

Mogden STW East Side Improvements

a £15m refurbishment project for Thames Water

by
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Mogden Sewage Treatment Works is a Thames Water site located in the shadow of Twickenham Rugby Ground, Twickenham, west London. It is currently capable of treating 690MLD of effluent. The aim of the Phase One Improvements is to increase the capacity of the existing plant to 790MLD by converting redundant primary settlement tanks to provide increased final tank capacity.



View across Final Settlement Tanks

Courtesy of Biwater Treatment Ltd

Background

Mogden Sewage Treatment Works was built between 1931 and 1935 on a 120 acre green-field site to replace several smaller works in the then expanding west London area.

Today the works serves a large proportion of west London, and is undergoing improvements to increase its sewage treatment capacity by more than 50 percent. This will significantly reduce the amount of storm sewage that overflows into the tidal stretches of the River Thames when the site becomes overloaded after heavy rainfall. The improvements will also help the company to meet tighter effluent quality standards set by the Environment Agency.

The work is being carried out in two phases:

- Phase 1, which is almost complete, will increase the site's capacity by 100MLD by utilising redundant assets, and is being carried out by Biwater Treatment Ltd;
- Phase 2, which is due to start shortly, will increase Mogden's capacity by 274MLD through building additional treatment equipment.

Project Description

In February 2007 Biwater Treatment Ltd (BTL) was awarded the role

of Principle Contractor responsible for the detailed design and construction of Phase 1. A summary of Phase 1 is as follows:

- The refurbishment aspect of the project consists of the refurbishment of 40 No. FST tanks;
- The complete replacement of a further 24 No. FST bridges;
- The replacement of various existing RAS pump-sets;
- The automation of the FST Outlet Bell-mouths;
- In order to increase the capacity of the works, 8 No. redundant PST Tanks have been converted into FSTs;
- 3 No. Standby Diesel Generators are provided to provide a back-up power supply for the project works.

The work has included all new MCC Panels and upgraded SCADA control to allow the Operators greater control over the existing works.

The refurbishment works

40 No. FST tanks were refurbished in pairs in order to minimise the impact on plant treatment capacity. The seventy year old tanks were found to be in good structural condition, a programme of cleaning the hoppers and pipelines led to improvements in flow through the FSTs. At the same time the half bridge scrapers had their consumable items such as Scraper Chains and wheels, replaced to improve performance.



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24 No. FST tanks had their existing bridges replaced completely by Half Bridge Type Chain Scrapers. The old Scrapers consisted of a simple tube support for the Chain with a drive carriage at the rim. This system did not allow for easy access to the centrally located Slip Rings which had subsequently led to numerous failures not being rectified.

At the same time the opportunity was taken to replace the existing FST Outlet Flow Control Bell-mouths with new automated ones allowing Operators to control the throughput of all FSTs at the touch of a button.

6 No. RAS pumps had to be replaced on the 'East' side of the works. The existing pumps were located in a dedicated pumping station with no room for expansion. In order to overcome this, new locations for the replacement pump-sets were created by converting space within an existing subterranean gallery into two new dedicated Pumping Stations.

In order to service the new pumping stations, new lifting gantries had to be erected to allow transport of the pumps between station and roadway.

A seemingly minor part of the scope of Phase 1 was that of the connection of new pumping station 4B to the existing feed channel. It had originally been envisaged that this works would be undertaken by briefly shutting down flow to the feed channels to allow for the installation of a stanked-off working area at which point an interconnecting slot could be made in the wall separating the pumping station and feed channel. In the event, due to the necessity to keep the plant operational without interruption, an alternative method for creating a dry working area within the channel had to be sought. To complicate matters further the channel had concave radii at its base, corbels at its top and the added complication of an air pipe fixed to one side. The profile of the channel could not be ascertained because it was submerged under a metre of sludge.



Mogden Battery C RAS Pumps Located within Subterranean Gallery *Courtesy of Bewater Treatment Ltd*

Bewater Engineers hit upon the idea of using cryogenics (liquid nitrogen) to seal a loose fitting stank that then created a watertight and mechanical seal that allowed the sewage to be pumped out. This allowed diamond cutting work to continue in a safe and dry environment. An estimation of the radii was used to design the stank which then had copper pipes fixed around its perimeter to allow the liquid nitrogen to pass around the edge to form the frozen seal. Bishop Pipe Engineering were sub-contracted to provide the freezing technology. The temperature of the edge of the stank was reduced to around -177°C, measured by thermo-couplers fixed around the frame. Having achieved a safe seal around the stank, work commenced on diamond saw cutting the slot in the channel.

A further 6 No. Canister Type RAS pumps had to be replaced on the 'West' side of the works. In this instance the replacement was more straightforward. The new pumps had to be installed in the same locations as the old pumps, these being located in another subterranean gallery serving the Aeration lanes. The location and age of the existing assets presented a challenge to the Project team that was overcome through accurate design of replacement assets and effective on-site management of the replacement works.

During the course of the refurbishment works, 3 No. new MCCs were also provided allowing the retirement of some distinctly antique Control Centres.

PST – FST Conversion works

The conversion of the PSTs would present the greatest challenge to the project Team. With the plant process running from 'North' to 'South' the redundant PSTs were located at the North of the site and the existing FSTs with their feeds from the Aeration Lanes and final effluent outfall connection located at the South end. In order to overcome this, new pumping mains were constructed to feed in Mixed Liquors from the Aeration lanes and return RAS back. The site was already well developed with space both above and below ground at a premium. To avoid the disturbance to buried services the new mains have been run at ground level only going underground to cross the site access roads.



Mogden New Mixed Liquor and RAS Return Rising Mains

Courtesy of Bewater Treatment Ltd

The location of the Mixed Liquor Feed Pumps created a maintenance issue. In order to overcome this, an overhead gantry was constructed to allow plant for the pumping stations to be lifted out and transported safely to the nearest access roadway.

The remaining challenge was to connect the new FSTs to the existing effluent outfall. The existing outfall collects the combined flows from all the existing FSTs before running eastwards and then northwards to the North-East corner of the site. The main outfall away from the works flows out here and onto the River Thames some 5 miles away.



Maintenance Gantry for Mixed Liquor Pumping Stations

Courtesy of Bewater Treatment Ltd

A new connection direct to this main outfall was planned by the Project Team. The result is a 134m DN1500mm main constructed by tunnelling and pipe-jacking at a depth of 7m in order to avoid existing buried services and damage to an established tree line used to shield the works from the view of local residents.

The final connection breakthrough works were undertaken by a specialist diving team so that the rest of the plant could be kept in continuous operation. The work was undertaken from the 'dry' side of the breakthrough, within the newly created pipeline. The Dive team were harnessed to prevent them being 'washed away'. During a low tide period, the dive team began to break their way through a long established brick wall separating two sections of the existing culvert. During the course of this work the opportunity was taken to remove a host of redundant services that had built up around the FSTs over the years.

Standby Generation

With the increase in automated plant a need for additional standby

generation had been identified. 3 No. 2000kVA Continuously Rated Containerised Generators and a 135,000 Litre Fuel tank have been installed on site. At time of writing the Generators are currently being commissioned and incorporated into the plant Ring Main.

Summary

At the time of writing, commissioning of the Phase 1 Improvements is under way. Flows have commenced through the 8 No. new FSTs and are being increased gradually to ensure there are no detrimental effects on the performance of the works due to divergence of flows. The Phase 1 Project team have successfully upgraded an active Sewage Treatment Plant with no shutdowns and only occasional, minimal reductions in Plant outflow capacity.

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New Scraper Bridge installed in existing Final Settlement Tanks

Courtesy of Bewater Treatment Ltd



Pumping station 4A and Overhead Gantry

Courtesy of Bewater Treatment Ltd