



Flooding: An overview

What is a flood?

A flood can be defined as the temporary covering by water of land not normally covered by water. Floods are the most common and widespread of all weather-related natural disasters.

Floods can occur within minutes or over a long period, and may last days, weeks, or longer. They can cover an area with just a few inches of water or they can bring enough water to cover the roof of a house.

What causes flooding?

Floods can happen for a number of reasons:

- In extreme weather conditions, rivers, streams and drainage systems reach their capacity and the ground becomes completely saturated with water and no more can drain through. There is nowhere for the water to go, so it remains as surface run off. When there is too much rain for a drainage system to cope with, a river's embankments will no longer be able to retain the water, resulting in the banks overtopping. This overflowing water follows the path of least resistance, settling in low-lying adjacent areas and flooding them.
- Flooding can occur as a result of interference with natural drainage processes, such as changes to the width, depth and direction of river channels, excessive surface run off or blockages in river channels, sewerage systems or culverts. This can build up, blocking the watercourse, leaving nowhere for the water to go, and consequently flooding land.
- When frozen precipitation melts due to rising temperatures, a huge volume of water is released which drains into the nearest river, potentially causing a flood if river levels are already high.
- Storms are low pressure weather systems that can cause a rise in the sea level beneath them. When accompanied with high winds they can push seawater towards the coast, resulting in flooding.
- Dams or levee failure can suddenly send a destructive surge of water downstream. On the 2nd November 1925, Dolgarrog in the county of Conwy was devastated when two dams above the village burst, sending a torrent of water and boulders down towards the village below. The flood killed 10 adults and six children.

Four common types of flooding:

Coastal flooding

Coastal regions are particularly vulnerable to flooding. Occurring when sea levels along the coast or in estuaries exceed the height of land levels or coastal defences, waves breach or overtop these areas of land, resulting in coastal flooding.

Coastal flooding is caused by extreme tidal conditions that occur as a result of a one or all of the below factors:

- **High tide levels** - Variations in tidal levels due to gravitational effects of the sun and moon can result in higher sea levels. There is an approximate twice daily variation between high and low tide. Additionally, due to gravitational forces, there are two higher or lower than average tides. They occur twice monthly and are called neap and spring tides. When the gravitational pull of the sun and moon combine, we see larger than average tides, known as spring tides. When the gravitational pulls offset each other, we get smaller than average tides known as neap tides. When spring tides coincide



with storms, water levels can rise significantly potentially causing flooding and damage to both the coastline and property.

- **Surges** – Storm surges are a temporary build-up of water in shallow areas of sea close to the coastline. They form as a result of a combination of low atmospheric pressure and strong winds which create a temporary increase in the volume of water. The height of a surge will depend on meteorological conditions however if surges coincide with a high tide, they can cause sea levels to be raised several metres higher than normal.
- **Wave action** – Created as a result of the wind blowing over the surface of the sea, waves are created by the moving air transferring its energy into the water. The amount and size of energy held within a wave depends on the strength of the wind and how far the wave has travelled (it's fetch). Waves with a small fetch have not travelled far and will be smaller, whereas waves with a longer fetch have travelled further and will be larger and more powerful. When waves reach the coastline, they release their energy by breaking. Depending on how much energy they have accumulated, wave action can cause or exacerbate coastal flooding.

River flooding (fluvial)

River or fluvial flooding occurs following a period of heavy rainfall. The water runoff exceeds the natural capacity of rivers or stream channels, causing them to break their banks allowing water to flow out onto adjacent land, infrastructure and homes.

There are a range of factors which can exacerbate the risk of fluvial flooding:

- **Size and slope of the catchment area** – A river catchment is a natural drainage basin. The drainage basin collects water from various sources and channels them into a low point. Every drop of water that falls within the catchment will be funnelled into small watercourses which then channel the water downhill, eventually merging into a main river before flowing out to the sea. Flooding can occur quickly in a catchment which covers a small area or has short, steep slopes. Water run off within the catchment will drain over a short period of time into streams and rivers causing them to rise quickly, increasing the risk of flooding.
- **Geology and soil type** – In catchments with areas of permeable rocks e.g. limestone and soil, water can slowly drain easily through before reaching a watercourse. This helps to reduce the volume and speed of run-off. In areas where there is impermeable rocks e.g. granite or compacted soil e.g. clay soil, the rock/soil structure doesn't allow water to drain freely though, resulting in water sitting on the surface as run-off, taking longer to drain and resulting in a higher chance of flooding occurring.
- **Diverting water from urban areas into watercourses** – The introduction of hard, impermeable surfaces such as concrete and tarmac in urban areas means that the land in these areas has a reduced capacity to absorb rainfall. Water from these surfaces and rooftops is funnelled into gutters, drains and eventually into sewers, away from urban areas. To reduce the pressure on sewers during extreme weather events, combined sewers often have overflows through which excess water can be discharged directly to watercourses. By transferring water rapidly away from where it falls through sewage systems there is a risk of watercourses being inundated with more water than they can cope with, causing flooding.
- **Building on floodplains** – As villages, towns and cities grow due to an increasing demand for housing, land on floodplains is sometimes used for new housing developments. Floodplains are areas of flat land which lie adjacent to watercourses and are natural areas for a river to overflow onto and act as water storage areas when river levels are high. Building on these areas reduces the natural area within a catchment for a river to flood and temporarily store water. Any houses built on a floodplain are at high risk of being flooded and as the floodplain is no longer available to temporarily store excess water, there is a risk that water will get displaced and flood elsewhere.



- **Weather and climatic conditions** - Some catchments receive more rainfall than others. As the effects of climate change are increasingly felt, changes may occur in rainfall patterns, impacting the scale and frequency of flooding in different river catchments.
- **A lack of vegetation cover** - An abundance of trees and plants in an area can help intercept, slow down and absorb water before it reaches the ground, reducing the risk of flooding. The presence of vegetation allows some of the water to evaporate back into the atmosphere without ever reaching the ground. Where there is a lack of vegetation, precipitation reaches the ground at a greater speed and drains directly into the nearest watercourse, increasing the risk of flooding.

Surface water flooding (pluvial)

Surface water or pluvial flooding often occurs after short, intense, heavy downpours of rain. The rain falls so fast that the underlying ground cannot absorb it fast enough or the capacity of an urban drainage system to drain it away is surpassed.

Flooding occurs naturally but the introduction of hard, impermeable surfaces such as concrete and tarmac in urban areas means that the land in these areas has a reduced capacity to absorb rainfall. This, coupled with rooftops funnelling rainfall quickly away into gutters, drains, sewage pipes and culverts means that drainage systems can quickly become overwhelmed. Surface water can no longer enter the sewerage system and the drainage network overflows, resulting in excess water collecting, standing and flowing over land, streets, buildings and homes.

Groundwater flooding

Groundwater flooding occurs following a period of prolonged rainfall when water levels stored within the ground rise to the ground's surface and overflow as runoff as a result of the ground's storage capacity being exceeded.

Impacts of flooding

Flooding poses a risk to people's health, safety and well-being. It can cause loss of life, damage to property, loss of possessions, disruption and loss of business and can affect critical infrastructure such as electricity and water supply systems. In rural locations it can lead to the destruction of crops and a loss of livestock. Habitats can be flooded, leading to the destruction of nests and wildlife homes.

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