Callington Sewage Treatment Works

£3.2m upgrade for catchment growth

by

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Callington is a small town in south east Cornwall with a population of around 5,000. Once a busy mining area, its main industries are now farming and tourism although since the sixties it has been the home of the famous Ginsters Pasty Factory. Ginsters is the largest employer in the town today and produces over two million products a week, As well as receiving flows from Ginsters the STW also treats flows from a local dairy.The Sewage Treatment Works that serves Callington and other outlying areas is located at Caddapit, some 2km to the south of the town and discharges to the Haye Valley Stream, which is a tributary of the River Lynher. In March 2001 the consent was modified to comply with River Quality Objectives to 14mg/l BOD; 28mg/l suspended solids, and 4mg/l ammonia.

Callington STW under construction *photo courtesy Hyder Consulting*

Proposals in the Local Plan to erect a further 1000 properties in the area by 2011 meant that additional pressure would be applied to a works that was already overloaded. The works had been shown to be borderline with respect to consent compliance over a number of years and a scheme to upgrade the STW was, therefore, implemented by South West Water in 2006.

Existing works

The existing STW was built in 1988 to treat a residential population of up to 7000, plus some flow from Ginsters. Data from a flow and load analysis undertaken in 2003 indicated that Ginsters flows alone were contributing an additional BOD load equivalent to approximately 4,200PE.

Crude unscreened sewage gravitated to an oxidation ditch fitted with a single mammoth surface aerator and a recently added diffused aeration mat. Mixed liquor passed over the outlet weir to the Final Settlement Tank (FST) distribution chamber which was fitted with a 6mm mixed liquor screen prior to being split equally between two 17m diameter FSTs.

Sludge wasted from the process was transferred to a picket fence thickener prior to further thickening through a sludge press.

There were no storm separation of settling facilities upstream of the ditch, therefore, the mode of operation was to treat all flows entering the works up to 180 l/s, which approximated to treating all flows up to Formula A.

Process modelling of the works performance showed that the poor reliability was due to high diurnal peaks, short circuiting within the oxidation ditch, the return of high strength sludge liquors from the sludge press and the septicity of the incoming sewage.

Proposals for achieving compliance

To address compliance, any modifications to the works needed to address the ability of the plant to treat diurnal peak loads, the management and return of sludge liquors and the capacity of the aeration basin to operate at a sufficient sludge age and Dissolved Oxygen level to reliably achieve nitrification under all loading conditions.

With this in mind a number of options were reviewed at the feasibility stage to enable the plant to treat up to 3DWF, rather than the current Formula A pass forward rate.

Inlet works and storm separation

The existing mixed liquor screening arrangement placed a high solids and rag load on the aeration plant and encouraged deposition and ragging on the aeration plant equipment.

It was proposed, therefore, to provide a new inlet works complete with inlet screens and grit removal for all flows entering the works.

Separation and settlement of flows above 3DWF would be required and this was achieved by providing a new inlet pumping station to lift flows up to 68 l/s to a new primary settlement stage, and the excess flows would then gravitate to the storm tank. With a new flow to full treatment (FFT) of 68 l/s only one of the existing FST's would be required for final settlement. Due to the reduction in FFT, it was therefore possible to convert the other FST to a storm tank.

Primary Settlement Tanks

A primary settlement stage was provided to reduce the applied BOD load to the aeration plant and reduce the volume of aeration required.

Biological Treatment

Improvements to the biological stage included the provision of a new anoxic selector tank with a capacity of 60m^3, the retention of the existing 1300m^3 completely mixed aearation ditch with an increased water depth to provide additional capacity, New aeration system and new banana mixers to maintain adequate horizontal velocities in the ditch. The ditch hydraulic design has also been modified and the inlet and outlet arrangements altered to minimise any short circuiting.

To reduce the proliferation of filamentous bacteria, selector zones have been provided in the anoxic tank to assimilate the bulk of the readily biodegradable fraction of the total BOD load by absorption. The selector comprised two compartments split in the ratio of 33% and 66% of the total volume .

FST improvements

Significant improvements have been made to the performance of the process by replacement of the undersized diffuser drum in the FST.

The FST at Callington has a diameter of 17m and a stilling well. diameter of 2.5m, i.e. only 14.7% of the diameter or just 2.1% of the tank area, extending 1.5m below the water level. Under peak flow conditions the upflow velocity in the tank was estimated to be 1.3m/h. This is considered reasonably conservative provided that the sludge does not have poor settling characteristics. However, the downward flow from the stilling well would be 92m/h. Under peak flow conditions the velocity between the bottom of the skirt and the sludge blanket would be around 50m/h - also high enough to cause scouring of the blanket.

At Callington, we have therefore, adopted a maximum downward velocity of 30 m/h, and a velocity between the bottom of the stilling well skirt and the top of the sludge blanket of around 25 m/h. These recommendation gave a new diameter of the stilling well baffle of 5.1m (30% of tank diameter) with a depth of skirt reduced to 1.1m.

In addition, to improve flocculation and reduce the suspended solids concentration in the effluent, the FST's include a flocculation centre well or Energy Dissipating Inlet (EDI). The design of the flocculation centre well provides a retention of around 10s at maximum flow in a flat bottomed centre well, nominally 1.8m diameter and 0.5m deep attached around the inlet bellmouth. This is provided with peripheral chutes with angled baffles to help reduce the energy of the incoming flow and assist flocculation,

Scheme construction

The scheme was completed for South West Water under the K4 Programme by *Edmund Nuttall and May Gurney* in 2006. Civil, Structural, Process and MEICA design was provided by *Hyder Consulting.*■

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