Geography

ORGANISATIONAL DETAILS

Aim of field work

To look at the landscape of Talkin Tarn and the impact recreation has on the area.

Target Group

Key Stage 4 geography.

Location

Talkin Tarn, Cumbria

Location

This fieldwork half day is based at Talkin Tarn Country Par, 6 miles east of Carlisle in Cumbria (GR: NY 545592). The first half of the day will involve a circular walk around the Tarn looking at the landscape of the area and the historical use of the park for recreation. The second half of the day will concentrate on the impact recreation has had on the area and what the future holds for Talkin Tarn under its new management with Carlisle City Council.

Practical Details

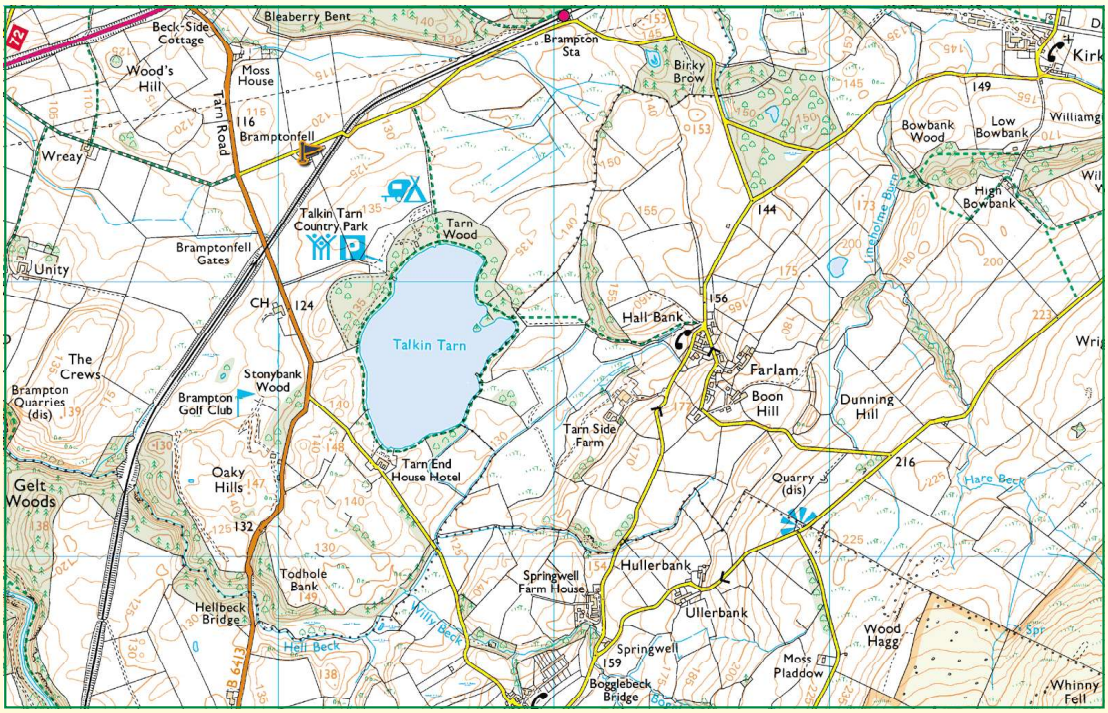
- Parking - there is a large car park at Talkin Tarn that is suitable for coaches. Parking charges apply.
- There are toilet facilities, picnic areas, a café, a play area and education facilities. Talkin Tarn is owned and managed by Carlisle City Council. For more information visit the Education Centre or Telephone: 01288 817000 or e-mail: customerservices@carlisle.gov.uk
- Useful maps - Ordnance Survey 1:25,000 Explorer Map OL5 The English Lakes: NE Area

Safety Issues:

- There is open access to the water all the way around Talkin Tarn
- Refer to the Hazards Identification Sheet

Landscape and Recreation Pressure at Talkin Tarn

Fieldwork Outline - Teacher Resource Sheet



HAZARDS IDENTIFICATION SHEET

The following notes will help teachers conduct their own risk assessments. This is not a risk assessment and teachers should follow guidelines from the Department of Children, Schools and Families.

Hazard Identified	Risk and to whom	Control measures
Vehicles in the car park	Caution needed when getting off the coach or minibus in the car park, and crossing any roads. All students and staff.	Supervise students getting off the coach or minibus and gather in a safe place.
Uneven paths	Paths are uneven and may be slippery in wet weather. Students may slip and fall. All students and staff.	Warn about conditions.
Unfenced water	The lake at Talkin Tarn is not fenced. Students could fall into the water. All students and staff.	Warn about conditions.

INTRODUCING THE FIELDWORK

Purpose and aims of the visit

The main purpose of the fieldwork is to look at the landscape of Talkin Tarn, the impact of recreation on the area and the views of users' of Talkin Tarn about the future of the country park.

The aims of the fieldwork are:

- To look at the factors which have been important in forming the landscape of Talkin Tarn.
- To investigate the impact of recreation on the area surrounding the tarn and
- To develop a plan for the future use of Talkin Tarn that reflects the views of the user groups.

Background information

The fieldwork can be introduced in the field and the information required for the circular walk is outlined in the 'Undertaking Fieldwork' section.

Introducing the fieldwork

The fieldwork can be mainly introduced in the field although it may be easier to prepare the questionnaire in advance for the visitor survey. The fieldwork will include:

1. The landscape of Talkin Tarn – This fieldwork will involve a circular walk around the tarn to look at the factors that have influenced the landscape of Talkin Tarn. Information on each site is provided in the 'Undertaking fieldwork' section and information can be recorded on Student Resource Sheet 1.

2. The impact of recreation at Talkin Tarn – Enquiry-based work will be undertaken to look at the impact of recreation on the wooded esker ridges. Introduce this work using Student Information Sheet 2 and add the fieldwork recordings to Student Resource Sheet 2.

3. The future of Talking Tarn – Fieldwork aspects of this work will include undertaking a visitor survey. The results of this will feed into follow-up work that will involve developing a plan for the future of Talkin Tarn Country Park. Use Student Information Sheet 3 to help with designing a questionnaire in advance or use the sample questionnaire on Student Resource Sheet 3.

UNDERTAKING THE FIELDWORK

1. The landscape of Talkin Tarn

The landscape of Talkin Tarn has been influenced by both physical and human processes. The table below provides information about each stop on the circular walk around the tarn and students can record the information on Student Resource Sheet 1.

2. The impact of recreation at Talkin Tarn

This part of the fieldwork will involve enquiry-based work looking at the impact of recreation on the wooded esker ridges of the tarn. Introduce the enquiry work using Student Information Sheet 2 and record the results on Student Resource Sheet 2.

3. The future of Talkin Tarn

Talkin Tarn is now owned and managed by Carlisle City Council who have spent more than £1 million on improvements including new educational facilities, new toilets, a play area, better access for disabled people, improvements to the tea room with lift access and improved car parking. In the coming years the council wish to develop a management plan for the whole site incorporating the views of user groups. Carry out a survey of people using Talkin Tarn Country Park. Use Student Information Sheet 3 to help you design a questionnaire or use one you have prepared in advance. There is a sample questionnaire on Student Resource Sheet 3 that you could use instead of designing your own.

Location and grid reference	Background information
1. Western boathouse (GR: NY 544590)	As you enter Talkin Tarn Country Park from the car park the boathouse is in front of you. Find a place just to the south of the boathouse that gives you a good view across the tarn. Use the O.S. map extract to describe the location of Talkin Tarn - the North Pennines immediately to the east, the Eden Valley to the west and the Lake District further to the west. *Complete Activity 1a on Pupil Resource Sheet 2.* Look at Talkin Tarn Country Park. The country park covers 120 acres, half of which is the lake or tarn. The rest of the area is covered in beech woodland or farmland. The main rock type in the area is a red sandstone but on top of the sandstone are deposits of other materials that form mounds and ridges. *Complete Activity 1b on Pupil Resource Sheet 2.*
2. View southeast across the tarn (GR: NY 543585)	Continue the walk westwards around the tarn. About halfway between the boathouse and the Tarn End Hotel stop and look east across the tarn. About 20,000 years ago at the height of the last ice age this area was covered by 1 km of ice. Talkin Tarn is a glacial feature called a **kettle hole** that was created at the end of the last ice age around 15,000 years ago. Kettle holes are formed by detached blocks of ice, which are left by the glaciers as they retreat, or which are moved by meltwater onto the area in front of the ice. The ice blocks become partially or completely covered with sediments deposited by meltwater. When the ice blocks melt they leave depressions that may fill water to form kettle hole lakes. *Complete Activity 1b on Pupil Resource Sheet 2.*
3. Esker ridge (GR: NY 546584)	Continue to walk southwards around the tarn. Just beyond the wooded area there is a stile in the fence. Cross the stile and walk back towards the wood. Behind the wood you will see a 'sheep scrape'. This is the next stop. The sheep have exposed one of the ridges that surround the tarn at this point. These ridges areglacial features called eskers. Eskers are elongate, winding ridges of sand and gravel. Eskers are formed by streams flowing in or below the ice sheet. They carry sand and gravel that infill these ice-walled river channels. The material that makes up the eskers will give an indication of where the ice sheet has moved from. It may be possible to use mole hills in the field instead! *With the help of Pupil Information Sheet 1 complete activity 3 on Pupil Resource Sheet 2.*
4. Sedge Bay - small bay looking south west (GR: NY 547589)	The origins of the tarn and the sand and gravel ridges both relate to the ice sheet that covered this area during the last ice age. However, before this was understood people made stories to explain things in the landscape that they didn't understand. Talkin Tarn has its own myth! The story says that there was an old woman walking from the North Pennines in the east to Brampton, on a very wild and stormy night. The weather got so bad she decided to see if she could find somewhere to stay for the night. She stopped in Talkin village and knocked on the doors of the cottages but no one would let her stay the night. She continued on her way until she reached the edge of the village and there she cast a spell (because she was a witch) that flooded the village. To this day on midsummer's night you can hear a bell and it is thought to be the bell of Talkin church ringing out from beneath the waters of the tarn. *Re-tell the Talkin Tarn myth using Pupil Information Sheet 2.* *Complete activity 4 on Pupil Resource Sheet 2.*
5. Sandy Bay (GR: NY 546592)	People have also influenced the landscape of Talkin Tarn. Talkin is Norse for tear drop and in about 1340 the land around the village was granted to Edward de Talkin. From the mid 1800s the landscape changed with trees being planted on the ridges around the tarn as the Victorians wanted a 'Capability Brown' landscape, which 'perfected nature'. The hotel was built with its own landscaped grounds, a footpath was put around the tarn and a trackway came from the railway station. Victorians came to use the area for recreation – walking, rowing, and taking in the views. Talkin Tarn Country Park is now owned and managed by Carlisle City Council and is still used by the public for walking, boating, picnicking and attending events and activities. A number of places act as 'honey-pot' sites, attracting a lot of people and so need managing to ensure the environment is not damaged. The areas that are under the most pressure are the entrance to the park, the café and information area, the picnic areas and the wooded ridges. Rare plants including orchids grow in the woodland and quiet areas are needed for wildlife. Carlisle City Council are looking at the future of the park and want to develop a plan for the area that will make it "sustainable". By this is meant the park can generate an income to help with the maintenance of the site, provides for the needs of the people who use the site and looks after and improves the environment. *Complete activity 5 on Pupil Resource Sheet 2.*

FOLLOWING UP THE FIELDWORK

1. The landscape of Talkin Tarn

Using the information gathered on the walk around the tarn describe how physical and human factors have influenced the landscape of Talkin Tarn. Include information on the following - kettle holes, eskers, movement of the ice, landscaping and recreation.

2. The impact of recreation at Talkin Tarn

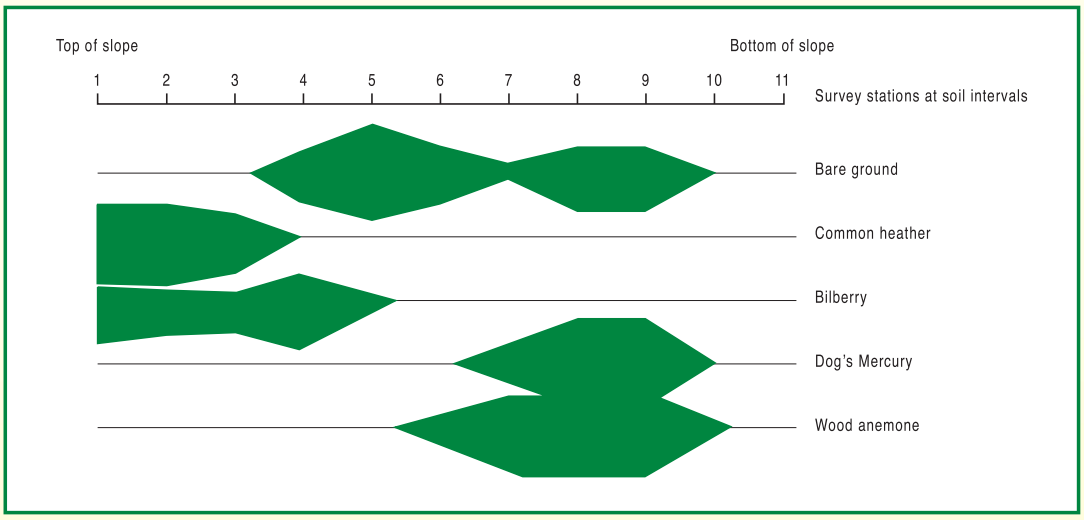
Presenting and describing your results

a. On graph paper or using the computer draw the profile of your section of footpath using your gradient measurements. Put the distance along the footpath (in metres) on the x-axis and then use your slope angle data to plot the profile.

b. On the same graph draw a bar to represent the width of the path at the appropriate points along your profile.

c. Use the percentage cover/bare ground data to draw kite diagrams for each of your path width sections. Draw a kite diagram for the bare ground data. The diagram below shows a kite diagram. If at site 1 bare ground accounted for 46% of the area of the quadrat, an area representing 23% is shaded each side of the horizontal axis. This is repeated for each site and the kites made by joining the results for each site together and shading the area. This type of graph shows the change in the amount of bare ground across the footpath very clearly.

d. Draw a graph with bars to represent the width of the path for each site. The x-axis should represent the distance along the footpath in metres and the y-axis the width of the footpath in metres. Calculate the bulk density of the soil for each of your sites. On the same graph add another scale to the y-axis to represent the bulk density and then plot the bulk density value with a cross or circle for each site.



e. Make a copy of the table below to show the path width with distance along the footpath. Add the width of the footpath from your field data.

f. Describe what each of your results show.

Analysing your results

Try and explain why your results show what they do. Accept or reject your hypotheses.

Distance along footpath (m)	Width of footpath (m)
5	
15	
25	
35	
45	
55	
65	
75	
85	
95	
105	
115	
125	
135	

Summarising your results

From your results summarise the following:

- Does the width of the footpath vary with gradient? Explain your answer.
- How does the vegetation cover/bare ground vary across the width of the footpath? Explain your answer.
- Does the bulk density of the soil vary with the width of the path. Explain your answer.
- Is the footpath wider close to the car park or the visitor centre? Explain your answer.
- Can your fieldwork data be used to help determine footpath location and management in the future?

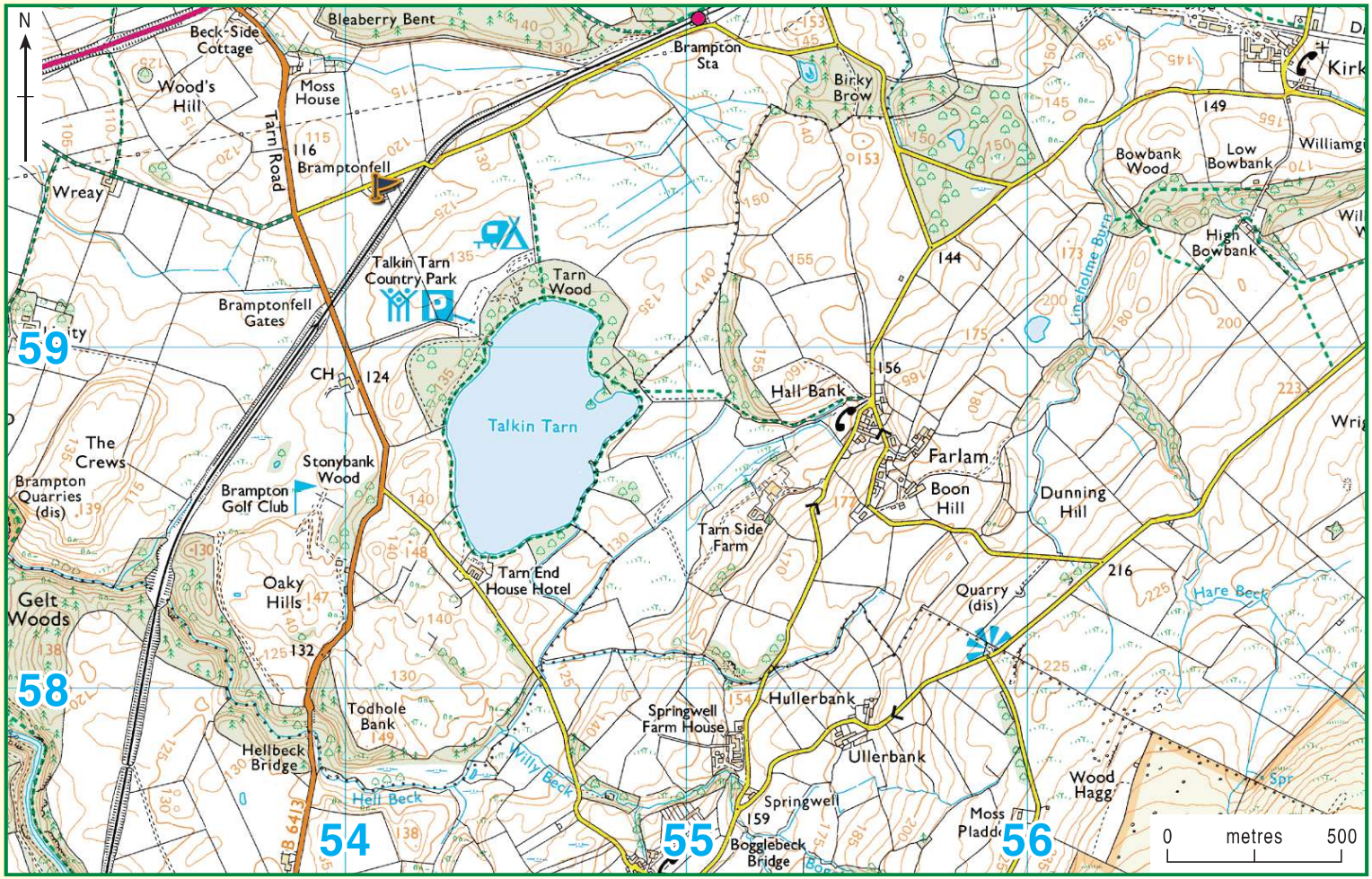
3. The future of Talkin Tarn

a. Combine the questionnaire data collected by the whole class from the survey of people's views of Talkin Tarn.

b. Present the data using appropriate methods and describe and analyse your results.

c. Use all the information collected on your field trip to Talkin Tarn to prepare a report describing how you would like to see Talkin Tarn developed over the next 5 years. Make sure you are informed by what the visitor survey suggests and provide evidence for your suggestions. Consider the following:

Visitor facilities
Footpath networks
Events and activities
Interpretation and information
Places for wildlife
Landscaping



O.S. Map of Talkin Tarn



Ordnance Survey Map Symbols

ROADS AND PATHS

- M1 or A6 (M) — Motorway
- A35 — Dual carriageway
- A30 — Main road
- B3074 — Secondary road
- Narrow road with passing places
- Road under construction
- Road generally more than 4m wide
- Road generally less than 4m wide
- Other road, drive or track, fenced and unfenced
- Path

RAILWAYS

- Multiple track
- Single track

PUBLIC RIGHTS OF WAY

- Footpath
- Bridleway

BOUNDARIES

- National
- County (England)
- Civil Parish (CP)
- National Park boundary

SELECTED TOURIST AND LEISURE INFORMATION

- P — Parking
- Information centre
- PC — Public convenience
- Telephone
- Campsite / caravan site
- Golf course or links
- Public house
- Walks
- Viewpoint
- Picnic site
- Country park

GENERAL FEATURES

- \+ — Place of worship
- Building
- Bus or coach station
- Triangulation pillar
- Windmill
- BP/BS — Boundary post / stone
- CH — Clubhouse
- FB — Footbridge
- Mon — Monument
- PO — Post Office
- Pol Sta — Police station
- Sch — School
- TH — Town hall



Landscape and Recreation Pressure at Talkin Tarn

Student Resource Sheet 1

THE LANDSCAPE OF TALKIN TARN

ACTIVITY 1

a) With the aid of an O.S. map describe the location of Talkin Tarn Country Park..

b) Draw a field sketch of Talkin Tarn Country Park from the view in front of you. Add the following labels:

Tarn ***Ridges*** ***Beech woodland***

Farmland ***Hotel*** ***Boathouse*** ***North Pennine hills***

ACTIVITY 2

Describe how kettle holes are formed

……

……

……

……

……

……

ACTIVITY 3

Describe how eskers are formed:

……

……

……

……

……

……

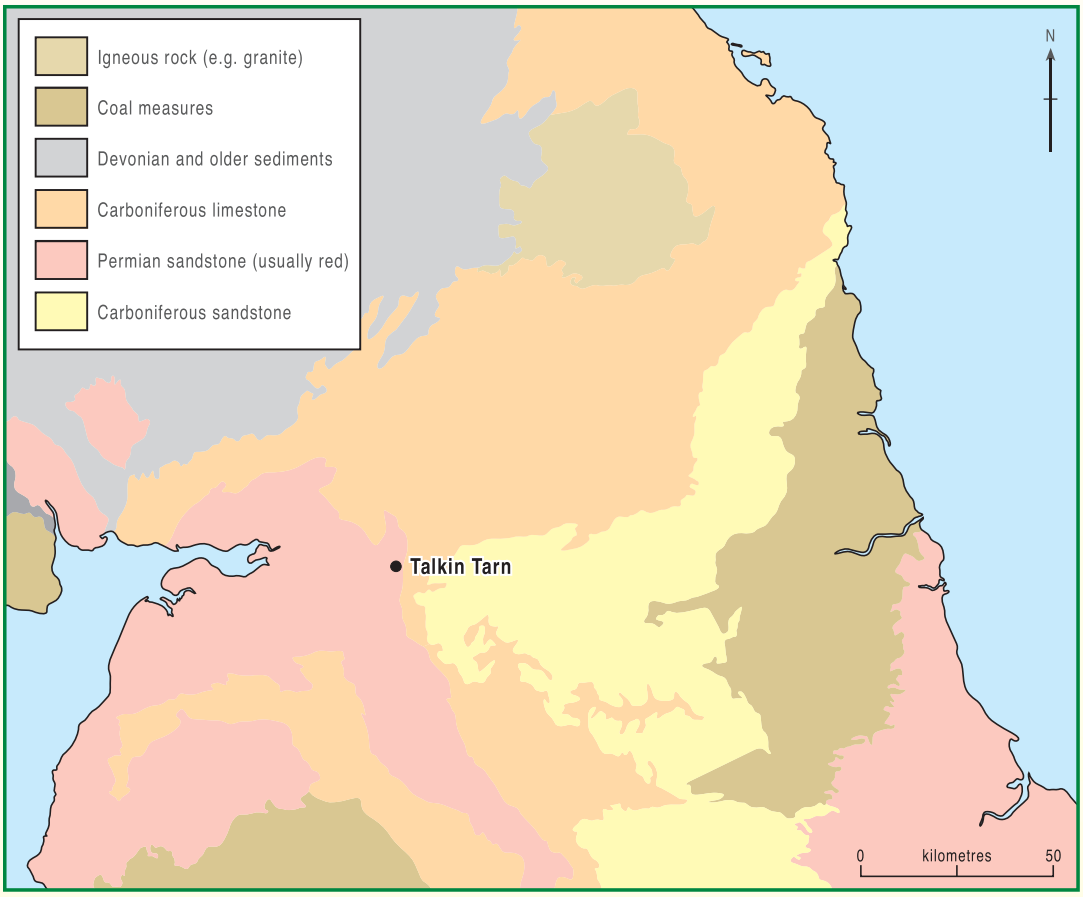
ACTIVITY 4

The sheep scrape or molehills expose what the esker is made of – a mixture of sand and a range of different sized rocks. In groups of 4 randomly choose 30 rocks from the sheep scrape or molehills. Complete the chart below using the rock identification guide on Pupil Information Sheet 1:

Rock Number	Type of rock	Rock Number	Type of rock	Rock Number	Type of rock
1.		11.		21.	
2.		12.		22.	
3.		13.		23.	
4.		14.		24.	
5.		15.		25.	
6.		16.		26.	
7.		17.		27.	
8.		18.		28.	
9.		19.		29.	
10.		20.		30.	

On the geology map below mark arrows to show where the different rocks you have found in the esker must have come from to get to Talkin Tarn.

Simplified geological map of Northern England



How do you think the rocks got to Talkin Tarn?

.....

.....

.....

.....

.....

.....

.....

.....

.....

ACTIVITY 5

Describe how people in the past believed Talkin Tarn was formed:

ACTIVITY 6

Describe how people have influenced the landscape of Talkin Tarn:

Landscape and Recreation Pressure at Talkin Tarn

Student Resource Sheet 1

ROCK IDENTIFICATION GUIDE

Carboniferous limestone from the North Pennines

Carboniferous sandstone from the North Pennines

Granite from the Cheviots

Permian red sandstone from the Eden Valley

Quartz (could be from a variety of places)



Landscape and Recreation Pressure at Talkin Tarn
Student Information Sheet 2

AN ENQUIRY INTO THE IMPACT OF RECREATION ON THE WOODLAND RIDGES AT TALKIN TARN COUNTRY PARK

Background

Footpath erosion is a major issue on the esker ridges at Talkin Tarn Country Park causing unsightly tracks, damaging vegetation and causing soil erosion. Footpaths vary in width depending on factors such as slope angle, the number of people using them and vegetation type. In these woodlands it is slope angle that has a major impact on the width of the path. By comparing slope angle and path width the information gained can be used to inform future decisions concerning the location of footpaths within the woodland.

Aim

The aim of this enquiry is to look at the impact of recreation on the footpaths in the woodland areas of Talkin Tarn Country Park.

Questions to ask

- How does the width of the footpath vary with slope angle?
- How does the vegetation cover/amount of bare ground vary across the footpath?
- How does the compactness of the soil vary with the width of the footpath?
- How does the width of the footpath vary with distance from the car park/café area?

(Turn these questions into hypotheses and record them Student Resource Sheet 2)

Methods

1. In groups of 4 – 6 choose a footpath that runs through the woodland, either southwest from the car park or southeast from the café area. Follow the footpath for at least 100m or until it reaches the tarn. Every 10m along the path you will need to carry out a number of fieldwork techniques.

2. Gradient of footpath – For each 10m section of the footpath measure the angle of slope. This can be done using a gun clinometer and ranging poles. Two students stand 10m apart along the transect. The student at the top of the slope holds the gun clinometer to the ranging pole. The student at the bottom of the slope holds the other ranging pole and places their hand at the same height on the ranging pole as the top student has the gun clinometer on the top pole. The student at the top of the slope sights along the gun clinometer to the height of the student's hand at the bottom of the slope. The trigger is released so that the dial on the clinometer can swing. When it has stopped swinging the trigger is let back to stop the dial from moving again. The slope angle can then be read off the clinometer in degrees. Remember to record a positive angle for an uphill reading and a negative angle for a downhill reading.

3.Width of footpath – In the middle of every 10m section (i.e. 5m, 15m, 25m etc) measure the width (in m) of the path using a tape measure.

4.Vegetation cover – In the middle of every 10m section (i.e. 5m, 15m, 25m etc) measure the percentage cover of vegetation. Use a 0.5m x 0.5m quadrat to calculate the percentage cover of vegetation across the footpath. A quadrat is a frame, usually a square, of a known area. The quadrat may be divided with string so there are 25 smaller units to make estimating the percentage cover easier. Start 1m beyond the edge of the footpath and put the quadrat on the ground. The percentage cover of the vegetation and the bare ground is estimated by eye. Move the quadrat along and estimate the percentage cover again. Repeat this, until you are 1m beyond the far edge of the footpath, so you have a continuous set of percentage cover results for the width of the footpath.

5. Compactness of footpath – To see how compact the soil has become as a result of trampling the Bulk Density can be calculated. This compares the weight of identical volumes of soil. – the more compact the soil the less air there is and the heavier the soil will be for a given volume. To measure the bulk density hammer bulk density rings (baked bean tins with both ends removed can be used instead) into the ground. Take one measurement in the middle of the footpath at the same locations as the footpath width and percentage vegetation cover sites (i.e. 5m, 15m, 25m etc). Remove the bulk density ring full of soil and measure the weight using a spring balance or take back to school in a plastic bag and weigh on scales. Make sure you label each sample. The bulk density is given by the formula:

$$\text{Bulk Density} = \frac{\text{Weight of soil (g)}}{\text{Volume of soil (cm}^3\text{)}}$$

Equipment

The following equipment will be required:

- 50m tape
- Gun clinometer
- 2 x ranging poles
- Bulk density rings
- Spring balance or plastic bags and permanent marker
- 0.5m x 0.5m quadrat

Results

Record your results on student Resource Sheet 2.

Landscape and Recreation Pressure at Talkin Tarn
Student Resource Sheet 2

RECREATION PRESSURE RECORDING SHEET

Hypothesis

Use the questions identified on Student Information Sheet 2 to give 5 hypotheses below:

a) .....

.....

b) .....

.....

c) .....

.....

d) .....

.....

e) .....

.....

Distance from start of footpath (m)	Gradient (degrees)	Distance from start of footpath (m)	Width (m)	Percentage cover	Bulk density (g/m^3)
0		5		1. 2. 3. 4. 5.	
10		15		1. 2. 3. 4. 5.	
20		25		1. 2. 3. 4. 5.	
30		35		1. 2. 3. 4. 5.	
40		45		1. 2. 3. 4. 5.	
50		55		1. 2. 3. 4. 5.	
60		65		1. 2. 3. 4. 5.	
70		75		1. 2. 3. 4. 5.	
80		85		1. 2. 3. 4. 5.	
90		95		1. 2. 3. 4. 5.	
100		105		1. 2. 3. 4. 5.	
110		115		1. 2. 3. 4. 5.	
120		125		1. 2. 3. 4. 5.	
130		135		1. 2. 3. 4. 5.	

Landscape and Recreation Pressure at Talkin Tarn
Student Information Sheet 3

DESIGNING A QUESTIONNAIRE

You are going to carry out a survey of people's views about Talkin Tarn Country Park. The following information will help you to design a questionnaire.

1. Designing the questionnaire

The design of the questionnaire is important as it will affect how respondents answer and how well you analyse or interpret your results.

'The Dos'

Do:

- Know what problem or issue you are tackling.
- Know what questions you want to ask.
- Keep the questionnaire short.
- Start with the easy questions.
- Ask questions about the person to start with as it will help to interpret the information later and indicate if your sample is representative. For example age, sex, where they live.
- Ask if the person is aware of the problem or issue you are investigating.
- Ask questions that require a 'tick box' answer rather than opinions.
- Ask simple 'yes' or 'no' questions rather than questions that have 'but', 'if' or 'maybe'.

'The Don'ts'

Don't:

- Ask offensive questions regarding age or income. For example ask which age category they are in rather than their age.
- Ask questions that 'expect' a certain response. For example do you shop here because it is cheaper?
- Ask long-winded questions. Keep it simple.

2. Using the questionnaire

Always do the following when using your questionnaire:

- Conduct a pilot survey first to test your questionnaire.
- Think about where you will conduct your survey as it will affect your results.
- Introduce yourself and explain who you are and what you are doing.
- Make sure you are polite and let the person see the sheet you are completing.



Landscape and Recreation Pressure at Talkin Tarn

Student Resource Sheet 3

VISITOR SURVEY AT TALKIN TARN

Location: _____ **Day:** _____

Date: _____ **Time:** _____

1. How far do you live from Talkin Tarn?

Within a mile ☐ Half a mile to 1 mile away ☐ 1-5 miles away ☐

5-10 miles away ☐ 10-40 miles away ☐ More than 40 miles away ☐

2. How often do you visit Talkin Tarn Country Park?

Most days ☐ Once a week ☐ Once a month ☐

A few times a year ☐ A one-off visit ☐

3. What do you like best about Talkin Tarn Country Park?

The landscape ☐ The walks ☐ The woodlands ☐

The tarn ☐ Boating ☐ The café ☐

Educational facilities ☐ Other ☐

4. What improvements would you like to see at Talkin Tarn Country Park?

More extended walks ☐ More events and activities ☐ More educational visits ☐

More leisure facilities ☐ More shops ☐ More interpretation ☐

Other (*please specify*) _____

5. Are there any other comments you would like to make about the future plans for Talkin Tarn Country Park?

_____

_____

_____

_____

_____

Thank you for your co-operation



ORGANISATIONAL DETAILS

Aim of field work

River features and processes of the upper course

Target Group

Key Stages 3 & 4 Geography.

Location

This fieldwork day is based on the River Gelt in the north west of the North Pennines Geopark. Four river sites are identified for the river measurements to be carried out. The first site is on a tributary of the River Gelt, the How Gill, above Gairs (GR: NY 583556) just below the footbridge on the footpath. The second site is also on the How Gill and accessed by following the track down below Gairs and using the section of the river below the confluence of the tributaries of the How Gill but above the section where the river enters a small gorge (GR: NY 582555). The third site is on the River Gelt, just upstream of the bride at Hynam. A fourth site can be used at Low Geltbridge, just to the east of the A69(T) (GR: NY522592).

Practical Details

• Parking – There is parking at Jockey Shield (GR: NY 557556). The first three river sites can be accessed from here along a good track. There is parking at Low Geltbridge for the fourth river site if used (GR: NY 520593).

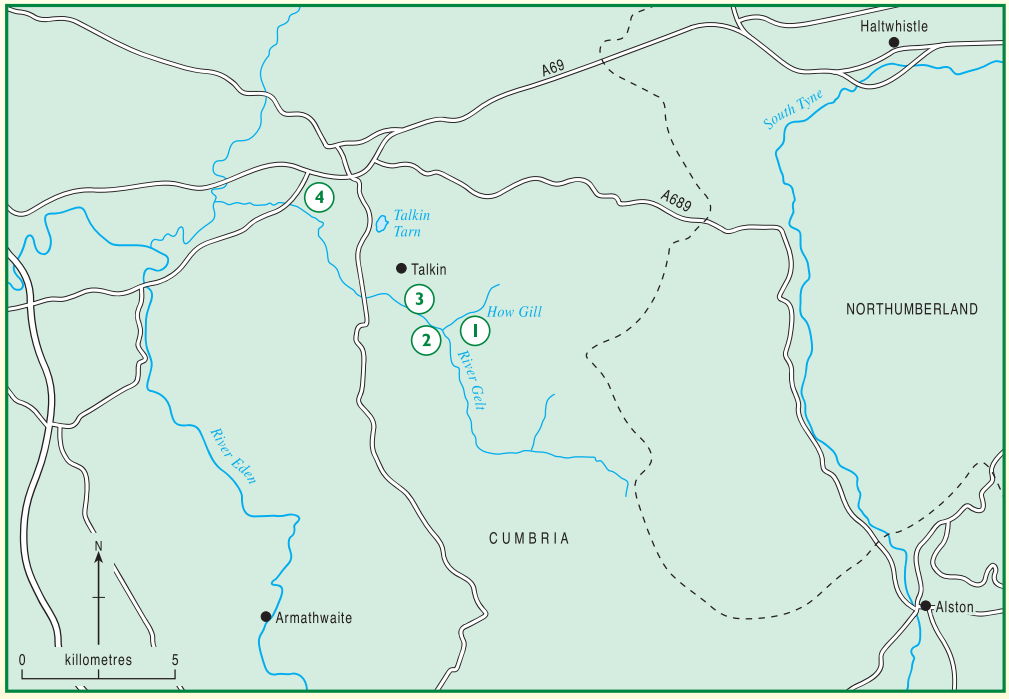
• Useful map – Ordnance Survey Landranger Map, 1:50 000, sheet number 86.

Safety Issues:

- The fieldwork activities on the River Gelt will involve the students working in the river and the fieldwork should only be undertaken at low flow conditions.
- Refer to the Hazard Identification Sheet

River Features and Processes on the River Gelt

Fieldwork Outline - Teacher Resource Sheet



HAZARDS IDENTIFICATION SHEET

The following notes will help teachers conduct their own risk assessments. This is not a risk assessment and teachers should follow guidelines from the Department of Children, Schools and Families.

Hazard Identified	Risk and to whom	Control measures
Vehicles in the car park	Caution needed when getting off the coach or minibus in the car park, and crossing any roads. All students and staff.	Supervise students getting off the coach or minibus and gather in a safe place.
Uneven paths	Paths are uneven and may be slippery in wet weather. Students may slip and fall. All students and staff.	Warn about conditions.
Working in rivers	Rocks in the river may be slippery and there is the risk of falling into the river. All students and staff.	Warn about conditions and the possibility of hypothermia if getting wet.
Low Geltbridge	Fast flowing water and areas of deeper water. At this site the river is larger and will only be suitable at low flow conditions. All students and staff.	Only use in low flow conditions. Warn students of faster and deeper flows at this site.

INTRODUCING THE FIELDWORK

Purpose and aims of the visit

The main purpose of the fieldwork is to look at the features and processes that operate in the upper course of a river.

The aims of the fieldwork are:
- To look at the features of the upper course of How Gill and the River Gelt
- To find out what controls the energy levels of the river.
- To find out how changes in energy affect the processes at work in the river.

Background information
The features of a river vary from source to mouth. The energy available for erosion, transportation and deposition vary with time and over the course of the river. Introduce river features and processes using Student Information Sheet 1.
Having introduced the aims of the fieldwork, set up hypotheses based upon the following:
- What factors influence how fast a river flows?
  - Gradient?
  - Amount of water in the river? (Discharge)
  - Shape and efficiency of the channel? (Cross sectional area, hydraulic radius)
- Where will the river have most energy?
- Where does the river flow fastest?
- What processes will be dominant in different parts of the river?
- How does the material carried by the river change with the river's course?
  - Size?
  - Shape?

Introducing fieldwork methods
Introduce the fieldwork methods needed to test the hypotheses. Use Student Information Sheet 2 to introduce the methods.
Use the O.S. extract to show the location of the river sites.

UNDERTAKING THE FIELDWORK

River measurements are to be carried out on 3 or 4 sites. The first two sites are on the How Gill, a tributary to the River Gelt and third and fourth sites on the River Gelt at Hynam and Low Geltbridge. See O.S. map extract.

At each site the following measurements are carried out:

- Width
- 10 x depth recordings
- Wetted perimeter
- Float velocity – 10 x across the river
- Flow meter velocity – 10 x across the river
- Gradient
- Bed load test
- Suspended load test
- Measurement of the A-axis of 10 pebbles
- Measurement of the roundness of 10 pebbles
- Field sketch and description of the river features. The main features to observe are the 'v'-shaped valley, interlocking spurs and pools and riffles. The How Gill at Gairs also demonstrates tributaries and confluences very well.

All measurements can be recorded on Student Resource Sheet 1.

Fieldwork equipment

The following equipment will be required:

- Clipboards
- 30m tapes
- Metre rules
- Float – boneo (biodegrades if left behind or eaten by sheep!) or orange
- Stopwatch
- Flow meter
- Gun clinometer
- Laminated board and spring balance
- Pot for suspended sediment
- Student Resource Sheet 1 – Recording Sheet.

FOLLOWING UP THE FIELDWORK

Results

1. Processing the data
Use Student Resource Sheet 2 to process the data collected in the field. Each group should use their own data. This will allow the students to see the change in the river's characteristics as they move from site 1 to 3/4 (i.e. as they move downstream).

2. Cross sectional areas
Using graph paper plot the cross sectional areas of the 3 river sites. Use these to describe the shape of the river channel. The shape can be related to the amount of water in touch with the bed and banks of the river and so the amount of friction produced. The channel shape with the least amount of water in contact with the bed and banks will be more efficient. Relate these cross sectional areas to the results for the hydraulic radius, which is a measure of the efficiency of the river.

3. Field sketches
Tidy the field sketches made and add the site description information to them.

4. Describing your results
For each of your results describe what they show.

5. Analysising your results
Use the data collected to accept or reject the hypotheses set up before the fieldwork. Explain what your results mean.

6. Summarising your results
From the results summarise the following:

- What are the controls on velocity and what are the relationships?
- Where does the river flow fastest and why?
- Where does the river have the most energy?
- What processes are most important at each site?
- How is this outcome reflected in the shape and size of the pebbles you measured?

ADDITIONAL WORK

- Use a range of graphical techniques to present the results.
- Use Spearman's Rank Correlation Coefficient on the results to identify significant positive and negative correlations between the variables measured in the field.
- Use the measurements to calculate Manning's 'n' – a measure of the channel's roughness.
- Use the case study of the River Gaunless Flood Alleviation Scheme to look at the factors that affect flooding on a North Pennines river and a flood alleviation scheme that has been put in place.



O.S. Map of River Gelt and How Gill

O.S. Map of River Gelt and How Gill



Ordnance Survey Map Symbols

ROADS AND PATHS

- M1 or A6 (M) — Motorway
- A35 — Dual carriageway
- A30 — Main road
- B3074 — Secondary road
- Narrow road with passing places
- Road under construction
- Road generally more than 4m wide
- Road generally less than 4m wide
- Other road, drive or track, fenced and unfenced
- Path

RAILWAYS

- Multiple track
- Single track

PUBLIC RIGHTS OF WAY

- Footpath
- Bridleway

BOUNDARIES

- National
- County (England)
- Civil Parish (CP)
- National Park boundary

SELECTED TOURIST AND LEISURE INFORMATION

- P — Parking
- Information centre
- PC — Public convenience
- Telephone
- Campsite / caravan site
- Golf course or links
- Public house
- Walks
- Viewpoint
- Picnic site
- Country park

GENERAL FEATURES

- \+ — Place of worship
- Building
- Bus or coach station
- Triangulation pillar
- Windmill
- BP/BS — Boundary post / stone
- CH — Clubhouse
- FB — Footbridge
- Mon — Monument
- PO — Post Office
- Pol Sta — Police station
- Sch — School
- TH — Town hall

River Features and Processes on the River Gelt

Student Resource Sheet 1

RIVER FEATURES

Rivers usually start on high land and flow to the sea. The start of a river is called the source and where it enters the sea is called the **mouth**.

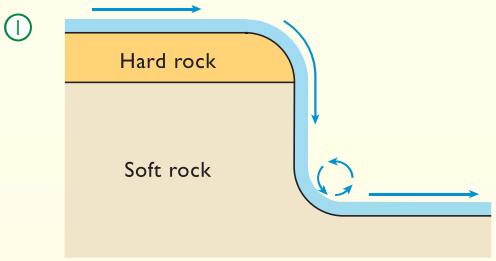
The main features of the upper course are features produced by erosion and include 'V' shaped valleys, interlocking spurs, waterfalls and rapids:

'V' shaped valleys – the energy of a river in its upper course is used to cut downwards, developing steep-sided, narrow valleys shaped like the letter 'V'.

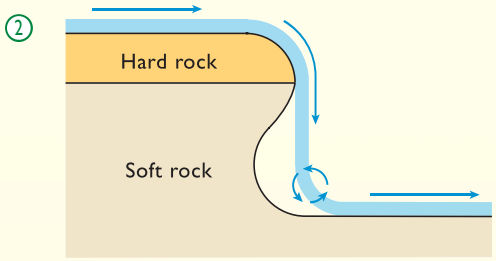
Interlocking spurs – the river is forced to wind its way around protruding hills and outcrops of rock. The protruding outcrops are called interlocking spurs and restrict the view up and down the valley.

Waterfalls – most waterfalls are formed when the river meets a band of softer, less resistant rock after flowing over a relatively hard resistant rock. The softer rock is worn away more quickly and the harder rock is undercut. The undercut rock will be unsupported and will eventually collapse. The rocks that have collapsed, will be swirled around by the river at the foot of the waterfall and create a plunge pool. This process will be repeated and the waterfall will move upstream leaving a steep-sided gorge in front of it.

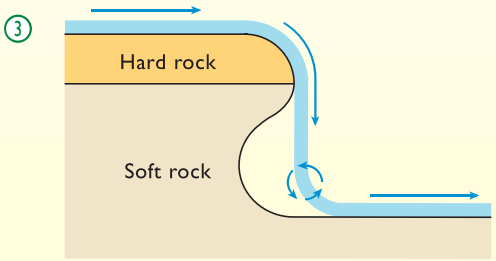
How are waterfalls formed?



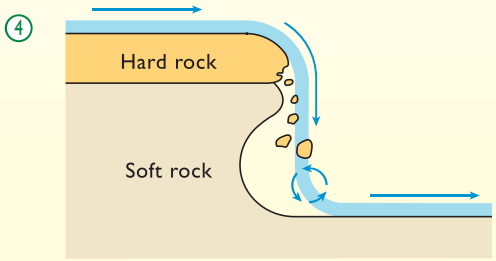
STEP 1: Most waterfalls are formed when the river meets a band of softer, less resistant rock after flowing over a harder, more resistant rock.



STEP 2: The softer rock is worn away more quickly to form a step in the bed of the river.



STEP 3: The harder rock is undercut by the river.



STEP 4: The undercut rock is left unsupported and will collapse.

Rapids – these occur where the layers of hard and soft rock are narrow and so there is no break in slope like when a waterfall is formed. The wearing away of the less resistant rock makes the gradient steeper producing rapids or areas of fast flowing water. There are often sequences of fast and slow flowing water called pools and riffles.

The main features of the lower course are depositional and include, **flood plains**, **levees** and **deltas. Meanders** and **ox-bow** lakes are the result of both erosion and deposition. These features will not be seen, as our study will be concentrated on the upper course.

RIVER PROCESSES

The river has three types of processes: erosion, transportation and deposition.

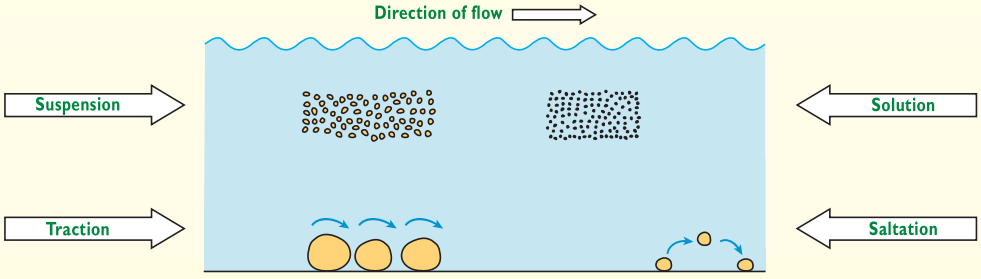
Erosion – The material carried by a river erodes the bed and banks. A river erodes by 4 different processes:

- **Attrition** – boulders and material moved by the river along its bed, collide and break up into smaller pieces. This is the main process of erosion in the river's upper course.
- **Corrasion** or **Abrasion** – material carried by the river in suspension (carried in the water) wears away the banks of the river. This is the main process of erosion in the lower course, as the material carried by the river is small enough to be transported in suspension.
- **Corrosion** – this where slightly acidic river water dissolves the bedrock when it is an alkali rock like limestone. This can occur at any point during the river's course.
- **Hydraulic action** – this where the force of the water in the river dislodges particles from the river's bed and banks.

Transportation – The river can transport material by 4 main processes: traction and saltation along its bed, suspension and solution within the river itself.

- **Traction** – this is the rolling of stones along the bed of the river and requires the most energy.
- **Saltation** – sand-sized particles bounce along the riverbed.
- **Suspension** – silt and clay-sized particles are carried within the water itself
- **Solution** – this is where minerals are dissolved in the water and are carried along. This method of transport requires the least energy.

Transportation in a river



Deposition – this occurs when the river does not have enough energy to carry its load and the material is dropped onto the bed or banks of the river. The heaviest material is dropped or deposited first and may occur when the amount of water (or discharge) in the river is reduced or the velocity of the water decreases such as on the inside of a meander bend.

The river's energy

Energy levels in a river vary over time and over the course of a river. When energy levels are high the river can transport material and erode the bed and banks. If energy levels fall the river may not be able to transport, as much material and it will be deposited.

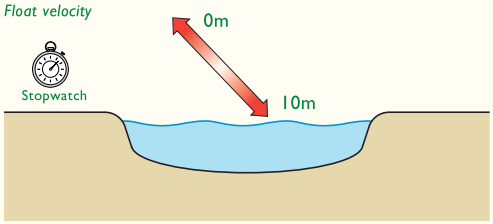
River Features and Processes on the River Gelt

Student Information Sheet 2

FIELDWORK METHODS

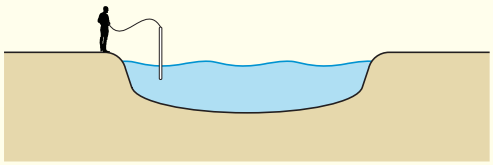
1. Velocity measurements

Float velocity



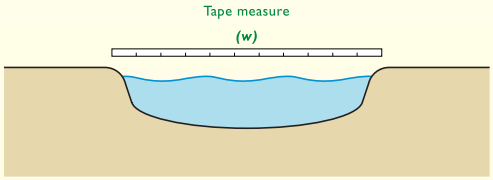
Record the time it takes for the float to travel 10m.
Repeat the exercise 10 times across the width of the river.

Flow meter velocity



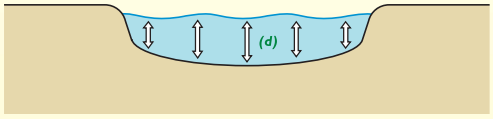
Place the flow meter in the river 2/3 up from the bottom or 1/3 down from the top.
Record the velocity 10 times across the stream.

2. Width



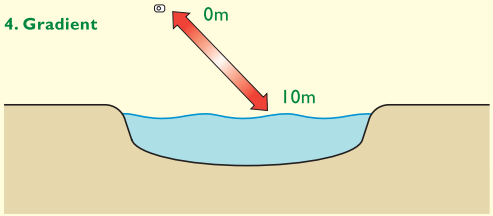
Measure the width of the stream from the surface of the water on one side to the surface of the water on the other side.

3. Depth (m)



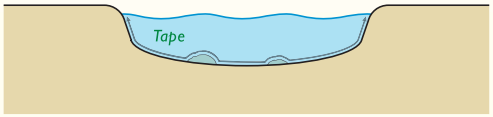
Take 10 depth measurements across the width of the river.

4. Gradient



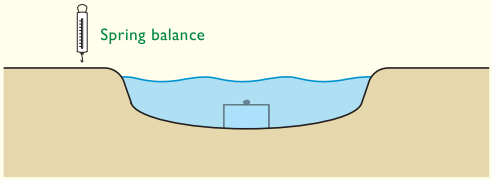
Use the gun clinometer over 10m. Site on the eyes of a person the same height as yourself and when the gun clinometer stops swinging, stop it and read the angle.

5. Wetted perimeter



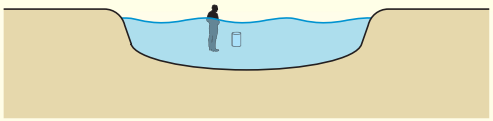
Measure the wetted perimeter from the surface of the water on one side, over every hump and bump on the river bed, to the surface of the water on the other side.

6. Bedload test



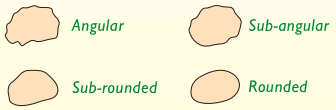
Weigh the pebble that gradually moves across the laminated board on the bed of the river.

7. Suspended load



Collect a sample of water from the middle of the river.

8. Size and shape of bedload



Record the length of the A-axis of 10 pebbles

Record the roundness of 10 pebbles using the roundness chart

9. Site description

Fill in description on the recording sheet.

Describe the features of the upper course.

Draw a field sketch or take a photograph and label the main features.



River Features and Processes on the River Gelt

Student Resource Sheet 1

RIVER RECORDING SHEET

Results	Site 1 *Name:*	Site 2 *Name:*	Site 3 *Name:*	Site 4 *Name:*
Grid reference				
Width (m)				
Depth (cm)				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Wetted perimeter (m)				
Float velocity (time taken to travel 10m)				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Results	Site 1 *Name:*	Site 2 *Name:*	Site 3 *Name:*	Site 4 *Name:*
Float metre velocity (m/s)				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
Gradient (degrees)				
Mass of pebble that just moves across board (g)				
Depth of sediment from suspended load (mm)				
Length of A-axis (cm)				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Results	Site 1 *Name:*	Site 2 *Name:*	Site 3 *Name:*	Site 4 *Name:*
Bed load shape:				
No. Angular				
No. Sub-angular				
No. Sub-rounded				
No. Rounded				
Site description:				
1. Size of valley				
2. Steepness of valley				
3. Is the river large or small compared to the valley				

Field Sketches

Site 1: _____

Site 1: _____

Site 1: _____

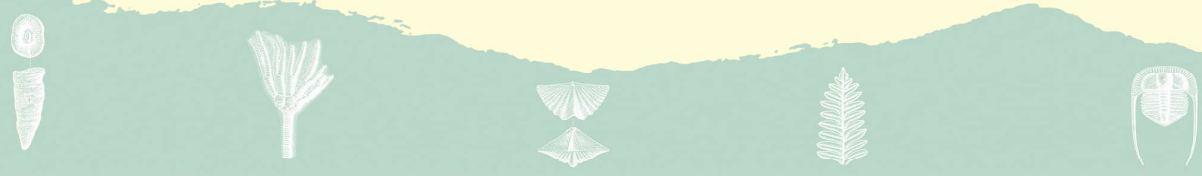
Site 1: _____

River Features and Processes on the River Gelt

Student Resource Sheet 2

RIVER ANALYSIS SHEET

	Site 1 *Name:*	**Site 2** *Name:*	**Site 3** *Name:*	**Site 4** *Name:*
Width (m)				
Mean depth (m) (add 10 depth measurements together and divide by 10)				
Cross sectional area (CSA) (m^2) (Width x mean depth)				
Mean float velocity (m/s) (10 divided by the mean number of seconds)				
Mean flow meter velocity (m/s)				
Discharge (m^3/s) (CSA x flow meter velocity)				
Wetted perimeter (m)				
Hydraulic radius - a measure of the efficiency of the stream (CSA divided by wetted perimeter)				
Gradient (degrees)				
Mass of pebble (g)				
Bed load shape				
% Angular				
% Sub-angular				
% Sub-rounded				
% Rounded				
Bed load size (mean length of A-axis (mm)				
Depth of suspended sediment (mm)				



Talkin Tarn and Surrounding Area, Cumbria

Signposting of places of interest and information at Talkin Tarn and in the surrounding area

Talkin Tarn – Talkin Tarn Country Park is a beautiful spot to visit. The stunning 65 acre glacial tarn with a backdrop of the Pennine hills is surrounded by mature woodland and grassland. A 1.3 mile lop walk around the tarn is hard surfaced and level with plenty of benches for tired legs or just to take in the view. Wildlife is abundant in the park throughout the year and we are lucky to provide a home to the red squirrel.

Facilities include toilets, woodland trails, disabled parking, a gift shop, bird observation hides, pike fishing and a small children's play area. In the summer rowing boats are available to hire and private boats can be launched for a small fee all year round.

After a walk visit our Boathouse Tearoom for some refreshment and a fantastic view over the tarn. The tearoom, gift shop and toilets are all fully accessible to people with disabilities.

Talkin Tarn is located approximately 9 miles east of Carlisle and just a mile south off the A69 (follow the brown signs from the roundabout) at Brampton, on the Castle Carrock road.

Car parking is free for 2 hours. £2/car for over 2 hours.

For further information please call the site office on 016977 3129.