

# Annex J - Regional Price Adjustments PC21

Northern Ireland Utility Regulator

6 July 2020



**FINAL REPORT**

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## EXECUTIVE SUMMARY

The Utility Regulator (UR) intends to consider regional price adjustments (RPAs) to its capital unit cost assessment as part of its forthcoming price control for NI Water (PC21). CEPA developed a model to estimate RPAs for the UR's PC15 price control. The model estimates regional price differences in capital expenditure between a typical water and sewerage company in Northern Ireland and the rest of the UK. We have been commissioned to update this model to reflect more recent data whilst also reviewing and refining the methodological approach where appropriate.

We estimate that on average, capital unit costs for the typical water and sewerage company in Northern Ireland are approximately 6% to 13% lower than those incurred by a typical water and sewerage company in other regions of the UK. Our baseline estimate places the overall RPA at 9%, although we caution against placing too much weight on a single point estimate. Our range is consistent with the regulator's previous determination at PC15, which estimated costs in Northern Ireland to be around 94% of those in the UK, resulting in a downward adjustment of 6% although our point estimate suggests that there has been some widening of the gap.

Our findings are supportive of analysis conducted by the Northern Ireland Department for the Economy, which found that cost competitiveness does exist for Northern Ireland relative to the remainder of the UK and the Republic of Ireland.<sup>2</sup> In particular, the study found that labour and property costs continue to be lower than in the majority of UK regions and the Republic of Ireland, meaning that Northern Ireland presents itself as an attractive region for potential business investment. The cost competitiveness of the Northern Ireland economy is also reflected in the fact that 15% (£10.6 billion) of total Northern Ireland sales in 2018 were to the remainder of the UK.<sup>3</sup>

### Approach

We estimate individual RPAs for the key resource categories of labour, plant & equipment, and materials. These are then aggregated to a single adjustment to be applied across all capex. This avoids the potential for spurious accuracy in seeking to identify different allowances for individual cost components. Consistent with regulatory precedent from the UR, we assume that capital costs are comprised of 40% labour, 20% plant and equipment, and 40% materials.<sup>4</sup>

Our approach is to first estimate RPAs at resource level. We make use of objective, independently published regional indices where they exist. To the extent possible, we use specific weightings and sub-resource RPAs to distinguish between different categories and sub-categories of cost, but this is constrained by data availability. At a minimum the indices we use distinguish between Northern Ireland and the rest of the UK.

Table E.1 summarises the key data sources used to arrive at our resource level RPAs, and the weightings used when aggregating them.

*Table E.1: Data sources for resource RPAs*

Resource	Weighting	Baseline RPA (% of UK price)	Source(s)
Labour	40%	88%	ASHE survey, 2019 <sup>5</sup>

<sup>2</sup> Source: Department for the Economy (April 2019). Research Bulletin 19/1. [The Cost of Doing Business in NI](#).

<sup>3</sup> Source: Northern Ireland Statistics and Research Agency (April 2020). [Overview of Northern Ireland Trade](#).

<sup>4</sup> We note that the weights used in the RPA are slightly different to the weights used by the UR within its frontier shift analysis as a result of data availability (i.e. the UR's frontier shift analysis is conducted at a more disaggregate level).

<sup>5</sup> The Annual Survey of Household Earnings (ASHE), published annually by the ONS and collected in NI by the Northern Ireland Statistics and Research Agency (NISRA).

Resource	Weighting	Baseline RPA (% of UK price)	Source(s)
Plant & Equipment	20%	100%	Qualitative analysis
Materials	40%	89%	ICMS Survey, 2019; <sup>6</sup> WRAP report, 2018; <sup>7</sup> Qualitative analysis

### Labour

Our labour RPA estimates are based on ASHE data for Northern Ireland workers compared against the rest of the UK. We estimate regional wage differentials using hourly median wages of all employees excluding overtime.

Following the approach taken at PC15, our baseline estimate uses a mix of skilled and general labour appropriate for a water and sewerage company (20% and 80% respectively), focusing on relevant occupational subcategories. Our upper and lower estimates for labour are based on the price differential using whole-economy wages and construction sector specific wages respectively. Our analysis indicates that, on average, labour costs in Northern Ireland are approximately 12% lower than the rest of the UK.

### Plant & Equipment

We find no strong evidence for an adjustment to plant and equipment costs. Transport costs may mean some equipment is difficult to trade on a national or international scale and could therefore lead to a wide variation in regional costs. Similarly, plant hire will depend heavily on regional factors, as well as others such as seasonality or length of hire. However, there is no clear evidence that these lead to costs in Northern Ireland being systematically higher or lower than the UK in general, which will also face such variations.

In our baseline we therefore assume zero adjustment. We use a  $\pm 5\%$  range of 95% to 105% in our sensitivity analysis.

### Materials

We split this resource into six key subcategories, including concrete, rebar, and disposal costs. We estimate the price differential in Northern Ireland quantitatively for each, where data is available. For two subcategories – pipes and meters – we note that the materials are traded nationally and globally and so, in the absence of detailed data, make the assumption that costs will be equalised across the country.

Our baseline estimate indicates that Northern Ireland materials costs are 89% of the UK average implying an adjustment of 11%. This is driven largely by our assumptions on concrete, rebar and other materials:

- **Concrete** (6% of capex): we estimate that Northern Ireland concrete costs are 65% of UK implying an adjustment of 35%. This adjustment is slightly higher than the adjustment applied at PC15<sup>8</sup> but does not have a significant effect on the overall RPA as concrete only makes up a relatively small proportion of total capex.
- **Rebar** (2% of capex): we estimate that Northern Ireland rebar costs are 78% of UK implying an adjustment of 22%. This adjustment is slightly higher than the adjustment applied at PC15 but does not have a significant effect on the overall RPA as rebar only makes up a relatively small proportion of total capex.<sup>9</sup>

<sup>6</sup> Turner & Townsend: *International Construction Market Survey 2019*.

<sup>7</sup> Waste and Resources Action Programme (WRAP) (2018): *Gate Fees 2017/18 Final Report*.

<sup>8</sup> An adjustment of 30% was applied at PC15.

<sup>9</sup> An adjustment of 10% was applied at PC15.

- **Other building materials** (12% of capex): includes materials such as bricks, aggregates and metals. We estimate that Northern Ireland other building materials costs are 90% of UK implying an adjustment of 10%. This is in line with the differential identified at PC15.<sup>10</sup>

We test our results by carrying out sensitivity testing. Sensitivities are developed using alternative data sources where available. Where only a single data source was available, we conducted sensitivities using a range of  $\pm 10\%$  of the baseline estimates. The sensitivity analysis shows that the RPA model is well-behaved and robust regarding the cost breakdown and variations in the estimated price differentials. A small change of the input value does not cause a sudden change in the model output.

## Aggregated RPA estimates

Based on the approach described above, Table E.2 summarises the ranges for the individual resource RPAs and aggregates them to an overall price differential which can be applied across all capex.

Table E.2: Aggregated RPA based on baseline weights and price differences

Resource	Share of total capex	Baseline estimates (% of UK price)	Minimum estimate (% of UK price)	Maximum estimate (% of UK price)
<b>Labour</b>	<b>40%</b>	<b>88%</b>	<b>87%</b>	<b>89%</b>
<b>Plant &amp; equipment</b>	<b>20%</b>	<b>100%</b>	<b>95%</b>	<b>105%</b>
<b>Materials</b>	<b>40%</b>	<b>89%</b>	<b>83%</b>	<b>94%</b>
Concrete	6%	65%	58%	71%
Rebar	2%	78%	70%	86%
Pipes	14%	100%	100%	100%
Meters	<1%	100%	100%	100%
Other	12%	90%	84%	100%
Disposal	5%	93%	65%	93%
<b>Aggregated RPA</b>		<b>91%</b>	<b>87%</b>	<b>94%</b>

Source: CEPA analysis

Hence, the RPA range (% of UK price) is between 87% and 94%, with a baseline RPA estimate of 91%. This implies the overall price differential between a water company operating in Northern Ireland and other UK water companies to be between 6% and 13%, with a baseline price differential of 9%.

<sup>10</sup> An adjustment of 9% was applied at PC15.

## **1. INTRODUCTION**

The Utility Regulator (UR) intends to consider applying regional price adjustments (RPAs) to the capital unit cost assessment in its forthcoming price control determination for NI Water (PC21).

An RPA is applied to control and adjust for regional differences in the costs faced by regulated companies. Costs may vary by region as a result of:

- regional wage differences;
- local differences in materials prices; or
- differences in transportation costs.

CEPA developed a model for regional price adjustments for the UR's PC15 price determination. The model estimated regional price differences in capital expenditure (capex) between a typical water and sewerage company in Northern Ireland and the rest of the UK. CEPA has been commissioned to update this model of regional price differentials for the upcoming price control determination under the assumption that the outputs of the model will be applied within the PC21 capex assessment methodology.

This report presents our methodology, analysis and recommendations. It is structured in line with the list of deliverables:

- Section 2 explains the chosen methodology.
- Sections 3, 4 and 5 discuss the price differences in the labour, plant & equipment, and materials capex categories, respectively.
- Section 6 derives our aggregate RPA estimates based on the resource price differentials identified in the previous sections.
- Appendix A provides further sensitivity analysis, while Appendix B sets out in more detail the weighting of NI Water's capex activities.

## 2. APPROACH

Our model analyses the differences in costs between Northern Ireland and the rest of the UK. We consider costs relevant to water companies in three broad resource categories – labour, plant & equipment, and materials. Based on estimates for RPAs for each of these categories, we aggregate the price differences into a single RPA that may be applied across all capex.

In order to estimate the resource RPAs, we make use of objective, independently published regional indices. In addition to our quantitative assessment of regional cost data, we consider qualitative arguments, particularly where robust data sources are not available. At a minimum we require that any indices used distinguish between Northern Ireland and the rest of the UK. The data and methods used to arrive at our resource RPAs labour, plant & equipment, and materials are discussed in detail in Sections 3, 4 and 5 respectively.

The single, aggregated RPA that we develop is directly applicable to the total capex determination. This includes cost categories that may not be affected by regional price differences. Therefore, when applying the RPA there is no need to determine the fraction of total capex that is unaffected by regional prices, as this analysis is already part of the comprehensive cost breakdown. The RPA is set for the whole price control period in line with the UR's previous approach. Historic trends are considered in the labour RPA analysis given that a long historical time series is available but we do not attempt to forecast changes in price differences going forward.

### 2.1. JUSTIFICATION

We use this approach for a number of reasons, with key advantages being that it is transparent, easy to understand and avoids issues of spurious precision. This is particularly important because there is only limited data available on regional prices for relevant inputs.

Many well-established datasets on prices are gathered at a national level and are not available for individual regions such as Northern Ireland. For example, the Royal Institution of Chartered Surveyors (RICS) Building Cost Information Service (BCIS) collects data on construction materials at national level only.<sup>11</sup> Similarly, the European Commission's Eurostat database collects sector data mainly at member state level and rarely at sub-member state granularity.<sup>12</sup>

Some organisations publish specialist datasets and price books detailing prices at a regional level. However, the datasets that attempt to derive regional prices from observed data suffer from data limitations. The smaller the region – primarily in population terms – the fewer observations will be available in any given time frame. This means that particular types of building projects could be dominant in an observation period, while others are missing completely. This type of issue can severely skew the sample and make the derived estimates less reliable and difficult to interpret. The problem is particularly severe when looking at a specific sector, such as water and sewerage, which has a different cost structure from other construction activities.

In summary, the key benefits and features of our approach include:

- **It is easy to understand, transparent and simple to apply.** This ensures the RPA model is robust and flexible enough to match the structure of the UR's efficiency assessment.
- **Consistent methodology.** The approach is consistent with the methodology applied in NI Water's previous price determinations. In addition, the simplicity of the method also reduces the likelihood of spurious challenges to irrelevant details during consultation.

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<sup>11</sup> Source: <https://www.rics.org/uk/products/data-products/>

<sup>12</sup> Source: <https://ec.europa.eu/eurostat>



- **Effective use of reliable data.** The resource level chosen ensures that the available data is used effectively and avoids a level of detail for which reliable data cannot be obtained. Even if data could be obtained to a greater level of detail, e.g. prices for individual items of plant and equipment, this would not necessarily improve the RPA estimates as data quality can be reduced. In addition, a regulated company should retain flexibility for its operational choices. A carefully constructed high-level RPA estimate is applicable across a broad range of management decisions, and application of the RPA to total capex is less likely to interfere with operational decisions of the regulated company.
- **Robustness-granularity trade off.** There is a trade-off between the robustness of estimates and their granularity. It is generally considered that higher-level cost estimates are more robust than very granular data on specific items as the latter may be driven by very few firms or projects. On the other hand, very broad estimates might not adequately reflect the specific cost structure faced by a water company. By considering the three broad resources, and refining the weights used for different capex categories where appropriate, we consider that we are able to reach a balance between the two characteristics.

## 2.2. COST STRUCTURE

Once individual RPAs are estimated for each of the resources, it is necessary to combine them in order to reach an aggregate RPA. In our RPA model we assume the same proportions of labour, plant and equipment, and materials that were used at PC15. Discussions with the UR and NI Water within Cost Assessment Working Group (CAWG) meetings have not identified any reasons why the input mix would significantly change between PC15 and PC21. These proportions lie between those used recently by the World Bank and Ofgem.<sup>13 14</sup>

- 40% labour;
- 20% plant and equipment; and
- 40% materials.

The proportions constitute an approximation consistent with our experience in various industry sectors and with the UR's previous work including its PC10, PC13, and PC15 determinations. We consider the impact of varying these weightings as part of our sensitivity analysis.

In section 2.1 we explored why our approach and chosen level of aggregation offers the most effective use of available data. While price estimates for materials face less of a small sample size issue, the fact that different capex projects may use very varied materials can pose a challenge for estimating robust RPAs. Often, the same materials are used across many construction activities, which permits pooling of the available observations. However, we have to identify a standard cost structure for a typical capex project. The breakdown by activity and resources is necessarily industry specific and to some extent affected by genuine operational choices of the regulated company. While engineering experience can provide some estimates, there are very few formal sources that can be utilised in developing a specific capital project breakdown the more granular that breakdown becomes.

For the purposes of RPA estimation, we therefore break down our materials RPA into further sub-estimates, to the extent that reliable information is available. We consider the following sub-resources:

- concrete;
- rebar;
- pipes;

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<sup>13</sup> World Bank (2011): International Comparison Program.

<sup>14</sup> Ofgem (2012): RIIO-T1/GD1: Initial Proposals – Real price effects and ongoing efficiency appendix.

- meters;
- other building materials; and
- disposal costs.

These are aggregated to create a materials RPA using weightings that differ depending on the type of activity the capex project relates to; this is shown in Table 2.1. The weights remain unchanged from PC15 as discussions within the CAWGs led to no clear reason why they should be amended for PC21.<sup>15</sup>

Table 2.1: Weightings for materials RPAs across capex activity areas

Materials sub-resource	Water		Sewerage	
	Infrastructure <sup>16</sup>	Non- infrastructure	Infrastructure	Non- infrastructure
Concrete	10%	20%	15%	20%
Rebar	3%	7%	3%	7%
Pipes	48%	25%	45%	25%
Meters	5%	0%	0%	0%
Other building materials	24%	35%	25%	35%
Disposal costs	11%	13%	12%	13%

### 2.3. CROSS CHECKS

Our approach seeks to deliver robust estimates that will enable the UR to make strong, defensible decisions about the appropriate regional price adjustment and its application. This position is strengthened by cross-checks and a thorough understanding of the aggregate RPA model's sensitivities and limitations. Given the specific cost structure of the water industry and the limitations of the available datasets, some of the assumptions and estimates in our analysis are necessarily imprecise. We engaged with the UR and NI Water at regular CAWG meetings to ensure any assumptions required were appropriate.

Given this imprecision, we emphasise the importance of considering the conclusions from cross-checks applied and the range of estimates from sensitivity analyses, not just the central point estimate(s).

We employ three approaches to increase confidence in the RPA estimates:

- **Sensitivity analysis of the model.** Our sensitivity analysis identifies which factors have a large impact on the aggregate RPA estimate and how the model reacts to changes in the underlying assumptions.
- **Cross-checks of assumptions against other options.** Views of the assumptions made in the model by other parties can provide a valuable cross-check. For example, data obtained on an individual project would not provide a statistically significant verification of assumptions but might still strengthen the UR's overall position. Similarly, NI Water may have a view, e.g. on the typical resource mix for its projects which could make for an insightful comparison.

<sup>15</sup> We consider the split of NI Water's capex activities into water and sewerage with further detail in Appendix A.

<sup>16</sup> Weightings sum to 101% due to rounding.

### 3. LABOUR

Estimating a regional difference in wages between Northern Ireland and the rest of the UK forms a central part of our RPA estimate. Labour is one of the single largest items in the capital expenditure of a water and sewerage company. It is also a resource that is procured almost entirely at a local or regional level. Our analysis uses hourly, median wages for all employees from the Annual Survey of Household Earnings (ASHE).

Price differentials in the water supply and sewerage industry specifically are unsuitable for inclusion in our RPA calculations since we expect NI Water's own labour costs to bias the differential within this category. We calculate a composite wage estimate for regional price differences that reflects the labour resources used in NI Water's activities, which relies on categories that are less susceptible to influence by NI Water's salaries.

#### Box 3.1: Regional price adjustments for labour

Labour costs in Northern Ireland are lower than in the rest of the UK and as our analysis in this section shows, are structurally entrenched. We estimate regional wage differentials for hourly median wages of all employees excluding overtime. Our baseline composite occupational wage estimate is 88% (of the UK price) implying an adjustment of 12%.

We use a range of 87% to 89% as a lower and upper bound. These are derived from the price differentials using whole-economy wages (full-time wages and all wages). This range includes the composite occupation wage adjustment applied in PC15.<sup>17</sup>

#### 3.1. ASHE DATA

Data on labour costs in Northern Ireland is readily available for our RPA model. We use the Annual Survey of Household Earnings (ASHE) as our main data source for estimating the labour cost differential. The ASHE survey is published annually by the Office for National Statistics (ONS). The Northern Ireland Statistics and Research Agency (NISRA) collect the ASHE data for Northern Ireland.

ASHE is a UK wide survey that provides information on hourly, weekly and annual earnings broken down by region, sector, industry and occupation. Our baseline analysis considers all employees' median hourly wages excluding overtime across relevant occupations. We discuss our baseline selection in the following sections.

#### Median and mean wages

We use median rather than average wages in our calculations. Median wages are less likely to be affected by extreme values and skewed distributions that are usually associated with earnings data. This is especially relevant when analysing both full-time and part-time employees. Our approach is consistent with the approach taken by the UR in previous price reviews. We revisit this assumption in Appendix A as part of our sensitivity analysis and find that the choice between median and mean wages has a very limited impact on our baseline RPA.

We exclude overtime in our analysis as differences in overtime hours may be the result of company policies on overtime pay, which lie within company control.

#### Hourly and weekly wages

We employ hourly wages in our baseline analysis of regional price differences. Hourly wages excluding overtime were used by the UR for PC13 to determine the allowance for a regional wages special factor within the operating cost models. The UR used weekly wages at PC15. For PC21, we recommend using hourly wages in the RPA model since weekly wages might capture other elements of company policy, such as differences in working hours both

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<sup>17</sup> A composite occupational wage adjustment of 11% was applied at PC15, which suggests that the regional wage differential between Northern Ireland and the rest of the UK is structural and has not changed significantly over the past 5 years.

within and between different regions. This approach was taken by the UR in its final price control determination for NIE Networks for the period 2017-2024 (RP6), Ofgem at RIIO-ED1 and Ofwat at PR14.

We consider both hourly and weekly wages in our sensitivity tests. The wage differential resulting from using either measure is broadly similar so the choice of hourly or weekly wages does not have a large impact on the final RPA estimate.

### **All employees and full-time employees wages**

We use all employee estimates as opposed to full-time employees only for our analysis. We expect that companies employ a mix of full-time and part-time staff. Any bias that might be introduced from part-time staff working fewer hours will be mitigated by our use of hourly wages.

### **3.2. COMPOSITE OCCUPATIONAL WAGE**

We calculated a composite occupational wage to adequately reflect the mix of labour resources used in NI Water's activities. The composite wage includes different categories of both skilled and general labour.

NI Water is the only water and sewerage company in Northern Ireland. Therefore, we do not consider it suitable to calculate an RPA based on the labour cost differentials in the water supply, sewerage and waste management sector only because we would expect NI Water's own labour costs to bias the differential of this category.

For this reason, we have calculated a composite occupational wage split that seeks to reflect the mix of labour resources used in NI Water's activities. The composite occupational wage is calculated based on an estimated split of the labour cost into skilled (20%) and general labour (80%). This split is based on the UR's approach in PC15. We split these two categories into more granular occupational subcategories (SOC codes in brackets) to create our comparator for NI Water:

*Table 3.1: Applied split into occupational subcategories*

Skilled labour (20%)	General labour (80%)
Science, research, eng. and tech. professionals (21)	Skilled construction and building trades (53)
Science, engineering and technology associate professionals (31)	Plant and machine operatives (81)
Corporate managers and directors (11)	Elementary trades and related occupations (91)
Administrative (41)	

We use 2-digit occupational categories rather than the more detailed 3-digit and 4-digit categories in our labour cost estimation. Estimates are prone to be less reliable when using more granular occupational data given the risk of relying on smaller sample sizes. We use higher level occupational categories to address these concerns and to obtain more robust estimates.

We highlight the use of SOC codes 21 and 91, which is a change from PC15 where we employed the more granular categories of Engineering professionals (212) and Elementary construction (912), respectively. This change has been made because the 2019 ASHE data release highlighted the imprecision of SOC codes 212 and 912. While the 2-digit SOC codes may not be as cost reflective as the 3-digit SOC codes, they are typically more statistically precise due to a larger sample, as mentioned above.

The table below outlines the 2019 labour RPA with 2-digit SOC codes.

Table 3.2: Composite labour RPA for 2019

Occupation	SOC Code	Weighting	RPA (2019)
Skilled construction	53	56%	87%
Plant and machines operatives	81	16%	92%
Science, research, engineering and technical professionals	21	10%	83%
Elementary trades and related occupations	91	8%	95%
Science, engineering and technical associate professionals	31	4%	89%
Corporate managers and directors	11	4%	95%
Administrative	41	2%	94%
<b>Labour RPA</b>			<b>88%</b>

Source: CEPA analysis

Our composite occupational wage RPA estimate is 88%. We consider that the composite estimate reflects regional differences for labour costs in the water industry better than more general estimates for the whole economy. We use the composite estimate in our baseline analysis and revisit this assumption during our sensitivity analysis.

We tested the sensitivity of our composite occupational wage estimate by changing the weights attached to different occupations. We note that:

- Changing the proportion of skilled to general labour does not have a strong impact on the overall RPA given that the estimated RPAs for these two subgroups are within 0.5 percentage points of one another.
- Adjusting the weight of occupations within the skilled and general labour categories does not have a material impact on the overall RPA. Even increasing the share of occupations with the highest RPA factors within each labour group by 10 percentage points shifts the overall RPA by less than 0.5 percentage points.

### 3.3. HISTORICAL TREND

Our analysis reflects the wage differential in the latest year (2019), which may not capture trends over time. We note that the Competition Commission, in the NIE Final Determination, used a five-year average of ASHE data to determine the wage adjustment.<sup>18</sup> In this section we consider headline ASHE wage measures over recent years to check whether wage differentials differ significantly between years and exhibit a trend that should be taken into account when setting an RPA for the next price control period.

Table 3.3: Historical regional wages (as percent of UK wages)

Wages	2014	2015	2016	2017	2018	2019	5-year avg.
All	85%	89%	88%	88%	89%	<b>88%</b>	<b>89%</b>

Source: CEPA analysis of ASHE data.

Table 3.3 shows the development of the wage differential between Northern Ireland and the UK over time. The historical comparison suggests only small changes in wage differentials over the last few years. The regional price difference for labour appears to be entrenched rather than driven by asynchronous economic cycles. The historical average of 89% is in line with our composite occupational wage estimate for the current year. We therefore use the most recent ASHE data (2019) in our analysis.

<sup>18</sup> Competition Commission (2014): Northern Ireland Electricity Limited price determination – Final determination.

## 4. PLANT & EQUIPMENT

To obtain an RPA for plant and equipment, we evaluate differences in the cost of purchasing and hiring plant and equipment between Northern Ireland and the rest of the UK. We considered the potential for regional price differences within the category as a whole rather than splitting it into further subcategories. Our evaluation makes use of qualitative arguments that we discuss in more detail below.

### Box 4.1: Regional price adjustments for plant & equipment

We found no strong evidence for an adjustment to plant and equipment (i.e. Northern Ireland plant and equipment costs are equivalent to the rest of the UK). Therefore, in our baseline we assume zero adjustment. We use a  $\pm 5\%$  range of 95% to 105% in our sensitivity checks.

### Plant and equipment components

Plant and equipment costs account for only a relatively small share of capital expenditure of 20% or less. This resource category covers a wide range of plant and equipment relevant to capex programmes in the water and sewerage sectors from concrete mixers to excavators. It also includes plant equipment specific to this sector such as water pumps and specialist tools for pipes.

The wide range of relevant equipment included in this category hinders a comprehensive market review. Consequently, we do not split plant and equipment into further subcategories in the RPA model. General price data is also unsuitable since it does not account for equipment specific to the water and sewerage sector. Instead, we consider qualitative arguments to determine the RPA adjustment for this category as discussed below.

### Purchase of plant and equipment

We make no adjustment for the purchase of plant and equipment. We base our analysis on the assessment of two main factors that could potentially drive regional price differences for purchasing plant and equipment:

- purchase prices; and
- transportation costs.

We consider purchase prices for plant and equipment to be similar across Northern Ireland and the UK. High value plant and equipment is traded nationally or even globally and should not therefore be subject to regional price differences.

Transportation costs are not insignificant for large plant and equipment and are likely to be higher in a relatively remote region such as Northern Ireland than in some other parts of the UK. These extra costs, however, would not be specific to Northern Ireland but are also likely to be incurred by companies operating in other UK regions located at a distance from major transportation hubs or warehouses. We do not consider transportation costs in Northern Ireland and the rest of the UK to systematically differ.<sup>19</sup> Based on this analysis above, we consider the cost to purchase plant and equipment in Northern Ireland and the rest of the UK to be broadly the same and propose no RPA adjustment.

### Plant hire

We also propose no adjustment for plant hire. Two main factors potentially drive regional price differences for plant hire:

- labour costs, especially if equipment is hired with operator; and

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<sup>19</sup> Ofwat previously made a similar argument in its PR09 price control for “large plant” but allows for a limited local premium in high-cost regions. See Ofwat, Cost base feedback report, (December 2009)

- regional over-capacity.

Compared to purchasing plant and equipment, the market for plant hire is clearly more regional in nature, depending on the value and typical utilisation of the equipment. While there may be differences in labour costs and regional over-capacity between regions, hire rates are also likely to vary considerably based on seasonal demand and length of time hired. The impact of these factors is uncertain.

Hire rates are further constrained by the option of purchasing plant and equipment in the national market, except for equipment whose utilisation is too low to make purchase viable. With little difference in purchase prices we would expect the price difference for plant hire to be limited in the long run.

### **Adjustment factor for plant and equipment**

Based on the analysis above, we consider that plant and equipment costs can be considered to be broadly similar between Northern Ireland and the rest of the UK. Some price differences may arise, for example, plant hire may be cheaper in Northern Ireland due to lower labour costs and greater supply but the impact of these factors is uncertain and the overall impact on our model is likely to be low. We therefore make no adjustment for plant and equipment price differentials in our baseline analysis. To account for a potential difference, we included a variation of  $\pm 5\%$  of relative prices in Northern Ireland in our sensitivity analysis and found that it does not have a significant effect on the overall RPA adjustment.

The results are summarised in Table 4.1 below.

*Table 4.1: Overview of the regional price adjustment for plant & equipment*

<b>Cost driver</b>	<b>Explanation</b>	<b>RPA adjustment</b>
<b>Purchase of plant and equipment</b>		
Purchase prices	High value plant & equipment is traded nationally/globally and not subject to regional price differences	
Transportation costs	Transportation costs are likely to be higher in more remote regions like Northern Ireland but similar to other UK regions located at a distance from major transportation hubs	No
<b>Plant hire</b>		
Labour costs	Hire rates vary considerably based on seasonal demand and length of time hired. The impact of these factors is uncertain and not systematic.	
Regional over-capacity	Price differences for plant hire will be limited by the option of purchasing plant & equipment.	No



## 5. MATERIALS

Our regional price adjustment for construction materials comprises individual RPAs for six subcategories of materials. These six subcategories are the main materials likely to be used in capex projects. We calculate individual RPAs for each. These individual RPAs are then applied to each capex sub-programme based on predetermined weights, as described in Section 2.2.

We base our assessment on quantitative analysis of industry data and qualitative arguments. The results are summarised in Table 5.1 below.

*Table 5.1: Regional price adjustments for materials*

Material	Estimated RPA range (% of UK price)	Explanation	% of total costs
Concrete	58% - 71%	Data analysis ICMS survey.	6%
Rebar	70% - 86%	Data analysis ICMS survey.	2%
Pipes	100%	Traded nationally and globally. Significant transportation costs but similar across the UK.	14%
Meters	100%	Traded nationally and globally.	1%
Other materials	84% - 100%	Data analysis ICMS survey.	12%
Disposal	65% - 93%	Data analysis WRAP report.	5%
<b>Aggregated RPA</b>	<b>81% – 94%</b>		<b>40%</b>

*Source: CEPA analysis*

Given the inevitable degree of uncertainty surrounding any individual point estimate, we apply a 10% range for several of the above estimates in our sensitivity analysis (see Appendix A). The following sections discuss each of these materials in turn.

### 5.1. CONCRETE

Based on the UR's previous work we assume that concrete makes up around 10-20% of total materials cost, or around 5-6% of total costs. We assume a higher share of concrete for sewerage capex than for water capex to account for precast concrete pipes being used for sewerage.

Concrete prices depend on a variety of factors such as transport costs (determined by the distance from the plant), competition in the market, quality of aggregates used, availability of raw materials, etc). The price is also likely to vary depending on quantity purchased, mix specification and method of discharge.

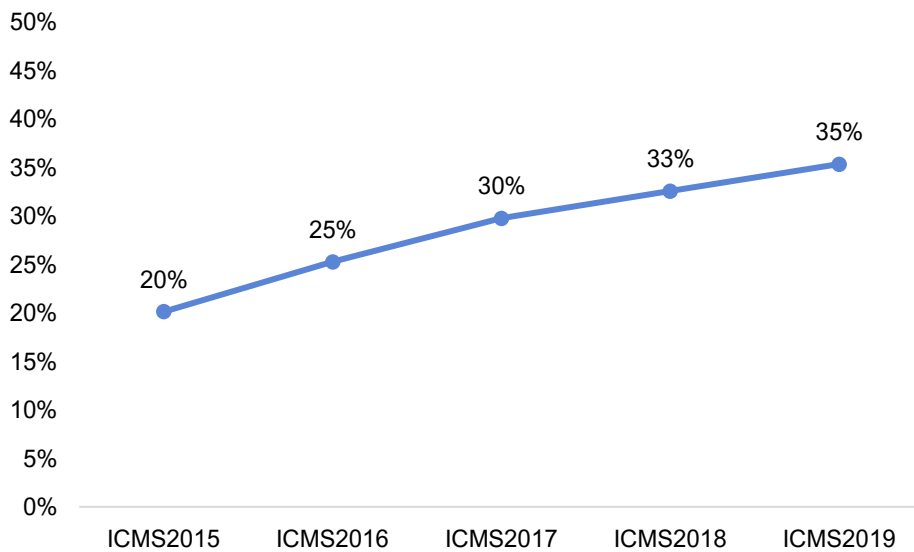
The professional services company Turner & Townsend produces annual average price estimates for key construction materials including concrete for each region in the UK. We estimate the price differential between Northern Ireland and the UK for concrete based on their latest International Construction Market Survey, which was published in 2019 (ICMS).<sup>20</sup> The resulting RPA estimate for concrete is 65% implying a price differential of 35%.

Figure 5.1 shows how the concrete price differential between Northern Ireland and the UK has changed over the period 2015 and 2019. The evidence indicates that the concrete price differential has gradually widened over the period, increasing from 20% in the 2015 ICMS report to 35% in the 2019 ICMS report.

<sup>20</sup> Turner & Townsend: *International Construction Market Survey 2019*.



Figure 5.1: Concrete, Northern Ireland : UK price differential, 2015 to 2019



Source: Turner & Townsend. International Construction Market Survey.

Given the uncertainty surrounding an estimate based on a single data source, and movements in the price differential over time, we use a  $\pm 10\%$  range in our sensitivity analysis.

## 5.2. REBAR

Rebar refers to steel or iron bars commonly used in reinforced concrete to strengthen a structure and is a relatively minor materials input relative to other materials being considered (3% of infrastructure capex materials and 7% of non-infrastructure capex materials).

Rebar is made of metals such as steel, iron and copper, which are commodities that are traded globally. Any regional price differences for rebar are constrained by the global market price for the metal itself. In this context, exchange rate fluctuations would generally play a role for globally traded commodities but have no impact on regional price differences between Northern Ireland and the UK due to their common currency.

The largest price difference would arise for rebar produced from iron. Iron itself is relatively low in value, which means that transportation costs play a larger role than for steel and copper.

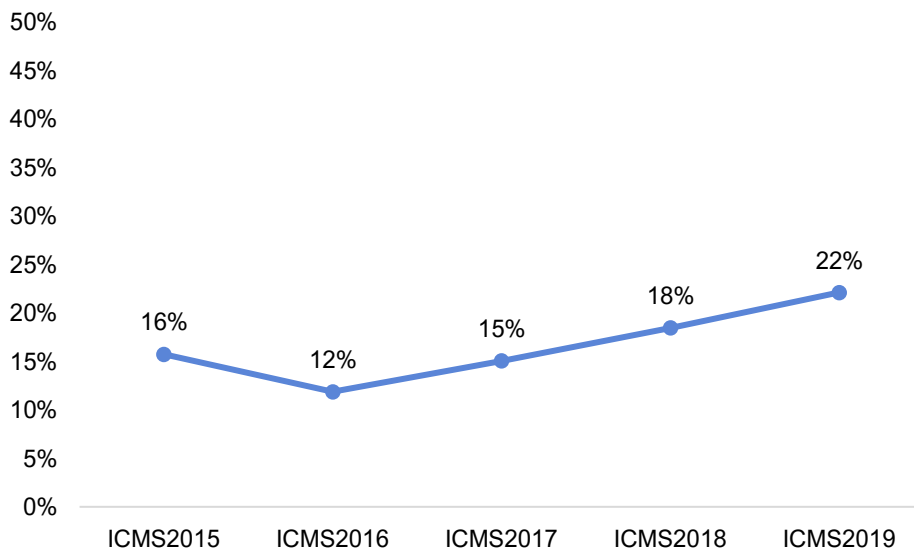
The ICMS survey also includes estimates for regional rebar prices. We follow the same approach taken for concrete, which leads to an RPA estimate for rebar of 78% implying a price differential of 22%.

It is important to note that there is a relatively large number of rebar suppliers in Northern Ireland. Walter Watson alone can produce 1200 tonnes of rebar per week from its facility in Castlewellan.<sup>21</sup> This means that the 78% RPA estimate provided in the ICMS survey should cover a range of suppliers and not be driven by an outlier.

This is reflected in Figure 5.2 below, which shows there has been a consistent and widening rebar price differential between Northern Ireland and the UK over the period 2015 to 2019.

<sup>21</sup> Source: <https://www.walter-watson.co.uk/reinforcement/overview.php>.

Figure 5.2: Rebar, Northern Ireland : UK price differential, 2015 to 2019



Source: Turner & Townsend. International Construction Market Survey.

Nevertheless, given the uncertainty surrounding an estimate based on a single data source, and movements in the price differential over time, we use a  $\pm 10\%$  range in our sensitivity analysis.

### 5.3. PIPES

Pipes represent one of the largest shares of construction materials used in the capex programmes for the water and sewerage industry. Based on the UR's previous work we assume that pipes account for up to 50% of material costs per capex programme. This implies that pipes account for approximately 14% of total capex costs.

Pipes used in the water and sewerage industry would generally be of two types: PE pipes and concrete pipes (where concrete is used only for large sewers). PE pipes can be transported relatively easy across the UK and Ireland. We therefore consider that PE pipes are traded in a national market and would not be subject to regional price differences and no adjustment in our RPA model.

Concrete pipes can also be transported fairly easy, but due to their weight and volume transportation costs are higher relative to the value of the pipes. The value of concrete pipes is relatively low compared to more complex precast concrete parts. Concrete pipes will therefore be traded in geographically smaller markets than PE pipes and regional price differences are not fully arbitrated away.

The regional price of concrete pipes depends primarily on the regional price of concrete. If price differences for concrete are large, we expect that locally produced pre-cast concrete pipes would also be cheaper. As described in section 5.1, the price differentials for concrete are significant (estimated 29% to 42% lower than in the rest of the UK) which should be reflected in lower prices for concrete pipes. We therefore employ the same price differential for concrete pipes as we do for concrete more generally.

### 5.4. METERS

We make no adjustment for the cost of meters. Meters are traded nationally and globally and there is no reason to expect significant price differences for these materials. Meters account for only 0.5% of overall capex costs so their impact on the overall RPA is small.

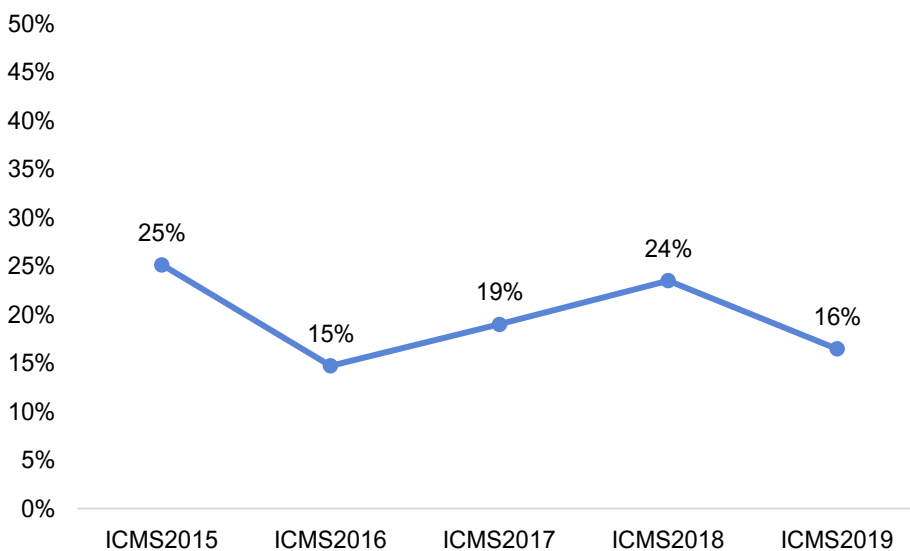
## 5.5. OTHER BUILDING MATERIALS

In this section we discuss other building materials such as bricks, aggregates and metals. These other building materials account for approximately 12% of total expenditure and comprise a wide range of products. Each individual item in this mix will have a small share of the total cost and little impact on the overall RPA.

In line with our general approach to avoid the spurious precision of a bottom-up assessment, we do not aim to estimate a regional price difference for individual materials separately. Instead, we estimate an average price differential that we can apply to this residual category. For this we use the Turner and Townsend average prices for steel, bricks and timber to derive an unweighted average estimate for other building materials published in the 2019 version of the ICMS. This analysis leads to an estimated RPA of 84% implying a price differential of 16%.

Figure 5.3 below shows that there has been a persistent price differential between Northern Ireland and the UK for 'other building materials' over the period 2015 to 2019, with a range of between 15% and 25%. This provides evidence that the price differential identified in the 2019 version of the ICMS is not an anomaly.

Figure 5.3: Other building materials, Northern Ireland : UK price differential, 2015 to 2019



Source: Source: Turner & Townsend. *International Construction Market Survey*.

Clearly this estimate excludes a wide range of materials and does not account for the different proportions in which other materials might be used in the water and sewerage industry. But it does provide further evidence of a clear price differential between Northern Ireland and the UK for a large range of inputs used by NI Water.

In PC15 we estimated an RPA of 91% for other materials but adopted a conservative approach and made no adjustment for regional price differences in this category in the baseline analysis (i.e. 100% RPA). Compared to the PC15 estimates, all three estimates for other materials are considerably lower using the ICMS 2019 survey data. There also appears to be a persistent price differential over time. However, these estimates rely on a different source since the EC Harris data used for PC15 is no longer available for current price estimates.

We adopt a conservative approach and use an RPA estimate of 90% implying a price differential of 10%. This acknowledges the level of uncertainty around the new data source and the fact that a wide range of materials are not considered due to the lack of more granular data. While conservative, the estimate lies below our PC15 estimate, reflecting the lower RPAs across all three estimates. We use the 84% RPA estimate from the ICMS survey, and the 100% RPA estimate adopted in PC15 in our sensitivity analysis.

## 5.6. DISPOSAL COSTS

We assume disposal costs account for around 5% of total costs and include them under the “Materials” heading of our RPA model. Disposal costs are largely made up of landfill taxes and landfill gate fees (charged by the landfill operators where the waste is disposed).

Gate fees can be subject to regional price differences as the level of these fees varies for each facility depending on a range of factors, such as the level of competitiveness in the market, location, size of the facility, revenues generated by the facility from sale of recovered materials, etc.<sup>22</sup>

We base our estimate of an RPA for disposal costs on the median non-hazardous landfill gate fees from the Waste and Resources Action Programme (WRAP) Gate Fees Report 2017/18. The fees exclude landfill taxes and haulage. The resulting RPA estimates are presented in Table 5.2 below.

*Table 5.2: Disposal costs regional price adjustment (RPA)*

Source	RPA (as % of UK price)
WRAP report 2017/18 (excl. landfill taxes)	65%
CEPA calculation based on WRAP report gate fees (incl. landfill taxes of £86.10/tonne)	93%

We consider disposal costs relevant to the total capex costs to also include the landfill taxes paid. Therefore, we use a price difference estimate including the standard UK landfill tax rate of £86.10 per tonne. This leads to an estimated RPA of 93% for disposal costs implying an adjustment of 7%. The estimate is significantly lower than the PC15 estimate.

<sup>22</sup> Waste and Resources Action Programme (WRAP) (2018): Gate Fees 2017/18 Final Report.

## 6. AGGREGATED REGIONAL PRICE ADJUSTMENT

Table 6.1 summarises our estimated price differences for labour, plant & equipment and materials discussed in sections 3 to 5. We aggregate individual RPAs into an overall RPA based on the cost breakdown described in Section 2.2.

Table 6.1: Aggregated RPA based on baseline weights and price differences

Resource	Share of total capex	Baseline estimates (% of UK price)	Minimum estimate (% of UK price)	Maximum estimate (% of UK price)
<b>Labour</b>	<b>40%</b>	<b>88%</b>	<b>87%</b>	<b>89%</b>
<b>Plant &amp; equipment</b>	<b>20%</b>	<b>100%</b>	<b>95%</b>	<b>105%</b>
<b>Materials</b>	<b>40%</b>	<b>89%</b>	<b>83%</b>	<b>94%</b>
Concrete	6%	65%	58%	71%
Rebar	2%	78%	70%	86%
Pipes	14%	100%	100%	100%
Meters	<1%	100%	100%	100%
Other	12%	90%	84%	100%
Disposal	5%	93%	65%	93%
<b>Aggregated RPA</b>		<b>91%</b>	<b>87%</b>	<b>94%</b>

Source: CEPA analysis

Aggregating the individual RPAs according to the weights presented in the table above yields an **aggregate RPA range of between 87% to 94%**, which includes the PC15 RPA of 94%.

Our baseline aggregate RPA estimate of 91% implies a **regional price differential of 9%**. This suggests that capex costs of a water and sewerage company in Northern Ireland are 9% lower than the rest of the UK.

These findings are supportive of analysis conducted by the Northern Ireland Department for the Economy, which found that cost competitiveness does exist for Northern Ireland relative to the remainder of the UK and the Republic of Ireland.<sup>23</sup> In particular, the study found that labour and property costs continue to be lower than in the majority of UK regions and the Republic of Ireland, meaning that Northern Ireland presents itself as an attractive region for potential business investment. The cost competitiveness of the Northern Ireland economy is also reflected by the fact that 15% (£10.6 billion) of total Northern Ireland sales in 2018 were to the remainder of the UK.<sup>24</sup>

### Box 6.1: Aggregated regional price adjustment

- We recommend an aggregated RPA of between 87% to 94%, which implies a price differential of 6% to 13%.
- Our baseline aggregate RPA estimate of 91% implies a regional price differential of 9%. This suggests that capex costs of a water and sewerage company in Northern Ireland are 9% lower than the rest of the UK.

<sup>23</sup> Source: Department for the Economy (April 2019). Research Bulletin 19/1. [The Cost of Doing Business in NI](#).

<sup>24</sup> Source: Northern Ireland Statistics and Research Agency (April 2020). [Overview of Northern Ireland Trade](#).

## Appendix A **SENSITIVITY ANALYSIS**

We conduct sensitivity analyses to demonstrate the robustness of our estimates. Several aspects of our analysis are considered in greater detail to evaluate the sensitivity of the aggregated RPA to changes in the weights and price estimates.

### **A.1. VARIATION OF THE COST BREAKDOWN**

The aggregated RPA uses the weights assumed in the cost breakdown in Section 2.2. This implies that the aggregated RPA estimate is sensitive to the weights assumed in the cost breakdown for any fixed choice of estimated price differences.

We therefore systematically analyse the sensitivity of the aggregated RPA model with respect to this dimension (otherwise referred to as “RPA” for simplicity within this Appendix). The weights in the cost breakdown are varied according to the following four scenarios:

- **Baseline** – 40% labour, 20% plants and equipment, and 40% materials.
- **Scenario 1** – low labour cost scenario: decrease in the assumed share of labour by 10 pp (percentage points) and concurrent increase in the share of plant & equipment and materials by 5 pp each.
- **Scenario 2** – high labour cost scenario: increase in the assumed share of labour by 10 pp and concurrent decrease in the share of plant & equipment and materials by 5 pp each.
- **Scenario 3** – high materials cost scenario: increase in the assumed share of materials by 10 pp and concurrent decrease in the share of plant & equipment and labour by 5 pp each. To maximise the impact on the RPA we assume the increase in the share of materials is due to increases in the share of those materials (concrete, rebar, other materials, disposal) for which regional price differences have been estimated.
- **Scenario 4** – Drawing on Ofgem’s RIIO-GD1 cost breakdown we increase labour by 15 percentage points (to 55% of total expenditure (and reduce plant & equipment by 15 percentage points to 5% of total costs).

Our sensitivity analysis creates additional scenarios measuring the sensitivity of the RPA to the weights assumed in the cost breakdown. For each scenario, we calculate a lowest and highest RPA factor using the minimum and maximum estimates of our regional price difference estimates. This evaluates the sensitivity to the estimated price differences calculated for the individual resources. Table A.3 below details the results of our baseline RPA for each of the scenarios described above.

*Table A.3: Sensitivity of the overall and minimum and maximum RPAs (% of UK price)*

Scenario	Selected RPA factor	Low RPA factor	High RPA factor
Baseline (40-20-40)	91%	87%	94%
Scenario 1 (30-25-45)	92%	87%	95%
Scenario 2 (50-15-35)	91%	87%	93%
Scenario 3 (35-15-50)	90%	85%	93%
Scenario 4 (55-5-40)	89%	86%	92%

Overall the possible RPA ranges from 85% (Scenario 3) to 95% (Scenario 1) when varying the cost breakdown across the four scenarios. The scenarios cover a wide range of plausible variations where the share of labour ranges from 30% to 55% of total capex expenditure. The analysis considers simultaneous adjustments of the individual RPA factors to the highest and lowest estimates, respectively, which explains the large range of the sensitivity RPAs.

The sensitivity analysis shows that the RPA model is well-behaved and robust regarding the cost breakdown and variations in the estimated price differentials. A small change of the input value does not cause a sudden change in the model output. The following sections present several cross-checks of the model output against RPA estimates derived with different methodologies.

## **A.2. MEAN VS. MEDIAN WAGES**

As discussed in Section 3.1, there exists some regulatory precedent for using mean instead of median wages. The Competition Commission in a previous determination used mean rather than median wages as it considered this form of average more appropriate for estimating wages costs across a group of staff.<sup>25</sup> We have therefore repeated our analysis using mean hourly wages as a sensitivity check to our baseline results. Table A.4 displays the effect on our baseline RPA estimate of using mean wages.

*Table A.4: Comparison of RPA estimates using median and mean wages (% of UK price)*

	<b>Selected RPA factor</b>	<b>Low RPA factor</b>	<b>High RPA factor</b>
Individual labour RPA – median wages	88%	83%	89%
Individual labour RPA – mean wages	90%	86%	90%
Aggregated RPA – median wages (baseline)	91%	87%	94%
Aggregated RPA – mean wages	92%	86%	93%

Choosing mean instead of median wages has a limited impact on our baseline RPA. It changes our baseline RPA by 1 percentage points from 91% to 92%.

<sup>25</sup> Competition Commission (2014): *Northern Ireland Electricity Limited price determination – Final determination*.

## Appendix B COST BREAKDOWN

Our RPA model breaks capital expenditure into water infrastructure, water non-infrastructure, sewerage infrastructure, and sewerage non-infrastructure. Within these broad areas, capital expenditure is broken into sub-programmes as shown in Table B.5.

Table B.5: Water and sewerage capex sub-programmes

Water infrastructure	Sewerage infrastructure
<ul style="list-style-type: none"> <li>• Mains (laying)</li> <li>• Mains (rehabilitation)</li> <li>• Communication pipes</li> <li>• Meters<sup>26</sup></li> </ul>	<ul style="list-style-type: none"> <li>• Sewer (laying)</li> <li>• Sewer (rehabilitation)</li> </ul>
Water non-infrastructure	Sewerage non-infrastructure
<ul style="list-style-type: none"> <li>• Water treatment works</li> <li>• Water pumping stations</li> <li>• Water storage</li> </ul>	<ul style="list-style-type: none"> <li>• Sewerage treatment works</li> <li>• Sewerage pumping stations</li> <li>• Sewer structures</li> <li>• Sludge treatment and disposal</li> </ul>

This breakdown is consistent with the UR's approach in PC15 and we have been informed that the UR expects to use a similar breakdown in PC21. An RPA model based on this breakdown should therefore be directly applicable for the UR's determination.

### B.1. ASSUMPTIONS

Based on the UR's previous determination, we assume a broadly equal share of capital expenditure on water and sewerage services. This results in a split of:

- 30% water infrastructure;
- 20% water non-infrastructure;
- 20% sewerage infrastructure; and
- 30% sewerage non-infrastructure.

The breakdown into sub-programmes is shown in Figure 1.1. The proportions reflect NI Water's relative capex allowances for PC15. The proportion of capex programmes will have only limited impact on the derived RPA as long as the breakdown into resources is similar for the sub-programmes.

Table B.6: Capex sub-programme as percentage of total capital expenditure

Water (50%)	
<b>Water infrastructure</b>	<b>30%</b>
Mains (laying)	7.5%
Mains (rehabilitation)	16.5%
Communication pipes	4.5%
Meters	1.5%
<b>Water non-infrastructure</b>	<b>20%</b>

<sup>26</sup> Note: NI Water currently only meter 'non-households'.



<b>Water (50%)</b>	
Water treatment works	6.0%
Water pumping stations	6.0%
Water storage	8.0%
<b>Sewerage (50%)</b>	
<b>Sewerage infrastructure</b>	<b>20%</b>
Sewers (laying)	10%
Sewers (rehabilitation)	10%
<b>Sewerage non-infrastructure</b>	<b>30%</b>
Sewerage treatment works	7.5%
Sewerage pumping stations	7.5%
Sewer structures	7.5%
Sludge treatment and disposal	7.5%

Within these capex sub-programmes costs are broken down by resource into:

- 40% labour;
- 20% plant and equipment; and
- 40% materials.

For the RPA model we assume the same proportions of labour, plant and equipment and materials that were used at PC15. Discussions with the UR and NI Water within the Cost Assessment Working Group (CAWG) have not identified any reasons why the input mix would significantly change between PC15 and PC21. These proportions lie between those used recently by the World Bank<sup>27</sup> and Ofgem<sup>28</sup> in similar analysis. The proportions also constitute an approximation consistent with our experience in various sectors and with the UR's previous work and its PC10, PC13, and PC15 determinations.

These resources are split into subcategories where appropriate. We split labour into general and specialist labour, and materials into subcategories such as concrete, rebar, pipes and disposal costs. We employ the same resource mix across all capex programmes, with some adjustments where appropriate.

The proportion of individual resource components within the three resource categories varies between the sub-programmes. For example, concrete may make up a larger share of material costs for reservoirs than for communication pipes. It is difficult to estimate the proportion of resources with certainty. The resource mix typically varies from sector to sector and could differ from project to project within a sector.

The breakdown of capex into programmes, and the proportion of resources within each sub-programme, relies on a number of assumptions as described above. We re-visited these assumptions as part of our sensitivity analysis in Annex A.

<sup>27</sup> World Bank (2011): International Comparison Program.

<sup>28</sup> Ofgem, RIIO-T1/GD1: Initial Proposals – Real price effects and ongoing efficiency appendix, (July 2012).



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