New WwTW for Larne, N.Ireland

compliance with EU bathing & urban water directives

by Mike Woodward

The new wastewater treatment works at Larne, Northern Ireland, are located on reclaimed land from a tidal seawater lagoon – Redlands lagoon – that was previously utilised by an aluminium smelter that has long since closed down. The new works – totally new as there is no existing wastewater works to modify or replace –needs to be able to serve a population of 33,000. Until now, there have just been two outfalls in the adjacent Sandy Bay, close to the Larne ferry terminal, but this is clearly unacceptable with the new regulations.

Larne WwTW: Three lamellas under construction *courtesy: Purac & NI Water Service*

When the Department for Regional development and Northern Ireland Water Service needed to build on previous improvements to the sewerage network in Larne, they turned to *Purac* to come up with a solution that would ensure compliance with the EU Bathing water and Urban Water directives.

Site

The very visible nature of the site demanded a sensitive approach to planning and construction, resulting in the main process plant being under cover, housed in a single building that blends well with its immediate surroundings.The new works will be in an innovative new building with a 'bats wing' style roof that, perhaps surprisingly, will not only blend into but add significantly to the location. Although the new works is just that, it has to fit a fairly limited 'footprint' so careful planning to maximise the usage of available land was key to taking this project forward.

This is a major contract – valued at £12.5 million – and the new sewage treatment works will comprise a new inlet works, the provision of lamella primary sedimentation, biological aerated flooded filters (BAFF), UV disinfection, sludge thickening and storage, an air management and odour control system, standby generation facilities, a new remote pumping station at Sandy Bay, new outfall along with new combined storm overflow (CSO) and modifications to the local sewerage system.

20 CSOs

Prior to the new works, there were some twenty CSOs in Larne, many discharging to small brooks. Once completed, the new works will significantly reduce this activity ensuring that the new CSO on the existing trunk sewer diverts the majority of these flows to the new works, the remainder coming from the new pumping station at Sandy Bay. The sewer is subject to saline intrusion and the effluent could well have chloride concentrations of up to 300 mg/l.

So, how is the new works configured?

A rotating bar interceptor (RBI) provides protection to the inlet pumping station. Four pumps are provided to cover the range of expected flows to the new works. A combined inlet works, consisting of duty/standby 6mm fine screens and a spiral flow grit and grease removal plant provides preliminary treatment prior to the flow

Larne WwTW: Innovative new works building with 'bats wing' style roof *courtesy: Purac & NI Water Service*

getting to the lamella separators. All screening and grit removed from the flow are washed and bagged and collected in skips for ultimate disposal.

Three lamella separators, each consisting of an inlet distribution system, lamella plates, scum scraper, sludge scraper and sludge removal hoppers are incorporated. Because of the saline intrusion the lamella plates are made of light-weight PVC, making them suitable for that kind of environment. Flows enter the lamella tanks via overflow weirs, ensuring an equal flow distribution to each tank.

Settled primary effluent gravitates to the BAFF Feed Pumping station.

Flow distributed evenly

Three variable speed pumps arranged as duty/assist/standby, pump the settled primary effluent to the BAFF feed splitter tank. The splitter box is a circular structure located centrally to the BAFF reactors and fitted with seven overflow weirs. This enables an equal division of flow to the base of each BAFF reactor. Seven BAFF cells, arranged in a row of five and a row of two, provide secondary treatment. Flows are introduced to a concrete duct at the base of each reactor which is fitted with a distribution plate with 80 x 50 perforations. This allows flows to be distributed evenly across the base of the reactor without clogging or blocking. Backwash flows are also removed via the distribution channel.

Three zones

The reactor is arranged with three zones – prefiltration, the biozone and clean water zone. The prefiltration zone is not aerated. It acts as a filter and removes suspended solids and its associated BOD. The aeration grid is situated above this and comprises a horizontal pipework distribution system and provides coarse bubble aeration. Above this, a further 3 metre 'plus' of media provides the zone for biomass growth and BOD removal.

Flow passes through this media and into a clean water zone at the top of the reactor. The clean water zone retains a volume of water to be used in the backwash cycle and replaces the need for a clean water holding tank and associated pumps. Treated final effluent is discharged into a common pipe and gravitates to the UV channel.

Reactor cleaning

Reactor cleaning is initiated by lapsed time, detection of high pressure in the splitter tank dropper or by manual initiation. Typically, three cells will be backwashed in one day and four the following day. However, all seven cells can be accommodated in one day if necessary. The system is designed to be able to treat full flow even whilst one cell is out of action or being cleaned.

Final effluent undergoes UV disinfection prior to being pumped to a new sea outfall. There is a disinfection requirement to achieve less than 20,000 Faecal Coliform units/100ml on a 95%ile basis.

Co-settled primary and BAFF sludge is pumped to the sludge buffer tank adjacent to the drum thickener room, where a mixer prevents the solids from consolidating. Under normal circumstances one drum thickener will meet the daily thickening requirements, however two have been provided and they can run simultaneously if required.

Thickened sludge is pumped to two sludge storage tanks outside the main building and is exported by tanker and skip removal trucks.

One of the benefits of this being a brand new works is that the whole plant can be odour controlled and all process plant is covered. The Building Air Management System (BAMS) will maintain the quality of the air in the building at all times. A modular approach to the process used was required so that planning constraints could be adhered to in addition to the normal legislative requirements. To help achieve this *Purac* partnered with *Brightwater Engineering* to utilise their BAFF technology to take advantage of their past experience of enclosed plants in this design. The modular nature of the *Brightwater* process allowed some important flexibility in the layout of the proposed works.

The new works will be complete and operational by February 2006 and, it is planned, passing flow from December 2005. ■

Note: *The author of this article, Mike Woodward, is Projects Manager, Purac Limited.*