

Paper 1

Authors:

Helen Udale-Clarke H.Udale-Clarke@hrwallingford.com

Richard Kellagher R.Kellagher@hrwallingford.com

Elizabeth Gorton E.Gorton@hrwallingford.com

Ed Bramley ed.bramley@yorkshirewater.co.uk

Phil Hulme phil.hulme@environment-agency.gov.uk

John Spence JJSpence@aol.com

**Water UK's 21st Century Drainage Programme - Workstream 2 – Capacity Management:
Development and application of a framework to understand the available capacity in the UK's
drainage systems**

Introduction

The vision of the 21st Century Drainage Programme is to enable the UK water industry, in partnership with the UK's governments and regulators, to take action now that will ensure the resilience and sustainability of our drainage infrastructure in the future.

As part of this Programme, Workstream 2 has been focused on understanding the available capacity in the UK's foul and combined drainage systems to accommodate present-day flows and flows expected in the future. The first phase of this work resulted in *The 21st Century Drainage Programme Capacity Assessment Framework* - a consistent, transparent and high-level approach to assessing available capacity and investment needed in the long term.

This paper describes the approach adopted by the Framework (completed in April 2017) for assessing performance and investment (present day, future and future with intervention), the metrics used by the assessment and how this information is to be visualised.

This paper also introduces the second phase of work, which is currently underway, supporting all 12 of the UK's sewerage undertakers as they embed the Framework into their organisations. This includes the development of a first draft National Picture of present day drainage capacity, due for publication in late November 2017.

The Challenge

The 21st Century Drainage Programme recognises the need to move away from the short-term delivery of levels of service towards planning for long-term resilience. As a starting point, the Government and Ofwat have challenged the industry to provide a common understanding of the current and future performance of the UK's drainage systems at the national level. Once this is available, it will then be possible to have a meaningful discussion about the desirable future level of resilience and, on this basis, identify the interventions necessary to maintain this level now and in the future.

There are nine workstreams in the Programme, aimed at providing some of the answers needed to begin to shape the nation's future drainage strategy. Workstream 2 has been looking at how the industry can develop a consistent, transparent and high-level approach to assessing the available capacity in the UK's drainage systems to accommodate future flows.

In essence, Workstream 2 has focused on the following:

- What is the current available capacity of the UK's drainage systems?
- Is this sufficient and will this be enough in the future?
- When will lack of capacity become a problem?
- What needs to be done to prevent it becoming too much of a problem?
- When should this investment be made?

The Framework

Workstream 2 has developed *The 21st Century Drainage Programme Capacity Assessment Framework* that sets out a recommended approach for sewerage undertakers to follow to assess at a high-level the available capacity of their drainage systems.

It provides a pragmatic and consistent approach to assessing: how much capacity is currently available in each drainage system; what will be available in the future; and the beneficial effects of intervention for improving the performance of the drainage system.

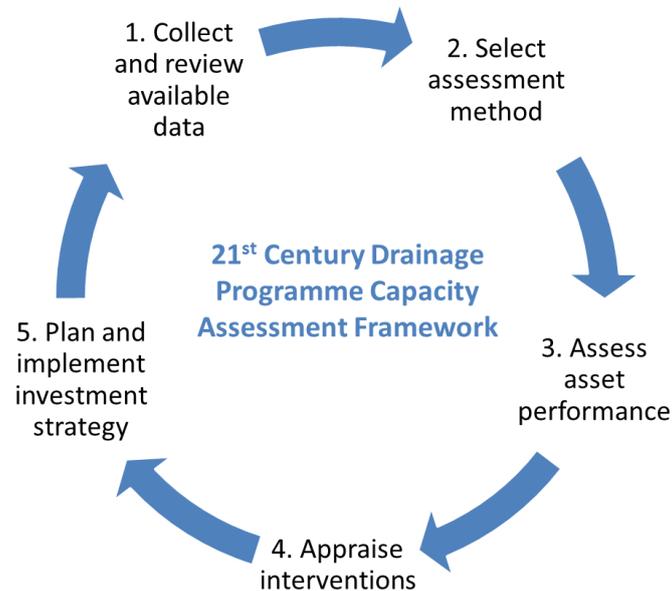
The assessment covers both pipe capacity and CSO spills. The Framework proposes a common set of simple metrics to be used by all sewerage undertakers, taking into account that drainage network data can be scarce in some catchments and the uncertainties of predicting future change.

The five steps of the Framework are summarised in Figure 1.

For now, the focus has been on how to assess the available capacity of the UK's foul and combined sewers only. It is intended that the framework will be extended, in time, to assessing the available capacity of existing surface water drainage. In theory, the assessment process would be the same. But because surface water drainage systems are the responsibility of multiple organisations, there are additional steps in the process that would need to be carried out to be able to provide a national picture.

The capacity of the UK's foul and combined sewers will be best understood when a high proportion of the systems have been modelled. At the present time, however, a significant number of systems have not been modelled (often due to a risk-based approach having been adopted where high risk systems have been prioritised) or the models are so old that they are deemed too unreliable for use. Therefore, two assessment approaches have been developed: a simple assessment approach where drainage models do not already exist (Initial Method) and a more detailed assessment approach where there are existing drainage models (Enhanced Method).

Figure 1 The five steps of the Framework



The metrics and scoring system

Simply reporting the actual available capacity for every pipe is meaningless without context. Therefore, a set of metrics has been chosen that can be measured easily and relatively quickly, but also gives a better overview of system performance from the context of drainage capacity.

System performance is split into two parts - pipes and CSOs.

Metrics for pipes:

1. Pipe full capacity / Factored dry weather flow
2. Surge return period

Metrics for CSOs:

1. Continuation pipe full capacity / Factored dry weather flow
2. Number of spills per year
3. Number of spills per summer (June, July, August) - although this is not being used for the first draft National Picture.

For each metric there is a set of recommended performance thresholds to enable users to summarise performance based on a scoring system.

There are two stages to the scoring process:

- The individual score for each pipe and CSO in the drainage system is determined first and then
- The aggregate score is determined for the identified areas (polygons) being used for reporting and visualisation purposes.

These thresholds were developed based on the testing of four pilot catchments. As experience of using the Framework grows, these thresholds can be modified.

Further details of these metrics and the scoring system are provided in Gorton et al. (2017a).

Pilot testing the Framework

The assessment method, proposed metrics and scoring system were tested on four pilot catchments; one each for England, Scotland, Wales and Northern Ireland. The results from these catchments led to a number of refinements to the Framework, whilst recognising that until the approach was tested on a much larger set of data it would not be possible to understand fully whether the metrics provide sufficient understanding of available capacity to enable meaningful decision-making.

The pilot testing was particularly useful in identifying the most suitable metrics to be used in the assessment; the best way to score the metrics; the sensitivity of the catchments to variations in future pressures (i.e. population growth, urban creep and climate change); and the sensitivity of the catchments to different levels of intervention.

Full details of the results from the testing of the pilot catchments can be found in Gorton et al. (2017a).

Embedding the Framework

Following the development of the Framework and the publication of the Guidance Document (Gorton et al. 2017b), sewerage undertakers have been encouraged to start embedding the approach into their organisations. The intention is also for the Framework to act as an enabler for companies to further embed the principles of the Drainage Strategy Framework and develop their long term Drainage and Wastewater Management Plans.

As part of this embedding process, all 12 UK sewerage undertakers agreed to contribute data to the first draft National Picture of present-day available capacity, based on the methods described in the Guidance Document. Each company reviewed the current status of their sewerage data and provided:

- a) An estimate of the level of coverage they would be able to provide for this first draft National Picture
- b) The method (i.e. Initial or Enhanced) that would be followed to provide an estimate of available capacity

Based on total national wastewater resident population, it is anticipated that 86% coverage will be achieved for pipe capacity and 72% for CSO performance for this first draft National Picture. This will

be achieved by using a combination of Initial and Enhanced methods, which varies across the different companies.

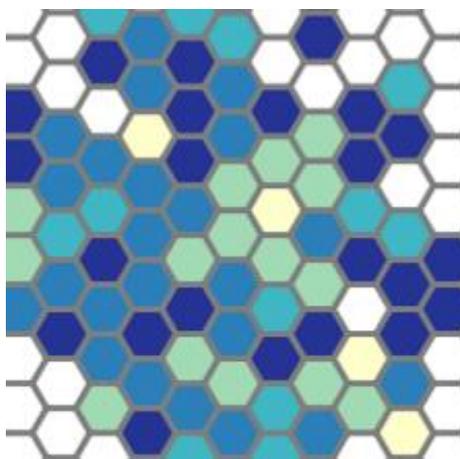
For this first draft National Picture, a pragmatic approach has been adopted to the application of the Framework methods so as to maximise coverage. This means that not all data is fully compliant with the methods presented in the Guidance Document. In general, non-compliance has been accepted where the results are unlikely to be sensitive to variations in the method used. For future iterations of the National Picture, it is expected that the need for compliance to the agreed method will increase - pending refinements to the Framework as a result of the experience gained from this first draft.

The first draft National Picture

The first draft National Picture will show present-day performance only, with separate maps for pipe capacity and CSO performance.

Figure 2 shows an example of how results will be represented geo-spatially for the first draft National Picture. Each colour represents a metric score that falls between a lower and upper threshold. At the time of writing, these thresholds are yet to be finalised and the descriptions to accompany each colour/score have yet to be decided.

Figure 2 An example of representing available capacity at the national scale



This first draft National Picture will be purely that - a picture. However, the assessment approach has been designed so that it would be feasible, with further development, to present an interactive map, allowing the user to zoom in and select hexagons for additional information. This is discussed in detail in Gorton et al. (2017a).

Conclusions

Completion of this work will provide the following key benefits:

- An opportunity for sewerage undertakers to share their experience of applying the Framework
- An opportunity to assess the appropriateness of the Framework and to provide recommendations for improvement or refinement

- A process for sharing and using performance data for the development of future iterations of the National Picture.

The development of the first draft National Picture has enabled many lessons to be learnt already, including:

- The current coverage and status of foul and combined sewer data and models across the UK
- The different approaches that sewerage undertakers have taken for recording sewer data and model results
- The different approaches that sewerage undertakers have adopted for modelling their sewerage systems
- The level of effort that would be required for each sewerage undertaker to deliver data that would be fully compliant with the Framework approach

Once this first draft National Picture has been completed, reviewed by each sewerage undertaker and put into the public domain, it is anticipated that further lessons will emerge regarding the effectiveness of the metrics used and how they have been scored; the meaningfulness of the data and accompanying narrative to wider stakeholders; and the real benefits of having this national picture in moving the industry towards a sustainable and resilient future.

Acknowledgements

The authors wish to thank the support provided by the UK's 12 sewerage undertakers in both developing the Framework and in delivering the first draft National Picture: Anglian Water, Northern Irish Water, Northumbrian Water, Scottish Water, Severn Trent Water, Southern Water, South West Water, Thames Water, United Utilities, Welsh Water, Wessex Water, Yorkshire Water.

References

Gorton, E., Kellagher, R. and Udale-Clarke, H. (2017a) *21st Century Drainage Programme - Workstream 2 - Capacity Management: Project Report*, Water UK, April 2017.

Gorton, E., Kellagher, R. and Udale-Clarke, H. (2017b) *21st Century Drainage Programme - Workstream 2 - Capacity Management: Guidance Document*, Water UK, April 2017.

Where to find more information

The reports available for Workstream 2 can be found here:

<https://www.water.org.uk/policy/improving-resilience/21st-century-drainage>