Tyne South Bank CSOs

screening overflows to the River Tyne

by
Graham Watson and Gwen Christini

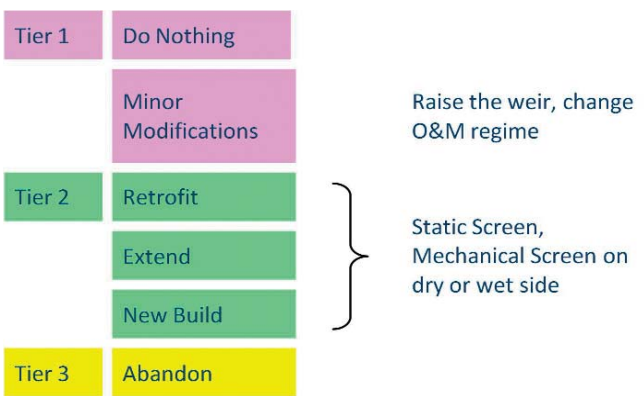
In the spring of 2010 Northumbrian Water (NW) completed a £9m project to resolve thirty-one unsatisfactory intermittent discharges (UIDs) with aesthetic drivers along the River Tyne. These combined sewer overflows extend over a 15 mile stretch from the mouth of the River Tyne at South Shields to Gateshead and upstream to Crawcrook, which is a total area of approximately 3,000 ha with a population of approximately 175,000. The work completed by MWH utilised a streamlined approach to develop solutions, managed extensive stakeholders, and worked with the contractor to overcome numerous construction challenges.

Static screen at West Holborn CSO located in South Shields *Courtesy of Northumbrian Water*

Feasibility

The Environment Agency identified 31 No. unsatisfactory intermittent discharges (UIDs) along the south bank of the River Tyne. As specified in the consents, the CSOs were not to discharge a significant quantity of solid matter having a size greater than 6mm in more than one dimension. In April 2007, NW tasked MWH to do a feasibility study to provide solutions.

MWH completed hydraulic model updates, flow monitoring, and model verification to assess the magnitude and frequency of overflows into the River Tyne. Data collection was completed including manhole surveys, CSO surveys, topographic surveys, ground investigations, and environmental surveys. For each site, a common set of solutions was considered:



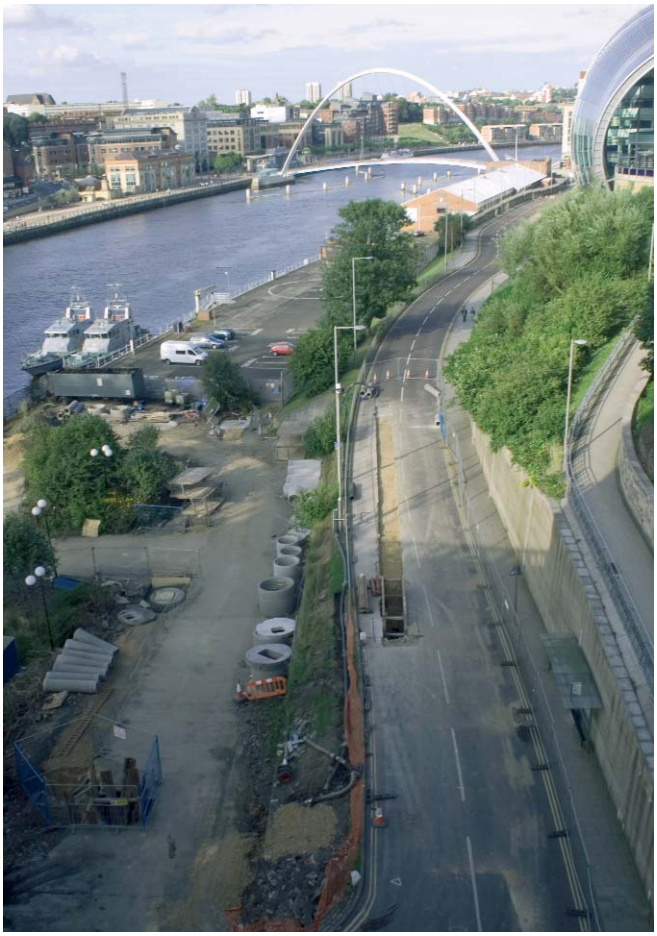
Where possible, screens were retrofit into existing structures to minimise construction requirements, unknown conditions, and cost. At several sites, separation was carried out to minimise the combined overflow and thereby allowing the size of some screens to be reduced. In Gateshead, separation was completed and a large combined sewer was redesignated as surface water as part of the solution for 3 No. CSOs. This surface water system will provide long term drainage to the area.

MWH worked with NW to develop a methodology to streamline the decision making process between a static and a mechanical screen based on spill volume and spill frequency. This criteria was adopted by NW for use across all projects and was shared with the other framework consultants across the AMP4 Programme.

The 6mm screen requirement was met by using either static or mechanical screens. Hydrok static peak screens were used to provide screening for CSOs with smaller flows (< 1 m^3/s for 1 in 5 year events) and less frequent overflows.

Mechanical screens including Huber Rotamat ROK2 and ROK1, and Hydrok MecMex screens were used to provide screening for CSOs with larger spill flows (ranging from > 1 m^3/s up to 8 m^3/s for 1 in 5 year events) or more frequent overflows. Mechanical screens required installation of a control kiosk, a power supply, and a telecom supply for connection to NW's telemetry system.

Recommendations were provided for NW for each site with a mix of static and mechanical screens as well as a range of retrofits and new builds. CSOs within close proximity were assessed together to determine where rationalising would provide the best solution. The range of solutions included retrofitting existing CSO structures, constructing new CSOs, reducing spill volumes by separation of combined systems, and rationalising and abandoning of CSOs.



Quayside Site *Courtesy of Northumbrian Water*

(Left) Huber ROK1 mechanical screen at new build Eldon Street CSO, and (right) Huber ROK2 mechanical screen retrofit into the Rose Street *Courtesy of Northumbrian Water*

Solutions were assessed to confirm that existing levels of service would be maintained.

Design

MWH provided outline and detailed design for each of the twenty sites that required construction to solve the unsatisfactory discharges. A standardised approach that aligns with the WaPUG CSO Design guidance was utilised to streamline the design process.

For Temple Street CSO, which had a large spill volume of 8m^3/s, a physical model was built to analyse the design and confirm the levels required. The design of this new 18m x 11m chamber included four mechanical screens on the split inlet channel. The physical modelling was completed by Hydrotec Consultants Ltd. A 1/9th size scale model was constructed and tested for the Temple Street CSO.

Most of the sites were located in urban areas with minimal ecological impacts. Environmental walkovers were required at the more rural sites. A great crested newt survey was carried out at one site, but newts were not located during the survey. Tree surveys and removal permissions were carried out where needed.

Planning applications were completed at sites where required for the new kiosks or where changes to the site deemed planning approval necessary. Works were across two local authorities, which had differing planning requirements.

Design review meetings were held with NW's operational staff to discuss the planned work and discuss any maintenance concerns from the team. Remote jetting was provided for two of the static screens and revisions to the access to two sites located in highways were made based on their input. Access tracks with reinforced plastic paving were used at seven of the sites.

Third party liaisons included coordinating with planners and developers who have long term plans for the areas, arranging working in residential and commercial areas, working within other construction sites, working around local events including the Great North Run, planning work across a football pitch before the season, balancing highway closures, arranging for service diversions, and arranging for new electricity and telecom service connections. All of these required coordination, planning, and balancing of requirements of multiple parties to reach satisfactory and timely resolution.

Construction

The project was divided into four phases, and competitively tendered under NEC's Option A contract by NW's framework contractors. Construction works were phased to suit location, programme, scope and site constraints. Construction work was awarded to, and completed by, Seymour (Civil Engineering Contractors) Ltd and Lumsden & Carroll Construction Ltd. Construction began in January 2009 and continued in a phased approach to final completion in May 2010. MWH carried out construction project management, supervision, and CDMC roles during the construction phase.

Challenges faced on site included numerous uncharted services, restrictions of road closures due to proximity with other sites on the project, restrictions due to local events, and restricted working areas.

In addition, the Contractor had to deal with live flows, tidal inflow, slow excavation through rock, online construction of manholes on brick culverts, a wet autumn followed by a cold and snowy winter, and directional drilling beneath banks of services. The team worked closely to provide support and develop alternatives as needed. For example when difficulties were encountered during construction of an online manhole on an existing 2m brick culvert at Temple Street, the supervisor liaised with the structural engineer and Contractor to deliver a practical solution whilst addressing health and safety concerns on site.

Restricted working area at High West Street in Gateshead *Courtesy of Northumbrian Water*

Summary
Upon completion, 17 No. mechanical screens and 7 No. static screens were installed as part of solutions to improve the 31 No. unsatisfactory discharges from the south bank of the River Tyne. The final cost of the project was in excess of £9m. To complete the project, MWH utilised a streamlined approach to develop solutions, managed extensive stakeholders, and worked with the contractor to overcome numerous construction challenges. The Tyne South Bank CSOs project, along with the similar project on the north bank of the river, enabled NW to resolve the unsatisfactory discharges along the River Tyne.

Note: ***The Editor & Publishers thank Graham Watson, Project Manager with Northumbrian Water, and Gwen Christini, Civil Engineer with MWH, for preparing the above article for publication.***■

(Top left) Temple Street scale model, (bottom left) Construction site for the Temple Street CSO in South Shields, and (right) Temple Street CSO during construction *Courtesy of Northumbrian Water*