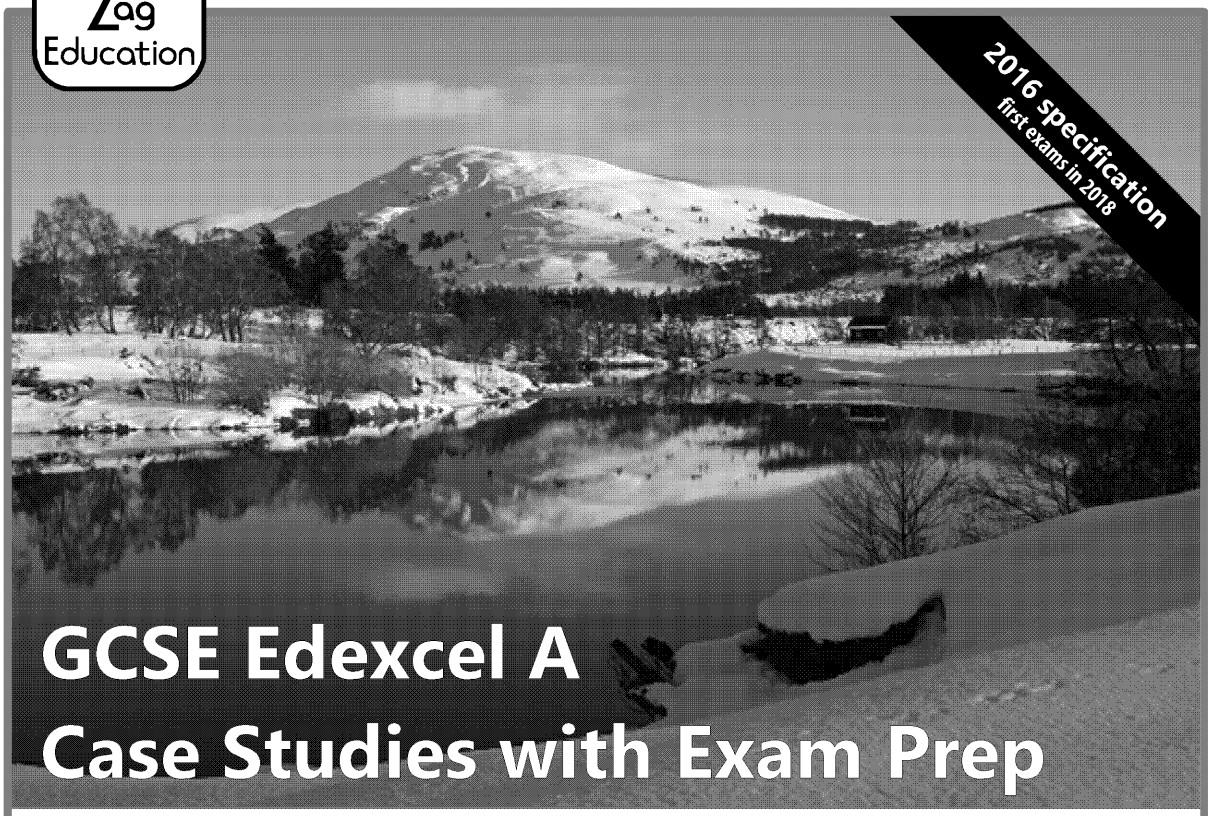
Zig Zag Education

Geography GCSE (9–1) | Edexcel A | 1GA0



GCSE Edexcel A Case Studies with Exam Prep

Changing Landscapes of the UK: Rivers

The River Spey

zigzageducation.co.uk

POD 8818

Contents

Teacher's Introduction

This resource has been developed to provide case studies and exam preparation material to support the GCSE Edexcel A specification (1GA0) **Topic 1: The Changing Landscapes of the UK**.

This detailed case study is on **The River Spey** representing a **river landscape** within in the UK.

The case study includes a main content section which can be used as part of a lesson plan or distributed to students for self-guided research; a selection of ICT interactive links to further students' research around each topic and a set of Springboard Images and discussion questions (also available as a PPT file accessible by digital download) which makes a fantastic starter activity.

*A webpage containing all the links listed in this resource is conveniently provided on ZigZag Education's website at **zzed.uk/8818***

You may find this helpful for accessing the websites rather than typing in each URL.

The exam preparation section which follows the case study contains a summary table, bringing together all of the key facts and figures relating to the case study; rapid-fire revision questions (with answers) to help recall and retention of the main points; and an exam-style question and mark scheme, written in the style of the Edexcel A sample material, so that students can practice answering questions relating to case studies and applying relevant knowledge in their answers.

The resource may be used as a source of reference for the required case studies for individual study, or for group work leading to discussion or debate. Subheadings in the information sections are designed to enable tabulated comparisons of social, economic and environmental impacts.

Other detailed case studies are available for this topic area (two coastal landscapes, another river landscape, and two glacial landscapes):

- The Jurassic Coast (Coastal)
- The Seven Sisters (Coastal)
- The River Spey (River)
- Snowdonia (Glacial)
- The Lake District (Glacial)

A PowerPoint presentation containing the Springboard Images starter activity to accompany this resource is available as a free digital download. Just register for free updates using the link below to download all available content for your school or purchasing site.

November 2018

Part 1: Case Study

Content

Introduction

The River Spey is located in north-east Scotland between the Monadhliath and Cairngorm ranges. The source of the river lies approximately 300 metres above sea level and 107 miles [illegible] reaches its mouth at Spey Bay and flows into the Moray Firth. The 3,000 km² area contains hundreds of tributaries that flow down the mountains. It is the ninth longest river in the UK and the fastest flowing river in Scotland.

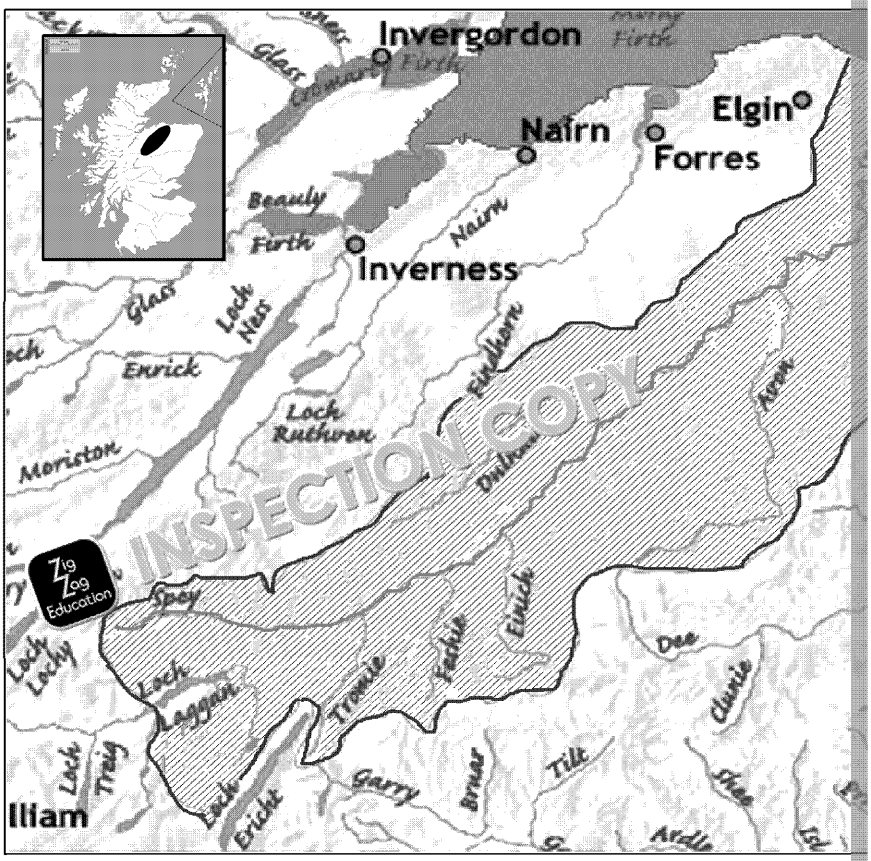


Figure 1 River Spey Basin

The River Spey is an upland river with fast-flowing and turbulent water. The valley was formed thousands of years ago over the course of four ice ages, which created the landscape it now flows through.

It is famous for its abundance of Atlantic salmon and trout, which makes it a popular river for fishing. The river is considered a Special Area of Conservation (SAC) and a Site of Special Scientific Interest (SSSI) due to the unusual habitats and rare species that can be found there.

The region around the Spey is not very built up, with only around 23,000 people living in the area. This makes the area very attractive to tourists for its serene nature and beauty. The area is very popular during the Scottish ski season and attracts those who enjoy hiking, walking and white-water rafting all year round.

The long profile of the River Spey is shown in the graph below. It shows h
the river changes as you go downstream.

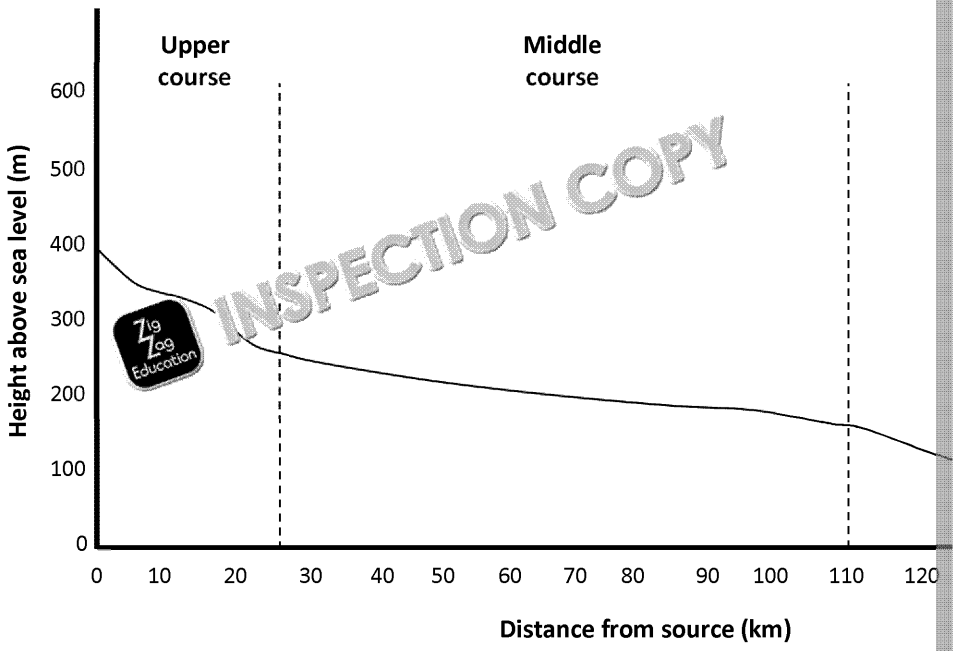


Figure 2 Graph showing the long profile of the River Spey

In most rivers the slope of the river decreases from source to mouth. How
graph, the River Spey is a bit unusual because the lower course is actually f
than the middle course. This has some consequences for the landforms and
different sections of the river.

The River Profile and Landforms

Like most rivers, the distinct shape of the River Spey changes as the river f
way it is influenced by the fluvial processes of erosion, transportation and
river down shows how these fluvial processes work in different way
and the size of the river changes.

The Upper Course:

The upper course of the River Spey is relatively steep, with a narrow chann
riverbed consists of large rocks and boulders that are slowly being moved
upper course has a fairly steep valley with numerous tributaries flowing d
the mountains.

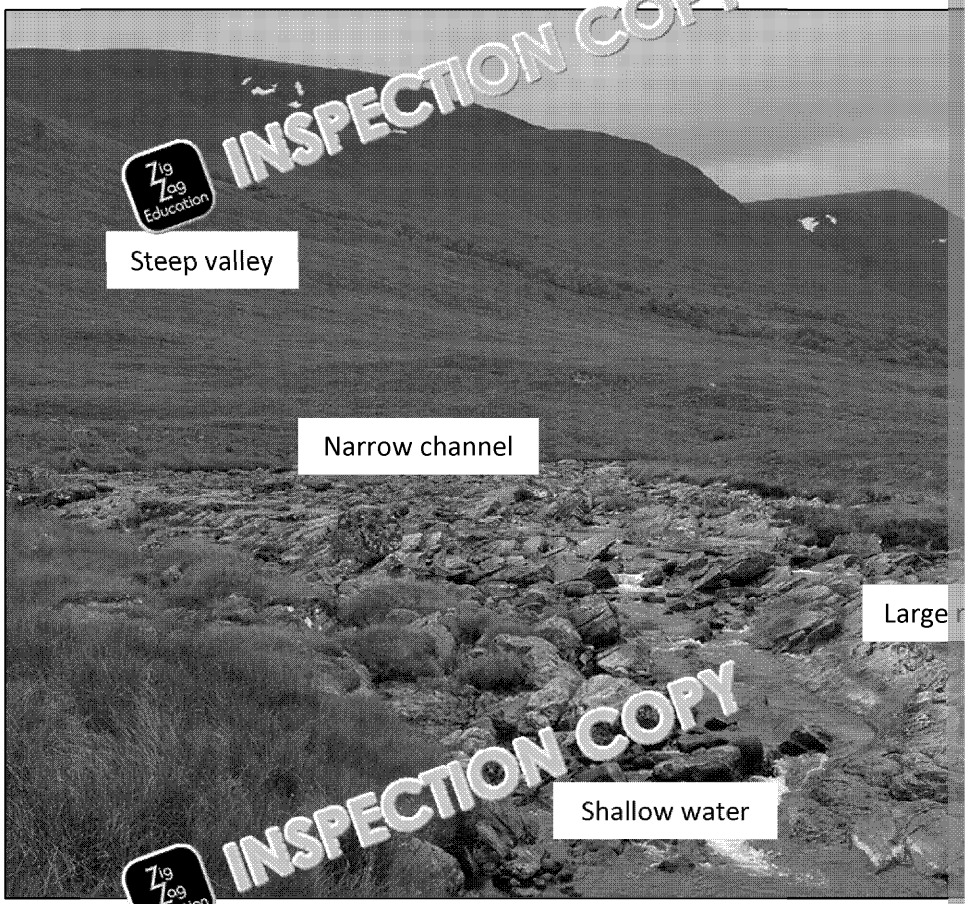


Figure 3 Upp rse of the River Spey

Upper Course Fact File

Discharge	=	Low but gradually building up as tributaries flow into the river
Velocity	=	Slow due to large rocks and boulders and rough riverbed
Gradient	=	Steep; gradient ratio = 1:225
Channel depth	=	Shallow – 48 cm
Channel width	=	Narrow
Load size	=	Large rocks and boulders
Load quantity	=	Small
Riverbed	=	Rough

Landforms found on the upper course of the River Spey are mainly formed through vertical erosion as the water weakens the bedrock through hydraulic action.

Waterfalls, for example, are formed through the river cutting into the rock vertically. They occur when a layer of hard rock lies next to a layer of soft rock.

The softer rock is more easily and undercuts the hard rock. Over time, the undercut gets deeper and the hard rock ends up collapsing into the river, forming a waterfall.

Rapids are another feature that can be found on the upper course of the River Spey. These form when fast-flowing waters flow over alternating sections of hard and soft rock. This makes the water more turbulent and rapids form. These rapids are partly what makes the river so attractive for canoeing and white-water rafting!

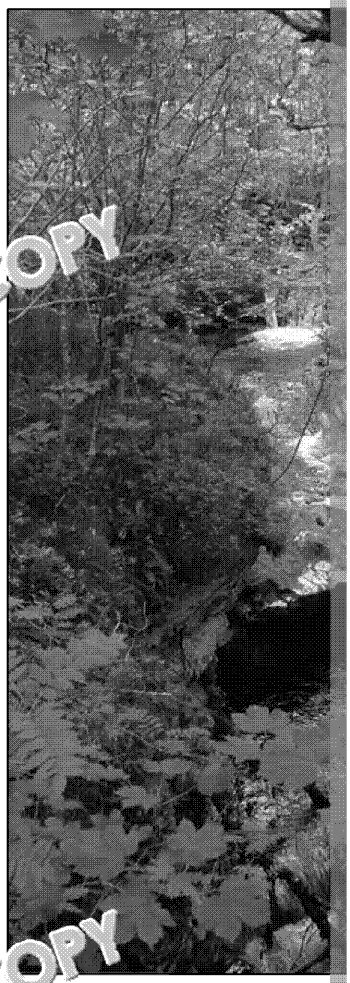


Figure 4 Waterfall on the River

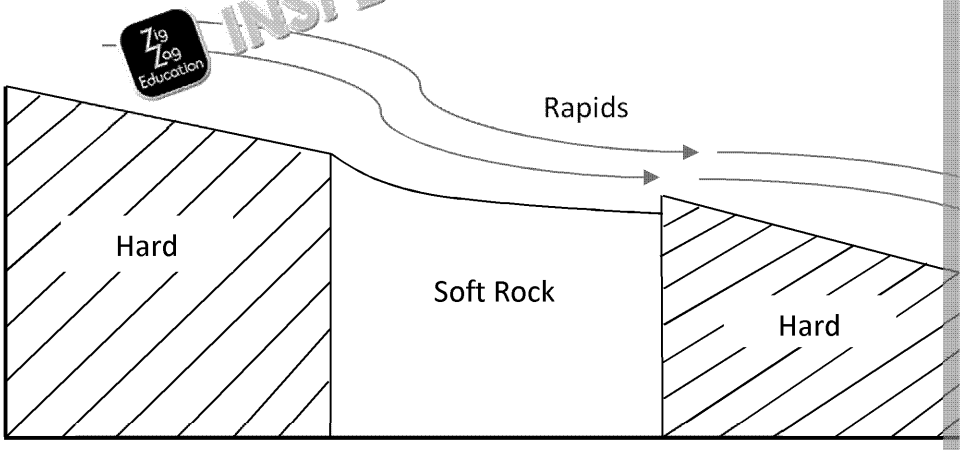


Figure 5 Formation of rapids

The Middle Course:

The middle course of the River Spey is characterised by a wider and deeper the upper course. By this point the rocks in the river have been smoothed abrasion and attrition. They are also being transported further downstream suspension. Due to the shallow gradient of the middle course of the River more similar to what you might normally find in the lower section of a river

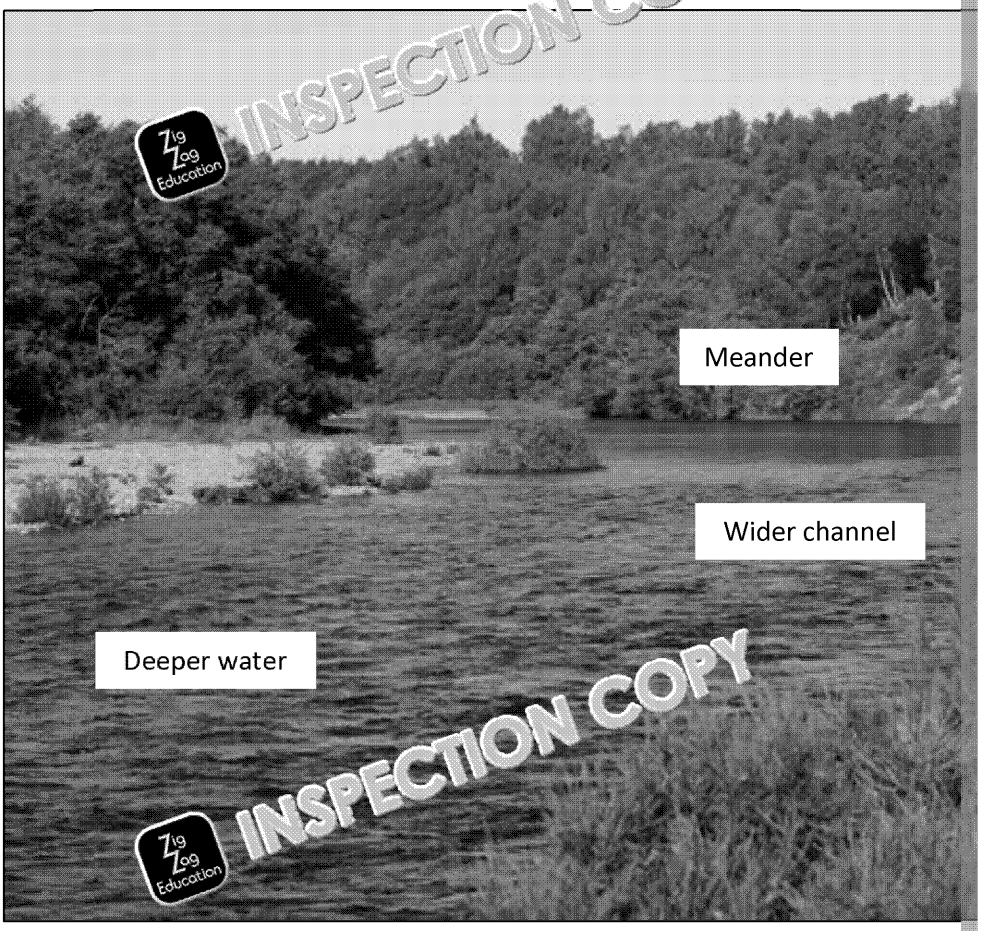


Figure 6 Middle course of the River Spey

Middle Course Fact file:

Discharge	=	Higher than the upper course as more tributaries join the main river
Velocity	=	Faster than the upper course as discharge has increased
Gradient	=	At its flattest; gradient ratio = 1:1200
Channel depth	=	Deeper than upper course – 68 cm
Channel width	=	Wider than upper course
Load size	=	Mixture of smaller, smoother pebbles and large rocks
Load quantity	=	Larger load than upper course
Riverbed	=	Smoother than upper course

Landforms found in the middle course are different to that of the upper co
deeper and at its shallowest gradient, it means both lateral erosion and de
causes the river to meander and form floodplains.

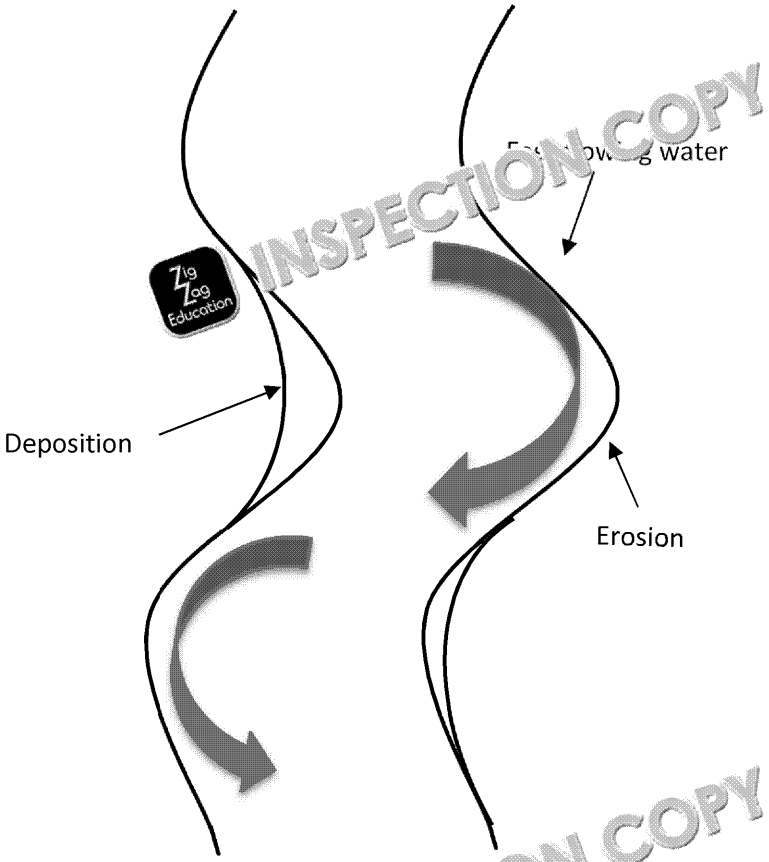


Figure 7 Formation of a meandering river

Meanders f
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will flow fr
the other. A
of the bank
depositing t
other side, c
change cou

The middle
features a l
normally ju
course of th
time as the
and deposit
area. Over t
floodplain.

Figure 8 River Spey meander and floodplain

The Lower Course:

The lower course of the River Spey is the widest and deepest section of the
has its largest load of sediment that is being carried downstream by suspen
steeper slope and faster velocity of this section of the river also means that
to the usual lower sections of a river. Although there are still fine particles
able to carry larger pebbles all the way to the shore.

Figure 9 Lower course of the River Spey

Lower Course Fact file:

Discharge	=	At its highest as all the tributaries have joined the river
Velocity	=	At its fastest due to the high discharge and steep angle
Gradient	=	Steeper than the middle course; gradient ratio = 1:380
Channel depth	=	At its deepest – 89 cm
Channel width	=	At its widest
Load size	=	Mixture of fine particles and larger pebbles
Load quantity	=	Largest load
Riverbed	=	Smooth

The **landforms** of the lower course are formed through lateral erosion and
course of the River Spey is steeper than the middle course, more erosion ha
in the lower course of the river. The erosion, combined with deposition an
that the river has wide channels that fluctuate and change shape frequently
and the amount of sediment being brought down from upstream and depo
the river.

Figure 10 Bra ers and estuary of the River Spey

The unusual combination of steep slope and large sediment load also leads
river. This is when the river breaks up and rejoins as it flows towards the s
and inlets of sediment.

Another feature of the lower course of the River Spey is its estuary as the ri
characterised by a wide plain and the mixing of fresh water and salty seaw

Flooding on the River Spey

Flooding is a natural and frequent occurrence on the River Spey. The river is often
flooding downstream and across the floodplains.

Figure 11 River Spey in spate

A spate is the sudden flooding of a river

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Figure 12 Flooded Garmouth golf course

Physical Influences on the River Spey

The River Spey is heavily influenced and shaped by fluvial processes from the lower course. However, what other physical factors affect the river? W river to flood? This section will concentrate on how geology and climate h the flow of the river.

Geology

The geology of a river system can affect [illegible] discharge, velocity and the lan The catchment area of the River Spey is mostly formed of very hard crystal are very resistant to erosion but that's what keeps the river steep, with larg upper cou[illegible]

There is very little soil and vegetation in the upper catchment area of the river. This, combined with the hard geology, means that rainfall is not absorbed by the soil and instead creates high amounts of run-off. The tributaries of the River Spey have little capacity to hold much water so the run-off tends to flow straight into the River Spey. This is what makes the river the most fast-flowing river in Scotland but is also one of the reasons the river floods so easily.

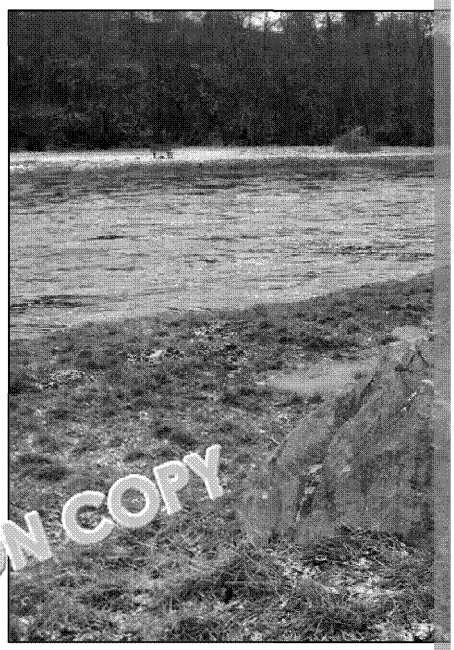

Figure 13 Rock on the River Spey

The variety of more resistant and less resistant rock is also [illegible] some of the features of the upper course, such as rapids and waterfalls.

Climate

Climate is another factor that can affect the flow in a river system.

North-east Scotland has a wet and mild climate and is prone to snow during the winter months. In the winter and spring, this high amount of rainfall and the snowmelts tend to cause spates in the river. During the summer, however, the spates are often caused by summer storms that bring heavy [illegible]

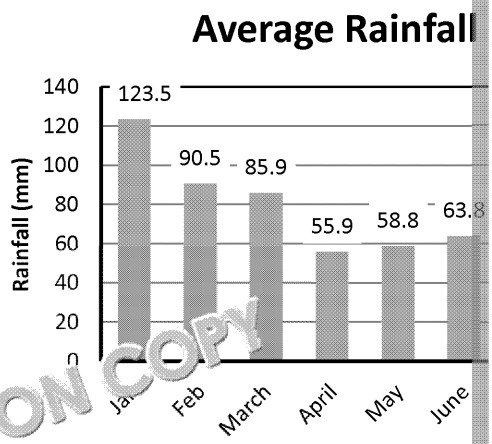

Figure 14 Rainfall in Aviemore

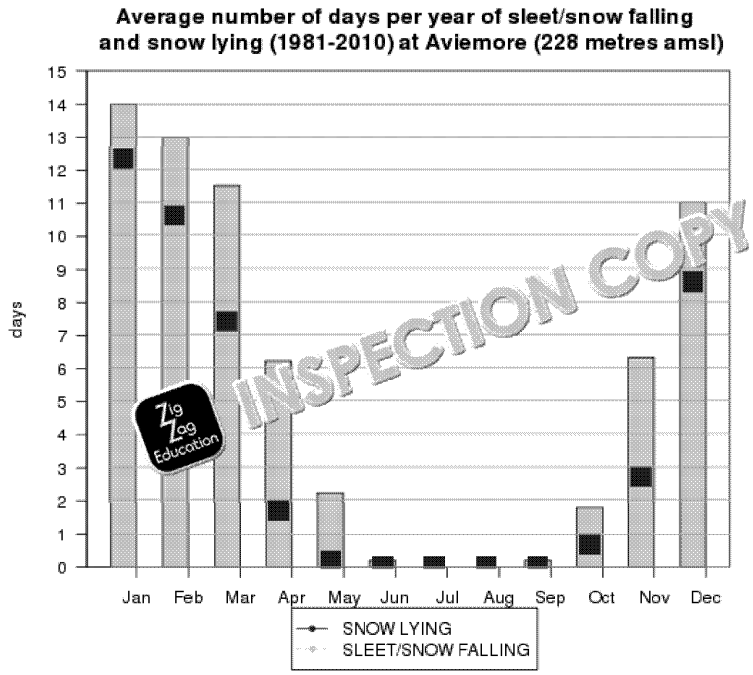

Figure 15 Average Snow levels in Aviemore

The upper co
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The middle c
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Spey, has an a
977.1 mm eve
the UK averag
heavy snow d

The lower co
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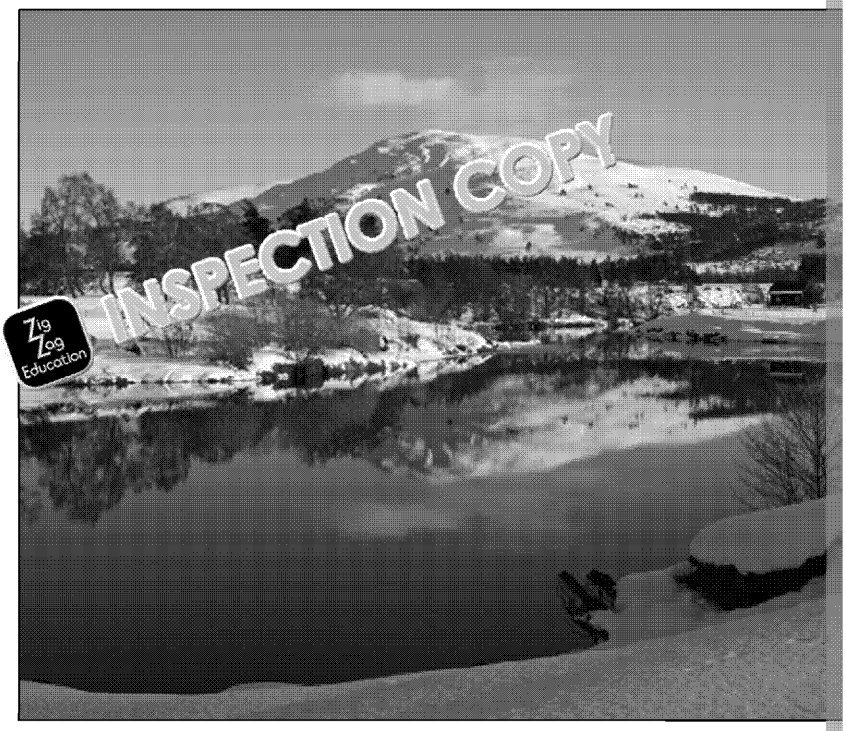


Figure 16 Snow on the River Spey

How climate change might affect the River Spey

- Increased rainfall in winter months will increase the flow of the rivers and flooding.
- More frequent storms will also bring unpredictable water levels and
- Warmer summers with less rainfall so there may be fewer spates durin
- Rising sea levels may impact flooding around the mouth of the river.

Human Influences on the River Spey

Human activities can influence the flow and flooding of a river system. In
main ways human activity affect the river system are:

- **Farming** in the catchment area has stripped areas of land of natural vegetation. This means less rainwater is soaked up by the land, potentially making the impact of floodin
worse.
- **Hydroelectric dams.** W r fr the upper course is diver to make hydropower for neigh g regions of Scotland. A dam has form all reservoir which allows water to be diverted. This affects the amount of water that is in the river system.
- **Built-up area.** Around 23,000 people live in the catchment area of the River Spey. Although this is relatively few people, any settlement can cause a river to flood due to there being more impermeable surfaces, such as concrete.

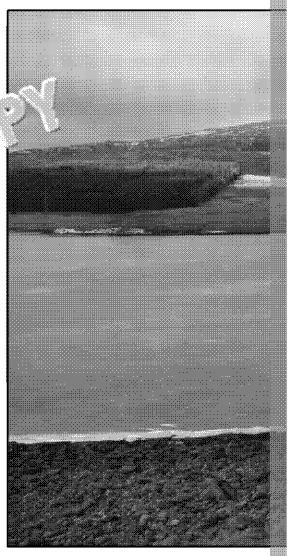


Figure 17 The small reserv

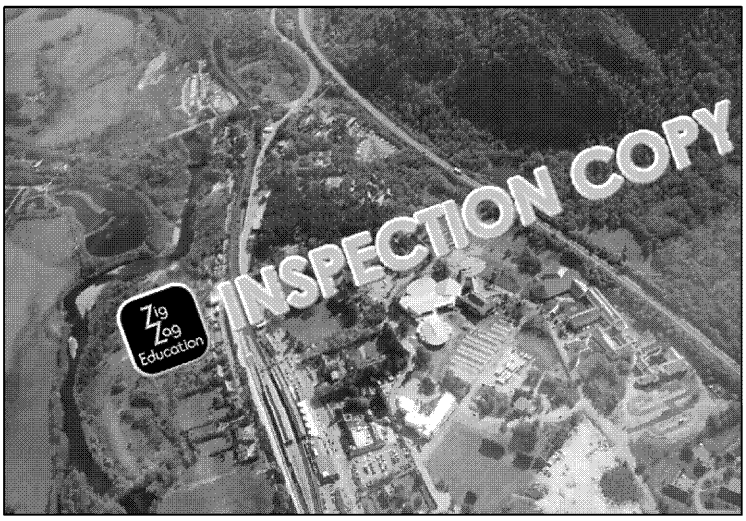


Figure 18 Town of Aviemore on the bank of the River Spey

On the whole,
the River Spey
system. The fr
Spey seems to
activities than
that reason, an
influence the R
management.

Flood Management on the River Spey

Why is flood management needed?

Across the catchment area, there are around 130 residential properties and 40 non-residential properties at risk of flooding. This leads to around £300,000 average damages per year.

The flood defence plan:

The overall plan for the flo defen in the region is mainly strategies of sof
the river is a site of conservation and, therefore, any planning permis
would be t and could ruin the unique ecology of the area. Soft engine
considered most sustainable, with the broad aim of adaptation rather tha
although there are vulnerable areas on the river there are only a few towns t
the river. For these reasons, soft management was deemed the most appropr
the River Spey.

Flood Defence Scheme	How it works
Flood warnings	Stations that are located up and down the river measur water is too high and there is a risk of flooding the poli organisation Floodline are alerted, who then warn the p
Flood forecasting to improve the warnings	The Scottish Environment Protection Agency (SEPA) pr updates on the river's water levels to help improve the
Engage with community groups	Talking to the communities affec[illegible]y the flooding hel understanding of the issues. It also means that the com of the action against flooding.
Self-help	Per[illegible]ividuals to manage their own flood risk b [illegible]idual flood plans and emergency kits, as well as m have the right insurance on their property.
Maintain the waterways	Clear the waterways of debris, such as fallen trees or se some conflict over this due to the expense. Some peopl the waterways is obtrusive to the natural habitats whil necessary for flood protection.
Development restrictions	The zoning of some areas so no development can take p the floodplains.
Roadworks	The only bit of hard engineering planned is to be comp for Scotland around any roads at risk of flooding. Thes be completed for another 10–15 years.

The Impacts

Social:

- Flood warnings and individual flood plans help people feel more prep a flood.
- Community involvement means the local people feel they are playing their own town.
- There has been some conflict between the local people and the council defence. Some local people feel not enough money is being put into th areas they live in and that soft options more hard engineering should be b
- Some residents also feel that the flood warning systems are not quick e flood quickly and so warning systems need to be able to give suff

Economic:

- The flood defence costs less than hard engineering.
- Saves money from all the damages in the long run.
- Not actually as effective as hard engineering techniques.
- Conflict with the need to build more houses so building restrictions ca

Environmental:

- It's the most sustainable form of management.
- It allows the river to flow naturally and flood when it needs to flood.
- However, the flooding can cause damage to the environment round the r
- With the uncertain nature of climate change, the scope of the flooding engineering plans may not be enough.

Fact table

Location:	North-east Scotland
Source:	Near Loch Spey in th
Mouth:	Spey Bay into the Mo
Length:	107 miles
River basin size:	3,000 km²
Rankings:	Ninth longest river in Fastest-flowing river
Status:	Special Area of Conse Site of Special Scienti
Human population in catchment:	23,000 (approx.)
Gradient ratios:	Upper course: 1:225 Middle course: 1:120 Lower course: 1:380
River depth (averages):	Upper: 48 cm Middle: 68 cm Lower: 89 cm
Upper course features:	Waterfalls Rapids
Middle course features:	Meanders Floodplains
Lower course features:	Braided channel Estuary
Number of homes evac[illegible] in the 2009 floods:	400
River Spey [illegible]:	Crystalline rock and
Average [illegible]ll in Aviemore:	977.1 mm
Residential properties at risk from flooding:	130
Non-residential properties at risk from flooding:	40
Average yearly damages from floods:	£300,000
Flood defence type:	Soft engineering

ICT interactive page

Rather than type out these w

Videos:

River Spey – Source to mouth

- **https://www.youtube.com/watch?v=P46 O g2Y**

News Stories:

BBC – 200 ds

- **http:// bc.co.uk/1/hi/scotland/8239074.stm**
- **http://news.bbc.co.uk/1/hi/scotland/8239567.stm**

Residents' response to the frequent flooding on the River Spey

- **http://www.northern-scot.co.uk/Home/Flooding-nightmare-5751043.**

Residents' response to flood plans in Garmouth and Kingston

- **https://stv.tv/news/north/186543-flood-plan-for-kingston-and-garmo time/**

Criticism of Floodline by local residents

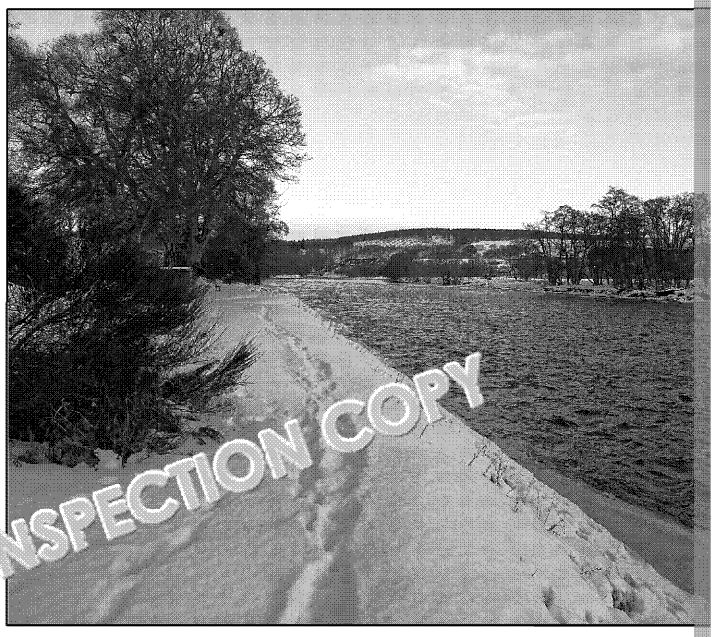
- **http://www.strathspey-herald.co.uk/News/Flood-of-SEPA-complaint 10122015.htm**

Springboards

Springboard 1

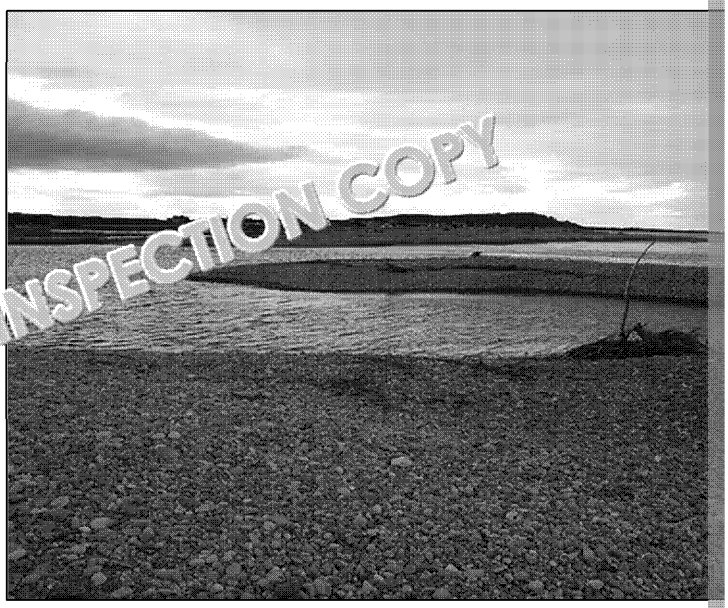
1. Which section of the river do you think this is? Why?
2. Suggest which fluvial processes are at play in this part of the river.
3. Suggest how the geology of the River Spey might affect these fluvial processes.

Springboard 2



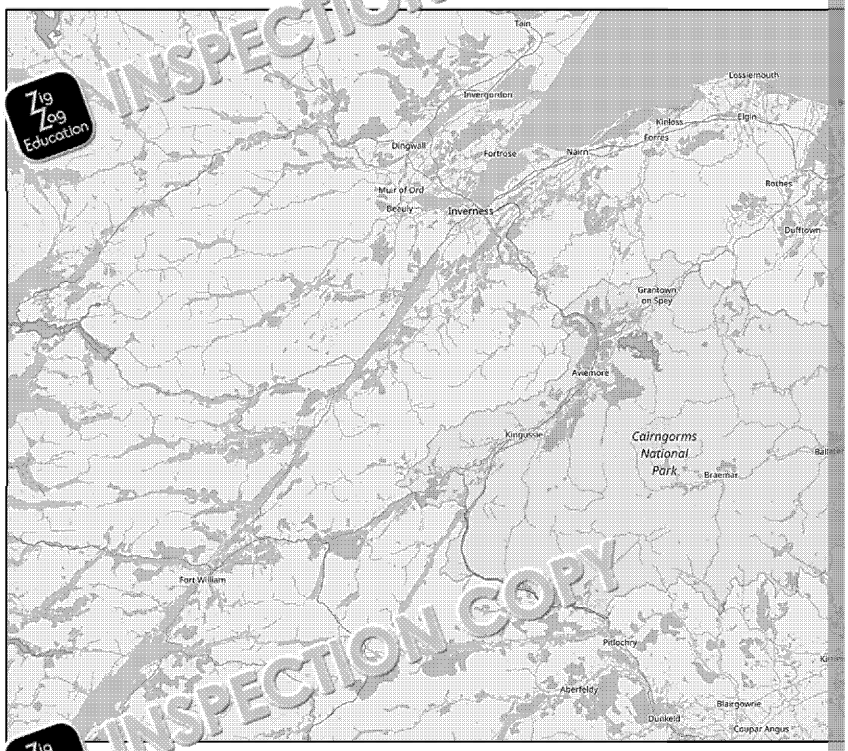
1. What does this image suggest about the climate around the River Spey?
2. Suggest how this amount of snow might affect the River Spey and its source.
3. Suggest how climate change might affect the River Spey in the future.

Springboard 3

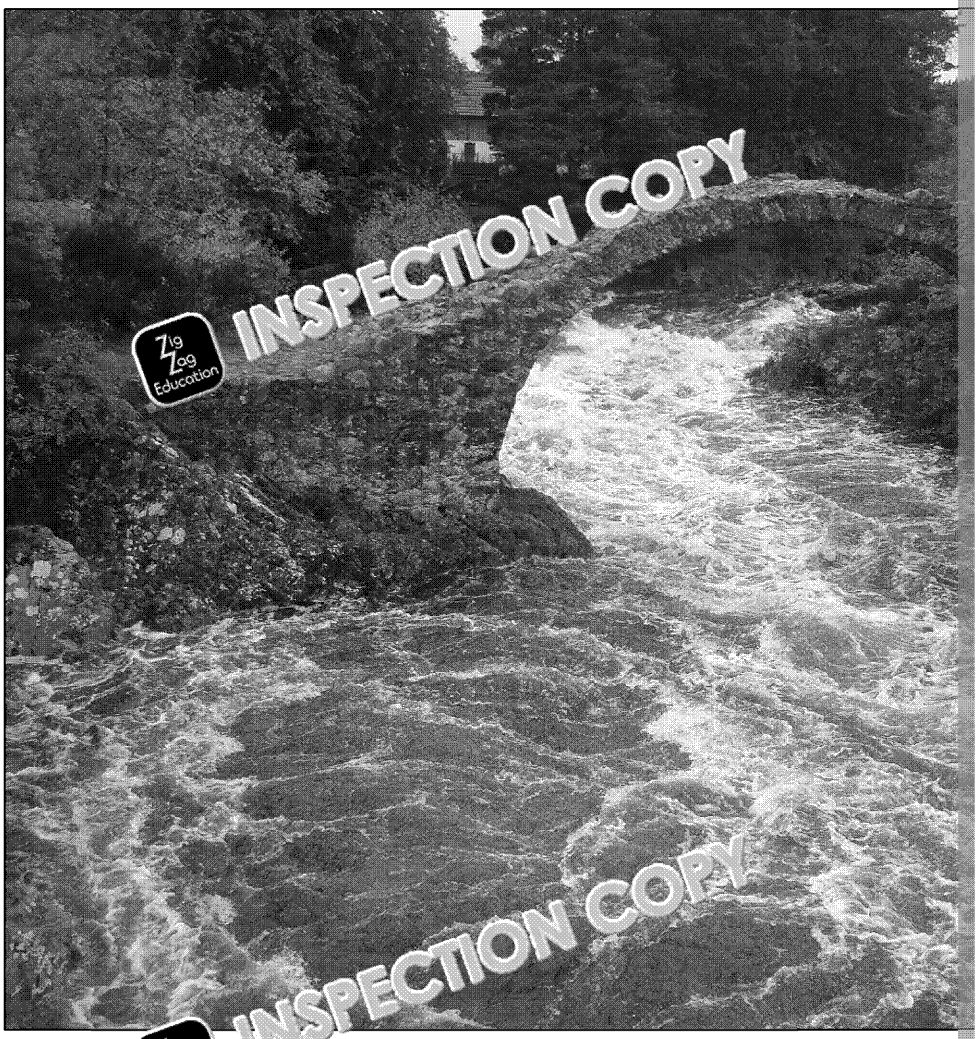


1. What section of the River Spey do you think this picture shows? Why?
2. Suggest which fluvial processes are at play in this section of the river.
3. How might the frequently changing course of the river affect the local

Springboard 4



1. What does this map tell you about the area where the River Spey is loc
2. What does the map tell you about the human population in the region
3. What does the map suggest about human activities in the region arou



1. What might have caused the spate in this tributary of the River Spey?
2. How might the spate affect the people living on the River Spey?
3. Discuss the different ways flooding from spates could be prevented.

Springboard Suggested Answers

Springboard 1

1	The upper section • Mountainous area • Steep gradient • Large rocks an[illegible]s • Sh[illegible]ow[illegible] • [illegible]ther valid point(s)
2	Vertical erosion is the main fluvial process working on this section of the [illegible] weathering from the rain, ice and snow.
3	The geology of the river might affect these processes because some rocks [illegible]

Springboard 2

1	The image suggests that the climate around the River Spey can get very c[illegible] precipitation.
2	• When the snow melts the water could flow into the river and cause it[illegible] • This could flood the surrounding land, causing damage to any vegeta[illegible] • It could flood buildings and roads around the river. • The high water levels and the flooding could also be dangerous to the[illegible]
3	• There will be wetter winters which could [illegible] t[illegible]e river may flood m[illegible] • Storms could be a more frequent occ[illegible]rre[illegible] which may also cause th[illegible] • Although there may be d[illegible] su[illegible]mers so there may be fewer summe[illegible]

Springboard [illegible]

1	The[illegible]er course • Wider channel • Lots of deposition • Estuary – where the river meets the sea
2	Deposition with some lateral erosion due to the wide plain and high amo[illegible] seen around the river.
3	• It could cause more flooding • It also makes the river unpredictable, which can make the flooding w[illegible] • It creates a larger floodplain

Springboard 4

1	• Flows through the Cairngorms National Park, which has very natural • This also implies it is an upland river • There are only a few towns in the region • There are quite a lot of other rivers around the region • Any other valid point(s)
2	There are a few small towns but the area as a whole is not very densely p
3	• The towns suggest that there are a number of people living in the area • The variety of main and smaller roads also suggests the movement of • The river has its source partly in the Cairngorm mountains also sugg people to enjoy the landscape, go hiking or even go skiing in the w • Any other valid point(s)

Springboard 5

1	• Heavy rainfall • Snowmelts • Storms
2	• Could flood the villages and towns around the river very quickly • Flood the roads around their village, making them more isolated • People may have to be evacuated from their homes • The water could affect the power and water supplies
3	• Could use hard engineering or soft engineering techniques. • Soft engineering would focus more on adaptation and preparation, su and emergency flood plans. • Hard engineering techniques could change the course of the River Spe the built-up areas. Dams or flood barriers could also be built to stop t

Summary

The River Spey

Introduction

- The River Spey is a [illegible]land river located in north-east Scotland coveri
- The so[illegible] of the river is located in the Highlands approximately 300 m
- The riv[illegible]en flows for 107 miles to the river mouth at Spey Bay.
- It is ranked the ninth longest river in the UK and the fastest-flowing riv
- Its unique ecology and rare species make it a Special Area of Conserva Scientific Interest.
- The river is a popular site for fishing for salmon and trout as well as ac water rafting or gorge walking.
- The long profile of the River Spey is unusual in that the lower course o middle course.

River profile and landforms

- The size and shape of the river change from source to mouth.
- The fluvial processes of erosion, transportation and deposition act at ea ways.
- The upper course is steep. It has a narrow ch[illegible]el and shallow waters boulders.
- Waterfalls and rapids [illegible]be found at this section of the river.
- The middle co[illegible]s wider and deeper than the upper course. The roc
- The ri[illegible]t its shallowest gradient at this point and its features cons floodpl[illegible]ns.
- The lower course of the river is the widest and deepest section with a h particles and pebbles.
- It features a braided river and an estuary.

Flooding on the River Spey

- Flooding is a frequent occurrence on the River Spey.
- It is often subject to spates, which can flood the towns and land aroun
- The most recent major flood was in 2009 when 400 homes were evacua near Garmouth was completely flooded and a small road bridge was s

Physical influences on the River Spey

- The geology of the River Spey affe[illegible] flows and the landforms t
- The catchment area is mos[illegible]d of hard crystalline rock and grani there are high am[illegible] run-off that can cause spates.
- The cl[illegible] of the area also affects the river system.
- North-[illegible]cotland experiences high amounts of rainfall and snow in of the snow and the high amount of rain can also cause spates.
- Climate change could also increase the amount of flooding due to it be amounts of rainfall and storms.

Human influences on the River Spey

- Humans also influence the River Spey through their activities, such as hydroelectric dams.
- They also try to influence the river through flood management.
- The strategy for flood management on the River Spey mainly consists techniques, such as flood warning systems and development restrictio
- The schemes have helped people feel more secure and safe but some p not doing enough to protect them.
- The schemes are, however, cheaper and more sustainable than hard en

The River Spey

Quick-fire Questions

1	Where is the River Spey located?	
2	Approximately where is the source of the river?	
3	How long is the River Spey?	
4	How big is the river basin?	
5	How many people live in the area around the River Spey?	
6	Name one specially protected species found in the river.	
7	What is unusual about the long profile of the River Spey?	
8	What is the gradient ratio of the upper course of the River Spey?	
9	Name two features found on the upper course of the River Spey.	
10	How deep is the middle course of the River Spey?	
11	Name two features found on the middle course of the River Spey.	
12	What is the sediment load like in the lower course of the River Spey?	

13	Name two features found on the lower course of the River Spey.	
14	What is a spate?	
15	How many homes had to be evacuated in the 2009 flood [illegible] River Spey?	
16	What type of geology does the River Spey have?	
17	What can the geology affect on [illegible]?	
18	What is the [illegible] rainfall in Aviemore?	
19	Name one way [illegible] change may affect the River Spey.	
20	Name one way other than flood management that humans influence the River Spey.	
21	How many residential properties are vulnerable to flooding?	
22	Name two flo[illegible] schemes in place for the River Spey.	

23	Name one social impact of the flood defence plan on the River Spey.	
24	Name one economic impact of the flood defence plan on the River Spey.	
25	Name one environmental impact of the flood defence plan on the River Spey.	

Quick-fire Answers

1	Where is the River S[illegible]?	*North-e*
2	Appr[illegible]ely [illegible]here is the source of the river?	*In the S*
3	How l[illegible]g is the River Spey?	*107 mil*
4	How big is the river basin?	*3,000 k*
5	How many people live in the area around the River Spey?	*Approx*
6	Name one specially protected species found in the [illegible]	*Atlanti* *Otters* *Pearl m* *Sea lam*
7	What is unusual a[illegible]t the [illegible]ng profile of the River Spey?	*The low*
8	Wha[illegible]ra[illegible]ent ratio of the upper course of the River Spey?	*1:225*
9	Name two features found on the upper course of the River Spey.	*Waterfa* *Rapids*
10	How deep is the middle course of the River Spey?	*68cm (*
11	Name two features found on the middle course of the Ri[illegible] Spey.	*Meande* *Floodpl*
12	What is the sediment load like in th[illegible]ourse of the River Spey?	*It holds* *A mixtu*
13	Name tw[illegible]fea[illegible]t[illegible]d on the lower course of the River Spey.	*Braided* *An estu*
14	What i[illegible] spate?	*A sudde*

15	How many homes had to be evacuated in the 2009 floods of the River Spey?	*400*
16	What type of geology does the River Spey have?	*Hard crystalline r*
17	What can the geology affect on a river?	*The discharge, vel*
18	What is the annual average rainfall in Aviemore?	*977.1 mm*
19	Name one way climate change may a[illegible] the River Spey.	*Increased rainfall*
20	Name one way that flood management that humans influence the River Spey.	*Farming* *Hydroelectric dam* *Residential/built-u*
21	How many residential properties are vulnerable to flooding?	130
22	Name two flood defence schemes in place for the River Spey.	• *Flood warning* • *Flood forecast* • *Engaging the* • *Self-help plan* • *Maintaining* • *Development* • *Work on the r*
23	Name one social impact of the flood defence plan on the River Spey.	• *Residents feel* • *Community fe* • *Some local pe* • *Some have co* *enough*

24	Name one economic impact of the flood defence plan on the River Spey.	• *The flood defence costs less than hard engineering.* • *Saves money from all the damages in the long run.* • *Not actually a* • *Conflicts with* *can be seen as*
25	Name one envi[illegible]nt[illegible]pact of the flood defence plan on the River Spey.	• *It's the most s* • *It allows the r* • *However, the* *the river, such* • *With the unce* *could get wors*

Extension Questions

1. Describe the path of the River Spey from source to mouth.
2. Explain why the long profile of the River Spey is unusual.
3. Describe how the fluvial processes change as you go downstream.
4. Compare the upper course to the lower course of the River Spey.
5. Suggest how geology and climate influence the River Spey.
6. Suggest how human activities can influence the River Spey.
7. Evaluate how climate change may affect the River Spey catchment area
8. Examine why soft management flood defence was chosen for the River
9. Evaluate what might be different about the River Spey if hard engineerin
10. Using your knowledge of flood management, discuss whether soft or h actually be better for the River Spey.

Extension Answers

1. The River Spey begins in the Scottish Highlands about 300 m above sea level.

   It then flows through the mountain valleys in the Ca[illegible]rms, with tributaries Cairngorm and Monadhliath mountains.

   It passes by a few small towns [illegible] into the middle course where the lar floodplains on both sid[illegible] river.

   It then [illegible] below on the plateaus to the north-east of the Cairngorms u flows i[illegible] Moray Firth.

2. The long profile of the River Spey is unusual because the lower course is actu course. In most rivers, the lower course is at its shallowest gradient. The reas Spey is because the slope of the land gets steeper nearer the sea.

3. The upper course – main fluvial processes are vertical erosion, weathering and This can be seen in the type of landforms found in the upper course, such as wa

   The middle course – both lateral erosion and deposition are at play in this sec discharge and velocity of the river and the larger bedload. The bedload is no both traction and suspension. The lateral erosion and deposition cause the ri create floodplains.

   The lower course – the main fluvial process that is happening on the lower co River Spey also experiences a fair amount of later[illegible]sion on the lower cours bedload is being carried out to shore by su[illegible]nsi[illegible]and solution. The combi deposition has created the braid[illegible]ve[illegible]y the mouth of the Spey.

4. The upper cours[illegible] River Spey is in a mountainous region, with a steep v fairly [illegible] w[illegible] shallow waters. The rocks are large and are moved by trac section [illegible]ainly created by vertical erosion.

   The lower course of the River Spey, however, is very wide and deep. At this p The bedload is mainly just fine particles with some pebbles. The landforms fo deposition and lateral erosion.

5. Geology
   - The hard rock and lack of soil means that the river basin experiences hig tributaries also have little capacity to hold all this water so it ends up in t cause spates.
   - The alterations between hard and soft rocks also cause the features such as w

   Climate
   - The wet and cold climate of north-west Scotland [illegible]ns that there are oft flowing into the River Spey, causing it to flood

6. Farming – can strip the land [illegible] near the river from vegetation making the land m to flooding.

   Hydro[illegible] dam – There is a small dam on the upper course which has crea diverted [illegible] hydropower. The dam plays a role in influencing how much wat

   Built-up areas – any towns or villages that are on the banks of the River Spey easily due to the increase of impermeable materials, such as concrete.

   Flood management – forms of flood management can change how the river fl

7. Climate change could have a significant impact on the River Spey in the futu
   - The increased amount of rainfall during the winter months could cause th
   - The more frequent number of storms that may occur could have the sam
   - If there are more frequent floods it may not give towns and villages enou each one. If this is the case, other flood management techniques may be
   - There should be drier summers, however, so there may be fewer floods d

8. Soft management could have been chosen for the River Spey for the following
   - The area is both a Special Area of Conservation and a Site of Special Scie ecological importance so hard management could have brought dan
   - Soft management is more sustainable and, therefore, will be better for fu
   - It is cheaper
   - There is not a high population in the catchment area so the area may be
   - Any other valid point(s).

9. Differences to the River Spey if hard engineering was used:
   - The river could have changed course.
   - There could have been worse damage up or downstream from the mana
   - More houses could have been built in the area if it was not deemed to be
   - Wildlife and habitats could have been lost.
   - Any other valid point(s).

10. Soft engineering impacts:
    - Cheaper for the area
    - Sustainable
    - Isn't as effective as hard engineering
    - The area still floods and causes damage
    - May not be effective against the future impacts of climate change

    Hard engineering (potential) impacts:
    - More effective than soft engineering
    - Could initially protect the residents who are living there now
    - May allow for more development in the area
    - It's expensive
    - It isn't sustainable and upkeep is expensive
    - Hard to know if it would work without knowing the full impact of clima

Exam Style Question

Question 1

With the help of Figure 1, examine whether human factors in the risk of a river flooding more than physical factors.

Figure 1: Flooding along the River Thames

Level Marking

Level	Mark	Description
1	1–3	• The student evidences limited understanding between places, environments and processes. • A limited ability to evaluate is evidenced thr knowledge and understanding. The argumen There is little evidence to support the conclus
2		• The student evidences good understanding o between places, environments and processes. • A reasonable ability to evaluate is evidenced of knowledge and understanding. The argum only partially logical. There is some evidence
3	7–8	• The student evidences a firm understanding between places, environments and processes. • A strong ability to evaluate is evidenced thro knowledge and understanding. The argumen explored. There is consistent evidence to sup

Indicative Content

- Students should offer an assessment of the variety of physical and human fac river flooding.
- They may use specific examples of rivers they have studied.
- Figure 2 is for guidance; students may use ideas beyond those which may be
- The student should clearly demonstrate a comparative assessment of physical flood risk. They should then consider whether one set of factors increases the other. Lower-level marks will be given to students who do not form an argu

Suggested Content

Answer in relation to the River Thames.

Human factors that increase flood risk:

- Human settlements. The Thames is the most populated river basin in the UK settlements, including London. The building of these settlements has increase of vegetation and the building of more impermeable surfaces.
- The river has also been manipulated by humans in a variety of ways, such as straighter. These things can cause the river to flood as the route and amount o
- However, human activity has also decreased the risk of flooding by implemen such as the Thames Barrier.

Physical factors that increase flood risk:

- The geology of rivers can make them more or less prone to flooding. For exam over clay, which is impermeable, the river is more likely to flood.
- The relief of the land also influences the flood risk. For example, if the surrou is more chance that the river will flood those areas.
- The climate of an area can also increase flood risk. For example, the Thames h there has been heavy rainfall and storms. However, the Thames does lie in a does not experience as much flooding as it could.