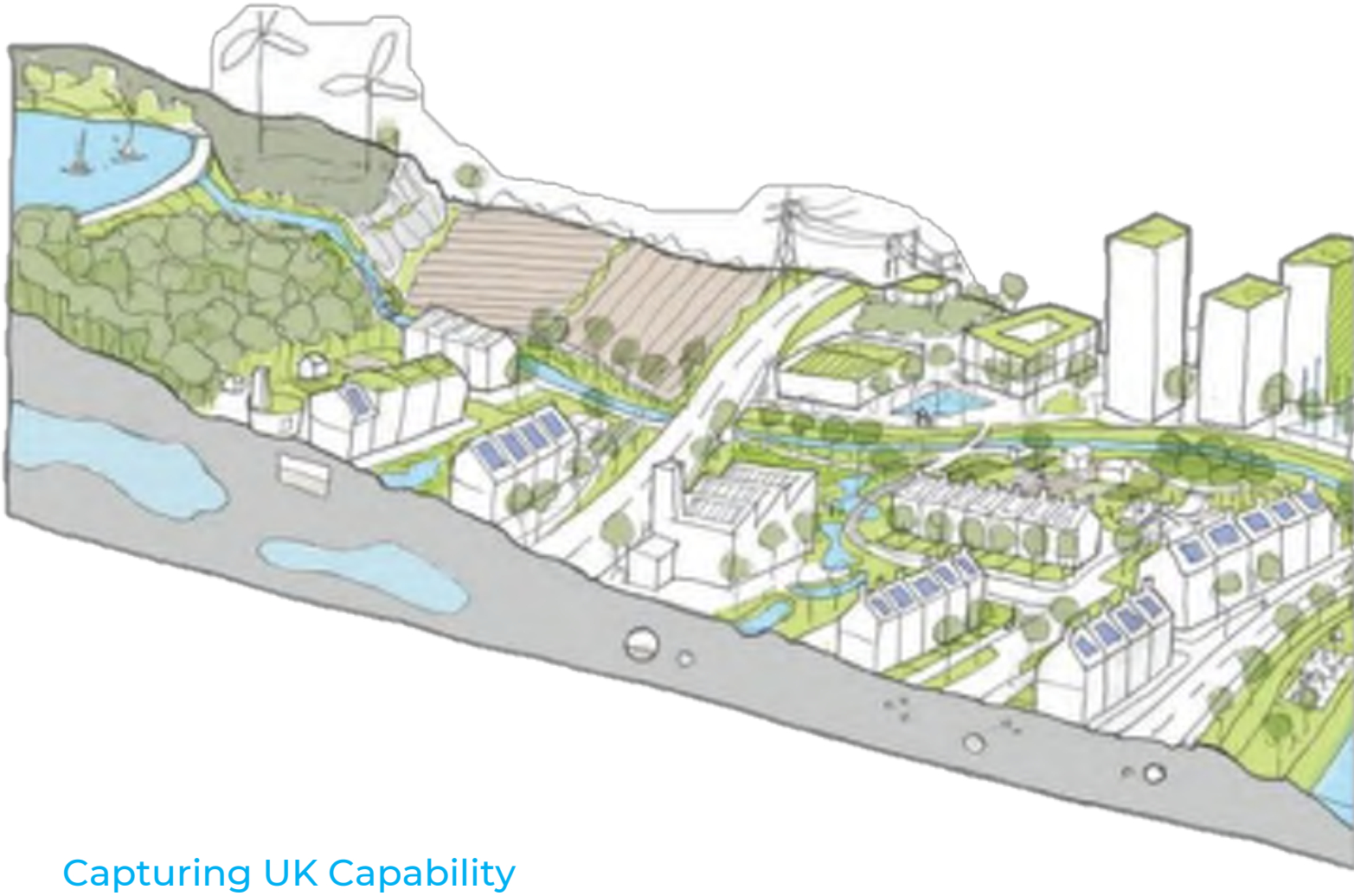
UK CAPABILITY

A new collection of case studies which illustrate the UK's breadth and depth of capability across the field of water resilience.

For the case studies published in 2022, please see here.

UK CAPABILITY & CASE STUDIES



Capturing UK Capability

This section of the paper captures a selection of case studies demonstrating UK capability across the field of Water Resilience. These case studies have been categorised by service offering (e.g. research, advisory, design, build, operate), capability readiness (whether it is an existing, emerging or future capability), and the type of solution being provided.

Updates to Water Resilience Case Studies

This is a live document that will be reviewed and updated at regular intervals to capture both existing and emerging capability.

To have case studies considered for inclusion in future updates, please submit case studies via the UKWP Capabilities Directory:

UK Capabilities Directory

www.theukwaterpartnership.org/initiatives/capabilities-directory

Improving water supply resilience of Metro Manila

Organisation(s)
Arup

Client(s)
Maynilad Water Services, Inc.

Location

Major Cities, Global

Focus Area

- ○ Digital Water
- ● Water Resilience
- ○ Net Zero

Service Offering

- ○ Research
- ○ Advisory
- ● Design
- ○ Build
- ○ Operate

UK Capability

- ● Now (existing capability)
- ○ New (emerging capability)
- ○ Next (future capability)

Overview

Built in the 1980s, La Mesa Treatment Plant 1 is the largest water treatment plant in the Philippines with a design capacity of 1,500 million liters per day, serving more than six million people. The plant experiences varying levels of raw water quality from upstream dams and watercourses at different times of the year. In the recent years, peak turbidity levels have become higher and at times reach up to 10 times the plant's design limit, which directly impacts the treatment process and production capacity.

Process and Structural Upgrading
At its heart, the plant has undergone upgrading works to increase its capacity to treat turbidity in the raw water. This included addition of lamella settlers in the existing sedimentation basins. Also the sludge handling system was massively upgraded. Risk-based decision making was needed to size the sludge facility to accommodate 'typical' conditions with a normal degree of redundancy but then maximize the use of the assets when short-duration peak turbidity events occur. This optimizes the usage of the plant and reduces the likelihood that when needed, key equipment is not available as a result of not having been run for a long preceding period. To further maximize the use of water as a resource, the recovered water system was also improved by recycling filter backwash, supernatant and filtrates to reduce plant wastage. Finally, the treatment basins and plant buildings underwent a seismic retrofit. The retrofit upgraded the capacity of structures to handle larger earthquake forces – as the understanding of the possible forces has developed significantly since original construction. This minimizes the risk of downtime in the event of major earthquakes.

Renewable Energy
Solar panels have been added, sitting over the previously unused space about the sedimentation basins, therefore utilizing space more efficiently to offset the plant power usage from the grid supplier.

Key Words

water resources	resilient infrastructure	ecosystem services
catchment management	planning and urban design	
demand management	green infrastructure	urban retrofit
buildings and public realm	rivers and waterways	
asset management	smart infrastructure	coasts

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Company profiles

Arup is the creative force at the heart of many of the world's most prominent projects in the built environment and across industry. From 90 offices in 35 countries, their 10,000 planners, designers, engineers and consultants deliver innovative projects across the world with creativity and passion. The successful design, development and maintenance of our water infrastructure requires the integration of many disciplines. Arup's water team has wide-ranging skills spanning advisory and specialist technical services. We apply them on every kind of project, from flood risk management and water resource planning, to dam engineering, treatment works design and river engineering.

Peru Reconstruction Programme

Organisation(s)
Arup

Client(s)
Government of Peru, Authority for the Reconstruction with Changes (ARCC)

Location

Peru

Focus Area

- ○ Digital Water
- ● Water Resilience
- ○ Net Zero

Service Offering

- ● Research
- ● Advisory
- ● Design
- ○ Build
- ○ Operate

UK Capability

- ● Now (existing capability)
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- ○ Next (future capability)

Overview

In 2017 the El Niño Southern Oscillation hit Peru, causing the loss of lives and a billion dollars of damage to homes, businesses, public facilities and critical infrastructure. Through a Government to Government agreement with the Peruvian government, Arup, as part of the UKDT were embedded within the ARCC to accelerate the reconstruction, "with changes" of 74 schools and 18 healthcare facilities in the areas hardest hit, as well as flood protection and water management across 17 river basins - including natural infrastructure - drainage systems for 7 cities and a national, integrated early warning system.

At its core, this programme is a commitment to building sustainable and resilient infrastructure and empowering national and community resilience to the impacts of climate change. The sustainability and resilience strategy we developed for this programme has been focused on 5 strategic areas:
•Adaptation through resilient infrastructure and design of nature-based solutions;
•Mitigation through carbon reduction and carbon sequestration;
•Adding social value by enhancing the resilience of communities;
•Capacity building by transferring climate capabilities; and
•To leave a legacy to empower local institutions.

This strategy was implemented across the schools, hospitals and health centres and integrated solutions (water infrastructure) approaches and projects.

We secured a presence for the Peru Reconstruction Programme in COP26 through various presentations (panels + within the water pavilion), film exhibitions and a digital story board.

Key Words

water resources	resilient infrastructure	ecosystem services
catchment management	planning and urban design	
demand management	green infrastructure	urban retrofit
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Digital Testing for Arsenic in South Asia

Organisation(s)
Aquaffirm

Client(s)
UNICEF and Department of Public Health Engineering (Bangladesh)

Location

Peru

Focus Area

- ○ Digital Water
- ● Water Resilience
- ○ Net Zero

Service Offering

- ○ Research
- ● Advisory
- ○ Design
- ○ Build
- ○ Operate

UK Capability

- ● Now (existing capability)
- ○ New (emerging capability)
- ○ Next (future capability)

Overview

Groundwater is an important water resource in South Asia, acting as a lifeline for many, particularly in rural communities, as a source of drinking water. High naturally occurring arsenic concentrations in groundwater are a severe problem in many regions of South Asia, with the magnitude of arsenic contamination being highest in Bangladesh (20-35 million people at risk), but with many millions also at risk in Pakistan, India, Nepal and elsewhere. Chronic long-term exposure to arsenic (particularly in the arsenite oxidation state) leads to arsenic poisoning, causing skin lesions, cancers, fertility problems, affecting childhood neurological & cognitive development and killing thousands each year. A key issue is the lack of a robust digital connected field test; current tests are complex, slow, and, critically, have no cloud connectivity - a major drawback for arsenic mitigation programs.

AquAffirm-As™ approach: digital sensors and mapping software
AquAffirm Ltd has developed the world's first real-time digital cloud-connected test for arsenic in drinking water. This innovative test uses low-cost digital sensors in the form of test strips, digital micro-reader, and Android smartphone (loaded with the AquAffirm app) for rapid measurement of this debilitating water contaminant. The system also includes software for real-time mapping of results and analysis.

Project
This collaborative project (funded by the Dutch foundation Aqua for All) involves seven independent testers (managed by Dhaka University) who are testing the arsenic concentrations of over 2000 wells in affected regions across the country using the AquAffirm-AsTM system; these results will be compared with concentrations as measured using conventional laboratory methods in order to validate the method. The aim is to launch the product in Bangladesh later this year, with roll-out to other countries following shortly thereafter.

Key Words

water resources	resilient infrastructure	ecosystem services
catchment management	planning and urban design	
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asset management	smart infrastructure	coasts

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Company profiles

AquAffirm develops proprietary digital tools/services to help clients from industry, government, and the water sector reduce their environmental impact and improve sustainability. Specifically, AquAffirm is commercialising innovative digital smartphone-enabled point-of-use sensors and software platforms to help clients manage critical water infrastructure networks, control unwanted environmental contaminant release, and monitor/map environmental impact. As a service, AquAffirm also develops bespoke digital sensors for our clients' specific needs. AquAffirm's long-term vision is to build a mobile-enabled network of sensors & software for water sustainability to include the most advanced digital water contaminant measurement platform for rapid measurement, monitoring and mapping of contaminants at the point-of-use. The new sensors and software are designed to:

- *Enhance accuracy:* Employ advanced technology to ensure precise measurements of contaminant levels, surpassing current industry standards.
- *Increase sensitivity:* Detect even trace amounts of specific contaminants, providing a comprehensive measurement of their prevalence in water sources.
- *Enable real-time monitoring and mapping:* Enable real-time monitoring and mapping of contaminants, allowing for timely responses to any emerging issues related to aqueous contamination.
- *Benefit from a user-friendly interface:* AquAffirm has developed a user-friendly software interface to facilitate easy deployment and data interpretation, making the technology accessible to a wide range of stakeholders.

Dhaka University (Dept of Geology) was one of the early research groups investigating the presence and prevalence of arsenic in drinking water in Bangladesh from the 1990s onwards. Prof Kazi Matin Ahmed has been at the forefront of research efforts focused on monitoring arsenic-affected drinking water for many years. The groups have been collaborating since 2015.

Design of Optimised Greywater Systems

Organisation(s)
Aquaffirm Ltd

Client(s)
Sanepar (Curitiba, Brazil)

Location

Peru

Focus Area

- (●) Digital Water
- ( ) Water Resilience
- ( ) Net Zero

Service Offering

- ( ) Research
- ( ) Advisory
- (●) Design
- ( ) Build
- ( ) Operate

UK Capability

- ( ) Now (existing capability)
- (●) New (emerging capability)
- ( ) Next (future capability)

Overview

The intensification of the global water crisis, driven by expanding population, industrial development, urban sprawl, and increasing agricultural demands, and compounded by climate change impacts and finite water reservoirs, necessitates universal adoption of water reuse practices. By 2030, worldwide water consumption may grow to ~160% of the currently available volume.

Water Reuse in Brazil

At the start of the project Brazil was reusing less than 0.1% of the clean water produced, compared to the global model offered by Singapore with 30% water reuse. With severe water crises in many parts of Brazil and sustainability efforts by water utility companies, there is strong evidence that water reuse will experience a massive growth in the coming years. To facilitate the significant investments needed, decision makers in both private and public sectors require innovative tools/methodologies to assess the cost-benefit of undertaking major infrastructure projects and innovative ways to optimize delivery of these projects at optimum capital (CAPEX) and operating (OPEX) cost levels.

AquaFORM™ software for greywater system design optimisation

To address this need, AquAffirm developed the AquaFORM™ infrastructure design & optimisation platform, a user-friendly, GIS-enabled software tool that enables users (planners, developers, utilities) to optimise design of greywater systems. The web-based platform facilitates design, optimisation, and visualisation of water infrastructure networks, offering significant usability and cost benefits to users both in the UK and internationally. Using advanced algorithms, a sophisticated user interface and interactive visualisation features, the platform can be customised to help our clients design and optimise new water infrastructure networks and assets.

Key Words

water resources	resilient infrastructure	ecosystem services
catchment management	planning and urban design	
demand management	green infrastructure	urban retrofit
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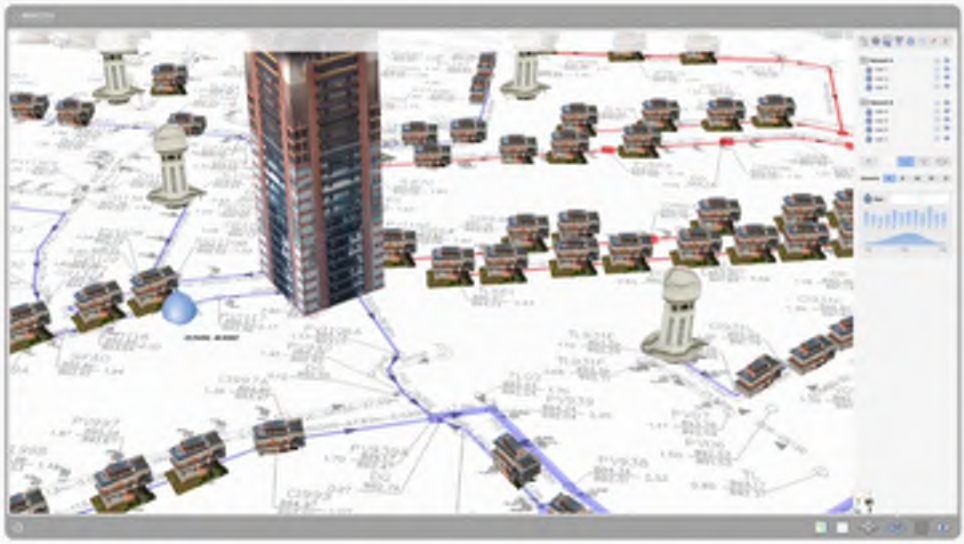
Case Study 1 **Grey Water Network**



Network features:

- Grey water sources
- Water storage facilities
- End users
- Pipework

Software features:

- Network design
- Realtime pipe routing

Company profiles

AquAffirm develops proprietary digital tools/services to help clients from industry, government, and the water sector reduce their environmental impact and improve sustainability. Specifically, AquAffirm is commercialising innovative digital smartphone-enabled point-of-use sensors and software platforms to help clients manage critical water infrastructure networks, control unwanted environmental contaminant release, and monitor/map environmental impact. As a service, AquAffirm also develops bespoke digital sensors for our clients' specific needs. AquAffirm's long-term vision is to build a mobile-enabled network of sensors & software for water sustainability to include the most advanced digital water contaminant measurement platform for rapid measurement, monitoring and mapping of contaminants at the point-of-use. The AquaFORM™ software is customizable and highly flexible, making it ideal to address the needs of our international customers.

Drought forecasting in St Kitts and Nevis

Organisation(s)
HR Wallingford

Client(s)
UN Climate Technology Centre and Network (CTCN), Department of Environment, Ministry of Environment and Cooperatives (government of St Kitts and Nevis)

Location

Saint Kitts and Nevis

Focus Area

- [x] Digital Water
- [x] Water Resilience
- [ ] Net Zero

Service Offering

- [ ] Research
- [ ] Advisory
- [x] Design
- [x] Build
- [x] Operate

UK Capability

- [x] Now (existing capability)
- [ ] New (emerging capability)
- [ ] Next (future capability)

Overview

St Kitts and Nevis is classed as water scarce, which the UN defines as countries with less than 1000 cubic meters per capita of renewable water resources a year. Recent studies have shown that St Kitts and Nevis is expected to see more frequent and severe droughts from reduced precipitation and increased evaporative demand due to anthropogenic climate change. The recent push towards an agricultural and tourism-based economy places a greater demand on already stressed water resources. Identifying areas and vulnerable groups most susceptible to water supply shortages is crucial to facilitate early action to manage risks.

By providing timely information in advance of, or during the early onset of a drought, action can be taken to reduce potential impacts. In doing so, this increases resilience in the water sector of St Kitts and Nevis.

HR Wallingford has developed a drought prediction system, which provides stakeholders with information that improves their ability to plan in advance for managing water shortages in the areas most at risk. Government officers can now identify areas most susceptible to water supply variability and shortages, and therefore take early action to manage these risks.

Key Words

climate risk	preparedness	scarcity
water resources	resilient infrastructure	ecosystem services
catchment management	planning and urban design	
demand management	green infrastructure	urban retrofit
buildings and public realm	rivers and waterways	
asset management	smart infrastructure	coasts

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Company profiles

Our specialist research and consultancy know-how solves the world's most complex water-related challenges. Exceptional people make us who we are. Our ability to innovate and push the boundaries of conventional thinking is renowned across the globe. When it comes to water, we're in our element. Ingenious solutions add value to our clients, create resilience, protect vulnerable communities and improve lives. We collaborate, build knowledge and innovate wherever water interacts with people, infrastructure and the environment.

A not-for-profit organisation, we reinvest our profits into strategic research. This allows us to tackle pressing problems; create next-generation tools and technology; and create state-of-the-art facilities. We lead the way in all that we do. Our research underpins our smart solutions – meaning our clients benefit from our fresh thinking before anyone else. We value our independence. We don't have shareholders. It means we give clear, evidence-based advice that our clients use to make intelligent decisions. Decisions that are genuinely right for them, their stakeholders and the communities they work in.

Restoring saltmarsh in the Solent through beneficially reusing dredged sediment

Organisation(s)
Earth Change

Client(s)
EA, philanthropists, companies ESG budget

Location

Intertidal area in Chichester and Lymington

Focus Area

- Digital Water
- Water Resilience
- Net Zero

Service Offering

- Research
- Advisory
- Design
- Build
- Operate

UK Capability

- Now (existing capability)
- New (emerging capability)
- Next (future capability)

Overview

The project in collaboration with Land & Water, focuses on innovatively restoring salt marshes in the UK to counteract significant habitat loss. The project utilises a re-invented drag box solution, originally from the early 1900s, to restore salt marshes, with the first full-scale trials completed in March 2023.

Salt marshes play a crucial role in environmental balance, serving as flood defences, nutrient absorbers, and wildlife habitats.
The drag box method efficiently retrieves sediment from dredging operations, repurposing it for salt marsh restoration. Borrowing modern hydraulic winching technologies, Land & Water ensures minimal environmental impact during sediment recovery.

The project's success offers promising prospects for enhancing natural capital value while addressing coastal erosion, improving biodiversity, and mitigating climate change effects. Collaboration with stakeholders and validation through research led by experts further solidifies the project's credibility and potential for widespread adoption.

The innovative approach not only demonstrates environmental stewardship but also introduces circular economy concepts by repurposing waste materials. This initiative aligns with broader conservation efforts and offers opportunities for developers to contribute to nature's recovery alongside their projects.

The trial's outcomes were satisfactory and other parties have expressed interest in adopting the method. The project's success sets a precedent for similar initiatives, showcasing the potential for restoring vital ecosystems and reversing biodiversity decline trends.

Key Words

nature-based solutions	water quality	scarcity
water resources	resilient infrastructure	ecosystem services
catchment management	planning and urban design	
demand management	green infrastructure	urban retrofit
buildings and public realm	rivers and waterways	
asset management	smart infrastructure	coasts

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Company profiles

Earth Change, a sister company of Land & Water, was established to optimise natural capital solutions for distressed land. Their purpose is to help nature finance her own restoration and their mission is to deliver profitable Nature-based Solutions.

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