Canal & River Trust | STEM

Part 3: **Managing, maintaining and restoring canals and rivers**

3A: The cost of keeping canals in working condition

Presentation activities
- Careers in maintaining and restoring canal
- Interpreting information from photographs
- Graph work and data interpretation

3B: The need for protection: Toddbrook case study

Presentation activities
- Interpreting photographs
- Chronological understanding

In this section:
- Restoration and maintenance work to keep the network resilient and safe to use
- The threat from climate change and the damage caused by severe weather events
- Work to protect the network against climate change
- The cost of protecting canals and rivers
- The benefit to people and wildlife to be derived from investment

3C: Keeping the waterways navigable: Diglis case study

Presentation activities
- Interpreting visual information
- Labelling photographs

3D: Balancing navigation and ecological concerns: Montgomery Canal case study

Presentation activities
- Identifying social, economic and environmental benefits
- Opinion-forming and decision-making

Delivery in the classroom: The accompanying presentation slides are designed to help you deliver key information and stimulate discussion. You can select the slides you want to use and adapt to your needs.

The slides also facilitate activities which encourage students to apply their skills and knowledge, including deriving information from video and photographs, and plotting and interpretating data.

The following pages can be used as teacher or student notes for the case studies.

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3A: The cost of keeping canals in working condition

Canals needs constant upkeep and investment to keep it in working condition and as a safe space for people and wildlife to thrive. Without this work, canals face decline and closure. Ecologists, hydrologists, planners, environment, and heritage experts restore and maintain the network sensitively, balancing the needs of wildlife with the working nature of the network.

An ageing canal network

Many canals, aqueducts, reservoirs, and locks are hundreds of years old. The 2,000-mile network comprises 2,706 listed buildings and structures, examples of Georgian, Victorian, and Edwardian engineering and architecture, and the oldest collection of working industrial heritage in the UK. Maintenance and repairs require specialist knowledge and bespoke training and replacement parts are not mass produced. Lock gates are hand crafted in specialist workshops. It costs millions of pounds every year to keep the 250-year-old network in working order.

The challenge of climate change

Canals and rivers are threatened by the growing impact of climate change and more extreme weather events. Storms and flooding can cause £millions of structural damages to bridges, locks and heritage buildings, collapse riverbanks, breach canals, and wash away towpaths. Habitats can become unstable, or even destroyed by floods and storms. Extreme weather events disrupt life cycles, and some animals and plants are struggling to adapt.

During periods of drought, a lack of rainfall interrupts the flow of water from reservoirs and rivers that feed the canals and maintain water levels. To save water, the use of locks may be restricted, and some canals closed to boat movement. Changes in weather patterns can cause water temperatures to rise and encourage the growth of invasive plants, threatening fish and other aquatic life.

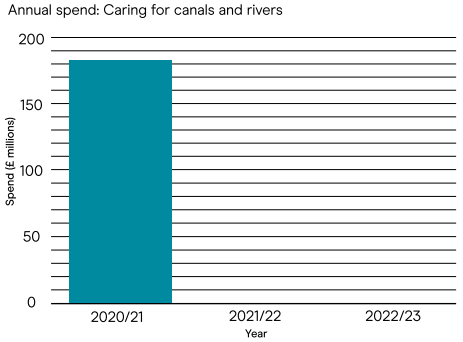
The canal network needs to become more resilient to climate change. Routine inspections and maintenance keep it in a good condition, and new materials and refurbishment techniques are being introduced, particularly to reinforce high risk sites such as reservoirs. Water levels are monitored via a bespoke, alarmed system and pumping stations control levels and speed of water entering and going out of canals and can even move water through locks to unaffected locations. Reinforcing, and improving the condition of canal banks and towpaths creates and protects vital waterside habitat and can be critical for the survival of threatened species such as water vole.

The cost of climate change

The total cost of the Trust's work to care for canals and rivers in 2022/23 was over £19 million more than in the previous year.

This includes emergency response, large scale maintenance and repairs, infrastructure works, day to day maintenance, regeneration, and work to mitigate effects of climate change.

The Canal & River Trust is a charity and relies on funding from Government grants, partners such as People's Postcode Lottery, boater licences, mooring fees and other donations to be able to carry out this work



Annual spend:

2021/22	£180.2 million
2022/23	£199.5 million

3B The need for protection

71 large reservoirs, across England and Wales, store water to keep the canals topped up and functioning as places for people and nature to thrive. The reservoirs are some of the oldest in the UK and are an important part of national infrastructure.

It is essential that they are well maintained and are resilient to climate change and adverse weather. Safety and flood risk management are priorities. If a reservoir were to fail it would have a huge impact on homes, schools, transport networks and utilities in the surrounding area.

Dams and spillways

- A dam controls the amount of water that flows out of a reservoir and protects the surrounding areas.
- A spillway is the part of a dam that releases water to prevent flooding.

Case study: Toddbrook Reservoir

Toddbrook Reservoir was opened in 1840 as a feeder for the Macclesfield and Peak Forest Canals. 1.1km in length and with a dam wall that stands 23.8m high, it can hold 1,238 megalitres of water – enough to fill almost 500 Olympic sized swimming pools. The reservoir is classified as a Site of Special Scientific interest (SSSI) due to its value to nature.

On 1 August 2019, after a period of intense rainfall, serious damage occurred to the spillway at Toddbrook Reservoir. There were concerns of a catastrophic failure of the dam as water could not drain over the spillway. A full-scale emergency was declared, and 1,500 people were evacuated from homes and businesses in the town of Whaley Bridge downstream.

The water level was quickly drawn down, and urgent measures taken to shore up and stabilise the dam. Once the immediate danger had passed, those evacuated could return, but the reservoir has remained closed. A £50 million restoration project to construct a new overflow spillway and restore the reservoir is scheduled to be completed in 2025.

Toddbrook was constructed at a time when little was known about extreme rainfall events and the effect of floods passing over spillways. Over the years the spillway was enlarged and improved, it was compliant with legislation around reservoir safety and had recently been inspected, so the incident in 2019 was unexpected. Management of reservoir safety across the UK has since been improved, with increased legislation and a requirement for full and regular maintenance. £40 million has been invested in reservoir works over the last 3 years.

Toddbrook image timeline in correct order

1. The spillway was releasing water following intense heavy rainfall.
2. On 1 August 2019, serious damage occurred to the spillway at Toddbrook.
3. Further collapse of the spillway occurred.
4. There were concerns that the dam might fail and 1,500 people were evacuated and sandbags were used to secure the slipway.
5. The water level was reduced, and the dam was stabilised.
6. A £50 million restoration project is underway to create a new spillway.

3C: Keeping the waterways navigable

Weirs are man-made structures that help to control the flow of a river or canal. They increase water depth and slow the flow upstream, to keep the water suitable for navigation.

Weirs require regular maintenance which can disturb habitat, and the construction of a weir can have wide-ranging impact for nature. For example loss of habitat through river bed and bank excavation, loss of vegetation, protected species and birds disturbed, and obstructing the movement of fish.

To mitigate this impact, work is carefully planned and designed. It might include translocation of protected species, conducting work outside of fish spawning seasons, introducing an otter pass to prevent them having to cross roads, or carrying out a fish rescue. Ledges, burrows and overhangs can be incorporated into the design of a weir, (as replacement habitat and protection for nesting birds), bat roosts placed in nearby buildings, new habitats created through bankside planting, and fish passes built to help fish travel upstream to breeding grounds.

Case study: Diglis Basin

The weir at Diglis on the River Severn creates a barrier for fish. It is 2m high with a very steep surface, and the water flowing over the top moves very quickly, making it extremely difficult for fish to swim or jump over it. Fish species such as Shad need to migrate upstream, for spawning. If they are unable to reach breeding grounds this can lead to population decline.

A fish pass is a deep trench that is 100m long – the same length as a football pitch. It contains a series of pools. Each pool is slightly higher than the last, allowing the fish to gradually make their way up the height of the weir and swim off into the river upstream. The fish pass at Diglis has allowed thousands of Shad and other species of fish pass over the weir and helped to bring back natural ecology.

3D Balancing navigation and ecological concerns

Case study: Montgomery Canal

The Montgomery Canal runs for 35 miles between England and Wales. It was closed due to a breach in 1936 and over time, the man-made channel has become colonised by a wide range of rare flora and fauna. It is known for its outstanding natural beauty, wildlife and heritage and is designated as a Site of Special Scientific Interest (SSSI) and a Special Area of Conservation. The area attracts wildlife such as damselflies, dragonflies, kingfishers, otters and water voles, and rare aquatic plants like Floating Water Plantain.

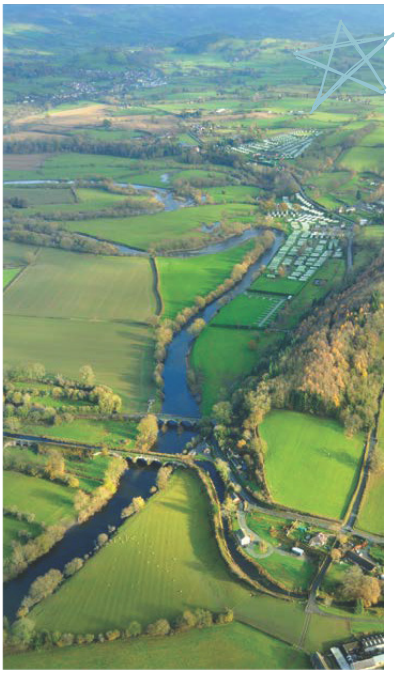
Since 1969, parts of the Montgomery Canal have been regenerated. Now 60% of the canal has re-opened. The most recent phase of restoration is a £4m project to reinstate a 2km section of the canal and 8km of towpaths near Oswestry, meaning people and boats can finally return there.

Waterway restoration can deliver economic, environmental, and social benefits to the local community, and act as a catalyst for wider regeneration, but the impact on wildlife must also be considered. Without intervention, the canal's ecology could risk being lost.

A derelict canal results in the loss of open water and fringe habitat, meaning it can no longer support aquatic species. This can lead to habitat succession, where trees begin to establish and invasive species take control, which reduces biodiversity and imbalances the canal's eco system. To protect the canal's ecology, intervention is needed.

A wildlife habitat, including two new nature reserve lakes, is being created parallel to the restored stretch of canal. This will provide a protective home to conserve rare aquatic flora and fauna removed from the canal, while enabling boats to return by excavating the main channel into a navigation. Hedgerows will be restored, and trees planted in the right places.

Once restoration work is complete, the channels and nature reserves will be given the chance to become established. Once the habitats are in good condition, a small number of boats be introduced gradually.



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