

High Lane Service Reservoir

AMP5 security of supply

by Sabin Hoye BEng (Hons)

United Utilities' High Lane Service Reservoir is located on the outskirts of Stockport in the village of High Lane and is fed by water from the adjacent Wybersley WTW. Treated water produced by Wybersley WTW is currently stored in a 27ML (maximum capacity) service reservoir, which was constructed in 1932, and is located immediately adjacent to the WTW site. A new service reservoir is currently being constructed to work in conjunction with the existing reservoir to improve the security of supply to approximately 350,000 customers in High Lane and Stockport and the surrounding areas.



High Lane Service Reservoir site prior to development - Courtesy of United Utilities

Background

It was identified by United Utilities that the existing water distribution system served by the reservoir suffered significant risk of interruption, with only approximately 4 to 6 hours of storage. In the event of a loss of production at Wybersley WTW or failure of an interconnecting pipe from the WTW to the existing service reservoir, supply interruptions to customers would occur since only partial re-zoning of the distribution system was possible. Support could be provided from elsewhere in the strategic water supply system, however this left a shortfall of approximately 20ML/day as the loss of this water could not be replaced from other sources.

Undertakings

The development comprises the construction of a new 28ML/day working capacity rectangular service reservoir measuring 54m x 94m. Hydraulic considerations mean that the new reservoir will be located entirely below existing ground to a maximum depth of around 8.5m.

The project to construct the new SR is being undertaken under the auspices of the United Utilities AMP5 Process Alliance South, a collaboration of the client, United Utilities, MWH Ltd, for the supporting solution design, and the GCA JV (Galliford Try, Costain, Atkins) for detail design and construction.

Reservoir design

The reservoir is a twin compartment structure. To ensure compliance with United Utilities' disinfection asset standard of 15mg/min/l for waters from a surface source, each reservoir compartment will be fitted with a 1.2mm thick Drinking Water Inspectorate approved Hylam flexible polypropylene alloy (FPA) baffle curtain. The curtain will be arranged to promote plug flow between the inlet and outlet by dividing each reservoir compartment into four lanes.

An integral below ground two-storey valve house measuring 10.5m x 24.3m x 9.2m deep and comprising an intermediate floor and basement contains the inlet, outlet, overflow and scour

pipework and associated valves. To reduce the visual impact to the surrounding area, separate buildings housing access staircases and a control room are located above ground, adjacent to the buried valve house. To facilitate maintenance of plant and equipment within the valve house a removable roof is fitted so that any valves or fittings can be lifted out in the future using a mobile crane.

High Lane Service Reservoir is the first project to be designed and constructed by GCA JV to Eurocode 2 for United Utilities. This recently introduced code incorporates the results of research over 15 years into autogenous healing and flow rate mechanisms, which require the application of more complicated calculations to accurately predict crack widths. The structural analysis of the reservoir was carried out using STAAD which took account of the soil structure interaction and the thermal effects on the tank both in the temporary and permanent condition.

Minimising the impact

The potential impact on local residents was a key consideration of the project. The southern and western boundary of the site is shared with the rear gardens of the residential properties bordering the site. Immediately to the east of the site is Wybersley WTW which was shielded from the local residents view by a landscape mound which rises to approximately 12m above existing ground level.

In order to minimise the impact to local residents of the new service reservoir during construction and once complete and operating, it is being constructed within the existing landscape mound around Wybersley WTW.

Noise during construction was extensively computer modelled by Entec UK Ltd to assess the impact on the local residents. A 3-Dimensional computer model of the proposed spoil stockpiles were generated and assessed to determine the optimum height and configuration to mitigate noise from the site. This material will

be reused following completion of the works to create a landscape mound shielding the new service reservoir and water treatment works from local residents view.

The project team has maintained close contact with the community. Regular newsletters advise local residents of progress on site and update them on likely events which could disrupt the local community such as days when large concrete pours will occur. Community meetings were held to ensure the impacts in the next period are made public, any issues are identified and dealt with.

Biodiversity surveys

During the planning stage, extensive biodiversity surveys were carried out on the site to identify any important habitats and the presence of any important or protected species. The habitats on site consisted of woodland around the existing WTW planted around 1995, semi improved neutral grassland and five hedgerows.

To facilitate construction of the new works, the grassland and two hedgerows were lost, however a number of semi-natural habitats have been retained and the lost habitats will be replaced by new habitats under a habitat creation and long term biodiversity management plan following completion of the works. This restoration will involve the creation of approximately 1.1Ha of broad leaved woodland plantation, meadow pasture and areas of wetland. Similarly new hedgerows will be planted to provide additional habitat for badgers, bats, hares and breeding birds.

Advance works

Advance works started on site in May 2011. One of the first activities on site was to create a Great Crested Newt receptor pond and hibernaculae as part of the mitigation against the loss of habitat. The hibernaculae were constructed in accordance with Natural England Guidelines given in the Great Crested Newt Mitigation Guidelines, English Nature 2001.



Excavation to service reservoir formation level June 2012 - Courtesy of United Utilities

The badger setts were closed under licence and then amphibian and badger proof fencing were erected around the perimeter of the construction site and amphibians relocated to the newly created habitat under a Natural England license in August 2011.

Other advance works included the diversion of an existing 1,000mm diameter overflow pipe and a 300mm diameter foul sewer from Wybersley WTW that ran through the site.

Construction

The main bulk excavation for the new SR started in October 2011. This was hampered at times by wet weather. A noise monitoring system was established which measured peak and average noise levels generated by the operation, and sent text alarms to the site team if any of the planning condition noise parameters were breached. The mounding which provided shielding to the local residential property was hydroseeded to improve the appearance and to reduce dusting should it ever dry out!

The run-off water was very difficult to settle due to the presence of very fine particles. It was stored on site in a lagoon between the mounds and treated through the waste stream process of the WTW, avoiding the need to build a temporary chemical desilting plant.

Construction involved the excavation of approximately 111,000m³ of material including Glacial Till, Made Ground, Coal Measures, and rock and spoil remaining from the construction of the Disley Rail Tunnel in 1902. To avoid unnecessary vehicle movements and the negative effects this would have on both carbon emissions and the residents of High Lane, it was imperative that as much spoil as possible was retained on site.

Through the use of every available parcel of land and the bespoke design of each and every cutting and embankment slope, including nearly 80m of soil nailed slope to protect the existing works,

it was possible to retain all the spoil on site, which will later be incorporated into the permanent landscaping. Cut and fill balances were able to be checked prior to breaking the ground through the use of 3D CAD modelling.

Because groundwater presented a problem during excavation, a drainage system was constructed as a temporary measure, which has now been incorporated into the permanent design.

Concrete works for the reservoir started in August 2012, with deliveries carefully planned to minimise disruption to the residential area. The site is very exposed and concrete mix designs were developed to allow concreting in colder weather where the rate of rise within the 8m high wall pours was temperature limited.

Further challenges were presented by the presence of significant existing landscaping bunds, a brick built air shaft to the Disley Rail Tunnel and the presence of the existing Wybersley WTW adjacent to the main excavation.

The final landscape arrangement reprofiles a man-made spoil heap to the north of the new SR site which was created by the construction of the Disley Tunnel railway tunnel in 1902.

The railway tunnel, located approximately 55m below the existing ground level, runs across the north east corner of the Wybersley Water Treatment Works site.

Pipework

The installation of new buried pipework connecting into the existing network provided major challenges. The new pipelines consisted generally of 1,000mm diameter ductile iron pipes at depths up to 12m and the connections themselves adopted extensive use of Scotchkoted™ steel fittings which have been manufactured to suit the non-standard connection angles encountered.



Service reservoir under construction July 2013 photo courtesy of GCA JV



Service reservoir construction November 2012 - Courtesy of United Utilities

In addition, the main outlet connection to the Stockport main has to take place without compromising the current supply to customers. The maximum permitted shutdown is 2 hours, which effectively made working in the dry impossible.

The existing main also required installation of an in-line flowmeter downstream of the connection point. A solution was developed utilising a temporary diversion around the connection point installed by hot-tapped connections and line-stops to facilitate the removal of a section of pipe for the new connection.

Progress

At the time of writing (July 2013) construction on site is proceeding to programme with water testing of the structure recently having been commenced, and tie-in pipework using live tapping onto a strategic 600mm water mains being progressed. Project completion is anticipated in February 2014. To date 205,000 man-hours have been worked to date without a lost time accident.

Accolades

The site is registered with the Considerate Construction Scheme (CCS) and has been awarded a certificate for 'performing beyond compliance'. In addition the project has won a Green Apple Award for Environmental Performance, with an award presentation that took place at the House of Commons in November 2012.

United Utilities set up a community grant scheme where local community groups could apply for funding to support worthwhile schemes. Examples included support for the local Scout group, cricket club and junior football team.

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Computer visualisation of new service reservoir site once landscaping is established - Courtesy of United Utilities