Bradford Urban Pollution Management

Yorkshire Water's largest AMP3 uID improvement scheme

by

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Yorkshire Water is solving approximately 700 unsatisfactory Intermittent Discharges (uIDs) throughout its region in AMP3, including those contained in four Urban Pollution Management (UPM) study catchments. The Bradford UPM scheme is the largest of these, upgrading a sewer network serving the 225,000 population of central Bradford. This catchment contains 69 Combined Sewer Overflows (CSOs), the majority of which discharge into the Bradford Beck river system, a tributary of the River Aire.

Yorkshire uID improvement scheme courtesy: Yorkshire Water

Initial studies undertaken for Yorkshire Water by *Montgomery Watson Harza* determined that 45 of the CSOs in the catchment were causing aesthetic deficiencies and that intermittent discharges from the sewer network were having a significant negative impact on water quality in the Bradford Beck river system. A capital investment of approximately £19m was set aside to meet Yorkshire Water's obligations under the Urban Wastewater Treatment Directive with construction to be completed by the summer of 2004. In December 2002, the design and construction phases of the scheme were awarded to *Mott MacDonald Bentley (MMB),* a joint venture company with a successful track record of delivering capital schemes in AMP3 as wastewater Capital Solutions Partner for Yorkshire Water's north operational area.

River impact analysis

Preliminary analysis undertaken by *MMB* concentrated on fully understanding the impact of intermittent discharges on the Bradford Beck river system in parallel with the identification of possible construction sites. This analysis enabled the design of an effective stormwater management system to solve river water quality deficiencies, efficient both to construct and operate. Liaison with the manufacturers of CSO screens and stormwater storage products was also undertaken at this stage so that the applicability and importantly, considering the project timescale, availability of different options was fully understood.

The river impact analysis was structured around 15 reaches on the river system and these reaches were used as a management tool for sub-dividing the project. Sub-projects comprising of a group of CSOs were assigned to Project Leaders who assumed responsibility for the design of all the solutions required in a given reach. Structuring the project in this way provided scope for design innovations such as rationalising the number of CSOs in a reach,

Yorkshire uID improvement scheme courtesy: Yorkshire Water

constructing off-line chambers to screen the spill flow from groups of CSOs and utilising existing capacity within the sewer network rather than constructing stormwater storage tanks.

Aesthetic solutions

Aesthetic solutions have been provided for 51 intermittent discharges in the catchment including the installation of 35 CSO screens. The variety of site-specific requirements present necessitates the use of several different types of screen. So, to ease problems associated with operating and maintaining unique assets, only four different types were selected. In summary: *16 Hydro-Heli, 6 Hydro-Static, 11 Huber Rotamat and 2 Hydrok Peak* screens have been installed.

Wherever possible, screens have been retrofitted into existing CSO chambers, although this has only been viable at a handful of locations. The majority of CSO screens have required the construction of new chambers, either because the existing chambers did not provide suitable solids retention, were too small or because no chamber existed previously. Operational issues were key to the design of screen chambers and features such as CCTV cameras and above ground drive systems were incorporated to simplify operation and maintenance.

Efficient construction techniques were used to build CSO chambers, such as the use of the *Mabey Frami* clip-together shuttering system for chamber walls and *EMJ Plastics* permanent soffit shutters.

Water quality solutions

River water quality deficiencies have been solved through construction to retain 20,000m^3 of stormwater within the sewer network. Existing capacity has been utilised where possible and ten storage units have been constructed ranging in size from 300m^3 to 4,000m^3 with a total capacity of 17,275m^3. Real time control modelling was utilised to size the pumps used to empty the storage units and ensure that all stored water is retained within the sewer network.

Three principal methods of constructing the stormwater storage units have been used. For smaller storage volumes pre-formed glass reinforced plastic tanks were purchased from *Spel*, whilst for medium sized volumes, large diameter pipes were utilised. Due to its location in a field, 2.4m diameter High Density Polyethylene (HDPE) *'Weholite'* pipes made by *Asset International* were used in this instance. Where storage units are required to withstand highway loading, large diameter concrete pipes made by *Hepworths* have been used.

The overall solution to water quality deficiencies in the Bradford Beck river system includes three large stormwater storage volumes ranging in size between 3,500m^3 and 4,000m^3. Due to the very nature of the sewer network, these volumes need to be stored in the more central areas of the city. In order to eliminate the immense disruption that would be caused by re-laying long sections of sewer, it was decided that small footprint solutions were required to fit into the available space. For this reason, *Mowlem-Johnston* were sub-contracted to construct shafts to store these volumes of stormwater.

Construction was carried out using pre-cast segments by the under pinning method. In order to provide a standard set of assets to Yorkshire Water and to assist procurement, these shafts were all designed to be 15m in diameter with common access, sump and other details. **Figure 4** shows the construction of a unit to store 4,000m^3 of stormwater. When this photograph was taken, excavation had reached a depth of 15m with the final depth excavated to be 26m.

Minimal disruption

Through comprehensive analysis of the deficiencies caused by intermittent discharges in Bradford, an effective and efficient stormwater management strategy has been designed. Innovative detailed design and construction techniques have been applied to ensure that this major scheme has been delivered within the required timescale and with negligible disruption to the city's residents. ■

Note: *Yorkshire Water Solutions Manager for the Bradford UPM scheme is Steve Cooper. The author of this article, Matthew Caudwell is Project Leader for Mott MacDonald Bentley. Yorkshire Water and Mott MacDonald Bentley would like to thank all parties who have participated in this environmental improvement scheme for Bradford.*