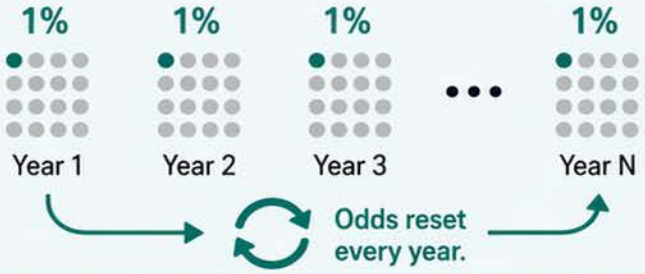
What a ‘100-Year Flood’ Actually Means

A 100-year flood is a flood with a 1% chance of occurring in any given year.

A 100-year flood can happen twice in a decade—or even in back-to-back years.

‘100-year’ refers to annual chance, not a fixed schedule.

Each year carries the same 1% chance. The odds **reset** every year.



Annual chance by flood type

10-year flood	= 10% annual chance
50-year flood	= 2% annual chance
100-year flood	= 1% annual chance
500-year flood	= 0.2% annual chance

Why this matters for policy

- informs floodplain management
- affects infrastructure and building decisions
- helps communicate risk more accurately to the public

KEY TAKEAWAY

A 100-year flood does not mean you are safe for the next 99 years.

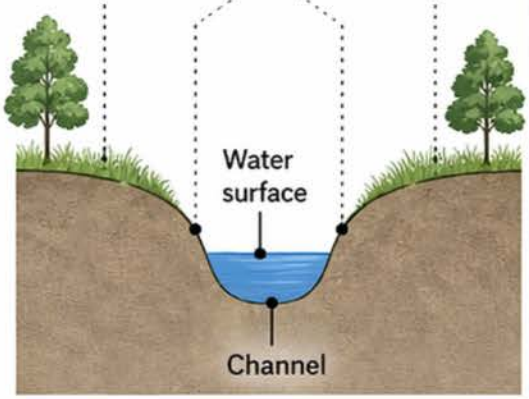
What Bankfull Flow Is and Why Rivers Spill Over

Bankfull flow is when water fills the river channel up to the top of its banks.

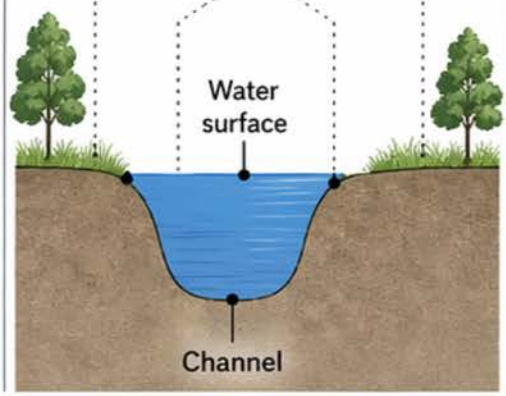
Overbank flooding happens when flow exceeds channel capacity and spreads onto the floodplain.

Rivers naturally rise and fall, and some overbank flow is a normal part of river behavior.

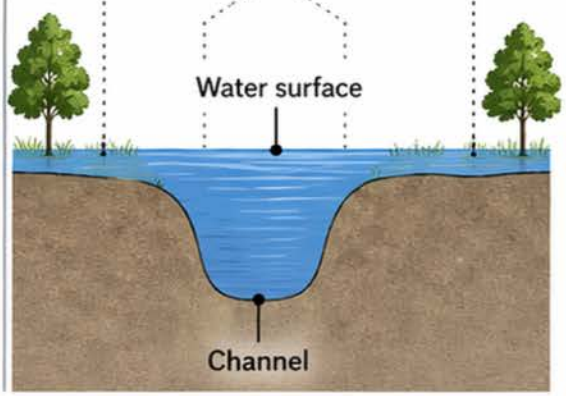
1 Low flow



2 Bankfull flow



3 Overbank flood



Bankfull flow is often close to the level where a river begins interacting strongly with its floodplain.

Not all flooding is catastrophic; some flooding is part of how rivers function.

Why rivers spill over

Heavy rainfall

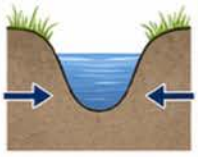
Intense or prolonged rain adds more water to the river system.

Snowmelt

Warming temperatures melt snow, sending large volumes of water downstream.

Runoff from the watershed

Water flows over land and through tributaries into the main river.



Channel limits

Every channel has a maximum capacity. When flow exceeds it, water spills over.

Why this matters for policy

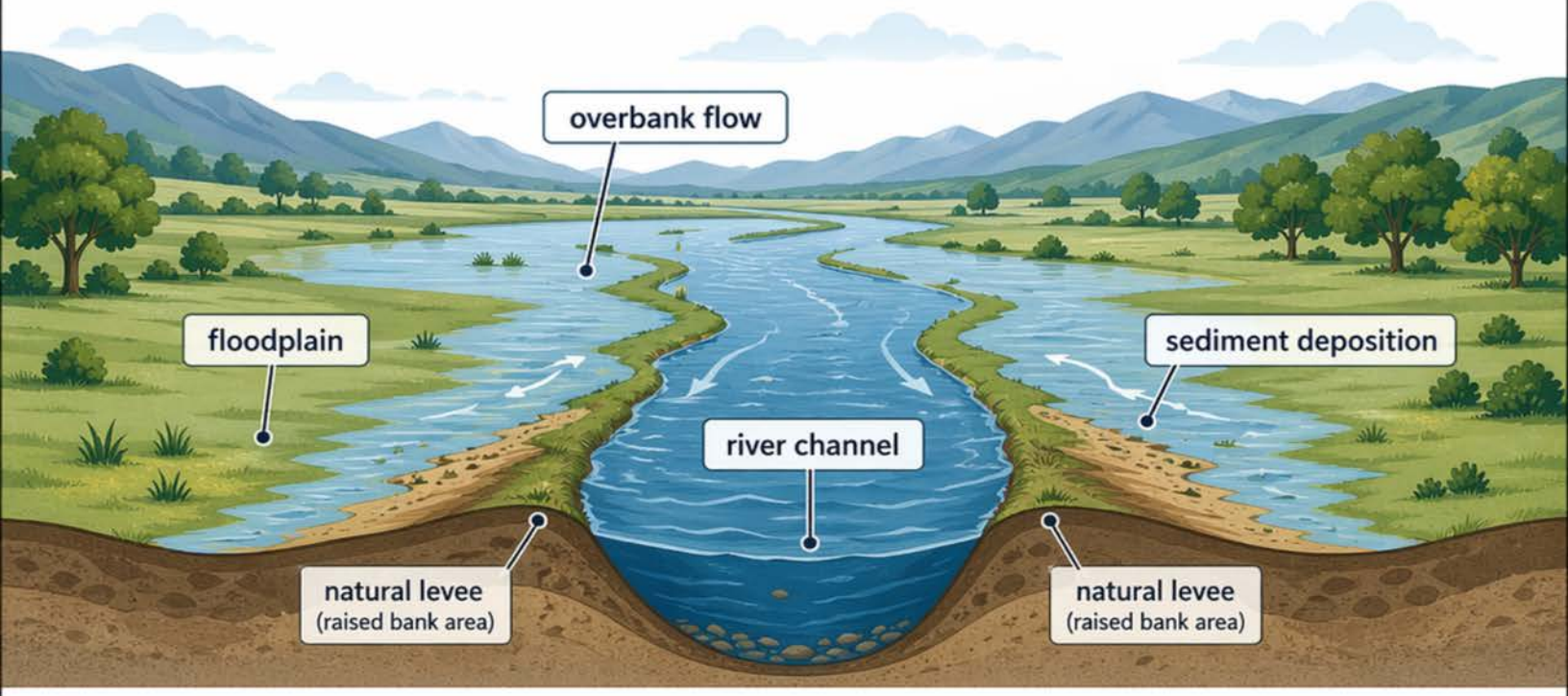
- helps explain where water naturally goes
- supports floodplain and infrastructure planning
- helps distinguish normal river processes from damaging flood events

Key takeaway

Rivers are designed to overflow sometimes; floodplains are part of the river system.

Why Floodplains Exist

Floodplains are not just empty land — they are part of how rivers work.

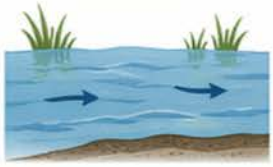


How floodplains form: a natural process

1. Rivers carry water and sediment

2. High flows spread beyond the channel

3. Water slows down on the floodplain



4. Sediment is deposited

5. Over time, a broad floodplain develops

What floodplains do

store floodwater temporarily

slow water down

deposit sediment

support ecosystems

Why this matters for policy

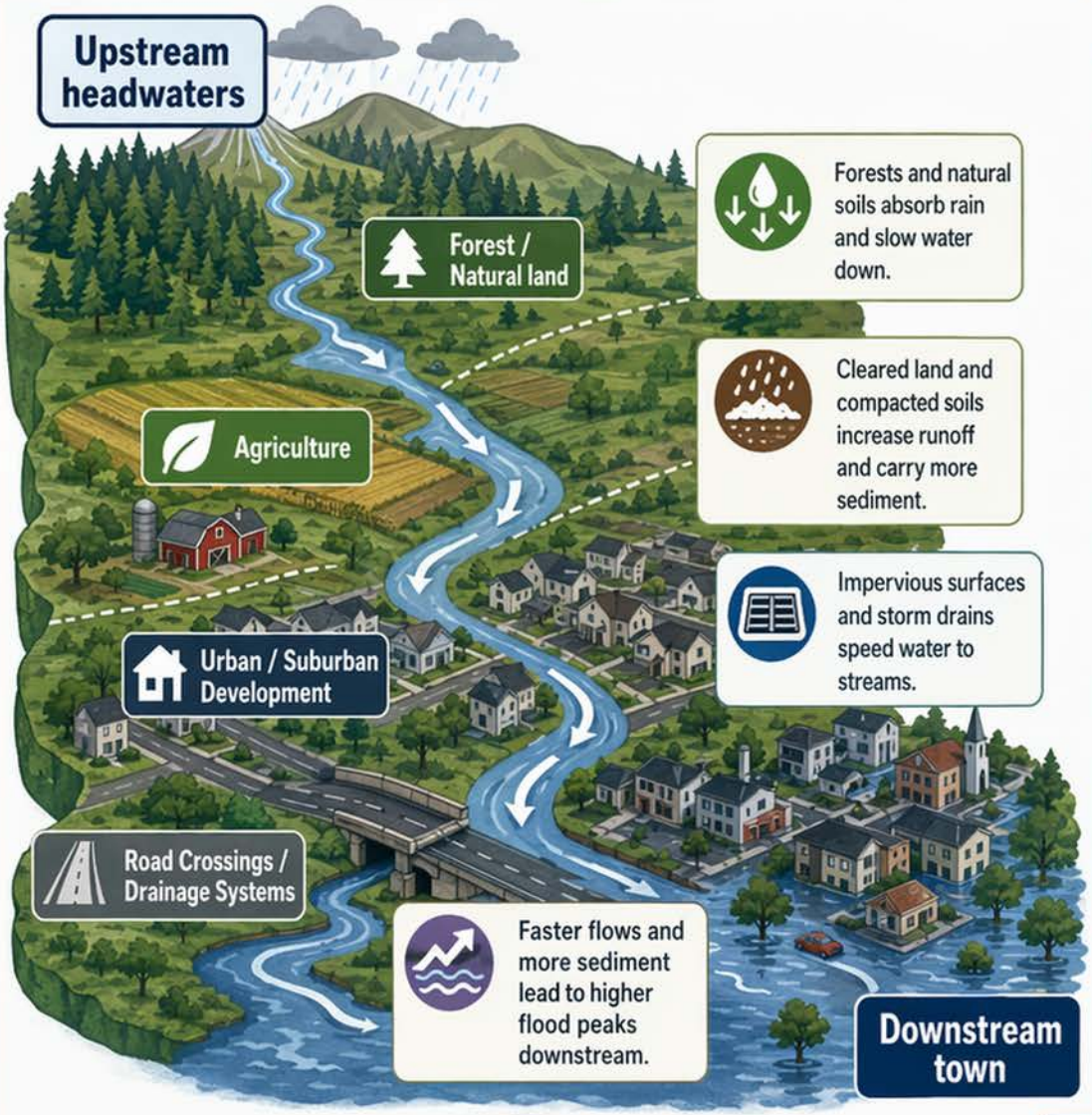
- floodplains help reduce pressure on the channel
- development in floodplains can increase damage when floods occur
- floodplain management is a land-use decision as much as a hazard issue

KEY TAKEAWAY

Floodplains exist because rivers naturally need room to spread out.

How Upstream Land Use Changes Downstream Flooding

Flooding is shaped by what happens across the watershed, not just at the place that floods.



What changes upstream?

- less vegetation
- more compacted soil
- more drainage infrastructure
- more sediment delivery
- faster runoff

More natural watershed

slower runoff | more infiltration

VS.

More altered watershed

faster runoff | higher flood peaks

Why this matters for policy

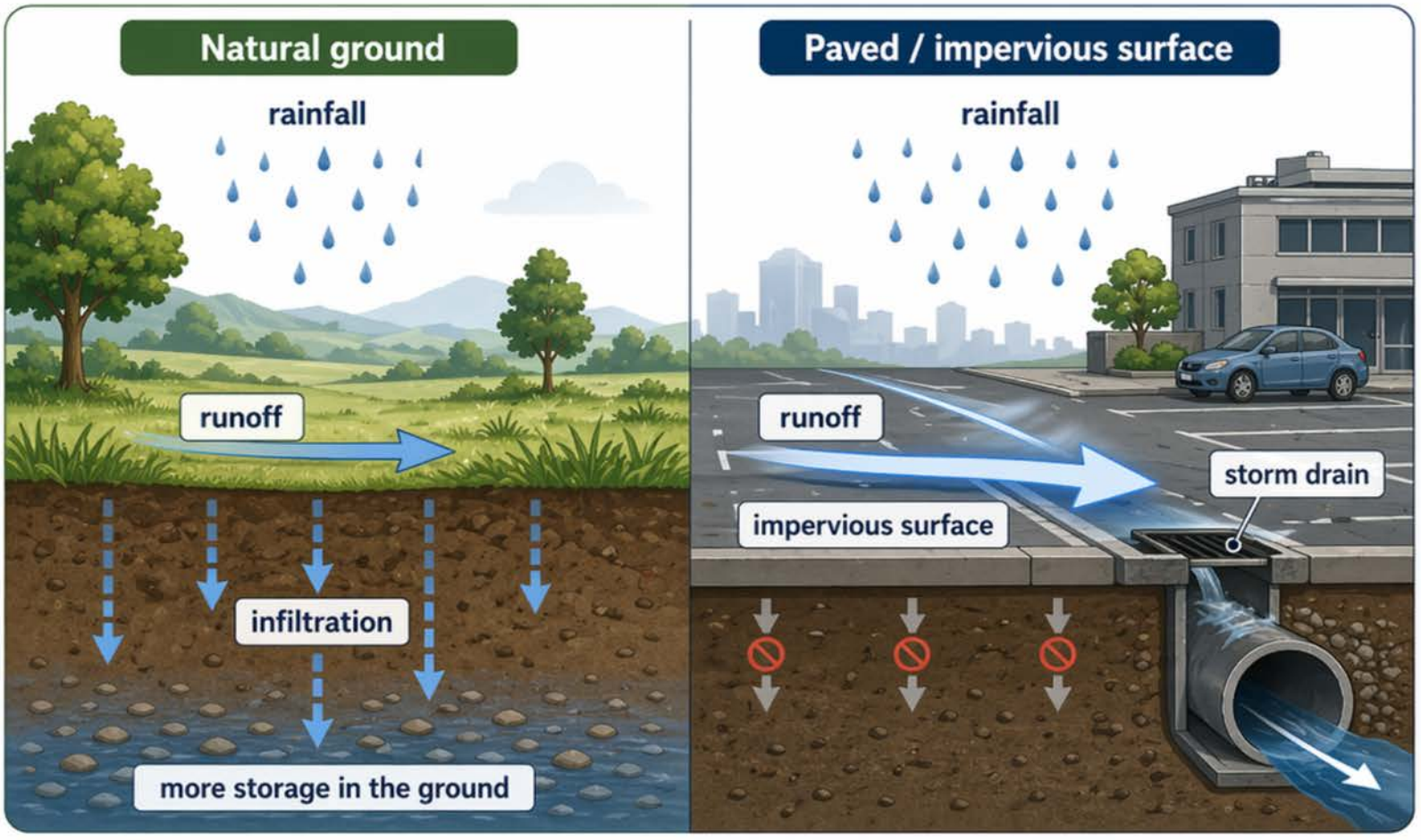
- local flooding can be influenced by upstream decisions
- stormwater, land clearing, and development have downstream consequences
- watershed-scale planning is often more effective than site-by-site thinking

KEY TAKEAWAY

Downstream flood risk is partly shaped by upstream land use.

Why Pavement Changes Runoff

Pavement and other impervious surfaces reduce infiltration and increase runoff, often making flooding worse.

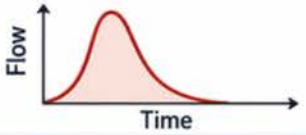


Pavement speeds up water movement and can increase peak flows downstream.

At a glance comparison

Natural ground: more infiltration, slower runoff

Paved surfaces: less infiltration, faster runoff



Why this matters for policy

Urban development changes flood behavior.

Drainage systems can move water faster rather than eliminate risk.

Site design and stormwater policy influence flood outcomes.

KEY TAKEAWAY

Pavement does not create more rain — it makes more of the rain become fast-moving runoff.

Why Flood Depth Is Not the Whole Story

Flood damage depends on more than how deep the water gets.

Why the same depth can produce different damage

SLOW, SHALLOW STANDING WATER
Lower impact

- **DEPTH** ~0.5 m
- **VELOCITY** Low
- **DURATION** Several hours
- **DEBRIS** Minimal
- **EROSION / SCOUR** Low
- **CONTAMINATION** Low risk
- **EXPOSURE** Limited

SIMILAR WATER DEPTH ~0.5 m

FAST-MOVING WATER WITH DEBRIS AND EROSION
Higher impact

- **DEPTH** ~0.5 m
- **VELOCITY** High
- **DURATION** Many hours to days
- **DEBRIS** High
- **EROSION / SCOUR** High
- **CONTAMINATION** High risk (sewage, chemicals, fuel, etc.)
- **EXPOSURE** High

WHAT MAY BE EXPOSED TO FLOOD DAMAGE

BUILDINGS

ROADS

UTILITY INFRASTRUCTURE

PEOPLE / COMMUNITY

Flood impact depends on multiple factors, not just water depth. The speed of the water, how long it remains, what it carries, whether it erodes the ground, whether contamination is present, and what is located in the flooded area all affect the level and type of damage. Considering all these factors leads to better maps, better warnings, and better decisions.

FACTORS THAT INFLUENCE IMPACTS

- **DEPTH** — How deep the water gets
- **VELOCITY** — How fast the water moves
- **DURATION** — How long water remains
- **DEBRIS** — What the water carries
- **EROSION / SCOUR** — Whether the water erodes the ground
- **CONTAMINATION** — Whether the water is contaminated
- **EXPOSURE OF HOMES, ROADS, UTILITIES, & PEOPLE** — What is located in the flooded area

WHY THIS MATTERS FOR POLICY

- flood maps and warnings should not focus only on water depth
- infrastructure damage can result from erosion and debris as well as inundation
- emergency planning needs to consider multiple dimensions of risk

KEY TAKEAWAY

Depth matters, but speed, duration, debris, and what is in harm's way matter too.

What Levees Do and Do Not Do

Levees can reduce some flooding, but they do not eliminate flood risk.

WHAT LEVEES DO

HOLDS BACK SOME FLOODWATER

Levees are built to keep river water in the channel during many flood events.

DIRECTS WATER WITHIN A CONSTRAINED CORRIDOR

Levees confine high flows to the river channel, which can reduce erosion and protect adjacent areas.

REDUCES FREQUENT OVERBANK FLOODING

Protected areas behind levees experience less frequent overbank flooding compared to unprotected floodplains.

WHAT LEVEES DO NOT DO

DO NOT ELIMINATE RISK ENTIRELY

Levees lower the likelihood of some flooding, but risk always remains.

DO NOT PREVENT OVERTOPPING

In extreme floods, water can flow over the top of levees and into protected areas.

DO NOT PREVENT FAILURE OR BREACH

Levees can fail or breach due to erosion, instability, seepage, or other causes.

DO NOT ELIMINATE FLOODING FROM OTHER SOURCES

Rainfall in the protected area, drainage backup, and groundwater can still cause flooding.

WHEN LEVEEIS ARE OVERTOPPED OR BREACHED

During extreme events, water can go over or through a levee, leading to flooding in areas that are usually protected.

RESIDUAL RISK REMAINS

Areas behind levees can still flood, especially during extreme events or from other water pathways. The depth, timing, and duration of flooding can vary, and impacts can still be severe.

WHY THIS MATTERS FOR POLICY

- protected does not mean risk-free
- land use behind levees should still account for flood risk
- emergency planning is still necessary in levee-protected areas

KEY TAKEAWAY

Levees reduce some flood risk, but they do not remove it.

Why Flood Risk Is Not the Same as Flood Hazard

Hazard is only one part of the story. Risk depends on what is exposed and how vulnerable it is.

Flood Hazard + **Exposure** (Homes, Roads, Utilities, People / Communities) + **Vulnerability** = **Flood Risk**

Hazard
The physical flood event or flood conditions, such as depth, speed, extent, or timing.

Exposure
The people, buildings, infrastructure, and assets located in the flood area.

Vulnerability
How susceptible those exposed people and assets are to damage or disruption.

Risk
The potential for harmful consequences when hazard, exposure, and vulnerability interact.

A Area A
High hazard, low exposure

High flood hazard | Low exposure | Lower risk

B Area B
Similar hazard, higher exposure and vulnerability

Similar flood hazard | High exposure | Higher vulnerability | Higher risk

What policy can influence

Policy may not stop the flood hazard itself, but it can shape where development occurs, how resilient systems are, and how severe the impacts become.

- **Hazard** (Limited control) — locked
- **Exposure** (Reduce) — − +
- **Vulnerability** (Reduce) — − +
- **Consequences** (Reduce) — − +

Why this matters for policy

- helps prioritize smarter land use and infrastructure decisions
- supports equitable resilience planning
- improves how flood information is communicated

KEY TAKEAWAY

A flood hazard becomes a flood risk when people and assets are exposed and vulnerable.