IW RC3 (2020-2024) Look Forward Submission Assessment: Opex

Prepared for Commission for Utility Regulation

22 July 2019
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Executive Summary

The Commission for Regulation of Utilities (CRU) commissioned NERA Economic Consulting (NERA) and Jacobs (together “NERA Consortium”) to support CRU in reviewing Irish Water’s (IW) submission for the third review of charges (RC3) and to advise the CRU on the revenues that IW should be allowed to recover for RC3, covering 1st January 2020 to 31st December 2024. We summarise our conclusions and recommendations for opex at RC3 below.

Opex: IW forecasts €3,719bn opex over RC3, and broadly flat, absorbing upward cost pressures through continued cost efficiency

In its business plan submission, IW proposed to spend on aggregate €3,719m over the five-year RC3 period, as shown in Figure 1: below.

Figure 1: IW IRC1/IRC2 outturn and RC3 Proposed Operating Expenditure (€3,719m)

IW’s proposed controllable opex for RC3 is broadly in line with IRC2 controllable opex, with a marked decline in service level agreement (SLA) at RC3 being offset by an increase in target operating model (TOM) and shared services centre (SSC) costs. This shift in the allocation of costs away from the SLA into TOM and SSC reflects the transition from the existing decentralised model to the single public utility model, during the transition phase from 2020 to 2022. The respective costs shares are then relatively stable for the remainder of the period.

IW has set out that it faces upward cost pressures to bring its operational performance to the level of leading European peers. It also anticipates that it can absorb these cost pressures from the implementation of a single utility, and lean utility, models, with controllable operating expenditure broadly constant over the period.

There is a clear risk from the implementation of the single utility model, with the lean utility model savings also in part dependent on the creation of a single entity. Following the submission of its business plan in November, IW also considered risks around the re-profiling
of the Water Industry Operating Framework (WIOF) programme. As shown in Figure 2 below, IW identified a one-year WIOF delay results in an increase in controllable expenditure in 2024 to €708m relative to €673m (i.e. €35 million higher), as a consequence of the delay in the Single Public Utility realised efficiencies.1

Figure 2: IW RC3 Proposed Operating Expenditure Under Original Submission (€3,719m) and WIOF Delay Scenario (€3,816m)

Source: IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.7. IW response to the Q&A.

Opex: As at IRC2, IW expects that costs related to compliance, growth and external will be equal to and offset by improved cost efficiency

IW estimates that over RC3, the potential €130m savings in efficiency will result from:

- Direct savings of the transition to a single public utility (€54m), particularly through payroll and other SLA level savings;
- “Lean savings” from the single public utility improvement on the value of systems and processes (€61m); and
- Supply chain actions to standardise agreements and improve economies of scale (€15m)

In terms of cost pressures, IW estimates these will sum up to €122m over RC3, with the main items comprising:

- Compliance through the investment plan “delta opex” (i.e. new opex arising from capital enhancement to move towards compliance with European directives) and lead mitigation (€71m);

1 IW submission in response to the Q&A.
- External pressures of: economic and population growth, energy costs, and extreme weather events (€18m);
- Government policy of taking-in charge, and other policies (€25m)

IW identified cost pressures of €122m are broadly offset by improved cost efficiencies of €130m, in particular through the Single Public Utility savings. However, under IW’s one-year WIOF delay scenario savings decline to €95m over RC3, i.e. overall costs will be €35 million higher.

**Figure 3: IW opex is broadly stable over RC3: growth in costs offset by efficiencies**

![Graph showing cost growth and efficiencies over RC3](image)

*Source: IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.7. IW response to the Q&A.*

**Opex: Based on IW forecasts, costs will be around 20 to 52 per cent higher than benchmark at end of RC3 plan, or ca 27 to 61 per cent under WIOF delay**

We have reviewed IW’s cost efficiency by comparing its cost to peers in UK, drawing on econometric benchmarking. Our benchmarking takes into account IW factors, including taking account of its greater network length in certain model specifications, its higher number of wastewater treatment works, and higher real wages in Ireland relative to UK comparators. We also consider IW’s cost efficiency with respect to predicted or average costs as opposed to “frontier” costs, to take into account (at least in part) statistical error in the modelling process. By contrast, UK regulators more stringently compare companies costs to frontier or the least cost company.

Our overall conclusion from the modelling exercise is that IW’s proposed RC3 operating expenditure is high compared to a benchmark level of efficient expenditure formed based on UK water and sewerage companies.
For the water service, we consider that a reasonable interpretation of the evidence is that IW’s opeX costs are around 28 to 42 per cent higher than the benchmark level in 2019, and around 20 to 32 per cent higher than the model predicted costs by the end of RC3.²

Figure 4: IW’s Water Service RC3 Plan Costs 20 to 32 Per Cent Higher than Benchmark at end RC3 Under Original Submission, and 27 to 39 Per Cent Higher Under WIOF Delay Scenario

Source: NERA analysis of Ofwat’s PR19 dataset, IW submissions, WICS regulatory accounts for Scottish Water and Northern Ireland Water Annual Information Return.
Note: Models estimated using E&W data (2012-18). All UK modelled and observed costs presented in this chart correspond to 2018. All costs are in 2017 prices.

Similarly, for the waste water service, we estimate that IW’s costs are around 49 to 62 per cent higher than the model predicted costs in 2019, and 40 to 52 per cent higher at the end of RC3.³

² If we consider the impact of a one delay in the implementation of the WIOF, IW proposed costs remain around 27 to 39 per cent higher than the model predicted costs by the end of RC3.
³ The one year delay in the implementation of WIOF increases IW efficiency gap to around 48 to 61 per cent at the end of RC3.
Our analysis suggests that Irish Water’s original business plan opex (i.e. assuming timely implementation of WIOF) is around 26 (range: 20 to 32) to 46 (range: 40 to 52) per cent higher than the benchmark for water and wastewater services respectively in the final year of RC3, 2024. Both the water and wastewater service analyses therefore suggest that IW’s plan is not sufficiently stretching in reducing its costs, and that there is scope for further efficiency improvements over the period.

**Opex:** We propose an opex efficiency challenge starting at 2 per cent in 2020, and increasing to 6 per cent by the end of RC3

IW remains an outlier in terms of cost performance against both the mature utilities in England and Wales. However, we do not expect IW to close the assessed gap to the benchmark company immediately, or necessarily over a single control period. We have informed the expected year-on-year improvements from a review of SW, NIW and other utilities at a similar stage of development, which achieved year-on-year cost reductions of up to 10 per cent at comparable stages of development. We recommend that CRU sets an average target for improving operating cost performance of 5 per cent per annum over RC3, as Irish Water may be constrained by an operational model which impedes the cost reductions realised by the best performers elsewhere. We also recognise that it has a substantive
element of costs, DBOs, which in part lie outside of its control. Acknowledging that DBO costs lie in part outside management control, we apply an average 5 per cent p.a. reduction to opex excluding DBO, which translates as an average 4 per cent p.a. reduction applied to total opex (including DBO).

In profiling the annual efficiency challenge, we considered IW may need additional time to implement WIOF and its intended operational model. We recommend that CRU sets an efficiency challenge of 2 per cent in 2020 and 2021, ramping up to 4 per cent in 2022, and 6 per cent in 2023 and 2024, relative to the 2019 opex. Our recommended allowance implies a decrease in its controllable opex expenditure from €680.5m in 2019 to €554.3m in 2024, as shown in Table 1 below.

Table 1: Opex Projections for RC3 based on a 4 per cent Efficiency Challenge

<table>
<thead>
<tr>
<th>Opex</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>Total RC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>IW controllable opex (Original BP)</td>
<td>680.5</td>
<td>690.0</td>
<td>694.4</td>
<td>696.2</td>
<td>687.8</td>
<td>672.8</td>
<td>3441.1</td>
</tr>
<tr>
<td>IW controllable opex (WIOF Delay)</td>
<td></td>
<td>687.0</td>
<td>710.0</td>
<td>712.0</td>
<td>718.0</td>
<td>707.0</td>
<td>3534.0</td>
</tr>
<tr>
<td>NERA controllable</td>
<td></td>
<td>666.8</td>
<td>653.5</td>
<td>627.4</td>
<td>589.7</td>
<td>554.3</td>
<td>3091.8</td>
</tr>
<tr>
<td>IW non-controllable costs</td>
<td>55.5</td>
<td>55.5</td>
<td>55.5</td>
<td>55.5</td>
<td>55.5</td>
<td>55.5</td>
<td>277.5</td>
</tr>
<tr>
<td>IW total opex (Original BP)</td>
<td>745.5</td>
<td>749.9</td>
<td>751.7</td>
<td>743.3</td>
<td>728.3</td>
<td></td>
<td>3718.6</td>
</tr>
<tr>
<td>NERA total opex</td>
<td></td>
<td>722.3</td>
<td>709.0</td>
<td>682.9</td>
<td>645.2</td>
<td>609.8</td>
<td>3369.3</td>
</tr>
<tr>
<td>£m reduction relative to IW BP.</td>
<td>23.1</td>
<td>40.9</td>
<td>68.8</td>
<td>98.1</td>
<td>118.4</td>
<td></td>
<td>349.3</td>
</tr>
</tbody>
</table>

Source: NERA analysis of IW BP submission, assuming a 2 per cent efficiency challenge on controllable costs including DBO costs in 2020 and 2021, 4 per cent in 2022, and 6 per cent in 2023 and 2024.

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4 Irish Water (January 2019) RC3 Opex look-forward, presentation, slide 30. Irish Water’s analysis shows that DBO contract costs are relatively constant over RC3 until the final year 2024, where there are number of contracts of material value that expire.
1. **Introduction**

NERA Economic Consulting (NERA), along with Jacobs, an engineering consultancy, was commissioned by the Commission for the Regulation of Utilities (CRU) to assist with a review of Irish Water’s (IW) submission for the third review of charges (RC3) and to advise the CRU on the revenues that IW should be allowed to recover for RC3 covering 1st January 2020 to 31 December 2024.

The next control follows the first and second interim price controls (IRC1 and IRC2), which set allowed revenues for the period Q4 2014 to end 2016, and 2017-19 respectively.

The report addresses the opex analysis, and is structured as follows:

- Section 2 sets out our review of IW’s proposed operating cost (opex) proposals;
- Section 3 sets out IW’s proposed improvements in cost efficiency over the period, and our recommendations; and
- Section 4 sets out our assessment of IW proposal for depreciation policy and our recommendation.

The CRU has published a separate report by Jacobs, an engineering consultancy, reviewing Irish Water’s capital investment proposals. However, we include in this report two items relevant to the capex assessment:

- In section 3, an analysis of the rate of improvement in capital cost performance to inform the setting of IW’s capital allowance; and,
- In Appendix C, an assessment of the magnitude of IW’s proposed capex program relative to E&W companies and benchmark analysis for IW’s proposed capital maintenance expenditure.

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5 Together, the “NERA Consortium”.

6 Jacobs (July 2019) Review of Irish Water’s RC3 Capital Investment Plan
2. Operating Cost Assessment

In this section we set out our review of IW’s operating expenditure proposals. Unless otherwise stated, all prices are expressed in € 2017.

Our approach to assessing IW’s operating expenditure is to:

▪ Review IW’s expenditure proposals in specific functional areas and comment on the business case presented, including any supporting evidence;
▪ Compare IW’s expenditure proposals to UK comparators drawing on unit cost comparisons, as well as econometric benchmarking to assess the comparative cost performance of IW and UK water and sewerage companies.

Along with its business plan submission, IW’s also provided two supporting documents from CEPA, its economic consultants, on its comparative efficiency and expected real price and productivity effects over RC3. We address these two reports in this section.

These analyses inform our view of IW’s current cost performance levels, which feed into our assessment of the appropriate cost efficiency profile for IW over IRC2, described in Section 3.

2.1. Overview of IW’s Proposals

In Figure 2.1 below, we present IW’s opex proposal submitted to the CRU. IW proposes to spend on aggregate €3,719m over the five-year RC3 period. This expenditure figure represents an increase of 1 per cent in controllable operating expenditure over RC3 relative to IRC2 average, and 9 per cent increase in total opex largely because of the introduction of commercial rates.

Figure 2.1: IW IRC1/IRC2 outturn and RC3 Proposed Operating Expenditure (€3,719m)

Source: NERA analysis of IW RC3 submission.
In terms of high level trends, Figure 2.1 shows IW’s controllable opex for RC3 is broadly in line with IRC2 controllable opex. Figure 2.1 also demonstrates a marked decrease in service level agreement (SLA) costs throughout the regulatory periods with an accentuated decline in RC3, offset by an increase in target operating model (TOM) and shared services centre (SSC) costs.

While at IRC2 the SLA costs accounted for 77 per cent of controllable costs, at RC3 IW envisage that SLA costs will account for 53 per cent over the period, i.e. a decrease of around 30 per cent in average SLA costs from the IRC2 period to RC3. By contrast, IW expect TOM costs to increase from 15 per cent (IRC2) to 33 per cent (RC3), and SSC costs from 4 per cent (IRC2) to 9 per cent (RC3).

This shift in the allocation of costs away from the SLA into TOM and SSC reflects the transition from the existing decentralised model to the single public utility model, during the transition phase from 2020 to 2022. The respective costs shares are then relatively stable for the remainder of the period.8

2.1.1. Variation in IW’s plan

Following the submission of its business plan in November, IW also considers risks around the re-profiling of the WIOF programme, and it identified the consequences of a one-year delay. A one-year delay results in an increase in controllable expenditure in 2024 to €708m relative to €673m (i.e. €35 million higher), as a consequence of the delay in realised efficiencies.9

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7 Controllable costs are represented in Figure 2.1 as the total bar minus the light orange portion of the bar.
8 From 2022-2024, SLA and TOM expenditures represent 47 per cent and 38 per cent of controllable opex, respectively.
9 IW submission in response to the Q&A.
2.1.2. Summary of IW proposed controllable expenditure

In its submission, IW differentiates between base opex, as well as the additional “compliance, growth and external costs” and efficiencies. As set out in Figure 2.3, IW identified a broadly flat base opex figure, reflecting an additional €122m opex due to greater compliance etc over RC3, offset by anticipated efficiency savings of €130m. The level of efficiencies and costs assumes that the single utility model is implemented in 2021.\textsuperscript{10}

\textsuperscript{10} IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.7.  IW response to the Q&A.
We describe below in detail the drivers of the cost growth and efficiencies and the expected evolution of each IW cost category over the RC3 period.

2.1.2.1. Efficiencies

IW estimates that over RC3 it will realise €130m in efficiency savings. These savings are split across three key categories.
First, IW expects the transition to a single public utility to deliver €54m million in direct savings, particularly through payroll and other SLA level savings. The project involves the transformation of IW into a single organisation from the existing 32, the reduction in organisational layers from 15 to 7, and the introduction of standard ways of working.\textsuperscript{11} IW notes that the efficiency savings are dependent on the adoption of the single public utility model implemented in 2021, with savings through to 2023 as the benefits of the new model are realised.

Second, IW projects “lean savings” of €61m through an improvement of the value of systems and processes.\textsuperscript{12} A core focus is on automation and improved analytics through: optimising asset management technologies (such as telemetry, hand-held, Maximo); sludge management; chemical usage and usage of technology (e.g. meter readings and travelling costs); cost-benefit analysis of hiring or buying plant & machinery; acquisition of jetting equipment and shifting contractor costs to in-house; and review of working arrangements (e.g. office space).

IW also notes that energy and fleet are two core areas where it expects to realise further efficiencies:\textsuperscript{13}

\begin{itemize}
\item Developing a sustainable energy strategy through replacing inefficient assets and using renewable energy sources where possible.
\item Investing in national fleet.
\end{itemize}

Finally, IW notes that supply chain actions to standardise agreements and improve economies of scale can derive an additional c.€15m in savings.\textsuperscript{14}

Figure 2.5 summarises the expected efficiency savings across these categories. In broad terms, the single utility model savings fall largely in the period 2021-23, with the lean model savings concentrated in 2023-24.

\textsuperscript{11} IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.14.

\textsuperscript{12} IW describes a lean culture as “minimising the total cost of managing, operating and maintaining water and wastewater assets while delivering exceptional service to customers.” IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.15.

\textsuperscript{13} IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.16.

\textsuperscript{14} IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.17.
2.1.2.2. Cost Growth

IW anticipates there will be additional operating expenditure of €122m over RC3. IW identified compliance, external costs, government policy and industry transformation, as the four sources of these cost pressures, as per Figure 2.7 below. We assume that Irish Water expects to incur these costs irrespective of the timing of WIOF.
2.1.2.2.1. Compliance

The cost pressures in compliance account for 58 per cent of the total additional costs. We describe the compliance costs below.

The investment plan “delta opex” and lead mitigation, reflective of the operating costs of new and upgraded assets, account for the major expenditure in compliance (c.€61m). This expenditure is related to catching up with European peers on compliance standards and meeting the requirements of the Water Framework Directive (WFD) and the Urban Wastewater Treatment Directive (UWWTD), namely “delta opex” to meet the following outputs:

- Eliminate the number of agglomerations with infringement proceedings by the EU;
- Increase the wastewater treatment capacity by approximately 1.3m population equivalent;
- Reduce in c.687,500 the properties at risk of microbiological non-compliance; and
- Eliminate all schemes from the EPA’s RAL but for the Lough Talt (due to its higher complexity).

The remaining three compliance cost growth drivers – sludge management, FOG\(^\text{15}\) programme, and management of trade effluent – represent the remaining 15 per cent of the compliance costs.\(^\text{16}\)

In contrast to Irish Water’s approach, Ofwat does not make additional opex allowances for enhancement expenditure.\(^\text{17}\) Similarly, in Scotland, the stated impacts of Scottish Water’s

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\(^\text{15}\) Fats, oil and greases (FOG)

\(^\text{16}\) IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), pp. 21-22.

\(^\text{17}\) Ofwat states: “We consider that our efficient base cost allowance, which is estimated on the basis of reported base costs, covers all operating costs, including those for enhancement. [...] In most cases, our enhancement allowances
proposed investments on operating expenditure over the period 2015-21 amounted to 2 per cent of the proposed investment in enhancement expenditure.\(^{18}\)

However, Irish Water may be different to E&W companies where the enhancement opex relates to first time provision of a particular service (e.g. first time provision of waste water treatment), as opposed to enhancing existing levels of service.

### 2.1.2.2.2. External factors

The second cost pressure IW identified are external factors, which IW forecasted to increase opex in €18m at RC3 through:

- Economic and population growth putting pressure on the cost of key variable inputs like energy and chemicals to grow over RC3 in line with GDP projections (c.€10m)
- Energy costs growing due to the rising trend in prices of international fossil fuel (c.€7m)\(^ {19}\)
- Likelihood of damaging extreme weather events in the future (c.€1m).\(^ {20}\) IW engaged with the National Adaptation Framework – Planning for a Climate Resilient Ireland to address the emergencies that may arise during RC3.

### 2.1.2.2.3. Policy

IW also recognises additional costs driven by government policy (c.€25m):

- Increase in Taking-in-Charge costs (conservative forecast of €12m) due to: an increase of residential states by 1,900 implying a network expansion of 1,500km,\(^ {21}\) a transfer of 250 Group Schemes that require an increase in network length of a further 1,500km, and cooperation in the operation and maintenance of Developer Provided Infrastructure Schemes.
- Manage the Asbestos Containing Material in Water Disposal through specialised hazardous waste contractors (€5m). IW regards this expenditure as necessary to comply with legal and statutory requirements of waste management.
- Educate and encourage customers to reduce excessive water usage (€3m), as per government policy.

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\(^ {19}\) Despite IW’s new energy price strategy and the 33 per cent forecasted efficiency gains in energy at 2021 compared to a 2009 baseline. IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.23.

\(^ {20}\) In IW view, these can damage IW’s assets, reduce availability of water for abstraction, reduce dilution of capacity for wastewater treatment, increase water temperature and increase in treatment costs. IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.23.

\(^ {21}\) Where 15 per cent of the additional residential states have a wastewater pump station. IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.24.
• Ensure IW non-domestic customer base has the right volumetric charge classification and is up to date (€1m).

IW identified an additional €25m cost increase in opex if the EU proposal for the Drinking Water Directive (DWD) is adopted.

2.1.2.2.4. Transformation

IW’s transformation cost driver represents c.6 per cent of the total growth in cost drivers. Transformation costs include:

• Maintenance of the standards of operational sites within LAs control, with the objective of ensuring a safe place to work (€5m)
• Create site security to protect property, assets and water supply, while also ensuring staff and public safety (€2m)\(^{22}\)

IW also provides detail on how the above opex splits between expenditure categories, e.g. SLAs, TOM etc. We provide a description of each total opex category in the following sections.

2.1.3. SLA expenditure

Upon the establishment of Irish Water in 2014, IW entered into SLAs with the 34 (now 31) local authorities. The SLAs were signed for a period of 12 years, with review points at year two and year seven.\(^{23}\)

SLA’s expenditure refers to the costs incurred in Operations and Maintenance (O&M) of activities delivered in partnership with the local authorities and of the operational component of DBO costs which are contracted to external suppliers.

IW categorises its O&M expenditure falling under various categories as summarised in the bullets below and the expenditure profiles shown in Figure 2.8:

- Payroll (associated with LA staff);
- Goods and services (including materials and services, e.g. chemicals plant hire and contractor costs)
- Design build and operate (DBO) contracts;
- Energy costs (excluding energy purchased under DBO)
- Overhead costs (costs not attributable to an individual plant)
- Central management costs (CMC, incurred by LAs in managing and supporting the SLAs).

As shown in Figure 2.8, IW forecasts a significant reduction in SLA costs, from €515m in 2019 to €332m in 2024. IW will achieve SLA savings over the RC3 period mainly through a steady decrease in SLA payroll costs.

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\(^{22}\) We understand IW undertook 633 assessments of site security, of which 34 per cent did not meet the security requirements. IW decommissioned 2100 sites.

\(^{23}\) As defined in the Water Services Act (No.2) 2013
Under WIOF delay scenario, we assume that the SLA costs will be higher equal to the delay in realised efficiencies, as shown by the line in Figure 2.8.

**Figure 2.8: IW IRC1/IRC2 Outturn and RC3 Proposed SLA Expenditure (€1,819m)**

Source: NERA analysis of IW RC3 submission.

We understand from IW’s RC3 submission and presentations to the CRU that there will be significant reduction in O&M (SLA) costs offset by an increase in other labour costs categories. The shift in costs from SLA to other categories reflects a different cost allocation under the implementation of the single public utility model through the WIOF programme.24

IW expects an increase in its controllable costs in 2020.25 IW then anticipates a 10 per cent decrease in SLA costs from 2019 to 2020, and further declines in in 2021-2022 with the new streamlined work, additional savings in payroll, and termination of CMC costs. Under the original submission, IW forecasts SLA costs will then increase 4 per cent between 2022 and 2023, and 2 per cent from 2023 to 2024, due to rising energy and DBO costs.

### 2.1.4. Target operating model

Figure 2.9 shows IW’s expenditure under its centralised TOM over the course of IRC1 (outturn), IRC2 (outturn/allowed) and RC3 (proposed). TOM supports the organisational structure, processes and systems required for IW operations.

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24 IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.12.

25 IW (January 2018) RC3 IW Opex Look Forward, Overview, presentation, slide 27

26 We have incorporated all the additional costs / delays in realised efficiencies under WIOF delay scenario as higher SLA costs, and therefore assume that TOM costs are invariant to the WIOF delay.
IW forecasts that TOM costs will increase around two-and-half fold from 2019 to 2022. After the peak of TOM costs in 2022, IW forecasts a decline of around 10 per cent by the end of IRC3 from the peak following the realisation of the efficient operating model.

**Figure 2.9: IW IRC1/IRC2 Outturn and RC3 Proposed TOM Expenditure (€1,145m)**

![Graph showing actual and proposed expenditure for different service categories from 2014 to 2024.]

Source: NERA analysis of IW RC3 submission.

### 2.1.5. Group and shared service centre

The group and shared service centre refers to the allocation of services from the Ervia Group. As with TOM costs, we have assumed that these costs are invariant to WIOF delay. NERA (February 2019), Review of IR’s IRC2 Cost and Output Performance.

- **Shared services** cover finance, procurement, facilities, HR and IT. Irish Water report an increase in activity level to explain the rise in outturn costs. For example, the IRC2
submission outlined that shared services supported 3,000 users of Asset Management applications which has now increased to ca. 5,700.  

The shared service centre provides transactional support services to IW and GNI and the other shared services at Ervia level. In particular, the SSC covers transactional activities relating to:

- Enterprise Application delivery and support;
- IT Service Delivery;
- IT Infrastructure Service;
- IT Project Management Office (PMO) support, and;
- IT vendor and contract management.

At IRC2, Irish Water assumed the cost of these centres was shared with Gas Networks Ireland (GNI), on the basis of a 65:35 split between IW and GNI. IW determined this allocation drawing on assumed cost drivers (e.g. customer numbers) for shared service centre costs at IRC1.  

For RC3, we understand that the allocation methodology is based on the approach and cost drivers employed by Irish Water at IRC2 (e.g. the respective volume of users) to derive Irish Water’s share of shared service costs.  

- **Group allocation**, a category outlined by Irish Water as critical in supporting critical business projects, shows a minor change in outturn costs relative to allowed.  

As displayed in Figure 2.10, IW proposed a significant increase in expenditure of shared service centre while maintaining group allocation expenditure constant with the 2019 allowed level.  

As discussed in section 2.1, the increase in SSC expenditure, together with the increase in TOM expenditure, offsets the marked declined in SLA costs. The increase in costs up to 2022 and subsequent decrease is consistent with the timing IW anticipates for the consolidation of IW into a single public utility.

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29  Irish Water (November 2018) Irish Water Revenue Control 3 submission, operational expenditure, look-back, p. 12; p.25  
31  IW submission in response to the Q&A
IW allowed SSC expenditure in 2019 is €25m. IW then forecasts SSC expenditure to almost triple to 2022 (c. €70 million) before declining slightly in the latter years. Group allocation is stable at €15m from 2019 up to 2024.

### 2.1.6. Irrecoverable VAT & Insurance

IW is exempt from VAT. All costs – except allocations from the Ervia Group and the shared services centre – are VAT inclusive. IW explains that the irrecoverability of VAT on these allocations is included as a separate cost.\(^{32}\) Insurance costs relate to a centralised Self-Insured Retention model of IW/LA Employer/Public Liability Policy managed through Ervia insurance program.

As displayed in Figure 2.11 below, IW forecasted both irrecoverable VAT and insurance in line with the 2019 level over all year of the RC3 period (i.e. €5m irrecoverable VAT and €17m insurance per annum).

As with the above categories, we assume these costs are invariant to the WIOF profile.

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\(^{32}\) Irish Water (November 2018) Irish Water RC3 submission, opex, look-back, p.8
2.1.7. Non-controllable costs

As previous reviews CRU designated “licences and levies” and “commercial rates” as expenditures outside Irish Water’s control:

- **Licences and levies** comprise the CRU levy and EPA licence fees for which Irish Water has limited control; and
- **Commercial rates** reflect the fees that Irish Water must pay to the local authorities. Irish Water was not required to pay these fees during IRC2.

The DHPLG confirmed IW will have to pay commercial rates over the RC3 period. In its BP submission, IW estimates commercial rates will be c.€50m p.a. over RC3. The rise in commercial rates explain the increase in non-controllable costs in 2020, shown in Figure 2.12 below.

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2.1.8. Innovation funding

In its look-forward opex submission, IW also asked CRU to extend the innovation fund which remained unused at IRC2 to RC3, and to provide an additional €4m innovation fund for RC3.34

2.1.9. Conclusions on IW’s main opex submission

IW has articulated the substantive cost pressures it faces to bring its operational performance to the level of leading European peers. It also anticipates that it can absorb these cost pressures from the implementation of a single utility, and lean utility, models, with controllable operating expenditure broadly constant over the period.

There is a clear risk from the implementation of the single utility model, with the lean utility model savings also in part dependent on the creation of a single entity. As we show, IW’s revised submission suggests that total opex could be around €3816 million over RC3 if WIOF is delayed one year, instead of €3719 if WIOF progresses as per its business plan.

The challenge to IW is whether it can go beyond absorbing upward cost pressures from its “delta opex” and other costs, and start to realise net cost savings, to ensure it continues on its path to achieve the long-run efficient level of costs.

IW operational cost plan itself does not provide benchmarking against its peers at functional levels or total cost levels, but it has submitted an accompanying report which examines its performance against peers. In the following sections, we review IW’s expected performance against its peers, including a review of IW’s own consultancy reports.

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34 IW (November 2018), Irish Water Revenue Control 3 submission, Operational Expenditure, 2020-2024 (Look forward), p.28.
2.2. Operating Expenditure Comparisons

In this section, we consider IW’s opex costs at an aggregate and unit cost level compared to UK water companies.

2.2.1. Total expenditure level comparisons

Figure 2.13 compares IW’s proposed average annual operating expenditure for water and wastewater service for the RC3 period (2020-2024) at an aggregate level with the aggregate level of UK water companies for the regulatory year 2017-2018.

**Figure 2.13: IW Annual Opex Compared to UK Water and Sewerage Companies’ Levels**

Note: All figures presented in € 2017. Opex levels relate to the 2017/2018 results. Controllable opex is calculated as: 1) IW: total opex excluding non-controllable costs, 2) E&W: total opex excluding rates, third party services, abstraction charges, statutory water softening, costs associated with Traffic Management Act, and costs associated with the Industrial Emissions Directive, 3) SW: total opex excluding costs associated with PPP schemes, charges to SEPA, rates and third party services, and 4) NIW: total opex excluding service charges, rates and third party services.

Source: NERA analysis of IW RC3 submission, Ofwat PR19 dataset, WICS regulatory accounts for Scottish Water and Northern Ireland Water Annual Information Return.

IW’s expenditure is above most of its peers, apart from United Utilities, Thames Water and Severn Trent. However, this is a crude measure of cost performance, as it does not control for the differing scale of operations. We control for differences in scale and other characteristics in our unit cost and econometric analysis in the following sections.
2.2.2. **Unit cost analysis**

We examine the performance of IW against its UK peers based on simple unit cost analysis.\(^{35}\) We construct these Figures based on IW’s business plan submission rather than the WIOF delay. In the more detailed econometric benchmarking, we show the impact of WIOF delay on Irish Water’s efficiency.

2.2.2.1. **Water service**

Figure 2.14 shows IW and UK comparator operating unit cost performance for the water service.\(^{36}\) The Figures shows that IW has made some substantive progress in the early review periods, effectively absorbing additional costs from growth and compliance through efficiencies such that overall unit costs have declined.

We cannot draw any firm conclusions on IW’s level of cost efficiency given the crudeness of these unit cost comparisons, and we fully accept that the comparison is very dependent on the selection of the cost driver, e.g. the use of length of main would show IW in a better light.

However, we can draw inferences on rates of changes. Since the introduction of incentive based regulation in 2002-2003, Scottish Water has converged on the average unit opex performance of E&W comparators.\(^{37}\) Northern Ireland Water (NIW) has undergone a similar trend of unit costs converging to the E&W average since the introduction of incentive based regulation in 2007-2008. (We discuss their performance in more detail in section 3.) By contrast, IW foresees no improvement in its comparative operating cost performance, maintaining a constant gap to the opex levels achieved in the UK.

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\(^{35}\) To help identify areas where IW’s cost submission varies relative to the performance of the mature E&W utilities and from SW and NIW, we asked IW to complete a breakdown of operating expenditure by functional area as part of its BPQ response. At this review, IW does not have the systems in place to identify functional level expenditure; this will become an important objective at future reviews.

\(^{36}\) Note: we have only been provided with data at combined service level in the BPQ response. For analytical purposes, we allocate 55 per cent of IW’s opex to the water service and 45 per cent to the sewerage service, as suggested by IW in the BPQ response.

\(^{37}\) In Figure 2.14 this is shown by the decrease in the size of the dark blue bars over time to a level comparable with the grey line representing the E&W average, which has been relatively constant in real terms over the period 2000-01 to 2009-10.
**Figure 2.14: IW Total Opex per Population Served - Water, € 2017**

Note: All figures presented in € 2017. Assumed for IW that the water service expenditure is 55 per cent of total opex. Assumed year 11 for E&W is equal to year 10 due to the lack of available directly comparable data.

Controllable opex is calculated as: 1) IW: total opex excluding non-controllable costs, 2) E&W: total opex excluding rates, third party services, abstraction charges, statutory water softening, costs associated with Traffic Management Act, and costs associated with the Industrial Emissions Directive, 3) SW: total opex excluding costs associated with PPP schemes, charges to SEPA, rates and third party services, and 4) NIW: total opex excluding service charges, rates and third party services.38

Source: NERA analysis of IW submissions, Ofwat June Returns dataset, WICS regulatory accounts for Scottish Water and Northern Ireland Water Annual Information Return.

### 2.2.2.2. Sewerage service

Figure 2.15 shows IW’s operating unit cost performance for the sewerage service.39 As with the water service, IW has made substantive progress over the early years in reducing unit costs in the face of upward cost pressure from improved compliance. Nonetheless, its unit costs are higher than all UK comparators in terms of population served, and this is also true for controllable opex. Only NIW has sewerage costs similar to IW over time.

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38 We understand that excluding SW PPP charges underestimates SW costs. Nonetheless, the nature of SW PPP agreements suggests that there is both a capex and an opex element to the PPP, while our analysis considers only opex expenditure.

39 Assuming the sewerage service is 45 per cent of IW expenditure for the combined services.
2.2.3. Functional unit cost analysis

Figure 2.16 provides an historical comparison for functional expenditure categories; IW has not been able to provide forecast data over RC3 by functional expenditure area. The analysis demonstrates some progress of Irish Water on employment costs, hired and contracted services, and materials, whereas Irish Water’s energy costs are broadly constant over time. It also suggests that IW’s employment costs and materials and consumable costs are high.

We acknowledge that the comparison of costs at disaggregated level may be distorted by differences in cost reporting and cost allocation rules, as well as the business model, e.g. balance of outsourcing relative to in-house. Therefore, we cannot draw firm conclusion based on such analysis. Indeed, Irish Water performs comparatively well on the “other controllable” cost category, which means that we have allocated a higher proportion of Irish Water’s costs to the four core functional areas than the comparators.

Note: All figures presented in €2017. Assumed for IW that the water service expenditure is 45 per cent of total opex. Assumed year 11 for E&W is equal to year 10 due to the lack of available directly comparable data. Controllable opex is calculated as: 1) IW: total opex excluding non-controllable costs, 2) E&W: total opex excluding rates, third party services, abstraction charges, statutory water softening, costs associated with Traffic Management Act, and costs associated with the Industrial Emissions Directive, 3) SW: total opex excluding costs associated with PPP schemes, charges to SEPA, rates and third party services, and 4) NIW: total opex excluding service charges, rates and third party services.  

Source: NERA analysis of IW submissions, Ofwat June Returns dataset, WICS regulatory accounts for Scottish Water and Northern Ireland Water Annual Information Return.
2.3. Econometric Modelling of Operating Costs

In this section, we review IW’s own comparative efficiency analysis and summarise our approach to econometric benchmarking. We present only a high-level summary of our methodology and results here, with full details of the modelling undertaken in Appendix A.

Sources: NERA analysis of Ofwat June returns, Scottish Water annual reports, Northern Ireland Water annual reports, and IW financial model.
2.3.1. **We rely on set of models developed at IRC2**

To inform our own assessment of IW’s costs, we have considered the approaches developed by UK regulators to assess comparative efficiency, including the econometric models developed by Ofwat at its most recent price control (PR19), as well as the UK’s Competition and Markets Authority (CMA) in its consideration of the appeal of Bristol Water’s decision of Ofwat’s PR14 price control decision. We also reviewed the models developed by the UREG in Northern Ireland in its assessment of NIW’s cost efficiency at PC15.

We have relied on the set of models that we developed at IRC2 that were based on the models developed for NIW. The main reason for not employing models employed by Ofwat at the most recent review is because Ofwat’s approach is based on “botex” (or base operating expenditure, or capital maintenance plus operating expenditure) whereas we need to specifically focus on operating cost efficiency, as per Ofwat’s approach at early price control reviews. The Ofwat models also employ cost drivers that are not available for IW. We summarise Ofwat’s approach in Appendix A, as a potential method for adoption at future reviews.

At IRC2, we developed a range of potential models to assess IW’s cost performance and we have adopted this approach at RC3. By setting out IW’s comparative performance based on a range of model specifications, our approach acknowledges that it is difficult to identify a definitive statistical model that fully explains water companies’ costs.

2.3.2. **We allow for IW specific factors, eg network length and higher wage costs**

We have been careful to investigate the impact of IW’s specific characteristics, such as its greater length of water network per connections on its comparative cost efficiency, namely, by including network length in certain model specifications. We do this even though in general, models developed by Ofwat, CMA and UREG show that connections rather than network length is the principal cost driver. For example, both total wholesale water models developed by Ofwat at PR19 use number of connections; for the disaggregated models, one of the three models uses length of mains.42,43 At PC15, UR assumed that the main cost drivers were distribution input (akin to our water delivered measure) and population (akin to our connection), and less weight was applied to mains length. 44

We also take into account IW’s higher unit labour costs relative to E&W companies, drawing on comparisons of indices of general and specialised labour costs.

We have also considered uncertainty around different approaches to the capitalisation of operating and maintenance expenditure that can affect the benchmarking results. In our

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42 Ofwat (2019) Securing cost efficiency – our approach to setting efficient cost baselines at the IAP, technical appendix 2 securing cost efficiency, p. 30

43 In relation to the optimal scale factor, Ofwat explains that: “For the aggregated wholesale water model, we use the number of households as the scale cost driver. It has a slightly better statistical fit than length of mains, it is a more intuitive cost driver of wholesale services (length of mains is not an intuitive cost driver to use for water resources and treatment), and it is more exogenous (ie it is not in management control).” Ofwat (2019) Securing cost efficiency – our approach to setting efficient cost baselines at the IAP, supplementary technical appendix, econometric approach, p.12

modelling, we assume IW has a similar approach to capitalisation as our benchmarks, but we allow for sensitivities for these results in Appendix A.

We also take into account expected growth in connections, mains and sewer length, water delivered, and load over the RC3 period. We assume growth in connections and mains of 1 per cent p.a., growth in sewer length and load of 0.5 per cent p.a., and 0 per cent growth in water delivered. For growth in water connections, where we assume growth from around 1.78 million in 2017 to 1.91 million by the end of RC3, i.e. an increase of around 130K connections, our analysis draws on connection growth data for ESB. For other elements, our forecasts are based on historical trends in the UK comparator set which shows modest growth in network length and approximately no growth in water delivered.  

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45 In the electricity sector, ESBN reports connection growth of around 18,000 households in 2018, which is higher than previous years. Source: CSO (2 February 2019), New Dwelling Completions, Quarter 4 2018. We have assumed 1 per cent connection growth for Irish Water, which provides for around 18,500 water connections and 13,000 sewerage connections per year.

46 For water network length we have assumed 1 per cent p.a. growth, and for sewerage network length we assumed 0.5 per cent p.a. These allow for expected increases in water mains from taking-in-charge of 3,000km, as well as residual network growth. Growth in network length for UK comparators is 0.3 per cent p.a. for both water and sewerage over period 2012 to 2018. Source: IW (November 2018), Irish Water Revenue Control 3 submission, operational expenditure, look-forward, p. 24. NERA analysis of Ofwat’s PR19 dataset.

47 We assume zero growth in water delivered drawing on analysis of historical trends in UK water sector companies over the period 2012 to 2018. UK companies have faced increases in connections at a similar level to our forecast for Irish Water (of around 1 per cent p.a.), while aggregate water delivered has remained broadly constant over period 2012 to 2018, explained by improvements in water efficiency and therefore static or declining per capita demand, reductions in leakage etc. For load, we have assumed 0.5 per cent p.a. growth consistent with our estimate of 0.5 per cent p.a. historical growth for UK companies.
2.3.3. We measure efficiency relative to predicted costs

We use the model results to generate predicted costs for each company, on the basis of the relationship between cost drivers and cost levels from the panel of English and Welsh companies. These modelled ranges do not represent an efficiency frontier, but represent expected cost levels based on the average performance of the E&W companies. Some companies therefore exhibit cost performance which is superior to the predicted range, while some companies exhibit cost performance above (i.e. inferior to) to the predicted range.

In UK water and energy sectors, both Ofwat and Ofgem compare companies to the upper-quartile performer, as opposed to predicted costs (which is the median company). In this respect, our approach shows IW in a more favourable light.\footnote{Under the original submission, and using the median company predicted costs, we estimate IW efficiency gap to be 20 to 32 and 40 to 52 per cent at RC3 end for the water and wastewater service, respectively. Changing the benchmarking approach to the upper quartile, as opposed to the median, would increase IW efficiency gap to around 37 to 50 per for the water service, and 48 to 61 per cent for the wastewater service. For example, see: Ofwat (2019) Securing cost efficiency – our approach to setting efficient cost baselines at the IAP, technical appendix 2 securing cost efficiency, p.11. Ofwat notes that it considers using an UQ approach “recognises imperfections of statistical analysis.”}
2.3.4. IW costs around 20 to 52 per cent higher than benchmark at end of RC3 under original submission

Our overall conclusion from the modelling exercise is that IW’s proposed RC3 operating expenditure is high compared to a benchmark level of efficient expenditure formed based on UK water and sewerage companies (hereafter referred to as modelled or predicted costs).

For the water service, we consider that a reasonable interpretation of the evidence is that IW’s opex costs are around 28 to 42 per cent higher than the benchmark level in 2019, and around 20 to 32 per cent higher than the model predicted costs by the end of RC3, i.e. taking into account IW’s proposed reductions in expenditure and expected growth in costs from increased connections etc.

If we consider the impact of a one delay in the implementation of the WIOF, IW proposed costs remain around 27 to 39 per cent higher than the model predicted costs by the end of RC3.

The analysis suggests that IW’s plan for the water service is not sufficiently stretching in reducing its costs.

**Figure 2.18: IW’s Water Service RC3 Plan Costs 20 to 32 Per Cent Higher than Benchmark at end RC3 Under Original Submission, and 27 to 39 Per Cent Higher Under WIOF Delay Scenario**

Source: NERA analysis of Ofwat’s PR19 dataset, IW submissions, WICS regulatory accounts for Scottish Water and Northern Ireland Water Annual Information Return.

Note: Models estimated using E&W data (2012-18). All UK modelled and observed costs presented in this chart correspond to 2018. All costs are in 2017 prices.

Similarly, for the waste water service, we estimate that IW’s costs are around 49 to 62 per cent higher than the model predicted costs in 2019, and 40 to 52 per cent higher at the end of
RC3, again taking into account IW’s proposed reductions in costs and expected increases in connections, sewer length and load.

The one year delay in the implementation of WIOF increases IW efficiency gap to around 48 to 61 per cent at the end of RC3.

As with the water service the analysis suggests that IW’s plan for waste water is not sufficiently stretching in reducing its costs.

Figure 2.19: IW’s Waste Water Service RC3 Plan Costs 40 to 52 Per Cent Higher than Benchmark at end RC3 Under Original Submission, and 48 to 61 Per Cent Higher Under WIOF Delay Scenario

Source: NERA analysis of Ofwat’s PR19 dataset, IW submissions, WICS regulatory accounts for Scottish Water and Northern Ireland Water Annual Information Return.
Note: Models estimated using E&W data (2012-18). All UK modelled and observed costs presented in this chart correspond to 2018. All costs are in 2017 prices. SW observed costs exclude PPP charges.

2.3.5. Summary of IW’s own comparative efficiency analysis and differences

IW commissioned CEPA to undertake a benchmarking exercise of IW’s opex costs relative to E&W company benchmarks to inform its business plan forecasts. As per the CRU’s approach at IRC1 and IRC2, CEPA employs econometric analysis to construct a model of water companies’ costs, drawing on operating cost data published by Ofwat from E&W companies. We briefly summarise CEPA’s approach and overall results, before discussing key differences in our respective approaches.

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49 CEA (9 November 2018), Benchmarking Irish Water opex, Final Report
2.3.5.1. Comparison with CEPA’s statistical modelling

CEPA reports a combined efficiency gap of around 35 to 40 per cent compared to predicted (prior to its proposed adjustment for special cost factors and other adjustments) costs drawing on its statistical modelling of Irish Water’s 2017 actual costs and RC3 business plan, a marked improvement on the 50 per cent efficiency gap for 2015 (see Table 2.1). As its starting point, the result of 35 to 40 per cent is consistent with our own average estimate of 20 to 32 per cent for the water service, and 40 to 52 per cent estimate concerning the wastewater service.

CEPA notes that the efficiency gap appears material but considers that the benchmarking results should be adjusted for special cost factors (SCF), namely, the stringent licensing conditions for treatment of sludge and sewerage, which leads to “IW’s wastewater opex efficiency gap decreasing by between 2 and 3 percentage points” or around 35 per cent in 2017, as shown in Table 2.1.

CEPA then forecasts the expected change in efficiency over time allowing for:

- **Growth in cost drivers.** CEPA allows for an increase in scale factors included in its model equal to population growth of 1 per cent.

- **Real price effect (RPE) net of on-going improvements in productivity.**

As shown below, these two adjustments result in a relatively similar adjustment to predicted costs by the end of 2024 (€29.1 million and €36.3 million for growth and RPEs respectively) by 2024, and which reduces the efficiency gap to around 17 per cent by 2024, according to CEPA. By contrast, we consider the efficiency gap lies between 20 and 32 per cent for the water service and 40 to 52 per cent for wastewater service.

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50 CEPA (9 November 2018), Benchmarking Irish Water opex, Final Report, p.7. CEPA report the efficiency gap as 1-(predicted/actual). In common with our previous approach, and the approach by GB regulators, we report the gap as (actual-predicted)/predicted. Under our approach, the efficiency gap can be interpreted a proportion of the predicted costs, e.g. IW’s costs are 40 per cent higher than the predicted or efficient level.

51 CEPA’s scale factors are length of mains, connected properties, sewer length and load. CEPA (9 November 2018), Benchmarking Irish Water opex, Final Report, p.8

52 CEPA (9 November 2018), Benchmarking Irish Water opex, Final Report, p.16
Table 2.1: CEPA predicts that IW’s costs will be 17 per cent higher than predicted by the end of RC3, based on RC3 planned opex (€m, unless stated)

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<td>Efficiency (post SCF)</td>
<td>35%</td>
<td>35%</td>
<td>34%</td>
<td>34%</td>
<td>35%</td>
<td>35%</td>
<td>33%</td>
<td>31%</td>
</tr>
<tr>
<td>Growth adjustment</td>
<td>4.1</td>
<td>8.1</td>
<td>12.3</td>
<td>16.4</td>
<td>20.6</td>
<td>24.9</td>
<td>29.1</td>
<td></td>
</tr>
<tr>
<td>RPEs adjustment</td>
<td>4.9</td>
<td>10</td>
<td>15.1</td>
<td>20.3</td>
<td>25.6</td>
<td>30.9</td>
<td>36.3</td>
<td></td>
</tr>
<tr>
<td>Predicted opex (inc growth and RPE)</td>
<td>504</td>
<td>522</td>
<td>531.5</td>
<td>545.7</td>
<td>556.4</td>
<td>567.4</td>
<td>576.6</td>
<td>583.7</td>
</tr>
<tr>
<td>Adjusted efficiency gap</td>
<td>35%</td>
<td>32%</td>
<td>29%</td>
<td>28%</td>
<td>26%</td>
<td>24%</td>
<td>20%</td>
<td>17%</td>
</tr>
</tbody>
</table>

Source: NERA analysis of CEPA (2018) Benchmarking Irish Water Opex, p.9, Table 1.3. In contrast to CEPA, we present the efficiency gap as (RC3 plan or actual minus predicted)/predicted.

2.3.5.2. CEPA’s comments on our IRC2 model specification

CEPA identify three main differences in its approach relative to the approach we undertook at IRC2 (and followed for RC3). These are:

▪ We use a composite scale variable (CSV) as our scale cost-driver, which is a weighted combination of the set of likely costs drivers (connections, mains, and throughput), whereas CEPA prefers to run models using a single scale driver for each model run, and then weights the individual model results.

▪ We excluded Irish Water from the modelling specification whereas CEPA include Irish Water.

▪ We include time-specific dummies whereas CEPA do not.

We do not agree that CEPA’s proposed changes to our modelling approach improve the accuracy of the benchmarking exercise. Overall, our IRC2 modelling approach scores better on a range of statistical test than CEPA models, according to CEPA own reported statistically tests. Our better model fit is explained by our inclusion of a CSV that allows for the fact that more than one scale driver is likely to explain companies’ costs; CEPA’s use of a single cost-drivers provides a poorer model specification because the model specifications omit important cost drivers. The better fit of our models is also related to the inclusion of time dummies which are statistically significant. The use of CSVs, and the exclusion of the

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53 For example, for the wholesale water and wastewater models, CEPA notes that NERA’s model passes all of the model performance tests whereas the set of CEPA’s models, with few exceptions, fail on one of the four test. The time specific dummies in NERA’s water and wastewater model are also strongly statistically significant. See: CEPA (9 November 2018), Benchmarking Irish Water opex, Final Report, pp. 28,30
Operating Cost Assessment

company that is the focus of the efficiency analysis in determining the model, is also commonplace.54

Like CEPA, we allow for growth in connections, mains, and water delivered or load over time. However, we do not allow for a positive RPE net of productivity, as we explain below.

Notwithstanding the differences in our modelling approach, the results using our model specification provide a broadly similar result to CEPA’s own models (before CEPA’s adjustments for special factors and RPEs).

2.3.5.3. We estimate RPEs net of productivity improvements at around zero over period

Irish Water’s revenue allowance is determined in real terms at review and indexed annually by HICP for determining actual revenues recovered from customers, and the government subvention. To the extent that Irish Water’s input prices grow at a rate that is higher or lower than the annual indexation by HICP may under or over-compensate Irish Water for the changes in costs relative to the baseline determined at review. Therefore, at review, regulators often include an allowance for input prices less expected HICP or a real price effect (RPE).55

Offsetting the increase in input prices, we expect annual improvements in productivity (i.e. a movement of the productivity frontier, in addition to Irish Water’s movement towards the efficient level of costs). The expected change in real price effects less annual improvement in productivity provides the expected net effect of how companies’ costs should change over time. The annual change is in addition to any movement of Irish Water towards its efficient level of costs or (“catch-up efficiency”).

CEPA assumes a net increase in unit costs of between 0.3 and 1.8 per cent p.a. over RC3.56 We have reviewed the expected value of real price effect less productivity improvement with respect to a review of recent regulatory decisions, as well as a review of CEPA’s proposals.

We have two main concerns with CEPA’s analysis. First, it places a very high weight (71 per cent) on its labour cost input price, which is between 1.7 and 2.3 per cent per annum.57 Taken together with other input price assumptions, this results in a high opex RPE of 1.3 to 1.8 per cent p.a. Assuming a lower weight of 50 per cent, reduces the input price assumption to between 1 and 1.3 per cent p.a.

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54 Ofgem has used CSVs at successive price control reviews for energy distribution networks. See for example, Ofgem (2014) RIIO-ED1: Final determinations for the slowtrack electricity distribution companies Business plan expenditure assessment, Appendix 5. Link: https://www.ofgem.gov.uk/ofgem-publications/91565/riio-


56 CEPA (February 2019) The impact of economic trends on Irish Water’s opex, and their evolution during RC3, p.23

Second, CEPA draws on a range of evidence for improvements in productivity, and concludes on a range of zero to 1 per cent p.a. However, other than its review of total factor productivity evidence (where it concludes a range of -0.1 to 0.4 per cent p.a.), its conclusion seems conservative relative to its own evidence (which supports a mid-point around 1 per cent p.a. improvement). Also, we consider CEPA’s analysis of total factor productivity (TFP) analysis understates the prospects for productivity improvements with evidence from comparable sectors in UK supporting higher rates of improvement of up to 1 per cent.

Recent UK water regulators’ decisions have assumed a decrease in real unit costs over time, as summarised in A.1. Correcting for the two changes identified above with CEPA’s approach, and drawing on precedent, we consider that a reasonable assumption is to assume a zero per cent increase in real unit costs net of productivity improvements, i.e. assume the two effects are broadly equal and offsetting.

2.4. Conclusions on Efficient Level of Operating Costs

To date, Irish Water has made some progress in reducing its operating costs in the face of upward cost pressure from a substantive capex programme.

However, our analysis suggests that Irish Water’s original business plan opex (i.e. assuming timely implementation of WIOF) is around 26 (range: 20 to 32) to 46 (range: 40 to 52) per cent higher than the benchmark for water and wastewater services respectively in the final year of RC3, 2024.

Irish Water forecasts relatively flat costs over the period, albeit with a slight reduction in controllable costs by the end of RC3. Taking into account growth in network length and other cost drivers, and the slight cost reduction, our analysis suggests that there is scope for further efficiency improvements over the period.

At IRC1, CRU set an average annual efficiency challenge of 7 per cent. At IRC2, CRU set an efficiency challenge of 5 per cent per annum for the first two years of IRC2 relative to the base year expenditure (i.e. a 10 per cent cumulative reduction), excluding DBOs. It also assumed a 5 per cent level of efficiency for 2019.

We recommend that CRU sets a target for improving operating cost performance of 5 per cent, on average, per annum over RC3. The evidence for this rate of change is supported by

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58 Excluding TFP analysis, CEPA’s analysis suggests a productivity improvement of around 1 per cent p.a. See: CEPA (February 2019) The impact of economic trends on Irish Water’s opex, and their evolution during RC3, Table 2.4, p.13
59 CEPA’s own TFP range also does not take into account the prospect for rationalisation of opex (labour) from greater automation of processes over time. See CEPA (February 2019) The impact of economic trends on Irish Water’s opex, and their evolution during RC3, p.13
the examples above, namely SW, NIW and UK energy networks in the early years of incentive based regulation, as discussed in section 3.

However, we recognise that there may be differences between Irish Water and these comparators which limit IW’s ability to achieve such rates at the very beginning of RC3, i.e. that Irish Water may be constrained by an operational model which impedes the cost reductions realised by the best performers elsewhere. It also has a substantive element of costs, DBOs, which in part lie outside of its control.\(^63\)

Our opex cost efficiencies are therefore based on assuming Irish Water achieves an average 4 per cent p.a. efficiency reduction from 2020 relative to the 2019 opex. We apply a 4 per cent reduction to controllable expenditure including IW’s DBO costs, which is broadly aligned with applying a 5 per cent p.a. efficiency challenge to expenditure excluding DBO costs.

In terms of profile, we recommend that CRU sets an efficiency challenge of 2 per cent in 2020 and 2021, 4 per cent in 2022, and 6 per cent in 2023 and 2024, as shown in Table 2.2 below. Our proposed efficiency profile acknowledges that IW’s efficiency savings may be lower in the initial years of RC3, due to the timing of WIOF implementation, but higher once the WIOF is fully implemented. Overall, we propose IW to reduce its controllable opex expenditure to €554.3m in 2024, from €680.5m in 2019.

### Table 2.2: Opex Projections for RC3 based on a 4 per cent Efficiency Challenge

<table>
<thead>
<tr>
<th>Opex - CRU</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>Total RC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>IW controllable opex (Original BP)</td>
<td>680.5</td>
<td>690.0</td>
<td>694.4</td>
<td>696.2</td>
<td>687.8</td>
<td>672.8</td>
<td>3441.1</td>
</tr>
<tr>
<td>IW controllable opex (WIOF Delay)</td>
<td></td>
<td>687.0</td>
<td>710.0</td>
<td>712.0</td>
<td>718.0</td>
<td>707.0</td>
<td>3534.0</td>
</tr>
<tr>
<td>NERA controllable</td>
<td></td>
<td>666.8</td>
<td>653.5</td>
<td>627.4</td>
<td>589.7</td>
<td>554.3</td>
<td>3091.8</td>
</tr>
<tr>
<td>IW non-controllable costs</td>
<td></td>
<td>55.5</td>
<td>55.5</td>
<td>55.5</td>
<td>55.5</td>
<td>55.5</td>
<td>277.5</td>
</tr>
<tr>
<td>IW total opex (Original BP)</td>
<td>745.5</td>
<td>749.9</td>
<td>751.7</td>
<td>743.3</td>
<td>728.3</td>
<td></td>
<td>3718.6</td>
</tr>
<tr>
<td>NERA total opex</td>
<td></td>
<td>722.3</td>
<td>709.0</td>
<td>682.9</td>
<td>645.2</td>
<td>609.8</td>
<td>3369.3</td>
</tr>
<tr>
<td>€m reduction, relative to IW plan</td>
<td>23.1</td>
<td>40.9</td>
<td>68.8</td>
<td>98.1</td>
<td>118.4</td>
<td></td>
<td>349.3</td>
</tr>
</tbody>
</table>

Source: NERA analysis of IW BP submission, assuming a 2 per cent efficiency challenge on controllable costs including DBO costs in 2020 and 2021, 4 per cent in 2022, and 6 per cent in 2023 and 2024.

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\(^63\) Irish Water (January 2019) RC3 Opex look-forward, presentation, slide 30. Irish Water’s analysis shows that DBO contract costs are relatively constant over RC3 until the final year 2024, where there are number of contracts of material value that expire.
3. **Expected Rates of Improvement in Opex and Capex Cost Efficiency**

In this section, we review opex and capex efficiency improvements in the early years following the establishment of incentive based regulation. We review performance by SW and NIW to date, as well as performance by UK energy networks. (There is no publicly available data on performance by E&W companies in the period following incentive based regulation in 1989.)

We draw on evidence on the rates of improvement in determining expected improvements in capex and opex and allowances, as per the preceding chapter for opex and as set out in the separate report by Jacobs in relation to capex.\(^{64}\)

**3.1. SW and NIW Improved Operating Cost Performance**

Scottish Water began operations in 2002, taking over the functions of three regional operators who in turn replaced the functions of the Scottish Regional Councils (nine mainland regions and three island areas) in 1996.\(^{65}\) In the first strategic review period, running from 2002 to 2006, the Water Industry Commissioner set SW a challenge to reduce operating expenditure by £158m below the baseline level of costs by the end of the period,\(^{66}\) equivalent to an annualised reduction of around 10 per cent. The WICS considered but ultimately decided not to apply an efficiency reduction in relation to SW’s private finance initiative (PFI) contracts, which are analogous to IW’s DBO contracts.\(^{67}\)

Evidence from WICS suggests that Scottish Water delivered reductions around £165m below the baseline, at an annualised unit cost improvement of around 11 per cent.\(^{68}\)

The WICS has updated analysis of Scottish Water’s performance to include performance in the most recent strategic review of charges (SRC09 covering 2010 to 2015).\(^{69}\) After the rapid cost reductions made in the early years post-introduction of incentive based regulation in the early 2000s, Scottish Water’s operating costs have remained relatively flat, at £296m in 2014-15 compared to £292m in 2009-10. For the period 2015-21, the Commission decided

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\(^{64}\) Jacobs (July 2019) Review of Irish Water’s RC3 Investment Plan


\(^{66}\) The WICS reports the baseline spend as £423m, from which SW was set an opex efficiency target of £158m. The implied cumulative annual rate of reduction over the SRC2002-2006 period is 11.0 per cent.

\(^{67}\) The WICS stated that “[In the 2006-10 Strategic Review of Charges], we presented analysis that suggested that customer’s bills were financing substantial and possibly excessive returns by equity holders in the PPP schemes. We therefore considered setting an efficiency target for the payments to PPP contractors. We considered that this would provide an incentive for Scottish Water to pursue opportunities with the PPP contractors to share the benefits of refinancing. A number of respondents to our methodology consultation in October 2004, including Scottish Water and Water UK along with the PPP contractors, did not consider that this was appropriate. […] We considered that these arguments had only limited merit. We did, however, consider that it would be possible to argue that we had not given sufficient notice of our intention to challenge the PPP contractors to provide better value for money for customers. We therefore decided to delay the decision about setting an efficiency target for PPP to the next regulatory control period”. Source: WICS (2005) Strategic Review of Charges 2006-10.

\(^{68}\) Cumulative Annual Efficiency Rates are NERA calculations, based on efficiency targets and outturn described in: WICS “Costs and performance report 2003-06”.

\(^{69}\) WICS (October 2015) “PERFORMANCE REPORT 2010-15”
that operating cost should be flat in real terms over the period of review. The first performance report also indicates that Scottish Water had kept expenditure below the allowance in the first year of SRC15.

As shown in Figure 3.1, SW succeeded in substantially reducing opex in the years following the introduction of regulation following the establishment of Scottish Water as a single national utility in 2002.

![Figure 3.1](image)

**Substantial Decline in SW Opex in Early Years**


A similar picture is observed in Northern Ireland Water’s operating cost performance to that observed for Scottish Water. After an initial increase in operating expenditure between 2003-04 and 2008-09, NIW achieved substantial cost reductions over the course of the first regulatory periods, PC10 and PC13. At PC10 in Northern Ireland covering the period 2010-11 to 2012-13, NIAUR set a target opex improvement of 6.5 per cent per annum against which NIW outperformed, as shown in Figure 3.2. In its PC15 determination, NIAUR allowed for a slight initial increase in costs early in the period, offset by a decline in the latter years to 2021.

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71 The 2015/16 report states that Scottish Water has made further progress, reducing costs from £288 in 2014/15 to £284 in 2015/16 on a like-for-like basis WIC (October 2016) Scottish Water’s Performance 2015-16, p. 3.

72 UREGNI (Feb 2010), “Water and Sewerage Service Price Control 2010-2013”, p.20

73 The 6.5 per cent efficiency challenge excluded the capital charge element of the private-public partnerships (PPPs). Source: UREGNI (Feb 2010), “Water and Sewerage Service Price Control 2010-2013”, p.20 footnote 3: “Efficiencies calculated on a percentage of prior year post efficiency opex (excluding PPP capital charges)”.

74 UREGNI (December 2014) “Key point briefing – Final Determination: Summary”
In its latest annual performance report, the Utility Regulators notes that NI Water’s £209m of opex spend in 2017-18 is above its regulatory allowance of £203m (in current prices), a difference of some £6m in-year, i.e. a marginal underperformance against the control.

The Utility Regulator also noted that according to it comparative benchmarking against E&W companies, NI Water closed the “efficiency gap to the frontier, or best performing comparator company, from around 49 per cent in 2007-08 to an estimated 13 per cent in 2014-15” (the latest year of efficiency results).75

Figure 3.3: The 2017/18 Performance Report Shows NIW is Underperforming Against Control

3.1.1. UK Energy Networks

We have also analysed recent data published by Ofgem that provides a full time series of opex since privatisation in 1990 which shows that opex per customer stood £51 per customer this year, compared to £154 at the time of privatisation in 1990, in real terms.

**Figure 3.4: DNO expenditure declined by 9 per cent p.a. in the first ten years following incentive based regulation**

![Graph showing DNO expenditure decline](image)

*Note: Real (RPI-deflated) 2016-17 prices. Source: Ofgem (18 December 2018), RIIO-2 Sector Specific Methodology Consultation, Electricity Distribution Data.*

This reduction came primarily in the first ten years following privatisation; from 1990 to 2000, opex per customer fell at 9 per cent per annum on average. However, despite the substantial improvements in efficiency since privatisation and the increase in costs associated with improvements in system reliability, the DNOs expect continued improvements over the current price control.76

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76 Source: Ofgem (18 December 2018), RIIO-2 Sector Specific Methodology Consultation, Electricity Distribution Data; Ofgem, RIIO-ED1 regulatory documents and supplementary files.
3.2. Capex Efficiencies

At IRC1, we reviewed the profile of capex efficiency savings made by UK water utilities. This analysis supported a potential for cost efficiencies to be achieved by IW of the order of 4 – 9 per cent per annum over the IRC2 period and out to 2021.77 In its decision, the CER’s IRC1 Decision set IW a challenge to achieve capital investment cost efficiencies of 7 per cent efficiencies per annum.78 This challenge excluded capital investments that had already been committed to under the WSIP, and capital maintenance, which we considered to be below the enduring levels and therefore not appropriate to make further reductions.

The IRC1 capital efficiency range was formed based on the performance during the first full price controls for SW and NIW:

- The target set by the WICS in SRC02 (2002/03 – 2005/06) of 8.4 per cent per annum, which SW beat by the end of the period, achieving a reduction of 9.1 per cent per annum;79
- The target set by the UREGNI, in PC10 (2010/11 – 2012/13) of 3.4 per cent per annum.80

At IRC2, CRU determined as a starting point 13.5 per cent efficiency challenge given that the investment plan costs used historical data which reflected Irish Water’s level of costs prior to the realisation of efficiencies over IRC1, followed by a 5 per cent efficiency challenge per

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77 NERA (July 2014) “IW Interim Review Assessment Prepared for the Commission for Energy Regulation (CER)”

78 CER (October 2014) “Water Charges Plan Irish Water’s Interim Revenue Review - Response to Comments and Decision Paper” CER/14/454

79 This period (2002-06) corresponds to the first full price control for SW. Cumulative annual efficiency rates are NERA calculations, based on efficiency targets and outturn described in: WICS “Costs and performance report 2003-06”.

80 This corresponds to the first full price control for NIW. UREGNI (Feb 2010), “Water and Sewerage Service Price Control 2010-2013”, p.12 give capex spending proposals from NIW and the UREGNI final determination. From baseline expenditure of £585m, UREGNI set a challenge to reduce capex to £27 over the three year review, implying a cumulative annual reduction of 3.4 per cent
annum for 2017 and 2018. This was based on a review of the following additional evidence: UREG’s determination for PC15 in Northern Ireland and the WICS determination for SRC 2016-2020 in Scotland.

**UREG PC15 Capital Efficiency Challenge**

The utility regulator set a more modest target for PC15 than had been set at PC10 (described above). Over the period 2015 to 2021, the UREG challenged NIW to meet a capital enhancement efficiency challenge of 8.9 per cent on average over the period or alternatively, with unit costs around 10.3 per cent lower by the end of the regulatory period.

The proposed reduction relates to improvements in cost efficiency, as opposed to reductions to scope for outputs that UREG considered were not well-justified.

The UREG made its efficiency challenge on the basis of a rate of catch up to cost performance based on unit cost analysis from NIW’s cost base proposals, against comparable cost base data from England and Wales (from PR09). As an appropriate rate of catch-up, the UREG asked NIW to make 75 per cent catch up to the upper quartile efficiency benchmark in year one of the six-year price control.

The UREG showed that the capital efficiency challenge set for NIW was at the upper end of efficiency challenges set around the same time, as shown in Figure 3.6.

![UREG Comparison of Average Capital Efficiencies](source: UREG PC15 Final Determination Annex L)

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WICS SRC 2016-2020 and SW Historic (SRC 2010-2015)

The WICS published a consultation note prior to its Final Determination for the 2015 Strategic Review of Charges, which summarised Scottish Water’s business plan proposed efficiencies for the period 2015-21. These amounted to 12 per cent on average for the capital enhancement programme and 16 per cent average efficiency target across all capex.83

For the period 2010 to 2015, the WICS set an average 13 per cent efficiency target for capital enhancement which Scottish Water was on track to achieve.84

UK historical evidence

Reports commissioned by Ofwat have shown historically that standard costs for the water and sewerage industry have exhibited decreasing unit rates from price control to price control over the 15 year period from PR94 to PR09 of around 10-20 per cent at each successive price control.85

3.3. Conclusions on Efficiencies for RC3

3.3.1. Opex

At IRC1, CRU set an average annual efficiency challenge of 7 per cent.86 At IRC2, CRU set an efficiency challenge of 5 per cent per annum for the first two years of IRC2 relative to the base year expenditure (i.e. a 10 per cent cumulative reduction), excluding DBOs.87 It also assumed a 5 per cent level of efficiency for 2019.88

For RC3, we recommend that CRU sets a target for improving operating cost performance of 5 per cent per annum over RC3, excluding DBO costs, and this is the basis for our proposed levels of cost improvements set out in 2.4. The evidence for this rate of change is supported by the examples above, namely SW, NIW and UK energy networks in the early years of incentive based regulation, which all achieved improvements materially above the 5 per cent that we recommend for IW for RC3. However, we recognise that there are differences between IW and these comparators which limit IW’s ability to achieve such rates at the very beginning of RC3, i.e. that Irish Water may be constrained by an operational model which impedes the cost reductions realised by the best performers elsewhere. It also has a substantive element of costs, DBOs, which in part lie outside of its control.89

3.3.2. Capex

For IRC2, a 13.5 per cent efficiency challenge was applied as a starting point to uncommitted capital expenditure. A 5 per cent p.a. cumulative efficiency challenge was applied for each of

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83 WICS (January 2014) “Note 21: Scottish Water’s draft business plan: Enhancement expenditure”
the years of 2017 and 2018 on uncommitted capital expenditure. For projects the efficiency challenge applied was dependent on the year in which the project was deemed to become committed. No efficiency challenge was applied to capital maintenance or Irish Water’s network extension programmes.90

To inform our RC3 approach in setting a cost efficiency target for Irish Water, we have reviewed cost efficiency improvements for water companies at comparable stages, namely, Northern Ireland Water, Scottish Water), and English and Welsh companies. We have also reviewed Irish Water’s own expected cost efficiencies over the period 2017-21.

In terms of comparative performance, Scottish Water was required to deliver a 13.0 per cent improvement in capex efficiency target on average over the 2010-2015 period. The NI Utility Regulator required NIW to achieve an average improvement of around 9 per cent over the period 2015-21. Evidence from England and Wales, as explained in Section 3.2, suggests that unit costs declined by at least 10 per cent in earlier review periods.

Drawing on this evidence and our review of Irish Water’s plan, we have assumed a 3 per cent p.a. efficiency improvement which provides for an approximate 8 per cent improvement on average over the RC3 period, in line with evidence for water companies at comparable stages of development. We have applied these efficiencies, assuming a 3 per cent improvement p.a. on a compound basis, to non-committed expenditure only (which explains why a 3 per cent annum improvement corresponds to an approximate 8 per cent on average over RC3). The implied cost allowance are set out in the separate report reviewing IW’s capital investment plan.91


91 Jacobs (July 2019) Review of Irish Water’s RC3 Investment Plan
4. **Updating the Regulatory Asset Base and Depreciation**

4.1. **Summary of Approach at IRC1 / IRC2**

At IRC1 and IRC2, NERA recommended IW’s capital expenditure to be depreciated based on the expected economic life of assets.\(^{92}\) Our recommended asset categories and lives were based on Ofwat’s classification for non-infrastructure assets,\(^{93}\) and an assumption of 100 years for the asset lives of infrastructure assets, as shown in the Table below.\(^{94}\)

**Figure 4.1: For IRC1 and IRC2, recommended asset lives based on approach in other jurisdictions**

<table>
<thead>
<tr>
<th>Category</th>
<th>Asset life range</th>
<th>Depreciation asset life</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Short</td>
<td>0-5 years</td>
<td>5 years</td>
</tr>
<tr>
<td>Short</td>
<td>6-15 years</td>
<td>10 years</td>
</tr>
<tr>
<td>Medium</td>
<td>16-30 years</td>
<td>20 years</td>
</tr>
<tr>
<td>Medium-long</td>
<td>31-50 years</td>
<td>40 years</td>
</tr>
<tr>
<td>Long</td>
<td>50+ years</td>
<td>60 years</td>
</tr>
<tr>
<td>Land</td>
<td>infinite</td>
<td>Not depreciated</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>100+ years</td>
<td>100 years</td>
</tr>
</tbody>
</table>

*Source: NERA (July 2014), IW Interim Review Assessment, p.87.*

For the capital expenditure allocation across these classes, we proposed IW’s new capex to be allocated in accordance with the actual nature of the capex spent (i.e. consistent IW’s proposed allocations). In the absence of IW data for the actual allocation, we based our proposal on analysis of the asset mix for comparable utilities, namely Northern Irish and Scottish Water.\(^{95}\)

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\(^{92}\) At the time, this recommendation was aligned with the one adopted by water regulators in the UK. NERA (July 2014), IW Interim Review Assessment, p.86.

\(^{93}\) June return reporting requirements and definition manual 2010, Chapter 34, p.2.

\(^{94}\) At PR09, below-ground assets were depreciated through a renewals accounting approach instead of regulatory accounts. Under renewals accounting, the effective depreciation charge was set equal to a 15-year average of infrastructure renewals expenditure (based on 5 years historical data and 10 years forecast).

\(^{95}\) The averages reflect: NIW average capex allocation per category over 2011/12 to 2014/15 (UREGNI PC13 financial model), and SW average capex allocation from 2008/09 to 2014/15 (WICS PC10 financial model).
For the opening RAB allocations, CRU principally relied on estimates of economic lives provided by IW. For metering assets, and because NIW and SW did not include substantive metering expenditure in their financial models, we followed other regulatory precedent\(^\text{96}\) and assumed a weighted average of “long” and “short/medium” lives, with weights of 45:55 respectively.\(^\text{97}\)

### 4.2. IW Proposed Changes at RC3

For RC3, IW proposes to broadly retain the existing depreciation arrangements for capital costs incurred over the previous review periods (“Status Quo +”), but adopt “alternative asset categories” for expenditure from RC3, i.e.

- **Status Quo+** approach: applied to depreciation of opening RAB and RAB additions over IRC1 and IRC2, and
- **Alternative Asset Categories** approach: applied to future RAB additions from the start of the RC3 period onwards.\(^\text{98}\)

#### Proposed changes to depreciation for opening RAB and IRC1&2 RAB additions

For the Status Quo+, IW proposes a revision to asset lives for the remaining metering and establishment assets to reflect more closely actual asset lives. For the other asset categories, IW considers the existing approach provides a reasonable representation of the actual asset lives.\(^\text{99}\)

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\(^{96}\) Based on the depreciation of infrastructure assets in the water and wastewater industry – this is the level of detail provided in the report. NERA (July 2014), IW Interim Review Assessment, p.87.

\(^{97}\) NERA (September 2016), IW IRC2 (2017-2018) Look Forward Submission Assessment, p.88.

\(^{98}\) IW, Draft Depreciation Methodology Submission, pp.15-19.

In IW view, the current methodology does not include asset categories reflective of the nature of the assets. However, IW does not suggest the application of the new approach to the opening RAB back to IRC1 due to the low level of detail for the information available.

Ofwat also changed its approach at PR14 (to be maintained at PR19). Ofwat’s current approach is a totex approach to cost recovery, with companies proposing how they should recover totex.

\(^{99}\) IW, Draft Depreciation Methodology Submission, p.15.
Specifically, for metering IW proposes two assets lives of 15 and 50 years with expenditure allocations of 30 and 70 per cent respectively, which has the effect of extending the average asset life compared to the current approach.\(^\text{100}\) IW has explained to us that the short asset life assumption relates to the meter itself, and the longer asset life to the boundary box, and the 30:70 allocation reflects its estimate of relative expenditure shares.\(^\text{101}\)

For establishment expenditure, IW proposes to extend the asset life assumptions such that the expenditure is depreciated over a longer-time period.\(^\text{102}\)

In both instances, IW does not propose any retrospective adjustments made to the depreciation charge in allowed revenues to the end of IRC2. Instead, it proposes that the asset lives and expenditure shares will be adjusted for RC3 onwards.\(^\text{103}\)

The proposed changes under “Status Quo” will apply to both the opening RAB, as well as expenditure capitalised over IRC1 and IRC2. IW’s proposed changes result in a moderate extension to the average asset life, and therefore lower depreciation charges and customer bills over RC3.

**Table 4.1: IW Proposed Asset Lives Mix for IRC1&2 RAB Additions: Slight Extension to Asset Lives**

<table>
<thead>
<tr>
<th></th>
<th>Current approach</th>
<th>Proposed approach</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Asset lives</td>
<td>Allocation</td>
</tr>
<tr>
<td>Very short</td>
<td>5 years</td>
<td>5%</td>
</tr>
<tr>
<td>Short</td>
<td>10 years</td>
<td>7%</td>
</tr>
<tr>
<td>Medium</td>
<td>20 years</td>
<td>23%</td>
</tr>
<tr>
<td>Medium-Long</td>
<td>40 years</td>
<td>0%</td>
</tr>
<tr>
<td>Long</td>
<td>60 years</td>
<td>19%</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>100 years</td>
<td>46%</td>
</tr>
</tbody>
</table>

*Source: NERA analysis of IW (November 2018) RC3, Depreciation methodology submission, Table 9, p.16*

### Proposed changes to future RAB additions

For the RC3 investment plan, IW considers that detailed information on the asset mix and asset lives are available. IW’s proposals are based on a review of the expected expenditure as well as a comparison of asset lives to the approach adopted by other water companies, such as Affinity Water and Northern Ireland Water.\(^\text{104}\)

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\(^{100}\) IW, Draft Depreciation Methodology Submission, pp.16-17.

\(^{101}\) Irish Water response to business plan Q&A.

\(^{102}\) IW, Draft Depreciation Methodology Submission, p.16

\(^{103}\) IW, Draft Depreciation Methodology Submission, p.16

\(^{104}\) IW, Draft Depreciation Methodology Submission, p.20
Table 4.2: IW’s Proposed Asset Life Mix for RC3 Capex

<table>
<thead>
<tr>
<th>Asset Type</th>
<th>Asset Lives</th>
<th>Average Allocation Plan 2020-2024</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater Network – Foul Sewer</td>
<td>100</td>
<td>18.4%</td>
</tr>
<tr>
<td>Wastewater Network Overflow Chamber</td>
<td>100</td>
<td>0.4%</td>
</tr>
<tr>
<td>Wastewater Outfall</td>
<td>100</td>
<td>0.7%</td>
</tr>
<tr>
<td>Wastewater Pumping Station</td>
<td>55</td>
<td>3.2%</td>
</tr>
<tr>
<td>Wastewater Treatment Plant</td>
<td>55</td>
<td>22.8%</td>
</tr>
<tr>
<td>Water Abstraction Point and Inlet Works</td>
<td>55</td>
<td>0.3%</td>
</tr>
<tr>
<td>Water Mains</td>
<td>100</td>
<td>19.8%</td>
</tr>
<tr>
<td>Water Network Pumping Station</td>
<td>65</td>
<td>1.6%</td>
</tr>
<tr>
<td>Water Network Storage – Reservoir</td>
<td>90</td>
<td>5.1%</td>
</tr>
<tr>
<td>Water Treatment Plant</td>
<td>65</td>
<td>17.2%</td>
</tr>
<tr>
<td>Laboratories</td>
<td>35</td>
<td>0.2%</td>
</tr>
<tr>
<td>Metering</td>
<td>15</td>
<td>1.8%</td>
</tr>
<tr>
<td>Telemetry &amp; Scada</td>
<td>15</td>
<td>0.9%</td>
</tr>
<tr>
<td>First Fix</td>
<td>15</td>
<td>1.0%</td>
</tr>
<tr>
<td>Others (Fleet, Facilities, Business change &amp; IT)</td>
<td>10</td>
<td>5.5%</td>
</tr>
<tr>
<td>HSQE (part of F&amp;F as per CIP output)</td>
<td>7</td>
<td>0.5%</td>
</tr>
<tr>
<td>WIOF</td>
<td>25</td>
<td>0.6%</td>
</tr>
</tbody>
</table>


4.2.1. Our View on Irish Water’s Proposals

IW has proposed to adjust the assumed asset lives, number of asset categories, and allocated expenditure for RC3, based on its more detailed understanding of its assets and expected capital expenditure. By contrast, at IRC1 and IRC2, asset lives and expenditure shares were based on evidence from the capital programmes for Northern Ireland Water and Scottish Water. IW considers that its approach will more closely align the costs that are recovered from customers to the expected operational lifetime of the asset.

We agree with IW’s proposals to more closely align the assumed asset lives and therefore recovery of capital costs (depreciation charge) with the assumed useful economic life of the asset. This ensures that charges to consumers more closely reflect the economic costs of service provision, which promotes intergenerational equity.

As Irish Water notes, there is no uniform approach in comparable sectors but the same broad principle applies (to align asset lives with useful economic lives). For example, Ofwat defines the depreciation charge (or RCV run-off rate) as the “economic value of capitalised expenditure expensed to the profit and loss account”. It also notes that the run-off rate can be interpreted as follows: “an equivalent re-investment […] required to maintain assets in steady-state”.\(^{105,106}\) We understand from Irish Water that its proposed approach brings the asset life

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105 Ofwat (July 2017) Delivering Water 2020: Consulting on our methodology for the 2019 price review, pp. 222

106 Similarly, in energy, Ofgem has determined run-off rates or depreciation charges based on estimated “economic asset lives” as opposed to statutory accounting charges. Ofgem (March 2011) Decision on strategy for the next transmission and gas distribution price controls - RIIO-T1 and GD1 Financial issues. Link: [https://www.ofgem.gov.uk/ofgem-publications/53838/t1decisionfinance.pdf](https://www.ofgem.gov.uk/ofgem-publications/53838/t1decisionfinance.pdf)
assumptions closer to the statutory accounting lives, but the proposed approach is not equivalent to the statutory treatment; rather IW has drawn on useful economic lives as the basis for its recommendations.

Finally, we also understand from discussions with IW that the overall effect is to extend asset lives relative to the current arrangements resulting in a lower relative depreciation charge, and therefore allowed revenues will be lower under RC3 than they would be otherwise. (However, of course, there is no impact on the present value of revenues recovered over time from these changes.)
Appendix A. Opex Comparative Efficiency Benchmarking

A.1. Data sources and variables used


For Irish Water (IW), Scottish Water (SW) and Northern Ireland Water (NIW), we have collected the corresponding comparable data from publicly available sources for each of the variables in our models. The data used for IW is based on the RC3 business plan submission. Table A.3 and Table A.4 summarise the mapping across jurisdictions between each of the variables used in the RC3 models.
Table A.3: Data Sources of the Variables Used in the RC3 Models - Water Service

<table>
<thead>
<tr>
<th>England and Wales</th>
<th>Scottish Water</th>
<th>Northern Ireland Water</th>
<th>Irish Water</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost variable</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wholesale water total operating expenditure <strong>minus</strong> abstraction charges/discharge content, business rates, third-party services, statutory water softening and costs associated with Traffic Management Act <strong>minus</strong> renewals in infrastructure and non-infrastructure (£m)</td>
<td>Wholesale total operating expenditure <strong>minus</strong> service charges to SEPA, local authority rates and third-party services (£m) (Regulatory Accounts, Table M18 W)</td>
<td>Wholesale total operating expenditure <strong>minus</strong> service charges, rates and third-party services (£m) (Annual Information Return, Table 21)</td>
<td>[Total operating expenditure <strong>minus</strong> Licenses &amp; Levies and VAT (£m)] x 0.55 (assumed water – sewerage split at 55:45)(^{108}) (BPQ, Tab &quot;6.3 Opex_activities&quot;; VAT figures from FE (2016))(^{109})</td>
</tr>
<tr>
<td><strong>Cost Drivers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water Delivered (Ml/day) (Ofwat PR19 dataset)</td>
<td>Net Distribution input treated water (Ml/day) (Annual Returns, Table A2.6)</td>
<td>Water delivered (potable) (Ml/day) (Annual Information Return - Table 10)</td>
<td>Total potable water delivered (Ml/day) (BPQ, Tab &quot;5.1.BusAss&quot;)</td>
</tr>
<tr>
<td>Household and non-household connected properties at year end (000s) (Ofwat PR19 dataset)</td>
<td>Total number of connected Properties (Annual Returns, Table A1.10)</td>
<td>Total connected properties at year end (Annual Information Return - Table 46)</td>
<td>Household and non-household connected properties (BPQ, Tab &quot;5.1.BusAss&quot;)</td>
</tr>
<tr>
<td>Total length of potable mains as at 31 March (km) (Ofwat PR19 dataset)</td>
<td>Total length of mains (km) (Annual Returns, Table E6.16)</td>
<td>Total length of mains (km) (Annual Information Return - Table 46)</td>
<td>Total Length of Mains (km) (BPQ, Tab &quot;5.1 BusAss&quot;)</td>
</tr>
<tr>
<td>Regional average wage SOC2 (£/h) (Ofwat PR19 and PR14 datasets, based on ONS)</td>
<td>Real Regional Wage (£/h) (NERA calculation based on ONS data. See further details below)</td>
<td>Real Regional Wage (£/h) (NERA calculation based on ONS data. See further details below)</td>
<td>Real Regional Wage (£/h) (NERA calculation based on CSO data. See further details below)</td>
</tr>
<tr>
<td>Water Treatment Works (Nr) (Ofwat PR19 dataset)</td>
<td>Total number of works - Water (Nr) (Annual Returns, Table E4.25)</td>
<td>Water Treatment Works (Nr) (NIW Annual Report)</td>
<td>Water Treatment Plants (Nr) (IW response to CEPA data request)</td>
</tr>
<tr>
<td>Average Pumping Head (m.hd) (Ofwat PR19 dataset)</td>
<td>Avg. Pumping Head – Resources and Treatment + Avg. Pumping Head – Water Distribution (m.hd) (Annual Returns, Tables E4.14 and E6.25)</td>
<td>Average Pumping Head (m.hd) (Annual Information Return)</td>
<td>Energy Proxy (m.hd) / Distribution Input (Ml/day) (IW Opex Benchmarking 2016, Exhibit 9; BPQ, Tab &quot;5.1 BusAss&quot;)</td>
</tr>
</tbody>
</table>

Source: NERA analysis of various sources (see cells in table).

\(^{108}\) We understand that in the UK, water companies’ VAT costs are recoverable and, for this reason, reported costs exclude VAT. Therefore, in order to put all opex levels into comparable terms, we also exclude VAT from IW’s submitted opex.

### Table A.4: Data Sources of the Variables Used in the RC3 Models - Sewerage Service

<table>
<thead>
<tr>
<th>England and Wales</th>
<th>Scottish Water</th>
<th>Northern Ireland Water</th>
<th>Irish Water</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cost variable</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wholesale water total operating expenditure <em>minus</em> business rates, third-party services, costs associated with Traffic Management Act and Industrial Emissions Directive <em>minus</em> renewals in infrastructure and non-infrastructure (£m)</td>
<td>Wholesale total operating expenditure <em>minus</em> costs of PPP schemes, service charges to SEPA, local authority rates and third-party services (£m)</td>
<td>Wholesale total operating expenditure <em>minus</em> service charges, rates and third-party services (£m)</td>
<td>[Total operating expenditure <em>minus</em> Licenses &amp; Levies and VAT (£m)] x 0.45 (assumed water – sewerage split at 55:45)(^{110}) (BPQ, Tab “6.3 Opex_activities”; VAT figures from FE (2016))(^{111})</td>
</tr>
<tr>
<td>(Ofwat PR19 dataset)</td>
<td>(Regulatory Accounts, Table M18 WW)</td>
<td>(Annual Information Return, Table 22)</td>
<td></td>
</tr>
<tr>
<td><strong>Cost Drivers</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total load received by Sewage Treatment Works (kg BOD/day)</td>
<td>Total load (kg BOD/day)</td>
<td>Total load entering sewerage syst. (to BOD/yr)</td>
<td>Load received at sewage treatment works (kg BOD/day)(^{112})</td>
</tr>
<tr>
<td>(Ofwat PR19 dataset)</td>
<td>(Annual Returns, Table E7.31)</td>
<td>Converted into kg BOD/day by multiplying by the SW’s average (2009-13) ratio between Total Load (kg BOD/day – Table E7.31) and Total Load (tonnes BOD/yr – Table A3.21).</td>
<td>(BPQ, Tab “5.1.BusAss”)</td>
</tr>
<tr>
<td>Household and non-household properties billed for sewerage, and void properties (000s)</td>
<td>Total number of connected properties (000s)</td>
<td>Total connected properties (000s)</td>
<td>Household and non-household connected properties (000s)</td>
</tr>
<tr>
<td>(Ofwat PR19 dataset)</td>
<td>(Annual Returns, Table A1.21)</td>
<td>(Annual Information Return – Table 17a)</td>
<td>(BPQ, Tab “5.1.BusAss”)</td>
</tr>
<tr>
<td>Total length of legacy public sewers as at 31 March (km)</td>
<td>Total length of sewer (km)</td>
<td>Total length of sewer (km)</td>
<td>Length of sewers (km)</td>
</tr>
<tr>
<td>(Ofwat PR19 dataset)</td>
<td>(Annual Returns, Table E7.8)</td>
<td>(Annual Information Return – Table 46)</td>
<td>(BPQ, Tab “5.1.BusAss”)</td>
</tr>
<tr>
<td>Regional average wage SOC2 (£/h)</td>
<td>Real Regional Wage (£/h)</td>
<td>Real Regional Wage (£/h)</td>
<td>Real Regional Wage (£/h)</td>
</tr>
<tr>
<td>(Ofwat PR19 and PR14 datasets, based on ONS)</td>
<td>(NERA calculation based on ONS data. See further details below)</td>
<td>(NERA calculation based on ONS data. See further details below)</td>
<td>(NERA calculation based on CSO data. See further details below)</td>
</tr>
<tr>
<td>Wastewater Treatment Works (Nr)</td>
<td>Number of Sewage Treatment Works (Nr)</td>
<td>Number of Sewage Treatment Works (Nr)</td>
<td>Wastewater Treatment Plants (Nr)</td>
</tr>
<tr>
<td>(Ofwat PR19 dataset)</td>
<td>(Annual Returns, Table E7.30)</td>
<td>(Annual Information Return – Table 15)</td>
<td>(IW response to CEPA data request)</td>
</tr>
</tbody>
</table>

*Source: NERA analysis of various sources (see cells in table).*

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110 See footnote 108.


112 The units indicated in IW’s BPQ are tonnes BOD/year, instead of Kg BOD/year. However, given its scale, we consider that the value only makes sense if it is expressed in Kg BOD/year, and therefore assume a mistake in the units given.
Constructing E&W controllable costs

To estimate E&W controllable costs, we follow Ofwat’s approach at PR19, described in Table A.3 and Table A.4.113 For the modelling dataset, we also remove from controllable costs the costs of renewals in infrastructure and non-infrastructure in each year because companies’ reported expenditures on renewals has changed over time with the change to accounting practices, i.e. six out of ten WaSCs only start reporting renewals costs as an identifiable operating cost item from 2016 onwards. We add the renewal costs later as a post modelling adjustment.

We calculate E&W controllable costs (excluding renewal costs) in 2017 prices, using the CPIH adjustment provided by Ofwat in the PR19 dataset. After the price adjustment, E&W costs relate to the financial year covering March 2016 to April 2017.

Since IW financial year starts covers the period from January 2017 until the end of December 2017, we inflate E&W costs from March 2016 to January 2017. This financial year adjustment aligns the E&W financial year (previously from April to March) with IW regulatory period (January to December).114

Constructing the regional wage indices

For E&W data, we use the regional average wage (SOC2) provided in the PR19 dataset.115 In the absence of a detailed methodology for Ofwat’s PR19 regional wage calculations, we use IW, SW and NIW relative wage indices as per our estimates at IRC2.116 We calculate the regional wage adjustments using the IRC2 wage ratios and the updated proportion of labour costs.

A.2. Summary statistics of key driver variables

In Table A.5 we present summary statistics of Irish Water’s operations alongside UK comparator statistics.117 The bars on the right-side show IW in green, and the England and Wales average in light blue. We note that IW is a relative outlier in the following respects:

- IW’s water mains length is 30 per cent higher than the closest comparator in the UK (Scottish Water);
- IW’s water property density (connected properties / mains length) is lower than all UK comparators, although relatively close to Northern Ireland Water’s density;
- IW’s number of water treatment works is more than three times higher than the closest UK comparator (Scottish Water);

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113 Ofwat (January 2019), Supplementary technical appendix: Econometric approach, pp.10 and 18.
114 To equate E&W costs with Irish Water’s financial year, i.e. inflating E&W costs from April to December, we use a 1.1 per cent inflation. ONS (13 February 2019), CPIH Annual Rate 00: All Items 2015=100. Link: https://www.ons.gov.uk/economy/inflationandpriceindices/timeseries/l55o/mm23
116 We define a wage ratio as, for example, (IW average regional wage)/(E&W average regional wage). For E&W predicted costs adjustment we use the regional average wage provided in the PR19 dataset, as it will be on a comparable basis for all E&W companies.
117 Note that this chart shows comparable data for UK WASCs only, which are most comparable to IW.
IW’s leakage as a proportion of distribution input is 50 per cent higher than the closest comparator in the UK (Northern Ireland Water); 118

The regional wage we have constructed for Ireland and Scotland appears to be well above the UK average.119

### Table A.5: IW and UK Comparator Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>E&amp;W Ave</th>
<th>E&amp;W Min</th>
<th>E&amp;W Max</th>
<th>SW</th>
<th>NIW</th>
<th>Irish Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Connections (000)</td>
<td>2,126</td>
<td>612</td>
<td>3,790</td>
<td>2,652</td>
<td>852</td>
<td>1,782</td>
</tr>
<tr>
<td>Water Population Served (000)</td>
<td>4,400</td>
<td>1,179</td>
<td>9,494</td>
<td>5,122</td>
<td>1,862</td>
<td>4,395</td>
</tr>
<tr>
<td>WW Connections (000)</td>
<td>2,480</td>
<td>734</td>
<td>5,795</td>
<td>2,652</td>
<td>852</td>
<td>1,257</td>
</tr>
<tr>
<td>WW Population Served (000)</td>
<td>5,838</td>
<td>1,748</td>
<td>14,574</td>
<td>4,919</td>
<td>1,537</td>
<td>3,201</td>
</tr>
<tr>
<td>Mains Length (km)</td>
<td>28,769</td>
<td>11,895</td>
<td>47,055</td>
<td>48,480</td>
<td>26,778</td>
<td>63,000</td>
</tr>
<tr>
<td>Water Property Density (Nr/km)</td>
<td>72</td>
<td>51</td>
<td>121</td>
<td>55</td>
<td>32</td>
<td>28</td>
</tr>
<tr>
<td>Sewer Pipes (km)</td>
<td>32,982</td>
<td>10,985</td>
<td>68,871</td>
<td>51,199</td>
<td>15,625</td>
<td>25,000</td>
</tr>
<tr>
<td>WW Property Density (Nr/km)</td>
<td>75</td>
<td>60</td>
<td>89</td>
<td>52</td>
<td>55</td>
<td>50</td>
</tr>
<tr>
<td>Water Treatment Works (Nr)</td>
<td>84</td>
<td>34</td>
<td>142</td>
<td>245</td>
<td>23</td>
<td>790</td>
</tr>
<tr>
<td>WW Treatment Works (Nr)</td>
<td>635</td>
<td>351</td>
<td>1,138</td>
<td>1,848</td>
<td>1,021</td>
<td>1,106</td>
</tr>
<tr>
<td>Average Pumping Head (m hd)</td>
<td>133</td>
<td>73</td>
<td>164</td>
<td>59</td>
<td>120</td>
<td>77</td>
</tr>
<tr>
<td>Water Delivered (Ml/d)</td>
<td>987</td>
<td>283</td>
<td>2,152</td>
<td>1,785</td>
<td>446</td>
<td>900</td>
</tr>
<tr>
<td>Usage (Ml/property per day)</td>
<td>0.46</td>
<td>0.41</td>
<td>0.57</td>
<td>0.67</td>
<td>0.52</td>
<td>0.51</td>
</tr>
<tr>
<td>Leakage/DI (proportion)</td>
<td>0.21</td>
<td>0.17</td>
<td>0.26</td>
<td>0.28</td>
<td>0.29</td>
<td>0.45</td>
</tr>
<tr>
<td>Sewage Load (Kg BOD/day)</td>
<td>391,018</td>
<td>106,188</td>
<td>960,572</td>
<td>225,902</td>
<td>73,294</td>
<td>321,015</td>
</tr>
<tr>
<td>Area Served (km²)</td>
<td>14,141</td>
<td>7,383</td>
<td>22,649</td>
<td>80,077</td>
<td>14,130</td>
<td>70,274</td>
</tr>
<tr>
<td>Water Regional Wage (£/h)</td>
<td>14.98</td>
<td>14.30</td>
<td>16.80</td>
<td>16.77</td>
<td>14.77</td>
<td>17.26</td>
</tr>
<tr>
<td>Wastewater Regional Wage (£/h)</td>
<td>14.96</td>
<td>14.41</td>
<td>16.66</td>
<td>16.77</td>
<td>14.77</td>
<td>17.26</td>
</tr>
</tbody>
</table>

Note: we have converted IW regional wage into GBP pounds per hour using the OECD’s Purchasing Power Parities (PPP) for private consumption (discussed below).

Source: NERA analysis of Ofwat PRI4 dataset, August Submissions, Regulatory Accounts and IW’s BPQ response.

Table A.6: Correlations between Explanatory Variables used in IRC2 Modelling

Water Service Table A.6 and Table A.7 show (for the water and sewerage service respectively) the variables for which we have data available for all companies, and which we initially considered potentially relevant explanatory variables for econometric cost models. The tables present the correlation between the explanatory variables. For both services, the three first explanatory variables are highly correlated. This is not surprising, as they are all variables that measure the scale of activity undertaken. This high degree of multicollinearity

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118 We did not include this variable in any of the IRC2 econometric models and we continue to not include this variable in the RC3 models.

119 As discussed in Section A.1, the new Ofwat regional average wage is below the one calculated at PR14. We therefore retain the average wage differential estimated at IRC2 (between SW, NIW, and IW relative to E&W) to control for Ofwat’s change in approach for calculating the average regional wage between PR14 and PR19.
can lead to instability in model coefficients for correlated variables, and we consider alternative model specifications to address this concern below.

Table A.6: Correlations between Explanatory Variables used in IRC2 Modelling Water Service

<table>
<thead>
<tr>
<th></th>
<th>Water delivered</th>
<th>Connections</th>
<th>Mains length</th>
<th>WTW</th>
<th>Avg. pumping head</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water delivered</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connections</td>
<td>0.980</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mains length</td>
<td>0.861</td>
<td>0.930</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WTW</td>
<td>0.624</td>
<td>0.675</td>
<td>0.754</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Avg. pumping head.</td>
<td>-0.340</td>
<td>-0.353</td>
<td>-0.307</td>
<td>-0.168</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Source: NERA analysis of Ofwat’s PR19 dataset.

Table A.7: Correlations between Explanatory Variables used in IRC2 Modelling Sewerage Service

<table>
<thead>
<tr>
<th></th>
<th>Water delivered</th>
<th>Connections</th>
<th>Sewers length</th>
<th>WW TW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Load (kg BOD5)</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Connections</td>
<td>0.997</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewers length</td>
<td>0.969</td>
<td>0.979</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>WW TW</td>
<td>0.092</td>
<td>0.119</td>
<td>0.289</td>
<td>1.000</td>
</tr>
</tbody>
</table>

Source: NERA analysis of Ofwat’s PR19 dataset.

A.3. Methodology

At RC3, we followed our previous approach to draw on the data available from E&W water and sewerage companies which have been subject to incentive based regulation for more than twenty years and provide a benchmark for efficient cost performance which IW should achieve over time. We then use the results of the econometric models estimated drawing on E&W companies to predict the efficient level of costs should be for each company, including for Scottish Water and Northern Ireland Water.

A.3.1. The Composite Scale Variable

Given the concerns around multicollinearity of the scale variables shown by the summary statistics for the current dataset in Section A.2, we have developed models which draw on a composite scale variable (CSV). The CSV provides a single driver that combines various different scale variables into a single scale variable and is a way of mitigating multicollinearity concerns in subsequent regressions. This method has been used by a number of utility regulators, including Ofgem and UREGNI.120

120 Ofgem (2014) “RIIO-ED1: Final determinations for the slow-track electricity distribution companies”, Appendix 5
In creating the CSV, we follow Ofgem’s methodology at RIIO-ED1, by combining the different scale variables using a weighted geometric mean. For example, for the water service the CSV takes the form:121

\[ CSV = (\text{Water Delivered})^{w_1} \times (\text{Connected Properties})^{w_2} \times (\text{Mains Length})^{w_3}, \]

where \( w_1, w_2 \) and \( w_3 \) are weightings on each of the scale variables.

Broadly, the weights can be interpreted as the relative importance of each of the scale factors in the CSV, and in all cases the weights sum to 1. We consider a range of weights informed by other regulators’ approaches to determining the relevant cost driver, as we discuss below.

**A.3.2. Regional Wage Adjustment**

Regional differences in wage levels may drive differences in company costs for companies operating in different regions. To the extent that these wage differentials are outside of the companies’ control, this should be accounted for in comparative efficiency analysis. There are two possible approaches to making such an adjustment:

- Off-model adjustments as adopted by Ofgem in RIIO-ED1122 and RIIO-GD1,123 by UR in PC15,124 and by the CC in the 2014 NIE decision.125
- Including regional wage as an explanatory variable in the econometric models, as implemented by Ofwat in PR14.126

We favour the first of these approaches which involves scaling costs up or down in order to improve comparability across companies before conducting cost benchmarking. This approach has been commonly adopted by regulators, and has the advantage that it avoids any risks of statistical bias in the estimation of the regional wage effect.127

**Step 1: Calculate regional wage indices**

The first step in this procedure is to calculate an index that provides, for each year and company, the ratio between the average wage in England and Wales in that year and the regional wage in that company. This implies that if, for example, a company’s regional wage equals 95 per cent of the E&W average, that company’s index is 1.053 (1.0/0.95).

**Step 2: Determine the proportion of opex which relates to internal labour costs**

The index calculated in Step 1 is then applied to the share of operating expenditure that

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121 The same applies to the sewerage service, using the variables: treated load, connected properties, and sewers length
122 Ofgem (2014): *RIIO-ED1 Final determinations for the slow-track electricity distribution companies - Business plan expenditure assessment*, 28 November 2014, para. 4.1
127 We also experimented with including regional wage as an explanatory variable in the econometric models but found that the coefficient was not robust to model specification and varied not just in magnitude but in sign.
corresponds to labour costs.\footnote{By using the formula: \[\text{Adjustment factor} = 1 - \text{Share of labour costs} + \text{Share of labour costs} \times \text{Wage Differential Index}.\]}

Using the latest data available, we have estimated that the average share of labour costs in the E&W water sector is approximately 31 per cent for the water service, and 38 per cent for the sewerage service.\footnote{Ofwat PR19 dataset, E&W average over years 2012-18. We calculate the proportion of labour costs as employment costs directly and indirectly attributed over total operating expenditure.} In our definition of labour costs, we include E&W employment costs directly and indirectly attributable as available in the PR19 dataset. For IW, we include both in-house employment costs and hired and contracted services. Ideally, we would only make the regional adjustment to costs that must be incurred at a local level, excluding hired services that need not be co-located with the network and hence could be outsourced outside the company’s region.\footnote{See e.g. Ofgem in RIIO-GD1, where only a percentage of work is considered to be required to be done locally.} We do not have sufficiently granular data to isolate this effect, and note that in the context of Irish Water the local labour market is likely to be the most relevant market for all labour service – both internal and outsourced.

**Step 3: Run econometric models on wage-adjusted company operating costs.** Running the econometric models on the adjusted operating expenditure data will provide, for each company, its predicted costs as if the company was placed in a hypothetical region with average wage levels.

**Step 4: Re-adjust modelled costs to account for the regional wage differential.** As a final step, we re-adjust the predicted costs to reflect the regional wage level as calculated in Step 1 in order for the results to be comparable with the companies’ actual costs. This is done by dividing the predicted costs by the same pre-modelling adjustment factor.

For IW, we retain the IRC2 real labour cost adjustment at around 8 to 10 per cent higher than the England and Wales, which we allow for in our efficiency assessment. Our real labour adjustment for IW is higher than for all comparator WaSCs, with the exception of Thames Water.

**A.3.3. Other Post-Modelling Adjustments**

To put the model results on a comparable basis to the data submitted by Irish Water in its RC3 submission, we make a number of post-modelling adjustments:

- We convert the 2017 price base UK cost data into euros using the OECD’s Purchasing Power Parities (PPP) for private consumption. PPPs are the rates of currency conversion that eliminate the differences in price levels between countries.\footnote{See http://www.oecd.org/std/purchasingpowerparitiespppsdata.htm} We use the 2012-17 average, which has a value of 1.24 €/£.\footnote{This is not substantially different from the Bank of England exchange rate, which has a 2013-April 2016 average of 1.27 €/£}
- We adjust Irish Water’s modelled or predicted costs to reflect its retail activities. The PR19 models and database are of wholesale costs only. To provide an estimate of the
modelled costs for an integrated utility providing both wholesale and retail services we uprate IW’s modelled costs by €16m for water and €13m for waste water. These values are based on the average proportion of customer operations costs reported by IW in the TOM costs.

- We adjust predicted costs to reflect the expenditure in renewals in infrastructure and non-infrastructure which is expensed. Since most E&W companies identified opex renewal costs from 2016 only, we use the average share of expensed renewals expenditure in controllable opex over the period 2016-25. For the period, Ofwat’s dataset suggests renewals will be 21 per cent of water and 16 per cent wastewater operating controllable costs and we adjust Irish Water’s modelled costs based on these proportions.

- We exclude VAT from IW’s submitted costs. In the UK water companies’ VAT costs are recoverable and, for this reason, reported costs exclude VAT. Therefore, in our comparisons with IW’s modelled costs, IW’s submitted costs also exclude VAT.

In IW’s IRC2 submissions, the only VAT included as a specific line item is “irrecoverable VAT” which we understand relates to VAT on items procured at the Ervia group level. In the absence of more reliable data, and as a conservative approach, we implement the values used by Frontier Economics in their external benchmarking report, submitted by IW as part of the formal Q&A process with the CER.

A.4. Results

We considered various combinations of explanatory variables in our models, including CSV variables with various weightings, water and waste water treatment works, and average pumping head.

All of our models are in logarithmic terms, with total controllable operating expenditure as the explanatory variable. Our estimation method is a pooled OLS regression in common with Ofwat, Ofgem and CMA modelling approach at past reviews. Table A.9 and Table A.10 show the resulting coefficients (and their p-values in parenthesis) of each of the various models and sensitivities we have estimated for each service.

At RC3, our approach to model selection was been to refine the IRC2 models in light of the new data. We continue to include the CSV variable as the main cost driver in all of our models.

133 Assuming an average of €29m costs incurred during IRC2.
134 For the purpose of illustrating the modelling results, we also uprate E&W companies predicted costs by 5 per cent, which reflects the proportion of IW retail costs in operating controllable expenditure.
135 The period 2019-25 is given as a forecast in the PR19 dataset.
136 This means we apply an uplift to IW predicted wholesale costs of 26 per cent for water and 19 per cent for wastewater. For the purpose of illustrating the modelling results, we also uprate each E&W WaSC predicted costs by the actual expenditure in renewals over 2018.
137 Frontier Economics (20 April 2016) “Irish Water Opex Benchmarking” – a confidential report for Irish Water. We maintain the 2018 VAT constant for each RC3 year.
A.4.1. Model results – water service

For the water service, we include only the CSV and time dummies in our full specification. In contrast to the models developed for IRC2, we do not include the number of water treatment works and average pumping head.

As at IRC2, we derive a negative co-efficient for water treatment works, implying that costs decline the greater the number of works. For Irish Water, this means that modelled or predicted costs are lower, and Irish Water’s comparative efficiency poorer, for model runs that include this variable. As discussed in our IRC2 modelling, it is possible that the number of treatment works acts as a proxy variable for density, e.g. with companies with a small number of works operating in a relatively high cost urban centres. We exclude water treatment works from our RC3 models because it is not clear that we are modelling a causal relationship rather than picking up noise from any omitted variables.

Average pumping head reflects topography and the pumping requirements to deliver water to connections across the network. A higher pumping head would be expected to increase energy costs and therefore raise opex. Due to the uncertainty in IW average pumping head estimate, we do not include average pumping head in our specifications.

As for IRC2, we include year dummies, taking 2018 as the reference year. The year dummies should account for any specific shock in a particular year that may have changed the cost environment and would also pick up any general trend in costs over time.

Finally, the main cost driver, the composite scale variable, includes mains length, properties connected and water delivered. To inform the CSV, we have drawn on a review of other regulators’ approaches and model a range of weights to demonstrate the sensitivity of our results.

In general, models developed by Ofwat, CMA and UREG show that connections rather than network length is the principal cost driver. For example, both total wholesale water models developed by Ofwat at PR19 use number of connections; for the disaggregated models, only one of the three models uses length of mains. Table A.8 shows UREGNI’s CSV weights (Set 1), along with the other two sets of weights (Set 2 and Set 3) that UREGNI includes in its range of alternative models.

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139 Average pumping head is intended to measure how much each megalitre of water is pumped through the process, from abstraction to supply, and is defined as \( \Sigma (l_i \times WP_i) / (V_p + V_g) \), where \( l_i \) is the annual mean lift (in meters) at site \( i \), \( WP_i \) is the volume of water pumped at site \( i \), and \( (V_p + V_g) \) is the total volume of water that enters supply.
140 Ofwat (2019) Securing cost efficiency – our approach to setting efficient cost baselines at the IAP, technical appendix 2 securing cost efficiency, p. 30
141 In relation to the optimal scale factor, Ofwat explains that: “For the aggregated wholesale water model, we use the number of households as the scale cost driver. It has a slightly better statistical fit than length of mains; it is a more intuitive cost driver of wholesale services (length of mains is not an intuitive cost driver to use for water resources and treatment), and it is more exogenous (i.e. it is not in management control).” Ofwat (2019) Securing cost efficiency – our approach to setting efficient cost baselines at the IAP, supplementary technical appendix, econometric approach, p.12
The set of variables used is slightly different from that used in our models. In particular, UREGNI uses distribution input instead of water delivered, and population served instead of connected properties. For the sewerage service, UREGNI also uses population served in preference to connections.\textsuperscript{143}

For IW, we prefer to rely on water delivered due to the high leakage (shown in Table A.5 above), and place greater weight on connections (as opposed to water delivered) due to the accuracy of the data.\textsuperscript{144}

### Table A.8: CSV Weights Used in UREGNI’s PC15 Alternative Efficiency Models

<table>
<thead>
<tr>
<th></th>
<th>Water</th>
<th>Sewerage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Set 1</td>
<td>Set 2</td>
</tr>
<tr>
<td>Distribution Input</td>
<td>0.66</td>
<td>0.40</td>
</tr>
<tr>
<td>Population</td>
<td>0.26</td>
<td>0.40</td>
</tr>
<tr>
<td>Mains Length</td>
<td>0.08</td>
<td>0.20</td>
</tr>
</tbody>
</table>


Our preferred models for RC3 present sensitivities around the weightings used for the CSV variable. We consider the following weights for water delivered, connections and mains length, respectively:

- **Model 1**: (33:33:33). We include a CSV model that gives equal weight to all variables. By placing a third weighting on mains length, we provide a higher weighting than Ofwat’s approach at PR19, which use connections as the scale driver for wholesale cost. As Irish Water has a high length of mains, this model specification provides a relatively higher estimate for Irish Water’s predicted costs.

- **Model 2** (0:75:25). Since the confidence in IW’s estimates of water delivered levels is relatively low compared to the other two scale variables, we include a model that excludes this variable. Since regulators have tended to assume that connections or population served is the principal cost driver for companies’ costs, we give mains length a lower weight (25 per cent) with respect to connected properties (75 per cent).


\textsuperscript{144} We understand from discussions with IW that there is not a reliable estimate of non-domestic population served.
Table A.9: IRC2 Econometric Model Results - Water

<table>
<thead>
<tr>
<th>CSV weights</th>
<th>Model 1</th>
<th>Model 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water delivered</td>
<td>33%</td>
<td>0%</td>
</tr>
<tr>
<td>Connections</td>
<td>33%</td>
<td>75%</td>
</tr>
<tr>
<td>Mains</td>
<td>33%</td>
<td>25%</td>
</tr>
<tr>
<td>ln_csv</td>
<td>1.003</td>
<td>0.982</td>
</tr>
<tr>
<td></td>
<td>1.58e-15***</td>
<td>7.13e-15***</td>
</tr>
<tr>
<td>y = 2012</td>
<td>-0.197</td>
<td>-0.173</td>
</tr>
<tr>
<td></td>
<td>.000021***</td>
<td>.0001067***</td>
</tr>
<tr>
<td>y = 2013</td>
<td>-0.190</td>
<td>-0.182</td>
</tr>
<tr>
<td></td>
<td>2.23e-06***</td>
<td>3.65e-06***</td>
</tr>
<tr>
<td>y = 2014</td>
<td>-0.176</td>
<td>-0.164</td>
</tr>
<tr>
<td></td>
<td>9.84e-06***</td>
<td>.0000271***</td>
</tr>
<tr>
<td>y = 2015</td>
<td>-0.134</td>
<td>-0.126</td>
</tr>
<tr>
<td></td>
<td>.0001388***</td>
<td>.0003217***</td>
</tr>
<tr>
<td>y = 2016</td>
<td>-0.090</td>
<td>-0.085</td>
</tr>
<tr>
<td></td>
<td>.0003541***</td>
<td>.0006455***</td>
</tr>
<tr>
<td>y = 2017</td>
<td>-0.046</td>
<td>-0.044</td>
</tr>
<tr>
<td></td>
<td>.0431584*</td>
<td>.0435152*</td>
</tr>
<tr>
<td>Constant</td>
<td>-3.303</td>
<td>-3.270</td>
</tr>
<tr>
<td></td>
<td>1.04e-09***</td>
<td>3.67e-09***</td>
</tr>
<tr>
<td>Adjusted R-Squared</td>
<td>0.967</td>
<td>0.963</td>
</tr>
<tr>
<td>Observations</td>
<td>122</td>
<td>122</td>
</tr>
</tbody>
</table>

Source: NERA analysis.
Statistical significance levels (p-values in parenthesis): * 5%, ** 1%, *** 0.1%.

We use the coefficients in Table A.9 to predict the level of opex that each company would be expected to undertake according to the observable characteristics of its water service. We also calculate predicted costs for Scottish Water, Northern Ireland Water and Irish Water, whose data is not included in running the econometric models.

Figure A.3 presents the modelled cost ranges for the water service. The bars represent the modelled costs as predicted by our models, while the triangles represent actual costs.145

The modelled cost range for IW is large compared to the other UK companies. This is because IW is currently an outlier with respect to some of the cost drivers; notably with respect to mains length and water treatment works.

IW’s proposed controllable (and net of VAT for comparability) operating expenditure at end of RC3 is €341m under IW’s original submission (or €361m under WIOF delay) is at least €57m (20 per cent) above our modelled opex for the original submission or €76m (27 per cent) under WIOF delay.

We consider the results provide a conservative view of Irish Water’s comparative efficiency. Notably, we have not adjusted Irish Water’s costs for any negative special factors, although

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145 For the comparator companies, the actual costs are outturn costs from 2013. For Irish Water the outturn costs are the average over the two years of the IRC2 submission. All values are expressed in 2015 prices.
Irish Water itself expects to incur substantial costs to improve compliance over the period (costs that are already borne by our comparator companies).\(^{146}\)

**Figure A.3: IRC2 Opex Model - Water Modelled Ranges**

Source: NERA analysis of Ofwat’s PR19 dataset, IW submissions, WICS regulatory accounts for Scottish Water and Northern Ireland Water Annual Information Return.

Note: Models estimated using E&W data (2012-18). All UK modelled and observed costs presented in this chart correspond to 2018. All costs are in 2017 prices.\(^{147}\)

### A.4.2. Model results – waste water

For the wastewater service, we include CSV, number of WWTW, and time dummies in our specification.

In general, we would expect more WWTW to increase costs, as we find in our models. Although the co-efficient is not statistically significant across all models, we retain WWTW alongside the CSV in our preferred specification given that Irish Water has a high number of plant and the model specification allows for this. As with the water models described above, we include year dummies for each year of data included in the models although unlike the water models the time dummies are not statistically significant.

Finally, the main cost driver, the composite scale variable, includes mains length and properties connected. In contrast to IRC2 models, we do not include sewage load due to the uncertainty in IW estimates for the load variable.

\(^{146}\) See section 2.1.2.2 for a discussion of the compliance costs Irish Water expects to incur over RC3.

\(^{147}\) Thames Water performs poorly under our RC3 analysis because we exclude models that were favourable to Thames Water (e.g. those that include WTW and average pumping head as explanatory variables). Ofwat, in its PR19 initial assessment of plans, also suggests that Thames overall costs are more than 20 per cent above efficient costs. Ofwat (January 2019), PR19 initial assessment of plans: Overview of company categorisation, p.37.
Unlike the water service, Irish Water is not an outlier with respect to a particular wastewater scale driver and the model results are not notably sensitive to the construction of the CSV. We show different combinations of weights on connections and length: Model 1 (50:50), Model 2 (75:25) and Model 3 (25:75).

Table A.10: IRC2 Econometric Model Results - Sewerage

<table>
<thead>
<tr>
<th>CSV weights</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connections</td>
<td>50%</td>
<td>75%</td>
<td>25%</td>
</tr>
<tr>
<td>Sewer length</td>
<td>50%</td>
<td>25%</td>
<td>75%</td>
</tr>
<tr>
<td>ln_csv</td>
<td>0.785</td>
<td>0.773</td>
<td>0.795</td>
</tr>
<tr>
<td></td>
<td>1.69e-06***</td>
<td>2.41e-06***</td>
<td>1.14e-06***</td>
</tr>
<tr>
<td>ln_WWTW</td>
<td>0.145</td>
<td>0.182</td>
<td>0.108</td>
</tr>
<tr>
<td></td>
<td>0.1868857</td>
<td>0.1199674</td>
<td>0.3055405</td>
</tr>
<tr>
<td>y = 2012</td>
<td>-0.080</td>
<td>-0.077</td>
<td>-0.084</td>
</tr>
<tr>
<td>y = 2013</td>
<td>-0.1006576</td>
<td>0.1128646</td>
<td>0.0884963</td>
</tr>
<tr>
<td>y = 2014</td>
<td>-0.005</td>
<td>-0.002</td>
<td>-0.009</td>
</tr>
<tr>
<td>y = 2015</td>
<td>0.8544164</td>
<td>0.9354518</td>
<td>0.7690097</td>
</tr>
<tr>
<td>y = 2016</td>
<td>-0.003</td>
<td>0.000</td>
<td>-0.006</td>
</tr>
<tr>
<td>y = 2017</td>
<td>0.9265005</td>
<td>0.992849</td>
<td>0.8393619</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.9200236</td>
<td>0.9806022</td>
<td>0.8550875</td>
</tr>
<tr>
<td></td>
<td>0.9372065</td>
<td>0.9753077</td>
<td>0.895871</td>
</tr>
<tr>
<td></td>
<td>0.9270908</td>
<td>0.8597420</td>
<td>0.8970862</td>
</tr>
<tr>
<td></td>
<td>0.005</td>
<td>0.006</td>
<td>0.004</td>
</tr>
<tr>
<td></td>
<td>0.8779098</td>
<td>0.8597420</td>
<td>0.8970862</td>
</tr>
<tr>
<td>Adjusted R-Squared</td>
<td>0.917</td>
<td>0.917</td>
<td>0.915</td>
</tr>
<tr>
<td>Observations</td>
<td>70</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

Source: NERA analysis.

Statistical significance levels (p-values in parenthesis): * 5%, ** 1%, *** 0.1%.

We use the coefficients in Table A.10 to predict the level of opex that each company would be expected to undertake according to the observable characteristics of its waste water service. When we run these predictions we also calculate predicted costs for Scottish Water, Northern Ireland Water and Irish Water, whose data is not included in running the econometric models.

Figure A.4 presents the modelled cost ranges for the waste water service. The bars represent the modelled costs as “predicted” by our models, while the triangles represent actual costs.148

IW’s proposed controllable (and net of VAT for comparability) opex expenditure at RC3 end of €279m (or €295m under WIOF delay) is at least €80m (40 per cent) above our modelled opex (or €96m (48 per cent) under WIOF delay).

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148 For the comparator companies, the actual costs are outturn costs from 2018. For Irish Water the outturn costs are the end of RC3 submission. All values are expressed in 2017 prices.
Figure A.4: IRC2 Opex Model - Sewerage Modelled Ranges

Source: NERA analysis of Ofwat’s PR19 dataset, IW submissions, WICS regulatory accounts for Scottish Water and Northern Ireland Water Annual Information Return.
Note: Models estimated using E&W data (2012-18). All UK modelled and observed costs presented in this chart correspond to 2018. All costs are in 2017 prices. SW observed costs exclude PPP charges.149

149 Thames Water performs poorly under our wastewater RC3 analysis because we exclude from our RC3 analysis models excluding WWTW, which was by far the model most favourable to Thames Water. As we mention in footnote 147, Ofwat, in its PR19 initial assessment of plans, also suggests that Thames overall costs are more than 20 per cent above efficient costs. Ofwat (January 2019), PR19 initial assessment of plans: Overview of company categorisation, p.37.
Appendix B. Real Price Effects and Productivity Improvements Applied to Opex

IW commissioned CEPA to provide a report on the expected level of real price effects (RPEs) and on-going productivity for Irish Water over the period of RC3 in relation to operating expenditure.\textsuperscript{150}

In this Appendix, we review CEPA’s report as well as recent decisions by UK water regulators on RPE and on-going productivity assumptions for opex.

B.1. Overview of Irish Water’s Proposals

B.1.1. CEPA’s view on on-going productivity

CEPA concludes on an on-going productivity improvement of 0 to 1 per cent for operating costs, which it considers is in line with regulatory precedent but also reflects “a potential decline in overall ongoing productivity within the business cycle.”\textsuperscript{151} In drawing on such conclusions, CEPA draws on:\textsuperscript{152}

- historic evolution, which it states supports a range of 0 to 2 per cent p.a.
- regulatory precedent (which supports a range of 0.9 to 1 per cent p.a.)
- TFP analysis based on so-called EU KLEMS dataset as we describe below (which it considers supports a range of -0.1 to 0.4 per annum)
- productivity forecasts for Ireland (which it states supports a range of 0.4 to .1 per cent p.a.)

With the exception of TFP (the third bullet), the other three sources of evidence support a more demanding improvement in opex productivity of around 1 per cent p.a. relative to CEPA’s assumed range of 0 to 1 per cent p.a. However, we also have concerns with CEPA’s conclusions on TFP estimates drawing on EU KLEMS, noting that these conclusions are lower than substantive evidence for UK economy.

B.1.1.1. We consider KLEMS data base supports TFP measure of between 0.5 and 1 per cent

We have investigated CEPA’s approach to the use of EU KLEMS data. The guidance notes on the methodology and the construction of the KLEMS database highlight a number of health warnings associated with the data.\textsuperscript{153} The guidance states that the growth accounting framework (which is the theoretical basis for the EU KLEMS productivity measures) rests on a number of assumptions about the real economy. It assumes that factor markets are

\textsuperscript{150} CEPA (February 2019) The impact of economic trends on Irish Water’s opex, and their evolution during RC3
competitive; with constant returns to scale; full utilisation of inputs, and that all companies are technically efficient. For example, if the assumption of constant returns to scale does not hold, then the TFP measure will reflect the effect of scale economies as well as productivity growth. The guidance note also highlights potential difficulties with output and input measurement, eg. in relation to measuring quality-adjusted output volumes for industries with rapid quality changes, such as IT, and indeed utilities.154

These theoretical and data measurement issues suggest that we should draw on longer time-series evidence (i.e. from 1970-2007). For example, a longer time period may help smooth for changes in scale effects, changes in capacity utilisation, and changes in efficiency, which are picked-up in the residual TFP measure.155 The theoretical and data measurement issues also suggest that we should not place weight on the productivity estimates associated with any particular sector but potentially place greater weight on aggregate industry measures, again, in order to smooth out any measurement issues.

We also draw on UK data to contrast the results with CEPA’s use of Irish only data. We also draw on partial factor productivity measures as opposed to only total factor productivity (TFP) measures. As noted by CEPA,156 its use of TFP fails to account for the tendency for water companies to engage in capital substitution, e.g. automation of processes that result in faster decline in operating expenditures. To take into account this effect, it is common to examine partial factor productivity measures (PFP), which are reported by KLEMS database, and reflect the improvement in labour, energy and materials (LEMS) productivity from both technological change and capital investment.157

Drawing on our preferred gross output (GO) measures for a range of comparator sectors, the Table below indicates that the TFP growth lies in the range of 0.5 to around 1 per cent p.a. Overall, our analysis suggests that CEPA’s assumption of productivity growth of -0.1 to +0.4 per cent per annum, based on shorter time-series data for the Irish economy understates the prospects for improvements in productivity.

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155 TFP growth is measured as the growth rate in physical outputs minus the growth rate in physical inputs. TFP (as set out in the KLEMS dataset) is a measure of disembodied technological change or technical change that is “costless” in the form of an expansion of general knowledge, adoption of better management techniques, more efficient organisation, etc. For an explanation of such terms, see: OECD (2001) Measuring Productivity, Measurement of aggregate and industry level productivity growth, OECD manual.; p. 116 Available on-line: http://www.oecd.org/std/productivity-stats/2352458.pdf


157 In measuring input quantities, the KLEMS database distinguishes between capital (K), labour (L), energy (E), materials (M), and service (S) inputs. PFP measures are calculated as the growth in physical outputs minus the growth in any one (e.g. labour) or more (e.g. LEMS) factor inputs. PFP measures reflect the extent of capital substitution. For example, an increase in capital employed per labour input will increase output per worker and improve labour or LEMS productivity.
<table>
<thead>
<tr>
<th>Industry sector</th>
<th>TFP</th>
<th>LEMS PFP (Capital Sub.)</th>
<th>LEMS PFP (Constant Cap.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacture of chemicals and chemical products</td>
<td>1.3%</td>
<td>1.4%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Manufacture of electrical and optical equipment</td>
<td>1.6%</td>
<td>1.9%</td>
<td>1.8%</td>
</tr>
<tr>
<td>Manufacture of transport equipment</td>
<td>1.0%</td>
<td>0.9%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Construction</td>
<td>0.2%</td>
<td>0.4%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Sale, maintenance and repair of motor vehicles; Retail sale of fuel</td>
<td>1.0%</td>
<td>1.4%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Transport and storage</td>
<td>1.2%</td>
<td>1.2%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Financial intermediation</td>
<td>-0.4%</td>
<td>0.3%</td>
<td>-0.5%</td>
</tr>
<tr>
<td>Other Manufacturing and Recycling</td>
<td>-0.5%</td>
<td>-0.3%</td>
<td>-0.5%</td>
</tr>
<tr>
<td>Manufacture of Rubber and Plastics</td>
<td>0.8%</td>
<td>1.0%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Electricity, gas and water supply</td>
<td>0.8%</td>
<td>0.6%</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

**Unweighted average (selected industries)**

<table>
<thead>
<tr>
<th>Industry sector</th>
<th>TFP</th>
<th>LEMS PFP (Capital Sub.)</th>
<th>LEMS PFP (Constant Cap.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manufacture of chemicals and chemical products</td>
<td>0.7%</td>
<td>0.9%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Manufacture of electrical and optical equipment</td>
<td>0.5%</td>
<td>0.8%</td>
<td>0.5%</td>
</tr>
</tbody>
</table>

Source: NERA analysis of EU KLEMS NACE 1.1 data. “Whole economy (excl. non-market sectors)” excludes real estate, public administration, education, health and social work and community services.

### B.1.2. CEPA’s view on input prices

CEPA analysis based on real wage growth assumption of 1.7 to 2.3 per cent p.a. over the next few years\(^{158}\); real energy price forecasts of 1.7 per cent p.a. based on UK government forecasts for UK\(^{159}\); and zero per cent for all other categories.

CEPA apply a 71 per cent weighting to labour cost.\(^{160}\) This seems extremely high to us. CEPA itself states that labour is responsible for “roughly half” of opex.\(^{161}\) Utility Regulator assumes labour cost weighting in opex of 50 per cent for NIW, which is itself is based on

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\(^{159}\) CEPA (February 2019) The impact of economic trends on Irish Water’s opex, and their evolution during RC3. p.21

\(^{160}\) CEPA (February 2019) The impact of economic trends on Irish Water’s opex, and their evolution during RC3. p.23, footnote 40

\(^{161}\) CEPA (February 2019) The impact of economic trends on Irish Water’s opex, and their evolution during RC3. p.18
E&W company data.\textsuperscript{162} We calculate a labour weighting in opex of 38 per cent based on Irish Water data.\textsuperscript{163} Drawing on E&W data, we calculate a labour weighting of 31 per cent in water opex and 38 per cent in wastewater opex.\textsuperscript{164}

If we assume labour has a 50 per cent weighting in totex (itself high), we calculate a modified RPE of 1 to 1.3 per cent p.a., if we were accept CEPA’s other assumptions.

\textbf{Table B.2: Correcting for CEPA’s Labour Cost Weight, RPE = 1 to 1.3 per cent p.a.}

<table>
<thead>
<tr>
<th>Weighting (%)</th>
<th>Growth Rate (%):</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Labour</td>
<td>50</td>
<td>1.7</td>
</tr>
<tr>
<td>Energy</td>
<td>8</td>
<td>1.7</td>
</tr>
<tr>
<td>Other inputs</td>
<td>42</td>
<td>0</td>
</tr>
<tr>
<td>RPE</td>
<td>1.0</td>
<td>1.3</td>
</tr>
</tbody>
</table>

\textit{Table Source}

\subsection*{B.1.3. Conclusions}

We have the following main concerns with CEPA’s analysis:

- It places a very high weight (71 per cent) on its labour cost input price, which is between 1.7 and 2.3 per cent per annum\textsuperscript{165}.
- Our analysis suggests that CEPA’s assumption of TFP growth of -0.1 to +0.4 per cent p.a. based on shorter time-series data for the Irish economy understates the prospects for improvements in productivity; we calculate a range of 0.5 to 0.9 per cent for comparable UK sectors and taking into account the prospect for rationalisation of opex (labour) from greater automation of processes over time.\textsuperscript{166}.

We consider that the real opex unit cost increase is of the order of 1 per cent, as is the expected on-going improvement in productivity. That is, we consider that a reasonable assumption is to assume a zero per cent change in real unit costs net of the improvement in productivity.


\textsuperscript{163} We calculate IW labour weighting as the proportion of labour and payroll costs out of controllable costs (excluding DBO costs).

\textsuperscript{164} We calculate E&W as the proportion of directly and indirectly attributed employment costs from total operating expenditure.

\textsuperscript{165} The forecasts are based on European Commission and Central Bank of Ireland forecasts for 2019. See CEPA (February 2019) The impact of economic trends on Irish Water’s opex, and their evolution during RC3, p.19

\textsuperscript{166} See CEPA (February 2019) The impact of economic trends on Irish Water’s opex, and their evolution during RC3, p.13
B.2. Recent UK Regulatory Precedent

B.2.1. Ofwat expects companies to reduce costs by 1.5 per cent p.a.

Ofwat has recently published its view on RPEs and on-going productivity as part of the ongoing price control for E&W companies. Ofwat concludes that “We do not consider that there is sufficient and convincing evidence for us to make an adjustment for real price effects for wholesale expenditure beyond the consumer price inflation index adjustment that is already made by the price control.” \(^\text{167}\) The main reasons provided by Ofwat are that of the two largest cost items – labour and materials – there is no evidence to suggest that the weight in companies’ costs is different from the weight in CPIH and therefore it considers that companies are adequately compensated through CPIH revenue indexation, and that recent evidence does not demonstrate a wedge between these cost items and CPIH.\(^\text{168}\)

Ofwat commissioned two studies to consider improvements in on-going efficiency over PR19. These studies found that:

- Europe Economics forecast a frontier shift of 0.6 per cent to 1.2 per cent per year for total expenditure and 0.6 per cent to 1.4 per cent per year for base expenditure (excluding enhancement), where the bottom end of this range is based on productivity growth in the most recent post crisis period. The top end of this range is based on the growth of better performing sectors, the pre-crisis period and longer time series data. \(^\text{169}\)
- KPMG also provide an estimate of frontier shift, based on total factor productivity, of 0.4 per cent to 1.5 per cent per year based on total productivity analysis of EU KLEMS data. \(^\text{170}\)

Overall, Ofwat proposes a 1.5 per cent p.a. frontier shift in its recent initial assessment of plans.\(^\text{171}\)

B.2.2. At previous UK water price control, CMA assumed a net reduction in company costs

Ofwat did not make an explicit allowance for RPEs at PR14. However, at appeal, the CMA agreed with Bristol Water that “there will be some elements of Bristol Water’s costs that will rise above RPI”. \(^\text{172}\) As a result it provided an RPE factor equal to 0.6 per cent p.a. \(^\text{173}\) The

\(^{167}\) Ofwat (2019) Securing cost efficiency – our approach to setting efficient cost baselines at the IAP, technical appendix 2 securing cost efficiency, p. 12

\(^{168}\) Ofwat (2019) Securing cost efficiency – our approach to setting efficient cost baselines at the IAP, technical appendix 2 securing cost efficiency, pp. 44-45

\(^{169}\) Ofwat (2019) Securing cost efficiency – our approach to setting efficient cost baselines at the IAP, technical appendix 2 securing cost efficiency, p. 36

\(^{170}\) Ofwat (2019) Securing cost efficiency – our approach to setting efficient cost baselines at the IAP, technical appendix 2 securing cost efficiency, p. 39

\(^{171}\) Ofwat (2019) Securing cost efficiency – our approach to setting efficient cost baselines at the IAP, technical appendix 2 securing cost efficiency, p. 40

\(^{172}\) CMA (2015): Bristol Water plc price determination – Provisional findings, 10 July 2015, para. 5.45.

CMA applied a productivity assumption of 1 per cent p.a., leading to an expected net reduction in costs over the control period.\textsuperscript{174}

At PC13 (2013-2014) Northern Ireland, the Utility Regulator allowed for an opex RPE of 0.4 per cent p.a., and an assumed productivity improvement of 0.9 per cent p.a., resulting in an overall net improvement of 0.5 per cent p.a.\textsuperscript{175} At the most recent PC15 review, it set an opex RPE of 0.7 per cent p.a., less a productivity improvement of 0.9 per cent p.a., resulting in an assumed net improvement in NIW’s opex of around 0.2 per cent p.a.\textsuperscript{176}

\textbf{B.2.3. In general, regulators assume around 1 per cent improvement in productivity}

At gas distribution and electricity and gas transmission price controls (RIIO-GD1 and RIIO-T1), Ofgem assumed a productivity improvement of 1 per cent p.a. for opex, and in general an overall net improvement in on-going efficiency or around 0.4 to 0.6 per cent p.a. depending on the sector.\textsuperscript{177}

At RIIO-ED1, Ofgem accepted DNOs’ proposed productivity improvements of between 0.8 per cent and 1.0 per cent p.a.\textsuperscript{178} For NIE at the 2014 CMA appeal, the CMA determined an RPE of -0.2 per cent, an on-going productivity improvement of 1 per cent p.a. and therefore a net improvement of 1.1 per cent.\textsuperscript{179}

\textsuperscript{174} CMA (2015): Bristol Water plc price determination – Provisional findings, 10 July 2015, paras. 5.46-5.51. Link: https://assets.digital.cabinet-office.gov.uk/media/559fd021ed915d1595000046/Bristol_Water_plc_price_determination_-_provisional_findings.pdf


\textsuperscript{177} Ofgem (2012) RIIO-T1/GD1: Real price effects and on-going efficiency appendix, p. 15. Link: https://www.ofgem.gov.uk/ofgem-publications/48159/5riiogd1fprpedec12.pdf


\textsuperscript{179} CMA (2014) NIE Price determination final determination, para. 11.27, p. 11- 6. Link: https://assets.digital.cabinet-office.gov.uk/media/535a5768ed915d0fd0b000003/NIE_Final_determination.pdf
Table B.3: UK Water Regulators Have Typically Assumed Real Unit Cost Decrease

<table>
<thead>
<tr>
<th>Regulatory decision</th>
<th>RPE</th>
<th>Productivity</th>
<th>(Net decrease in costs) / increase in cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ofgem PR19, IAP consultation</td>
<td>0</td>
<td>+1.5</td>
<td>-1.5</td>
</tr>
<tr>
<td>Utility Regulator, NIW PC15</td>
<td>+0.7</td>
<td>-0.9</td>
<td>-0.2</td>
</tr>
<tr>
<td>Utility Regulator, NIW PC15</td>
<td>+0.6</td>
<td>-0.9</td>
<td>c.-0.3</td>
</tr>
<tr>
<td>CMA, BW 2015</td>
<td>+0.6</td>
<td>-1</td>
<td>c. -0.4</td>
</tr>
<tr>
<td>IW BP</td>
<td>+1.8 to +1.3</td>
<td>-1 to 0</td>
<td>+0.3 to +1.8</td>
</tr>
</tbody>
</table>

Source: NERA review of regulatory decisions, and CEPA (February 2019)

B.3. Conclusions

CEPA’s presents evidence to support a net increase in opex costs over time of 0.3 to 1.8 per cent p.a. We consider that the evidence broadly supports no net real increase, i.e. input price increases (and notably labour) are largely offset by improvements in on-going productivity.

Our assumption is conservative relative to relevant UK regulators’ decisions, which have assumed a net decrease in costs over time (i.e. real input prices increases have been more than offset by improvements in productivity).
Appendix C. Complementary Capital Expenditure Analysis

In this section we assess the size of IW’s proposed capex program relative to E&W companies’ programmes, and benchmark the expenditure in capital maintenance to that of E&W companies.

C.1. Scale of the RC3 Plan Relative to E&W comparators

The absolute proposed size of the programme is large compared to English and Welsh (E&W) companies, and second only to Thames Water expenditure for 2018 (TMS), as shown below.

Figure C.1: Comparison of E&W gross 2018 capex with IW annualized capex for RC3

Relative to population served, as shown below, the capex programme is also large, yet on a par with Southern Water (SRN) and Wessex Water (WSX) for the most recent reported five-year period.

Source: NERA analysis of Ofwat PR19 dataset and IW capex submission, including and excluding Major Projects.
Our analysis, based on the above benchmarks, suggests that the size of the programme is challenging but not without parallels in England and Wales.

C.2. Capital maintenance

C.2.1. Overview of IW’s proposed RC3 capital maintenance expenditure

IW’s proposed designated capital maintenance programmes have a total proposed investment of €250m over RC3, split between service area and between non-infrastructure above ground assets and infrastructure below ground assets as follows:

- Water Above Ground, €91.25m
- Water Below Ground (excluding Water Network Management programmes), €2.5m
- Wastewater Above Ground, €91.25m
- Wastewater Below Ground, €65m

The four programmes are all at gate 3 and the plan profile of spend shows a gradual ramp up each year to €55m in 2024, as shown below.

<table>
<thead>
<tr>
<th>Year</th>
<th>Capital Maintenance, €m</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020</td>
<td>45</td>
</tr>
<tr>
<td>2021</td>
<td>46</td>
</tr>
<tr>
<td>2022</td>
<td>50</td>
</tr>
<tr>
<td>2023</td>
<td>53</td>
</tr>
<tr>
<td>2024</td>
<td>55</td>
</tr>
</tbody>
</table>

The value of the four proposed programmes is low for a utility of the size of IW; it is, however, not the total investment in capital maintenance, as designated capital maintenance does not include effective capital maintenance included across its entire capital programme,
including capital maintenance delivered as an element in IW’s quality programmes/projects. IW’s proposed expenditure in capital maintenance can be better identified from the base maintenance cost allocation provided in the BPQ I&O worksheet, where all project costs have been allocated by regulatory purpose (so-called QBEG allocation, which stands for quality, base maintenance, enhanced service and growth). The projects allocated to base maintenance are shown below.

Table C.2: IW proposes €995m expenditure for base maintenance

<table>
<thead>
<tr>
<th>Base Maintenance €m</th>
<th>Non-Infrastructure Asset Condition and Performance</th>
<th>Infrastructure Asset Condition and Performance</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital Projects</td>
<td>70</td>
<td>66</td>
<td>136</td>
</tr>
<tr>
<td>Capital Maintenance</td>
<td>183</td>
<td>68</td>
<td>250</td>
</tr>
<tr>
<td>National Programmes</td>
<td>115</td>
<td>493</td>
<td>609</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>368</strong></td>
<td><strong>627</strong></td>
<td><strong>995</strong></td>
</tr>
</tbody>
</table>

*Source: Jacobs’ analysis of IW capex submission.*

We identified base maintenance investment totalling €995m, approximately two thirds of which is expected to be invested in underground infrastructure assets. The allocation to water and wastewater is 30 per cent and 70 per cent respectively.

**C.2.2. External benchmarks of long-term capital maintenance required**

We have also undertaken an econometric benchmarking exercise, in line with our approach to assessing capital maintenance at IRC1 and IRC2. We have run econometric models at service level (i.e. two separate models for the water and the waste water service respectively) to generate “predicted” costs for each company, on the basis of the relationship between cost drivers and cost levels from the panel of English and Welsh companies. The drivers we included were properties served, leakage rates, number of water treatment works, and load. These modelled ranges do not represent an efficiency frontier, but represent expected cost levels based on the average performance of the E&W companies over the period included in the panel (2001 to 2011). In any given year companies may exhibit cost performance which is superior to the predicted range, while some companies exhibit cost performance above (i.e. inferior to) the predicted range.

For RC3, we have re-run the models developed at IRC1, updated for more recent data on IW’s drivers. The predicted costs are estimated based on IW’s 2017 cost drivers. The observed costs refer to the capital maintenance expenditure for England and Wales in 2017, and to average IW expenditure in capital maintenance per annum over IRC2 and RC3.

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180 See NERA (prepared for the Commission for Energy Regulation) (June 2014) “IW Interim Review Assessment – ANNEX Econometric Benchmarking” for the detailed approach taken to econometric modelling of capital maintenance at IRC1.
Figure C.3 presents the modelled cost ranges for the water and the sewerage service combined. The bars represent the modelled efficient costs as “predicted” by our models, while the triangles represent actual observed costs.

**Figure C.3: IRC1 Capital Maintenance Update – Water and Sewerage Services Combined Modelled Ranges**

Source: NERA analysis of annual regulatory returns (UK companies 2001 – 2011 and 2017); Information provided by Irish Water (average annual spend over the IRC2 and RC3 periods). All prices are expressed in EUR 2017.

Based on the models developed at IRC1, we estimate an enduring capital maintenance requirement between €162m to €243m per annum. IW’s designated capital maintenance shown by the red triangle programmes falls short of our estimate of the RC3 enduring level, and of IW’s estimate of enduring benchmark requirements carried out at IRC2. However, the capital maintenance activities implied by the QBEG allocation (i.e. activities allocated to base maintenance) – shown by the black triangle – are within our modelled range at both IRC2 and RC3.

On the basis of the above benchmarking, we consider the proposed level of capital maintenance for RC3 is reasonable to maintain the integrity of the network.
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