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Oxford STW – Digester No.2 Upgrade

End User: Thames Water

Client: Thames Water

Project Value: £2 Million

Contract Duration: 1 year

The Oxford Digester is a key asset for Thames Water and is a crucial part of the sewage treatment process. Its purpose is to manage sludge and waste-producing biomass (used for heat generation). It is critical that sludge waste is processed and digested efficiently, so that the resulting 'digestate' product can then be recycled and used as a form of fertilizer.



Figure 1 - Digester before start of work.

Scope:

Due for completion in July 2021, **GEL's** role of Principal Contractor and designer; having the responsibility for the construction and design of the fully upgraded infrastructure. Prior to commencing the project, a full operational & maintenance review was undertaken in conjunction with Thames Water, to ensure an outcome that meets all their operational requirements; resulting in **GEL** being able to offer a full in-house engineered solution, from design through to civils, mechanical and electrical.

Benefits:

The resulting benefits for Thames Water will be an asset with a further circa 25-year design life, incorporating increased capacity, thus maximising efficiencies (which can be realised through bio-gas production); ultimately, meeting stringent operational, maintenance and safety standards. This aligns with their strategic bio-gas reduction requirements in helping to reduce Thames Water's overall carbon footprint.

Potential project challenges:

The project is adjacent to another 'live' digester asset, and on a fully operational site, therefore challenges included:

- Demolition/working at height – removal of the digester roof, constructed in the 1980's, from a tank constructed in the 1950's. The lifting operations to manage this activity saw the roof lifted off in sections weighing up to approximately 6 tonne each.
- The removal of a 12m-high, free-standing column and refurbishment of the existing concrete structure.





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- Future-proofing subsequent access requirements for maintenance.
- Traffic Management – Thames Water office access directly through the centre of the project site/tight footprint.

Managing the risks

In light of the potential project challenges, **GEL's** approach to managing risk encompassed several strands; a full Hazard & Operability Analysis (HAZOP), to identify potential hazards both in the build and the subsequent upgraded plant & process was undertaken. **GEL** also undertook an operation and maintenance assessment to ensure that the new plant and equipment could be operated and maintained safely. **GEL** also adopted a DFMA (Design for Maintenance & Assembly) approach, for the construction of a 4m deep sludge outlet chamber which reduced the construction programme by 3 weeks, and significantly reduced working at height challenges – with obvious health & safety benefits for our teams. CFD Modelling (Computational Fluid Dynamics), was adopted to verify the performance and efficacy of the new sludge mixing system.

GEL also produced an in-house control philosophy and design specification to encompass all aspects of the civils/mechanical & electrical design with inputs from a large design team, resulting in a functional design specification for the upgraded asset which fully aligns with Thames Water's operational requirements.



Figure 2 - Upgrade in progress.



Figure 3 - Attachment of inner membrane



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Project Phases to date

1. Safe removal of digester roof
2. Demolition of 12m high free-standing column – safeguarding the existing structure
3. Demolition of approximately 72 linear metres of existing wall section using specialist wire sawing concrete cutting technique
4. Design & Construction of a new wall extension, capable of withstanding loads from the new structure
5. Sludge Chamber – installation of new drainage system, ensuring Thames Water Operations can comfortably operate and maintain the new digester mixing system
6. Installation of the new MCC – designed to operate & control the upgraded digester 2, with capacity for future expansion for digester 1.
7. Designed & Constructed new plinths and footpaths to allow safe access to all pumps, plant and equipment
8. Fabricated in-house (off-site) and subsequently installed a 360°, 70m access platform around the perimeter of the new structure for improved maintenance access
9. Installation of the new digester mixing system incorporating new 15Kw 'Positive Displacement Chopper Pumps', capable of dealing with rag and grit in the harsh sludge environment.
10. Application of specialist coating to extend the life of the asset.



Figure 4 - Upgraded Digester

Comments from the Project Manager

Commenting on the project to date, Brendan Ryan, **GEL** Contract Manager said; “This has been a multi-disciplinary project, which has provided **GEL** with an opportunity to demonstrate their expertise in design co-ordination, knowledge of operational requirements, specialist supply chain management, and our overall skill and capability to deliver a complex MEICA installation. Our in-house capability around design of & metal fabrication, has proved significant in eliminating risk and providing our client a great long-term access solution. I’m incredibly proud of all the teams that have contributed to and worked so hard to ensure the safe success of the project to date”.

