University of Exeter

Centre for Water Systems

CELEBRATING 25 YEARS

25th Anniversary Papers Collection

Compiled by Dr James Webber, on behalf of the Centre for Water Systems

Forward

We are delighted to celebrate 25 years of research at the University of Exeter's Centre for Water Systems. As part of our celebrations we've looked back over our publications to gather this collection of papers, showing some of the exciting research we've been a part of, so far.

We have sifted through hundreds of papers from us and our collaborators and selected a diverse range of research outputs which cover a broad range of authors and years. We've arranged the papers in order of publication, mapped to a series of themes, and it's been fantastic to track how our work has evolved within each of these from our founding through to the present day.

With so many papers available, we have prioritised presenting a broad selection covering the range of our outputs and there remains many excellent papers that we've had to leave out of this collection.

We hope you enjoy a selection of highlights from research at our Centre over the past 25 years, and that this gives you inspiration to remain with us on our journey as we progress together into the next 25.

Dr James L Webber
On behalf of the Centre for Water Systems,
2023

Research paper themes

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Resilience 19
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Research papers

Surface water and storm water

SIPSON – Simulation of Interaction between Pipe flow and Surface Overland flow in Networks
Djordjević S, Prodanović D, Maksimović Č, Ivetić M and Savić D
2005 Water Science and Technology
Keywords: Dual drainage, storm sewers, urban flood
Click here to read

A novel cellular automata based approach to storm sewer design
Guo Y, Walters GA, Khu ST and Keedwell E
2007 Engineering Optimization
Keywords: Cellular automata, Optimisation, Storm sewer design
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Decision support for sustainable option selection in integrated urban water management
Makropoulos CK, Natsis K, Liu S, Mittas K and Butler D
2008 Environmental modelling and software
Keywords: Decision support, Optioneering, New developments, Water management
Click here to read

A coarse-grid approach to representing building blockage effects in 2D urban flood modelling
Chen AS, Evans B, Djordjević S, Savić DA
2012 Journal of Hydrology
Keywords: Urban Inundation Model (UIM), Building blockage effect, Conveyance reduction factors
Click here to read

Formulation of a fast 2D urban pluvial flood model using a cellular automata approach
Ghimire B, Chen AS, Guidolin M, Keedwell EC, Djordjević S and Savić DA
2013 Journal of Hydroinformatics
Keywords: Cellular automata, 2D flood modelling
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Rainwater harvesting in the UK: exploring water-user perceptions
Ward S, Barr S, Memon F and Butler D
2013 Urban Water Journal
Keywords: Rainwater harvesting, Receptivity, Water saving
Click here to read

SUDS, LID, BMPs, WSUD and more – The evolution and application of terminology surrounding urban drainage
Fletcher TD, Shuster W, Hunt WF, Ashley R, Butler D, Arthur S, Trowsdale S, Barraud S, Semadeni-Davies A, Bertrand-Krajewski JL, Mikkelsen PS, Rivard G, Uhl M, Dagenais D and Viklander M
2014 Urban Water Journal
Keywords: Sustainable drainage systems, Green infrastructure, Stormwater management
Click here to read

Rainwater Harvesting Typologies for UK Houses: A Multi Criteria Analysis of System Configurations
Melville-Shreeve P, Ward SL and Butler D
2016 Water
Keywords: Rainwater harvesting
Click here to read

State of SuDS delivery in the United Kingdom
Melville-Shreeve P, Cotterill S, Grant L, Arahuetes A, Stovin V, Farmani R and Butler D
2017 Water and Environment Journal
Keywords: Policy, SuDS, Surface water management
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Experimental study on scour at a sharp-nose bridge pier with debris blockage
Ebrahimi M, Kripakaran P, Prodanović DM, Kahraman R, Riella M, Tabor G, Arthur S and Djordjević S.
2018 Journal of Hydraulic Engineering
Keywords: Masonry bridge pier; Debris blockage; Scour; Laboratory experiments
Click here to read

Quantifying Long-Term Benefits of Multi-purpose Rainwater Management Systems
Melville-Shreeve P, Cotterill S and Butler D
2018 UDM 2018: New Trends in Urban Drainage Modelling
Keywords: Rainwater management systems, SuDS, Water efficiency
Click here to read

Investigating the effects of pluvial flooding and climate change on traffic flows in Barcelona and Bristol
Evans B, Chen AS, Djordjević S, Webber J, Gómez AG and Stevens J
2020 Sustainability
Keywords: Flooding, Climate change, Traffic modelling, Resilience
Click here to read

Is green infrastructure a viable strategy for managing urban surface water flooding?
Webber JL, Fletcher TD, Cunningham L, Fu G, Butler D and Burns MJ
2020 Urban Water Journal
Keywords: Urban surface water management, Green infrastructure
Click here to read

Moving to a future of smart stormwater management: A review and framework for terminology, research, and future perspectives
Webber JL, Fletcher T, Farmani R, Butler D and Melville-Shreeve P
2022 Water Research
Keywords: Smart stormwater, Internet of things
Click here to read

Are sponge cities the solution to China's growing urban flooding problems?
Fu G, Zhang C, Hall JW, Butler D.
2023 Wiley Interdisciplinary Reviews: Water
Keywords: Flooding, Sponge city, Resilience
Click here to read

Water Supply and Demand

Evolutionary multi-objective optimization in water distribution network design
Farmani R, Savic DA and Walters GA
2005 Engineering Optimization
Keywords: Water distribution, Genetic algorithm
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Optimal design of water distribution systems using many-objective visual analytics
Fu G, Kapelan Z, Kasprzyk J, Reed P
2013 Journal of Water Resources Planning and Management
Keywords: Multi-objective optimisation, Visual analytics, Optimal design
Click here to read

A general multi-objective hyper-heuristic for water distribution network design with discolouration risk
McClymont K, Keedwell E, Savić DA and Randall-Smith M
2013 Journal of Hydroinformatics
Keywords: Hyper-heuristics, WDN design, Discolouration
Click here to read

Intermittent water supply systems: causal factors, problems and solution options
Simukonda K, Farmani R and Butler D
2018 Urban Water Journal
Keywords: Water distribution, Intermittent supply
Click here to read

Pipeline failure prediction in water distribution networks using weather conditions as explanatory factors
Kakoudakis K, Farmani R and Butler D
2018 Journal of Hydroinformatics
Keywords: Pipe failure, Water distribution
Click here to read

Deep learning identifies accurate burst locations in water distribution networks
Zhou X, Tang Z, Xu W, Meng F, Chu X, Xin K, Fu G
2019 Water Research
Keywords: Deep learning, Leakage detection, Mobile sensor
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Predicting failures in electronic water taps in rural sub-Saharan African communities: an LSTM-based approach
Mitchel ON, Wu Y and Memon FA
2020 Water Science and Technology
Keywords: Failure prediction, LSTM, Time-series data
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Pollution exacerbates China's water scarcity and its regional inequality
Ma T, Sun S, Fu G, Hall JW, Ni Y, He L, Yi J, Zhao N, Du Y, Pei T and Cheng W
2020 Nature Communications
Keywords: Water pollution, water scarcity, inequality
Click here to read

The Nile water-food-energy nexus under uncertainty: Impacts of the Grand Ethiopian Renaissance Dam
Elsayed H, Djordjević S, Savić DA, Tsoukalas I and Makropoulos C
2020 Journal of Water Resources Planning and Management
Keywords: Grand Ethiopian Renaissance Dam (GERD); Nile basin; Stochastic analysis; System dynamics modeling; Water-foodenergy nexus
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Integrated 1D and 2D model for better assessing runoff quantity control of low impact development facilities on community scale
Yin D, Evans B, Wang Q, Chen Z, Jia H, Chen AS, Fu G, Ahmad S and Leng L
2020 Science of the Total Environment
Keywords: Integrated modelling; Cellular Automata Dual-DraInagE Simulation (CADDIES); Sponge city
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Optimization of a Horizontal Axis Tidal (HAT) turbine for powering a Reverse Osmosis (RO) desalination system using Computational Fluid Dynamics (CFD) and Taguchi method
Khanjanpour MH and Javadi AA
2021 Energy Conversion and Management
Keywords: Horizontal Axis Turbine, Desalination, Taguchi method, CFD
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Capturing high-resolution water demand data in commercial buildings
Melville-Shreeve P, Cotterill S and Butler D
2021 Journal of Hydroinformatics
Keywords: Low-cost water sensors, Smart water meters, Ultra-low flush toilet, Water demand management
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A comprehensive comparative analysis of deep learning tools for modeling failures in smart water taps
Mitchel ON, Wu Y, Muniandy D and Memon FA
2022 Water Supply
Keywords: Deep learning, Failure prediction, Smart water taps, Digital Water
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The sustainability of desalination as a remedy to the water crisis in the agriculture sector: An analysis from the climate-water-energy-food nexus perspective
Zolghadr-Asli B, McIntyre N, Djordjevic S, Farmani R and Pagliero L
2023 Agricultural Water Management
Keywords: Sustainable Development, Desalination
Click here to read

A closer look at the history of the desalination industry: the evolution of the practice of desalination through the course of time
Zolghadr-Asli B, McIntyre N, Djordjevic S, Farmani R and Pagliero L
2023 Water Supply
Keywords: Sustainable Development, Desalination
Click here to read

Household flow detection using FEAT (flow estimating accelerometer-thermometer) device, Flow Measurement and Instrumentation
Wills P, Memon FA, Wu Y, Merchant P and Roberts M
2023 Flow Measurement and Instrumentation
Keywords: Sensors, Vibration, Temperature, Disaggregation
Click here to read

Gradual Leak Detection in Water Distribution Networks Based on Multistep Forecasting Strategy
Wan X, Farmani R and Keedwell E
2023 Journal of Water Resources Planning and Management
Keywords: Leak detection, Water distribution
Click here to read

Time Series Data Preparation for Failure Prediction in Smart Water Taps
Mitchel ON, Memon FA and Wu Y
2023 Multidisciplinary Digital Publishing Institute
Keywords: Deep learning, Smart water taps
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Multi-Objective Multi-Gene Genetic Programming for the Prediction of Leakage in Water Distribution Networks

Hayslep M, Keedwell E and Farmani R

2023 Proceedings of the Genetic and Evolutionary Computation Conference

Keywords: Genetic programming, Leakage, Real world problems

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Wastewater

Multiple objective optimal control of integrated urban wastewater systems
Fu G, Butler D and Khu ST
2008 Environmental Modelling and Software
Keywords: *Integrated modelling, Multiple objective optimization, NSGA II, Urban wastewater system*
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Modelling the potential for multi-location in-sewer heat recovery at a city scale under different seasonal scenarios
Abdel-Aal M, Schellart A, Kroll S, Mohamed M and Tait S
2018 Water Research
Keywords: Heat recovery, Heat transfer modelling, Wastewater, Clean thermal energy
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Modelling the diffusion and operation of anaerobic digestions in Great Britain under future scenarios within the scope of water-energy-food nexus
Abdel-Aal M, Haltas I and Varga L
2020 Cleaner Production
Keywords*: Anaerobic digestion, Water-energy-food nexus, Future scenarios, Agent-based model*
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Using long term simulations to understand heat transfer processes during steady flow conditions in combined sewers
Abdel-Aal M, Tait S, Mohamed M and Schellart A
2021 Water
Keywords: Wastewater temperature, Heat transfer, Heat recovery from wastewater
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An Analysis of SARS-CoV-2 in Wastewater to Evaluate the Effectiveness of Nonpharmaceutical Interventions against COVID-19 in The Netherlands
Stephens N, Béen F and Savić DA
2022 American Chemical Society
Keywords: SARS-CoV-2, Wastewater, Analytics
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Investigation and analysis of microplastics in sewage sludge and biosolids: A case study from one wastewater treatment works in the UK
Harley-Nyang D, Memon FA, Jones N and Galloway T
2022 Science of the Total Environment
Keywords: Plastics, Biosolids, Sludge treatment, Anaerobic digestion, Lime stabilisation
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A comparative evaluation of the sustainability of alternative aeration strategies in biological wastewater treatment to support net-zero future
Pryce D, Kapelan Z and Memon FA
2022 Journal of Cleaner Production
Keywords: Sustainable development, Net zero, Climate change, Wastewater treatment
Click here to read

Building knowledge of university campus population dynamics to enhance near-to-source sewage surveillance for SARS-CoV-2 detection
Sweetapple C, Melville-Shreeve P, Chen AS, Grimsley JMS, Bunce JT, Gaze W, Fielding S and Wade MJ
2022 Science of the Total Environment, volume 806, 150406
Keywords: COVID-19, Near-to-source, Normalisation, SARS-CoV-2, Wastewater-based epidemiology
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Groundwater

An evolutionary Bayesian belief network methodology for optimum management of groundwater contamination
Farmani R, Henriksen HJ and Savic DA
2009 Environmental Modelling & Software
Keywords: Groundwater management
Click here to read

A Cost-Effective Method to Control Seawater Intrusion in Coastal Aquifers
Abd-Elhamid HF and Javadi AA
2011 Water Resources Management
Keywords: Seawater intrusion, Control, Finite element, Genetic algorithm, Simulation-optimization
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Modelling of contaminant transport in soils considering the effects of micro- and macro-heterogeneity
Mousavi Nezhad M, Javadi AA and Rezania M
2011 Journal of Hydrology
Keywords: Contaminant transport, Stochastic finite element method, Dual-domain, Soil heterogeneity
Click here to read

Multi-objective Optimization of Different Management Scenarios to Control Seawater Intrusion in Coastal Aquifers
Javadi AA, Hussain M, Sherif M and Farmani R
2015 Water Resources Management
Keywords: Seawater intrusion, Simulation-optimization, Multi-objective GA, Treated wastewater
Click here to read

A surrogate model for simulation–optimization of aquifer systems subjected to seawater intrusion
Hussain MS, Javadi AA, Ahangar-Asr A and Farmani R
2015 Journal of Hydrology
Keywords: Seawater intrusion, Optimization, Surrogate model, Evolutionary modelling
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Developing a fuzzy logic-based risk assessment for groundwater contamination from well integrity failure during hydraulic fracturing
Milton-Thompson O, Javadi AA, Kapelan Z, Cahill AG and Welch L
2021 Science of the Total Environment
Keywords: Hydraulic fracturing, Risk assessment, Groundwater contamination, Well integrity
Click here to read

Coupled three-dimensional modelling of groundwater-surface water interactions for management of seawater intrusion in Pingtung Plain, Taiwan
Dibaj M, Javadi AA, Akrami M, Ke K, Farmani R, Tan YC and Chen A
2021 Hydrology Regional Studies
Keywords: Coupled model, Groundwater, Surface water, Seawater intrusion, FEFLOW, Taiwan
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Optimal management of mixed hydraulic barriers in coastal aquifers using multi-objective Bayesian optimization
Saad S, Javadi AA, Chugh T and Farmani R
2022 Hydrology
Keywords: Seawater intrusion, Coastal aquifer management, Gaussian processes, Hydraulic barriers
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Optimal management of mixed hydraulic barriers in coastal aquifers using multi-objective Bayesian optimization
Saad S, Javadi AA, Chugh T and Farmani R
2022 Journal of Hydrology
Keyword: Seawater intrusion, Coastal aquifer management, Gaussian processes, Surrogate model
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Efficient uncertainty quantification for seawater intrusion prediction using optimized sampling and Null Space Monte Carlo method
Saad S, Javadi AA, Farmani R and Sherif M
2023 Hydrology
Keywords: Seawater intrusion, Optimized Latin hypercube sampling, Uncertainty analysis
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Computational Fluid Dynamics

The use of CFD coupled with physical testing to develop a new range of vortex flow controls with attributes approaching the ideal flow control device
Jarman DS, Tabor GR, Butler D and Andoh RYG
2011 World Environmental and Water Resources Congress
Keywords: Vortex flow controls, CFD
Click here to read

Experimental and numerical investigation of interactions between above and below ground drainage systems
Djordjević S, Saul AJ, Tabor GR, Blanksby J, Galambos I, Sabtu N and Sailor G
2013 Water Science and Technology
Keywords: CFD, Flood modelling, Urban pluvial flooding
Click here to read

Computational fluid dynamics of vortex controls at low flow rates
Queguineur G, Jarman D, Paterson E and Tabor G
2013 Proceedings of the Institution of Civil Engineers
Keywords: CFD, Vortex flow control
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Modelling of vortex flow controls at high drainage flow rates
Jarman D, Butler D, Tabor G and Andoh R
2015 Proceedings of the Institution of Civil Engineers
Keywords: CFD, Vortex flow control
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Explicit calculation of natural aeration using a Volume-of-Fluid model
Lopes P, Tabor GR, Carvalho RF and Leandro J
2016 Applied Mathematical Modelling
Keywords: Air-entrainment, Air–water two-phase flow, Sub-grid explicit model
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Derivation of the Adjoint Drift Flux Equations for Multiphase Flow
Grossberg S, Jarman DS and Tabor GR
2020 Fluids
Keywords: CFD, Multiphase flow
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Application of multi-objective Bayesian shape optimisation to a sharp-heeled Kaplan draft tube
Daniels SJ, Rahat AAM, Tabor GR, Fieldsend JE and Everson RM
2022 Optimisation and engineering
Keywords: Multi-objective optimisation, CFD
Click here to read

Hydroinformatics

Genetic Algorithms for Least-Cost Design of Water Distribution Networks
Savić DA and Walters GA
1997 Journal of Water Resources Planning and Management
Keywords: Water distribution systems, Optimisation, Genetic algorithms
Click here to read

A symbolic data-driven technique based on evolutionary polynomial regression
Giustolisi O and Savić DA
2006 Journal of Hydroinformatics
Keywords: Machine learning, Genetic programming, Pipes, Friction characteristics
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Evolutionary algorithms and other metaheuristics in water resources: Current status, research challenges and future directions
Maier HR, Kapelan Z, Kasprzyk J, Kollat J, Matott SL, Cunha MC, Dandy GC, Gibbs MS, Keedwell E, Marchi A, Ostfeld A, Savic DA, Solomatine DP, Vrugt JA, Zecchin AC, Minsker BS, Barbour EJ, Kuczera G, Pasha F, Castelletti A, Giuliani M and Reed PM
2014 Environmental Modelling & Software
Keywords: Evolutionary algorithms, Hyper-heuristics, Position paper
Click here to read

From hazard to impact: the flood damage assessment tools for mega cities
Chen AS, Hammond M, Djordjević S, Butler D, Khan DM and Veerbeek W
2016 Natural Hazards
Keywords: Damage function, Hydraulic modelling, Hazard impact assessment, Urban growth
Click here to read

A weighted cellular automata 2D inundation model for rapid flood analysis
Guidolin M, Chen AS, Ghimire B, Keedwell EC, Djordjević S and Savić DA
2016 Environmental Modelling and Software
Keywords: 2D flood modelling, Cellular automata
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Serious Gaming for Water Systems Planning and Management
Savić DA, Morley MS and Khoury M
2016 Water
Keywords: Serious games, Water management
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An integrated model to evaluate water-energy-food nexus at a household scale
Hussien WA, Memon FA and Savić DA
2017 Environmental Modelling and Software
Keywords: Households, Seasonal variability, System dynamics modelling, Water-energy-food nexus
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The effect of inclusion of inlets in dual drainage modelling
Chang TJ, Wang CH, Chen AS and Djordjević S
2018 Journal: Journal of Hydrology
Keywords*: Coupled 1D/2D flood model, Dynamic flow interaction, Overland flow, Storm sewer flow*
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Rapid assessment of surface-water flood-management options in urban catchments
Webber JL, Gibson MJ, Chen AS, Savic D, Fu G and Butler D
2018 Urban Water Journal
Keywords: 2D flood modelling, Cellular automata, surface water management
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The role of deep learning in urban water management: A critical review
Fu G, Jin Y, Sun S, Yuan Z, Butler D.
2022 Water Research
Keywords: Artificial intelligence, Deep learning, Urban water management
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Computational Intelligence-based Optimization Algorithms: From Theory to Practice
Zolghadr-Asli B
2023 CRC Press
Keywords: Computational Intelligence, Optimization Algorithms
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Resilience

New policies to deal with climate change and other drivers impacting on resilience to flooding in urban areas: the CORFU approach
Djordjević S, Butler D, Gourbesville P, Mark O and Pasche E
2011 Environmental science & policy
Keywords: Urban flooding, Resilience, Collaborative research, Urban growth, Climate change
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Urban flood impact assessment: A state-of-the-art review
Hammond MJ, Chen AS, Djordjević S, Butler D and Mark O
2015 Urban Water Journal
Keywords: Urban flooding, Resilience, Impact assessment, Urban water management
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Reliable, resilient and sustainable water management: the Safe & SuRe approach
Butler D, Ward S, Sweetapple C, Astaraie-Imani M, Diao K, Farmani R and Fu G
2016 Global Challenges.
Keywords: Framework, Interventions, Reliability, Resilience, Sustainability, Water management
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Rainwater Harvesting and Social Networks: Visualising Interactions for Niche Governance, Resilience and Sustainability
Ward S and Butler D
2019 Water
Keywords: Rainwater harvesting, Resilience, Social network analysis, Sustainability
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Assessing the knock-on effects of flooding on road transportation
Pyatkova K, Chen AS, Butler D, Vojinović Z and Djordjević S
2019 Journal of Environmental Management
Keywords: Flood impacts, Microscopic traffic modelling, Model integration, Traffic disruption
Click here to read

Assessing and visualising hazard impacts to enhance the resilience of Critical Infrastructures to urban flooding
Vamvakeridou-Lyroudia LS, Chen AS, Khoury M, Gibson MJ, Kostaridis A, Stewart D, Wood M, Djordjević S and Savić DA.
2020 Science of the Total Environment
Keywords: Natural hazards, Climate change, Flood modelling, Resilience, Visualisation
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COVID-19 and the water sector: understanding impact, preparedness and resilience in the UK through a sector-wide survey
Cotterill S, Bunney S, Lawson E, Chisholm A, Farmani R and Melville-Shreeve P
2020 Water and Environment Journal
Keywords: Covid-19, Water sector preparedness, Resilience
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General resilience: Conceptual formulation and quantitative assessment for intervention development in the urban wastewater system
Sweetapple C, Fu G, Farmani R and Butler D
2022 Water Research
Keywords: Adaptation, General resilience, Middle state, Specified resilience, Urban wastewater
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Engaging Research Communities

Multi-stakeholder development of a serious game to explore the water-energy-food-land-climate nexus: The SIM4NEXUS approach
Sušnik J, Chew C, Domingo X, Mereu S, Trabucco A, Evans B, Vamvakeridou-Lyroudia L, Savić DA, Laspidou C and Brouwer F
2018 Water
Keywords: Nexus; Participatory modelling; Serious game; System dynamics; Water-food-land-energy-climate
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AccessLab: Workshops to broaden access to scientific research
Griffiths AGF, Modinou I, Heslop C, Brand C, Weatherill A, Baker K, Hughes AE, Lewis J, de Mora L, Mynott S, Roberts KE and Griffiths DJ
2019 PLOS Biology
Keywords: Decentralised research, Policy
https://journals.plos.org/plosbiology/article?id=10.1371/journal.pbio.3000258

Co-producing research with academics and industry to create a more resilient UK water sector
Baker K, Ward S, Turner B, Webber J, Sweetapple C, Drake P, Thomas D, Melville-Shreeve P, Fu G, Cherington-Rimmell S, Farmani R and Butler D
2020 Research for All
Keywords: Co-creation, Co-dissemination, Co-production, Engagement, Water sector
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Communities of practice at the center of circular water solutions
Fulgenzi A, Brouwer S, Baker K and Frijns J
2020 Wiley Interdisciplinary Reviews: Water
Keywords: Circular economy; Knowledge co-production; Social learning
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Hydroinformatics education – the Water Informatics in Science and Engineering (WISE) Centre for Doctoral Training
Wagener T, Savic D, Butler D, Ahmadian R, Arnot T, Dawes J, Djordjevic S, Falconer S, Farmani R, Ford D, Hofman J, Kapelan Z, Pan S and Woods R
2021 Education and Communication
Keywords: Education, Hydroinformatics, PhD, Cohort, Centre for doctoral training
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A modelling testbed to demonstrate the circular economy of water
Evans B, Khoury M, Vamvakeridou-Lyroudia L, Chen O, Mustafee N, Chen AS, Djordjević S and Savić DA
2023 Journal of Cleaner Production
Keywords: Water, Circular economy, Serious game, System dynamic modelling
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