

Sustainable solution provides long term benefits to client and community

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Abstract

While providing CSO screening solutions for Northumbrian Water Limited (NWL), MWH examined the long term needs of the client and community. The solution recommended an option in Gateshead that included separation of foul and storm water systems along with the screening of CSOs. This solution frees up capacity in the system, addresses future infrastructure needs, and enhances local development. The solution removes surface water from the sewer system that does not need to be treated or screened. By cooperating with the local council, new sewers will be coordinated with development to prevent relaying or moving sewers. The strategic decision to provide a surface water drainage system to an urban area will support the ongoing redevelopment. A long term goal of NWL is to have more separate systems and fewer combined sewers. NWL and the community benefit from this sustainable solution.

Introduction

As part of the UK Asset Management Plan 4 (AMP4), the Environment Agency (EA) identified a need to improve the aesthetic quality of the River Tyne. The sewerage system in this area is owned and maintained by Northumbrian Water Limited (NWL). Fifty combined sewer overflows (CSOs) along the north and south bank of the River Tyne were identified as aesthetic polluters and required screening. NWL contracted MWH to investigate 31 CSOs along the south bank of the river. This paper covers the solution, which includes screening, separation, and construction of new sewers, for three of these CSOs located in central Gateshead. This project is currently in the design phase and will be constructed prior to the March 2010 deadline agreed with the EA.

Background

The Newcastle - Gateshead area has undergone many redevelopment projects over the past ten years. The River Tyne Quayside area is well known for sites including the Gateshead Millennium Bridge, the Sage Music Centre, the Baltic Art Gallery, and the Gateshead – Newcastle Hilton Hotel. Both sides of the River Tyne have river walks for foot and bike traffic that are decorated with sculptures. There are also numerous restaurants and bars along the Quayside area.

However, central Gateshead has not kept up with the pace of development along the Quayside. Recently, this area has been changing with through redevelopments including new buildings at Gateshead College and new flats. Other development is planned for this area including removal of derelict buildings and a car park, and replacing these with new offices, a Tesco supermarket,

restaurants, shops, a movie theatre, and more flats. Gateshead Council is actively working with developers to plan for changes to this area. Figure 1 shows the areas planned for development.

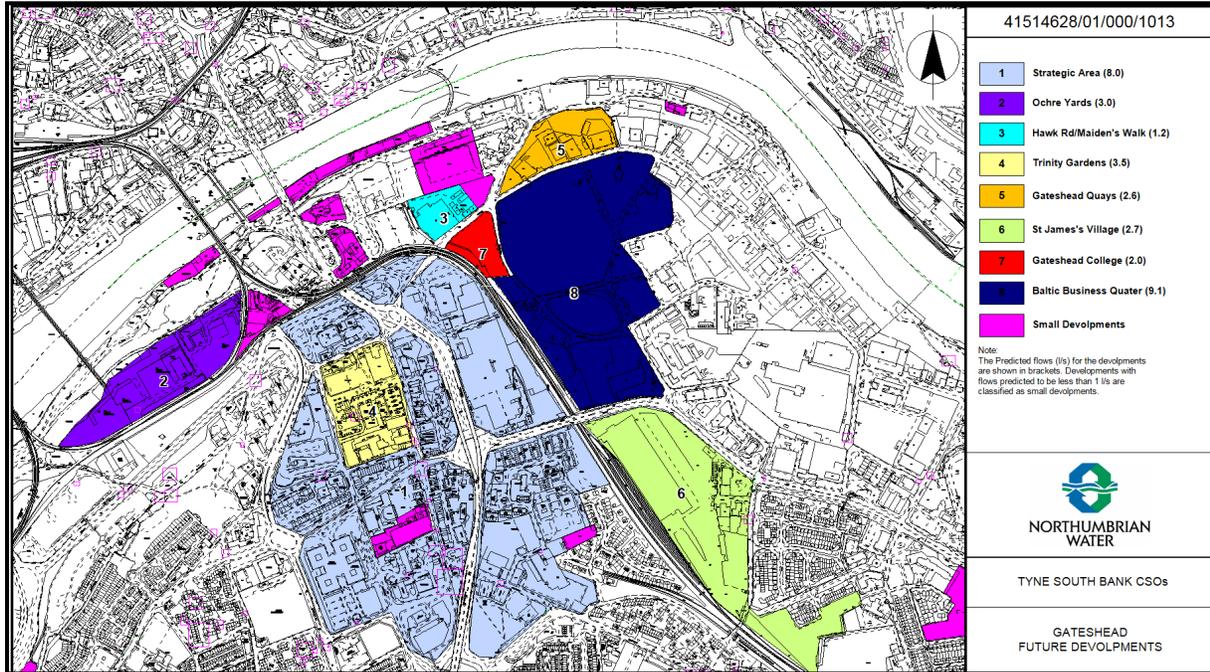


Figure 1: Planned Development in Gateshead

The CSOs included in this presentation are located in the heart of this development area. A traditional solution to the CSO project would be to simply provide screening at or near the existing CSOs. When options were assessed for providing screening solutions, the future of this area was considered. NWL was able to consider the long term implications of this project to their system and the area. A strategic decision was made by NWL to include separation in the CSO screening solution.

Solution

The three CSOs included in this solution are East Street CSO, Swinburne Street CSO, and High Street / Oakwellgate CSO. In the existing system, East Street CSO and Swinburne Street CSO are both located close to the interceptor and both spill into a combined sewer. This combined sewer is then regulated again further downstream at High / Street Oakwellgate CSO. A schematic showing the location of the CSOs is shown in Figure 2. East Street CSO regulates flow from catchments on the eastern side of Gateshead. Swinburne CSO regulates flow from catchments in the centre of Gateshead. There are also catchments in the western area of Gateshead that are regulated by High Street / Oakwellgate CSO. The High Street / Oakwellgate CSO limits pass forward flow to Saltmeadows Pumping Station. The interceptor sewer conveys flows downstream to the treatment works.

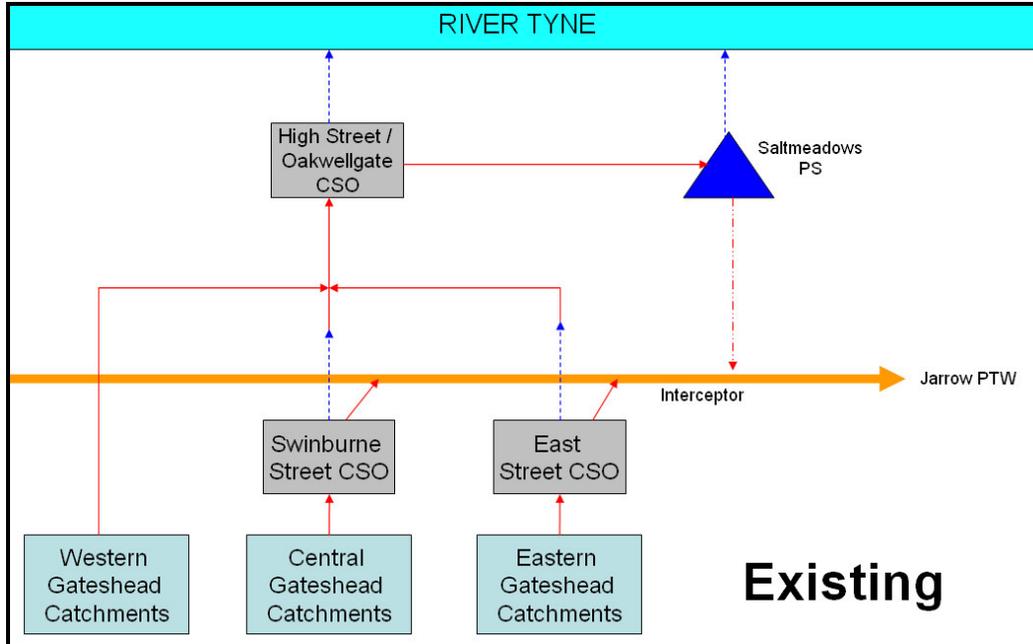


Figure 2: Existing arrangement of CSOs in Gateshead (not to scale)

All three of these CSOs have catchments that are predominately combined systems with some separate surface water and foul sewers (in newly developed areas) that reconnect back into the combined. The area is a mixture of residential and commercial with the shops, restaurants, hotels, and a college. The catchment area, population, inflows, spill flows, frequency, and volumes at the existing CSOs are listed in the table below. The flow data is from a verified InfoWorks model.

Table 1: Existing catchment and flow data at the CSOs

CSO Name	Catchment Area (ha)	Population	Existing 1 in 5 yr Inflow (l/s)	Existing 1 in 5 yr Spill Flows (l/s)	Frequency	Annual Spill Volume (m ³)
East Street	10	1300	1015	965	81	9,600
Swinburne Street	90	8500	2460	2250	77	46,00
High Street / Oakwellgate	35	1500	3970	3940	99	108,000

Screens were sized to for the peak 1 in 5 year return period flow. For each of these CSOs, a mechanical screen was required based on spill flow and frequency. The solution will include retrofitting the existing East Street CSO, building a new CSO chamber for Swinburne Street CSO, and building a new CSO along the Quayside. The existing High Street / Oakwellgate

CSO will be abandoned once the final upstream separation occurs. A schematic showing the arrangement of the CSOs in the solution is shown in Figure 3.

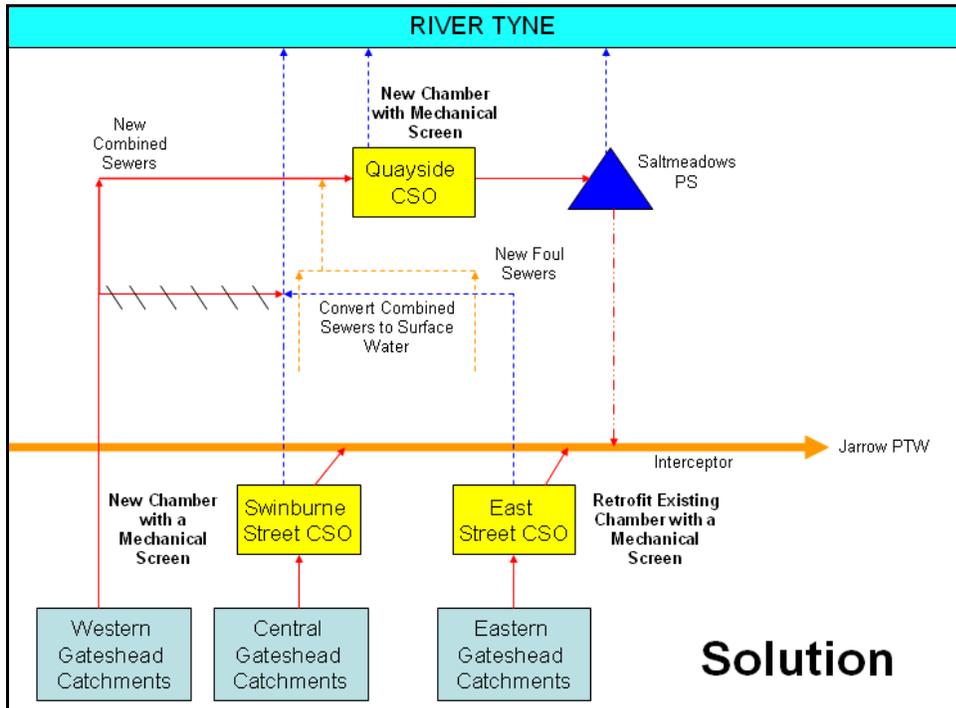


Figure 3: Screening solution in Gateshead (not to scale)

Table 2: Solution catchment and flow data at the CSOs

CSO Name	Catchment Area (ha)	Population	Future 1 in 5 yr Inflow (l/s)	Future 1 in 5 yr Spill Flows (l/s)	Frequency	Annual Spill Volume (m ³)
East Street	10	1300	1015	960	85	11,000
Swinburne Street CSO	90	8500	2470	2200	66	35,000
High Street / Oakwellgate (to be abandoned)	-	-	-	-	-	-
Quayside (new)	40	2300	930	860	90	40,000

This project will cost approximately £2,000,000. The cost for the CSO chambers and screens will be approximately £1,400,000 and the cost for new sewers required to allow redesignation of the system will be approximately £600,000. The new sewers are required to provide separation of the foul flows from the combined flow. The screening solution is not complete without this separation work.

Separation

As identified above, in addition to the construction of screens at the CSOs, separation of the system and new foul sewers is also required. East Street CSO and Swinburne Street CSO currently spill into large overflow pipes that are part of a combined system. Foul connections enter the system downstream of these CSOs. The strategic decision by NWL was made to utilise this existing asset as an overflow system and surface water drainage system. New foul sewers will be built in this area to convey the foul flow to treatment. Building new foul sewers will be less disruptive and less costly than building new, large surface water pipes. In total, 800 m of sewers will be redesignated as surface water sewers. In parallel, 270 m of new foul sewers will be constructed at a cost of approximately £600,000. Drainage assessments and CCTV are required to ensure that all of the existing sewer connections are picked up. Impermeability assessments will be required to ensure that surface water drains are correctly defined and attached to the appropriate sewer. There are approximately 10 connections that will have to be moved from the existing combined sewers to the new foul sewers.

By redesignating the existing pipes as surface water, several expensive and high risk alternatives were avoided. An option that would have rescreened flows at High Street / Oakwellgate CSO was avoided. This option would have created a long term asset that was partially redundant and in a very undesirable location. A new surface water pipe from central Gateshead would have cost at least £1,500,000 and would have been more disruptive due to the large diameter and busy highways crossed. Figure 4 shows the possible route for a new surface water sewer through this area in the future. Construction challenges in this area would be building a large diameter storm sewer crossing a major highway and railway line.

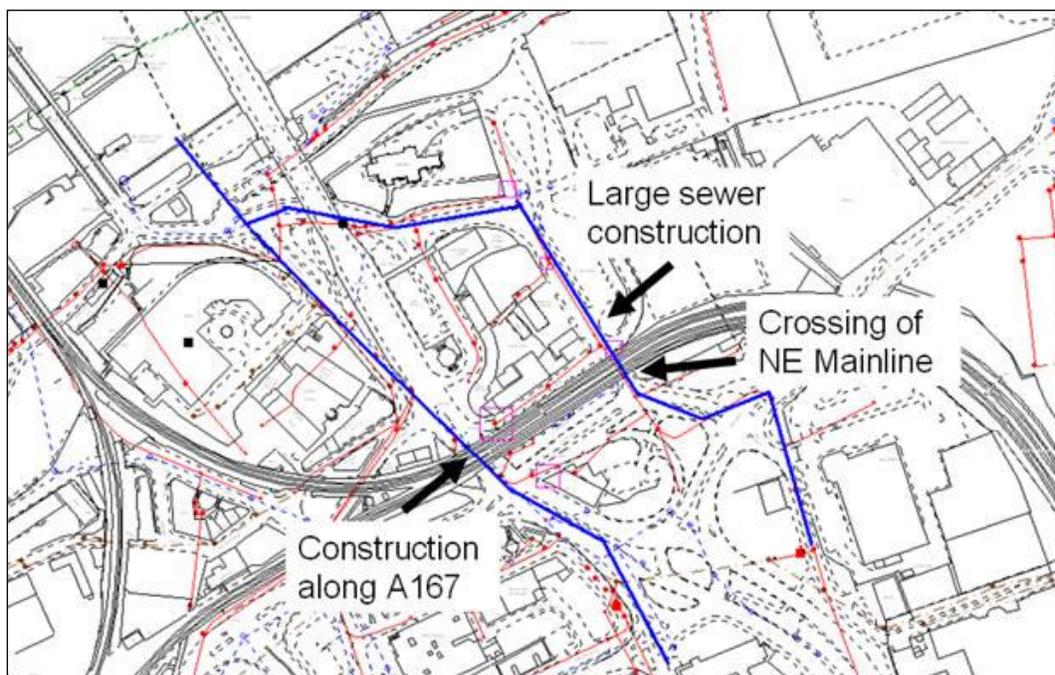


Figure 4: Difficult construction issues will be avoided in future

A long term goal of NWL is to have more separate systems and less combined. With the numerous regulatory and maintenance requirements, spending resources on separating is not a top priority. This project demonstrates that when coordinated with other schemes and the needs of an area, separation is a possibility. This decision by NWL aligns with UK government 'Future Water' strategy (within the current regulatory framework) which promotes "routing of surface water separate from the foul sewer, where appropriate".

In the area that will be separated there is a low density of buildings. In 6 ha, there are believed to be six foul connections. There is a large intersection with highway drainage, a train bridge, and the entrance to the Tyne Bridge. This low ratio of connections / area does make separation a more cost effective than in dense urban areas. In small catchments, the cost of new foul sewers may be less than the cost of a new CSO with a screen.

Coordination

Meetings were held with the local council to discuss the proposed solution at an early phase. The council used this information to help make decisions during their planning process with developers. There are several proposals for new construction, changing land use, and large construction projects. These projects are all approximately 0.5 - 1 km from the River Tyne. Within the past 10 years, there has been residential and commercial growth. This trend is expected to continue. All future new developments will be built with separate foul and surface water systems. Without a drainage system, the flow from the separate systems would have mostly likely reconnected into the combined system. In total, approximately 46,000 m³ additional flow would have been screened annually. This would have increased operational costs and would increase the volume and frequency of overflows.

In areas where new development is proposed within the next five years, new foul sewers and new connections will be coordinated with this construction to ensure the appropriate sizing of sewers and to reduce the frequency of construction in an area. This planning addresses future infrastructure needs. An area of 1.5 ha which includes an empty office building, a car rental pick-up centre, and several businesses is planned for redevelopment. New foul sewers in this area will be coordinated with the new construction in this area.

All projects would benefit from earlier coordination and communication with local councils. Infrastructure requirements for CSO projects should be coordinated with new sewers required for new development. Similarly, information about planned paving of roads or laying specialised footpaths can be coordinated between projects.

Development

This area has been undergoing redevelopment over the past 10 years and more development is planned over the next 10-20 years. The solution, which screens the CSOs and redesignates the overflow system, provides a route for the surface water flow to be conveyed to the River Tyne. All new foul and surface water sewers that are constructed in the future will be coordinated so that they connect to the correct locations.

Although NWL probably would have allowed some connections to the combined system, there may eventually have been a limit. The eventual cost to a developer to build a surface water drainage system from central Gateshead to the Quayside may have been a prohibitive cost. Having access to surface water drainage promotes additional growth in the area by eliminating the concern of drainage capacity.

As any area goes through redevelopment, the possibility of separating or using sustainable drainage systems should be considered. Water companies will need to identify the appropriate connection point as the closest connection point may not always be the most appropriate. Additional pipework to connect surface water to a separate system or an overflow may reduce the need for a CSO or reduce the size of a screen required in a CSO.

Long Term Impact

The existing system conveys combined flow and spills the unscreened overflow into the River Tyne during storm events. The solution provides screening at the overflows of the combined system. As the area develops and more is built with separate foul and separate systems, the flows to the CSOs will reduce. The unscreened combined sewer spill volume to the River Tyne will reduce. Also, over time even the screened combined sewer spill volume will decrease as the area continues to develop and move towards a more separate system.

Conclusion

NWL has made a strategic decision to redesignate an existing combined sewer as a surface water system and construct new foul sewers as part of a CSO project. This decision utilises existing assets and provides a long term drainage plan in an area undergoing redevelopment. The solution provides the screening required to improve the aesthetic quality of the River Tyne as required by the EA. Overall, the decision to separate a portion of the system will benefit NWL by reducing screening costs over alternative options, providing new foul assets, and moving toward a more separate system. The community will benefit from the solution by having a cleaner river, having a surface water drainage system in an urban area, and having assets that developers can connect into as the area continues to grow.