

Phillipshill WwTW – Upgrade

increasing treatment capacity & curing overloading problems

by Ross Tulloch BEng (Hons), CEng, MICE

East Kilbride, located just to the south of Glasgow, is the sixth largest town in Scotland. Since its designation as a new town in 1949, its population has grown to around 74,000. The principal waste water treatment works for the town is located at Phillipshill and has grown along with the town. The original works was built in 1960 and was extended in 1964 and again in 1972. The works consists of a common inlet works and two separate treatment streams both with primary and secondary treatment, that discharge to a common outfall. The plant regularly fails its discharge consent due to hydraulic overloading of the inlet works, problems with rising sludge and insufficient treatment capacity.



Phillipshill WwTW: New aeration tank access platform

courtesy: Scottish Water Solutions

Planned growth in the catchment area will result in a population equivalent for the works increasing from 46,766 to 67,590. In addition the Scottish Environmental Protection Agency (SEPA) have indicated that they intend to tighten the works discharge consent from 15mg/l SS, 10mg/l BOD and 30mg/l NH₄ to 15mg/l SS, 10mg/l BOD and 2mg/l NH₄. *Scottish Water Solutions*, the joint venture partnership formed by Scottish Water to deliver the bulk of its capital programme, was tasked with developing and constructing a solution.

The inlet works consists of fine screening, flow regulation and storm overflow, and flow distribution to the two treatment streams. The screenings handling systems are inadequate, resulting in the screens blinding and the inlet works being overtopped. There is no formula A flow control and the flow to full treatment regulator, which dates back to the 1950s no longer functions.

Older stream

The older treatment stream (phase A) has two primary settlement tanks, a six lane aeration tank and six final settlement tanks. The

existing air supply pipework is in very poor condition and the scrapers in the final tanks no longer function. There is no control over the aeration system, with the result that the mixed liquor is over aerated. The sludge has poor settling characteristics, resulting in high sludge blanket levels. Flows to the final tanks are currently restricted to prevent discharge of the sludge blankets. This results in drowning of the primary tanks and overtopping of the wall heads at the inlet to the aeration tanks.

Newer stream

The newer treatment stream (phase B) has two primary settlement tanks, a two lane aeration tank with vertical shaft mechanical aerators and two final settlement tanks. Sludge settleability is poor resulting again in problems with rising sludge. The problem is so significant that phase B is only capable of taking about 20 per cent of the total flow to full treatment. It was designed to take 40 per cent.

To keep costs as low as possible, SWS developed a solution that allows as much of the existing works as possible to be retained.

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Existing inlet works (FFT Weir) storm screen being overtopped

courtesy: Scottish Water Solutions

Phase B is currently being upgraded by the construction of a new 6000 m³ aeration tank. An anoxic zone has been incorporated to assist nitrification, in the aeration lanes, in removing ammonia. It also gives a reduction in the amount of oxygen required by the aeration process. A selector zone has been included within the anoxic zone to ensure that the sludge will have appropriate settling characteristics. Control over the fine bubble diffused aeration (FBDA) system will be provided by dissolved oxygen (DO) probes. Two new final tanks have been built to provide additional settlement capacity. The return activated sludge (RAS) system is being upgraded to allow increased RAS rates. The existing aeration tank is being retained and converted into a storm tank.

The phase A aeration tank will be retained but upgraded by replacing the aeration system in its entirety. Like phase B, a selector zone and an anoxic zone will be built onto the front end of the tank to improve the settling characteristics of the sludge, free up alkalinity to assist with ammonia removal, and improve the efficiency of the aeration process. DO probes will be installed to provide control over the FBDA system. Four of the six final tanks will be retained and new half bridge scrapers installed. Due to the steep slope on these tanks (about 30 degrees), chains will be used instead of scraper blades, to reduce the need for access. The RAS system will be automated.

Hydraulic problem solved

The hydraulic problems at the inlet works will be solved by the construction of a formula A overflow to restrict flow to the inlet screens. This will discharge to the new storm tank formed from the decommissioned phase B aeration tank. A new inlet screen, to allow full duty/standby operation of the screens is to be

installed and the screenings handling system will be upgraded to solve the problems with blinding. The existing flow regulator will be removed and an actuated penstock installed to limit pass forward flows to the required flow to full treatment rate.

Construction of the new works is being carried out in a phased manner to allow the existing plant to be operated and to bring an additional treatment capacity on line as quickly as possible. The new phase B final tanks and RAS system were commissioned at the beginning of June 2005. Work on the remainder of phase B is well advanced, with the new aeration tank substantially complete and commissioning due in October 2005.

Inlet works

Alterations to the inlet works, which are being carried out parallel with Phase B reconstruction, will be complete by the end of August 2005. On successful commissioning of the new aeration tank, the entire flow to full treatment will be diverted to phase B, to allow work to commence on phase A, which is scheduled for completion by the end of April 2006.

The project has been designed and constructed by an SWS in-house delivery team consisting of *Scottish Water design staff* and *MJ Gleeson* construction staff. Specialist consultants have been engaged as necessary. An integrated approach has been taken, with *Gleesons* staff heavily involved in the design process. Design improvements have resulted in a £1.3m saving on the target cost. The project has shown that SWS approach to partnering can result in significant efficiencies in the delivery of capital projects. ■

Note: The author of this article Ross Tulloch, is Design Lead, *Scottish Water Solutions*.



Construction of new aeration tank

courtesy: Scottish Water Solutions



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