Project Profile

Forkers Ltd

Bridgnorth Road UID, Wolverhampton

Client: Severn Trent Water
Designer: Severn Trent (in-house)
Value: £1.5m
Date: 2010/11

This UID project was undertaken to replace an underperforming CSO in the Compton area of Wolverhampton that was spilling foul flow to the adjacent Smestow Brook up to 50 times annually and was designed to intercept the existing spill pipe from the main sewer, store the first flush and then return it to the foul water system when flow conditions subside.

The shallow trunk sewer, local topography and results of hydraulic modelling meant that a screened solution could not be adopted and the design was developed to incorporate the full storage requirement. This was to be accommodated by constructing a pumped return shaft detention tank, 12.5m in diameter and 18m deep to provide 1850m^3 of storage and including 2 pumps, pumping 36l/s.

The jacked caisson shaft was to be sunk through 22m of water bearing sand and gravel. Initial proposals to dewater the full depth by using a combination of well points and a system of deep wells had to abandoned as the dewatering system did not produce a noticeable drawdown after 2 weeks of 'full bore' pumping giving rise to concerns over the longer term settlement effects in the local area if a larger dewatering system was installed.

The decision was made to continue sinking the shaft as a 'wet shaft' to the full depth in order to maintain groundwater equilibrium with a base plug tremmied underwater. The standing water level in the shaft was 1m below ground level.

Shaft sinking continued using an excavator with extending hydraulic grab and had reached a depth of 12m but was halted when a band of hard sandstone was encountered which could not be excavated with the grab. The position, angle and thickness of the rock band was confirmed by divers who were able to probe round the cutting edge and by probe drilling around the shaft perimeter which proved that the sandstone band was dipping and was up to 2m thick.

A 45 tonne, long reach excavator with breaker attachment was resourced to site to attempt to break out this rock in the shaft to allow shaft sinking to progress, however the operator could only work 'blind' due to the depth of silty water in the shaft. Some success was achieved and the combination of breaker and grab enabled sinking a further 1m however inspection of the steel cutting edge by divers revealed that it been damaged and buckled, either by the breaker or possibly by pushing the shaft over a remaining hard nib of rock. Following this it was accepted that it would be impossible to continue sinking the shaft without significant risk of damage.

In order to maximise the storage capacity of the shaft/pumping station it was necessary to minimise the base plug and base slab thickness. We were able complete a vertically drilled compaction grouting exercise around the shaft perimeter in order to maximise the skin friction around the shaft to resist uplift which allowed the thickness of the base plug to be reduced substantially. These external grout holes were drilled to full depth and a mortar grout injected in ascending stages to displace the soft sand and silt around the shaft perimeter.

Civil & Ground Engineering Contractors

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The shaft base plug was poured with the assistance of divers to place the non-wash out concrete mix.

A review of the scheme design requirements was carried out with Severn Trent and it was agreed that the remainder of the storage volume was still required in order to complete the EA agreed solution. We considered a number a storage solutions however decided to proceed with a pipe storage tank system consisting of 100m of 3.5m diameter Asset Weholite pipes placed adjacent to the shaft to provide the additional 950m^3 of storage required. The pipes were constructed in 3 legs with a connecting manifold to suit the available working area.

Due to the wet sand and gravel strata present a sheet piled cofferdam was constructed for the Weholite tank to allow the necessary internal excavated depth of 6m to be achieved.

The 3.5m diameter pipes were surrounded in lean mix concrete to ensure stability against flotation and movement under the high water table and to cater for the risk of a traffic accident which would potentially damage the shallow pipes if an HGV vehicle ran off the adjacent trunk road.

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