



Curriculum Vitae:

Dr Tom Headley

Treatment Wetland & Eco-technology Specialist



Professional Profile

Dr Tom Headley is a constructed wetland specialist with over 20 years' experience in the research, design, construction and operation of ecological technologies for wastewater treatment. He has published over 20 scientific papers, given keynote presentations at international conferences, supervised PhD students and taught at post-graduate courses on treatment wetlands.

Since completing his PhD in 2004, Tom has worked in New Zealand, Fiji, Denmark, Germany, Turkey, the USA and throughout the Middle East applying the full spectrum of wetland technologies across a broad range of applications, including treatment of sewage, sludge, oilfield production water, landfill



Plate 1: System in Oman treating >100,000 ML/d of oilfield wastewater, with 350 ha Surface Flow Wetlands and 450 ha of ponds. Dr Tom has been involved with the design, construction, vegetation management and operation of the facility since 2011.

leachate, industrial effluents, stormwater and agricultural runoff. Noteworthy in this experience was the world's largest industrial constructed wetland system, consisting of >700 ha of surface flow wetlands and ponds for managing 115,000 m³/d of oilfield wastewater in the desert of Oman. As Head of the Treatment Wetland Competence Centre at BAUER Resources (2011 – 2015), Tom was involved with the design, construction and operation of this flagship example of what can be accomplished using ecological technologies.



Tom returned to Australia in 2015 to lead the Ecological Engineering team for 2 years at the Water and Carbon Group, delivering innovative solutions for treatment of sewage, landfill leachate and pioneering the introduction to Australia of wetland technologies for dewatering and stabilising waste activated sludge using Sludge Treatment Reed Beds (STRBs). This is being done in partnership with leading international STRB experts from Denmark (Steen Nielsen, Orbicon) and will revolutionise the way sewage sludge is managed in Australia; converting it into a high class biosolid with the power of nature (no inputs of electricity, chemicals or mechanical equipment).



Plate 2: A Sludge Treatment Wetland system in Denmark operating for 20 years, converting waste activated sludge into stabilised biosolids.

Currently, Tom operates as an independent consultant, offering his expertise and services throughout Australia and internationally via Wetland & Ecological Treatment Systems Pty Ltd (WET Systems). WET System's goal is to foster the development and implementation of sustainable wastewater management solutions where they are needed most to protect the future of our water resources together with the well-being of those that depend on them. WET Systems pride themselves on providing world-class, cutting-edge expertise in a flexible and dynamic way to ensure a valuable service is provided at the highest levels of integrity and quality.



Plate 3: The 350 ha constructed wetland for which Dr Tom has been senior wetland expert for since 2011. Built in the Oman desert, each 10 ha cell was planted with a range of native wetland plants.



Core Competencies

- Design and implementation of natural and sustainable systems for wastewater treatment
- Wastewater engineering (mining, sewage, sludge, leachate, agricultural, industrial)
- Operation and maintenance of treatment wetland systems
- Effluent reuse and irrigation
- Applied science of wetland ecology
- Scientific research and publishing
- Teaching and training

Qualifications

- PhD in Applied Science: Constructed wetlands for management of horticultural wastewater
Southern Cross University (1998 – 2004)
- Honours Degree in Environmental Resource Management: Constructed wetlands treating school wastewater
Southern Cross University (1997 – 1998)
- Bachelor of Applied Science (Conservation Technology)
Southern Cross University (1994 – 1996)

Training

- MEDLI training (Introductory and Advanced)
- Post-graduate course in the Use of Wetlands for Water Pollution Control Aarhus University
- MS Project Introduction
- Māori Cultural and Language Course, Te Kūwaha (NIWA)
- Sand Filter Training Course, Centre for Environmental Training
- MUSIC® Modeling Course (Model for Urban Stormwater Improvement Conceptualisation)
- Wetland Management Workshop
Wetland Care Australia
- On-Site Waste Water Disposal Training Course
Centre for Environmental Training

Professional History

Present

Director & Constructed Wetland Specialist
Wetland & Ecological Treatment Systems
Maitland, Australia

2015 - 2017

Head of Ecological Engineering
Water and Carbon Group
Brisbane, Australia

2011 - 2015

Head of Constructed Wetlands Competence Centre
BAUER Resources
Muscat, Oman

2008 – 2011

Lead Scientist (Ecological Engineering)
Helmholtz Centre for Environmental Research (UFZ)
Leipzig, Germany

2006 – 2008

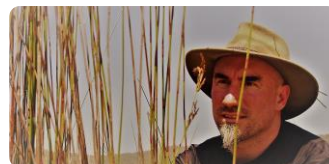
Ecotechnology Scientist
National Institute of Water & Atmospheric Research (NIWA)
Hamilton, New Zealand

2004 – 2007

Managing Partner
Wet Feet Aquatics (consulting, wetland nursery)
Lismore, NSW

2003 – 2006

Research Associate
Centre for Eco-Technology, Southern Cross University
Lismore, NSW



Portfolio of Selected Projects

Nimr Water Treatment Plant



Date:	2011 – present
Location:	Nimr Oilfield, Oman
Role in project:	Senior Wetland Expert for design, construction, planting, commissioning, operation and research activities
Wastewater type:	Oilfield Produced Water
Capacity	115,000 m ³ /day (currently designing expansion for additional 60,000 m ³ /d)
Technology used:	Treatment: Surface Flow Wetlands (350 ha), Hydrocyclone oil-water separators, ponds. Disposal/Reuse: Irrigation of biosaline agriculture, drill water, solar saltworks evaporation.



Wastewater Management System for Sundrop Farms

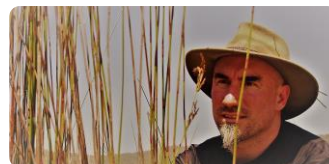


Date:	2015 - 2016
Location:	Port Augusta, South Australia
Role in project:	Design, Construct, Commissioning
Wastewater type:	Mixed (sewage, hydroponic irrigation water and industrial wastewater)
Capacity	22 m ³ /d
Technology used:	Treatment: Anaerobic Baffled Reactors followed by Vertical Flow Wetland Disposal: Evapotranspiration/Absorption Beds

Decentralised Wastewater Management System for Jubullum Aboriginal Community



Date:	2006 - 2007
Location:	Jubullum, New South Wales, Australia
Role in project:	Design, Construction, Commissioning
Wastewater type:	Domestic wastewater
Capacity	400 EP
Technology used:	Treatment: On-site Septic Tanks, Facultative Pond, Surface Flow Wetland, Horizontal Subsurface Flow Wetland (zero electricity) Disposal: Subsurface irrigation of pasture and citrus trees (via gravity)



Farha Oilfield Sewage Management System



Date:	2014 – 2015
Location:	Farha Oilfield, Oman
Role in project:	Design, construct, plant, commission, operate and monitor
Wastewater type:	Decentralised sewage
Capacity	120 m ³ /day
Technology used:	2 – stage Vertical Flow Wetland (raw sewage direct on 1 st stage)



Narrogin Sewage Treatment System Upgrade

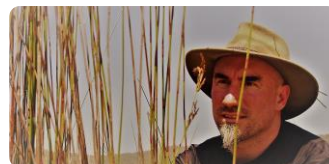


Date:	2015 – 2017
Location:	Narrogin, Western Australia
Role in project:	Planting, Commissioning and Vegetation Maintenance (designed by others)
Wastewater type:	Domestic sewage
Capacity	1 ML/day
Technology used:	Surface Flow Wetlands (2 ha)

Votua Village Decentralised Wastewater Management System



Date:	2006 – 2009
Location:	Votua Village, Fiji
Role in project:	Designed decentralized wetland treatment system for blackwater Developed and installed on-site greywater management systems
Wastewater type:	Domestic wastewater
Capacity	300 EP
Technology used:	Blackwater: on-site septic tanks, STEP sewer, Vertical Flow Wetland, Horizontal Subsurface Flow Wetlands, Surface Flow wetland gardens Greywater: Coconut husk and coral rock infiltration filters



Al Fuhais Decentralised Wastewater Demonstration Plant

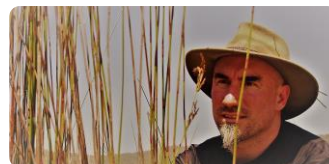


Date:	2008 - 2011
Location:	Al Fuhais, Jordan
Role in project:	Design, construction supervision, commissioning, monitoring and training for eco-technology systems at the demonstration plant
Wastewater type:	Municipal sewage
Capacity	1 m ³ /d
Technology used:	<ol style="list-style-type: none"> 1) Septic Tank followed by 2-stage Vertical Flow Wetland 2) Septic Tank with Recirculating Vertical Flow Wetland

Langenreichenbach Ecotechnology Research Facility



Date:	2008 - 2012
Location:	Langenreichenbach, Germany
Role in project:	Design and construct research facility, plan and coordinate research activities
Wastewater type:	Decentralised Domestic Wastewater
Capacity	15 x pilot plants
Technology used:	Vertical Flow Wetlands, Horizontal Subsurface Flow Wetlands, Aerated Subsurface Flow Wetlands, Reciprocating Fill and Drain beds



Lismore Landfill Leachate Treatment System



Date:	2003 - 2004
Location:	Lismore, NSW, Australia
Role in project:	Feasibility Study, Pilot Plant, Full-scale Design, Construction QC, Planting
Wastewater type:	Landfill Leachate
Capacity	40 m ³ /day
Technology used:	Ponds, Surface Flow Wetlands, Vertical Flow Sand Filter

Horticulture Runoff Treatment and Recycling System for Bau Farm Nursery



Date:	2000 - 2001
Location:	Lindendale, NSW, Australia
Role in project:	Design, Construct, Plant, Commission
Wastewater type:	Horticultural runoff
Capacity	125 m ³ /day
Technology used:	Treatment: Horizontal Subsurface Flow Wetlands Disposal/reuse: recycled for irrigation water within the nursery



Relevant-experience

Wetland & Ecological Treatment Systems (2017 – present) MAITLAND, AUSTRALIA

- Constructed wetland consultant for BAUER Resources, providing expert advice on maintenance and expansion of the 700-ha surface flow wetland and pond based system for managing > 110,000 m³/d of wastewater from an oilfield in Oman.
- Constructed wetland design services for polishing of effluent from sewage treatment plants in New Zealand, Australia and Asia.

Water and Carbon Group (2015 – 2017) BRISBANE, AUSTRALIA

- Feasibility Study for the Sydney Olympic Park Authority, to identify preferred options for treatment and reuse/disposal of leachate from four of their landfills.
- Design and construction of the wastewater treatment systems for Sundrop Farms, Port Augusta, South Australia. System involved treatment without use of power, with primary treatment in Anaerobic Baffled Reactors, secondary treatment in Vertical Flow Wetland and disposal of effluent via absorption beds.
- Concept design of 10 ha tertiary treatment wetland system for proposed STP at Cedar Grove, QLD, for Logan Water Infrastructure Alliance. Goal was to reduce the N and P loads by at least 50%, provide treatment of peak and emergency bypass flows in order to facilitate gaining approval from regulator to discharge to the Logan River downstream of Cedar Grove weir.
- Leading WCG's program of Sludge Treatment Reed Bed pilot projects, including trials at Wacol STP (2016 – 2017) and Coolum STP (2017).
- Commissioning Manager for the Narrogin Wastewater Treatment Plant upgrade, including plastic media trickling filter, wetland planting & establishment (45,000 plants) and performance proving.

BAUER Resources (2011 – 2015) OMAN

- Head of BAUER's Constructed Wetland Competence Centre, leading a team specialising in the design, construction and operation of natural treatment systems for the sustainable management of all kinds of contaminated waters (centralized and decentralized municipal sewage and sludge, produced water from the oil industry, industrial wastewaters, agricultural and urban stormwater). Operating internationally.
- Developed the largest constructed wetland project in the world, with 750 ha of surface flow wetlands and ponds, treating 115,000 m³/day of oilfield production water.
- 120 m³/day sewage treatment wetland and irrigation reuse system for remote oilfield camps.
- Leading research projects investigating the effects of polymers on constructed wetlands, and reuse of brackish produced water for irrigation of salt tolerant plants.



Helmholtz Centre for Environmental Research (2008 – 2011) LEIPZIG, GERMANY

- Coordination of research projects on the use and adaptation of Eco technologies for wastewater treatment in arid climates:
 - Development and design of appropriate constructed wetland technology for decentralized wastewater treatment in the Middle East (within SMART IWRM project)
 - Investigations into wetland plant water use efficiency and salt uptake in Jordan and Germany
 - Identification and assessment of plant species in Jordan for use in constructed wetlands
 - Managing research program on constructed wetlands and sand filter systems in Jordan and Germany
- Design, construction, and operation and monitoring of a decentralized wastewater treatment and reuse facility in Amman, Jordan for the purpose of technology transfer and demonstration, capacity building and research. The site includes 6 different treatment technologies (including sludge management) and 8 irrigation reuse fields and is part of a large IWRM program between Germany and Jordan (SMART), with a focus on technology development and knowledge transfer.
- Management of the construction of a state-of-the-art Eco technological wastewater treatment research facility in Germany, including the research strategy, design of treatment systems and monitoring equipment, supervision of staff and contracting for construction, funding acquisition, budget management and scheduling. The site includes 15 pilot scale constructed wetlands and other Eco technology systems.
- Management of the monitoring program for the above research facility, including staff and graduate students.
- Research collaboration with the China East Normal University in Shanghai on development of constructed wetland research activities for the remediation of polluted canals in Shanghai
- Graduate-level lecturing on Constructed Wetlands as Visiting Scholar at Ecole de Mines (France) and Aarhus University (Denmark)
- Supervision of Masters and PhD students, in Germany, Jordan and China
- Preparation of funding proposals at institutional, national and European levels.
- Publishing and presenting results

National Institute of Water & Atmospheric Research (NIWA) (2006 – 2008) NEW ZEALAND

- Design of sewage treatment and reuse wetland system for Votua Village, Fiji (NZ AID).
- Research and development of “floating wetland” treatment system for passive metal and nutrient removal from stormwater and eutrophic lake water (several projects for Auckland Regional Council, Environment Bay of Plenty and Hamilton City Council).
- Research into hydraulic and nutrient removal processes within field-scale surface flow wetlands treating dairy farm runoff (NZ Govt. funded research program).
- Design, construction and monitoring of a research pilot system for landfill leachate treatment at Tirohia landfill including the use of ponds, wetlands, wood-chip filter and land application (HG Leach Ltd).
- Technical guidance on implementation of appropriate technologies for improving on-site wastewater management in remote/poor NZ communities. Technologies included wastewater filters using peat, sand and crushed glass as media (Gisborne District Council, SWANSIG).
- Community-based seminars and workshops on sustainable water management at the household level, such as the “Green Homes Workshop Series” for Hamilton City Council.
- Design of constructed wetland systems for municipal sewage treatment for NZ townships:
 - Kaiapoi sewage treatment plant (STP), 26,000 KL per day (for URS International Ltd)
 - Ngunguru STP, 300 KL per day (for OPUS International Ltd)



- Kaikohe STP, 1500 KL per day (for OPUS International Ltd)
- Publishing and presenting results

Wet Feet Aquatics (2004 – 2007) LISMORE, AUSTRALIA

- Responsible for business management, design and implementation of constructed wetland treatment and reuse systems and nursery management (propagation, supply and planting of native wetland plants).
- Design and construction of wastewater treatment and irrigation reuse system for remote Aboriginal community (350 people) in north-eastern NSW (Jubullum), (for Department of Commerce).
- Review of options and detailed design of wetland-based wastewater treatment and reuse system for 1000 person settlement at remote Zinc mine in north-western QLD (for Zinifex Century Mine).
- Design and installation of numerous on-site wastewater management systems (from single households to village shopping centres) in northern NSW using wetlands/sand filters, subsurface irrigation, evapotranspiration/absorption beds.
- Assessment of site and soil capabilities to manage wastewater on-site for proposed rural land subdivisions.
- Development and editing of guidelines for design and construction of constructed wetlands on-site wastewater management (Lismore City Council, Byron Shire Council).
- Construction of waterless composting toilet systems and greywater management systems.
- Augmentation of wetland/pond/urban drainage systems to improve aesthetic and stormwater treatment values (e.g. Tweed Shire Council, Lismore City Council).

Centre for Eco-technology, Southern Cross University (2003 – 2006) LISMORE, AUSTRALIA

- Responsible for research and consultancy activities, including:
 - Establishment and management of on-site wastewater treatment trials using wetland and sand-filter systems.
 - Supervision of research students (Southern Cross University).
 - Piloting and subsequent design of full-scale constructed wetland system for treating leachate from the Whyralla Road landfill; 40 m³/d (for Lismore City Council).
 - Health risk assessment: on-site wastewater systems in Northern Rivers regional water supply catchments (collaboration with GHD Ltd, for Rous Water).
 - Development, design and implementation of agricultural runoff treatment and irrigation recycling systems.
 - Delivery of professional training courses, workshops and seminars on wetland design and construction, water quality and ecological sanitation.
 - Writing of funding applications to support research and consulting activities.
 - Publishing and presenting results



Publications

- Abed, R.M.M, Al-Kharusi, S., Gkorezis, P., Prigent, S. Headley T. (2017). "Bacterial communities in the rhizosphere of *Phragmites australis* from an oil-polluted wetland", *Archives of Agronomy and Soil Science*.
- Abed RM, Al-Kharusi S, Prigent S, Headley T. (2014). "Diversity, distribution and hydrocarbon biodegradation capabilities of microbial communities in oil-contaminated cyanobacterial mats from a constructed wetland.", *PLoS One*.
- Avila C, Nivala J, Olsson L, Kassa K, Headley T, Mueller RA, Bayona JM, García J. (2014). "Emerging organic contaminants in vertical subsurface flow constructed wetlands: influence of media size, loading frequency and use of active aeration", *Sci Total Environ*.
- Schaller J, Headley T, Prigent S, Breuer R. (2014). "Potential mining of lithium, beryllium and strontium from oilfield wastewater after enrichment in constructed wetlands and ponds", *Sci Total Environ*.
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- Tanner, C.C. Sukias, J.P.S., Headley, T.R., Yates, C.R., and Stott, R. (2012). "Constructed wetlands and denitrifying bioreactors for on-site and decentralized wastewater treatment: comparison of five alternative configurations", *Ecological Engineering*. 42: 112 – 123.
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- Fonder, N., and Headley, T. R., (2010), "Systematic classification, nomenclature and reporting for constructed treatment wetlands". In: *Water and Nutrient Management in Natural and Constructed Wetlands*, Vymazal J. (ed.) Springer, Dordrecht, The Netherlands, pp: 191 - 219.
- van Afferden, M., Cardona, J.A., Rahman, K.Z., Daoud, R., Headley, T., Kilani, Z., Subah, A., and Mueller, R. (2010). "A step towards decentralized wastewater management in the Lower Jordan Rift Valley", *Water Science and Technology*, 61 (12): 3117 – 3128.
- Headley, T.R. and Kadlec, R.H. (2007), "Conducting Hydraulic Tracer Studies in Constructed Wetlands: A Practical Guide", *Ecohydrology and Hydrobiology*, 7 (3-4): 269 – 282.
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- Bayley, M. Davison, L. and Headley, TR., (2003), "Nitrogen Removal from Domestic Effluent Using Subsurface Flow Constructed Wetlands: Influence of Depth, Hydraulic Residence Time and Pre-nitrification", *Water Science and Technology*, **48** (5): 175- 182.
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