

£10m Braystones, Nethertown, St Bees Scheme 'greenfield' WwTW for United Utilities on west Cumbria coast

Braystones WwTW scheme, located in West Cumbria, incorporates the construction of a greenfield sewage treatment works, as a result of the EU Urban Waste Water Treatment Directive, and will treat wastewater from the villages of Egremont, St Bees, Nethertown, Thornhill, Beckermest and Braystones. At present sewage from these villages is discharged to sea with little or no treatment, with St Bees being the exception and receiving full treatment. The project consists of modification of the St Bees WwTW and construction of three new off site pumping stations. A new transfer main is to be constructed which will connect the pumping stations from Nethertown and St Bees and carry all of the sewage to a new works at Braystones.



Braystones WwTW under construction

photo courtesy Carl Bro

The transfer main has been designed in-house by *United Utilities* and will be constructed by their framework mainlaying contractor, *Cheetham Hill*. Off site pumping stations and the treatment works itself are to be designed and constructed by *HMB Alliance* with *Carl Bro – Mott MacDonald Joint Venture* acting as designers.

The new works site, located approximately 1km south of Braystones village, is constrained by a local railway, Warborough Nook (a 18m high escarpment) and the River Ehen. It is located adjacent to the existing short sea outfall for the Egremont sewer network.

The existing St Bees WwTW treats a population equivalent of approximately 2,000 people and incorporates primary screening and settlement before discharging via a sea outfall that terminates short of low tide level. Upon completion of the works, screened sewage will be dosed with Calcium Nitrate, in order to reduce the potential for septicity and odour within the downstream rising mains. It will then be pumped at a rate of 40l/s to the Intermediate Pumping Station, located approximately 2km south of St Bees. An intermediate pumping station is required between St Bees and

Nethertown. St Bees PS discharges at 40l/s, this is required to maintain velocities in the steep pipework whilst the intermediate pumps, operating rate 23 l/s, control pass forward flow.

There are no existing treatment facilities at Nethertown, a population of approximately 100, and crude sewage is discharged into the Irish Sea via a short outfall. Sewage transferred from St Bees and from Nethertown will be collected in a new pumping station to the north of Nethertown village; this site will also have additional storm storage to help control the flow passing on to Braystones WwTW and therefore minimising storm overflows at the works. The pumps will operate on a duty/standby operation and pass forward 33 l/s.

The Braystones catchment area includes the villages of Egremont, Thornhill and Beckermest as well as Braystones village itself and has a combined population of approximately 10,000. Flows are currently discharged untreated to the sea via a short outfall at the low tide mark. The construction of a 2km long sea outfall, adjacent to the short sea outfall, was finished in 1994, but this has remained unused since completion.

The treatment process at Braystones WwTW site consists of screening both for FTFT and storm flows. Excess storm flows will then pass directly to the Outfall Pumping Station, while during normal conditions the screened sewage will pass through a grit removal process followed by the Compact Activated Sludge Plant. The CASP is based on the 'tank within a tank' principle whereby the outer ring forms the Aeration Lane and the central area acts as the Final Settlement Tank. Surplus activated sludge arising from this process will be thickened on site using a polymer dosing process before being taken off site for disposal.

After initial pumping through the primary screens the hydraulics have been designed such that the remainder of the treatment process runs under gravity. However, during periods of high tide the final effluent from the site must be pumped to discharge via the long sea outfall. The short sea outfall is also to be retained as an overflow for the Outfall Pumping Station and the site as a whole in extreme storm conditions. In addition, provision has been made for the future installation of UV disinfection.

The new works will have the capacity to accommodate a flow to full treatment of 81 l/s and a storm flow of 440 l/s. Consent for the new works is SS 45mg/l and BOD 30mg/l on a 95%ile basis. However, the design effluent quality is SS 18mg/l and BOD 12 mg/l.

Inlet pumping station

A connection will be made to the existing outfall sewer from Braystones and flow will be diverted into the inlet pumping station. Variable speed pumps operating on a duty/standby basis will pump flows up to 81 l/s to the inlet works. When this flow is exceeded three submersible pumps operating on a duty/assist/standby basis will pump storm flows up to 440 l/s to the storm screens.

Inlet works

6mm screening will be achieved by two Helical Screw Inclined Screws operating on a duty standby basis. Grit removal will be via a *Jeta* grit trap and screw grit classifier. Storm flows will be screened before discharge into the Outfall Pumping Station by two high capacity Helical Screw inclined screens, these also operate on a duty/standby arrangement.

Biological treatment

Inflows from the inlet works, Return Activated Sludge (RAS) and Returned Liquors will pass through a 60m³ selector tank providing 20mins retention at FTFT to condition the activated sludge. Biological treatment will take place in two extended aeration units. The outer walls of the CASP units are 27.5m in diameter with the

internal walls of the Final Settling Tank (FST) at 15.5m diameter. Aeration is supplied by three submersible fine bubble diffusers operating on a duty/assist/standby operation mode. Surplus Activated Sludge (SAS) and scum removed from the (FST) will be collected for sludge processing.

Outfall pumping Station.

Final effluent is discharged to the Outfall Pumping Station where it is pumped by two variable speed, suspended bowl pumps (operating on a duty standby basis), to the long sea outfall. Storm flows are pumped from the outfall pumping station by three submersible pumps (on a duty/assist standby operation), each discharging 230 l/s. The outfall pumping station will also be used to purge the Outfall, flushing the pipe on a regular basis. The risk of surge in the outfall is controlled by the landfall chamber. This controls air released from the outfall pipeline and minimises surge pressures. There will be an emergency overflow from the outfall pumping station via the existing short sea outfall.

Sludge processing

Sludge produced on site will be stored and thickened with polymer dosing equipment. Thickened sludge will be tankered from site for further treatment. Odour control will be provided on the sludge storage tanks.

Construction issues

The site is known to be a natterjack toad habitat and the project will incorporate toad protection measures i.e. all open tanks will have a minimum 300mm upstand and new artificial breeding pools will be built adjacent to the site. A toad exclusion fence has been erected as part of a pre-start monitoring programme to establish that the toads were excluded before construction work commenced. The fence will be maintained throughout the construction period but will be removed after commissioning.

Restrictions on construction work adjacent to the railway and potential modifications to ground levels to the west of the site have necessitated modifications to the original design. Railtrack have also restricted movement of cranes in the vicinity of the railway and monitor construction on a daily basis.

Construction began at the Braystones site in November 2003 and is due to finish October 2004, with handover to United Utilities early in 2005. ■

Note: *The Editor and publishers thank Carl Bro for providing the above article for publication.*

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