

Nuns Moor Pilot Sustainability Study

An integrated approach to surface water management

by Ian Gill

There have been on-going flooding issues with a number of properties in the north-west area of Newcastle, which comprises Victorian back-to-back terraced housing, with the land generally falling from south to north in the locality. There is very little soft landscape to the region south of Nuns Moor. Several feasibility studies have been carried out over the years by various engineering consultants to try and address the issue by providing a financially viable scheme which reduces the flood risk in the area. To date, potential solutions have been deemed “non cost beneficial” due to the high estimated capital expenditure in comparison to the number of properties which are afforded flood protection.



Figure 1: Nuns Moor Pilot Sustainability Study Region - Courtesy of Mott MacDonald

The project is located between the Fenham area of Newcastle-upon-Tyne and the River Tyne (the scheme boundary) and covers an approximate population of 19,000. The large scale of the project requires the agreement of a range of stakeholders, including Newcastle City Council (NCC) and the Environment Agency (EA), as well as other land owners including Newcastle University and the NHS Foundation Trust. The area in question is illustrated in Figure 1.

During times of heavy rainfall, a number of properties in the region are affected by flooding, resulting from hydraulic incapacity within the public sewerage system, along with highway and overland flow issues. The study carried out by Mott MacDonald seeks to address these issues amongst others, in an economically viable and sustainable way.

Tackling property flooding

Traditional means of tackling property flooding typically include the provision of additional capacity to the existing system. This comes in the form of either online or offline storage; often a concrete segmental shaft or precast unit tank, extending to significant depth in accordance with the level of storage required. These can be gravity solutions, however, mechanical and electrical equipment is often required to return flows to the sewer system as a result of prescribed storage depths.

The scheme seeks to provide catchment wide benefits by removing substantial amounts of surface water from the existing combined system. This surface water is attenuated during storm events, before being conveyed directly to the River Tyne.

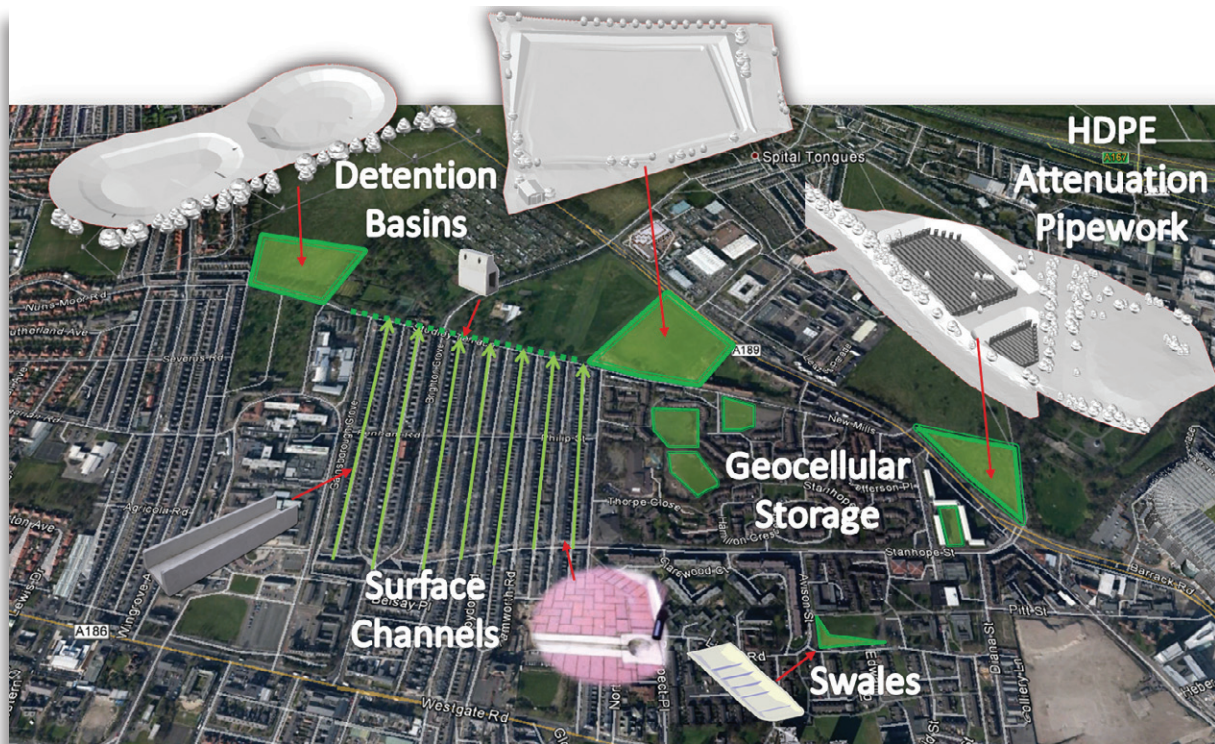


Figure 2 Nuns Moor Sustainable Drainage Opportunities - Courtesy of Mott MacDonald

SuDS features

This study looks to utilise a range of SuDS features, such as:

- **Detention basins as near to the run-off source as possible:** These are economic and quick to construct ground-level storage features, which minimise the required attenuation volume. They comprise large open areas with shallow side slopes and low retention depths. Excess flows from the storm system overflow into these basins where they are held and released into the downstream system at an attenuated, more manageable rate.
- **Ground level flow channels:** Beany blocks, slot drains etc. have been identified to collect runoff from areas where the topography permits. These will convey flows along back lanes where they will be discharged into existing storm sewers for conveyance to the River Tyne, after receiving appropriate treatment from the aforementioned basins.
- **Conveyance swales as opposed to traditional pipework:** To be utilised in grassed verges where possible in order to minimise excavation depths and provide a more maintainable asset.
- **Geo-cellular storage blocks:** Where surface land uptake is not practical, these storm cells attenuate runoff and involve shallow excavation depths. Their rapid installation and practical logistics minimise local disruption.

Figure 2 (above) illustrates some of these features and locations.

Benefits

Aside from flooding, the scheme has some other major drainage impacts upon the area and enhances the region on the whole. These benefits include:

- A reduction in CSO spill frequency and volume, minimising pollution incidents and improving the water quality of the River Tyne.
- A reduction in flows passed forward to treatment and hence reduced treatment, operational and maintenance costs.

- A reduction in the level of flooding with regards to the DG5 listed flooding properties, along with providing a longer term flood protection to the surrounding areas.
- Accommodation of property development over the next 40 years.
- Providing robust flooding solutions which are future-proofed to some extent – open water features easily capable of expansion in accordance with future demand.
- Providing enhanced biodiversity, educational and amenity value to the local community, instilling a “green culture”.
- Health and safety benefits associated with construction and maintenance.

Attenuated flow is conveyed through Newcastle City in traditional pipework, installed through various measures including open-cut and trenchless techniques. In an endeavour to fully utilise the existing infrastructure, proportions of combined sewerage will be re-designated as surface water sewers as they have sufficient capacity, with new smaller combined sewers constructed alongside collecting the foul flows. A significant benefit of this is that the scheme can reuse the existing outfall, mitigating any associated health and safety risks associated with tidal outfall construction.

Project delivery

A delivery plan comprising five phases of construction has been investigated. This would more likely allow a capital scheme of this scale to be carried out rather than a single lump sum – realising added benefits as more of the scheme progresses. This has enabled NWL to evaluate which elements of the scheme add the most value to their business and provide the best value for customers and residents in the area.

In order to deliver this study and provide best value to the client NWL, Mott MacDonald has commissioned development of software in-house which creates intelligent data links between hydraulic modelling software and civil design software. This software has gone some way in reducing the amount of errors associated in this data transfer exercise – turning modelled solutions into realistic designs.

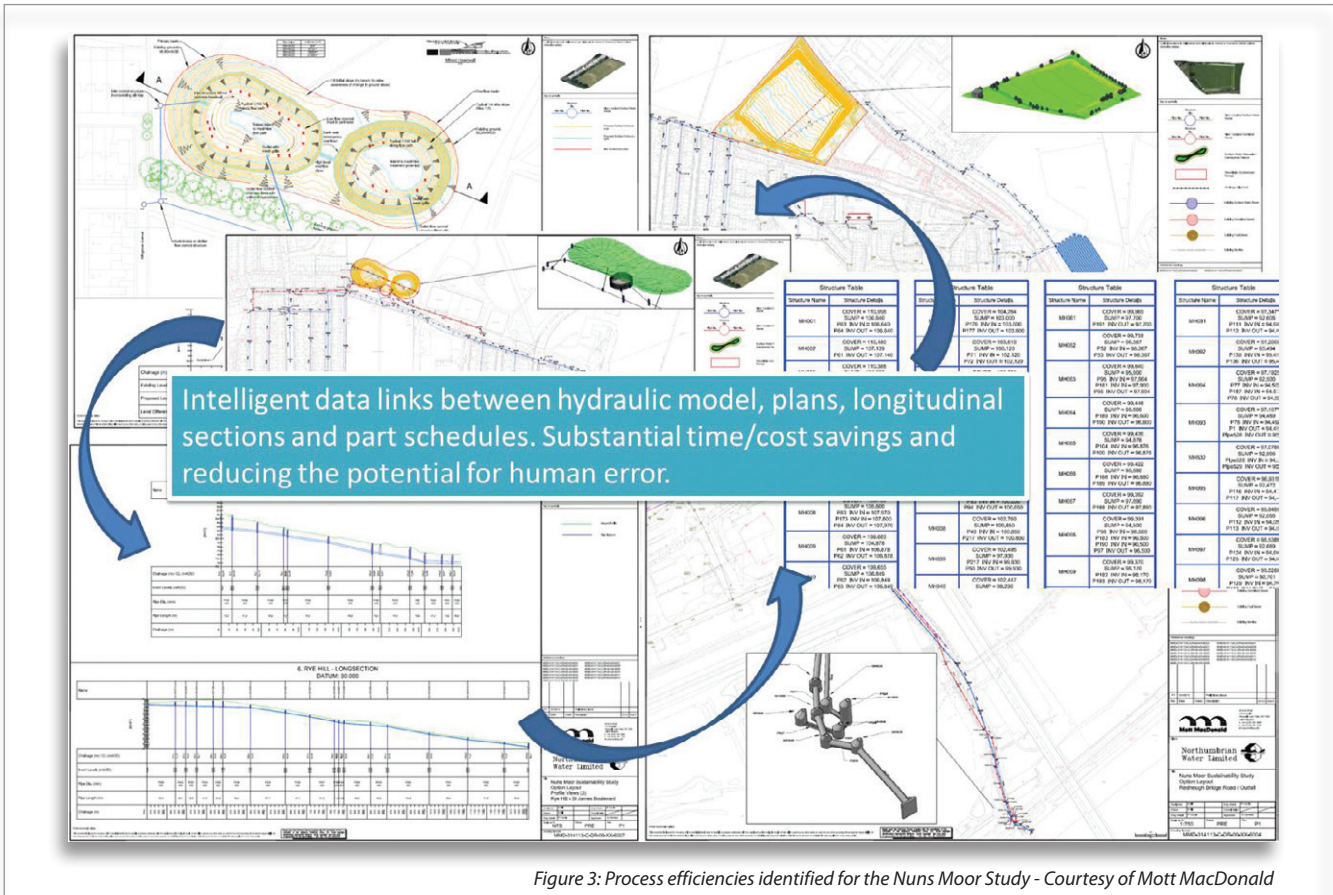


Figure 3: Process efficiencies identified for the Nuns Moor Study - Courtesy of Mott MacDonald

Embodied links between design drawings has allowed rapid production of automated longitudinal sections and schedules, with these links retained and updated with any future changes to the design. The software has also been used to create visualisations to communicate concepts to various stakeholders and to determine cut and fill volumes, designing to minimise material haulage and disposal. This is illustrated in Figure 3 above.

Conclusion

The study has identified a means of providing a holistic solution which identifies an array of needs for the catchment as opposed to traditional solutions which focus on local upgrades to the sewer network. It has highlighted the benefits that a scheme of this scale could bring and illustrates a new thinking in terms of investment, which would go a way to address the staggered spending issue associated with the AMP investment cycles.

It provides a vehicle for promoting substantial investment in green infrastructure while delivering benefits to NWL's customers and the residents of Newcastle.

This is a proactive approach to addressing flood risk while aligning with NWL's sustainability objectives and environmental improvement strategy.

New approaches to solving property flooding established in this project may well set the tone for a general approach across Northumbrian Water's wider flooding programme, thus realising greater reductions in carbon in the future.

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