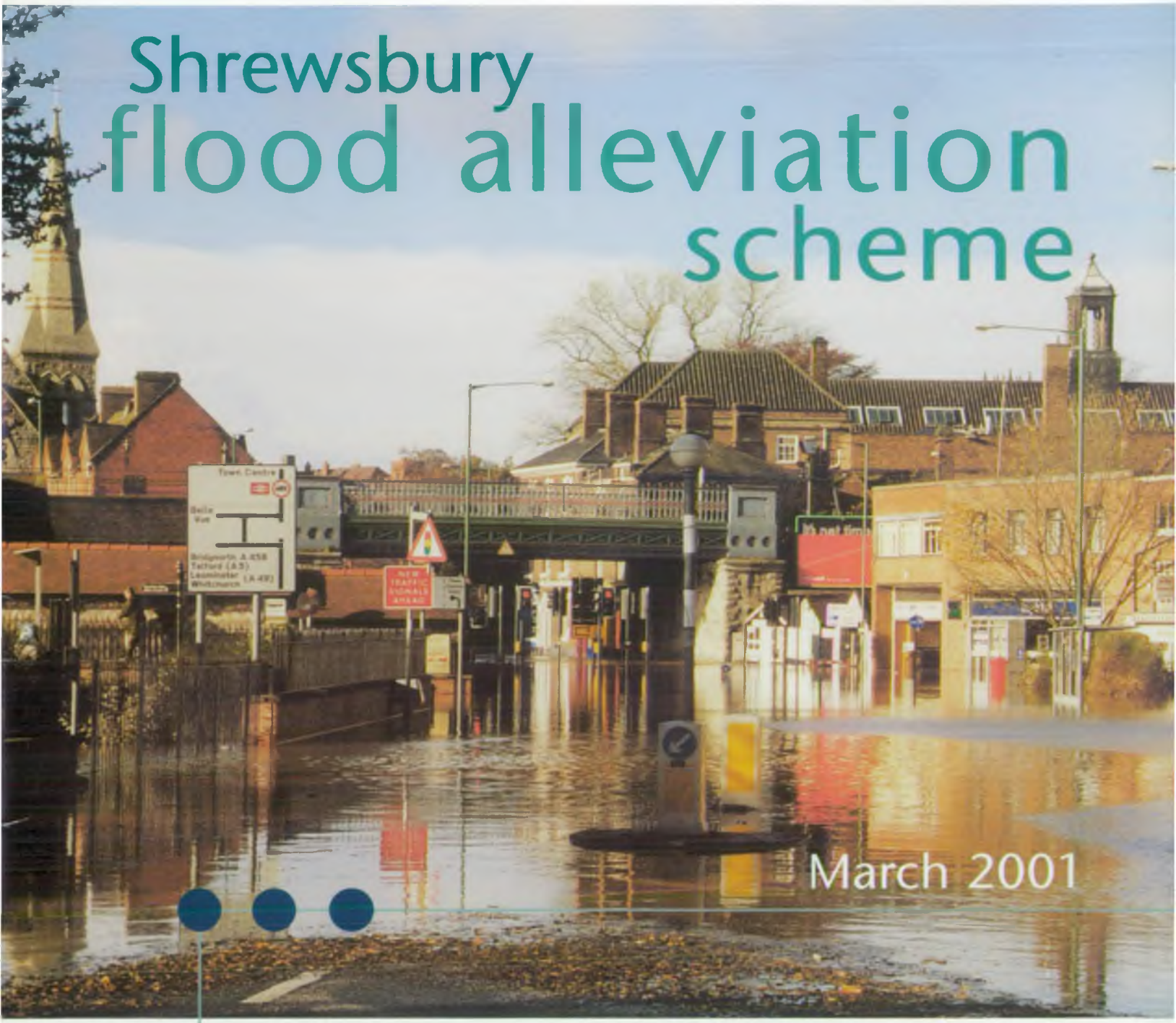
Shrewsbury flood alleviation scheme



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Your questions answered

Environment Agency


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Shrewsbury is one of the best preserved medieval towns remaining in the country, and its rich architectural and historical heritage is evident throughout the town. The town centre stands on a hill in the middle of a horseshoe loop on the River Severn in an enviable location near to the English/Welsh border.

...The River Severn has always played a central role in the development of the town, and it remains an important asset...

SBURY

Over many years development has spread down to the low-lying flood plain, particularly around the Welsh and English Bridge areas. 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 Shrewsbury. 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.

Shrewsbury floods - November 2000 ▲

◀ *View of the River Severn*

▲ *Shrewsbury floods - November 2000*

Flooding in the

Shrewsbury has a history of flooding with the earliest reported flood occurring in 1338. Reliable records date from 1672. The highest recorded level was in 1795 when the water at Welsh Bridge rose to 5.70 metres above the riverbed. This is nearly half a metre deeper than the November 2000 floods that reached a level of 5.25 metres.

The largest flood in living memory occurred in 1946, when a water level of 5.43 metres was recorded, with flood water entering the Abbey Church. Over the last 350 years a major flood has caused significant damage, on average, every ten years. However, the time between floods can vary significantly and an unusually flood free period during the 1970s, 1980s and early 1990s served to mask the ever present risk.

When the river flows are high, roads and property in the low lying areas of the town, especially around the bridge crossings, are vulnerable to flooding. As many as 400 properties can be affected by a major flood, with water up to 2 metres deep in places. The effect on the town is dramatic; this includes disruption to traffic and to public transport (both bus and rail), 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.

During the early 1990's a flood defence scheme was proposed for Shrewsbury by the

A helping hand in the floods of November 2000 ▶

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. Subsequently, Shrewsbury was lucky to experience several years when no significant flooding occurred, however, this luck ran out and more frequent and damaging floods returned.

In the autumn of 2000, the worst flooding for over 50 years devastated the length of the River Severn, hitting Shrewsbury particularly badly. 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 Shrewsbury after floods in 1998, but following the recent events the programme has been accelerated.

town

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 can not go ahead.

It is important to remember that Shrewsbury is being considered along with other towns and villages that were affected by the autumn 2000 floods, but the Agency has secured funds that should allow a £6 million scheme to start during 2001. The Government has released extra money for defence schemes that can commence quickly, and the Agency is keen to ensure that Shrewsbury benefits.

Shrewsbury Abbey ▶

▲ *Shrewsbury Abbey during the floods of November 2000*

What about towns and villages upstream and downstream of Shrewsbury?

The scheme is being proposed in the context of a catchment wide River Severn Strategy, looking at the river as a whole. Although schemes are being proposed for Shrewsbury and Bewdley 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.

▲ *Shrewsbury floods - November 2000*

What are the options for Shrewsbury?

▼ *Shrewsbury floods - November 2000*

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

- Creating upstream storage lakes
- Dredging the river
- Building more weirs and dams
- Changing the course of the river into bypass channels or tunnels
- Creating underground storage
- Building defences in the town itself
- A combination of solutions

So what about upstream storage lakes?

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 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. A statutory flood 'drawdown line' requires that under non-flooding conditions, the reservoir is operated whenever possible, at a level below the crest of the dam. In fact, a much lower discretionary line has been in use since the late 1970s to optimise the modicum of protection benefit.

When full, Llyn Clywedog stores up to 50,000 million litres of water. The flood protection benefit can be significant immediately downstream at Llanidloes, but the benefit diminishes rapidly as you go downstream. At Welshpool, some 55km downstream, the benefit is greatly reduced. In Shrewsbury, which is a further 25km downstream, the benefit is very small indeed. In fact, the Llyn Clywedog catchment represents only 1.8% of the total catchment to Shrewsbury.

▲ *Quarry/River Severn*

2 Lake Vyrnwy is located approximately 60km upstream of Shrewsbury beyond the confluence of the Severn and Vyrnwy rivers. The dam was built over one hundred years ago for the purpose of supplying drinking water to Liverpool. 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 component to the River Severn regulation system and tops up low summer flows. The catchment of this reservoir accounts for only 4% of the total catchment area to Shrewsbury. Consequently, as with Clywedog, any protection benefits are only experienced close to the reservoir, and not as far away as Shrewsbury.

3 Thirdly, there is an existing area of floodplain storage upstream of Shrewsbury in the Severn/Vyrnwy confluence near Melverley. Here a system of argaes (low flood embankments) that date back some 200 years, provide some degree of flood protection. When the argaes are overtopped, a series of sluice gates hold back approximately 20,000 million litres of water which provides some additional flood protection to Shrewsbury. To protect Shrewsbury from a 1 in 100 year event* at least a further 40,000 million litres of storage would have to be provided. This would mean rebuilding and increasing the height of over 40kms of floodbank. The cost of providing this additional storage would be substantial and certainly at least more than five times the cost of providing defences in Shrewsbury itself. If such a scheme were built, many homes and other property would be flooded. Large areas of agricultural land would be inundated for much longer periods, thus significantly reducing their value, and communities like Melverley would suffer much bigger floods.

** 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.*

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.

During normal conditions, the River Severn through Shrewsbury flows at just over 50 cubic metres per second. During events that flood the town, flow is approximately 450 cubic metres per second, some 9 times greater than under normal conditions. This flood flow is the equivalent of one Olympic sized swimming pool passing under Welsh Bridge EVERY second. To provide a deep enough river channel to contain this enormous amount of water would require much more than dredging a metre or two of silt. The riverbed itself would have to be excavated by a depth of some 6-8 metres.

To undertake such work, rock blasting of the bed would be necessary.

If dredging were to be carried out, bridges and other structures adjacent to the river would need to be reconstructed. It would be necessary to place their foundations at a depth where the deepened river channel would not cause undercutting. The cost of undertaking this work would be substantial and would mean the demolition of a large number of structures both up and downstream of Shrewsbury.

▲ *Shrewsbury floods - November 2000*

▲ *Welsh Bridge*

The Agency prefers not to dredge, as it adversely affects the ecological balance of the river. Habitats for plants, fish and animals are all jeopardised by dredging. The Agency has a responsibility to ensure that existing habitats are not only conserved, but also enhanced to encourage wildlife along the River Severn. Dredging in the channel also has the knock-on effect of increasing erosion in the adjacent riverbanks. It also gives rise to the significant environmental problem of disposing of many million tonnes of rock and silt, and is in itself an uneconomic and unsustainable solution.

The River Severn would have to be frequently dredged along much of its length as it would immediately start to silt up again as soon as the dredging had taken place. It would be necessary to dredge long lengths of river. Dredging would therefore become a continual and disruptive process to maintain a channel size large enough to carry the required flow. It would also affect the aesthetics of the river loved by so many, leaving a significantly deeper, gorge-like channel with the river way below in summer.

▲ *Portland Bridge*

What about weirs and dams?

The shallow gradient of the River Severn has the effect of slowing the flow in the river and means that weirs have little effect. The weir in Shrewsbury was built to enhance summer recreational use of the river by boats and canoes when flows are naturally low. During flooding events it soon becomes drowned out and subsequently has no effect in controlling river flows. Adding, or removing, further weirs would have no effect during a flood.

In theory it would be possible to construct a dam upstream of Shrewsbury to provide increased storage. However, as has already been highlighted, this would result in an unacceptable increase in flooding of communities in the Severn/Vyrnwy confluence. It would also be a very costly option as the topography of the land does not lend itself to the economic construction of a dam.

What about a bypass channel or tunnel?

Many people have suggested that it might be possible to construct a bypass channel around or under Shrewsbury.

There are several potential routes, possibly the old river channel or adjacent to the proposed bypass carriageway towards the north east of the town. The main purpose would be to divert water away from Shrewsbury to rejoin the River Severn downstream of the town. As has already been explained however, the river channel has a relatively flat gradient. To achieve sufficient flow around the town, the bypass channel would have to be substantial. It is estimated its size would need to be bigger than one of the Channel Tunnel bores. In addition, the channel would have to cross a varied topography, up to 50 metres high in places, including a range of obstacles such as railways, roads and both private and business property. For much of its length the channel would be in a tunnel. During construction there would be a substantial amount of disruption over many years. Until its completion there would be no flood protection to the town.

▲ *Shrewsbury floods - November 2000*

The estimated cost of such a scheme is estimated to be £50 to £100 million. This is an extremely large sum far in excess of the budget of £6 million.

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.

▲ *Shrewsbury Town Centre*

What about **flood defences** in the town?

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

▲ *An example of demountable defences in position*

There are four primary flooding areas in Shrewsbury. Two are located at each bank of the Welsh Bridge area and the other two are located on each bank around the English Bridge. The Agency is also investigating other areas in the town that flood, for example near the Quarry and along Underdale Road, etc.

It would be possible to undertake such a scheme in three year-long phases. Construction work could be programmed to minimise disruption to the town and as each phase is completed, an immediate protection would be achieved. After careful consideration of all the options, the Agency is recommending that flood defences are constructed in the town. This solution offers the most practical and economic approach. It is also the option that allows an accelerated start in Autumn 2001, because much information already exists from the investigations for the previous scheme.

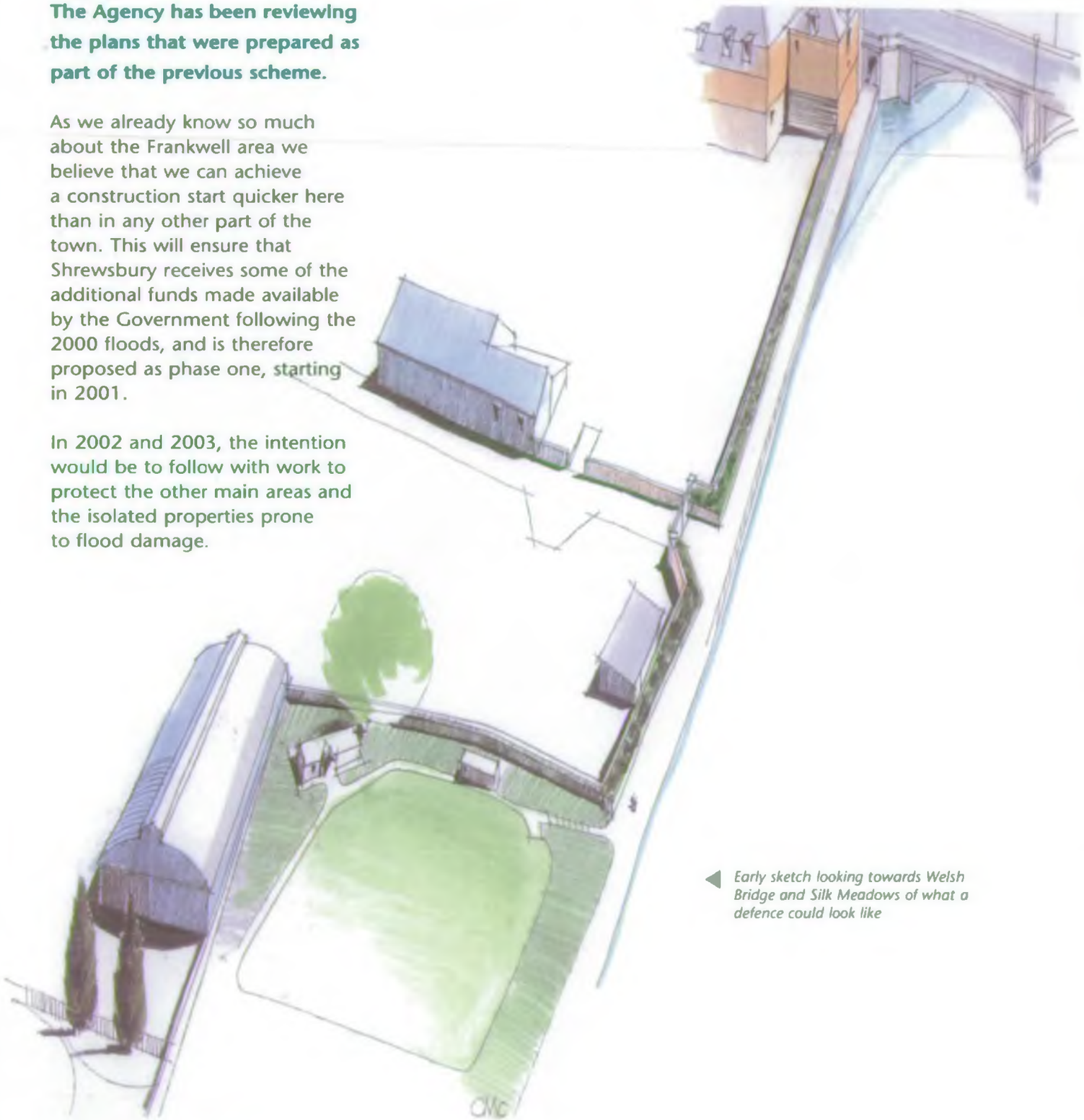
▲ *'During the majority of the year demountable defences are simply not there'*

So what might a scheme look like?

The Agency has been reviewing the plans that were prepared as part of the previous scheme.

As we already know so much about the Frankwell area we believe that we can achieve a construction start quicker here than in any other part of the town. This will ensure that Shrewsbury receives some of the additional funds made available by the Government following the 2000 floods, and is therefore proposed as phase one, starting in 2001.

In 2002 and 2003, the intention would be to follow with work to protect the other main areas and the isolated properties prone to flood damage.



Early sketch looking towards Welsh Bridge and Silk Meadows of what a defence could look like

▼ *One idea for Longner Street and Atlas Foundry*

◀ *An early idea of what the Frankwell Car Park could look like.*

Illustrations: Clive McWilliam for Binnie, Black and Veatch

So does this mean that the **Agency** is proposing the same **scheme** as in 1990?

Absolutely not. There have been significant technological advances since the early 90s which allow us to be much more creative and innovative in our approaches to flooding. This is especially important in towns like Shrewsbury which have such an historic heritage and where aesthetic considerations are paramount.

Our suggested scheme would combine traditional flood walls and embankments 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. They can be used on their own or on top of low flood walls, and so offer many possibilities.

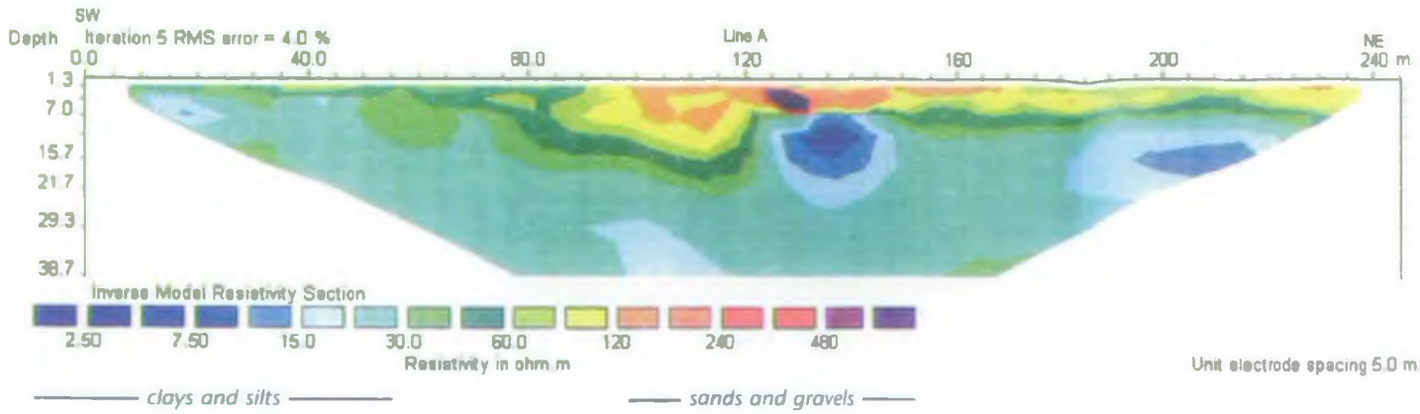
The scheme can protect those areas with historic value, enhance some of the less attractive stretches, while still offering adequate protection in the event of flooding. Altogether it is hoped that the scheme will make Shrewsbury even more attractive, with improved access to the riverside.

The scheme will also consider flooding from tributaries such as Rea Brook and Bagley Brook.

What about **groundwater?**

The ground in the flood plain is underlain by a thick and mixed sequence of Glacial Drift, comprising mostly gravels and silts.

Any flood defence above ground must also defend against water flowing underground or it will simply be bypassed. We are therefore carrying 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.



▲ *Ground makeup under Frankwell*

What about **water** coming back up the **drains?**

▲ *Shrewsbury floods - November 2000*

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 Shrewsbury 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. The drains in Shrewsbury are a major consideration and the Agency could not start construction on a scheme until the effect on the drains had been included.

So what happens now?

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

A flood defence scheme can have many social and environmental consequences for a town like Shrewsbury. Some of the effects will be positive, like the prevention of flooding, while others could be considered negative, like the felling of some riverside trees.

View of the River Severn

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
- Wildlife and habitats
- Water and air quality
- Cultural and heritage matters
- Landscape and visual impacts
- Soils and geology
- Noise levels
- Transport and access
- Maintenance and management.

A scoping report was published in January 2000 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 April 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 Shrewsbury will be identified and published in an Environmental Action Plan.

The Action Plan and Statement will form part of the Agency's Planning Application to be made at the end of April to Shrewsbury and Atcham Borough Council. They will have the final decision on whether the scheme is granted planning permission.

If planning permission is granted, construction could start on site for phase 1 (Frankwell) during the autumn of 2001. For phase 2, feasibility and scoping work would start in the summer with the aim of being on site in the spring of 2002. Phase 3 would then follow on in 2003.

Although it is the intention to protect the whole of Shrewsbury, each phase has to stand on its own merits, meet the Ministry of Agriculture, Fisheries and Food (MAFF) criteria, and gain planning permission. Detailed planning and development has not yet started on phases 2 and 3, however the Agency is already undertaking extensive geophysical and topographical surveys along the length of the riverbanks throughout the town. The Agency will also need to work closely with developers and Shewsbury and Atcham Borough Council as a number of potential redevelopment sites lie alongside the river.

▲ *English Bridge*

If the **Agency** constructs the scheme in **phases**, does that mean that areas in phases 2 and 3 will **suffer more flooding** in the short term?

The Agency is currently updating a mathematical model of the River Severn that will be 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 will use the model to predict the effect that the Frankwell phase will have on other areas of the town, and beyond. The Agency believes that the effect of the Frankwell phase on downstream water levels will be small, however these levels will be stated in the planning application. Similarly any effects upstream at Melverley or downstream at Ironbridge will be quantified, although no measurable effect is anticipated.

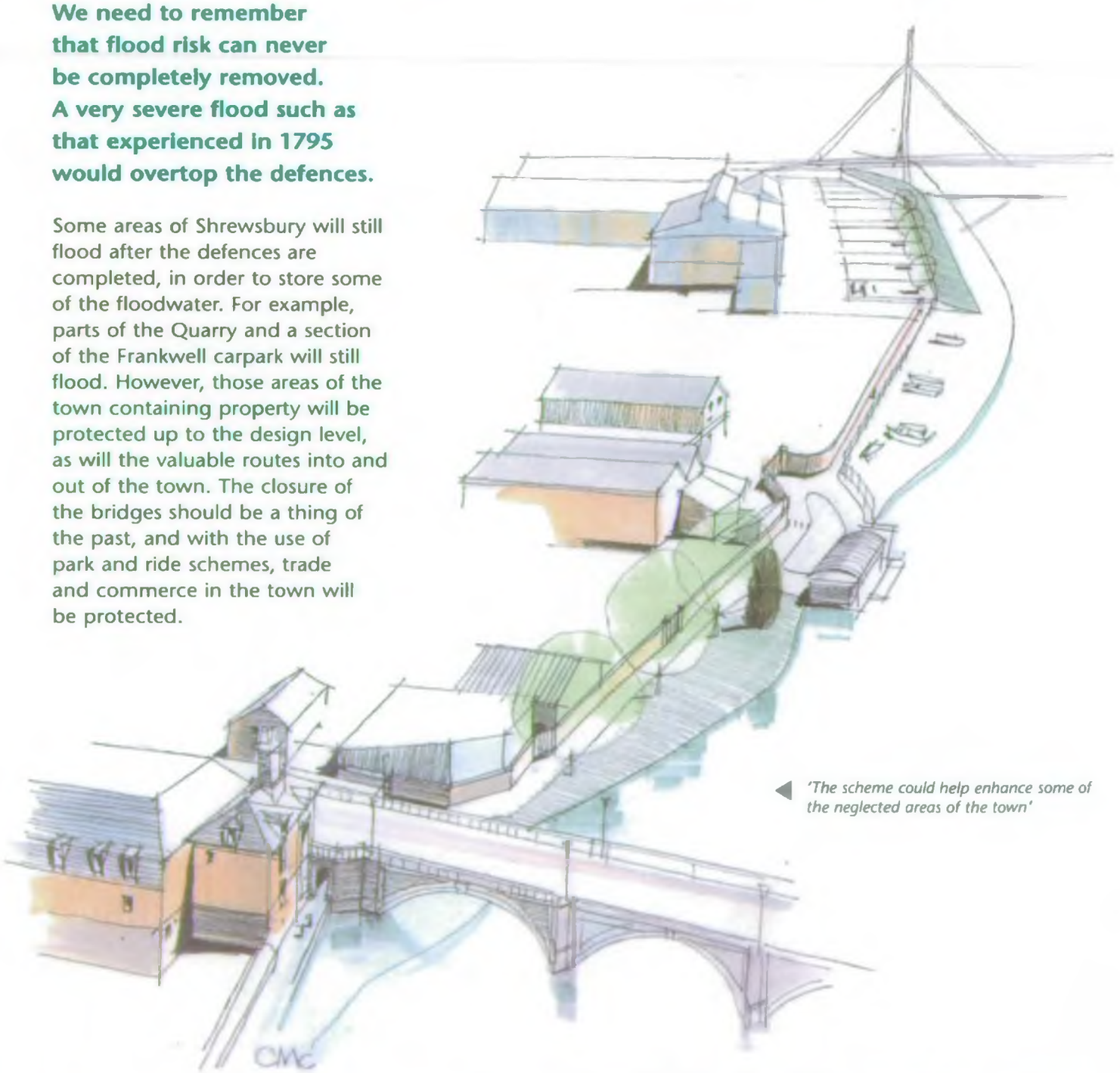
The Agency is also developing ideas to keep the town open during floods before the scheme is completed. Temporary barriers could for example be used along Smithfield Road, along with a park and ride scheme to allow shoppers continued access to the town.

◀ *Shrewsbury floods - November 2000*

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

We need to remember that flood risk can never be completely removed. A very severe flood such as that experienced in 1795 would overtop the defences.

Some areas of Shrewsbury will still flood after the defences are completed, in order to store some of the floodwater. For example, parts of the Quarry and a section of the Frankwell carpark will still flood. However, those areas of the town containing property will be protected up to the design level, as will the valuable routes into and out of the town. The closure of the bridges should be a thing of the past, and with the use of park and ride schemes, trade and commerce in the town will be protected.



'The scheme could help enhance some of the neglected areas of the town'

The scheme is being developed in association with Binnie, Black and Veatch, a nationally recognised consultancy

What does the **Environment Agency** think?

Steve Morley, Upper Severn Area Manager, says:
"The Agency is pleased to be able to propose a scheme to protect the county town of Shrewsbury. It is an attractive and historic town, and this scheme will protect its beauty as well as its inhabitants, and help enhance some of the neglected areas of the town. New technology means that we are able to propose a scheme in keeping with the town, that will offer protection against floods equal to those of autumn 2000, and greater."

▲ *The Quarry*

What does **Shrewsbury** and **Atcham Borough Council** think?

▲ *English Bridge*

Shrewsbury and Atcham Borough Council says:
"Shrewsbury and Atcham Borough Council is working closely with the Environment Agency to agree measures that will reduce the impact of flooding in Shrewsbury. The Council has set up a Flood Alleviation Committee to consider flooding issues and how the problem can be solved. These meetings have been very constructive and provide a useful means for the Agency to understand local concerns and for Councillors to appreciate the technical issues involved and feasibility of the solutions. The Council will be seeking the highest possible design standards compatible with the unique heritage of the town. The Committee will continue to work with the Environment Agency as schemes are developed and implemented."

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