Stirling WwTW

site clearance & plant diversions prior to SBR installation

by
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Stirling WwTW project was a Scottish Water Q&Sll Capital Investment scheme which was carried out in two stages. The initial stage was confined to enabling works which involved sanitising part of the Stirling site ready for a new treatment plant to be constructed. The enabling works involved the diversion of many services in the early part of 2006 which included mechanical and electrical systems as well as re-location of the existing sludge cake storage facility and site washwater booster system.Once the requisite area of the site had been cleared, construction could then commence on the Sequencing Batch Reactors (SBR) consisting of four cells, each measuring 15m by 40.5m and approximately 5.5m in depth. All of the structure was constructed over 300 concrete piles that were up to 30m in length.

Stirling site clearance & plant diversions prior to SBR installation *courtesy Enpure Ltd*

SBR structure

The SBR structure was designed to maximise efficiency of construction materials. Continuity reinforcement allowed thin wall construction without the need for expansion joints.

The use of driven segmental concrete ring sections for the SBR feed pumping station allowed the construction of a 4.5m internal diameter well 6.3m deep in an area of existing services without need for further diversions of the main process pipe work. This allowed the 600mm diameter gravity feed main and 500mm diameter pumped main to be located in predominantly sparse service corridors.The contract was awarded to *Purac Leslie Consortium* in late 2005. *Purac Ltd, now Enpure Ltd,* was the process and mechanical and electrical contractor. *George Leslie Ltd* undertook all of the associated civil engineering and building works. Civil design was undertaken by *Bullens.*

Purpose

The purpose of this Q&Sll project at Stirling was to provide compliance, meeting the new SEPA discharge consent which came into force on the 1st January 2007, namely 150mg/l SS, 25mg/lBOD_5,15mg/1 NH_3. The suspended solids and BOD consents were unchanged plus the project was primarily to ensure that nitrification took place and that the new ammonia consent could be met essentially during the period 1st April to 31st October inclusive. The process selection for this was made by Scottish Water Solutions and consisted splitting the main treatment into two process streams, the existing plant (traditional primary settlement tanks, aeration and final settlement tanks) and the new SBR stream, which were then blended together prior to discharge.

The incoming flow at Stirling enters a large existing pumping

Phased construction progress of the SBR structure to maintain access for concrete pours *courtesy of George Leslie Limited*

station/storage tank and all flows (up to the capacity of the pumps) are lifted up to a raised inlet channel where flows in excess of 1324 l/s overflow to river via a CSO screen. The remaining flow then passes to two inlet screens then splits to two grit plants before combining and then splitting out to 4 primary settlement tanks. After the primary settlement tanks, flows in excess of 709 l/s spill to the river via an overflow weir and are lifted by screw pumps into an aeration plant (Horizontal Surface Aerators) and then gravitate to 3 final settlement tanks.

In the new works the SBR plant takes 53% of the incoming flow up to Full Treatment maximum of 709 l/s (i.e. 53% = 376 l/s to SBR) and the remaining flow (1324 l/s - 376 l/s = 948 l/s) passes through the existing primary settlement tanks. Downstream of the existing primary settlement tanks is where the *Purac-Leslie Consortium* installed the hydroslide which limits the flow to the existing aeration plant to 333 l/s, thus making the Flow to Full Treatment 709 l/s (376 via SBR and 333 via Aeration).

ITT Sanitaire's ICEAS (Intermittent Cycle Extended Aeration System) SBR process was selected as it offered the following benefits:

* continual feed through all phases of the cycle increases capacity up to 25% over a conventional SBR plant;
* even distribution of the influent to all basins results in a simple time based control system, preferred by operators for its reliability and consistent high quality of final effluent;
* the pre-react zone traps grease and other floating debris, enhances nutrient removal and prevents short circuiting, constant availability of BOD in the pre-react zone eliminates the need for RAS pumping and associated equipment;
* the superior actuated decanter design discharges only settled effluent, acts as an overflow protection device and allows for all maintenance to be carried out without draining the basins;
* diffusers offer high oxygen transfer efficiency, long life and low operating & maintenance costs;
* the very compact nature of the ICEAS SBR enabled the new treatment plant to be installed within the confined area of the existing site boundaries, thus avoiding the need for additional land purchase.

In addition to the SBR scope supplied and installed by ITT Sanitaire, the project scope also included two KSB Variable speed SBR feed pumps (Duty/standby, each supplying 376 l/s, two KSB fixed speed SAS return pumps. a new 11kV RMU and transformer supplied by L J Monks Ltd., a Lintott Tyco MCC plus a Hydroslide flow limiter as supplied by Copa Ltd. The project a;also included the refurbishment of the existing Longwood inlet screens.

Whilst the initial design brief was supplied by Scottish Water Solutions, the Purac-Leslie Consortium implemented design changes as agreed with them in order to reduce the total project costs. The main changes were to construct the SBR above ground (initial design was 50% buried) and a modification to the SBR feed arrangement that negated the need for a new distribution structure that would otherwise have been required and relocation of the SBR pump station to ease construction. During the detailed design Purac Leslie Consortium also elected to utilise COPa's Hydroslide flow regulator which was supplied complete with pre-benched double skinned GRP chamber. This change allowed the flow limiter to be installed in a short shutdown and negated the need to construct a new overflow chamber off line.

The new SBR plant construction commenced in April 2006 following on from the enabling works and the SBR undertook successful takeover tests which were completed on December 18th., 2006. ■

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