

The Development of New and Enhanced Waste Water Serviceability Indicators

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Introduction

As the count down to the next Periodic Review begins in earnest, the importance of understanding current and future Capital Maintenance requirements has never been greater or attracted a higher profile. The majority of large 'Quality' driven programmes have now been completed and the shift of emphasis for future investment within the industry is towards maintaining and improving existing asset performance.

With virtually his 'parting shot' in his role as Director General of Ofwat, Ian Byatt used an open letter to water company Managing Directors (MD161) to criticise companies for not undertaking

"an economic analysis of the options available for maintaining serviceability to customers"

and commented that

*"Each company needs to demonstrate how the flow of services to customers can be maintained at least cost in terms of both capital maintenance and operating expenditure, recognizing the trade off between cost and risk, whilst ensuring compliance with statutory duties."*¹

The Government's view on developing an approach to serviceability reflected this in their response to the Environmental Audit Committee's report on PR99:²

*"it will be important for this work to investigate the practicability of approaches that are forward looking, taking account of the risk of asset failure (probability and impact) as well as past historical trends."*³

In June 2001, Ofwat and the Environment Agency jointly sponsored a project, undertaken by Ewan Associates and Mott MacDonald,⁴ to develop new and enhanced wastewater serviceability indicators. This action was part of Ofwat's own response to the Environment Audit Committee report:⁵

"As part of its work on developing a complete and intellectually robust framework, Ofwat recognises that there is a need to improve the indicators it currently uses so that they may better reflect the level of serviceability to customers and the environment".

This study ran in parallel with a similar clean-water serviceability study sponsored by Ofwat and DWI⁶ and the UKWIR sponsored 'Common Framework for Capital Maintenance Planning' project.⁷

The Common Framework has set out the building blocks of an approach to identify forward-looking capital maintenance expenditure that meets the requirements of MD161. Ofwat, through their involvement in the Common Framework project, are generally supportive of the approach and consequently will probably expect to see companies PR04 submission prepared in accordance with it.

Project Objectives

The key objectives defined at the start of the Ofwat / Environment Agency project into developing enhanced waste water serviceability indicators were:

1. To develop indicators that could be used to help identify any long term and gradual decline in asset serviceability corresponding to a general deterioration in asset condition.

This could be described as developing indicators that would assist the avoidance of a Water Industry equivalent to the 'Hatfield scenario'. For the rail industry this represented the situation where the condition of large parts of the infrastructure asset base were perceived to have declined through a process of incremental under-investment to the point where serviceability declined sharply and the cost of improving performance was dramatically increased.

2. Indicators should be forward looking and therefore predictive.
3. The nature of serviceability indicators used by Ofwat is such that they must be capable of being used for identifying long term trends within a company and for inter-company comparisons.

The project sought to develop enhanced or additional indicators which overcome the shortcomings of the existing indicators and in addition included considerations of:

- The spatial nature of serviceability i.e. is there a tendency to geographic clustering of particular "problems" within a company?
- The distribution of a given serviceability indicator measure across the asset base ie what proportion of problems are associated with a given proportion of the asset?
- What is the appropriate level in a company at which to assess serviceability for a given asset category and how can these be aggregated to give a company value?

Project Constraints

The project timescale was 14 weeks, dictated largely by the requirement that any new indicators proposed and adopted by Ofwat could be incorporated into the June Return reporting requirements for 2002. This would ensure that data was available for 3 consecutive years to support Ofwat's determinations following PR04.

The limited time available during the project for indicator development and subsequently for consultation inevitably placed severe constraints on what could be achieved. Perhaps the most notable of these was that any new or enhanced indicators proposed for JR02 depended largely on existing data.

Definitions

A starting point in the project was to clarify two definitions. What do we mean by *Capital Maintenance* and what do we mean by *Asset Serviceability*? Our working definitions within the context of the project were:

Capital Maintenance:

The capital investment required to enable assets to continue to deliver a specified base level of service to customers and the environment.

By definition, capital maintenance excludes operational expenditure and investment on assets which may be required to deliver an enhanced level of service (above base service) or which may be required to meet growth.

Serviceability:

In the context of capital maintenance we have defined *Asset Serviceability* as:

The ability of an asset to deliver a defined service to customers and safeguard the environment.

Thus the relationship between a serviceability indicator and an asset will be such that it should be a significant indicator of capital maintenance need. This is consistent with the approach adopted by Ofwat at PR99.

In practice, developing a serviceability indicator that reflects the requirement solely for capital maintenance and excludes the many other factors that impact on service to customers is extremely difficult.

As figure 1 illustrates diagrammatically, investment focused on improving the asset condition is likely to positively impact serviceability, but changes in the serviceability indicator may also be due to a number of factors that are possibly unrelated to asset condition. Conversely it is possible to develop indicators that reflect asset condition but do not take into account the service provided to customers. Existing asset condition grade assessments for example do not necessarily reflect the service provided.

Most existing serviceability indicators do not exclusively reflect a requirement for capital maintenance. The service provided to customers is likely to be a function of many factors, some of which are likely to be unrelated to the requirement for capital maintenance. An example is the quality of effluent produced by a sewage treatment works: the works may fail its consent for a variety of reasons including shock loading, excess hydraulic loading, structural failure, mechanical failure and poor operational practice. Deterioration in performance and a reduction in reliability might be masked (from the Serviceability Indicator) by increased expenditure on operating costs and effective management.

In order to build up the most complete picture of works performance and to reduce or eliminate the requirement for subjective information, a detailed understanding of the costs involved in operating individual assets was considered essential. Unfortunately

this data was not available during the project and it remains doubtful whether this information is likely to be collected at asset level in the near future by the majority of water companies.

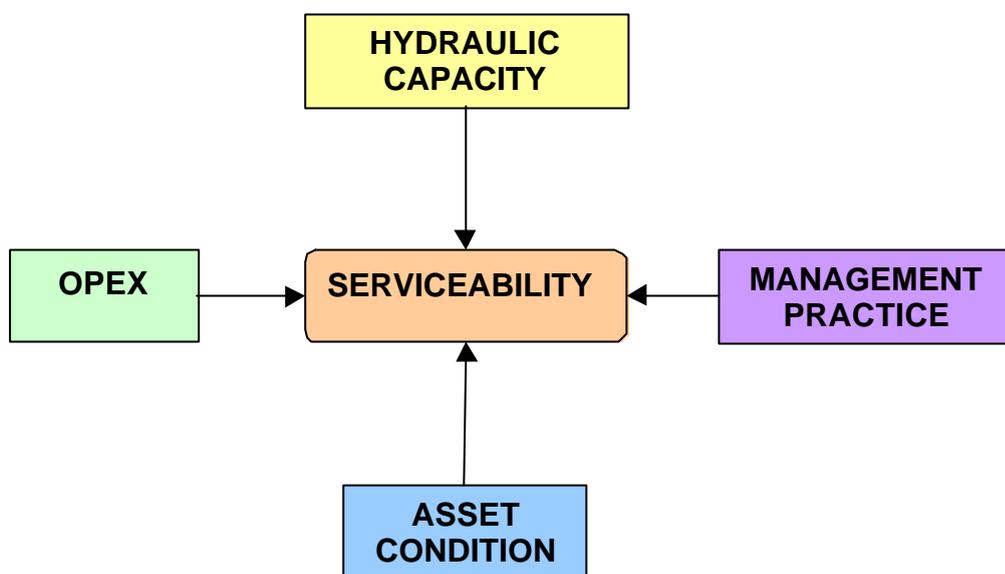


Figure 1. A wide range of factors impact on the serviceability of an asset however for capital maintenance purposes it is important to be able to identify the contribution of asset condition.

Asset Categorisation

For accounting purposes, the Ofwat accounting classification for assessing water company capital maintenance needs sub-divides the asset systems by service (water/sewerage) and by infrastructure and non-infrastructure (Table 1). It would have been attractive and perhaps more logical to consider the serviceability of the waste water systems as one integrated whole.

Infrastructure	Non-Infrastructure
The sewerage network comprising sewers, manholes, valves	Pumping Stations
Combined Sewer Overflows (CSOs)	Sewage Treatment Works
	Sludge Treatment and Disposal systems

Table 1. Waste Water Asset Categories

Each component within the wastewater carriage and treatment system was considered with respect to the ability of existing serviceability indicators to meet Ofwat’s objectives. Potential indicators were then developed for each asset group following consultation with the four volunteer water companies participating in the project.

Where new indicators were proposed that required new information to be collected, an objective was that this information should help companies run the asset group more

effectively and efficiently and justify any additional cost inherent in capturing the new data.

As the project developed it became clear that a significant amount of further development work and data collection would be required if indicators were to deliver the type of information needed to accurately inform companies and the regulator of ongoing and predicted future capital maintenance requirements. The objective of developing indicators that incorporated Risk was discussed and agreed with Ofwat and the Environment Agency as an ideal. However, the practicalities of developing risk based indicators that objectively reflect this approach ruled out their implementation in the short term largely on the basis of lack of available data.

As a consequence, a staged framework for indicators was developed. This was intended to reflect the 'where we are now position' of an indicator in terms of its development and how that indicator might be developed in the future to more fully reflect the asset's requirement for capital maintenance expenditure and finally to incorporate an assessment of Risk at Level 3. This framework is outlined in Table 2.

LEVEL 1 INDICATOR	'First Process' Presentation of Base Data	Level 1 indicators are 'first process' indicators. They are a simple report of base data which reflect asset state or customer / environmental impact. This may be in relation to defined targets (e.g. works compliance) or a report of event occurrence (e.g. number of collapses per length of sewer).
LEVEL 2 INDICATOR	Multi-Component Analysis (to enable assessment of trends).	Level 2 indicators require the analysis or combination of two or more base data to enable an identification of underlying change in asset state or customer service levels which may therefore inform an assessment of trends in serviceability. This may include spatial and probability analysis.
LEVEL 3 INDICATOR	Risk Indicator	Level 3 indicators are developments of Level 2 and incorporate the concept of Risk i.e. combine measures of both asset state and customer service.
LEVEL 4 INDICATOR	Local effects and detailed analysis	Level 4 indicators are those measures developed by W&SCs for internal management purposes and are not intended for reporting to OFWAT. They may provide for example a better understanding of local effects that may explain variations in performance or operating costs of individual assets.

Table 2. Framework for the Development of Serviceability Indicators

The proposed new indicators developed during the study were presented to Ofwat and the Environment Agency for discussion at the project mid point prior to further consultations with the volunteer water companies and final submission to Ofwat. .

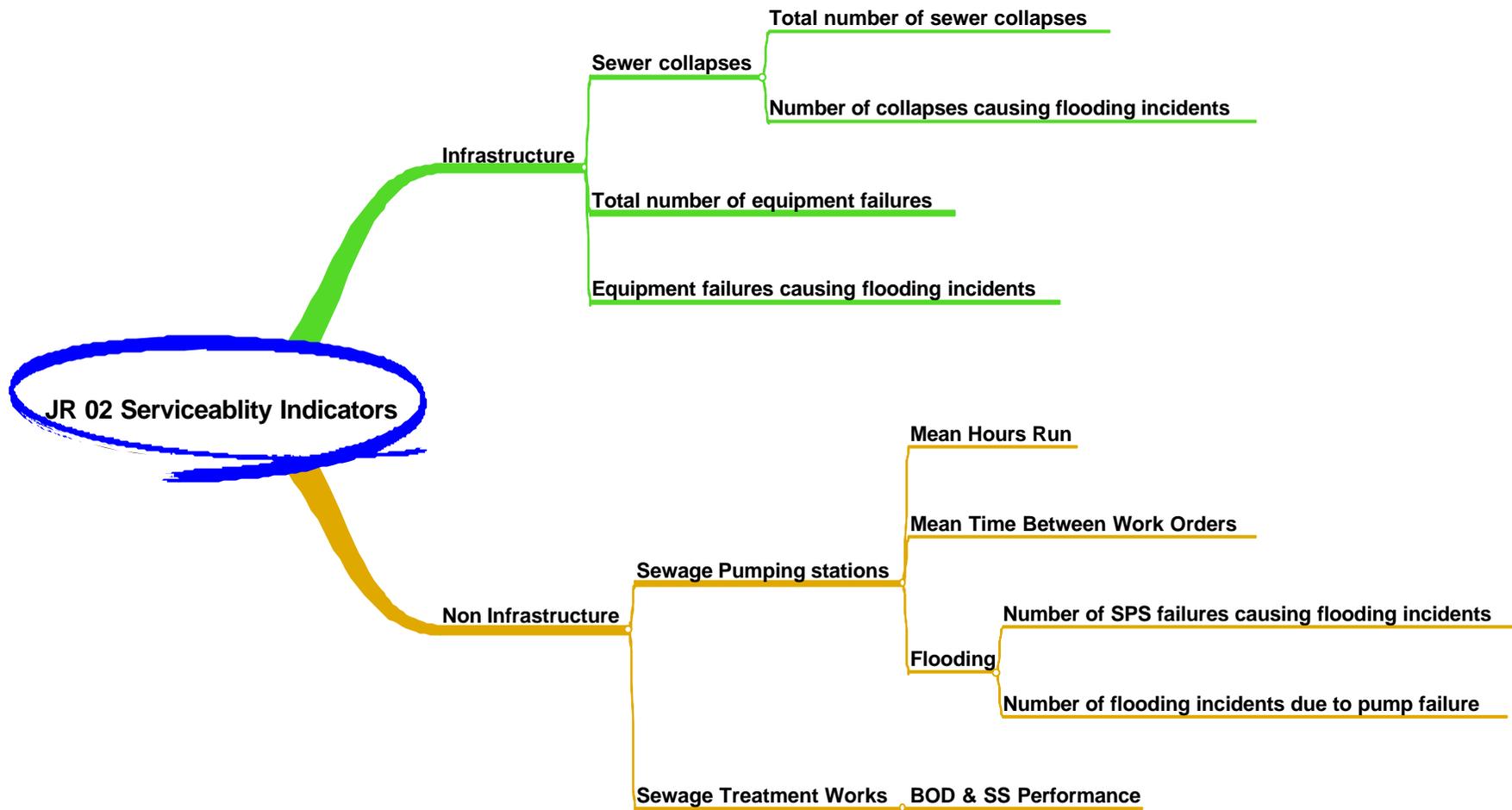


Figure 2. Indicators Included as new reporting lines for JR 02.

New Indicators For JR02

As figure 2 illustrates, a number of new lines are been included in the June Return reporting requirements, notably for sewerage infrastructure, pumping stations and sewage treatment works. Due to a lack of widely held data to support development, none of these indicators meet the objective of incorporating risk at this stage and it has also not been possible to incorporate any correlation of operating and maintenance costs with performance, again due to a lack of data.

Waste Water Treatment Works (Level 2 Indicator)

Based on existing effluent compliance data collected by the Environment Agency the new treatment works indicators are designed to provide, not so much an 'absolute' value in the same way as the existing reports for works compliance but to give a picture, through developing trends, of changes in underlying works performance. The indicators may also provide companies with an early warning of individual works whose performance is starting to deteriorate but has not yet reached statutory non-compliance. Although not incorporating an assessment of risk the new indicators do fulfill the requirement of being forward looking. The value calculated is a prediction of the performance for the coming year based on the previous 3 years of data.

Sewage Pumping Stations (Level 2 Indicator)

Sewage pumping stations represent a significant proportion of the asset base and an element which is directly responsible for affecting serviceability to customers when they fail and result in flooding. New reporting requirements are intended to highlight those pumping stations responsible for directly impacting customers in this way and to provide an overall picture of reliability within a given company's asset base. It is accepted that different companies have different maintenance policies which will affect the absolute values reported in the June Returns however changes or trends within an individual company may assist in warning of a change in the underlying condition of the asset stock that was not previously available.

Sewerage Network (Level 1 data to enable development of Level 2 Indicator)

The information requested for sewerage networks represents a 'Level 1' indicator that, by focusing on collapses and equipment failure, closely reflects the requirement for capital maintenance within the company, area or catchment. Inclusion of geographical information relating to location of events will allow subsequent cluster analysis and should allow a better feeling for the deterioration rates of particular groups or types of infrastructure assets.

Concluding Remarks

The study undertaken by Ewan Associates and Mott MacDonald on behalf of Ofwat and the Environment Agency has developed a framework for the development of serviceability indicators from their current retrospective and reactive position to predictive indicators that should ultimately incorporate an assessment of risk. The pragmatic approach adopted within the study recognises the limitations imposed by a lack of data in certain areas but allows for the evolution of indicators as available information improves.

A number of recommendations and areas for further work were made during the course of the project and the key indicators have been adopted within the JR02 reporting

requirements. These focused on potential new serviceability indicators in areas currently not assessed such as sludge treatment and combined sewer overflows as well as identifying how existing indicators might be evolved further with additional data. There is great potential to further enhance existing serviceability indicators. Companies however face an ongoing challenge to balance the costs associated with collecting and analysing new or additional asset information with the benefits this knowledge may bring both in terms of reduced risk and reduced capital maintenance.

Prediction of asset deterioration rates and the identification of the point when deterioration will affect serviceability to customers remains a key challenge facing the industry. The development of improved serviceability indicators together with the adoption of a strategy which takes risk into account will assist this process significantly. There is a general assumption that this will in turn lead to cost savings by enabling 'smarter' investment. A better understanding of asset performance will inevitably lead to a reduced level of investment uncertainty and enable risk to be managed rather than left unknown.

References

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