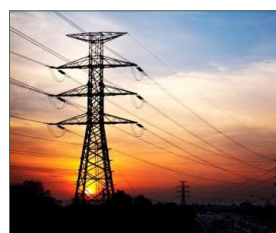


# Water & Sewerage Services Price Control 2015-21

Final Determination – Annex G  
Asset Serviceability  
December 2014



# Contents page

## Water and Sewerage Services

### Price Control 2015-21

#### Final Determination Annex G

#### Asset Serviceability

<b>1.0</b>	<b>Introduction.....</b>	<b>1</b>
<b>2.0</b>	<b>Selection of Serviceability Indicators.....</b>	<b>3</b>
<b>3.0</b>	<b>The Assessment of Serviceability .....</b>	<b>7</b>
<b>4.0</b>	<b>Regulatory Action in Respect of Serviceability.....</b>	<b>10</b>
<b>5.0</b>	<b>Sub-service Area Assessments .....</b>	<b>11</b>
5.1.	Sub-service assessment approach .....	11
5.2.	Water infrastructure sub-service .....	11
5.3.	Water non-infrastructure sub-service .....	12
5.4.	Sewerage infrastructure sub-service.....	13
5.5.	Sewerage non-infrastructure sub-service.....	14
5.6.	Overall service assessment using primary indicators.....	15
<b>6.0</b>	<b>Assessment of Individual Indicators .....</b>	<b>17</b>
6.1.	Overview .....	17
6.2.	Assessment of water infrastructure indicators.....	17
6.3.	Assessment of water non-infrastructure indicators.....	24
6.4.	Assessment of sewerage infrastructure indicators .....	30
6.5.	Assessment of sewerage non-infrastructure indicators .....	38
6.6.	Summary of reference levels and control limits .....	43

# 1.0 Introduction

- 1.1.1 This Annex to the PC15 final determination sets out the Utility Regulator's assessment of asset serviceability which contributes to our determination of future capital maintenance investment and allows us to establish 'control limits' which will be used to assess future performance.
- 1.1.2 In the final determination for PC13, we set out our intention to develop serviceability assessments to monitor delivery of the PC13 determination and provide the basis for a more robust serviceability assessment for PC15. During PC13 we engaged with the Principal Stakeholders, including NI Water, to develop a suite of indicators which could be used to assess serviceability. Our assessment is based on those indicators. We remain open to adopting alternative indicators which NI Water might propose to better represent serviceability and drive the right outcomes for its consumers.
- 1.1.3 Serviceability is the capability of an asset to provide a service. It is a broad measure based on a mix of service indicators, asset performance indicators and sub-threshold indicators which balance consumer experience and the underlying performance of the assets. Focusing asset maintenance planning on serviceability, rather than the condition or performance of the assets, will ensure that investment targets consumer outcomes in the short term and the right level of capital maintenance investment is maintained in the medium and long term.
- 1.1.4 In practice, serviceability is monitored by trending a series of defined asset performance indicators (such as the frequency of pipe bursts) and service indicators (such as the frequency of interruption to supply). Data trends are used to determine whether asset serviceability is improving, stable, marginal or deteriorating.
- 1.1.5 As well as monitoring what has been delivered, serviceability indicators provide a basis for planning asset maintenance investment to maintain a reference level of service to consumers and the environment, now and into the future.
- 1.1.6 Serviceability can be assessed for the asset base as a whole, by individual service areas, by individual assets or groups of assets, or by individual service metrics. While we present information for the individual serviceability indicators, we assess serviceability collectively for four sub-service areas of infrastructure and non-infrastructure assets in the water and sewerage service areas.
- 1.1.7 Our assessment for the final determination builds on the initial evaluation published in the draft determination. It incorporates updated information for 2013-14 received in the company's annual information return and accounts for data corrections resulting from queries raised with the company. It also addresses changes proposed by the company in its consultation response.
- 1.1.8 The overall outcome of our revised assessment remains unchanged, concluding that serviceability is stable in all four sub-service areas.

1.1.9 The remainder of this annex sets out our approach and assessment in the following sections:

- Section 2 Selection of serviceability indicators;
- Section 3 The assessment of serviceability;
- Section 4 Regulatory action in respect of serviceability;
- Section 5 Sub-service area assessments; and
- Section 6 Assessment of individual indicators.

## 2.0 Selection of Serviceability Indicators

2.1.1 This section describes how we selected serviceability indicators and sets out the indicators used in this assessment.

2.1.2 The serviceability indicators used in this assessment are set out in Table 2.1.

**Table 2.1 – Serviceability indicators**

Service	Indicator
<b>Water Infra</b>	<b>Mains bursts per 1,000km</b>
	Interruptions to supply greater than 3 hours resulting from equipment failure
	DG3 percentage of properties affected by interruptions greater than 12 hrs (unplanned & unwarned)
	Percentage of regulatory Iron samples exceeding 75% of the drinking water standard PCV
	Customer contacts per 1,000 population (Discoloured water)
	Distribution losses – an explanatory measure for mains bursts which is monitored but does not form part of the service area assessment
<b>Water Non-infra</b>	<b>Percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU</b>
	Number of regulatory THM samples exceeding 75% of the drinking water standard PCV
	Events at WTW resulting from treatment difficulties or ineffective treatments categorised as ‘significant’ or higher
	Percentage of regulatory samples taken for coliform bacteria at Service Reservoirs exceeding the drinking water standard PCV
<b>Sewerage Infra</b>	<b>Sewer collapses per 1,000km</b>
	Sewer blockages per 1,000km
	Number of H, M and L pollution incidents from the sewer network (CSOs, rising mains and foul sewers)
	Properties flooded in the year (other causes)
	Total number of equipment failures repaired
<b>Sewerage Non-infra</b>	<b>Percentage of WwTW discharges not compliant with numeric consents</b>
	Percentage of total population equivalent served by WwTWs not compliant with numeric consents
	Percentage of BOD, SS and Ammonia compliance sample results which exceeded their numeric consent value
	Number of WwTWs with one or more compliance sample result (BOD, SS or Ammonia) exceeding the numeric consent value

- 2.1.3 For each service area a primary indicator is shown first in bold. Particular weight is given to the primary indicators when assessing serviceability.
- 2.1.4 Serviceability is a relative measure which assesses the performance of a company relative to its historical performance. While the proposed approach is based on a methodology previously used in England and Wales, it was not essential to use the same basket of indicators. The choice of indicators has taken account of established monitoring practices by the quality regulators (Drinking Water Inspectorate DWI and Northern Ireland Environment Agency NIEA) and the indicators which NI Water uses to monitor its assets and inform asset maintenance investment.
- 2.1.5 The number of indicators used to assess serviceability is a matter of judgement. Too few indicators could lead to an ill informed assessment. Too many, and the assessment becomes unduly complex. Experience suggests that the order of six indicators is sufficient to judge serviceability in an individual service area.
- 2.1.6 A mix of three types of indicators has been adopted to assess serviceability:
- **Service indicators.** These measure the service as experienced by consumers and are based on the service targets used to measure NI Water's performance. For example service targets for interruption to water supplies;
  - **Asset performance indicators.** These measure the performance in terms of asset failure which becomes the root cause of service failures. For example the frequency at which bursts occur on water mains; and
  - **Sub-threshold indicators.** These have been introduced to monitor serviceability before a recognised service or asset performance failure level is reached. They allow deterioration of assets to be identified before the asset fails. For example, a water treatment works 'fails' if turbidity reaches the prescribed concentration value (PCV) of 1.0 NTU – a sub-threshold indicator of the number of samples above 0.8 NTU has been used. Sub-threshold indicators reduce the risk that management action to maintain service targets or asset performance targets masks an underlying deterioration of serviceability.
- 2.1.7 When developing our approach to serviceability we concluded that the following benchmarks were useful when assessing and selecting suitable serviceability indicators:

#### **Primary criteria**

- Is it appropriate for assessing asset performance linked to serviceability?

#### **Secondary criteria**

- Is it meaningful, practical, measurable and relevant to the company?

- Is it used by the company to monitor, assess and inform asset maintenance requirements?
- Is performance for the indicator within the company's control?
- Does it provide robust 'stable' data?
- Is it currently reported or externally verifiable?
- Is it used or recognised by external stakeholders, in particular the quality regulators?
- Is an historical data trend available or can a reasonable period of historical data be back-cast?

2.1.8 Based on the above criteria we reviewed the serviceability indicators used in England and Wales and identified other indicators for consideration. In addition to established service, performance and sub-threshold indicators we considered:

- Consumption indicators such as power usage or chemical consumption. We concluded that changes in this type of indicator were influenced more by changes in need and operational practice than by the performance of the assets; and
- Indicators which link asset failure and service consequence – for example sewage pump failure which results in an overflow. Some indicators of this type were included and we will consider additional indicators of this type in the future.

2.1.9 The serviceability indicators we use are the type of indicator the company should use to target investment and monitor the effectiveness of asset maintenance. The relative merits of each indicator were assessed and then reviewed with NI Water. As part of this process, NI Water was asked to propose other indicators which might better reflect serviceability and take account of the company's developing asset management systems. The company did not offer alternative measures. We believe that there is a need for indicators that represent non-infrastructure serviceability based on unplanned maintenance indicator(s) and we asked the company to draw up a specification for this type of measure. The company did not have a specific measure in place but has now developed a specification. However, it will be some time before a data trend is available to allow this to be effective.

2.1.10 While the assessment depends on the collection of long term data, the basket of serviceability indicators is not fixed. The Utility Regulator remains open to considering alternative indicators which would enhance the assessment. We would welcome suggestions from stakeholders for indicators that might provide a better indication of serviceability. In particular, we would encourage NI Water to continue to identify and propose alternative serviceability indicators as its asset management systems and processes develop.

- 2.1.11 Serviceability indicators will be reviewed from time to time to ensure that they remain appropriate and effective. As compliance improves towards 100%, some of the statutory compliance measures will become less useful and greater reliance might be placed on sub-threshold indicators. Where experience shows that the selected basket of indicators does not address a particular service issue, we will consider introducing alternative targeted indicators.
- 2.1.12 Effective assessment depends on reliable data which has been collected over the medium to long term using a consistent methodology. The poor quality of some historical data could compromise the assessment in the short term. We have recognised this in the selection of initial indicators and the quality of historical data will influence how we use serviceability assessments until robust data trends can be established.
- 2.1.13 The serviceability indicators and serviceability assessment do not replace regulatory targets or provide a performance measure for quality compliance. Their sole purpose is to assess asset maintenance and monitor the effective delivery of asset maintenance. Issues relating to quality compliance and regulatory targets will be addressed through existing statutory and regulatory processes.



## 3.0 The Assessment of Serviceability

- 3.1.1 This section describes how we will carry out an annual assessment of serviceability to determine whether serviceability is improving, stable, marginal or deteriorating.
- 3.1.2 The assessment of serviceability is based on the trend in performance for each individual indicator. This leads to an assessment of the serviceability for the service area as a whole which identifies whether serviceability is:
- Improving;
  - Stable;
  - Marginal; or
  - Deteriorating.

### Establishing serviceability control limits

- 3.1.3 The trend of each indicator is assessed against a **reference level of service** and upper and lower **control limits**.
- 3.1.4 We will have more regard to the upper control limit in our analysis. The lower control limit will act as a trigger for a review of the control limits. It should not be seen as a barrier to improved performance and it should not be taken as the Utility Regulator's view of an acceptable limit of performance which the company is not expected to out-perform. This is of particular importance where there are ongoing opportunities for management action and improved asset management techniques to continue to improve service at relatively low cost.
- 3.1.5 The reference level of service reflects the best historic level of performance unless this is demonstrably atypical or sub-optimal. In the first instance, it is based on the average performance over two consecutive years during a period when the data is considered to be of acceptable quality. This aims to identify a challenging but realistic reference level.
- 3.1.6 Upper and lower control limits allow for variability of performance around the reference level of service. It allows the company flexibility to manage asset maintenance and allows for the natural variability in performance due to external drivers such as weather. In the first instance, these limits are established by considering the variation between the two data points used to determine the reference level and are calculated using the following formulae:

$$\text{Upper control limit} = \text{Reference level} + \left[ A \times \frac{1}{2} (\text{difference between the two data points in the reference period}) \right]$$

$$\text{Lower control limit} = \text{Reference level} - \left[ A \times \frac{1}{2} (\text{difference between the two data points in the reference period}) \right]$$

- 3.1.7 The default value for the coefficient 'A' is normally taken as 3.

- 3.1.8 However, we do not adopt a prescriptive approach to the determination of reference levels and control limits. Where appropriate we will also consider:
- Longer trends and variability of historical data. Where we develop confidence limits based on longer term data trends, we will normally set the reference level at the mean and control limits at 2 standard deviations from the mean; and
  - The inherent variability caused when limited random sampling is used to assess performance. When we do this, we will normally set control limits at 2 standard deviations from the mean using a standard deviation determined from the binomial distribution approximation to random sampling from a population.
- 3.1.9 Where an indicator is a measure of customer service or a statutory quality compliance measure, we have tended to adopt a more challenging upper control limit. The use of these measures to monitor serviceability should not be seen as a reason for declining consumer service or quality compliance. Over time, we would wish to adopt serviceability indicators which relate more to the performance of the assets and move away from those which are based on consumer service or statutory compliance.
- 3.1.10 We recognise that some of the indicators can be materially affected by extreme events, often occurring over a short period. Where it is possible for the company to identify the impact of a short duration extreme event, we will consider adjusting the assessment to reflect the underlying serviceability of the assets. However, we will do so with caution as performance during extreme events may be a key signal for the need to improve the resilience of the asset base to maintain or improve the overall level of service provided.
- 3.1.11 We will take account of other factors in our assessment such as changes in methods of measurement and past and future investment.
- 3.1.12 This is the first time we have determined serviceability indicators, reference levels and control limits. For many of the indicators the useful data trend is relatively short either because past data was of doubtful quality or because significant quality investment over the last decade has resulted in a stepped change in performance. In view of this, we will review the reference levels and control limits at the mid-term review to take account of further changes in data quality, changes in methodology and improvements which quality investment will deliver. This will also give the company time to propose alternative indicators of serviceability and develop its asset management processes to better inform future serviceability trends.
- 3.1.13 The reference level does not need to be a constant level. Where the company has been funded to deliver service improvements, including improved quality compliance, these may be reflected in an improving reference level over the period of the relevant plan.

## Assessing serviceability against the control limits

- 3.1.14 NI Water is expected to monitor performance for each indicator and to manage and maintain its assets so that all indicator values remain well within the upper control limit.
- 3.1.15 The performance against the serviceability indicators will be assessed using four categories:
- Improving: Improved performance sustained over a number of years;
  - Stable: Performance broadly stable around the reference level and within control limits;
  - Marginal: Shorter term deterioration or improvement that indicates a stepped change from the level of service; and
  - Deteriorating: A reduction in performance sustained over a number of years that suggests that a reduction in the reference level of service has occurred.
- 3.1.16 Because the serviceability indicators can be influenced by external factors and sampling variance, a change in one year is not sufficient to determine a change in performance. A change in performance needs to be demonstrable over a number of years before re-categorisation occurs. For example:
- Two successive increases that together show a significant step up from the reference level of service would be considered a marginal trend irrespective of whether the upper control limit had been exceeded; or
  - Three successive increases, representing a significant cumulative change from the reference level, would be considered a deteriorating trend.
- 3.1.17 Persistent performance at or around the upper control limit could also result in a 'deteriorating' assessment irrespective of whether the upper control limit has been exceeded or not. This will ensure that the company operates within a range around the reference level rather than operating close to the upper limit.
- 3.1.18 The requirement for a sustained trend to be demonstrated before performance is categorised as deteriorating or marginal provides the opportunity for corrective action to be taken by the company to consider and address any deterioration in performance.

## Overall service area assessment

- 3.1.19 Stable serviceability is expected to be maintained for all of the company's assets and so the serviceability assessment concludes with an evaluation of whether the overall performance in each service area is improving, stable, marginal or deteriorating. The individual performance assessment for each indicator in the basket is used to determine an overall balanced service area assessment. Particular reliance will be placed on the primary indicator in each area in coming to the overall assessment. No formal weighting is employed and a degree of judgment is applied to determine the overall outcome.

## 4.0 Regulatory Action in Respect of Serviceability

- 4.1.1 This section sets out our requirement for the submission of serviceability data and assessments by NI Water and the action we would take if serviceability is marginal or deteriorating.
- 4.1.2 NI Water shall provide an annual serviceability submission and an assessment of whether serviceability is improving, stable, marginal or deteriorating.
- 4.1.3 Where serviceability is declining but marginal, the company should set out its assessment of the cause of the decline in serviceability and the steps it will take to restore stable serviceability.
- 4.1.4 Where serviceability has been confirmed as deteriorating, the company should set out a detailed action plan to arrest the deterioration and restore stable serviceability. We would monitor delivery of the action plan on a regular basis.
- 4.1.5 If we considered the company's action plan to arrest deteriorating serviceability to be inadequate, or it did not deliver the action plan, or delivery of the action plan did not restore stable serviceability, we would consider taking enforcement action under Article 30 of the Water and Sewerage Services (Northern Ireland) Order 2006.
- 4.1.6 We would also consider logging down the cost of work necessary to restore serviceability in such circumstances whether we proceed to take enforcement action or not.
- 4.1.7 Many of the serviceability indicators draw on quality compliance data used by the quality regulators (DWI and NIEA) to monitor compliance with statutory standards and consents. The work of these regulators and the action they take to enforce compliance means that a sustained deterioration in performance against a quality compliance measure is unlikely. If we conclude the performance against these indicators has deteriorated, we would first consult the relevant quality regulator before we consider taking enforcement action in respect of serviceability.
- 4.1.8 We recognise that the serviceability assessment is based on a selected basket of indicators chosen to be representative of the main assets and services provided. If there is evidence that there is a decline in other service indicators or sub-groups of assets, we will take the following action:
- We will ask the company to assess the cause of the decline and identify the steps it will take to restore stable serviceability; and
  - Consider whether it is appropriate to add the particular indicator to the basket of serviceability indicators and include it in future serviceability assessments.

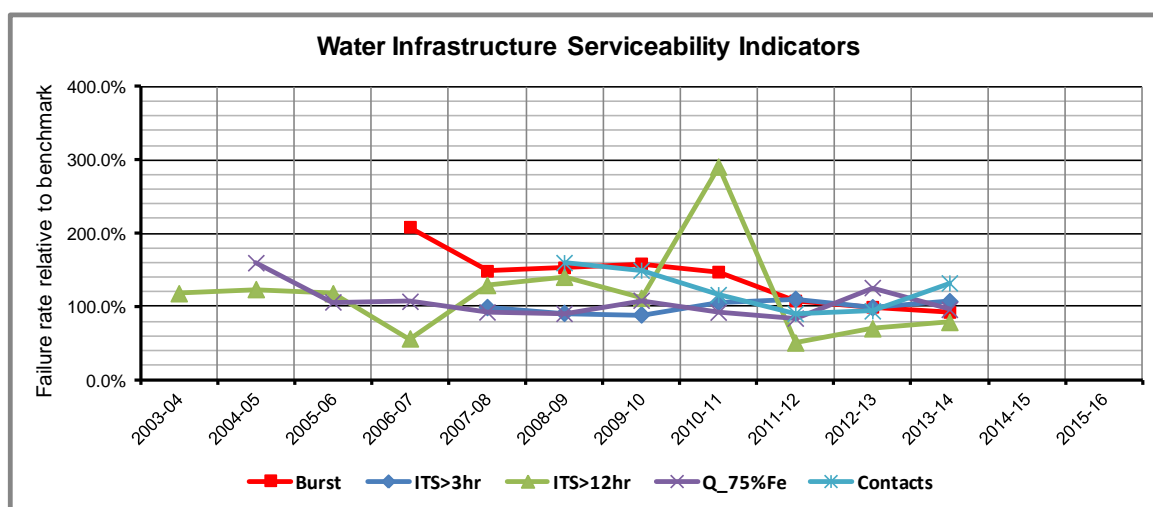
# 5.0 Sub-service Area Assessments

## 5.1. Sub-service assessment approach

- 5.1.1 This section summarises our assessment of serviceability by sub-service.
- 5.1.2 Sub-service serviceability is assessed using trends in performance relative to the selected reference level chosen for each indicator. This standardises data for different indicators allowing them to be plotted and compared on a common scale.
- 5.1.3 The assessment is a matter of judgement which follows the general principles outlined in Section 3.0. We give particular weight to the 'primary' indicator but consider the range of indicators used. We provide a brief explanation of our assessment highlighting any concerns with individual indicators. A more detailed assessment of the individual indicators is given in Section 6.0.

## 5.2. Water infrastructure sub-service

**Figure 5.1 – Water infrastructure service serviceability indicators**

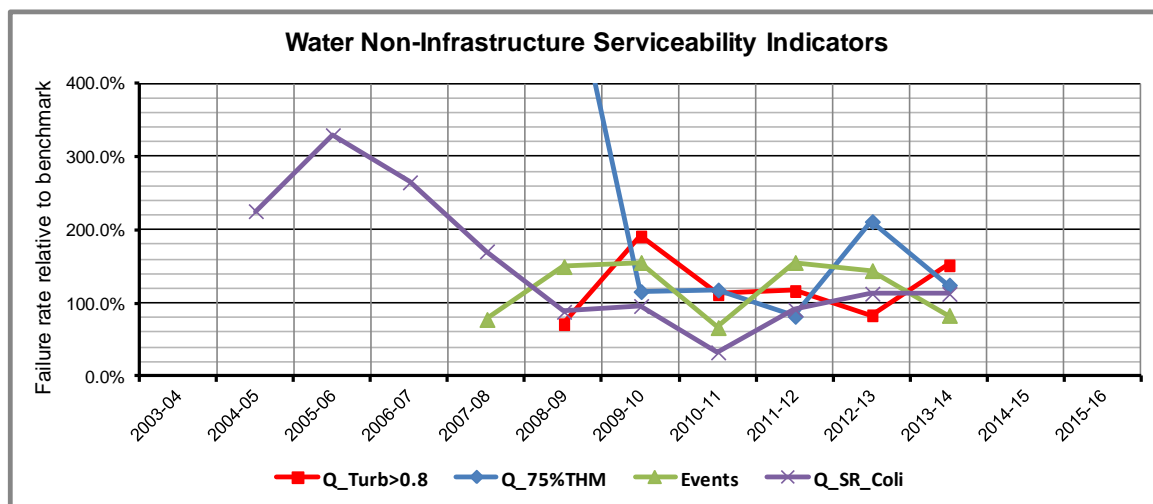


- 5.2.1 Our overall assessment of water infrastructure serviceability is stable.
- 5.2.2 The primary indicator (water mains bursts per 1, 000km) reduced significantly in 2011-12 and is now stable at levels comparable to the best performing systems in England & Wales. This is consistent with the relatively young age profile of water mains operated by NI Water. The spike in interruption to supply greater than 12 hours in 2010-11 is attributable to a major incident where it took some time to restore supplies.

- 5.2.3 We are aware of the significant increase in discoloured water complaints in 2013-14. This is an issue for the company to consider and address. We will review the impact on serviceability if this continues to a marginal or deteriorating trend in future years.

### 5.3. Water non-infrastructure sub-service

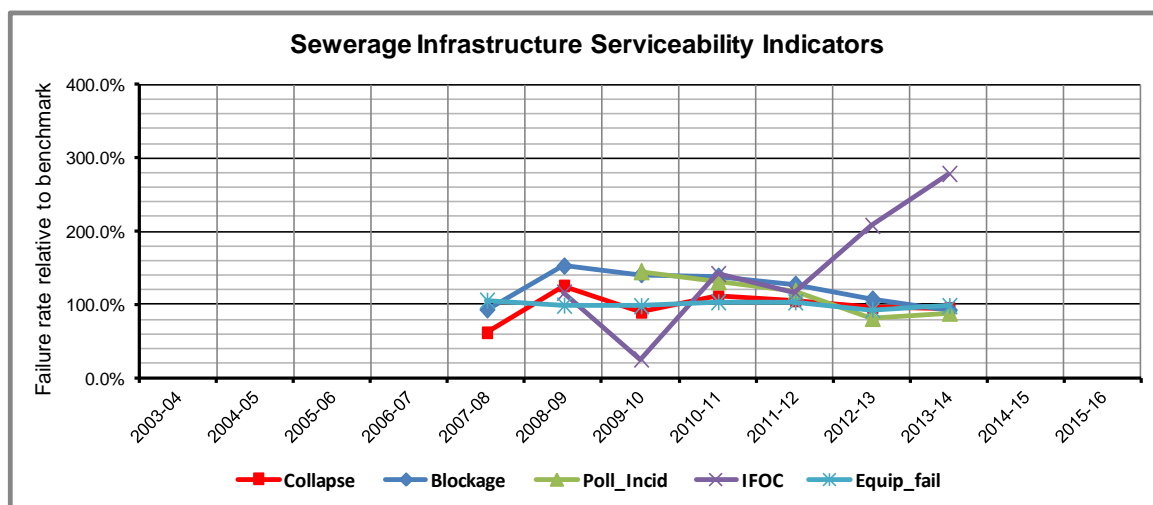
Figure 5.2 – Water non-infrastructure sub-service serviceability indicators



- 5.3.1 Our overall assessment of water non-infrastructure serviceability is stable.
- 5.3.2 Water treatment performance improved significantly over the period 2004-10 due to major investment in water treatment and service reservoir rehabilitation to secure compliance with drinking water quality standards. Serviceability has stabilised at a new improved level.
- 5.3.3 The trend for the primary indicator (percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU) has increased in 2013-14. This increase is an issue for the company to consider and address. We will review the impact on serviceability if this continues to a marginal or deteriorating trend in future years.
- 5.3.4 We are aware of the increase in service reservoir coliform bacteria over three years following a low figure in 2010-11. This occurred at a time when investment in service reservoir rehabilitation reduced because of delays to the procurement of a new framework contract. As part of its PC15 submission, the company has described work to develop the prioritisation of service reservoir rehabilitation which aims to address this trend.
- 5.3.5 We believe that there is a need for non-infrastructure serviceability indicators that are based on unplanned maintenance indicator(s) and we asked the company to draw up a specification for this type of measure. The company did not have specific measures in place but has developed a specification. However, it will be some time before a data trend is available to allow this to be effective.

## 5.4. Sewerage infrastructure sub-service

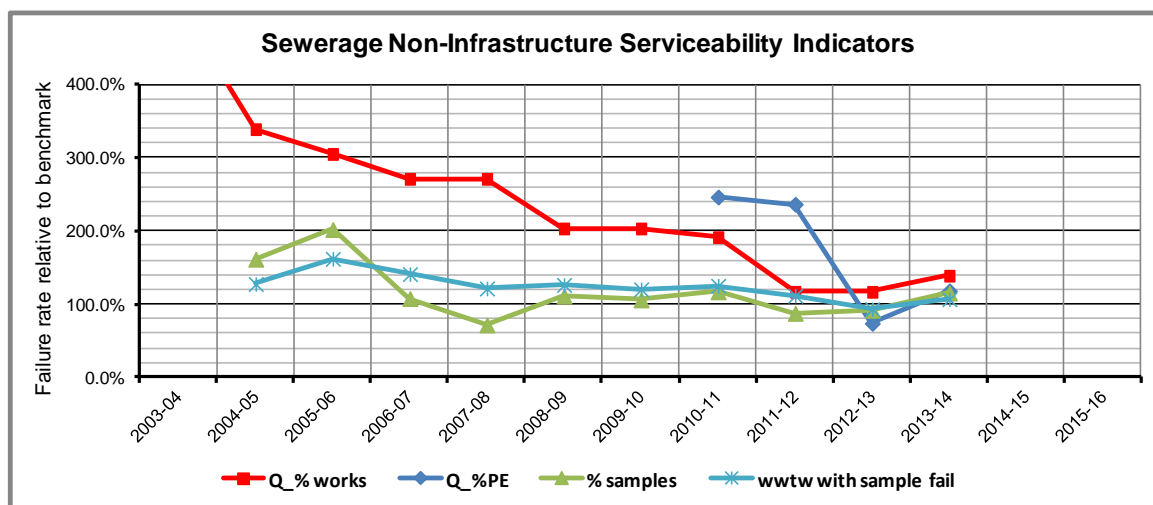
**Figure 5.3 – Sewerage infrastructure sub-service serviceability indicators**



- 5.4.1 Our overall assessment of sewerage infrastructure serviceability is stable.
- 5.4.2 The number of sewer collapses has remained stable since 2008-09 following improvement in data recording with some indication of a marginal improvement.
- 5.4.3 There has been a sustained improvement in the number of sewer blockages and pollution incidents. However, we believe that this is attributable to proactive management action to prevent repeat blockages and pollution incidents occurring rather than any change in the asset.
- 5.4.4 The level of sewer collapse and sewer blockage in Northern Ireland remains high when compared to England & Wales. It is possible that there is further action that management could take to target blockage hot spots and reduce the level of repeat blockage. Until this has been explored, we do not have confidence in the use of sewer blockage as a robust indicator of serviceability.
- 5.4.5 We note the increase in internal flooding caused by blockage or equipment failure (IFOC) in 2012-13 and 2013-14. We are aware that this indicator is affected by weather conditions and is a weak indicator of the underlying assets. However, flooding can have both major short and long term impacts on the people affected and the increase is an area for the company to consider and address.
- 5.4.6 We considered including the 'number of sewer repairs' in the basket of sewerage infrastructure indicators for the final determination. However the trend for this data was found to be almost identical to that for sewer collapses for the shorter period for which data was available. We therefore do not see any benefit in including it at this stage. We will continue to monitor the trend for this indicator and will consider its inclusion in the future if it emerges that it is providing an additional insight into asset performance.

## 5.5. Sewerage non-infrastructure sub-service

Figure 5.4 – Sewerage non-infrastructure sub-service serviceability indicators



- 5.5.1 Our overall assessment of sewerage infrastructure serviceability is stable.
- 5.5.2 The serviceability indicators used for sewerage non-infrastructure are based on the analysis of regulatory samples taken to monitor compliance with numeric consent standards.
- 5.5.3 Two indicators are based on standard of compliance using the percentage of works failing to meet their consent standard and the percentage population equivalent of works failing to meet their consent standard. With significant investment in wastewater treatment to meet new consents over the last decade, there has been significant improvement in these indicators, and further improvement might be expected as this quality investment continues. Two sub-threshold indicators have also been included based on the number of individual samples which fail to meet the numeric consent value. These have remained stable over the last eight years suggesting that serviceability is stable. This assessment may be superficial as the introduction of more onerous standards over this period requires a much higher performance to deliver the same score. As the move for tighter discharge standards in response the European directives reaches a conclusion, these indicators will provide a better measure of serviceability trends.



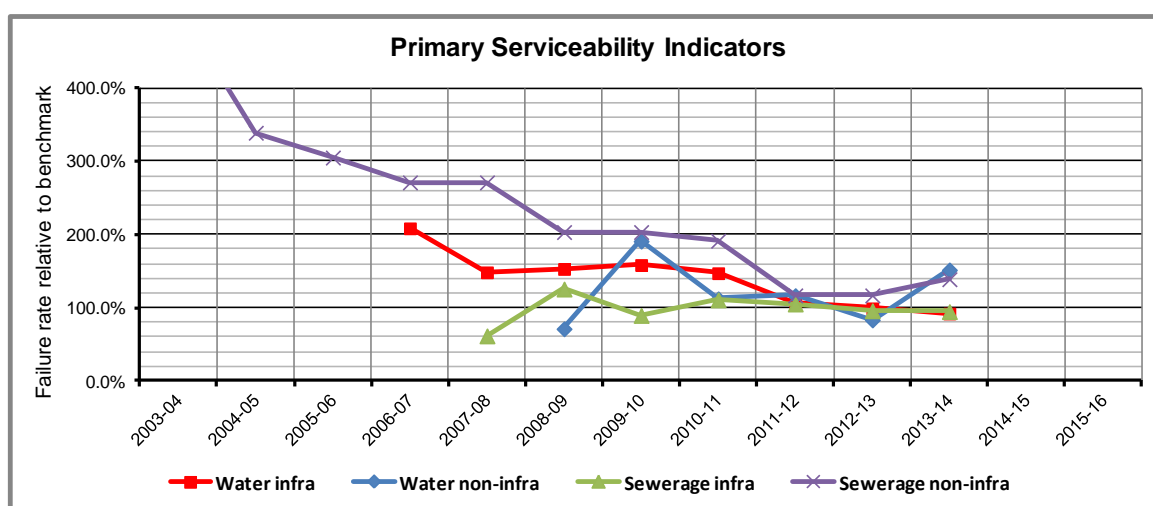
## 5.6. Overall service assessment using primary indicators

5.6.1 While we use a basket of indicators to assess serviceability, we give particular weight to a primary indicator in each sub-service area. The primary indicators used for the final determination are shown in Table 5.1 and their trend relative to reference levels are shown on Figure 5.5

**Table 5.1 – Primary serviceability indicators**

Service	
<b>Water Infra</b>	Mains bursts per 1,000km
<b>Water Non-infra</b>	Percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU
<b>Sewerage Infra</b>	Sewer collapses per 1,000km
<b>Sewerage Non-infra</b>	Percentage of WwTW discharges not compliant with numeric consents

**Figure 5.5 – Primary serviceability indicators**



- 5.6.2 The trends in the primary indicators show that the overall serviceability is stable, confirming the individual assessments for each sub-service area.
- 5.6.3 For the final determination we adopted the 'percentage of WwTW discharges not compliant with numeric consents' as the primary indicator for wastewater non-infrastructure. This is a change from the draft determination where the 'number of WwTWs with one or more compliance sample result exceeding the numeric consent' was used.
- 5.6.4 This change was made following concerns expressed by the company in its response to the draft determination. It advised that proposed changes in operational practice associated with delivery of efficiencies could lead to

variation in this figure in the short term which would not necessarily be reflective of asset deterioration.

- 5.6.5 We will explore the detail, rationale and implications of the changes referred to by the company and monitor their impact in the medium term. We still believe that the number of works with one or more sample result exceedance has the potential to be a stronger serviceability measure. It is a sub-threshold indicator which provides an indication of the trend in asset performance short of consent failure. We may therefore consider adopting this as the primary indicator at a later stage.

# 6.0 Assessment of Individual Indicators

## 6.1. Overview

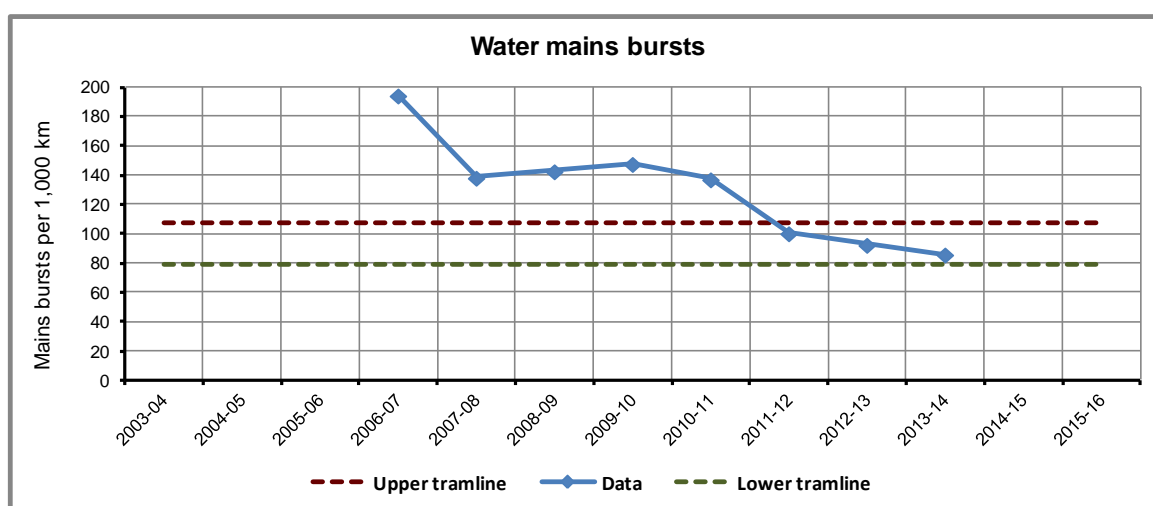
6.1.1 This section provides more detailed information and assessment of the individual serviceability indicators. It describes any amendments made following the draft determination and our assessment of proposals submitted by NI Water in its consultation response.

## 6.2. Assessment of water infrastructure indicators

### Water mains bursts

6.2.1 Water mains bursts are assessed as the number of bursts per 1,000km of water mains.

**Figure 6.1 – Water infra – water mains bursts**



Reference level	93.4	Upper control limit	107.9	Lower control limit	78.9
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6.2.2 NI Water agreed with our draft determination assessment and the approach for the final determination remains broadly unchanged.

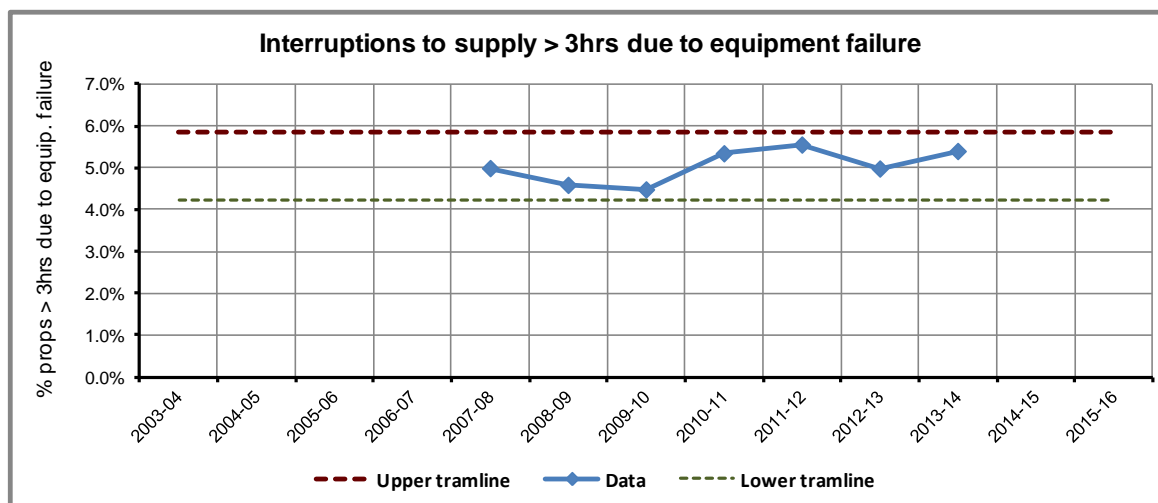
6.2.3 The reference level has been established on the average of performance in 2011-12 and 2013-14. In the draft determination the upper and lower control limits were set at 3 times the difference from the reference level for the selected years. For the final determination this was changed to 2 times the difference to account for the revised 2013-14 out-turn which indicates further improvement.

- 6.2.4 The trend is stable following a marked reduction in burst rate in 2011-12. Current levels of performance are comparable to the best performing water service providers in England & Wales, consistent with the relatively young age profile of water mains in Northern Ireland.

## Interruption to supply caused by equipment failure

6.2.5 Interruptions to supply caused by equipment failure are assessed as the percentage of properties affected by an interruption to supply lasting greater than three hours caused by equipment failure.

**Figure 6.2 – Water infra - interruption to supply caused by equipment failure**



Reference level	5.04%	Upper control limit	5.86%	Lower control limit	4.23%
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6.2.6 NI Water agreed with our draft determination assessment and the approach for the final determination remains unchanged.

6.2.7 The reference level has been established as the average of the seven years of data available with upper and lower control limits based on 2 times the standard deviation of the data from the reference level.

6.2.8 The trend is stable.

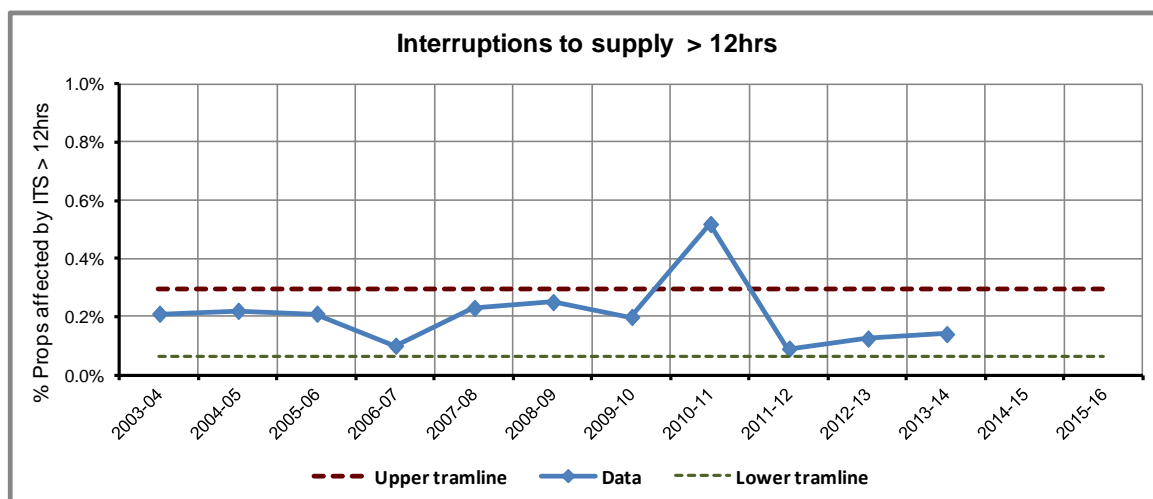
6.2.9 The data has been adjusted to exclude the extreme level of interruption to supply which occurred in the 2010-11 freeze thaw when demand exceeded NI Water's ability to produce and distribute water.

6.2.10 Given that water main bursts are a key cause of interruptions to supply, we note that the stable trend does not reflect the stepped reduction in bursts which occurred in 2011-12. The ability to analyse and understand this type of relationship would allow the company to identify and prioritise interventions which could be taken to reduce equipment failure with a view to reducing interruptions to supply.

## Interruptions to supply greater than twelve hours

6.2.11 Interruptions to supply greater than twelve hours are assessed using the DG3 measure for unplanned and un-warned interruptions to supply reported as the percentage of properties affected by an interruption to supply greater than twelve hours.

**Figure 6.3 – Water infra - Interruptions to supply greater than 12 hours**



Reference level	0.18%	Upper control limit	0.29%	Lower control limit	0.06%
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6.2.12 NI Water agreed with our draft determination assessment and the approach for the final determination remains unchanged.

6.2.13 The reference level has been established as the average of the data (excluding the peak in 2010-11) with upper and lower control limits based on 2 times the standard deviation of the data from the reference level.

6.2.14 The trend is stable.

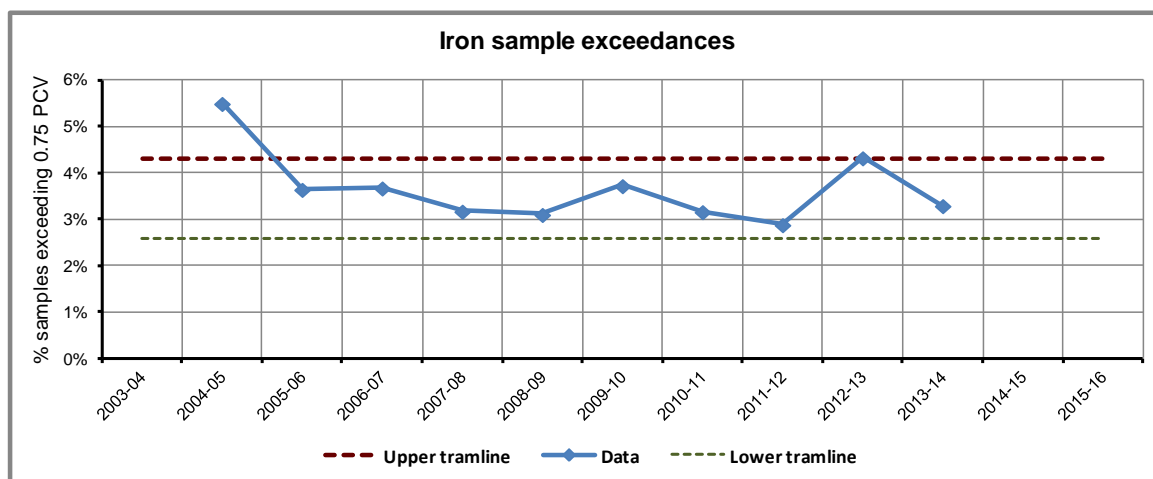
6.2.15 The data has been adjusted to exclude the extreme level of interruption to supply which occurred in the 2010-11 freeze thaw, where demand exceeded NI Water's ability to produce and distribute water.

6.2.16 The spike in interruptions to supply greater than twelve hours in 2010-11 is attributable to a major incident in Kilkeel where it took some time to restore supplies and remove airlocks. This highlights a key weakness in this indicator. It normally runs at a low level with the company making every effort to prevent interruptions to supply running for long durations. It is therefore susceptible to single events (such as a main which is difficult to access and repair) which can make the results unstable. We will therefore give a low weight to this indicator when judging overall serviceability. However, because of its high impact, we will retain it as an indicator and monitor performance against it. We expect the company to undertake root cause analysis of these events to learn lessons and minimise the risk of reoccurrence.

## Water quality – iron

6.2.17 Water quality - iron is assessed as the percentage of regulatory water quality samples taken at consumers' taps where the iron concentration exceeds 75% of the PCV. It offers an indication of how water quality is impacted in distribution by corrosion products from water mains.

**Figure 6.4 – Water infra – water quality - iron**



Reference level	3.45%	Upper control limit	4.32%	Lower control limit	2.58%
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6.2.18 NI Water agreed with our draft determination assessment and the approach for the final determination remains unchanged.

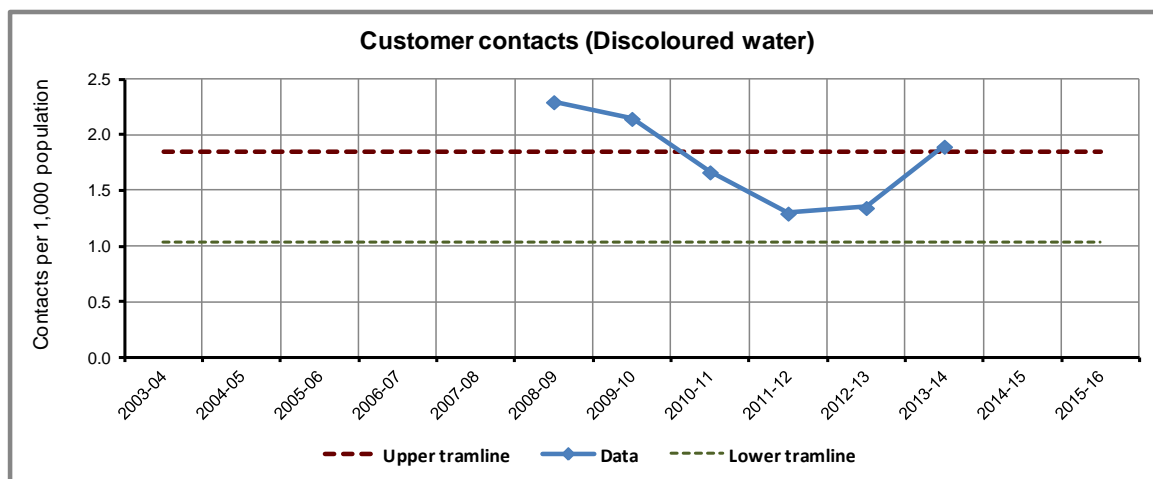
6.2.19 The reference level has been established as the average performance from 2005-06. The control limits are 2 standard deviations from the reference level with the standard deviation determined assuming a binomial distribution of failures to reflect the random sampling regime used to assess statutory water quality compliance.

6.2.20 The trend is stable. As yet, there is no strong indication that the work on mains rehabilitation has done more than keep pace with the deterioration of the system.

## Consumer contact regarding discoloured water

6.2.21 Consumer contact regarding discoloured water is assessed as the number of contacts per 1,000 population. The indicator provides a measure of the aesthetic quality of water delivered as perceived by consumers.

**Figure 6.5 – Water infra - consumer contact regarding discoloured water**



Reference level	1.44	Upper control limit	1.85	Lower control limit	1.03
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6.2.22 NI Water agreed with our draft determination assessment of the reference level but proposed control limits based on 3 times the standard deviation from the reference level rather than 2.

6.2.23 We have considered the company's proposal but do not believe this change to be appropriate. The resulting upper limit would allow an increase from average performance in the period 2010-11 to 2012-13 of over 40%. This does not seem reasonable for a measure which reflects customer dissatisfaction with the level of service being received. The company's response also indicated that 2014-15 performance was running roughly at the reference level, which suggests that 2013-14 performance may have been atypical despite the company saying that it did not believe this to be the case. Based on this information we have decided that our approach for the final determination should remain unchanged.

6.2.24 The reference level has been established as the average of three years data from 2010-11 with the upper and lower control limits based on 2 times the standard deviation of the data from the reference level.

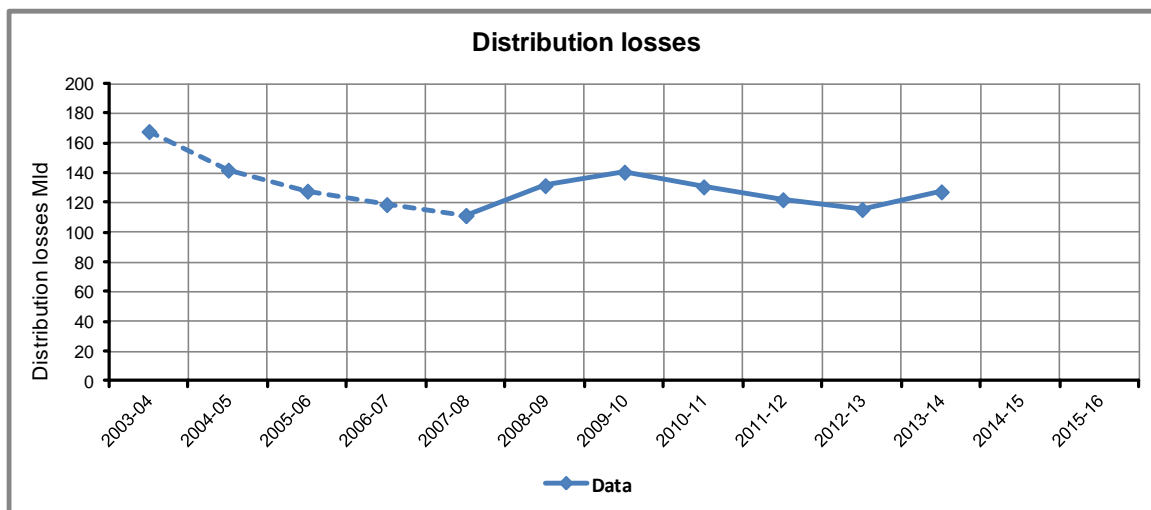
6.2.25 The trend shows performance reducing over the last two years becoming marginal. There has been an increase in complaints of around 50% from 2011-12. It is this type of increase that we would expect the company to investigate and explain the steps it will take to reverse the trend. This is an issue for the company to consider and address as it improves its understanding between asset performance and consumer service.



## Distribution losses

6.2.26 Distribution losses are assessed as the loss of water from the distribution system in mega litres per day (Mld) excluding estimated losses from consumer supply pipes.

**Figure 6.6 – Water infra – distribution losses**



6.2.27 NI Water's consultation response stated that it believed distribution losses would be an explanatory factor rather than an indicator which should be included in the 'water infrastructure' serviceability assessment.

6.2.28 We agree and can confirm that this is how we intend to use this data during PC15. The distribution loss performance trend is therefore included here for information only.

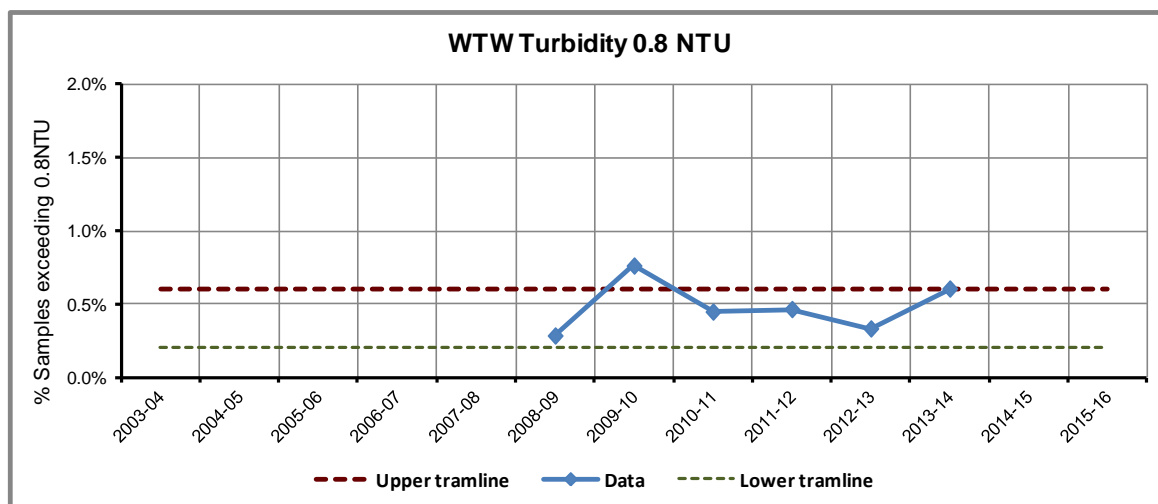
6.2.29 The methodology used to calculate distribution losses was revised and improved after 2007-08 so data prior to 2008-09 should not be considered as equivalent. A further change in methodology introduced in 2013-14 resulted in an increase of 2 Mld in reported leakage. Continuing investment to reduce leakage should result in a gradual reduction in distribution losses through PC15.

## 6.3. Assessment of water non-infrastructure indicators

### Water treatment turbidity

- 6.3.1 Water quality turbidity is assessed as the percentage of regulatory water quality samples taken at treatment works where the turbidity exceeds 0.8 NTU. This is 80% of the PCV for water entering into supply.

**Figure 6.7 – Water non-infra - water treatment turbidity**



Reference level	0.40%	Upper control limit	0.60%	Lower control limit	0.20%
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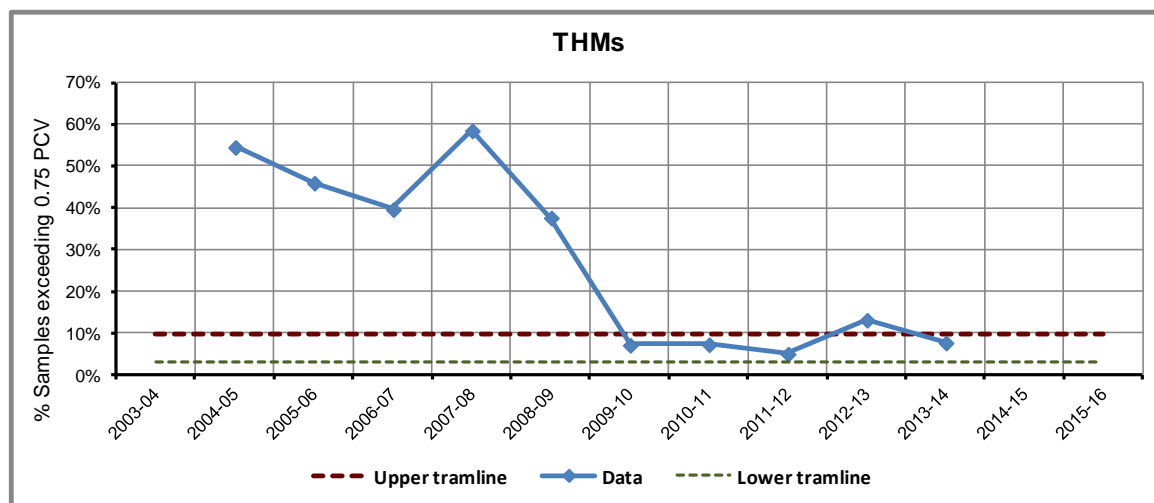
- 6.3.2 The improving trend presented in the draft determination reflected the major investment in water treatment quality improvements up to 2010-11, in particular the major investment delivered through the PPP concession and the decommissioning of boreholes and smaller works operated by NI Water. A stepped improvement was evident prior to 2008-09 and further improvements continued to 2012-13.
- 6.3.3 For the final determination we have amended this measure to exclude performance data for PPP works and sites that have been decommissioned to provide a trend which is more reflective of the assets currently operated and maintained by NI Water. This has produced a more stable trend.
- 6.3.4 Due to the deterioration in performance in 2013-14, the reference level has been established on the average of performance in 2011-12 and 2012-13. The upper and lower control limits are set at 3 times the difference between the reference level and the selected years. The trend is stable.
- 6.3.5 There is a marked increase in the indicator in 2013-14. This is also reflected in an increase in samples exceeding 1.0 NTU, which is the PCV for turbidity for water entering into supply. The company should consider the steps it can take to prevent this indicator moving to marginal or deteriorating.

- 6.3.6 NI Water's draft determination consultation response proposed doubling the width of the original control limits to incorporate 2010-11 and 2011-12 performance, but ignored the improvements that had been delivered subsequently as a consequence of the decommissioning boreholes and treatment works. This would not have been appropriate. Our revised approach addresses this issue and demonstrates that the underlying performance of works currently operated by NI Water in 2010-11 and 2011-12 lay close to the proposed reference level.

## Water quality – trihalomethane (THM)

6.3.7 Water quality trihalomethane (THM) is assessed as the percentage of regulatory water quality samples taken at consumers' taps where the concentration of THMs exceeds 75% of the PCV.

**Figure 6.8 – Water non-infra - water quality – trihalomethane (THM)**



Reference level	6.28%	Upper control limit	9.67%	Lower control limit	2.89%
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6.3.8 The trend in this indicator reflects the major investment in water treatment quality improvements up to 2010-11, in particular the major investment delivered through the Alpha PPP concession.

6.3.9 The reference level has been established on the average of performance in 2010-11 and 2011-12 with upper and lower control limits set at 3 times the difference from the reference level for the selected years. The trend is stable.

6.3.10 We note that the peak in 2012-13 exceeded the upper control limit and that this was reflected in an increase in samples failing the PCV for THMs.

6.3.11 NI Water's consultation response accepted the Utility Regulator's reference level but proposed using 2012-13 data to set the control limits. This would double the width of the control limits and bring 2012-13 performance within the range.

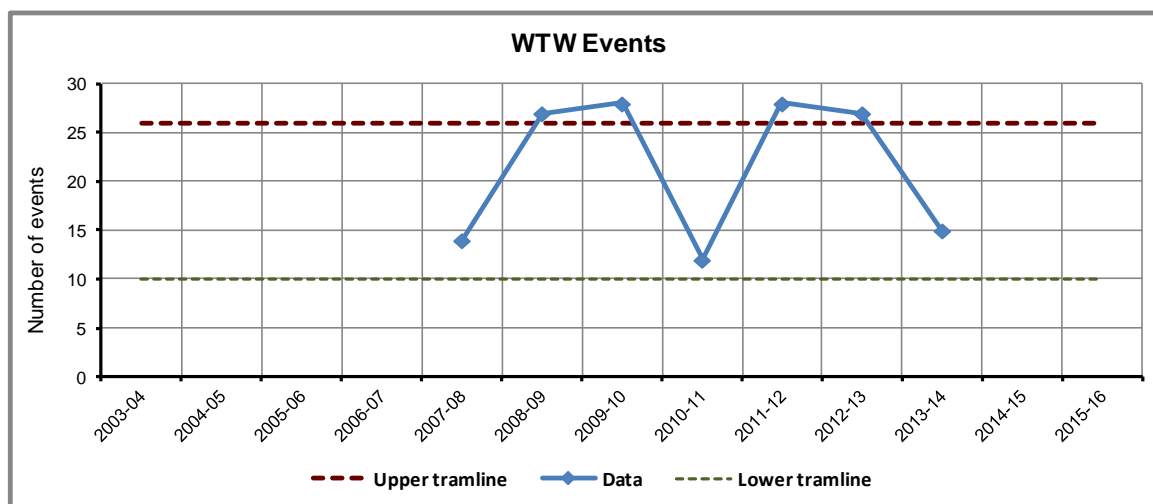
6.3.12 The company's response acknowledged that performance in 2013 had been affected by operational difficulties at a works which had been upgraded. The company suggested that this was not atypical and may continue into the future. We disagree. The company was funded to address THM issues at the works and has not yet done so. In addition, process optimisation and the introduction of additional treatment as a result of regulatory action will mitigate performance issues which occurred at other works during the year.

- 6.3.13 These are the types of issue that the Utility Regulator would expect the company to investigate and explain the steps it will take to reverse the trend. We therefore do not consider the use of 2012-13 data to set the control limits to be reasonable and our approach for the final determination remains unchanged.

## Water treatment works events

6.3.14 Water treatment works events are assessed as the number of events at WTW resulting from treatment difficulties or ineffective treatment which are categorised as 'significant' or higher, as defined by the DWI in its annual Drinking Water Quality Report.

**Figure 6.9 - Water non-infra - water treatment works events**



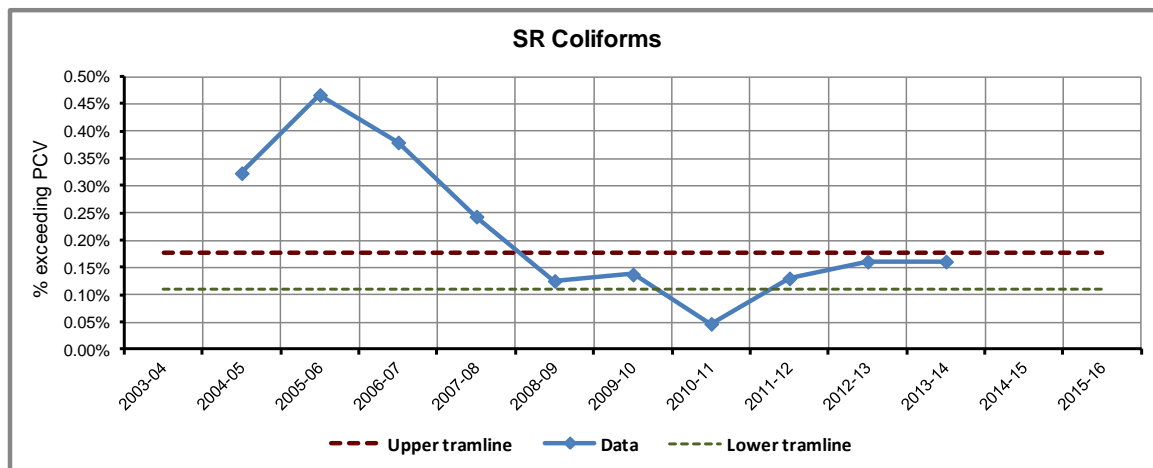
Reference level	18	Upper control limit	26	Lower control limit	10
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- 6.3.15 NI Water's consultation response proposed changing the upper limit to 30 to incorporate all recent performance.
- 6.3.16 We have considered this proposal, but still expect that the company will be focused on improving performance and moving to a lower level of significant events over time. We have therefore concluded that our approach for the final determination should remain broadly unchanged.
- 6.3.17 While the trend in the data is stable, the number of events reported move from an upper range to a lower range. Any analysis of two consecutive years of data or any statistical analysis of the data would provide unacceptably wide control limits. As a result we have made a subjective assessment of the reference level and control limits. The reference level has been set at 18, just below the average of 21. The upper limit has been set at 26, just below the historical peaks. The trend is stable but erratic.
- 6.3.18 We only plan to use this as a weak indicator of serviceability to inform our overall assessment. Events are reported to DWI which has the necessary enforcement powers to address any specific or general issues arising. Therefore we would not consider 'events' when deciding whether to take action in respect of capital maintenance investment and serviceability.

## Service reservoir quality - coliform

6.3.19 Service reservoir quality - coliform is assessed as the percentage of regulatory samples taken for coliform bacteria at service reservoirs which exceed the PCV.

**Figure 6.10 – Water non-infra - service reservoir quality - coliform**



Reference level	0.14%	Upper control limit	0.18%	Lower control limit	0.11%
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6.3.20 NI Water agreed with our draft determination assessment and the approach for the final determination remains unchanged.

6.3.21 The percentage of samples taken at service reservoirs with coliform failures reduced to a low level in 2010-11 but has increased over the last three years. This increase occurred at a time when investment in service reservoir rehabilitation reduced because of delays to the procurement of a new framework contract. As part of its PC15 submission, the company has described work to develop its prioritisation of service reservoir rehabilitation which aims to address this trend.

6.3.22 The reference level has been established as the average performance from 2008-09, excluding 2010-11. The control limits are 2 standard deviations from the reference level for the same data. The current trend is marginal.

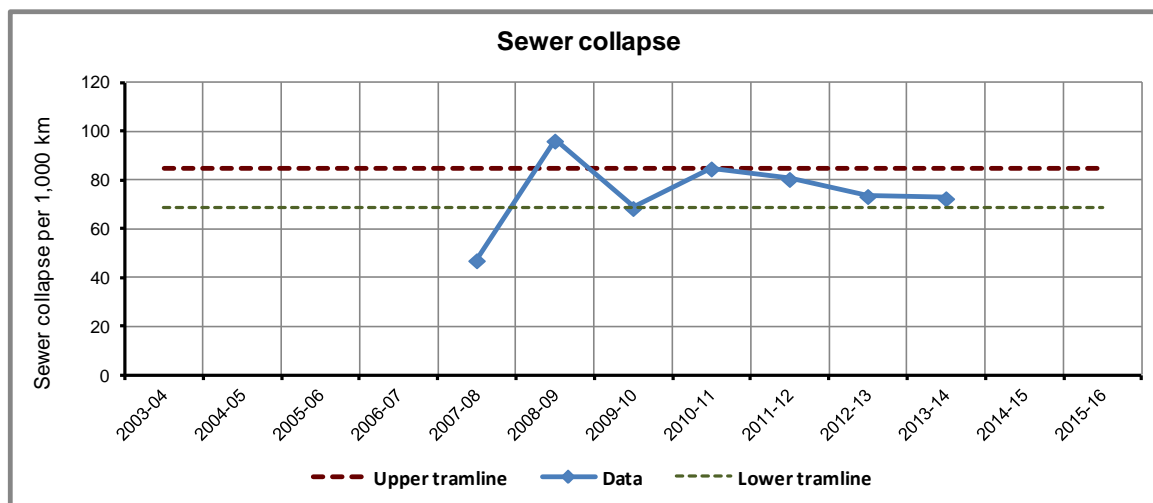
6.3.23 NI Water has attributed a large proportion of coliform failures at service reservoirs to unrepresentative samples. It has included investment in PC15 to improve and secure sample taps to address this. As a result, there may be a further stepped change in performance. We will consider this and review the reference levels and control limits as this investment is delivered and new trends are established.

## 6.4. Assessment of sewerage infrastructure indicators

### Sewer collapse

6.4.1 Sewer collapse is assessed as the number of sewer collapses per 1,000km of main sewer.

**Figure 6.11 – Sewerage infra – sewer collapse**



Reference level	77	Upper control limit	85	Lower control limit	69
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6.4.2 The outturn figure for 2013-14 was higher than projected in NI Water's business plan submission and very similar to performance in 2012-13. As a consequence the bandwidth would have been too narrow if we had continued to adopt the draft determination approach of using 2012-13 and 2013-14 data to establish the reference level and control limits.

6.4.3 For the final determination the reference level has therefore been established on the average of performance in 2011-12 and 2013-14 with upper and lower control limits set at 2 times the difference from the reference level for the selected years. This has resulted in a higher range and reference level than in the draft determination but a similar bandwidth. The trend is stable although there has been a consistent reduction for three years.

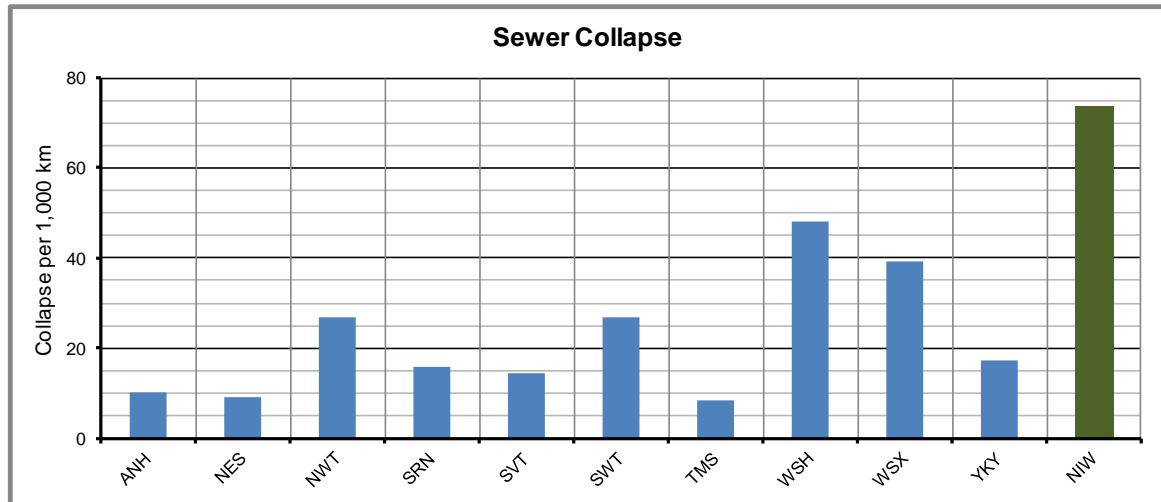
6.4.4 NI Water's consultation response proposed changing the width of the range to include performance back to 2010-11. Whilst our final determination assessment did not increase the control limit bandwidth, it resulted in a similar outcome due to the use of 2011-12 data and the associated movement of the range.

6.4.5 The number of sewer collapses reported by NI Water per 1,000km main sewer is significantly greater than that reported by sewerage companies in England & Wales (see Figure 6.12). This comparison includes collapse on private drains and laterals recently adopted by water companies in England & Wales. The data is standardised for the length of main sewer excluding laterals.



6.4.6 The level of sewerage collapse in Northern Ireland is high compared to England & Wales. It is possible that there is further action management can take to reduce the collapse rate and the reduction seen in the last three years will continue. We will consider longer term trends when we review the reference level and control limits at the mid-term review.

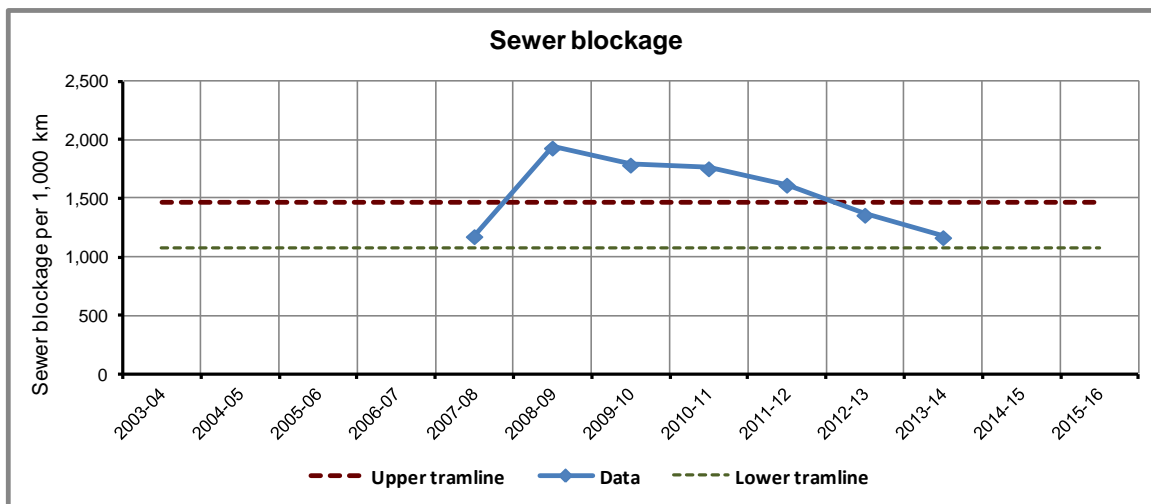
**Figure 6.12 – Sewer collapse rates**



## Sewer blockage

6.4.7 Sewer blockage is assessed as the number of sewer blockages per 1,000km of main sewer.

**Figure 6.13 – Sewerage infra – sewer blockage**



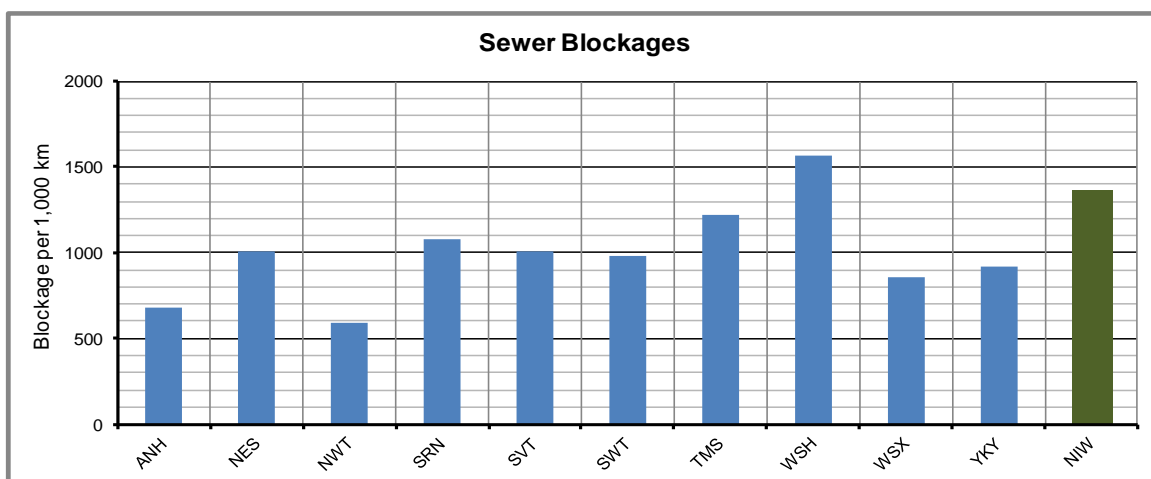
Reference level	1,268	Upper control limit	1,459	Lower control limit	1,076
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6.4.8 NI Water's consultation response proposed changing the width of the range to effectively include performance back to 2011-12. We do not believe this is appropriate for a trend which has shown continuous improvement since 2008-09. Our approach for the final determination therefore remains unchanged.

6.4.9 The reference level has been established on the average of performance in 2012-13 and 2013-14 with upper and lower control limits set at 2 times the difference from the reference level for the selected years. The reference level is marginally higher and the range marginally narrower than in the draft determination due to the 2013-14 outturn being slightly higher than originally projected. The trend is improving with a reduction in blockages in each of the last five years.

6.4.10 The level of sewerage blockage per 1,000km main sewer in Northern Ireland is high compared to the average in England & Wales (see Figure 6.14). This comparison includes blockage on private drains and laterals recently adopted by water companies in England & Wales. The data is standardised for the length of main sewer excluding laterals.

**Figure 6.14 – Sewer blockage rates**

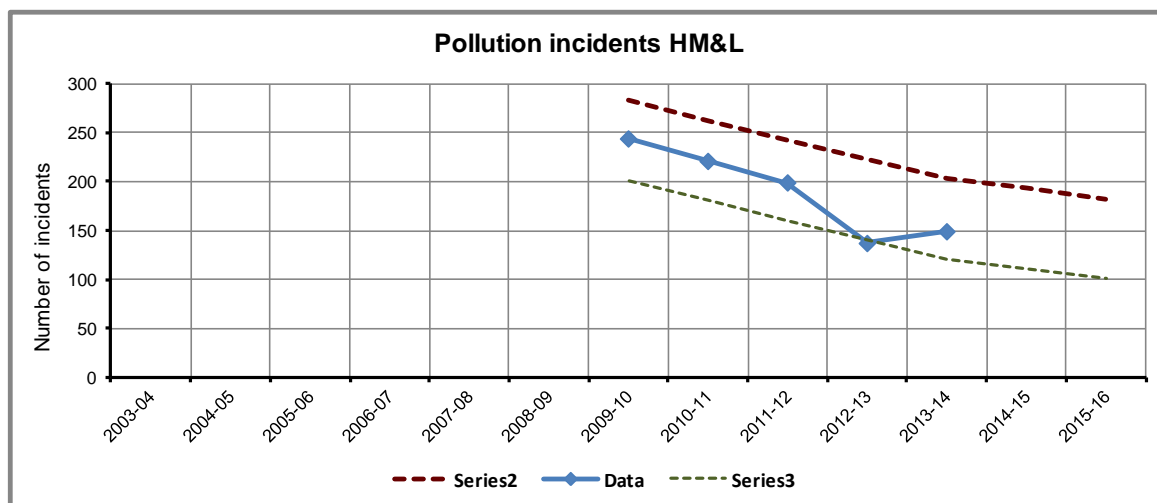


- 6.4.11 We believe that the reductions seen in this measure are probably due to management action rather than any change in the asset itself. It is possible that there is further action management can take to reduce the blockage rate by targeting areas with high blockage rates to prevent repeat blockages occurring. Until this is explored, we will not have confidence in sewer blockage as a strong measure of serviceability.
- 6.4.12 The reported figures for sewer collapse and sewer blockage include those on the main sewerage system and those on laterals and drains connecting properties to the main sewerage system. To date, NI Water has not been able to report data for the main sewers and laterals separately. Since these are distinct asset types, and different interventions may be appropriate, we will consider monitoring the serviceability for the mains sewers and laterals/drains separately once NI Water can report a robust trend of data.

## Pollution incidents

6.4.13 Pollution incidents are assessed as the number of High, Medium and Low pollution incidents caused by the sewer network (CSOs, rising mains and foul sewers)

**Figure 6.15 – Sewerage infra –pollution incidents**



Reference level	162	Upper control limit	203	Lower control limit	121
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6.4.14 The outturn figure for 2013-14 was lower than projected in NI Water's business plan submission. We have amended our approach to reflect this and have set a reference level for 2013-14 based on the average performance for the three year period 2011-12 to 2013-14. We have set upper and lower control limits as 1.25 times the standard deviation for these years. This produces control limits which are similar to the draft determination. It generates an upper control limit which is 25% higher than the reference level providing some allowance for changes in weather patterns or reported practice which can affect performance against this measure.

6.4.15 The historic improving trend has been attributed to management action in ensuring earlier responses to pollution incidents and learning lessons from past incidents which are then incorporated into operational procedures.

6.4.16 We have assumed that the trend in improvements will continue and we have assumed that the reference level and control limits should reduce by 10 per annum from 2013-14. We will review performance and control limits at the mid-term review to confirm that this assumption was appropriate.

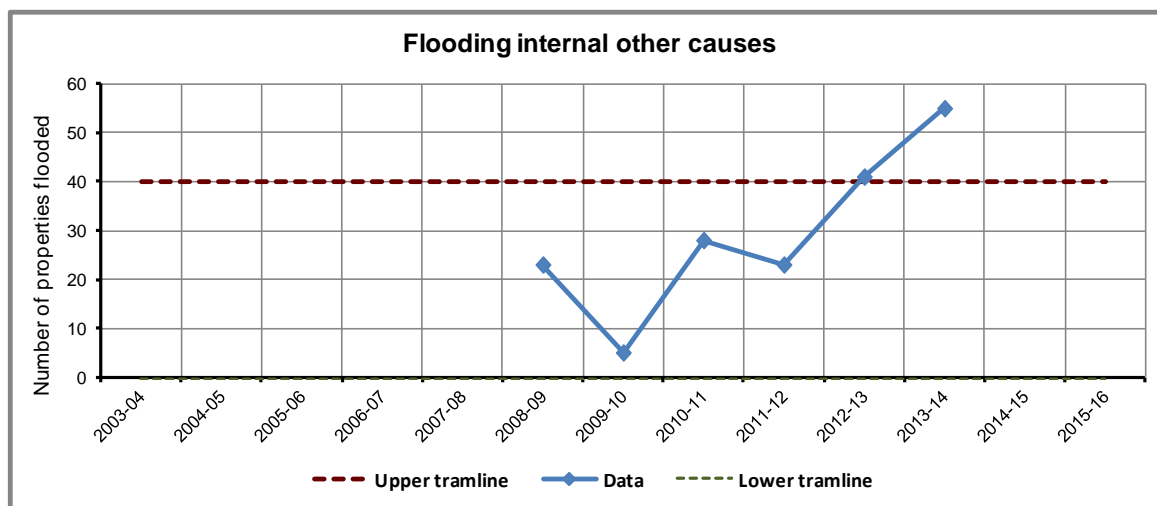
6.4.17 Whilst NI Water agreed with our draft determination assessment of the reference level and the spread for the control limits, it proposed making the tramlines horizontal. We disagree and believe that the adoption of reducing reference level and control limits is appropriate taking account of historic trends, comparative performance with England & Wales and the potential to build on the improvements already delivered by the company in this area.

- 6.4.18 The company's consultation response also proposed removing Low severity incidents from the indicator as the company believes that reporting of these incidents is more likely to be influenced by reporting practice than operation of the assets. This is not evident from the data trend which shows sustained and consistent improvement, with the exception of performance in 2012-13, which the company attributes to advantageous weather conditions.
- 6.4.19 We recognise that Low severity incidents are less important in terms of impact. This is already acknowledged in the PC15 output measure which monitors performance for High and Medium severity incidents only. However, we consider it important to incorporate a measure of the 'sub-threshold' impact of pollution in the serviceability indicator through the inclusion of Low severity incidents. While it is important that the company gives particular attention to preventing high and medium pollutions incidents, monitoring all sewerage related pollution incidents in a serviceability measure will provide an indication of the underlying trend in events which might develop into more severe events.

## Properties flooded (other causes)

6.4.20 This indicator is assessed as the number of properties flooded in the year due to causes other than hydraulic incapacity (typically sewer collapse, sewer blockage or pumping station failure).

**Figure 6.16 – Sewerage infra –properties flooded (other causes)**



Reference level	20	Upper control limit	40	Lower control limit	0
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6.4.21 Any property flooding remains unacceptable. However, some flooding of properties due to other causes such as blockage or equipment failure remains an inevitable consequence of managing a sewerage system. We have excluded data prior to 2008-09 because of concerns over data quality.

6.4.22 The level of incidents is lower in Northern Ireland than England & Wales. Because the level of incidents is relatively low and because weather is a key cause of the number of incidents occurring, it is doubtful that a meaningful serviceability trend can be established.

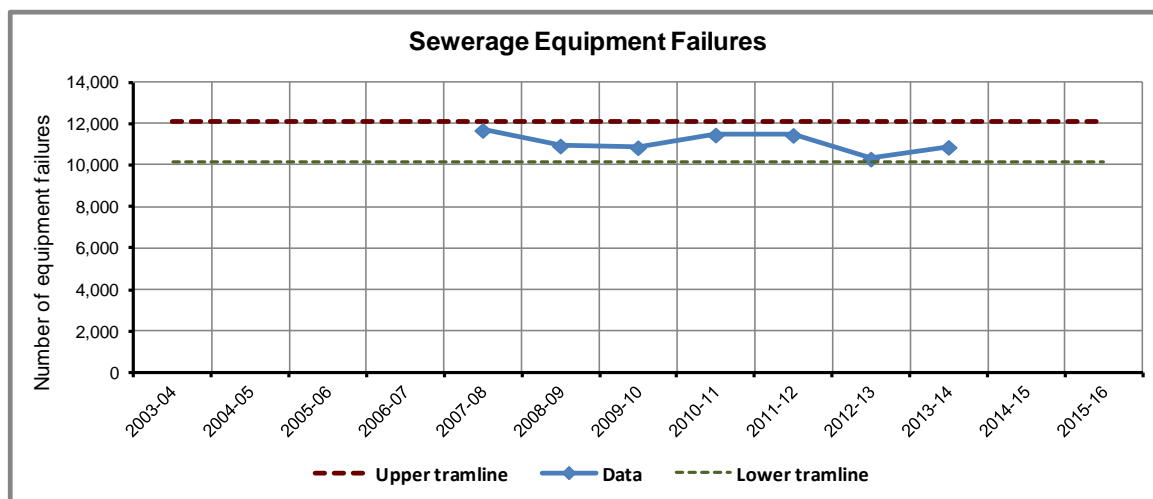
6.4.23 The reference level has been established as the average performance for the four years 2008-09 to 2011-12. The control limits are 2 standard deviations from the reference level. However, we remain concerned by the impact which weather can have on this indicator and we propose to monitor performance rather than incorporate this indicator in the serviceability assessment. The company's consultation response supported our proposed approach.

6.4.24 The company proposed basing the upper limit on 3 standard deviations if the indicator is to be included in the assessment. This would move the upper limit close to performance in 2013-14. We disagree as we do not believe that an approach which favours recent poorer performance would be appropriate in an area which consumers have consistently identified as being of high priority.

## Equipment failures

6.4.26 Equipment failure for sewerage infrastructure is assessed as the number of equipment failures on the sewerage system including those occurring on pumping stations and intermittent discharges.

**Figure 6.17 – Sewerage infra – equipment failures**



Reference level	11,109	Upper control limit	12,064	Lower control limit	10,154
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6.4.27 NI Water agreed with our draft determination assessment and the approach for the final determination remains unchanged.

6.4.28 The reference level has been established as the average performance for the seven years of available data. The control limits are 2 standard deviations from the reference level. The trend is stable.

6.4.29 The minor differences to the reference level and control limits in the draft determination are a consequence of the actual outturn figure for 2013-14 being slightly lower than originally projected.

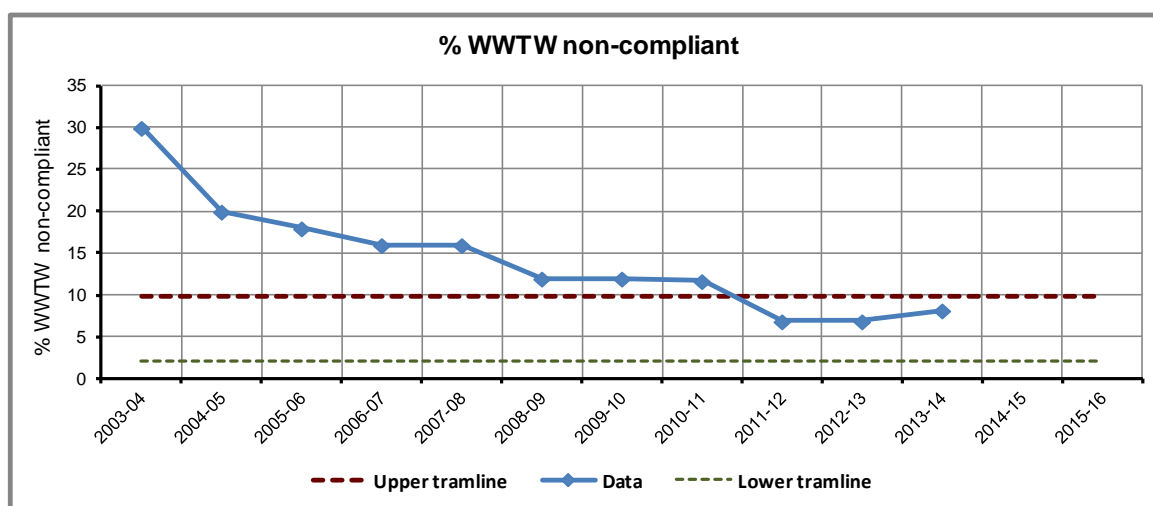
## 6.5. Assessment of sewerage non-infrastructure indicators

- 6.5.1 All the serviceability indicators for sewerage non-infrastructure are based on the reported compliance at wastewater treatment works. We have asked the company to draw up a specification for unplanned maintenance indicator(s) which would show trends in serviceability. The company has not monitored this type of indicator to assess trends in asset performance and serviceability. The company has developed a specification but it will be some time before trends can be established. In the absence of this type of information, we will continue to rely on wastewater treatment works compliance data to assess serviceability.

### WwTW compliance – percentage of works

- 6.5.2 WwTW compliance, percentage of works, is assessed as the percentage of WwTW discharges not compliant with their numeric consent.

**Figure 6.18 – Sewerage non-infra - WwTW compliance – percentage of works**



Reference level	5.9	Upper control limit	9.8	Lower control limit	2.0
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- 6.5.3 For the draft determination the reference level was established on the basis of the average of performance in 2011-12 and 2013-14, with upper and lower control limits set at 2 times the difference from the reference level for the selected years. The company's consultation response proposed using the same reference level but widening the range by using 3 times the difference.
- 6.5.4 In Annex F we have explained how wastewater treatment works performance can be affected by a range of factors including weather conditions and how this can cause variations in compliance from year to year. As a consequence we used historic performance data to estimate the likely range of compliance during PC15 in order to satisfy ourselves that the projections submitted by NI Water for its output target were reasonable.

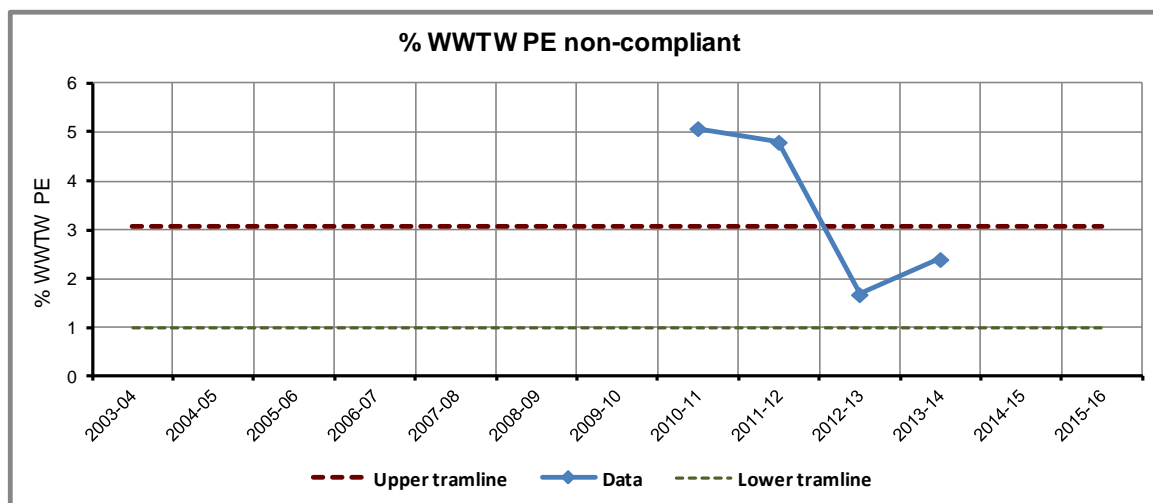


- 6.5.5 In the final determination we have decided to use the outcome of this analysis to set the upper and lower control limits for the serviceability indicator as well. We believe this will better reflect the potential variability of the performance data. It will also maintain consistency with the approach adopted for assessing the compliance target.
- 6.5.6 The upper and lower limits therefore reflect the upper and lower boundaries of the likely operating range for 2015-16 determined through the compliance assessment described in Annex F.
- 6.5.7 Continuous investment in quality enhancement will drive further improvement in compliance during PC15. The projected improvement is reflected in the overall compliance targets that we have set but is not currently accounted for in the serviceability control limits. We will therefore reassess these limits at the midterm review when the impact of investment on performance will be more evident.

## WwTW compliance – population equivalent

6.5.8 WwTW compliance, population equivalent, is assessed as the percentage population equivalent for WwTW discharges not compliant with their numeric consent.

**Figure 6.19 – Sewerage non-infra - WwTW compliance – population equivalent**



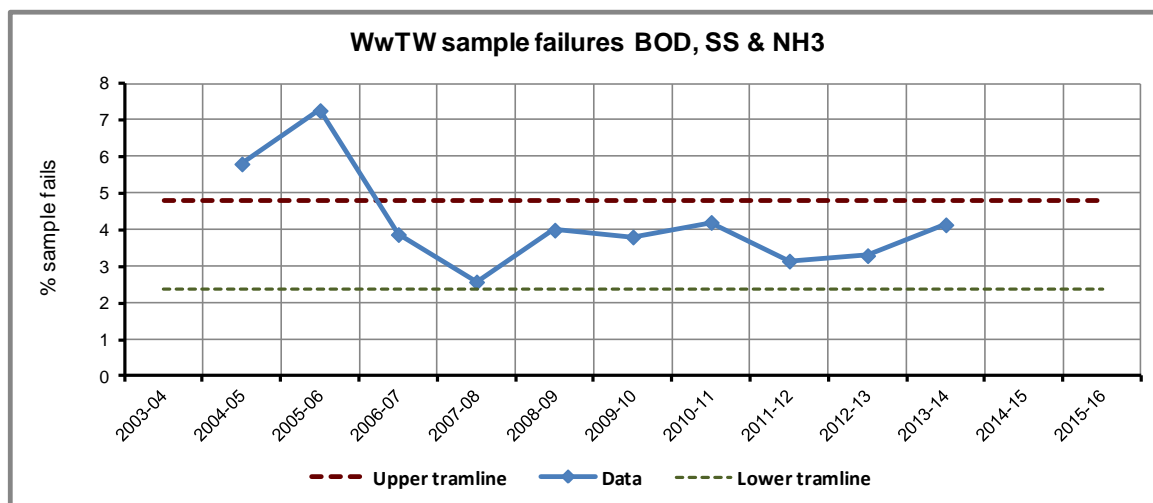
Reference level	2.03	Upper control limit	3.08	Lower control limit	0.98
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- 6.5.9 In the draft determination we included upper tier failures in the trend for this indicator. An upper tier failure is a gross failure of a single sample which immediately triggers a works failure for the year. Including upper tier failures in the assessment could result in significant volatility of this measure which does not reflect the underlying performance of the assets. As a result we have excluded upper tier failures from the data for the final determination.
- 6.5.10 For the draft determination the reference level was established on the basis of the average of performance in 2012-13 and 2013-14. For the final determination we have based the reference levels and control limits on the detailed analysis of historic compliance amended to take account of improvements from investment described in Annex F. This analysis reflects the marginal performance of some works which have still to be upgraded and the variability of external factors such as the weather.
- 6.5.11 Continuous investment in quality enhancement will drive further improvement in compliance during PC15. The projected improvement is reflected in the overall compliance targets that we have set but is not currently accounted for in the serviceability control limits. We will therefore reassess these limits at the midterm review when the impact of investment on performance will be more evident.

## WwTW compliance – samples

6.5.12 WwTW compliance samples is assessed as the percentage of regulatory samples at WwTW for BOD, suspended solids or ammonia which exceeded their numeric consent value

**Figure 6.20 – Sewerage non-infra - WwTW compliance – samples**



Reference level	3.60	Upper control limit	4.81	Lower control limit	2.38
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6.5.13 NI Water agreed with our draft determination assessment and the approach for the final determination remains unchanged.

6.5.14 WwTWs with numeric consents are allowed a small number of sample failures before the works is deemed to have failed its consent. We have adopted the number of samples which exceed the numeric consent value as a sub-threshold indication of asset serviceability.

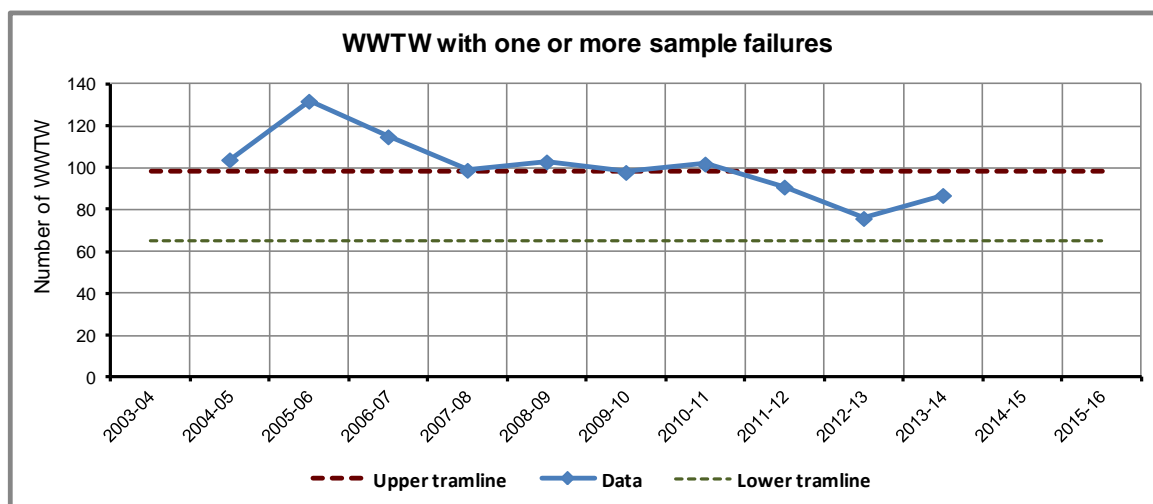
6.5.15 However, we recognise that performance against this indicator has been affected by a progressive tightening of consents over the last decade. To some extent, the benefit of investment in treatment works to improve performance is countered by the increased risk that more works will have small numbers of sample failures against the more onerous consents. As a result, the use of historic data trends could be deceptive as they are not based on a consistent set of consents.

6.5.16 As the reference levels and control limits set out above make use of the long term trends in the data, we will use this indicator with caution until a performance trend is established on a relatively consistent set of consents.

## WwTW compliance – works with one or more sample failure

6.5.17 WwTWs with one or more sample failure are assessed as the number of works where one or more regulatory sample for BOD, suspended solids or ammonia exceeds the numeric consent value.

**Figure 6.21 – Sewerage non-infra - WwTW compliance – works with one or more sample failures**



Reference level	81.5	Upper control limit	98	Lower control limit	65
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6.5.18 NI Water's consultation response proposed using the same spread to set the control limits but a higher reference level based on average performance since 2007-08. This would have resulted in an upper control limit of 111 and brought all years apart from 2005-06 and 2006-07 into the range. We do not consider this to be reasonable bearing in mind recent and ongoing investment to improve compliance. We believe that our approach, which allowed for a 20% increase over recent average performance, is more appropriate and so this remains unchanged for the final determination.

6.5.19 The reference level has been established on the average of performance in the last two years, 2012-13 and 2013-14 with upper and lower control limits set at 3 times the difference from the reference level for the selected years.

6.5.20 This indicator is affected by the issue of judging performance against progressively tightening consent standards referred to above. The use of recent data to establish control limits provides confidence that that they reflect current consents which are more onerous than those applied in the past.

## 6.6. Summary of reference levels and control limits

**Table 6.1 – Serviceability reference levels and control limits**

Service	Indicator	Ref. level	Upper limit	Lower limit
<b>Water Infra</b>	<b>Mains bursts per 1,000km</b>	93.4	107.9	78.9
	Interruptions to supply greater than 3 hours resulting from equipment failure	5.04%	5.86%	4.23%
	DG3 Percentage properties affected by interruptions greater than 12 hrs (unplanned & unwarned)	0.18%	0.29%	0.06%
	Percentage of regulatory Iron samples exceeding 75% of the drinking water standard PCV	3.45%	4.32%	2.58%
	Customer contacts per 1,000 population (Discoloured water)	1.44	1.85	1.03
<b>Water Non-infra</b>	<b>Percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU</b>	0.40%	0.60%	0.20%
	Number of regulatory THM samples exceeding 75% of the drinking water standard PCV	6.28%	9.67%	2.89%
	Events at WTW resulting from treatment difficulties or ineffective treatment categorised as 'significant' or higher	18	26	10
	Percentage of regulatory samples taken for coliform bacteria at Service Reservoirs exceeding the drinking water standard PCV	0.14%	0.18%	0.11%
<b>Sewerage Infra</b>	<b>Sewer collapses per 1,000km</b>	77	85	69
	Sewer blockages per 1,000km	1,268	1,459	1,076
	Number of H, M and L pollution incidents from sewer network (CSOs, rising mains and foul sewers)	162	203	121
	Properties flooded in the year (other causes)	20	40	0
	Total number of equipment failures repaired	11,109	12,064	10,154
<b>Sewerage Non-infra</b>	<b>Percentage of WwTW discharges not compliant with numeric consents</b>	5.9	9.8	2.0
	Percentage of total p.e. served by WwTWs not compliant with numeric consents	2.03	3.08	0.98
	Percentage of BOD, SS and Ammonia compliance sample results which exceeded their numeric consent value	3.60	4.81	2.38
	Number of WwTWs with one or more compliance sample result (BOD, SS or Ammonia) exceeding the numeric consent value	81.5	98	65