

River Medina Rising Main Crossing

Southern Water's £1.2m project to renew a strategically important rising main on the Isle of Wight

by Adnan Naeeni BSc CEng MICE MCIWEM MAPM

The existing River Medina Rising Main ran from the Medina Road Pumping Station under Cowes Harbour on the Isle of Wight, 560m across the River Medina to East Cowes Esplanade, where flows were then carried on to Sandown WTW for final treatment. It is a strategic asset with no alternative flow management options, collecting wastewater flows from all of West Cowes. The 400mm main was constructed in 1986 using epoxy-coated, welded steel and was reaching the end of its operational life. Though there was no previous indication of failure, internal inspection of the pipe using sonar had indicated that it was showing signs of ageing.



Contract Manager Steven Knight with the various drilling heads used throughout the works- Courtesy of Southern Water

Undertakings

Due to the various activities on the River Medina, constraints were placed upon the timescales for the construction work to be carried. The specific requirement was that the work must be undertaken and completed during the winter season to avoid any impact on the Cowes Week Annual Regatta.

Southern Water appointed Clancy Docwra as main contractors to carry out a £1.2 million off-line replacement project, upsizing the previous pipe to a new larger capacity 500mm PE plastic pipe.

Design investigations

There were a number of factors that had to be considered as part of designing and preparing to construct in this area.

Directional drilling was the most obvious choice for this scheme, given that this approach had been used successfully to install the original main. Also this approach would cause the least disruption

to the area and the River. However due to subsequent property development on the western side of the river having taken much of the previously available working space, location options for the drilling rig were limited.

Ground conditions under the River were known to be clay with limestone inclusions, however, accurate data was limited with the most recent borehole data being from the construction of the original main.

A topographical survey below the water plotted a number of old jetty piles, which required designers Pritchard Wilmot to adjust the design to include up to four changes of direction, allowing the new pipe to be manoeuvred between the piles and away from the existing pipe. Another consideration which also required close liaison with the Harbour Commission was the possibility of unexploded ordnance, as Cowes harbour was extensively bombed during WWII.



Cowes, Isle of Wight
Courtesy of AMS No-Dig Ltd

On the eastern side of the river the existing rising main converged with the East Cowes main, and at the chosen target exit point the distance between the two live mains was under 2m, allowing a safe tolerance of around 0.5m either side for the drilling.

The depth profile of the new pipeline had to be designed to take into account possible dredging works in the future to facilitate any possible Harbour development. A steeper climb profile was also chosen to avoid contact with the existing assets; however the radius of the curves had to be carefully designed to give the specialist drilling contractors the best probability of success.

Solution

Different options for the drilling were considered for this scheme, such as wire-guided. However these were deemed unsuitable due to the drilling depth of up to 25m required under the river-bed; and also the large volume of traffic on the waterway including frequent car and passenger ferries.



The new pipe is slowly pulled through from East Cowes to West Cowes
Courtesy of Southern Water

The solution to ensure the best possible success in installing this line was to use an innovative drilling technique using a guidance system which incorporates a Gyroscopic Steering Tool (GST). Drill guide technology was used for this, which is one of the most advanced drilling techniques currently available, and is one of only 30 in the world, allowing pin point accuracy.

This approach ensures minimum disruption, enables highly accurate measurement of azimuth and pitch angles thus allowing continuous real-time drill-head location data, without the need for any over-the-surface monitoring. Additionally, with this technique the designer's coordinates were programmed into the drilling contractor's 3D model to give a detailed drill profile for the length of the pipe. A further benefit of this approach is the avoidance of the need for expensive and labour-intensive tunnelling under the riverbed.

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Construction phase

The installation of this pipeline was achieved in stages, with a pilot hole first being drilled around 25m below the riverbed, using 111 (No.) drilling rods. By using the GST the drilling team knew exactly where the drill head was at all stages during this drilling operation.

On completion of the drilling, the line was expanded and compacted, and the pipe pulled back through the hole into position using a reamer attached to the drilling rod.

Prior to the pipe being pulled into the hole, the entire 46 sections of 12m long pipe was laid out along the Eastern Esplanade at West Cowes. This allowed all the sections of pipe to be joined and welded together, so the entire length could be pulled through the hole in one smooth continuous operation.

There were some specific constraints to the construction which had to be addressed, for instance:

- Ordinarily a recycling unit would be positioned next to the drilling rig on the launch side to separate the excavated soil from the bentonite slurry, however due to the limited space on the western side of the river, the recycling unit was located in the reception compound on the eastern side and tankers operated continuously to move the spoil.

This caused logistical problems in terms of transport, given that the quickest route between the two sites involved the use of a chain ferry, which could not be used by the tankers.

- The project was also constrained by the close proximity to residential properties on the Eastern Esplanade and the need to minimise disturbance and maintain complete access for residents.

The reception site compound was reduced to the minimum possible footprint and additional steps such as noise-level monitoring and extending up generator exhaust-pipes above the roof-height of the properties were employed, to reduce the impact on our customers.

Ground conditions proved challenging under the riverbed for the drilling of the pilot hole, with the clay found to be much firmer than expected. To cover the 560m, 111 (No.) drilling rods were used with progress slowing to around 35-40 minutes/rod as the drilling progressed through the harder ground.

As expected, the drill head finally broke surface in the centre between the two live mains. The 800mm reamer was then used to expand the hole, and a final cleaning run was carried out before the operation to pull the new pipe through took place.

Completion

Construction began in early November 2012 and the installation of the main was completed in early January 2013; with the whole project completed and sites reinstated in mid-February, 6 weeks ahead of programme.

This newly installed pipeline will ensure that customers on the Isle of Wight will continue to have an effective wastewater discharge system readily available to them for many years to come.

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The reception pit at East Cowes - Courtesy of Southern Water



*In the background Red Funnel ferries and Cowes Harbour
Courtesy of Southern Water*



The 500mm pipe was welded continuously in one length along East Cowes Esplanade - Courtesy of Southern Water