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The Rule Curve We Ignore: How Full Dams Manufacture Floods

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GEOGRAPHY**GS1****GS3**

CURATED & WRITTEN BY

**Bharat Choudhary**

UPSC Educator & Content Creator

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GS1

GS3

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THE LIFT LINE

A flood cushion that has been quietly filled with water to sell more power and irrigation is no cushion at all, and when the rain comes the reservoir does not absorb the surge, it forwards it, turning a manageable inflow into a man-made flood downstream.

WHY THIS EDITORIAL MATTERS FOR YOUR EXAM

Floods are a recurring GS1 (geography, physical processes) and GS3 (disaster management) theme, but candidates usually write about rainfall and [encroachment](#) and stop there. The examiner increasingly wants the governance layer: how reservoirs are operated, who coordinates releases across states, and why a natural monsoon becomes a human-amplified disaster. This editorial gives you that scarce governance angle.

It also lets you connect a physical concept (storage and release) to institutional design (dam safety law and river basin authorities), which is exactly the kind of multi-dimensional answer that separates a top script from an average one.

GS Paper 1: important geophysical phenomena; the distribution of water resources; the monsoon system.

GS Paper 3: disaster and disaster management; conservation and management of water resources.

For **Prelims**, hold the specifics: the **rule curve** (the reservoir operation manual that prescribes the safe upper storage level for each date in the season) and the **flood cushion** (the volume deliberately kept empty to absorb inflows); the **Dam Safety Act, 2021** and the **National Dam Safety Authority (NDSA)**, with the National Committee on Dam Safety and State Dam Safety Organisations; the **River Boards Act, 1956**, under which no effective board was ever set up; and the **Central Water Commission (CWC)**, which issues flood forecasts. For **Mains**, argue that rule-curve discipline and empowered river basin coordination are the cheapest flood defences India is not using.

BACKGROUND AND CONTEXT

A large dam is meant to do two opposing jobs. Through the year it stores water for irrigation, drinking supply and hydropower, which rewards keeping the reservoir as full as possible. During the monsoon it is meant to hold spare emptiness, the flood cushion, so that a sudden burst of inflow can be absorbed rather than passed on. The **rule curve** is the instrument that reconciles these jobs: for each date it fixes the maximum level the reservoir may hold, rising slowly as the monsoon recedes so the cushion is available exactly when heavy rain is likeliest.

The incentive problem is structural. Storage has visible commercial value, water sold, crops irrigated, units generated, while the flood cushion has only insurance value that shows up on the rare bad day. Operators, often under revenue pressure, tend to fill above the rule-curve level before the monsoon peaks. When an intense spell then arrives, the reservoir has no room, and the only remaining option is a large, sudden release. India's difficult 2026 monsoon, which opened with one of the driest Junes on record before swinging to intense later spells, has again exposed how brittle this balance is.

THE CORE ARGUMENT / ISSUE

The revenue temptation versus the cushion

The core failure is not engineering but incentive. A rule curve is a promise to leave money on the table today so the town downstream is safe tomorrow. Because the cost of a full reservoir is invisible until disaster strikes, and the reward is immediate, operators repeatedly breach the curve. The flood is then blamed on the rain, when the proximate cause was a reservoir that was too full to help.

From cushion to catapult

Once a dam is over-filled and heavy inflow arrives, the physics is unforgiving. Gates must open fast to protect the dam's own structural safety, and the discharge can equal or exceed what a natural, dam-free river would have carried, arriving with less warning. A structure built to **attenuate** floods ends up sharpening the peak, especially where downstream communities are not warned in time or where multiple dams on a system release together without coordination.

ELEMENT	DESIGNED INTENT	WHAT GOES WRONG
Rule curve	Safe upper level for each date	Breached to store more, sell more
Flood cushion	Empty space to absorb inflow	Filled for revenue, cushion lost
Release	Gradual, forecast-led	Sudden, forced, to save the dam
Inter-state coordination	Basin-wide operation	Fragmented, no empowered river board
Warning	CWC forecast to public	Reaches communities late

The missing basin authority

India legislated the **River Boards Act, 1956** precisely so that inter-state rivers could be managed as single systems, yet no effective board was ever constituted, and water remains a fiercely guarded state subject. So a river that crosses three states is operated as three disconnected sets of dams. The **Dam Safety Act, 2021** created the NDSA and mandated emergency action plans, but its focus is structural safety and its operational-discipline teeth are still being tested. Real-time inflow forecasting by the **CWC** exists, but its outputs are only as useful as the willingness to act on them and pre-release water.

HOW TO THINK ABOUT THIS (ANALYTICAL FRAME)

Frame the problem as an **incentive mismatch between storage and safety**. Every reservoir sits on a knife-edge between two values that peak at different moments: commercial storage, valuable every ordinary day, and flood absorption, valuable only on the extreme day. A system that rewards the first and never prices the second will predictably run out of cushion. The policy task is to make rule-curve compliance non-negotiable and to move from reactive release to anticipatory, forecast-led drawdown, so the cushion is restored before the storm, not discovered missing during it. Ask of any flood: was this water that fell from the sky, or water that was released from a tank that should have been emptier?

THE DIAGRAM IN WORDS

Rule curve prescribes safe level -> but storage sells power and irrigation now, cushion pays only on the bad day -> operators over-fill before the monsoon peak -> intense rain arrives, no room left -> forced sudden release to save the dam -> downstream flood sharpened, not absorbed -> [resolution] enforce rule curves + CWC forecast-led pre-release + empowered river basin coordination -> reservoir absorbs the surge as designed

WAY FORWARD

- ① **Make the rule curve binding.** Convert reservoir operation manuals from advisory documents into auditable, enforceable schedules, with the NDSA empowered to penalise revenue-driven over-filling.
- ② **Shift to forecast-led operation.** Use CWC and modern inflow forecasting to pre-release water ahead of predicted heavy spells, restoring the flood cushion before the storm rather than emptying in panic during it.
- ③ **Coordinate the whole basin.** Operationalise empowered river basin authorities so that cascades of dams across state lines are operated as one system, ending fragmented releases.

- 4 **Warn and protect downstream.** Strengthen last-mile flood warnings and emergency action plans under the Dam Safety Act so that any necessary release reaches communities with real lead time.

PYQ LINKAGE AND PRACTICE

UPSC has asked on the drainage system and floods, on disaster management and the shift from relief to preparedness, and on inter-state water disputes and river management. This editorial supplies a precise, current mechanism, the rule curve and the flood cushion, that turns a general flood answer into a specific governance argument.

Practice question: “Many of India’s monsoon floods are amplified by how reservoirs are operated, not merely by rainfall.” Examine the role of rule curves, the flood cushion and inter-state coordination, and suggest reforms. (250 words, 15 marks)

Sources: CBIP: Reservoir management by rule curve, Down To Earth on India’s reservoir storage

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