

Tyneside Sustainable Sewerage Pilot Study

development of an integrated, partnership approach to the provision of sustainable sewerage

by Martin Kennedy and Nicola Hyslop

Growth, climate change and urban creep all need to be accommodated without having a detrimental impact on the customer and environment. It is not always practical or cost effective to build larger sewers and therefore, there is the need to identify and develop new ways of working in order to provide the service expected by customers both now and for future generations. Northumbrian Water Limited (NWL) in collaboration with their drainage partners and AMP5 Technical Consultants have successfully delivered a pilot study exploring sustainable drainage options for Tyneside.

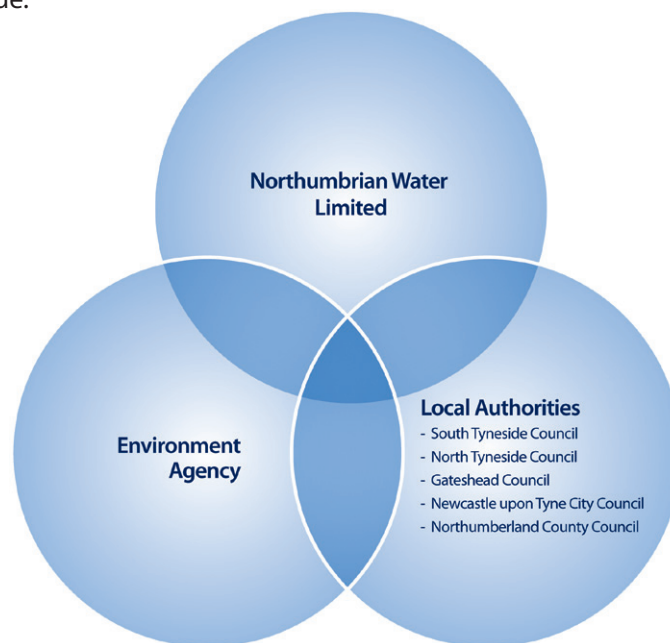


Figure 1: Interaction of Drainage Partners

Background

The Tyneside Sustainable Sewerage Study (TSSS) established and adopted an integrated partnership three stage approach aligned to the principles of surface water management. The objective of the study was to identify, and promote integrated sustainable drainage opportunities to be used by the partners to inform planning across the region (see figure 2 below).

Adopting this collaborative methodology moves away from the traditional "silo" methods towards a "one team" approach of shared responsibility in developing an understanding and addressing current and future sewerage issues. The approach aims to provide a balance between good customer service, environmental needs and costs in addition to facilitating growth.

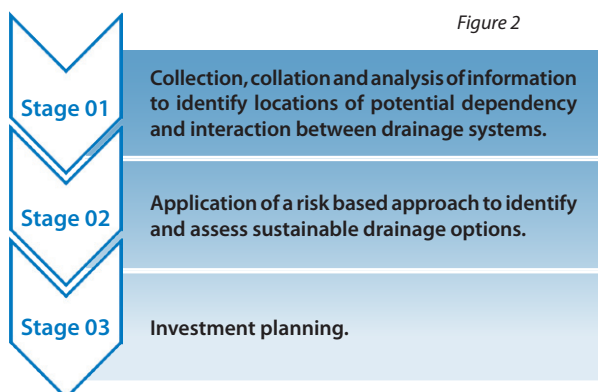


Figure 2

Following completion of Stage 1, six packages of work were identified for progression to Stage 2 with the intention to tender via NWL's Framework for Technical Services.

The outcomes of these studies will be used by the partners for future business planning.

Tendering

NWL identified that the study had an extremely tight programme and all drainage partners would be involved in a more collaborative approach; sharing drainage area information.

Following the initial meeting and after client approval, Grontmij recognised the opportunity to build a larger, better informed team and initiated discussions with the other framework consultants (AMEC, Mott Macdonald and MWH) to determine the potential for an alternative procurement strategy that would mirror the NWL approach.

The suggested new approach involved the creation of a larger team and allocation of workload based on expertise, resource availability and knowledge of drainage areas. The procurement strategy was subsequently revised to adopt the alternative strategy.

Benefits of the Grontmij approach included:

- Opportunity to promote best practice.
- Consistency of approach.
- Ability to start work sooner reducing risk associated with



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Figure 3: NWL Core values

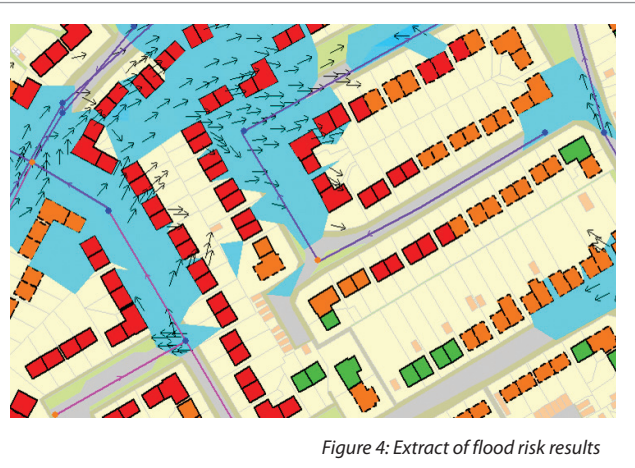


Figure 4: Extract of flood risk results

a tight deadline.

- Knowledge sharing between consultants.
- Demonstration of the supply chain adopting NWL core values (see figure 3 above).

Grontmij received the “Creative Award” at NWL’s annual GEM awards in recognition of this new approach and have successfully delivered three stage 2 studies.

The studies

The aim of the stage 2 studies was to achieve the following:

- Build/enhance sewer network hydraulic models for each drainage area verified against historical data and customer contacts.
- Integration of hydraulic network models with 2D overland flow routing, river and watercourse models.
- Establish current and future flows and establish the impact on assets.
- Identify risk locations, flooding sources and pathways.
- Assess interactions between drainage systems.
- Review local development frameworks and maintain dialogue with councils to determine existing and future growth.
- Assess, model and propose opportunities for surface water management measures at stage 1 locations.
- Identify “quick wins”, constraints, benefits and costs for both strategic and local opportunities.

Flood risk assessment

In order to assess risk, Grontmij in collaboration with RES Environmental Ltd developed a 2D flood risk mapping tool which was shared with other consultants. The tool reduces processing

time and provides a visual representation of flood risk for each of the study areas and scenarios. The results across the studies undertaken by Grontmij demonstrate the trend of increasing flood risk due to growth, impermeable surface creep and climate change.

Figure 4 (above) shows an extract from the flood risk results and overland flow paths (blue). Properties shown in red are defined as high risk, orange are medium risk and green are low risk properties. This methodology aligned with NWL’s requirements for a risk based assessment.

Hydraulic modelling

Integrated urban drainage modelling was undertaken and considered all aspects of the drainage area and included them in a single cohesive model. In the studies undertaken by Grontmij tidal influences from the River Tyne, hydraulic network models, watercourses and ground surfaces were combined in InfoWorks CS 2D to create a hydraulic model of the drainage area.

In order to successfully achieve the modelling requirements, NWL facilitated early and open discussion with partners to ensure all relevant information was collected and applied.

Maintenance of the hydraulic models and de-simplification was completed within the drainage area boundaries and included updating population and impermeable area takeoff calculations. The models were subsequently calibrated to historical rainfall data and customer contact records before they were updated to represent the current (2012) and future design horizon scenarios of 2020 and 2050.

In developing the various scenarios the models were updated based on the flow chart (see figure 5 below).

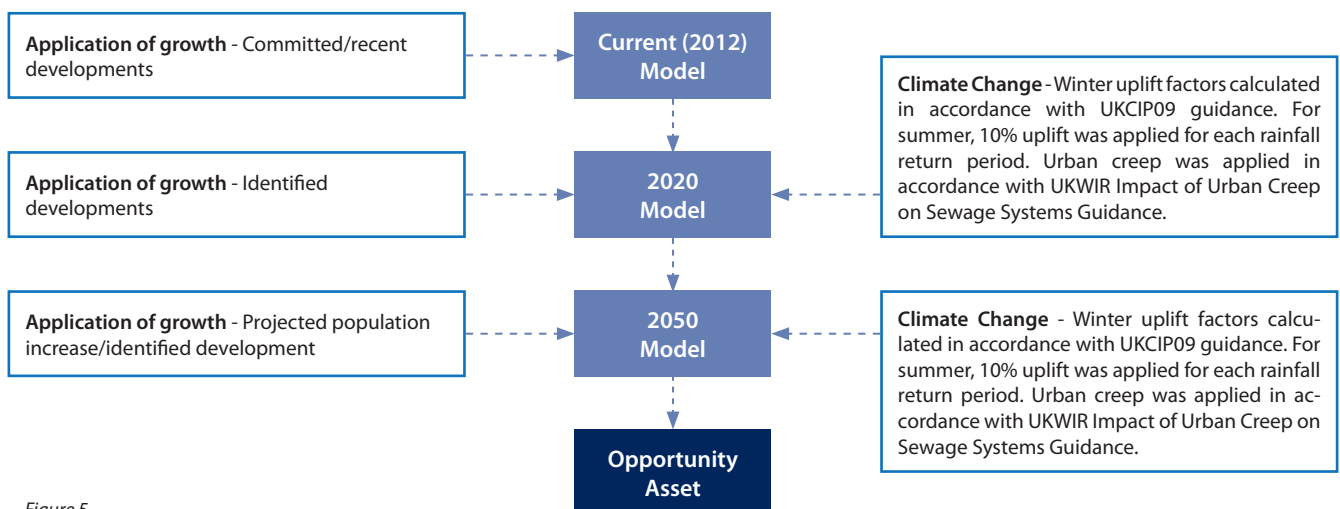
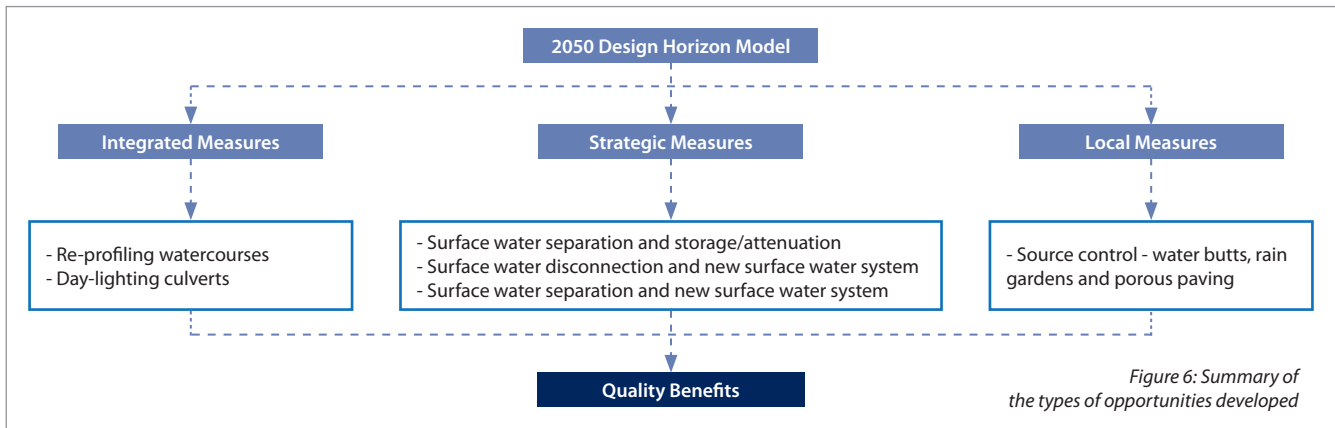


Figure 5



The hydraulic models were used to quantify the following:

- Sewer and watercourse flows at key locations.
- Flows passing between systems including overland flow.
- Operation of overflows, sewage pumping stations and pass forward flows.
- Property flood risk assessment.

Opportunities

The studies undertaken in collaboration with partners have identified measures which are appropriate for individual drainage areas and land use (figure 6 above). Opportunities were developed to ensure they were cost effective and had no adverse impact on levels of service. In addition, those identified were aligned to and support the targets defined by the partners involved in the studies, for example green spaces initiatives and engaging the local community.

Surface water management good practice was the philosophy for the studies in accordance with the SUDS Management Chain; which is to deal with surface water as close to source as possible.

Quantification of the benefits of the individual opportunities was achieved through representation in the hydraulic model and an evaluation has been carried out to compare costs for these measures.

Benefits of such measures may include:

- The opportunity to accommodate future growth which in some drainage areas is planned to increase by 30% by 2050 without increasing flood risk. In some areas predicted flood risk in the 2050 scenario was also reduced to below that of the 2012 scenario.
- The provision of landscaped water features and increased local amenity, which align with local authority green space initiatives, for example day-lighting culverts and improved drainage for open spaces.
- The removal of impermeable area contributing to the sewer network, which in some areas is up to 132Ha.
- Alignment where applicable with local surface water management plans.
- Improvements of CSOs by reducing annual spills and spill volume by up to 40%.
- Carbon reduction with reduced pumping and treatment of surface water.
- An evidence base for future investments for all partners; the positive results of measures implemented in this study could provide the basis for other areas of investment including the ability to encourage new industrial and commercial growth.

Opportunity costing methodology

The estimated construction costs of solutions were developed using two different sources of data. Solutions involving the construction of sustainable options, such as rain gardens or permeable paving,

were estimated using unit rates taken from the Environment Agency Science Report - SC060024: *Cost-benefit of SUDS retrofit in urban areas*.

Solutions involving more traditional construction, such as upsizing sections of the existing sewer network or the construction of underground storage tanks were estimated using unit rates supplied by NWL's Cost Estimation Team.

Outcomes

The TSSS Pilot Scheme achieved the following:

- Development of an integrated targeted approach.
- Development of innovative solutions which incorporate environmental enhancement.
- Developed a flood risk management strategy and tool to enable coherent understanding of the issues.
- Shared responsibility and data sharing between partners.
- Alignment to the ethos of partnership and NWL vision and values.
- Identification of the requirement to work with developers and planners to ensure strategic opportunities are explored and incorporated into new developments.

Conclusion

The pilot project was successfully delivered within the timescales and was aligned to NWL core visions and values. The integrated partnership method adopted ensures a proactive approach to the provision of sustainable capacity for regional growth, reduction in flood and or pollution risks and protection of the environment for future generations.

The study has ensured that a wider range of data sources can be realised, resulting in the construction of an integrated hydraulic model that allows a better understanding of the interactions and needs of all systems within a drainage area. Data sharing is now a 2-way process.

Using the risk based approach to inform on needs, the benefits of using integrated solutions has been quantified and presented to all partners and has been positively received, with all agreeing that the approach taken and the opportunities presented demonstrates that partnership working when considering water problems is essential to reach the best, most mutually beneficial and cost effective solutions, with the approach aligned with the DEFRA/EA Partnership funding approach.

NWL and its drainage partners have a platform upon which to progress with an integrated drainage approach.

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