largely based on the Expert Committee's report (Mohan et al., 2015).

Beyond the dam itself, the general health of Kerala's river ecosystems has been a concern. Many of its monsoon-fed rivers tend to dry up during summer (Binny, 2018). Reports indicate

widespread pollution from industrial and domestic wastes, pesticides, and fertilizers, with the Periyar and Chaliyar rivers being specific examples of industrial effluent contamination. Bacteriological contamination is also prevalent due to solid waste dumping and bathing. Furthermore, deforestation in the Western Ghats has reduced water retention capabilities.

6.4. Studies on Governance and Policy

The Mullaperiyar Dam dispute serves as a significant case study in India's inter-state water governance, primarily because its core contention is not water allocation but rather the safety of an over-century-old dam (Pushkaran Jayanthi). Academic and policy analyses highlight how this dispute reveals inherent challenges within India's legal and constitutional frameworks for managing shared water resources. While the Indian Constitution grants States exclusive power over water supplies and irrigation, the Union Parliament holds authority over inter-state rivers and river valleys (Bhatia et al., 2012). However, the Periyar River, though predominantly flowing through Kerala, was deemed an inter-State River by the Supreme Court because a small portion of its catchment area, approximately 114 sq km, falls within Tamil Nadu's territory (Supreme Court Reports, 2014; Mohan et al., 2015).

Despite the inter-state classification, the Supreme Court maintained its jurisdiction, reasoning that the dispute was primarily about the dam's safety, not a "water dispute" as defined by the Inter-State River Water Disputes Act, 1956. This jurisdictional ambiguity exposed the inadequacy of existing legal frameworks which are largely limited to adjudication for inter-state water conflicts and lack comprehensive strategies for dam safety issues (Pushkaran Jayanthi). Kerala's legislative attempt in 2006 to fix the dam's Full Reservoir Level (FRL) at 136 ft through an amendment to the Kerala Irrigation and Water Conservation Act was declared unconstitutional and ultra vires by the Supreme Court. The Court ruled that this act amounted to an "usurpation of judicial power," as a legislature cannot nullify a final judicial judgment without altering its fundamental legal basis (Supreme Court Reports, 2014; Mohan et al., 2015). Furthermore, the original 1886 lease agreement, which granted Tamil Nadu rights to the dam for 999 years, despite its colonial origins and Kerala's arguments of its invalidity, was consistently upheld as valid and binding by the Supreme Court, reinforced by supplemental agreements from 1970. This legal rigidity, combined with decisions based on often contested technical evaluations from different expert bodies like the Central Water Commission (CWC) and Indian Institutes of Technology (IITs), has complicated resolution efforts.

Media narratives and public campaigns have played a significant role in influencing both the political and legal proceedings of the Mullaperiyar dispute. Concerns about the dam's safety first surfaced in the Kerala press in 1979, following reports of damage (Ministry of Water Resources, 2015; Pushkaran Jayanthi). These fears were amplified after the 1979 Machhu II dam failure in Gujarat and a local earthquake, leading to widespread public anxiety (Sreejith S. G., 2022). In Kerala, an "anti-dam lobby" and groups like the Mullaperiyar Environmental Protection Forum (MEPF) and Mullaperiyar Samara Samithi vociferously argued that the dam, constructed with "now-antiquated techniques" and already serving for over 100 years, posed a significant threat to lives in downstream districts due to potential collapse or earthquake vulnerability (Empowered Committee, 2012; Mohan et al., 2015; Sreejith S. G., 2022). They actively campaigned through protests, hunger strikes, and memoranda to the Prime Minister, demanding the dam's decommissioning and the construction of a new one. The Kerala State Legislature's controversial 2006 Amendment Act, which sought to limit the water level, was a direct response to this intense public pressure and perceived safety concerns (Empowered Committee, 2012; Mohan et al., 2015).

Conversely, Tamil Nadu's public campaigns and political narratives have consistently called for the restoration of the dam's water level to its original capacity, citing the vital need for irrigation in its drought-prone southern districts (Thatheyus et al., 2013; Supreme Court Reports, 2014). Tamil Nadu's political parties have exerted pressure through hunger strikes, economic blockades, and restrictions on inter-state traffic, emphasizing their dependence on Mullaperiyar water for the livelihood of millions of farmers and citizens. The dispute has become a "sensitive issue" where emotions are "exploited by politicians according to their whims and fancies". This politicisation, fuelled by a "lack of risk communication to the public coupled with trust deficit between the states," has led to "hysterical public responses on both sides" and has directly propelled the prolonged legal battles in the Supreme Court (Pushkaran Jayanthi). The Court, while acknowledging the deep fears, has been criticized for its "reluctance to engage with ideas alternative to the sustenance of the Dam" and for its "dam analytic," which appears to prioritize developmental aspirations, thereby prolonging the resolution and leaving "concerns" that "will not die away soon" (Mohan et al., 2015; Sreejith S. G., 2022). Ultimately, the Mullaperiyar dispute illustrates how a complex technical and legal challenge can be exacerbated by entrenched political interests and amplified public sentiments, creating a "Sword of Damocles" for the downstream population, where scientific findings become battlegrounds and public safety is debated in courtrooms.

7. Landmark Judgements

The Periyar River basin has been the subject of several significant legal judgments, particularly concerning the Mullaperiyar Dam and environmental pollution. These landmark rulings highlight ongoing disputes over water management, dam safety, inter-state rights, and environmental protection. Here are the key judgments impacting the Periyar basin:

7.1. Mullaperiyar Environmental Protection Forum v. Union of India, 27 February 2006

Citation: AIR 2006 SUPREME COURT 1428, 2006 (3) SCC 643

This judgment permitted the water level of the Mullaperiyar Dam to be raised to 142 feet based on expert safety assessments. For a full discussion of the case context and arguments, see Section 3.2.

7.2. State of Tamil Nadu v. State of Kerala, 7 May 2014

Citation: AIR 2014 SC 2407, (2014) 12 SCC 696

This judgment declared the Kerala Irrigation and Water Conservation (Amendment) Act, 2006, unconstitutional and permitted Tamil Nadu to raise the water level to 142 feet. For a full discussion of the case context and arguments, see Section 3.2.

7.3. Russel Joy v. Union of India & Ors., 11 Jan 2018

Citation: AIR 2018 SC (Supp) 127, (2018) 3 SCC 179.

Background: Petition by a public-spirited individual (Russel Joy) seeking orders to decommission the 126-year-old Mullaperiyar Dam or to appoint experts to study its remaining lifespan, on grounds of perceived risk to downstream populations.

Highlights:

- The Supreme Court refused to order decommissioning. It observed that existing disaster-management measures “does not anyway remotely suggest any doubt about the safety or life span of the dam,” contrary to the petitioner’s allegations. The Court noted that the writ petition raised speculative fears but gave no ground for urgent action. Ultimately the petition was disposed of with no directions and no costs. In effect, the Court left the dam

in operation under previously mandated safeguards, without ordering any new study or shutdown.

7.4. National Green Tribunal (NGT) on Periyar River Pollution, significant order on May 27, 2022

Citation: Original Application No. 395 of 2013 (SZ)

Background: These applications address the persistent and serious pollution of the Periyar River across three districts of Kerala (Idukki, Ernakulam, and Thrissur) from various sources, including untreated sewage, industrial effluents, solid waste, slaughterhouse waste, biomedical waste, and plastic. A key concern was the failure to maintain minimum environmental flow in the river, contributing to pollution.

Highlights:

- The NGT expressed strong concern over the "utter lack of concern" for continuing pollution despite 15 years of proceedings in the Kerala High Court and the Tribunal.
- It cited the Supreme Court's judgment in *Paryavaran Surksha Samiti v. Union of India* (2017), which set a deadline of March 31, 2018, for the treatment of polluted water by local bodies and industries, and directed prosecution for non-compliance.
- The Tribunal directed the Chief Secretary, Kerala, to immediately constitute a high-level monitoring committee comprising four Additional Chief Secretaries (Environment, Local Self-government, Irrigation/Water Resource, and Finance).
- This committee was tasked with restoring the water quality of the Periyar River, ensuring that all concerned industries in the catchment area adopt Zero Liquid Discharge (ZLD), and taking remedial action against defaulting industries, individuals, and local bodies.
- A one-year timeline was set for the committee to complete the execution of action plans.
- The NGT emphasized the need to maintain a minimum environmental flow of 15-20% of the average lean season flow in the river to prevent pollution.

7.5. High Court of Kerala on Periyar River Pollution, March 14, 2025

Citation: W.P.(C) No. 31236 of 2023(S)

Background: This writ petition and connected cases deal with ongoing pollution in the Periyar River, including specific concerns like excavation work in Kuzhikandom Creek and the discharge of sewage and industrial waste. The court had previously constituted a High-Level Committee to address these issues.

Highlights:

- The High Court reiterated that every requirement of its previously constituted High Level Committee must be promptly addressed by all relevant government departments, local self-government institutions, the Kerala Pollution Control Board, and private and government industries within the specified timeframes.
- While acknowledging the government's formation of new two-level monitoring committees, the Court stated these were "unnecessary" given the existing High-Level Committee and directed them not to commence operations without further court order.
- The Court emphasized its intent to create a "powerful Authority for River Periyar" with immediate and swift action capabilities, rather than merely monitoring committees.
- The Court expressed disappointment that the Union Government had not yet filed pleadings regarding decisions on Kerala's communications, directing compliance by the next hearing date.

8. Legal Constrains Among Authorities (Legal Challenges across departments, Kerala)

Even though there are no explicit legal constraints among the different line departments of the state, several institutional challenges hinder their effective collaboration. One of the major challenges is the lack of effective co-ordination among the various water related departments, agencies, Non-Governmental Organizations (NGOs) and Local Self-Governments (LSGs). There is a widely shared concern that the present institutional mechanisms may not be able to address the challenges in the area of water management, especially in the context of climate change, frequent occurrence of hydrologic extremes, pollution and ecosystem degradation threats. Lack of co-ordination among different water and river basin related line departments and the lack of engagement from stakeholders further restricts the effectiveness of water governance (Kerala Planning Board, 2022; Padikkal et al., 2021). Given the series of successive extreme rainfall events, the Government of Kerala formed a committee to analyze the reasons behind successive extreme heavy rainfall events, follow-up floods, and landslides and suggest suitable policy actions. The scientific facts presented by the committee highlighted that the current policies and institutional

arrangements are inadequate to reduce the effects of EREs. On a positive note, the suggestions of the scientific community for effective disaster management during EREs were taken into account by the Government of Kerala to take the necessary measures towards establishing a climate-resilient society (Sudheer et al., 2023). Another significant intervention of the Government of Kerala is the establishment of a multilayered governance structure with diverse priorities for water resource management. A governing authority for ensuring equitable, sustainable distribution and utilization of water resources has been established by the Government of Kerala. The authority, "River Basin Conservation and Management Authority," is to decide the policy to give top priority to water distribution and make integrated river basin management master plans for every river system in consultation with all concerned stakeholders.

Another major institutional issue is that many reservoirs in Kerala are not managed in accordance with scientific guidelines or schedules for water releases, rotational supply, or the roster system suggested by the Central Water Commission (CWC). The efficiency of irrigation utilizing water from storage reservoirs is quite low, with an estimated usage rate of just about 30 percent (Kerala Planning Board, 2022). However, following the EREs of 2018 and 2019, the KSEBL and Kerala Water Resources Department (KWRD) revised the rule curves of the dams operated by them for better management of flood situations. Also, the KSEBL prepared Emergency Action Plans (EAP) for their dams following the guidelines of the Central Water Commission (CWC) (Sudheer et al., 2023).

Hydroelectric projects in Periyar and other rivers does not always consider downstream needs including water quality, the drinking water needs of the coastal regions, and ecosystem services. Competing demands for drinking water, irrigation, fisheries, and tourism often lead to conflicts in water usage. Upstream water utilizing pattern typically do not take into account the effects on downstream areas. It is necessary to tackle these issues scientifically, utilizing reliable data to ensure the sustainable management of water resources (Kerala Planning Board, 2022).

The catastrophic floods in 2018 and 2019 were marked as critical turning point in Kerala's water Governance. The Post Disaster Needs Assessment (PDNA) study, conducted with the assistance from UN agencies underscored the urgent need for an IWRM Plan and also highlighted the absence of an institutional framework for integrated management in Kerala and that led to the proposal of establishing River Basin Conservation and Management Authority in Kerala (Kerala Planning Board, 2022; Padikkal et al., 2021).

9. Conclusions and Recommendations to overcome Legal Constraints

The Periyar River Basin serves as a prime example of the complex legal and institutional challenges involved in managing interstate water resources in India. The historical background of the 1886 lease agreement, subsequent legal interpretations, and the evolving relationship between Kerala and Tamil Nadu have solidified the Mullaperiyar Dam conflict as a persistent interstate concern. The central government and the Supreme Court have made significant efforts to resolve the issue. However, Tamil Nadu advocates for strengthening the existing dam and keeping water level at the full reservoir level, 142 ft. Meanwhile, Kerala continues to raise safety concerns and insists on constructing a new dam.

Despite the efforts made through legal agreements, law and committees, there are still ambiguous legal issues surrounding water entitlements, environmental issues, and institutional co-ordination. PDNA study, following the 2018 floods emphasized the absence of a cohesive institutional framework to address both developmental and ecological needs at the river basin scale. In response to this, the Government of Kerala suggested the establishment of the River Basin Conservation and Management Authority (RBCMA), as proposed in the 14th Five-Year Plan. The draft RBCMA Act, supported by the Resilient Kerala Program, aims to create a unified body for integrated river basin management. The authority should be empowered to oversee water allocation, dam safety, pollution control, and disaster response across state boundaries. It should also establish a coordinated team to integrate multiple agencies for effective river management, ensuring active participation of local communities particularly those directly affected by the dam in decision making, and implementing grievance redress mechanisms to address their concerns during planning and execution. Additionally, strengthening judicial oversight by empowering the Supreme Court's supervisory committee to enforce safety and environmental compliance through regular audits and inspections will ensure the integrity of the Mullaperiyar Dam and related infrastructure.

In the context of rising challenges posed by climate change, extreme hydrologic events (like floods and droughts), and growing water needs, it is crucial to strengthen the institutional collaboration supported by legal and policy reforms. A river basin-scale institutional framework with clear mandates, data-sharing protocols, collaborative planning strategies, and stakeholder engagement is urgently needed to overcome existing current obstacles and facilitate sustainable, equitable, and climate-resilient water management in Periyar River Basin. A centralized platform for real-time data on water levels, rainfall, and ecological indicators accessible to all stakeholders, including government agencies, local communities, and researchers will facilitate in informed decision-

making. Such an approach, underpinned by unbiased scientific data, transparent information dissemination, and multi-stakeholder participation, would pave the way for a more holistic, equitable, and sustainable resolution to the conflict, ensuring optimal utilization of water resources for the long-term benefit of both states.

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