Eversho t STW

£2.2m dry weather flow exceedence scheme

by
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The village of Evershot near Dorchester, Dorset, has a population of approximately 200, with a peak of 270 in the summer due to local tourism. Population is predicted to grow by 27% by 2030 due to local developments. The sewage treatment works serves only the village and is surrounded on all sides by a site of special scientific interest (SSSI). The requirement for the scheme originated as the dry weather flow was exceeding its consented value, due to the Environment Agency's maintenance of load policy the site will require a tightening of the sewage treatment works discharge consent sanitary parameters, together with an increase in the flow to full treatment. So the new consent for Biological Oxygen Demand: Suspended Solids: AmmN will change from 20:30:5 to 11:22:3 with the FFT changing from 3l/s to 3.4l/s.

Site before construction *Courtesy of WECS (Wessex Engineering Construction Services)*

A strategic review was undertaken to identify the short and long term treatment requirements. The strategic plan concluded that the site should be expanded by the provision of additional primary and secondary treatment, a new tertiary treatment stage as well as improved full flow to treatment (FFT) control and flow-splitting at the Inlet.

Existing facilities and proposed solution

The works comprises of an inlet works with grit trap, storm overflow weir and inlet screen; two septic tanks, two RBC's (Rotating Biological Contactor), conical humus tank and flow measurement chamber. The biological capacity is supplemented by a high rate filter and a SAF unit which were both temporarily installed in approximately 1995 and 2005 respectively. With no on-site sludge storage, sludge is removed from the septic tanks every 7 weeks.

The following was the proposed solution:

- New inlet works: 6mm screenings, and grit removal;
- Positive control of FFT through an automated penstock;
- Improved flow splitting at the Inlet Works;
- Additional Septic Tank to meet current design standards;
- Additional RBC capacity to provide a total of 8,000m^2 of media;
- Condition assessment of existing RBC units and maintenance works required to provide an extended operational life (at least 15 years);
- Installation of Tertiary Aerated Sand Filters;
- Abandonment and removal of the existing temporary HRF and SAF units;
- Improvements to Storm Tank emptying and return; either by installation of pre-screening or provision of maci-type storm return pumps;
- Assessment of existing stand-by power generator capacity, and provision of additional capacity if required.

An opportunity arose early in the construction phase to purchase a suitably sized package membrane bioreactor plant (MBR) from Ovivo (formerly Eimco Water Technologies), which was available for immediate delivery. The scope of this option would include:

New inlet works: 6mm screenings, grit removal and FFT flow control;

- Re-use of existing septic tanks;
- New three way flow split chamber, with 3mm Copasacs;
- New MBR plant. 2 No. pre-formed buried tanks, each containing membrane packs, plus a permeate collection compartment;
- Improvements to storm tank emptying and return.

Wessex Engineering Construction Services (WECS) assessed the feasibility of both the original design and MBR option and subsequently proceeded with the MBR option giving an estimated CAPEX saving of approximately 20%.

Membrane Bioreactor Plant

The two new Ovivo (formerly Eimco) MBR tanks are each approximately 7.0m long by 2.5m diameter, and have a capacity of 135m^3 each. Each tank has 4 No. membrane packs, each containing 75 No. membranes, associated air and permeate pipe work and return sludge pumps. A compartment at one end receives the effluent which passes through the membrane under a gravity head. The permeate compartment contains duty/standby permeate pumps which deliver to a new chamber constructed on the existing final effluent pipe upstream of the flow measurement/sampling chamber. Surplus Activated Sludge is returned to upstream of the septic tanks for co-settlement. A duty blower is provided for each tank with a common standby, which can deliver to either tank automatically by an actuated valve. The blowers are located in a GRP kiosk supplied as part of the MBR plant. Light duty Technocover access openings were installed over each membrane pack and the permeate tanks.

The MBR package plant offers significant operational benefits due to its intrinsic simplicity & low mechanical and electrical equipment content. The plant can be commissioned quickly and produce compliant effluent within a few days. Thereafter the effluent quality should be consistently high.

Construction

WECS were constrained with several environmental and geological issues prior to construction. An access track in need of repair, a site contained within a SSSI and extremely poor ground conditions were the main issues to address.

The ground make up varies significantly across the site from peat to soft silty clays, with a high ground water table in places 1m below the surface. A drainage blanket with a non woven geotextile reinforced terram layer was placed under the sub base layer which consequently formed the temporary access road (which later will be used to support the new concrete access road).

De-watering provided a few headaches due to a high water table and limited space to discharge over land. Interlocked sheet piles managed to cut off most groundwater, whilst the rest was pumped to 2 No. settlement tanks set up in series, with a perforated outlet pipe discharging over straw bales which allowed separation of silts.

The shape of the MBR tanks made the installation onto the reinforced concrete base difficult. Formed concrete cradles allowed easier installation for line and level. The MBR's were then backfilled with a mass concrete surround, with an invert approximately 3.5m below ground level.

Further Scope Changes

The designed membrane flux rate with both tanks in operation is 0.61 m^3/m^2/d at FFT, and with one tank out of operation is 1.22 m^3/m^2/d at FFT.

Since the change to the MBR option a process review was undertaken which highlighted that measured final effluent flows have increased significantly since July 2009. It became evident that the current monthly average flows exceeded the new consented FFT and as a result, the MBR's will not see what would be considered to be a normal diurnal flow pattern which would have allowed the units to 'relax' and reduce the overall load on the plant and the time between chemical cleans of the membranes.

To overcome this the control of the plant was enhanced to include a membrane relaxation stage in the process, this closes the permeate (outlet) valves for two minutes every eighteen minutes, allowing the membranes to relax for a short period of time, this technique has been shown to increase the period between chemical cleans on similar sized plants. Our membrane plant has now been operating successfully for 3 months now and shows no signs of needing a chemical clean; therefore it appears that this relaxation technique is working well.

As a result of the increased flows, the likelihood of storm tank spills had also increased. Wessex Water has recently discussed this with the Environment Agency and proposed a medium term solution to provide greater forward flow capacity up to 5l/s to prevent flows prematurely entering the storm tank during dry weather.

To achieve this it is proposed to continue to use the old treatment units as a primary treatment stream taking only a 30% proportion of the flow, with the new MBR stream taking the other 60% of the flow. The effluents will then be blended prior to the sample point. This proposed solution also has the advantage of reducing the peak and average flux rate's of the new MBR plant.

Project Team

The client for the project is Wessex Water. The principal contractor was Wessex Engineering and Construction Services (WECS), undertaking the civil works and CDM coordination, with the detailed design by Pell Frischmann. The new inlet screen was supplied by The Haigh Engineering Company Ltd and the Mechanical and Electrical sub–contractor was Murray M&E.

Anticipated Completion

The team has recently met the EA regulatory date of 31st March 2010. Inlet screen and flume channel construction are the next challenges, as the only suitable location is adjacent to the fence line of the SSSI, and nearby overhead communication and high voltage cables. The site team has performed well in challenging circumstances, with numerous design changes and tight site conditions, and will continue to do so with a completion date of July 2010.

Note: ***The Editor & Publishers thank Daniel Tiley, Site Manager, and Scott Hughes, Project Manager, both with Wessex Engineering and Construction Services, for preparing the above article for publication.***■