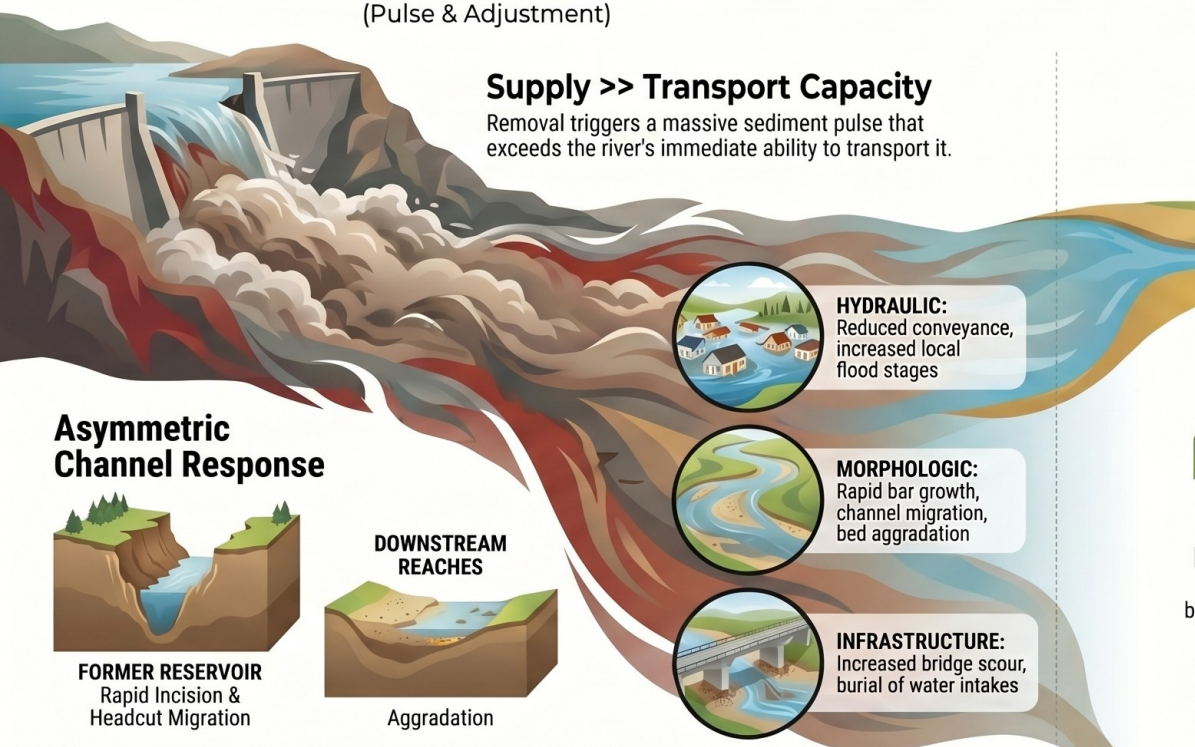
From Disturbance to Equilibrium: The Lifecycle of Dam Removal

THE DISTURBANCE PHASE
(Pulse & Adjustment)

Supply >> Transport Capacity
Removal triggers a massive sediment pulse that exceeds the river's immediate ability to transport it.



HYDRAULIC: Reduced conveyance, increased local flood stages

MORPHOLOGIC: Rapid bar growth, channel migration, bed aggradation

INFRASTRUCTURE: Increased bridge scour, burial of water intakes

Asymmetric Channel Response

FORMER RESERVOIR
Rapid Incision & Headcut Migration

DOWNSTREAM REACHES

Aggradation

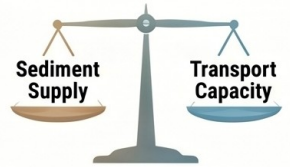
Multi-Scale Stabilization Timeline

Breach (HOURS)	Sediment Release (MONTHS)	Full Stabilization (YEARS)

While breaches take hours, sediment release lasts months and full stabilization requires years.

THE RECOVERY PHASE
(Guided Restoration)

Target: Dynamic Equilibrium
Restoration is successful when sediment supply approximately equals the river's transport capacity.



NATURAL PROCESSES

NATURAL PROCESSES
(Guided Balance)

STATIC CHANNEL GEOMETRY
(Forced Form)

Selective Intervention

BIOENGINEERING & GRADE CONTROL
(Critical Zones Only)

Use bioengineering or grade control only in critical zones to avoid "over-restoration"

Process-Based Over Form-Based Design
Engineers should guide natural processes toward balance rather than forcing a static channel geometry.

NATURAL RELEASE		Lowest Cost	Highest Downstream Risk
DREDGING		Maximum Control	Extremely Expensive
PHASED REMOVAL	 Time	Moderate Risk	High Operational Complexity