

# The Hydro Nation Annual Report 2021

Laid before the Scottish Parliament  
By the Scottish Ministers  
SG/2022/26

March 2022

## In this report

Developing the Water Economy Vision .....	3
National: Supporting communities and Scotland’s water economy .....	4
International – reaching out to the world .....	9
Knowledge sharing and capacity building activity .....	11
Promoting growth and innovation in the water sector .....	15
Looking ahead – 2022 and beyond .....	22
Annex A - Structure of governance .....	24
Annex B - Hydro Nation forum members.....	28
Annex C - Hydro Nation scholars .....	29
Annex D - Summary of improvements delivered in 2015-2021 .....	34

### Further information on the issues raised in this report can be found at:

Scottish Government [www.gov.scot](http://www.gov.scot)

Scottish Water [www.scottishwater.co.uk](http://www.scottishwater.co.uk)

Water Industry Commission for Scotland  
[www.watercommission.co.uk](http://www.watercommission.co.uk)

Drinking Water Quality Regulator  
[www.dwqr.scot](http://www.dwqr.scot)

Citizens Advice Scotland  
[www.cas.org.uk](http://www.cas.org.uk)

Scottish Environment Protection Agency  
[www.sepa.org.uk](http://www.sepa.org.uk)

Scottish Canals  
[www.scottishcanals.co.uk](http://www.scottishcanals.co.uk)

Or contact us at:

**Scottish Government**  
Water Industry Division  
[waterindustry@gov.scot](mailto:waterindustry@gov.scot)  
Area 3F South  
Victoria Quay  
Leith  
Edinburgh  
EH6 6QQ

**Minister for Environment and Land Reform**  
[scottish.ministers@gov.scot](mailto:scottish.ministers@gov.scot)  
St. Andrew's House  
Regent Road  
Edinburgh  
EH1 3DG

# Developing the Water Economy Vision

## Introduction by Mairi McAllan MSP, Minister for Environment and Land Reform



I am very pleased to be able to introduce this annual report to the Scottish Parliament for the first time. This is the eighth annual report which highlights our progress in delivering on our vision of Scotland as a Hydro Nation. 2021 has continued to present serious challenges in every aspect of our lives as we all adapt to new ways of working and living during the Covid-19 pandemic. I am proud of our water industry's response and there are some excellent examples in this report of how our water sector has had to change how they operate to help keep customers and communities safe. I should like to acknowledge in

particular the Covid-19 waste water monitoring, led by Scottish Water and SEPA, which provided a key response to covid-19 management during a period of unprecedented challenge for our nation.

In the seventh annual report, we highlighted that the Hydro Nation Forum would provide assistance to review the Hydro Nation agenda and ensure it remains relevant.

Unfortunately, pressures arising from the pandemic mean that the review is not yet complete. I intend to reconvene the Forum in early 2022 to help focus this review and the findings will be detailed in our ninth annual report.

Climate change remains the single greatest, long term threat we face and the impacts are being increasingly felt with Scotland suffering from extreme weather events including unusually long, dry summers which mean that communities can experience a lack of water, particularly where there is a reliance on a private water supply. On the other hand, we are witnessing an increase in severe wet weather events meaning that households and businesses are being impacted by flooding. Careful management of our water resources will ensure we keep the water running for our customers, especially when proper hygiene has never been more important, and proactive management of surface water – incorporating blue-green infrastructure - will be essential to safeguard our communities from flooding.

I am pleased that this report highlights examples of innovation as we seek to meet our net-zero emissions targets. All across Scotland, companies are finding new, efficient ways of operating and it is encouraging to be able to provide these case studies.

I should like to thank everyone involved in delivering the activities which are supporting our hydro nation agenda and I look forward to continuing to work together to promote our water economy.

## National: Supporting communities and Scotland's water economy

Scotland is a Hydro Nation, one that views and manages its water resources responsibly, and views our relationship, and the ways we work, with the water environment and industry as inextricably linked to our national identity.

Our water sector, including Scottish Water, is worth an estimated £1.7 billion<sup>1</sup> to the Scottish Economy. We are committed to the sector's growing success and will work with our enterprise agencies and Scotland Development International to support our businesses into new markets. The examples below help to underline how the Hydro Nation agenda is delivering in Scotland, and for Scotland.

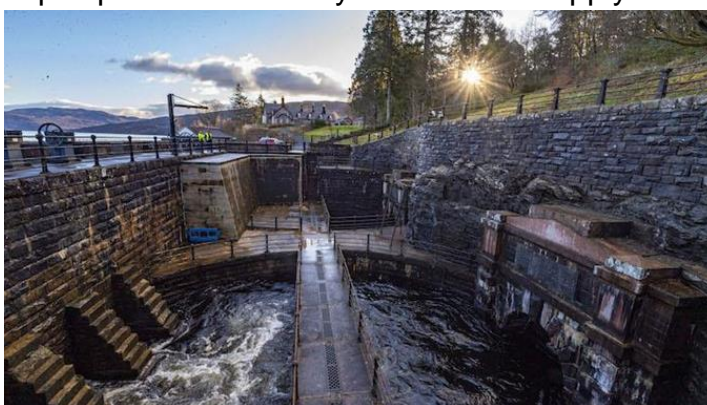
### Scottish Water: Delivering for you

Scottish Water continues to invest and deliver infrastructure that is fit for communities throughout the country now and for decades to come. Scottish Water has invested £3.9 billion during the 2015-21 regulatory period, improving services for customers. A summary of its achievements is available at annex D.

2021 marked the first year of an ambitious £4.5 billion capital investment programme which will span the 2021-27 period and deliver improvements to drinking water quality and the environment, whilst focussing on making progress towards achieving net-zero emissions by 2040.

**Katrine aqueduct** - A major upgrade to the Katrine Aqueduct, which serves more than 1.3 million people in parts of Greater Glasgow and the central belt, has been completed. The project to improve and refurbish parts of the two aqueducts, the first 34 miles long and the second 23.5 miles long, which take water from Loch Katrine to two of Scotland's biggest water treatment works, will help improve the security of the water supply to customers for generations to come.

The investment was the latest phase of the biggest upgrade to the megastructure since the first aqueduct was built in 1859 - a total of 17 miles of tunnel sections had concrete and masonry repairs and 10 bridge sections



had masonry and metalwork repairs carried out by a team of about 35 workers over the past two years, with a three-month break due to the Covid-19 pandemic.

The aqueduct takes raw water by gravity along its two routes from the south shore of Loch Katrine to the Milngavie and Balmore Water Treatment Works (WTW), just north of Glasgow. Milngavie WTW serves more than 700,000 people across much of the Glasgow area and Balmore WTW serves some 600,000 customers in areas from

---

<sup>1</sup> Figures from [The water sector in Scotland: market size research](#) – turnover, jobs, exports and gross value added report.

Bishopbriggs, Lennoxton and Torrance in the west to parts of north east Glasgow and Cumbernauld, north Motherwell and Linlithgow, Bo'ness and parts of Grangemouth in the east.

**Dundee storm-water management** - Scottish Water is currently developing storm water management opportunities, in collaboration with Dundee City Council, which will reduce demand on the sewer network and support multiple national agendas for blue/green infrastructure, sustainability, net zero emissions, wellbeing, and creating better places to live.



A project in St Mary's in Dundee, involves working closely with Dundee City Council, and other key stakeholders including SEPA and NatureScot, on the drainage strategy. It was also vital to include the residents living in the area. It

is looking at an opportunity for nature based solutions such as ponds, wetland areas and rain gardens as well as incorporating space for cycle paths, trees, playparks and wildflowers planting. Three members of the community planning partnership have been asked to join the core project group. They'll help develop the community aspect of the strategy, and provide valuable feedback from locals.

Phase 1 of the plan will deliver a conveyance route for surface water to manage flood risk in the area through St Leonard's Park. This conveyance route will manage flows in everyday rainfall events, but also have storage areas to help slow down water in larger storm events. Thanks to input from the community, Scottish Water will aim to incorporate features such as a cycle path and a running track around the new burn. The plans also include increased planting, play areas, safer routes to schools and a little bit of open water.



## **Covid-19 Adaptability**

### Water sampling

Water quality has been maintained at a very high level over 2015-21 on the standards set out in both Scottish and EU legislation and overseen by the Drinking Water Quality Regulator (DWQR). Water quality monitoring was maintained by Scottish Water throughout the pandemic and when it became clear that access to customer homes would be lost for sampling, a new testing approach was developed with the DWQR. This involved taking samples further upstream in the network at water treatment works, service reservoirs and from the homes of sampling employees, volunteers and commercial premises.

While tests taken during 2020 showed compliance of 99.947%, it is not possible to make a direct year-on-year comparison for results from customers' taps. The issues experienced in 2020-21 have allowed Scottish Water to improve business continuity practices and sampling processes.

### Covid-19 Monitoring

A pilot programme of wastewater sampling was carried out by Scottish Water in partnership with the Scottish Environment Protection Agency (SEPA) and the Roslin Institute, giving insight into the prevalence of Covid-19 in the community and likelihood of where further infection clusters might occur. The approach tested for genetic material from the coronavirus in wastewater. Most people infected with the coronavirus are believed to shed it in their faeces even if they have no symptoms, so waste water analysis has helped to identify local outbreaks ahead of a rise in hospital admissions.

The monitoring regime became fully operational in January 2021. The data, via over 200 wastewater samples per week from over 80 locations, has informed health boards and local authorities to deliver community testing and help government track the success of the vaccine roll-out. Analysis on concentrated areas of population in cities has taken place to enhance understanding of the virus spread and shape effective public health suppression efforts.

### Investing through a pandemic

On 23 March 2020, Scottish Water's entire capital programme shut down in response to the Covid-19 lockdown. In total, 483 live sites closed within 24 hours. This took a major effort from Scottish Water, their alliance partners and their wider supply chain. Only when Government restrictions were relaxed in June, after three months of closure, did the programme safely and cautiously restart. This was achieved through close collaboration across a network of delivery partners, alliances and wider supply chain partners, ensuring that the safety of personnel and the communities around their works was protected at all times. This collective approach was essential in establishing how to operate in such unprecedented circumstances.

Inevitably, challenges were faced during the year and Scottish Water did experience a very small number of Covid-19 outbreaks at their construction sites. As the pandemic continues, so does the focus on safety, with guidelines regularly reviewed as a result of lessons learned and changes in Government guidelines.

## **Private water supplies – A framework to deliver universal access to safe drinking water for all**

Citizens Advice Scotland (CAS), in partnership with the Drinking Water Quality Regulator (DWQR), commissioned research during 2020-21. The research set out to better understand what would create more resilient and empowered private water supply communities that can respond to the challenges of meeting minimum water quality standards and adapt to climate change impacts.

The summer drought of 2018 saw unprecedented numbers of requests for support from people and communities that had run out of water. This happened again during the dry

spring and summer of 2020 and also in 2021. The main barriers that private water supply users face when managing and treating their water supply, as well as coping with climate change impacts such as drought, are:

- the lack of access to information and advice,
- infrequent water sampling creating lack of understanding around water quality,
- lack of suitable funding support and
- a complex and expensive mains connection process.

The research identified the need for an adequate support framework for those on a private supply that addresses affordability issues and offers support to help communities to better manage their water quality as well as improve their resilience to climate change. The development of partnership-based approaches between private water communities and relevant public bodies (e.g. local authorities and Scottish Water) empower communities to effectively self-manage their water supply, access the necessary expertise and develop climate change resilience strategies.

## Support for businesses during the pandemic

The COVID-19 pandemic presented unprecedented challenges to businesses and the wider economy in Scotland. Mindful of its statutory duties to promote the interests of customers, it was important to ensure that the industry responded quickly to support non-household customers affected by the pandemic and transition the market back to its normal operations.

Towards the beginning of the pandemic, the Water Industry Commission for Scotland (WICS) implemented a series of steps to support customers and licensed providers affected by the pandemic by developing a customer deferral scheme, which allowed eligible customers in need to defer a certain portion of their charges through their licensed provider. Scottish Water also supported licensed providers by suspending the two-month wholesale prepayment requirement.

As WICS considered how to phase out the current support measures (whilst being mindful of its statutory duties to ensure an orderly functioning of the market and that there is no detriment to the wholesale business of Scottish Water), it worked closely with Scottish Water, Licensed Providers and other stakeholders by establishing an industry-wide Working Group to develop and implement two new voluntary licence conditions, including:

- Support for affected customers through a new deferral scheme which allows licensed providers to defer a portion (or all) of the primary wholesale charges for a given customer.
- Licensed providers to demonstrate their financial resilience to Scottish Water and WICS.

The vast majority of the retail market has formally committed to the new voluntary conditions.

## The recast Drinking Water Directive impact

The new EU recast Drinking Water Directive (rDWD) is the first Directive to be transposed post-Brexit, as part of Scotland's commitment to keep pace with EU law. CAS is working with other water sector stakeholders across a number of areas to assess the implications and solutions needed to meet the obligations of the rDWD.

A fundamental principle behind the new rDWD is to ensure access to safe drinking water for all. For consumers, this means ensuring that those on a private water supply are sufficiently equipped to effectively manage their water supply and cope with the impacts of climate change, which have seen many private supplies run dry in recent summers.

Additionally, the rDWD will impact how customers are informed about their water charges and the quality of their drinking water. It also seeks to inform consumers with the information and understanding they need to make water efficient choices. It may also require a new policy on lead water pipe replacement in domestic properties, as part of a new approach to address the health concerns associated with lead.

## Improving urban waters

In light of stay-at-home messages during the pandemic, customers and communities are becoming increasingly aware of the natural environment being an important resource for physical and mental well-being. In addition, our water environment provides for the sustainable growth of our economy. The Scottish Government is committed to ensuring our water environment is in the best possible condition. On 22 December 2021 the Minister for Environment and Land Reform gave a statement in the Scottish Parliament to highlight the progress made to date and to explain the proposed investment. On the same day the Scottish Environment Protection Agency (SEPA) published the latest River Basin Management Plan (RBMP3) which sets objectives and provides a programme of actions for delivering improvements to Scotland's water bodies. In tandem, Scottish Water has published an improving urban waters routemap to explain how it will direct its own investment to help achieve improvements under RBMP3.



## International – reaching out to the world

The Hydro Nation Strategy outlines our intent to deploy the potential of Scotland's knowledge and innovation in a global context. Hydro Nation International (HNI) describes our activity to co-ordinate and harness a range of international water-related activities across Scottish public bodies, universities and non-Governmental organisations that contribute not only to the Hydro Nation agenda but also to the United Nation's Sustainable Development Goals; in particular Sustainable Development Goal 6 (Ensure availability and sustainable management of water and sanitation for all by 2030). Activities completed as part of this agenda in 2020-21 include:

### Malawi Scotland Regulatory Partnership (MSRP)

The Scottish Environment Protection Agency (SEPA) has continued to lead the MSRP with support from the Scottish Government through the Hydro Nation International Centre. The programme offers institutional support and capacity building to Malawi's National Water Resources Authority (NWRA) and Malawi Environment Protection Agency (MEPA). In support of this, the MSRP welcomes multi-sectoral collaboration from across the Hydro Nation family, and beyond, currently bringing additional expertise from the James Hutton Institute (JHI), Hydro Nation Scholars and Water Witness International (WWI) in Scotland, and BASEflow and BAWI consultants in Malawi. This agile configuration of Scottish and Malawian expertise, united under the banner of Hydro Nation, continues to represent a novel and effective vehicle for supporting the operational needs expressed by the NWRA and MEPA.

As in previous years, the regulators remain in the early stages of operationalisation, requiring assistance with corporate governance and development of information systems and other key operational protocols and procedures that underpin regulatory decision-making. Following the emergence of Covid-19 in early 2020, the MSRP refocused efforts on aiding regulators through remote engagement and identifying a need for future enhancement of our digital delivery capacity in Malawi.

While managing to maintain some of the MSRP's core offering, the newfound restrictions also created an opportunity to consolidate and plan for delivery of international-focused work in a post-covid and Net-Zero world. These activities focussed on:

- Consolidating the MSRP's assessment and understanding of the challenges impacting the performance of Malawi's water sector,
- Reinforcing key relationships with stakeholders in Malawi,
- Building representation of the MSRP through Malawi partners, ensuring the future delivery is Malawi-led.

### Scottish Water Horizons (SWH)

The primary purpose of Scottish Water Horizons' international activities is to develop business opportunities abroad in line with the Scottish Government's Hydro Nation ambitions. Key highlights in 2021 include:

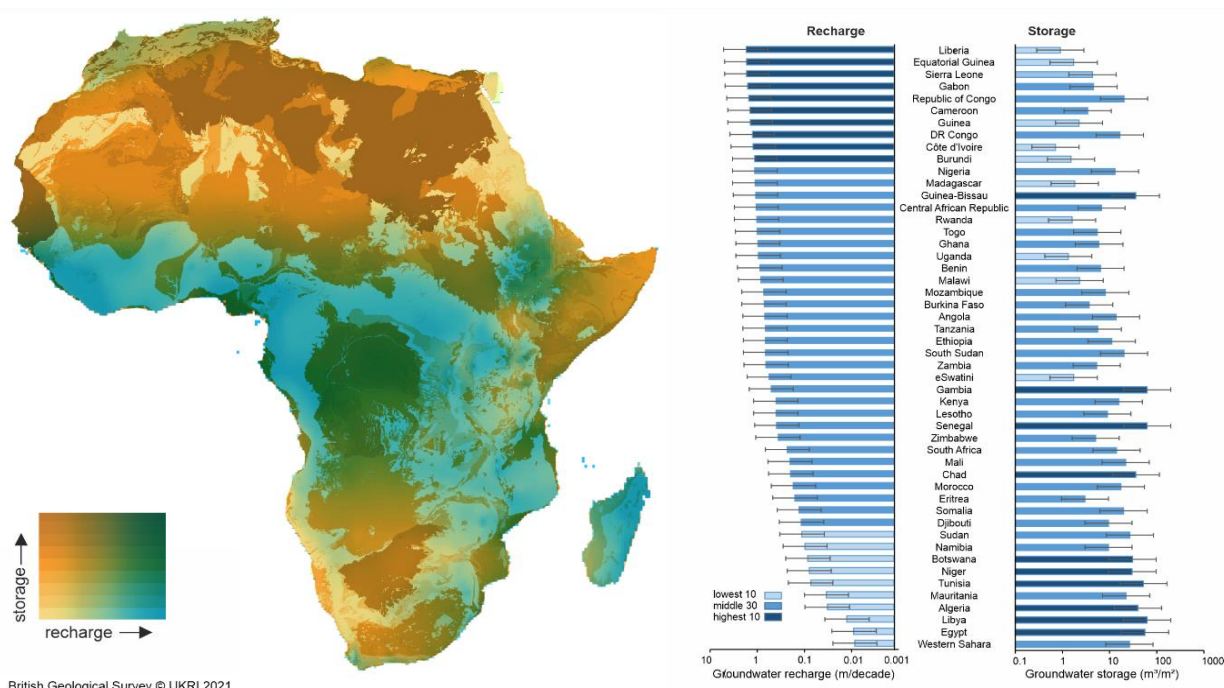
- **South Australia Water:** SWH has been continuing to provide expert advice and support to South Australia (SA) Water via a joint venture between KBR and Aurecon to transform the delivery of their Capital Investment Programme. The programme has successfully completed its first year with a smooth transition between investment periods and a newly implemented risk-management framework, whilst minimising impact from COVID-19. In the coming year, Scottish

Water Horizons will develop an integrated Risk and Benefits Management Framework and facilitate lifecycle efficiency opportunities to increase the productivity and quality of SA Water’s Capital Delivery outputs.

- **Queensland Urban Utilities:** Scottish Water Horizons has renewed its relationship with Urban Utilities (QLD) via KBR to provide expert advice to its Capital Solutions team. SWH will facilitate a benchmarking assessment between QLD, SA Water and Scottish Water through a collaboration network called “Delivering Connections” to help respective teams connect, share successes, innovations and lessons learnt; as well as providing a platform for sharing of ideas and collaborative problem solving with greater diversity of thinking.
- **Yarra Valley Water:** Scottish Water Horizons has extended its services in the Australian Water industry to include Yarra Valley Water (YVW) via a joint venture between KBR and Aurecon to support the development of the utility’s Portfolio Management Office (PMO). This has involved numerous knowledge transfer sessions between YVW and Scottish Water with the latter describing the challenges and experiences in establishing its own PMO.
- **New Zealand:** In partnership with WICS, Scottish Water is continuing to provide advice into the Three Waters Reform Programme, a new drinking water regulatory framework, with oversight on other services. This involved Scottish Water Horizons providing a knowledge transfer session with Wellington Water on its approach to business process development and quality management systems.

## British Geological Survey

The British Geological Survey (BGS) worked with partners across 14 Low to Middle Income countries in 2020-21 to deliver data and research on improving water security under future climate change. The work contributes to the Hydro Nation strategy of using our expertise in Scotland across the world, particularly to help the poorest countries and marginalised people. This global research programme run from offices in Edinburgh helped to deliver world leading research into groundwater and water security, as well as informing climate resilience water strategies in several East African countries. This year, with partners from African Universities, BGS published a map of groundwater for Africa, quantifying for the first time the rate of renewal for groundwater.



## Knowledge sharing and capacity building activity

### Covid-19: Surveillance, recovery and conflicting challenges

With the persistence of COVID-19 and the spread of the SARS-CoV-2 into 2021 following predictable wave patterns and attendant mutations of the virus, the need for observatory data and surveillance continues. While recovery from the pandemic still includes a lot of individual testing, a need for community level prevalence data is now essential as we move into the endemic phase. While office buildings are empty, or partially empty, the full impact of continuing measures have not fully been felt yet and there is a danger that this may impact on the drive to net zero in the coming years. Engineers and policy decision makers will need to skilfully navigate the combined challenges of, for example, the need to increase ventilation in buildings whilst reducing energy usage in buildings.

At Heriot-Watt University, work led by Professor Michael Gormley has continued to work extensively in measuring virus prevalence in the community. In a piece of research sponsored by the Scottish Government Hydro Nation and the Scottish Environmental Protection Agency (SEPA) and managed by CREW, the team set out to establish a methodology for very near source monitoring of the extent of infection in people in specific buildings through the novel approach of capturing aerosols and droplets in naturally occurring airstreams found in sanitary plumbing systems inside buildings. The [results of the covid-19 surveillance work](#), now published by CREW, established the protocols for detecting viral RNA in aerosols and droplets and suggested the optimal location for detection equipment.

The hypothesis is that when a toilet (which contains faeces, urine, or vomit of a person infected with SARS-CoV-2) is flushed, the virus will be present in aerosols generated within the system and so, will then be carried in the system airstreams. Sampling the airstreams will capture the aerosols, which can be tested for the presence of viral RNA. The work established that detection of viral RNA from sanitary plumbing systems is possible and could form part of the on-going surveillance efforts for SARS-CoV-2 and COVID-19, particularly where source questions arise, for example in care homes, prisons and university halls of residence. This information can then be used as part of the suite of surveillance tools used to inform public health policy. The next phase of this work – piloting in real buildings – will commence soon.

### Scottish Industry Directory

During the year Scottish Enterprise commissioned Optimat to create a [publicly available supply chain directory](#) for the water sector in Scotland. The database is searchable by company name, technology area or by geography. Over 500 companies are already listed making this a valuable tool to help project developers and procurement managers to source Scottish based companies for construction or to access materials, equipment or new technology.

### Hydro Nation Scholars

The Hydro Nation Scholars Programme supports PhD student research on cutting-edge water challenges and aims to develop the water leaders of the future. These studies help to create new expertise within Scotland and build its international profile and global alumni. Hydro Nation Scholars Programme PhD projects are highly relevant to the

objective of the Hydro Nation policy agenda - to develop the economic, environmental, and social value of Scotland's water resources. The PhD projects span industrial application, socio-economics and value, governance, climate change, resilience, rural economies and environmental, physical, ecological and hydrological mechanisms and impacts and innovation across the water sector (see Annex C).

In the reporting year 2020-2021, 20 Hydro Nation scholarships were in progress at eleven Scottish Universities by scholars of thirteen different nationalities, of which four scholars successfully completed and joined the growing Hydro Nation alumni (14 in total). The most recent alumni include; Dr Nandan Mukherjee "Integrated River Basin Management Framework Under the Lens of Loss and Damage" (University of Dundee), Dr Valerio Cappadona "Can Wastewater Treatment Plants Cope with Future Nanoparticle Loading Scenarios" (University of Strathclyde), Dr Bhawana Gupta "Tackling the Challenge of the Water Food Energy Nexus in India and Scotland" (University of Dundee and the James Hutton Institute), and Dr Lydia Niemi "Pharmaceutical Occurrence, Distribution and Degradation in Rural Wastewaters and Surface Waters in Scotland" (University of Highlands and Islands).

There continues to be a close ongoing relationship between the Hydro Nation Scholars (and their academic supervisors) and external communities, including the wider water industry in Scotland and the key governmental institutions who have responsibility for aspects of water policy, regulation and governance. The Covid-19 pandemic has been highly disruptive to the work of the scholars, especially those with projects involving international work. As such the programme has been working with the scholars individually to support them throughout this challenging time.

## The One Health Breakthrough Partnership

Developed in 2017, the [One Health Breakthrough Partnership \(OHBP\)](#) brings together key regional and national stakeholders across the water, environment, and healthcare sectors who are committed to addressing the issue of pharmaceutical pollution in the environment. Four agencies make-up the steering group; Scottish Water, SEPA, NHS Highland and University of the Highlands & Islands Environmental Research Institute, with associate members including Scottish Higher Education Institutes, businesses, and social enterprises.

The Scottish Government Water Industry Division provided funding to the OHBP in 2020-21 for a dedicated co-ordinator to drive forward the work of the Partnership. This has enabled a number of achievements including:

- Improving the visibility and 'brand' of the OHBP through establishment of a website, logo and promotional and communication materials.
- Prioritising and enacting recommendations from the CREW Phase I baseline study of pharmaceuticals in the water environment, and contributing to the Phase II study with SEPA to develop an interactive data visualisation tool by winter 2021;
- Developing and delivering the OHBP [innovation seminar "One Health, Water, and Pharmaceutical Pollution in Scotland"](#). This included creation of high-quality online course materials, as part of the international Global Challenges Research Fund (GCRF) [One Health network online course](#) and conference;

- Publishing the [Caithness General Hospital pilot study](#) conducted in Wick, Highlands as a case study with the Alliance for Water Stewardship (AWS), and as a [case study with Healthcare Without Harm](#);
- External recognition through winning a VIBES 2020 Scottish Environment Business award, and being selected a finalist in the “Making a Difference” category of the Scottish Knowledge Exchange Awards 2021;
- Engaging with the private sector through regular Project Oversight Group (POG) meetings with members of the water, environment, healthcare, and prescribing branches of the Scottish Government to discuss the need for a Pharmaceuticals in the Environment (PiE) policy statement and programme.

## The Hydro Nation Virtual Water Pavilion: COP26

The Hydro Nation Virtual Pavilion provided an online go-to portal for water-related COP26 news and events, as well as an online showcase of the Hydro Nation and Net Zero journeys. It ran alongside the main COP26 conference from 1st-12th November 2021.

The Virtual Pavilion was created to target a broad audience - both international and domestic, experts and the general public – with the aim of capturing the global audience seeking to know more of Scotland’s expertise and delivery and to identify waters-related events during the conference. The [Hydro Nation Virtual Water Pavilion](#) had a dedicated website with a number of accompanying three-dimensional virtual tours, each focused on a theme related to the Hydro Nation strategy, as well as collated information on all waters-related activities planned throughout COP26.

## World Water Day – 22 March 2021

In light of the Covid-19 pandemic, it was agreed that an in-person event would be inappropriate. The James Hutton Institute instead provided a [virtual world water day event space](#) so that stakeholders could discuss the important theme of “Using water wisely”. The website provides showcases of relevant themes such as innovation and blue-green infrastructure.

## Centre of Expertise for Waters

The Centre of Expertise for Waters (CREW), supported by the Scottish Government and delivery partners, seeks to inform and steer water policy by delivering objective and robust research, and expert opinion. The Centre has contributed to the development of a range of Scottish/UK/EU policies and implementation strategies, and continues to serve Scotland's legislative Hydro Nation agenda.

### Delivering research to address policy needs

In particular, CREW has delivered outputs supporting policy including:

- National surveillance programme for Covid-19 RNA in wastewater. Bringing together scientists and collaborators to understand the presence and infectivity of COVID-19 in wastewater as part of the [Tracking SARS-CoV-2 via Municipal Wastewater](#) project.
- Feeding into the development of Sector Plans to support the delivery of SEPA's regulatory strategy – One Planet Prosperity. In particular, the Sector Plans for 'Water supply and wastewater', 'Finfish Aquaculture', and 'Crop Production'.
- Evidence from a range of CREW projects was instrumental in Scotland's response to the consultation process for the third six-yearly River Basin Management Plan under the (EU) Water Framework Directive (WFD; 2000/60/EC, OJEC, 2000). Plans for implementation of the RBMP will be guided by the timely delivery of the report - [Lags in water quality response to diffuse pollution control measures: a review](#).
- [Flood Risk Management \(Scotland\) Act 2009](#) was laid before the Scottish Parliament by the Scottish Ministers under Section 52 of the Flood Risk Management Scotland Act (2009) in January 2021, citing research from Dynamic Coasts, [Impacts of Flooding in North East Scotland](#), [Quantifying Rates of Urban Creep in Scotland](#).
- [Dynamic Coast](#) (Phase 2) continues to support the UK Climate Change Risk Assessment and multiple strands within the Climate Change Adaptation Plan (SCCAP1 & 2), Terrestrial Planning Policies (NPF3 & 4) and Marine Planning Policies (National and Regional Marine Plans). Important evidence from Dynamic Coast was presented for public sector duties under the Flood Risks Management Act (via SEPA and local authorities) and supported Scottish Government's Marine Licensing Team, in their licensing for harbour dredging. Furthermore, the project (Phase 1 & 2) contributed to a portfolio of evidence that led to a £12 million boost for coastal change adaptation that was announced in the Programme for Government (September 2020). Outputs from Dynamic Coast (DC) 2 will be used to prioritise actions on the ground during its implementation 2022-23.
- CREW engaged in several consultations including: UK Water Innovation Strategy that sets out a vision for transformational change across the water sector (in anticipation of the recently initiated Ofwat innovation fund).

Given the challenges of a rapidly changing world, CREW has broadened its delivery to address the cross-cutting needs of stakeholders. This includes the impacts and mitigation of climate change, land use and increased urbanisation, how to promote the circular economy, resource efficiency, post-COVID/green recovery, the move to net zero, and a just transition for communities.

## Promoting growth and innovation in the water sector

### Scottish Water's route to net-zero

#### Net Zero Emissions Routemap

Scottish Water's Net Zero Emissions Routemap was published on 14 September 2020 with an update on progress in September 2021. It is one of the most ambitious plans in the industry due to its scope and scale. It targets operational emissions which are under their control, as well as those emissions embedded in investment programmes and supply chains which they have influence over. It is a genuine net zero plan which does not include the purchase of carbon credits.

The Routemap explains how Scottish Water will reduce its emissions, embrace the circular economy and enhance the natural environment. Through this they will maximise their contribution to renewable energy generation by supporting the greening of the grid and increasing their ability to capture and store emissions in their land.

By the end of 2027, Scottish Water will be 35% through the timeline to their target, emphasising the need to change behaviours and processes at pace. In recognition of this, they have developed an ambitious target to achieve net zero operational emissions by 2030, 10 years ahead of the overall net zero emissions target of 2040.

#### Peatland Restoration

The restoration of peatbogs across Scotland is helping to protect source water quality and reduce carbon emissions. Scottish Water is carrying out analysis of 400 sites throughout the country to ensure they are as healthy as possible to lock up greenhouse gases as a natural "carbon sink".

The majority of the drinking water supplied to customers has run through peatland at some point on its journey to reservoirs and water treatment works. It can help stop harmful emissions and even help capture and store carbon from the atmosphere that might otherwise be contributing to climate change.



According to the International

Union for Conservation of Nature UK (IUCN), 42% of the world's carbon is trapped in stable bog peatlands, with a quarter of Scotland blanketed in peat it is home to some of the finest peat in the world. Some peatland areas are considered so rare and crucial to carbon capture and storage they are currently being considered for World Heritage status.

Each year tonnes of dried, destabilised peat is washed or blown down from the upper peatlands, releasing CO<sub>2</sub>, and requiring high energy water treatment processes to remove the organic matter during the freshwater treatment process. Stabilising the peatland should dramatically decrease the amount of peat being stripped off the hills and reducing the need to use energy to remove organics matter.

Over the next six years Scottish Water's Sustainable Land Management team will complete the assessment of all catchments. Where restoration work is required, they will negotiate with landowners and stakeholders to agree who will fund and deliver projects.

In 2020/21, 45 hectares of restoration took place, which equates to capturing and storing between 31.5 and 126 tCO<sub>2</sub>e per year.

### Trialling Low Carbon Construction Materials

Scottish Water and its delivery and supply chain partners are actively investigating and trialling low carbon alternatives to traditional construction materials. Examples include smart surfaces and low carbon cement.



Traditionally, when repairing potholed roads, the existing road surface is dug up and replaced with aggregate which is made up of quarried sand, gravel and rock. Excavating and removing old materials and bringing in new materials (with associated use of transport and heavy plant) all add to the carbon emissions produced.

Mackenzie Construction have come up with a more sustainable solution using a binder to stabilise the existing ground materials. Where sufficient material exists on site it is possible to have zero importation of aggregate and zero off-site disposal of waste, greatly reducing the environmental footprint of projects.

Scottish Water have successfully used this process on the 800-metre access road for Biggar Waste Water Treatment Works in South Lanarkshire.

Concrete is produced by mixing cement with aggregate and water and is the most widely used man-made material in the world with over 17.5 billion tonnes produced each year. Traditional Old Portland Cement (OPC) is made by heating ground limestone and clay. However, as limestone contains carbon and oxygen, carbon dioxide is released. In fact, for every tonne of cement produced a tonne of carbon dioxide is emitted and cement manufacturing contributes around 8% of global emissions. To reduce the carbon emitted through their capital programme, Scottish Water have started investigating and trialling low carbon concrete alternatives. One of these is a product called 'Cemfree' - Cemfree can be used in place of cement to produce a low carbon concrete with up to 80% less embodied carbon.



## **Net-zero and economic regulation**

For Scottish Water to achieve its emissions targets by 2040, it is vital that it operates, refurbishes and replaces its assets in such a way that looks to minimise the carbon emissions in addition to the financial costs. In its Final Determination, the Water Industry Commission for Scotland (WICS) has set out what it is doing to help allow Scottish Water to achieve this. WICS is moving away from a model of regulation that looks for Scottish Water to minimise costs over the next six-year regulatory control period. It has instead adopted Ethical Business Regulation, which will allow Scottish Water to focus on options that reduce carbon emissions and cost. In addition to this, it is working with Scottish Water while it completes a transformation programme which will enable it to improve its asset appraisals to include carbon, natural and social capital and to put customers views at the heart of its business.



In addition, WICS has established a ring-fenced allowance of £132m to allow Scottish Water to including externalities such as carbon, natural and social capital into its investment appraisals. This fund will cover the extra expenses incurred while Scottish Water broadens its investment appraisals to include the above externalities. This money will be accessible when Scottish Water can evidence that it has selected an option that has a higher net present value when including externalities than the lowest financial cost option that may otherwise have been chosen. This fund will encourage Scottish Water to look at investments which allow it to reduce its carbon emissions and achieve net zero emissions by 2040.

## Aqualibrium Low Carbon Heat Scheme

Scottish Water Horizons will launch the latest of its heat from waste water schemes at Aqualibrium in Campbeltown in early 2022.

In partnership with Argyll & Bute Council and Live Argyll, with support from the Scottish Government's Low Carbon Infrastructure Transition Programme, the scheme uses heat from waste water technology to provide low carbon heating to Aqualibrium leisure centre – a rural community-based hub featuring a library, fitness suite and swimming pool.

The new installation works by intercepting waste water from Scottish Water's adjacent Kinloch Park Pumping Station. The technology extracts the naturally occurring residual heat, amplifies it and transfers it to the clean water network to provide heating to the leisure facility.



This method of heat generation is a sustainable and affordable alternative to traditional fossil fuels. As the area is not connected to the gas network, compressed gas is delivered to the local community by road tankers. The introduction of the heat from waste water system means that heat will be transported underground, significantly reducing carbon miles. Air quality will also be improved by replacing the need to burn natural gas or other fuel types.

The new heat scheme will supply Aqualibrium with up to 95% of the facility's heating needs. The project builds on previous investment by Scottish Water on a £23million improvement scheme which delivered key infrastructure upgrades to the town in 2012.

## BGI - The role of blue-green infrastructure in creating positive living environments

During 2020-21 Citizens Advice Scotland (CAS) commissioned its first piece of research into blue-green infrastructure (BGI). This is a way of designing shared spaces to tackle surface water flooding as well as deliver wider benefits to communities, such as

improved access to nature, recreational facilities and improved connectivity in urban spaces.

The research examined practices of local authorities and housing associations in engaging with communities through use of the placemaking principle, to deliver BGI. CAS also undertook a YouGov survey to test public awareness and opinions on how surface water should be managed more sustainably, and to better understand the public's perception of BGI terminology and the extent to which language around BGI, flooding and water management is understood. The key findings from the research found, use of terminology such as 'flooding' could limit community interest in BGI and its wider benefits, to only those impacted by a flood event. Furthermore, lack of consumer understanding around stakeholder roles, and early identification of BGI opportunities in project design and planning, were all likely to impact the success of a project.

Findings from the case studies and the public survey were brought to a virtual stakeholder workshop, which generated the development of positive and practical ideas around the effective delivery of BGI within the sector. Insights from the workshop will inform an insight report, which CAS intends to publish. Further research will be carried out during 2021-22 to better understand and map the developing BGI area, particularly focusing on: stakeholder roles, community engagement in the planning and development of BGI, and barriers to successful implementation of surface water management designs. This will support ongoing development of Scottish policy and strategy as it seeks to implement effective BGI on a wider scale and for greater benefit.

## Launch of new asset vesting service to for Scottish developers

Scottish Water Horizons launched a new service earlier on this year to support Scottish Water's efforts to remediate unvested water and waste water assets for the Scottish housing community.

Unvested assets relate to new water or waste water infrastructure which have not met the standards agreed at technical approval stage. As these assets cannot be adopted by Scottish Water, the ownership of the asset sits with the developer who built it; this makes the developer responsible for all operation and maintenance and can carry significant risk – especially if the asset breaks down.



Scottish Water Horizons is tackling this issue by offering an end-to-end remediation service to bring unvested infrastructure up to the correct specification. From complex assets such as pumping stations and Sustainable Urban Drainage Systems (SUDs) to minor works such as raising manhole covers, the company provides consultation and upgrade work to ensure these assets can be safely adopted.

This new service contributes to economic growth by supporting much-needed new housing across Scotland.

## Digital water foresighting

Scottish Enterprise (SE) has been carrying out foresighting research into the opportunities for technology and water companies in the digitalisation of the water sector. The pandemic has pushed digital solutions to the forefront to support safe and healthy working, but this has come on the back of an already rising profile for 'digital water' as its benefits are starting to be realised globally.

SE's research has considered the drivers for digitalisation, which include supporting a move to net zero with more efficient use of resources; better operational oversight for improved decision making and customer engagement; and supporting companies to meet regulation and reporting requirements. Barriers to adoption have been identified as cyber security, lack of skills and risk aversion to new technology. The report considers real case studies of digitalisation to help businesses understand water sector opportunities and the benefits and savings that can be achieved.

SE's survey of companies showed that 77% of the 44 respondents stated that digital water is important to their company, with 84% predicting growth in the digital water side of their business within 3 years. The most significant area of digitalisation was within sensors and instrumentation (69%), with one-third working across all aspects (sensors and instrumentation; data, analytics and communications; and networks). Respondents were most likely to work in installation of digitalisation technology (68%) with almost half involved in manufacture (49%), consultancy (49%) and research (46%).

The results showed that there is significant interest in the digitalisation of water from both the water and digital sectors, with expectations for significant growth. The next stage of the foresighting research will cover the technology gaps, focussing on the opportunities for Scottish companies to get involved. If you would like to find out more about this research, please contact [Johanna.money@scotent.co.uk](mailto:Johanna.money@scotent.co.uk).

## British Geological Survey

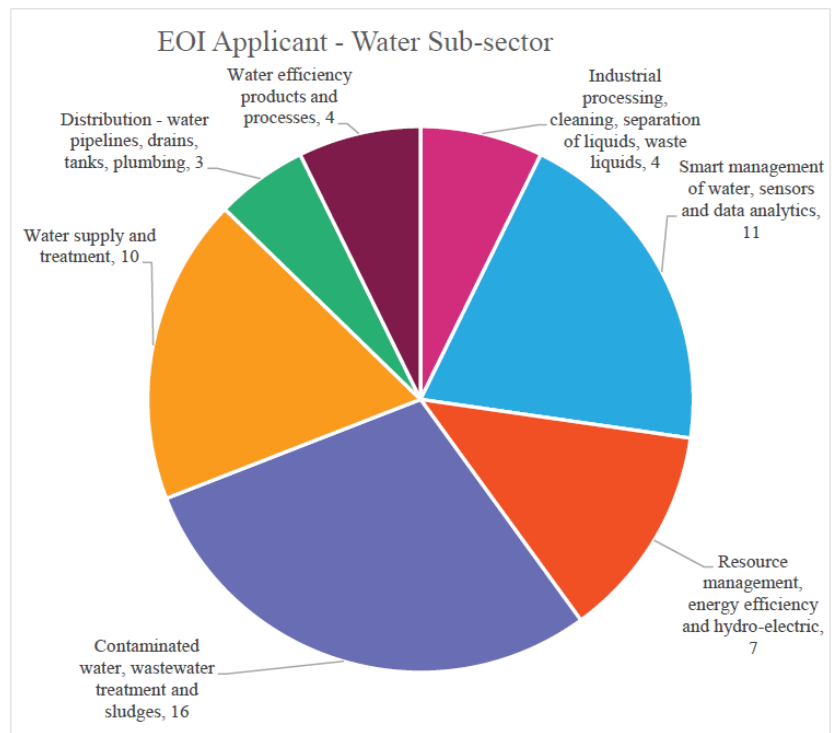
Geoscience solutions are part of the Scottish ambitions for Net Zero. British Geological Survey (BGS) is undertaking research on the critical minerals required for low carbon technologies, such as lithium for batteries and rare earth elements for electronic and motors. The sub surface can also be used for storing energy in the form of compressed air or hydrogen, and is also one of the ways for storing and sequestering excess carbon dioxide (CO<sub>2</sub>). BGS is investigating the potential for geothermal energy to both heat and cool houses and offices. BGS is also looking at how our landscape can be used to help adapt to climate change, by slowing down flooding and increasing water security.

## Hydro Nation Water Innovation Service (HNWIS): Supporting Innovation

Innovation is critical to the health of our water industry and the contribution it makes to the overall economy, driving down costs for consumers and helping to differentiate businesses by developing new processes, technology or materials that are more efficient, effective and cheaper than those they replace. Supporting innovation is a major focus of the Hydro Nation agenda and has been delivered the Hydro Nation Water Innovation Service since 2015.

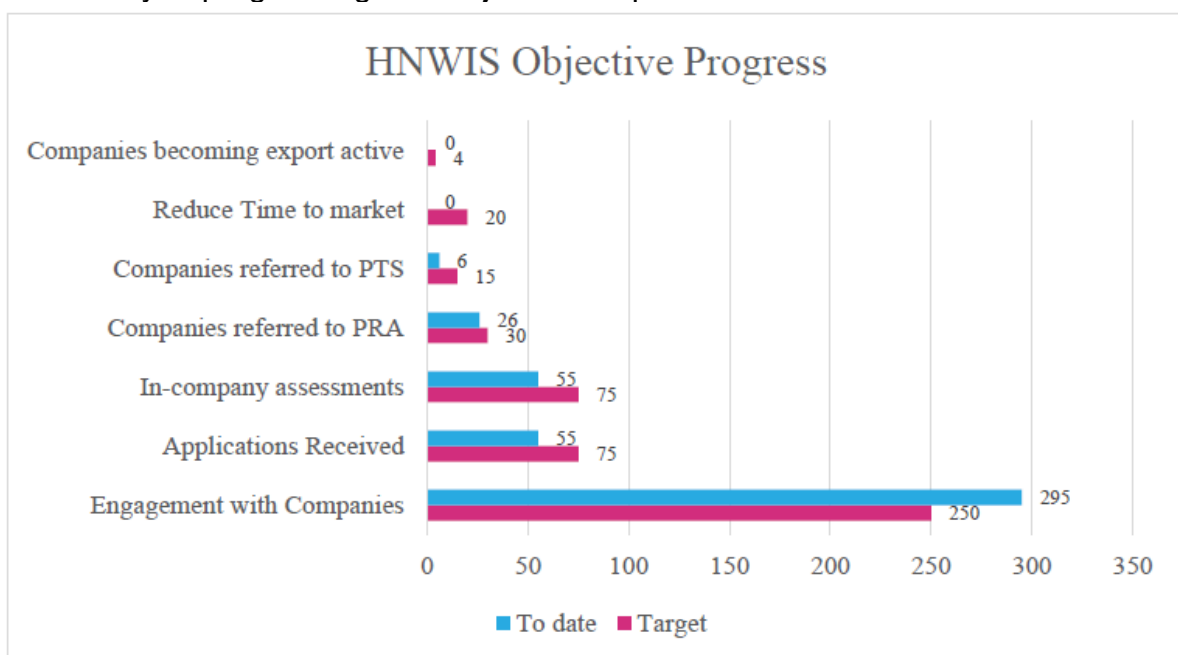
The most recent service contract for HNWIS has now ended and transitional arrangements are in place to continue to provide support to businesses while a new model is being developed with public sector partners expected to be announced in Spring 2022.

In year 3, HNWIS reported that it engaged almost 300 different companies, exceeding its target of 250. A total of 55 Expression of Interest (EOI) applications were received. Of these, 26 were referred to a Product Readiness Assessment (PRA) and 6 to Product Trial Support (PTS). From these referrals 23 undertook the PRA and 5 undertook the PTS. The reduced time to market was difficult to measure but companies who received the support stated that they found it helped their progress to market.



In total, 27 of 55 (~50%) EOI applicants did not receive either package of technical support. This suggests there is an opportunity for Scottish Enterprise (SE) to provide earlier product stage support, or alternatively to extend the length of the service contract to better support companies to a stage where they are ready for technical support. Five applicants took longer than three months to receive technical support, they needed extra support from HNWIS to get them to the stage where they were ready for the technical support.

A summary of progress against objectives is provided below.



Lessons learned from HNWIS delivery, along with research into wider provision commissioned through CREW have informed thinking on the development of the Scottish Government's next phase of innovation support for the water sector which will launch in the first half of 2022.

## Dalmarnock District Heating Network

A £6.1million district heating network has been installed at Clyde Gateway in the east end of Glasgow as part of Scotland's largest regeneration project to date. The new heat network is a partnership between Scottish Water Horizons and Clyde Gateway, with a grant from SP Energy Network's Green Economy Fund. Construction on the project has recently been completed, with customers due to be connected to the new heat system in early 2022.



Built on-site at Scottish Water's Dalmarnock Waste Water Treatment Works, the system uses a mix of heat from waste water technology alongside a combined heat and power (CHP) engine to provide instant heat and hot water to homes and office buildings. The network benefits from two 100kw heat pumps which capture and amplify the

natural heat found in waste water. These pumps extract heat energy from the final effluent at the treatment works, adding additional resilience and capacity to the network whilst contributing to the green credentials of the project.

The district heat network has been designed to help tackle fuel poverty in the area, using a metered system that ensures residents and businesses only pay for the energy they use. Costs are reduced thanks to the mix of technologies used, which are significantly more efficient than conventional heating.

One of the main benefits of the project is that it has stimulated investment into a district heat network for the area that should have an asset life in excess of 50 years regardless of the energy source feeding it.

The Clyde Gateway project is a huge undertaking, designated as Scotland's first Green Regeneration and Innovation District. It covers a massive 840 hectares of land across Glasgow and South Lanarkshire, transforming derelict, vacant or polluted spaces into a thriving destination with the aim of tackling inequalities, generating jobs, and ultimately improving lives for the local community.

## Looking ahead – 2022 and beyond

### Customers and communities

Following the establishment of a new Independent Customer Group in Spring 2021, Scottish Water will set out how they aim to define empowerment of customers and communities, to build appreciation, empowerment and engagement with customers and communities through a national engagement strategy. Tailored service packages will be introduced to boost support for customers in vulnerable circumstances and those most impacted by recurring issues. They will extend engagement programmes such as Learn to Swim, Top Up Taps and customer behaviour campaigns (water efficiency and preventing sewer blockages).

### Hydro Nation Chair

A University of Stirling professor has been appointed as the Scotland Hydro Nation Chair, which will see him lead a £3.5 million initiative to position the country as a global leader in water research. Andrew Tyler, a Professor of Environmental Science in the Faculty of Natural Science, heads the new initiative – a partnership involving Scottish Water and the Scottish Funding Council – which will act as a catalyst for academic research and innovation. Funded by Scottish Water, the Chair will lead the creation of collaborative partnerships across the sector, to deliver solutions for sustainable water management in Scotland.

### Covid-19 detection

The COVID-19 pandemic continues to dominate the research agenda. While we know a lot more about the virus, its survival and fate in the built and natural environments, there is still much to learn about this novel virus and its transmission. While it is generally understood that while the virus can be detected in wastewater systems, it is not in an active or infective state. This is good for the wastewater management industry and limits the extent of virus spread. Extensive research has been carried out on wastewater treatment plant influent and effluent and main sewers, there has been less evidence presented close to the source – people. More work will need to be carried out on this important area, specifically in buildings. Further work, planned by Heriot-Watt University will look at the feasibility of applying viral RNA detection methods very near the source. This could be of immense assistance in tracking the virus and may also inform future debate around managing building related systems and their energy needs.

### Malawi-Scotland Regulatory Partnership (MSRP)

As the MSRP looks to the future in light of a global pandemic, the continued impact of climate change and the just transition towards Net-Zero; the programme will maintain the ambition of supporting the institutions charged with safeguarding Malawi's environment and water resources. The MSRP recognises that Hydro Nation creates the springboard to foster diverse multi-sectoral collaboration, aligned under one common goal. With this in mind, the MSRP will look to:

- Develop a longer-term vision and development plan to support the operationalisation of the NWRA and MEPA, enshrined through formal agreement with SEPA.
- Enhance the MSRP's offering through Malawi-partners.

- Provide a coordinating function to Hydro nation-linked activities in Malawi by supporting knowledge exchange and research impact associated with the Hydro Nation Scholars, and by exploring wider public sector collaboration opportunities.
- In support of a just transition, investigate, plan and pilot ways through which the programme can be delivered digitally, thus limiting the carbon-cost associated with international programme delivery.

## One Health Breakthrough Partnership (OHBP)

The OHBP plans to build on the successes in 2021-22 in a number of areas including:

- Developing a OHBP strategy to address Pharmaceuticals in the Environment (PiE), through SEPA and Scottish Water’s “One Planet Choices” (OPC) initiative. The OPC trial will utilise an established method and qualitative technique to map entrance of priority compounds into the environment and identify the best point of intervention in the PiE cycle.
- Further collaboration with the Alliance for Water Stewardship (AWS) to:
  1. Roll-out the international AWS accreditation at other NHS Highland sites, building on the Caithness General Hospital pilot study and stimulating innovation and impact in the Highland region which can be scaled-up across Scotland.
  2. Establish a PiE focus group of members with similar interests/challenges related to emerging contaminants and incorporate PiE into their international accreditation scheme.

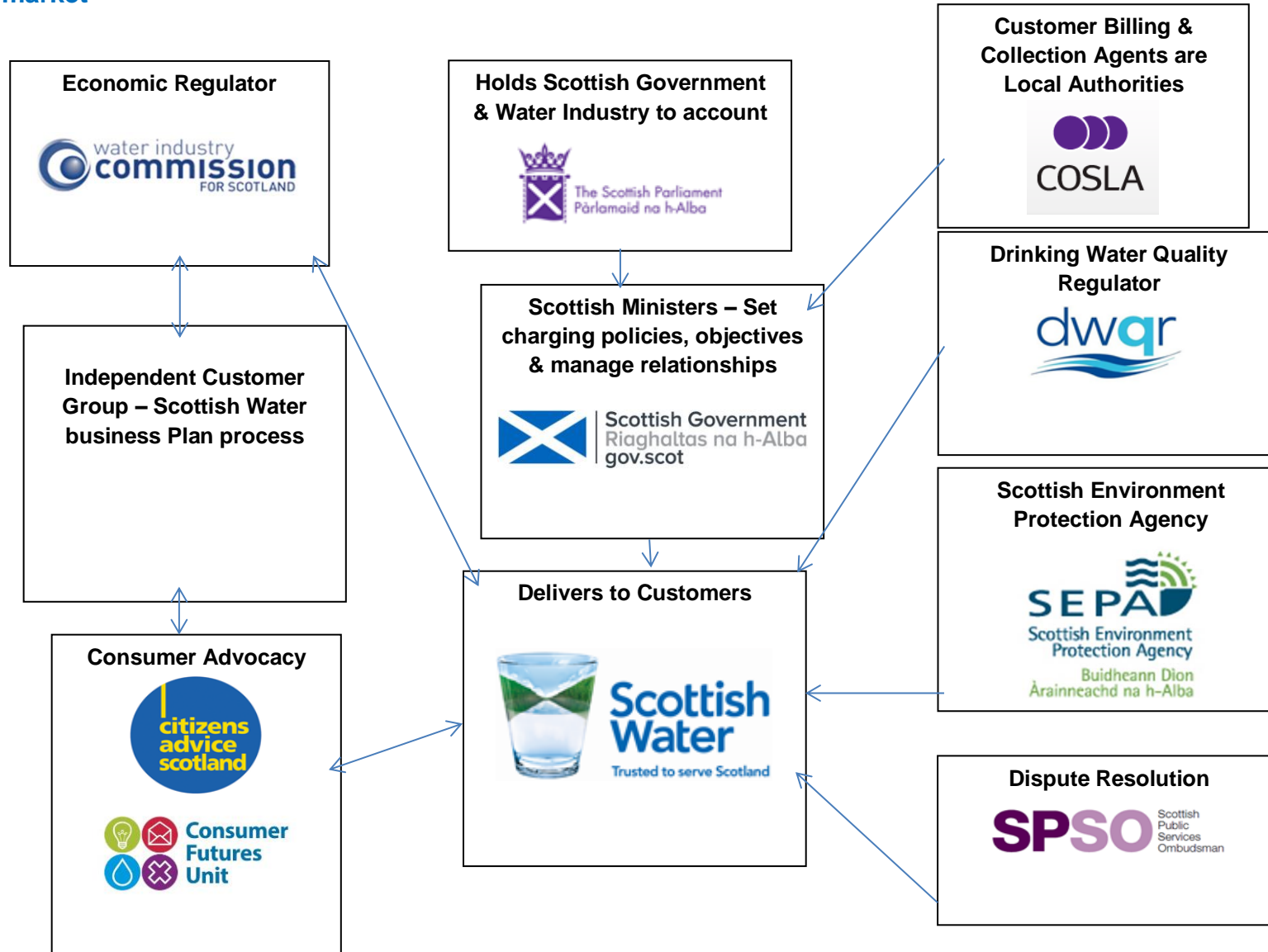
## World Water Day 2022

On the 22<sup>nd</sup> March 2022, the Hydro Nation International Centre will host Scotland’s World Water Day 2022 event, on the theme of water “the hidden resource”. The intention is that this will be an in-person event, with an additional virtual component inspired by the success of World Water Day 2021.

# Structure of governance

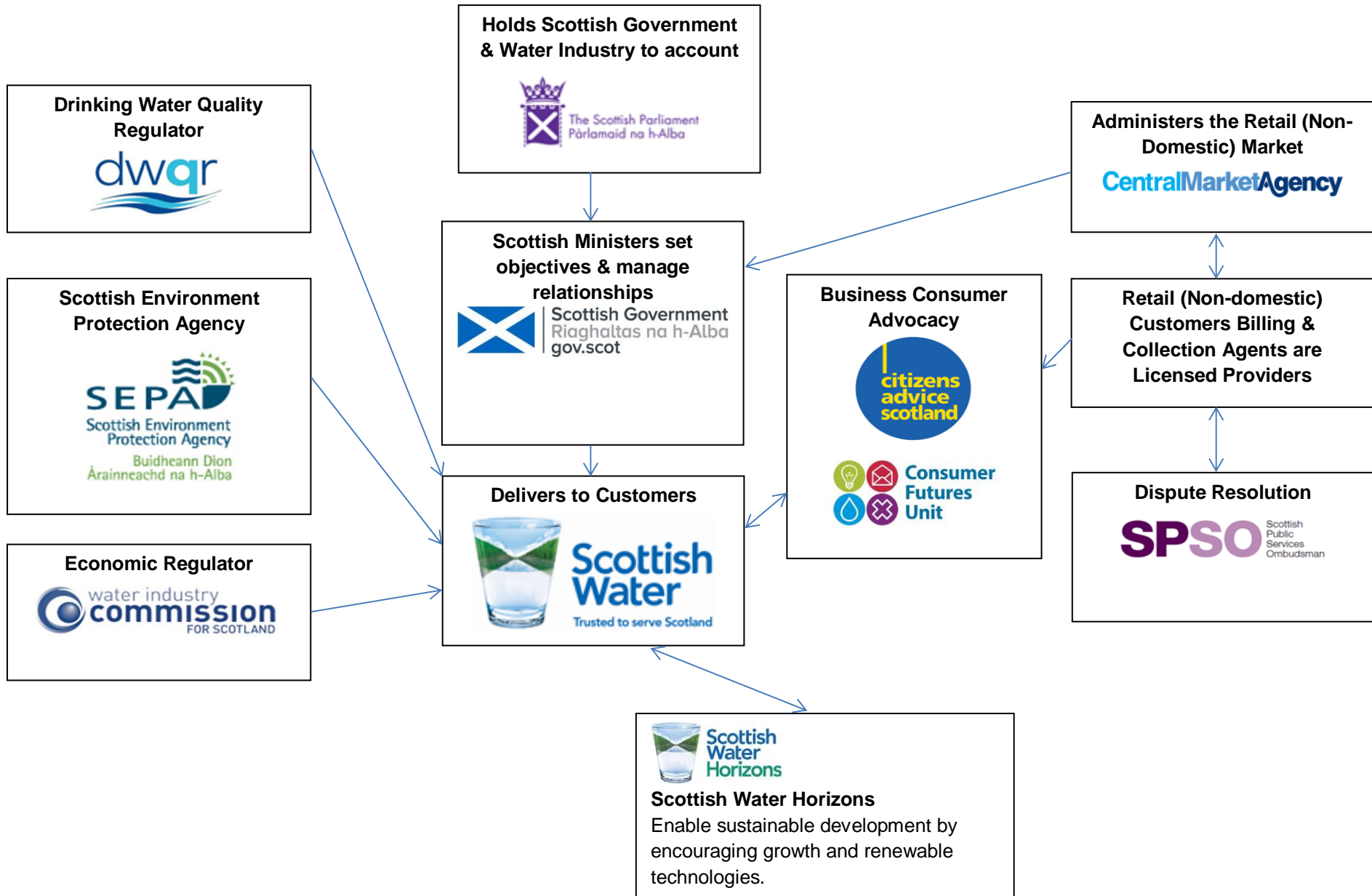
# Annex A

## Domestic market





## Retail (non-domestic) market



## Structures of governance – who does what?

**The Scottish Parliament** scrutinises the work of the Scottish Government and its public bodies, and holds them to account. Both the Scottish Government and the Scottish Parliament are accountable to the people of Scotland.

**The Scottish Government** – Scottish Ministers and their officials manage the relationship with Scottish Water and its regulators within the statutory framework established under the Water Industry (Scotland) Act 2002. Scottish Ministers set the objectives for the industry (as [set out in the Ministerial Directions](#)) and the principles that should underpin charges (as [set out in the Principles of Charging Statement](#)).

**The Water Industry Commission for Scotland (WICS)** has the statutory duty to set price limits for Scottish Water based on the lowest overall reasonable cost of achieving Ministers' Objectives for the water industry.

**Scottish Environment Protection Agency (SEPA)** is responsible for ensuring that Scottish Water meets strict environmental requirements. SEPA also advises Ministers on the delivery of and the need for future investment in environmental improvements

**The Drinking Water Quality Regulator (DWQR)** is responsible for monitoring and confirming that the drinking water supplied by Scottish Water through the public water mains system meets the requirements of the drinking water quality regulations and is safe to drink. DWQR also advises Ministers on the delivery of and the need for future investment in drinking water quality.

**The Scottish Public Services Ombudsman (SPSO)** is the final stage for complaints about Local Authorities, most licensed providers, the Scottish Government and its agencies and departments.

**Central Market Agency (CMA)** – On 1 April 2008, competition was introduced into the water industry in Scotland for retail (non-domestic) customers. The CMA is the organisation that administers the retail market for water and waste water services in Scotland. They are a company limited by guarantee and owned by its members.

## Key sector stakeholders

**Scottish Water** is a public corporation accountable to Scottish Ministers and through them to the Scottish Parliament. The service Scottish Water provides to 2.57 million households and 153,000 business premises is essential to daily life in Scotland. Every day, Scottish Water delivers 1.53 billion litres of clear, fresh drinking water and takes away 1.08 billion litres of waste water that it treats and returns safely to the environment. With more than 60,000 miles of pipes and 2,000 treatment works, Scottish Water supports communities the length and breadth of Scotland every day. In providing these essential services to customers, Scottish Water recognises these activities and operations can be visible in the communities it serves. That is why Scottish Water works very hard to ensure it is responsive and sensitive to the needs of its customers in every corner of Scotland and aims to put communities at the heart of the business.

**Scottish Water Horizons Ltd** is a commercial subsidiary wholly owned by Scottish Water. The company plays a key role in supporting the development of Scotland's sustainable and circular economy by making the most of the public utility's vast array of assets. Drawing on its experience of the remarkable transformation in the water industry in Scotland, it also offers international services to utilities, governments and other clients from around the world, including the Middle East, Canada, Ireland and Australia.

**Licensed Providers (LPs)** – Retail (non-domestic) customers are able to choose who supplies their water and sewerage services. All water and sewerage service providers must be licensed by the Water Industry Commission for Scotland (WICS). WICS publishes [a list of licensed providers and information on the retail market](#).

**The Consumer Futures Unit (CFU) of Citizens Advice Scotland (CAS)** represents water consumers, and is a key partner in many areas of policy development.

**The Convention of Scottish Local Authorities (COSLA)** is the representative voice of Scottish local government. Local Authorities provide the collection and billing for water and sewerage services on behalf of Scottish Water for all domestic (and non-metered) customers.

1. **Mairi McAllan MSP (Chair)**, Minister for Environment and Land Reform
2. **Professor Bob Ferrier**, Director of Research Impact, James Hutton Institute.
3. **Chrysoula Pantsi**, Edinburgh Napier University School of Engineering and Built Environment.
4. **Dr Alan MacDonald**, Principal Hydrogeologist at the British Geological Survey.
5. **Terry A'Hearn**, Chief Executive of SEPA.
6. **Professor Robert Kalin**, Professor of Environmental Engineering for Sustainability at Strathclyde University.
7. **Richard Millar**, Chief Operating Officer, Scottish Canals.
8. **Peter Robinson**, Head of Engineering, Scottish Canals
9. **Alan Sutherland**, Chief Executive, Water Industry Commission Scotland.
10. **Neil Gordon**, Regional Manager (Edinburgh) & Principal Consultant, EnviroCentre.
11. **May East**, UNITAR Fellow.
12. **Galen Fulford**, Managing Partner of Biomatrix Water Technology.
13. **Dr Michael Gormley**, School of Built Environment, Heriot Watt University.
14. **Professor Simon Parsons**, Director of Strategic Customer Service Planning, Scottish Water.
15. **Gail Walker**, Water Policy Team Manager within the Consumer Futures Unit at Citizens Advice Scotland.
16. **Andrew Allan**, Interim Director, UNESCO Centre for Water Law, Policy and Science, University of Dundee.
17. **Nick Lyth**, Director, Green Angel Syndicate.
18. **Jan Reid**, Senior Manager, Low Carbon Technologies at Scottish Enterprise.
19. **Steven Hutcheon**, Head of Technology and Advanced Engineering at Highlands and Islands Enterprise.
20. **Jim Panton**, CEO Panton McLeod Ltd., and Chair Of institute of Water (Scotland).
21. **Hanna Peach**, Hydro Nation Scholar.
22. **Adrian Sym**, Chief Executive Officer, Alliance for Water Stewardship.
23. **Robert Orr**, Strategic Relations Manager, Skills Development Scotland.
24. **Sue Petch**, Drinking Water Quality Regulator for Scotland.

## Hydro Nation scholars

## Annex C

Scholar	Cohort	Project	University
Kathleen Stosch	2015-21	Building Resilience to Respond to Future Environmental Change Across Scottish Catchments. <b>Community Impact:</b> Better understanding of the complex interactions in catchment management will contribute to strategies to improve resilience and reduce harmful outcomes impacting on those living in catchments.	Stirling
Carolin Vorstius	2015-21	Safeguarding and Improving Raw Water Quality by Increasing Catchment Resilience. <b>Community Impact:</b> Better integrated catchment resilience enhances environmental protection and reduces treatment costs resulting from compromised catchments.	Dundee and James Hutton Institute
Kirsty Holstead	2016-20	Governing Water One Drop at a Time: Responses to, and Implications of, Community Water Management in Scotland & Beyond. <b>Community Impact:</b> will help optimise community engagement to protect and maintain raw water quality, improving quality of supply and reduce treatment in remote rural communities.	St Andrews and James Hutton Institute
Jonathan Fletcher	2016-22 (p/t)	Optimising Multi-Pollutant Phytoremediation Strategies to Sustainably Improve Raw Water Quality. <b>Community Impact:</b> Contribution to increased raw water security will develop more sustainable and innovative treatment options, reducing environmental impact and costs.	Stirling
Sughayshinie Samba Sibam	2017-21	Epidemiology of Private Drinking Water Supplies in Scotland. <b>Community Impact:</b> The primary aim of this project is to have a better understanding on the relationship of water contamination by microbial pathogens in PWS, with the incidence of gastrointestinal diseases.	Aberdeen

Lucille Groult	2017-21	Socio-Legal Responses to the Challenges of Contaminants of Emerging Concern. <b>Community Impact:</b> The objective is to improve availability of “safer” products and assess feasibility of potential legal improvements. Furthermore, the project will look for ways to support consumers to make informed choices.	Dundee
Victoria Porley	2018-22	Water Purification in Rural India Using Sunlight and Low-Cost Materials. <b>Community Impact:</b> The objective will be proof-of-concept of a low-cost, solar photocatalytic materials and system, enabling future roll-out of the approach in rural India and in other developing countries with similar communities and climates.	Edinburgh
Craig McDougall	2018-22	The Role of Scotland's Inland Waters in Promoting Blue-Health of Rural Communities. <b>Community Impact:</b> The objective, through a programme of integrated natural and social science research, is to determine how future scenarios of land use and climate change might alter the blue health impacts (positive and negative) of inland waters for communities.	Stirling
Kerr Adams	2018-22	The Scottish Water Landscape and Its Resilience to Change: An Assessment to Support Future Policy. <b>Community Impact:</b> The objective is to provide a systematic insight into the future of Scottish land use/management/industry and its relationship with water quality and quantity, and provide the necessary evidence (for national strategy, planning and policy) of the resilience of policy and management options to uncertain drivers of change.	Edinburgh
Elliot Hurst	2018-22	Adaptive Engineering Solutions to Water Abstraction and Control for Developing Countries. <b>Community Impact:</b> The objective is to provide solid evidence to support best practice guidance for rural communities on the application and adaptive needs of wetland treatment systems utilising different vegetation types, and how effectiveness may vary across wet and dry seasons.	Stirling and James Hutton Institute

Hanna Peach	2018-22	Optimising Microbial Communities for Removal of Priority Chemical from Water. <b>Community Impact:</b> The objective is to characterise in detail the degradation of the OMPs diclofenac and triclosan by microbial biofilter communities formed in a range of Scottish source waters. This information is an essential prerequisite for targeted design of biofilter microbial communities for OMP degradation.	Edinburgh and James Hutton Institute
Sydney Byrns	2019-23	Co-developing strategies to promote inclusive water governance in Malawi <b>Community Impact:</b> Through cross-scale analysis of social network structure, dynamics, and beliefs, this project aims to strengthen national and institutional water policies together with the methods of providing feedback between water sector stakeholders, with the objective of this leading to more adaptive water governance in Malawi.	Stirling
Julius Cesar Alejandro	2019-23	Blue-green prescribing for a healthier population and a healthier water environment <b>Community Impact:</b> The study aims to investigate the feasibility of adopting a blue green prescribing strategy in local health boards by examining the components of existing models of prescribing green pharmaceuticals and blue space interventions; mapping out key stakeholders and policies that influence the uptake of pharmacological and non-pharmacological prescribing; and analysing viewpoints of stakeholders about blue green prescribing. This information is useful in the development of a bespoke blue green prescribing strategy that fits in the context of Scottish healthcare system and considers behavioural, environmental, social, and systemic facets of intervention adoption.	Glasgow Caledonian
Rita Noelle Moussa	2019-23	Conversion of wastewaters and organic waste into chemicals, energy, and organic fertiliser <b>Community Impact:</b> The objective is to establish an anaerobic digestion process for the bio-decomposition of wastewaters and organic waste to be able to provide cleaner and healthier water before being discharged into the environment. Moreover, the process will produce valuable chemicals such as ethanol, short chain organic acid for industrial use and hydrogen, methane for energy production (biofuel and electricity).	Aberdeen

Diana Souza Moura	2019-23	Microplastics as a vector for micropollutants in aquatic environments. <b>Community Impact:</b> Affect societal attitudes in respect of the use of plastics and provide tools to influence policies by understanding the mechanism of interaction between microplastics and natural toxins, such as microcystins, and pharmaceuticals, as well as the effect of microplastics loaded with micropollutants on aquatic biota in freshwater, and the potential dangers of underestimating these pollutants in drinking water as current water sampling protocols do not account for adsorbed pollutants.	Robert Gordon
Martyn Roberts	2020-24	The role of place and scale on effectiveness of temporary storage areas for surface runoff attenuation <b>Community Impact:</b> To provide a decision support framework for policy and practitioners. This will communicate the functioning of temporary storage areas (TSAs) in various scenarios and provide a useful tool for effectively targeting and managing future TSAs.	Aberdeen and the James Hutton Institute
Ilgaz Cakin	2020-24	Reed Bed Use Within Scotch Whisky Distilleries to Treat Wastewater: A New Toolkit to Help Maximise Performance <b>Community Impact:</b> To research sustainable, high-performance green wastewater treatment technologies for the Scottish whisky sector.	Highlands and Islands
Indira De Menezes Castro	2020-24	Elimination at source of biocidal agents from fresh water environments by TiO <sub>2</sub> photocatalysis <b>Community Impact:</b> To research developing a pilot scale modular photocatalytic treatment unit that can be deployed for source management of biocide discharge, i.e. in drainage channels, waste gutters, rural SuDS, or waste water ponds.	Robert Gordon
Sayali Pawar	2020-24	Future proofing Scotland's water security: delivering safe and resilient water supplies <b>Community Impact:</b> To relate past drought periods to observed water quality in drinking water supply catchments (chemical and biological status) to examine empirical evidence of drought impacts in Scotland in terms of water quantity, quality and ecosystem resilience, with a special focus on private water supplies and users.	Dundee and the James Hutton Institute



Manuel-Thomas Valdivia Moya	2020-24	<p>Nanomaterials and photonic solutions: Novel 'at source' approaches to stop hospital-derived priority substances reaching the sewer network</p> <p><b>Community Impact:</b> To study the nature and extent of the emerging problem of pharmaceuticals in wastewater prior to developing novel at-source solutions to eliminate the risk, particularly with respect to healthcare facilities (e.g. at hospitals).</p>	Highlands and Islands
-----------------------------	---------	--	-----------------------

## Summary of improvements delivered in 2015-2021

### Introduction

Scotland's communities continue to enjoy the benefits of an ambitious investment programme by Scottish Water. Over the last six years drinking water quality and levels of service to customers have reached their highest levels ever, and many improvements have been made to reduce the impact of Scottish Water's activities on the environment despite increasingly challenging weather conditions. This investment period has brought further unexpected challenges as the industry has reacted and adapted to the on-going Covid-19 pandemic.

Scottish Water is Scotland's national provider of public water and sewerage services. Customers have seen marked improvements in services since Scottish Water's creation in 2002. Improvements continue to be made such that customers now receive levels of service that are comparable to the leading water companies in England and Wales – all whilst the average household charge is little more than £1 per day.

The improvements Scottish Water is required to make are specified by Scottish Ministers and set out in [Directions](#). This report summarises Scottish Water's progress in delivering the improvements that were required during the 2015-21 period and shows how these have contributed to the Government's purpose and Strategic Objectives.

## Monitoring progress

Scottish Water's progress in delivering the improvements is monitored and reported on by the 'Delivery Assurance Group'<sup>2</sup>. The group brings together key water industry stakeholders.

Scottish Water's investment programme for 2015-21 comprised more than 3,700 projects associated with delivering improvements to drinking water quality, environmental performance and customer service, and providing additional capacity to service new developments. 86 projects remain to be completed at March 2021 and 22 of these, while not fully complete, are already providing benefits to customers.

Scottish Water has invested £2 billion during the 2015-21 period in maintaining its assets to support the achievement of its targets and maintain a high quality service to customers. Highlights of Scottish Water's progress are detailed below.

Scottish Water Customer Satisfaction increased from 92% in 2015 to 94.08% in 2021 showing its determined focus to listen to its customers.

## Leakage

Scottish Water has continued to reduce the level of leakage during the 2015-21 period, from 544 to 463 megalitres per day. Lower levels of leakage are beneficial as it reduces the volume of water extracted from the environment and treated, reduces costs and increases the reliability of water supplies to customers.

Leakage has reduced by a further 15% during 2015-21 – enough to supply over 200,000 households every day.

## New Strategic Capacity

At the end of the period, Scottish Water confirmed that it had provided additional water and waste water capacity for nearly 50,000 customers through over 140,000 new connections, meeting the Ministerial requirement for the 2015-21 period.

## Drinking water quality

During the 2015-21 period, improvements were made to drinking water assets in order to protect or improve the quality of drinking water provided at customers' taps.

Drinking water quality compliance was 99.946% at March 2021.

Overall Scottish Water delivered improvements to the quality and reliability of water treatment works serving over 2.5 million customers.

<sup>2</sup> DAG comprises the main stakeholders in the water industry: Scottish Government (SG), Scottish Water (SW), the Water Industry Commission for Scotland (WICS), Scottish Environment Protection Agency (SEPA), Citizens Advice Scotland (CAS), Scottish Public Services Ombudsman (SPSO) and the Drinking Water Quality Regulator (DWQR). The Group is chaired by the Scottish Government and operates under [terms of reference](#) agreed by Ministers.

## Environmental protection

During the 2015-21 period improvements were made to waste water assets in order to protect or improve the environment and to comply with a number of European Directives.

23 waste water treatment works were improved either to comply with existing licence requirements or to meet new and more stringent requirements and a total of 129 unsatisfactory intermittent discharges (mainly storm overflows from the sewer network) were improved.

The Ministerial Target for environmental pollution incidents was at most 330 annually and Scottish Water outperformed in all 6 years.

## Climate Change Mitigation and Adaptation

Scottish Water's operational emissions at the end of the 2015-21 period were around 50% lower than the 2007 baseline year.

In 2020-21, despite the extremes in weather, Scottish Water generated a total of 40GWh of on-site, self-generated renewables using a portfolio of wind, hydro and solar schemes. In addition to renewable energy, Scottish Water's PFI partners generated an extra 32GWh from biogases produced by waste water treatment processes.

Across the period, Scottish Water's carbon foot print reduced from 125kg/household to 73kg/household.

Scottish Water is one of the country's biggest electricity users and one of the three largest construction sector investors. Their industry-leading [Net Zero Emissions Routemap](#) commits them to become net zero by 2040 and then go beyond.

Scottish Water self-generates over 30GWh of renewable energy from hydro schemes.

## Delivering Greater Innovation

Working in partnership with Stirling Council, with additional funding from the Scottish Government, [Scottish Water Horizons delivered a low carbon energy centre](#) at Stirling WwTW.

## Flooding

Weather conditions are increasingly challenging in Scotland with more intense storm conditions being experienced more often. Scottish Water has completed a number of projects to help protect customers from the risk of flooding including [construction of the Shieldhall Tunnel](#).

The £100m Shieldhall Tunnel took 2 years to construct and is 3.1 miles long – it is the biggest wastewater tunnel to ever be built in Scotland.

Scottish Water has also refined its Storm Water Management Strategy, which can be summarised as: “no more surface water in, and what's in out.”



TheScottishGovernment



@ScotGov



Scottish Government  
Riaghaltas na h-Alba  
gov.scot

© Crown copyright 2022



This publication is licensed under the terms of the Open Government Licence v3.0 except where otherwise stated. To view this licence, visit [nationalarchives.gov.uk/doc/open-government-licence/version/3](https://nationalarchives.gov.uk/doc/open-government-licence/version/3) or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or email: [psi@nationalarchives.gsi.gov.uk](mailto:psi@nationalarchives.gsi.gov.uk).

Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

This publication is available at [www.gov.scot](http://www.gov.scot)

Any enquiries regarding this publication should be sent to us at

The Scottish Government  
St Andrew's House  
Edinburgh  
EH1 3DG

ISBN: 978-1-80435-128-4 (web only)

Published by The Scottish Government, March 2022

Produced for The Scottish Government by APS Group Scotland, 21 Tennant Street, Edinburgh EH6 5NA  
PPDAS1036350 (03/22)

W W W . g o v . s c o t