Turn down the volume

In Wakefield, West Yorkshire, Galliford Try is helping to stop water engulfing parts of the city centre, which has suffered floods for years

PROJECT REPORT
PAUL THOMPSON

Project Ings Beck flood alleviation scheme
Client Environment Agency
Project value £13 million
Main contractor Galliford Try

Despite being on the edge of the rain shadow cast across parts of Yorkshire by the Pennine range of hills to the west, Wakefield has been dogged by floods for years.

Sitting in a natural bowl in the landscape, the industrial city has been hit by floodwater surging down Ings Beck and other watercourses before emptying into the River Calder.

This has been exacerbated over the years as the town has developed, with an ever larger volume of water pouring off the increased surface area of impermeable ground created by roads, as well as industrial and residential developments.

With the river and becks often hit by flash floods – which can see the volume of water pouring down their channels increase dramatically in just a matter of minutes – the Environment Agency has developed a plan to help combat the flooding that casts a shadow over some residential and business properties within Wakefield, one which is offering flood protection against all but a one in 100-year event.

The road diversion (top) was essential to allow work on the Westgate culverts (bottom) to begin

"For many years there has been a strategic plan in place to help alleviate flooding within Wakefield," says Galliford Try senior agent Steve Hamer.

"The work we are undertaking now will help reduce the 'spikes' in flow into the River Calder and through Wakefield.

"Ings Beck itself is very prone to flash-flooding. It's not uncommon to see it rise as much as a metre in 20 minutes."

400 m
Length of the Fenton dam

Dam defence

With variations like that to contend with, the Galliford Try team – as part of its term contractor arrangement with the Environment Agency – is busily closing in on the completion of a £13 million scheme that will slow the flow of water into the River Calder and reduce the likelihood of floodwaters overtopping the Ings Beck channel.

The scheme itself is actually broken down into a number of elements, each of which will contribute to the overall protection of Wakefield itself.

From a new dam being constructed on the north-eastern outskirts of the city to raising and replacing existing flood defences throughout the outlying village of Wrenthorpe, the scheme is the final phase in the city's flood alleviation plan.

But it is perhaps the work the Galliford Try team is carrying out on the Ings Beck as it crosses underneath the dual carriageway A638 at Westgate End that is proving the most technically challenging part of the project.

Here existing culverts, including a double brick arch culvert – the origin of which can be traced back to medieval times – can quickly become choked with debris washed down the beck during spate conditions. This causes water to back up along the channel and water to flood the surrounding area.

FLOOD RETENTION

For all their importance to the overall goal of reducing the likelihood of flooding in the area surrounding Ings Beck, the culverts at Westgate are only one part of the scheme that will protect Wakefield's residents from the extremes of the West Yorkshire weather.

Further upstream as the becks pass through Wrenthorpe on the outskirts of the city, the Galliford Try team has used a disused railway embankment to create a flood retention structure.

By extending this embankment and driving a sheet pile retaining wall throughout its centre, Environment Agency designer Jacobs is convinced the new structure will help hold back the worst of the floodwater.

The male/female jointed sections are slightly smaller than initially planned, enabling them to squeeze beneath the existing service ducts

These conditions should be alleviated as the project team works to increase the capacity of this vital section. To do this, it is installing new precast concrete culverts underneath the main carriageway and opening out the river channel as the beck continues its flow to the south of the road and on into the River Calder further downstream.

But the difficulty of the work in this vicinity has been heightened by the lack of space between the crown of the culverts and the underside of the bridge deck.

This area is packed with services, making it extremely difficult for the Galliford Try engineers to squeeze the precast concrete culvert sections in without forcing the wholesale realignment of a gas main, water main and dozens of service cables that run through the area.

"It's not uncommon to see the River Calder rise as much as a metre in 20 minutes"
STEVE HAMER, GALLIFORD TRY

Dodging traffic

As the local authority Wakefield Metropolitan District Council insisted that three of the four-lane flow of traffic in and out of the town was maintained throughout the work, Mr Hamer and his team have had to juggle the scheme to fit around this constraint.

"This is the pinch-point of the entire scheme here," explains Mr Hamer. "If we didn't carry out the work to improve the water flow and culvert capacity at this point then the maximum protection we could expect for the rest of the scheme is one in 20. We had to carry out the work here to justify the rest of the project, but it has been awkward."

In fact the initial design had outlined a 1.3 m-deep, 6 m-wide precast culvert but the shallow positioning of the services, located using vacuum excavation techniques, meant that this was

FLOW CONTROL

To the north-east of Wakefield on a patch of farmland that during the Second World War was mocked up as the nearby city of Leeds in a bid to lure Luftwaffe bomber pilots away from their targets, the largest single structure that makes up the series of preventative measures is being built.

The site will once again leap to the defence of this part of Yorkshire as the Fenton Dam will be capable of checking the flow of more than 230,000 cu m of water before it gushes down the beck into Wakefield.

The 400 m-long and 50 m-wide earth fill dam is being constructed using around 38,000 cu m of clay excavated from a borrow pit just upstream. This material is being placed in 300 mm compacted layers to bring the dam up to height.

A spillway, protected with a concrete grid, will allow water from a storm event greater than one in 100 years to pour over its crest, preventing catastrophic failure. Water during normal flow passes through a twin culvert in the centre of the dam but this structure will contain a control system to help check flow as water levels increases during heavy rain.

"There is a hydrobrake which will restrict flow during a flood event," explains Environment Agency representative Sally Leng. "It will help us keep control of flow along the channel and help iron out any dangerous peaks. There is also a penstock alongside which will give us more control in an emergency."