

Lound WTW, Suffolk

£7.4m Trihalomethane project for Essex & Suffolk Water

by
Guy Walker

Lound Water Treatment Works, situated in Northern Suffolk between Great Yarmouth and Lowestoft, supplies the Southern regions of Great Yarmouth and Lowestoft and some outlying areas. The works has a maximum nominal design output of 20MI/d but, in recent years, has used an operating range of 10-12 MI/d. At times of peak demand and poor raw water quality, the works can be assisted by up to 6MI/d from Ormesby WTW in Eastern Norfolk. Water Supply (Water Quality) Regulations 2000 Trihalomethane (THM) compliance values changed from December 31st 2003 to 100µg/l maximum. Essex and Suffolk Water agreed a Section 41 Programme of Work with the DWI to alleviate the threat of compliance failure.



Lound WTW: A concrete pour on washwater balancing tank. DAF cells in background

courtesy Essex & Suffolk Water

Raw water for treatment at Lound is abstracted from interconnected lake and pond systems with a maximum volume of 20.4MI/d. The Fritton system consists of Fritton Lake and Lound Run which is around 80 hectares in area. Main source is a local catchment and it suffers from seasonal algal blooms causing operational problems. The Hopton raw water system is a series of five ponds that are spring fed. These ponds are relatively shallow at 2m and, until recently have represented the higher water quality.

Lound WTW dates back to the 19th Century when early versions of Slow Sand Filters (SSF) were utilised. In the 1930s, the works was upgraded to include inlet sedimentation and Rapid Gravity Filtration (RGF). In the years since, asset additions have included a filter backwash tank, disinfection phase and TW reservoirs, which remains the general works process today. The chemistry of the site has also seen changes with the discontinuation of coagulation during the 1980s and the adoption of chloramination in 1992.

In May 2002, Essex & Suffolk Water commissioned *Montgomery Watson Harza* to carry out studies mimicking their appointment at the Ormesby WTW. This appointment sought to capture a thorough desk top study and laboratory testing culminating in a firm recommendation to the business for investment.

An examination of the raw water clearly demonstrated an organic rich source with high TOC concentrations at 10.6mgC/l max for Fritton lake and 12.0mgC/l for the Hopton system. The organic concentration from historical data, has been increasing at a steady rate. Both water sources are slightly alkaline and prove comparable in terms of moderate colour levels, low turbidity, pH and TOC, but Hopton contains almost double the peak iron (Fe) level.

Algae counts reach very high levels on a seasonal basis, peaking at 40,000 cells/ml in the Fritton system and 31,000 cells/ml from Hopton. Green, Blue-Green and Diatoms all dominate at various periods of the year.

The THM formation trials unmistakably verified that in order to meet the PCV levels, the only water sources 'blend' would constitute 100% Lound Run, where algal blooms are seasonally very high. Results of the studies, at a desk top and laboratory scale, recommended enhanced coagulation/flocculation involving Dissolved Air Flotation (DAF) or Lamella Separators.

DAF clarification

Clarification is an effective method of removing solids and organics as a primary process. The laboratory testing clearly demonstrated that the generated sludge possesses a low cohesion factor and had good flotation potential. The choice of process also had to consider that the laboratory results showed that a high acid and coagulant dose (20mg/l @ pH 5.2 - 5.4) would be required and, as a result, lend itself to significant Opex costs. After a two month period of pilot plant testing, to reinforce laboratory results, the decision was taken to invest in the DAF process.

The contract was awarded under ECC Option C to *M J Gleeson*, an NWL/ESW Framework contractor, with a target cost of £7,411,000. *Earth Tech Engineering Ltd* (ETEL) are providing the process works as a back-to-back sub-contract. Both contractors were engaged early in the procurement process, under the ECC PSC, to have a full and active role in the outline design, and, the VE and Hazop workshops.

Environmental considerations

Lound WTW is situated in a rural area and is home to a great deal of protected wildlife, flora and fauna. There are also areas of archeological interest. Extensive investigations, by the local authorities, were carried out alongside our in-house environmental department to put together an environmental portfolio for submission to the district council. Noise and traffic surveys for construction and operational scenarios also formed part of this report.

Early consultation led to Planning permission being granted ahead of programme, but E & SW was required to develop a DAF building more sympathetic to the picturesque surroundings. This led to additional design being necessary, culminating in a significant change to the building sub-structure and super-structure. This obviously caused the contract programme to be re-profiled against baseline, but with the project running slightly ahead of schedule, the changes could be effectively managed without affecting the completion date.

The works comprise a DAF plant and chemical building consisting of three process streams with a capacity of 6MI/d each. The post DAF water is then transferred to the RGFs and continues through the aforementioned site processes. The sludge that is produced goes to a washwater balancing tank where it is met by the RGF backwash water. This is then passed through a lamella clarifier before being thickened and held in a sludge storage facility.

The programmed end date of 30th June 2004 was a very demanding time scale to meet. The partnering ethos, although this is not an official partnering project, has been paramount to the project remaining on programme and cost.

Rapid Gravity Filters

The Primary Rapid Gravity Filters are unsuitable for their new purpose resulting from the installation of the DAF process. There will be a significant change in the nature of treatment from chemical free roughing filters, where surface filtration occurs reducing turbidity to full-bed floc removal resulting from the chemical DAF process carryover.

The filters are currently in a poor state of repair. Some have undergone maintenance work in recent years to repair or clean



Excavation for access roads



Working through a Suffolk winter

the filter nozzle and under drain system. The main cause of this blockage/damage is linked to the presence of polyzoa in the system. The existing collection system acts to trap the organisms on the underside of nozzles. This has resulted in two areas of concern:

- * dislodged polyzoa tend to congregate at the extremities of the lateral system leading to reduced washing efficiency and fouling of the medium;
- * excessive build-up of polyzoa within the nozzles can result in physical damage as they are ruptured during air scouring or washing. Quantities of medium can enter the under drain system and the filter is rapidly rendered inoperable.

With these points in mind, E & SW has invested in installing a *Leopold* flooring system and replaced key valves and actuators. This work, through Minor Works Framework contractor *Aquazone Limited*, must concur with the Completion Date for the DAF works and currently remains on programme to do so. ■

Note: The author of this article, Guy Walker, is Project Manager, Essex & Suffolk Water.