

# Research Associate in Bioinspired Solutions for Soil

Department	Civil and Environmental Engineering ( <a href="http://www.strath.ac.uk/engineering/civilenvironmentalengineering/">www.strath.ac.uk/engineering/civilenvironmentalengineering/</a> )		
Faculty	Faculty of Engineering ( <a href="http://www.strath.ac.uk/engineering/">www.strath.ac.uk/engineering/</a> )		
Staff Category	Research	Reference No	440195
Reports To	Dr Matteo Pedrotti	Grade:	7
Salary Range:	£33,309	Contract Type:	Fixed term (24 months)
FTE:	1 (35 hours/week)	Closing Date	Sunday, 10 April 2022

## Job Advert

The Department of Civil and Environmental Engineering seeks to recruit a talented researcher to a 24-month Research Associate position. The new Associate is required to demonstrate research experience in either Soil Mechanics, Soil Science or Plant Science. Within this project the Research Associate will work on a bioinspired system that uses emerging materials and concepts in geotechnical engineering to mimic the wicking mechanisms that plants use for transpiration. This position is funded by the EPSRC New Investigator Awards project: An ‘energy free’ pump: nanoporous gels to passively lift subsurface water” led by Dr Matteo Pedrotti.

The aim of the project is to develop a bioinspired pump capable of passively lifting subsurface water, from depths of tens-to-hundreds of meters, using only energy that is provided naturally by the atmosphere. Through the design of a colloidal silica-based hydrogel that can be injected into soils and rocks, a soil-hydrogel network will be created that has an increased soil hydraulic conductivity and water retention capacity during periods of high negative soil water pressure, thus enabling the passive lifting of water from the deep groundwater table to near-surface soils during periods of drought. Providing a zero-energy engineering solution at the nexus between water, energy and food.

The project will tackle three specific challenges: to manipulate the hydrogel properties so that a sufficient water flux is provided over a desired range of negative pore water pressure values, whilst still maintaining injectability (a low initial viscosity and controllable gel time); to create a continuous, durable network of nanopores within the grouted soil that is resistant to repeated cycles of wetting and drying, i.e. the system must not irreversibly cavitate (form cracks or bubbles) at high negative water pressure, or the long-term hydraulic continuity will be lost; to demonstrate that plants can thrive when connected to an “Energy-free water pump”.

The successful researcher will be based in the Department of Civil and Environmental Engineering at the University of Strathclyde in Glasgow, UK and will have the opportunity to undertake additional research at the Materials Science and Nanotechnology laboratory at Imperial College, London, and at the School of Chemistry laboratory at the University of Glasgow. Additional contribution to the project will be also provided by the Institute of Terrestrial Ecosystems - Department of Environmental Systems Science at the Swiss Federal Institute of Technology, Zurich (ETH).

The University is seeking an excellent and enthusiastic candidate that can contribute to laboratory-based research ranging from micro scale characterization to macroscopic scale experiment. This project lies at the interface between a range of disciplines and as such will make use of a wide range of laboratory skills (e.g. unsaturated soil mechanics, hydrogels characterization, plant science and imaging techniques). It is not necessary that you have expertise in all of these areas as training will be given, but you should have experience in at least some of these areas. To be considered for the role, you should have a relevant undergraduate degree (e.g. Geotechnics, Ground Engineering, Soil science, Plant science, Material Science, Chemistry, Physics, Environmental

Engineering, Civil Engineering and Environmental Sciences) and have successfully completed a PhD in a relevant field (e.g. Soil Mechanics, Soil Science, Plant Science).

## Job Description

### Brief Outline of Job:

To undertake a specific research on “An ‘energy free’ pump: nanoporous gels to passively lift subsurface water” under the general guidance of a research leader; to establish a personal research portfolio and plan research proposals, with assistance from senior colleagues as required; to engage where required in relevant professional and knowledge exchange activities.

### Main Activities/Responsibilities:

1.	To understand the micro-mechanisms controlling the interaction between the selected hydrogel and the surrounding soil lattice and provide information on whether its physical properties need to be further modified
2.	To develop cross-linked colloidal silica-based composite hydrogels that have a low initial viscosity, a high water content and a nanoporous structure, and that incur minimal shrinkage upon drying and, hence, have a low susceptibility to cracking when coupled with a stiffer material
3.	To demonstrate via experiments in soil columns the potential, for the optimal soil-hydrogel system to sustain a continuous water flow driven by evaporation at the bare soil surface
4.	To demonstrate via experiments in soil columns that a soil-hydrogel system can sustain a continuous water flow when driven by plant transpiration
5.	Write up research work for publication, individually or in collaboration with colleagues, and disseminate results as appropriate to the discipline by, for example, peer reviewed journal publications and presentation at conferences.
6.	Join external networks to share information and ideas, inform the development of research objectives and to identify potential sources of funding.
7.	Collaborate with colleagues on the development of knowledge exchange activities by, for example, participating in initiatives which establish research links with industry and influence public policy and the professions.
8.	Contribute to supervision of postgraduate students within the research group.
9.	Liaise with colleagues and students in the research group and report to external project partners (both from academia and industry)
10.	Continually update knowledge and understanding in the field to inform research activity.
11.	Engage in continuous professional development.

## Person Specification

### Educational and/or Professional Qualifications

(E=Essential, i.e. a candidate must meet all essential criteria to be considered for selection, D=Desirable)

E1 Good honours undergraduate degree or Masters Degree in a relevant science or engineering discipline (e.g. Geotechnics, Ground Engineering, Soil science, Plant science, Material Science, Chemistry, Physics, Environmental Engineering, Civil Engineering and Environmental Sciences)

E2 PhD (or equivalent professional experience) in an appropriate discipline (e.g. Soil Mechanics, Soil Science, Plant Science)

### Experience

E3 Experience of relevant laboratory-based research

E4 Sufficient breadth or depth of knowledge in the relevant discipline/s to contribute to research programmes and to the development of research activities.

D1 Experience of multi-disciplinary research

D2 Experience of managing acquisition systems.

### Job Related Skills and Achievements

E5 Ability to write high quality journal papers

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D3 Ability to plan and organise own workload effectively.

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### **Personal Attributes**

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D4 Ability to work both independently and within a multi-disciplinary team.

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E6 Excellent interpersonal and communication skills, with the ability to listen, engage and persuade, and to present complex information in an accessible way to a range of audiences.

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## **Application Procedure**

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Applicants are required to complete an application form including the name of three referees who will be contacted before interview without further permission, unless you indicate that you would prefer otherwise. Applicants should also submit a Curriculum Vitae and a covering letter detailing the knowledge, skills and experience you think make you the right candidate for the job. Applicants should also complete the Equal Opportunities Monitoring Form.

## **Other Information**

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Further information on the application process and working at Strathclyde can be found on our website (<http://www.strath.ac.uk/hr/workforus>).

Informal enquiries about the post can be directed to Dr Matteo Pedrotti, Chancellor's Fellow ([matteo.pedrotti@strath.ac.uk](mailto:matteo.pedrotti@strath.ac.uk)).

### **Conditions of Employment**

Conditions of employment relating to the Research staff category can be found at: [Conditions of Employment](#).

### **Rewards and Benefits**

Our staff have access to a wide range of outstanding benefits that include financial rewards, family friendly and wellbeing benefits and career development opportunities, details of which can be found [here](#).

### **Probation**

Where applicable, the successful applicant will be required to serve a 9 month probationary period.

### **Pension**

The successful applicant will be eligible to join the Universities' Superannuation Scheme. Further information regarding this scheme is available from [Payroll and Pensions](#).

### **Relocation**

Where applicable, the University offers a relocation package to support new employees who meet the eligibility criteria. The relocation package is offered as a contribution towards costs incurred, and is designed to be flexible, allowing staff to use the financial support available in the way that will be most helpful to them. Further details are outlined in the Relocation Policy.

### **Interviews**

Formal interviews for this post will be held on Monday, 20 June 2022.

### **Equality and Diversity**

The University of Strathclyde is a socially progressive institution that strives to ensure equality of opportunity and celebrates the diversity of its student and staff community. Strathclyde is people-oriented and collaborative, offering a supportive and flexible working culture with a deep commitment to our equality, diversity and inclusion charters, initiatives, groups and networks.

We strongly encourage applications from Black, Asian and minority ethnicity, women, LGBT+, and disabled candidates and candidates from lower socio-economic groups and care-experienced backgrounds.

### **University Values**

The University's Values capture what we're all about: who we are, what we believe in and what we stand for. [Our Values](#) have been derived from how we act and how we expect to be treated as part of Strathclyde.

