

Moorside South, Fenham, Newcastle-upon-Tyne

£1.5m project to solve 7 internal DG5 flooding problems

by Richard Woodhouse IEg, CPM, MAPM, MIWO

Fenham suburb of Newcastle has built up from the grounds of Fenham Hall in the late 19th century to a major area of housing today. Majority of this development has taken place in the 1920s and 1930s. Moorside South is adjacent to Nunns Moor, an ancient grazing land that forms part of Newcastle Town Moor and is managed by the Freeman of the City of Newcastle. The properties in Moorside South were amongst the first developments to take place and the original sewers installed for this and neighbouring streets have been utilised as the main trunk sewer for the Fenham area. Sewer flooding problems were first reported to Northumbrian Water during the intense summer storms of 1999. Flooding, on this date was reported by three customers and Northumbrian Water carried out normal clean up services. Investigations identified that the flooding had been affecting these three properties since the increase in development in the 1930s, due to incapacity in the main trunk sewer serving Fenham, and indicated that a problem has been present for nearly 70 years.



Moorside South, Fenham: 25m dia. storage tank 6m deep solves flooding problem

Photo: courtesy Northumbrian Water

Along with all other UK water companies, Northumbrian Water is required to report to the Director General of Ofwat annually those properties that are at risk of internal and external flooding due to hydraulic incapacity of the sewerage system. This being the 5th required measure to be reported it is assigned the term DG5.

As part of Northumbrian's Asset Management Plan 3 (AMP3) there was a requirement to reduce the number of properties reported on the DG5 register by April 2005. For this to be achieved increased investment was allocated to the Sewer Flooding Programme and one location identified for investment was the flooding problem at Moorside South in the Fenham suburb of Newcastle.

Project

Northumbrian Water Sewer Flooding Group prioritised this problem for investment and *Mott MacDonald Limited* were appointed from the water company's Civil Engineering Consultant Framework to carry out the initial Feasibility Study. Their brief was to establish the extent of the hydraulic problem and to identify a number of options that would solve it.

Feasibility

To establish the true extent of the problem in the main trunk sewer, a hydraulic model was built and verified. This verification was achieved by utilising flow data gathered by *Total Flow Surveys*, an



Storage tank 25m diameter x 6m deep giving storage area 1800m³ to solve flooding problem

Photo: courtesy Northumbrian Water

in-house Northumbrian Water company. This flow monitoring exercise commenced in the summer of 2002 and was completed when the required numbers of storm events were captured some 6 months later. The hydraulic model was used to confirm the flooding mechanism and also identified the properties on Moorside South as the lowest point of relief on the system.

During the feasibility stage, *Mott MacDonald* carried out a number of innovative techniques such as hard standing surveys of properties, depth calculations of above ground flooding and overland flow mapping. This latter technique was used to determine the route taken by sewage that escaped from manholes and gullies during storms. By using these and other techniques a number of options were identified to reduce the risk of flooding to properties within Northumbrian Water's design standard of 1 in 40 years return period storms. At the time, this standard was the highest level of protection for new assets of any UK water company.

Design

After agreement by all stakeholders of the preferred option outlined in the Feasibility Report, *Mott MacDonald* was appointed to carry out the Design and Planning Supervisor roles for the project.

The option to be developed was to disconnect the gravity connection for the sewers that serve Moorside South and Moorside North from the main trunk sewer and to store flooding volumes in a below ground storage tank. During normal operation, foul flows are returned to the trunk sewer via a dry weather pumping station but this is electronically cut off during storms. Storm flows are stored and returned via a storm return pumping station when the receiving sewer has spare capacity. The design identified the need to install oversized ovoid sewers to ensure that self cleaning was maintained in the new sewers at all time. The design also determined the volume of storage required to store a one in forty year storm event to be 1800 cubic metres.

A location for construction of the storage tank, storm pumping station and foul flow pumping station was identified and notice was served under the Water Industry Act 1991 to gain access for construction. This agreement was given after Legal Counsel gave advice to Northumbrian Water on the rights granted water companies under the Water Industry Act 1991 and rights granted to the Freemen of the city of Newcastle under the Newcastle Town Moor Act 1988. This advice was made available to the Freemen of the City of Newcastle and they kindly granted permission, thus avoiding any delay to construction of the works.

Site investigation

A site investigation survey determined rock head to be 8m below ground level and due to the close vicinity of the storage tank to residential property, the most cost effective design for the storage tank was determined to be 25m diameter and 6m deep. This gave a usable storage area of 1800m³.

Construction

Byzack Ltd was appointed under Northumbrian Water's Civil Engineering Contractor's Framework to carry out construction of the works. A negotiated NEC ECC Target Cost was agreed and work commenced in October 2004.

Construction of the storage tank and installation of the new ovoid sewers commenced in parallel with the storage tank being on the critical part of the the programme.

The storage tank construction consisted of segmental shaft design with an in situ segmental roof slab supported by nine internal columns. A *Flygt Flyjet* system is to be installed to ensure that solid matter is kept in suspension and enable tank cleansing to be reduced to a minimum.

Ongoing discussions with local residents and other stakeholders have been carried out during construction to minimise any adverse impact. Detailed surveys of nearby properties were undertaken before construction commenced and the reports have been shared with house owners. These surveys will form the base level for any complaints for damage raised during the construction works.

Construction has gone according to programme and no complaints from nearby residents have been received to date.

Problems encountered

Main delay to the project was caused by the requirement to obtain Planning Permission for the permanent access to the works and the removal of two mature trees. These trees form part of an avenue of trees in Fenham and the local planning authority was reluctant to grant permission for them to be removed. A tree survey was carried out that showed the trees were close to the end of their expected life. After receiving the tree survey permission was granted by the local planning authority for the works to take place.

A number of gas main replacements were required to enable sewer crossing to take place. This required careful co-ordination as both the gas diversions and the installation of the new sewer took place on opposite lanes of the same traffic sensitive street at the same time.

No major construction problems have so far been encountered.. Although not insurmountable these problems along with discussions with the Freemen of the City of Newcastle, did delay the start of construction of the designed solution but the programme was still maintained and customers will be removed from the DG5 register upon completion. ■

Note: *The author of this article, Richard Woodhouse, is Project Manager, with Northumbrian Water Ltd.*