

An Coimisiún um Rialáil Fóntais

**Commission for Regulation of Utilities** 

# Water Services Innovation Fund

# **Annual Report 2020**

**Information Paper** 

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## **Executive Summary**

Irish Water provides public water and wastewater services in Ireland. As part of its role as economic regulator, the Commission for Regulation of Utilities (CRU) sets the revenue Irish Water can recover to deliver water and wastewater services over a period of time known as a 'revenue control period'. This includes the money that Irish Water requires to efficiently abstract, treat and distribute water and to collect and treat wastewater before returning it safely to the environment.

The Water Services Innovation Fund (the Fund) was established by the CRU in 2015<sup>1</sup> to encourage Irish Water investment in research projects – outside of 'business as usual' activities – that have the potential to improve how water services are delivered. These projects may be undertaken in collaboration with research partners such as universities or consultancy firms. As these innovative projects are riskier by nature and may not deliver defined outcomes, a separate fund is provided outside of normal operating costs and Investment Plans.

The proposed projects under the Fund must further at least one of the following objectives:



Conservation of water resources.



Enhanced energy savings.



Environmental standards and the objectives of the Water Framework Directive



Safe, secure, & reliable water services.



Mitigation of negative climate change impacts.



Understanding customer behaviour and effective engagement.



Economy and efficiency

<sup>&</sup>lt;sup>1</sup> CER/15/076 Water Services Innovation Fund Information Paper

The CRU allowed Irish Water access to €4 million under the Fund over 2015-2019, of which Irish Water has spent just over €1 million and accessed a further budget of €2 million. For the period 2020-2024, the CRU has allowed €4 million under the Fund. As at end 2020, Irish Water has accessed over €1 million of this.

This report provides an update on the projects undertaken in 2020 that are supported by the Fund. To date, four projects have been completed. Three of these – *Meter Data Collection Pilots* – *Multi-Unit Developments (MUDs)*, *Research on promoting sustainable household water consumption* and *Climate Change Adaptation - Identification of Climate Sensitive Catchments* – were completed on time and in budget prior to 2020. Further information on these projects is available in previous Water Services Innovation Fund Annual Reports<sup>2</sup> and on Irish Water's website<sup>3</sup>.

The fourth project completed under the Fund, *Investigating Novel Sensing Techniques for Monitoring Trade Effluent*, was completed in 2020 on time and in budget. A final report has been submitted to the CRU for formal review and is to be published on Irish Water's website<sup>3</sup>. This project will be discussed further in this information paper.

In 2020, the *Enhancing Existing Wastewater Treatment Plants Through Aerobic Granular Sludge Addition* project was still ongoing and four further projects had been approved (see Table below). This information paper provides an update on the progress of these projects individually as at the end of 2020. The paper also provides an overview of the updates to Irish Water's previously completed projects under the Fund, including its application of these projects and the impacts of the projects and their learnings on Irish Water's activities.

A list of the individual projects discussed in this Annual Report is provided in the table below.

<sup>&</sup>lt;sup>2</sup> CRU Water Services Innovation Fund Document Group

<sup>&</sup>lt;sup>3</sup> Irish Water Research & Innovation Webpage

List of Innovation Fund Projects Completed or Ongoing In 2020				
Project	Approval Date	Status at End 2020		
Investigating Novel Sensing Techniques for Monitoring Trade Effluent	March 2017	Complete		
Enhancing Existing Wastewater Treatment Plants Through Aerobic Granular Sludge Addition	July 2019	Ongoing		
Development of pilot Sludge Treatment Reed Beds for Use in Treating & Dewatering Water Sludge Containing Aluminium Sulphate	April 2020	Ongoing		
Effecting Transformational Change in Leakage Reduction within the Greater Dublin Area (GDA)	June 2020	Ongoing		
Developing the Evidence Base for Treatment Wetlands Targeting Phosphorus Removal and Delivery of Co-Benefit	October 2020	Approved		
WRc Collaborative Research Project with UK Utilities – CP609 Manhole Rehabilitation: Assessing Condition & Rehabilitation Options	October 2020	Ongoing		

### **CRU Mission Statement**

The CRU's mission is to protect the public interest in water, energy and energy safety.

The CRU is guided by four strategic priorities that sit alongside the core activities we undertake to deliver on the public interest. These are:

- Deliver sustainable low-carbon solutions with well-regulated markets and networks
- Ensure compliance and accountability through best regulatory practice
- Develop effective communications to support customers and the regulatory process
- Foster and maintain a high-performance culture and organisation to achieve our vision

### **Public/Customer Impact Statement**

By publicly reporting on Irish Water's activities under the Water Services Innovation Fund, the CRU helps to ensure Irish Water operates efficiently and effectively and performs its functions in an open and transparent manner.

This paper provides an update on the projects undertaken under the Fund as at the end of 2020. It provides transparency around the project activities carried out and sets out the benefits Irish Water expects to achieve as a result of undertaking the projects. This paper also supports accountability regarding the use of monies spent under the Fund.

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### 1. Introduction

### 1.1 The CRU's Role

The Commission for Regulation of Utilities (CRU) is Ireland's independent energy and water regulator. The CRU was established in 1999 and has a wide range of economic, customer protection and safety responsibilities in energy. The CRU is also the regulator of Ireland's public water and wastewater system. Our mission is to protect the public interest in water, energy and energy safety.

The CRU's role is to provide effective economic regulation of Irish Water to deliver secure, efficient and sustainable outcomes in the public interest. In its position as economic regulator, the CRU sets the revenue Irish Water can recover to deliver water and wastewater services over a period of time known as a 'revenue control period'. This revenue includes the money that Irish Water needs to efficiently abstract, treat and distribute water and to collect and treat wastewater before returning it safely to the environment. The CRU established the Water Services Innovation Fund (the Fund) as part of Irish Water's first revenue control (2014-2016)<sup>4</sup>.

### 1.2 The Water Services Innovation Fund

The purpose of the Fund is to encourage Irish Water to implement and invest in research projects that would not otherwise be funded under the allowed operating costs or Investment Plans.

A separate allowance to fund innovation is commonly used by economic regulators to encourage regulated entities – in this case Irish Water – to find new ways to provide and improve the services provided to customers outside of 'business as usual' activities. This is because innovative projects tend to be riskier and may not result in defined outcomes for customers. Successful projects may allow Irish Water to become more efficient and effective in its day-to-day operation. However, research projects that do not achieve their desired outcomes are still of benefit as they allow Irish Water to better understand its assets, activities and customers. This contrasts with activities included in investment plans where a regulated entity is required to deliver defined outputs and outcomes for the money invested. Where the regulated entity does

<sup>&</sup>lt;sup>4</sup> CER/14/746 Water Charges Plan Decision Paper

not deliver, the regulator may disallow the expenditure. A separate allowance for innovative projects is therefore appropriate to promote innovation while still managing the risk to customers.

In order to qualify for the Fund, proposed projects must have a reasonable probability of delivering defined, tangible benefits to Irish Water customers in a defined timeframe should the project be successful. The potential benefits must outweigh the costs of the project. Projects must also further at least one of the following objectives:

- Provision of safe, secure, and reliable water services.
- Increased understanding of customer behaviours and their drivers and effective customer engagement.
- Enhanced energy savings in the provision of water services.
- Achievement of relevant environmental standards and the objectives of the Water Framework Directive.
- Mitigation of negative climate change impacts.
- Provision of water services in an economic and efficient manner.
- Improved conservation of water resources.

The CRU allowed €4 million under the Fund as part of Irish Water's first Revenue Control (IRC1 2014-2016) and access to this continued into the second Revenue Control (IRC2 2017-2019). Of this, Irish Water spent just over €1 million and accessed a further budget of €2 million. €4 million has been allowed under the Fund as part of Irish Water's third Revenue Control (RC3 2020-2024). As at end 2020, Irish Water has accessed over €1 million of this.

In addition to the work supported by the CRU through the Water Services Innovation Fund, Irish Water has advanced innovation and improvement through targeted investments in initiatives such as the Leakage Reduction Programme, the National Disinfection Programme, the Small Towns and Villages Growth Programme, and Energy Efficiency Programmes. In parallel, Irish Water continues to work with stakeholders to build a national water utility that can provide the efficient, resilient and sustainable public water and wastewater services that are required to meet the future population and economic needs of the country.

#### 1.2.1 Related Documents

- <u>CRU20031</u> Water Services Innovation Fund Annual Report 2019
- CRU19123 Water Services Innovation Fund Annual Report 2018
- <u>CRU17345</u> Water Services Innovation Fund Annual Report 2017
- <u>CRU15076</u> Water Services Innovation Fund Information Paper
- CRU19148 Irish Water Revenue Control 3 (2020 –2024) Decision Paper

More information on the projects supported by the Fund, including the final reports of completed projects, can be found on Irish Water's dedicated webpage <a href="here">here</a>.

Information on the CRU's role and relevant legislation can be found on the CRU's website at <a href="https://www.cru.ie">www.cru.ie</a>.

## 2. Innovation Fund Projects

### 2.1 Overview

Since the Fund's establishment in 2015, ten proposed projects have been approved under the Fund by the CRU. These are as follows:

Project	Approval Date	Status at end 2020
IF-01 Pilot Technology Trials of Water Metering Systems for Multi-Unit Developments	September 2015	Complete
IF-02 Promoting Sustainable Household Water Consumption	December 2015	Complete
IF-03 Universal Water Meter Display Platform	December 2015	Not progressed
IF-04 Climate Change Adaptation – Identification of Climate Sensitive Catchments	December 2016	Complete
IF-05 Investigating Novel Sensing Techniques for Monitoring Trade Effluent	March 2017	Complete*
IF-06 Enhancing Existing Wastewater Treatment Plants Through Aerobic Granular Sludge Addition	July 2019	Ongoing*
IF-07 Development of pilot Sludge Treatment Reed Beds for Use in Treating & Dewatering Water Sludge Containing Aluminium Sulphate	April 2020	Ongoing*
IF-08 Effecting Transformational Change in Leakage Reduction within the Greater Dublin Area (GDA)	June 2020	Ongoing*
IF-09 Developing the Evidence Base for Treatment Wetlands Targeting Phosphorus Removal and Delivery of Co-Benefit	October 2020	Approved*

IF-	-10 WRc Collaborative Research Project with UK	October 2020	Ongoing*	
Uti	ilities – CP609 Manhole Rehabilitation:			
As	sessing Condition & Rehabilitation Options			

<sup>\*</sup> Updates on these projects are provided in Section 2.2 below.

Further information on all projects can be found on Irish Water's dedicated Research & Innovation webpage (available <a href="here">here</a>), and in previous CRU Water Services Innovation Fund Annual Reports (available <a href="here">here</a>).

### 2.2 Innovation Fund 2020

#### 2.2.1 Investigating Novel Sensing Techniques for Monitoring Trade Effluent

#### **Research Partner**

Dublin City University

#### **Potential Benefits**

- Better management of the wastewater network
- Real-time monitoring for improved environmental protection

#### **Project Description**

This project was approved by the CRU in March 2017 with the aim to characterise high-risk trade effluent from three sectors: food and drink, waste, and pharma-chemical. The project was completed on time and in budget in 2020.

The project characterised and analysed trade effluent (wastewater that requires a licence to allow it to be sent to the public sewer) from five companies in each of the above sectors. The results of this analysis helped determine which parameters would be the most useful for monitoring the composition of trade effluent using off-the-shelf sensor or passive sampler technologies. The analysis and deployments indicated that a selection of sensor technologies such as turbidity, conductivity, pH, chloride, ammonia, nitrite, and nitrate provide useful insight into trade effluent composition that inform trade effluent properties in real-time.

The data obtained on the composition of trade effluent samples can be used to inform levels of input to sewer systems and the selection of sensor and passive sampler technologies for monitoring trade effluent properties. Specifically, the project found that the levels and variation of chemical oxygen demand (COD), total organic carbon (TOC), nutrients and ionic species indicate that the organic and inorganic components of trade effluent are present at levels that can be picked up by sensor, spectroscopic and passive sampling monitoring.

It was also found that testing with conductivity and turbidity sensors indicated that these commercially available sensors are able to detect bulk differences in the properties of trade effluent samples which may provide insight into changes in trade effluent composition. There is also significant evidence for the potential of spectroscopic, conductivity and turbidity sensors to obtain surrogate information linked to trade effluent parameters. For example, analysis suggests that conductivity (which can be more readily identified by sensors) may serve as a useful surrogate for chloride levels.

This project will ultimately assist Irish Water in its management of the wastewater treatment process. The findings and learnings can inform the requirements of sensors to provide real-time monitoring data and allow Irish Water to take preventative measures to help protect its wastewater treatment processes and, ultimately, the environment. This could also result in a more cost-effective management of trade effluent because of lower monitoring costs and a lower cost of conveyance and treatment of trade effluent from a reduction in the number of shock-loadings from trade effluent.

Future research into the cost effectiveness of various sensor technologies compared with conventional trade effluent monitoring was identified to be highly valuable to both industry and Irish Water. Additionally, research into the recovery of nitrogen and phosphorous materials may prove a valuable opportunity to extracting additional value from trade effluent by facilitating the development of circular economies.

The results of the project ultimately suggest real value in sensor-based monitoring of trade effluent and potential for use of targeted passive sampling approaches to refine the information that can be obtained.

The project's final report will be made available on Irish Water's website here.

## 2.2.2 Enhancing Existing Wastewater Treatment Plants Through Aerobic Granular Sludge Addition

#### **Research Partner**

Royal HaskoningDHV

#### **Potential Benefits**

- More efficient and effective wastewater treatment at appropriate sites
- Reduce future investment needs in wastewater treatment plants at appropriate sites
- Contribute to achievement of relevant environmental standards and the objectives of the Water Framework Directive

#### **Project Description**

This project was approved by the CRU in July 2019. The aim of this project is to identify if and how the addition of aerobic granular sludge from dedicated wastewater treatment plants could improve conventional wastewater treatment plant capacity and/or performance.

The majority of wastewater treatment plants operated by Irish Water use conventional wastewater treatment methods. Some of these plants are approaching or exceeding their capacity to treat the wastewater they receive. A small number (four) of wastewater treatment plants operate with a process using aerobic granular sludge, a comparatively newer treatment process.

Aerobic granular sludge has been proven, in certain circumstances, to provide effective treatment of wastewater in a more cost-efficient and space-effective manner than the conventional treatment methods. During the operation of the plant, a surplus of this sludge is produced as a by-product of this wastewater treatment process.

This project will validate whether this surplus aerobic granular sludge can be transferred to and used in plants that treat wastewater using conventional methods. This is to increase their capacity to treat wastewater and/or improve the treatment performance. This could, in turn, reduce operational costs and/or defer the need for capital expenditure.

This project commenced in Q2 2020. By the end of the year, a preliminary desktop study to identify possible donor and recipient wastewater treatment plants had been carried out to determine three donor sites and three recipient sites for the project. Baseline and monitoring

equipment had then been implemented at the recipient sites and the planning for transfer of the sludge between sites was underway.

The project remains on track to be completed on time and in budget in 2022.

# 2.2.3 Development of pilot Sludge Treatment Reed Beds for Use in Treating & Dewatering Water Sludge Containing Aluminium Sulphate

#### **Potential Benefits**

- Provide low-cost sustainable solution for dewatering sludge that is a by-product of the treatment of drinking water
- Reduce operational costs compared to conventional methods
- Provide a sustainable solution within an environmentally friendly habitat which will benefit the environment and encourage biodiversity

#### **Project Description**

This project was approved by the CRU in April 2020. The aim of this project is to design, construct and operate pilot sludge treatment reed beds over three years which will be used to dewater sludge from water treatment plants containing Aluminium Sulphate & Ferric Chloride.

In Ireland, in excess of 90% of the coagulant used for treating water is Aluminium Sulphate. Aluminium Sulphate is used to clean drinking water and is removed with other contaminants as an Aluminium Sulphate based sludge. The dewatering and reuse/disposal of this sludge requires significant energy with the majority of the resultant material transported for disposal in landfill.

While sludge treatment reed beds have been successfully deployed to treat Ferric (Iron) based sludge in other countries, they have not been used to treat Aluminium based sludge other than at a pilot scale in intermediate bulk containers. This project aims to verify the use of sludge treatment reed beds to provide an alternative low-cost sustainable solution for dewatering this product.

Since commencement in Q2 2020, preliminary desktop studies were undertaken to identify and choose a site. By the end of the year, engagement with the EPA regarding the required environmental licensing has been completed, as has the design of the trial reed bed project and the procurement of reeds. The planning application had also been prepared and submitted.

The project remains on track to be completed on time and in budget in 2023.

## 2.2.4 Effecting Transformational Change in Leakage Reduction within the Greater Dublin Area (GDA)

#### **Potential Benefits**

- Reduce time to detect leaks and to reduce leakage levels.
- Less disruptions to supply and associated water quality issues in comparison to traditional leak detection methods.

#### **Project Description**

This project was approved by the CRU in June 2020. The aim of this project is to effect a change in how Irish Water addresses leakage levels using an approach that is more efficient and effective than Irish Water's current practices.

The reduction of leakage within a water distribution network has typically been carried out using sounding. While this method has been useful in managing leakage in high-pressure metallic pipe networks, the use of advanced pressure management and polyethylene based 'flexible' pipes has resulted in the transmission of sound through the pipe wall to be reduced. Research into more advanced acoustic logging technologies and associated data analytics could aid in reducing leakage more efficiently.

This project will deploy and verify the performance of four types of acoustic loggers across the Greater Dublin Area as a trial in supporting Irish Water's National Leakage Reduction Programme. The results of the project will then be analysed to determine the loggers' efficiencies and effectiveness in pinpointing leak detection and improving leak repair compared to the other logger types and to traditional methods of leak detection. If successful, acoustic logging could be rolled out at a national level.

This project began in 2020. Engagement with other utilities to determine the lessons learned regarding the use of acoustic loggers has been completed and the four logger types have been procured. By the end of the year, the training of crews and the deployment of the loggers was underway in line with Covid-19 restrictions and guidelines.

The project remains on track to be completed on time and in budget in 2022.

## 2.2.5 Developing the Evidence Base for Treatment Wetlands Targeting Phosphorus Removal and Delivery of Co-Benefit

#### **Research Partners**

- Cranfield University
- UK Environment Agency
- UK Water and Wastewater Utilities

#### **Potential Benefits**

- Provide a relatively simple, low-tech and sustainable solution to addressing phosphorus removal
- Increase robustness and resilience of overall treatment process
- Reduce carbon footprint and contribute to overall sustainability goals

#### **Project Description**

This project was approved by the CRU in October 2020. The aim of this project is to determine the use of surface flow treatment wetlands for the removal of phosphorus.

Nature-based systems are widely recognised as a sustainable method of treating wastewater. However, the variability of their performance poses challenges to their widespread adoption for both operators and regulators, particularly in the case of phosphorus removal. This collaborative research project between Irish Water, a number of UK water/wastewater utilities, the UK Environment Agency and Cranfield University will look at the use of surface flow treatment wetlands for the removal of phosphorus.

There are currently several wastewater treatment plants that are non-compliant or at risk of non-compliance with current or enhanced phosphorus removal requirements. Many of these wastewater treatment plants are located in rural areas where generally there is more opportunity to deploy a surface flow treatment wetlands solution. Some larger wastewater treatment plants have also been identified as potential sites where a surface flow treatment wetlands solution may also be suitable.

The research project seeks to summarise the evidence base on the use of surface flow treatment wetlands for phosphorus removal. The project will also address knowledge gaps identified and, through investigative work, establish the design envelope for surface flow treatment wetlands

targeting phosphorus removal, delivery of compatible co-benefits, and provide recommendations for their design, operation and maintenance. This project is set to commence in early 2021.

#### 2.2.6 Manhole Rehabilitation: Assessing Condition & Rehabilitation Options

#### **Research Partners**

- WRc
- UK Water and Wastewater Utilities

#### **Potential Benefits**

- Provide approaches or interventions to manage the risks of network surcharging and flooding resulting from failure of manhole covers
- Minimise the overall manhole maintenance and asset replacement costs
- Reduce flow in sewers which will lead to reduced pumping and treatment costs

#### **Project Description**

This project was approved by the CRU in October 2020. The aim of this project is to assess the range of techniques applicable to manhole inspection and rehabilitation and to develop best practice and provide industry specifications to improve the operational efficiency through their use.

Manholes are an integral part of the sewer network, but the knowledge of the various manhole inspection techniques and rehabilitation methods is not as clearly defined as they are with gravity sewers. Recent developments in manhole inspection methods, including 3D imagery, have made condition assessment more accessible but new guidance is required on their use to fulfil building information modelling requirements.

Reducing infiltration of groundwater into sewers is also an increasingly important activity for wastewater undertakers. Efforts to quantify the infiltration reduction capabilities of popular renovation techniques such as lining with cured-in-place pipes is ongoing. Ingress occurs through both defective pipework and manholes with the latter reported to contribute up to 50% of infiltration in sewerage networks. Renovating sewers can also potentially cause local water table rises that may exacerbate infiltration into defective manholes.

With new manhole rehabilitation systems becoming available in the UK market, and some trials underway, this project will address the need for a best practice guide on the technical feasibility, specification and cost effectiveness of manhole inspection and rehabilitation.

This project began at the end of 2020 and is on track to be completed on time and in budget in 2021.

#### 2.2.7 Previously Completed Projects

Since its establishment in 2015, four projects have been completed under the Fund. Three of these projects had been completed prior to 2020 and so have not been discussed in detail above. This section provides an overview of how these previously completed projects have been applied in Irish Water's day-to-day operations and the benefits that have been accrued since their completion.

In 2017, Irish Water completed the *Pilot Technology Trials of water metering systems for Multi-Unit Developments*. The trials provided Irish Water with insights into the technical solutions available for the measurement of water usage in apartments, including radio communication technologies and data management systems. The knowledge gained from these trials is being applied in the development of future meter supply frameworks and should ensure that products and systems are procured that offer flexibility for customers to be provided with more information about their water usage. The trials also provided Irish Water with real examples of smart water systems, which informs the development of its policy and strategy development on future digitisation and smart water networks.

In 2019, Irish Water completed the *Promoting Sustainable Household Water Consumption* project. This research project focused on building an evidence base for future water conservation programmes to promote sustainable household water consumption. The B&A research and survey commissioned in relation to this project provided rich insights which informed Irish Water's ongoing quarterly sentiment research questionnaires. The results of these questionnaires provides data for Irish Water's internal use regarding customers views on their trust and confidence with Irish Water.

Further to this, the Trinity College Dublin report generated as part of this project referenced the effectiveness of primary school initiatives to encourage small interventions in daily behaviour. The report highlighted some 'unconscious' casual usage examples, such as turning off the tap when brushing teeth, noting that establishing small changes that can become a shift in habits are

critical in beginning a positive dialogue. This has led Irish Water to develop a schools education campaign, which can be viewed on its website here.

In 2019, Irish Water completed the *Climate Change Adaptation - Identification of Climate Sensitive Catchments* project which has since informed a number of other research and work areas. First, the methodology for assessing the vulnerability and future impact of abstracting water from the River Shannon has been used to inform Irish Water's proposed Water Supply Project, Eastern & Midlands Region. Second, this research has been used to inform what the best available techniques are for assessing the vulnerability of services to climate change and in turn to inform adaptation methods. The indicative risk-based allowances allow water and wastewater project planners to understand the impact of climate change on future water resources and receiving bodies and in turn plan for the delivery of sustainable services beyond 2050.

Finally, the *Climate Change Adaptation - Identification of Climate Sensitive Catchments* research provides a risk-based allowance for five different catchment sensitivity types which can help inform national climate services in the water sector. The rules regarding allocation of sensitivity type provided a straightforward means for categorising all catchments in Ireland. Applying these Q95 allowances, as set out in the research paper, across Ireland to catchments not covered in the research is currently being investigated by Irish Water with other stakeholders in climate services for the water sector including the EPA, the National Federation of Group Water Schemes, Geological Survey Ireland, and Met Eireann.

## 3. Next Steps

The CRU has allowed €4 million for the Water Services Innovation Fund over 2020-2024 as part of Irish Water's third Revenue Control (RC3). As Irish Water has accessed just over €1 million of this to date, just under €3 million remains for Irish Water to access to end 2024. Irish Water may continue to submit research project applications under the Fund. Potential applications will be reviewed by the CRU and approved where the projects are found to meet the qualifying criteria.

The CRU will provide an update detailing the ongoing research carried out this year in the Water Services Innovation Fund Annual Report 2021. This will be published in 2022.