The Use Of RTC to control flows to Sandon Dock WwTW, Liverpool

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1. The Original Commission

Reid Crowther were commissioned by NWW to do some outline modelling using their RUNSTDY hydraulic modelling system, to examine the utilisation of the Sandon Dock interceptor sewers. These are the tunnelled interceptor sewers, diameter commonly 2000mm which carry flows from the whole Liverpool catchment to the new WwTW at Sandon Dock. Most of the tunnel is constructed already although the later stages have recently started on site with a comissioning date of December 1996. At Sandon the primary treatment only is operational. Prior to this project all combined flows from Liverpool discharged into the Mersey estuary untreated.

The object of the study was to look at the possibilities of adding flows from Fazakerely and Halewood, and the possible benefits of extending the real time control elements of the present system.

2. How the existing system operates

The existing system is designed for local control on each catchment to limit the flows into the interceptor sewer. The interceptor is not controlled and everything that enters it has to be pumped out to the treatment works by the pumping station at Sandon Dock.

Each catchment is controlled to limit the flow into the interceptor to Formula A. This is done by measuring the flow and using a local control loop to adjust a control gate to limit the flow.

Excess flow overflows into an off line detention tank and can be drained to the interceptor after the storm. If the detention tank becomes completely full then another control gate on the outfall opens to allow through flow to the estuary.

By using only local control the system can suffer from two types of problem. If there is heavy uniform rain across all of the catchments so that they are all discharging at Formula A then the total flow may be too much for the pumping station and the treatment works. Alternatively if only one catchment is suffering heavy rainfall then there may be overflow spill even though there is remaining capacity in other parts of the system.

3. The work undertaken by Reid Crowther

The system was modelled as a set of simplified lump catchments to predict the runoff from the system, with a more detailed hydraulic model of the overflows and the interceptor sewer. The catchment modelling used the SWMM hydrology model which can give a good representation of the runoff from very large catchments. The overflows and interceptor sewer was modelled using RUNSTDY. This is a hydraulic model developed by Reid Crowther for analysis of looped sewerage systems. It has two advantages over other similar models that made it particularly suitable for this study. Firstly it has good description of control structures and real time control and secondly it runs very fast.

The model was used to analyse a series of rainfall events that had been previously recorded (for another purpose) by radar. The results were compared to actual flows recorded in the system at those times to provide a basic verification of the model. The amount of storage available in the interceptor when the overflows start to spill was then investigated.

4. What was found

Fazakerely and Halewood flows could easily be accommodated and more importantly, assuming that the pumps at the Sandon Dock inlet can draw the full treatment capacity, then the interceptor tunnel is never more than about half full. The question these results raise of course, is how best can this spare capacity be utilised?

5. Alternative uses for the available storage

One possibility is to utilise it to reduce spills to the Mersey. The whole system has been designed to do just that - prior to the construction of Sandon the whole catchment discharged untreated to the Mersey, so that huge improvements have recently been made and the scale of additional water quality improvements would be negligable.
It was suggested that RTC could be used to operate the system to the limits of the consent in order to reduce the amount treated. However the consent details, which include the current control strategy, prevent this.
The idea that has met the most favour is to use the spare storage to reduce the maximum flow that EVER goes to treatment, whilst not changing the spilled load. This would enable a reduction in secondary treatment capacity.

Pollution Trapping

The flow is more polluted at the start of a storm than at the end, since the initial rain washes off pollutants from roads and roofs, flushes out gulley pots and washes sediment deposited in sewers during dry weather flow. Therefore, if the overflows are set to retain more than formula A at the start of an event, but then reduce to less than formula A as the storm continues, it is possible to retain more pollutants for the same

volume of flow, or the same amount of pollutants for a lower volume.
To test the theory a simple representation of pollutant sources was added to the catchment models and tested. It showed that the same amount of pollution could be trapped with an increase in total annual spill volume of about 10%. The maximum flow rate into the interceptor for short periods of time was now increased, but for longer periods of time was reduced. The short peaks could be attenuated by the storage in the interceptor and the maximum rate at which flow had to be pumped out to treatment could be reduced.

6. Where to now?

Of course a more detailed catchment model will be needed to establish the exact storage available and the optimum control settings needed to mobilise this system with confidence. This work is in North West Water's forward Capital Programme.