



Greenwich Pumping Station Inlet Penstock Replacements

Careful Planning and Implementation

End User: Thames Water

Client: Thames Water

Project Value: £800k

Length of contract: 6 months

Scope:

Thames Water Greenwich Pumping Station serves a 28mile² catchment area in South East London. To the rear of the pumping station is the Inlet Penstock Chamber (wet well). Within this chamber there are 5 no. penstocks which are used to isolate incoming and/or outgoing flows depending on operational requirements. The existing penstocks were installed in the early 1900's.

The existing 7' 7" diameter penstocks were made from cast iron. Cast iron can be difficult to inspect and certify as being fit for purpose as it can contain minute cracks within its structure. These small cracks, in safety critical assets, can lead to catastrophic failure events when large heads of water are being managed.

In 2017, the existing cast iron penstock on the western face of the 'old chamber' failed when subjected to off-seating pressure applied from the pumping station side. As such, an executive decision was made to suspend the use of these existing assets and replace them with new stainless-steel penstocks.

The scope of works required the replacement of five penstocks and actuators along with deck steelwork, flooring mesh and handrails. The project had a direct impact on the new Tideway CSO, as it was in close proximity to this wet well, and the new penstocks would provide safe and secure isolation for Tideway works to proceed.

Proposed solution:

Gel Engineering was awarded the project as Principle Contractor and Principle Designer working closely with Thames Water to design and deliver the optimum solution for the pumping station. It was noted at an early stage of the design that the existing deck steelwork within the chamber was unsuitable for both penstock replacement works and the provision of suitable access.





Gel Engineering elected to undertake a full 3D model of the wet well to inform the design stage.

Gel Engineering modeled the new penstocks in such a way, that it eliminated any conflict with in-situ assets during the removal and installation processes. This then informed the working methodology.

Upon inspection of the wet well, it was observed that the North wall of the chamber was in poor condition and badly deteriorated from constant exposure to H₂S. Whilst studying historic drawings of the chamber, **Gel Engineering** noted the absence of two structural arches within the chamber and the presence of a significant vertical crack in the brickwork. Core samples of the brickwork were taken and analysed to determine the extent of any deterioration which aided the decision to reinforce the wet well in advance of penstock replacement works. This led to the design and installation of a semi-permanent steel bracing structure which effectively emulates the original arches which had been removed previously.



Gel Engineering used diamond wire cutting to remove the existing penstock frames from the chamber walls. This method ensured that each penstock frame could be suspended from a gantry crane and cut clean from the wall without putting operatives at risk.

The Equipment:

- Penstocks – 4no. KWA KSA-HD Type Penstocks & 1no. KWA KSA-MD-RVS Type Penstock
- Actuators – 5no. AUMA Actuators





Figure 1 - FAT of KWA KVS-HD Penstock

Challenges Experienced:

Gel Engineering thrives on innovation and challenges - combined, these result in magnificent project delivery.

Greenwich PS Penstocks had many challenges some of which are outlined below:

Lifting Arrangements – The existing inlet chamber did not have a means of lifting to service the chamber. An assessment of the lifting requirements suggested it would be more economical to erect a 10t Gantry Crane to service the project rather than hire mobile craneage.



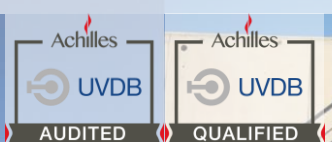
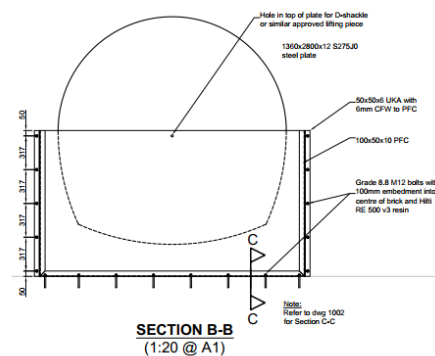


Structural Bracing – Gel Engineering designed and installed a bespoke steelwork bracing system to support the chamber. The installation was designed to be positioned without isolation of the flows beneath. Installation had to be cognisant of the removal of existing penstocks which had to be cut out to permit installation of new penstocks.

Combining knowledge of an absent original arch structure and detailed structural assessment; it was determined that the existing primary deck steelwork would now act in compression, thus help support the chamber's structural integrity. This added to the project complexity as the 'props' now had to remain and as such be navigated during the installation/removal phase.

Removal – Gel Engineering used an innovative approach to the removal of the existing penstocks. This involved utilising a diamond wire saw rig to cut the penstock frames from the chamber walls – this left a clean, smooth face upon which the new penstocks frame could be mounted.

Isolations – The project had to be split into three stages to allow the pumping station to operate whilst the project progressed, this allowed for some careful planning to achieve suitable isolations so works could proceed safely. All isolations were the responsibility of the Client however, there were challenges with achieving full isolation. Gel Engineering considered the issues faced and elected to design and fabricate temporary dam boards. The boards would contain residual flow, and beneficially, allow flow to weir over once increased thus mitigating any risk to the network and allowing works to proceed. In addition, the use of inflatable by-pass stoppers was incorporated to manage residual flows where necessary.





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Client Engagement:

Gel Engineering engaged with Thames Water regularly throughout the life cycle of the project, building strong relationships that ensured the project's success. From inception to design stage, through installation to commissioning we have engaged with the Client to ensure all their requirements were met.

Why this reference is comparable:

The Greenwich PS Penstocks Project is a fantastic example of the diverse range of ability within our business to provide the full CDM package. Minimising the stress and hassle from the client and giving them the confidence that problems will be overcome. Forward thinking and innovative ideas were implemented at every stage. **Gel Engineering** are capable of reacting, innovating and delivering this type of work. It demonstrates how **Gel Engineering's** ethos, culture, and decision-making activities follow the vision of Thames Water – Innovating for life in a changing environment.

The essence of **Gel Engineering** - Imagine, Innovate, Implement was captured throughout this project.

