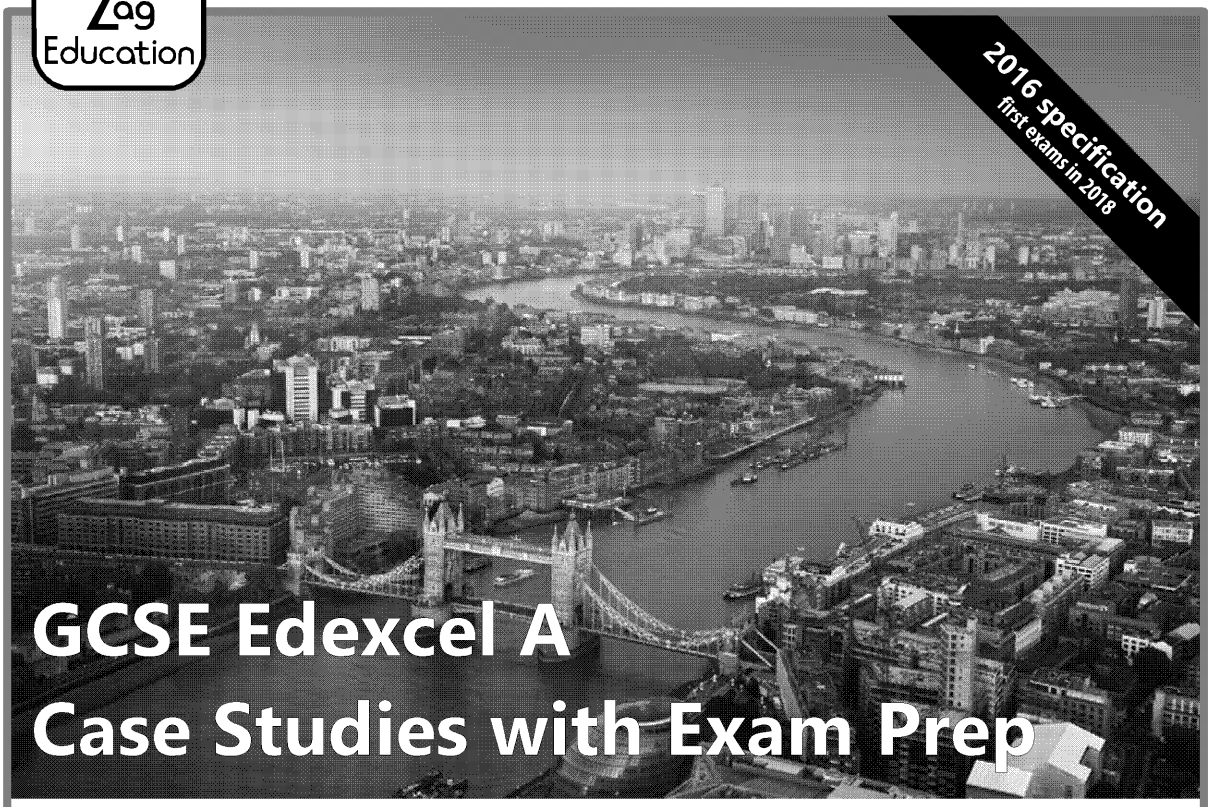
Zig Zag Education

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



GCSE Edexcel A Case Studies with Exam Prep

Changing Landscapes of the UK: Rivers

The River Thames

zigzageducation.co.uk

POD 8817

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 Thames** 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/8817***

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 Thames is probably the most famous river in the UK. It flows for
England from the Cotswolds to the North Sea, passing through eight count
Most famously it flows through London and then out into the North Sea at

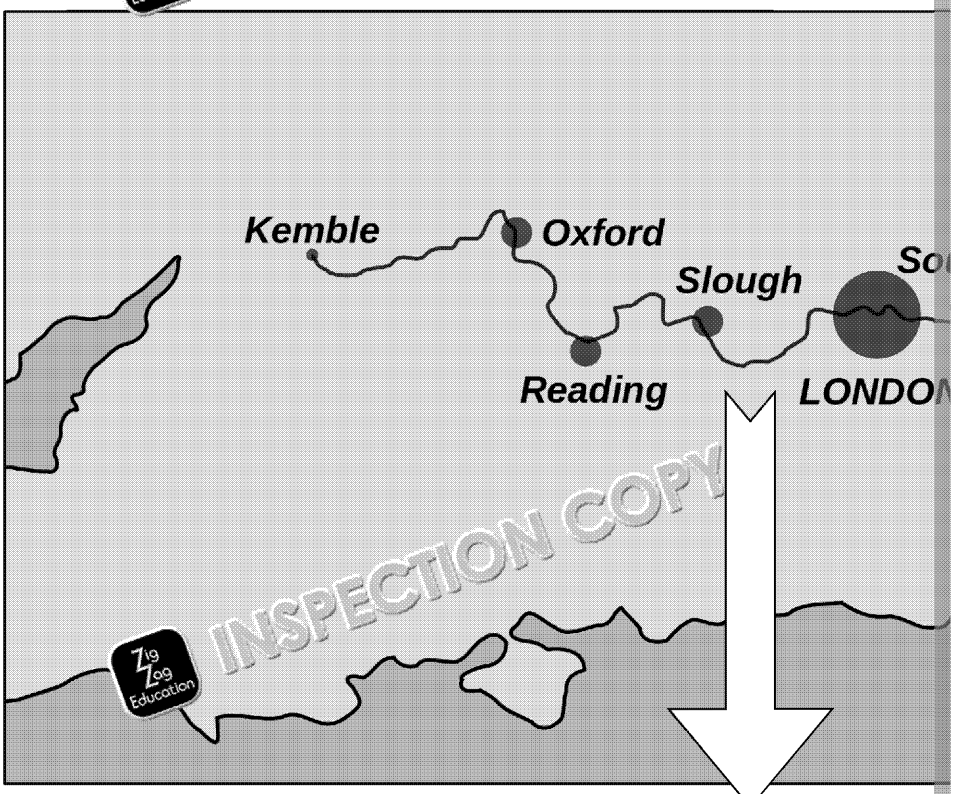
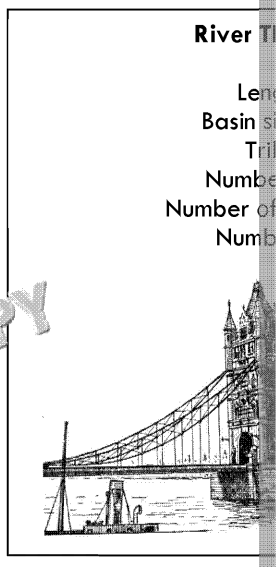


Figure 1 Map of the River Thames

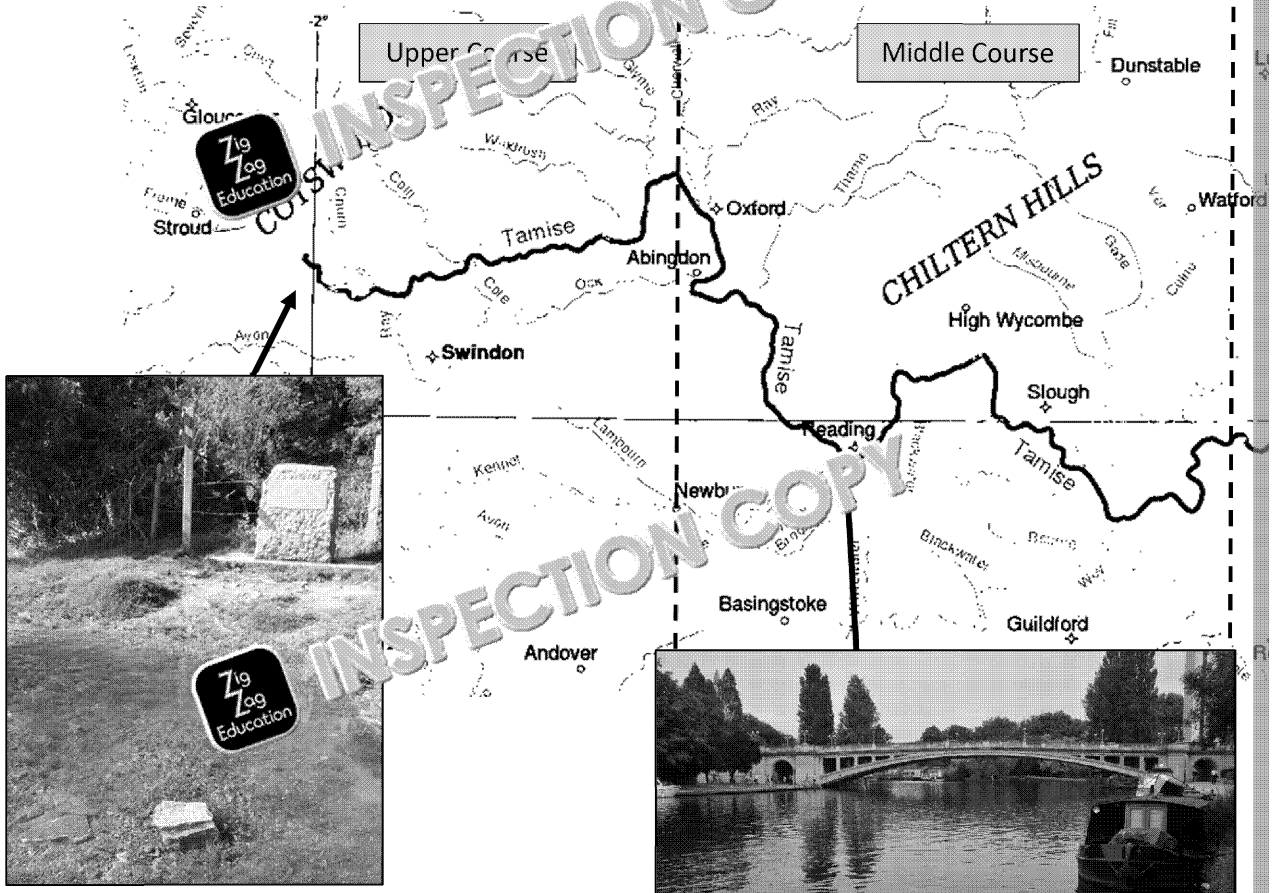
The Thames is the longest river in England and the second longest in the UK. It has 38 main tributaries flowing into it, with a basin size of 12,935 km². It is a lowland river with a shallow gradient; its source is only around 108 m above sea level.

It is also the most densely populated river basin in the UK, with around 13 million people living in it.

Throughout history, humans have used the Thames as a key trade and transport route. Today, it is mostly used for recreation, travel, sport and tourism.



Source to Mouth of the River Thames:



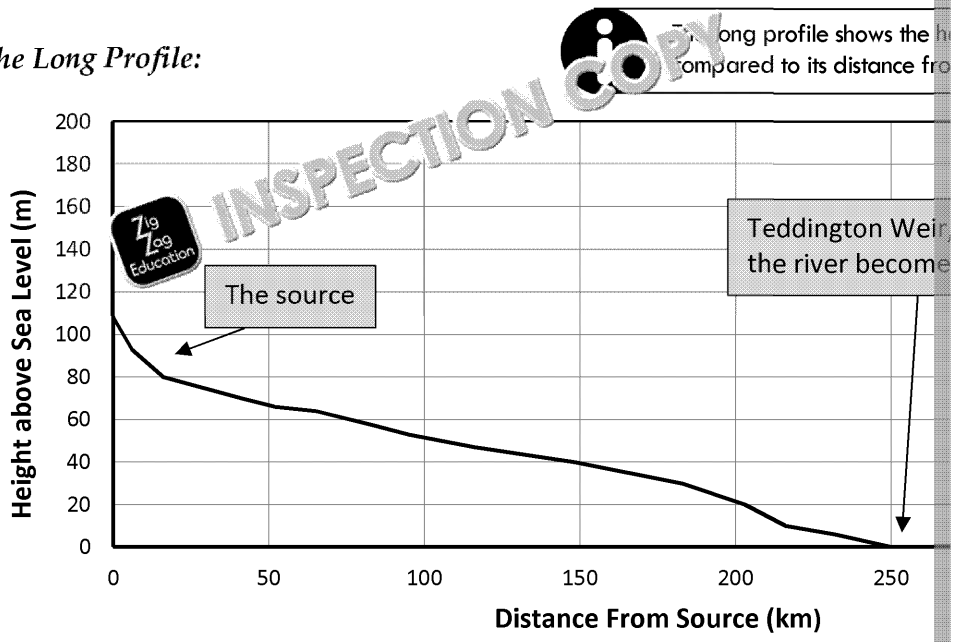
The source of the River Thames is located in a field near the town of Kemble in the Cotswolds. It is marked by a headstone and a large puddle of water. However, during the dry summer months there is no sign of any water at all, making it hard to believe it's the source of a great river!

The middle section of the river flows through various large towns and cities. This image is of the River Thames flowing through Reading.

River Profile and Landforms

Like most rivers, the size and shape of the River Thames changes as the riv due to various factors, such as the gradient of the river and the fluvial proc and deposition) acting on the river. By examining the different sections of mouth you can see how the shape and landforms of the river change.

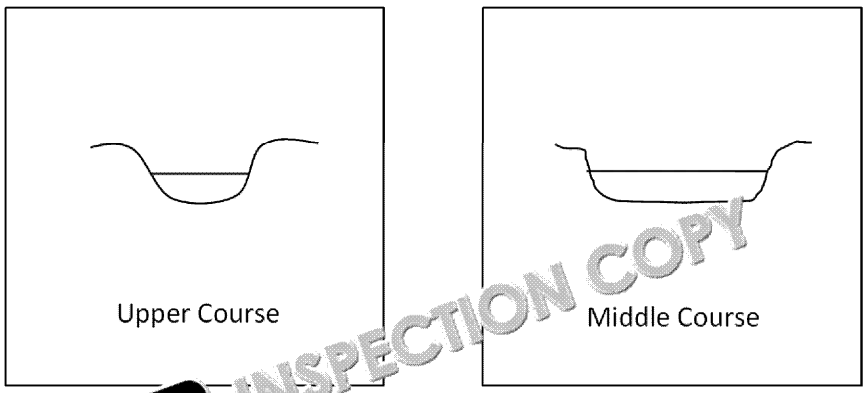
The Long Profile:



The graph above shows the long profile of the River Thames. The long pro the gradient gradually decreasing downstream, in a co ave fashion. As y gradient of the Thames does decrease as it flo to stream but there are bumps are most likely formed from c where the riverbed is due t thousands of years. This has t en h an impact on the gradient of the riv

Another th n about the long profile of the Thames is that the heigh is only arou 8 m. Comparing this to other rivers around the UK, such source lies 610 metres above sea level, the Thames does not have a high alti the Thames is tidal, it means the river is at sea level from this point.

Cross Profiles:



The Upper Course:

The upper course of the River Thames is not a typical upper course due to its gentle gradient. Although the channel is narrow and shallow it is not very steep. Instead the stream gently flows downhill through beautiful countryside and a few villages. At this point the river has a low discharge of around 17.6 m^3/s. It also carries a small load of larger rocks that are being transported downstream through traction.

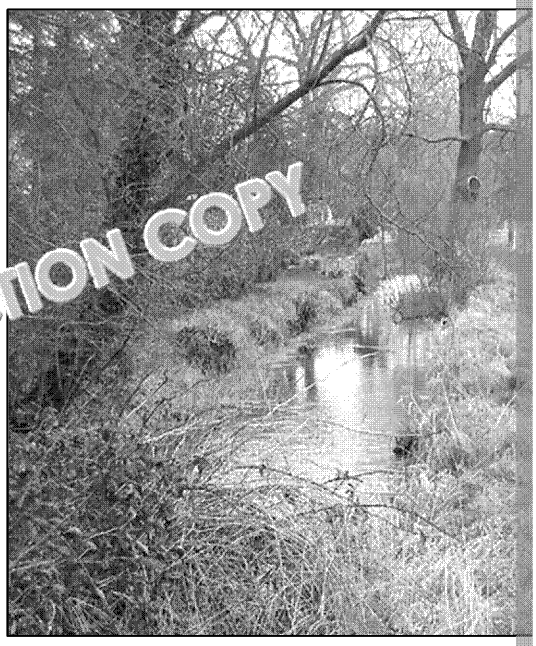


Figure 2 The gentle upper course of the River Tha

Even though the river only flows gently downhill, it still cuts into the riverbed through vertical erosion. However, the erosion is not very powerful so there are no an upper course, such as waterfalls, gorges or rapids.

The Middle Course:

The middle course of the Thames is characterised by a wider and deeper ch More tributaries join the main river in this section, causing the discharge to greater energy and shallower gradients cause the river to erode laterally.

Figure 3 The meandering River Thames

The bedload at this point is also larger as the tributaries have deposited m
The load consists of smaller rocks than the upper course, which are being t
suspension and traction.

Just from looking at a map of the Thames you can see how significantly the river **meanders** along its course. This meandering is caused by lateral erosion and deposition. As the gra[illegible] the river has d[illegible] middle course, its [illegible] moves from side to side and erodes the riverbank laterally. Where the water is deeper and moves faster, it erodes the bank. The river then deposits this material on the other side of the bank where the water moves more slowly, creating the meander. Over time this meandering changes the course of the river.

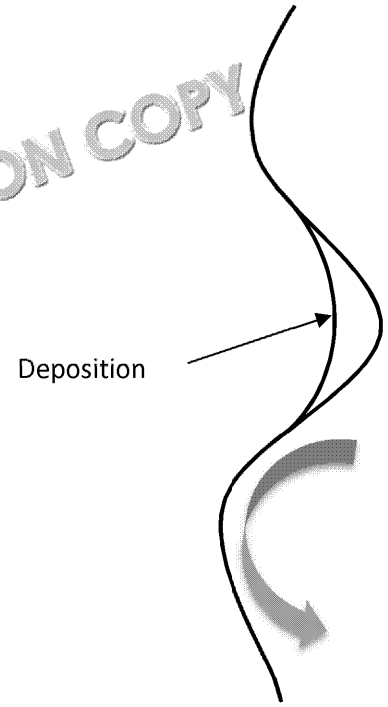


Figure 4 Diagram of

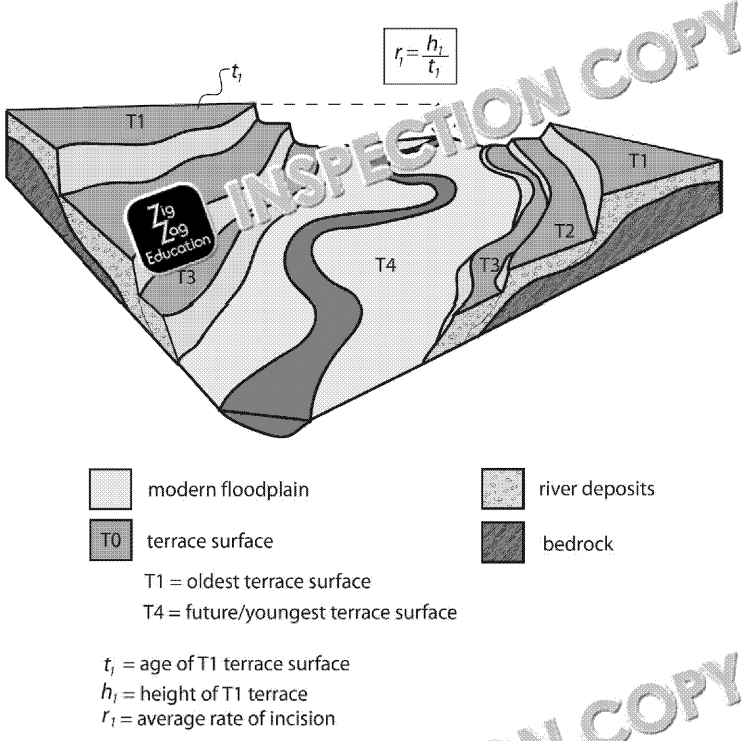


Figure 5 Diagram of river terraces

River terraces a
to occur in the
They formed th
fluctuations in
ages. When sea
rivers more ene
vertical erosion
causes the river
riverbed and fo
riverbeds are ca

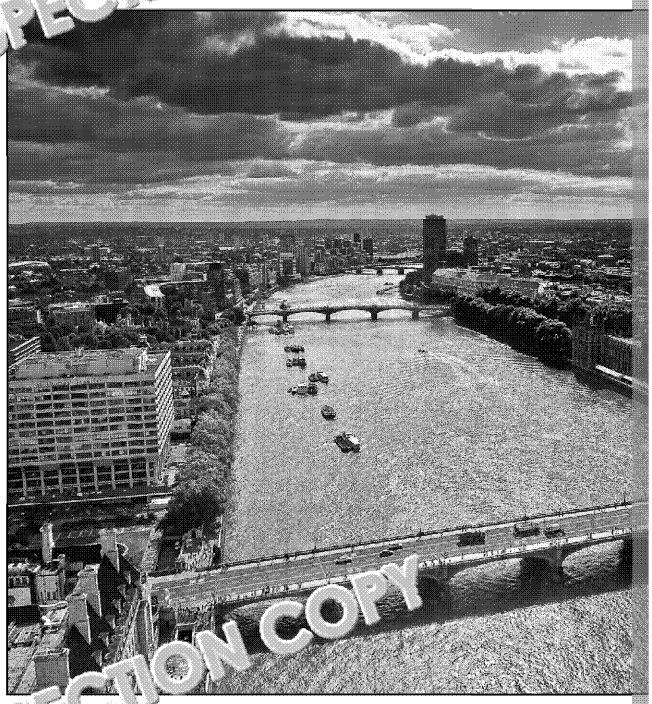
Terraces don't j
section of the ri
these river terra

Lower Course:

The lower course of the Thames is the widest and deepest section of the riv
around 65.9 m³/s and the river widens from 100 m as it flows through Lond
its mouth. The Thames is at sea level at this point due to its tidal nature; it
down with the tide.

The lower Thames also carries the largest bed load of around 300,000 tonne
and silt which are transported thro[illegible]ension and solution.

Deposition and lat[illegible]
erosion ar[illegible]
fluvial proc[illegible]
taking place in the lower Thames. One feature of these processes is **floodplains**, where the river has repeatedly flooded over time, depositing silt onto the land. This creates flat and fertile land either side of the riverbank. Today, much of the Thames floodplains have been built on. London is one example of a floodpla[illegible] settlement



[illegible]Thames flowing through London

As the Thames reaches its mouth it forms an **estuary** where the fresh water and salty seawater mix together. As deposition is the main fluvial process in this section of the river, the Thames estuary is characterised by its mud and silt deposits. This forms a flat and muddy coastline with few coastal features

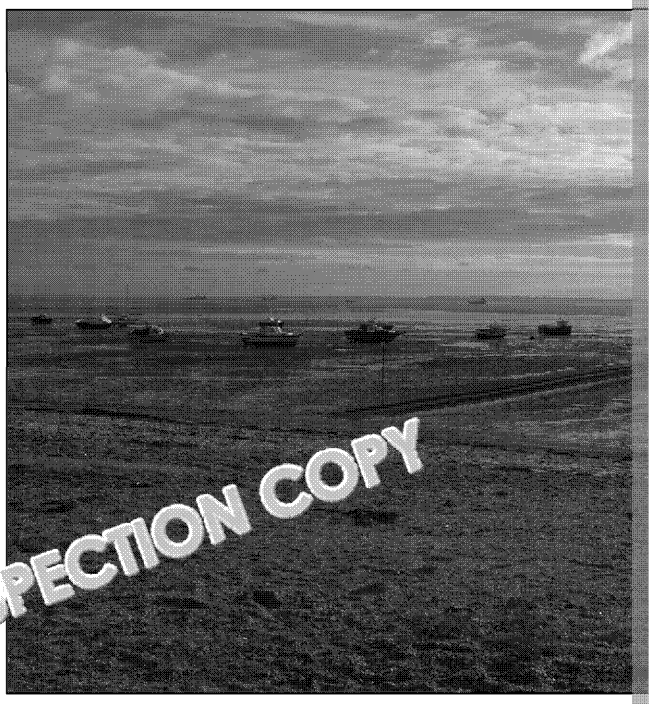


Figure 7 Thames Estuary

Flooding

The River Thames is prone to flooding, which can have serious consequenc
living in its basin. In the last century there have been around 10 major floo
occurred in the last 20 years. The flooding of the Thames is either caused b

Notable floods of the twentieth century:

1928 – On 7th January the Thames flooded an [illegible] er the embankments
Thousands lost their homes a[illegible] people died.

1947 – Heavy snow [illegible] ter caused major floods when it melted in
mil[illegible] r[illegible] the damage to the Thames Valley. That's equivale
tod[illegible]

1953 – On 31st January a large storm surge came up the Thames from the N
devastating flood which killed around 300 people.

February 2014

The most recent significant flooding of the Thames was in the winter of 2014, when the UK was subject to the worst sequence of storms in 20 years. These storms caused the Thames to burst its banks across the counties of Berkshire, Oxfordshire and Surrey, causing widespread disruption for the villages and towns in these areas.

Facts:

- The Thames reached its highest water level in 60 years
- 14 severe flood warnings were declared along the Thames
- Around double the average [illegible] fell in many areas around the Thames
- Around [illegible] homes were affected just in the Thames Valley
- Overnight from 8th–9th February, 150 people were rescued from their homes in Surrey
- In the village of Datchet in Berkshire, 10,000 sandbags were distributed

Physical Influences on the River Thames

We have already explored how fluvial processes such as erosion and depos
but what other physical processes can influence the river and its flow? Thi
relation to the two significant physical influences of geology and climate.

Geology:

The geology of the River Thames affects its discharg[illegible] velocity, and the
along the river.

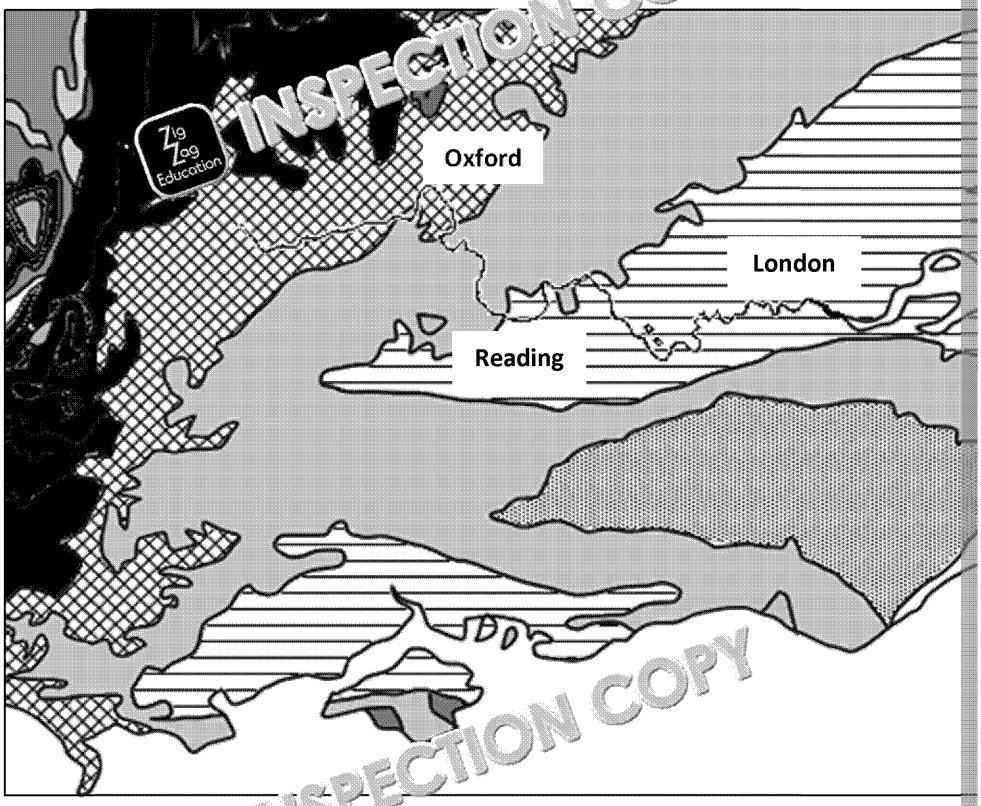


Figure 8 The [illegible] south-east England

The geolog[illegible]and the source is limestone rock, a relatively hard porous r
over clay in Oxford. Clay is an impermeable rock so does not soak up any
the river is at high discharge it is more likely to flood where it flows over cl
Oxford, the geology of the area changes to chalk. Chalk is a permeable roc
(also known as an aquifer) and is used as a source of water for us. As the ri
flows over London clay, which is again impermeable and more prone to flo

Climate:

The discharge of the Thames is actually lower than you might expect despite being a large basin. This is partly due to the climate being fairly dry in south-east England, with only 690 mm of rainfall per year compared to the UK average of 897 mm. Due to the relative scarcity [illegible] water in the region and the [illegible]dra[illegible] water stores that lie in [illegible]k, a large amount of [illegible] is [illegible]acted for drinking w[illegible]nd sewage treatment. In fact, it is said that from source to mouth the Thames will go through eight people!! Most of the year the water level in the Thames is quite low. So wh
can change this and cause the river to flood?

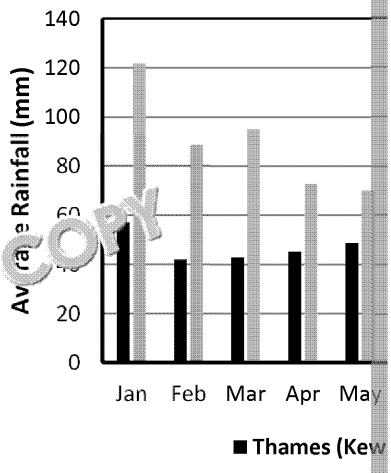


Figure 9 Average rainfall graph of [illegible]

1. Heavy rainfall
   As we have seen, when heavy rain does happen it can cause the Tham
   February 2014.

2. Storm surges
   These occur in the Thames when an area of low pressure travels down
   With this area of low pressure come strong wind- t.at push the sea in
   can cause very high tides and consequen y f.ding. This is what cau

Another thing to consider f.r the f.ture is how **climate change** might be in
According to expe.. ides of the Thames are rising around 60 cm ever
continues at this rate or faster it could have significant effects on the
On top of sea level rise, it is likely that more rainfall will occur in the winte
storms may also occur. The Environment Agency predicts that these factor
of properties in the Thames catchment by 20%!

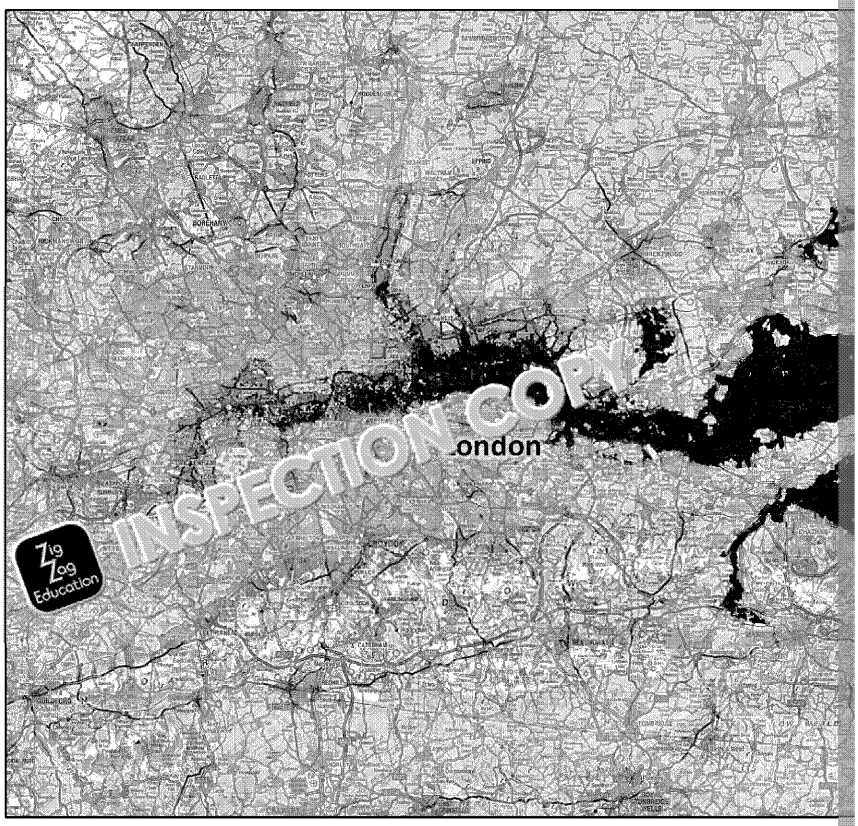


Figure 10 London with a six-metre rise in sea level

Human Influences on the River Thames

Human activities have heavily influenced the River Thames for thousands
first invaded Britain, they saw how the Thames could be useful for trading
building a settlement there, which they named Londinium. Since then, the
bringing wealth to the country. Throughout human history, the Thames ha
by human activity.

As London developed, the increasing de[illegible]on and urbanisation of the
more prone to flooding due to the [illegible]se in impermeable surfaces being

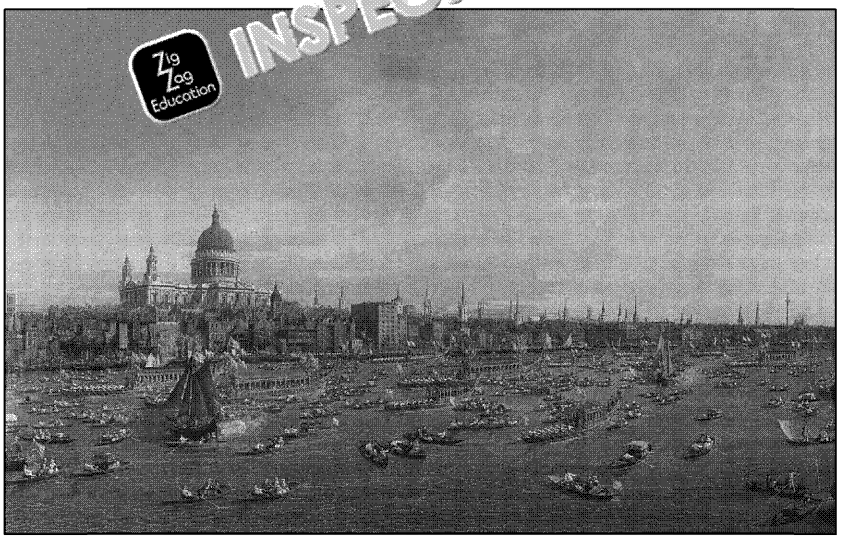


Figure 11 River Thames in 1746

For cen
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dead b
meant
life. Th
toss th
it now
fish an
dolphi

There are 45 locks and weirs along the Thames river. These help make the river easy fo
boats to travel dow[illegible]ll as controlling [illegible]ow of water downstrea[illegible]. Their construction has also made the river narrow and deeper, which has had further effects on the flow of the river.

[illegible]2 A lock along the Thames

Another way the discharge of the Thames has been affected is through the number of water treatment plants that extract the water for drinking water and sewage treatment. In recent years, demand for water has been growing in the regio[illegible] and this could mean [illegible] strain is p[illegible]he [illegible]r itself, further affecting its discharge.

However much human activities have shaped the Thames, there is still an
shaping us through the constant threat of flooding. One of the biggest way
influence the Thames is through flood management.

Flood Management

Due to the 13 million people living in the Thames Basin and the significanc
towns, the Thames has been subject to plenty of flood management plans.
form of hard engineering due to the scale and importance of the areas that

Why is flood management needed?

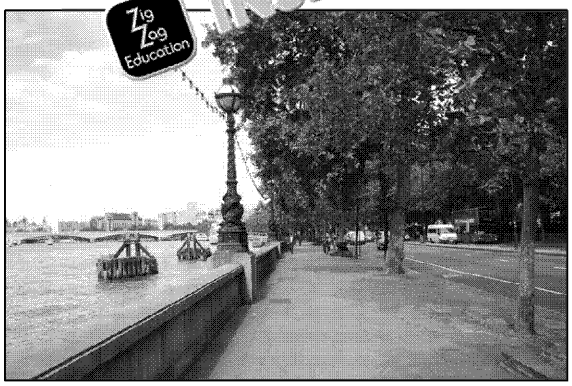
In the Thames Estuary alone, there are around 1.5 million people and £20(
of flooding. London transport, schools and hospitals are all also at risk. O
important cultural sites, such as the Houses of Parliament and City Hall, w
river. Further upstream, beyond the tidal section of the river, there are more
The frequency of flooding over the last 20 years have increased the pressure to d
Each section of the river has its own management strategies that are helpin
damage of flooding.

The Flood Defence Plans

The Thames Barrier

After the destruction of th
were put in place to creat
from the tidal river. In 19
opened, stretching across
metres high. The barrier
that in normal tide the riv
can get through. Howeve
storm surge is due to hit,
safely from the high volum

Embankments and Flood Walls



For centuries there were
along the Thames to help
London from the water.
century, embankments w
both with sewerage syste
building the embankmen
they reclaimed 89,000 m²
Thames narrower.

In addition to the embank
around 100 miles down th
Thames Barrier was built,
also strengthened downst

River Diversion Schemes

Upstream from London, t
diversion schemes put in
side rivers that help to a
in the main river. This is
the water on a different c
again downstream.

Jubilee River is one exam
1990s around the areas of
It is approximately 7.2 mi
natural river. The aim of
the water around the tow

The Impacts

Social:

- The schemes are helping to protect many properties, transport system
  are key sites for London and the whole of the UK.
- There seems to be a lack of public awareness about the flood risks of th
  that people are not very prepared for the impacts of any flooding. So
  schemes they may still be at risk.
- The Jubilee River diversion was criti[illegible] the 2014 floods for actu
  worse for some residents, although it alleviated the flooding in some
  flooding worse in [illegible]

Economic:

- Although these hard engineering schemes cost large amounts of mone
  any floods in London would far exceed that of the cost of flood defence
  economically beneficial to put the defences in place.
- However, the flood defences are in need of repairs, which can cost con
- There is also continued pressure to build more houses as the UK's pop
  This means more and more houses are planned for the floodplains aro
  defence schemes, they could still be at risk if proper protection is not p

Environmental:

- The construction process of many of these engineering schemes can mean t
- How climate change may affect the flood defence schemes is somethin
  considered. The Thames Barrier, for example, may need to adapt as se
  become more frequent. Before 2014, the barrier had only been closed 1
  However, during the winter storms of 2013/14, the barrier closed a stagge
  suggest that the high tides and storm surges are increasing at a rate tha
  be able to cope?

Fact table

Location:	South England
Source:	K[illegible]nble, Cotswolds
Mouth:	Thames Estuary into
Length:	346 km
Number of counties it cro[illegible]s:	8
Number of towns a[illegible]ies it goes through:	18
Basin siz[illegible]	12,935 km²
Tributarie[illegible]	38
Number of locks:	45
Number of bridges:	Over 200
Source height:	108 m above sea leve
Population in basin:	13 million
Daily movement of tidal section:	7 metres every day
Discharge:	Lower course = 17.6 m Middle course = 39.7 Lower course = 65.9 m
Landforms:	Meanders Terraces Floodplains Estuary
Bedload in lower course:	300,000 tonnes
Most recent major flood:	February 2014
Number of severe fl[illegible]ings in Feb 2014:	14
Number [illegible]d[illegible]used in Datchet:	10,000
Geology of the basin:	Limestone Clay Chalk London clay
Average rainfall in south-east England:	690 mm per year
Climate change impact:	Flood risk will increa
Flood management schemes:	Thames Barrier Embankments and fl River diversion strate

ICT interactive page

Rather than type out these w

Videos:

The River Thames – Introduction:

- **https://www.youtube.com/watch?v=[illegible]1Doo**

2014 Thames Floods:

- **http://[illegible]/news/uk-26123674**
- **http://[illegible]bbc.co.uk/news/uk-26114540**

Ariel Footage of Thames Floods, 2014:

- **http://www.bbc.co.uk/news/uk-26117373**

Thames Barrier:

- **https://www.youtube.com/watch?v=Dvg2asACsG0**

The Jubilee River:

- **https://www.youtube.com/watch?v=GwiUPaA9BDo**

News Stories:

ITV – Flooded River Thames:

- **http://www.itv.com/news/2014-02-11/in-[illegible]residents-evacuated-**

The Guardian – How Safe is Lo[illegible] flooding?

- **https://www.the[illegible]com/cities/2015/feb/19/thames-barrier-how-risk**

The Guardian – Climate Change and the Thames

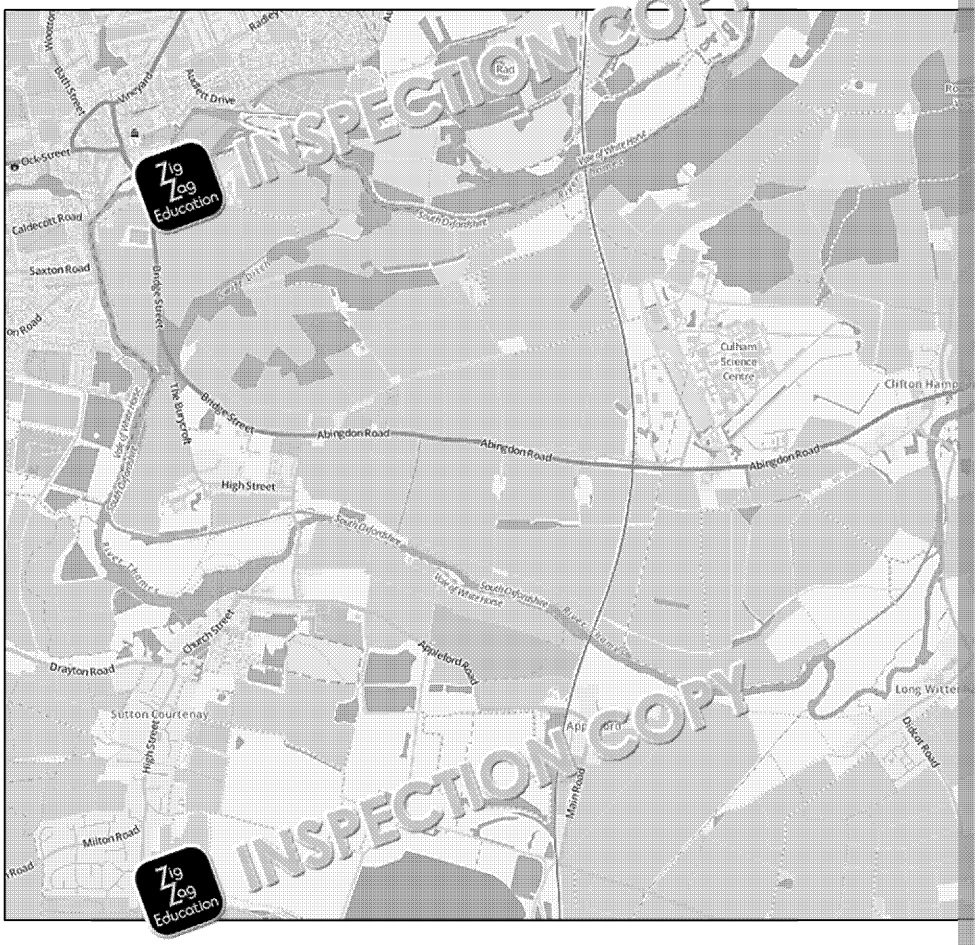
- **https://www.theguardian.com/world/2016/jul/07/great-tide-is-britain-warming**

BBC – Criticism over River Jubilee

- **http://www.bbc.co.uk/news/uk-england-berkshire-25727040**

Springboards

Springboard 1



1. What river landform can be seen in this map of the Thames?
2. Explain how this landform is created.
3. Over time, what other river landform might form here?

Springboard 2

1. Describe the features of an estuary.
2. Compare this image of the lower course of the Thames with your kno
3. What evidence does this image show of different fluvial processes?

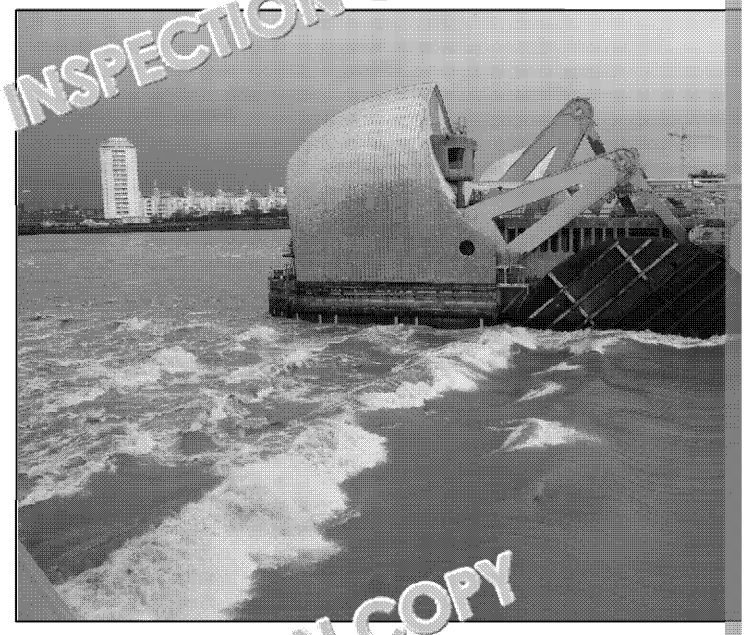
Springboard 3

1. What does this image suggest about the relationship between London
2. Discuss whether London poses more of a threat to the Thames or vice
3. Suggest the impact the flooding of the Thames could have on London.

Springboard 4

1. Suggest the causes behind the flooding of the Thames in this image.
2. Discuss the social, economic and environmental impacts this flooding
3. Suggest some flood defence plans for the area in the image.

Springboard 5



1. Discuss why the Thames Barrier is so important to London.
2. Suggest other forms of flood defence that could be used in London.
3. Consider the potential impacts of climate change – what might the London

Springboard Suggested Answers

Springboard 1

1	Meander
2	Meanders form through the fluvial p[r]ocesses of lateral erosion and deposit As the gradient of the ri[v]er has decreased, the water moves from bank to b[a]nk is deepest and moving fastest is eroded. The sediment from this erosion is side[d] ba[n]k where the water is shallower and slower. This creates a m[e]ander of th[e]
3	An oxbow lake. This would form if the river flooded and formed a new straight channel m[e]ander the course of the river.

Springboard 2

1	• Where the river meets the sea • Wide channel • Deep channel • Interesting habitats for wildlife • Lots of sediment • Any other valid point(s)
2	The lower course of the Thames has a very wide and deep channel. It hold[s] form of silt and fine particles. The lower course is at sea level. The upper course has a narrower and shallow channel. It carries a small bed[load]. The upper course has a steeper gradient.
3	The [e]stuary is the evidence of deposition in the mud flats and silt that c[an] It also shows a very wide channel, which indicates lateral erosion.

Springboard 3

1	• The Thames and London are very interconnected. • Can see how London has formed around the Thames. The number of b[ridges] • River still being used for transport etc. • Can see how the river has been manipulated with the flood walls / emb[ankments] • Any other valid point(s).
2	London poses a threat to the Thames in the form of urbanisation, deforesta[tion] things have changed the way the river would naturally behave. We have a[lso] through flood management. However, the Thames itself poses a significant threat to London in the form[er] large amount of damage. It is also hard to predict exactly how the threat fr[om] with climate change.
3	• Put over a million people's lives at risk • Could damage billions worth of property • Damage to transport systems, such as the underground and overgroun[d] • Disrupt businesses • Damage important cultural sites • Any other valid point(s)

Springboard 4

1	• Heavy rain • Storms • Tidal surges • Geology of the riverbed • Human activities, such as the increase of impervious surfaces due to • Any other valid point(s)
2	Social: • Damage to personal property • Stop people from getting to work or school • Could cause helplessness or despair over the damage to property and Economic: • Large cost of damage • Any damage to businesses means economic loss • Transport disruption causes economic loss Environmental: • Floods could have caused damage to any natural habitats or parks nea • Could cause damage to sewers and, therefore, contaminate the floodw
3	• Flood walls could be built or made taller • Embankments • Flood warning systems • River diversion scheme • Any other valid point(s)

Springboard 5

1	The Thames Barrier is London's main protection from tidal flooding • Protects significant amount of property and people • Protects significant cultural and political sites from flooding • Protects the transport systems • Protects hospitals • Any other valid point(s)
2	• More floodwalls and embankments • Better flood warning system and preparedness • Modified buildings that cope well during floods • River diversions • Any other valid point(s)
3	With the potential of more frequent storms and sea level rise, flood defence to there being more floods. The Thames Barrier may need modifying to cope with being closed more of Embankments and sea walls may need to be heightened. Residents of London will need to be more aware and prepared for the imp

Summary

The River Thames

Introduction:

- The River Tha[illegible] lowland river located in South England.
- It cros[illegible]hu[illegible]ounties from its source in the Cotswolds to its mouth i
- The ba[illegible] home to 13 million people and many major towns and citi
- It is England's longest river and the UK's second longest.
- It has a basin size of 12,935 km².
- The source is marked by a headstone in a field near the village of Kemb
- The last 100 km of the river, as it flows through London, is tidal and mov

River profile and landforms:

- The size and shape of the Thames changes as you go downstream.
- It has quite a shallow gradient for its length as the source is only 108 m
- This means that the upper course does not have the usual features of a flows gently downhill.
- The upper course has a small discharge and its bedload is of large rock
- The middle course of the Thames is characterised [illegible] wider and deeper
- Lateral erosion and its shallow gradient [illegible] river to meander.
- River terraces are also a featur[illegible] middle course.
- The lower course is th[illegible]'s widest and deepest section, with the lar
- It has fea[illegible] lateral erosion and deposition in the form of floo river [illegible] mouth.

Flooding on the Thames:

- The Thames is prone to flooding. With the large population living in t and landmarks the impact of flooding can be devastating.
- In the last century there have been 10 major floods, five of which occur
- These floods can either be caused by the tide or by the river.
- In 1953 a large storm surge caused devastating floods along the Thame
- More recently, in 2014, major floods affected 1,700 homes in the Thame flood warnings were issued as the Thames reached its highest level in

Physical influences on the Thames:

- The geology and climate of the Thames ha[illegible]ts on the shape and f
- The Thames flows over a variety [illegible] types. The chalk and limestor water in, whereas the clay is [illegible]eable.
- The river is more [illegible]lood over areas where clay is the bedrock.
- Despi[illegible]riv[illegible]ing prone to flooding, South East England is actual the UK[illegible]vever when heavy rain does hit it can cause flooding.
- Storm surges caused by low pressure in the North Sea can also cause ti
- Climate change could cause the Thames to flood more often with mor level rise.

Human influences on the Thames:

- The Thames has been an important river throughout human history fo
  helped to make London the city it is today.
- Humans have changed the Thames through activities such as urbanisa
  water treatment.
- The main way humans have changed the Thames, however, is through
- This has mainly been in the form of hard engineering with the Thames
  walls and river diversion schemes.
- Although it is expensive to build these defences, they are helping to sa
  devastation from flooding.
- However, it is hard to predict whether climate change may render thes

Quick-fire Questions

1	Where is the Thames located?	
2	How long is the Thames?	
3	How big is the basin of the Thames?	
4	How many people live in the basin of the Thames?	
5	Where is the source of the Thames located?	
6	Where is the mouth of the Thames located?	
7	Where does the Thames become tidal?	
8	What does the long profile of a river show?	
9	How high is the source of the Thames above sea level?	
10	What is the discharge of the upper course of the Thames?	
11	Name one feature of the middle course of the Thames.	
12	What fluvial processes are happening in the middle course of the river?	
13	How much sediment does the lower course of the Thames hold?	
14	When was the last major flooding of the Thames?	
15	How many flood warnings were issued along the Thames?	
16	How many homes were affected in the Thames valley?	

17	Name an impermeable rock found in the Thames Basin.	
18	How much average rainfall does the south-east of the UK receive annually?	
19	Name one way climate change might affect the Thames basin.	
20	Name one way human activities have influenced the Thames.	
21	What event inspired the creation of the Thames Barrier?	
22	How much land did the building of the embankments claim from the river?	
23	Name one social impact of the flood defence schemes along the Thames.	
24	Name one economic impact of the flood defence schemes along the Thames.	
25	Name one environmental impact of the flood defence schemes along the Thames.	

Quick-fire Answers

1	Where is the Tham[illegible]	*South E*
2	How [illegible] the Thames?	*346 km*
3	How big is the basin of the Thames?	*12,935*
4	How many people live in the basin of the Thames?	*13 mill*
5	Where is the source of the Thames located?	*In a fie*
6	Where is the mouth of the Thames located?	*The Th*
7	Where does the Thames become tidal?	*Teddin*
8	What does the long profile of a river show?	*The hei the sou*
9	How [illegible] the source of the Thames above sea level?	*108 me*
10	What is the discharge of the upper course of the Thames?	*17.6 m³*
11	Name one feature of the middle course of the Thames.	*Meand River t*
12	What fluvial processes are happening in the middle course of the river?	*Lateral*
13	How much sediment does the lower [illegible] of the Thames hold?	*300,00*
14	When was the last major flooding of the Thames?	*Februa*
15	How [illegible] several flood warnings were issued along the Thames?	*14*
16	How many homes were affected in the Thames valley?	*1,700*

17	Name an impermeable rock found in the Thames Basin.	*Clay*
18	How much average rainfall does the south-east of the UK receive annually?	*690 mm*
19	Name one way climate change might affect the Thames basin.	*Sea level rise* *More frequent st*
20	Name one way human activities have influenced the Thames.	• *Urbanisation* • *Pollution* • *Extraction of* • *Locks and we*
21	What event inspired the creation of the Thames Barrier?	*The 1953 floods*
22	How much land did the building of the embankments claim from the river?	*89,000 m²*
23	Name one social impact of the flood defence schemes along the Thames.	• *Protects peop* • *Protects impo* • *Lack of public could be desp* • *The Jubilee R different area*
24	Name one economic impact of the flood defence schemes along the Thames.	• *Saves money* • *Although mo defences alrea* • *Pressure to b on floodplains defences in pl*
25	Name one environmental impact of the flood defence schemes along the Thames.	• *Damage to na* • *Uncertainty defence schem modifications*

Extension Questions

1. Describe how the Thames changes from its source to its mouth.
2. Explain why the discharge of the river ch[illegible]es [illegible] you go downstream.
3. Suggest the social, eco[illegible]ic a[illegible] environmental impacts of the 2014 flo
4. Expla[illegible] g[illegible]logy and climate can influence the River Thames.
5. Suggest how climate change could impact the Thames in the future.
6. The Thames is the most densely populated river basin in the UK. In w[illegible] river?
7. Explain why flood management schemes are needed in the Thames Ba[illegible]
8. Explain why hard engineering schemes were chosen for flood defence[illegible]
9. Suggest what the Thames would be like without any flood managemen[illegible]
10. Discuss whether you think the Thames flood m[illegible]ement schemes are[illegible]

Extension Answers

1. The Thames changes in several ways as it flows from its source to its mouth.
   - At its source and in the upper course of the river it is a narrow, shallow c at its steepest here although it is not as st as usual upper river, mear The main process is lateral erosion but cut down into the riverbed due t
   - In the middle section of the river the channel is wider and deeper. It has has greater velocity due to the shallower gradient in this section the riv feat su anders.
   - Th r section of the river has the widest and deepest channel with th larg discharge and moves at its greatest velocity. The main process th some lateral erosion, which has created floodplains.

2. The discharge of the river increases as the river flows from its source to its mo

   This is because all the tributaries in the basin drain into the river as it flows d

   By the lower course, all the tributaries in the basin have drained into the main rive greatest.

3. Social:
   - Damage to over a thousand homes
   - Emotional damage to the residents and communities where the flooding
   - Any other valid point(s)

   Economic:
   - Significant costs in damage to pro y a infrastructure
   - Travel disruptions cost th tr money
   - More money to h in flood defence schemes
   - An er nt(s)

   Enviro l:
   - Damage to natural habitats close to the river
   - Damage to sewers can contaminate floodwater and pose a health risk
   - Takes a while for ground to recover from the floodwater
   - Any other valid point(s)

4. Geology:
   - Impermeable rocks, such as the London clay, make the river more prone
   - Permeable rocks, such as chalk, make flooding less common in that area. means people can extract water from them, which can affect the discharg

   Climate:
   - Storms and heavy rain can cause the river to flood
   - Storm surges cause the tide to rise abnormal n the tidal section of

5. Impacts of climate change in th m s
   - More frequent st cause more flooding and more storm surges
   - Sea l ri also cause more flooding.
   - W and drier summers could decrease the discharge of the river na mo people demand more water.

6. Potential effects of large population in the Thames Basin:
   - More urbanisation and deforestation around the Thames causing the floo
   - It means the Thames has been adapted by human activity. For example, locks and weirs to make it easy to travel down.
   - More strain on the Thames to provide drinking water and water for sewa
   - More chance of the Thames becoming polluted.
   - Any other valid point(s).

7. Reasons for flood management on the Thames:
   - The high population - lots of people need protection.
   - London being a[illegible] important city it needs to be protected.
   - Cheaper to manage the floods than pay for the damage.
   - Floods also occur fairly frequently, making flood defence viable.
   - Any other valid point(s).

8. Reasons for choosing hard engineering:
   - There are many people and a lot of property and important infrastructur engineering is the most effective way of doing that.
   - Hard engineering techniques are known for being more successful than s
   - The cost of the damages from flooding would be significant so, despite th engineering, it is worth it.

9. The Thames with no flood management:
   - Considerable area of London would be prone to frequent flooding and, th retreated. This would probably be true for various settlements around th
   - The river would be wider in places; for example, where embankments ha foreshores of the Thames.
   - There may be more meandering of the river.
   - Greater floodplains.

10. Sustainable:
   - The aim is to protect the towns and cities in the region over a long period
   - The schemes are effective in their job.
   - For the Thames it is economically and socially sustainable because it wou the defences weren't in place.
   - Any other valid point(s).

   Unsustainable:
   - Because the schemes are hard engineering they can cause long term-dam during construction
   - They also stop the natural flow of the river.
   - They do not take into account how the river may change in the future. Fo more defences may be needed.
   - Any other valid point(s).

Exam-style Question

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 responses 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.