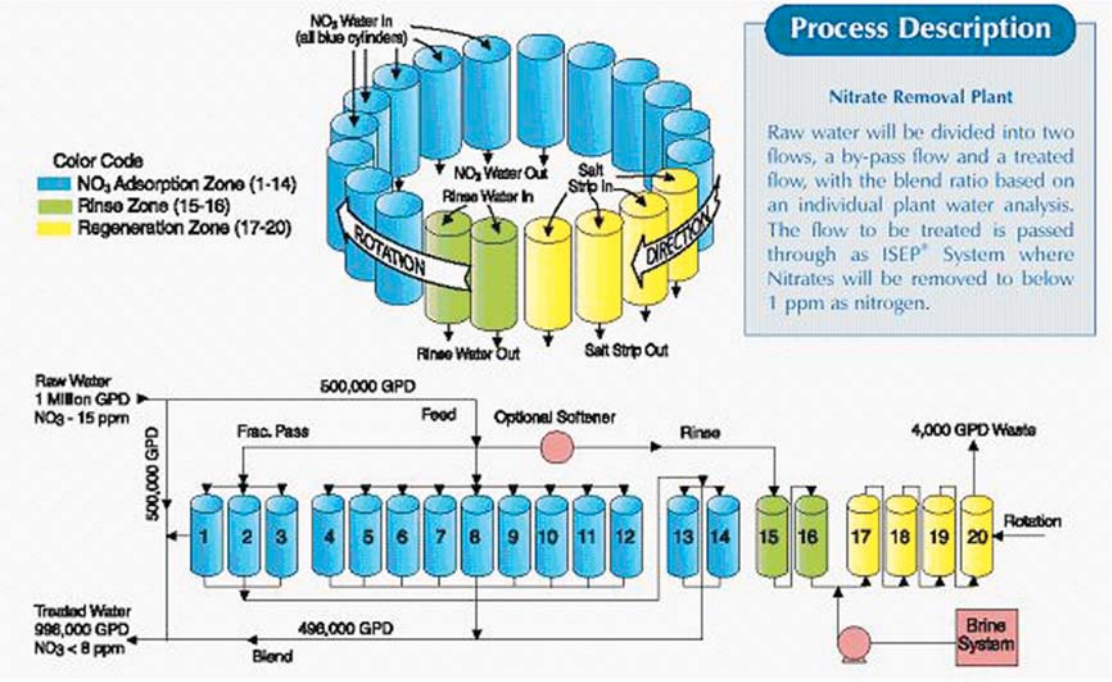
Lane End Water Treatment Works

Darent Alf, restoring flows in the River Darent

by
Adrian Jack, BEng (Hons)

Thames Water entered into an agreement in 1998 with the Environment Agency to reduce the amount of water it abstracted from a number of groundwater boreholes along the River Darent between Sevenoaks and Dartford. This agreement intended to help restore flows in the River Darent during dry summers, had two phases; the first implemented a complex agreement which reduced groundwater abstraction until a permanent solution could be completed, with exemptions under emergency conditions. The second phase required Thames Water to close its existing Eynsford source and reduce the abstraction of its Horton Kirby source by 50% by 31st March 2005, a total loss of 27.3Ml/d. In order to achieve this Thames Water had to locate new water resources to replace these losses from its existing boreholes.



Graphics courtesy Chemviron

Delivery strategy

In January 2001, two parallel project teams were set up to implement the second phase of the Darent Alf, which comprised in-house designers and specialist support staff and two of Thames Water's AMP3 Alliances; Network South (*Morrison Construction)*, responsible for borehole development and new distribution pipelines which was completed in April 2004, and Trident South (Costain Black & Veatch), responsible for a new water treatment works. The project team was led by *Adrian Jack, a Thames Water Senior Manager.*

Water treatment works

Replacement water sources totalling 16.3Ml/d were developed at four new boreholes located over 11 kilometres away from the existing Horton Kirby WTW. The decision was therefore made to treat the water at a new WTW near to the borehole sources on vacant land at an existing Thames Water borehole site in Lane End as this would avoid land purchase delays. The works had to be capable of a future expansion to 32Ml/d.

The site was, however, in an area of Green Belt and had active badger setts. Rather than trying to relocate them , a badger proof fence was constructed to keep the badgers out of the proposed WTW site, which ironically has provided protection to the badgers who are now thriving despite living next door to a construction site.

Despite being located in the green belt, careful design of the buildings and choice of materials along with tree screening from adjacent property and a junior school, ensured that an EIA was not required and planning permission was obtained in June 2003.

Although water quality in the new boreholes was generally satisfactory, evidence from abstraction tests and from Thames Water's existing groundwater sources nearby showed that there is a rising trend of high nitrate levels which would need to be removed. The result of over use of fertilisers by farmers over many years. Nitrate levels in the raw water already exceeded Thames Water's internal threshold of 10.5mg/l as N and were predicted to rise to 13.8mg/l by 2015. The PCV for nitrate is 11.3mg/l as N.

Treatment processes – nitrate

Traditionally fixed bed Ion Exchange Adsorption plant have been used to remove nitrates, but these produce high volumes of salty process waste from backwashing the large resin vessels. The nearest sewer large enough to accept this waste was over 4km from the treatment works site but suffered from high levels of infiltration and could not be relied upon during periods of heavy rain. A low waste solution had to be found.

Aerial view of WTW site, Junior school at left and badger setts in woodland to rear *courtesy: Chemviron*

View of underside of ISEP valve at centre of turntable surrounded by resin vessels *courtesy: Chemviron*

Lane End: View of ISEP plant with blending by-pass in foreground *courtesy: Chemviron*

Following a competitive tender process the *Chemviron Carbon* "ISEP" process was chosen as this was very efficient in the use of resin and produced less than one per cent total volume of waste water.

The ISEP provides a continuous, counter-current regeneration process, and consists of a single unit comprising some 20 small vessels each equipped with resin mounted on a rotating turntable. A single large valve mounted in the centre of the turntable above the resin vessels distributes flows so that 14 are in the service mode with the remainder in the regeneration and rinse modes.

Because of the low volumes of washwater, the ISEP system does not require rinse water or other holding tanks. Ancillaries are provided to allow for the regeneration of the ion exchange resin with critical items such as salt saturators, water softeners and brine pumps provided duty/standby.

To ensure compliance with water quality standards it is not necessary to treat all of the source water and therefore only a proportion of the raw water is diverted to the ISEP. The resulting almost nitrate-free water is then blended back with the by pass water to provide treated water for disinfection to a target maximum value of 10.0mg/l as N.

The proportion of total flow passing through the ISEP is constantly varied dependent on the following factors:

* total flow rate of water from the source boreholes;
* nitrate concentration in the raw water;
* nitrate concentration required in the final water;
* proportion of the flow to the ISEP that is lost as waste water during regeneration.

Treatment processes – disinfection

Super-chlorination is carried out using a 10% sodium hyperchlorite solution to disinfect the water as it leaves the ISEP building and an orthophosphoric acid solution is also dosed to control soluble lead in customer pipes. The water then passes through three 27 metre long steel contact tanks (each delivered and installed in one piece) in series to provide a minimum of 20 minutes contact time to disinfect the water before it is de-chlorinated using a 20% sodium bi-sulphite solution. Space has been provided to install two more tanks for any future expansion of the works.

Teamwork success

The new Lane End WTW was successfully completed on programme by the end of March 2005 and is on target to be delivered at a total cost of £13.5m, almost 10% below the original Target Cost. ■

The achievement has been the result of a strong team spirit amongst the design team *(Thames Water/Black & Veatch),* the contractor *(Costain)* and sub-contractors including *Chemviron Carbon, Aston Dane, Portacel and Anord.*

Note: *The author of this article, Adrian Jack is Senior Project Manager, Thames Water. Graphics have been supplied by Chemviron.*