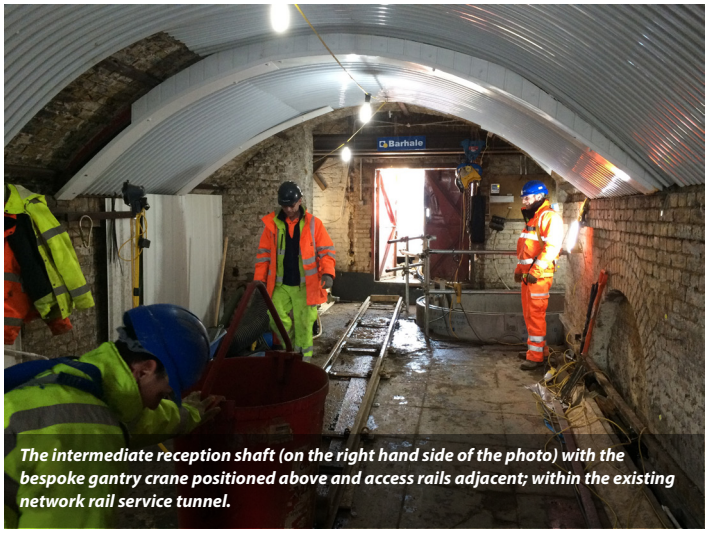
Barhale

Battersea Waste Water Connection

Client:	Battersea Power Station Development
Location:	Battersea, South London
Value:	£1.12m
Duration:	21 weeks

Barhale's site set up, in front of the iconic grade II listed Power Station.*



The intermediate reception shaft (on the right hand side of the photo) with the bespoke gantry crane positioned above and access rails adjacent; within the existing network rail service tunnel.

In Brief...

Original Scope

As part of the Battersea Power Station development in south London, Barhale were employed to construct a 70m long micro-tunnel to carry sewer flows away from the new development. The drive was required to run directly adjacent to a live railway, pass underneath a Network Rail service bridge and connect into one of the most critical combined sewer overflows (CSO) in south London.

Changes to Scope

Following the excavation of the reception cofferdam; designed to enable retrieval of the tunnelling boring machine (TBM), it was established that the existing sewer was not in the location shown on the drawings. Also, the area surrounding the sewer was overlaid by a dense zone of utility services including an Extra High Voltage (EHV) trough and large diameter potable water mains; consequently it was no longer possible to retrieve the TBM from the cofferdam.

Solution

Barhale engineered a solution that consisted of building an intermediate reception shaft (2.1m diameter) within the Network Rail subway tunnel, which would allow the retrieval of the TBM. From this intermediate shaft, the remainder of the tunnel connection into the CSO was completed through constructing a timber heading, which enabled the team to safely tunnel under the densely populated service area.

On the project Barhale were able to draw upon their wealth of tunnelling experience to develop innovative solutions to mitigate un-foreseen changes to the scope of works. Our proactive approach to potential problems saved the client time and money in delivering a very tight programme.

Customer Benefits...

- Provided several specialist design and fabrication solutions to overcome numerous site restrictions
- Carried out extensive stakeholder engagement throughout the works to ensure third party assets were protected and disruption was kept to a minimum
- Developed contingency plans through collaboration with Thames Water and Network Rail to ensure their requirements were met
- Undertook ground stabilisation techniques and monitoring to enable the works completion through water bearing ground

Technical Features...

Working Constraints and Innovative Design – Shaft Construction

While the revised scope provided the most feasible solution it also brought additional working constraints that required innovative design solutions and stakeholder liaison as detailed below:

Bespoke Gantry Crane

The Network Rail subway tunnel had just 3m of headroom, which meant that getting the segmental rings into the tunnel and then into the ground required bespoke designs.

Technical Features Cont...

The team laid a rail track from the tunnel entrance to the location of the shaft so the segmental rings could be transported in to the tunnel. This in turn also provided the egress for muck away leaving the tunnel. Due to the limited headroom within the tunnel it was not possible to use a traditional jacking system to sink the shaft down into the ground. As a result Barhale designed and fabricated a custom built gantry crane – spanning above the shaft location. These two innovations worked concurrently; the rings were brought into the tunnel on the rail, stopping directly underneath the gantry crane – adjacent to the shaft, the rings were then hooked onto the roller block and electric hoist, pulled out to the centre of the shaft and lowered into position. After which the rings were jacked down into position by having Kentledge weights lifted on top of them via the gantry crane. The shaft excavation was carried out entirely by hand – with the spoil loaded into a heading skip and lifted in and out of the shaft by the gantry crane.

Ground Stabilisation

The team also had to contend with a high water table (4m below ground level) and resultant bad ground. As the shaft was located in between two of the Network Rail bridge abutments there were concerns from the client that de-watering the excavation would cause adverse settlement around the bridge foundations. To combat this, Barhale worked closely with Network Rail and proposed the use of injection grouting around both the shaft and the timber heading (which was actually constructed below the water table). Extensive settlement monitoring was also undertaken by Barhale throughout the injection grouting phase; these measures resulted in the successful stabilisation of the ground around the new structures and prevented settlement to the existing foundations.

Connection into Existing Sewer

The existing sewer had to be kept on-line during the works due to its critical importance to the area. Following close liaison with Thames Water, Network Rail and other utility owners, Barhale devised a programme, which allowed the 450mm connection to be made to the existing sewer with minimum disruption to Thames Water's service operation.

This involved devising contingency measures for each phase of the works to mitigate the risk to stakeholders through programme delays and structural damage. These mitigations included:

- Installing temporary propping within the existing sewer prior to the coring in order to prevent structural failure.
- Completing the connection during night works, when 50% of the dry weather flow could be re-routed by Thames Water.

These works were carried out by a specialist Barhale team who were trained and experienced in 'high-risk' confined space environments.

Barhale's site set up, in front of the iconic grade II listed Power Station.*

Members of the team installing temporary propping in the existing sewer, prior to the connection.