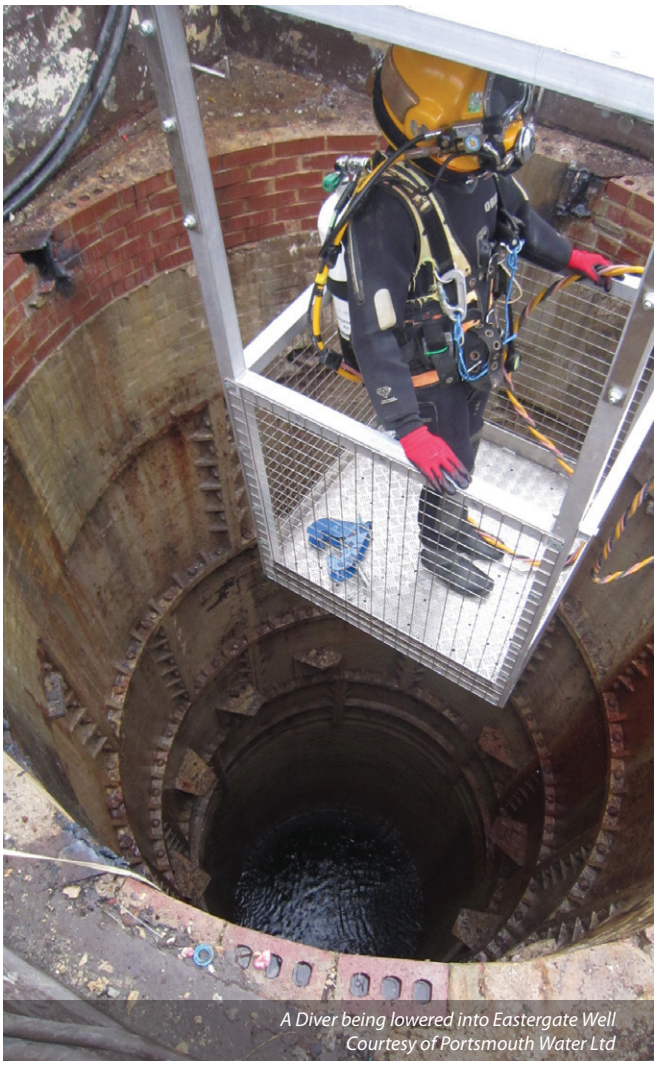
Eastergate Well Relining

Portsmouth Water's *'well'* thought out solution to minimise the risk of groundwater ingress

by Connor Peter Smith

Eastergate WTW is located in the area of Fontwell, Chichester. Treated water is pumped to Littleheath Reservoirs which serve a population of approximately 83,200, including the town of Bognor Regis. The WTW abstracts water from the lower chalk where it is overlain by the Lambeth group rock strata. Eastergate Well provides a consistent supply of raw water which is treated at the WTW: the average amount abstracted daily is 8.1ML. In September 2012, G.Stow plc conducted a CCTV survey to ascertain the internal condition of the well. The survey established that for its age the asset remained in a serviceable condition. However, deposits of salt were found on the brick lining of the well and under further inspection there were leaks allowing groundwater ingress. This paper describes the measures taken to improve the condition and extend the life of the well, preventing a potential reduction in water quality.

Maneuvering one of the steel tube sections into position
Courtesy of Portsmouth Water Ltd



A Diver being lowered into Eastergate Well
Courtesy of Portsmouth Water Ltd

Background

Portsmouth Water Ltd is the utility company responsible for the supply and distribution of potable water to parts of East Hampshire and West Sussex including the city of Portsmouth. The company has been supplying clean drinking water since 1857, to an area covering 868km^2. The average distribution input for the company is 180ML/d.

Eastergate WTW abstracts water from a borehole sunk in the base of a large diameter well. In the permeable chalk layer surrounding the borehole there are numerous fissures which yield raw water from the South Downs. The well and borehole was originally sunk in 1893, the well measuring 2.4m in diameter and 25m in depth. The borehole was reamed out in 1993 to a diameter of 1.2m and its current depth is 65m below ground level. The widening of the borehole increased the sources total yield which allowed it to cope with the rising local population.

The headpit houses both butterfly isolating valves and non-return valves on riser pipework from the pumps. Water is abstracted by

three pumps and associated rising mains joining into a single main delivery pipe feeding the Works.

The headpit is accessed by ladder located 1.35m below ground level. Securing this large asset is a bespoke alarmed galvanised steel kiosk made by Technocover, with removable roof panels which make pump changes more efficient.

At Eastergate, the disinfection process employs superchlorination, killing any bacteria and disinfecting the water for safe consumption. After this initial dose, sulphur dioxide is then added, which degrades the chlorine concentration to a safe residual level (dechlorination). Following treatment the water is pumped 2.5km north to Littleheath reservoirs with a capacity of 32ML and subsequently gravitates to the town of Bognor Regis and surrounds.

Contractors

Few contractors in the UK have the technical competence and specialist equipment needed to reline a well of this scale. G. Stow plc, who have over 100 years experience in the water industry, was contracted by Portsmouth Water. The survey conducted by the contractor highlighted a degrading brick lining in the well, and it was determined that by inserting a new mild steel liner any unwanted contaminants found in groundwater would be prevented from entering.

Well lining construction

The existing galvanised steel kiosk was dismantled and the checker headplate and headworks were removed by the contractor prior to any deliveries to site, which provided unencumbered access to the well. Once the well was open, the subcontracted diving company was able to enter and remove debris consisting of masonry, bricks and a large oxidised steel plate previously lost from the old headplate.

The steel liner comprised three separate sections, ensuring ease of transportation and providing extra manoeuvrability needed for delivery. A 60 tonne mobile crane was used to manoeuvre all sections of the mild steel tubes into place. Sections were joined sequentially by arc welding and lowered incrementally into the well; the total liner length is 25m.

Installation was achieved by supporting each section of the liner using temporary welded supporting brackets to transfer its self weight through the ground. The subsequent section of the liner was then welded to the top of the supported section. Once the weld had been inspected, the section was lowered into the well, supported once again with brackets, before the final section was attached using the same method. The total weight for the complete liner suspended by the crane was 23.3 tonnes.

The internal face of the steel liner was coated with a DWI approved Copon Hycote 162 PWX epoxy to provide protection against corrosion and chemical resistance.

To prevent any lateral movement and ensure rigidity, grout was placed into the gap between the new steel liner and the old brick lined well. A strong singular cementitious mix was initially used in the bottom of the well to achieve a seal, then a C30 concrete design mix was poured in stages into the annulus, to the upper lip and left to cure. The Tremie method of concrete placement was adopted to effectively displace water in the area without washing out the cement content resulting in a homogeneous mix.

In the headpit new pipework was installed and, due to the intricacies of the angles, fabrication was completed in situ before being sent to the factory for coating. The steel pipework was coated with Plascoat® PPA 571 Aqua, developed for the water industry with both DWI and WRAS approval. The pipework was returned and installed before final commissioning took place.

Full compliance with health, safety and environmental legislation was achieved through risk assessments and method statements being produced for each aspect of work. The use of a winch, fall arrester, cranes, gable and man riding cages allowed work to be completed quickly and safely. In addition, due to the nature of the work, all personnel involved were trained in confined space. There were no health and safety incidents as a result.

During the peaks of aquifer recharge, high groundwater levels intermittently result in water rising above the headplate. This water is removed through a built in drainage pipe within the chamber. Should the high artesian flow become more frequent, the liner could be lengthened to accommodate the rise in water level.

Conclusion

The relining of Eastergate Well has achieved its intended purpose, sealing the degrading upper brick lining against groundwater ingress, thus preventing any contamination contained within the immediate surrounding ground from polluting a vital abstraction source. The work was completed on time and within budget at a total value of £180,000.

The Editor & Publishers would like to thank Connor Peter Smith, Graduate Civil Engineer with Portsmouth Water Ltd, for providing the above article for publication.

Welding sections of liner - Courtesy of Portsmouth Water Ltd