Flow Measurement at Sewage Treatment Works

ensuring accuracy to meet standards & requirements

by John Bentley CEng, MIEE

Flows through sewage treatment works have to be measured to the standards and requirements of the Urban Waste Water Treatment Directive (UWWTD) and of the Environment Agency (EA) in their policy document "Procedure for Flow Measurement of Discharges". This requirement was brought about by the Water Resources Act 1991 as amended by the Environment Act 1995. Severn Trent Water has embarked on a programme to ensure compliance of all their sewage treatment works by the end of the AMP3 period.

STW flow measurement installation *(courtesy Severn Trent Water)*

The requirements of the UWWTD and EA can be summarised as follows:

1. measurement of total daily flow with an uncertainty of 8% with 95% confidence;
2. measurement of diurnal flow;
3. presenting the data from 1 to the Environment Agency in an annual return;
4. certification by independent experts of the flow measurement installation and the data collection system;
5. maintaining the accuracy of the data throughout the life of the installation, using appropriate quality systems.

Severn Trent Water has over 1000 sewage treatment works, of which about 40% have a flow of less than 50m^3/day. Works with a flow of less than 50m^3/day do not require certified flow measurement unless specifically requested by the Environment Agency.

To meet these requirements Severn Trent has to:

* provide a data collection and recording system;
* ensure that the flow measurement installations and the recording system have the required accuracy and are certified to this effect;
* maintain the installations such that the accuracy in retained.

Scope of work
Some 600 works throughout the company, spread over a five year period, require attention. The scope at each site varies with some installations meeting the standards and, therefore, only requiring certification and connection to the data collection system. At the other extreme are sites where, usually due to age, the installation does not meet the standards and requires major refurbishment. To determine the scope at each site required a survey by qualified personnel experienced in flow measurement, particularly involving the use of flumes and weirs.

Feasibility
During 2000, feasibility studies were carried out in an attempt to estimate the scope of work and cost across the company sites, by carrying out surveys at selected sites. Based upon this data Severn Trent set a budget for the projects.

Discussions with the EA identified critical sites generally with a population equivalent of greater than 15,000 which required early attention.

Project strategy
Severn Trent Water Engineering and Purchasing Services were appointed as project managers. *Carl Bro* were appointed as consultants to act as Engineer for the site works. Working within the Severn Trent AMP3 Contract strategy, three contractors were chosen, based on their experience, to bid for the site works. From these *Droicon Ltd* was selected following a tendering process using data from the feasibility work.

The scope of work was divided into three parts:

* site works including data connections to the Severn Trent Telemetry System;
* data collection and recording from telemetry for presentation to the EA in an annual report;
* setting up Quality Systems to support the certification and recording systems.

The first of these is being let as a series of contracts to *Droicon* with *Carl Bro* as Engineer using G90 Conditions of Contract modified for Target Price Conditions.

Following consideration of the alternative methods of collecting the data, including down loading of data from site instrumentation onto lap top computers and using telemetry, the latter was chosen based on whole life costs. *Severn Trent Systems* was employed by *Engineering and Purchasing Services,* to write the software to collect the data in the form required by the EA.

Carl Bro are producing Quality Systems to ensure that the standards required by UWWTD and the EA are met. The documentation produced is considered by the project team and other stakeholders prior to implementation.

Contract strategy
Sites identified as requiring early attention were divided into batches of approximately 20 sites. The initial batches were determined based upon the anticipated scope and value of work, available

STW flow measurement installation *(courtesy Severn Trent Water)*

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resources, location and the desire to get some 'quick win' sites. The determination of initial batches was made by *Engineering and Purchasing Services* and *Carl Bro,* with *Droicon* quickly being brought into the discussions.

Droicon, using *Critical Flow Systems (CFS)* as a specialist flow company, *Gamma Automation* for mechanical and electrical works and *Stirling Technical Engineering Ltd* for telemetry connections were awarded the first batch of sites in January 2001.

Subsequent batches have been awarded at intervals of approximately six weeks with the resources provided by the contractor and sub-contractors being increased as the programme was accelerated to meet completion within AMP3. Each batch takes approximately 6 months to completion.

Having completed the urgent sites, the project team is now seeking to improve efficiency by concentrating each batch on an individual Severn Trent Assistant Manager area to reduce the amount of liaison and to give increased flexibility of working.

Early in the project, Severn Trent recognised that it would be inefficient to survey all the sites to identify detailed scopes of work, so that the works could be tendered in the traditional manner. Not only would this be inefficient and increase the length of the programme but a significant risk would be introduced that site conditions changed between survey and contract.

The Severn Trent AMP3 contract strategy of Target Prices and Risk Management based on batches of sites was an ideal solution.

At the start of each batch, each site is surveyed by specialists from the project team to determine the scope of work and to identify shared and Purchaser risks. From these, a Target Price for each site is developed and an Agreement to Commence Construction is entered into. This allows costs to be controlled with an opportunity to refer expensive sites for further discussion and approval. Involving the whole project team allows cost effective solutions to be found for each site.

The EA policy allows for sites where it may not be cost effective to meet the 8% target to be referred to the EA for a revised target. In such cases, the consultant prepares a report examining alternatives and making a recommendation for consideration for referral to the EA. To date there have been a limited number of such cases.

Stakeholder involvement

There are a number of stakeholders outside the project team. These include Severn Trent Management and Finance, Programme Management, Quality and Environmental Services, Operations and Maintenance and the EA. All these stakeholders need up to date programmes, progress reports and financial statements. The project team has developed, with assistance of the other stakeholders, reporting systems to meet their various needs. These reporting systems are underpinned with regular meetings which aim to resolve any issues in a timely manner.

Flow

Severn Trent AMP3 contract strategy has enabled efficient management of complex and wide ranging work to achieve cost effective and on time achievement of the programme. It is currently forecast that the programme will be completed 6 months before the end of the AMP3 period. ■

Note: *The author of this article, John Bentley, is Senior Engineer, Process, with Severn Trent.*