Scotland: The Hydro Nation Annual Report 2019

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

Scottish Government www.gov.scot

Scottish Water www.scottishwater.co.uk

Water Industry Commision for Scotland
www.watercommission.co.uk

Drinking Water Quality Regulator
www.dwqr.scot

Citizens Advice Scotland
www.cas.org.uk

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Our Water Economy Vision

Introduction by Roseanna Cunningham MSP, Cabinet Secretary for the Environment, Climate Change and Land Reform

I am very pleased to introduce this annual report to the Scottish Parliament on progress in delivering against our Hydro Nation agenda. Since the introduction of legislation in 2013 we have worked to support and develop the water sector with greater focus as we seek to realise our vision of Scotland as a Hydro Nation.

In July 2019 Scottish Enterprise published new, independent research which shows the impact of the sector in Scotland; it employs 16,600 direct jobs, has a turnover of £3.7 billion and exports of £170 million. The sector overall has grown by an impressive 29% in the past 3 years, whilst over 60% of companies have plans for growth. These are extremely encouraging figures, and within the sector once again Scottish Water continues to perform strongly and is a real public sector success story. I welcome their achievements, including reaching the highest-ever level of customer satisfaction despite the challenges presented by the warmest summer for a quarter of a century, and a forerunner of what we can expect to see increasingly in the future.

Last summer's events serve to highlight the First Minister's acknowledgement that we are facing a general climate emergency, and the need for all of us to up our game to help meet Scotland's world-leading climate change targets. I am therefore delighted that as part of the Scottish Government's Programme for Government, Scottish Water have committed to being a zero carbon user of electricity by 2040 – five years before our net zero target.

As previous editions of this report have shown, the water sector has been consistently stepping up to the climate change challenge. To build on this, I have recently asked Scottish Water to work with its partners to develop a new, long-term co-ordinated vision for the water sector that clearly identifies how it will transform the way it delivers its vital service to maintain the highest standards of customer service and improve technical standards. It will do so whilst taking a leading position in our journey to Scotland's target of net zero carbon emissions by 2045, the development of the circular economy and one planet living. Wastewater and sewage should no longer be thought of as a problem to be solved away, but rather as a potentially valuable resource that can be harnessed. The sector should aspire to excellence in everything it does.

The vision must highlight ambition for excellent water quality and enhancing the environment whilst remaining an affordable service to customers. It is expected to highlight the critical role the sector has in supporting the economy and creating a flourishing Scotland. By working together closely as we have done successfully for many years, we will deliver on this vision that supports a flourishing Scotland. Our water sector, with the publicly-owned Scottish Water at its heart will continue to be something everyone in Scotland can be justly proud of**.**

HIGHLIGHTS

The Hydro Nation Forum continues to provide guidance and advice, and to track evolvement at its biannual meetings. With the Forum's help we frequently review our overarching strategy across the four key interlinking themes set out below to ensure the Hydro Nation programme is fit for purpose, and is working to support the sector's needs. The last year has seen extensive activity against each of the themes comprising the ensuing highlighted examples:

National

Scottish Water has helped one of the smallest island communities it serves to achieve a 24-hour electricity supply for the first time. Fair Isle sits almost halfway between the southernmost tip of the mainland in Shetland, 24 miles to the north-east, and North Ronaldsay in Orkney, 27 miles to the south-west. The community energy scheme uses wind, solar and battery power in combination to harness Fair Isle's renewable energy resources more effectively than ever before, while greatly reducing the community's reliance on expensive diesel generation. This achievement marks the culmination of years of hard work by the islanders, which took a key step forward in 2014 when Scottish Water supported a feasibility study as it investigated options to meet the future energy needs of the island's water supply.

International

Scientists from the James Hutton Institute share the successes of the DWWT project with DFM John Swinney

In 2018-19, the Government funded Decentralised Wastewater Treatment System became operational and is now serving approximately 200 children and 20 members of staff at Berambadi primary school in the south Indian state of Karnataka. Deputy First Minister John Swinney attended an interactive stakeholder event at the Taj West End in Bangalore in November 2018.

Knowledge

Scottish Enterprise commissioned research on the size of the water market in Scotland. 412 companies with a base in Scotland have been identified that sell water related products and services. A survey of these companies concluded that the water sector supported 16,600 direct full-time jobs and has a turnover of £3.7 billion. Half of this turnover is with Scottish Water, the rest is across other markets including oil and gas, food and drink and the public sector. Over 1,000 staff work in research and development and innovation. Exports are £170 million, mainly to the EU, the Middle East and the USA. There has been significant growth in jobs, turnover and exports over the last 3 years of 29%, 23% and 28% respectively; and 60% of the companies surveyed had further plans for growth. The report concluded that this is an innovative and fast growing sector, and

helpfully also identified some areas for further consideration to support future growth, such as in targeted skills and staff development. The report can be accessed at http://www.evaluationsonline.org.uk/evaluations/Search.do?ui=basic&action=show&id=691

Innovation

Altitude Thinking has been supported by Scottish Canals and several other organisations including HNWIS, SEPA, Business Gateway, Scottish Enterprise and CENSIS in the development of Aquabot by identifying potential market needs and specifying parameters that are of interest to water asset owners and regulators. From an initial meeting ~12 months ago to introduce the Aquabot product, which they have been developing to provide a remote means of collecting water quality data, Scottish Canals has facilitated this being tested and demonstrated on the Forth & Clyde Canal near Falkirk.

This is a great example of collaboration working within the Hydro Nation community in creating innovative ways to meet the future challenges that we will face in responding to the climate emergency, developing a net zero carbon economy and protecting our valuable resources. This was recently highlighted on the BBC Nine programme, https://www.bbc.co.uk/programmes/p07gz2wf.

NATIONAL: SUPPORTING COMMUNITIES AND SCOTLAND'S WATER ECONOMY

Scotland is a Hydro Nation, one that views and manages its water resources responsibly, and sees 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[1] 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 give a picture of how the Hydro Nation agenda is delivering in practice in Scotland.

OECD: Water Governance Review Pilot

Scotland's participation in an OECD pilot project to identify best practice for each of the OECD Water Governance Principles, and to develop water governance indicators to assess progress was published in the OECD Water Governance at a Glance Report (2018). While the Pilot project highlighted the Scottish framework as an exemplar of good practice an Action Plan is being developed with Stakeholders to further strengthen and improve Scotland's water governance by May 2021, focussing on a small number of areas identified during the pilot process including enhancing links between academia and industry, data availability and sharing and resourcing for catchment management work.

Glasgow Smart Canal

Glasgow City Council Leader Susan Aitken, Scottish Canals' CEO Catherine Topley and Simon Parsons, Scottish Water Strategic Customer Services Planning Director

The substantial construction of Glasgow's 'smart canal' scheme completed in July 2019 has now entered a phase of commissioning. The project combines the 250-year-old Forth and Clyde Canal and 21st century technology to provide surface water drainage to support significant regeneration in the north of the city.

The pioneering digital surface water drainage system is unlocking 110 hectares for investment, regeneration and development, paving the way for more than 3,000 new affordable homes.

Officially named the North Glasgow Integrated Water Management System, the project to create a so-called 'sponge city' will see North Glasgow passively absorb, clean and use rainfall intelligently. Advanced warning of heavy rainfall will automatically trigger a lowering of the canal water level to create capacity for surface water run-off.

Before periods of heavy rain, canal water will be moved safely through a network of newly created urban spaces – from sustainable urban drainage ponds to granite channels – that absorb and manage water in a controlled way, creating space for surface water run-off.

[1] Figures from The water sector in Scotland: market size research – turnover, jobs, exports and gross value added report. Available at http://www.evaluationsonline.org.uk/evaluations/Search.do?ui=basic&action=show&id=691

The project is being delivered by Glasgow City Council, Scottish Canals and Scottish Water under the Metropolitan Glasgow Strategic Drainage Partnership. It uses sensor and predictive weather technology to provide early warning of wet weather to proactively reduce water levels in the canal by up to 100mm, thereby creating 55,000m^3 of storage before receiving runoff and excess rainfall from residential and business across a number of key regeneration sites. Preliminary estimates indicate that the project will deliver CO2 savings of ~500t per year by reducing the amount of wastewater requiring to be pumped and treated, through separating it and using the canal network for conveyance.

Management of New Zealand Pigmyweed on the Caledonian Canal

Scottish Canals is leading the development of innovative management techniques to control the spread of a pernicious non-native invasive amphibious plant New Zealand Pigmyweed (NZP) (Crassula helmsii) in and around the Caledonian Canal, Inverness. This is being supported by the Can Do Innovation Challenge Fund (CDIF), which is administered by Scottish Enterprise. NZP has been found growing on land and in the water in the canal system. It is a significant problem that threatens the native biodiversity and has the potential to clog waterways and impede navigation. This alien plant is able to spread from the smallest fragment of stem and has the potential to invade many other water bodies in Scotland.

Scottish Canals has recruited four expert teams of Scotland based innovators from the marine engineering and environmental sectors to develop new management techniques to control the spread of, and where possible eradicate, NZP on their estate. The first phase of the project will run to March 2020.

Protecting Scotland's Environment

As part of Hydro Nation and 'Team Scotland', Scottish Environment Protection Agency (SEPA) is committed to helping tackle environmental challenges globally. This commitment is reflected by its regulatory strategy – 'One Planet Prosperity' – which recognises the urgency to act around global challenges, the value of working proactively with partners and the importance of helping communities and businesses thrive in a resource constrained world. SEPA recognise that the world requires increasingly sophisticated solutions to today's complex challenges and that these challenges know no boundaries. SEPA, therefore, support projects across the world in tackling such challenges, sharing its experience and knowledge with others. Not only does this contribute to the global community and build Scotland's reputation on the global stage but SEPA also bring back knowledge and experience to Scotland, ensuring that SEPA take the best approach to protecting Scotland's environment.

Scottish Water: Delivering for You

Scottish Water continues to invest and deliver, through its £3.9 billion capital programme for the 2015-21 period, infrastructure that is fit for communities throughout the country now and for decades to come.

Your Water, Your Life – Top up taps: Scotland's 10th water top up tap was opened in Dunfermline in April as part of Scottish Water's Your Water Your Life campaign. The high-tech Top Up Tap was installed at the Kingsgate end of the High Street as part of Scottish Water's national initiative to encourage people to carry a reusable bottle and stay hydrated out and about.

Each of Scottish Water's Refill taps are connected to units plumbed into the public water supply. They are fitted with technology which will enable them to digitally track water usage at each spot, transmitting the data via cloud technology to the specialists managing Scotland's water networks.

Managing Flood Risk: In August last year Scottish Water completed a nine-month sewer upgrade project at Haymarket Terrace in Edinburgh – increasing capacity in the network and reducing the risk of flooding for properties and businesses in the area.

Scottish Water's alliance partner Amey Black and Veatch (aBV) began the work in October to install 250m of new sewer up to 3.5m underground. A new 1.2m diameter storm storage sewer pipe was installed in four phases to keep disruption to a minimum.

During the project Scottish Water and aBV liaised with people impacted by the works, including residents and businesses. Haymarket railway station and Edinburgh Trams continued to operate as normal throughout. The project team also worked in partnership with authorities to also ensure the Scottish Child Abuse Inquiry, taking place at Rosebury House, was uninterrupted by noise.

St Andrews Fat Diet: Sewers in St Andrews are 160 tonnes lighter after being put on a diet by Scottish Water. Scottish Water launched its first ever proactive drive to reduce the amount of fats, oils and grease (known as FOG) being put into the sewer network in St Andrews last September. The dramatic weight loss – equivalent to the weight of 28 adult elephants – was achieved with the help of dozens of businesses which serve food. They were visited as part of the unique drive and as a result have fitted grease trapping equipment to their kitchens. Some had no traps at all, while others were using ones which were the wrong size.

Scottish Water worked with environmental inspectors from Environmental Compliance and Services (ECAS) to visit 172 businesses which serve food to educate them on the importance of disposing of FOG the right way. Businesses included restaurants, cafés, hotels, fast food outlets, academic institutions, supermarkets, and nursing homes. Staff were given advice and support on best kitchen practices and, after their kitchen areas were inspected, they were advised what grease trapping equipment they needed. The

campaign proved so successful it was expanded to include a number of businesses in Cupar and at the Quayside in Dundee.

As a result of the campaign 119 new or bigger grease traps were fitted – ensuring fats, oils and grease are stopped from going into the sewers and causing fatbergs, which can lead to blockages and ultimately pollution. ECAS says this will prevent 140 tonnes of FOG in the town's sewer in the first year and every year after. Scottish Water also carried out a six-week 'deep clean' of the sewers in the main streets in St Andrews, when 20 tonnes of FOG was vacuumed out using specialist equipment.

INTERNATIONAL – REACHING OUT TO THE WORLD

The Hydro Nation Strategy outlines intent to grasp the potential of Scotland's knowledge and innovation in a global context. Hydro Nation Research International (HNRI) was established to coordinate 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 2018/19 include:

Hydro Nation International Services (HNIS)

Focus right now is looking at Brexit contingencies and options and aligning Stakeholder organisation's international activities to support international Hydro Nation strategic activity.

Decentralised Wastewater Treatment System – Global Innovation for Sustainable Rural Communities in India

The James Hutton Institute is leading an interdisciplinary team of researchers based in Scotland and India to deliver a low cost, low energy, decentralised wastewater treatment and recycling system (DWWT). The project is an excellent example of a circular economy whereby social interests are balanced with environmental sustainability through the most efficient use of water resources. In the context of the climate emergency the project is drawing on and developing expertise and experience in energy efficient use and reuse of water resources. This sort of expertise is increasingly valuable, not just for India but increasingly for Scotland and beyond.

In 2018-2019 the Scottish Government funded Decentralised Wastewater Treatment System (DWWT) became operational and is now serving approximately 200 children and 20 members of staff at Berambadi primary school in the south Indian state of Karnataka. This year has seen the continuation of key research activities from 2017-2018, as well as new activities including:

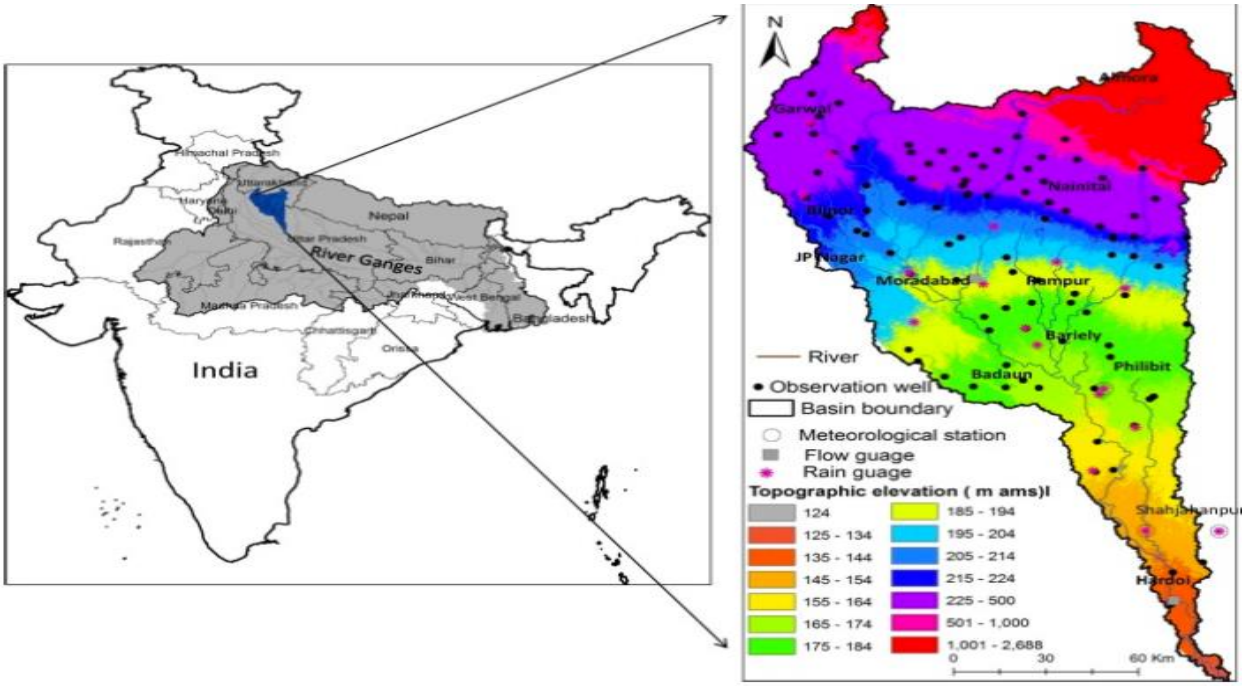
- High-profile launch events.
- Active engagement of key domestic and international stakeholders.
- An economic valuation exercise.
- Initiation of a youth training programme.
- Monitoring and optimisation of treatment processes.

The project team organised several launch activities to raise the profile of the project to Indian domestic and international audiences. The first launch was hosted at Berambadi primary school, where the school management team took formal ownership of the new system, and the children showcased their new knowledge of the links between safe treatment of wastewater and environmental and health benefits through dramatic performances and personal accounts. This event was attended by local and regional political representatives, the project teams, as well as village residents.

Official opening of the DWWT at Berambadi

Research and monitoring activities at Berambadi continued throughout the year and this information was used to optimise the system and plan for the phased handover of maintenance responsibilities to the village community. As part of the plans to ensure the longer term legacy of the infrastructure, JHI economist and former Hydro Nation scholar Nazli Koseoglu began work to estimate how much of the maintenance and operation costs can be offset if the community is engaged and trained to be as self-sufficient as possible to keep the facilities functional. The results of this exercise should also inform external bids to help the community finance the facility after the community take-over.

Ganga River Health Project



The Ramganga basin showing basin boundaries and topographical elevation

A multi-disciplinary team led by the University of Dundee with partners from Southampton University, James Hutton Institute and ETI-Dynamics completed an ambitious project to determine how research, policy support and capacity building can provide the infrastructure development required to restore the health of the River Ganga, particularly in relation to pollution levels, and support socio-economic systems and governance.

To facilitate better targeting of scarce resources, the River Health project has used new approaches to understand the impacts of poor water quality on the population of a representative section of the river, the Ramganga. Improved understanding of the impacts of water quality on vulnerable communities ultimately allows for the identification of hotspots where specific risks coincide with especially vulnerable communities.

The project breaks new ground by shedding light on the multiple ways in which those living in the Ramganga basin can be affected by pollution. It examined the extent to which they are not only vulnerable to its immediate impacts but also how effectively they are able to recover from these effects using judicial and administrative solutions. The cross-disciplinary work has transcended existing research and provides potentially valuable new insights for regulators in terms of better targeting of resources.

SCOTLAND/MALAWI

The Scottish Government is committed to support work in Malawi, most importantly through the Hydro Nation programme's contribution to the Climate Justice Fund with the aim of making Sustainable Development Goal 6 in respect of water and waste water provision a reality in Malawi.

Climate Justice Fund (CJF) Water Futures Programme: During the past year the CJF Water Futures Programme in Malawi has continued to support the Government of Malawi to achieve Sustainable Development Goal 6 (SDG6) through four main work streams, (1) Rural Water Asset Analysis, (2) Policy Support, (3) Capacity Building and (4) Research and Knowledge Exchange. Working together with implementation partners BASEflow, BAWI, United Purpose, CACECOM, World Vision, and CARE, the programme continues to work within all 28 Districts in Malawi and with the Ministry of Agriculture, Irrigation and Water development where over 300 Government of Malawi staff are involved in the collection and interpretation of data to underpin SDG6.

Collection of Rural Water Supply Asset Information Across Malawi (Click here for detailed data on mWater): The CJF Programme is now completing (by end 2019) the first National Dataset for Rural Water Supplies in Malawi. This national asset register will, for the first time, provide a homogenous dataset from which SDG6 and water resources planning can be implemented by the Government of Malawi.

Hi-Level Outcomes: A total of 102,631 unique rural water points have been identified of which 82,436 improved water points with asset registry data have been visited and evaluated. A total of 252,285 sanitation facilities that are co-located with these water points have been mapped as potential risks of contamination (sources). A total of 9,643 co-located solid waste sites have been mapped as potential risks of contamination (sources).

In May 2019, the Government of Malawi developed a 5 year strategy to adopt the asset management approach developed by the CJF Programme as a new National Management Information System that will be used for not only Water Resource Planning, but also for regulation and enforcement. The CJF programme will continue to support the Government of Malawi in this important step forward.

Response to Tropical Storm Idai Flooding in Malawi: On 11 March 2019 the scale and impact of Flooding in Malawi was beginning to become clear. On 14 March 2019, funding of £175,000 was provided by Scottish Government to the CJF Water Futures Programme at Strathclyde University to support emergency flood relief in Malawi and an

additional £50,000 has been allocated from the CJF Programme funds as logistical support of field borehole forensics equipment. Strathclyde quickly initiated a partnership with CARE International in Malawi, and the money was used to deliver critical work to secure water supplies and treat contamination in the immediate aftermath of the disaster at over 300 Displacement Camps in Southern Malawi.

Matching Flood Relief Support from USAID (Click Here for detailed data on mWater): The success of the Scottish Government / CJF Programme response to the flood captured the attention of USAID who then funded an additional matching $200,000 for a Borehole Repair and Rehabilitation Project (B2RP) as an emergency response initiative in Mulanje District (which had been almost totally ignored previously). These matching funds contributed to repairing and rehabilitating 218 boreholes in the catchment area of internally displaced peoples' (IDPs) camps and in flood affected areas of Mulnaje District. This USAID funding through MSH/ONSE was implemented by Strathclyde University in partnership with CARE International in Malawi. The total number of people that gained access to improved drinking water supplies as part of B2RP is estimated to be 184,521.

Advancing Research and Knowledge Exchange – Automated mWater SDG6 Indicators: mForensics is a method of real-time tracking SDG6 Indicators (ladders) developed by researchers at the University of Strathclyde working as part of the Climate Justice Fund: Water Futures Programme (CJF). The project was initiated in response to a request from the Government of Malawi to the Scottish Government to actively support investment within the rural water sector.

A pilot was conducted in three districts in southern Malawi; Chiradzulu, Zomba and Mangochi. Each district has a largely rural population with varying SDG6 water service challenges identified by both local and national government. The mForensics methodology was applied to each area to assess and inform the SDG6 status of the water services being delivered. The mForensics pilot assessment successfully demonstrated the value of data in evidenced led decision making. The data collected in the pilot was successfully used to inform both the drilling of new boreholes and the rehabilitation of existing water points (here focused as Afridev hand-pumps) – improving on current practices that rely on local knowledge and fractured data sets.

Malawi Scotland Regulatory Partnership (MSRP): As part of Hydro Nation, SEPA has been working in Malawi since 2018, primarily through the Climate Justice Fund (CJF) Water Futures Programme. This work has focused on providing support to the Government of Malawi (GoM) to bring their own water regulator (the National Water Resources Authority) into operation and, ultimately, supporting its journey towards meeting the requirements of Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all.

Phase one of the project focused on three core objectives:

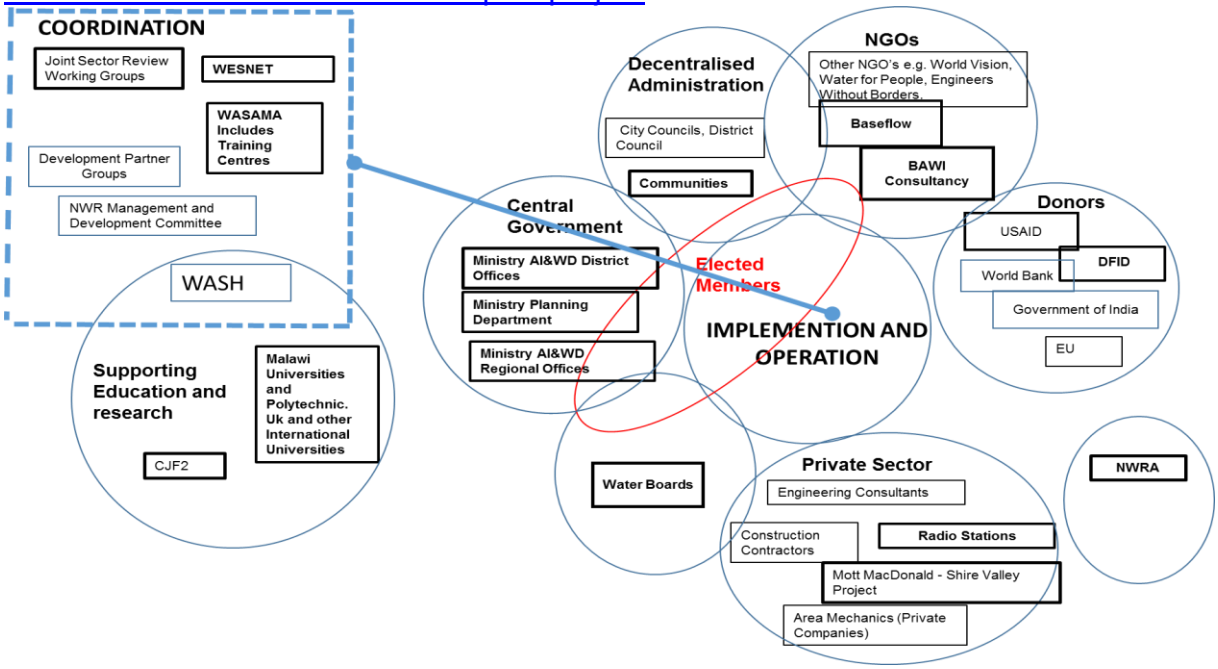
- Undertaking a needs assessment of the NWRA;
- Engaging with stakeholders, forming links with existing initiatives and identifying opportunities for productive partnerships; and
- Exchanging policies and practices with the Government of Malawi.

Meeting between SEPA and Government of Malawi officials.

The main product of Phase One was a delivery plan that will support the NWRA as it comes into operation, initially over the next three years. Embedded within this delivery plan is a proposed vision and characteristics and potential organisational structure of the NWRA, including operational and resource requirements of a world-class regulator. All of these align with SEPA's own principles and approach as set out in its regulatory strategy: One Planet Prosperity.

Phase Two of the project will move towards implementation of the delivery plan, specifically in relation to organisational/corporate governance, policy and regulation and organisational structure/people. Collaboration and partnership is at the heart of this project and SEPA will continue to work alongside 'Team Scotland' partners with the aim of continuing to bring the best of Scotland to Malawi.

Evaluation of research activities in Malawi: Abertay University and the James Hutton institute were commissioned by the Scottish Government (SG), to undertake an independent evaluation of the "Integrated Water Resource Management - Southern Malawi" Climate Justice Fund (CJF) project. The key elements of the report focus on Stakeholder mapping, Critical Path and Enhancement Indicators. The full report can be accessed at https://www.crew.ac.uk/publication/integrated-water-resource-management-southern-malawi-enhancement-report-project.



The Stakeholder Map above provides a representation of the water sector in Malawi showing stakeholders in relation to their contribution to key areas of governance and policy development, regulation, policy implementation and service provision. The representation shows the diverse range of actors resulting in a complex interaction amongst stakeholders. It highlights the complexity of the planning and co-ordination processes and a need for enhanced coordination of activities in the sector. It was found that the nature of these processes limits the effectiveness of the planning process, which in turn restricts the effective operation of the water sector and the implementation of water development projects.

Overall, this study provided new tools and templates for assessing and developing effective interventions to address SDG6 needs in sub-Saharan African countries.

Developing a Regulatory Framework in Cyprus

In 2018, SEPA provided support, through the European Commission, to the Cyprus Ministry of Agriculture, Rural Development and Environment (MARDE) to implement a programme of modernisation in its approach to environmental regulation. The support resulted in the development of a new institutional framework for environmental permitting and inspection system and ultimately, the creation of a new environmental inspectorate department.

As a follow up to this work, SEPA, in 2019, delivered a comprehensive training and development programme to the new inspectorate. This programme of training ensured staff members possessed the necessary skills to discharge inspection and permitting duties in an effective, efficient and safe manner that is fully aligned with the EU's environmental acquis.

Member of SEPA team delivering training in Cyprus.

Strengthening Economic and Environmental Regulation in the Romanian Water and Wastewater Sector


Opening of the project 'Strengthening Economic and Environmental Regulation in the Romanian Water and Waste Water Sector'.

WICS has worked closely with the Structural Reform Support Service (SRSS) of the European Commission as well as Scottish Water International (SWI) and SEPA to support the National Regulator for Public Services for Romania (ANRSC).

The project supported the development of an economic and environmentally sustainable water and waste water sector in Romania. It focused on working with three pilot regional operating companies to establish an effective information framework for the Romanian water and waste water industry. This involved providing in-country technical support to ANRSC and the three pilot Regional Operating Companies (ROC).

The team worked with the regional operating companies to explain, complete and analyse the information required by the framework. The team also worked with ANRSC to review the information provided by the pilot companies and, where necessary, seek clarifications. In order to appreciate the magnitude of the challenge the WICS team set out to understand the investment that may be required in Romania to meet the expectations of all stakeholders. Building on over 20 years of regulation in the UK, WICS evaluated the extent of the investment requirements of the Romanian water industry. The project was successfully completed in March 2019.

WICS has renewed the MoU with Romania following the change of President of ANRSC and will continue to facilitate learning opportunities and study visits between the two regulatory offices. Two visits are planned in September and October 2019.

SEPA's primary focus was in relation to River Basin Management Planning and the essential evidence framework required to ensure the robust monitoring of the environmental outputs. The overall aim of the work undertaken was to integrate the data collection and decision making process to achieve the best environmental outcome.

To achieve this aim, SEPA worked closely with Romanian colleagues to exchange knowledge, skills and experience of River Basin Management Planning in both Romania and Scotland, identifying issues and sharing solutions that, in turn, ensured the necessary information available for effective river basin management planning (including environmental and water quality regulation). A series of workshops identified a number of recommended next steps to help improve Romania's RBMP and address issues identified, including areas of further information exchange and potential collaboration opportunities for the future.

Scottish Water International (SWI)

SWI has continued to deliver a diverse range of consultancy assignments to help transform utilities. Key highlights include:

Australia: SWI have been continuing to support South Australia (SA) Water to build asset management capability and drive efficient customer focussed capital investment delivery, whilst on the operational side of the business they have also been supporting SA Water's response to customer service interruptions.

Ireland: SWI is continuing to provide expert advice and support to the transformation of the water industry in Ireland. As a subcontractor to EY, SWI have delivered the detailed design of the Water Industry Operating Framework which will transform the water industry in Ireland over the next few years. During the last year SWI (with EY) were successful in winning the tender to implement this new framework in Ireland, which is due to start during 2020.

Romania: In partnership with the WICS and SEPA, SWI has delivered a cross public sector partnership to support Romania's water regulator and the regional water operating companies to strengthen the regulatory environment and also to assist the regional water companies in responding to that improved regulation.

Guernsey Water: SWI have assisted Guernsey Water to ensure the safety of drinking water on the island by using a risk assessment and risk management approach through the provision of SW tools and knowledge on drinking water safety plans.

Ashghal visit: SWI recently hosted a 3-day visit for the Ashghal Public Works Authority, who have the responsibility for managing the drainage system in Qatar. Their visit was focused on Scottish Water sharing its experience in the delivery of uninterrupted customer and environmental service performance during large scale events, such as the 2014 Commonwealth Games in Glasgow.

The objective was to share Scottish Water lessons learnt in advance of the FIFA 2022 World Cup, providing an input into Ashghal's own planning for the event. Areas covered included strategic capital investment in Glasgow

ahead of the games, tactical asset improvements made, stakeholder management and working in a multi-agency environment, creating operational reliance and readiness, incident management, a visit to the intelligent control centre, including a preview of Scottish Water preparations for managing the Solheim Cup at Gleneagles in September 2019.

KNOWLEDGE SHARING AND CAPACITY BUILDING ACTIVITY

The Hydro Nation Scholars Programme, managed by CREW on behalf of the Scottish Government, funds postgraduate research projects aligned to the strategic priorities of the Hydro Nation Agenda, with the aim of creating a global water alumnus. Scholars benefit from specialised programmes including the opportunity to undertake placement at water-related institutions such as Scottish Water, the Scottish Government, Scottish Environment Protection Agency, or industry. We presently have 19 current scholars from 14 countries and a further 5 starting in October 2019.

A further three scholars completed their studies this year – Dr Juan Carlos Sanchez, Dr Bas Buddendorf and Dr Yuan Lia – and join three others on the Hydro Nation Scholars Programme Alumni Association which will support the goals of the wider Hydro Nation Programme, to strengthen ties between the alumni, CREW, the Hydro Nation and Scholars Programme communities, and to help maintain a lifelong connection with the Hydro Nation Scholars Programme, and each other to share experiences and expertise.

The past year has seen a number of scholars receive international recognition. Nandan Mukherjee was awarded the UN 2019 Risk Award for developing the concept of floating homes in Bangladesh. Victoria Porley received the Young Water Engineer Award at the UK-IWA Young Water Professionals Conference for her presentation on drinking water purification in India.

SURICATES Research Project

Scottish Canals are currently engaged as a partner in the EU funded SURICATES (**S**ediment **U**ses as **R**esources **I**n **C**ircular **A**nd **T**erritorial **E**conomie**S**) project. The primary aim of the project is to increase sediment reuse for erosion and flood protection. The total project budget is €5.67 million with the project team comprising of 10 organisations from Ireland, France, Netherlands and Scotland. The canal network in Scotland is currently utilised for flood and water management but siltation reduces capacity and dredging is required to maintain the status quo and develop further capacity.

Three project pilot sites will aim to deliver solutions that provide Net-Zero Carbon options for managing sediment and providing flood management across a range of sectors. The knowledge gained from the project will allow for innovative, sustainable solutions to be developed to create alternative reuse options for sediment which can be replicated at other locations.

Research on Support Systems for Consumers reliant on Private Water Supplies

During 2018, Citizens Advice Scotland (CAS) worked in partnership with Scotland's Drinking Water Quality Regulator to carry out research to understand what support private water communities need to help them improve their water quality and to get a better understanding of what would help them achieve a sustainable supply of safe

drinking water. Findings will inform ongoing Scottish Government strategies, in the longer term, to improve the quality of drinking water within private water communities. Key findings were:

- Managing a Private Water Supply can be a complex and difficult task: many are untested so identifying appropriate treatment is difficult and users remain at risk from health issues.
- A lack of technical knowledge, sufficient funding or access to appropriate support to put the right solution in place leaves unregulated (do not have to be tested) private water communities largely to their own devices.
- There is no comprehensive framework in Scotland to provide private water communities with the information, advice, training and funding they need in a way that they need it.
- Local authority support varies: some are more involved and proactive than others in offering support and advice; in addition, relations between communities and local authorities can be dysfunctional resulting in communities not receiving the help and support they need.
- Incorrect advice on treatment and maintenance from friends and neighbours may lead to poor water quality; often advice is based on opinion rather than science.
- Treating and maintaining water supplies may be unaffordable or high costs may be a disincentive to investing in necessary treatment, resulting in poor water quality which could compromise health.
- Complexity in identifying the most appropriate treatment for raw water quality may result in the wrong solution being purchased, requiring further investment at a later date.
- The use of contractors to diagnose and install the right treatment system or maintenance regime also comes with risks:
    - They may not purchase the right solution to address the specific water quality issues present
    - Quality of work may not be up to standard and securing redress can be difficult
- Relationships between those sharing a water supply can be strained, leading to unfair financial arrangements and at times a breakdown in treatment leading to health risks.
- Communities are largely unprepared for water shortages, such as during long, hot summers (e.g. 2018) or increased usage during tourist season.

Research into Community Engagement Best Practice

CAS' report 'Untapped Potential'[2] resulted in Scottish Water committing to develop a more robust community engagement strategy – 'built in not bolted on'. This will support more effective engagement and co-design of projects between Scottish Water and communities of interest or geography, which may be impacted by its activities, particularly around the delivery of capital investment. Currently, this is progressing through the 'Flourishing Scotland' aspect of Scottish Water's strategic vision for the next regulatory period (2021-27), supported by CAS and other key stakeholders.

In order to inform this process, in early 2019, CAS, the Customer Forum and Scottish Water jointly commissioned research to carry out deliberative research to identify the components of best practice community engagement, which should be at the centre of organisations' policy and practice. CAS will produce an insight report based on this research and will work collaboratively with Scottish Water and the Customer Forum throughout this process.

[2] https://www.cas.org.uk/publications/untapped-potential-consumer-views-water-policy

World Water Day – 22 March 2019

To mark World Water Day on the 22 March 2019, the Centre for Expertise on Waters (CREW) and the James Hutton Institute, with the financial support of the Scottish Government Hydro Nation International programme and in partnership with the University of Stirling and the Centre for Ecology and Hydrology, organised an event around this year's UN theme of "Leaving No One Behind" focussing on "Resilience to Drought and Low Flow Conditions in Scotland". The event welcomed key stakeholder representatives, government officials, academics and emerging scientists from the Hydro Nation Scholars Programme.

The first part of the event focused on presentation from scientists, stakeholder groups and government representatives, discussing various issues and strategies around drought and drought management in the UK and Scotland in particular. Following presentations, the participants split into three discussion groups, focusing on three key topics at the policy-research nexus: (1) Resilience planning and adaptation strategies (2) Emerging issues for drought and low flow conditions and (3) Enhanced monitoring through technical innovation and citizen science. The results of these expert discussions will be published in a report in September 2019.

PROMOTING GROWTH AND INNOVATION IN THE WATER SECTOR

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 detailed below are examples of this in practice.

Water and Effluent Support to Industry

The Scottish Enterprise Sustainability Team work with businesses across Scotland to assess water efficiency and effluent management opportunities. The Team supports the Hydro Nation Strategy by helping companies in any sector with water efficiency and effluent management. Resource efficiency is imperative to many companies, particularly within Scotland's Food and Drink Industry where utilities usage and costs can have a significant impact on the company's bottom line and environmental credentials.

The Team provides independent expert support on water and effluent, typically in the form of a detailed water balance and cost breakdown and options appraisal report. By providing details on Best Available Technology and best practise, including indicative capital costs, carbon savings, water savings, cost savings and Return on Investment, these reports highlight practical opportunities for improvement, helping to secure investment onsite.

Aqualution Systems

Aqualution Systems is a fast growing SME based in the Borders. Its turnover has grown from £450k to £1 million over the last two years, with exports amounting to £600k. The business produces a safe, environmentally friendly biocide used in many sectors including healthcare, agriculture, food and drink processing and pharmaceuticals to stop harmful micro-organisms including Norovirus, E-coli, MRSA, influenza and C-difficile.

Photo of Aqualution plant in Africa

Aqualution's customers include companies in the Marks & Spencer's supply chain, in Kenya and Egypt, who use the company's technology to decontaminate ready to eat foods such as fruit, salads and vegetables. The technology was initially developed to support Marks and Spencer's 'Plan A' sustainability strategy, which includes targets to reduce emissions by 80% and turn the company into a zero-waste business.

Aqualution won the VIBES Hydro Nation Water Innovation award in 2018 for dramatically reducing water, chemical and electricity consumption and associated costs in produce washing.

Scottish Enterprise recognised Aqualution as a fast growing innovative SME with export ambitions and brought it into its Account Management portfolio in 2018. Scottish Enterprise has provided a commercial loan of up to £450k to facilitate cash flow to enable the next three ambitious projects and further the company expansion overseas. Scottish Enterprise has also helped with market research in African markets and is supporting Aqualution with an application to Innovate UK for an innovation grant to improve the storage of mangos in Africa which will dramatically reduce food wastage.

Aquabio

Aquabio is a European leader in the treatment and energy recovery of industrial waste water. They provide sustainable and economical solutions in waste to energy, water recycling and water reuse projects encompassing both anaerobic and aerobic system, providing turnkey packaged solutions for design, build, finance and operation. Aquabio are owned by Freudenberg, a multi-national technology development and manufacturing group of companies.

Two years ago Aquabio decided to target the Scottish market where the technology provided a natural fit in the distillery and dairy sectors, giving direct benefits of cost reduction through greatly improved discharge consents, waste to energy conversion and the reuse of waste water. Initial engagement with the Hydro Nation Water Innovation Service provided links into Scottish Enterprise and Scottish Development International who provided marketing data sets that allowed Aquabio to target specific sectors and companies.

To deliver the scale of these projects in Scotland, many in the Highlands, a local supply chain is critical. The relationship with Scottish Enterprise gave introductions to Scottish based companies who could support Aquabio in project delivery. Aquabio had sales of £2.5 million in 2018 and an order book of £9 million to the end of 2019. In addition to a now established major supply chain in Scotland, Aquabio now employ three dedicated people and are just about to open their first office in Stirling to consolidate and focus further their growth in both Scotland and the overseas market. The Stirling office will be Aquabio's head office for international sales. Attendance with Scottish Development International on international trade missions and industry exhibitions has resulted in licensee partners being secured in South America, Australia and the Netherlands.

Flow Cytometry

Scottish Water is the first utility in Europe to use new online technology which will revolutionise water sampling across Scotland. The online bacteria monitor being trialled

could significantly improve the accuracy of water sampling and reduce the time it takes from up to five days to just 15 minutes.

The flow cytometry technology, known as On Cyt, is being used at the Glencorse Water Treatment Works near Edinburgh, to analyse the water quality of a sample in real-time, giving a count of all bacteria in the sample. It is the latest example of how science plays a big part in the delivery of 1.35 billion litres of clear, fresh and safe water to customers every day. The latest technology allows Scottish Water scientists to operate the bacteria monitor online, enabling the set-up of the equipment at any treatment works in Scotland. A sample line can then be fed into a point of interest and bacteria can be monitored at regular intervals. The technology produces more regular counts which mean scientists can establish what is going on across different water treatment stages and accurately assess the treatment performance of a water treatment works.

Prior to this, the sampling of a whole treatment works would have taken several scientists weeks of work to collect and analyse the data. The online monitor reduces man hours improving speed and accuracy of samples. Scottish Water are currently trialling the monitor at Glencorse Water Treatment Works and will be transporting it to various locations on its network.

Hydro Nation Water Innovation Service: Supporting Innovation

The second phase of the three year Hydro Nation Water Innovation Service (HNWIS) project was launched in November 2018 and has undertaken significant activity since then. Building on the success of phase one, the service now has a dedicated Network Integrator with the principal focus of stimulating the emerging innovation cluster through active industry engagement and forming effective linkages across the sector. This is a tried and tested model that has been utilised across many sectors as an effective way of supporting the development of emerging innovation clusters in Scotland.

The Network Integrator role was awarded to consultancy firm Arup, who will deliver the service for the three year period on behalf of the project partners who include the Scottish Government, Scottish Enterprise, Highlands and Islands Enterprise, SEPA, Scottish Water and Scottish Funding Council. Arup brings an international track record in horizon scanning, research, foresight and innovation in the water sector, working with clients to explore drivers of change, to generate innovative ideas about business futures and to evaluate new technology.

Companies developing innovative water solutions face significant challenges before they can bring a product or technology to market such as testing, verification, regulatory compliance and certification. Those considering exporting their products to international markets face the additional challenge of navigating different regulations in each country. HNWIS, through the project partners and its suppliers Arup, WRC and Mabbett, is a bespoke service, providing free practical support and signposting to Scottish companies with innovative solutions for the water and wastewater sector to help accelerate commercialisation. The service encompasses:-

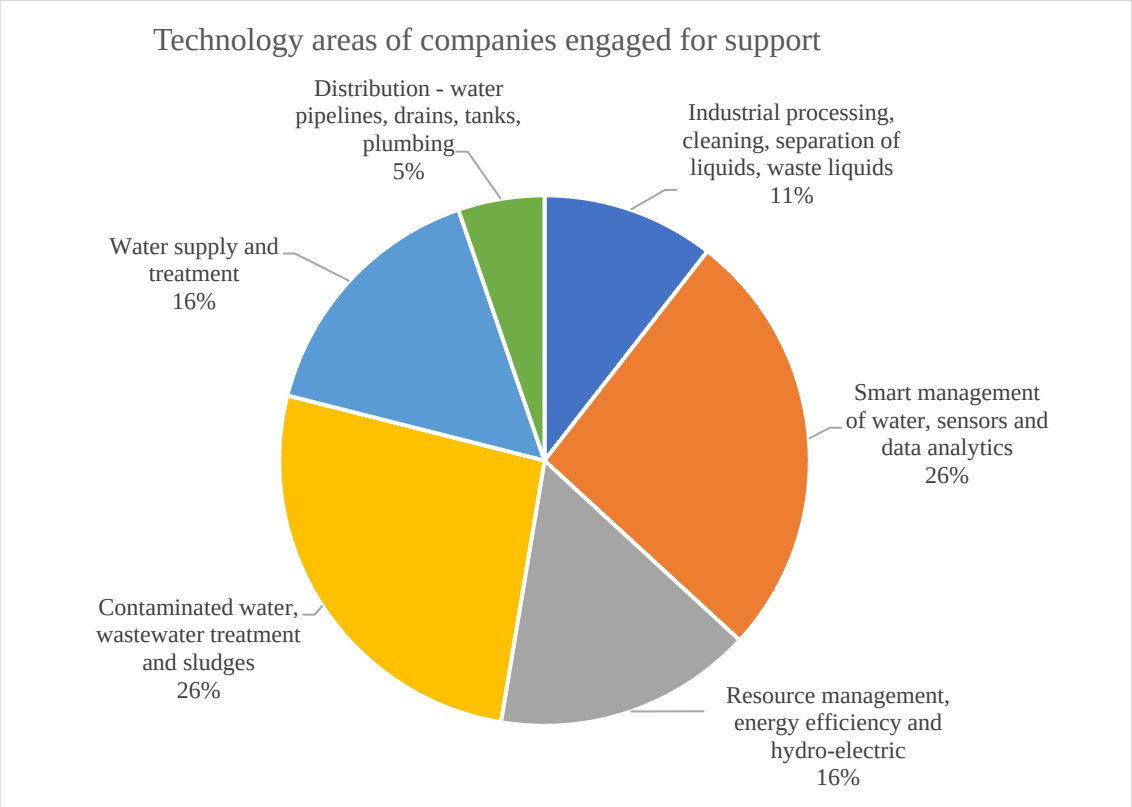
- **Specialist Technical support** – direct access to free specialist technical support for products in later stages of development including 1) product readiness assessments,

delivered by renowned water technology specialists WRC and 2) product trial support, delivered by Mabbett;

- **General support** – Signposting and access to R&D support, product development funding, business support & IP advice, regulatory and compliance advice, signposting and access to a wide range of testing and demonstration facilities including the Scottish Water Development Centres, James Hutton Institute and wider EU Water Test Network;
- **Market insight and information** – providing access to information on market needs, as well as specific opportunities and challenges;
- **Networking & Collaboration** – identifying and encouraging collaborative projects and providing opportunities for companies to engage with other sector players through events, webinars and online innovation platform.

Since relaunch, the service has:-

- Engaged with over 100 Scottish companies developing technologies or products for the water & wastewater sector;
- Provided signposting, advice and/or guidance to 40 companies;
- Referred those at an appropriate stage of development to the HNWIS specialist technical support and further support packages offered by Scottish Enterprise and Highlands and Islands Enterprise; and
- Connected companies to potential customers as part of product development.



Active Industry Engagement & Collaboration: With an active engagement programme, HNWIS has engaged with over 200 organisations across industry including product and service developers, end-users, academia, research & development establishments, innovation centres, funding organisations, industry networking organisations etc, and linking these together where there is alignment and potential for collaboration. The engagement programme to date has included:

- Presentation and presence at 14 industry events across the UK, gaining and sharing market insight and providing the opportunity for Scottish companies to build connections with the wider industry;
- Webinars together with Scottish Enterprise and Water Test Networks to inform Scottish companies of the packages of support available. There will be a series of webinars organised at regular intervals;
- Bringing insight to a range of industry challenges and opportunities and development of cross-sector challenges to Scottish companies;
- HNWIS industry event in Glasgow which brought together over 140 water sector professionals and academics.

Looking ahead over the next year, HNWIS will continue to actively engage across the sector, providing Scottish companies access to opportunities to collaborate and network with the wider ecosystem and in particular through collaboration with innovation centres, R&D institutions and industry organisations.

HNWIS will also continue to reach out to other sectors, including engineering & construction, food & drink, oil & gas, identifying Scottish innovative technologies which have potential to be utilised in the water sector.

Planned activities include over the next year include:-

- The first Wet Networks event in Scotland. The Network Integrator and Arup together with WRC are joint conveners of this established series of events which create a platform for organisations with interesting water technology innovations to connect to funders and those with water technology needs.
- A second HNWIS industry event early next year.
- Series of themed webinars and focussed workshops, co-organised with a range of industry organisations.

Companies can access the service as follows:-

www.hnwis.scot

Email: info@hnwis.scot

Tel: 0141 202 7679

Follow on social media:

https://twitter.com/hnwis_scot
https://www.linkedin.com/in/hnwis-scot/

Water Test Network

Last year saw the official launch of the Water Test Network, an INTERREG North-West European funded programme led by Scottish Water Horizons, which has established a transnational network of water and waste water test facilities to support innovation within the small-medium enterprise (SME) market.

Water Test Network launch in Brussels, December 2018

Fourteen locations across North West Europe form the network of operational-scale facilities which allow pioneering technology to be brought to market-ready status more quickly for the benefit of water users and consumers.

Already the programme, which is managed by Scottish Water Horizons alongside six partner organisations, has seen a strong pipeline of companies and research organisations wishing to demonstrate, test and validate new equipment and technologies on location.

Earlier this year, Belgian-based AcquaNovus, was the first of a number of companies to receive funding and test their technology via the Water Test Network. Using Scottish Water's Waste Water test facility, the company spent eight weeks trialling new technology that deals with waste water contaminated with organic pollutants such as leachates from landfill sites and other industrial operations. The results are currently with the James Hutton Institute, one of the partners within the Water Test Network, for verification.

The Water Test Network also recently launched their first Innovation Challenge calling for SMEs willing to showcase prototype technologies to help improve the sludge process in a test environment for real world application. The winner of the Innovation Challenge is due to be announced shortly.

Working in collaboration with HNWIS, the network is actively promoting funding, available test facilities, guidance and support to help stimulate growth within the Scottish SME market as well as further afield.

Low Carbon Heat Project in Stirling

A ground-breaking energy hub which will deliver low-carbon heat to a city community has been welcomed by First Minister Nicola Sturgeon. She recently toured the site at Stirling, which harnesses energy from waste water through a mixture of cutting-edge technologies, and is the first in the UK to deliver heat in this way.

The £6 million project is being delivered by Scottish Water Horizons in partnership with Stirling Council, with additional funding provided by the Scottish Government. The facility, at Forthside in Stirling, will pump low-cost and low-carbon heat generated from waste water from the adjacent treatment works serving the city. It's projected to save 381 tonnes of carbon per annum – the equivalent of 1.5 million miles driven in an average petrol car, or a passenger jet flying from Glasgow to Sydney, Australia, about 82 times.

This is one of a number of heat from waste water projects actively being explored, including the installation of a heat recovery scheme at Aqualibrium leisure centre in Campbeltown which is due to be commissioned by the end of 2019.

Pressure Transients

Scottish Water is the first water utility in the UK to use innovative technology to predict the location and timing of where a burst will happen. It does this by looking at the cause and effect of previous bursts and previous customer contact in relation to bursts and works out where future incidents might occur. Scottish Water began using the technology in 2013 and since then there has been a 35 per cent reduction in customer contacts owing to fewer calls about bursts and their associated impact including water loss and low pressure. It has also delivered an energy saving of more than £40,000.

Scottish Water discovered how transients – a short-lived pressure wave – in the water network can cause increased pipework bursts. Transients are caused by normal variation in water demand patterns resulting in sudden ‘shocks’ to the network, for example a pump starting or stopping. Before the project began, Scottish Water, and the water industry in general, had little understanding of them.

The technology is being run at 110 sites across Scotland with an average 81% reduction in bursts in each 5km radius. To date this has prevented 2,500 expected bursts – with each burst costing Scottish Water about £1,400 a time that is a £2 million saving. The technology has been so successful it is estimated it will have saved the business £4.1 million on operational costs by 2021. It also means less disruption to the network which means a better service for Scottish Water’s five million plus customers.

Galafoot Waste Water Treatment Works

Galafoot Waste Water Treatment Works in the Borders has become one of Scottish Water’s most self-sufficient energy sites. The plant in Galashiels now generates more energy than it uses. The site generates the electricity from sewage sludge – the semi-solid by-product of waste water treatment – using a technique called Combined Heat and Power (CHP). On average the Galashiels site generates more than 18,000 kWh/week of renewable energy – which is enough to power 204 homes for a year.

The site does still have to import a small amount of power when the CHP needs to be maintained, but the consumption of imported power has dropped by a dramatic two thirds since the CHP was installed three years ago.

More than 70 of Scottish Water's water and wastewater treatment works are either self-sufficient or partly sufficient in their power requirements, leading to lower operating costs and a more sustainable business. Galafoot is one of the top five that offset most of the site's use as well as being able to export to the grid. Others include Glencorse Water Treatment Works, near Edinburgh and Loch Turret Water Treatment Works in Perth and Kinross.

LOOKING AHEAD – 2020 AND BEYOND

The Hydro Nation Forum met in June 2019 and endorsed the revised Hydro Nation strategy, which sets several areas of focus in the coming year.

Water Sector Vision

Scottish Water, following the Cabinet Secretary's request, is to work with its partners to develop a new, long-term co-ordinated vision for the water sector that clearly identifies how it will transform the way it delivers its vital service to maintain the highest standards of customer service and improve technical standards.

Over the next 25 years, the strategic plan will enable Scottish Water to transform how services are delivered as Scottish Water plays its full part in responding to the climate crisis.

Scottish Water have a leading role in achieving Scotland's ambitious Water Sector Vision, and have set three key outcomes that it will focus on delivering:

- Customers will receive consistently excellent water and waste water services.
- Customers will receive great value - now and in the future.
- Scottish Water will contribute to a healthy and prosperous Scotland.

Year of Coast and Waters

The Scottish Government, Event Scotland and Scottish Water are working together on plans for the 2020 Year of Coast and Waters, which aims to celebrate Scotland's coasts, rivers and loch and to promote tourism. Scottish Water aims to build on the success of its customer engagement programmes over the last two summers by joining some of the 30 events that will be held as part of the themed year. As well as celebrating water the events will provide an opportunity to engage with people about the responsible disposal of waste to prevent choked sewers as well as beach and river pollution.

Aquatic Pollutants

Scottish Enterprise has successfully bid, as part of a large consortium, for EU funds to support research and innovation for emerging pollutants in the aquatic environment. This will focus on the issue of pharmaceutical pollution, including antibiotic resistance within water ecosystems across Europe. The consortium will launch an innovation call during 2020 inviting companies and research institutes to form collaborative consortiums with other EU countries to bid into this fund. Research and innovation funding will be allocated for measuring, evaluating risk and action to reduce these emerging pollutants.

Scottish Development International (SDI)

SDI will continue to support companies to export water related goods and services and to attract inward investors to Scotland. Building on previous successful missions to Singapore and the Barcelona i-water conference, SDI will attend the major European water trade fair, Aquatech in Amsterdam, in November 2019. The aim of this mission is

to attract international companies to access the EU funded Water Test Network and ultimately to establish water related inward investment in Scotland building on innovation strengths and physical test centres.

Hydro Nation (Research) International

In the coming year the team will launch the Youth Training Programme at Berambadi. The programme will be administered as an internship which will provide participants with marketable skills and facilitates the embedding knowledge of the Decentralised Wastewater Treatment system and processes within the community. Currently there are eight young people enrolled in the programme. The programme will be rolled out in three rounds to enable ongoing monitoring and amendment of the materials and in response to the changing requirements of the system as it stabilises. The team will also continue with the monitoring and optimisation of the treatment and reuse systems, and the data gathered about treatment efficacy will be continually fed into the economic valuation exercise. The interdisciplinary team will continue to work together to identify opportunities for achieving maximum social and environmental impact from the system. In doing so they will be refining the Decentralised Wastewater Treatment proof-of-concept with the aim of identifying new opportunities in India and Scotland to draw upon the knowledge and experience gained through this innovative project.

Hydro Nation Scholars

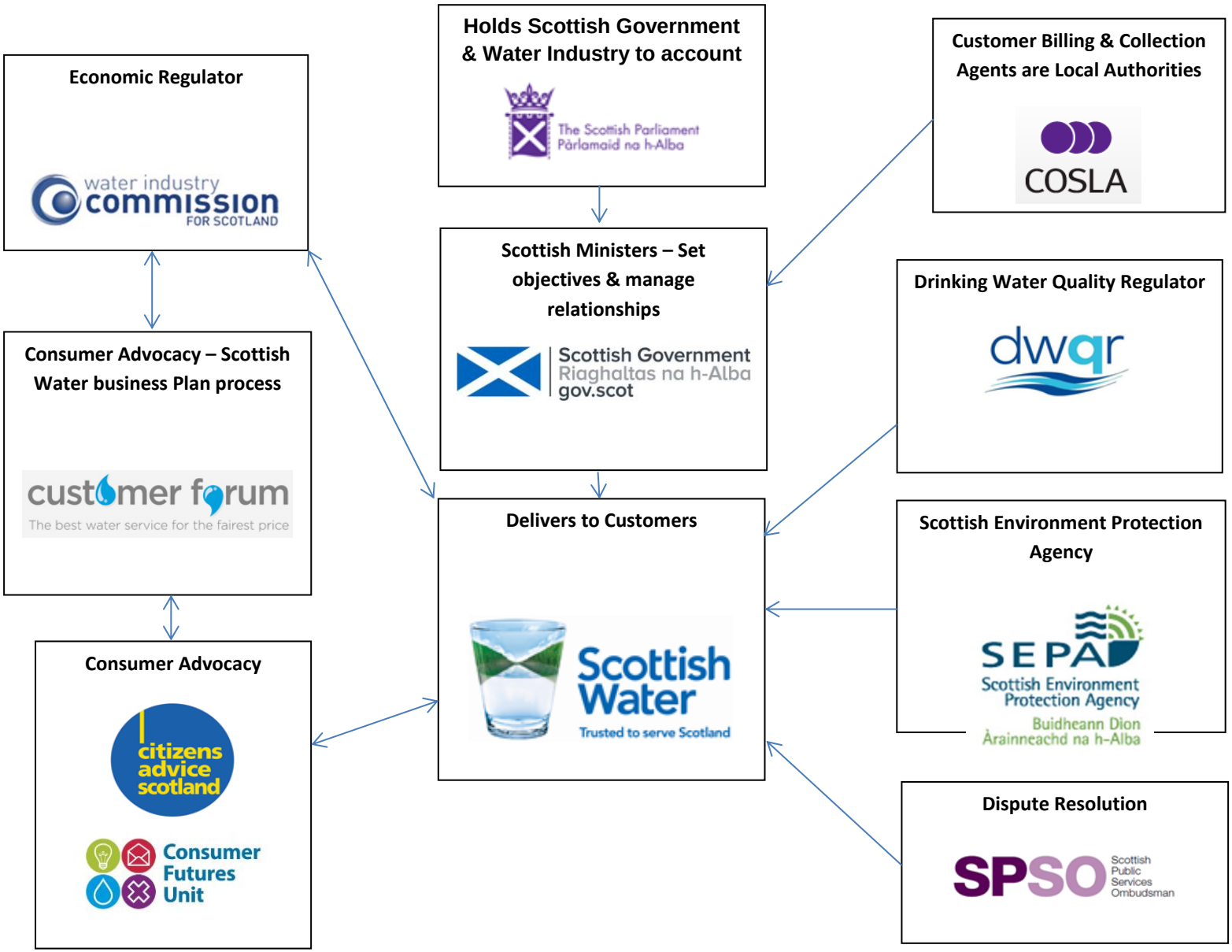
Scottish Canals are exploring opportunities to develop learning and research opportunities with academic institutions for future Hydro Nation Scholars to develop innovative thinking and utilise opportunities that our canal networks can provide in developing understanding in water resource, surface water management, climate change and to provide a basis for live development and exploitation.

SNH BCF Funding for Greening Pinkston Basin

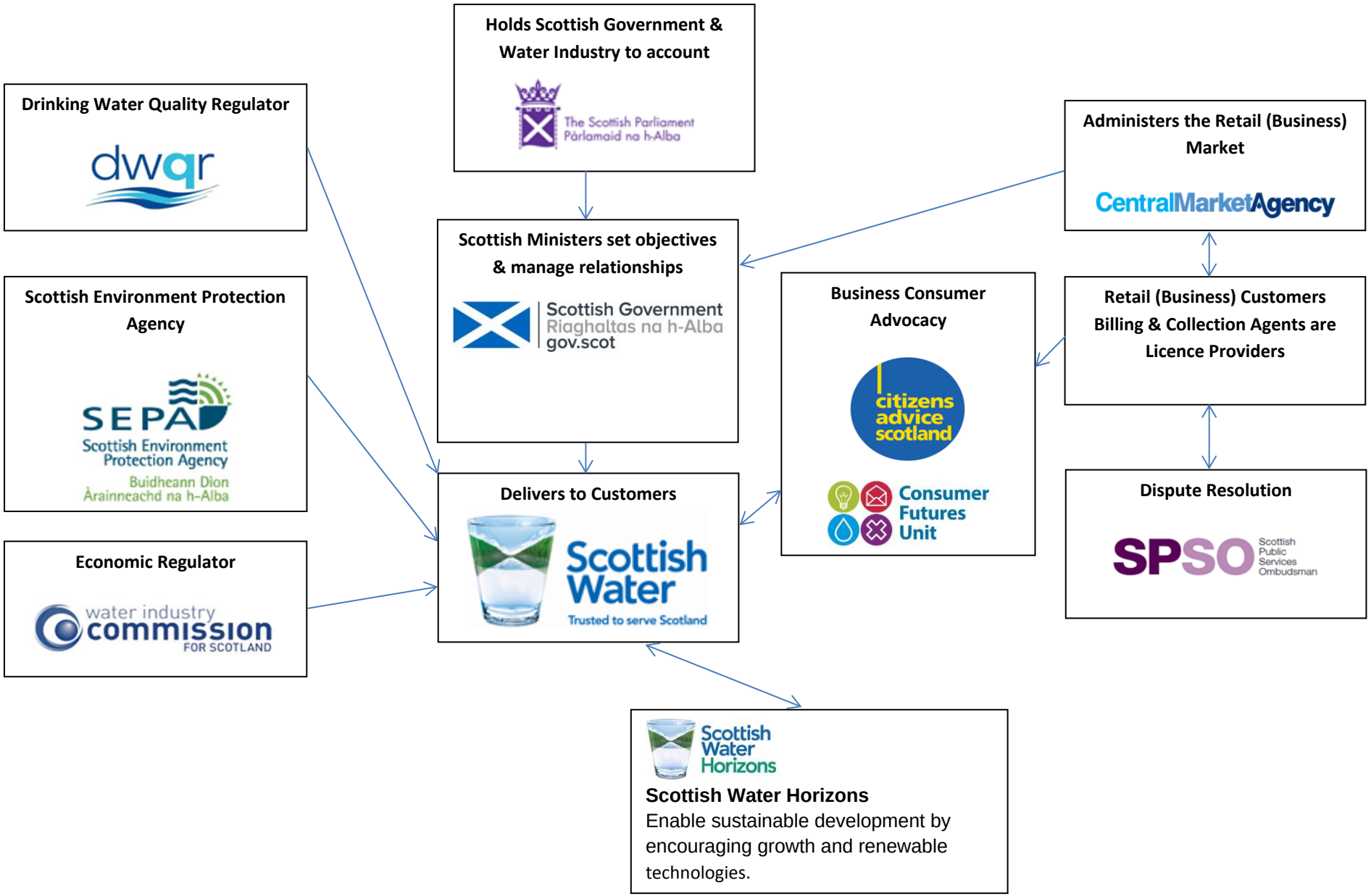
To further complement the Glasgow Smart Canal project, Scottish Canals were recently successful in securing funding from the SNH Biodiversity Challenge Fund to install floating ecosystems within the Pinkston Basin, Glasgow. Following the installations, which will start in the autumn of 2019 and be completed over a period of 12 months, there will then be a 10 year monitoring programme to measure the benefits of habitat creation, which will provide an evidence base for delivery of aquatic green infrastructure within an urban environment. This project will also deliver significant aesthetic, amenity and potentially air quality improvements.

STRUCTURES OF GOVERNANCE – DOMESTIC MARKET

ANNEX A



STRUCTURES OF GOVERNANCE – RETAIL (BUSINESS) MARKET



STRUCTURES OF GOVERNANCE – WHO DOES WHAT?

Central Market Agency (CMA) – On 1 April 2008, competition was introduced into the water industry in Scotland for retail (business) 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.

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

- Advocacy - to provide advice and information, make proposals and represent the views of consumers to Ministers, regulators, European Institutions and other relevant bodies.
- Evidence – conducting research to obtain information about consumer matters and consumers' views on those matters.
- Empowerment – facilitating the dissemination of advice and information to consumers

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.

The Customer Forum was established to participate in the price setting process for 2015-2021 in order to provide customers with a stronger voice and to secure the most appropriate outcome for customers.

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.

Licence Providers (LPs) – Retail (Business) customers are able to choose who supplies their water and sewerage services. All water and sewerage service providers are licensed and are therefore known as Licensed Providers.

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 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 available here) and the principles that should underpin charges (as set out in the Principles of Charging Statement available here). More information about our role can be found on our website.

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

The Scottish Public Services Ombudsman (SPSO) is the final stage for complaints about Local Authorities, most water providers, the Scottish Government and its agencies and departments. If customers have, complaints they should in the first instance try to resolve that with the organisation they have a complaint about. However, if they remain dissatisfied they may be able to raise their issue with the SPSO.

Scottish Water is a public corporation accountable to Scottish Ministers and through them to the Scottish Parliament. The service Scottish Water provides to 2.52 million households and 153,000 business premises is essential to daily life in Scotland. Every day, Scottish Water delivers 1.38 billion litres of clear, fresh drinking water and takes away 929 million litres of waste water that Scottish Water 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 work very hard to ensure it is responsive and sensitive to the needs of its customers in the community 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. From generating renewable energy from wind, solar power and waste water to recycling food waste and facilitating industry innovation, Scottish Water Horizons is helping Scotland meet its renewable targets, reduce carbon emissions and support sustainable development. The company's growth strategy is to support Scotland as a developing Hydro Nation and take opportunities to harness Scottish Water's asset base through both its own development and working in partnership with other organisations including the public and private sectors.

Scottish Water International is a wholly owned subsidiary of Scottish Water, delivering reputational-enhancing projects. Drawing on its experience of the remarkable transformation in the water industry in Scotland, Scottish Water International offer services to utilities, governments and other clients from around the world, including the Middle East, Canada, Ireland and Australia. Scottish Water International's team of high calibre in-house consultants offer services to support utilities transform their efficiency and service, with specific focus on:

- Operations and maintenance advice and support, including training and strategic advice;
- Asset management and capital investment governance;
- Regulatory and financial restructuring for public utilities; and
- Customer satisfaction and customer engagement strategic advice.

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. There is a competitive market for the provision of retail services to business and public sector customers in Scotland. All retailers must be licensed by WICS and a list of licensed providers is available from its website. For further information on retail competition for non-domestic customers, please see the Scotland on Tap website (available here).

Scottish Canals looks after Scotland's canals, conserving them as part of our heritage, and transforming them to play a vital role in Scotland today.

HYDRO NATION FORUM MEMBERS ANNEX B

1. **Roseanna Cunningham MSP (Chair)**, Cabinet Secretary for Environment, Climate Change 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**, Director of Infrastructure, Scottish Canals.
8. **Alan Sutherland,** Chief Executive, Water Industry Commission Scotland.
9. **Neil Gordon**, Regional Manager (Edinburgh) & Principal Consultant, EnviroCentre.
10. **May East**, UNITAR Fellow.
11. **Professor Campbell Gemmell**, University of Glasgow.
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. **Alan Simpson**, Chairman of the Institute of Civil Engineers.
17. **Andrew Allan**, Interim Director, UNESCO Centre for Water Law, Policy and Science, University of Dundee.
18. **Nick Lyth**, Director, Green Angel Syndicate.
19. **Jan Reid**, Senior Manager, Low Carbon Technologies at Scottish Enterprise.
20. **Steven Hutcheon**, Head of Technology and Advanced Engineering at Highlands and Islands Enterprise.
21. **Jim Panton,** CEO Panton McLeod Ltd., and Chair Of institute of Water (Scotland).
22. **Maricela Blair**, Hydro Nation Scholar.
23. **Adrian Sym,** Chief Executive Officer, Alliance for Water Stewardship.
24. **Robert Orr,** Strategic Relations Manager, Skills Development Scotland.

HYDRO NATION SCHOLARS

ANNEX C

Scholar	Cohort	Project	University
Kathleen Stosch	2015-19	Building Resilience to Respond to Future Environmental Change Across Scottish Catchments. **Community Impact:** 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	2015-19	Safeguarding and Improving Raw Water Quality by Increasing Catchment Resilience. **Community Impact:** Better integrated catchment resilience enhances environmental protection and reduces treatment costs resulting from compromised catchments.	Dundee and James Hutton Institute
Fortune Gomo	2015-19	Supporting Better Decisions Across the Nexus of Water-Energy-Food Challenges. **Community Impact:** Improved understanding of interactions benefits and trade-offs will improve quality of decision making enhancing the sustainability of rural communities.	Dundee and James Hutton Institute
Aaron Neill	2015-19	Linking Small-Scale Hydrological Flow Paths, Connectivity & Microbiological Transport to Protect Remote Private Water Supplies. **Community Impact:** Better understanding the complex movement of pathogens to reduce impacts on Private Water Supplies will positively impact public health in remote rural communities.	Aberdeen
Maricela Blair	2015-19	Micro & Nanoplastics in Waste Water Treatment Systems & Receiving Waters. **Community Impact:** better understanding the movement of these plastics is essential in designing policy to tackle environmental harm and reduce treatment costs thereby enhancing the lives of coastal and other communities.	Glasgow

Scholar	Cohort	Project	University
Robert Šakić Trogrlić	2015-19	Community-based Non-Structural Flood Risk Management for Malawi. **Community Impact:** this project will directly benefit communities adversely affected by flood by engaging them in activity to minimise impacts through low-cost strategies.	Heriot-Watt
Valerio Cappadona	2016-20	Can Waste Water Treatment Plants Cope with Future Nanoparticle Loading Scenarios? **Community Impact:** Improved understanding contributes to strategies to more efficient and effective treatment understanding the impact of nano-particles on treatment will help optimise plant efficiency, reduce costs and protect receiving waters thereby enhancing the natural environment for communities with receiving waters.	Strathclyde
Lydia Niemi	2016-20	Assessment of the Degradation Pathway, Persistence & Eco-Toxicological Impacts of Human Pharmaceuticals to the Aquatic Environment. **Community Impact:** efficient removal of pharmaceuticals reduces treatment cost to support improved environmental & public health & reduced impact on receiving waters.	Highlands & Islands
Kirsty Holstead	2016-20	Governing Water One Drop at a Time: Responses to, and Implications of, Community Water Management in Scotland & Beyond. **Community Impact:** 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	2016-20	Optimising Multi-Pollutant Phytoremediation Strategies to Sustainably Improve Raw Water Quality. **Community Impact:** Contribution to increased raw water security will develop more sustainable and innovative treatment options, reducing environmental impact and costs.	Stirling
Bhawana Gupta	2016-20	Tackling the challenge of the water, food, energy nexus in India & Scotland. **Community Impact:** Through improved understanding, project will contribute to better cross-sectoral approaches to improve the livelihood of rural communities.	Dundee and James Hutton Institute

Scholar	Cohort	Project	University
Sughayshinie Samba Sibam	2017-21	Epidemiology of Private Drinking Water Supplies in Scotland. **Community Impact:** 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. **Community Impact:** 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. **Community Impact:** 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. **Community Impact:** 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

Scholar	Cohort	Project	University
Kerr Adams	2018-22	The Scottish Water Landscape and Its Resilience to Change: An Assessment to Support Future Policy. **Community Impact:** 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. **Community Impact:** 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. **Community Impact:** 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

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