**AUSTRALIAN RESEARCH COUNCIL**
**Mid-Career Industry Fellowships**
**Application for Funding Commencing in 2023**

IM

**Project ID: IM230100640**

**First Investigator: Dr Kerry Nice**

**Admin Org: The University of Melbourne**

Total number of sheets contained in this Application: 25

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# Part A - Administrative Summary (IM230100640)

## A1. Project Title

*(Provide a short title (up to 75 characters, approximately 10 words).)*

| |
|---|
| Cooling urban environments through smart irrigation and urban greening |

## A2. Person Participant Summary

*(Add the Mid-Career Industry Fellowship candidate participating in this application.)*

| Number | Name | Participant Type | Current Organisation(s) |
|---|---|---|---|
| 1 | Dr Kerry Nice | Mid-Career Industry Fellowship | The University of Melbourne |

## A3. Organisation Participant Summary

*(Add all organisations participating in this application. Refer to the Instructions to Applicants for further information.)*

| Number | Name | Participant Type |
|---|---|---|
| 1 | The University of Melbourne | Administering Organisation |
| 2 | SOUTH EAST WATER CORPORATION | Key Industry Partner |

## A4. Project Summary

*(Provide a Project Summary focusing on the aims, significance, expected outcomes and benefits of this project, simply, clearly and in plain English. Specifically state what the problem will be solved. If the application is successful, the Project Summary will be used, along with the National Interest Test statement to give the public an understanding of the research. Refer to the Instructions to Applicants for further information (up to 750 characters, approximately 100 words).)*

| |
|---|
| Extreme heat is Australia's most dangerous natural hazard. This project aims to help protect urban areas from extreme heat through measuring and modelling the cooling benefits of blue-green infrastructure. This is significant because despite evidence that the use of can be an effective method of urban cooling, we lack detailed observations to understand how to optimise their benefits in urban design. This project aims to provide these observations and then use them to build models needed to test scenarios and find optimal urban heat mitigation and adaptation strategies. The benefits will be the ability to design more heat resilient urban areas and reduced risk associated with extreme heat. |

## Part B - Classifications and Other Statistical Information (IM230100640)

### B1. Government Research Priority areas

*(Does this application align with an announced Australian Government policy?*
*For reporting purposes, the ARC is capturing relevant Australian Government policies for your application. If your application does not align with an announced Australian Government policy, please enter Not Applicable.)*

Full name of current Australian Government Policy and, if known, year of announcement.

| |
|---|
| Australia's Science and Research Priorities 2015 - Environmental change: resilient urban, rural and regional infrastructure |

### B2. ANZSIC Codes

*(Select 1 Australian and New Zealand Standard Industrial Classification code (ANZSIC code) at the 3-digit level that best represents the proposed research.)*

| Code |
|---|
| 281 - Water Supply, Sewerage and Drainage Services |

### B3. Field of Research (FoR-2020)

*(Select up to 3 FoR classification codes that relate to the application. Note that the percentages must total 100.)*

| Code | Percentage |
|---|---|
| 330410 - Urban analysis and development | 60 |
| 370401 - Computational modelling and simulation in earth sciences | 40 |

### B4. Socio-Economic Objective (SEO-2020)

*(Select up to 3 SEO classification codes that relate to the application. Note that the percentages must total 100.)*

| Code | Percentage |
|---|---|
| 280111 - Expanding knowledge in the environmental sciences | 50 |
| 200406 - Health protection and disaster response | 25 |
| 190101 - Climate change adaptation measures (excl. ecosystem) | 25 |

### B5. Does the proposed research involve international collaboration?

*(This is a 'Yes' or 'No' question. If you select 'Yes' 2 additional questions (B6 and B7) will be enabled.)*

| |
|---|
| Yes |

### B6. What is the nature of the proposed international collaboration activities?

*(Select all options from the drop down list which apply to this application by clicking on the 'Add' button each time an option is selected.)*

| |
|---|
| Correspondence: eg email; telephone; or video-conference |
| Attendance at and/or hosting of workshop or conference |

### B7. If the proposed research involves international collaboration, please specify the country/ies involved.

*(Commence typing in the search box and select from the drop down list the name of the country/ies of collaborators who will be involved in the proposed project. Note that Australia is not to be listed and is not available to be selected from the drop down list.)*

United States of America

**B8. How many PhDs, Masters and Honours positions will be filled as a result of this project?**

*(For reporting purposes, the ARC is capturing the number of Research Students that would be involved if the proposed project is funded. Enter the number of all student places (full-time equivalent - FTE) that will be filled as a result of this project, not just those that will be requested as part of the one-line budget project costs in the application form.)*

Number of Research Student Places (FTE) - PhD

0

Number of Research Student Places (FTE) - Masters

1

Number of Research Student Places (FTE) - Honours

2

## Part C - Project Eligibility (IM230100640)

### C1. Medical Research

*(This is a 'Yes' or 'No' question. Does this application contain content which requires a statement to demonstrate that it complies with the eligible research requirements set out in the ARC Medical Research Policy located on the ARC website?)*

No

### C2. Medical Research Statement

*(Justify why this application complies with the eligible research requirements set out in the ARC Medical Research Policy located on the ARC website. Eligibility will be based solely on the information contained in this application. This is your only chance to provide justification, the ARC will not seek further clarification (up to 750 characters, approximately 100 words).)*

## Part D - Assessment Criteria (IM230100640)

**D1. Upload your response to the assessment criteria in no more than 5 A4 pages.**

*(Upload your response to the assessment criteria in the required format (up to 5 A4 pages).)*

Uploaded PDF file follows on next page.

**PROJECT TITLE:**
Cooling urban environments through smart irrigation and urban greening

## PROJECT AIMS AND BACKGROUND

The effects of extreme heat are seen through global impacts on mental health, domestic violence, strains on emergency and health services, damage to urban infrastructure, and economic disruptions[15]. Impacts are also seen in Australia, with significant costs to public health, infrastructure, and the economy[36]. The 2009 heat wave in southern Australia affected 1 million people and caused 420 deaths. The same event cost AU$800 million from power disruptions, transportation outages (from infrastructure damage from heat), and response costs[17]. Future climate projections warn of more frequent, severe, and long-lasting heatwaves[16] such that dangerous human heat stress may increase by a factor of 5-10 by 2080[7]. Risks from urban heat are exacerbated by the design of cities[19] that have altered urban energy balances[24], the distributions of energy manifested as heat, stored in surfaces, or reflected back into space. For example, anthropogenic (human generated) heat from buildings and transport and reduced shading through diminished tree canopy cover results in larger amounts of heat stress experienced by people at street level. There has been a shift away from cooling through shading and evapotranspiration from vegetation to heat storage via energy entrapment in impervious urban surfaces. These factors are commonly understood by urban climate scientists, however designers and planners have rarely been able to incorporate these findings into their designs due to the complexities of the many factors involved and analysis required[12].

The retention and better use of water and vegetation in cities has long been recognised as an effective method [9, 1] to mitigate urban temperature extremes. These water and vegetation systems can be termed blue-green infrastructure (BGI)[23, 14, 22] and encompass strategies such construction of green roofs and green walls, increased tree canopy cover targets, urban water features and sustainable stormwater or recycled water practices. However research into the effectiveness of BGI is rare and still at very early stages[13]. A lack of high resolution measurements of temperature reductions and cooling mechanisms from irrigation leads to unrealistic and inconsistent expectations of cooling magnitude**[6]**. There are uncertainties in the required amounts of water and optimal strategies to maximise cooling impacts**[4]**. Human thermal comfort (HTC), a measure of thermal stress on people resulting from solar exposure and the energy/heat radiating from the complex mix of elements in urban environments, can help determine the impact heat has on human health. The success of an urban cooling strategy can be determined through the improvements in HTC, which can be measured in observations or calculated through modelling. To fully incorporate BGI into urban planning so as to provide urban cooling requires mechanistic modelling tools, with sufficient ability to resolve parameters necessary for HTC calculations, to simulate different scenarios and to represent the unique characteristics of every urban landscape context. Currently, this capability is insufficient in most available models and a lack of observations impedes the effort to re-design and validate models so that they can account for the influences of BGI on human thermal comfort and human health in cities. This project's industry partner, South East Water (SEW), through their Aquarevo housing estate, aims to utilise water and BGI to deliver cooling benefits to residents, but these research gaps create difficulties in their planning and design of how to best deliver them.

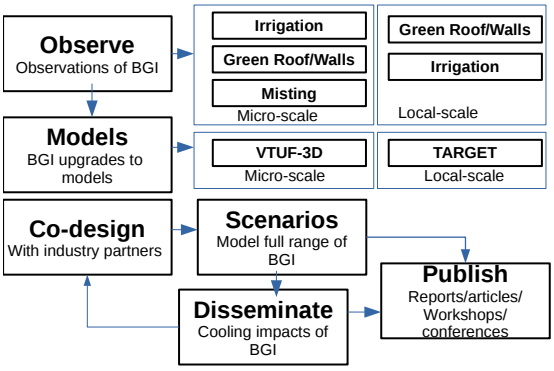


Figure 1: Project work packages and steps to achieve urban human thermal comfort analysis of BGI infrastructure.

**This project has three overarching aims: 1) To measure and quantify the cooling impacts of BGI and uncover the mechanisms, patterns, and magnitudes behind the cooling by performing a wide range of observations on BGI features, 2) Utilise these measurement observations to improve existing mechanistic urban climate models so that they can better simulate a range of BGI features and their impact on human thermal comfort, and 3) Create the control and monitoring systems necessary for the industry partner to deliver and automate optimised cooling benefits at a neighbourhood scale based on the new insights from fundamental observations of BGI and the tools generated from Aims 1 and 2. Following from these, tools and knowledge can be provided to a wide range of users including urban planners, consultants, and future researchers, enabling them to analyse and redesign urban areas to maximise the cooling benefits of BGI.**

While there are many urban climate models, there are few available at a scale that can account for all elements of vegetation impacts and urban hydrology, and that can explicitly handle parameters needed to calculate human thermal comfort. The Air-temperature Response to

Greenblue-infrastructure Evaluation Tool (TARGET)**[2]** offers lower resolution local-scaled modelling or TEB[18] and Urban Tethys-Chloris (UT&C)**[20]** models a single point averaged across an idealised urban canyon. Some, such as ENVI-met[3] and PALM[10] are highly spatially explicit but with high computational costs and/or high licensing fees. SURFEX[27] requires high levels of model configuration and modification and compilation of FORTRAN code.

Enhancements to existing models, Vegetated Temperature of Urban Facets in 3-D (VTUF-3D)**[33]** and TARGET, are necessary to produce low to medium computational intensity models that are also able to account for the full range of BGI. Making meaningful adaptations to these existing urban climate models is hampered by a lack of comprehensive observations to enable model development and validations[25]. For micro-scaled model validations, these datasets must cover the entire soil/plant/atmosphere continuum, urban greenery at a micro-scale, and account for heat and energy fluxes under a wide range of irrigation scenarios. Datasets for neighbourhood scale validations should contain spatial and temporal distribution of heat and cooling, as well as, ideally, detailed statistics about the amounts, times, and locations of outside water usage (i.e. which household, how many litres used to irrigate, and what hour of the day). The scarcity of these types of observations limits our understanding of the full benefits that can be realised with BGI, and by extension, makes difficult ensuring that modelling tools accurately reproduce the underlying mechanisms of cooling using BGI. Without suitable tools, it is difficult for designers and planners to explore the use of BGI in urban areas and minimise the impacts of their designs on urban heat and heat stress. **These are the major outputs of this project: 1) a unique database of BGI elements and their local climate cooling benefits and properties, 2) development of the control and monitoring systems needed to maximise their benefits, 3) implementation of this knowledge into modelling tools, then 4) fully exploring the utilisation of BGI as an urban cooling strategy.**

## CRITERION 1: IMPACT

The 2010s were the hottest decade on record and heatwave occurrences and intensities are projected to be even more severe in the future. The cost and impact of climate change to society will be especially great in urban areas, while the importance of infrastructure planning and management will grow accordingly. The expanded knowledge of urban heat and exploration of methods to reduce heat impacts, and the model development and validation enabled through this data will help urban planners and city managers to make better, evidence-based decisions, to design better new cities. It will also support the retrofitting of existing areas and design of new more liveable and climate-safe cities. Climate change will also bring new regional weather patterns and understanding how different areas might perform under these new conditions allows better planning future responses to best protect human health. **The Australian science and research priority of environmental change, the adaptation to the impacts of environmental change in urban and rural communities, is addressed by this project. It will be realised through the fundamental knowledge generated by this project about the cooling impacts of BGI and the application of this knowledge to the design, and redesign, of urban areas to maximise the benefits.**

SEW in conjunction with Villawood Properties and Arden Homes have made large investments in the Aquarevo[30] housing estate in Melbourne. Cooling through sustainable BGI is a central tenet of the strategic design phase, with the intention of showcasing how sustainable water usage and energy efficient housing can be brought into the mainstream. SEW's research has centered around designing and testing the control systems and infrastructure necessary to deliver these benefits to home owners in new green-field commercial and housing developments. Centralised control systems using SEW's OneBox®device, connecting smart meters to SEW's central office, provides detailed water and energy usage data and controls rainwater tanks and minimises overflows by releasing water before rainstorms or to provide cooling before heatwaves. SEW also supplies a full range of alternative sources of water, recycled and rainwater, to the estate, enabling the wider use of water for other benefits. To ensure maximum commercialisation value (value-added to the estate and potential tool spin-offs), SEW needs the data generated, the scientific rigour, development of meaningful mechanistic urban climate models to demonstrate and simulate the impact that can be realised in these neighbourhoods of different viable BGI scenarios to deploy and manage the infrastructure needed to maximize cooling across Aquarevo and future housing developments. To manage this, ownership of Background IP shall not be altered or transferred, and each party agrees that Project IP will be owned by SEW. UoM will be granted permanent, royalty-free, non-exclusive licence (including right to sub-licence) to use Project IP for the purpose of the project and for its non-commercial research, education and training internal purposes.

## CRITERION 2: COMMITMENT AND ALIGNMENT

This project is built on a long standing relationship with SEW growing from an eight year involvement in the CRC for Water Sensitive Cities. SEW first contacted me, CI Nice, in 2019, recognising the unique opportunity the infrastructure in the estate provided to examine heat mitigation strategies and to bring robust scientific urban climate knowledge into their research. My involvement in the CRC resulted in a large body of research around cooling with BGI **[8, 35, 31,**

**28, 32, 29]**, and is a foundation to build on for this project. The SEW industry/academic partnership has launched a PhD project, partially funded by SEW, starting in 2020 to examine micro-scale cooling through irrigation**[5, 6, 4]**, an experimental trial of a courtyard misting system for cooling, and the beginning of research into the development of smart irrigation systems. The PhD project is making observations in Aquarevo of micro-scale impacts of irrigation at two sites and has started to design and build smart irrigation control systems capable of matching vegetation water demands to current weather conditions. Additionally, through the PhD project, monitoring equipment has been installed at Lyndhurst Primary School with the students engaging in the monitoring program. Through incorporation into the curriculum, this program has helped educate them in weather, science, and data analysis.

The current project aims to expand the research undertaken at Aquarevo to a neighbourhood scale and build a greater understanding of how water can be used in conjunction with BGI to maximise cooling across a neighbourhood scale and design and build the control systems needed to automate and optimise the benefits. SEW has demonstrated their belief in the value of this research through their substantial financial commitments. They have committed to a cash contribution of $30,000 per annum ($90,000 over the 3 year project). They have also committed $98,197 of in-kind contributions, $38,197.20 of equipment, the 60 LoRa sensors (material costs of $636.62 per sensor) that will be deployed across the Aquarevo estate to monitor the widescale cooling due to irrigation. This also includes $10,000 per annum in personnel for community engagement and to source and assemble the sensors and $15,000 per annum for the first two years of the project to provide access to the Aquarevo estate and to detailed water usage smart meter data. **In total, this represents a $188,197 cash and in-kind commitment towards the project.**

The Aquarevo estate has been a productive test bed for both SEW and for my own academic research. All of the datasets collected there will be unique and have many uses outside of the original projects. Observations of the influence of outdoor irrigation on neighbourhood cooling patterns have not been possible before without the detailed water usage data that SEW can provide. Unique observation datasets can have a long life and be used in a multitude of other research projects and will be made openly available to other researchers.

A workshop earlier this year, which included the research team, SEW, and other stakeholders, started the process of synthesising the current tranche of research (from 2019-2022) into guidance and key messages for council planners, property developers, and public utility providers. Goals for further research were outlined, from which much of this research proposal has been drawn and represents a second tranche. This will expand the previous experiments, test new control systems, then use the results to improve the modelling tools, use the models to test scenarios that are too difficult to observe, then synthesise the results back into policy guidance and into goals for a third tranche of research.

## CRITERION 3: CANDIDATE CAPABILITY

I am currently a research fellow at the University of Melbourne in the Transport, Health and Urban Design Research Lab (THUD) in the Melbourne School of Design. My research areas include urban climate modelling and urban analytics and modelling of urban design and transportation systems and their impacts on public health using machine learning and computer vision techniques. I am a CI on a AUD$608,910 (and GBP £479,387) 2020-2023 UKRI/NHMRC grant. This grant builds on my recent Lancet Planetary Health publication **[34]**, utilising neural networks, computer vision techniques, and urban imagery to discover the impacts of urban design on non-communicable disease. I am an investigator on a Swiss National Science Foundation grant with Eawag (the Swiss Federal Institute of Aquatic Science and Technology), using my TARGET to model urban heat mitigation through stormwater infrastructure. I am a CI on a ARC Centre of Excellence for Children and Families over the Life Course: Agile Funding Grant Scheme 2022, 'Computer vision applications to derive a spatial index of access to social services'. Finally, I am a CI on a $402,000 2021-2023 ARC Discovery project, creating a platform for city-wide modelling of cycling exposure generated from an inventory of cycling infrastructure extracted from satellite imagery through computer vision and machine learning. My involvement and leadership in these projects have required hiring and supervision of research assistants, mentoring of junior staff, and extensive collaborative work with researchers and industry stakeholders across Australia and internationally.

During my PhD, I developed the VTUF-3D**[33]** urban micro-climate model to examine the human thermal comfort impacts of street trees and water features (i.e. BGI). Immediately following, I co-developed TARGET**[2]**, UT&C**[20]**, and the Monash Simple Climate Model**[11]** (MSCM). The source code for VTUF-3D, and my other local-scaled model TARGET, is freely available and currently being used by a number of other urban climate scientists (and consulting groups such as Alluvium[21] and Marsden Jacob) around the world. I have published my model development work**[33, 2, 20, 11]** in the Q1 journals, Geoscientific Model Development (SJR Q1 3.238) and Urban Climate (SJR Q1 1.301). These publications demonstrate my range of expertise in designing, building, and using local and micro-scale models, models that account for urban surface energy balances and the influence of BGI and the processes of urban hydrology and vegetation physiology. Overall, as a result of my research and publications, I have achieved a h-index of 9, i10-index of 9, and 336 citations on Google Scholar through 24 peer reviewed journal articles and numerous industry reports.

I have supervised 10 Masters students' Master of Information Technology capstone projects and an honours student project, 'Cooling through irrigated impervious surfaces'. I have two PhD students engaged in research on cooling through irrigation. The first, the Aquarevo project is described above. A second project, in conjunction with South Australia Water (a member in the CRC), has been examining the cooling benefits of irrigation at the Adelaide Airport[26].

My participation in the CRC for Water Sensitive Cities has led to connections with local and state governments as well as industry partners. It has also lead to consulting work (fully detailed in Section E5), work that translates academic knowledge into policy responses and urban planning guidance for industry and government.

My research lab, the Transport, Health and Urban Design Research Lab (THUD), strongly supports my independent research under the umbrella of urban design and public health. This project provides a unique opportunity to integrate the issue of urban heat and how to create better urban design to mitigate its impacts as a major research area into the lab's areas of expertise.

Prior to completing a master's degree and PhD, I had a 13 year career (fully detailed in E5) as a senior level software engineer, working predominately in C++ and Java (the J2EE Java 2 Enterprise Edition). The experience gained in software design, development, and project management, to create and implement the user interfaces and the backend functionality for complex business process flows has proven to be highly transferable to climate model development and a research career utilising computer vision techniques, machine learning, and big data.

## CRITERION 4: RESEARCH QUALITY AND INNOVATION

This project will be delivered through five work packages. These work packages include local and micro-climate **observations** of BGI, upgrading **models** to make them suitable for HTC assessments of BGI, a **co-design** process with industry partners and urban climatologists of the **scenario** analysis process to design scenarios of the greatest value to them, and a **dissemination** process to output the results back through the industry partners (reports and workshops) in addition to the traditional scientific channels (journals and conferences) and plan the next steps for the research to allow widespread adoption of the tools and insights.

**Work Package 1**: **Observe** - *Measure and monitor the local climate cooling of a wide variety of blue-green infrastructure features at a range of spatial and temporal scales necessary to understand the underlying processes driving the cooling benefits.*

Observations to be made are of a range of BGI features at local and micro-scales, enabling the model development process. These BGI features include misting systems, green roofs and green walls, and irrigation of vegetated surfaces and impervious surfaces. Wider precinct scale observations made at Aquarevo will capture the cooling effects of outdoor water use. Aquarevo is an ideal site for this as each household has rainwater tanks that are also remotely controlled to minimise overflows by releasing water before rainstorms or before heatwaves. In addition, each house is fitted with smart water meters, and provide detailed usage measurements for drinking, rainwater, and recycled water. The design and testing of systems to monitor current weather conditions driving evapotranspiration and drive smart irrigation control systems will be performed. SEW has begun preliminary work on this step and intends to deploy the system across the Aquarevo estate, automating the optimised cooling benefits of irrigation. Adelaide-based observations will include a residential cooling project with installed misting system at around 100 residences along with thermometers, flow meters, and soil moisture probes combined with surveys to quantify the effectiveness of the cooling and the impacts on their outdoor behaviour and comfort.

Honours and masters students will be recruited to complete small discreet projects related to this project, such as observations of individual BGI features (e.g. swales and rain gardens) and to develop the appropriate models to simulate them. To widen the full range of BGI features observed and modelled, these projects will be opportunistic and are not intended for the critical BGI elements needed to complete the project.

**Work Package 2**: **Models** - *To build urban climate modelling tools that are suitable to model human thermal comfort benefits of blue-green infrastructure and urban water usage.*

This work package focuses on utilising existing observational datasets and acquiring additional observations to upgrade and validate the two models I have previously developed (VTUF-3D and TARGET). TARGET, as a local scale model, produces results at a lower resolution, however runs quickly so can be used first during an analysis process to make first-order estimates to guide subsequent, more detailed modelling with the micro-scaled model VTUF-3D. As a result, the models will benefit from performing similar upgrades to both. New features include include a simple horizontal advection scheme and the hydrology and physiological processes of many common urban vegetation types (grass, trees). Much of this is currently parameterised in the models instead of being explicitly calculated.

**Work Package 3**: **Co-design** - *To implement co-design principles in the development, implementation and delivery of the findings with key stakeholders mapping out the tools and results that will be of highest value.*

This co-design process has already completed one round earlier this year. Many of the research goals detailed at

that workshop are included in this application. The research team and SEW currently meet monthly to discuss current progress. Through periodic workshops and monthly meetings, this process continually refines the goals and outcomes for the next phase, the scenario modelling, and ensures scenarios relevant to all the participant's needs are included. Future investigations include spatial arrangements of vegetation and interactions with the built form, types and forms of vegetation, and targeted cooling through misting and pavement watering. Other stakeholders to be included in this process will include future users of the research outputs: South Australia Water and consulting and government partners.

**Work Package 4**: **Scenarios** *Demonstrate BGI cooling benefits through urban scenario modelling.*

This work package will utilise the newly improved modelling tools to systematically test the cooling impacts of BGI. This will uncover optimal scenario parameters, design limitations, and ranked priorities to guide redesign efforts. Scenarios of smart irrigation at Aquarevo will guide optimal use of the control systems for neighbourhood cooling. Other interventions to be tested include canopy cover modifications and conversion of driveways and other hard surfaces to permeable pavement. Redesigns will be iteratively modelled and analysed to converge on the best designs and discover the significant factors impacting urban heat and generate redesigned areas.

**Work Package 5**: **Disseminate** *Share results and methods from the project.*

The final work package in the project will disseminate the methods and results. Firstly, dissemination will occur through the co-design process of Work Package 3 and the ongoing engagement with industry partners, involving follow-up workshops and reports. The second will be through the traditional academic outputs of journal publications, international and domestic conference presentation, and ongoing collaborations with other urban climate researchers. The final method will be to package the tools, model code, and datasets so that they can be easily adopted by a wide base of users including other researchers and consultants, promoted through conferences, publications, and my research network.

## REFERENCES (bold font indicating publications (co-)authored by CI)


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Sochacka. **Water Sensitive Outcomes for Infill Development: Infill Performance Evaluation Framework: CRC for Water Sensitive Cities**. Technical report, CRC for Water Sensitive Cities, 2020. [29] M. Siebentritt, M. Eadie, T. Watson, S. Day, N. Tapper, **Nice, Kerry**, N. Nazarian, and S. Pfautsch. **Cool Suburbs: User Guide and Science Rationale**. Technical report, Western Sydney Regional Organisation of Councils, 2022. [30] South East Water. Aquarevo: A New Way of Living, 2020. [31] N. Tapper, S. Lloyd, J. Mcarthur, **Nice, Kerry**, and S. Jacobs. **Estimating the economic benefits of Urban Heat Island mitigation Biophysical Aspects**. Technical report, CRC For Water Sensitive Cities, 2019. [32] **Nice, Kerry**. **Managing urban heat in water sensitive cities: research and policy responses**. Technical report, CRC for Water Sensitive Cities, 2021. [33] **Nice, Kerry A.**, A. M. Coutts, and N. J. Tapper. **Development of the VTUF-3D v1.0 urban micro-climate model to support assessment of urban vegetation influences on human thermal comfort**. *Urban Climate*, 24:1052–1076, 2018. [34] J. Thompson, M. Stevenson, J. S. Wijnands, **Nice, Kerry A.**, G. D. P. A. Aschwanden, J. Silver, M. Nieuwenhuijsen, P. Rayner, R. Schofield, R. Hariharan, and C. N. Morrison. **A global analysis of urban design types and road transport injury: an image processing study**. *Lancet Planet. Health*, 4:32–42, 2020. [35] T. Todorovic, G. London, N. Bertram, O. Sainsbury, M. A. Renouf, **Nice, Kerry A.**, and S. J. Kenway. **Models for water sensitive middle suburban infill development**. In *9th State of Australian Cities National Conference*, 2019. [36] J. Zuo, S. Pullen, and et al. Impacts of heat waves and corresponding measures: a review. *J. Clean. Prod.*, 92:1–12, 2015.

# Part E - Participant Details (Dr Kerry Nice)

## E1. Personal Details

*(All fields for this question are auto-populated from the candidates RMS profile. To update any Personal Details, click on the 'Manage Personal Details' link below. Note this will open a new browser tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.*
*Note: The date of birth, country of birth, material personal interests and Indigenous status section will not appear in the PDF version of the form and will not be visible to assessors.*
*Data may be shared with other Commonwealth Entities. All information contained in Part F is visible to the Administering Organisation on this application.*
*)*

Participation Type

Mid-Career Industry Fellowship

Title

Dr

First Name

Kerry

Middle Name

Alan

Family Name

Nice

## E2. Current country of residence

*(If the candidate is not an Australian citizen, they must obtain a legal right to work and reside in Australia.)*

Australia

## E5. Upload a CV in no more than 2 A4 pages

*(Provide a CV of up to 2 A4 pages relevant to this application noting that it is not required to include qualifications or current and previous appointment(s) / position(s) employment as this will be automatically populated from your profile at questions E6 and E7.)*

Uploaded PDF file follows on next page.

**Dr. Kerry Nice**

**Experience Summary**

My research is primarily in urban climate science and focuses on urban micro-climate modelling of water sensitive urban design and making climate observations of the cooling effects of blue-green infrastructure in urban areas. My research also includes modelling complex systems utilising software development, computational methods, and data analysis. These complex systems include the conjunction of urban design, transportation systems, public health, and urban vegetation. The modelling methods I use include neural network machine learning, computer vision, agent based modelling, and climate modelling.

**Research outputs most related to this Industry Fellowship project**

*The first two papers describe some of the climate models I have developed to examine the cooling impacts of blue-green infrastructure (BGI). Both these models are core components for this project, the mechanistic modelling tools required to simulate different scenarios and to represent the unique characteristics of every urban landscape context to fully incorporate BGI urban cooling strategies into urban planning. These models will be extended and improved utilising the observations of the mechanisms and results of the irrigation trials performed in Aquarevo:*

K. A. Nice, A. Coutts, and N. J. Tapper, Development of the VTUF-3D v1.0 urban micro-climate model to support assessment of urban vegetation influences on human thermal comfort. *Urban Climate*, 2018. (SJR Q1 1.301)

A. Broadbent, A. Coutts, K. Nice, M. Demuzere, E. Krayenhoff, N. Tapper and H. Wouters, The Air-temperature Response to Green/blue-infrastructure Evaluation Tool (TARGET v1.0): an efficient and user-friendly model of city cooling. *Geoscientific Model Development*, 2019. (SJR Q1 3.238)

*This is my most extensive paper, utilising VTUF-3D to model 10,000 urban configurations at a micro-scale to comprehensively assess the impacts of different urban morphologies and built environment material types on urban heat and thermal stress. A similar methodology will be utilised in this project to examine the impacts of BGI:*

Kerry A. Nice, Negin Nazarian, Mathew J. Lipson, Melissa A. Hart, Sachith Seneviratne, Jason Thompson, Marzie Naserikia, Branislava Godic, and Mark Stevenson, Isolating the impacts of urban form and fabric from geography on urban heat and human thermal comfort, *Building and Environment*, 2022. (SJR Q1 1.736)

*This is my highest profile paper, utilising neural networks to discover urban typologies from maps of 1700 global cities and discovering how urban design impacts road trauma:*

J. Thompson, M. Stevenson, J.S. Wijnands, K. Nice, G.D.P.A. Aschwanden, J. Silver, M. Nieuwenhuijsen, P. Rayner, R. Schofield, R. Hariharan, and C. N. Morrison, A global analysis of urban design types and road transport injury: an image processing study, *The Lancet Planetary Health*, 2020. (SJR Q1 3.389)

*The next three papers directly relate to my expertise in using irrigation to cool urban areas. They utilise observation campaigns of irrigation of grass, reviews of literature of green space irrigation, and guidance for using irrigation for cooling and are outputs from the PhD project at Aquarevo undertaken in conjunction with industry partner South East Water:*

Pui Kwan Cheung, C.Y. Jim, Nigel Tapper, Kerry A. Nice, Stephen J. Livesley, Daytime irrigation leads to significantly cooler private backyards in summer, *Urban Climate*, 2022. (SJR Q1 1.301)

Pui Kwan Cheung, Kerry Nice, Stephen Livesley, Irrigating urban greenspace for cooling benefits: the mechanisms and management considerations, *Environmental Research: Climate*, 2022.

Pui Kwan Cheung, Stephen J. Livesley, Kerry A. Nice, Estimating the cooling potential of irrigating green spaces in 100 global cities with arid, temperate or continental climates, *Sustainable Cities and*

*Society*, 2021. (SJR Q1 2.015)

*These two reports translate urban climate knowledge into policy guidance and planning guidelines. The first resulted in an assessment tool to rate thermal performance of precinct-level developments while the second synthesises the research outputs from the eight year CRC for Water Sensitive Cities research program into an overall urban heat guidance report:*

Mark Siebentritt, Malcolm Eadie, Tim Watson, Sarah Day, Nigel Tapper, Kerry Nice, Negin Nazarian, Sebastian Pfautsch. Cool Suburbs: User Guide and Science Rationale. Western Sydney Regional Organisation of Councils (WSROC), 2022.

K. Nice. Managing urban heat in water sensitive cities: research and policy responses. Melbourne, Australia: Cooperative Research Centre for Water Sensitive Cities, 2021.

**Academic consulting**

*I have completed a number of academic consulting jobs for local, state, and federal government, directly translating urban climate knowledge into policy responses and reports for future planning guidance. This demonstrates my capability to work with industry partners and deliver research and knowledge in the form that is most useful to them. This will be important to ensure the academic research generated by this project will ultimately be useful and adopted by the industry partners.*

Most recently this included the project 'Health cost impacts of urban heat amelioration through integrated water cycle management (IWCM) measures', a consortium under Marsden Jacob for the Department of Agriculture, Water, and Environment with a modelling team led by Prof. Nigel Tapper (Monash) with Dr. Andrew Coutts, and Dr. Matthias Demuzere (RUB) and health team led by Prof. Ping Bi (University of Adelaide).

I served on the science advisory panel for the Western Sydney Regional Organisation of Councils resulting in a synthesis of urban climate research into the Cool Suburbs Rating and Accreditation tool (see output above).

I delivered modelling of future heat vulnerability for the Queensland Fire and Emergency Services and micro-climate heat assessments for the ACT government.

I was also on the team delivering the Fishermans Bend Ecology Strategy for the Victorian government which included urban heat along with ecology and biodiversity guidance.

**Industry history previous to research career**

*Previous to entering academia, I have 13 years of industry experience as a software engineer. This has translated well into research through experience with project management (Agile methodologies), working with (often remote) teams, and delivering products that customers want and that have co-designed. It also demonstrates my capability to work in an industry context and deliver the products most important to their needs. These positions include:*

Consulting Software Engineer (11/2000 to 7/2008) with LexisNexis/Reed Elsevier designing and implementing systems to support book and publication publishing using Java J2EE technology. This used an Agile methodology which designs and ranks the most desired product features with customers. Served on the software architecture board to define technology choices for the company.

Senior Java Programmer (7/2000 to 11/2000) using Java J2EE for web portal development for STSHotelnet.com.

Java Programmer (12/1999 to 7/2000) for Decision Consultants coding a medical claims database.

Professional Services Consulting Engineer (7/1997 to 12/1999) with Rogue Wave Software helping clients with any number of different problems and projects using C++ and Java and teaching classes about the use of the Rogue Wave software libraries.

## E6. Qualifications

*(To update any qualifications, click on the 'Manage Qualifications' link in this question. This will open a new browser*

*tab. When returning to the form ensure to 'Refresh' the page to capture the changes made to the participant's profile.)*

| Conferral Date | AQF Level | Degree/Award Title | Discipline/Field | Awarding Organisation | Country of Award |
|---|---|---|---|---|---|
| 08/03/2017 | Doctoral Degree | Doctor of Philosophy | Science | Monash University | Australia |
| 13/10/2011 | Masters Degree | Master of Enviroment and Sustainability | Geography | Monash University | Australia |
| 31/05/1990 | Bachelor Degree | Bachelor degree | English and Film Studies | University of Colorado at Boulder | United States of America |

**E7. Current and previous appointment(s) / position(s) - during the past 10 years**

*(To update any details in this table, click on the 'Manage Employment Details' link in this question. Note this will open in a new browser tab. 'Refresh' the application page when returning to the form to capture changes made to the participant's profile.)*

| Description | Department | Contract Type | Employment Type | Start Date | End Date | Organisation |
|---|---|---|---|---|---|---|
| Research Fellow | Faculty of Architecture, Building and Planning | Contract | Full Time | 14/11/2016 | 31/12/2022 | The University of Melbourne |
| Research Fellow | School of Earth Atmosphere and Environment | Contract | Part Time | 01/04/2019 | 31/12/2020 | Monash University |
| Research Fellow | School of Earth Atmosphere and Environment | Contract | Part Time | 14/06/2017 | 31/12/2018 | Monash University |
| Research Assistant | School of Earth, Atmosphere and Environment | Contract | Part Time | 01/06/2012 | 01/10/2016 | Monash University |
| Doctoral Researcher | School of Earth, Atmosphere and Environment | Contract | Full Time | 01/04/2012 | 01/08/2016 | Monash University |
| Practical session teaching/lecturing | School of Earth, Atmosphere and Environment | Contract | Part Time | 01/08/2013 | 01/11/2015 | Monash University |
| Research Assistant | School of Mathematical Science | Contract | Part Time | 01/04/2012 | 01/04/2013 | Monash University |
| Environmental Science Assistant | School of Geography & Environmental Science | Contract | Part Time | 01/08/2011 | 27/04/2012 | Monash University |

## Part F - Project Cost (IM230100640)

**F1. What is the proposed budget for your project?**

*(There are rules around what funds can be requested from the ARC. You must adhere to the scheme specific requirements listed in the grant guidelines.)*

Total requested budget: $739,601

### Year 1

| Description | ARC | Admin Org | | Key Industry Partner | |
|---|---|---|---|---|---|
| | Cash | Cash | In-kind | Cash | In-kind |
| Total | 238,857 | 60,000 | | 30,000 | 63,197 |
| Personnel | 199,824 | | | | |
| Dr Kerry Nice (Mid-Career Industry Fellowship) | 199,824 | | | | |
| Project Costs | 39,033 | 60,000 | | 30,000 | 63,197 |
| Project costs | 39,033 | 60,000 | | 30,000 | 63,197 |

### Year 2

| Description | ARC | Admin Org | | Key Industry Partner | |
|---|---|---|---|---|---|
| | Cash | Cash | In-kind | Cash | In-kind |
| Total | 256,500 | | | 30,000 | 25,000 |
| Personnel | 199,824 | | | | |
| Dr Kerry Nice (Mid-Career Industry Fellowship) | 199,824 | | | | |
| Project Costs | 56,676 | | | 30,000 | 25,000 |
| Project costs | 56,676 | | | 30,000 | 25,000 |

### Year 3

| Description | ARC | Admin Org | | Key Industry Partner | |
|---|---|---|---|---|---|
| | Cash | Cash | In-kind | Cash | In-kind |
| Total | 244,244 | | | 30,000 | 10,000 |
| Personnel | 199,824 | | | | |
| Dr Kerry Nice (Mid-Career Industry Fellowship) | 199,824 | | | | |
| Project Costs | 44,420 | | | 30,000 | 10,000 |
| Project costs | 44,420 | | | 30,000 | 10,000 |

**Key Industry Partner**

| Organisation | Year 1 | | Year 2 | | Year 3 | |
|---|---|---|---|---|---|---|
| | Cash | In-kind | Cash | In-kind | Cash | In-kind |

| | | | | | | |
|---|---|---|---|---|---|---|
| SOUTH EAST WATER CORPORATION | 30,000 | 63,197 | 30,000 | 25,000 | 30,000 | 10,000 |
| Total | 30,000 | 63,197 | 30,000 | 25,000 | 30,000 | 10,000 |
| Committed Total | 30,000 | 63,197 | 30,000 | 25,000 | 30,000 | 10,000 |

**F2. Justification of non-salary funding requested from the ARC**

*(Fully justify, in terms of need and cost, each budget item requested from the ARC in up to 2 A4 pages.)*
Budget Justification

Uploaded PDF file follows on next page.

**Year 1**

**Personnel**

**$21,265**, **Research Asst Fixed term A.1, 0.5 FTE**: In the first year, assistance will be required with a number of tasks. The first is the data collection and data processing from the observations. The second is collection of relevant academic literature and manuscript formatting according to journal guidelines for the two publications planned in the first year. The RA will need to have a good understanding of modelling and climate. These costs will be covered by $30,000 of cash contribution from South East Water and $21,265 of ARC cash.

**Travel**

**$1,750, International conference, accommodation**, 7 nights @ $250/night: Presentation of findings at an international climate conference discussing misting and irrigation observations, the American Meteorological Society or the general assembly of the European Geoscience Union.

**$1,680, International conference, per diem**, 7 days @ 70% of $240/day: Per diem rates are requested at the standard 'Category 5' ATO rate for CI Nice to cover meals and incidentals.

**$2,500, International conference, return economy airfare**: Airfare estimates are based on the University's Price Guide for international flights.

**$1,750, International conference, registration fee**: Registration fee required to attend and present.

**Field Research**

**$3,960**, **2x CNR4-L10m net radiometer** for energy balance observations of mising systems at Aquarevo and Adelaide (for control and experimental sites) net radiometers are required for energy balance observations of misting systems at Aquarevo and Adelaide. These energy balance observations are an essential component to validate modelling tools and fits into work package 1, the micro-scaled observations of BGI. These costs will be covered by $3,960 in ARC cash and $22,580 from the University of Melbourne $60,000 establishment grant.

**$350, Adelaide Fieldwork year 1, Flights to Adelaide**: Fieldwork will be performed in Adelaide in conjunction with South Australia Water to perform micro-climate observations of the impacts of irrigation and misting systems. This fieldwork fits into Work Package 1, the observations. Airfare estimates are based on the University's Price Guide for domestic flights to Adelaide.

**$1,099, Adelaide Fieldwork year 1, accommodation**, 7 nights: This estimate for domestic accommodation is based on the standard ATO rate for accommodation in Adelaide.

**$679, Adelaide Fieldwork year 1, per diem**, 7 days: Per diem rates are requested at 70% of the standard ATO rate for domestic travel, covering CI Nice's meals and incidentals.

**Other**

**$4,000, Open access publication fees**: Fees related to one publication in a highly reputable academic journal.

**Year 2**

**Personnel**

**$24,188**, **Research Asst Fixed term A.2, 0.5 FTE**: Assistance will be required with a number of tasks. The first is the data collection and data processing from the observations. The second is collection of relevant academic literature and manuscript formatting according to journal guidelines for the three publications planned in the second year. Finally, the modelling will require collection of urban morphology information, scenario creation, and data analysis. The RA will need to have a good understanding of modelling and climate. These costs will be covered by $30,000 of cash contribution from South East Water and $24,188 of ARC cash.

**Travel**

**$2,500, International conference 1, return economy airfare**: Presentation of findings at an international climate conference discussing green roof observations. The aim is to present this at the annual meeting of the American Meteorological Society or the general assembly of the European Geoscience Union. Airfare estimates are based on the University's Price Guide for international flights.

**$1,750, International conference 1, accommodation**, 7 nights @ $250/night: Presentation of findings at an international climate conference discussing green roof observations. The aim is to present this at the annual meeting of the American Meteorological Society or the general assembly of the European Geoscience Union. International accommodation estimates are based on the University's Price Guide for international hotel rates at Frequently Requested Destinations.

**$1,680, International conference 1, per diem**, 7 days @ 70% of $240/day: Per diem rates are requested at the standard 'Category 5' ATO rate for CI Nice to cover meals and incidentals.

**$2,500, International conference 2, return economy airfare**: Presentation of findings at an international climate conference discussing local scale misting and irrigation impacts. The aim is to present this at the annual meeting of the American Meteorological Society or the general assembly of the European Geoscience Union. Airfare estimates are based on the University's Price Guide for international flights.

**$1,750, International conference 2, accommodation**, 7 nights @ $250/night: International accommodation estimates are based on the University's Price Guide for international hotel rates at Frequently Requested Destinations.
**$1,680, International conference 2, per diem**, 7 days @ 70% of $240/day: Per diem rates are requested at the standard 'Category 5' ATO rate for CI Nice to cover meals and incidentals.
**$1,750, International conference 1, registration fee**: Registration fee required to attend and present at year 2 'International conference 1', as detailed above.
**$1,750, International conference 2, registration fee**: Registration fee required to attend and present at year 2 'International conference 2', as detailed above.

**Field Research**

**$1,099, Adelaide Fieldwork year 2, accommodation**, 7 nights: This estimate for domestic accommodation is based on the standard ATO rate for accommodation in Adelaide.
**$679, Adelaide Fieldwork year 2, per diem**, 7 days: Per diem rates are requested at the standard ATO rate for domestic travel, covering CI Nice's meals and incidentals.
**$350, Adelaide Fieldwork year 2**, Flights to Adelaide: Fieldwork will be performed in Adelaide in conjunction with South Australia Water to perform micro-climate observations of the impacts of irrigation and misting systems. This fieldwork fits in work package 1, making observations of BGI. Airfare estimates are based on the University's Price Guide for domestic flights to Adelaide.

**Other**

**$8,000, Open access publication fees**: Fees related to two publications in highly reputable academic journals.
**$7,000, PSMA Geoscape urban data set**: Licensing the PSMA Geoscape data will provide the baseline data needed to analyse all the Australian cities in their present form. The scenario generation in work package 4 requires urban morphology information to build and run the scenarios and to analyse each city. This information includes building heights and locations, tree heights and locations and detailed maps of land use and surface types across each urban area.

**Year 3**

**Personnel**

**$27,120**, **Research Asst Fixed term A.3, 0.5 FTE**: Assistance will be required with a number of tasks. The first is collection of relevant academic literature and manuscript formatting according to journal guidelines for the two publications planned in the third year. Second, the modelling will require collection of urban morphology information, scenario creation, and data analysis. Finally, assistance will be required in setting up workshops. The RA will need to have a good understanding of modelling and climate. These costs will be covered by $30,000 of cash contribution from South East Water and $27,120 of ARC cash.

**Travel**

**$2,500, International conference 1, return economy airfare**: Presentation of findings at an international urban planning or geography conference detailing the new improvements to the VTUF-3D model. The aim is to present this at the annual meeting of the American Association of Geographers. Airfare estimates are based on the University's Price Guide for international flights.
**$1,750, International conference 1, accommodation**, 7 nights @ $250/night: Presentation of findings at an international urban planning or geography conference detailing the new improvements to the VTUF-3D model The aim is to present this at the annual meeting of the American Association of Geographers. International accommodation estimates are based on the University's Price Guide for international hotel rates at Frequently Requested Destinations.
**$1,680, International conference 1, per diem**, 7 days @ 70% of $240/day: Per diem rates are requested at the standard 'Category 5' ATO rate for CI Nice to cover meals and incidentals.
**$1,750, International conference 1, registration fee**: Registration fee required to attend and present at year 3 'International conference 1', as detailed above.

**Field Research**

**$350, Industry workshop-Adelaide, flights**: This workshop will be conjucted with South Australia Water to bring the results of the fieldwork and bring the usage of the modelling platform into SA Water's urban cooling strategies. This workshop fits in both work package 3, co-design of scenarios and work package 5, the dissemiation of observation results to industry partners. Airfare estimates are based on the University's Price Guide for domestic flights to Adelaide.
**$785, Industry workshop-Adelaide, accommodation**, 5 days: This estimate for domestic accommodation is based on the standard ATO rate for accommodation in Adelaide.
**$485, Industry workshop-Adelaide**, per diem, 5 days: Per diem rates are requested at the standard ATO rate for domestic travel, covering CI Nice' meals and incidentals.

**Other**

**$8,000, Open access publication fees**: Fees related to two publications in highly reputable academic journals.

**F3. Details of non-ARC contributions**

*(Provide details of how non-ARC contributions will support the proposed project in up to 2 A4 pages.)*
Details of non-ARC Contributions

Uploaded PDF file follows on next page.

**Year 1**

**Personnel**

**$30,000**, **Research Asst Fixed term A.1, 0.5 FTE**: In the first year, assistance will be required with a number of tasks. The first is the data collection and data processing from the observations. The second is collection of relevant academic literature and manuscript formatting according to journal guidelines for the two publications planned in the first year. The RA will need to have a good understanding of modelling and climate. These costs will be covered by $30,000 of cash contribution from South East Water and $21,265 of ARC cash.

**Other**

**$15,000**, **Suburb access and data**: South East Water will provide $15,000 of in-kind contribution to provide access to the residential estate and provide access to detailed water usage data in the neighbourhood.

**$10,000**, **Personnel (community engagement)**: South East Water will provide $10,000 of in-kind contribution to engage in community engagement and to source components components for the sensor network and assemble and install them.

**Field Research**

**$26,540**, **2x CNR4-L10m net radiometer** for energy balance observations of mising systems at Aquarevo and Adelaide (for control and experimental sites) net radiometers are required for energy balance observations of misting systems at Aquarevo and Adelaide. These energy balance observations are an essential component to validate modelling tools and fits into work package 1, the micro-scaled observations of BGI. These costs will be covered by $3,960 in ARC cash and $22,580 from the University of Melbourne $60,000 establishment grant.

**$37,420**, **2x Campbell Scientific weather stations**. These research quality instruments are required to measure soil moisture and weather conditions at experimental and control sites. Components ($ price per unit) for each station consists of 1x SI-111-SS-L5m Apogee radiometer ($1070), 1x SN-500-SS-L5m Apogee net radiometer ($4545), 3x HFP01SC-L10M-CSA soil heat flux plate ($2120), 6x CS650-33-PT-VS soil moisture sensor ($550), 5x RMY 03301 wind sentry vane ($715) and $1700 GST. The total cost of $37,420 will be covered from the University of Melbourne $60,000 establishment grant.

**$38,197**, **60X LoRa sensor nodes** for Aquarevo neighbourhood observations: LoRa sensor nodes with 1 x humidity sensor ($26), 2 x soil moisture sensors ($57), 2 x soil temperature sensors ($67), 1 x ambient temperature sensor ($24), 1 x ambient light intensity sensor ($9), and solar radiation shield ($132) (and batteries, cables, boxes, and power boards) to observe neighbourhood scale cooling during Aquarevo fieldwork. This equipment is required for Work Package 1 and will allow high resolution observations to be made across this neighbourhood and determine how the outside irrigation of each individual household provides localised cooling. Each node will be assembled based on existing sensor nodes designed by South East Water currently being used at a small scale in Aquarevo. Each node costs about $640. This equipment is being supplied by South East Water as in-kind.

**Year 2**

**Personnel**

**$30,000**, **Research Asst Fixed term A.2, 0.5 FTE**: Assistance will be required with a number of tasks. The first is the data collection and data processing from the observations. The second is collection of relevant academic literature and manuscript formatting according to journal guidelines for the three publications planned in the second year. Finally, the modelling will require collection of urban morphology information, scenario creation, and data analysis. The RA will need to have a good understanding of modelling and climate. These costs will be covered by $30,000 of cash contribution from South East Water and $24,188 of ARC cash.

**Other**

**$15,000, Suburb access and data**: South East Water will provide $15,000 of in-kind contribution to provide access to the residential estate and provide access to detailed water usage data in the neighbourhood.

**$10,000, Personnel (community engagement)**: South East Water will provide $10,000 of in-kind contribution to engage in community engagement and to source components components for the sensor network and assemble and install them.

**Year 3**

**Personnel**

**$30,000**, **Research Asst Fixed term A.3, 0.5 FTE**: Assistance will be required with a number of tasks. The first is collection of relevant academic literature and manuscript formatting according to journal guidelines for the two publications planned in the third year. Second, the modelling will require collection of urban morphology information, scenario creation, and data analysis. Finally, assistance will be required in setting up workshops. The RA will need to have a good understanding of modelling and climate. These costs will be covered by $30,000 of cash contribution from South East Water and $27,120 of ARC cash.

**Other**

**$10,000, Personnel (community engagement)**: South East Water will provide $10,000 of in-kind contribution to engage in community engagement.

## Part G - Partner Organisation Details (SOUTH EAST WATER CORPORATION)

### G2. Key Industry Partner/Other Industry Partner details

*(Provide the ACN for the Key Industry Partner in the required format. Enter the 9-digit number in this format 999 999 999 only. The ACN is mandatory only for the Key Industry Partner Organisation Type: Australian Registered Company. Enter in or confirm the populated ABN number, noting the ABN field is not mandatory. Enter in the 11-digit number in this format 99 999 999 999 only. If an ABN is already on record this will be populated in the ABN field and is editable if the number has updated.)*

Partner Organisation Role

| |
|---|
| Key Industry Partner |

Key Industry Organisation Type

| |
|---|
| Australian Registered Company |

Australian Company Number (ACN)

| |
|---|
| 066 902 547 |

Australian Business Number (ABN)

| |
|---|
| 89 066 902 547 |

### G3. Key Industry Partner/Other Industry Partner Organisation certification

*(Provide the organisation certification using the proforma as per the Instructions to Applicants.)*

Uploaded PDF file follows on next page.

**Letter of Industry Partner Organisation Certification**
This declaration is to be completed by each Industry Partner in the collaboration. Each declaration must be uploaded as an attachment in RMS.

- I certify that our organisation will meet the requirements for Key Industry Partner/Other Industry Partner as outlined in the Industry Fellowships Program Grant Opportunity Guidelines and a standard ARC grant agreement, including:
  - the requirement to enter into arrangements regarding Intellectual Property which do not unreasonably prevent or delay academic outputs, and
  - (for the Key Industry Partner) supporting the Fellow to spend at least 20% of the project activity period on-site or otherwise working in an industry setting and provide appropriate facilities for this.
- I declare (subject to this application being successful) that our organisation will support and actively participate in the proposed project.
- I declare that our organisation will contribute (subject to this application being successful) the staff, funds and other resources indicated in the application and has obtained, or will obtain, the necessary authorisations to do so.

| Total In-Kind Contribution ($) | Total Cash Contribution ($) |
|---|---|
| 98,197 | 90,000 |

- If a Cash Contribution is being made, I certify that no part of our organisation's Cash Contribution is drawn from funds previously appropriated or awarded from Commonwealth or Australian State or Territory Government sources for the purposes of research, nor from funds previously used to leverage government research or research infrastructure funding.
- I declare the information contained in this application that relates to our organisation together with any statement provided, is to the best of my knowledge, true, accurate and complete. I also understand the giving of false or misleading information is a serious offence.
- I declare I am authorised to sign and submit this declaration on behalf of our organisation.

By signing below, I agree to the above declaration and confirm all the above statements to be true.

| | |
|---|---|
| Industry Partner (organisation name):<br>South East Water Corporation | |
| Partner ACN/ACNC/ABN (if applicable):<br>066 902 547/89 066 902 547 | |
| Authorised representative (name): David Bergmann<br>  | |
| Position/role: Research & Development Manager | |
| Phone:<br>Direct – 0425 741 909<br>General - 03 9552 3000 | Email:<br>Direct - david.dergmann@sew.com.au<br>General R&D – ip@sew.com.au |
| Ensure the Industry Partner organisation name and Partner ACN match those provided in the application form. Electronic signatures are acceptable. | |

# Certification

**Certification by the Deputy/Pro Vice-Chancellor (Research) or their delegate or equivalent in the Administering Organisation**

I certify that—

- I have read, understood and complied with the Grant Guidelines Linkage Program – Industry Fellowships Program and to the best of my knowledge all details provided in this Application form and in any supporting documentation are true and complete in accordance with these Grant Guidelines.
- Proper enquiries have been made and I am satisfied that the participant and the organisations listed in this Application meet the requirements specified in the Grant Guidelines.
- I have received confirmation that the Industry Partner(s) agree to the project and have the necessary resources and approvals to fulfil the commitments, including contributions, that are described in this Application.
- I have received confirmation that the listed participant will not be undertaking a Higher Degree by Research during the project activity.
- I will notify the ARC if there are changes to the named participating organisations after the submission of this Application.
- The listed participant is responsible for the authorship and intellectual content of this Application and has appropriately cited sources and acknowledged significant contributions to it.
- To the best of my knowledge, all Conflicts of Interest relating to parties involved in or associated with this Application have been disclosed to this Administering Organisation, and, if the Application is successful, I agree to manage all Conflicts of Interest relating to the project in accordance with the Australian Code for the Responsible Conduct of Research (2018), the ARC Conflict of Interest and Confidentiality Policy and any relevant successor documents.
- The Application, including all parties involved in or associated with it, has undergone due diligence to assess risks from foreign interference in line with the Guidelines to Counter Foreign Interference in the Australian University Sector (2019) developed by the University Foreign Interference Taskforce.
- This Application complies with the eligible research requirements set out in the ARC Medical Research Policy located on the ARC website.
- This Application does not request funding for the same research activities, infrastructure or Project previously funded or currently being funded through any other Commonwealth funding.
- This application complies with the requirements to manage other similar or linked research applications by the Candidate and management is ensured to avoid duplication of Australian Government funding if all applications are funded.
- I consent, on behalf of all the parties, to this Application being referred to third parties, who will remain anonymous, for assessment purposes.
- I consent, on behalf of all the parties, to the ARC copying, modifying and otherwise dealing with information contained in this Application.
- I acknowledge, on behalf of all the parties, that information from this application may be provided to other Commonwealth agencies to seek advice on national security or other matters.
- I confirm that the potential risks have been taken into consideration for the proposed project, including the impacts of COVID-19 and if awarded a risk management plan will be in place before the project can commence.
- To the best of my knowledge, the Privacy Notice appearing at the top of this form has been drawn to the attention of the participant whose personal details have been provided.