



Matthew R Daniel

CEO [Global Urban Forest Pty Ltd](#)



**Global Urban Forest**  
Soil Health • Tree Health

### **Discipline**

Arboriculture / Urban Forestry / Soil Health

### **Expertise**

Quantified Plant and Soil Health Investigation & Remediation, App – Based Environmental Sensing Technology and Application - Tools for the Internet of Nature (IoN , Photosynthetic Plant Science , Micro – climate Data and Quality Assessments, Pest and Disease / Biosecurity.

### **Arboriculture**

Matthew has over 25 years' international experience in Urban Forest/ Arboriculture Industries and Regenerative Agriculture.

### **Technology Developer**

Plant and Soil Health Applied Science for the Urban Forest Industry. Quantifying Plant and Soil Health and function via Laboratory Analysis and App – Based Environmental sensors.

- [OurSci](#) [PhotosynQ](#)

### **Regenerative Agriculture**

Consultant / Trainer in Advanced Compost Production and Actively Aerated Compost Tea (AACT) and Waste Stream Analysis (Circular Economy)

- Weilong Grape Wine Company, Shandong Province, Eastern China.
- Queensland Government, Great Barrier Reef Recuse Soil Health Grant 2008, Monduran Citrus, Gin Gin, QLD.

## Project Experience

- Scholarship Arborist with Launceston City Council led to overseas placement with Boston Tree Preservation on a H1 Residency Visa for 3 yrs.
- Dangerous Tree Management (Lead Climber) – Queensland Arboriculture Industry (QAA) - Boston Tree Preservation Massachusetts USA.
- Plant and Soil Health Science- Boston Tree Preservation Mass, USA.
- Powerline management (HV, LV – Feeder / Distribution Shutdown (Lead Climber). QLD
- Cyclone Storm Event Repair / Plant Health Care, Soil Health Rehabilitation – Laucala Island, Fiji
- Soil Health Industry Development
- Biohazard Identification and Management – Victorian, Giant Pine Scale Outbreak.
- Mornington Peninsula Shire - Phytophthora Cinnamomi and Tree Decline Investigation.
- Glen Eira City Council Phytophthora Remediation – Allnutt Park.
- Hume City Council – Quantified Plant and Soil Health study in collaboration with Massachusetts Institute of Technology.
- Swinburne University of Technology – Environmental Sensing Masterclass. [Swinburne University of Technology - Environmental Sensing Masterclass](#)
- Partner Collaborator - Mc Greggor Coxall – Climate Resilience, Bristol City, UK.
- Beta Tester / Expert Team - [PhotosynQ](#) Michigan State University – Urban Forest Photosynthesis.

## Qualifications

- Arboriculture Cert 5 – 1997 – 1999 TAFE Tasmania
- Landscape Gardening Trade Certificate – 1997 – 1999 TAFE Tasmania
- Dangerous Tree Removal - Electrical Distribution Line Clearing certification Tas, QLD, NSW
- Soil Food Web International – Experts Program 2008-9 Southern Cross University

## THE BOOK OF FAIL

The Book of Fail is a collection of case studies investigating Plant and Soil Health in Urban Forestry.

An evidence-based measure of failed Plant and Soil Health is the consistent theme.

It includes real world examples of demonstrating Matthew R Daniel and Owens Richard's Integrated Water & Soil Regenerative Method (IWSRM)

Alarminglly it identifies declining and or failing Living Infrastructure projects in capital cities around Australia. This is due to many layers of industry not recognising that our environment is broken and the

importance of a better understanding of Water Cycle and Plant and Soil Health, and how that relates to Living Infrastructure development.

Collecting these Case Studies is designed, not to criticize, but to shine light on the fundamental issues in Urban Forest development that is not working.

A practical way to demonstrate how best practice can map out a better path, where the outcome is resilient highly functional Living Infrastructure.

We must recognise that Living Infrastructure is a long-term investment.

Trees take decades to build microclimates, we cannot afford failed infrastructure.

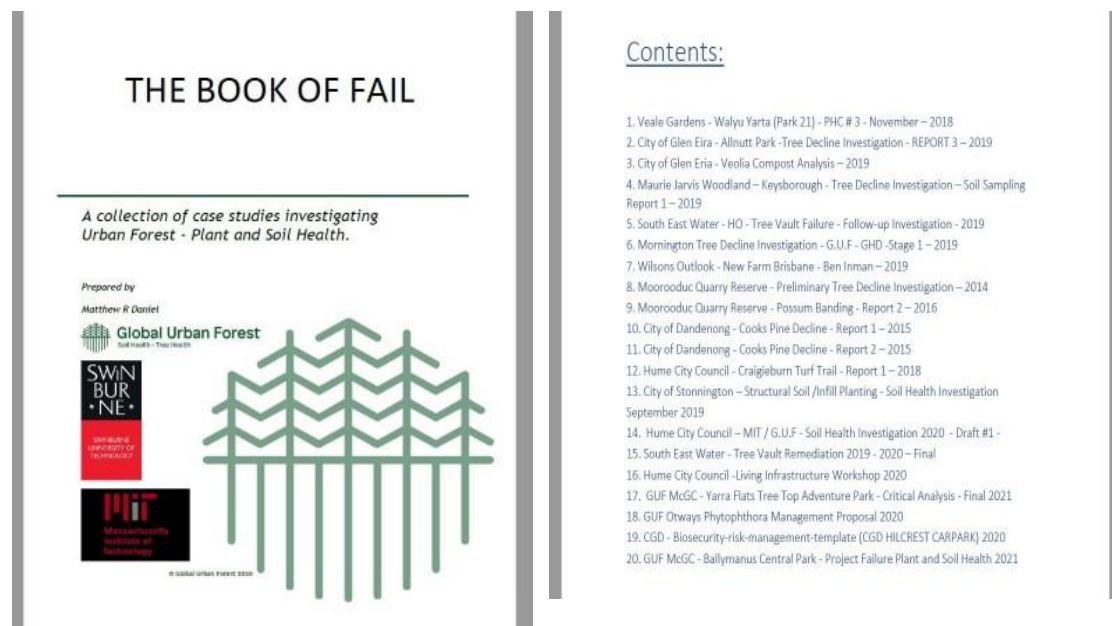


Figure 1 - THE BOOK OF FAIL – A Collection of Case Studies Investigating Urban Forest Plant and Soil Health

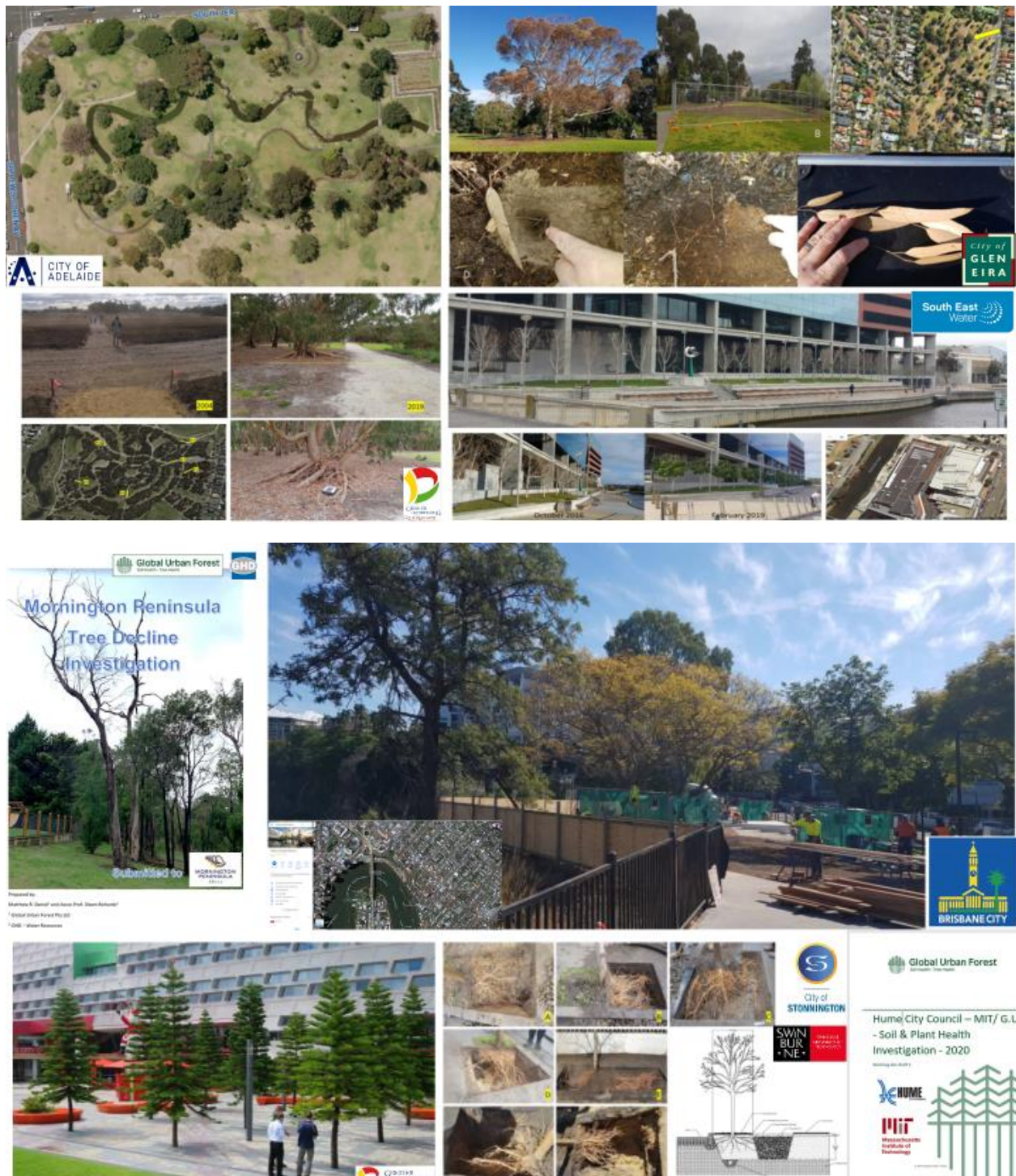


Figure 2 – GLOBAL Urban Forest Projects in THE BOOK OF FAIL



## Case Studies

1. Adelaide City - Veale Gardens - Walyu Yarta (Park 21) - PHC # 3 - November – 2018
2. City of Glen Eira - Allnutt Park -Tree Decline Investigation - REPORT 3 – 2019
3. City of Glen Eira - Veolia Compost Analysis – 2019
4. Maurie Jarvis Woodland – Keysborough - Tree Decline Investigation – Soil Sampling Report 1 – 2019
5. Southeast Water - HO - Tree Vault Failure - Follow-up Investigation - 2019
6. Mornington Peninsula Shire - Tree Decline Investigation - G.U.F - GHD -Stage 1 – 2019
7. Wilsons Outlook - New Farm Brisbane City - Ben Inman – 2019
8. Moorooduc Quarry Reserve - Preliminary Tree Decline Investigation – 2014
9. Moorooduc Quarry Reserve - Possum Banding - Report 2 – 2016
10. City of Dandenong - Cooks Pine Decline - Report 1 – 2015
11. City of Dandenong - Cooks Pine Decline - Report 2 – 2015
12. Hume City Council - Craigieburn Turf Trail - Report 1 – 2018
13. City of Stonnington – Structural Soil /Infill Planting - Soil Health Investigation  
September 2019
14. Hume City Council – MIT / G.U.F - Soil Health Investigation 2020 - Draft #1 -
15. South East Water - Tree Vault Remediation 2019 - 2020 – Final
16. Hume City Council -Living Infrastructure Workshop 2020
17. GUF McGC - Yarra Flats Tree Top Adventure Park - Critical Analysis - Final 2021
18. GUF Otways Phytophthora Management Proposal 2020
19. CGD - Biosecurity-risk-management-template (CGD HILCREST CARPARK) 2020
20. 20. City of Ballarat, Ballymanus Central Park- Critical Analysis - GUF McGC -Draft 3 2021
21. Moreland City Council - Brunswick Parklands - APPENDIX 1 GUF McGC - 2021

## Quantifying Plant and Soil Health and the Internet of Nature (IoN)

Quantifying Plant and Soil Health requires a combination of laboratory ground truthing assessments, agronomic equipment, and App – Based sensors.

Global Urban Forest CEO Matthew R Daniel has been collaborating with an international team developing tools for the Internet of Nature (IoN).

Sophisticated App – Based sensors are used to assisting in reducing the cost of Quantify Plant and Soil Health.

This means evidence-based decision making can inform design and management of Living Infrastructure projects.

App based sensors can also inform large valuable data sets used to manage health status of Living Infrastructure.

Community engagement projects using QCodes and Smart phones can easily gather sophisticated Photosynthesis measurements and soil spectrometry measures that can assist in real world best practice management of trees.

### ArborSci – Tools for the Internet of Nature (IoN)

[arborsci.com.au](http://arborsci.com.au)

ArborSci has been developed and tested for Urban Forestry by OurSci and Global Urban Forest to assist in Quantifying Plant and Soil Health.

- Soil Spectrometry
- Photosynthesis
- Co2 Respiration Chamber burst method.

These Internet of Nature (IoN) App – Based Sensors raise the bar in best practice tree management.

- Monitoring Tree Health status (Chlorophyll production overtime)
- Soil spectrometry (soil nutrients / heavy metals)
- Co2 respiration (Soil microbiome / Compost quality)



Figure 3 – ArborSci – Reflectometer and Co2 Respiration Chamber Burst Method. Measuring Photosynthesis and Soil Health indicators.

## Citizen Science Microclimate Assessments.

<https://citizenscienceproject.org.au/>

A collaboration between RMIT and the University of New South Wales, the Citizen Science Project will mobilise a league of enthusiastic citizen scientists to assist Australia's leading Universities and scientific organisations with their research.

This research aims to involve citizens to measure urban heat island, overheating, and local climate change, providing the data required for citizens to understand, mitigate, and adapt to extreme heat; and for policy makers to predict future health and energy needs and plan the urban built environment and open space.

Global Urban Forest Microclimate Assessment.

GUF got involved to assist in the Microclimate research. Urban Heat Island Effect is often discussed but rarely measured.

These types of sensors will be used all over future Urban Forests quantifying the effect of optimised Living Infrastructure.



Figure 4 – Microclimate Measurement Kit Instal @ GUF 2020 headquarters – 22 Carr Street Coburg North, Vic

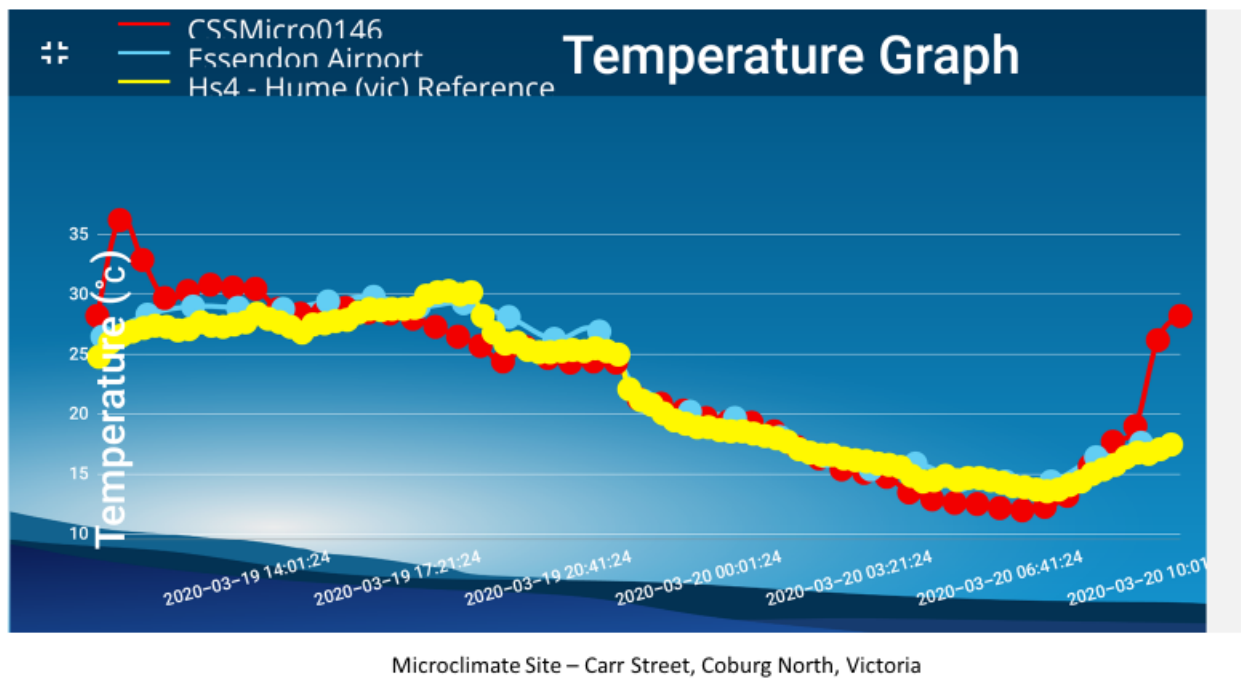


Figure 8 – Microclimate Assessment – (Temperature / Time)- GUF 2020 headquarters – 22 Carr Street Coburg North, Vic



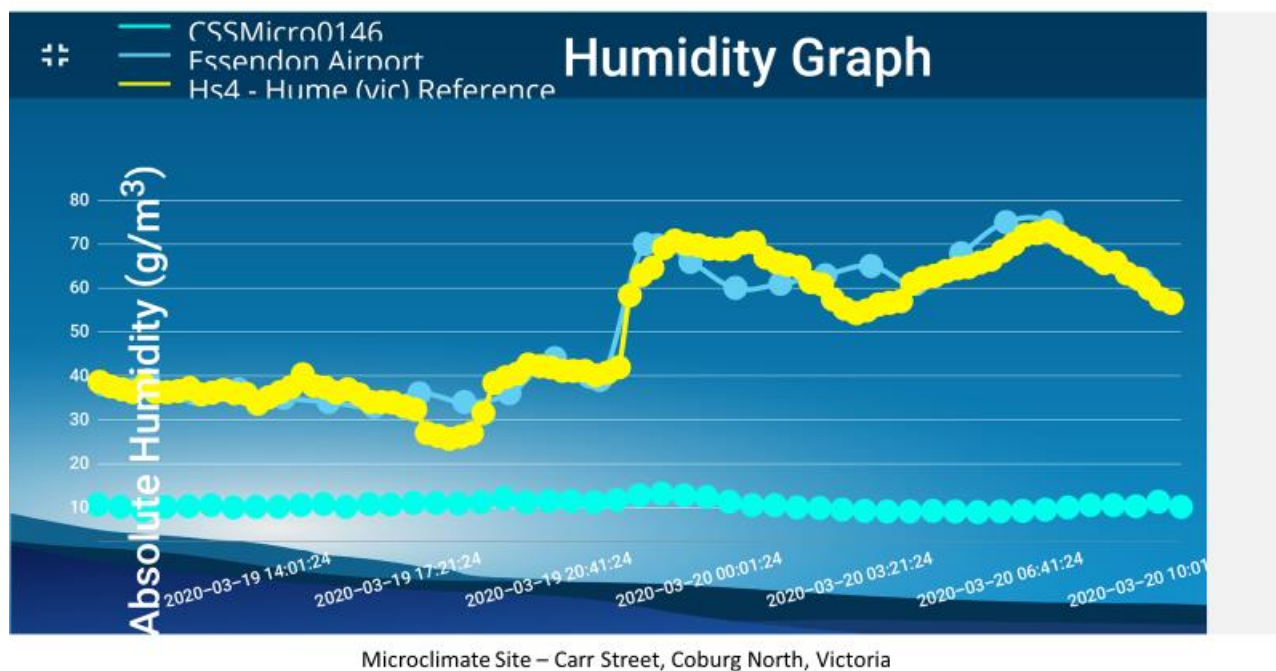


Figure 9 – Microclimate Assessment – (Humidity/ time) GUF 2020 headquarters – 22 Carr Street Coburg North, Vic

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## Citizen Science Research

[our-sci.net](https://our-sci.net)

Global Urban Forest has partnered with OurSci to deliver Citizen Science Research for Urban Forestry around the world.

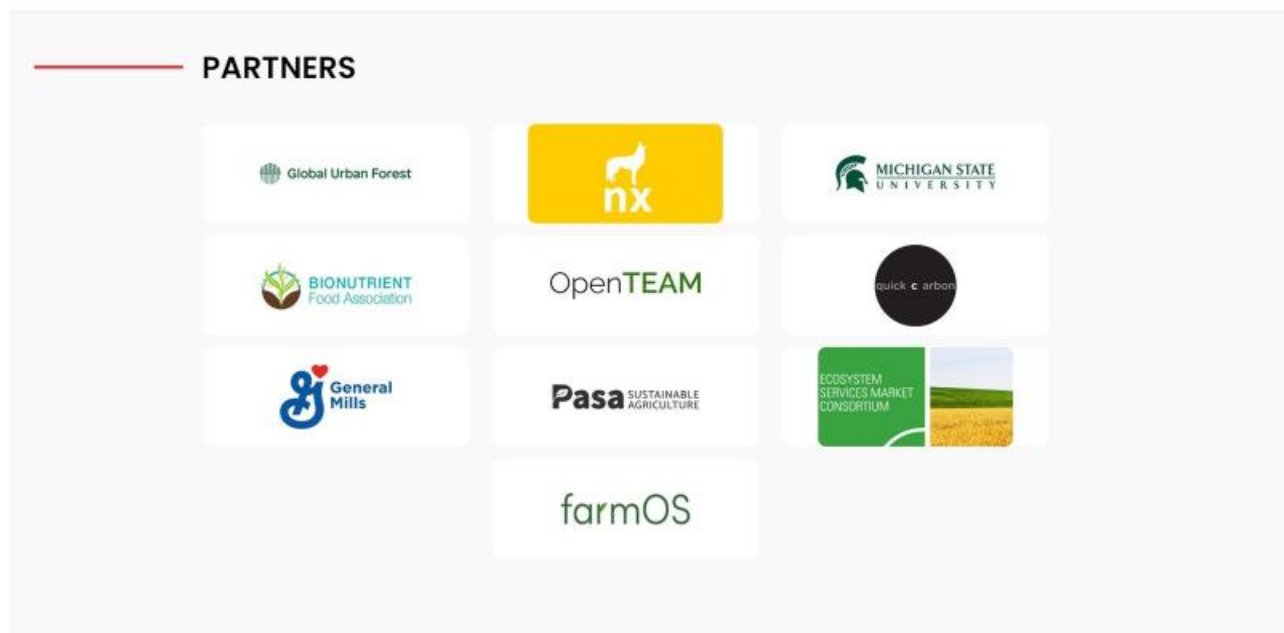
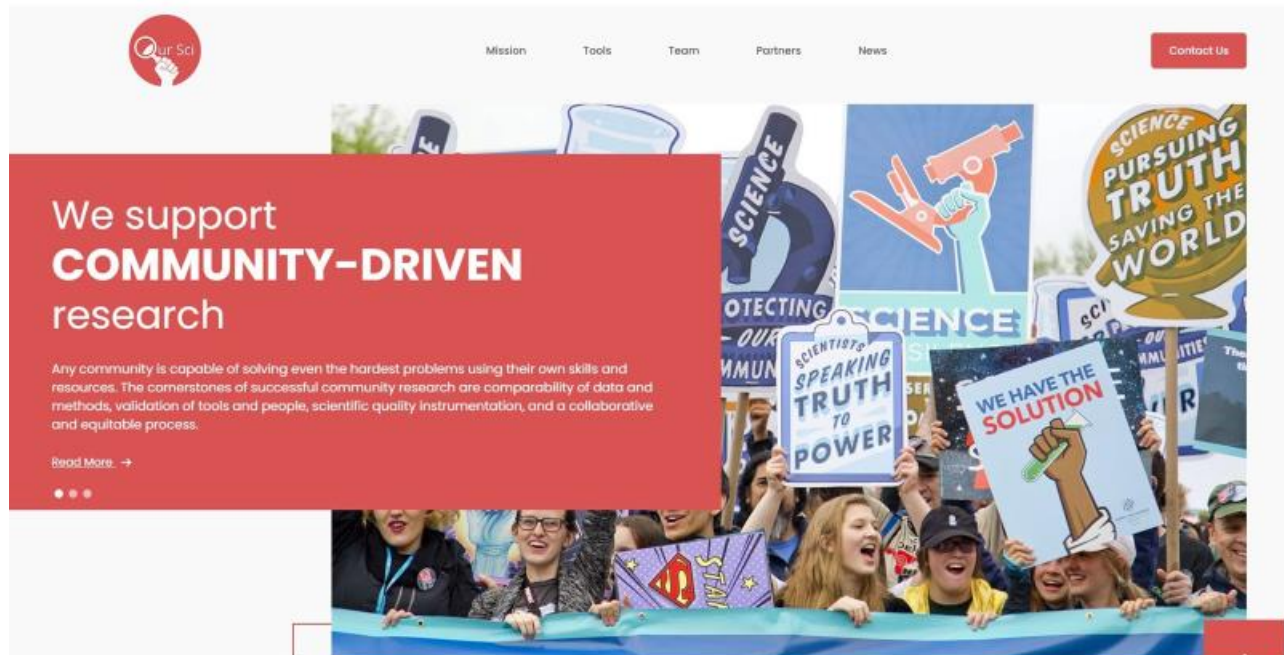
Collaboration on the Internet of Nature (IoN)

### The OurSci Motivation

Research today is driven by industry, government, and academia. These institutions have an important place, but they should not be the only place for science and research. They tend to produce expensive, closed, large-scale solutions which are not responsive to the values of the researchers doing the work or the needs of the communities benefiting from it.

But the traditional barriers to science are gone.

Information is accessible, communication is borderless, sensors are cheap and the sharing economy is quickly becoming the new normal. We can now connect people + sensors to tackle both local and global problems.







## Owen Richards

Associate Director | Global Environment Leader

**Qualified.** Adjunct Associate Professor - Environmental Engineering Murdoch University (2018), Bachelor Environmental Engineering (Hons) Deakin University (1999), Graduate Certificate Management – Technology Management, APESMA, Deakin University, (2001), Certificate IV Fitness, Victorian Fitness Academy (2003), accredited IOWEU/Related Vision client coach (2013).

### Affiliations.

Stormwater Association WA – Vice Chair (2015-2018)  
Deakin University Engineering Academic Advisory Board – Member (2006 – 2011)  
Committee for Geelong – Member (2006 -2012)  
Committee for Perth – Member (2012 – 2015)  
Member - Australian Stormwater Association  
Member - IPWEA  
Member - Sustainable Engineering Society

**Career History.** Owen has over 25 years' extensive experience in both public and private sectors of environmental and civil engineering. Owen's experience is extremely diverse and includes: sea level rise, coastal vulnerability, storm surge assessments, subdivision design, hydrodynamic modelling, design of sewer and water infrastructure, water planning, integrated water cycle management (IWCM), water sensitive urban design (WSUD) and Asia Sponge City projects.

During his career with Bonacci Water under the guidance of Dr. Peter Coombes and more recently with AECOM in Perth as Technical Practice Leader – Sustainable Water, Owen has become a recognised 'creative' engineering leader across the Asia Pacific region for his innovation in integrated water, source control stormwater, decentralised, sustainable, resilient living infrastructure.

The development of the award winning, largest source control stormwater management system for a public authority in the Southern Hemisphere, became a catalyst for Owen's first invention the *Continuous Aggregate Stormwater Inlet System*.

Owen's more recent project involvement in Sponge Cities, climate adaptation, and urban tree decline investigations with Global Urban Forest's Matthew Daniel, conceived his second invention, the *Tree Nurturing System (TNS)*. Based on blue-green (living) infrastructure and biomimicry the TNS can help: mitigate flooding; maintain even soil moisture ratios reducing surface temperatures; increase oxygen and mineral flows through soils; maintain soil health increasing soil carbon storage; increasing root biomass, tree stability and integrity reducing tree fall risk, increasing canopy density, cover and shade.

## McGregor Coxall

### Lewis Park Integrated Water Management | Knox City Council | Victoria

Providing environmental design thought leadership towards the design development of blue-green (living) infrastructure and integrated water management across the sport and recreation facilities of Lewis Park, Wantirna South.

### Climate Resilience Strategy & Delivery Plan | Bristol City Council | Bristol, UK

The McGregor Coxall team is applying a progressive, systematic Climate Resilient approach that holistically considers BCC's estate. Informed by global research, international experience, and best practice design we have the knowledge to set out high level actions to enable the Council to meet the commitment of climate resilience across the property estate by 2030.

### Design for Sustainability and Resilience (PARIWAR) | Australian Government, Department of Foreign Affairs and Trade (DFAT) | New Delhi, India

Leading this project as principal consultant for our primary partner, World Resources Institute (WRI) India. Applying leading bio-urbanism, biomimicry, clever and creative design towards nature-based solution demonstration projects in New Delhi.

### Future City Circular Economy Framework Development | Saudi Arabia

Providing environmental design thought leadership towards the development of a Circular Economy Framework for the New Future City development in Saudi Arabia. Incorporating McGregor Coxall's Biocity Research and Planning Framework to strengthen interdisciplinary collaboration at the region, city and project level to improve resilience in urban, rural and natural environments.



## Future Smart Bio-Urbanism City Planning | Saudi Arabia

Applying leading bio-urbanism, biomimicry, clever and creative living infrastructure inventive solutions merged and integrated with the Internet of Things (IoT) to the world's newest and largest future city development.

## Daishan Island Sponge City and Harbour Rejuvenation | Hangzhou Zhejiang | China

Providing environmental design thought leadership towards the development of innovative Sponge City Concepts to coastline shoreline rejuvenation works and coastal and environmental engineering concepts for harbour floating ship docks.

## Smiths Beach Development | Yallingup | Western Australia

Providing environmental design thought leadership towards the new One Planet Living sustainable coastal development in Yallingup, Shire of Busselton, Western Australia. The design incorporates Nature Based Solutions and biomimicry bespoke design to maximise sustainable triple bottom line (3BL) benefits and climate resilience.

## Circular Quay Renewal | NSW Government | Sydney

Providing environmental design thought leadership towards the Circular Quay redevelopment and application of bespoke blue-green infrastructure solutions.

## Sydney Science Park | Celestino Developments | Luddenham, NSW

Providing environmental design thought leadership towards the new innovative, clever and creative smart city development in Sydney's west.

## Yarra Flats Park Water & Soil Restoration | Global Urban Forest | Heidelberg, VIC

Assessment of the urban water cycle and regenerative approaches towards reintroducing the natural water cycle within a mostly historically degraded agricultural landscape.

## GHD

## Urban Water Cycle Impacts on Tree Decline | Mornington Shire Council | Victoria

Through Owen's affiliation with Mathew Daniel of Global Urban Forest Pty Ltd, GHD are assessing the impacts of the urban water cycle on soil health and tree decline, namely phytophthora. This project involved site assessment of urban catchment hydrology & drainage characteristics across nine sites identified for tree decline and phytophthora outbreaks. Hypotheses were provided on potential impacts from urbanisation and potential remedies through integrated water management (IWM) approaches.

## Castlemaine Town Vision | Coliban Water | Victoria

Provided innovative, alternative input of 'small town wastewater systems' and blue-green infrastructure for the development of Castlemaine's water industry 'Town Vision'.

## Soil & Plant Health Investigation | Hume City Council | Victoria

This project brings together a world first collaboration between Matthew Daniel of Global Urban Forest, Nadiné Galle, Fullbright Scholar & MIT Senseable City Lab and Owen Richards of Murdoch University & GHD to develop accurate and holistic value in plant and soil function based on quantifiable measures. The associated soil and plant health parameters measured and interpreted will assist in best practice Urban Forest management.

## Ceres Clean Fill Landfill and Rehabilitation Environmental Management Plan | Septimus Corp | Geelong

Provided stormwater management, flooding and earthworks modelling input for a Landfill and Rehabilitation Environmental Management Plan (LREMP). The development of the LREMP is to satisfy planning permit conditions.

## Ceres Clean Fill Civil & Environmental Services | Septimus Corporation | Geelong, Victoria

Development of 12D Model Earthworks design, environmental and stormwater management plans to support a planning permit for the ongoing clean fill import operations of a site at the edge of the Barrabool Hills, Ceres, and west of Geelong.

## VicRoads Drainage Assessment | Septimus Corp | Ceres, Geelong

Undertook an assessment of stormwater, drainage, erosion and sediment movement across a VicRoads drainage easement and the detrimental impacts on private property.

## Christmas Island Flood Modelling Peer Review | Department of Infrastructure, Transport, Cities and Regional Development | Western Australia

Provided peer review, technical support relating to TUFLOW modelling, flood mitigation and drainage optimisation at Christmas Island.

## Drainage Network Capacity Assessment | Northern Territory Government | Darwin

The Department of Infrastructure, Planning and Logistics (DIPL) engaged GHD for technical services delivery of a stormwater capacity assessment and developer design review of Henbury School and Carpentaria Disability Services drainage infrastructure. Services included revitalise the client relationship, site inspection, hydrologic & hydraulic modelling, documentation and stakeholder engagement.

## Werribee Racecourse Stormwater Harvesting Scheme Functional Design | Melbourne Water | Victoria

Provided technical services relating to the functional design of an underground modular tank stormwater harvesting system for irrigation supplies at the Werribee Racecourse.

## Detailed design peer review | Northern Territory Government | Darwin

The DIPL engaged GHD for peer review of detailed stormwater and detention tank systems for the Dripstone Middle School drainage system. The peer review involves design examination, adjudication and guidance to ensure the stormwater management system is designed to the satisfaction of NT Government policy and mitigating flood risk to the downstream environments, infrastructure and communities.

## Real-time catchment monitoring/modelling Melbourne Water Corporation | Victoria

Developed a real-time Smart Infrastructure monitoring and modelling system of MWC's drainage network that will:

- Improve understanding and knowledge of the range of integrated catchment management services provided by drainage systems;
- Improve understanding within and between delivery agencies of the functioning of the drainage network and interfaces and interdependencies in managing and operating the drainage network;
- Enable better delivery of the range of integrated services provided by the drainage network; and
- Improve ability to operate the drainage system to enhance service.

Smart infrastructure may involve doppler ultrasonic area/velocity sensors and soil moisture sensors calibrated against high speed GPU flood modelling of incoming storm events. System should enable forecasting of failures, extent of failure, infrastructure risk priorities, general monitoring and asset management.

## Dynamic Influences on Coastal Stormwater – Waihi Beach Western Bay of Plenty District Council | NZ

Proposed Pilot of internet connected, continuous monitoring (Internet of Things (IoT)) as a means to provide insights and support quantification of site specific and dynamic drivers for - stormwater, flooding (including real-time alerts), infrastructure maintenance needs, as well as refined, advanced warning of such events, and how existing stormwater infrastructure performs.

Smart infrastructure proposed includes doppler ultrasonic area/velocity sensors, soil moisture sensors, water level sensors, cameras (coastal & open drains) and pressure transducers.

The cameras are intended to capture information regarding flood events (image recognition for flood height correlation). As the stormwater reports predominantly to a central canal, they will also provide some indication of storm surge and wave influence on stormwater dissipation.

## Wangoom Water Supply Tank Site Porous Pavement Detailed Design | Wannon Water | Victoria

Provided technical services relating to hydrological assessment of catchment flows, determination of stormwater retention volumes and porous pavement detailed design.

## Stormwater rationalisation and optimisation, attenuation, IWM and ISCA | North East Link Authority (NELA) | Melbourne

Technical support services relating to modelling stormwater systems to determine optimal configurations. Integrated Water Management incorporating alternative stormwater management philosophies, approaches and infrastructure. Infrastructure Sustainability Council Australia (ISCA) project rating development and assessment including assessment of triple bottom line (3BL) benefits: 1. Economics (capex/opex), 2. Social amenity, heat island effects; and 3. Environment. These benefits are assessed in respect to elements including but not limited to climate change, total water cycle, stormwater quality and flooding.

## Climate Adaptation Support – Water & Infrastructure Directorate of Environmental Resource Management & Sustainability (DERMS) | Department of Defence | Canberra

Technical support services relating to climate change adaptation. The services require a specialist with experience in infrastructure climate adaptation and an understanding of the Department of Defence (DoD) operations to assist the DERMS team.

Services include assisting DERMS in developing a climate adaptation policy with information about the effects of climate change currently known to inform on-base risk assessments and decision making. Review detailed climate vulnerability work by DERMS and provide additional input and revisions with respect to climate change profiles.

## Hazelwynde Urban Development Stage 1 | Yarra Valley Water | Victoria

Provided peer review, technical support and reporting relating to Integrated Water Management (IWM) strategies for Yarra Valley Water's Hazelwynde Land Development Project, Beveridge North.

## SOMe Engineering

### 100 Lot Subdivision ZigZag Consortium | Baldivis, WA

Project director for a proposed integrated water, sustainable Green Star community development with Josh Byrne & Associates in Baldivis, Western Australia.

### Western Highway Stage 2B – Hopkins River Bridge Crossing Hydrodynamic Modelling VicRoads | Victoria

Developed a 2D TUFLOW model and memo report detailing the hydrodynamics and hydraulics impacting the proposed new bridge crossing over the Hopkins River. The modelling included 20, 100, 2000 year ARI storm events, climate change and sea level rise scenario assessment.

### Western Industrial Precinct | Three Pillars | Armstrong Creek, Geelong

Project director for civil engineering smart design services at the 156 Ha Armstrong Creek Western Industrial precinct.

## Alternative Water Supply Matrix Assessment Tool Fremantle Council | Fremantle, WA

Delivered Alternative Water Supply Matrix Assessment Tool (AWSMAT) to assist Council in the endorsement / approval of the most fit for purpose alternative water supplies for new and infill urban developments.

## 100 Lot Subdivision, Arrav Investment | Cox Road, Norlane, Geelong

Project director for civil engineering services at the former Norlane High School site, Geelong.

## Maddington Kenwick Employment Area (MKSEA), Beeliar Professors Group | Kenwick, WA

Total water cycle management, flood water planning and climate change impacts for the City of Gosnells MKSEA industrial development, Kenwick, Western Australia.

## ARCADIS

### Northlink Stage 2 – Perth Darwin Highway | ARCADIS-AECOM with Laing O'Rourke-BGC for Main Roads WA | Perth, Western Australia

Stormwater Lead for the Stage 2 detailed design and construction of the Perth – Darwin Highway for Main Roads WA (MRWA), a JV between ARCADIS and AECOM with BGC and Laing O'Rourke. Provided technical input, guidance and advice towards the stormwater management, drainage design, flood modelling and Infrastructure Sustainability Council Australia (ISCA) IS rating for the project. Project incorporated cost/risk matrix assessment of climate change adaption design options.

### Belmont Racecourse Grandstand Redevelopment ARCADIS for Perth Racing | Burswood, WA

Provided sustainable IWCM / WSUD stormwater design input into the Belmont Racecourse Grandstand Redevelopment adjacent to the New Stadium Rail Station – Perth. Services included augmentation, rehabilitation and rejuvenation of various existing ecosystems, stormwater elements and infrastructure.

### Central Maddington Outline Development Plan | City of Gosnells | Western Australia

Stormwater/Drainage Lead for the detailed design development of the Central Maddington Outline Development Plan (CMODP) in conjunction with ARCADIS and SHAWMAC, Western Australia. Services included hydrodynamic flood modelling, drainage and earthworks design for minor and major design flood events including climate change scenarios for local catchment and regional Canning River catchment impacts.

## AECOM (Perth)

### Orrong Road 6-lane widening drainage design Main Roads WA | Welshpool, Perth, WA

Provided expert advice and support during the development of the Orrong Road drainage design associated with the 6-lane widening.

## Corrugated Steel Pipe (CSP) flood modelling and implosion risk management system Fortescue Metals Group (FMG) | WA

Provided technical and expert input and advice towards the development of surface water modelling, drainage inputs and implosion risk assessment tool for FMG CSP drainage assets throughout the FMG network.

## Central Pilbara Infrastructure Project – Surface Water Management | Rutila Resources | Pilbara, WA

Provided technical and expert input and advice towards surface water modelling, drainage design inputs, innovative design alternatives and configurations for drainage and bridge assets along the proposed 165 km single-track standard gauge railway from central Pilbara to the port site between Dampier and Port Hedland. Design alternatives included reduction of bridge crossing span lengths through the application of CSP's.

## North Quay Rail Terminal (NQRT) Extension Fremantle Ports Authority | Fremantle, WA

Provided technical and expert input, advice and support during the development of the NQRT Extension design including sustainable stormwater management, hydrological modelling, ocean outfall design, infiltration basin design and drainage design. Innovative design of a High Early Discharge (HED) pit to maximise hydraulic flow efficiency to the ocean outfall and halve the detention basin requirements for the facility.

## Shek Wu Hui Sewage Treatment Plant Sustainable Rejuvenation Works – Technical Advisor Hong Kong Drainage Services Department | HK

Provided technical advice to the Assistant Professor of The University of Hong Kong towards Phases 1A and 1B- D&C: Porous Pavement Pilot Study for AECOM, Hong Kong.

## Crown Towers Redevelopment Crown Resorts | Burswood, Perth, WA

Provided technical and expert input, advice, design and assessment towards surface water management, sustainable drainage, WSUD elements, stormwater quality treatment, eco-system rehabilitation and rejuvenation.

## Rail Drainage Study, FMG | Pilbara region, Western Australia

Provided technical and expert input and advice towards surface water modelling and drainage inputs for assessment of drainage assets throughout the FMG rail network.

## New Perth Stadium Station | PTA WA | Perth, Western Australia

Lead the development, design and construction of sustainable IWM for the New Perth (Optus) Stadium Rail Station. The project also incorporates augmentation, rehabilitation and rejuvenation of various existing ecosystems and civil infrastructure. Capex and opex savings in the order of 40%.

## Airport Link | Public Transport Authority | Western Australia

Provided sustainable IWCM / WSUD stormwater design input towards stormwater management of the Airport Rail Link for the Western Australia Public Transport Authority (PTA).

## East Perth Station Upgrade – New Perth Stadium Project | PTA WA | Perth, Western Australia

Provided sustainable IWCM / WSUD stormwater design input into the design and construction of the upgrades to the East Perth Station under the PRISM Alliance for the WA PTA.

## Camfield Drive Extension – New Perth Stadium Project | Department of Sport and Rec | WA

Provided sustainable IWCM / WSUD stormwater design input towards the Camfield Drive Extension from Crown Perth to the proposed Busport at the New Perth Stadium and National Tennis Center under the PRISM Alliance (Laing O'Rourke and AECOM) for the Department of Sport and Recreation.

## Mirrabooka Sustainable Streetscape Works | City of Stirling | Mirrabooka, WA

Provided technical and expert input, advice, design, modelling and assessment towards surface water management, sustainable drainage and WSUD elements for urban design streetscape works.

## WestConnex Stage 2 – New M5 (Beverly Hills to St Peters) | NSW

Provided technical advice and peer review of the stormwater quality management modelling undertaken in eWater MUSIC for various elements throughout Stage 2 of WestConnex New M5.

## Aubin Grove Station | PTA WA | Perth, Western Australia

Provided sustainable IWCM / WSUD stormwater design input towards stormwater management options of the Aubin Grove Station and associated facilities under a D&C JV for the WA PTA.

## Yandicoogina Iron Ore Project - Oxbow Deposit | Rio Tinto | Pilbara, WA

Provided technical and expert input and advice towards surface water modelling, drainage and 12d Design for the Oxbow Iron Ore Project.

## McPhee Creek Mine Surface Water Study and Railway Feasibility Design | Atlas Iron | McPhee Creek, WA

Beta tested TUFLOW GPU hydrodynamic modelling of 30,000 m<sup>2</sup> LiDAR digital elevation models (DEMs) towards assessment, flood risk and design of drainage and bridge assets along a 200 km Pilbara rail alignment. Modelling detail and efficiencies during the feasibility stage significantly reduced design flow conservatism from the pre-feasibility stage (by others). Detailed modelling and flood mapping resulted in replacing seventeen [17] bridge crossings, of a total of eighteen [18], with CSP's, saving the project \$350m.

## Brisbane Airport Corporation – Domestic Northern Apron Grading, Drainage and Staging Review

Provided a review of a concept design for the Brisbane Airport Domestic Northern Apron including hydrological, surface water and underground drainage technical and expert input, design advice, design documentation, reporting and client presentation. Design options incorporated assessment of climate, rainfall variations and sea level rise for impacts and interactions on drainage into the Brisbane River and Moreton Bay.

## Bandaranaike International Airport, Katunayake, Colombo, Sri Lanka

Provided hydrological and drainage technical and expert input, advice and design documentation for alternative airport drainage systems providing hydraulic efficiencies and mitigating flood risk.

## Mattala Rajapaksa International Airport, Hambantota, Sri Lanka

Provided hydrological and drainage technical and expert input, advice and design documentation for airport drainage systems providing hydraulic efficiencies and mitigating flood risk.

## Mungalalu Truscott Airbase Truscott Mining | Anjo Peninsula, Kimberley, WA

Provided hydrological and drainage technical and expert input, advice and design documentation for airport drainage systems in the remote Kimberley region of Western Australia.

## Perth Airport Sustainable (drainage) Infrastructure Perth Airport Corporation | Western Australia

Provided assessment of existing (drainage) infrastructure affected by hydrology, BAU outfall constraints and climate change impacts. Provided technical and expert input, advice and design documentation for alternative, sustainable airport drainage and associated infrastructure systems.

## Perth Airport Expansion Project Perth Airport Corporation | Western Australia

Provided sustainable at source stormwater management design input towards stormwater management and mitigation of bird strike drivers for the Airport Expansion Project, Perth Airport.

## Various Subdivisions | Geraldton, WA

Provided WSUD input to several urban developments in Geraldton, WA.

## Ungani Oil Well Project | Buru Energy | Canning Basin, Kimberly, WA

Provided technical and expert input, advice and support during the development of a flood model and mitigation options for an oil well site in the Canning Basin, ~100 km east of Broome.

## Department of Defence | Learmonth Air Base Flood and Storm Surge Modelling, Flood Mitigation Design Works | WA

Provided technical advice and input for TUFLOW hydrodynamic modelling, GIS terrain mapping and development of various 12d Model design surfaces for



flood risk options assessment. Provided technical advice on resilient drainage infrastructure considering climate change and storm surge projections.

## Department of Defence | Campbell Barracks | WA

Provided technical and expert input, advice, design, assessment and documentation towards surface water, flood mapping, drainage design, WSUD and IWCM elements. Flood modelling included assessment of climate change risk of infrastructure through assessment of sea level rise scenarios and forecasted variations in rainfall patterns, frequencies and intensities.

## Department of Defence | Bindoon Training Facility | WA

Provided technical and expert input, advice, design and assessment towards surface water, drainage, WSUD and IWCM elements, and climate change risk of infrastructure. Review of existing drainage infrastructure for stormwater harvesting feasibility, design options and infrastructure requirements for integrated water and firefighting requirements. Assessment of existing and projected rainfall predictions to incorporate resilience into infrastructure.

## Department of Defence | HMAS Stirling | Garden Island, WA

Provided alternative stormwater management design and infrastructure options for proposed new facilities. Options proposed were responsive to actual environmental and geological conditions. Options would generate maximum value add benefits through at source stormwater harvesting for alternative, integrated water sources and firefighting purposes. This approach negated the requirement for end of line detention basin, removal of vegetation, additional fill and earthworks. Alternative design unfortunately not adopted.

## Rous Head Industrial Park Flood Study | Fremantle Ports Authority | Fremantle, WA

Provided technical input, advice and support for the development of a Flood Study for the Rous Head Industrial Park including 2D hydraulic modelling. The flood study incorporated sea level rise scenario and risk assessment.

## Rous Head Reclamation Area Drainage | Fremantle Ports Authority | Fremantle, WA

Provided expert advice and support during the development of the Rous Head Reclamation Area Industrial Development design including hydrological modelling, drainage design and input to other services including ISCA IS rating for the project. The development and infrastructure design incorporated measures considering climate change, flood risk and sea level rise impacts. Works included sea wall design, ocean outfall's with Tideflex duckbill check-valves.

## Rous Head Helipad | Fremantle Ports Authority | Fremantle, WA

Provided civil engineering design and documentation for the Rous Head Reclamation Area Helipad. Works included hardstand area, access, carpark, pavement,

drainage, ocean outfall and Tideflex check-valve design.

## Safelinks Alliance | Maca Ltd for Main Roads WA | Mid-West region, WA

Provided hydrological and drainage technical and expert input, advice and support during the design phase of the Main Roads WA, Safelinks Alliance, regional highways upgrade program of ~100 km highway upgrade from Morawa to Mullewa

## Forrestfield Terminal (container transport) Extension | Intermodal Group | Forrestfield, WA

Provided high level conceptual advice towards drainage mitigation and solutions for a proposed extension to the Intermodal Group Terminal. Included development and assessment of hydrological and hydraulic models and generation of conceptual drainage arrangements.

## Stage 2 - Port Access Road Project | Main Roads WA | Bunbury, WA

Provided technical support and advice towards drainage mitigation and solutions for 100 % design stage of Lot 2 and Lot 4. Included development and assessment of hydrological and hydraulic models.

## Various Waterways Studies – Waterways Panel | Main Roads WA | South Western Region, WA

Provided technical support, input and mentoring advice towards assessment of waterways, bridges and structures for hydraulic and flooding behaviour throughout South Western region WA. Many of these studies also included waterways rehabilitation, augmentation and rejuvenation works.

## Ferguson & Preston River Re-alignments | Main Roads WA | Bunbury, WA

Provided technical support, input and mentoring advice towards assessment and design of Ferguson and Preston River restoration re-alignments. The river restoration and re-alignments incorporated water quality and erosion control mitigation measures to enhance and sustain local ecosystems.

## Beveridge Williams

### Coastal Vulnerability Assessments for townships/regions including:

Apollo Bay (Colac Otway Shire), Newcomb (COGG), Warneet (Cardinia Shire), Tooradin (Cardinia Shire), Pioneer Bay (Bass Coast), Coronet Bay (Bass Coast) and Dalyston (Bass Coast).

Coastal vulnerability assessments incorporated storm surge modelling integrated with climate change and sea level rise projections.

### Stormwater Management Plans (SWMP's) for various developments throughout:

Ballarat, Ballan, Melbourne's West, outer suburbs, extending to the south east including Grantville, Phillip Island, San Remo and further east including Dalyston, Wonthaggi, Leongatha and Sale.

Stormwater management plans incorporated prescribed assessment of sea level rise on developments.

## Casey/Cardinia UGB Stormwater Harvesting Study Melbourne Water Corporation | VIC

Stormwater harvesting strategy for the Casey/Cardinia region – catchment assessments, hydrologic modelling (DRAINS & RORB) and water balance modelling. Scenario's incorporated assessment of predicted changes in climate and rainfall.

## Various Drainage Scheme Catchments Modelling | Melbourne Water Corporation | VIC

TUFLOW hydrodynamic flood modelling & mapping.

## Metropolitan Melbourne Urban Growth Boundary (UGB) Drainage Schemes | Melbourne Water | VIC

Development of drainage schemes for Melbourne's UGB areas – consultation, workshops, hydrological modelling, mapping and reporting. Drainage schemes incorporated assessment of sea level rise on growth areas, particularly schemes most at risk due to proximity to rivers, bays or the coastline.

## Casey/Cardinia UGB Stormwater Harvesting Study | Melbourne Water Corporation | VIC

Stormwater harvesting strategy for the Casey/Cardinia region – catchment assessments, hydrologic modelling (DRAINS & RORB) and water balance modelling.

## Wonthaggi North East Development Area - Stormwater Management Strategy | Bass Coast Shire Council | VIC

Stormwater quantity modelling - TUFLOW & DRAINS, stormwater quality modelling – MUSIC and development of a stormwater management strategy.

## Bunurong Memorial Park Flood Protection Cheltenham & Regional Cemeteries Trust | VIC

Flood management hydrodynamic modelling, mapping, risk mitigation, 12D Model design development, and options assessment.

## Sustainable Water Use & Stormwater Harvesting Strategy | Ford Motor Company Australia | Ford Proving Ground Facility | Lara, VIC

Development of sustainable water use strategy for the Ford Motor Company Proving Ground Facility – water audit, water balance modelling, catchment assessment and hydrological modelling (DRAINS).

## Bonacci Group / Water

### ACUGA Stormwater Management Strategy and Policy development City of Greater Geelong (COGG) | ACUGA, Geelong

Stormwater Management Plan strategy and policy development, hydrology, hydraulics & flood mapping, creek and waterway rehabilitation design. Strategy and policy documentation covered carbon credits through alternative (decentralised) infrastructure, predicted climate and rainfall impacts on hydrology and flood risk from sea level rise of the Barwon River.

### Sustainable Water Use Plan COGG | Armstrong Creek Urban Growth Area (ACUGA), Geelong

Development of a sustainable water use plan, integrated water cycle management plan, creek and waterway rehabilitation plan incorporating assessment of infrastructure carbon footprints, climate change scenarios and sea level rise impacts.

### Stormwater Management and IWM Plan | DPCD | Werribee Employment Precinct | VIC

Stormwater Management Plan, Hydrology, Hydraulics & Flood Mapping, waterway rehabilitation. Designs and assessment incorporated prescribed sea level rise projections.

### Gidgegannup township IWM Plan | Greg Rowe & Assoc. with Josh Byrne & Assoc. for Port Bouvard | Gidgegannup, Western Australia

Water balance modelling, IWCM, hydrology, hydraulics, stormwater, drainage, WSUD, wetlands and aquifer recharge assessment towards development of the township Master Plan.

### Breakfast Point Urban Development | Rosecorp and CBUS JV | NSW

Rehabilitation earthworks 12D Model design, stormwater drainage and civil siteworks.

### Armstrong Creek East Precinct (ACEP) | Collie | ACUGA, Geelong

Assist urban planning, water planning through hydrology, hydraulics & flood mapping, stormwater management and IWCM plans.

### Armstrong Creek Western Industrial Precinct Cullin Capital | ACUGA, Geelong

Development of subdivision concept layout, IWCM Plan, SWMP, Hydrology & Hydraulics.

### Queens Park Golf Club Sewer Mining Study | COGG, Barwon Water | Queens Park, Geelong

Feasibility study for establishment of sewer mining system at sewer pits along the Barwon Water sewer network adjacent to the golf course. System proposed included MBR treatment container, pump, tank and reticulation concept design.

### Whittlesea City Council - Lalor and Thomastown drainage reticulation modelling & main drainage design.

### Geelong Baseball field relocation | COGG | Waurm Ponds, Geelong

Geelong Baseball field design, 12D Model, stormwater drainage design, Waurm Ponds creek outfall, waurm ponds creek rehabilitation, structural design of bridge.

### Leisurelink Aquatic Centre Civil Design COGG, Hassell Architects | Waurm Ponds, Geelong

IWCM, Civil design, site works 12D Model, stormwater drainage, WSUD, rainwater harvesting and reuse.

### Fyansford Quarry Rehabilitation and Cement Works Urban Development | Moltoni Corporation | Fyansford, Geelong

12D Model subdivision concept design, 12D Model fly through animation development, bulk earthworks modelling, IWCM Plan, SWMP, hydrology & hydraulics,

decentralised wastewater treatment study with rising main to Queens Park Golf Course.

## Various IWM projects for COGG at Kardinia Park including:

- Kardinia Park Stormwater Harvesting and Reuse Scheme.
- Geelong Cricket Club – Skilled Stadium - Ford Stand rainwater harvesting, 250 kL rhino tank, irrigation pump and reticulation design.
- Skilled Stadium Water Audit
- Skilled Stadium Sewer Mining for Playing Surface Irrigation Feasibility Study

**Melbourne Water Corporation** | Sunshine Leisure Centre | HECRAS surface water modelling.

## Mernda Villages Civil Design Stockland | City of Whittlesea, VIC

IWCM, hydrology, hydraulics, stormwater, drainage, WSUD, wetlands and HECRAS main drainage channel assessment.

## Fyansford Landfill Site Earthworks Remediation Moltoni Corporation | Fyansford, Geelong

12D Model earthworks and drainage design. Hydrology, hydraulics and flood mapping.

## Moorabool River flood assessment | Moltoni Corporation & CCMA | Fyansford, Geelong

Hydrology, HECRAS and TUFLOW hydraulics & flood mapping of the Moorabool River diversion and interface with the Barwon River.

## Fisher Stewart / EarthTech

**13th Beach Golf Links and Barwon Heads Golf Course** | Recycled Water Pipeline Design and Construction Management.

**Alcoa of Australia** | Anglesea Power Station | Groundwater systems waterhammer analysis.

**Barwon Valley Golf Course** - Course wide drainage review, modelling, augmentation, enhancements, design and documentation.

**Glenelg Hopkins CMA** | Rural Drainage Assessment & mitigation.

**Ocean Acres Estate** | Torquay | Water, sewer & drainage infrastructure.

**Santospirito Torquay Flower Farm** | Black Rock Treatment Plant recycled water & hypochlorite dosing, retention storage recycled water system.

## Various projects for Barwon Water including:

- Aireys Inlet Sewerage Scheme.
- Geelong and Otway Region Drought Response Curves.
- Apollo Bay, Skenes Creek and Marengo Water Reticulation.
- Torquay and Ocean Grove Water Supply Tanks and Pump Stations.

- Development of Drought Response Curves for Geelong and Otway regions.

- Sewer Mining Reuse scheme, Torquay, Black Rock Treatment Plant.

## Various projects for the Corangamite Catchment Management Authority (CCMA) including:

- Birregurra Creek Inspection & Report.
- Retreat Creek Assessment and erosion mitigation.
- Stock Crossings Assessment.
- Wormbete Creek Assessment and erosion mitigation.
- Various projects for COGG including:
- Bell Park Stormwater Catchments Drainage Strategy.
- Corio Bay Stormwater Outfall, GPT Design and Construction Management.
- Coronet Drive Drainage, HECRAS modelling.
- Drysdale Drainage Analysis, catchments & outfalls.
- Indented Heads Stormwater Drainage Marine Outfall Design.
- Indented Heads Stormwater Catchments, Detention System Analysis & Design.
- Jetty Road/Wyndham St Drainage Analysis & Design.
- Leopold Catchments Stormwater Detention Analysis & Design.
- Rollins Road Catchments Stormwater Detention Analysis & Design.
- Various projects for Surfcoast Shire including:
- Moriac Recreation Reserve Water Supply Irrigation Analysis & Design.
- Mount Duneed Catchment Drainage Assessment.
- Torquay Stormwater Drainage Reticulation Analysis & Mitigation Study.

## Barwon Region Water Authority

North Geelong Flow Retarding Facility.

Santospirito - Torquay Flower Farm - Recycled Water Pipeline Construction Management.

Taylors Reserve underground detention system and Torquay Pump Station No.1 assessment.

Literature Review - Wastewater Reuse.

Torquay and South Bellarine Trunk Sewer Strategies.

## Professional History

August 2020 – present

### McGregor Coxall

Associate Director | Global Environment Leader

January 2019 – August 2020

### GHD

Technical Director – Water Strategy

August 2016 – November 2018

### SOMe Engineering

Founding Director – Sustainable Development + Water

August 2016 – June 2017

### Arcadis

Manager – Sustainable Development + Water

July 2012 – August 2016

### AECOM (Perth)

Technical Practice Leader – Sustainable Water

Systems - APAC

Oct 2009 – July 2012

### Beveridge Williams

Geelong Office Manager /

Principal Engineer – Water Resources

Dec 2004 – Aug 2009

### Bonacci Group & Bonacci Water

Geelong Office Manager / Associate

Apr 1998 – Dec 2004

### Fisher Stewart / EarthTech

Environmental / Design / Senior Engineer

Nov 1996 – Apr 1998

### Barwon Region Water Authority

Technical Officer



## **Inventor.**

Invention name 发明创造名称: Tree Nurturing System 一种植被养护系统 World Intellectual Property Organization (WIPO) Patent application number 申请专利号: 202010737882.5. Consisting of a continuous porous kerb rainwater inlet system, rainwater retention cells, soil structural cells and tree pit. Patent Pending.

## **Co-Inventor.**

KerbiDrain™ continuous aggregate inlet drainage system. WIPO, International Bureau. Patent Cooperation Treaty (PCT). International Publication Number WO 2018/068095 A1 – PCT/AU2017/051108. Filing date 13.10.2017.

## **Awards.**

Richards, O. (2003). *Stormwater Industry Association, AWA, Water Recycling Australia, Brisbane. City of Greater Geelong/EarthTech Engineering with CSIRO – Indented Head First Flush Reuse Project.*

Richards, O.; Tay, M.; Wallis, S. (2015) *Stormwater Association WA – Integrated Stormwater Design, New Perth Stadium Railway Station – AECOM, DS Agencies.*

## **Conferences/Published.**

Anson, C.; Coombes, P.; Richards, O. (2006). A shift in paradigm curve of sustainable water use. A practical example: Mernda Villages, Victoria. Stormwater Industry Association. Conference, Launceston, Tasmania.

Anson, C.; Coombes, P.; Richards, O. (2008). A shift in paradigm curve of sustainable water use. A proposed fully integrated approach for the Gidjegannup Town Master Plan, Western Australia. Stormwater Industry Association. Conference, Perth, Western Australia.

Cummins, L.; Richards, O. (2013). Review and comparison of ERM and ILSAX hydrological models on drainage modelling for the Gateway WA Project, Perth, Western Australia. AECOM, Perth, WA.

Richards, O. (2013). Development of a High Early Discharge (HED) Stormwater Pit to halve detention volumes at the North Quay Rail Terminal (NQRT) Extension for Fremantle Ports. Infrastructure Project Innovation (nomination), AWA WA Annual Awards, Perth.

Richards, O. (2014). Practical application of Texas Tech University, Project 0-6549, Hydraulic Performance of Staggered Barrel Culverts for Stream Crossing for Rutilla Resources Central Pilbara Infrastructure Project, AusRAIL Conference & Exhibition, Perth, Western Australia.

Richards, O. (2015) Prof. John Argue, Engineers Australia, AR&R - Source Control for Stormwater Management. A practical example: New Perth Stadium Railway Station. Engineers Australia Education Course, Perth, Western Australia.

Richards, O. (2015). 4D Stormwater Asset Management & Failure Risk Forecasting System. OzWater, Perth.

Richards, O. (2016) Prof. John Argue, Engineers Australia, AR&R - Source Control for Stormwater Management. SOME Source Control Stormwater Management: Application of continuous aggregate inlets. Engineers Australia Education Course, Perth, Western Australia.

Richards, O. (2016) IPWEA Training Week. Paper: Richards, O. SOME Source Control – Stormwater Management, The most practicable approach in source control methodology.

Richards, O. (2017). SOME Source Control Stormwater Management. IPWEA International Conference, Perth, Western Australia.

Richards, O (2017) Rich and Rare: Knowing and Caring for the Brixton Street Wetlands and Yule Brook. Paper: Richards, O. Wallis, S. SOME Source Control – Stormwater Management, The most practicable approach in source control methodology.

Nayak, A.; Richards, O.; Wallis, S. (2017). SOME Source Control – Stormwater Management, The most practicable approach in source control methodology. Future Drainage & Stormwater Networks Conference, Dubai.

Anda, M.; Dallas, S.; Richards, O. (2018). Performance assessment of an innovative 'at source' stormwater management system utilising permeable aggregate – the KerbiDrain™ system. IWA SWWS2018 Conference on 'Small Water & Wastewater Systems and Resources Oriented Sanitation', Perth, Western Australia.

Richards, O. (2018). SOME Source Control – Stormwater management through biomimicry, reducing climate change impacts and building resilient urban centres. CRCWSC, DEDJTR, DELWP, Sichuan Sponge City Programme, Chengdu, China.

Richards, O. (2019). Book Chapter: Impacts of urbanisation and conventional drainage infrastructure on the natural water cycle of Yule Brook, Maddington Kenwick Strategic Employment Area (MKSEA), Perth, Western Australia.

In: Lambers, H. ed. A Jewel in the Crown of a Global Biodiversity Hotspot. Perth: Kwongan Foundation and the Western Australian Naturalists' Club Inc.

Skills Matrix	Low Proficiency				Role Model
Dimension					
Water planning, integrated water urban planning					
Sustainable Water / Climate adaptation					
Rural Catchment Hydrology					
Civil / Hydraulic Infrastructure					
Airports stormwater/drainage					
Linear Drainage					
Resources Industry					
Rivers & Waterways					
Coastal					
Flood Mitigation					
Winning client conversations					
Design					
Asset Design – planning, conceptual					
Asset Design – Detailed Design & Docs					
Asset Delivery (construction)					
Asset Audit					
Asset Maintenance					
Modelling					
Water Quality Modelling (eg MUSIC)					
Water Balance Modelling (eg Aquacycle)					
IWCM Modelling (eg Urban Developer)					
Hydrologic Modelling (eg DRAINS)					
Hydraulic Modelling (eg DRAINS, HECRAS)					
Hydrodynamic Modelling (eg TUFLOW)					
Water / Sewer Modelling (eg PIPES++)					
Earthworks Modelling (eg 12D)					
Costing & Finance					
Costing (construction)					
Costing (operation & maintenance)					
Life Cycle Assessment					
Cost Benefit Analysis					
Business Development, Planning & Improvement					
Strategic Business Development & Planning					
Establishing new connections & opportunities					
Business Improvements (work task efficiencies)					
Facilitation & Training					
Training/Mentoring Development					
Workshop/Stakeholder Engagement					



Australian Water Association & Water Recycling Australia & Stormwater Industry Association - Industry Innovation - 2003

Conceived the idea and established the Indented Head (Geelong) First Flush Reuse Pilot Project for the City of Greater Geelong, researched by CSIRO.



Stormwater WA - Integrated Stormwater Design - Awards for Excellence 2015

The first and largest public authority source control integrated stormwater management infrastructure project in Australia and the Southern Hemisphere.