# PL3 UK Physical Landscapes: River Landscapes

AQA 8035 · Calculators not allowed · about 65 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

**Answer ALL questions. Show all your working.**

**1** State what is meant by each of these processes of river erosion.

**(a)** Hydraulic action **(1)**

**(b)** Abrasion **(1)**

**(c)** Attrition **(1)**

**(d)** Solution **(1)**

**(Total for Question 1 is 4 marks)**

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**2** State what is meant by each of these processes of river transportation.

**(a)** Traction **(1)**

**(b)** Saltation **(1)**

**(c)** Suspension **(1)**

**(Total for Question 2 is 3 marks)**

**3** This question is about how a river changes along its course, from source to mouth.

**(a)** Describe how the gradient of a river's long profile typically changes from source to mouth. **(2)**

**(b)** Describe how the width and depth of a river's channel typically change from source to mouth. **(2)**

**(c)** Explain why the velocity (speed) of a river generally increases downstream, despite the gradient becoming gentler. **(3)**

**(Total for Question 3 is 7 marks)**

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**4** Explain how a waterfall and gorge are formed.

**(Total for Question 4 is 6 marks)**

**5** This question is about a named UK example of a waterfall.

**(a)** Name a waterfall you have studied in the UK, and state its location. **(2)**

**(b)** Describe one feature of this waterfall. **(2)**

**(Total for Question 5 is 4 marks)**

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**6** Explain how a meander (a bend in a river) is formed.

**(Total for Question 6 is 6 marks)**

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**7** Explain how an oxbow lake forms from a meander.

**(Total for Question 7 is 5 marks)**

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**8** Explain how a floodplain and levees are formed.

**(Total for Question 8 is 4 marks)**

**9** Describe TWO features commonly found in a river estuary.

**(Total for Question 9 is 4 marks)**

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**10** This question is about hard engineering strategies for managing river flood risk.

**(a)** Name one hard engineering method of managing river flood risk. **(1)**

**(b)** Describe how this method reduces flood risk. **(2)**

**(c)** State one disadvantage of this method. **(2)**

**(Total for Question 10 is 5 marks)**

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**11** This question is about soft engineering strategies for managing river flood risk.

**(a)** Name one soft engineering method of managing river flood risk. **(1)**

**(b)** Describe how this method reduces flood risk. **(2)**

**(c)** State one advantage of soft engineering methods compared with hard engineering methods. **(2)**

**(Total for Question 11 is 5 marks)**

**12** Describe a named UK flood management scheme you have studied, and evaluate how effective it has been. (For example, you could refer to the Banbury Flood Storage Reservoir on the River Cherwell, Oxfordshire, which opened in 2012.)

**(Total for Question 12 is 6 marks)**

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**13** Explain TWO factors, one physical and one human, that can increase the risk of a river flooding.

**(Total for Question 13 is 4 marks)**

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**14** Explain how interlocking spurs form in the upper course of a river.

**(Total for Question 14 is 3 marks)**

**15** Use the flood management strategies and named UK example you have studied in this pack (e.g. the Banbury Flood Storage Reservoir) to answer this question.

'Hard engineering strategies are more effective than soft engineering strategies for managing river flood risk.' Assess the extent to which you agree with this statement.

**(Total for Question 15 is 8 marks)**

# Mark scheme · PL3 UK Physical Landscapes: River Landscapes

## Question 1

- (a) **B1** the force of the river's moving water hitting the banks and bed, which can wear away material and force air into cracks, oe
- **(a) Answer: The force of moving water hitting the banks and bed, which wears away material.**
- (b) **B1** material carried by the river (load) rubs against and wears away the banks and bed, oe
- **(b) Answer: Load carried by the river rubs against and wears away the banks and bed.**
- (c) **B1** rocks and stones carried by the river collide with each other, breaking into smaller, more rounded pieces, oe
- **(c) Answer: Rocks carried by the river collide and break into smaller, more rounded pieces.**
- (d) **B1** soluble minerals (e.g. from limestone or chalk) are dissolved into the river water, oe
- **(d) Answer: Soluble minerals are dissolved into the river water.**

## Question 2

- (a) **B1** large, heavy material (e.g. boulders) is rolled along the river bed, oe
- **(a) Answer: Large, heavy material is rolled along the river bed.**
- (b) **B1** smaller stones and pebbles are bounced/hopped along the river bed, oe
- **(b) Answer: Smaller stones and pebbles are bounced or hopped along the river bed.**
- (c) **B1** small, light material (e.g. silt and clay) is carried within the flow of the water, oe
- **(c) Answer: Small, light material is carried within the flow of the water.**

## Question 3

- (a) **B1** the gradient is steep in the upper course, near the source, oe
- (a) **B1** the gradient becomes gentler through the middle and lower course, becoming almost flat near the mouth, oe
- **(a) Answer: The gradient is steep near the source and becomes gradually gentler downstream, almost flat near the mouth.**
- (b) **B1** the channel is narrow and shallow in the upper course, oe
- (b) **B1** the channel becomes wider and deeper through the middle and lower course, oe
- **(b) Answer: The channel is narrow and shallow near the source, and becomes wider and deeper downstream.**
- (c) **B1** the channel becomes wider and deeper downstream, oe
- (c) **B1** this increases the hydraulic radius, so a smaller proportion of the water touches the bed and banks, oe
- (c) **B1** this reduces friction, allowing the water to flow faster overall, despite the gentler gradient, oe
- **(c) Answer: A wider, deeper channel downstream means less water (proportionally) is in contact with the bed and banks, reducing friction, so the river flows faster overall despite the gentler gradient.**

## Question 4

- **B1** a waterfall forms where a river flows over a band of resistant (hard) rock lying on top of less resistant (softer) rock, oe
- **B1** the softer rock is eroded faster than the resistant rock, by hydraulic action and abrasion, oe
- **B1** this creates a step in the river bed, and an overhang of resistant rock forms as the softer rock beneath is undercut, oe
- **B1** eventually the unsupported overhang collapses, and the fallen rock is swirled around at the foot of the fall, oe
- **B1** this abrasion carves out a deep plunge pool at the base of the waterfall, oe
- **B1** over time, this process repeats and the waterfall gradually retreats upstream, leaving behind a steep-sided gorge, oe
- **Answer: A waterfall forms where resistant rock lies over softer rock; the softer rock erodes faster, undercutting the resistant rock until it collapses, carving a plunge pool. Repeated over time, this makes the waterfall retreat upstream, leaving a steep-sided gorge.**

### Question 5

- (a) **B1** High Force
- (a) **B1** on the River Tees, in County Durham, in the north Pennines, England
- **(a) Answer: High Force, on the River Tees, in County Durham, England.**
- (b) **B1** it has a drop of around 20 metres, making it one of the largest waterfalls in England by volume of water, oe
- (b) **B1** it forms where the river flows over the resistant Whin Sill (a layer of hard igneous dolerite rock) lying above softer sedimentary rock, oe
- **(b) Answer: High Force has a drop of around 20 metres and forms where the River Tees flows over the resistant Whin Sill, a hard igneous rock layer, above softer sedimentary rock beneath.**

### Question 6

- **B1** meanders typically form in the middle to lower course, where the river has more lateral (sideways) energy, oe
- **B1** the fastest current (the thalweg) swings towards the outer bank of a bend, oe
- **B1** erosion (mainly hydraulic action and abrasion) is greatest on the outer bank, undercutting it to form a steep river cliff, oe
- **B1** the current is slower on the inner bank, oe
- **B1** so the river has less energy and deposits material there, building up a gently sloping point bar/slip-off slope, oe
- **B1** this combination of erosion on the outside and deposition on the inside makes the bend become more pronounced over time, oe
- **Answer: The fastest current swings towards the outer bank, eroding it to form a steep river cliff; the slower inner bank current deposits material, forming a gently sloping point bar. This combination makes the bend more pronounced over time.**

### Question 7

- **B1** over time, continued erosion on the outer banks makes a meander bend increasingly loop-shaped, oe
- **B1** the neck of land between two parts of the loop becomes narrower, oe
- **B1** during a flood, the river has enough energy to cut across the narrow neck, taking the shorter, more direct route, oe
- **B1** deposition then seals off the entrance and exit of the old loop, oe
- **B1** leaving the old meander bend isolated from the main channel as a curved, oxbow-shaped lake, oe
- **Answer: As a meander loop tightens, the neck of land between the two sides narrows. In a flood, the river cuts across the neck, taking the shorter route; deposition then seals off the old loop, leaving it as an isolated oxbow lake.**

### Question 8

- **B1** during a flood, a river overflows its banks and spreads out across the flat land alongside it, oe
- **B1** as the water spreads out, it slows down and loses energy, so it deposits the sediment it was carrying, oe
- **B1** this happens repeatedly over many floods, gradually building up a wide, flat area of fertile deposited sediment: the floodplain, oe
- **B1** the heaviest, coarsest material is deposited first, closest to the channel, building up raised banks called levees along the river's edge, oe
- **Answer: When a river floods, it spreads across the flat land beside it, slows down and deposits sediment. Repeated over many floods, this builds up the floodplain; the heaviest material settles closest to the channel, building up levees.**

### Question 9

- **B1** feature 1 named, e.g. mudflats, oe
- **B1** linked detail, e.g. formed where fine sediment carried by the river settles out as the current slows where it meets the sea, oe
- **B1** feature 2 named, e.g. salt marsh, oe
- **B1** linked detail, e.g. vegetation that can tolerate salt water colonises the mudflats, stabilising them further, oe
- **Answer: For example: mudflats, formed as fine sediment settles where the river's current slows on meeting the sea; and salt marsh, where salt-tolerant vegetation colonises and stabilises the mudflats.**

## Question 10

- (a) **B1** any valid hard engineering method, e.g. a dam and reservoir, or channel straightening, or embankments, oe
- **(a) Answer: For example, a dam and reservoir.**
- (b) **B1** a dam holds back river water in a reservoir upstream of the area at risk, oe
- (b) **B1** water can then be released in a controlled way, so the river downstream does not flood, oe
- **(b) Answer: A dam holds back water in a reservoir upstream, so water can be released in a controlled way, preventing flooding downstream.**
- (c) **B1** any valid disadvantage, e.g. it is very expensive to build and maintain, oe
- (c) **B1** linked detail, e.g. or it can flood upstream land/displace people to create the reservoir, or it traps sediment that would otherwise fertilise land downstream, oe
- **(c) Answer: For example, dams are very expensive to build and maintain, and the reservoir created can flood upstream land and displace people.**

## Question 11

- (a) **B1** any valid soft engineering method, e.g. floodplain zoning, or river restoration, or afforestation (planting trees) in the drainage basin, oe
- **(a) Answer: For example, floodplain zoning.**
- (b) **B1** floodplain zoning restricts what can be built on land that is likely to flood, oe
- (b) **B1** e.g. only low-value land uses such as farmland or parks are allowed on the floodplain itself, keeping homes and valuable property out of the highest-risk areas, oe
- **(b) Answer: Floodplain zoning restricts building on land that is likely to flood, allowing only low-value uses such as farmland there, keeping homes and valuable property out of the highest-risk areas.**
- (c) **B1** any valid advantage, e.g. soft engineering is usually cheaper than building hard defences, oe
- (c) **B1** linked detail, e.g. or it works with natural processes and has a smaller impact on the river's ecosystem/landscape, oe
- **(c) Answer: For example, soft engineering is usually cheaper than hard engineering, and it works with natural river processes rather than against them.**

## Question 12

- **B1** names a valid UK flood management scheme, e.g. the Banbury Flood Storage Reservoir, on the River Cherwell, Oxfordshire
- **B1** describes the scheme, e.g. it is a flood storage reservoir/dam that holds back river water upstream of the town of Banbury during periods of high flow, oe
- **B1** further descriptive detail, e.g. it was built after Banbury suffered serious flooding in 1998, and opened in 2012, oe
- **B1** evaluates a strength, e.g. it has protected the town centre and thousands of homes and businesses from flooding since it opened, oe
- **B1** evaluates a limitation, e.g. large hard engineering schemes like this are expensive to build, and cannot remove flood risk completely in a very extreme event, oe
- **B1** reaches an overall judgement, e.g. supported by evidence, on how effective the scheme has been, oe
- **Answer: For example, the Banbury Flood Storage Reservoir (River Cherwell, Oxfordshire, opened 2012) holds back flood water upstream of the town; it has successfully protected homes and businesses from flooding since opening, though such large hard engineering schemes are costly and cannot guarantee protection in an extreme, rare flood event.**

## Question 13

- **B1** physical factor, e.g. heavy or prolonged rainfall increases the volume of water reaching the river quickly, oe
- **B1** linked detail, e.g. or impermeable rock/steep relief in the drainage basin, which increases surface runoff rather than infiltration, oe
- **B1** human factor, e.g. urbanisation covers the ground with impermeable surfaces (roads, roofs), increasing surface runoff into drains and rivers, oe
- **B1** linked detail, e.g. or deforestation reduces interception of rainfall by trees, so more water reaches the river more quickly, oe
- **Answer: Physical: heavy or prolonged rainfall (or impermeable rock/steep relief) increases surface runoff into the river. Human: urbanisation covers the ground with impermeable surfaces, increasing runoff (or deforestation reduces**

## Question 14

- **B1** in the upper course, a river has limited energy and mostly erodes vertically (downwards) rather than sideways, oe
- **B1** the river is forced to wind (flow around) areas of harder, more resistant rock that it cannot easily erode, oe
- **B1** this leaves ridges of land projecting into the valley from alternate sides, which interlock like the teeth of a zip as the valley is viewed from above, oe
- **Answer: In the upper course, a river erodes mostly downwards and has to wind around areas of harder rock rather than eroding through them, leaving ridges of land from alternate sides that interlock as the valley is viewed from above.**

## Question 15

- **Level 4** (7-8): A detailed, well-balanced assessment that uses accurate, detailed reference to named hard and soft engineering strategies (and a named UK example); weighs their relative effectiveness, cost and impact, and reaches a clear, justified conclusion.
- **Level 3** (5-6): A clear assessment that uses accurate reference to hard and soft engineering strategies; a conclusion is reached, though the balance of the argument may be less developed or use less named detail.
- **Level 2** (3-4): Some relevant points about hard and/or soft engineering are made, with limited or generalised detail; a simple conclusion is given with little justification.
- **Level 1** (1-2): One or two isolated relevant points about flood management are made, with little or no comparison of strategies.
- **Level 0** (0): No relevant content.
- **Indicative content:**
  - Hard engineering (e.g. dams/reservoirs such as Banbury Flood Storage Reservoir, embankments, channel straightening) can provide strong, reliable protection for the specific area it defends, and can protect large populations and valuable property.
  - Hard engineering is expensive to build and maintain, can have negative impacts elsewhere (e.g. increasing flood risk downstream from channel straightening, or flooding land upstream to create a reservoir), and cannot remove all risk in extreme, rare events.
  - Soft engineering (e.g. floodplain zoning, river restoration, planting trees in the drainage basin) is usually cheaper and works with natural river processes, often with wider environmental benefits (e.g. improved habitats).
  - Soft engineering may be less effective at protecting existing developments that are already built on the floodplain, since it often relies on managing future risk rather than removing existing risk.
  - Many real flood management schemes, including UK examples, actually combine hard and soft methods, suggesting effectiveness depends on using the right combination for the specific location, not just one approach.
  - A well-supported conclusion should state a clear judgement on which approach (or combination) is more effective, backed by evidence from named examples.