

Bewdley flood alleviation scheme



May 2001



Your questions answered



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Bewdley is a lovely, largely Georgian town nestling on the banks of the River Severn in Worcestershire. It has a picture postcard quality and has become famous for its riverside vistas - indeed the name of the town is derived from Beau Lieu - beautiful place. The large number of historic buildings and houses gives a high cultural value to the town.

The River Severn has played a major role in the development of the town's fortunes. By the 17th century Bewdley had become an important inland port with prosperous manufacturing industries, most notably pewter.

The town centre and neighbouring Wribbenhall lie on land which gently rises on either side of the river, joined by the Grade 1 Listed river bridge which was designed and built by Thomas Telford in 1801.

Over the centuries, development has spread along the river frontage into the low-lying flood plain. This flood plain is the natural overflow area for the river in times of high flows, and buildings on this land are at constant risk of flooding.

The increased frequency of recent floods has highlighted the need to look urgently at the possibilities for alleviating the effects of flooding in Bewdley. This

booklet provides some background information and examines many of the potential solutions that have been suggested. It also outlines the process for designing and implementing a scheme that the Environment Agency will follow - this process ensures that any environmental impacts are addressed and opportunities to enhance the environment taken.



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▲ Bewdley floods - November 2000

Flooding in the town

The largest flood in living memory occurred in 1947, when a water level of 5.8 metres above summer levels was recorded. Records show that some properties are likely to have been flooded at least 50 times in the last hundred years. The areas of Bewdley most severely hit by flooding are Severnside North and Severnside South, around the bridge crossing on the west bank of the river.

As many as 175 properties can be affected by a major flood. The effect on the town is significant; this includes disruption to traffic and to public transport, with a knock-on effect to the emergency services. Amenities cannot be reached, trade and commerce in the town is lost and affected home and business owners suffer great upheaval and distress. This is made all the worse when clean up operations are wrecked by recurring flooding.

In 1995 a flood defence scheme was proposed by the Environment Agency's

predecessor the National Rivers Authority. However, there were doubts about some aspects of the proposals, in particular the perceived visual impacts and the scheme did not proceed.

In the autumn of 2000, the worst flooding for over 50 years devastated the length of the River Severn, hitting Bewdley particularly badly with levels reaching 5.6 metres above summer levels. The town was extensively flooded three times in the space of six weeks. Public and political interest was raised, resulting in a renewed drive to

provide a flood alleviation scheme. The Agency had already begun to re-consider flood defences for Bewdley after floods in 1998, but following the recent events the programme has been accelerated.

The Agency has permissive powers to protect people and property from river and sea flooding. Money for this is raised through a levy on local authorities and from grants obtained from central government. To ensure that money is spent to the best effect, every scheme has to meet Treasury Rules implemented by the Ministry of Agriculture, Fisheries and Food (MAFF). This process is carried out using a benefit/cost analysis. This means that the limited funds available are spent where most benefit can be gained. If a scheme does not meet the benefit/cost criteria, it cannot go ahead.

It is important to remember that Bewdley is being considered along with other towns and villages that were affected by the autumn 2000 floods. The Government has released extra money for defence schemes that can commence quickly, and the Agency is keen to ensure that Bewdley benefits.

What about towns and villages upstream and downstream of Bewdley?

The scheme is being proposed in the context of a catchment wide River Severn strategy, looking at the river as a whole and continuing to explore ways of alleviating flooding problems in the longer term, including changes to land management and land usage.

Although schemes are being proposed for Bewdley and Shrewsbury, these schemes are not being developed in isolation and

careful calculations and extensive computer modelling will be used to ensure that neither of these schemes impact negatively on

other communities. When weighing up which are the best options, neighbouring communities are a clear priority.

What are the options for Bewdley?

There are many options that have been discussed. These include:

- Creating upstream storage lakes
- Dredging the river
- Building a dam
- Changing the course of the river into bypass channels or tunnels
- Creating underground storage
- Building defences in the town itself.





Can upstream storage help?

There are already three main areas of upstream storage which store water during a flood event - Llyn Clywedog reservoir, Lake Vyrnwy and the Severn/Vyrnwy confluence area.



1 Firstly, at the top of the catchment, is the Llyn Clywedog reservoir. This was built in the 1960's for the purpose of regulating the flow along the River Severn, in order to supplement low flows in the summer during drought conditions. The reservoir is owned and operated by Severn Trent Water and managed by the Agency. When full, Llyn Clywedog stores up to 50 million cubic metres of water. The flood protection benefit can be significant immediately downstream at Llanidoloes, but the benefit reduces rapidly as you go downstream - by the time you get to Bewdley, where the Llyn Clywedog catchment represents only 1% of the total catchment, the benefit is negligible.

2 Secondly, Lake Vyrnwy is located beyond the confluence of the Severn and Vyrnwy rivers, 120km upstream of Bewdley. It is owned and operated by Severn Trent Water but the water supply is licensed to North West Water. The reservoir also provides a small flow regulation system and tops up low summer flows. As with Clywedog, any protection benefits are only experienced close to the reservoir, and not as far away as Bewdley.

3 Thirdly, there is an existing area of flood plain storage upstream of Bewdley in the Severn/Vyrnwy Confluence near Melverley. Here a system of argaes (low flood embankments) and sluice gates hold back approximately 20 million cubic metres of water, which provides some flood protection to Bewdley. To significantly improve the level of protection offered by this storage would involve rebuilding and increasing the height of at least 40kms of floodbank. This is not a viable option financially and would cause large areas of farmland and many homes and properties in the Melverley area to be inundated by extensive flooding for much longer periods.



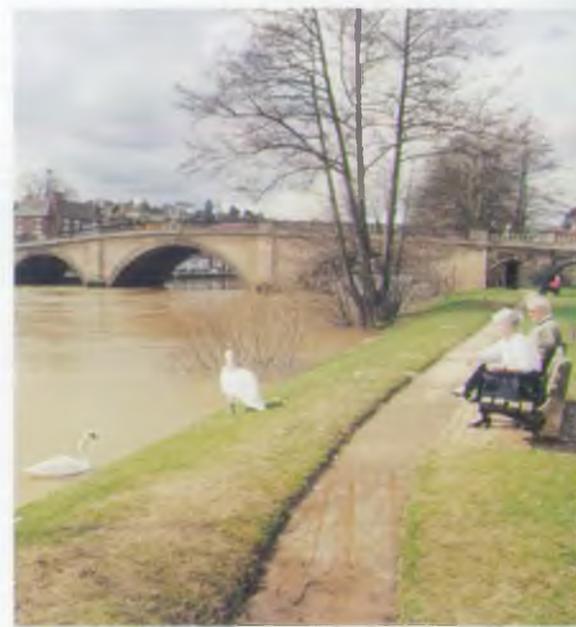
Why not dredge the river?

Dredging the river is often suggested as a simple solution. However, dredging would have big implications for the town and the wider riverside environment.

To accommodate the flow in a 1 in 100 year event* (about 675 cubic metres per second - or some 9 times more volume than normal), would require more than simply removing the silt from the river channel through Bewdley. The depth would have to be increased by at least 3 metres, requiring rock blasting of the river bed. This would have to extend some distance downstream, possibly as far as Worcester.

All bridges and other waterside structures along this length would have to be reconstructed to place their foundations at a depth where the deepened river channel would not cause undercutting. This would include the historic bridge in the centre of Bewdley.

The cost of this work would be substantial in both financial and environmental terms, and would significantly alter the appearance of Bewdley.



What about a dam?

It might be possible to construct a dam across the river just upstream of Bewdley for storage purposes. A suitable location exists about 1km upstream of the bridge, subject to detailed investigation.

A provisional examination would suggest that there is no scope for storage of significant amounts of water here, as the channel is relatively steep sided and narrow. In addition, there are a number of properties adjacent to the river which are likely to be inundated.

A preliminary examination of flood plain maps would suggest that there is little scope for storage anywhere else between Shrewsbury and Bewdley either, although there are some areas in some of the tributaries which may be worth investigating during the course of the strategic study.



▲ Floods - November 2000

*Floods are categorised by their size and the frequency with which they can be expected to occur. A 1 in 5 year flood is one that has a 20% chance of happening in any year - this is a relatively minor flood. A 1 in 100 year flood has only a 1% chance of happening in any year, but its effects can be enormous.



What about a bypass channel or tunnel?

There have been a number of suggestions for constructing a diversion channel around Bewdley for diverting flow and to reduce the flow along the existing river channel in times of possible flooding.

The level of a new channel would have to be similar to that of the existing river channel. Because the ground either side of the river rises steeply, the further away from the river the channel was located, the deeper and wider the channel would have to be. In practice, because of the extent of development in the town, there is no obvious route without massive excavation and extensive disruption to property, access routes etc. on either side of the river.

A tunnel, or series of tunnels would provide a more practical solution. One possible route is available to the west of the river commencing at the disused railway at Dowles. The route would pass well to the west of the

town under the Hales Park area and then pass just to the west of Ribbesford to rejoin the river shortly after. At its deepest point, the tunnel would be some 70 metres below existing ground level.

At the point where the tunnel rejoins the river, the water level for the 1 in 100 year event, would be the same as if there was no tunnel, since it is the downstream conditions that control the level of the water at this point. The maximum amount that water levels near Bewdley bridge could be reduced, by diverting all the flow through the tunnel and stopping any flow through the town, would be about 1 metre. The water would back up the



existing river channel as a still level pool. This would mean that there would still be considerable flooding in the town.

Provisional calculations indicate that ten 6 metre diameter, or six 7.6 metre diameter tunnels, would be required to pass the flow. For comparison, the Channel Tunnel comprises two 7.6 metre diameter tunnels. The current estimated cost is in the order of £470million.

What about underground storage?



Some people have enquired whether the flood waters could be either contained within underground holding tanks, or funnelled back into the ground itself to join existing groundwater reserves.

The huge volumes of water involved mean that it would be impossible to engineer or construct tanks. To contain the huge flow, any such tanks would need to be many square kilometres in size. They would also be very difficult to maintain.

It would similarly be impossible to funnel such a flood into the ground. Groundwater in this area is already under pressure. Any boreholes drilled into the underlying sandstones, would encounter flowing groundwater which would add to the flood waters.

What about flood defences in the town?

There are two principal flooding areas in Bewdley - Severnside North and Severnside South, both on the west bank of the river.



Sketch view from Bewdley Bridge of the proposed demountable defence in place on Severnside North.

The defence will be erected when the rising river could affect properties. The red line on the defence indicates the level of the November 2000 flood at its peak.

It would be possible to construct defences within the town itself in two phases, using a combination of flood walls, embankments and 'demountable' defences placed along the western side of the river. This option would provide an opportunity for enhancement of the riverside, and would not cause problems for neighbouring villages and towns.

The Agency is accelerating a flood alleviation scheme for Severnside North as the first phase of defences for Bewdley. It would be possible to undertake this first phase of the scheme in a 9 to 12 month period. Construction work could be programmed to minimise disruption to the town and when this phase is completed, an immediate protection of

Severnside North would be achieved. This solution offers the most practical and economic approach. It is also the option that allows an accelerated start in Autumn 2001.

Phase 2 will include Severnside South and would be an essential and integral part of the scheme to protect Bewdley from severe flooding.



▲ An example of demountable defences in position



So does this mean that the Agency is proposing the same **scheme** for **Sevenside North** as in 1995?

Absolutely not. There have been significant technological advances since the mid 1990's that allow us to be much more creative and innovative in our approaches to flooding. This is especially important in towns like Bewdley which have such an historic heritage and where aesthetic considerations are paramount.

Our suggested scheme for Sevenside North would combine a short length of traditional brick-faced flood wall with new 'demountable' defences. 'Demountable' defences would

only be erected in the event of a flood. During the majority of the year when the river is not a threat, they would simply not be there. The scheme can protect the flood-prone properties

on Sevenside North while preserving the historic character of the quayside. It can also provide an opportunity to significantly improve the upstream end of the quayside.

What about the **other side** of the **river**?

The areas to the east of the river will remain unprotected and will still flood. As stated earlier in this booklet, every scheme has to meet Treasury Rules, a process which is carried out using a benefit/cost analysis.

Schemes to protect the areas to the east of the river, including Wribbenhall and Beale's Corner, unfortunately do not meet the benefit/cost criteria and therefore cannot be considered by the Agency as viable options at present.

The Agency is hoping that the River Severn strategy will help identify broader options for solutions along the river, and will uncover new options that have not previously been possible to identify.



What about groundwater?

The ground in the vicinity of Severnside North is underlain by a thin covering of alluvium which contains clays and gravels and rests on a bedrock of sandstone. Many of the properties have cellars which are very prone to flooding at present.

Any flood defence above ground must also defend against water flowing underground or it will simply be bypassed. We have therefore carried out a comprehensive borehole drilling

and ground investigation programme supplemented where necessary by underground imaging. This gives a two dimensional continuous image of the ground composition to

depths of over 60 metres and will help us define the work needed below the surface. Flood defences are like icebergs, most of the defence is actually hidden under the ground.

What about water coming back up the drains?

We know that this is a problem, and the effect of the river flooding on the drains will need to be addressed. However the Agency has carried out many schemes where similar problems have been overcome.

The foul and surface water drains in Bewdley are the responsibility of Severn Trent Water, with some drains that the Highway Authority is responsible for.

We are currently working with both organisations to identify all of the issues relating to the drains. Once these problems have been identified then solutions can be designed.





So what happens now?

Our plans for Severnside North are still developing and it is important that everyone in Bewdley who wants to comment and influence proposals has a chance to have an input.

A flood defence scheme can have a range of social and environmental consequences for a town like Bewdley. Some of the effects will be positive, like the prevention of flooding, while others could be considered negative, like the temporary inconvenience to residents and businesses during the construction period.

To make sure that both positive and negative environmental effects are fully understood before the scheme is built, the Environment Agency (by law) will undertake an Environment Impact Assessment (EIA). The EIA process looks at the likely impacts on:

- Residents
- Local planning policies
- Ecology and natural environment
- Water and air quality
- Cultural, archaeological and heritage matters
- Buildings and roads
- Landscape and visual resources
- Soils and geology
- Noise and vibration levels
- Transport and access
- Maintenance and management
- River recreation.

A scoping report for Severnside North was published in February 2001 and residents

and interested parties have fed back their comments. The findings of the EIA process will be evaluated and presented in an Environmental Statement to be published in May 2001. Public exhibitions will be held. Measures to protect valuable aspects of the existing environment, mitigate against any unavoidable damage and enhance the visual environment in Bewdley will be identified and published in the Environmental Statement as an Environmental Action Plan.

The Action Plan and Statement will form part of the Agency's Planning Application to be made in June to Wyre Forest District Council. They will have the final decision on whether the scheme is given planning permission.

If planning permission is granted, construction could start on site for Phase 1 (Severnside North) during the autumn of 2001. For Phase 2 (Severnside South) feasibility and scoping work has already started with a likely start on-site in the autumn of 2002. Although it is the intention to protect the whole of the west side, each phase has to stand on its own merits, meet the Treasury Rules and gain planning permission.





If the Agency constructs the scheme in Severnside North, does that mean that other areas in Bewdley will suffer more flooding in the short term?

The Agency has updated a mathematical model of the River Severn which is used to predict river levels under varying flow conditions. Whilst previous models exist, with the advent of powerful computer programs we can predict the effect of river levels with greater accuracy than ever before.



We have now used the model to predict the effect that any defences on Severnside North will have on other areas of the town, and beyond. This leads the Agency to conclude that the effect of the Severnside North phase will be very small. Similarly any effects upstream or downstream will be quantified, although no measurable effect is anticipated.



If the whole scheme goes ahead does it mean that no areas of Bewdley will ever flood again?

We need to remember that flood risk can never be completely removed. This scheme is designed to provide protection against a 1 in 100 year flood, so a very severe flood greater than this, which in fact has never been recorded, would overtop the new defences.

Areas to the east of the river, including Wribbenhall, as has been explained earlier, will not be covered by the scheme and will still flood.

However, those areas of the town containing property on

the west bank of the river will be protected up to the design level. Extensive flooding of the areas adjacent to the river on this bank should be a thing of the past and the protection of trade and commerce in the town will be improved.

▼ Floods - November 2000



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