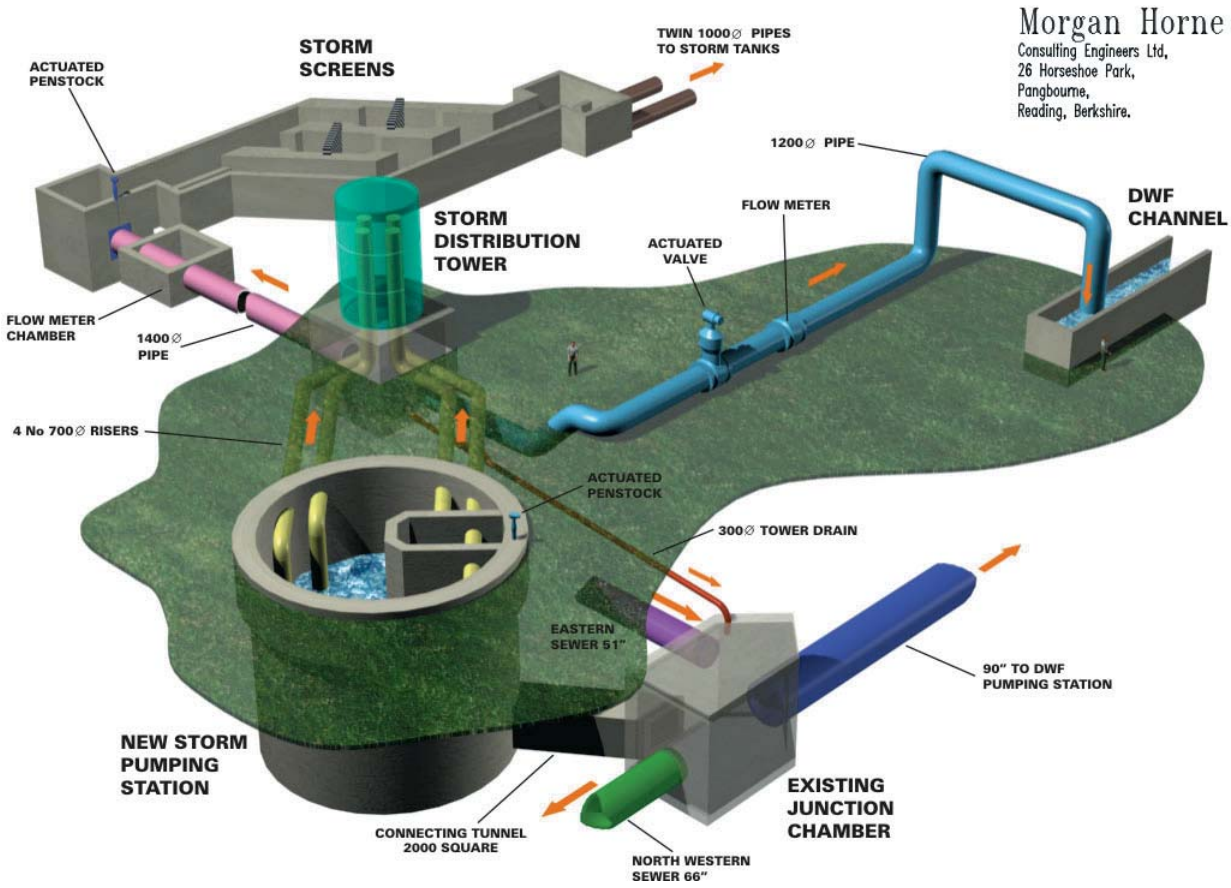
Rye Meads STW

new storm pumping station to reduce flooding risk

Rye Meads STW is located in Stanstead Abbots, near Harlow and serves a total population of 400,000. The new pumping station is designed to lift 3.5 tonnes of storm water per second to the storm tanks to reduce the risk of flooding in the catchment. Sewage gravitates to the works via two main trunk sewers, which extend as far as Stevenage and Welwyn Garden City to the West and Harlow to the East. To prevent undiluted sewage being pumped to the storm tanks when a storm occurs in only part of the catchment, the pumping station has been located at the confluence of the two incoming sewers. This has resulted in the pumping station being constructed on a very confined site, adjacent to the public road and one of the works accesses.



Schematic showing pumping arrangements at new Rye Meads storm pumping station *(courtesy Morgan Horne Consulting Engineers Ltd)*

Space restrictions have had a considerable impact on the design, construction and the choice of plant and equipment. The small area available has restricted the plan area and the capacity of the sump, which has caused high approach velocities in the influent.

Pump selection

Each of the four pumps is required to pump 875 l/s through a 12m static head. As the approach velocities of the storm flow will be high, the pumps will experience vortex effects known as pre-swirl. *Hidrostal* pumps have been selected, as they are able to accommodate these pre-swirl effects.

Various pump sump arrangements were considered; the adopted design was the result of consultation between the design team, construction team, pump manufacturer and *Hydrotec Consultants Ltd*. Before construction, *Hydrotec Consultants Ltd* were engaged to create and test a hydraulic model of the pump sump. This model confirmed the extent and orientation of the pre-swirl at the pumps. These are within the ranges that can be accommodated by the pumps and the manufacturer is confident in their performance. The model test has supported the original design of the sump with only slight modifications.

Power supply

The four new pumps will replace existing diesel pumps and place a considerable additional electrical load on the works. The existing available power supply from the regional electricity company is not sufficient to power the total demand of the works with these pumps. Provision of an upgraded power supply was investigated but found not to be feasible. A fixed generator set will, therefore, be used to provide power for the storm pumps.

Pumping proposals

It is necessary to operate the generator at regular intervals for test pumping and maintenance. This may occur when there is no storm, necessitating the pumping of undiluted sewage to provide the load. These flows could be pumped into the storm tanks and then be drained back to the works pumping station to be re-lifted back into the treatment stream. This represents a considerable waste of energy. Operational benefits can also be gained by pumping the sewage into the treatment stream from the pumping station. One or two pumps are required to provide the generator load, their output will also match the treatment flow. The pumping arrangements have been designed to make this possible.

The design allows the flow to be lifted by the storm pumps via dedicated risers to a storm distribution tower. Flow can then be diverted away from the storm tanks by closing the actuated penstock at the storm screens and opening the valve in the inlet pipe. Flow is then delivered to the treatment stream via the DWF channel as indicated in the illustration.

The introduction of the storm distribution tower provided savings when compared with a conventional valve chamber as the large diameter manifold and valves were not required. Locating the storm distribution tower away from many of the existing services achieved further savings, these would not have been possible with the valve chamber adjacent to the pumping station.

Civil construction

As a result of the restricted area available the pumping station has been designed to be as compact as possible, whilst still providing safe access.

It is constructed in waterlogged sands and gravels, overlying a thin layer of firm chalk, with soft chalk below. The preferred construction method has been to sink a shaft through a guide ring, which is also used as an anti-flotation collar and then to place a plug at the bottom of the shaft, prior to pumping out the water. Steel reinforcement for the plug was placed under the water with little difficulty. The concrete mix has been designed to be self levelling and to become properly compacted without additional work. Construction within the shaft is now being undertaken in the dry. The connection from the shaft to the adjacent junction manhole, although only a short distance, will be difficult to construct and the intention is to use conventional tunnelling techniques in heading, having first grouted the granular material to be excavated.

Prior to construction, the circumference of the shaft was probed to the full depth to reduce the risk of obstruction impeding construction. Despite the prior probing some obstructions were encountered during shaft sinking and these were readily removed by divers.

Contracting arrangements

Design and construction of the pumping station is being carried out under the Trident Alliance arrangement between Thames Water Utilities, Laing Construction and Hyder Consulting. For this part of the project Morgan Horne Consulting Engineers Ltd., have been retained by Hyder Consulting because of their experience and knowledge of Rye Meads sewage treatment works from previous projects.

The designers, construction staff, Thames Water operational staff and suppliers, were brought together early in the design process to produce an integrated team. This design approach has enabled rapid decision making and design development in response to suggestions from the team members. ■

Note: *The above article is by S R Bruffell, Regional Director of Pell Frischmann Morgan Horne Ltd., formerly Morgan Horne Consulting Engineers Ltd., who wishes to thank Thames Water Utilities and all those who have helped with the project.*