

**AREAS OF EXPERTISE**

- project management
- contract management
- business management
- quality management
- health & safety
- water management
- hydrogeology
- water supply development and management
- water licensing
- wastewater & contaminant management
- mine water control
- groundwater modelling

**EDUCATION**

Flinders University of South Australia, Bachelor of Science (Geology), 1986

Deakin University/  
Association of Professional Engineers Scientists & Managers, Australia, MBA (Technology Management), progressive

**PROFESSIONAL HISTORY**

Saprolite Environmental, Senior Principal Consultant, 2012 to present

Saprolite Pty Ltd, Managing Director, 2012 to present

Saprolite Environmental, Principal Consulting Hydrogeologist, 2009 to 2012

Saprolite Pty Ltd, General Manager, 2009 to 2012

Rich Consulting Services, Principal Consulting Hydrogeologist, '99 to 2009  
Richards & Associates (WA) Pty Limited, Director, '99 to 2012

Woodward-Clyde, Senior Hydrogeologist, '96 to '99

**REPRESENTATIVE EXPERIENCE**

Garth Richards, Principal Consultant, has worked in the industry since 1985. His fields of expertise are project management, water management, hydrogeology, geology, geophysics, and quality management. Much of his experience has been in the investigation, development and management of groundwater resources throughout Western Australia and in the Northern Territory. He also has considerable experience in mine water control/dewatering studies for the mining industry in Western Australia and Queensland. He has participated in a wide range of projects at all levels up to project management/direction, and since 2001, management of staff, field and office.

**EXPERT WITNESS**

- Provision of expert advice in matters concerning search for groundwater associated with Murrin Murrin's water supply projects.

**STAKEHOLDER CONSULTATION**

- Stakeholder and community presentations on behalf of Murrin Murrin with respect to their water supply projects, general overview on the principals of hydrogeology, water resources and palaeochannel development within WA's NE Goldfields.

**WATER LICENSING**

- Direct liaison and lobbying with Department of Water on behalf of clients. Work also includes preparation of licence applications and amendments, operating strategies, monitoring programs, DMP tenograph plans, general tenement location plans, advertising requirements. Clients have included Agnew, Lawlers, Murrin Murrin, Jundee, Hermes, Simcoa, Norton Paddington Operations, and Venturex.
- Review and input into the preparation of Notice of Intent and Borefield Development Plan for Environmental Approvals for the proposed development of the Grey Mare Borefield at Murrin Murrin.

**HYDROLOGY AND SURFACE WATER STUDIES**

- Catchment mapping for surface water harvesting projects at Murrin Murrin, Jundee, and Agnew.
- Project direction and management of technical staff for surface water hydrological studies and drainage designs at Venturex (Whim Creek) and Jupiter Mines (Mt Mason), and for water harvesting projects at Murrin Murrin, Jundee and Agnew.
- Desktop review and assessment of surface water/groundwater interactions at Mt Garnet and Surveyor-Balcooma (NQ).
- Third party independent review of other consultant's hydrological and surface water studies (Mt Mason).

**MINE WATER CONTROL**

- Mine dewatering investigations at NSR's Hermes Gold Project, including technical direction and management of production and monitor bore installation, test pumping, hydraulic analyses, stakeholder liaison, hydrogeological reporting and licensing

Woodward-Clyde, Project Hydrogeologist, '94 to '95  
Hydro Resources / Resource Investigations,  
Hydrogeologist to Senior Hydrogeologist, '92 to '94  
Western Mining Corporation (Exploration Division)  
Geologist to Hydrogeologist, '87 to '92

Western Mining Corporation (Windarra Nickel Project),  
Geological Assistant, '86  
CRA Exploration (South Australia), Field Assistant, '86

AMDEL (South Australia),  
Technical Assistant, '85

## **TRAINING**

Area Warden Course, '01

Job Safety Analysis Training, '01

Mining and Resource Contractors Safety & Training Association (MARCSTA) Induction, '97, 2000, '02, '04, '06

Internal Auditor Training ISO 9001, 9002, 9003, Quality Assurance Services, '98

Senior First Aid Certificate, St Johns Ambulance, '97, '00

24 Hour Health and Safety Course, Woodward-Clyde, '96

Project Management Course, Woodward-Clyde, '95.

5 Day Fundamental of Supervision Course, AIM '90

3 Day 4WD Training, '92

1 day 4WD Training, '01

AMF 9th Groundwater School, Adelaide, '87

## **MINE WATER CONTROL (CONT)**

- Mine dewatering investigations at Simcoa's Moora Quartz Mine, including dewater and monitor bore installation, test pumping, hydraulic analyses, stakeholder liaison, hydrogeological reporting and licensing
- Preliminary hydrogeological investigations of potential dewatering impacts from the proposed Mt Mason Hematite Project (WA Goldfields). Work included 3<sup>rd</sup> party technical review, desktop study and scoping study.
- Preliminary investigations for pre-feasibility of pit dewatering from open pits at Murrin Murrin's laterite nickel project.
- Provision of expert technical advice in matters associated with groundwater, dewatering impacts, and water quality issues in relation to the Caijiaying Zinc-Gold Project, Hebei Province, China.
- Site supervision of drilling, installation and testing of dewatering bores in palaeochannel and fractured rock aquifers at Mt Pleasant Gold Operations (WA).
- Project management and field management of the Cockburn Pit dewatering borefield augmentation and operation at Mt McClure Gold Mine (WA).
- Project management and field management of drilling and testing of a dewatering wellfield (60 ML/d from 12 bores 300m deep) in a Cambrian limestone aquifer for the Century Zinc Mine (Queensland).
- Hydrogeological and dewatering studies of the Wedge Pit and Toedter Pit at Gidgee (WA) which included impact assessment of dewatering on other groundwater users.
- Dewatering investigations at open cut gold mines at Bronzewing (WA). This included supervision and reporting on the installation and testing of production dewatering bores.
- Pre-feasibility dewatering investigations at proposed open cut nickel mines at Honeymoon Well (WA). This also included supervision and reporting of installation and testing of test dewatering bores.
- Supervision and reporting of installation and testing of dewatering bores at open cut nickel and gold mines at Forrestania and Ora Banda (WA), and underground nickel mines at Forrestania.
- Investigations to assess potential groundwater inflows and dewatering requirements to established underground mines at Agnew and Leinster (WA).

## **WATER SUPPLY SCHEMES**

- Project Manager, Director and Field Supervisor for the development of an 18ML/d palaeochannel borefield at Grey Mare, 100km NW of Murrin Murrin (WA). Work included development of all technical work scopes, tender calls for drilling and test pumping. Stage 1 was completed in 2006 with 20 production bores and Stage 2 in 2007 with 18 production bores. The total project comprised 5-6 months each Stage with the management of a team of wellsite supervisors, 2 to 3 drilling rigs and 2 test pumping rigs, surveyors, geophysical wireline logging contractor and earth moving contractors.

**AFFILIATIONS**

Australian Institute of Geoscientists

International Association of Hydrogeologists

Geological Society of Australia

Australian Drilling Industry Association

**WATER SUPPLY SCHEMES (CONTINUED)**

- Hydrogeological and water resource technical advisor to Murrin Murrin Operations, including provision of ongoing Borefield Performance Assessments on 4 palaeochannel borefields (NE Goldfields) that included 110+ production bores pumping in excess of 27ML/d.
- Ongoing advice for Murrin Murrin for total site water management, including scoping studies, test pumping analyses, overseeing technical works programs, reviewing work undertaken by others. Regional investigation desk-top studies and literature reviews.
- Supervision and reporting of drilling and testing exploration and production bores to supply process water to Bronzewing Gold Operations (WA).
- Hydrogeological and water resource technical advisor to Jundee Operations (Jundee/Nimary), including provision of Borefield Performance Assessments and Hydrogeological Review on 2 borefields that included 12 production bores pumping 4ML/d.
- Field management of drilling and testing two 300mmND subartesian production bores and two monitoring bores completed at depths of 350m at Eneabba (WA) for the North Mine mineral sand project. Pumping yields were in excess of 4.3 ML/d from each bore completed in the Yarragadee Formation of the Perth Basin.
- Project management and field management of drilling and testing two 200 mmND artesian bores to depths of 550 metres at Lake Macleod for the Dampier Salt Gypsum Project (WA). Total free flowing discharge is 3 ML/d, and water temperature is 50°C.
- Field management and site supervision of drilling and testing programmes including borefield development. Such projects include 3.5 ML/d borefield at McArthur River (NT) and 12 ML/d borefield at Paraburdoo (WA).
- Regional study and assessment of potable and process groundwater supply prospects within 50km of Honeymoon Well Joint Venture (WA). Supervision and reporting of drilling and testing exploration and production bores in various aquifers to supply potable water to a proposed 300 person camp and process water to a proposed nickel processing plant.
- Supervision and reporting of drilling and testing low yielding exploration and production bores to supply potable water to Forrestania (WA).
- Project management, supervision and reporting of supply & development of groundwater resources for process requirements (3 ML/d) for Leinster Nickel Op. and potable water for the mill/mine and Leinster Township. This included the Mid-Gum Pool and Alans Pool Borefield. This also involved regional groundwater investigations and the training of field personnel.

**WATER SUPPLY SCHEMES (CONTINUED)**

- Regional studies & assessments of water supply prospects & supervision of & reporting on exploration drilling & installation & testing of bores to supply process/potable groundwater to the following W.A. projects/areas: Agnew, Davyhurst, Jasper Hill, Kambalda, Lady Bountiful, New Mexico, Sand King/Siberia, Thiel Well.
- Hydrogeological assessment and reporting for agricultural property in Northern Perth Basin for compliance with Department of Fire and Emergency Services (DFES) for water supplies for fire hydrants and systems.
- Project direction and technical management of technical staff in the design and supervision of replacement production bore at Twin Bonanza Gold Project (Tanami –NT). Work also included design, implementation, analysis and reporting of a test pumping program on 3 water supply production bores.

**WASTEWATER AND CONTAMINANT MANAGEMENT**

- Hydrogeological assessment of waste management facilities at Mt Garnet (NQ).
- Seepage management and hydrogeological investigations into the migration of contaminant seepage from paddock and In-pit tailings storage facilities in NE Goldfields, WA (Agnew, Lawlers, Murrin Murrin, Jundee), and in Pilbara, WA (Whim Creek)
- Project management, technical supervision and direction of drilling and installation works for seepage recovery bores at Murrin Murrin's tailings storage facilities (WA), including site supervision of bore drilling, baseline chemical testing, trial testing and test pumping, modelling and reporting.
- Project management and technical direction of drilling and installation works for seepage indication/recovery bores and monitor bores at waste storage facilities at Murrin Murrin, Jundee, Agnew, Lawlers and Whim Creek.
- Acid rock drainage investigations and seepage investigations of ore stockpiles and concentrate storage facilities for a confidential client in WA.
- Environmental compliance reporting for a confidential industrial site at Kwinana, WA.
- Project management and specialist hydrogeological advice for Phase I and II Environmental Site Assessments, Groundwater Monitoring Events, Soil Validation, and Soil Remediation projects for selected Service Stations in Perth, and country WA.
- Site supervision and reporting of drilling and construction of experimental observation and production bores for recovery of contaminants beneath an industrial site at Baldivis (WA).
- Phase 1 hydrogeological assessments, including site reconnaissance, desktop study and scoping study; and Phase 2 hydrogeological assessments including project and technical direction for the installation of monitoring bores, baseline testing and reporting. of fertiliser operations at Albany, Esperance and Geraldton

**PROJECT AND BUSINESS MANAGEMENT**

- EPCM Contractor role in management of a large water supply borefield project (Grey Mare – Murrin Murrin), including Camp Management in a remote area, Contractor Management, Logistics, Communications, Health and Safety. Capital cost for borefield was \$70M+
- Project management, in a non-technical role, over a 12-month period, for a landslide-engineering project. The project objectives included geotechnical investigation and assessment as part of review of major rock slope failure affecting a \$US1.98 billion Power Station and National Highway construction in Indonesia.

**QUALITY ASSURANCE**

- Design & implementation of Management Systems for Quality Assurance & Quality Control in Hydrological and Hydrogeological Work Practices to AS/NZSISO.9001, World Health Org and Aust. Drinking Water Guidelines.
- Design and implementation of work procedures, guidelines, checklists, and forms for work practises in hydrology and hydrogeology in accordance with AS/NZS 5667.

**GROUNDWATER MONITORING & WATER MANAGEMENT**

- Hydrogeological assessment and total site water management of Mt Garnet and Surveyor-Balcooma Mine sites in NQ.
- Design, planning and implementation of Sampling, Measurement and Analysis Plans (SMAPs) using QA/QC management principles for monitoring surface water and ground water at various mining operations within WA. Including: Agnew, Lawlers, Three Springs, Mt Keith, Murrin Murrin, Tronox (Kwinana), and Venturex (Whim Creek). Also included a Job Management role at Mt Keith, Lawlers, Murrin Murrin, and Whim Creek.
- Design of baseline groundwater monitoring bores, and technical management and support for the drilling and installation of 18 monitor bores at Twin Bonanza Gold Project (Tanami –NT). This also included detailed review and assessment of the existing Standard Operating Procedure for Groundwater Monitoring
- Project direction and management of technical staff in the baseline monitoring of completed monitoring bores and production bores at Twin Bonanza (NT), including co-author of hydrogeological baseline and bore completion report.
- Project direction and management of quarterly groundwater monitoring at a fertiliser operations at Kwinana.
- Training of clients' monitoring staff and own staff in the implementation of the SMAPs, and in water monitoring and sampling techniques, including calibration of equipment, baseline testing, field water quality measurements, sample preservation, the use of sampling and monitoring equipment.

**GROUNDWATER MONITORING & WATER MANAGEMENT (CONT)**

- Review and audit of Kalgoorlie Nickel Smelter and Kambalda Nickel Concentrator, in relation to their respective groundwater and surface water data, monitoring programmes, and issues (potential and otherwise) that are prevalent at these operations.
- Design, planning and implementation of Sampling, Measurement and Analysis Plans (SMAPs) using QA/QC management principles for monitoring potable water supply systems at various mining operations within WA. Including: Mt Keith and West Musgraves.
- Development of a Drinking Water Quality Management Plan for compliance with Small Community water supply guidelines, as per Department of Health criteria, and Australian Drinking Water Guidelines.
- Implementation, supervision & reporting of groundwater monitoring programmes & procedures for water supply schemes at Agnew, Kambalda, Leinster & Sand King/Siberia, in W.A.
- Groundwater monitoring reporting associated with Groundwater Well Licences for groundwater extraction schemes at Agnew, Bannockburn, Gidgee, Jubilee, Jundee/Nimary, Lawlers, Leinster, Meekatharra, Mt McClure, Mt Keith, Mt Monger, Mt Morgans, Mt Pleasant, Murrin Murrin, Ora Banda, Plutonic, and Paddington (W.A. Goldfields), Kemerton (south-west coast), Lake Macleod, Three Springs and Moora (west coast), Cadjebut, Paraburdoo, Tom Price and Whim Creek (Pilbara) in WA; & at McArthur River in NT.
- Annual environmental and groundwater monitoring compliance reports for Government environmental authorities for mining operations at Agnew, Bannockburn, Jundee/Nimary, Lawlers, Meekatharra, Mt Keith, Mt Morgans, Murrin Murrin (W.A. Goldfields), and Three Springs (west coast) in WA, and for fertiliser and mineral processing at Kwinana (Perth Basin).

**BOREFIELD REHABILITATION**

- Project Director, Manager and Peer Reviewer of bore rehabilitation of selected production bores at the Sandhill Well Borefield at Jundee Gold Mine.
- Supervision and reporting of the rehabilitation of five production bores that were affected by iron bacteria that were previously completed into the Yarragadee Formation of the Perth Basin Eneabba (WA).
- Design and partial supervision of rehabilitation of four production bores that were affected by iron encrustation in the Emu Borefield (Agnew, WA).

**GROUNDWATER MODELLING**

- Multi-layer groundwater flow model predictions, calibration, data auditing, and transient simulations for dewatering at Century Mine (Qld), and Ernest Henry (Qld).
- Multi-layer groundwater flow model development for use in long term pumping optimisation on palaeochannel sand aquifers at Leinster (WA) and in open cut dewatering scenarios in anisotropic fractured rock aquifers at Forrestania (WA).
- Multi-layer conceptual groundwater flow model design and set-up for numerical modelling at Murrin Murrin Borefields including overall project direction and management.