Water & Sewerage Services Price Control 2021-27

Final Determination – Annex F

Asset Serviceability

May 2021

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1. Introduction

1.1 This Annex to the PC21 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.

1.2 Serviceability measures were first introduced in PC13. The water sector Principal Stakeholders were engaged to aid the development of a suite of indicators that would form the basis of the asset serviceability assessment and facilitate an improving service for customers. This approach was then built on for PC15 and, as we approach PC21, we continue to adjust and refine the serviceability measures and remain open to adopting alternative indicators to better represent serviceability and drive the right outcomes for consumers.

1.3 Serviceability is the capability of an asset to provide a service. It is a broad measure based 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.

1.4 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 customer interruptions to supply). Data trends are used to determine whether asset serviceability is improving, stable, marginal or deteriorating.

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.

1.6 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 have assessed serviceability collectively for four sub-service areas of infrastructure and non-infrastructure assets in the water and sewerage service areas.

1.7 Our overall conclusion from this assessment is that serviceability is stable in three of the four sub-service areas and improving in the area of sewerage non-infrastructure.

1.8 The proposed reference levels and limits are summarised at the end of Section 6.

2. Selection of Serviceability Indicators

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

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

Service	Indicator
Water Infra	**Mains bursts per 1,000km**
	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 (explanatory only)
Water Non-infra	**Percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU**
	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
Sewerage Infra	**Sewer collapses per 1,000km**
	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
Sewerage Non-infra	**Percentage of WwTW discharges 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
	Percentage of total population equivalent served by WwTWs not compliant with numeric consents

Table 2.1: Serviceability indicators.

2.3 For each service area, a primary indicator is shown first in bold. Particular weight is given to the primary indicators when assessing serviceability.

2.4 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.

2.5 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 five indicators is sufficient to judge serviceability in an individual service area.

2.6 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?

2.7 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.

2.8 Some of the indicators measuring quality (i.e. water quality) are recorded on a calendar year basis. However for consistency and ease of comparison we have shown all data against financial years rather than calendar years.

2.9 Based on the above criteria we reviewed the serviceability indicators previously used in England and Wales and identified other indicators for consideration. In addition to established service and performance 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.

2.10 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.

2.11 A ‘primary’ serviceability indicator is identified in each service area. This is listed first in Table 2.1 and highlighted in bold text. Particular reliance is placed on the performance of these indicators in reaching an overall assessment for the service area.

2.12 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.

2.13 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.

2.14 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.

2.15 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 our indicators and the quality of historical data will influence how we use serviceability assessments until robust data trends can be established.

3. The Assessment of Serviceability

3.1 This section describes how we carry out our annual assessment of serviceability to determine whether serviceability is improving, stable, marginal or deteriorating.

3.2 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.
- Deteriorating.

3.3 A serviceability measure can be 'suspended' if we do not have confidence that it offers a consistent trend of robust data which allows historical trends to be established and reference levels and limits to be projected. For example: if data quality issues are identified or there has been a change in data collection methodology and consistent data cannot be back-cast. As well as being an issue when assessing serviceability, the delivery of asset management excellence by NI Water is also dependent on robust consistent data on asset performance.

Establishing serviceability control limits

3.4 The trend of each indicator is assessed against a reference level of service and upper and lower control limits.

3.5 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 continued opportunities for management action and improved asset management techniques to continue to improve service at relatively low cost.

3.6 The reference level of service (sometimes referred to as the 'benchmark average') reflects a reasonable but challenging assessment of how the company is expected to perform, taking account of both best performance and medium term trends in the data. For previous determinations we have used the 'best and next best' methodology in order to determine the

reference level of service. This methodology involves averaging the best two annual figures recorded (the last two years' data if the trend is steadily improving) and is ideally suited to produce a benchmark for a trend that is showing consistent positive progression. However, as the company improves against the service measures they will experience diminishing returns and over time we expect the trend to flatten and become stable. Many of the serviceability measures are approaching this more stable phase, and consequently the 'best and next best' methodology no longer produces the optimum reference level of service. We are therefore moving our standard methodology to the averaging of a number of recent years' data to produce the most suitable reference level.

3.7 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 data points used to determine the reference level. Where the reference level is calculated from two data points, the formulae used will be similar to the following:

(i) Upper control limit = Reference level+ [A × 1/2 (difference between the two data points in the reference period)]

(ii) Lower control limit =Reference level- [A × 1/2 (difference between the two difference between the two data points]

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

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

3.8 The default value for the coefficient 'A' is normally taken as 3, although any number is acceptable if it reflects the longer term trend of the data over time.

3.9 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.

3.10 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.

3.11 We recognise that some of the indicators can be materially affected by extreme events (such as extreme weather conditions), 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.

3.12 We will take account of other factors such as changes in methods of measurement and past and future investment.

3.13 The reporting of these serviceability measures began in PC13 and in many cases a settling in period was required before the data could be considered reliable. For PC15 we set limits based on relatively short trends of reliable data. For PC21 we have additional data which increases the confidence we have in historical trends and our projection of reference levels and limits. We will continue to review performance against serviceability measures in our Annual Information Returns and consider changes to reference levels and limits at our mid-term review.

3.14 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. Where we are aware of future changes in regulation (such as the introduction of new consent

standards), we have taken this into account in the determination of reference levels and limits.

3.15 Since the draft determination we have updated some of the serviceability measure assessments. This has been done where further data points have become available or where more suitable control points were identified.

Assessing serviceability against the control limits

3.16 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.

3.17 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 that indicates a deteriorating trend may be starting but where it has not yet been established whether this will be sustained.
- **Deteriorating**: A reduction in performance sustained over a number of years that suggests that a reduction in the reference level of service has occurred.

3.18 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 from the reference level of service could 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.

3.19 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 encourage the company to operate within a range around the reference level rather than operating close to the upper limit.

3.20 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

3.21 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.

3.22 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. Regulatory Action in Respect of Serviceability

4.1 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 either marginal or deteriorating.

4.2 NI Water shall provide an annual serviceability submission and an assessment of whether serviceability is improving, stable, marginal or deteriorating.

4.3 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.

4.4 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.

4.5 If we considered the company's action plan to arrest deteriorating serviceability to be inadequate, or if it either 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.

4.6 If we considered the company's action plan to arrest deteriorating serviceability to be inadequate, or if it either did not deliver the action plan, or delivery of the action plan did not restore stable serviceability, we would consider logging down the cost of work necessary to restore serviceability whether we proceed to take enforcement action or not.

4.7 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.

4.8 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. Sub-service Area Assessments

Sub-service assessment approach

5.1 This section summarises our assessment of serviceability by sub-service.

5.2 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.

5.3 The assessment is a matter of judgement which follows the general principles outlined in Section 3. 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.

5.4 At the time of our final determination, some of the individual measures have 2020-21 data available while others do not. In order to view the measures side by side in the sub-service graphs we have not included any of the 2020-21 data, however this data has been included in the individual graphs to ensure that the most appropriate control limits are selected.

Water infrastructure sub-service

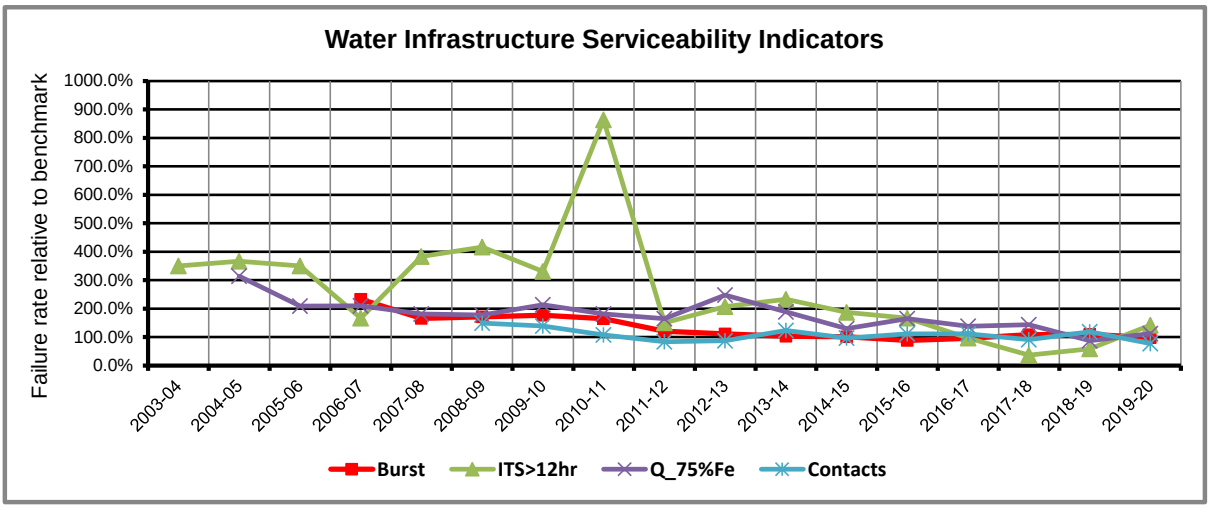

Figure 5.1: Water infrastructure service serviceability indicators.

5.5 Our overall assessment of water infrastructure serviceability is that it has been 'stable' throughout PC15.

5.6 The primary indicator (water mains bursts per 1,000km) is stable. NI Water have maintained performance at current rates of mains replacement activity.

5.7 PC15 initially saw sustained improvements against the >12 hour interruptions with the submitted figures falling as low as 190 interruptions in 2017-18. However, in the last two years there have been subsequent deteriorations bringing the figures back to similar levels found at the start of the price control.

5.8 There has been a stepped improvement in performance against the sub-threshold measure for iron. Performance levels are consistently below the lower bound of performance prior to 2014-15. The level of consumer contacts relating to discoloured water continue at the same levels seen in PC10 and PC13.

5.9 The >3 hour interruptions measure has been suspended due to a reporting methodology change. We will we consider reintroducing this measure when we have confidence that new data is provides a consistent trend.

5.10 All water infrastructure serviceability measures have been recorded as 'stable'.

Water non-infrastructure sub-service

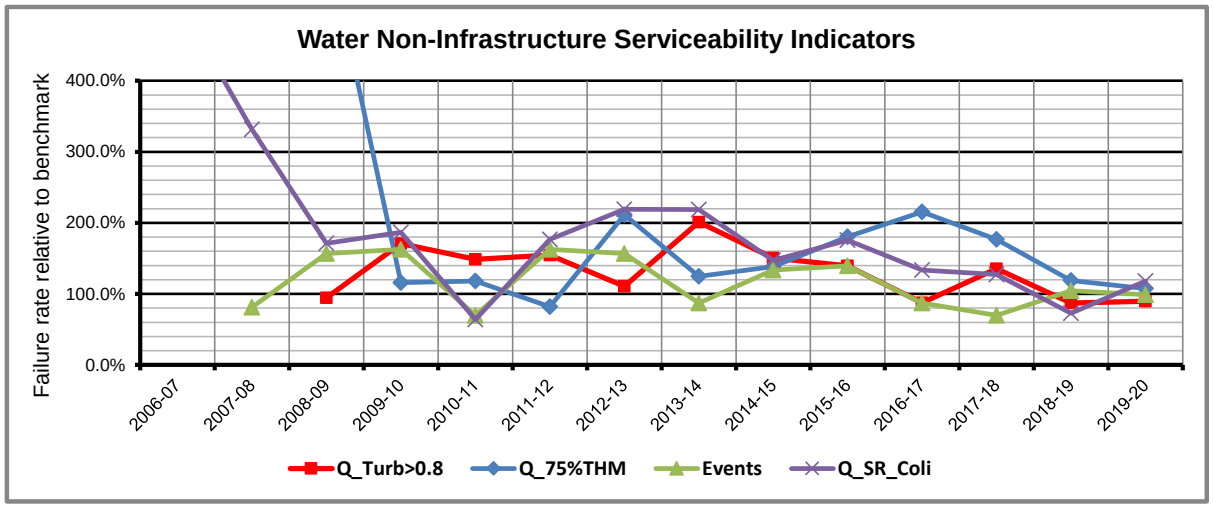

Figure 5.2: Water non-infrastructure sub-service serviceability indicators.

5.11 Our overall assessment of water non-infrastructure serviceability is 'stable'.

5.12 The primary indicator (percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU) has been stable in PC15. While annual values continue to fluctuate, there is some indication of improvement in PC15 compared to previous performance.

5.13 The '75% THM' has been assessed as stable despite a rising trend seen at the start of the price control. This rising trend has been rectified, and in

2018-19 and 2019-20 it moved closer to the best levels of performance seen in 2011-12.

5.14 The WTW Events measure has been recorded as stable. However, we do note that there is evidence of improving performance in PC15. We will continue to monitor this to see if the trend is maintained.

Sewerage infrastructure sub-service

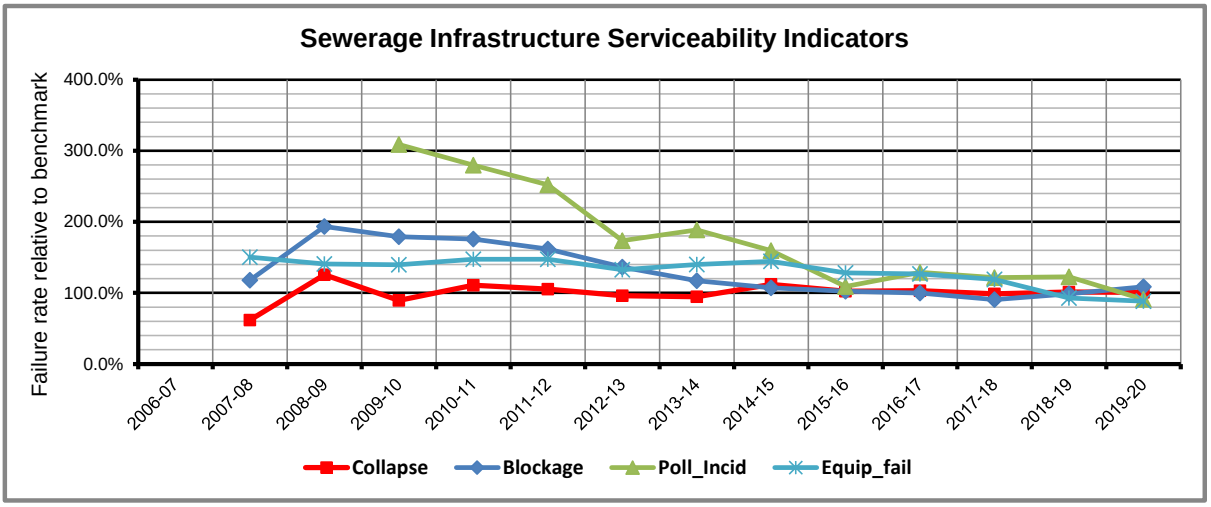

Figure 5.3: Sewerage infrastructure sub-service serviceability indicators.

5.15 Our overall assessment of sewerage infrastructure serviceability is 'stable' in PC15 following sustained improvements in most measures up to 2015-16.

5.16 The primary measure for sewerage infrastructure is the number of sewer collapses. This measure has remained stable since 2008-09 suggesting that the underlying condition of the sewerage fabric remains stable.

5.17 The 'sewer blockages' measure continued its consistent improvement into the beginning of PC15 but began to stabilise towards the end of PC15. A stepped improvement in 'sewerage equipment failures' occurred at the end of PC15 and warranted the measure being recorded as 'improving'. Additionally, the number of pollution events has stabilised in PC15 following sustained improvement during previous price controls.

5.18 The graph does not show the 'Properties flooded' measure as it has been suspended because there are low numbers of failures with weather having a major impact on variability.

Sewerage non-infrastructure sub-service

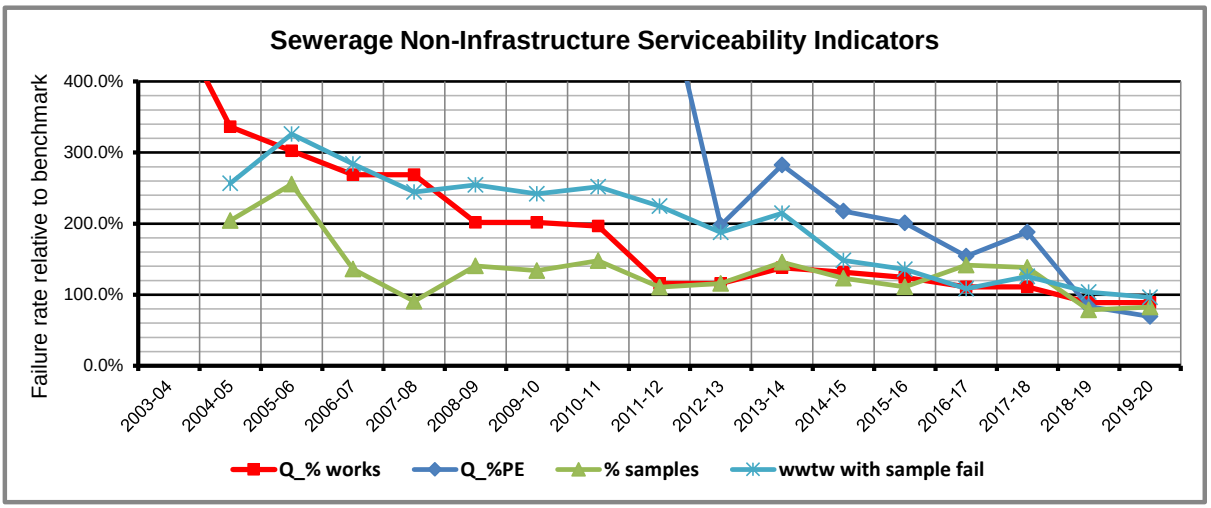

Figure 5.4: Sewerage non-infrastructure sub-service serviceability indicators.

5.19 Our overall assessment of sewerage non-infrastructure serviceability is 'improving', as improvements have been seen in almost all areas.

5.20 The serviceability indicators used for sewerage non-infrastructure are based on the analysis of regulatory samples taken to monitor compliance with numeric consent standards.

5.21 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 historic investment in wastewater treatment in order to meet new consents there was significant improvement in these indicators before the beginning of the price control, we are pleased to see this improvement has continued through PC15.

5.22 Two sub-threshold indicators have also been included based on the number of individual samples which fail to meet the numeric consent value. These indicators have been recorded as 'improving' and 'stable' through PC15.

5.23 All serviceability measures in this sub-service group have been recorded as 'improving' apart from the 'Percentage of BOD, SS and Ammonia compliance sample results which exceeded their numeric consent value' one, which is recorded as 'stable'.

Overall service assessment using primary indicators

5.24 While we use a basket of indicators to assess serviceability, we give particular weight to a primary indicator in each sub-service area. These

primary indicators are shown in Table 5.1 and their trend relative to reference levels are shown on Figure 5.5.

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

Table 5.1: Primary serviceability indicators.

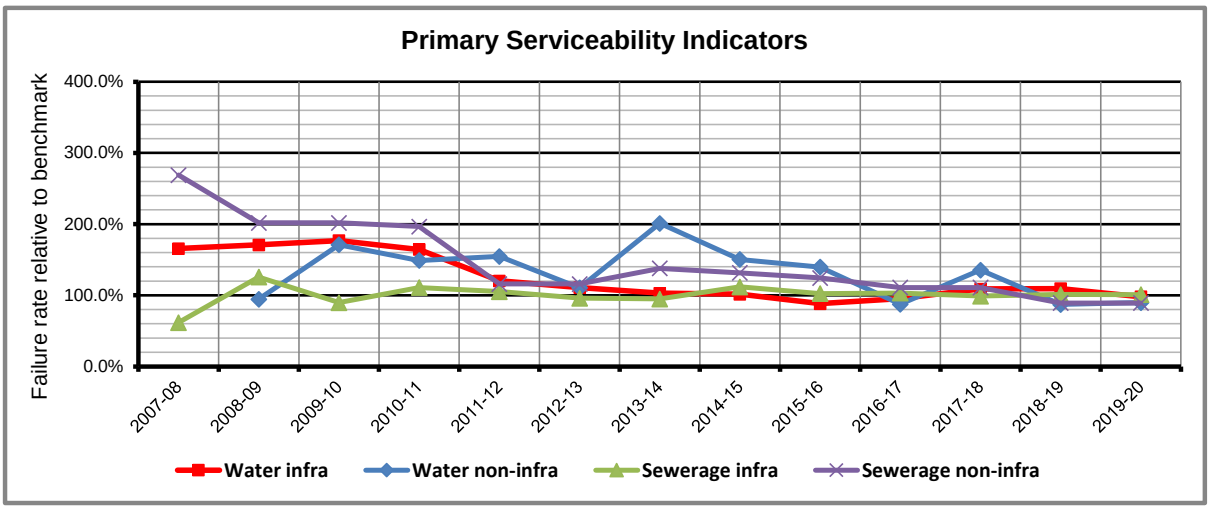

Figure 5.5: Primary serviceability indicators.

5.25 Of the four primary measures, three have been recorded as ‘stable’, with one ‘improving’ (sewerage non-infra). This results in an overall trend of ‘stable’.

6. Serviceability Limits for PC21

6.1 This section provides more detailed information and assessment of the reference levels and serviceability limits for PC21 based on current performance of serviceability measures. The proposed reference level and serviceability measures are summarised in Table 6.1 at the end of this section.

Assessment of water infrastructure indicators

Water mains bursts

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

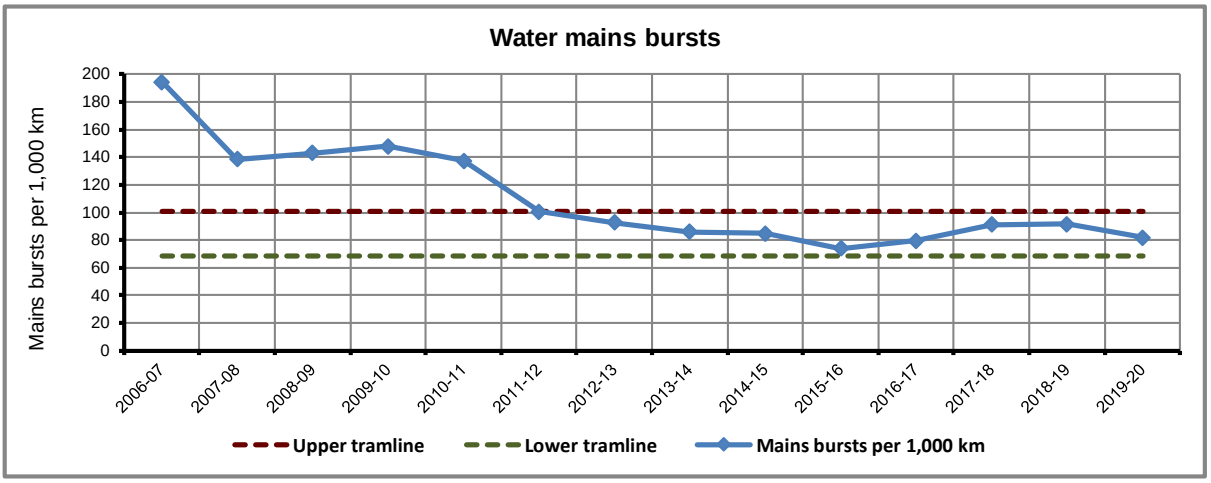

Figure 6.1: Water infra – water mains bursts.

Reference level	84.56	Upper control limit	100.59	Lower control limit	68.42

6.3 Since a stepped change on reported performance in 2012-13 on water mains bursts in 2010-11 has been stable with evidence of a rising trend towards the mid-point of PC15 appearing to correct itself in 2019-20.

6.4 We have used the average of all yearly figures since 2013-14 to determine a reference level of 84.6.

6.5 A multiplier of 1.5 was applied to maximum variance from the reference level to establish the upper limit.

6.6 This measure's reference points have been updated since the draft determination and now include the 2019-20 data. This has had a minimal impact on the graph, slightly widening the control limits.

Interruption to supply caused by equipment failure

6.7 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.

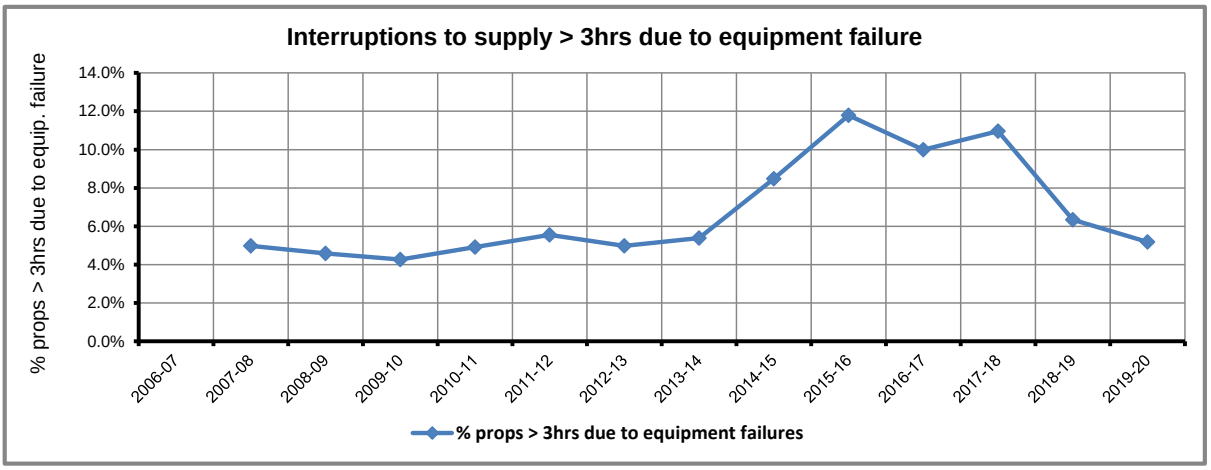

Figure 6.2: Water infra - Interruption to supply caused by equipment failure.

Reference level	Suspended	Upper control limit	Suspended	Lower control limit	Suspended

6.8 A stepped change is apparent in the data from 2014-15 onwards due to a change in the reporting methodology. NI Water has stated that;

"*Although it appears there has been a deterioration for this indicator since AIR14 we believe this is due to the introduction of the Central Incident Management System (CIMS) in July 2014. CIMS is aimed at addressing any outstanding issues relating to the reliability of data on supply interruptions. The new system ensures that more unplanned and unwarned interruptions are being captured than would previously have been the case and this is helping to improve the accuracy of NI Water's return rather than a reflection of service deterioration.*"

6.9 We welcome a change in methodology which results in improved data which can inform decisions on asset management. However, a consistent trend has not yet been established which would give confidence that the measure reflects asset condition and maintenance requirements. As a result, this measure has been suspended. We will re-evaluate the trend with a view to reinstating the measure once more data is available. This may be possible once the 2020-21 data is presented, however we anticipate waiting until the mid-term review point before reinstatement is possible.

Interruptions to supply greater than twelve hours

6.10 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.

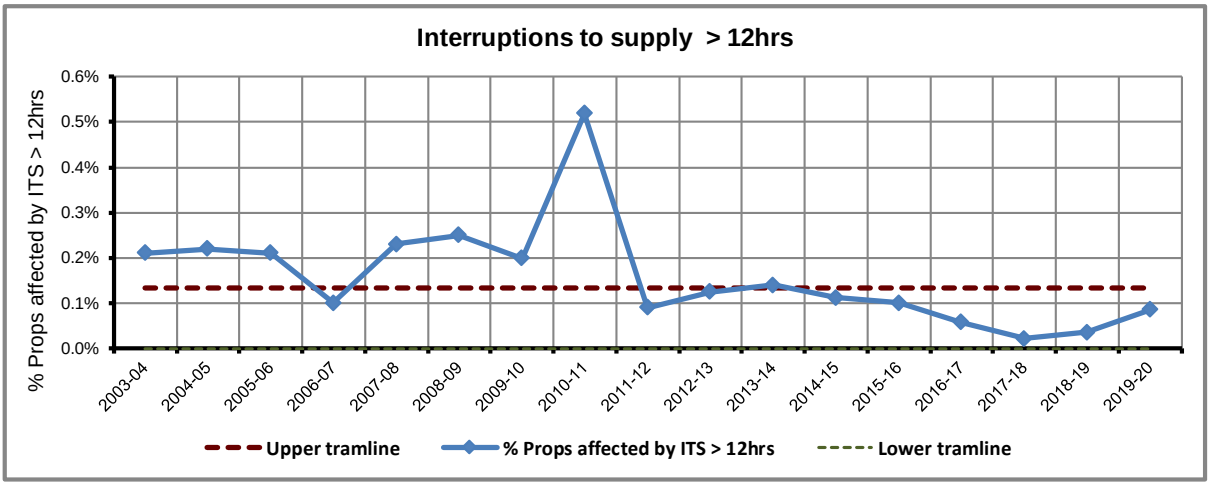

Figure 6.3: Water infra - Interruptions to supply greater than 12 hours.

Reference level	0.07%	Upper control limit	0.13%	Lower control limit	0.00%

6.11 Since 2013-14 NIW saw a consistent improvement against the >12 hour interruptions measure and improved annually between 2013-14 and 2017-18. This sustained improvement peaked in 2017-18 when just 190 properties in Northern Ireland experienced an interruption greater than 12 hours. In the last two years however this trend has reversed to the extent where we are now at a similar level to that of 2015-16 at the start of PC15. We are concerned by this reversal in trend, however we have decided to determine this measure as 'stable' due to the overall PC15 level remaining relatively consistent on average.

6.12 We have opted to use an average of the years 2014-15 to 2019-20 to establish a reference level.

6.13 Using the chosen methodology and applying a spread of 2x the standard deviation has resulted in an upper tramline of 0.13% and a lower tramline of 0%. NI water has only exceeded the upper limit once in the last 8 years.

6.14 Since the draft determination we have changed the reference level calculation to include more data points. The overall impact of this has been small, raising the upper control level slightly.

6.15 Discussions are ongoing as to the merit of changing the metric for this serviceability measure and reporting on the number of average customer minutes lost resulting from >12hour interruptions. This change in metric could align the >3 hour and >12 hour interruptions measures and present a composite view on the average amount of time a NIW customer is interrupted in each year.

Water quality – iron

6.16 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.

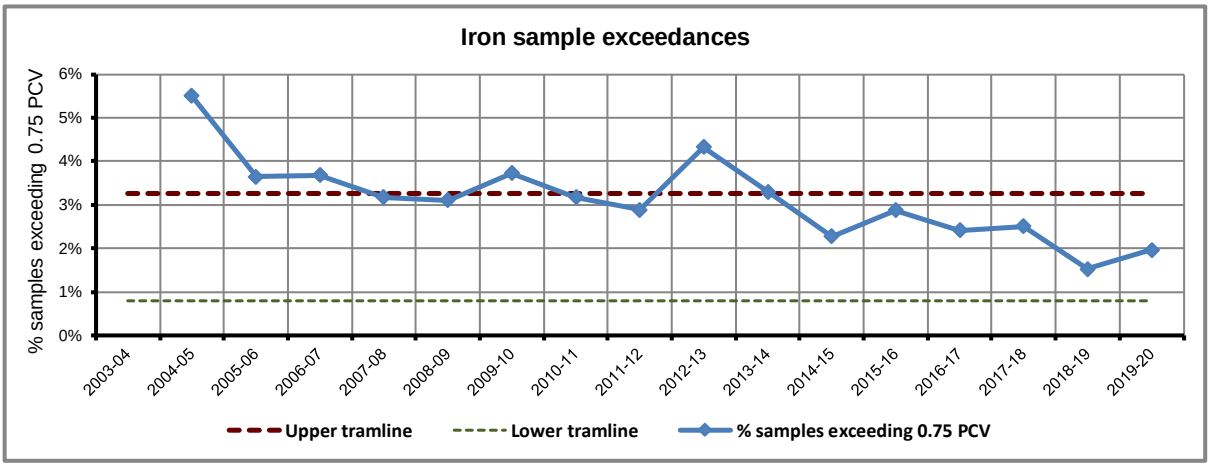

Figure 6.4: Water infra – water quality – iron.

Reference level	2.02%	Upper control limit	3.25%	Lower control limit	0.80%

6.17 There has been a stepped improvement in performance against the sub-threshold measure for iron in PC15. Performance levels are consistently below the lower bound of performance prior to 2014-15 with a further marked improvement in 2018-19 which, although it has not been fully sustained, 2019-20 is still the second best year on record. We have determined this measure is 'stable'.

6.18 The method of calculation for the benchmark level was to average the two years 2017-18 and 2018-19, resulting in a benchmarked average of a 2.02% failure rate.

6.19 A standard deviation of 2.5 was then applied to this average which resulted in a challenging, but suitable upper control limit of 3.25%. NIW have not exceeded this upper limit since 2013-14. Furthermore the last two reported

figures shows NIW significantly outperforming the upper control limit with annual totals of 1.53% and 1.97% respectively. As a result of this we have deemed the upper control limit appropriate.

Consumer contact regarding discoloured water

6.20 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.

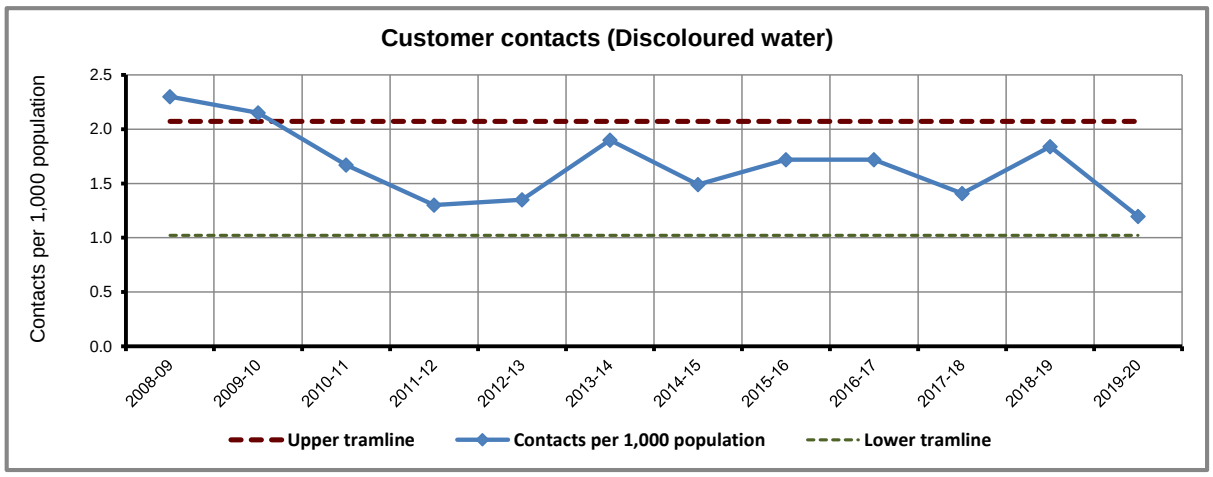

Figure 6.5: Water infra - consumer contact regarding discoloured water.

Reference level	1.55	Upper control limit	2.07	Lower control limit	1.02

6.21 Following an initial reduction in early data, the number of 'Discoloured Water Customer Contacts' has followed a stable trend with some volatility. The measure has been recorded as 'stable'.

6.22 The reference level was based on the average of all year's data since 2011-12 and has been updated since the draft determination to include the 2019-20 data.

6.23 The control limits were calculated using a standard deviation of 1.5. The upper and lower control points are slightly wider than those presented at the draft determination and reflect the performance of the last year which was the best on record.

Distribution losses

6.24 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.

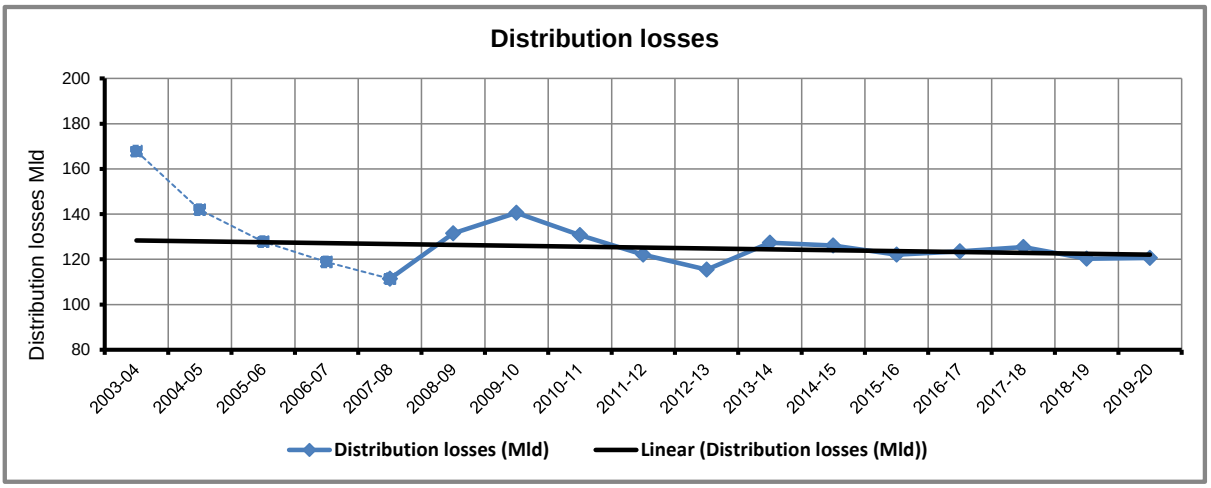

Figure 6.6: Water infra – distribution losses.

6.25 Distribution losses are not measured for the purpose of a separate indicator, but rather as a check and an explanatory factor for the 'Mains Bursts' serviceability indicator. For that reason, we do not set an average benchmark or control limits.

6.26 The data includes changes in reporting methodology although the impact is within the margin of variability of the data and has not affected our view of the trend.

6.27 Throughout PC15 the metric has remained stable, supporting the assessment of mains burst data as stable.

Assessment of water non-infrastructure indicators

Water treatment works turbidity

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

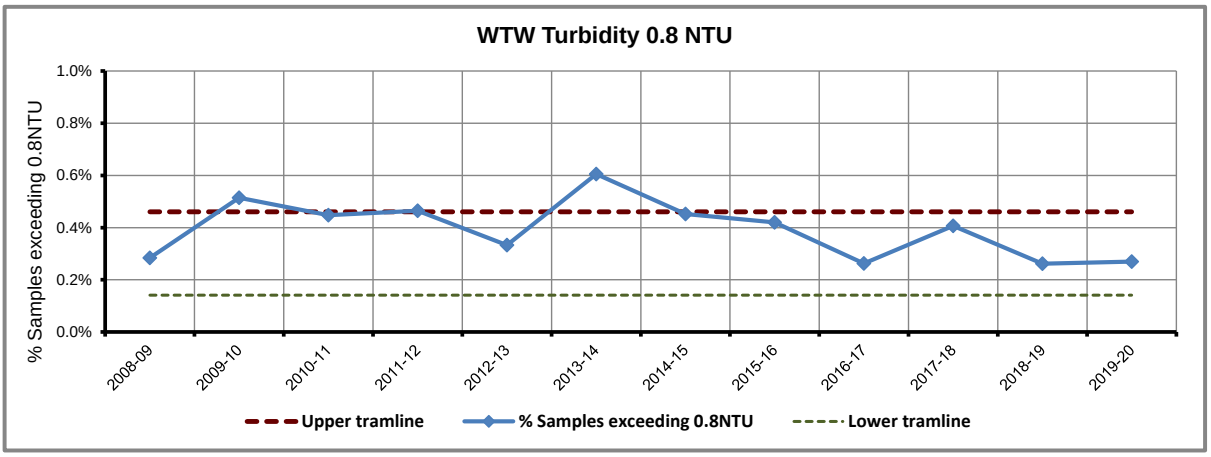

Figure 6.7: Water non-infra - water treatment turbidity.

Reference level	0.30%	Upper control limit	0.46%	Lower control limit	0.14%

6.29 Since the 'Water Treatment Works Turbidity Sampling' serviceability measure was introduced in 2008-09 there has been a relatively consistent and stable level of service. In PC15 there is evidence of improvement.

6.30 The reference level for this measure has been set using an average calculated from the last four years of available data (2016-17 – 2019-20).

6.31 A standard deviation of 1.5 was applied to the average to result in the upper and lower control levels as seen above.

6.32 Since the draft determination this measure has been updated to include the most recent years' data in the average calculations. The decision was made to maintain a four-year average which brought the upper reference level down slightly. This level was deemed appropriate as it has only been exceeded twice since 2010-11 and three of the previous four years are under the average reference level.

6.33 To date, the measure excludes Alpha PPP works. Since Alpha PPP has now been taken over by NI Water, we will consider including these works in our measure in the future.

Water quality – trihalomethane (THM)

6.34 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.

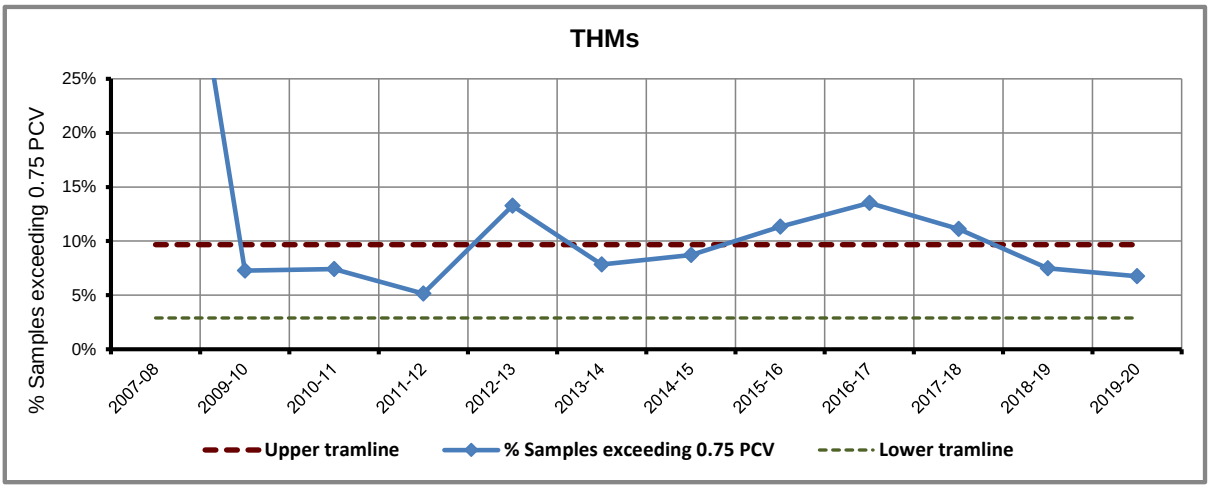

Figure 6.8: Water non-infra - water quality – trihalomethane (THM).

Reference level	6.28%	Upper control limit	9.67%	Lower control limit	2.89%

6.35 NIWs performance against the 'THM Sampling' serviceability measure initially saw a significant improvement up to 2009-10 following investment. However, there was a subsequent deterioration in performance up to 2016-17 with improvement since moving towards the reference level.

6.36 For PC21 we have maintained the reference levels established in PC15 using the averaging of 2010-11 and 2011-12. A standard deviation of 3 has been applied to establish the limits. Performance in PC15 moved above the upper limit before improving. Further investment planned for PC21 following treatability studies should allow NI Water to improve performance against this measure and help secure performance within the established upper limit.

Water treatment works events

6.37 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.

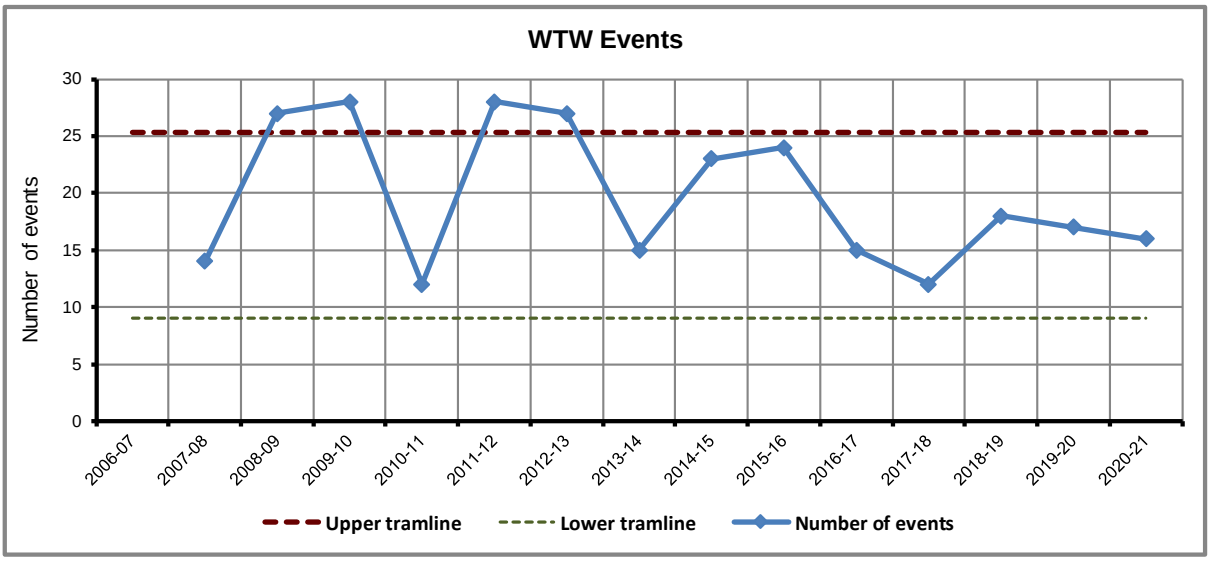

Figure 6.9: Water non-infra - water treatment works events.

Reference level	17.20	Upper control limit	25.36	Lower control limit	9.04

6.38 The 'Number of Events' serviceability measure has been volatile. Because of this volatility we were unable to make a meaningful assessment of the data in PC15 based on our defined methodology and instead made a subjective assessment of the measure. However, over PC15 the average number of events reduced and there has been a reduction in volatility. The additional data provided in PC15 and in particular the more recent years have allowed us to move away from the previous subjective view to a more calculated one.

6.39 To calculate the benchmark average for this measure, an average of the last four years of available data was used (2015-16 to 2019-20). This produced an average of 17.20 events per year. When this average figure is compared to the last available two years of data at 18 and 17 events respectively, it shows that the average is appropriate and, in the last two years, NIW have been very close to this benchmark figure.

6.40 A standard deviation of 2 was applied to the benchmark in order to produce the control limits. This lower spread multiplier was used due to the wide range of data points from which the average was taken and produced an upper control limit of 25.36. This upper limit has not been reached since 2012-13 and has not been exceeded at all in either the current or previous price controls. The lower control limit is set at 9.04 events.

6.41 For the final determination this graph was updated with the 2020-21 data but the methodology remained the same and the additional data was not included in the calculations. The consistency of performance shown in the

past three years indicates that the time is approaching when it would be suitable to narrow the upper and lower reference levels, however we have decided to defer this for now with the potential to revisit at the midterm review.

Service reservoir quality – coliform

6.42 'Service Reservoir Quality – Coliform' is assessed as the percentage of regulatory samples taken for coliform bacteria at Service Reservoirs which exceed PCV.

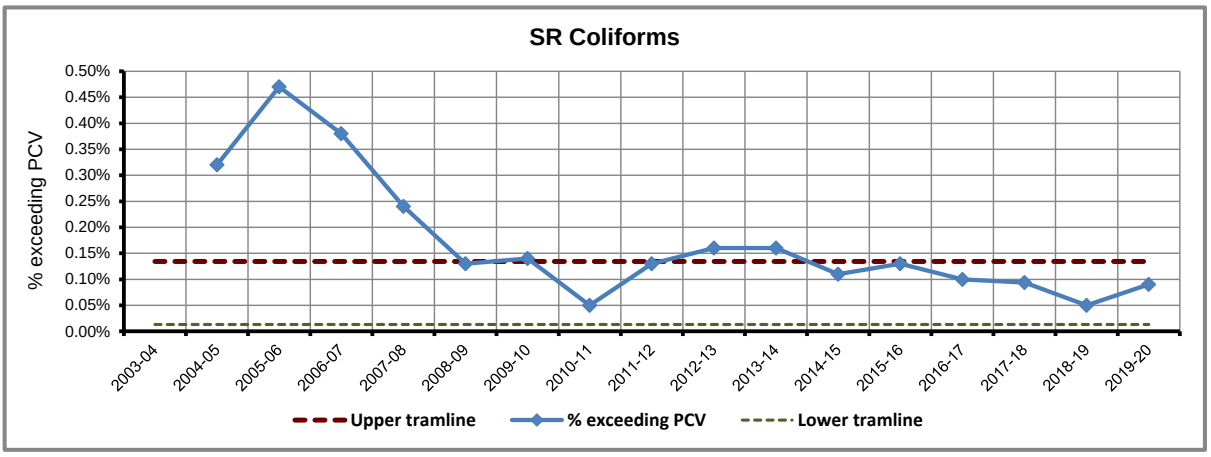

Figure 6.10: Water non-infra - service reservoir quality – coliform.

Reference level	0.07%	Upper control limit	0.13%	Lower control limit	0.01%

6.43 The 'Service Reservoir Coliforms' serviceability measure initially saw steep improvements to service when it was first introduced before the service improvements flattened off in 2008-09. This performance stayed relatively stable until 2014-15 when they began to steadily improve throughout the PC15 period.

6.44 As part of their PC15 submission, NIW stated that service reservoir rehabilitation was to be prioritised and that they aimed to improve the trend against this measure. We are therefore pleased that they have realised the improvement promised over the PC15 period. This improvement has been sustained, to the extent that four of the lowest five figures ever achieved have been in the last five years recorded (2016-17 to 2019-20). We have taken the decision to record this measure as 'stable' due to the 2019-20 data point falling at a level consistent with performance throughout PC15.

6.45 To calculate the benchmark average for this measure an average of the two years 2018-19 and 2017-18. This methodology was chosen for the draft determination and has been continued through to the final determination as

the additional years' data (2019-20) does not warrant a change in the upper or lower control points.

6.46 A standard deviation of 3 was used to create an upper control level of 0.13%, a level that has not been exceeded since 2013-14 and which NIW have reported a figure equal to or less than eight times. The lower control limit has been set at 0.01%.

Assessment of sewerage infrastructure indicators

Sewer collapse

6.47 The 'Sewer Collapse' measure is assessed as the number of sewer collapses per 1,000km of main sewer.

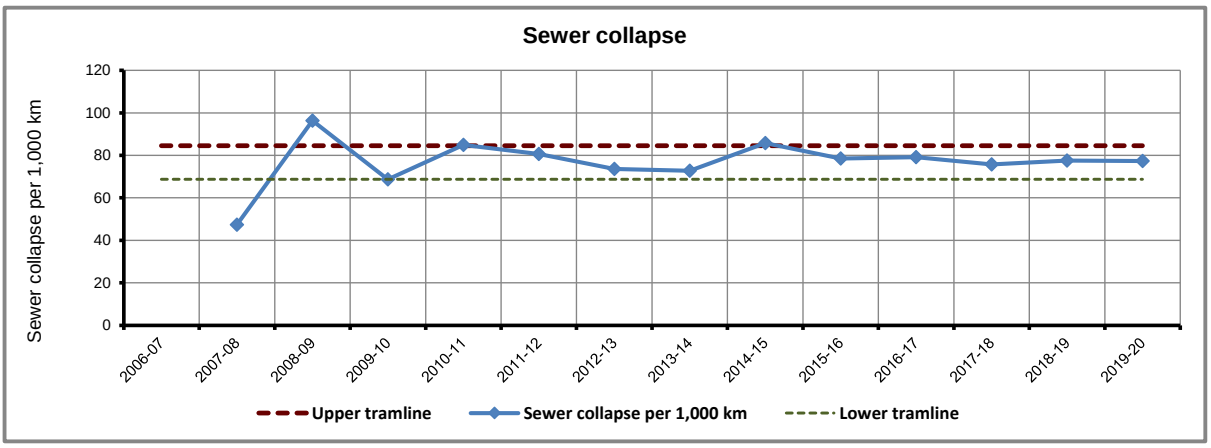

Figure 6.11: Sewerage infra – sewer collapse.

Reference level	76.7	Upper control limit	84.5	Lower control limit	68.8

6.48 The 'Sewerage Collapse' serviceability measure, NIWs performance over the PC15 period has been stable. For this reason the method of calculation for the average figure and the upper and lower control limits have not been altered moving into PC21.

6.49 The calculation was made using an average calculated from the 2011-12 and 2013-14 figures. This methodology produced upper and lower control points from a standard deviation of 2 that have been shown to be reliable.

6.50 This measure of sewer collapses includes collapse on sewer laterals.

Sewer blockage

6.51 The 'Sewer Blockage' measure is assessed as the number of sewer blockages per 1,000km of main sewer.

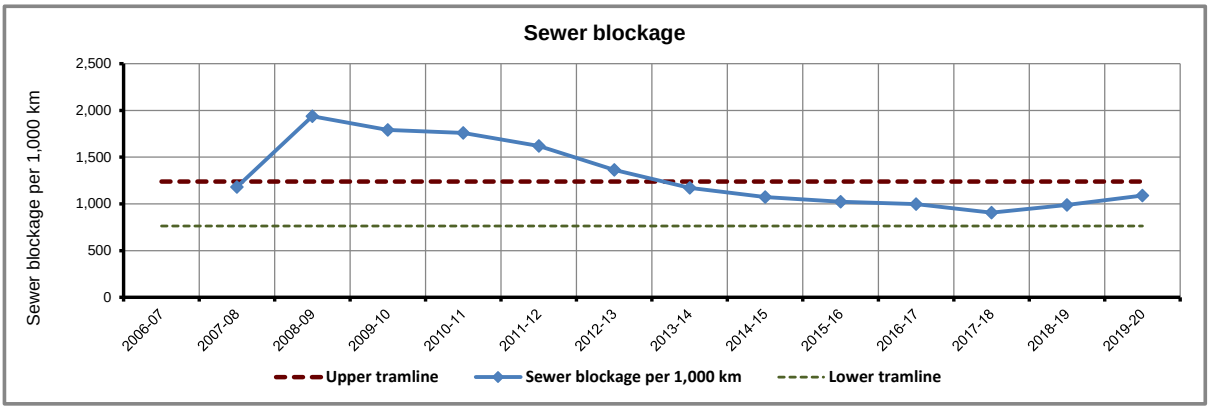

Figure 6.12: Sewerage infra – sewer blockage.

Reference level	1,001	Upper control limit	1,238	Lower control limit	763

6.52 NI Waters historic performance in this measure has been one of continual steady improvement, with every year in the history of the measure being the best year on record at that time until 2018-19 where the trend started to reverse. There is therefore indication that performance has begun to stabilise in PC15.

6.53 This serviceability measure has been deemed 'stable', to reflect the fact that the consistent but slight improvements shown up to 2018-19 have reversed in the previous two years.

6.54 In order to produce the upper and lower control points for the 'Blockages per 1000km' serviceability measure, an average was calculated from the previous five years data (2015-16 to 2019-20). A 2.5 times standard deviation was used to defined the limits with all data from 2014-15 falling within this limit. This represents a slightly wider area between the upper and lower control limits when compared to the draft determination and has been caused by the reversing trend over the last two years.

6.55 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. NI Water have 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

6.56 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).

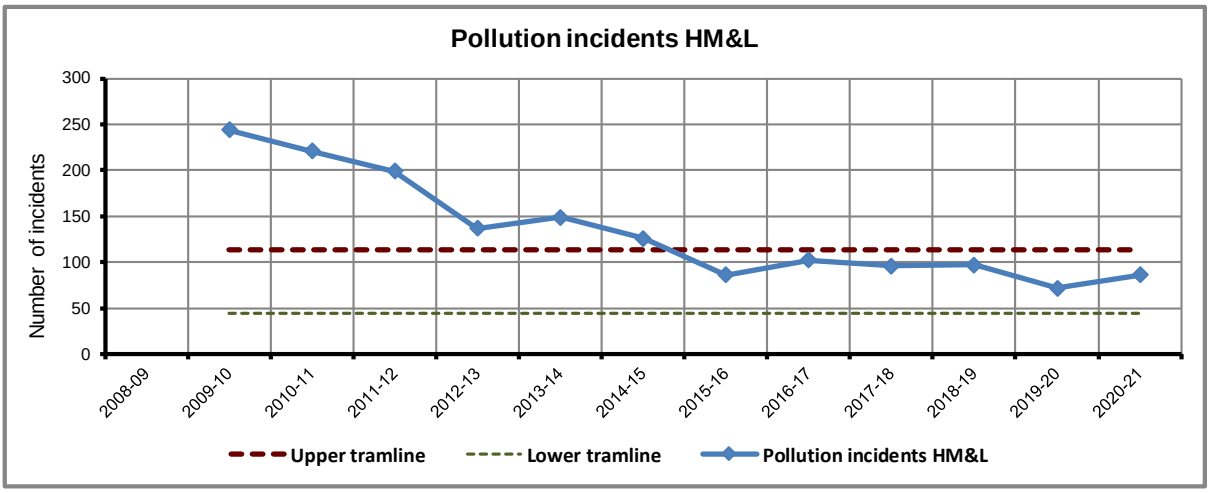

Figure 6.13: Sewerage infra –pollution incidents.

Reference level	79	Upper control limit	114	Lower control limit	44

6.57 The 'Pollution Incidents' serviceability measure improved up to 2015-16 with performance stabilising since then.

6.58 This measure has now been recorded as 'stable' to reflect the consistency seen in the results over the last three years.

6.59 The calculation of the average benchmark figure for the PC21 assessment of the Pollution Incidents measure has been based on the average of the last two years data (2019-20 and 2020-21 to calculate a benchmark average of 79.

6.60 For this measure a standard deviation of 5 was applied to the average. The upper control level has therefore been calculated at 114 incidents. This level has not been exceeded since 2014-15 and is 42 incidents greater than their most recent figure of 72. Additionally, when the most recent data point was added to the graph the control limits were shown to be appropriate. We have therefore not changed the calculations for the final determination.

6.61 We recognise that the company has stated that it anticipates that the number of pollution incidents could rise in PC21 due to changes in the approach to inspections. We have decided however, that any potential increase cannot be quantified at this stage and therefore we have designed the serviceability

control levels to fit the current trend and will address any increases as necessary in PC21.

Properties flooded (other causes)

6.62 This indicator is assessed as the number of properties flooded in the year due to causes other than hydraulic incapacity. Typically the causes of flooding recorded under this measure include; sewer collapse, sewer blockage and pumping station failure.

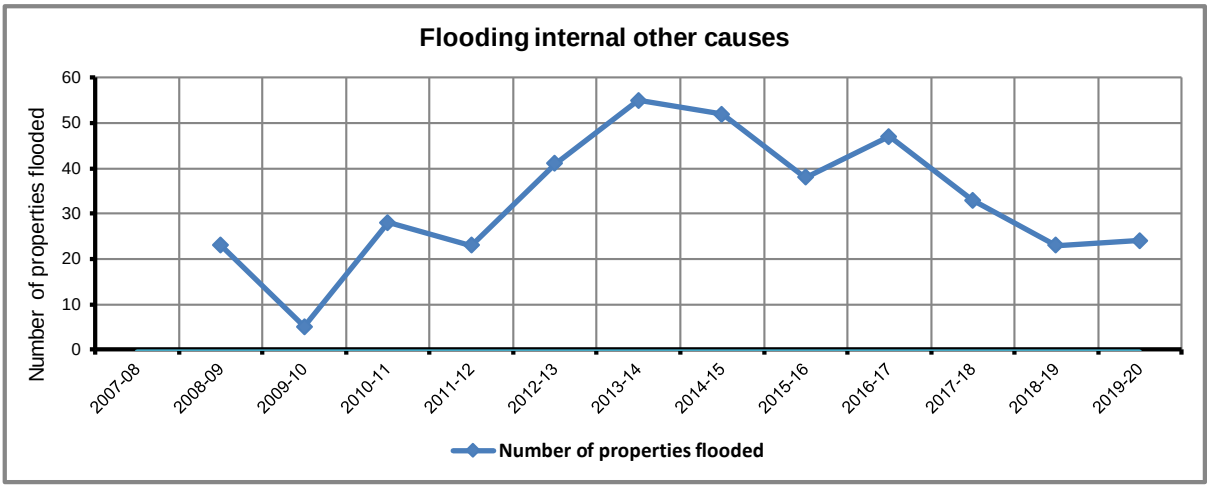

Figure 6.14: Sewerage infra –properties flooded (other causes).

Reference level	Suspended	Upper control limit	Suspended	Lower control limit	Suspended

6.63 The 'Flooding Internal Other Causes' serviceability measure has been volatile since it was first recorded in 2008-09. Its best year occurred in 2009-10 when only 5 properties were recorded as flooded, however since then that figure has reached 55 in the 2013-14 year before recently reduced to 23 properties in 2018-19.

6.64 We have previously commented regarding our concern over the use of this measure due to the relatively low incidence level in Northern Ireland and the fact that the metric is driven, to a large extent, by external factors. We have therefore decided that while we will continue to track and monitor this metric we will not use it when drawing conclusions. This approach will remain until a clear and stable trend is evident, at which point we will re-evaluate our approach.

Equipment failures

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

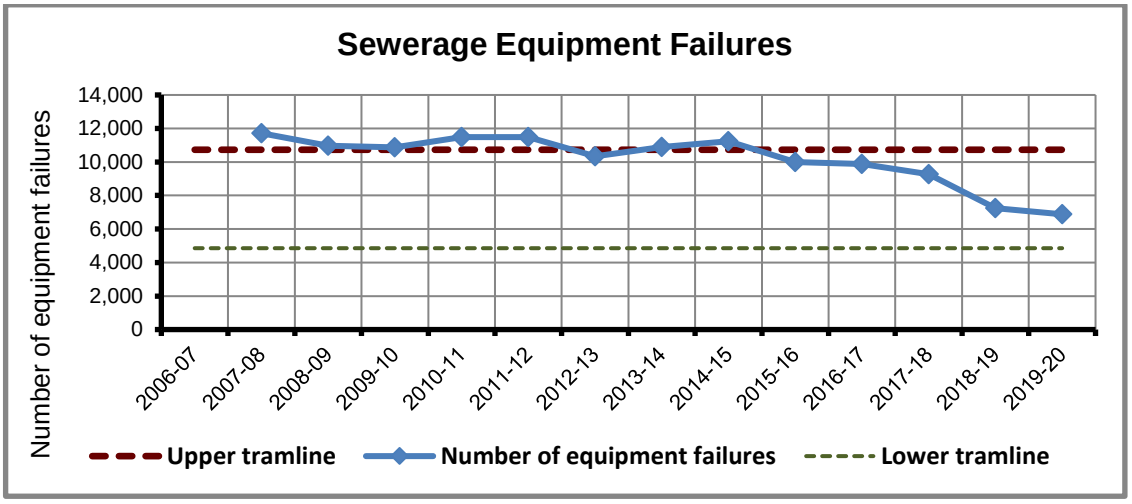

Figure 6.15: Sewerage infra – equipment failures.

Reference level	7,793	Upper control limit	10,731	Lower control limit	4,855

6.66 The 'Sewerage Equipment Failures' serviceability measure showed an initial stable trend up to 2014-15 with an improving trend since. This serviceability measure has been deemed 'improving'.

6.67 Given the stepped reduction in 2018-19 we have used an average of the last three years a reference level of 7,793 failures a year. A standard deviation of 2 was applied to the data to produce upper and lower control levels at 10,731 and 4,855 failures per year. The upper control level has been achieved in each of the last five years.

Assessment of sewerage non-infrastructure indicators

6.68 All the serviceability indicators for sewerage non-infrastructure are based on the reported compliance at wastewater treatment works. We asked the company to draw up a specification for unplanned maintenance indicator(s) which would show trends in serviceability. Although it developed and implemented a measure in PC15, it will take time before there is a sufficient trend to undertake an assessment. In the meantime, we will continue to rely on wastewater treatment works compliance data to assess serviceability.

WwTW compliance – percentage of works

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

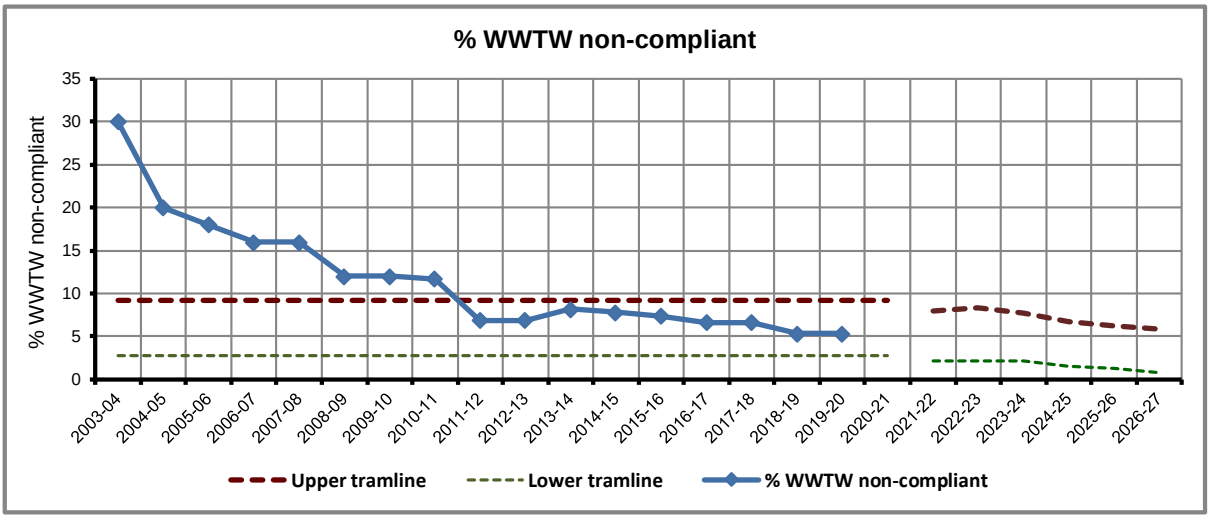

Figure 6.16: Sewerage non-infra - WwTW compliance – percentage of works.

Reference level	variable	Upper control limit	variable	Lower control limit	variable

6.70 Wastewater treatment works compliance has continued to improve through PC15 as investment in wastewater treatment continues. The trend for this serviceability measure is improving.

6.71 We are aware that in the coming years there are several waste water treatment works that will become non-compliant as new consents are issued in advance of investment. The reference levels and limits for PC21 were determined through a risk based analysis which takes account of historical performance of individual works changes in future consents and planned investment as described in Annex E.

WwTW compliance – population equivalent

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

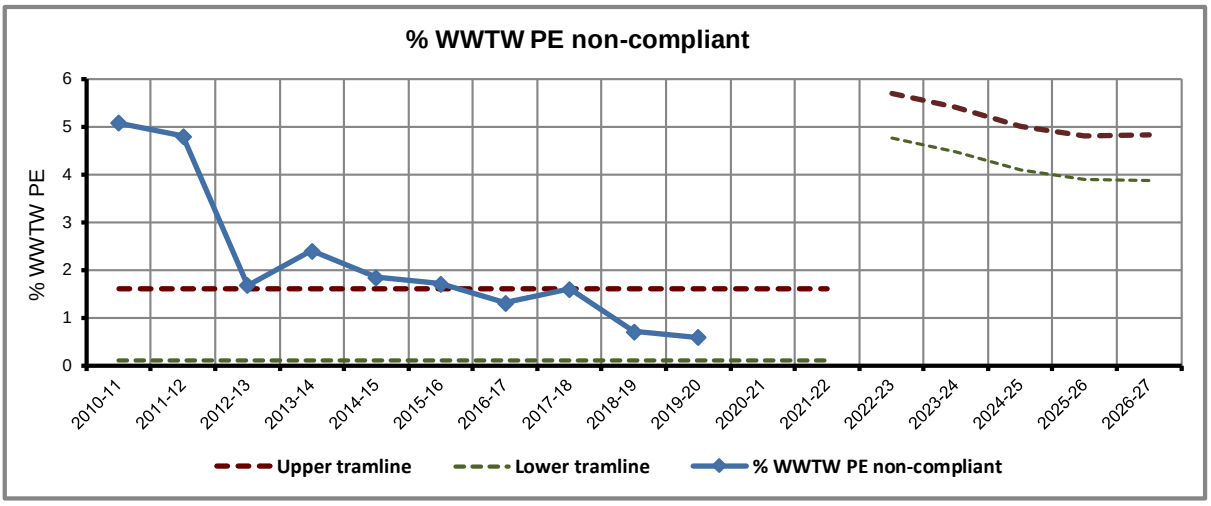

Figure 6.17: Sewerage non-infra - WwTW compliance – population equivalent.

Reference level	variable	Upper control limit	variable	Lower control limit	variable

6.73 The 'Percentage Waste Water Treatment Works Non-Compliant' serviceability measure has seen a steady improvement since it was introduced in 2010-11. This improvement has continued throughout PC15 and, with the exception of 2017-18, each year has bettered the previous.

6.74 This measure has been recorded as improving.

6.75 We are aware that in the coming years there are several waste water treatment works that will become non-compliant as new consents are issued in advance of investment. The reference levels and limits for PC21 were determined through a risk based analysis which takes account of historical performance of individual works changes in future consents and planned investment as described in Annex E.

WwTW compliance – samples

6.76 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.

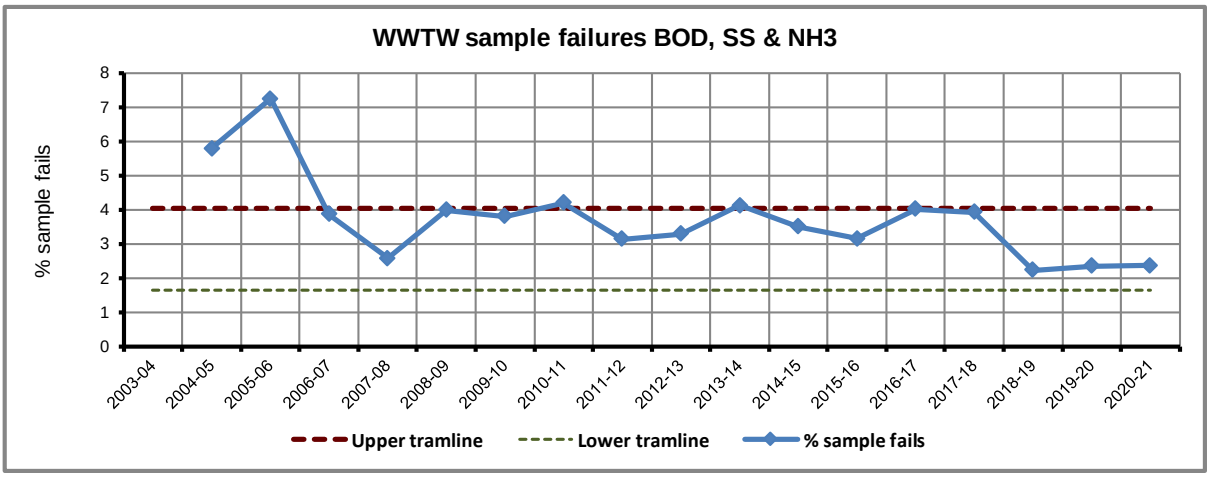

Figure 6.18: Sewerage non-infra - WwTW compliance – samples.

Reference level	2.84%	Upper control limit	4.05%	Lower control limit	1.64%

6.77 The 'Waste Water Treatment Works Sample Failures for BOD, SS, and NH3' serviceability measure has held relatively stable, returning a figure of between approximately 3% and 4% since 2007-08. The largest step change in data has occurred recently between 2017-18 and 2018-19 where the figure dropped to 2.24%. This level of service was then sustained over the following two years.

6.78 Given that, at this stage, the recent improvement has not been demonstrated over the medium term, this measure is deemed ‘stable’.

6.79 In view of the recent stepped change in performance, the reference level and limits were calculated using the average from the three years of data 2017-18, 2018-19 and 2019-20. The benchmark average has been set at 2.84%.

6.80 A standard deviation of 2 was applied to the spread to return an upper control level of 4.05%, a level that has not been exceeded since 2013-14 and one that has been achieved in all but one of the last nine years. Given the consistency of data seen in 2020-21 we have decided that the draft determination control limits are still appropriate.

WwTW compliance – works with one or more sample failure

6.81 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.

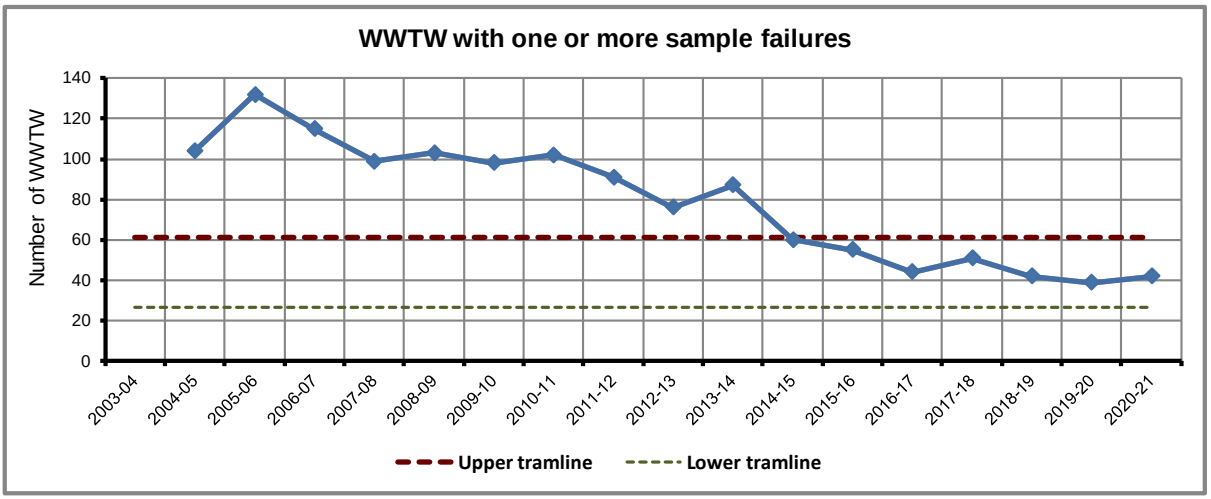

Figure 6.19: Sewerage non-infra - WwTW compliance – works with one or more sample failures.

Reference level	44	Upper control limit	61.5	Lower control limit	26.5

6.82 The 'Waste Water Treatment Works with more than One Sample Failure' serviceability measure has seen a steady improvement since it was first recorded in 2004-05.

6.83 The benchmark average for this measure has been updated since the draft determination and has now been calculated by averaging the 2016-17 to 2019-20 data. This calculation was updated due to the apparent stabilising of the data trend.

6.84 The control limits were established using a standard deviation of 2.5 resulting in the control limits shown above.

6.85 Despite the trend appearing to flatten and stabilise we have determined this measure as ‘improving’ due to the consistent downward trend since the measure began.

Summary of reference levels and control limits for PC21

Service	Indicator	Ref. level	Upper limit	Lower limit	Status	Indicator Usage
Water Infra	Mains bursts per 1,000km	84.56	100.59	68.42	Stable	Primary
	Interruptions to supply greater than 3 hours resulting from equipment failure					Suspended
	DG3 Percentage properties affected by interruptions greater than 12 hrs (unplanned & unwarned)	0.07%	0.13%	0.00%	Stable	Secondary
	Percentage of regulatory Iron samples exceeding 75% of the drinking water standard PCV	2.02%	3.25%	0.80%	Stable	Secondary
	Customer contacts per 1,000 population (Discoloured water)	1.55	2.07	1.02	Stable	Secondary
	Distribution losses	N/A	N/A	N/A	Stable	Explanatory
Water Non-infra	Percentage of regulatory samples taken for Turbidity at WTWs which exceed 0.8 NTU	0.30%	0.46%	0.14%	Stable	Primary
	Number of regulatory THM samples exceeding 75% of the drinking water standard PCV	6.28%	9.67%	2.89%	Stable	Secondary
	Events at WTW resulting from treatment difficulties or ineffective treatment categorised as 'significant' or higher	17.20	25.36	9.04	Stable	Weak
	Percentage of regulatory samples taken for coliform bacteria at Service Reservoirs exceeding the drinking water standard PCV	0.07%	0.13%	0.01%	Stable	Secondary
Sewerage Infra	Sewer collapses per 1,000km	76.7	84.5	68.8	Stable	Primary
	Sewer blockages per 1,000km	1,001	1,238	763	Stable	Secondary
	Number of H, M and L pollution incidents from sewer network (CSOs, rising mains and foul	79	114	44	Stable	Secondary

Service	Indicator	Ref. level	Upper limit	Lower limit	Status	Indicator Usage
	sewers)					
	Properties flooded in the year (other causes)					Suspended
	Total number of equipment failures repaired	7,793	10,731	4,855	Improving	Secondary
Sewerage Non-infra	Number of WwTWs with one or more compliance sample result (BOD, SS or Ammonia) exceeding the numeric consent value	40.5	55.5	25.5	Improving	Secondary
	Percentage of WwTW discharges not compliant with numeric consents	Variable limits set			Improving	Primary
	Percentage of total p.e. served by WwTWs not compliant with numeric consents	Variable limits set			Improving	Secondary
	Percentage of BOD, SS and Ammonia compliance sample results which exceeded their numeric consent value	2.84%	4.05%	1.64%	Stable	Secondary

Table 6.1: Serviceability reference levels and control limits