First class flood alleviation for Forres

Home to 9,000 residents, the picturesque town of Forres, in Moray, Scotland, dates back to Roman times. However, the town was blighted by severe floods in 1997 and 2000 when the Burn of Mosset, which flows through the centre of Forres, inundated homes and businesses and severely affected the local economy.

In 1997, 430 residential and 27 commercial properties were flooded at an estimated cost of £3.7 million. Hundreds of residents had to vacate their homes and move into short-term accommodation, and the main rail and road transport links to the area were forced to close temporarily.

It was estimated that without intervention flood damage in Forres would exceed £43 million over the next 50 years. Future flooding would not only affect homes, businesses and the economy of the town and surrounding region, but would also put the area’s schools, emergency services and sewage works at risk.

Appointed by The Moray Council in 2000, Royal HaskoningDHV was part of a team whose challenge was to find a cost-effective, sustainable solution to alleviate flooding in Forres, as well as nearby Lhanbryde and Elgin. The team combined expertise from Royal HaskoningDHV, The Moray Council, the principal contractor Morrison Construction, and more recently cost consultant EC Harris.

Royal HaskoningDHV has extensive global experience of designing, constructing and managing flood alleviation schemes and was able to use this expertise at all stages of the project. A range of proposals were considered, with Royal HaskoningDHV leading the data collection and option appraisal, advising on the design stages and estimated costs and benefits, then finally supervising construction, which began in November 2007.

Prior to the scheme, the flow capacity of the Burn of Mosset though Forres was insufficient to convey flood flows without inundating properties. It was agreed that the most appropriate solution was to construct a large flood storage reservoir on the Burn of Mosset at Chapelton. The flood storage reservoir is formed by a main dam (Chapelton Dam) across the Burn of Mosset and two smaller dams on the periphery of the reservoir. There are also minor flood defences within Forres itself.

The flood storage reservoir makes use of a large natural basin upstream of Forres that drains through a narrow valley at Chapelton. A cost effective and practical solution, the reservoir has a 3.8 million cubic metre capacity and stores excess water during high-flow events.

“Royal HaskoningDHV’s involvement in the flood alleviation scheme in Forres, from submitting the initial business case to designing and constructing a solution that is a pioneering example of 21st century engineering, has been first class.”

Peter Haslam, Project Sponsor
The Moray Council
Chapelton Dam is the main part of the scheme and took two years to build. Constructed from sands and gravel sourced on-site, the dam is 165m long and up to 8m high, although much of the structure and heavy engineering is hidden below ground.

The purpose of Chapelton Dam is to restrict the peak flow of water passing through Forres during flood events. Its main feature is the innovative baffled crump weir control structure, which is the largest of its kind constructed in the UK and regulates discharge of water from the dam.

During low levels, water flows over a ‘crump weir’ and then freely through the fixed opening in the dam, which allows the passage of migratory fish. When the flow rate increases the water level rises and the top surface hits an upstream ‘baffle’, a vertical block situated above the crump weir, which restricts the flow through the dam. As the flow rate increases further the water level rises and water also flows over the top of the upstream baffle. The turbulence created further restricts the flow passing through the dam. This complex hydraulic structure provides a relatively constant discharge rate whatever the water level in the reservoir.

Daniel Moysey, senior engineer for Royal HaskoningDHV, said: “Various types of control structure can be used for flood storage reservoirs, ranging from a simple fixed orifice to complex and expensive mechanical gates that automatically move to regulate flow. The baffled crump weir provides a successful balance between the two as it delivers a relatively constant discharge over a range of hydraulic heads. The benefit is that there are no moving parts and it requires no power or user intervention, which minimises ongoing operation and maintenance.”

The sheer scale of the engineering and construction work required meant a key challenge for the project team was to successfully combine engineering and aesthetics, as well as minimise the impact on the local environment. Prior to the construction work the valley at Chapelton was a natural, undeveloped habitat, close to woodland areas and used for recreation.

The dam was designed so the majority of the heavy engineering work is below ground level and in visible areas the concrete walls are clad to match local sandstone. The 160m spillway crest, designed to meet stringent reservoir safety requirements to convey extreme floods, was given a curved appearance to
maximise its length in the least possible space and provide pleasing aesthetics. The spillway and the stilling basin are heavily engineered and comprise open stone asphalt and rock armour respectively. The whole area is top-soiled and grassed and so despite the buried engineering the surface looks natural.

A permanent wetland for wildlife was also created as part of necessary river restoration work to the Burn of Mosset. The challenge was to manage the long-term geomorphological development of the Burn of Mosset within the footprint of the flood storage reservoir, particularly with respect to deposition of sediment. The solution was to permanently divert a proportion of the flow into the adjacent floodplain. This has created a wetland that has increased the numbers of wildfowl in the area, and has been commended by Scottish Natural Heritage.

An ongoing challenge for the project team were the many regulatory and statutory procedures necessary for the scheme to progress. Continuous consultation and negotiation with the individuals, landowners and businesses impacted by the scheme was also essential. Royal HaskoningDHV worked closely with The Moray Council, preparing a business case to secure funding from the Scottish Government, a planning application, the Environmental Impact Assessment, and a Flood Prevention Order. The introduction of the Controlled Activity Regulations midway through the project meant that new licenses had to be obtained prior to construction, which presented a steep learning curve for the project team and the regulator alike.
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A vast amount of data and knowledge was accumulated over nine years from beginning investigations to completion of the scheme. The continuous involvement of key individuals within the team over the duration of the project ensured that this knowledge was retained. It also helped to establish beneficial working relationships with local businesses and the town’s community, who have since given positive feedback regarding the overall appearance of the project.

The success of the scheme was apparent just one week after its official opening on 28 August 2009, when it operated to prevent the flooding of hundreds of properties after more than nine centimetres of rain fell in just 30 hours.

The team is now focussing on managing flood risk elsewhere in Moray, building on the successes of Forres and the other completed scheme in Lhanbryde.

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