United Utilities UIDs

case study detailing the work at Princess Parkway UIDs, Rossendale UID and Wyre Estuary UIDs

by
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Combined Sewer Overflows (CSOs) provide relief points within a sewerage system for periods when storm flows become too large for the system to cope with. An Unsatisfactory Intermittent Discharge (UID) occurs when the spills from an overflow on a sewer network affect the environmental standards for the water body into which it discharges. A number of regulatory drivers, including aesthetics, river impact and bathing water quality were specified by the Environment Agency to ensure the receiving waters met their long term water quality objectives. Over recent years United Utilities has undertaken a substantial programme of improvement work in order to alleviate the problems caused by a number of UIDs located throughout its sewer network. This article features the work carried out at three such sites in the North West, namely Princess Parkway, Rossendale and Wyre Estuary.

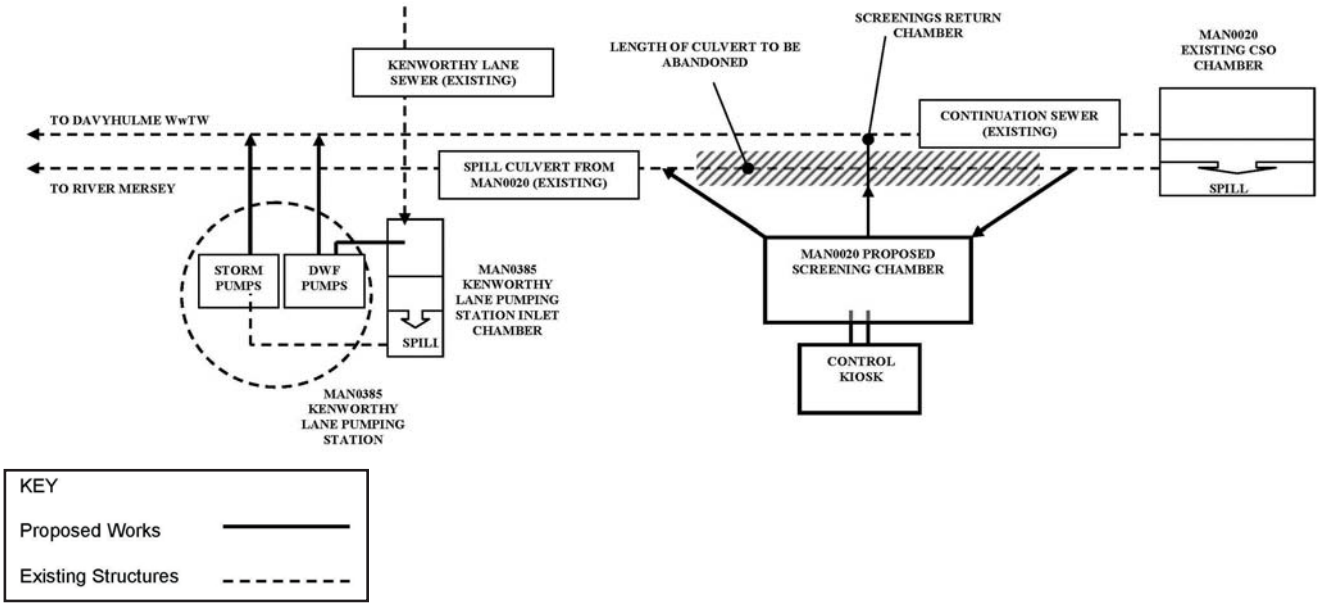
Princess Parkway Screening Chamber *Courtesy of United Utilities*

Princess Parkway UIDs - (Ref MAN0020 & MAN0385)
MAN0020 Princess Parkway combined sewer overflow (CSO) is located adjacent to the west bound on-slip road at Junction 5 on the M60 motorway. MAN0385 Kenworthy Lane CSO is located a short distance away at the head of Kenworthy Lane and adjacent to the west bound off-slip road at Junction 5 on the M60 motorway. Both of these CSOs had been classified as an unsatisfactory intermittent discharge (UID) on aesthetic grounds and has a regulatory output date of 31st March 2009.

Both UIDs are located in the Mersey South drainage area which is situated approximately 6 miles south of Manchester city centre and covers an area of 94 km^2. The drainage area has a resident population of just over 72,000 which is mainly comprised of the residential areas of Wythenshawe and Northenden.

A number of key issues needed to be resolved with the Highways Agency prior to work commencing on site including the proposals for traffic management and vehicular access into the site from Princess Parkway. In addition it was necessary for the contractor to ensure that temporary works were in place for the duration of the contract which would be sufficient to deal with a potential 1 in 30 year storm event.

Design work to resolve the problems at these two locations was carried out by a joint team consisting of MWH and Galliford-Costain-Atkins on behalf of United Utilities over an 18 month period between May 07 and November 08. The scope of the design work included the preparation of a Solution Scope Book, drawings and resolution of all third party constraints and issues for each design project.



Princess Parkway & Kenworthy Lane CSOs schematic *Courtesy of United Utilities*

Prior to construction work being carried out at the site unscreened storm flows from the Princess Parkway trunk sewer discharged directly to the River Mersey from the MAN0020 CSO via an existing 3.8m x 2.45m brick arch culvert. The situation at the MAN0385 CSO was very similar whereby unscreened spill flows were pumped via the Kenworthy Lane pumping station to the existing brick arch overflow culvert prior to discharging to the River Mersey during storm conditions.

The spill problems at Princess Parkway and Kenworthy Lane have now been resolved by means of a new screening facility which has been constructed alongside the existing brick arch overflow culvert at a suitable location approximately 100m downstream from MAN0020 CSO. The new facility is capable of screening the combined 1 in 5 year spill flow from MAN0020 and MAN0385 of approximately 10.5m^3/sec. In order for the new facility to handle spill flows from Kenworthy Lane pumping station it was necessary for the existing storm flow rising mains at the pumping station to be reconfigured to enable the flows to be pumped directly into an adjacent 1450mm diameter combined sewer which goes to Davyhulme WwTW. Under storm conditions this arrangement causes reduced pass forward flow at the existing MAN0020 CSO and more flow through the new screening facility.

The new screening facility is comprised of a main inlet/outlet channel which opens out into three 2.5m wide screening channels. Each screening channel contains a single 6mm Longwood escalator screen rated at 3580 l/sec capacity, together with upstream and downstream penstocks to enable the screen to be isolated. The proposal is for storm flows to be diverted from the existing brick arch overflow culvert to the new screening facility and then returned by gravity to the existing culvert via new diversion and re-connection chambers. The screening facility also contains a by-pass arrangement consisting of a relief weir which discharges into the adjacent brick culvert.

A number of value engineering opportunities were identified as a result of the contractor's early involvement with the project, the most significant being the decision to utilise the existing brick culvert rather than construct a dedicated by-pass channel as had been specified in the original design. A hydraulic model of the screening facility was constructed to confirm the feasibility of the value engineering proposal. The proposal was accepted and generated circa £500k cost savings and a 4 week construction saving.

The main outlet channel downstream from the escalator screens is equipped with duty/standby launder pumps located in a sump to collect screened storm water. The screen launder troughs convey the screenings to a collection chamber and then via a screenings return chamber to the existing 1450mm diameter combined sewer.

The capital value of the combined MAN0020 and MAN0385 projects is £3.9 million, and has been completed as part of the United Utilities AMP4 programme.

Princess Parkway Screening Chamber and Existing Brick Arch overflow culvert *Courtesy of United Utilities*

Galliford Costain Atkins (GCA) was the main contractor for the project. The team provided significant input to the constructability proposals for the scheme and identified a number of important value engineering opportunities. Furthermore the team's expertise in dealing with the Highways Agency to secure access agreements played an essential part in the successful delivery of the project.

The construction works for Princess Parkway and Kenworthy Lane was successfully completed on 19th March 09 ahead of the 31st March 09 regulatory date.

Rossendale UID - (Ref ROS0030 / ROS0018)

ROS0030 Rossendale combined sewer overflow (CSO) is located adjacent to the A681 Newchurch Road approximately one mile to the east of Waterfoot village. Waterfoot village itself is situated between Rawtenstall and Bacup and lies close to the centre of the Rossendale Valley. Prior to the commencement of the recent programme of construction work ROS0030 had been classified as an unsatisfactory intermittent discharge (UID) on river impact and aesthetic grounds.

Rossendale Detention Tank *Courtesy of United Utilities*

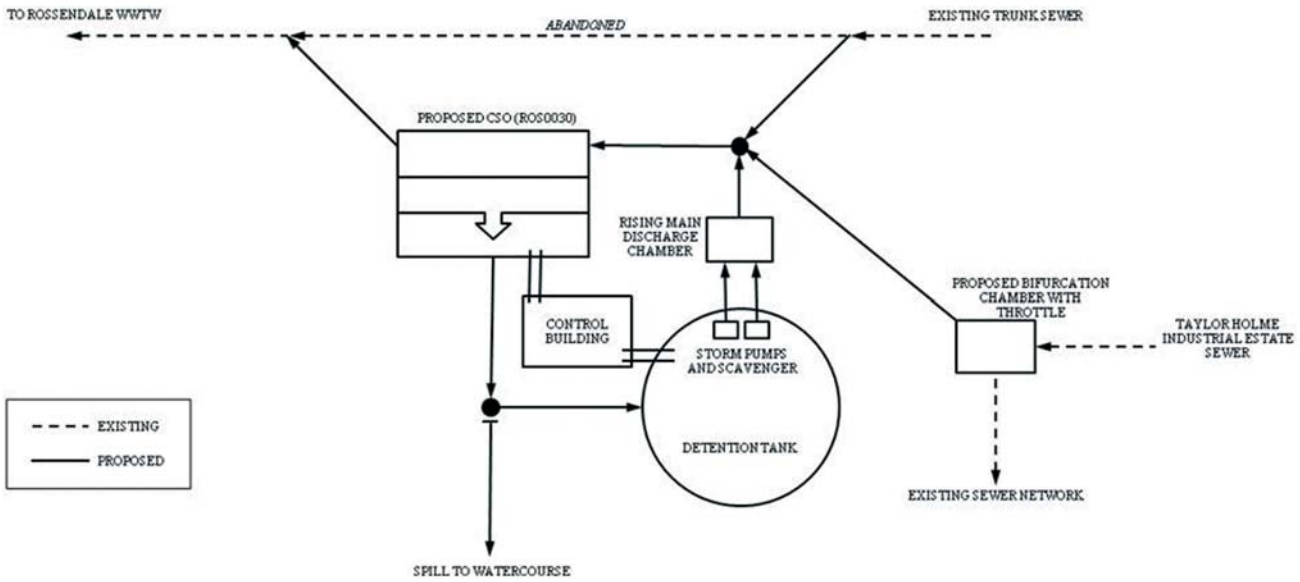
In order to derive a river water quality solution for ROS0030 it was necessary for MWH to undertake an urban pollution management study which entailed extensive data collection, hydraulic model build and verification, followed by an analysis of the solution options. In that respect it was clear that any design solution for ROS0030 would have to take account of the need to maintain target river water quality parameters in the receiving watercourse, namely the River Irwell. It would also be necessary to screen all discharges to the river up to the 1 in 5 year spill rate in order to satisfy the aesthetic driver.

A number of key issues needed to be resolved prior to work commencing on site. In particular it was necessary to find a suitable site for the detention tank in what is a developed urban area. It was also necessary to obtain planning permission for the associated control kiosk and landscaping, together with obtaining the Environment Agency's agreement to the construction of the tank itself and the outfall structure within an existing flood plain. In addition there were a number of design issues to resolve with regard to the size and depth of the detention tank. Traffic management was also a key issue due to the location of the site adjacent to the main highway. Again, early involvement from the contractor was sought and proved invaluable to reach a satisfactory conclusion of the extensive third party issues associated with this project in the required timeframes.

Design work to resolve the spill problem at ROS0030 was carried out by MWH on behalf of United Utilities over a 25 month period between Jan 06 and Feb 08 Once again the scope of the design work included the preparation of a Solution Scope Book, drawings and resolution of third party constraints and issues. Prior to construction work being carried out at the site unscreened flows from the 600mm x 950mm brick trunk sewer located in Newchurch Road discharged directly to the River Irwell from the ROS0030 Rossendale CSO during storm conditions. That problem has now been resolved by means of a new CSO chamber and powered screen arrangement which has been constructed in conjunction with a new detention tank on spare land to the east of the existing CSO.

The works have also involved the construction of a new bifurcation chamber and hydrobreak arrangement which has been located on a separate sewer network near to the site of the proposed CSO. This network serves a number of industrial and commercial sites to the south of Newchurch Road before discharging to the brick trunk sewer located in Newchurch Road itself. In storm conditions unscreened flows from the network spill directly to the River Irwell from the ROS0018 CSO located at its downstream end in the vicinity of Waterbarn Lane. Hence the purpose of the new bifurcation chamber is to reduce the spill flows at ROS0018 to less than the 1 in 5 year return rate by ensuring that flows over and above the controlled pass forward rate go instead to the new CSO chamber via a new length of sewer.

The new CSO is approximately 3.6m deep and is fitted with a Longwood Stormguard screen capable of screening the combined flow from the existing brick trunk sewer in Newchurch Road and the new bifurcation chamber, up to a maximum 1 in 5 year flow rate of 1367 l/sec.



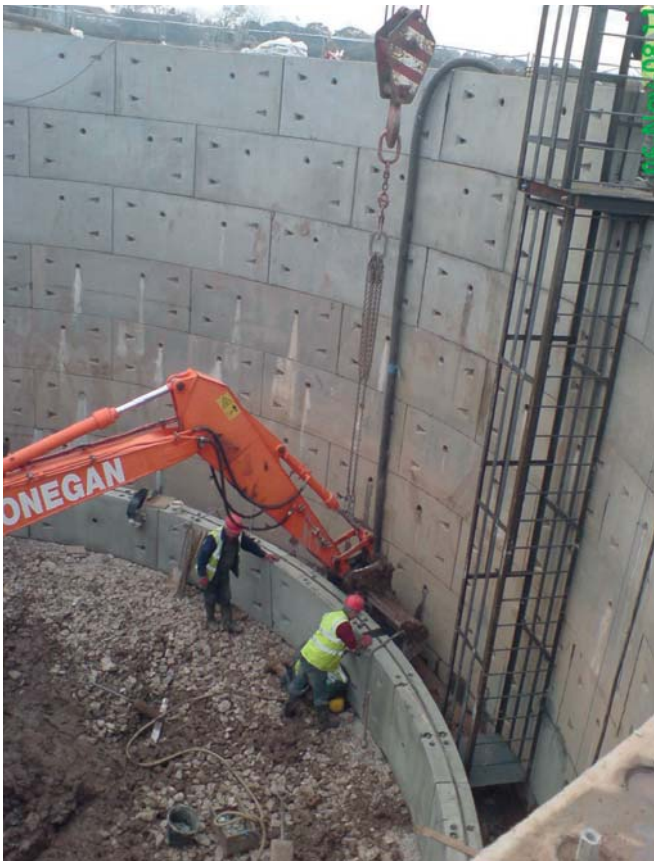
Rossendale CSO schematic *Courtesy of United Utilities*

The screened spill flows from the new CSO go to the new 25m diameter x 30m deep detention tank which has a capacity of 12,400m³. When the tank is full excess screened flows go direct to the River Irwell via a new outfall structure. The detention tank is fitted with return pumps to enable the spill flows to be returned to the network once the storm has subsided together with a Vacflush system to ensure that the tank remains clean once it has been emptied.

The capital value of the ROS0030 project is circa £9 million, and the scheme is currently being undertaken as part of the United Utilities AMP4 programme. Galliford Costain Atkins (GCA) is the main contractor for this project, and work is due to be completed by the end of February 2010.

Wyre Estuary UIDs -
(Ref WYR0041, WYR0042 and WYR0043)

Poulton le Fylde lies approximately 4 miles to the north east of Blackpool and immediately to the south of the Wyre Estuary. The town is served by a mixture of combined and separate gravity and pumped sewerage systems which ultimately discharge to Fleetwood WwTW.



Holt's Lane Detention Tank *Courtesy of United Utilities*

WYR0041 Beech Drive combined sewer overflow (CSO), WYR0042 Holt's Lane CSO and WYR0043 Oldfield Carr Lane CSO are all located on the same section of the sewer network serving the western end of the town. Prior to the implementation of the current programme of construction work each of these CSOs had been classified as an unsatisfactory intermittent discharge (UID) on aesthetic and river impact grounds.

A study undertaken by United Utilities into the drainage infrastructure needs of the town had confirmed that the capacity of the existing sewer network was inadequate during storm conditions, resulting in unscreened flows from all three CSOs discharging to a common surface water culvert and then into Main Dyke located nearby. Main Dyke, which is a tributary of the River Wyre, skirts the eastern edge of Poulton le Fylde before discharging to the Wyre Estuary at Skippool Marsh approximately 2.4km to the north of the site.

Design work to resolve the spill problems at these three locations was carried out by MWH on behalf of United and the deliverables were similar to those provided for Princess Parkway UIDs and Rossendale UID. It was established at the commencement of the design programme that the Environment Agency required a solution based upon one spill per summer with all spills up to a 1 in 5 return period storm event having to be screened to 6mm.

In 2008 construction work commenced on a new 3.5km long drainage system which will enable spill flows from the existing sewer network to discharge directly to the Wyre Estuary. The proposal is that the spill flows from the three CSOs will be intercepted and transferred to the site of a new detention tank by means of new flow diversion pipe work including a 1500mm diameter transfer sewer. The detention tank and the transfer sewer will provide a combined storage volume of 2148m³.

Unscreened flows will then be passed forward to a high point located approximately 1.5km to the north of the site at a maximum rate of 400l/sec by means of duty/standby variable pumps located in the detention tank. At one point along this route it will be necessary for the rising main to cross the Preston to Blackpool railway line on a specially constructed pipe bridge. Pumped flows will then discharge by gravity from the high point to a new pumping station located a further 1km to the north via a new mechanical screen chamber. The pumping station and screen chamber will be constructed on land adjacent to the Main Dyke watercourse.

In the final phase of the new drainage system screened flows will be pumped beneath the main A585 to a further high point located approximately 0.5km to the north before finally gravitating to the Wyre Estuary via a new gravity sewer and headwall.

If the volume of the detention tank is exceeded during heavy rainfall then excess storm water will discharge directly to the existing surface water culvert via a static screen located adjacent to the tank. The size of the screen will be sufficient to handle a 1 in 5 year return period storm event across the network. Once the detention tank has emptied a scavenger pump located in the base of the tank will return any residual storm water to the local sewerage system at a point immediately upstream of WYR0042. The detention tank itself will be protected from flows backing up from the surface water culvert during storm conditions by an automated penstock located immediately downstream from the static screen.

Westshield Ltd was appointed as the main contractor for the scheme which once again is being carried out under the United Utilities AMP3 programme. The capital value of the Wyre Estuary UIDs project is £8.4 million and construction work is due to be completed by November 2009.

Note: ***The Editor & Publishers wish to thank Anthony Salt, Project Manager, MWH, who prepared the above article for publication and who wishes to thank the efforts of the entire project team including Ronald Macdonald and Dave Sawyer, MWH, Galliford-Costain-Atkins and David Baines, Project Manager United Utilities.***■