

£20.6m Linwood Johnstone Rationalisation aids Scottish Water's operational & environmental objectives

by

Phil Sheridan BEng (Hons), CEng, MICE

Black Cart Water is a tributary of the River Clyde with major wastewater treatment facilities along its length at Johnstone (pop 23,000) and Linwood (pop 38,000). The two works also treat waste from local sources, including a tannery and a whisky distillery. Both plants fail to meet current standards because of a number of problems, including periodic high river levels at Johnstone that block the outlet channel. Discharge standards are expected to rise significantly in the Environment Protection Agency's (SEPA) action plan to clean up the River Clyde. To improve its operational efficiencies – Scottish Water determined to rationalise its wastewater treatment facilities for Linwood and Johnstone through the Linwood Johnstone Programme that wastewater treatment facilities for Linwood and Johnstone will be replaced by a single new plant at Erskine.



- 3D Model of Erskine WwTW - after completion

courtesy Biwater Treatment

Preferred option selection

The appraisal exercise to identify the lowest whole life cost solution, which included value engineering and risk assessment components was carried out by a fully integrated partnership between Scottish Water Solutions and *Biwater Leslie (the Joint Venture of Biwater Treatment Ltd and George Leslie Ltd)*.

Amongst the scenarios considered was to upgrade the existing works, but this was found to be excessively costly and raised concerns about the feasibility of meeting future consents.

The option recommended by the project team (and adopted by Scottish Water) was to discontinue treatment at Johnstone and Linwood, replace the works with pumping stations to transfer flows to Erskine WWTW, nine kilometres downstream on the River Clyde, and to refurbish and extend Erskine to provide the necessary additional capacity,

Benefits of the recommended option

By making use of the storm structures and outfalls at Johnstone and Linwood and the facilities at Erskine, the proposal meets the stated capital and operational objectives in a process efficient manner, effectively combining three plants into one. Environmentally, it contributes directly to the clean-up of the Black Cart by avoiding effluent discharges into its waters completely.

All the land on which the redevelopment takes place is already owned by Scottish Water, so there are no real issues with respect to planning consents.

A final benefit is that Erskine is adjacent to the Dalmuir to Shieldhall sludge pumping main, which will reduce handling costs by eliminating tanker movements to and from the two redundant works.



Erskine FST bridges under construction



Erskine site before refurbishment and extension

Contract scope and cost

The contract for implementing the entire project was awarded to *Biwater Leslie* on a cost reimbursable basis at an Agreed Target Cost of £20,560,452 – 24% less than the initial capital allowance in the project brief. It encompasses the manufacture, delivery, erection, installation, commissioning and testing of all process, mechanical, civil, electrical, instrumentation and control plant. Contract conditions are in accordance with the IChemE 'Green Book', with an agreed pain/gain mechanism

The scheme has been designed to meet the following asset management needs:

- * treatment for the Linwood and Johnstone catchments to meet current and future discharge standards;
- * removal of the discharge and flooding problems experienced at Johnstone WwTW;
- * provision of appropriate storm storage and overflow facilities at both locations;
- * rationalisation of treatment facilities across the Renfrewshire area to improve operational efficiency;
- * opportunity to address asset efficiency and safety issues, particularly at Erskine, where mechanical and electrical items are close to the end of their design life;
- * assurance of legal compliance with discharge standards.

Pumping arrangements

At Johnstone, the new pumping station has gravity inlet flow via the existing inlet channel. The storm storage tanks are being refurbished for temporary storage of all peak storm flows above 465 litres/sec, with a two hour retention time and a minimum capacity of 1000m³ in line with Scottish Development Department guidelines.

The storm overflow uses an existing outlet from the storm storage tanks via a 6mm unpowered screen to discharge all flows above the designed volume for transfer into the Black Cart Water. There are two storm return submersible pumps, each capable of returning storm flows to the pumping station for transfer to Linwood when flows are above Formula A via a 2.2km 500mm dia GRP pumping main.

The semi-permanent wet well pumping station is a circular, smooth bore shaft construction with three submersible pumps installed on twin guide bars with automatic connection to discharge.

A bund is being erected around the works to prevent flooding in a temporary or permanent condition. Arrangements at Linwood pumping station are broadly similar, receiving gravity and pumped feeds from Johnstone and other sources and transferring them to

Erskine via a 7.0km 900mm dia GRP pumping main.

Enhanced treatment facilities

New facilities at Erskine begin with overflow chambers for the Linwood and Erskine flows, with a 6mm un-powered screen for flows greater than Formula A.

The new covered channel inlet works has 6mm screening on a Duty/Duty/Standby basis with a 25mm bar screen and a manually raked by pass channel.

Screenings are handled through a launder channel and macerator, followed by dewatering and compaction and transferred to an odour controlled skip; and grit removal using a crossflow detritor with a bypass channel, grit rake and classifier delivering to an odour controlled skip.

There is a new FFT chamber and aeration distribution chamber and aeration lanes have been refurbished with the addition of an extra lane. Final settlement is carried out in four new 30m diameter tanks, with secondary treatment to 20BOD 30SS and final outfall into the River Clyde.

Stormwater capacity has been increased by refurbishing the existing storm tank and converting the existing primary settlement tanks to the same purpose.

Sludge facilities include a new RAS/SAS pumping station, new SAS tank and new building housing Ram pumps to transfer 0.8-1.3% ds sludge into the existing Greater Glasgow sludge pumping main to Shieldhall.

The plant is designed for a flow of 136.8 MLD and a loading of 373 BOD 560 SS.

Mains laying

There are a large number of obstacles along the route of the pipelines between Johnstone, Linwood and Erskine, among them the A8 and M8, the Glasgow to Greenock rail link and two river crossings – the River Gryfe and Black Cart Water itself. In these and most other cases (where the presence of many other underground services was often an issue), specialist techniques such as auger boring were used.

Progress

The letter of award was dated 19 March 2003 with a completion date of 21 July 2005. Completion is forecast for February 2005. ■

Note: The author of this article, Phil Sheridan, is a project manager, Biwater Treatment