

# Yorkshire Water's UID Programme

## innovative solutions to uCSO problems beat obligations

by

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**Y**orkshire Water's Southern wastewater area covers South Yorkshire and North Derbyshire and includes the major conurbations of Sheffield, Barnsley, Rotherham, Doncaster and Chesterfield. In March 2004, the company's Capital Solutions Partner (CaSP) completed their 150th uCSO in two years, exceeding the regulatory obligation of 137. The profile of work for Year 4 has been back end loaded with over 75% of the 81 regulatory outputs and £18m expenditure programmed between January and March 2004. Model build, verification, and initial water quality modelling of the existing systems had been carried out by others for Yorkshire Water under separate contracts, and in many instances, these models were not available until part way through the year.



Burngreave Prefabricated CSO

Photo: ETM; courtesy Yorkshire Water



Burngreave CSO

Photo: ETM; courtesy: Yorkshire Water

**ETM, a 50/50 joint venture formed by Earth Tech Engineering and Morrison Construction is the Capital Solutions Partner for Yorkshire Water's Southern Wastewater Area.**

**In order to meet the tight programme for optioneering, design, construction and commissioning, together with the significant levels of third party consents and agreements required, their solutions have had to be innovative.**

#### **Burngreave, Sheffield**

The Burngreave scheme required the improvement of discharges from two aesthetically deficient uCSOs located within a busy arterial road into Sheffield city centre. *ETM* undertook extensive research to investigate potential alternative sites away from the road. It was established that the area had been heavily bombed during the war and that there was contaminated land in the only viable off-line location.

A presentation was subsequently made to Sheffield City Council showing that the only practicable solution for the scheme involved closing the road and modifying the existing structures. The council accepted this, but only permitted a 6 week closure, coinciding with the school summer holidays.

The existing pre-cast concrete channels and weirs within the chambers were not suitable for re-use. A solution that maximised the space available within the chamber and minimised over-pumping was required. The concept of incorporating the main flow channel, the overflow weirs and the screen into one pre-fabricated stainless steel unit was generated. This was developed in conjunction with *Hydro International*, the framework steel supplier and the fabricator. This minimised the numbers of lifts required and reduced the installation time significantly.

#### **The results of this innovation were:**

- \* each channel and screen unit was installed within one 8 hour shift;
- \* over pumping was only required on three days;
- \* the road was reopened before the end of the 6 week window.

#### **Conisborough, Rotherham**

This scheme involved the resolution of two aesthetic uCSOs in Conisborough, near Doncaster. A relatively straightforward solution for the Burcroft Hill No 1 CSO, consisting of a rebuild within Yorkshire Water land at Burcroft WwTW, was quickly agreed.

Low Road CSO provided significant challenges. The existing CSO is located at a dangerous bend in the carriageway of the main road link between Rotherham and Doncaster. Initial solutions included extending or re-orientating the CSO to move the access openings away from the highway. However, it was established that even with extensive service diversions, the construction work would have a huge impact on traffic and Doncaster Council indicated that a road closure would not be readily approved. Moving to the adjacent grassed area was quickly rejected, the land being part of Conisborough Castle, a scheduled ancient monument.

The overflow pipe from Low Road CSO passes close to the proposed Burcroft Hill No 1 CSO. It was realised that it would be possible to screen the overflows in this new chamber within the WwTW boundary. This would require a short length of new sewer but would eliminate the need to work in the carriageway at Low Road CSO.

Further hydraulic investigations resulted in the design of a new chamber to house two independent sets of screens – one to screen overflows from Low Road CSO and one to replace the screens at



Darnall

Photo: ETM; courtesy: Yorkshire Water

Burcroft Hill No 1 CSO. The chamber is designed to the WaPUG standard, but it is unusual in that two hydraulically independent screens are incorporated at different levels within one chamber.

**Results of this innovation were:**

- \* elimination of construction and future maintenance within a busy highway;
- \* 20% saving over construction at separate locations;
- \* improved operational access.

**Shirtcliffe Brook, Sheffield**

The problem was to resolve the aesthetic deficiency of an existing uCSO located under the carriageway of a very narrow residential cul-de-sac. The existing main structure occupied almost the full width of the carriageway with a depth to formation of 6 metres. The CSO was 2m from adjacent garden boundaries and only 7m from the building line of properties. There was no alternative location available.

Optioneering identified that minimum works would result from the use of the existing transverse weir arrangement. The choice of two one-metre diameter *Hydro International Heliscreens* allowed the maximum flow capacity possible for the limited weir length and the limited headroom, which was crucial for the viability of this solution.

**Innovations associated with the screen were:**

- \* its use on a transverse weir rather than its normal mode of side weir operation;
- \* associated use of opposite thread directions on each half of the two metre long helix so as to direct the screenings towards the continuation pipe located at the mid point of the transverse weir wall.

As the overall length of the required screen and motor were greater than the available width of the existing chamber at this point, a suitable means of extending the chamber at the 6m depth was required to house the motor and gearbox. In order to achieve this with minimum working area, a small semi-circular antechamber was built onto the side of the existing chamber using precast concrete smooth bore shaft segments. This was both a cost effective

and a safe method of construction within the required limited working area.

**Darnall, Sheffield**

The existing sewerage system at Darnall, close to the Meadowhall shopping complex in Sheffield, discharges via 22 CSOs to the Car Brook. The watercourse receives a peak 5 year spill flow of 9 cumecs with a modelled total of 1,247 water quality failures per annum, against a permitted 87. The existing sewers are up to 10m deep, pass under railways and trunk roads, frequently throttle from 1200mm diameter to 225mm diameter and are all within an ex-coal mining area. The notional storage volume identified for the area was 24,500m<sup>3</sup>.

Design of the new system was focussed on avoiding the provision of isolated storage tanks within the catchment and instead, providing a new system of trunk sewers that provide additional capacity and increased pass forward flow. This has allowed the storage to be provided at a single point where the downstream system has sufficient capacity to drain the tank within a reasonable time period. The volume required has been reduced to only 3,600m<sup>3</sup>, a saving of over 85% against the notional volume.

Pipeline routes have been carefully selected such that out of more than a kilometre of re-sewerage less than 100m has been undertaken in highway.

**Of the 22 CSOs:**

- \* 6 were abandoned;
- \* 8 were screened at a single location;
- \* 2 were retrofitted;
- \* only 6 were rebuilt.

The scheme is forecast to save over £2m against the target capex and all of the 16 outputs required for 31st March 2004 were achieved, despite having started notional storage assessments less than 12 months previously. ■

**Note:** The author of this article, James Wood, is Design Manager for ETM.