Water and sewerage service Price Control 2015-2021 Northern Ireland Water

Our approach to asset maintenance

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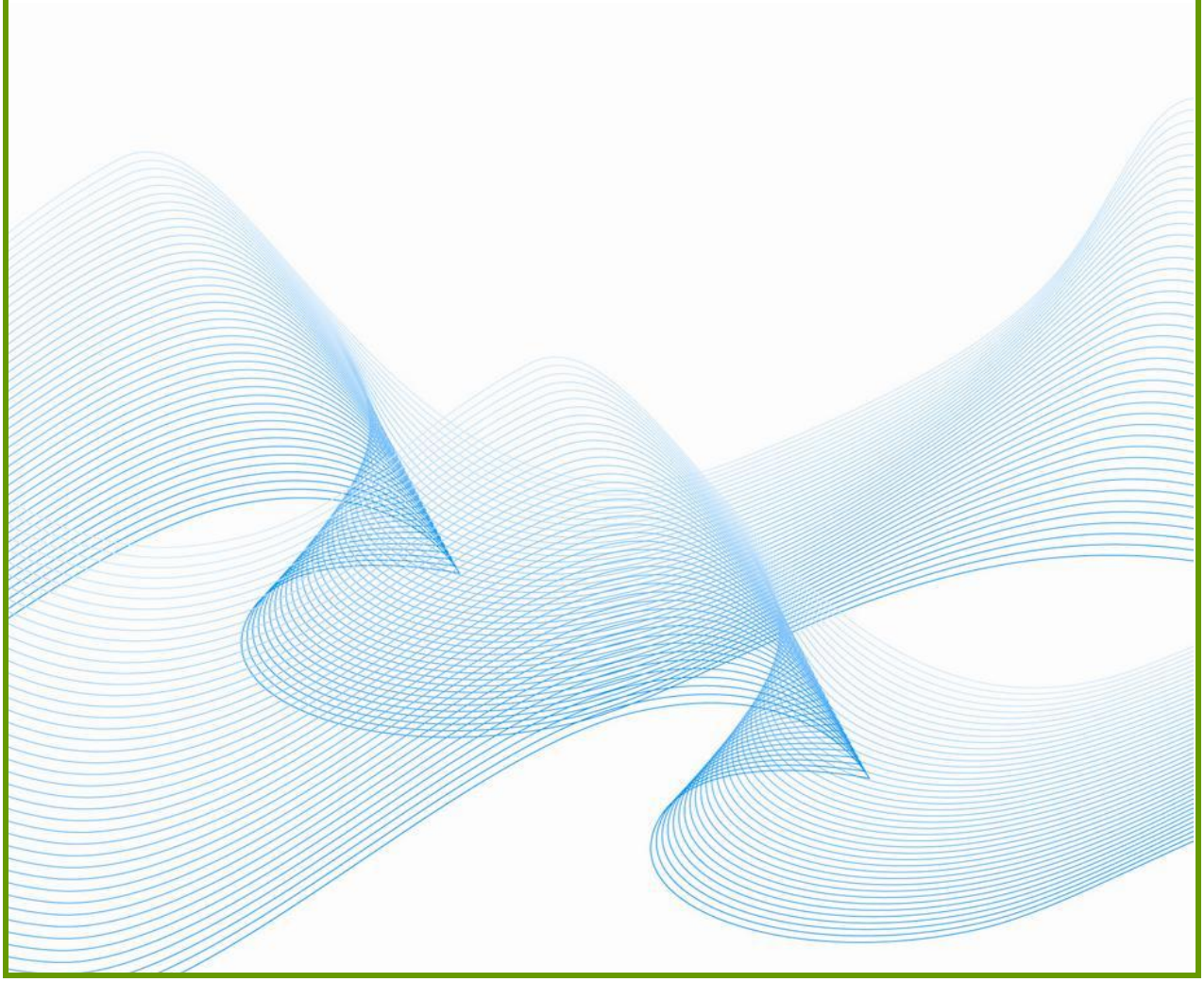

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About this document

The Utility Regulator's primary role within the Northern Ireland water industry is to promote and protect the interests of consumers. One way we do this is by determining price controls that make sure consumers receive adequate levels of service at the best value for money.

Price Control 2015 to 2021, referred to as PC15, will be our third price control for NI Water. We published our overall approach to PC15 in October 2012 and we committed to publish further detail of how we would approach the key area of asset maintenance investment.

Asset maintenance investment (sometimes referred to as base maintenance or capital maintenance) is the investment necessary to replace assets which have reached the end of their useful life or to provide alternative means to support continued service delivery. In this document we review the main techniques which NI Water might use to assess future asset maintenance needs and we describe how we will use this information to determine a reasonable value of asset maintenance investment over the PC15 period.

We will consult NI Water and the other principal stakeholders on our approach to asset maintenance. We have also published this approach and we would welcome feedback from interested parties. We will take account of feedback received by the 5 April 2013 as we finalise our approach. We plan to publish our final approach to asset maintenance by the 31 May 2013, following publication of our Information Requirements for PC13.

1. Introduction

1.1.1 The delivery of water and sewerage services is an asset intensive process which requires:

- Substantial impounding reservoirs to store raw water.
- Complex water treatment works to treat raw water abstracted from rivers, loughs and impounding reservoirs to meet exacting drinking water quality standards.
- An extensive system of pipes, pumping stations and service reservoirs to distribute water to consumers. NI Water operates over 26,000 km of water mains – more than 30 m of water main for every connected property.
- A network of sewers and pumping stations to collect wastewater and surface water run-off and convey it to treatment works. NI Water operates over 15,000 km of sewers.
- Wastewater treatment works, including simple and complex plant, which treat wastewater to meet environmental consent standards before it is discharged to rivers, estuaries or the sea. NI Water operates over 1000 wastewater treatment works, many of which are small works serving rural communities.

1.1.2 NI Water has estimated that the gross replacement value of the assets used to deliver water and sewerage services at March 2012 was £8.7 billion (this equates to just over £12,000 of asset for each domestic property served with a water supply).

1.1.3 Asset maintenance investment (sometimes referred to as base maintenance or capital maintenance) is the investment necessary to replace assets which have reached the end of their useful life or to provide alternatives which will support continued service delivery. At present NI Water invests approximately £80 million per annum to maintain existing assets and services.

1.1.4 Because this investment maintains current services, it is paid for by current consumers through direct charges to non-domestic consumers; a subsidy to NI Water from the Department for Regional Development (DRD) in lieu of domestic customer charges; and, a payment by DRD Roads Service for road drainage. Almost a quarter of the revenue raised by NI Water is used to maintain the assets and the service they deliver.

1.1.5 Dividing the estimated gross value of the assets and current level of asset maintenance investment suggests that the expected average life of an asset is approximately 110 years. However, this type of simplistic analysis can be misleading because:

- different types assets are deployed to deliver water and sewerage services ranging from short life assets such as vehicles and IT systems to long life assets such as concrete structures, pipes and embankment dams;
- historical investment has not been uniform – but has varied as technology and society's expectations developed and as economic conditions permitted; and,
- some of the long life assets deployed have not yet been replaced for the first time and standard assumptions of asset life have not been tested in practice – these assets may last a longer or shorter time than expected.

1.1.6 The complex mix of assets requires a robust assessment to establish the 'right' level of asset maintenance in the medium and long term. If investment is made too early we lose the opportunity to either reduce charges or invest in other service improvements. If investment is made too late, service may deteriorate until an adequate level of investment is restored.

1.1.7 For our first Price Control (PC10), NI Water was not able to provide a robust assessment of asset maintenance investment based on risk to service. In the absence of this assessment, we estimated a reasonable allowance by using an econometric comparison with asset maintenance investment by water service providers in England and Wales. We carried this approach forward into PC13 for a short (two year) duration price control.

1.1.8 However, since its inception in 2007 (and before), NI Water has been investing in asset maintenance systems and data which should allow it to develop a forward looking, risk based approach to asset maintenance. It is not possible to prejudge the outcome of this work. A better understanding of its assets might allow the company to reduce or delay asset maintenance investment. Alternatively, a better understanding might show that higher levels of asset maintenance investment are necessary in the medium to long term.

1.1.9 For PC15, we expect the company to have developed its assessment of asset maintenance investment in a practical way based on improving information quality. It is for the company to decide how it can best make this assessment taking account of its systems, data and capability. In the remaining sections of this approach document we have:

Section 2	Considered the broad range of asset maintenance techniques which might be applied to assess future asset maintenance investment. We have outlined how we would apply each of these techniques to determine the level of asset maintenance investment in PC15. Where appropriate, we have identified specific information we will ask the company to provide to support our assessment.
Section 3	Described how asset maintenance investment is currently funded and consider the impact that this might have on long term financial sustainability and equity between today's and future consumers,
Annex A	Provided a brief description of each generic asset maintenance technique considered in Section 2. We summarise key strengths and weaknesses and note how we will use each technique to develop our determination.

2. Asset Maintenance Techniques

2.1 Overview

2.1.1 In this section of our approach we consider the broad range of asset maintenance techniques which might be applied to assess future asset maintenance investment.

2.1.2 Eight generic asset maintenance techniques are identified and reviewed:

Top down expenditure analysis

1. The projection of historical expenditure by the company.
2. An econometric analysis of historical expenditure by other companies.
3. A depreciation approach based on a modern equivalent asset valuation.

Asset maintenance outcomes

4. An assessment of historical trends in asset 'serviceability'.
5. An assessment of historical trends in condition and performance of the assets.

Asset maintenance plans

6. A specific asset maintenance plan setting out specific outputs and expenditure.
7. A forward looking risk based approach which takes account of how asset serviceability deteriorates over time and analyses the cost of running or replacing the asset to arrive at a cost effective or cost beneficial asset management plan.

Asset planning capability

8. A structured assessment which demonstrates that the company has the capability to make a robust assessment of future asset maintenance needs and identifies further improvements which can be made in asset maintenance, data and processes to support long term planning.

2.1.3 Annex A provides a summary description of each technique. It identifies key strengths and weaknesses and summarises how we will incorporate these techniques into our overall approach.

2.1.4 The different techniques are more or less appropriate for different types of assets. They are more or less valid depending on the quality of the data, systems and process applied by the company. As a result we will employ the range of the techniques available to triangulate to a reasonable determination of asset maintenance investment for PC15. The

weight we give to each technique in arriving at our determination will depend on the type and quality of information provided by the company in its Business Plan submission.

2.1.5 In line with the principles set out in our approach to PC15, we expect the company to develop the data necessary to support a robust assessment of expenditure and outputs. Where it is necessary to use a light regulatory approach because there is insufficient data to support more robust analysis, we will adopt an approach to funding which is prudent but conservative until the company can provide robust information based on sound data and analysis.

2.2 Projection of historical expenditure

2.2.1 The projection of historical expenditure provides a basic methodology for assessing medium term asset maintenance investment. It assumes, but cannot demonstrate, that:

- the level of investment required to maintain a mixed portfolio of assets will be broadly constant in the medium term;
- historical asset maintenance investment has been adequate and delivered efficiently; and,
- the company has been free to decide the right level of investment in the past and has not been constrained by external events, including previous funding limits.

2.2.2 It is possible to address some of these concerns. For example:

- Comparing historical investment with historical serviceability trends can establish whether investment has been adequate.
- Comparative efficiency assessment can determine whether investment has been delivered at efficient unit costs - although it does not determine whether it has been targeted effectively.

2.2.3 Despite these limitations the analysis of historical investment and serviceability trends provides a baseline against which future estimates of asset maintenance can be judged. We would expect the company to include an assessment of historical asset maintenance investment in its Business Plan submission and be capable of demonstrating why planned levels of investment are different from historical investment.

2.2.4 We will ask the company to submit historical cost information in its Business Plan submission based on the breakdown of asset maintenance expenditure by sub-service and selected asset type as detailed in Table 32 of the Annual Information Return. We will also consider any further breakdown of historical investment which the company may offer to support its assessment of future asset maintenance investment for individual asset groups.

2.2.5 We will consider the unit cost efficiency of asset maintenance investment before using historical investment trends in our analysis. Our approach to capital expenditure efficiency will be published in May 2013.

2.3 Econometric analysis of historical expenditure by other companies

2.3.1 Econometric modelling analyses the historical expenditure of companies delivering a similar service using explanatory variables to develop comparative expenditure models. The models are used to estimate the level of asset maintenance investment with further adjustments made to account for special factors or the relative efficiency of the company.

2.3.2 For our first Price Control (PC10), we used econometric analysis as the primary method for assessing asset maintenance investment. We adopted the general to specific modelling approach developed by Ofwat to determine asset maintenance investment for water service providers in England and Wales, making adjustments for:

- relative efficiency including regional price adjustment;
- the transfer of assets to PPP service providers; and,
- any commitment to deliver specific outputs included in the final determination.

2.3.3 Since PC10, Ofwat has reduced the amount of data collected from water service providers in England and Wales. It no longer collects the costs and explanatory factor information used to develop asset maintenance econometric models. To date it is not clear how Ofwat will assess asset maintenance requirements in its next price control, although work is being undertaken on total expenditure (totex) combining operational and asset maintenance expenditure (a sub-set of capital investment) alongside that of total costs, combining operational and capital costs.

2.3.4 In the absence of this source of data we will develop econometric analyses of asset maintenance expenditure as follows:

- We will ask NI Water to submit cost and explanatory data to update the econometric models used in PC10. Much of this data is already collected in the Annual Information Return.
- We will refresh the econometric models from PC10 using the latest available data from water service providers in England & Wales (up to 2010-11).
- We will consider alternative econometric models based on total asset maintenance expenditure and/or service expenditure.
- We will consider whether an average or a frontier company's expenditure level is appropriate for PC15.
- We will continue to adjust the output from the econometric models for regional price differentials, special factors and frontier shift
- We will account for local circumstances such as PPP plant alongside commitments to deliver specific outputs.

2.3.5 In PC10 we used a central estimate from the econometric models to determine asset maintenance investment. Taking account of the development of NI Water, we will consider whether, and what type of frontier position should be used to determine asset maintenance investment in PC15.

2.3.6 NI Water has made the case that increased enhancement investment in recent years will increase the need for future asset maintenance investment. However, the company has also made the case that companies in England and Wales have benefitted from 20 years of

investment since privatisation whereas NI Water has only made the same investment in recent years. Therefore, the impact of increased enhancement investment on asset maintenance need is already captured in expenditure incurred by water service providers in England and Wales and reflected in the econometric models we use. In our determination, we will consider the impact of the timing of enhancement investment on the econometric models used to assess future asset maintenance needs.

2.3.7 Econometric modelling provides an independent benchmark for the efficiency and effectiveness of asset maintenance investment. However, it continues to rely on historical expenditure information and remains backward looking. It assumes that asset maintenance investment will continue at broadly constant levels and does not allow for possible waves of asset replacement which are not reflected in historical investment levels. The more detailed, bottom-up approaches described below must be used to assess whether the medium and long term future investment need is different from the past.

2.3.8 We will continue to monitor developments by other regulators, in particular the approach taken by Ofwat in developing PR14. If this provides opportunities to apply other techniques or relevant data, and this can be done in a timely way, we will consider whether it is practical to expand the range of comparative analysis for our determination.

2.3.9 As for PC10 we shall continue to adopt a triangulated approach, recognising that no single econometric model can provide a point estimate of asset maintenance requirement. We will use a variety of econometric and bottom-up analyses to derive the 'right' quantum of asset maintenance to at least sustain delivery of service to consumers in PC15 and beyond.

2.4 Depreciation approach based on modern equivalent asset valuation

2.4.1 This technique assumes that the level of asset maintenance in the medium to long term must reflect the replacement costs of assets as they reach the end of their useful life. It is based on an assessment of the residual life of each asset and the cost of replacing the assets as necessary to maintain the service provided. A key advantage of this approach is the ability to identify and make provision for historical waves of investment.

2.4.2 The data used is the same data used to estimate the current cost depreciation of the assets. For a stable asset base, the estimate of asset maintenance investment and current cost depreciation should be broadly equivalent over the medium to long term.

2.4.3 The replacement cost of the assets should be assessed on a modern equivalent asset basis. The 'modern equivalent asset' is the asset which would be installed today to deliver the same service and takes account of new technologies, new materials and current design standards.

2.4.4 The residual life of the asset used in the analysis is often based on one of the following: the installation date of the asset and a nominal asset life; expert judgement following site surveys; or it is inferred from other observations such as condition and performance grades. A key weakness is that there may be little supporting evidence to justify the asset life used in the analysis. In particular, the assessment is of limited value for long life assets (such as sewers and water-mains) where there is still insufficient experience of assets reaching the end of life to allow a reliable assessment of asset life to be made.

2.4.5 A robust asset valuation and current cost depreciation estimate on a 'modern equivalent asset' (replacement) basis can provide verification of medium to long term asset

maintenance investment. The valuation brings together asset information (type, size and age of the assets) with cost data for construction or replacement of the assets. Both are core information sets which we would expect the company to maintain to allow it to manage its assets effectively. The quality of an asset valuation is only as good as the quality of the asset inventory and costing data available. Because we have concerns about the quality of this core data, we have already indicated that we do not require the company to undertake a comprehensive asset valuation for PC15. Instead, we will ask the company to:

- Report on the quality of the current asset valuation which the company has used to estimate current cost depreciation.
- Report on its current asset inventory and asset costing systems.
- Identify the work necessary to address material gaps in its asset inventory and asset costing systems which would allow the company to:
  - develop a more robust gross and net asset valuation;
  - refresh its estimate current cost depreciation; and,
  - Improve the medium to long term estimate of asset maintenance investment.

2.4.6 Following a review of the company's submission, we will consider the benefits of asking the company to prepare an asset valuation during the first three years of PC15 and to use the results to update its assessment of asset maintenance investment and current cost depreciation. Before we reach a decision on this we will consult relevant stakeholders on the merits of refreshing the asset valuation and current cost depreciation estimate.

2.4.7 If NI Water offers a modern equivalent asset valuation in its PC15 Business Plan to support asset maintenance investment, we will critically assess the underlying asset data, costing systems and residual life estimate and decide whether the information is of sufficient quality to inform our determination of asset maintenance. To give confidence in this type of analysis we would expect the company to show how it has used relevant and robust asset observations to assess the residual life of the assets.

2.5 Assessment of historical serviceability trends

2.5.1 'Serviceability' is a measure of the capability of an asset to provide a service. In practice it is assessed 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 stable, improving, deteriorating or marginal. The approach focuses attention on how the asset delivers service to consumers.

2.5.2 We will use serviceability trends as our primary means of determining asset maintenance outcomes. We will use historical trends in serviceability to assess whether historical levels of asset maintenance investment were adequate.

2.5.3 In our final determination for PC13, we indicated our intention to prepare an annual serviceability assessment to assess delivery. We will publish proposals for serviceability monitoring in February 2013. We will discuss the proposed serviceability measures with NI Water and other principal stakeholders before finalising our approach and the serviceability indicators we will adopt.

2.5.4 We will ask NI Water to make an initial serviceability submission in parallel with the 2013 Annual Information Return to establish as long a baseline for serviceability trends as

possible from historical records. We will publish our assessment of this initial serviceability submission and use the results to inform our draft determination for PC15. We will use updated information from AIR14 to inform our final determination.

2.5.5 We expect the company to include an assessment of historical serviceability trends in its Business Plan submission and consider the relationship between historical expenditure and serviceability in its assessment of investment need. We expect the company to justify future asset maintenance investment in terms of the impact on serviceability measures both individually and collectively.

2.6 Assessment of asset condition and performance

2.6.1 In the past, asset condition and performance grading has been used as a primary asset observation in the water industry to assess asset maintenance outcomes and inform future asset maintenance investment.

2.6.2 Standard definitions of condition and performance grades were established by Ofwat for the regulation of water service providers in England and Wales. Companies undertook extensive surveys to assess the condition and performance of assets against these criteria and the quantity and value of assets in each condition and performance grade were assessed.

2.6.3 Condition and performance grades are composite measures which combine asset characteristics relating to probability of failure, consequence of failure, operational efficiency and residual asset life. Combining these different characteristics requires a degree of expert judgement and generates grades with different meanings for different assets.

2.6.4 In the past, attempts have been made to link condition and performance grade to residual asset life. In practice, this can become complex and lack the confidence which comes from an analysis of direct asset observations. Experience has shown that it is difficult to replicate condition and performance grading over time to establish trends and link these to the timing of asset maintenance interventions. Material changes in grading between price reviews have often been attributed to changes in methodology, changes in the sample surveys and changes in staff employed in the surveys. Because the surveys can be difficult to replicate the results cannot be used with confidence.

2.6.5 In view of the weaknesses inherent in condition and performance grading we will not ask NI Water to undertake a defined condition and performance assessment for PC15. Instead, we will rely on serviceability as our primary measure of asset investment outcomes. We expect the company to base its asset maintenance assessment on relevant asset observations which it uses to assess asset maintenance requirements. Key asset observations can be incorporated in future serviceability assessments where they provide a useful insight into the trends in asset serviceability.

2.6.6 We will consider any assessment of condition and performance grade provided by the company as part of its asset maintenance plan. If it relies on condition and performance grade in its assessment, we would expect the company to demonstrate how these have been used to assess the residual life of the assets. We would expect the company to demonstrate that any condition and performance grade assessment is used and useful in its current asset maintenance assessments and can be applied consistently in future asset maintenance assessments.

2.7 Specific asset maintenance plans

2.7.1 The company may opt to prepare specific asset maintenance plans which address current issues and use expert judgement to assess future asset maintenance needs.

2.7.2 The advantage of this approach is that it identifies specific asset maintenance outputs. However, while current issues can be identified, it is more difficult to identify the timing of future interventions for assets which are currently serviceable. The use of expert judgement to fill this gap can only provide limited confidence on the estimates of residual life and the timing of future interventions.

2.7.3 We will assess any specific asset maintenance plans which the company submits in its Business Plan to support future asset maintenance investment. We recognise that it may be necessary for the company to continue to use expert judgement where existing data is insufficient to support a more rational analysis of asset maintenance needs. If this is the case, the company should demonstrate how asset observations have been used to inform expert judgement on residual asset lives. The company should demonstrate the steps it will take and the timescale required to move to a forward looking risk based approach to provide an economic assessment of asset maintenance investment.

2.7.4 The interventions identified through specific asset maintenance plans are often assumed to be in addition to the historical level of investment. In the absence of other evidence, we would expect the company to prioritise specific investment plans within the overall asset maintenance budget derived from historical trends or econometric analysis

2.7.5 We will assess the unit cost efficiency of costings including in specific asset maintenance plans.

2.7.6 Where we accept specific asset maintenance plans we will consider including specific outputs in the determination to monitor delivery and manage any subsequent changes.

2.8 Forward looking risk based assessment

2.8.1 A forward looking risk based assessment of asset maintenance investment is a rational, evidence based assessment taking account of:

- Asset failure rates and rates of deterioration.
- The on-going cost of repairs.
- The escalation of operating cost with age (for example reducing energy efficiency).
- The probability of service failure following asset failure.
- The consequential cost of service failure, including direct costs to the company and wider social costs such as environmental impact or traffic disruption.
- The costs of the potential interventions available to improve asset serviceability.
- Consumer willingness to pay to avoid service failure.

2.8.2 The assessment provides a rational basis for establishing the residual life of the assets which balances the costs of continuing to operate the existing assets with the costs and benefits of replacing the asset or maintaining the service by other means.

2.8.3 The overall concept of a forward looking risk based approach to asset maintenance was set out in UKWIR report 02/RG/05/3 – Capital Maintenance Planning a Common Framework. Subsequent reports have been written to review the application of the framework in England & Wales and assess its application to specific types of asset.

2.8.4 The Capital Maintenance Planning Common Framework (CMPCF) sets out sound principles on asset maintenance planning and a framework for developing and recording asset maintenance plans. However, it is not prescriptive and provides for a range of techniques which can be applied to different groups of assets and at different levels as asset information and observations develop. We would expect NI Water to follow the principles and framework set out in the CMPCF when developing its overall asset maintenance plan. However, it is for the company to decide how it can best use this technique taking account of its systems, data and capability. We expect the company to report its assessment using the structure of activities set out in the CMPCF.

2.8.5 The purpose of maintaining the assets is to maintain the service provided to consumers. The company should focus its assessment on the maintenance of service.

2.8.6 We are aware that implementation of the CMPCF for Business Plan submissions in England, Wales and Scotland has sometimes led to the use of theoretical 'black-box' models which cannot be supported by the available data. This type of approach can provide misleading answers dictated by poor quality data. We expect the company to use practical, targeted and transparent methodologies which can be tested and developed as information improves over time. For example:

- The methodology should be able to generate answers at a range of summary levels and generate sample calculations which provide a facility to drill down into the answer, confirm that it has been implemented correctly and allow the impact of material assumptions and data to be identified.
- Asset information should be analysed at a reasonable level of granularity allowing the analysis of discrete assets (or cohorts of assets of similar type), failure modes and service impact.
- The methodology should define individual assets at an appropriate level of granularity to ensure that different failure modes and a range of potential interventions can be considered. For example, a pump comprises a motor, an impeller, a casing, a bearing and seal, instrumentation and valving. An effective analysis will consider failure modes and interventions for these components as opposed to grouping them as a single asset with a single 'replace pump' intervention.
- There is a risk that the analysis of limited data or the use of external data will generate spurious asset failure rates, service failure rates and deterioration rates. The information used to analyse asset and service failure should be calibrated against current and emerging asset service failure rates to confirm that it is robust.
- Repair costs and repair times used in the analysis should be assessed carefully to ensure that there is sufficient data recorded accurately in the works management system to generate robust parameters. Data should be used in a way which is consistent with the underlying records and analysis used to generate it. For example time to repair assessed from works management systems should take account of the time taken to open and close work orders.
- Repair costs, operating costs and consequential costs should be a realistic assessment of the marginal cost saving which would be achieved if an

intervention is applied. Other costs and benefits should be included where they have a material bearing on the analysis and have the support of stakeholders.

- Where a stepped change in asset maintenance is proposed to reduce operational costs (for example bringing forward pump replacement to improve energy efficiency) the company should identify the operational savings as 'OPEX from CAPEX'.
- The analysis should take account of the criticality of the asset and its likely impact on service. This would include taking account of time to repair, the time from asset failure to service failure, the provision of stand-by plant and the availability of critical spares either in-house or through the supply chain. For non-critical assets a reactive maintenance policy based on run-to-failure may be the appropriate response. Management interventions to reduce asset criticality, including work order management, spares management and asset monitoring should be considered as part of the asset management plan.
- The analysis should include the opportunity to identify and replace the worst performing assets first to reflect the detailed assessment of interventions which will be carried out in practice. Conversely the assessment should consider how interventions assumed in the asset maintenance plan will be identified in practice. Where necessary the frequency and cost of interventions should allow for the investigation, trial excavations and testing required to identify interventions.
- A wide range of capex and opex solutions should be assessed to reflect the range of solutions which are considered in practice. If the analysis favours a particular outcome which does not reflect the balance of work normally carried out, this should be questioned and the reason the analysis suggests a change in practice should be established and tested.
- The analysis should take account of the residual economic value of the asset including potential reuse or resale. This may be significantly different from the residual book value. If the analysis demonstrates that the cost effective plan is to replace assets with a significant residual book value or allow assets to continue in service well beyond their nominal asset lives, the company should advise what adjustments it might need to make to its depreciation accounts to reflect its asset maintenance plan.
- The company should be able to demonstrate that the analysis it carries out for the Business Plan has direct links to asset management delivery. An approach which is used and useful has the advantage of being credible and provides a basis for feedback and learning which will ensure continuous improvement of asset management techniques and inform future asset maintenance plans.

2.8.7 A forward looking, risk based asset maintenance plan can be prepared as:

- a cost effective plan to maintain or achieve a pre-defined level of service; or,
- a cost benefit plan which takes account of consumer willingness to pay and establishes the economic justification for the planned level of service.

2.8.8 We would expect the company to develop a cost effective plan which will maintain current levels of service in the short to medium term. The company should draw on the outcome of consumer engagement to support the level of service it intends to deliver. The company should also consider how its asset maintenance planning techniques should be developed to incorporate a full cost benefit analysis. As part of a cost-effective plan, the

company should assess the marginal cost of service improvement to inform stakeholders and consumers on the cost of improving service from the current levels of serviceability.

2.9 Asset maintenance planning capability assessment

2.9.1 An assessment of the company's asset maintenance planning capability allows the company to demonstrate that it has the capability to make a robust assessment of future asset maintenance needs. It provides a framework for identifying further improvements which can be made in asset maintenance, data and processes to support long term planning.

2.9.2 We expect the company to provide a structured assessment of its asset maintenance planning capability as part of its PC15 Business Plan submission. The company should show that it has adequate data, systems and processes in place to support its plan for asset maintenance in PC15 and demonstrate how it has addressed any gaps in data systems and processes in its plan.

2.9.3 There are a range of standard processes available to assess asset planning capability. For example:

- The Asset Management Planning Assessment Process (AMPAP). AMPAP is a self assessment methodology and tool for evaluating asset maintenance competencies developed for the UK water industry by UKWIR (ref 07/RG/05/19).
- The Asset Management Assessment (AMA). AMA is a modified version of AMPAP used by Ofwat to assess water company business plans in 2009.
- PAS55. PAS55 is an international standard for good asset management for which accreditation can be obtained by undergoing an audit from external auditors.

2.9.4 These systems are broadly similar in that they ask set questions covering aspects of effective asset management such as stakeholder engagement, management, data, processes and systems. As well as establishing current capability, they allow a company to undertake a gap analysis and assess and prioritise improvement.

2.9.5 There may be some benefits in comparing asset management capability across the utilities regulated by the Utility Regulator, or in comparing NI Water with other water service providers. However, at this time, we have concluded that we should not dictate the methodology the company should adopt although we see advantages in adopting a water industry approach. We expect the company to adopt a recognised methodology which it considers be relevant and useful. We expect the company to advise us of its preferred methodology for our approval. The company should describe how its preferred methodology will inform both the development of asset maintenance planning and its PC15 Business Plan.

2.9.6 The company should use its capability assessment to identify gaps in its asset management planning capability. In its Business Plan submission, the company should set out its plan for closing the gaps identified including the benefits, timescale and cost of doing so.

3. Financing Asset Maintenance

Introduction

3.1.1 We set out our current approach to financing asset maintenance in our final determination for PC10. We continued this approach for PC13. It follows established regulatory practice, relying on a combination of infrastructure renewals accounting and current cost depreciation, moderated by a broad equivalence test, to determine a reasonable level of revenue.

3.1.2 The application of our approach was influenced by a lack of confidence in the quality of NI Water's asset valuation and asset planning systems at that time. We placed greater reliance on econometric estimates of expenditure than the company's asset valuation and its estimates of current cost depreciation and infrastructure renewals charge. As a result, our approach approximates to a cash based approach, and this aligns well with the public expenditure regime which NI Water is subject to.

3.1.3 In this section we set out how we finance asset maintenance investment in principle and in practice, describing the different approaches we take for 'infrastructure' and non-infrastructure' assets. We then consider the issue of financial sustainability. Our broad conclusion is that it is necessary to address the uncertainty in the quality of NI Water's asset planning systems and asset valuation before we consider adjusting our approach to financing asset maintenance. In the mean time, we will continue to engage with the principal stakeholders on our approach to funding and consider representations on the balance of revenue and debt funding of capital works.

Financing non-infrastructure assets

3.1.4 Non-infrastructure assets include treatment works, pumping stations, buildings vehicles and IT systems. They are a mix of short, medium and long life assets and there should be sufficient experience of asset life cycle to allow a reasonable estimate of asset life to be made.

3.1.5 Non-infrastructure assets are depreciated in line with accounting conventions, under historic or current cost accounting as appropriate, and the appropriate depreciation charge made to the profit and loss account to represent the economic consumption by the business during the year.

3.1.6 In principle we fund non-infrastructure asset maintenance in line with current cost depreciation, subject to a broad equivalence test. This is intended to ensure that current consumers pay for the assets as they consume them.

3.1.7 In practice, we adopted a simpler approach to funding non-infrastructure asset maintenance investment for NI Water in PC10 and PC13. We assumed that the CCD funded through revenue should equal the level of planned non-infrastructure investment over the price control period. Our approach placed greater reliance on historical experience of serviceability and econometric estimates of expenditure than the company's asset valuation and current cost depreciation estimates.

Financing infrastructure assets

3.1.8 Infrastructure assets generally comprise: underground systems of mains and sewers; impounding and pumped raw water storage reservoirs; dams; sludge pipelines; sea outfalls. These assets are expected to last in excess of 60 years and experience suggests that many will continue to provide service after 100 years provided they are maintained through their life.

3.1.9 The underground network will never be replaced in its entirety. Instead, sections are renewed when their condition and performance deteriorates to the point where it is cost-effective to replace them or it is necessary to replace them in order to maintain customer service levels. It is, therefore, not realistic or meaningful to assess an „average life" for the infrastructure assets. This makes it difficult to use conventional accounting methods to calculate depreciation for infrastructure assets, as these methods rely on the concept of establishing an average asset life for each component of the asset base. Instead, we treat the whole infrastructure network as a single system. The complete asset will never become obsolete or require replacement at any one time. It is replaced in parts as different elements come to the end of their useful lives.

3.1.10 As a result, infrastructure assets are not depreciated. Instead, an infrastructure renewals charge (IRC) is made to the profit and loss account to represent the maintenance of asset value by the business during the year. The IRC should reflect the company's assessment of its long-term capital maintenance needs to maintain infrastructure asset serviceability and operating capacity. The IRC is taken to the balance sheet as a provision (for liabilities and charges) and actual expenditure (IRE) on infrastructure assets is set off against this provision as it occurs. Any difference from year to year between IRC and IRE is accumulated in the balance sheet as a cumulative accrual or prepayment as appropriate.

3.1.11 In practice, we have also adopted a simpler, cash-based, approach to funding infrastructure asset maintenance investment for NI Water. In the absence of a robust estimate of IRC by the company, we made an assumption that the IRC funded through revenue should equal the level of planned infrastructure investment over the price control period. Again, this approximates to a cash-based approach.

3.1.12 A key risk associated with infrastructure assets such as pipes and sewers is that significant historical waves of investment (often using the same materials and methods of construction) will need to be replaced at the same time. It is possible that this future asset maintenance expenditure is not reflected in historical levels of investment and has not been foreseen in the estimates of future asset maintenance. As part of its PC15 Business Plan, we expect the company to assess the medium to long term needs of its infrastructure assets to identify potential waves of future investment demand.

Sustainable financing of asset maintenance

3.1.13 In its response to our draft determination for PC13, NI Water noted our approach to funding the company on a 'cash-basis' (where revenue equals projected expenditure). The company accepted that there are valid reasons for adopting this approach, noting the lack of a robust Modern Equivalent Asset Valuation (MEAV). However, the company expressed its concerns that the continued funding of capital maintenance in this way may act to increase the reliance on debt funding and therefore gearing. The company stated its view that in the current governance model the issues this approach raises are of a secondary nature.

3.1.14 We agree that this is an important issue which we will keep under review. Getting the right balance between revenue and debt funding of asset investment is a key part of

ensuring equity between today's and tomorrow's consumers. We believe that our approach to asset maintenance set out above provides a framework for addressing key issues which must be resolved before we consider moving to an alternative method of funding asset maintenance, in particular:

- The development of a forward looking risk based approach to better inform the 'right' level of asset maintenance expenditure in the short to medium term.
- The review and reassessment of the MEAV and the current cost depreciation to produce more robust estimates, including the use of asset lives informed by asset maintenance assessments.
- An assessment of the medium to long term investment required in water mains and sewers (and other infrastructure assets) to identify whether we should begin to plan for a significant increase in investment as groups of similar assets come to the end of their useful life.

3.1.15 Until this work is complete, we are minded to continue with the 'cash-based' approach to asset maintenance investment. In the mean time, we will continue to engage with the principal stakeholders on our approach to funding and consider representations on the balance of revenue and debt funding of capital works.

Annex A – Asset maintenance techniques

In this Annex we provide a one page summary of the asset maintenance techniques we have considered when developing our approach for PC15 as follows:

Top down expenditure analysis

1. The projection of historical expenditure by the company.
2. An econometric analysis of historical expenditure by other companies.
3. A depreciation approach based on a modern equivalent asset valuation.

Asset maintenance outcomes

4. An assessment of historical trends in asset 'serviceability'.
5. An assessment of historical trends in condition and performance of the assets.

Asset maintenance plans

6. A specific asset maintenance plan setting out specific outputs and expenditure.
7. A forward looking risk based approach which takes account of how asset serviceability deteriorates over time and analyses the cost of running or replacing the asset to arrive at a cost effective or cost beneficial asset management plan.

Asset planning capability

8. A structured assessment which demonstrates that the company has the capability to make a robust assessment of future asset maintenance needs and identifies further improvements which can be made in asset maintenance, data and processes to support long term planning.

The summary of each technique includes:

- A brief description of the technique.
- A summary of key strengths and weaknesses.
- A summary of our approach in respect of each technique.

Technique 1 – Projection of historical expenditure	
Description	• Historical asset maintenance costs are collated in total, by service and by groups of assets to establish medium to long term trends. • Costs are trended and compared with serviceability trends (see Technique 4) to demonstrate that the level of expenditure has or has not been sufficient to maintain serviceability.
Key strengths	• Historical cost projection provides firm information on past expenditure which provides a baseline for future expenditure. • Comparing expenditure with serviceability trends demonstrates whether or not the historical level of expenditure has maintained serviceability. • In the absence of other information to demonstrate that the future will be different from the past, it provides an indication of the level of expenditure the company has considered adequate in the medium term.
Key weaknesses	• It provides no information on the future expenditure unless we assume that the future is similar to the past. • It requires historical information to be collected in a standard format. This is available for NI Water but the allocation of costs prior to 2008-09 is incomplete. • It may be self fulfilling by reflecting prior determinations rather than medium term need. • It assumes that historical expenditure has been efficient and effective. It is possible that an efficiency company would have delivered the same benefit at lower cost.
Our approach	• We expect the company to consider historical expenditure in its assessment. The company should be able to demonstrate why the future is different from the past. • We will ask the company to submit historical cost information, much of which will be drawn from Table 32 of the AIR which includes a breakdown of expenditure by sub-service area and selected asset type. • We will use historical expenditure trends as a weak technique to provide a baseline for historical expenditure. • We will continue to collect structured asset maintenance expenditure data through PC15 to build medium term trends.

Technique 2 – Econometric analysis of historical expenditure by other companies	
Description	• Historical expenditure by similar companies is analysed against appropriate explanatory factors to develop comparative expenditure models. Econometric models may be developed for total expenditure, by service and by groups of assets groups. • The econometric model(s) are applied to estimate an appropriate level of asset maintenance. • Adjustments can be made for special factors relevant to the company including commitments to deliver specific outputs. • If necessary, the econometric estimate is adjusted to reflect the capex efficiency position of the company.
Key strengths	• Econometric modelling provides an independent assessment or validation of the company's proposed expenditure against other similar companies. • Where we draw on comparative data from England & Wales, the comparative expenditure data takes account of a more advanced investment cycle, embedding the potential increase in asset maintenance from a recent increase in non-infrastructure investment and the use of shorter life assets.
Key weaknesses	• Econometric analysis is based on historical data and remains a backward looking analysis. • The only substantive source of data is from water and sewerage service providers in England and Wales regulated by Ofwat. Ofwat last collected the expenditure in 2010-11. • Ofwat is unlikely to undertake an econometric analysis in PR14. It may be necessary to rely on historical econometric models which have not been refreshed. • The companies used for comparative data may have spent to budget making the refreshed econometric models self-fulfilling. Historical expenditure might not reveal an efficient cost.
Our approach	• We will ask NI Water to submit the data necessary to refresh the econometric analysis previously carried out. • We will consider alternative econometric models such as total asset maintenance or service level models. • We will consider whether an average or a frontier company's expenditure level is appropriate for PC15. • We will continue to adjust the output from the econometric models for regional price differentials, special factors and frontier shift • We will account for local circumstances such as PPP plant alongside commitments to deliver specific outputs. •

Technique 3 – Depreciation approach based on modern equivalent asset valuation	
Description	• An asset inventory is prepared to establish the quantity, size, age, life-span and residual life of the company's assets. • The value of the assets is estimated on a 'modern equivalent asset' basis to reflect the cost of the assets with the 'modern equivalent' asset which would be used to continue to provide the service. • The time of replacement and cost of replacement is estimated and the profile of replacement costs provides a short, medium and long term estimate of asset maintenance expenditure.
Key strengths	• A depreciation approach based on modern equivalent asset valuation can provide a robust medium to long term assessment of asset maintenance investment without recourse to detailed assessment of asset observations. • The source data is the same data used to calculate the current cost depreciation and this aligns medium asset maintenance investment with the current cost depreciation and company revenue. This can contribute to stable funding and customer charges in the medium term. • It allows for changes in the level of historical investment to be identified and reflected in medium term funding for asset maintenance investment.
Key weaknesses	• It requires an assessment to be made on residual life. These are often based on industry 'norms' for which there is little or no supporting evidence. • It is unreliable for long life assets (such as sewers and water-mains) for which there is little reliable data on asset life. • The analysis assumes that an asset is replaced in its entirety at the end of its assumed life. It does not take account of part replacement or other interventions might extend the life of the asset. • It requires good quality asset inventory and cost data at sufficient granularity to prepare a robust replacement plan. In practice the granularity of the data can be poor, relying heavily on a limited number of low quality cost functions.
Our approach	• We have already signalled that we do not expect the company to undertake a comprehensive asset valuation for PC15. • We will ask the company to report on its current asset inventory and asset costing systems which are fundamental to the company's work irrespective of whether an asset valuation is prepared. • We ask the company to assess gaps in its asset inventory and cost data and ask the company to set out proposals to close any gaps in the data necessary to allow it to complete a modern equivalent asset valuation in PC15. • If the company offers a MEAV assessment to support future asset maintenance investment, we will assess the reliability of the underlying asset data, costing systems and residual life assessment and decide whether the information is of sufficient quality to be incorporated in our assessment.

Technique 4 – Assessment of historical serviceability trends	
Description	• 'Serviceability' is a measure of the capability of an asset to provide a service. In practice it is measured by trending a series of defined asset performance indicators (such as the frequency of pipe burst) and service indicators (such as the frequency of interruption to supply). • Asset performance and service indicators are defined and historical data collected to establish serviceability trends. Serviceability trends are assessed as either stable, improving, deteriorating or marginal. • The trend in serviceability is compared to historical levels of expenditure to assess whether this has been sufficient.
Key strengths	• It focuses attention on investment to maintain serviceability to consumers rather than the maintenance the condition or performance of the asset base. • It uses data which are recognised by the principal stakeholders to assess the outcome of asset maintenance investment. • It provides a framework for monitoring the sufficiency of asset maintenance investment in PC15. • Company specific serviceability measures can be used, allowing the individual companies to select measures relevant to their asset maintenance processes.
Key weaknesses	• The assessment is backward looking. • Short term targeted interventions to maintain serviceability might mask the need for investment to maintain serviceability in the long term. • The methodology used to assess trends (particularly in the short term) requires a degree of judgement as well as analysis. • Higher than necessary levels of investment might have limited impact on serviceability measures in the short term but suggest that the high level of asset maintenance investment continues to be necessary. • A medium to long period of reliable records is required to establish robust trends. • In a limited period of records exceptional events and the most recent data point can have a significant impact on the perception of trends.
Our approach	• We will implement serviceability reporting in parallel with AIR13, asking the company to establish as long a baseline as possible from historical records. • We will compare historical investment and serviceability trends to show whether past investment has been adequate. • We will publish our assessment of serviceability trends and consider the implications in our draft determination. • We will use updated information from AIR14 in our final determination for PC15.

Technique 5 – Assessment of asset condition and performance	
Description	• Defined condition and performance criteria are established for different types of assets. • A detailed (or statistical representative sample) of assets are surveyed to establish condition and performance grades. • The survey is repeated at intervals to determine trends in condition and performance grades for the assets over time. • The trend in condition and performance grade is compared to historical levels of investment to assess whether investment has been sufficient.
Key strengths	• Changes in condition and performance grades can provide an indication of overall asset deterioration which might result in a future deterioration in serviceability.
Key weaknesses	• Condition and performance grading requires wide ranging and expensive surveys of the assets. • It suggests a commitment to investment is necessary to maintain condition and performance of assets which remain serviceable. • Condition and performance criteria are often defined by regulators and may not necessarily be useful to a company when developing its asset maintenance plan. • The assessment for key assets requires judgement which is not necessarily repeatable. Evidence from water service providers in England & Wales shows that changes in condition and performance grading over time is often attributed changes in staff and methodology rather than a change in the asset base. • There is little relationship between condition or performance grade and residual life, although this is sometimes inferred in asset maintenance analysis. • The condition and performance grades are aggregate measures which mask or lose the discrete asset observations required for effective asset maintenance.
Our approach	• We will not require the company to carry out a defined condition or performance grading assessment. Instead we will rely on serviceability as our primary asset measure and expect the company to use targeted asset observations to develop an asset maintenance plan. • We will consider any assessment of condition and performance grade data and analysis offered by the company as part of its asset maintenance plan. However, we would expect the company to demonstrate how condition and performance grade has been used to assess asset deterioration and residual life.

Technique 6 – Specific asset maintenance plans	
Description	• The company makes a specific assessment of asset maintenance need taking account of current issues and using expert judgement to determine future asset maintenance needs.
Key strengths	• The plan identifies specific asset maintenance outputs.
Key weaknesses	• While current issues can be identified, the approach does not offer a robust assessment of future asset maintenance needs. • The use of expert judgement to identify residual asset lives and time of replacement often lacks robust evidence. • The technique tends to be used to justify additional expenditure on specific items over and above historical levels of asset maintenance investment. It might not assess whether the specific activities identified can be addressed by prioritisation within existing levels of investment.
Our approach	• We will review specific asset maintenance plans prepare by the company. • We would expect the company to provide information to support expert judgement on replacement times and demonstrate that the specific activities identified cannot be accommodated by prioritising within existing expenditure levels. • Where supporting evidence is not available we will take a prudent but conservative approach to any proposed increase in funding.

Technique 7 – A forward looking risk based assessment	
Description	• A detailed assessment of current and future asset performance is made, leading to an economic decision on asset replacement which takes account of: ➢ asset failure rates and the rate of deterioration; ➢ on-going cost of repairs; ➢ operating cost escalation with age (e.g. reducing energy efficiency); ➢ probability of service failure following asset failure; ➢ consequential cost of service failure; ➢ consumer willingness to pay to avoid service failure; ➢ the cost of a wide range of capital or operational interventions to maintain asset performance. • The assessment can be based on a cost effective plan to maintain a defined level of service or a cost benefit plan to provide economic justification for the planned level of service. If a cost effective plan is adopted the analysis can be used to demonstrate the marginal cost of the current level of service.
Key strengths	• A forward looking risk based approach provides a rational economic basis for decisions on the timing of asset investment based on service. • The analysis uses asset observations (including serviceability measures) to establish residual asset life. • The supporting analysis promotes learning and development which leads to more effective asset planning and investment.
Key weaknesses	• Sound medium term data on asset performance deterioration and potential interventions may not be available. • May result in complex systems of analysis which mask material assumptions, are not well understood by the user and do not reflect the day to day investment decisions made by the company. • Interventions must be defined in sufficient granularity to develop a well targeted effective plan. • The available data may be weaker than the theoretical analysis requires resulting in a misleading or unreliable outcome.
Our approach	• We expect the company to develop targeted forward looking risk based analysis to support proposals for asset maintenance investment. • We have highlighted the risk of theoretical 'black-box' models which require data which is not yet available and can generate misleading answers. We expect the company to address these weaknesses and develop targeted, transparent, economic assessments of future asset maintenance investment. • We will assess and challenge the company's analysis to ensure that there is a comprehensive robust case before committing to any increase in asset maintenance investment. • We expect the company to develop a plan to acquire the data it requires to develop future asset maintenance plans.

Technique 8 – Asset maintenance planning capability assessment	
Description	• The company prepares a structured, critical assessment of its capability to develop asset maintenance plans. • The assessment must cover a wide range of topics including: stakeholder engagement; leadership policy and strategy; management; people; processes; systems; data; analysis and reporting. • The assessment of capability is used to moderate the company's assessment of asset maintenance investment. Where the company demonstrates its capability is strong, the outcome of its asset maintenance plan has credibility. • The assessment can identify areas of weaknesses in asset maintenance planning and the company should set out a plan to address these weaknesses.
Key strengths	• Allows a company and regulators to understand and challenge the company asset maintenance planning capability and take account of this when determining a prudent level of capital maintenance. • Allows a company to assess its asset maintenance planning capability and plan to improve areas of weakness. • Allows subsequent improvements in asset maintenance planning capability to be tracked. • Can provide a basis for comparative assessment of capability and the opportunity to explore and learn from other organisations using similar techniques.
Key weaknesses	• Risks creating a focus on process and presentation rather than outcome – the assessment becomes an end in itself rather than a vehicle for critically challenging current capability and supporting the effective development of capability. • The assessment is prepared for regulators only and is separate from the development of asset maintenance capability within the company.
Our approach	• We will ask NI Water to prepare and submit an asset maintenance capability assessment to support its asset maintenance investment plans for PC15. • We will not dictate which methodology the company adopts to assess its asset maintenance capability provided the methodology adopted by the company is a recognised methodology of which we approve. • We will critically challenge the company's view of asset maintenance capability to moderate proposed investment in asset maintenance for the Price Control and determine future investment to develop asset maintenance capability.