

## Video question script: small scale processes and mighty rivers

Question/Activity	Likely response	Rationale
<p>What do I have here? – and here? Is all the sand the same size?</p>	<ul style="list-style-type: none"> <li>• A piece of flat-bottomed plastic guttering with two end pieces</li> <li>• Damp sand, with some different sizes (not too well sorted) filling the gutter to within 1.5 cm of the top</li> <li>• A block so the gutter slopes downward</li> <li>• A water supply (tubing connected to a tap or a jug of water)</li> <li>• A bucket, to catch the overflow</li> </ul>	<p>Concrete preparation = asking them to describe the apparatus</p>
<ul style="list-style-type: none"> <li>• We will pour water into the top end. What do you expect to happen?</li> <li>• When we do this, what do you think will happen to the sand?</li> <li>• Will the sand grains move in the same way in all parts of the gutter?</li> </ul>	<ul style="list-style-type: none"> <li>• The water will flow over the sand to the bottom of the gutter and then overflow, some will sink into the sand</li> <li>• The flowing water will move the sand grains</li> <li>• Maybe the flow will be faster at the top, moving more grains</li> </ul>	<p>Construction = thinking through what might happen based on past experience</p>
<p>Add water to the top of the gutter</p>	<ul style="list-style-type: none"> <li>• At the top of the gutter, where water has the most energy, a cone-shaped erosion hollow forms</li> <li>• The water then flows down the gutter moving the sand as it does so</li> <li>• When it reaches the bottom of the gutter it forms a pool, and as the water slows down on entering the pool, sand is deposited in a micro-delta</li> </ul>	
<p>From what you have seen in the gutter, how does water flow affect the surface of the Earth?</p>	<p>In areas of high flow, material is eroded, in medium-flow areas it is transported and in low flow areas it is deposited, on beaches, in gutters and in streams and rivers.</p>	<p>Bridging = applying observations and learning to new 'real world' contexts.</p>
<p>This is the experience you may wish 11-14 year old pupils to have. You may just want them to come away with the learning that: high energy flow causes erosion (erosion hollow), intermediate energy flow causes transportation, whilst lower energy flow results in deposition (in the pool). However, you can enhance learning about Earth processes and critical thinking skills by including part or all of the continuation below.</p>		
<p>Stop the water flow, Ask: Does the water flow smoothly down the gutter?</p>	<ul style="list-style-type: none"> <li>• Some will think it does flow smoothly</li> <li>• Those who are more observant will have noted the channel patterns and the effects of small pebbles. They may be able to explain these observations</li> <li>• They may comment on the erosion hollow at the top and the pool at the bottom</li> </ul>	<p>Cognitive conflict = different ideas about flow Metacognition = possible explanation of observations</p>

Continue the flow of water	<ul style="list-style-type: none"> <li>• Channels form which fill up over time and switch, so forming a braided pattern</li> <li>• Around each small pebble there is a scour hollow upflow while sand deposited in a small sand shadow down flow</li> </ul>	
As the flow continues, ask for observations of the different ways in which the sand grains are moved	<p>Close study of the sand shows that:</p> <ul style="list-style-type: none"> <li>• Some of the larger grains roll down</li> <li>• Some slide down</li> <li>• If you look really carefully some smaller grains are seen to have a jerky movement – this is bouncing or saltation</li> <li>• The water in the bucket at the end is coloured by muddy sediment – which has been carried in suspension</li> </ul>	<p>A test of observation skills (Grains moved by rolling or sliding are being carried by traction) (Rolling, sliding and bouncing grains are part of the bedload; grains in suspension are in the suspended load)</p>
As the flow continues, ask for observations about how the micro-delta is building	<p>Close study of the micro-delta shows that:</p> <ul style="list-style-type: none"> <li>• Sand is carried across the gently downward sloping top of the delta</li> <li>• It is tipped over the end to form a steeper slope of 20° or more.</li> </ul>	<p>A test of observation skills (Sand is deposited in sloping layers on the front of the delta; these sloping layers are called cross-bedding)</p>
Where could you find an environment that has erosion hollows, braided channels and micro-deltas?	On a sandy beach or in a shallow sandy river	Bridging = from observations of the gutter to reality
This activity models what happens on the Earth's surface at a much larger scale. Where and how?	<ul style="list-style-type: none"> <li>• The erosion hollow models the plunge pool under a waterfall</li> <li>• The braided patterns form in the same way as the large-scale braided channels in rivers such as the Ganges</li> <li>• The micro-delta models how larger deltas form in lakes and the sea (e.g. the Ganges delta)</li> <li>• In flooding rivers, boulders and pebbles are moved by traction and saltation, whilst sand is carried in suspension</li> <li>• In rivers there is scour upstream of boulders, and sediment shadows are deposited downstream</li> </ul>	Bridging = from the model to reality