Clarendon Nitrate Reduction Scheme

high tech in the countryside

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Clarendon Park is one of Wessex Water's borehole sources of raw water, supplying some of the needs of the Salisbury area. With two boreholes and an average extraction of 8.6 Ml/d (licence is 14Ml/d), the water at this site has, in common with many other sites in the UK, seen a steady increase in nitrate concentrations over recent years - to the point where something had to be done. The Current peak nitrate concentration recorded at the site was 18.9mg/l as N, measured during the winter of 2001. Although values are generally much lower than this, the measured nitrate data trend line was indicating an increase of around 0.27 mg/l as N per year. Clearly action needed to be taken in order to be able to meet consistently the Wessex treated water target of 9mg/l N (Maximum Allowable Concentration (MAC) is 11.3 mg/l N)

Clarendon Nitrate Reduction Scheme: Anion Skid inside new process building *photo courtesy Christ Kennicott Water Technology Ltd*

Clarendon Park itself is predominantly open estate land, and the treatment site is in an environmentally sensitive area, reached by a single track estate road and overlooked from an adjacent ridge by Monarch's Way - Britain's second longest walking trail. The existing site had been carefully designed to have the appearance of agricultural buildings, and its high visibility meant that any modifications had to be extremely sensitive to visual and traffic impact.

Process selection

An option study undertaken by Wessex Water's in-house engineering team, recommended a high rate, low waste ion exchange plant as the preferred solution. This would split and treat part of the supply then blend it back with raw water prior to treatment from the existing granular activated carbon plant, chlorination and pumping away.

The selected process 'Advanced Amberpack', is supplied by Christ Kennicott Water Technology Ltd, under an exclusive licence agreement from Rohm and Haas. At this time 2004, the low waste Advanced Amberpack process had not been used in the the UK by a Water Utility, but it had a track record, particularly in mainland Europe, in supplying highly purified treated water to industry.

The process is a backwashable packed bed ion exchange system used in water purification processes for the reduction of nitrate, natural organic matter, colour, arsenic and hardness from groundwater. In the process, some of the raw water passes through the ion exchange resin to remove the nitrates and is then blended back with the main plant flow to the required concentration. The nitrate ions are replaced by chloride ions using ion exchange. The resin has a set capacity for nitrate, and after it becomes exhausted it is regenerated using a salt solution (sodium chloride) from the regeneration and water softening plant.

Two of the reasons for selecting this process were that it is compact, and is also a maximum efficiency high recovery process. This meant that the plant building, the consumable (salt) deliveries and the waste for disposal could be minimised.

In addition to the main process, new borehole pumps were required in order to meet new duty points, relift pumps were needed to pump to reservoir after treatment, and (of course) the works had to remain on line throughout.

Procurement and construction

The procurement strategy involved a carefully co-ordinated sequence of contract awards. Because of the high environmental sensitivity, a successful planning application was fundamental to the scheme. However, in order to obtain this, detailed environmental investigations were needed, in parallel with information about the size and layout of the process plant and associated equipment, so as to be able to design the buildings to blend into the area. Nevertheless, early expenditure needed to be carefully controlled. as the project remained at risk until planning approval could be obtained.

Atkins was commissioned to carry out the overall site and ancillary plant design, while *Christ Kennicott Water Technology Ltd* provided the process design and *Race Cottam Ltd* prepared the outline design and landscape architecture of the plant building and site. The overall project programme was managed by Wessex Water's in-house construction department, *Wessex Engineering and Construction Services.*

Planning approval was received in late 2004, subject to a number of conditions and Atkins and Christ Kennicott commenced the detailed design in early 2005. Some particularly interesting constraints were imposed, including a limit on some working activities around the pheasant rearing and shooting seasons, which together with the need to meet the process installation date, meant that civil construction started in early summer 2005, after an intense design and tender period. Finishes to the building were also critical, and the site was designed to hide as much as possible of the salt saturator and turning area from the prevailing view, using the new building.

Challenges

One of the main challenges of the design was to resolve the internal layout of the main process building and the plant within it. The building profile had by this time been fixed by the planning approval process, and ancillary plant layouts had to be developed in a very intense two month period. This work involved designers from Atkins and Christ Kennicott, co-ordinating with each other, the end managers Wessex Construction). In this time, layouts were developed of the treatment and relift streams - two physically

Clarendon Park: New process building *photo courtesy Atkins*

separate but interdependent plant, control and pipework layouts in the same building space. A cob-located team with representatives of the different designers was considered but ruled out within the time constraints, and instead, conventional design cob-ordination was used successfully

Implementation

At the time of writing, the main civils construction was completed by *Dyer and Butler* in January 2006, and the mechanical and electrical installation is in progress by *May Gurney Ltd.* To facilitate rapid installation of the process plant, *Christ Kennicott* skid fabricated all of the key process equipment at their works in the West Midlands where it was factory tested ;prior to despatch. *Christ Kennicott* commenced their installation of the process plant two months ahead of programme in March 2006, and commissioning of the plant is underway. The complete plant is programmed for completion and takeover by October 2006.■

Note: *The author of this article, P. Sagar, is Design Project Manager, Atkins.*