

Scotland: The Hydro Nation Annual Report 2018

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Laid before the Scottish Parliament
By the Scottish Ministers
SG/2018/151

September 2018

 Scottish Government
Riaghaltas na h-Alba
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- Hydro Nation Scholars Annex C

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 Commission for Scotland
www.watercommission.co.uk

Drinking Water Quality Regulator
www.dwqr.scot

Citizens Advice Scotland
www.cas.org.uk

Scottish Environment Protection Agency
www.sepa.org.uk

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SCOTLAND THE HYDRO NATION – ANNUAL REPORT 2018

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 innovative Hydro Nation agenda.

Scottish Water continues to perform strongly and are a real public sector success story. I welcome their achievements, including the highest ever levels of customer satisfaction.

I am delighted with the breadth of work undertaken by our Hydro Nation partners and I must highlight the excellent examples from Scottish Canals who are featured for the first time. Scotland has completed the initial phase of work as one of a small number of pilot studies contributing to the OECD Water Governance Initiative Principles, and this year we hosted the ISO Technical Committee on Water Quality Standards in Edinburgh helping to support their important work that benefits us all.

Elsewhere, I am very pleased to report that Scottish Water is the lead partner in a significant EU INTERREG North-West European bid: Living Labs for Water Innovation Demonstration Exchange - 'LL4WIDE'. Managed by Scottish Water Horizons, the project will establish a trans-national network of operational-scale testing/demonstrator facilities in Scotland, France, Germany, the Netherlands and Belgium. This achievement and many other areas of progress are detailed further in the Report.

HIGHLIGHTS

The **Hydro Nation Forum** continues to provide guidance and advice, and to track progress at its biannual meetings. With the Forum's help we continually 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 for example in recognition of the central importance of consumer issues the Forum has made this a standing item on its agenda.

The last year has seen considerable activity against each of the themes including the following highlighted examples:

National

Scottish Water continues to make solid progress in respect of reducing energy demand, increasing the use and generation of renewable energy and lowering carbon emissions. Following on from commissioning of the utility's largest solar panel scheme to date at Speyside (1.2 MW) in August 2017, eleven additional photovoltaic schemes are now operational including major schemes at Invercarnie Water Treatment Works (0.7 MW), Erskine Waste Water Treatment Works (0.5 MW) and Ardoch Waste Water Treatment Works (0.2 MW), all delivered by its commercial subsidiary, Scottish Water Horizons.

Through a combination of investment in renewable energy, and hosting private investment on the Scottish Water estate, Scottish Water is now facilitating the generation of renewable energy amounting to more than twice the level of energy consumed by the organisation annually.

International

A significant milestone has been reached with the **Water Futures Project in Malawi** now over 35% complete on its national water asset mapping exercise. Round one mapping was completed in March 2018. Round one mapped over 47000 water points and submitted 75347 sanitation surveys across eight districts across the Lower Shire. This effort is providing an open data resource to evaluate the risks and help address water gaps to a population of 4,852,405 people. New project partners started work on Round two in April 2018.

At the Commonwealth Heads of Government meeting held in London in April 2018, the Scottish Government signed a Memorandum of Understanding/Collaboration Agreement with the **National Mission for Clean Ganga** on behalf of the wider Hydro Nation family. This represents a milestone in discussions between officials and stakeholders over the last two plus years and will support more detailed discussions between Scotland: the Hydro Nation and **India** around opportunities for scientific cooperation and collaboration.

Knowledge

To mark **World Water Day 2018**, the James Hutton Institute organised an event on behalf of the Scottish Government to recognise the contribution of Scottish academics, practitioners and policy makers to the Sustainable Development Goals and, in particular, Sustainable Development Goal 6 "Ensure availability and sustainable management of water and sanitation for all". The event offered an opportunity for Scottish delegates to highlight and share information about current International research and policy activity

contributing to the global goals through presentations and discussions designed to promote stronger networks and opportunities for future collaboration.

Innovation

The **European INTERREG programme** has granted funding to Scottish Water and six partner organisations to create a North-West European network of water and waste water test facilities to support innovation within the small-medium enterprise (SME) market.

The partnership consists of water utilities, research institutes and economic development agencies from Belgium, France, Germany, Ireland, Scotland and The Netherlands. Scottish Water is the lead partner, whilst its commercial subsidiary, Scottish Water Horizons, will project manage and deliver the project.

The project mirrors and extends the Hydro Nation Water Innovation Service model to include international partner businesses and uncover investment opportunities, setting ambitious targets for the numbers of businesses/products supported and tested during the project period.

Through access to test facilities and innovation vouchers, innovators will be able to test, demonstrate and verify technologies on location, which will accelerate market uptake and provide an investor-ready pipeline of new products and processes. The project has a target that 120 innovators will be supported by testing 90 new technologies.

This funding award was the only successful UK-led project in this round and represents an excellent result for Scotland and Hydro Nation given the close involvement of a range of key stakeholders in bid preparation and support, including Scottish Enterprise and the Scottish Government.

HYDRO NATION – NATIONAL: SUPPORTING COMMUNITIES AND SCOTLAND'S WATER ECONOMY

Our water sector, including Scottish Water, is worth an estimated £1.8 billion¹ to the Scottish Economy. That value can be increased through our actions to improve Scotland's capacity for innovative technological development; effective knowledge transfer across the industry; and ensuring focussed support for our water sector companies. We can also create value from our respected leadership in our unique governance of our water industry. We are also promoting the need for sustainable water efficiency measures.

Provision of high-quality rural services in remote or sparsely populated areas presents distinctive challenges in many parts of the world, including here at home. Scotland is developing innovative approaches to demonstrate our resilience to these challenges. Our work will capitalise on advances in technology; catchment management techniques; supporting Communities' participation; raising quality standards and protecting the environment by supporting businesses to deliver within our valued sustainable service.

Key to our National Strategy is to ensure that, as the sector grows, we support local communities, businesses, and entrepreneurs to develop their own, and share in our, sustainable approach. Below are some examples of how we are delivering in practice.

Rural Service Provision for Drinking and Waste Water

Work on rural provision continues at pace with further trials on small community supply water treatments technologies at Scottish Water's Development Centre for Water at Gorthleck. The first round of trials suggest that multi stage treatment will be required for the most complex rural waters and so the next step is to test combinations of treatment approaches to establish potential resilient treatment solutions. On waste water provision, a research project is being initiated looking at alternative treatment approaches. A pilot first time provision scheme for private supply users is now under consideration for the 2021-2027 period. We continue to support research that will help us build criteria for identifying communities that are most in need of water infrastructure support in rural areas.

At the same time, we are not forgetting our cities. We will join the international trend towards **Blue-Green cities** by addressing the management of surface and storm water. Blue-Green cities bring water management and green infrastructure together to provide high quality places for public amenity and help reduce flooding.

Hydro Nation Commercial and Advisory Service (HNCAS)

The Scottish Government has made good progress with arrangements to support collaborative work across key public bodies with water-related interests to help them deliver commercial services in a more aligned way. The revised Hydro Nation Strategy clarifies that the Scottish Government will act as Secretariat to the HNCAS Group, providing administrative support and facilitating the delivery of an agreed work plan including prospect scanning and handling, consortium support, and appropriate promotion and publicity.

¹ Figures from Innovas Consulting (commissioned by SE) (2014) Analysis of the Scottish Company Base and Market Opportunities: Low Carbon Heating & Cooling and Water Supply & Waste water. A Final Report. Scottish Enterprise & Highlands and Islands Enterprise. Available at: <http://www.evaluationsonline.org.uk/evaluations/Search.do?ui=basic&action=showPromoted&id=556>

Since the establishment of the HNCAS Group, a number of stakeholders have been successfully awarded further significant projects to deliver Scottish expertise and knowhow drawn from our widely acknowledged strengths, including:

- governance assistance project in Romania to deliver improvement of River Basin Management Planning support. Discussions are already ongoing for a follow-up Phase 2 project (HNCAS lead Water Industry Commission Scotland (WICS) – Consortium includes SEPA and Scottish Water International).
- SEPA have successfully closed out a significant contract in Cyprus, assisting with the establishment of a new legal and institutional framework for an integrated environmental permitting and inspection system, and are in discussion for follow-up training projects (HNCAS lead – SEPA).

Leading HNCAS stakeholders Scottish Water/WICS/SEPA are working together on a formal Business Plan over the next 2-4 years to underpin joint activity. In the meantime, other work either has been completed, or is ongoing by HNCAS partners in China and Czech Republic, led by WICS, who are also developing collaboration MoUs with Latvia, Bulgaria and Kosovo covering training and consultancy support.

Scottish Water International is developing a new project in Victoria, Canada and has other ongoing projects in Australia and New Zealand. A range of potential opportunities for other future work has been identified for consideration by HNCAS, following-on from earlier contract successes, or by recommendation. These include projects in Macedonia, Turkey, Dominican Republic and Egypt, where Hydro Nation has been invited, via SEPA, to express interest in providing a ‘Key Expert’ for a 2-year EU project to improve water resource use. The HNCAS Secretariat is developing an approach whereby such opportunities are systematically assessed, logged and circulated to the Group for their consideration and views whether or not to respond individually, or as part of a consortium with other HNCAS stakeholders.

Scottish Environment Protection Agency (SEPA) – Protecting Scotland’s Environment

As part of Hydro Nation and ‘Team Scotland’, SEPA is committed to helping tackle environmental challenges globally. This commitment is reflected by its regulatory strategy – ‘One Planet Prosperity’. This strategy drives SEPA to protect and enhance Scotland’s environment, helping communities and businesses move towards a circular economy. SEPA also recognise that environmental challenges know no boundaries and it is essential that nations work together to tackle today’s environmental challenges. This is why SEPA works to support projects across the world in tackling such challenges, sharing 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 it takes the best approach to protecting Scotland’s environment.

REIMAGINING SCOTLAND'S CANALS

For the first time we are featuring the work of Scottish Canals and how they are contributing to Hydro Nation.

Once the catalysts of the Industrial Revolution today Scotland's canals have been reimagined to contribute positively to Scotland's circular economy offering a wide range of sustainable and long-term benefits for the many people of Scotland, as well as the few.

Valuable fresh water: The 332 million litres of water used daily to operate Scotland's canals have the potential for multiple re-use functions. Canal water has a significantly lower carbon footprint than drinking water as it is 95% gravity fed and currently provides permanent supplies to industry and for recreational activities including supplying The Falkirk Wheel water play parks.

Energy generation: Scottish Canals is currently investigating the potential to generate renewable energy from canal water including low head hydropower schemes and water source heat pumps to offset their carbon footprint.

Biodiversity value: Scotland's 200-year-old canals are home to a wide range of plants and animals including protected species such as otters and bats and plants, which are rare elsewhere in the UK.

Waste re-use: Scottish Canals is collaborating with organisations from across Europe in the Interreg North-West Europe SURICATES funded project investigating ways to increase the re-use of canal and port waste sediments for erosion and flood control.



Image: Union Canal Habitats

A high proportion of the 200 million m³ of dredged sediments from across Europe produced each year is currently disposed of at sea; Scottish Canals along with partners are leading the way in testing new uses for this material from road surfaces to paths and even bricks!

Sustainable transport: Our canal network attracts over 22 million visits per annum in partnership with Sustrans; Scottish Canals has upgraded the towpath network offering safe, accessible traffic free routes for all the people of Scotland.

To further reduce transport emissions Scottish Canals is in positive discussions with Scottish and Southern Energy on the Coire Glas pumped storage hydropower scheme on Loch Lochy to use the Caledonian Canal for water-based freight transport.

Glasgow's Smart Canal



The construction of Glasgow's 'smart canal' scheme started in May 2018. The project combines the 250-year-old Forth & 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 will unlock 110 hectares across the north of the city 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.

The project, being delivered by partnership between Glasgow City Council, Scottish Canals and Scottish Water under the Metropolitan Glasgow Strategic Drainage Partnership, will use sensor and predictive weather technology to provide early warning of wet weather to proactively reduce water levels in the canal by up to 100 mm, thereby creating 55,000 m³ of storage before receiving runoff and excess rainfall from residential and business across a number of key regeneration sites.

This solution avoids the requirements to upgrade existing sewerage systems and, through the diversion of surface water, actually creates additional capacity to enable the development of new communities in areas that were once considered too costly to invest in. In addition, there are significant environmental benefits through the inclusion of green infrastructure and the avoidance of significant excavation and construction activities.

Ness Weir

The lifespan of an historic weir, which raises the level of Loch Ness by over a metre, has been extended by a century. A £2 million Scottish Government-funded project saw the Caledonian Canal's Thomas Telford-designed Ness Weir, which sits at the mouth of Loch Dochfour and the River Ness near Inverness, reinforced with 10,000 metres of steel piling to strengthen the structure and safeguard it for future generations.

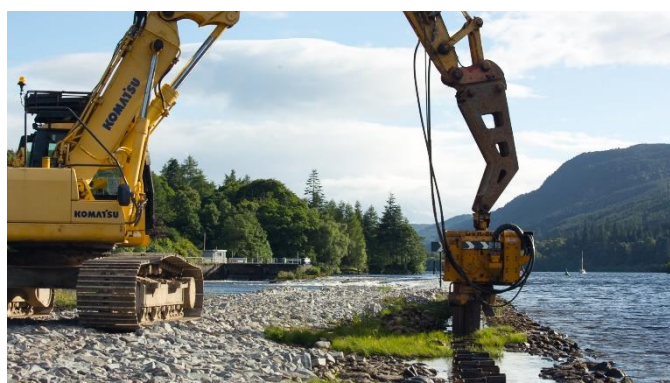


Image: Ness Weir Piling

Over the course of the eight month project, engineers utilised more than 1,000 tonnes of rock to construct a temporary access road; a helicopter to install a temporary 'fish pass' to retain the link between the River Ness and the mouth of Loch Dochfour; and over 800 tonnes of steel, enough to construct two and a half Kelpies, to reinforce the weir.

Constructed between 1825 and 1830, the weir raises the water level of Loch Dochfour by almost two metres, Loch Ness by 1.2 metres, and holds back around 100,000,000 m³ of water. Thanks to this elegant engineering solution, thousands of vessels – from holiday hire yachts to coast-to-coast fishing boats – are able to make the journey from Dochgarroch, through Loch Dochfour, and into Loch Ness each year helping support the Highland's thriving tourism economy.

[Click here](#) to watch Scottish Canal's video and find out more.

Pinkston Watersports



The Glasgow Branch of the Forth & Clyde Canal is home to Pinkston Watersports, Scotland's only artificial whitewater course and a flat-water basin with bathing quality water.

In 2010, an independent annual survey revealed that canoeing was the most popular and fastest growing water sport for the seventh year running. At the time, within the City of Glasgow, there were no specific facilities for watersports and Scotland as a whole was

lacking a purpose-built whitewater course.

Officially opened in 2014 the development of the £3.25 million Pinkston Watersports Centre was driven by partners in the Glasgow Canal Regeneration Project. Today the thriving centre, run by a charitable trust for the benefit of the community, offers something for everyone; a training facility for elite athletes on the artificial white water course, a venue for regular paddlesport club and open water swimming sessions, a water safety training resource for the Scottish Fire Service and Royal Life Saving Society and a community hub providing the opportunity for local people – whether beginners or seasoned enthusiasts – to get out on the water. This is a great example of Hydro Nation – community empowerment.

More information can be found at www.scottishcanals.co.uk or by following [@scottishcanals](https://twitter.com/scottishcanals) on Twitter.

Scottish Water: Delivering for You

Scottish Water is investing £3.9 billion throughout the country in the 2015-21 period to deliver infrastructure that is fit for communities now and for decades to come.

The **Shieldhall Tunnel**, which was completed by Scottish Water in July this year, is a great example of the capital investment programme delivering real long-term benefits for customers and communities by reducing flooding, helping to deal with the impact of climate change and improving the environment. It is a significant part of the overall investment in Greater Glasgow, which is essential to economic prosperity regionally and nationally.

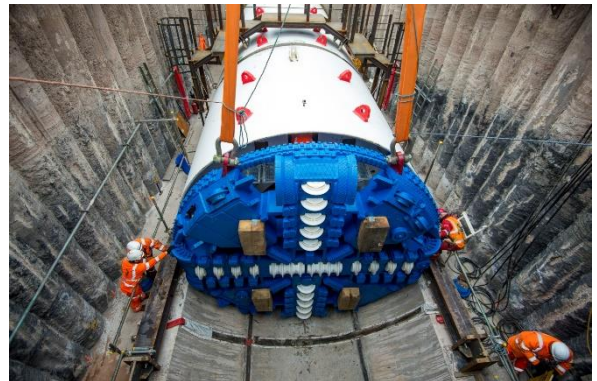


Image: Shieldhall Tunnel construction, credit to SNS Photography.

The £100 million tunnel stretches 3.1 miles from Craigton to Queen's Park via Bellahouston and Pollok parks and flows have started to run through it from across the south-side of the city which will lead to fewer flooding incidents and better environmental conditions for local residents.

In February 2018, Scottish Water launched **Shaping the Future** a consultation to seek its customer's and stakeholders' views on the future of water and waste water services, and their thoughts on the challenges, opportunities and ambitions going forward.

This consultation sets out Scottish Water's intent, and three long-term ambitions, to achieve a level where services are truly reliable and sustainable for future generations:

- Ambition 1: Delivering a consistently leading customer experience.
- Ambition 2: Keeping customer prices low by driving for further innovation and efficiency and through smart investment choices.
- Ambition 3: Increasing the reliability, resilience and sustainability of all our services.



Image: Scottish Water represented at the Royal Highland Show in Edinburgh

Feedback from customers, communities and stakeholders will help to define service and spending priorities over the next 25 years and make the best choices for Scotland.

Throughout the consultation period, Scottish Water took the opportunity to engage with its customers at various events including The Royal Highland Show, The Belladrum Tartan Heart Festival, and at Pride Scotland events in Edinburgh and Glasgow.

The **'Your Water, Your Life'** campaign, launched by Scottish Water in June 2018, aims to make 'tap' the first choice of Scotland's water drinkers, for the environment, their health and their pocket. The campaign was launched to encourage people to carry a refillable bottle and top up from the tap. For further information visit www.YourWaterYourLife.co.uk



Water is of fundamental importance to Scotland's economy, health, social wellbeing and environment and Scottish Water makes a vital contribution to the Hydro Nation strategy to develop the value of Scotland's water resources. Taking an approach in line with **circular economy principles** is essential to meet the Hydro Nation ambition and Scottish Water continues to be committed to become increasingly more resource efficient.

Scottish Water has seen its operational carbon footprint fall by nearly 32% since it started reporting it in 2006/07. Scottish Water's water service continues to have the lowest carbon intensity in the UK, and the carbon intensity of waste water service is lower than the UK average.

In order to reduce energy consumption and help target energy efficiency opportunities, Scottish Water has installed over 4,000 smart meters at its sites and is on track to deliver over 11 GWh of energy efficiency savings by 2021 through changing operational practices, adapting assets to optimise power requirements of treatment processes and investing in low-cost, low-carbon treatment solutions (see the Nereda process case study below).

Scottish Water and Scottish Water Horizons contribute to the circular economy through renewable energy waste recycling and heat energy generation on Scottish Water core assets and land. The electricity produced is used on-site to offset Scottish Water's consumption with any surplus electricity being exported to the grid. A major milestone was reached in March 2018 when the amount of renewable energy generated and hosted on Scottish Water land exceeded twice the amount of electricity used annually – around 440 GWh.



Image: Scottish Water and SEPA signing the agreement.

Scottish Water and SEPA signed what the Cabinet Secretary described as a 'historic' **sustainable growth agreement**. The agreement explores ways to increase the recovery of value from waste water, make more sustainable choices in the regulation and management of natural catchments, and to make Scottish cities more resilient to climate change.

HYDRO NATION INTERNATIONAL

The Hydro Nation Strategy outlines intent to realise the potential of Scotland's knowledge and innovation in a global context. **Hydro Nation International (HNI)** 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 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 the Hydro National International programme in 2017/18 include:

- The integration and management of international Hydro Nation activities including three new Scottish Government funded research projects, the first Hydro Nation Fellow, and engagement of existing (and new) Hydro Nation Scholars in International projects.
- Alignment of HNI activities with the wider Hydro Nation family (Hydro Nation Forum and Hydro Nation Commercial and Advisory group).
- An exercise to map academic partners in Scotland with International research interests in water resources (quantity and quality) management; drinking water supply and technologies; and waste water treatment systems. The key aim of the mapping exercise was to enhance professional engagement and the number of research proposals submitted promote Scotland's international academic reputation and wider engagement with the commercial sector and water industry.
- Provide senior level engagement with key policy and industry figures, to capture and better understand the needs and aspirations of Scottish organisations in the water sector.
- Aid-appropriate reporting on Sustainable Development Goal 6 delivery in both domestic and international contexts through collaboration with the UNESCO Centre for Water Law, Policy and Science, University of Dundee.

Decentralised Waste Water Treatment System: Global Innovation for Sustainable Rural Communities in India

The James Hutton Institute is leading a team of academics from Scotland and India to deliver a low cost, low energy, decentralised waste water treatment and recycling system that moves towards a closed loop system, recovers resources, improves sanitation, improves public health, builds social capacity and safeguards the environment.

The project is an excellent example of a circular economy where by social interests and needs are balanced with environmental sustainability through the most efficient use of resources.



Image: New toilet block (left) and the old toilet block to the right

The project aims are aligned with the Sustainable Development Goal 6 and include:

- Reduce open defecation.
- Reduce waste, water use and energy.

- Educate to improve public and environmental health.
- Address gender inequalities.
- Youth training programme at the heart of the maintenance plan.
- Future investment plan to ensure project legacy.



Image: Community engagement: Discussing the final co-created design plan with the school and local community

The team adopted a co-creative, demand driven, and gender sensitive approach. This involves not only the selection of appropriate technologies that are suited to environmental and social conditions, but also an awareness of the various socio-cultural and economic factors that shape sanitation behaviours and change.

The system contains several established processes and is supplemented with a range of innovative technologies (i.e. grey water recycling) but it is the integration of the component parts and engagement with the local community at all stages of the project that offers novelty and research impact.

The decentralised waste water system was designed for remote rural Indian communities and makes use of low cost, simple technologies (as specified in Sustainable Development Goal 6) that utilise harvested rainwater and minimise the demand for other sources of water.

In addition, the system design is modular and so can be adapted for other installations depending on local conditions such as climate variability, population density and land availability. After a period of testing and refinement, new funding opportunities will be sought to adopt the prototype in other situations such as to treat waste and reduce water consumption in hospitals, secondary schools in rural and peri-urban areas in India and Scotland.

This integrated project addresses the Hydro Nation ambition to deliver international research that is innovative; draws on knowledge and expertise of partners and stakeholders including local communities, and has the potential for wider large-scale application.

The Scottish Government are continuing to follow up on opportunities flowing from **Hydro Nation engagement with India** including potentially significant inward Indian investment in Scottish renewable technology, and supporting SEPA who have signed an MoU with the National Mission for Clean Ganga to finalise scoping a governance support project to improve River Basin Management Planning in the Ganges basin.

At the Commonwealth Heads of Government meeting held in London in April 2018, the Scottish Government signed a Memorandum of Understanding/Collaboration Agreement with the National Mission for Clean Ganga on behalf of the wider Hydro Nation family. This represents a milestone in discussions between officials and stakeholders over the last two plus years and will support more detailed discussions between Scotland: the Hydro Nation and India around opportunities for scientific cooperation and collaboration.



In August 2017, **Scottish Development International** led a group of seven Scottish companies and SEPA to assess their readiness to set up demonstrator technical projects to address some of the key water challenges of the River Ganges and its tributaries. The companies met with key Government officials, the water authorities and potential investors and companies to collaborate.

The Scottish Government is committed to support work in **Malawi**, most importantly through the Hydro Nation programme's contribution to the **Climate Justice Fund**. The Government is working with the Government of Malawi, academic institutions and Non-Governmental Organisations on water governance; policy exchange; water-resource mapping and refurbishment and water supply enhancement. Together, the aim is to make Sustainable Development Goal 6 in respect of water and waste water provision a reality in Malawi with Scotland playing an important global role by supporting Malawi to universal water access and adequate sanitation.

Following on from the President of Malawi's visit in April 2018, the Cabinet Secretary was pleased to welcome the Minister for Agriculture, Irrigation and Water Development in July 2018 for a series of policy exchanges and knowledge sharing engagements further cementing the close working relationship between our countries.

Malawi is perceived to be a country rich in water resources, with Lake Malawi and other sources covering one-fifth of the country's surface area. However, critical issues affecting Malawi's water supply is stopping the country making real and sustainable progress in addressing poverty:

- Agriculture, which underpins the Malawian Economy, is dependent on Water Resource Management.
- Energy Production is, and will continue to be, highly dependent on Water Resources.
- Over 2 million Malawians lack a clean water supply – and the actual number may be twice as high due to failing water points, effects of climate change, and a rapidly growing population.
- Waterborne diseases are a major cause of death for over 1,700 young children every year.
- Diarrhoea is the cause of around 1 in 12 of all deaths in Malawi, behind only HIV/AIDs and tuberculosis.

Malawi has significant groundwater resources, but these are not easily accessible to the 80% of the population living in rural areas lacking adequate infrastructure. Even where there are wells and boreholes in place, mapping led by Professor Robert M Kalin, from the University of Strathclyde, shows almost half of all water points are not working, as they should. This leaves communities relying on unsafe sources like shallow wells and surface water.

Since 2011, the University of Strathclyde has worked in partnership with the Government of Malawi and the Scottish Government to help achieve Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all, as well as working with the World Bank and Governments on investment needs for Sustainable Development Goal 6. The work of the Climate Justice Fund: Water Futures Programme focuses on four key areas:

- **Asset Management and Data Collection (Mapping):** Using the mWater Platform to map all water-related infrastructure across Malawi (surface water, groundwater, sanitation, waste etc.) as well as supporting drilling and forensic analysis for partner projects. The numbers mapped as at 23 August 2018 are as follows; Total Water Points: 53,693; Water Points with Detailed Information less than 12 months old: 37,300; Total Sanitation Points: 95,200; Total Sanitation Points with Detailed Information less than 12 months old: 89,580; and Total Waste Sites: 2,959.
- **Capacity Building:** Delivering training across all 28 districts in groundwater resources management, key technical skills for drilling oversight and hydrogeology for staff across every local government District Water Development Office and Malawi's Ministry of Agriculture, Irrigation and Water Development.
- **Policy Support:** Sharing policy best practice with the Government of Malawi to assist the sustainable long-term management of the water resources in Malawi.
- **Research and Knowledge Exchange:** Pursuing over 60 targeted research reports to fill key knowledge gaps for decision-making, as well as providing a distance learning MSc in Hydrogeology to support technical knowledge and capacity building in Malawi. A safe and effective water infrastructure is the keystone in helping people to stay healthy and in turn gain education, start businesses, create employment and grow economies. There are also significant areas of work on gender equality. Investing in water and sewage promises to be the bridge from poverty to wealth for Malawi.

To find out more visit <https://www.cjfwaterfuturesprogramme.com/> or please contact:
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Scottish Water International has started to work with the Scottish Government and Strathclyde University to support their efforts in achieving the Sustainable Development Goal 6 to ensure access to water and sanitation for all by 2030 in Malawi.

The approach that is being developed will improve the capability of the water supply assets by improving the data and asset register of all water access points through water point mapping. This will document condition and location and will be the basis for best practice asset management to prioritise interventions and to target the funding of improvements.

Capacity building is also planned at all levels. The Scottish Government and Strathclyde University are supporting the Government of Malawi; Scottish Water International supporting the water companies; and charities such as World Vision or WaterAid supporting the development of water and sanitation hygiene knowledge within the communities. The desire is to align the efforts of Non-Governmental Organisations for maximum benefit and return for the communities of Malawi.



Image: SWI and Strathclyde University inspect borehole pump as part of Water point Mapping exercise in Malawi

This approach ensures a sustainable legacy with government policy supporting the Water Industry, the correct asset stock being established and maintained, capabilities developed at all levels in the water industry and community buy-in to hygiene. With the basic need of water being satisfied, communities can become better educated and time can be focussed on growing their economy.

Scottish Water International undertakes a diverse range of consultancy assignments around the world to help transform utilities. Scottish Water International uses an innovative model drawing expertise from the core business creating value for the economy and developmental opportunities for staff. Examples of recent successes are set out below:

- **Qatar** – providing real operator and asset management experience, as a subcontractor to Stantec (formerly MWH), supporting Ashgal (Public Works Authority) with its six-year transformation programme of the operations and maintenance of drainage and waste water services in Doha. This programme has delivered tangible improvements in operating efficiency, levels of service and customer service through process improvements, creation of an intelligent control centre, a customer centre and introduction of real time monitoring of the network and new outsourcing framework contracts. This programme is complete.

- **Ireland** – continuing to provide expert advice and support to the transformation of the water industry in Ireland. As a subcontractor to Ernst & Young, Scottish Water International is working on the development, design and implementation of the Water Industry Operating Framework, which will transform the water industry in Ireland over the next few years. Following its successful appointment to Irish Water’s business change framework, Scottish Water International is deploying its people to help lead change in Irish Water’s operations for example in improvements to its scientific services capability.



Image: SWI consultant sharing scientific expertise to enhance Irish Water capability

- **Romania** – in partnership with the Water Industry Commission for Scotland and SEPA, Scottish Water International is currently working in a cross public sector partnership to support Romania’s water regulator and regional water operating companies to strengthen the regulatory environment and to assist the regional water companies in responding to that improved regulation. The EU supports this project.

- **Canada** – following the successful delivery of consultancy to support The City of Calgary to improve the efficiency and effectiveness of their operations, maintenance, asset management and capital delivery functions Scottish Water International has been engaged in carrying out a similar review of the water operations of the Capital Regional District in Victoria, British Columbia. The review has evaluated their maintenance and capital delivery capability resulting in



Image: SWI consulting team in Victoria, British Columbia, Canada Identifying and driving efficiencies for regional water service company, CRD.

19 key recommendations that will deliver significant business benefits to the Capital Regional District business.

- **Australia** – continuing to support SA Water, the utility serving the water and waste water needs of the state of South Australia, as sub-consultants to KBR (formerly Kellogg Brown & Root), to build asset management capability, drive efficient customer focussed capital investment delivery. Also supporting their response to service interruptions. This KBR relationship has now been extended winning a new contract in Queensland Urban Utilities, Brisbane building Program Management Office capability to improve the governance and efficiency of their capital investment delivery.



Image: SWI Consultant (Right) with Sydney Water Employee on the Treatment Change Program.

Scottish Water International has also been supporting KBR with a new contract in Tasmania for the delivery of the Regional Towns Water Supply Program for TasWater. This is delivering small membrane plants to rural communities (drawing on our experience of delivering similar plants which have been installed in Scotland) to improve the drinking water quality standards of Tasmania.

Scottish Water International also worked with Sydney Water, as sub consultants to Ernst & Young, in their Treatment Change Program, which supports them to drive effective and efficient water services in New South Wales.

International: Business Support



Aquatech is one of the world's leading trade exhibitions for process, drinking and waste water and is part of the biennial Amsterdam International Water Week. In 2017, Scottish Development International took a pavilion at the event aimed at promoting Scotland's Hydro Nation agenda and assisting Scottish companies to access international trade opportunities.

Aquatech provided an ideal opportunity to highlight Scotland's ambition and Scottish companies' capabilities at an event, which is recognised as one of the biggest global platforms for the sector. Nine Scottish companies participated at the Scottish pavilion. Scottish Development International worked with a range of partners to engage with international delegations and the companies participated in the matchmaking session organised by Enterprise Europe Network to meet potential new business partners. One company signed a contract during Aquatech for £3 million value over 3 years.

EU Water Framework Directive Capacity Building in Turkey

The Water Framework Directive is the most substantial piece of water legislation from the European Commission to date. European Commission candidate countries such as Turkey must demonstrate that they can adapt to the directive and prepare a national implementation plan.

In Scotland, responsible authorities alongside SEPA are tasked with securing compliance with many aspects of the water framework directive. SEPA has a strong EU wide reputation on Water Framework Directive implementation and in particular on groundwater dependent wetlands.



Image: Delivering a WFD Workshop in Ankara – Johan Schutten, SEPA Principal Ecologist.

As a result, SEPA was asked to support a major EuropeAid Groundwater Management Capacity Building in Turkey. SEPA's specific role was to develop and provide training to senior officials from the Ministry of Forestry and Water Affairs on two aspects of Water Framework Directive and groundwater dependent wetlands (a) EU guidance and (b) Scottish/UK experience.

Through this knowledge-exchange project, SEPA has successfully supported the Turkish authorities in their development of groundwater protection areas and wider support surrounding the administration and maintenance of associated groundwater protection area registers.

The successful delivery of this project has led to SEPA securing a further, larger project in Turkey where SEPA experts are supporting the establishment of a national groundwater protected areas register. This project is currently underway.

OECD: Water Governance Review – Scotland Pilot

Scottish Government has demonstrated strong leadership through participation in a pilot OECD project, which aims to identify and scale-up local, basin and national best practices for each of the [OECD Water Governance Principles](#), and to develop water governance indicators to assess the state of play in interested countries, basins and cities.

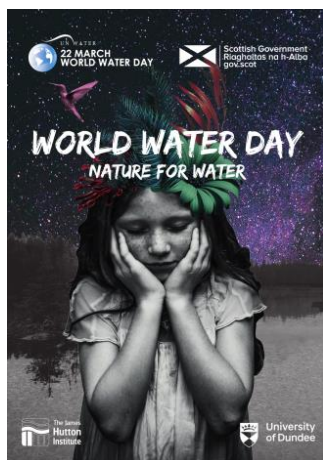
The results of the initial project phases have been recently published in the [OECD Water Governance at a Glance Report \(2018\)](#) and work is underway to develop an Action Plan to further strengthen and improve Scotland's water governance.

KNOWLEDGE SHARING AND CAPACITY BUILDING ACTIVITY

Dr Christopher Schultz was the first **Hydro Nation Scholar** to complete his studies in July 2017. Dr Munire Nazli Koseoglu and Dr Ruby Mahana Moynihan have also now successfully completed theirs and five new scholars have recently accepted places on the programme for 2018:

- **Victoria Emma Porley** – Adaptive Engineering Solutions to Water Abstraction and Control for Developing Countries: Water Purification in Rural India Using Sunlight and Low-Cost Materials.
- **Hanna Peach** – Achieving Regulatory Compliance with Low-Cost, Low-Impact Rural Provision Solutions: Optimising Microbial Communities of Removal of Priority Chemicals from Water.
- **Elliot Hurst** – Adaptive Engineering Solutions to Water Abstraction and Control for Developing Countries: The Multiple Benefits of Low-Cost Decentralised Solutions for Water Treatment and Supply in Rural India.
- **Craig McDougall** – Innovation in Water and Health: The role of Scotland's inland waters in promoting blue-health of rural communities.
- **Kerr Adams** – Assessing the Future Water Landscape of Scotland: The Scottish Water Landscape and its resilience to change an assessment to support future policy.

The Hydro Nation International Fellow (Ms **Buvi Sriramulu**) has now commenced her role, working with experts at the James Hutton Institute on modelling nitrate contamination in groundwater, a critical, yet under-researched, area of study.



To mark **World Water Day** (22 March 2018), the James Hutton Institute organised an event on behalf of the Scottish Government to recognise the contribution of Scottish academics, practitioners and policy makers to the Sustainable Development Goals and, in particular, Sustainable Development Goal 6. The event offered an opportunity for Scottish delegates to highlight and share information about current International research and policy activity contributing to the global goals through presentations and discussions designed to promote stronger networks and opportunities for future collaboration.

The event recognised the four key Hydro Nation themes (National, Innovation, International and Knowledge) through discussions lead by our Hydro Nation Scholars and key academic/experts from the water industry on the following areas:

- Water resources (quantity and quality).
- Drinking water supply and technologies.
- Waste water treatment systems.
- Future challenges facing water resource managers.

The event considered linkages with related areas of policy such as the Scottish Government's International Framework and Department for International Development's (DFID) international programme and the role of aid to meet the necessary policy and research needs to achieve Sustainable Development Goal 6. Some of the key issues around the financing of the Sustainable Development Goals were also raised.

Around eighty Scottish academics are currently working on International water related research activities. To ensure that key research outcomes are both captured and contribute to Sustainable Development Goal 6 it is important that Scotland reports activities via the Scottish Voluntary National Reporting process and those other countries such as India and Malawi also engage in respective Voluntary National Reporting procedures. Different mechanisms to make this happen were discussed. Through engagement with the UNESCO Centre for Water Law, Policy and Science, University of Dundee the key points and recommendations from the event will also be reported to the UNESCO International Hydrological Programme (IHP) Governing Council to inform the upcoming World Water Assessment Programme report on the Sustainable Development Goals. The report will also inform the Department for International Development who are keen to better understand the water-related research landscape in Scotland.

The **‘Local Water Solutions for Global Challenges’** e-learning course was launched at the World Water Day event in Edinburgh in parallel with events taking place in Brasilia at the International Water Forum. The course was conducted in a partnership between CREW, UNITAR, Gaia Education, University of Strathclyde and the Scottish Government and registered over 300 participants from 83 countries. World Water Day 2018 also marked the launch of the UN International Decade for Action – Water for Sustainable Development (2018–2028).

Encouraging Knowledge Sharing



Over the coming months Scottish Water, through its subsidiary Scottish Water Horizons, will be introducing a new series of WebEx sessions, known as the ‘Big Knowledge Exchange’, to provide users

of its Development Centres with a platform to showcase new technologies, equipment and processes to key functions within the business prior to trials going live.

The sharing of views and ideas on upcoming trials will help to drive collaboration and encourage knowledge sharing between industry, academia and Scottish Water to tackle challenges within the water industry and accelerate market adoption.

The first session will be hosted by UK-based Endo Enterprises to evaluate a non-chlorine based disinfectant against conventional chlorine systems within the potable water market.

The **Alliance for Water Stewardship (AWS)** is the custodian of the AWS Standard, a globally applicable framework for major water users to understand their water use and impacts, and to work collaboratively and transparently for sustainable water management within a catchment context. On October 31st and November 1st 2017, with support from the Scottish Government and Highlands and Islands Enterprise, AWS convened 125 water stewardship practitioners and promoters from across the globe in Edinburgh for the second **AWS Global Water Stewardship Forum**. The objective of the Forum is threefold: to provide a peer learning and networking space for practitioners, to serve as an entry point for potential practitioners new to AWS and to provide input to the strategic direction of AWS in the coming twelve months. The Forum provides a valuable opportunity for the global water stewardship community to come, collaborate and learn from each other to build and strengthen water stewardship activities around the world.

STUDYING IN SCOTLAND

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 17 current scholars from 14 countries and a further 5 starting in October 2018. This year saw the second Summer School, which provided scholars with an opportunity to visit a range of key sites in Scotland contextualise their work and collaboratively consider how to meet the water challenges of the future in an interdisciplinary and holistic way.

Professor Bob Ferrier, the Director of CREW and HNSP Chair commented, “This Scottish Government support is developing some of the brightest global talent to become the water leaders of the future and the reputation of the programme is receiving international recognition. Individually excellent in their own fields, they collectively share and support each other in consideration of some of the complex problems we face, which adds tremendously to their professional development”.

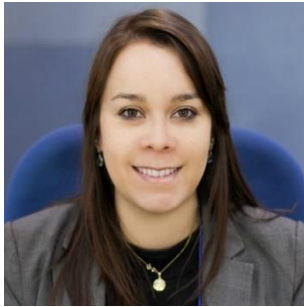


Last year, the first scholar passed his viva and completed his PhD. **Dr. Christopher Schulz** offered the following on his experience studying in Scotland: “One year ago, I passed my viva and completed my PhD at the University of Edinburgh as the first Scottish Government Hydro Nation Scholar, with a thesis entitled “The Value Base of Water Governance in the Upper Paraguay River Basin, Mato Grosso, Brazil” (defended with no corrections). The objective of my (human geography) research project was to identify the multiple values of water and forms of valuation that

underpin water governance in one of the major Brazilian river basins, located in the geographical centre of South America. The Upper Paraguay River Basin is of global interest, as it hosts the world’s biggest wetland (and important biodiversity refuge), the Pantanal, as well as Brazil’s fast-growing soybean and agribusiness sector with relevance for global commodity markets. There had also been a history of collaborative research between Scottish and Brazilian researchers working on the Pantanal, both from the natural and social sciences, and my project built on these previous collaborations, not least thanks to my excellent supervisory team of Dr Antonio Ioris (Edinburgh, now Cardiff), Dr Julia Martin-Ortega (James Hutton Institute, now Leeds) and Dr Klaus Glenk (Scotland’s Rural College). I spent extended periods on fieldwork in Mato Grosso, interviewing diverse stakeholders from the water sector; I also conducted the largest study on public preferences for water governance in Latin America so far, with findings summarised in an article currently under review in *Global Environmental Change* (ranked no. 1 among international geography/environmental social science journals).

None of this would have been possible without the excellent support of the Hydro Nation team, and I am extremely grateful for having had this opportunity. Not least, having had four years of funding gave me a competitive advantage, as it allowed me to carry out both a qualitative and a quantitative study during my PhD, which would have not been possible within three years. I also very much appreciated the Hydro Nation idea of connecting science and policy, and have enjoyed the exchange of ideas with policy-makers and practitioners e.g. at the Scottish parliament or SEPA. I am currently working as a researcher at the University of St Andrews, investigating the multiple values of tropical peatlands in the Amazon, in a highly interdisciplinary project in collaboration with

the Peruvian Amazon Research Institute (IIAP), in Iquitos, Peru. My PhD experience in Brazil has been decisive in securing this job, which deals with a novel field of research, and is likely to influence many subsequent studies on the relationship of local people with peatlands in the tropics. Upon completion of the project at St Andrews, I will move to the University of Cambridge, to work on global science-policy interfaces, with a case study on the work of the World Commission on Dams. Again, I believe that being a Scottish Government Hydro Nation alumnus has played a large part in securing this position, which is as much about concrete water policy as about advancing academic debates. I hope that the Hydro Nation Scholarship programme will long continue, and am looking forward to keeping in touch with current scholars, my fellow alumni, and the wider Hydro Nation team.”



Maricela Blair, one of the current scholars, explains here about her research and her experience so far; “I am a third-year PhD student and Hydro Nation scholar from Honduras based at the University of Glasgow. The focus of my research project is on microplastics contamination in freshwater environments. Microplastics are a type of plastic pollution commonly defined as smaller than 5 mm in size, and are classified as contaminants of emerging concern, making them a priority area for water research. Microplastics research started in the oceans, but there

has been growing attention to freshwaters, including waste water treatment systems as important transport vectors of land-based contaminants to oceans. The aim of my project is to explore the prevalence, distribution, and fate of these materials in a waste water treatment plant and its recipient freshwater channel. Plastic and microplastic pollution are urgent global challenges and currently sit at the top of the political agenda worldwide, thus this project is to contribute to current conversations around identifying what needs to be monitored and where controls should be implemented, making it relevant to inform policy and practice.

I was firstly drawn to the Hydro Nation Scholars Programme and this particular project because of their interdisciplinary nature and as it provided an opportunity to work in a fast-paced and hands-on research study driven by my interest on the complex interactions between humans and the natural environment. Secondly, I share Hydro Nation’s commitment to knowledge exchange and international aid, and in connecting research with policy. As a Hydro Nation Scholar, I have had the unique opportunity to be a part of an international and diverse group of brilliant colleagues, interact with multiple government, academia and industry members during Hydro Nation meetings and events, and to collaborate with Scottish Water and SEPA for my specific project. This has allowed me to gain invaluable expertise and further develop my understanding that current global challenges cannot be targeted in isolation. Concerted actions are needed that draw from multiple disciplines through government, business, and academia interactions in order to develop effective policies and promote good practice. This understanding has allowed me to tailor my research to further contribute to the Hydro Nation agenda and to water research and policy worldwide.

In addition to the training and wealth of knowledge that I have acquired for my specific field of research, this programme has allowed me to enhance and develop important individual skills that have contributed positively to my professional and personal growth. I am very grateful and proud to be a Hydro Nation Scholar.”

Further information about the Hydro Nation Scholars Programme and what it can offer can be found here: <http://www.hydronationscholars.scot/Scholars.html>

HYDRO NATION – INNOVATION

Our Innovation strategy is designed to support Scottish businesses to bring new products to market through the **Hydro Nation Water Innovation Service**, including provision of advice, research, and testing facilities to trial new products, as well certification and accreditation.

Hydro Nation Water Innovation Service: Supporting Innovation

The 3-year Hydro Nation Water Innovation Service project phase one ended in May 2018. The service successfully supported 16 companies with a range of technical advice around developing products for the water and waste water markets. Nine of those companies successfully completed testing at a variety of test centres. A number of case studies of the support provided and outcomes of the projects can be found on the Hydro Nation Water Innovation Service website. Also available are six Market Intelligence Reports that were well received by companies. These outline the challenges and economic opportunities from the water sector. Further information on the next iteration of Hydro Nation Water Innovation Service is set out later in this report.

The **CAN DO Innovation Challenge Fund** is a national fund which supports Scottish public sector organisations to find and develop innovative solutions to operational service and policy delivery challenges. The fund is managed by a partnership of Scottish Enterprise, Highlands and Islands Enterprise, Scottish Government and the Scottish Funding Council. The aims of the fund are to:

- Find solutions for societal and service delivery challenges faced by the public sector.
- Improve public service quality and reduce delivery costs.
- Boost Scotland's innovation and economic development performance.

Scottish Water has launched a CAN Do Challenge to invite companies to find new ways of treating water and providing safe drinking water to rural households in a cost effective way at the point of use. Up to five successful applicants could win a share of £450,000 to produce a feasibility study of their proposal, which must focus on treating water containing a high level of organic material.

Scotland has more than 10,000 water supplies that serve only one household, while another 20,000 supplies serve a population of fewer than 50 people. Most of these supplies are served by surface waters high in organic matter which currently proves challenging for existing technologies to treat reliably.

Low Carbon Heat from Waste Water

Scotland has around 32,000 miles of sewer networks spanning the length and breadth of the country. Within these networks flows a steady stream of thermal energy, thanks to the discharge from showers, washing machines and a range of industrial processes. In partnership with industry expert SHARC Energy Systems, Scottish Water Horizons is progressing initiatives to capture this natural heat from Scotland's sewer network and put it to good use to bring a sustainable, low carbon, low cost heating solution to a range of buildings and developments.



Image: Borders College, Galashiels campus, now uses heat from waste water network

A partnership between Scottish Borders College, Scottish Water Horizons and SHARC Energy Systems has resulted in a scheme that now supplies the vast majority of the Campus' annual heating and hot water demand. The first installation of its kind in the UK, the Borders College heat scheme won two industry awards in 2017 for the innovative delivery of sustainable heat.

Scottish Water Horizons now looks to expand and accelerate the rollout of heat from waste water schemes across Scotland. Projects are due to commence, with support from the

Scottish Government's Low Carbon Infrastructure Transition Programme, including a leisure centre in Campbeltown (further details later in this report).

Scottish Water Horizons is also developing an energy centre for a low carbon energy solution in collaboration with Stirling Council. This project will provide power to the waste water treatment works at Stirling and deliver heat into a new district heating network being developed by Stirling Council.

Towable Vacuum Excavator (T-Vac)



Image: towable vacuum excavator.

This is a practical innovation developed by Scottish Water in collaboration with its supply chain that enables safe excavation, minimises waste material left behind and is within the weight limits of Scottish Water's standard vans. T-Vac won the Institute of Water (Scotland) Strictly Innovation Awards.

DEVELOPING INNOVATIVE TECHNOLOGIES IN SCOTLAND

Scottish Water is helping to drive innovation and growth within the water sector by enabling businesses and academia to access test facilities at its two Development Centres at Bo'Ness and Gorthleck to conduct trials in live, operational-scale environments.

Since commissioning of the Development Centres in 2015, the company has worked closely with a number of users to enable large-scale testing for various technologies for real-world application.



Rebecca Skuce, Project Manager for Scottish Water's Development Centres, said: "The acceleration of new technologies and equipment is fundamental to meet global needs and secure a sustainable future.

"Our Development Centres provide users with the opportunity to demonstrate and conduct scenario testing on a range of water-related applications, facilitating proof of concept to prototype development to support market adoption.

"By working closely with businesses and research bodies, we aim to foster a culture of knowledge sharing and co-working to deliver industry relevant results. Already we're engaging with a number of companies within the drinks, pharmaceutical, bioprocessing and construction sectors to help bring new products to market."

Water Development Centre

Scottish Water's Development Centre for Water is Scotland's first full-scale test facility dedicated to supporting innovation in water treatment. Transformed from a membrane water treatment works, the centre benefits from varied raw water quality that is typical to many rural areas.

As the facility is no longer on the distribution network, users have a unique opportunity to test and demonstrate prototype products, processes and technologies under live conditions and on an industrial scale.



Image: Water Development Centre test area.

The centre benefits from modern welfare facilities, a laboratory area and four test bays each with dedicated feeds of varied water quality, water post filtration, drainage discharge points and power supplies.

Supported by specialist technical expertise and access to UKAS accredited sampling and analysis services, the centre can be hired out at bespoke commercial rates.

Waste Water Development Centre



Image: Waste Water Development Centre Test Area.

Scottish Water's Development Centre for Waste Water provides users with unique access to a waste water treatment asset to enable testing of pre-commercialised equipment on an industrial scale.

Located on a live, operational treatment works, the centre enables users to test, demonstrate and develop prototype products, processes and technologies and upscale experimentation in a safe and dynamic environment.

There are three test bays, each with live feeds at different stages in the treatment process namely, post screening, post primary treatment and final effluent.

As the facility carries a Waste Management Licence, users also have the flexibility to import waste from alternative industrial streams to test on non-domestic sewage, enabling industry relevant results. The centre benefits from a small-scale waste water treatment test rig, as well as a screening area to facilitate trials at the inlet to the works.

Supported by specialist technical expertise and access to UKAS accredited sampling and analysis services, the centre can be hired out at bespoke commercial rates.

For further information contact:

Rebecca Skuce, Project Manager

Tel: 07483 143439

Email: Rebecca.Skuce@scottishwater.co.uk

FORWARD LOOK

The Hydro Nation Forum met in June 2018 and endorsed the revised Hydro Nation strategy, which sets several areas of focus in the coming year.

Procurement is complete for a new **Hydro Nation Water Innovation Service** to commence in October 2018. The new service is a partnership of Scottish Government, Scottish Enterprise, Highlands & Islands Enterprise, SEPA and Scottish Water Horizons. The aim of the Hydro Nation Water Innovation Service is to help accelerate the route to market for companies developing innovative water technologies. Companies will be able to apply to the Hydro Nation Water Innovation Service, be assessed for their market readiness, and if suitable be referred to the most relevant support from across these public sector agencies. The core of this support is to help companies to take their new products to test and demonstration facilities by supporting trials and providing an independent report on the results of such trials. Successful demonstration of new technologies is an essential part of the commercialisation process for domestic and international markets. Further information is available at <https://www.hnwis.scot/>

Hydro Nation International: The decentralised waste water treatment system was constructed in the first year of the project (2017/18). The focus in year two will be to test the system and ensure it aligns to the decentralised Waste Water Treatment Works archetype. In addition to baseline monitoring of water consumption and water quality, a new post installation monitoring campaign will begin to assess the effectiveness of each module in terms of reduced water consumption and improved water quality. Work will be initiated on a maintenance/financial plan (including an internship programme) as part of the legacy activities of the project. Communication and dissemination will be an important part of future activities with the launch of the system at a school and community level and wider, high profile, awareness raising at events in Scotland and India.

Scottish Environment Protection Agency (SEPA) is embarking on a new partnership with the Climate Justice Fund Water Futures Programme in Malawi. Hydro Nation already has a strong presence in Malawi through the Climate Justice Fund programme with Strathclyde University, Scottish Water International and other Scottish partners providing support to the Government of Malawi in meeting the requirements of Sustainable Development Goal 6. SEPA will become part of the existing 'Team Scotland' partnership and has a specific mission of helping the Government of Malawi bring its own environmental regulator (the National Water Resources Authority) into operation. Through knowledge-exchange and sharing best practice, SEPA is well placed to help the Government of Malawi shape the formation of the National Water Resources Authority to suit the needs of Malawi.

Scottish Water International refreshed its strategy and identified Europe, Australasia and North America as key target markets and effort will be primarily focussed in these areas in future years. Scottish Water International will also continue to fulfil its contracts and support the Scottish Government and Strathclyde University through the Climate Justice Fund work to support the Government of Malawi to provide safe access to water and sanitation to everyone by 2030.

UNESCO Centre: Scotland is proud to host the only UNESCO Category 2 Centre in the UK. The Centre for Water Law, Policy and Science at the University of Dundee is globally recognised as a key research contributor in projects covering a wide variety of topics, including transboundary water governance, integrated water and coastal zone management, ecosystems services, biodiversity, shared groundwater, and is leading

work on the groundbreaking Hydro Nation International–funded Ganga River Health Project. We are working with the Centre, building on its international reputation and global reach to consider how to enhance its role in relation to the wider Hydro Nation agenda.

Low Carbon Heat from Waste Water: A new joint venture between Scottish Water Horizons and SHARC Energy Systems, established in March 2018, secured funding from the Scottish Government’s Low Carbon Infrastructure Transition Programme (LCITP) to allow the installation of a sustainable heat from waste water schemes. The first of these schemes is located in Argyll & Bute.

Tapping into Scottish Water’s vast sewer network, the innovative SHARC technology can capture residual heat found in waste water and use it to provide low-carbon heating and cooling across various applications.



The £1.1 million project will deliver sustainable heating to the Aqualibrium centre – a library, swimming pool and leisure complex – in Campbeltown, and is only the second project of its type in the UK.

Once commissioned, the new heat recovery system will provide the centre with 95 percent of its heating requirements, whilst using just 25

percent of the energy required by their existing gas system.

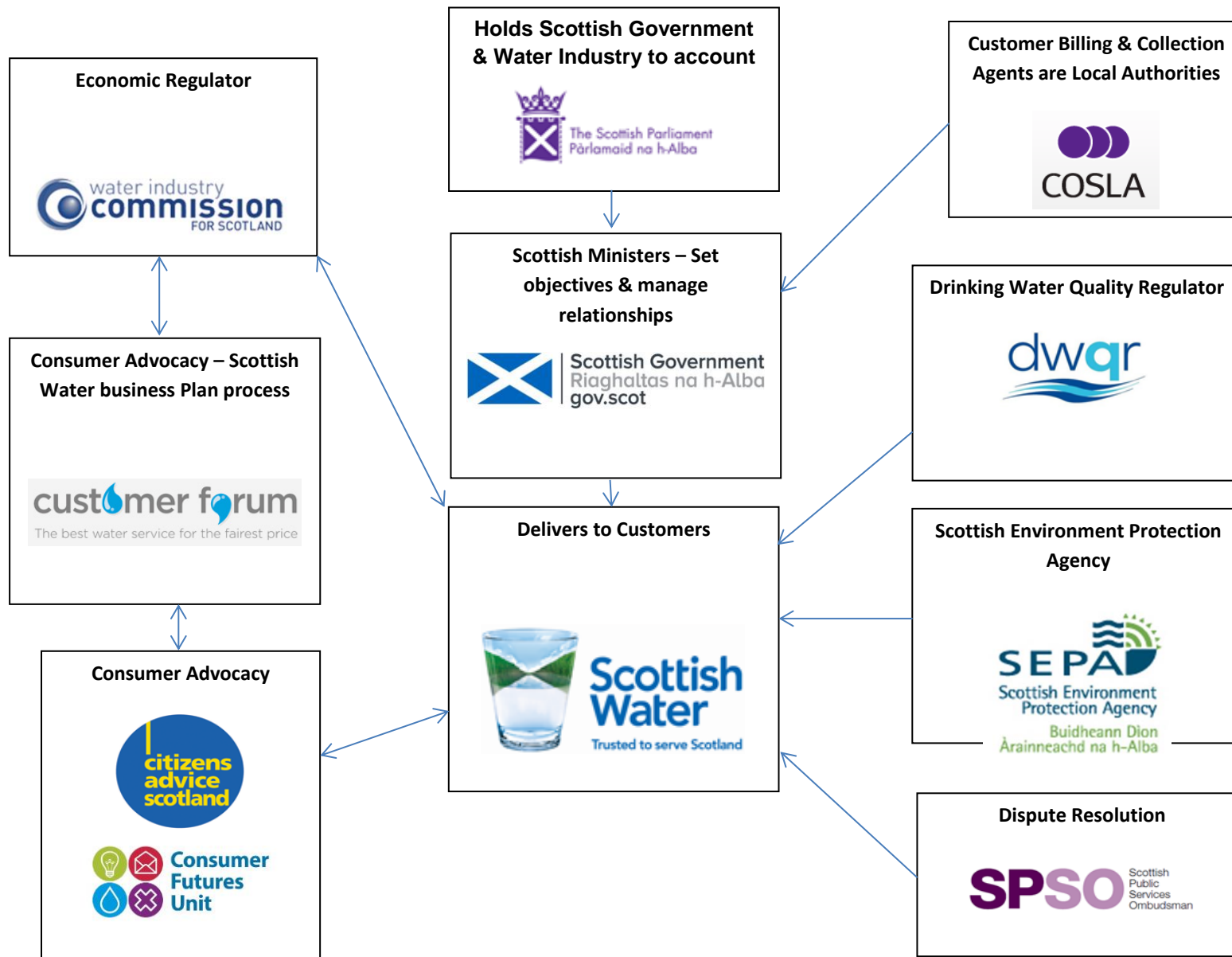
Argyll & Bute Council will benefit from a significant reduction in carbon output, bringing environmental benefits to the local community whilst contributing to Scotland’s green agenda. The system also reduces the cost of heating when compared to traditional methods, and requires no upfront capital, freeing up funds for the Council to invest in other areas.

Scottish Water Horizons’ partnership with SHARC Energy Systems will support the Scottish Government’s renewable heat and carbon reduction targets for 2020 and aims to create a pipeline of potential installations at suitable sites across Scotland that, when deployed, could generate 170 GWh annually of heating and cooling to displace the fossil fuel currently used.

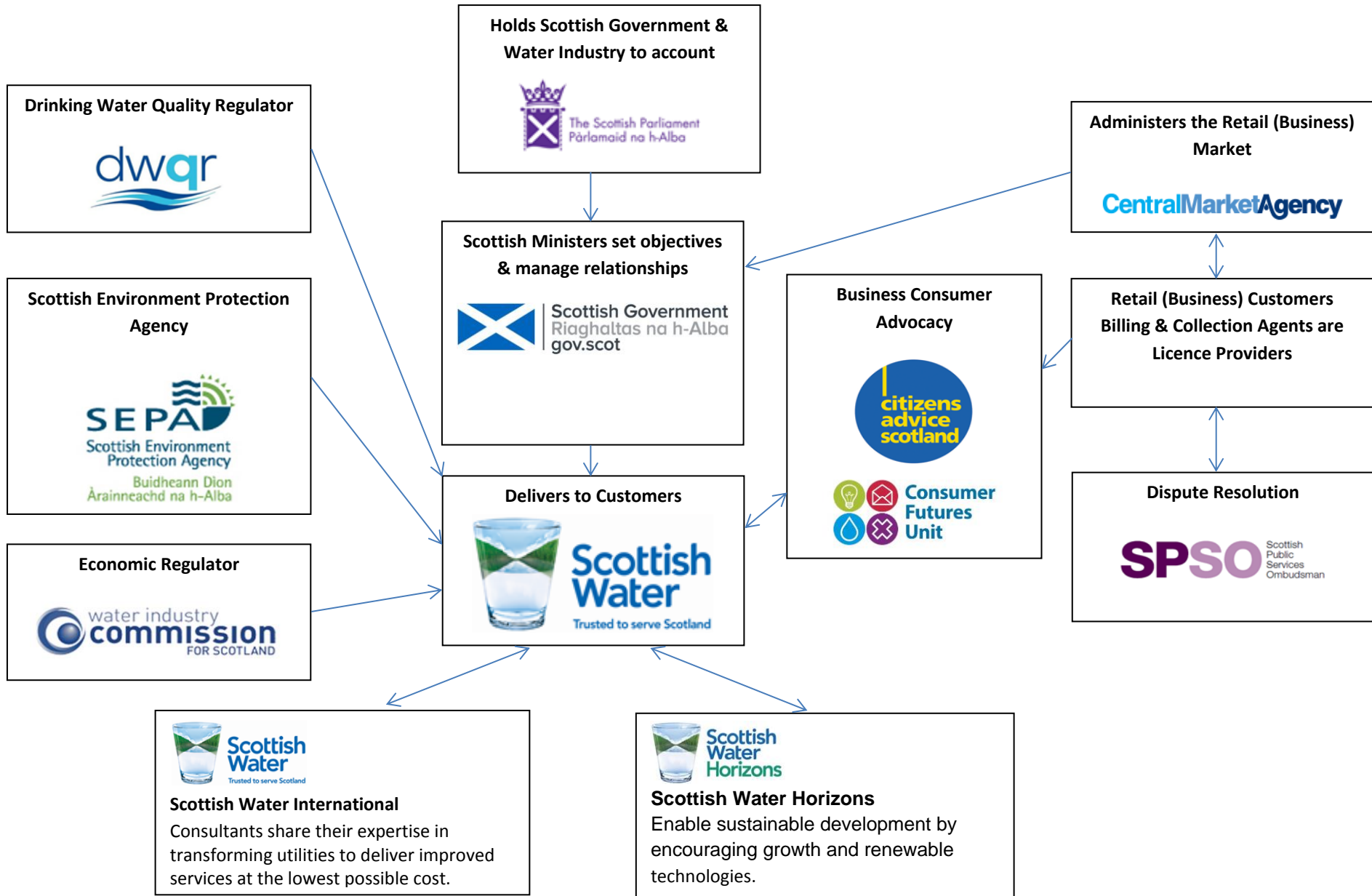
Scottish Water is progressing with a £21 million investment in a state of the art waste water treatment works for Inverurie, the first **Nereda treatment plant** in Scotland. This investment will help to reduce energy usage and carbon footprint, and enable Scottish Water to treat waste water even more effectively. By embracing innovation like this Scottish Water will be using less chemicals, energy and materials, which will benefit their customers. The new works is expected to be in operation in 2019.



Image: Nereda technology was developed by the Dutch company RHDHV, and uses aerobic granular activated sludge to treat waste water to higher standards, using less energy.



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.

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. **Dr David Johnstone**, Senior Visiting Research Associate at the School of Geography and the Environment, University of Oxford.
16. **Gail Walker**, Water Policy Team Manager within the Consumer Futures Unit at Citizens Advice Scotland.
17. **Alan Simpson**, Chairman of the Institute of Civil Engineers.
18. **Professor Chris Spray**, Chair of Water Science & Policy, UNESCO Centre for Water Law, Policy and Science, University of Dundee.
19. **Nick Lyth**, Director, Green Angel Syndicate.
20. **Jan Reid**, Senior Manager, Low Carbon Technologies at Scottish Enterprise.
21. **Steven Hutcheon**, Head of Technology and Advanced Engineering at Highlands and Islands Enterprise.
22. **Jim Panton**, CEO Panton McLeod Ltd., and Chair Of institute of Water (Scotland).
23. **Kirsty Holstead**, Hydro Nation Scholar.
24. **Adrian Sym**, Chief Executive Officer, Alliance for Water Stewardship.

HYDRO NATION SCHOLARS - WHO ARE THEY & WHAT ARE THEY DOING?

ANNEX C

Scholar	Cohort	Project	University
Juan Carlos Sanchez	2013-17	Trans-boundary Waters & Ecosystems: Opportunities for Improved Cooperative Governance. Community Impact: Improved governance frameworks will enhance the quality of communities' lives by ensuring the more equitable delivery of water services between jurisdictions	University of Dundee
Ruby Mahana Moynihan	2013-17	Contribution of the UNECE Water Regime to Multi-Level Co-operation & Cross-Sectoral Coherence in International Water Law. Community Impact: More coherence and institutional coordination will enhance the quality of communities' lives by contributing to better balanced decisions impacting on water services and biodiversity	University of Edinburgh
Christopher Schulz	2013-17	A Multi-Stakeholder Perspective on the Value of Water in the Brazilian Cuiaba River Basin & in the Pantanal to Inform Water Governance Across Brazil and Scotland. Community Impact: Improved understanding of the economic and cultural value of water will contribute to better governance and reduce risk for communities	University of Edinburgh
Nazli Koseoglu	2013-17	Optimising Water Use in Scotland: Valuation, Tradability & Portfolio Theory. Community Impact: Improved understanding of competing uses and economic and cultural value of water will contribute to better policy making on governance and resource allocation	University of Edinburgh

Scholar	Cohort	Project	University
Bas Buddendorf	2014-18	Multi-scale modelling to assess impacts on flows & ecology in regulated rivers. Community Impact: communities benefit through improved understanding and management of complex ecological systems to optimise usage and minimise environmental impact.	University of Aberdeen
Nandan Mukherjee	2014-18	Integrated river basin management framework under the lens of loss and damage. Community Impact: more sophisticated assessment of the impact of climate change on water resources will lead to improved management and planning, improving understanding of appropriate adaption/mitigation action for fragile communities.	University of Dundee
Yuan Li	2014-18	Can low-cost bio-sorbent technology be used to efficiently remove steroid hormones & pharmaceutical residues from waste water effluents? Community Impact: the efficient removal of pharmaceuticals reduces treatment costs and support improved environmental and public health.	University of the Highlands and Islands
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.	University of 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	University of Dundee & James Hutton Institute

Scholar	Cohort	Project	University
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	University of Dundee & 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	University of 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	University of Glasgow
Robert Trogrlic	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 University
Valerio Cappadonna	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.	University of 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.	University of the Highlands and Islands

Scholar	Cohort	Project	University
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	University of St Andrews
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.	University of 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.	University of Dundee & James Hutton Institute
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.	University of 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.	University of Dundee



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This publication is available at 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: 978-1-78781-184-3 (web only)

Published by The Scottish Government, September 2018

Produced for The Scottish Government by APS Group Scotland, 21 Tennant Street, Edinburgh EH6 5NA
PPDAS458906 (09/18)

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