

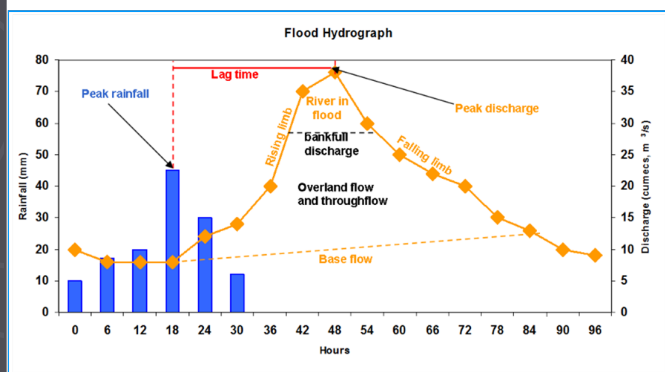
# Theme 2: CHANGING ENVIRONMENTS

## Key Idea 2.2: Shaping the landscape - River management

### CAUSES OF FLOODING

PHYSICAL	HUMAN ACTIVITIES
<p><b>Geology:</b> Impermeable rocks (e.g. clay/granite/slate through which water cannot permeate) increases rates of <b>overland flow</b> to the river which increases flood risk.</p>	<p><b>Urbanisation:</b> Tarmac and highly efficient drainage from newer buildings increases rates of <b>overland flow</b> to the river and increases flood risk.</p>
<p><b>Vegetation:</b> poor coverage decreases storage (in stems and roots) and <b>interception</b> which increases rate of flow to ground surface and <b>overland flow</b> which increases flood risk.</p>	<p><b>Changes to ecosystems:</b> deforestation decreases storage (in stems and roots) and <b>interception</b>. Increases rates of flow to ground surface and <b>overland flow</b> which increases flood risk.</p>
<p><b>Climate patterns:</b> prolonged precipitation causes <b>saturation</b> of ground, increases rates of <b>overland flow</b> causes <b>seasonal flooding</b>.</p>	<p><b>Extreme weather (linked to climate change):</b> chance of <b>infiltration</b> decreases, ground quickly saturated, increases rates of <b>overland flow</b> which causes <b>flash flooding</b>.</p>

### FLOOD HYDROGRAPH



Shows how a river's **discharge** changes in response to precipitation.

Calculate lag time:  
Predict how the shape of the discharge curve would change with:

- Dam construction
- Afforestation.

### SOCIAL AND ECONOMIC CONSEQUENCES OF FLOODING



My named flood event:

### FLOODS EFFECT DIFFERENT GROUPS OF PEOPLE IN BOTH POSITIVE AND NEGATIVE WAYS.

NAMED STAKEHOLDER	POSITIVE IMPACTS	NEGATIVE IMPACTS
Local residents		
Business owners/ developers		
Town/city councils		
National government		

### DRAINAGE BASIN MANAGEMENT

PLANNERS (WITH THE ENVIRONMENT AGENCY) MUST TRY TO FIND SUSTAINABLE SCHEMES OF MANAGING THE DRAINAGE BASINS. THIS INVOLVES COST-BENEFIT ANALYSES BEING CARRIED OUT (IF COSTS < BENEFITS THE SCHEME IS MORE LIKELY TO GO AHEAD). THIS IS OFTEN CONTROVERSIAL AS STAKEHOLDERS HAVE DIFFERENT VIEWS AND ATTITUDES

STRATEGY (HARD = H or SOFT = S)	BENEFITS	COSTS
<p><b>Dam construction (H):</b> Walls built across rivers holds water back forming a reservoir.</p>	Store and regulate flow. Can create recreational opportunities, fresh water source and hydroelectric power generated.	Very expensive, floods large land areas, damaging habitat and displacing people. Trap sediment which reduces fertility downstream.
<p><b>River engineering (H):</b> Flood walls, earth embankments, dredging, channel straightening.</p> 	<p>The size and height of the walls reassures stakeholders. Deep piling prevents seepage and walls can be 'dressed' with local brick/stone to blend in with surroundings.</p> <p>Encourage 'through-flow' away from high value land.</p>	Very expensive (including maintenance). Not all stakeholders benefit. Can restrict access to areas. Often encourages 'flow-through' and makes flooding (and erosion) worse downstream for residents/businesses. Embankments can fail. Dredging causes habitat damage.
<p><b>Temporary flood barriers (H/S):</b> Only used when required.</p>		
<p><b>Temporary flood barriers (H/S):</b> Only used when required.</p>	Temporary nature means cost is lower than engineering there is not a permanent eye-saw. Access is only restricted during flood events.	High value land could flood if not erected in time. Local stakeholders do not feel protected.
<p><b>Land use zoning (S):</b> Land uses with low economic value, such as car parks and playing fields are not protected but used to store flood water.</p>	Relatively cheap and effectively protects high value land. Effects of floods are minimised. Green spaces allow infiltration and groundwater storage, reducing lag time.	Sports clubs have fixtures cancelled and prevents access to green spaces. Restricts industrial/urban development exacerbating housing shortage.
<p><b>Afforestation (S):</b> Tree planting</p>	Low-cost, environmentally sustainable. Increase interception and ground storage, reducing overlap flow, increasing lag time. Provides habitat and reduces soil erosion.	Requires a lot of space and reduces land available for farming or alternative development.
<p><b>Improved prediction and flood risk warnings (S):</b> Flood warnings issued by Environment Agency so people can plan and prepare for flooding.</p>	Cheap and gives people time to evacuate and protect homes/businesses. Sand bags can be put in place which offers some flood protection.	Warnings only effective if people take action. Not all stakeholders have access to mobile phones and social media.