

Durleigh WTC

Wessex Water's flagship clean water project

by Sam Richards BSc

Durleigh Water Treatment Centre is located approximately 2km west of Bridgwater, Somerset and is Wessex Water's second largest surface water treatment works serving a population of 44,500. The site was originally designed to treat up to 28.5 Ml/d, with water drawn down from the 959,000m³ Durleigh Impounding Reservoir. Raw water quality has deteriorated in recent years and the condition and design of the existing plant means the works is unable to produce compliant, treated water at its design capacity. Optioneering and feasibility studies were carried out and determined that refurbishment was required.



Main treatment building with Vessco RGFs installed and Powerrun Pipe-Mech pipework underway - Courtesy of Wessex Water

Existing works

The existing site's main treatment processes consisted of two streams of flocculation and dissolved air filtration (DAF), then pumping through 11 (No.) sand pressure filters (RGFs) and onto the final stage of 8 (No.) granulated activated carbon filters (GACs). The flow then entered the treated water contact tank before finally being pumped through a UV treatment system and onwards to the nearby distribution reservoir.

Chemical treatment applied in stages across the process included sulphuric acid and aluminium sulphate for pH adjustment and coagulation pre-DAF, sodium hypochlorite post DAF, sodium hydroxide pre-RGFs and finally disinfection with chlorine gas post GACs. Orthophosphoric acid and sodium hydroxide were dosed for plumbosolvency control and pH adjustment post contact tanks.

Project delivery

The project is being delivered by Wessex Water's internal construction department Engineering and Sustainable Design

(ESD), who will be delivering both the civils and MEICA elements, with specialist contractors engaged as necessary. It will be the largest single value scheme delivered internally with a forecast spend of £50m and programmed for completion April 2022.

BIM/digital delivery

The project is the first to be delivered by Wessex Water to BIM lv.2 compliance. In 2015 a team of internal and external designers began the optioneering and outline design phase. In 2017 the detail design package was tendered with AECOM being appointed. AECOM's industry leading expertise in the water sector and BIM/digital delivery enabled the smooth and efficient completion of the design. The digital design has been completed using the Autodesk suite of products, whilst Bentley's ProjectWise software has been used for the Common Data Environment.

New works

The reconstructed works is designed with an output range of between 5 and 30 Ml/d. Due to the age and condition, 85% of the



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existing assets are to be de-commissioned and removed with 75% of buildings and structures demolished and replaced.

Areas of the site that remain include buildings housing the treated water tanks, UV treatment, distribution pumps and chemical storage and dosing. A building which previously housed the wastewater return pumps and the external concrete wastewater tanks are being re-purposed.

The building will now house the poly dosing plant, pumps and blowers for the GAC plant and new reservoir return pumps whilst the existing wastewater settlement tanks are being refurbished to allow for the installation of two new lamella units. These will sit on top of a new concrete slab cast above parts of the existing tanks. New compartments will be created in the tanks to provide sludge storage and a separate chemical spill bund.

The newly constructed assets are split into three main areas: main treatment building (MTB), interstage pumping building and GACs and waste area, whilst the existing reservoir tower and chemical building areas are being refurbished. Both the MTB and interstage buildings are steel frame buildings utilising the Securiclad security rated wall panelling systems. This provides an element of modular construction reducing the time required on site for installation.

Main treatment building (MTB)

The MTB contains three DAF streams flowing into 6 (No.) RGF tanks. The process in the MTB is gravity fed. To ensure even hydraulic flow the DAF tanks have a single inlet and outlet tank with the RGFs being fed via a large inlet weir trough. All these elements have been manufactured offsite in stainless steel by Vessco Engineering Ltd.

Also, within the MTB there are numerous chemical dosing points including aluminium sulphate, sulphuric acid, sodium hydroxide and sodium hypochlorite. The flow leaves the MTB and enters the low lift sump within the Interstage building.

Interstage pumping building

The interstage building is a complex area which consists of numerous, separate, below ground concrete tanks: clean backwash, dirty backwash, pump dry well and low lift sump. The interstage pumps lift the flow through 6 (No.) new manganese filters and then onto the 9 (No.) new GAC vessels; as with the tanks in the MTB these vessels are manufactured off site in stainless steel. The dirty backwash water is also pumped across the site to the new lamellas.

During the design process geotechnical reports identified that artesian water pressure could be an issue during the construction of the below ground interstage structure. The final design consists of a secant wall (with some 200 (No.) CFA piles) and a substantial base slab.

GAC and waste area

Around the GAC and waste area, new works consist of the erection of 9 (No.) new GACs, a concrete clean water backwash tank and modifications to the existing wastewater tanks. The GAC and backwash tank concrete slab are supported by CFA piles.

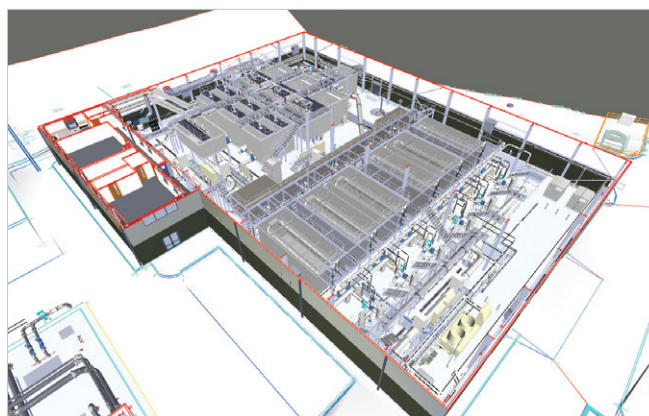
To allow the lamellas to sit on the existing wastewater tanks, additional walls are required within the structure and a new soffit slab above.

Chemical building

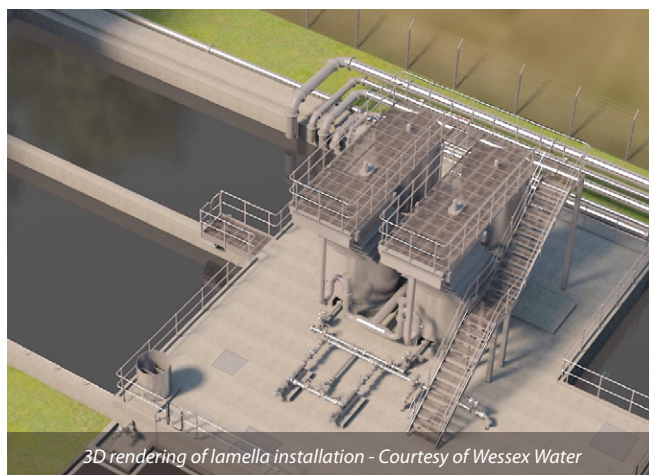
The existing chemical building houses the contact tanks, UV treatment, chemical storage and dosing, MCCs and distribution pumps. All M&E elements are being replaced with only the chemical storage tanks and bunds and contact tanks remaining. These are all undergoing a major refurbishment. Adjacent to the chemical building, a secure compound has been created for the new transformer required as part of the upgraded 11Kv power supply.



Existing Durleigh WTC prior to demolition - Courtesy of Wessex Water



Main treatment building model from Navisworks
Courtesy of Wessex Water



3D rendering of lamella installation - Courtesy of Wessex Water



GAC area progress - Courtesy of Wessex Water

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Excavated lowlift pumping area (LPA) with single concrete pour for base in progress - Courtesy of Wessex Water



Lowlift pumping area progress with MGF propping beam removed - Courtesy of Wessex Water



Main treatment building with Vessco RGFs installed and Powerrun Pipe-Mech pipework underway - Courtesy of Wessex Water



3D render from BIM model of completed site - Courtesy of Wessex Water

Progress

At the time of writing (September 2020), the project is well under way on site with a scheduled water into supply date of 31 March 2022. Since the construction teams mobilised in September 2019, closely coordinated site management has ensured efficient and safe working practices are adhered to, enabling the teams to successfully deliver challenging programme commitments throughout this complex and large scale construction project. Due to restricted space within the original works site, the site office compound and storage areas have been created in land adjacent to the works, across Enmore Road. Access to site the site is via a pedestrian bridge.

Full demolition of the site has now been completed by specialist demolition contractor RM Penny. Around 5000 tonnes of demolition material have been recycled for reuse on site. Bulk excavation of the MTB area is complete with 2800 tonnes of soil removed to allow the construction of a 2500m² multi-level slab. Roger Bullivant Piling installed 215 (No.) CFA reinforced piles allowing Carney Construction to progress reinforcement and concreting works. The MTB has required 380 tonnes of steel reinforcement installed with 1750m³ of concrete poured to create the base of the MTB structure. The stainless steel RGF tanks have been delivered with the remaining DAF tanks scheduled for delivery during September 2020.

The secant piled wall was installed by Dawson Wam. A capping ring beam was then cast in situ and to provide support to the excavation extensive temporary works were installed. This included a large central prop spanning 28m with a loading of 1850kN. Approximately 5200m³ of material was excavated. With the excavation complete the base slab was cast, this was undertaken in one continuous 880m³ pour. Once cured the large prop system could be removed. Further reinforced concrete works to create the internal tanks, are ongoing.

Piled foundations and reinforced concrete base for the GACs is complete and 9 (No.) GAC vessels are installed. Construction of the GAC clean backwash tank is complete. Mechanical and electrical installation has commenced with pipework, access staircases and walkways, all manufactured by Berry & Escott, interlinking GAC vessels and the clean backwash tank.

The concrete works within the wastewater tanks were also completed enabling the installation of the two lamella units and associated pipework.

De-commissioning and removal of all redundant plant and equipment within the existing chemical building is now complete with two new MCCs, supplied by general panel systems, installed. Further mechanical and electrical fit-out is scheduled to start imminently.

Scheduled works moving into 2021

Over the next few months and moving into 2021, scheduled works include completing the installation of the DAF tanks, completion of the concrete tanks and soffit in the lowlift pumping area (LPA), erection of the building steel frames and installation of the security cladding for both the MTB and LPA. This enables the installation of the two remaining MCCs and allows the mechanical and electrical installations to commence in both buildings. The GAC and waste areas are due to be completed by early 2021.

Further case studies covering the remaining construction and commissioning of Durleigh WTC will be published in future edition of UK Water Projects and on www.WaterProjectsOnline.com.

The editor and publishers would like to thank Sam Richards, Assistant Project Manager with Wessex Water, for providing the above article for publication.

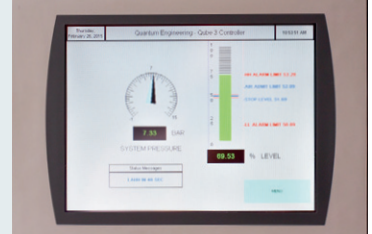
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