

Case Study



Long-Awaited Northallerton Flood Defences Use Sustainable Vortex Technology

Project profile

Objective

To implement a low-maintenance alleviation solution to reduce the flooding risk in Northallerton using vortex flow control technology to provide a sustainable solution.

Solution

Two giant Hydro-Brake® Flood vortex flow controls were installed in newly-refurbished culverts on the outskirts of the town enabling excess water to be held back in specially widened channels, which form flood storage basins.

A £3.2 million project to build a long-awaited alleviation solution to end flooding misery in Northallerton, UK is using innovative vortex flow control technology to provide a sustainable solution based on sound Sustainable Drainage Systems (SuDS) principles.

The North Yorkshire town and surrounding villages have been plagued with flooding since the early 20th Century, with major floods most recently in 2000 and 2008 that caused widespread disruption and damage including to the town's Friarage Hospital.

When funding was finally secured after a long wait, the Environment Agency (EA) wanted to develop a solution that was sustainable with low-maintenance needs and conforming to SuDS principles of holding back flood waters on the outskirts of the town and discharging flows safely into the town's culverted watercourses at a controlled rate.

The solution designed is based on two Hydro-Brake® Flood vortex flow controls, installed in discreet, newly-refurbished culverts on the outskirts of the town. They enable excess water to be held back in specially-widened channels, 18 m wide and 2 m deep, which form flood storage basins on the approach to the culverts.

Product profile

Hydro-Brake® Flood is a vortex flow control that provides large-scale protection at the watercourse level, preventing costly damage and disruption to residents, businesses and essential services.

Each Hydro-Brake® Flood flow control is designed according to the specific requirements of the site, ensuring that each system is precision engineered to deliver exactly the right level of flood protection.



"The Sun and Turker Becks have repeatedly overtopped, and threatened the town," reports the EA area project manager Ian Cooke. "That's why, after consultation and looking at similar successful projects in other areas, we decided to use vortex flow control technology to reduce the flooding risk."

"The resulting solution needs very low maintenance, and is resistant to blockage. In addition, the ability to carefully size the Hydro-Brake® Flood means we could minimise the back-up storage requirements, even under high rainfall conditions."

Flood Risk

The Northallerton catchment, with the villages of Brompton and Romanby is in a low lying river valley, surrounded by steep, well-drained agricultural land which makes it susceptible to flash flooding.

Largely culverted, the Turker and Sun Beck watercourses run through suburbs and the centre of the town, causing flood threats to amenities including Grade II listed buildings, conservation areas and listed monuments as well as the Friarage Hospital. At times of peak flow, excess floodwaters have overtopped the watercourse in the agricultural land on their approach to the culverts, causing flooding in the east of the town.

The rivers in the catchment are constricted by bridges, culverts and their channel capacities and recent CCTV surveys have revealed that some were in a poor state of repair, or could be threatened with collapse should flows continue at high volumes.

Lower flows would also reduce back-ups in the remaining combined sewerage entering the culverts. On top of this, frequent floods have already necessitated the reconfiguration of the ground floor of Friarage Hospital so as to reduce major disruption from flooding, although it remains vulnerable.

The Turker Beck joins the Sun Beck south of the Friarage Hospital, skirting its grounds, and the Sun Beck then enters Northallerton from the north east, joining the North (aka Brompton and Willow) Beck that runs north to south through the town.



Hidden Protection

To reduce the risk of flooding to about 300 properties, the EA has adopted a solution designed with advanced self-regulating hydrodynamic vortex flow controls to protect against a 1 in 100 years storm with a 30% extra provision for climate change. Detailed hydraulic modelling was conducted for the Northallerton catchment before designing the new solution.

Ian Cooke continues: "The solution is designed to protect the area from flash floods, even in the event of an intense storm which could occur only once in 100 years, even with climate change," continues Ian Cooke. "The design meets sustainable principles, by attenuating (holding back) excess flows and allowing them to discharge at a controlled rate."

"The Hydro-Brake® Flood flow controls have been installed in specially-constructed below-ground concrete culverts. The storage basin is grassed over so the flood defences are virtually invisible."

The cone-shaped Hydro-Brake® Flood flow control devices installed in the culverts are based on an industry-standard method of flow attenuation, most frequently used in much smaller dimensions as part of urban surface water drainage designs. Hydro International's UK Europe Stormwater Operations Manager Andy Kane explains:

"The Hydro-Brake® Flood flow control's internal geometry is designed so that water can flow unrestricted through the device for as long as possible, before a self-activating vortex is triggered when the water reaches a pre-determined head. In a flood, water is throttled back and released at a controlled rate."

"We have individually sized both the controls at Northallerton to create an optimal internal geometry that delivers best-possible hydraulic performance with the minimum amount of upstream storage."



"Compared to alternative flood control devices such as orifice plates or penstocks, the vortex flow controls have a larger opening, so more water is able to flow through the culvert unimpeded, meaning less flood storage is needed. At the same time, there is less risk of blockage. This, together with the fact that the flow controls have no moving parts or power requirements, means they require minimal maintenance."

To protect the inlets of the flow control devices, a series of new stepped trash screens have been installed. The low flow channels to the control devices back-up storage are sited in the original stream beds. Shallow grassed banks lead up to the same level as the original banks, thereby remaining unobtrusive while providing the amenity of grass meadows outside of high flood events.

As well as providing storage along the Turker Beck site, an opportunity for improving the habitat to accommodate a biodiversity action plan has been taken, by including 12 m buffer strips on the previously cultivated land. This is expected to qualify for Entry Level Environmental Stewardship and, with adjacent tree and hedge planting, will improve water quality as well as encourage wildlife; early consultation with Natural England supported this action.



Technology Opportunity

The installation at Northallerton follows successful flood alleviation schemes built on the White Cart Water in Glasgow, the River Douglas in Wigan and at Weedon Bec in Northamptonshire since 2002.

"The Northallerton scheme demonstrates the versatility of Hydro-Brake® Flood technology to deliver a sustainable solution to controlling flood risk, in line with SuDS principles. As funding becomes available for other planned flood defence schemes across the UK, we hope the technology can provide a low maintenance and minimal storage solution," Andy Kane adds.



Learn more

To learn more about how Hydro-Brake® Flood can help you to manage water more effectively, visit hydro-int.com, search **Hydro-Brake Flood** online or contact us:

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