Office 16
Level 4, 60 Moorabool Street
Geelong VIC 3220
P +61 3 7068 5699
E mailbox@psm.com.au
www.psm.com.au

Our Ref: PSM5665-016L

6 February 2025

McRaes Landslide
Harwood Andrews Legal
70 Gheringhap Street
Geelong VIC 3220
bbroadhead@ha.legal

Attention: Ben Broadhead

Dear Ben Broadhead

RE: MCRAES LAND SLIDE REVERSE BRIEF AND PROPOSAL

1. Introduction

This letter provides Harwood Andrews Legal (HA) and Mornington Shire Council (Council) details of scope PSM has performed to date, or been requested to be performed at this time, to establish a reverse brief of PSM's current scope and our proposal to perform that scope. We expect this scope will continue to evolve as the investigations and assessment of the landslide continue. We will continue to provide updated proposals to capture the evolution of scope and budget as this occurs.

PSM was initially requested to provide advice to Mornington Peninsula Council (Council) on the McRaes landslide following the initial landslide event on 5 January 2025. PSM has continued to provide geotechnical advice and services to Council since that time. This advice has been in response to numerous requests from Council and/or Council's legal representation Harwood Andrews Legal who has engaged PSM on Council's behalf.

This reverse brief and proposal has been prepared as follows:

1. Project Timeline and correspondence.
2. Scope completed to date.
3. Proposed scope.
4. Project Program.
5. Project budget.
6. Key personnel.
7. Project Administration.
8. Closing comments.

2. Project Timeline and Correspondence

We provide the following summary of the project timeline and advise issued to date:

- 5 January 2025 – Initial Landslide occurred at night with debris striking property at 3 Penny Lane.
- 7 January 2025, PSM Email: *PSM5226-017E Preliminary landslide risk assessment 3 Penny Lane, McCrae, VIC* – Preliminary landslide risk assessment following landslide impacting a property at 3 Penny Lane McRae at the request of Council and following a site visit on 6 January 2025.
- 14 January 2025 – Second and larger landslide occurred with debris striking property at 3 Penny Lane.
- 15 January 2025 – in person community consultation by a Principal Geotechnical Engineer (Dromana meeting and interviews with property owners thereafter).
- 16 January 2025 LIDAR Survey completed and with links to data provided within seven days of fieldwork.
- 17 January 2025, PSM email: PSM5665 Impacted / at danger properties - Landslip site – Advice in response to Council's request regarding Evacuation orders.

3. Scope to Date

3.1 Scope Completed to Date

The scope completed to date is summarised as follows:

1. Initial response to Council request for assistance after 5 January 2025 event (including preliminary risk assessment to support).
2. Emergency response to support Evacuation Orders after 14 January 2025 event.
3. Meeting attendance with various parties including Council, SES, Community group, others.
4. LIDAR survey and Photogrammetry Modelling – includes disbursement to procure from Diodrone Pty Ltd and post processing of LIDAR and imagery by geospatial scientist for use.
5. Recover historical aerial imagery - includes disbursement to procure from Lotsearch Pty Ltd.
6. Water quality surface water sampling by JBSG (includes disbursement to JBSG). Factual results received. Additional quote received for ongoing support.
7. Emergency Response Monitoring design development to support procurement including consideration of Radar, Prisms, Global Navigation Satellite System sensors, Tilt sensors and inSAR.
8. Preliminary Engineering Geological Mapping – Tim Nash site visit.
9. Mobilisation of IDS Radar to 10 View Point Drive – includes disbursement to procure and hire equipment from IDS (Ex. Brisbane). Remote real time monitoring now established.
10. Initial walkover over of Sewer assets up to and beyond Bay View Drive.
11. Design of intrusive investigation.
12. Additional LiDAR by plane for remainder of escarpment (4 February 2025).
13. Underground service clearance to support intrusive works. Completed 4th February 2025.

3.2 Scope Currently Underway

The scope currently underway is summarised as follows:

1. Additional historical aerial imagery search for escarpment.
2. Desktop study of escarpment.
3. Procurement of monitoring system (prisms, GNSS and tilt sensors).
4. Baseline monitoring of RADAR data to establish movement trends.
5. Procurement of drill rig, CPT rig for intrusive investigations.
6. Procurement of groundwater monitoring instruments.
7. Procurement of groundwater quality testing consultant.
8. Landslide characterisation of 2025 event and EO area.

9. Budget estimates and reverse brief.

4. Proposed Scope / Reverse Brief

We provide herein our proposed scope to continue to support HA and Council with the landslide investigation and risk management.

We have developed a Work Breakdown Structure for these Services as listed below and described in the following sections:

- Stage 000 - Project Management
- Stage 001 -Meetings
- Stage 002 - Initial Response
- Stage 010 - EO Area - Site investigation and Factual Reporting
- Stage 020 - Escarpment - Site investigation and Factual reporting
- Stage 030 - Monitoring Systems
- Stage 040 - Geotechnical Assessment & Report
- Stage 050 - Coburn Avenue Geotechnical Investigation & Advice00 Project Management.

4.1 Stage 001 - Project Management

This task relates to the project management of the project scope and cost including generating updated forecasts.

PSM will prepare and issue a weekly report every Tuesday for submission to HA and Council summarising the project status including the following information:

- Cost and budget summary including costs to date and weekly costs incurred in the previous week according to this work breakdown structure.
- Summary plot of total cost, budget and invoicing to date.
- Weekly Summary of Tasks and Status – a short dot point list of tasks completed in the previous week and general project status.
- Requests for Information Summary – Summary of information or other requests of HAL or Council requiring responses to inform PSM's scope.
- Scope and Budget Summary – Discussion of budget and scope including status of pending proposal approvals, etc.

We trust that this weekly report will provide HA and Council will real time status of the services being performed by PSM as they evolve with the demands of the project.

4.2 Stage 001 - Meetings

This task is to capture time spent at meetings required to be attended with HA/Council or third parties. We have provided a nominal weekly allowance for attendance at meetings.

4.3 Stage 002 - Initial Response

The task captures the initial four weeks of PSM's involvement from the 5th to 31st January. This included a variety of tasks as summarised at Section 3 up to the week ending 31st January 2025. This task will now be closed, with future fees and cost will be captured according to the scope definition of the other tasks described herein to improve the traceability of the scope being performed as we proceed in assisting HA and Council.

4.4 Stage 010 - EO Area - Site investigation and Factual Reporting

This scope relates to the site investigations to be performed within the Evacuation Order Area which will include borehole drilling, Cone Penetration Testing (CPT), sampling and laboratory testing and installation of monitoring equipment (ie VWP's and possibly inclinometers).

A detailed proposal for this scope has been issued (ref. PSM5665-017L, 6/02/2025).

This task will culminate in the compilation of a factual report of the site investigations undertaken that will inform the Stage 040 Geotechnical Assessment.

4.5 Stage 020 - Escarpment - Site Investigation and Factual Reporting

This scope relates to proposed site investigations to be performed across the broader escarpment.

A detailed proposal for this scope is currently under preparation and will be provided under separate cover.

This task will culminate in the compilation of a factual report of the site investigations undertaken that will inform the Stage 040 Geotechnical Assessment.

4.6 Stage 030 - Monitoring Systems

This task includes the development of a monitoring system and associated monitoring plan to monitor the ongoing slope performance including:

- Radar
- Survey prisms
- Global Navigation Satellite System sensors (GNSS)
- Tilt sensors.

We have compiled technical specifications for this monitoring and obtained quotes (competitive bid process with two suppliers) to procure this for the project that has been provided under separate cover.

Refer documentation:

- Diospatial Monitoring Proposal (Rev2), 25010.Q01 Rev2, 31 January 2025.

4.7 Stage 040 - Geotechnical Assessment & Report

This task captures the geotechnical assessment, analysis and generation of advice regarding the project. At this stage we have generated a resource-based estimate as this scope will evolve as the site investigations inform the ground model and the monitoring informs the slope performance.

We expect that this scope element will include the following tasks in the near term:

- Development of geotechnical model
- Monitoring data assessment and analysis
- Forensic assessment of site investigation and historical data
- Slope back-analysis
- Risk assessment, management and mitigation advice to HA, Council and potentially third parties
- Mitigation and remedial works options development
- Advice to HA and Council on status and performance of the site.

4.8 Stage 050 - Coburn Avenue Geotechnical Investigation Factual Geotechnical and Groundwater Investigations

HA have indicated that PSM will be requested to provide advice relating to this area upslope of the EO Area. The scope requirements for this area are yet to be confirmed, so will be updated as the scope becomes apparent.

5. Project Budget

Table 1 provides a summary of the budget forecast by task.

The detailed budget and program that informed this budget is attached that provides details on the estimate of resources, subcontractor and other expenses for each of the tasks described above. This estimate has been

generated from consideration of the next 12 weeks of the project (i.e. through to the week ending 24 April 2025). We note that this timeframe does not represent the completion of the scope but is considered to represent a reasonable period that forecast of fees and scope can be provided. A longer-term forecast can be provided on request or as the scope and program of the project becomes more clearly defined.

Table 1 – Summary of budget forecast to 24 April 2025 and costs as at week ending 31 January 2025

	Scope Stage	Budget Estimate	Cost to date
000	Project Management	Commercial in Confidence	
001	Meetings		
002	Initial Response		CIC
010	EO Area - Site investigation and Factual Reporting		
020	Escarpment - Site investigation and Factual reporting		
030	Monitoring Systems		
040	Geotechnical Assessment & Report		
050	Coburn Avenue Geotechnical Investigation Factual geotechnical and groundwater investigations	Awaiting confirmation of scope	
	TOTAL	Commercial in Confidence	

The estimate herein is contingent upon a number of variables so is expected to change as logistics, site access constraints, site investigation findings and other variables become apparent.

We will continue to update this forecast by both capturing cost to date with hindsight and estimation of future resources, subcontractor and expenses costs. As a minimum we propose to reforecast the project monthly to coincide with our invoicing cycle.

5.1 Project Rates

The following table summarises the project rates proposed for the project:

Table 2 – Project Rates

Position	Example Personnel (refer Key Personnel)	Rate
Senior Principal 1	Garry Mostyn	Commercial in Confidence
Senior Principal 2	Ben Rouvray	
Principal 1	Tim Nash	
Principal 2	Dane Pope	
Associate	Andrew Wilson, Christine Lion	
Senior Engineer	James Wang	
Engineer	Luke Lewis	
Geologist	Various	
Drafting/GIS	Various	
Project Administrator	Raina Kishore	
Engineering Assistant	Various	

6. Project Program

We have developed an indicative program and this is attached. Note that there are a number of variables that need to be confirmed that may affect this program. We will continue to update the program weekly as the project progresses.

The program is also communicated within our detailed budget estimate attached that communicates when tasks will be performed for the upcoming 12 week period.

The program milestones will continue to be updated as the scope develops.

7. Key Personnel

Please note that key personnel have been assigned based on our current project understanding. PSM is not resource constrained and can assign more resources on request.

The following key personnel are currently working on the project or are proposed to support the delivery of PSM's scope.

This team is supported by PSM's over 150 geotechnical personnel who will be utilised for various aspects of the project according to the scope and competency requirements ranging from senior personnel at a Principal level, to Associate, Senior and graduate level Geotechnical Engineers and Engineering Geologists.

The project will also be supported by a Project Administrator, drafting personnel and potentially engineering assistants (i.e. undergraduate staff) for data processing where required.

A detailed summary of rates for our various personnel is provided with the Project Budget.

Dane Pope – Principal Geotechnical Engineer - Project Lead

Dane has led PSM's scope to date for the project and will continue to lead PSM's involvement. Dane is based in Victoria and has previously advised Council on the 2022 slope stability matter at the Site.

Garry Mostyn – Senior Principal Geotechnical Engineer - Technical Reviewer

Garry is an industry leading geotechnical engineer with extensive experience in landslide forensic assessment, risk assessment, design and construction. Garry has also been an expert witness or subject matter expert for a significant number of geotechnical matters. Garry was a member of the AGS working group that delivered the Landslide guidelines that will be relevant to the project.

Tim Nash – Principal Engineering Geologist

Tim Nash has performed mapping at the landslide site and is proposed to continue as the engineering geology lead for eth development of the geological model for the project site.

Ben Rouvray – Senior Principal Geotechnical Engineer - Project Management

Ben Rouvray has a broad range of experience of leading projects ranging from small scale landslide investigation and remediation to delivery of major infrastructure projects and expert witness studies. Ben has been brought into the project to specifically relieve Dane of project management and administrative matters with the benefit of his technical understanding and experience of geotechnical project delivery. Ben will also be available as a Principal Geotechnical Engineer where required to support the project.

Andrew Wilson – Associate Geotechnical Engineer

Andrew will support Dane with geotechnical engineering assessment and analysis. Andrew has extensive experience of landslide assessment, risk management and delivery of remediation works.

Christine Lion – Geospatial Scientist

Christine retains unique and highly specialised skills with respect to geospatial data collation, analysis and assessment. She has supported numerous geotechnical projects utilising geospatial data to support the assessment of geotechnical behaviour and analysis of ground movement. Christine has already led the analysis and use of the LIDAR survey completed by Council.

Raina Kishore – Project Administrator

Raina is proposed to support the project owing to her experience with the delivery of expert witness and major infrastructure projects. She has extensive experience of program and budget management, document control and other administrative matters to ensure the project team is efficiently supported.

8. Project Administration

We provide herein a brief summary of Project Administration measures proposed for the project.

8.1 Terms and Conditions

We propose that PSM's engagement be in accordance with our standard terms and conditions. A copy of our standard terms is attached.

8.2 Project Status Reporting

In acknowledgement of the evolving scope for the McRaes landslide, we recognise the importance of providing Harwood Andrews and Council clear reporting of our activities and status in real time.

We propose to issue a concise weekly report summary that will provide the following information:

- Costs to date relative to forecast costs and invoiced to date
- Costs for past week
- Brief summary of progress
- Information requests
- Summary of scope and budget change (where relevant).

We attach an example weekly report that we propose to issue each Tuesday once the prior week's timesheet entries have been collated.

We expect this summary will provide sufficient information for HAL or Council to oversee PSM's scope, but should you require more detailed information this can be provided on request, for example timesheet records, etc.

8.3 Invoicing

PSM will submit monthly invoices for the work completed that month. As this includes subcontractors (i.e. for site investigations) this may include their progress claims.

Monthly Invoices will include a detailed summary of hours by personnel and subcontractor costs.

8.4 Document Control

8.4.1 Outgoing Correspondence

PSM's document control system will nominate a document number to all formal correspondence in the following format:

PSM5665.XXXY

This is explained as follows:

- PSM5665 – PSM's project number for the McRaes Landslide project
- XXX – Sequential numbering system for correspondence
- Y – Character to represent the document type, may include
  - L- Letter,
  - E-Email,
  - M-Memo,
  - R-Report,
  - O-Other.

8.4.2 Incoming Correspondence

- A “Docs In” folder will be maintained in the project directory
- An Incoming Document register will also be maintained for reports or significant correspondence received by PSM
- Email correspondence will be saved to the project folder.

9. Closing Comments

We trust this reverse brief and proposal is suitable for your current requirements. We will continue to update HAL and Council as the scope evolves utilising the templates provided herein and through or weekly reporting.

We request HA confirm acceptance of this proposal by return correspondence for our records.

Should you require any further information at this time to support our engagement, please do not hesitate to contact the undersigned.

Yours Sincerely

Personal Information

DANE POPE
PRINCIPAL

Enc.

Appendix A	PSM Standard Terms and Conditions
Appendix B	Detailed Budget and Program Summary
Appendix C	Weekly Report Template
Appendix D	CVs

Appendix A
PSM Standard Terms and Conditions

G3 56 Delhi Road
North Ryde NSW 2113
P +61-2 9812 5000
F +61-2 9812 5001
E mailbox@psm.com.au
www.psm.com.au

STANDARD TERMS OF AGREEMENT – JULY 2024

Agreement

1. The contractual relationship ("**Agreement**") between PSM and the client ("**Client**") is constituted by:
   a. These Standard Terms of Agreement ("**Terms**")
   b. The letter that accompanies these Terms ("**Commission**"); and
   c. Any other document the parties have agreed in writing forms part of this Agreement.
2. The Client shall be deemed to have accepted that this Agreement applies to the Services on the earlier of:
   a. The date of the Commission; and
   b. Substantial commencement by PSM of the Services.

PSM Responsibilities

3. PSM shall provide to the Client the consulting engineering services described in the Commission, together with such other services as may be agreed from time to time "**Services**" on the terms and conditions of this Agreement.
4. In providing the Services, PSM shall exercise the degree of skill, care and diligence normally exercised by consulting engineers in similar circumstances at the time the Services are provided.

Client Responsibilities

5. The Client shall provide to PSM:
   a. Briefings, documents and all other information and/or materials concerning the Client's requirements for the Services
   b. Directions, instructions, and decisions, sufficient to enable PSM to perform the Services in accordance with this Agreement; and
   c. PSM is entitled to rely on any such documents and materials, information, directions, instructions and decisions.
6. The Client must:
   a. Procure sufficient access to any premises or sites necessary for PSM to perform its obligations in accordance with this Agreement; and
   b. Promptly give written notice to PSM of its representative who is deemed to have full authority to act on its behalf for all purposes in connection with the Services.

Payment

7. The Client shall pay to PSM the fee and the reimbursable expenses ("**Fee**") as set out in the Commission.
8. PSM shall invoice the Client on a monthly progress billing basis.

9. All monies payable by the Client to PSM shall be paid within 30 days of invoice. Monies not paid within that period shall attract interest from the date of invoice until payment at the rate applicable to PSM's operating overdraft with its principal bankers plus a further 3%. In addition, the Client will be responsible for all debt recovery and legal costs incurred by PSM, plus a further 3% on such costs.

Variations

10. If the Client proposes a change to the scope of the Services, PSM may notify the Client whether the proposed change can be effected and, if so, provide PSM's estimate of the:
    a. Cost of the proposed change; and
    b. Effect on the time for performance of the Services, including any date for completion of the Services.

    The Client may by written notice accept PSM's estimate, in which case the Services, the Fee and the time for performance of the Services are adjusted accordingly.
11. If a new law or change in law after the date of PSM's proposal necessitates a change to the Services, then the extent to which the Services are changed by that legislative requirement shall be a deemed change to the Services and the Fee and the time for performance of the Services are to be adjusted by a reasonable amount and period respectively.
12. If PSM is delayed in performing the Services due to an event or circumstance beyond its control, then:
    a. The date for completion of the Services shall be extended by the extent of the delay; and
    b. PSM shall be entitled to the additional costs and expenses reasonably incurred as a result of that delay.

Liability

13. To the maximum extent permitted by law and subject to paragraph 14 below, the liability of PSM to the Client arising out of or in any way in connection with the Services, the performance or non-performance of the Services and/or this Agreement, whether under the law of contract, tort (including negligence), equity or otherwise, shall be limited to the cost of rectifying the Services or the sum of **CIC** whichever is the lesser. The provisions of this paragraph 13 continue to apply notwithstanding breach of a fundamental term, rescission, frustration, repudiation, or termination for any reason whether deliberate, unintentional or by operation of law.
14. PSM is not liable to the Client in respect of any loss of use of any property, loss of profit, loss of income, loss of revenue, loss of business, loss of contract, loss of goodwill, loss of opportunity, loss of anticipated savings, loss of production or for any indirect or consequential loss or damage which may be suffered by the Client in connection with the Services and/or this Agreement, whether present, or future, fixed or unascertained, actual or contingent.
15. Notwithstanding anything to the contrary, PSM shall have no liability to the Client and will be deemed to have been discharged from all liabilities, whether under the law of contract, tort, (including negligence), equity or otherwise at the expiration of the period of one year from the date of PSM's tax invoice in respect of the final amount claimed by PSM pursuant to clause 7, and the Client (and persons claiming through or under the Client) shall not be entitled to commence any action or claim whatsoever nature against PSM (or any employee of PSM), in each case arising out of or in any way in connection with the Services, the performance or non-performance of the Services and/or this Agreement after that date.

Intellectual Property

16. Intellectual Property Rights in all drawings, reports, specifications, bills of quantity, calculations and other documents and/or any other materials prepared by PSM arising out of or in any way in connection with the Services, including any documents and/or materials provided to the Client, vests in PSM.
17. Subject to clause 18, PSM grants to the Client an irrevocable licence to use that material for any purpose for which the Services are provided.
18. If the Client is in breach of any obligation to make a payment to PSM, PSM may at its discretion and without incurring any liability:

a. Revoke the licence referred to in clause 17, whereupon all the Client's rights in respect of the documents referred to in clause 16 shall terminate and those documents (and all copies thereof) must forthwith be delivered by the Client to PSM; and

b. Suspend the provision of the Services.

Disputes

19. PSM and the Client agree that if any dispute or difference between the parties "**Dispute**" arises in connection with the Services or this Agreement, then the parties must, in good faith, subject to paragraph 19(d), attempt to resolve the Dispute in accordance with the procedure set out in this paragraph below as a condition precedent to commencing any legal proceedings:

    a. If the Dispute is not resolved within fourteen [14] calendar days after a notice of dispute given under paragraph 19 is received by the other party, the Dispute must be referred to the parties' respective Chief Executive Officers who shall confer at least twice to resolve the Dispute or agree on a method of doing so. All aspects of these conferences except the fact of occurrence shall be privileged.

    b. In the event that Chief Executive Officers are unable to resolve the Dispute, the parties will within a further fourteen [14] calendar days agree on a process to resolve the Dispute without court proceedings which may be either:

        i. An independent expert
        ii. Mediation; or
        iii. Arbitration.

    c. The parties must meet to agree on:

        i. The selection of any third party to be engaged by the parties and the involvement of any dispute resolution organisation
        ii. Any procedural rules
        iii. The timetable, including any exchange of relevant information and documents; and
        iv. The place where meetings will be held.

    d. Each Party must bear its own costs of endeavouring to resolve and of resolving a Dispute and the parties must bear equally the costs of any third party engaged.

    e. If the Dispute has not been resolved within a further twenty eight [28] calendar days, either Party may terminate the Dispute resolution process by giving written notice to the other party and may commence litigation in respect of that Dispute.

    f. The requirements in the preceding paragraphs do not prevent PSM from:

        i. Instituting proceedings to enforce payment under this Agreement or to seek injunctive or urgent declaratory relief; and
        ii. Acting pursuant to clause 18.

Modern Slavery

20. The parties must ensure to not engage in Modern Slavery (bears the same meaning given under the Modern Slavery Act 2018 (Cth) or any other relevant law which has as its objective the prohibition of exploitation of workers, human trafficking, slavery, slavery-like behaviour, involuntary servitude, forced marriage, forced labour, child labour, debt bondage or deceptive recruiting for labour or services (or similar), and when performing its obligations under the Agreement, comply with all applicable Modern Slavery legislation and PSM's Corporate Policy relating to Modern Slavery.

Termination

21. The Client may terminate its obligation under this Agreement:

    a. In the event of material breach by PSM of its obligations hereunder, which breach has not been remedied within 30 days of written notice from the Client requiring the breach to be remedied, or

    b. Upon giving PSM 30 days written notice of its intention to do so.

22. PSM may terminate its obligations under this Agreement:

a. If monies payable by the Client to PSM are more than 30 days outstanding from the due date for payment
b. If the Client commits a breach of its obligations hereunder, which breach has not been remedied within 15 days of written notice from PSM requiring the breach to be remedied; or
c. Upon giving the Client 15 calendar days written notice of its intention to do so.

23. If this Agreement is terminated for any reason other than pursuant to paragraph 21(a), the Client shall pay to PSM a fair and reasonable fee (including overheads and profit) for the performance of the Services up to the date of termination together with payment of costs and expenses reasonably incurred by PSM to that date.

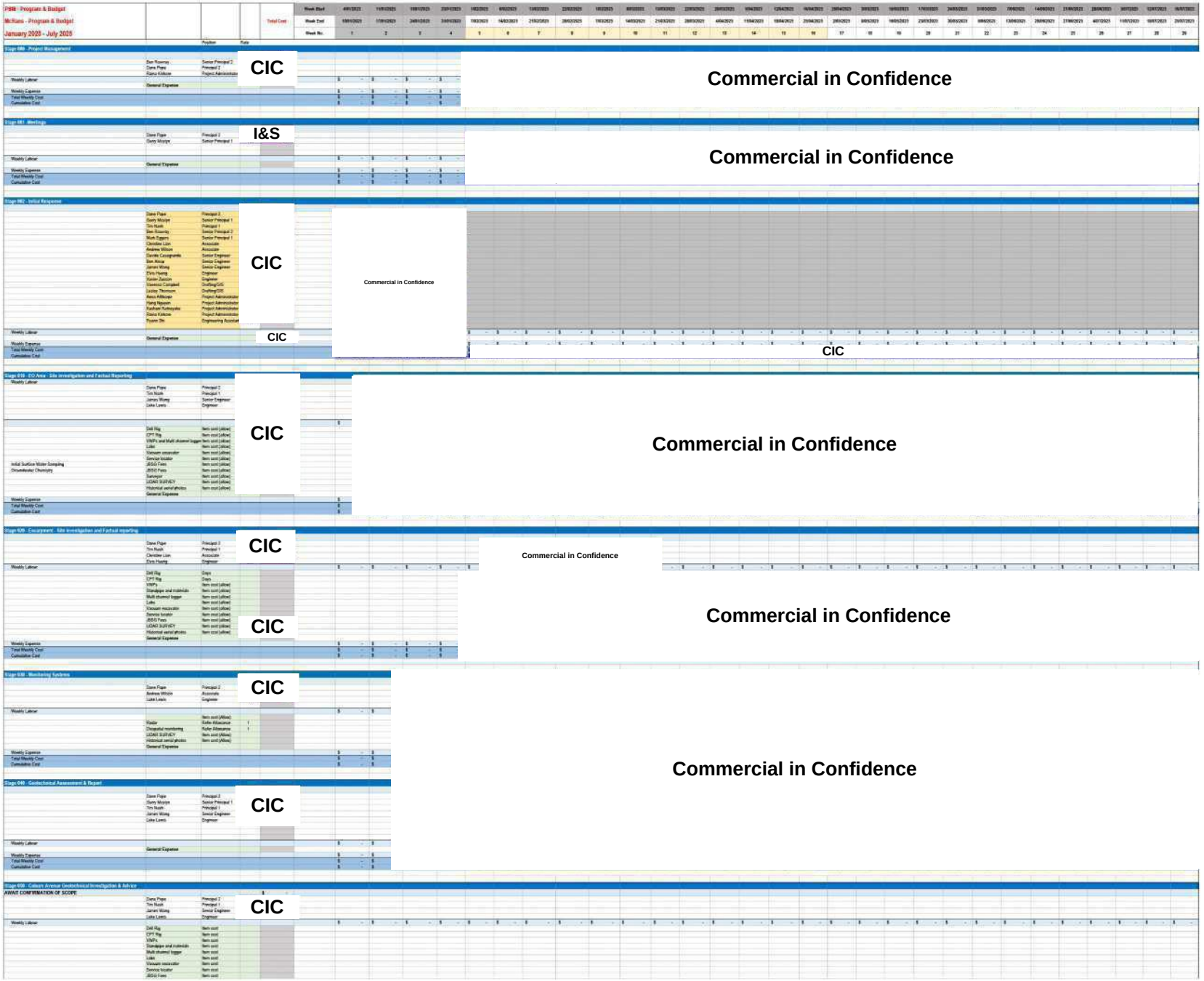
Subcontracting and Assignment

24. If PSM considers it appropriate to do so, it may with the Client's prior approval, which shall not be unreasonably withheld or delayed, subcontract any part of the Services but will remain fully responsible for those services.
25. Subject to clause 23, neither party may assign, novate or otherwise transfer any of its rights or obligations under this Agreement without the prior written consent of the other party. Unless stated in writing to the contrary, no assignment, transfer or novation shall release the assignor from any obligation under this Agreement.

General

26. Unless arrangements are made to the contrary, core samples will be held in storage for a maximum period of one [1] month from the date of investigation.
27. PSM shall be excused from performing under the terms of this Agreement if and for so long as such compliance is hindered or prevented by an occurrence of force majeure. For the purposes of this clause, “force majeure” means events beyond the reasonable control of PSM, including (without limitation) acts of God, public enemy, acts of the Government, fires, floods, earthquakes, epidemics, pandemics, quarantine restriction, wars, freight embargoes and work stoppages.
28. In the interpretation of this Agreement, no rule of construction applies to the disadvantage of one party on the basis that it put forward this Agreement or any part of it.
29. This Agreement and any documents or information relating to this Agreement or the Services are confidential and the parties must not disclose any of these without the prior written consent of the other party, except to the extent that the disclosure is required to perform this Agreement or by law.
30. Unless otherwise directed in writing by the Client, PSM may include references to the Services in its promotional material. Such references shall exclude any confidential material.
31. This Agreement is subject to and is to be construed in accordance with the laws of the State or Territory in which the Services are performed.
32. If the Client comprises two or more persons, each person will be jointly and severally bound by the Client's obligations under this Agreement.
33. All payments under this Agreement are exclusive of GST. If the provision of the Services is a taxable supply, the Client will pay PSM an additional amount equal to the amount of the consideration for the Services multiplied by the GST rate. The additional amount is payable at the same time and in the same manner as the consideration for the Services.

Appendix B
Detailed Budget and Program Summary


PSM - Program & Budget
McKaos - Program & Budget
January 2025 - July 2025
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PSM - Program & Budget					Week Start	4/01/2025	11/01/2025	18/01/2025	25/01/2025	1/02/2025	8/02/2025	15/02/2025	22/02/2025	1/03/2025	8/03/2025	15/03/2025	22/03/2025	29/03/2025	5/04/2025	12/04/2025	19/04/2025	26/04/2025	3/05/2025	10/05/2025	17/05/2025	24/05/2025	31/05/2025	7/06/2025	14/06/2025	21/06/2025	28/06/2025	5/07/2025	12/07/2025	19/07/2025
McRaes - Program & Budget				Total Cost	Week End	10/01/2025	17/01/2025	24/01/2025	31/01/2025	7/02/2025	14/02/2025	21/02/2025	28/02/2025	7/03/2025	14/03/2025	21/03/2025	28/03/2025	4/04/2025	11/04/2025	18/04/2025	25/04/2025	2/05/2025	9/05/2025	16/05/2025	23/05/2025	30/05/2025	6/06/2025	13/06/2025	20/06/2025	27/06/2025	4/07/2025	11/07/2025	18/07/2025	25/07/2025
January 2025 - July 2025					Week No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
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Weekly Expense						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Weekly Cost						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Cumulative Cost						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -

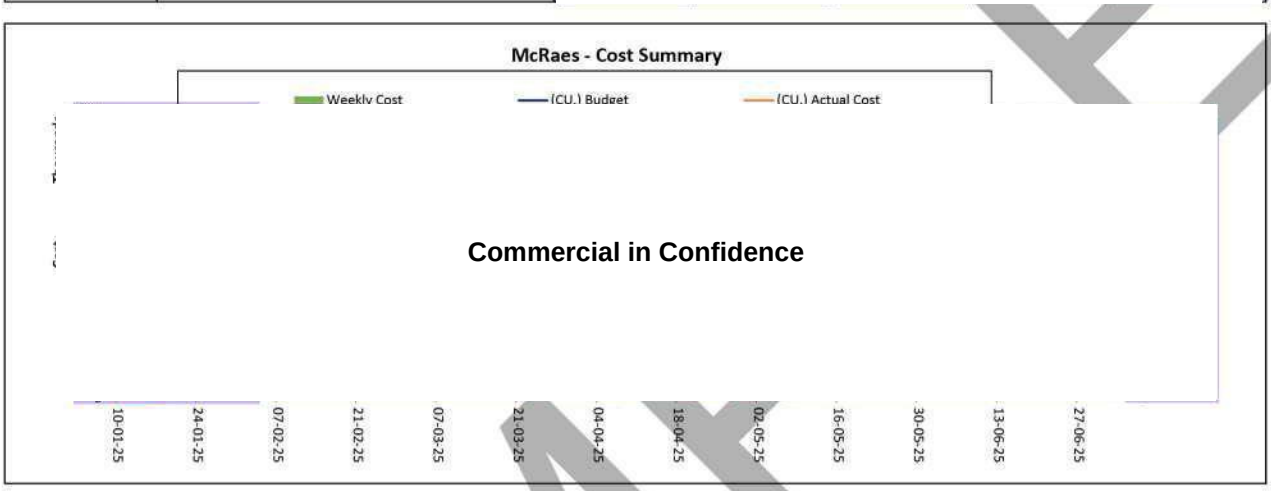
Appendix C
Weekly Report Template

PSM5665 - McRaes Weekly Summary

Week Ending 31/01/2025

Cost Code	Description	Budget	Cost to Date	Weekly Cost	Invoiced to Date	Costs to Invoice
PSM05665.00.000	Project Management					
PSM05665.00.001	Meetings					
PSM05665.00.002	Initial response					
PSM05665.00.010	EO Area - Site investigation and Factual Reporting					
PSM05665.00.020	Escarpment - Site investigation and Factual reporting					
PSM05665.00.030	Monitoring Systems					
PSM05665.00.040	Geotechnical Assessment & Report					
PSM05665.00.050	Coburn Avenue Geotechnical Investigation & Advice					

Commercial in Confidence



Weekly Summary of Tasks and Status

1. Additional historical aerial imagery search for escarpment..
2. Additional LiDAR by plane for remainder of escarpment.
3. Desktop study of escarpment.
4. Procurement of monitoring system (prisms, GNSS and tilt sensors).
5. Baseline monitoring of RADAR data to establish movement trends.
6. Underground service clearance to support intrusive works.
7. Procurement of drill rig, CPT rig for intrusive investigations.
8. Procurement of groundwater monitoring instruments.
9. Procurement of groundwater quality testing consultant (quote received).
10. Landslide characterisation of 2025 event and EO area.
11. Budget estimates and reverse brief.

Requests for Information Summary

1. Access to commence intrusive works on these properties:
   - 10-12 View Point Road
   - 6 View Point Road
   - View Point Road Reserve only
   - Prospect Hill Road Reserve only.
2. Request permission from property owners to install monitoring equipment on their properties.
3. Council records for 2010 LiDAR completed for hydrological study (MBS Dave mentioned this was done).
4. Preferred supplier of vacuum excavation trucks – does the FH alliance have this equipment and can PSM use it? Can Council coordinate this?
5. SEW records of repairs to Sewer trench to 6 View Point Road. Property owner records of trench at time of repairs.
6. Photographs and videos of 10 and 6 View Point Road of landslide area prior to and during the event. It is my understanding that 6 View Point has a drone video from 2023.

Scope and Budget Summary

1. Reverse brief and proposal issued for approval on 07/02/2025

Appendix D
CVs

Curriculum Vitae

Dane Pope
Principal Geotechnical Engineer

Dane Pope is a Principal Geotechnical Engineer at Pells Sullivan Meynink. He graduated from Griffith University, Gold Coast in 2006 with Bachelor of Engineering in Civil Engineering (Honours 1) and was awarded the University Medal. Dane joined PSM in November 2011, during which time he completed his master's degree in geotechnical engineering at UNSW in 2015.

Dane moved to Victoria in early 2016 and has actively been involved in civil infrastructure and property development projects throughout Victoria. Dane re-joined PSM in late 2019 to help to establish PSM's Victorian office.

Educational Qualifications:

- BE Hons Bachelor of Engineering (Civil), Griffith University, Gold Coast, 2006
- MEngSc. in Geotechnical Engineering, University of New South Wales, 2015

Professional Associations:

- Chartered Professional Engineer (CPEng)
- Registered Professional Engineer Queensland (RPEQ)
- Registered Professional Engineer Victoria (RPEV)
- Engineers Australia

Experience:

- 2020 – Current: Principal Geotechnical Engineer, Pells Sullivan Meynink
- 2019 – 2020: Associate Geotechnical Engineer, Pells Sullivan Meynink
- 2015 – 2019: Senior to Associate Geotechnical Engineer, P.J. Yttrup & Associates
- 2011 – 2015: Senior Geotechnical Engineer, Pells Sullivan Meynink
- Mar 2011 – Oct 2011: Geotechnical Engineer, MEC Mining
- 2006 – 2011: Geotechnical Engineer, Golder Associates
- 2005 – 2006: Undergraduate Engineer, Macdonald Sheet Piling

Field of Competence:

- Industrial and residential subdivisional geotechnics including pavement design
- Unsaturated Soil Mechanics
- Landslide Risk Assessment for Local Government and Road Authorities
- Surface Coal Mining and Quarry Operations and slope design
- Detailed instrumentation planning, installation and analysis
- Deep basement excavations

MINING PROJECTS

Clermont Coal Mine, QLD

Western wall review including three dimensional domains using ATV, field mapping and Vulcan. Site visit to calibrate structural model. Stability analysis of structurally complex pit slopes.

Burton Coal Mine, QLD

Maximised coal recovery from large slope failures without incident. Site based geotechnical support for two open cut terrace mines. Maintenance of highwall and lowwall hazard management systems (radar and survey) and monitoring of slope failures. Civil projects included; anchor pull-out tests, wet weather road construction, crane pad selection, plate load testing.

Baralaba Central and North Operations, QLD

Design reviews of pit slopes. Site inspections to provide operational advice for unstable slopes and their interaction with large dams.

Baralaba Expansion, Geotechnical Investigations – Feasibility, QLD

Geotechnical investigation and design of the proposed 200 m deep terrace mining operations. Training of site based rig geologists.

Norwich Park (BMA), Geotechnical Management System, QLD

Seconded to BMA's Norwich Park open cut coal mine. Pit inspections, mapping, radar monitoring and implementation of a revised TARP.

Tutupan Coal Mine, Pressuremeter Testing, South Kalamantan Indonesia

Trained a Jakarta based geotechnical engineer in the use of the pressuremeter at the South Kalimantan Coal Mine.

QC LNG and Pipelines, Pressuremeter Testing and Fieldwork, Gladstone, QLD

Large pressuremeter testing program in various materials from residual clays to high strength rock. Mobilisation of drilling rigs in difficult access conditions for the narrows pipeline project including use of a hover-barge.

Lysterfield Quarry, Boral, VIC

Geotechnical review of quarry slopes and providing slope stability advice. Review and update of structural model.

Montrose Quarry, Boral, VIC

Geotechnical review of quarry slopes and providing slope stability advice.

CIVIL PROJECTS

Western Sydney Airport, Pavement Tender

Part of the successful bid team for the Pavement Tender. Worked with the Pavement Designers to assess risk of collapse settlement of engineered fill and differential settlement at cut/fill interfaces.

Geelong & Melbourne, Site Classification, VIC

Managing geotechnical investigations, analysis and reporting for residential developments in highly to extremely reactive soils with a focus on residual Basalt and Limestone profiles. Coordinating activities for a small team of engineers and a technician. Establishing and managing borehole reporting standards. Specialise in measuring total suction profiles to provide ground movement estimates for sites with abnormal moisture conditions.

Geelong Subdivisions, VIC

Geotechnical support from site investigation, pavement design and construction supervision for numerous greenfield sub-divisions in the Geelong region including Manzene Village, Lara West, Armstrong creek, Charlemont Rise, Leopold and Point Lonsdale Golf Course.

Bulk Earthworks Supervision, City of Greater Geelong, Colac Otway Shire, VIC

Provision of Level 1 certification of bulk earthworks for residential and commercial projects. Assessment and re-classification of lots to AS2870-2011.

Deviation Road, Fyansford, VIC

Landslide Risk Assessment for complex profile of Newer Volcanic Basalt overlying Gellibrand Marl. Groundwater monitoring to identify multiple aquifers.

Wintringham Social Housing, Travancore VIC

Geotechnical investigation and temporary works for basement excavation in Old Volcanics.

Barwon Water Easement Investigations, City of Greater Geelong, Colac Otway Shire, VIC

Forensic investigations into collapse settlement in stormwater and sewer easements at three sites. Development of backfill specification to reduce risk of collapse settlement.

Brownfield Basalt quarry redevelopment, Tottenham VIC

Geotechnical investigation and design advice for industrial development on complex landfill site. Ground improvement strategies including rigid inclusions.

Armstrong Creek Town Centre, Investigation & Pavement Design, VIC

Geotechnical investigation for $20M town centre including earthworks specification, detailed ground movement assessment in extremely reactive ground and pavement design.

Due Diligence - Dandenong South, VIC

Due diligence assessments for property developers across several large industrial sites throughout Dandenong South. Constraints typically including buildings approaching the end of their design life, poor quality subgrades and one backfilled sand quarry with inferred collapse settlement issues.

Wye River, Landslide Assessments, VIC

Landslide risk assessments for properties affected by the recent bushfires. Established structural domains of township to aid in better understanding mode of failure across the town. Assessment for proposed new stormwater network.

Cumberland River, Rockfall Assessment, VIC

Rock fall assessment for VicRoads included mapping by hand and photogrammetry methods. Detailed assessment of the structural controls of a 90 m high slope.

Sunshine North, Quarry infill sub-division, VIC

Rock Face Assessment of abandoned Basalt quarry for potential sub-division. Key inputs into landslide risk assessment.

Deer Park, Boral, VIC

Ongoing auditing of bulk earthworks for backfill of existing Basalt quarry. Bulk earthworks design and specification for industrial development.

Campbellfield Industrial Development, Campbellfield, VIC

Investigation, settlement analysis and bulk earthworks design and supervision for proposed automated glass manufacturing facility with a high-performance building specification in a Basalt profile.

High Bay Developments and Expansion, Truganina, VIC

Investigation, design advice and specification for three different high bay shed sites in a Basalt profile. Including validation of total suction profile four years after construction of the initial pavement slabs.

High Bay Development, Moorebank, NSW

Investigation, design advice and specification for proposed high bay sheds.

Greystanes Industrial Development, NSW

Investigation, design advice and specification for proposed industrial subdivision.

ACFS Logistics Terminal, Port of Brisbane, QLD

Subgrade remediation in poor soils. Footing and subgrade inspections including plate load testing.

Soleil Tower, Ten Story Basement Excavation, Brisbane, QLD

Monitored excavation activities for a 10 storey basement car park excavation. Completed anchor inspections and review, ‘hit and miss’ sequencing, detailed instrumentation planning, implementation and reporting.

Vision Apartments, Seven Story Basement Excavation, Brisbane QLD

Geotechnical investigation. Diaphragm wall design using PLAXIS and MSHEET. Supervision of diaphragm wall and secant pile wall construction. Rock bolt design, mapping, anchor supervision and review, ‘hit and miss’ excavation sequencing on all shoring walls.

Infinity Tower, Twelve Storey Basement Design, Brisbane QLD

Geotechnical investigation including pressuremeter testing. Design of shoring walls using PLAXIS.

Springfield to Darra Rail, Pile Design, Brisbane QLD

Successful tender pile design for 6 bridges varying in size from single span to ten span viaducts.

TUNNEL PROJECTS

Clem 7 Tunnel, Investigation & Monitoring, Brisbane QLD

Coordinated drilling activities over the tunnel alignment, including permitting, service clearances, supervision and reporting. Installed and monitored settlement monitoring equipment including magnetic and rod extensometers, vibrating wire piezometers, profile gauges and inclinometers.

Burnley Tunnel, VIC

Site based tunnel crack mapping of the tanked section of the tunnel.

Melbourne Metro Tunnel, VIC

Annual inspections and reporting on behalf of the insurer. High level assessment of risk during construction.

EXPERT OPINION/ADVICE

Industrial Subdivision, Melbourne

Forensic investigation into collapse settlement including review of property damage and remediation. Acted for the plaintiff. Cross examined by Senior Council of up to 8 parties in the Supreme Court of Victoria.

Residential Subdivision, Western Sydney NSW

Forensic investigation into collapse settlement including review of property damage and site classification for 100's of dwellings.

Directional Drilling, Melbourne

Expert opinion regarding collapse of a service tunnel during construction.

Retaining Wall Settlement, Victoria

Expert Opinion regarding settlement of gravity retaining wall including collapse settlement.

Preloading Soft Soils, Pinkenba QLD

Review of settlement controls and effectiveness of preloading activities for deep compressible sediments.

Damaged building assessments, Victoria

Numerous geotechnical investigations to support expert opinion reports for damaged homes on reactive ground. These typically including testing shrink swell, total suction and providing ground movement estimates for seasonal movement and movements due to the growth or removal of trees and removal of old timber floor dwellings prior to construction.

Publications, Articles and Patents

1. Developments in Engineering Geology the Geological Society (2016). Published Paper: Geological structural controls on stability of footwall slopes, an example from the Bowen Basin.
2. Field Measurements in Geomechanics (FMGM) Sydney, (Sept. 2015). Published Paper: Real-time monitoring of cut slopes and the importance of identifying the mode of failure.

Curriculum Vitae

Garry Mostyn
Principal Geotechnical Engineer

Garry Mostyn graduated from the University of New South Wales in civil engineering in 1973. He subsequently completed a master's degree in geotechnical engineering at UNSW and a bachelor's degree in geology and statistics at Macquarie University. He worked as a cadet and engineer with the NSW Department of Public Works and with consulting geotechnical engineers from 1970 until 1986. He joined the School of Civil Engineering at the University of New South Wales as a senior lecturer in civil and environmental engineering practice and geotechnical engineering. He returned to consulting at PSM in 1997 as a Principal and has been an Adjunct Associate Professor at UNSW. He remains a senior Principal and Director at PSM.

Garry has lectured extensively in geotechnical engineering including presenting postgraduate courses in foundation engineering, slope stability, dam engineering, rock mechanics and underground structures. He has completed research on the stability and reliability of slopes and the engineering properties of rocks and rock masses. Previously he has completed the training for and been graded as an arbitrator by the Institute of Arbitrators and Mediators, Australia.

Garry has undertaken or supervised geotechnical investigations for several hundred projects and has experience in most aspects of geotechnical engineering. He has worked on major projects throughout Australia and in Thailand and PNG. He has provided expert advice and evidence in numerous disputes.

In 2019, Garry was named as the EH Davis Memorial Lecturer by the Australian Geomechanics Society, for a distinguished recent advancement of geomechanics knowledge in Australia. In June 2020, Garry was named as an inaugural Honorary Life Member of the Australian Geomechanics Society in recognition of the significant contribution he and 14 others had made in supporting the geotechnical profession in Australia.

He has been a Member of the Standards Australia Committee CE/27 producing AS3798 “Guidelines on Earthworks for Commercial and Residential Developments” since its formation in the 1980s and has been Member / Chairman of CE/32 producing AS4678 “Earth-retaining Structures” since its formation in the 1990s.

Educational Qualifications:

- BE (Hons), UNSW, 1974
- MEngSc, UNSW, 1977
- BA (Geology), Macquarie University, 1980

Professional Associations:

- Fellow, Institution of Engineers, Australia
- Registered Professional Engineer of Queensland (RPEQ)
- Australian Geomechanics Society
- National Committee Member, 1988 – 2001
- Chairman, 1994-1995
- Editor, Australian Geomechanics Journal, 1998 – 2001
- International Society for Rock Mechanics
- Vice President, 1995 – 1999

Experience:

- 1997 – Present: Principal, Pells Sullivan Meynink
- 1986 – 2008: Senior Lecturer, UNSW
  Adjunct Associate Professor, UNSW
- 1981 – 1986: Senior Engineer, Dames & Moore, Sydney
- 1978 – 1981: Senior Engineer, McMahon, Burgess & Yeates, Sydney

- 1974 – 1976: Engineer, Longworth & McKenzie Pty Ltd, Sydney
- 1970 – 1974: Cadet Engineer, Department of Public Works, NSW

Field of Competence:

- Foundation Engineering
- Deep Fills, Earthworks and Embankments
- Slope Engineering
- Rock Mechanics
- Pavement Engineering
- Geotechnical Risk Analysis
- Forensic Engineering

EXPERTISE

- Responsible for completing or supervising geotechnical investigations for several hundred projects. Involvement on each project varied from a few days to several months and included extensive contact with owners, consultants and contractors and preparation of reports presenting the results of the studies.
- Have acted as expert witness in over one hundred matters over last twenty five years involving several separate fatalities and many large civil and contractual claims.
- At UNSW, actively involved in research and development work in many areas of risk, rock engineering, slope stability and foundation design.
- Has taught extensively at postgraduate level including 42 hour subjects in: Slope Stability and Stabilisation; Foundation Engineering; Rock Engineering; Applied Soil Mechanics. Has contributed to graduate teaching subjects in: Embankment Dam Engineering; Site Investigations; Underground Structures in Rock; Geological Engineering; Qualitative Risk Assessment of Landslides.
- Applied probabilistic, statistical and risk based methods to various engineering problems including slope design, parameter selection, &c.
- Responsible for the overall supervision and completion of geotechnical site investigations for numerous residential, commercial, industrial and public buildings.
- Extensive experience in all aspects of geotechnical engineering as applied to mining, especially design of pit slopes and waste dumps.
- Involved in the geotechnical aspects of the design and construction of several dams including as principal designer of earth dams.
- Involved in setting up and operation of several geotechnical laboratories and actively involved in hardware and software applications of microcomputers since 1978.
- Water management and contaminant movement studies for major proposed uranium mines in the Northern Territory.
- Involved as principal in investigations, design and monitoring for rectification works at East Arm Port, Darwin.
- Assisted with PSM investigations and advice to NSW Coroner on Inquiry into Thredbo Landslide and principal investigator for RMS submissions to the Somersby Inquest
- Supervised 5 doctoral theses and co-supervised 5 doctoral theses.
- Completed General and Advanced Arbitration courses conducted by the Institute of Arbitrators, Australia, passed Grading Examination, graded Grade 3 Arbitrator (1993).
- Geotechnical design, project management and auditor for several deep quarry fills for residential or industrial development.
- Numerous forensic investigations, analyses and advice/opinions for legal matters.
- Epping Chatswood Rail Link, monitoring 10m deep cofferdam for river crossing.

PRINCIPAL INVESTIGATOR – MAJOR PROJECTS

Somerset Dam, QLD

Supervised investigation into existence and continuity of defects in the foundation rock mass, including drone survey of quarry, data reduction, fracture modelling and numerical analysis. The work resulted in substantial increase in assessed rock mass strength.

Ok Tedi Project, Western PNG

Two tailings dams, a hydroelectric dam, 150 km of road through extremely inhospitable terrain, two towns, two airfields and river and ocean port facilities. Recently completed geotechnical aspects of due diligence study and provided advice on slope failures on access roads.

Mae Moh Lignite Mine, Northern Thailand

Geotechnical investigations, consisting of 240 m high slopes in steeply dipping, very weak and extensively faulted rocks. Sixty geotechnical and over fifteen hundred exploration boreholes completed. Each degree of slope angle had a present value cost of well over $30 million.

Woodside, North Rankin A Flare Tower, Karratha, WA

Review of all information relating to very loose calcareous soils forming foundation to large offshore platform. Information had been collected during ten years of detailed investigations utilising virtually all available in-situ and laboratory techniques. A gravity based anchor system was then designed to provide foundation support to portions of the structure. This system has now been implemented.

Burnley Tunnel, Melbourne Citylink, Victoria

Investigation of cause of wall failure, design of rectification works. Investigation and design of improvement works to north and south walls of tanked tunnel.

Gladstone Coal Stockpile, Central Queensland Ports Authority, QLD

Detailed investigation and design for site improvement works for major coal stockpile and reclaim tunnel on soft soil site.

Greystanes Estate Development, Greystanes, NSW

Geotechnical advice regarding industrial developments of large quarry, including batter stabilisation and earthworks.

Whisper Bay, Airlie Beach QLD

Site improvement over old quarry for waterfront apartments.

Cumberland Green Industrial Park, Rydalmere NSW

Site improvement over very poor ground for industrial development.

M2 Shaft, Chatswood Epping Rail Link NSW

Major investigation into the cause of distress to tunnel at M2 Shaft at base of deep fill.

Dendrobium Mine, Wollongong NSW

Dyke assessment.

Mermaid Marine, Barge Berth Extension, Dampier WA

Site supervision port extension, including:

- Earthwork construction, field testing and interpretation
- Sheet pile installation
- Concrete pin construction, comprises sub-surface assessment during drilling to achieve the required capacity
- Slipway screen foundation design.

The Entrance Seawall, NSW

Stability assessment of an existing seawall for local Council, including stability analysis and provision of recommendation for the seawall.

Sydney Coastal Council Groups, NSW

Under collaboration with Worley Parsons, provided significant inputs to a geotechnical guideline for Sydney Coastal Group to assess seawall stability and the effect of climate change to coastal structure.

Port Waratah Coal Services, Kooragang Island, Port of Newcastle NSW

Investigation into design and construction issues associated with water ingress into dump station and conveyor tunnel.

Barangaroo, Sydney NSW

Classification of rock class in proof cores.

Karara Iron Ore Port Train Unloader, WA

Investigation and advice related to construction stage failure associated with dewatering.

Burrinjuck Dam, Yass NSW

Rock fall risk assessment.

Wynyard Walk pedestrian tunnel, Sydney CBD

300 m long tunnel/shaft/cut and cover/bridge linking Wynyard Station with Barangaroo, beneath operational roads, rail, and buildings.

Geotechnical investigations, preparation of geotechnical model.

Shaft excavation and underpinning design.

Ground movement assessment and monitoring plan.

EXPERT ADVICE/WITNESS

Devonshire St, Sydney NSW

Expert advice, 8 m deep contiguous pile retaining wall failure.

Coledale, NSW

Review of previous work and supervision of design of remedial work for failed railway embankment. This failure had tragically resulted in two fatalities.

Rushcutters Bay, NSW

Expert advice, effect of contiguous pile wall on adjacent residence.

Denistone, NSW

Review of design of remedial works for embankment failure.

Schofields, NSW

Expert advice on leaking dam.

Bayswater Colliery, NSW

Advice on highwall failure.

Wollongong, NSW

Expert advice, fatality due to excavation failure.

Wentworth Park Greyhound Track, NSW

Expert advice, design and contract for track design.

Bungan Head, NSW

Expert witness, cliff line stability.

Kiewa, VIC

Expert advice, McKay Power Station stability.

Gilmandyke, NSW

Advice on land stabilisation.

Bayview, NSW

Expert witness, retaining wall failure.

Pambula, NSW

Expert witness, damage to motel.

Sth Alligator R Bridge, NT

Expert advice on foundation design.

Paddington, NSW

Expert advice on conservation options, terraces.

Bolton Pt, NSW

Expert advice, earthquake damage to house.

Barnsley, NSW

Expert advice, use of coal refuse.

Chatswood, NSW

Expert advice, underpinning failure.

Punchbowl, NSW

Expert advice, murder victim.

Various, NSW

Expert advice on many cases of damage to houses.

Alexandria, NSW

Expert advice on cable creep.

Kidston, QLD

Expert advice on slope design.

Laverton, QLD

Expert advice, reinforced soil wall.

Kogarah, NSW

Expert advice on fatal gas explosion.

Rydalmere, NSW

Expert advice, reinforced soil wall.

Griffith, NSW

Expert advice, fatality due to trench collapse.

Lake Macquarie, NSW

Expert advice, cracked houses.

Lismore, NSW

Expert advice, damage to motel.

Thredbo, NSW

Member of PSM team acting as advisers to the NSW Coroner on the causes of the 1997 landslide at Thredbo, NSW.

Wetherill Park, NSW

Impact of retaining wall construction on existing factory and retaining wall.

Western Ring Road, VIC

Provision of expert opinion on deformation of reinforced soil wall.

Cooks River, NSW

Investigation and expert opinion on cause of failure of construction cofferdam.

Aquatic Centre, NSW

Provision of expert opinion on reinforced earth wall and deformation of Aquatic Centre.

Ok Tedi Mine, PNG

Road and pipeline failures due to landsliding.

Sydney, NSW

Independent Property Impact Assessment Panel for the Cross City Tunnel.

Eastern Distributor, NSW

Expert panel assisting with resolution of final 40 damaged properties.

Darwin, NT

Detailed analysis of fill placement behind very large sheet pile wall.

Clovelly, NSW

Damage to block of strata units.

Niddrie Quarry, VIC

Provision of Expert Advice on contract dispute for deep fill.

Mona Vale, NSW

Expert opinion on damage to building.

Wallsend, NSW

Provision of expert opinion on retaining wall failure and slope instability.

Manly, NSW

Provision of expert opinion on damage to building.

Howlong, NSW

Advice on effect of dam on road fatalities.

Old Pacific Highway, Somersby NSW

Expert Advice to RTA on road failure and fatalities.

Apollo Bay & Lorne, VIC

Expert Advice on Failure of Aeration Tanks at WWTPs.

Woollahra, Waverley & Leichhardt Councils, NSW

Expert Advice on various Development Applications.

Alexandria, NSW

Expert opinion on retaining wall failure.

Kingscliffe, NSW

Provision of expert opinion on a development application.

Whitebridge, NSW

Provision of expert opinion on damage to residential building.

Lilli Pilli, NSW

Expert opinion relating to a landslip.

Somersby, NSW

Expert opinions on geotechnical and engineering matters relating to retaining walls.

Bellevue Hill, NSW

Provided expert opinion on geotechnical issues related to overturning or toppling of a piling rig.

Port Waratah Coal Services, Newcastle NSW

Expert opinion on design and construction issues regarding dump station and load out tunnel.

Epping Chatswood Rail Line, NSW

Expert opinion on damage associated with shaft excavation and tunnel.

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96. SALIM A. & MOSTYN G. (2018). Industrial Slab on Ground Design over a highly reactive site. Conference: AGS SA-NT Annual Seminar 2018 “Design and construction of earthworks and pavements on expansive clay”.
97. HAERTSCH, MOSTYN G, AND SALIM A. (2019). Foundation analysis and ground improvement for industrial high bay warehouse developments, 13th ANZ Conference on Geomechanics, Perth, April 2019.
98. PICCOLO, D. & MOSTYN G. (2019). A cliff regression model to estimate the travel distance distribution of boulder falls and risk to persons and property downslope of the cliff, Sydney, Australia. 13th ANZ Conference on Geomechanics, Perth, April 2019.
99. CLARKE S.J., MOSTYN G, AND SHEN B. (2019). Collapse of the Old Pacific Highway, Piles Creek, Somersby. 13th ANZ Conference on Geomechanics, Perth, April 2019.
100. PELLS PJN, MOSTYN G, BERTUZZI, R, WONG, PK, (2019) Classification of sandstones and shales in the Sydney region: A forty year review, AGS Journal Vol 54, No.2 June 2019
101. TOH, J.C.W., TEOH, M.L. & MOSTYN, G. (2019). Recent experiences in design and construction of high consequence temporary soil nail walls. Australian Geomechanics, V54, No 2.
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103. WEIR, F.M., BREHAUT, R. and MOSTYN, G., (2022). Development of a 3D geotechnical model and discrete fracture network approach for a review of dam footing stability. In: Proceedings of the 3rd International Discrete Fracture Network Engineering Conference, Santa Fe, New Mexico, USA, June 29-July 1, 2022.
104. STOCKER R., PICCOLO D. AND MOSTYN G. (2024). Erosion and weathering rates of Sydney sandstone. (Submitted)

Curriculum Vitae

Tim Nash
Principal Engineering Geologist

BSc, MSc (Hons), MIEAust, CPEng, NER, RPEV

Tim graduated from the University of Canterbury in 2003 with a BSc in geology and an MSc in engineering geology. In 2004, Tim joined PSM as an engineering geologist until 2006 when he worked for five years in Western Australia as a consulting engineering geologist. Tim returned to PSM in 2011 where he now works as a Principal Engineering Geologist.

Tim has worked on several major infrastructure projects including road and rail, tunnels, and mining. His work experience includes pre-feasibility through to detailed design and construction phases of project development.

Educational Qualifications:

- BSc (Geology) University of Canterbury, New Zealand, 2000
- MSc (Engineering Geology), First Class Honours, University of Canterbury, New Zealand, 2003
- Sir Julius Von Haast Prize in Engineering Geology, 2003

Professional Associations:

- Member Institute of Engineers Australia
- Chartered and Registered Professional Engineer (Engineers Australia, 3080931)
- Registered Professional Engineer (Civil), State of Victoria (PE0014043)
- Member Australian Geomechanics Society (2005 present)
- Member of Australian Tunnelling Society (2007 present)
- Member New Zealand Geotechnical Society

Experience:

- 2015 – Present: Principal Engineering Geologist, Pells Sullivan Meynink
- 2011 – 2015: Associate Engineering Geologist, Pells Sullivan Meynink
- 2006 – 2011: Senior Engineering Geologist, 4DGeotechnics
- 2004 – 2005: Engineering Geologist, Pells Sullivan Meynink

Field of Competence:

- Terrain analysis and landslide risk assessments
- Developing geological and geotechnical models
- Earthworks design
- Underground and surface construction phase services
- Geotechnical site investigation and characterisation
- Waste rock dump design

TUNNEL PROJECTS

Western Harbour Tunnel North, Sydney

PM for the provision of proof engineering, temporary work design and independent checking engineering for surface construction sites.

WestConnex Stage 3b, Rozelle Interchange, Sydney

Development of project wide GIR and HIR for successful tender. Reviewer of the project wide GIR and HIR for the detailed design phase of the project involving 20 km of mined tunnels and 4 traffic interchanges for road tunnel. CPS lead during construction of the road tunnels and interchanges.

WestConnex Stage 3a, M4M5 Link

Design Manager for NCS and PBR temporary adits, spoil shed and decline, tunnel backfill.

M4E 1b Tender and Design Stage, Sydney

Development of the tender GIR and hydro report. Lead for delivery of geotechnical interpretive, hydrogeological, salinity and contamination reports for design of tunnel and civil components.

M4E 1b Construction Stage, Sydney

Geotechnical Construction Phase Services (CPS) project manager for four interchanges at the surface (civil) and 25 km of tunnelling through shale and sandstone. stage 1 and 2 site investigations comprising over 150 boreholes, test pits and CPTs.

Installation of surface instrumentation at surface including multipoint extensometers, single point extensometers, inclinometers (bored pile and borehole), crack meters and piezometers.

North West Rail Link (NWRL) design stage, Sydney

Lead for the development of the geotechnical interpretive and hydrogeological reports.

North West Rail Link (NWRL) Construction stage, Sydney

Lead geologist, alternative CPS PM for validation of geological models for stations, mined tunnels, cross over cavern and cross passages during construction.

Cockatoo Island Historical Tunnels, Sydney

Review of existing heritage-listed 100 year old tunnels located on Cockatoo Island for access and use by the public and Sydney Harbour Federation Trust Staff.

Sydney Metro West, Central Tunnelling Package Tender

Assisted development of the project wide and structure specific GIR for tender.

Wheatstone Shore Crossing, Onslow, WA

Review of geological model, microtunnelling tender bid reviews.

Lane Cove Tunnel Project, NSW

Tunnel support determination during construction of 3.5 km vehicle tunnel. Installation, analysis and interpretation of monitoring instrumentation including: inclinometers, extensometers (surface and underground), piezometers, tunnel convergence equipment, instrumented rock anchors and endoscopes.

Parramatta Rail Link, Sydney

Monitoring installation and data acquisition for TBM tunnel during construction.

CIVIL PROJECTS

Cape Lambert Port Expansion, Cape Lambert, WA

Lead team of Geotechnical Engineers and Engineering Geologists for site investigation and the design of earthworks, foundations and ground retention systems for new Port infrastructure including car dumper, stacker/reclaimer machine berms, transfer stations, surge bins, conveyors, screen houses, new railway lines and Wharf abutment.

Port A Sustaining Works, Cape Lambert, WA

Tender, plan and conduct site investigation, develop geological model for foundation design of stackers, screen houses, transfer stations, HV access roads, mobile crane footings and conveyors.

Stirling Dam Upgrade, WA

Installation of inclinometers in existing zoned earth dam, geological mapping of dam abutments and spillway.

Super Cor Arch, Bridge 11 Replacement, WA

Site investigation and develop geological model to identify/prove suitability of structural and bulk fill for two new 20m diameter Super Cor Arches and MSE Wall for heavy haulage rail. Construction support for temporary 15m high embankment around damaged bridge, construction support for permanent Super Cor Arches.

Parker Point Surge Bins, Dampier, WA

Review of existing geotechnical data for two new 1,000t surge bins on reclaimed ground, determine appropriate investigations for foundation design and assess settlement characteristics of existing adjacent structures.

Power Station Upgrade, Cape Lambert, WA

Site investigation for new Sub Station, geological model development, assessment of excavatability, preliminary geotechnical parameters and model development.

Dampier Fuel Wharf, WA

Plan and conduct site investigation, develop geotechnical model, assist foundation design of new fuel pipeline footings. Determine suitability of local borrow material.

Alkimos Ocean Outfall Pipeline, Perth

Nearshore site investigation and geological model development for 3km long wastewater treatment plant ocean outfall pipeline dredging operation

Walpole Onshore Pipeline and Ocean Outfall, WA

Pipeline route geological model, route selection and geohazard assessment.

Karuah Road Bypass, RTA, NSW

Review of geotechnical conditions and geological model for a construction claim.

Browse Basin Offshore Processing Pipeline, WA

Development of site geological model.

ROAD & RAIL PROJECTS

Mine to Port Haul Road (189 km), Pilbara Region, WA

Prefeasibility geotechnical evaluation of 189 km haul road from mine to new port in the western Pilbara region of Western Australia. Key objectives included identification of route engineering geological and geotechnical characteristics to advise pre-feasibility design and cost estimations. Included advice on potential borrow material, re-use of cut materials, anticipated foundation conditions, material excavatability and geotechnical hazards and constraints (e.g. soft soils, adverse rock types) and preliminary design parameters for haul road design. Provision of scope and cost estimates for site investigations for subsequent stages of project development.

Mesa A Railway, WA

Involved in the development of a 45 km of new greenfields heavy haul railway line from route selection through to full time construction support including preliminary and detailed site investigation, geological model development, cutting and embankment foundation design, borrow material identification and suitability, factual and evaluation reporting and project implementation.

Epping to Thornleigh third track (ETTT), Sydney

Geological model for cut back of several rock cuttings in sandstone adjacent to live rail. Rockfall assessment.

Woolgoolga to Glenugie, northern NSW

Stage 1 and 2 excavatability and material reuse assessment.

Transmission Gully, New Zealand

Involved in the development of the geological model and assessment of debris flows across the project.

Forty bends, NSW

Excavatability assessment for road cuttings.

Pacific Highway Upgrade, Bulahdelah Bypass, NSW

Provision of field mapping of constructed cuttings to confirm the engineering geological model for the site to assist in the assessment and resolution of earthworks related issues encountered during construction.

Amaam Coal Mine Development, Siberia

Prefeasibility geotechnical engineering desktop assessment of the Amaam Coal Mine CHPP area and Port to Mine 25 km Road and Rail alignment in a remote site located within a permafrost region. The project involved identifying geotechnical domains representing areas of common geomorphology and engineering geological characteristics, establishing anticipated ground conditions and provision of advice on geotechnical engineering aspects of each domain.

White Quartz Road Upgrade, WA

Site investigation for 45 km long White Quartz Road upgrade from unsealed to sealed to comply with Main Roads WA specifications.

Maules Creek Mine Rail Loop Tender, NSW

Assisted bidding Contractor to identify earthworks opportunities for Tender bid including revised strategies for excavatability, material reuse, problematic foundation conditions and equipment selection and use. Contractor was subsequently awarded this project.

Brockman 4 Line Extension, WA

Site investigation for development of greenfields 50 km heavy haul railway line and airstrip including engineering geological mapping and detailed site investigation for cutting and embankment foundation design, bulk and select fill identification and suitability, geohazard assessment, factual/evaluation reporting. Site investigation for ROM pad, stackers/reclaimers, train loadout, transfer stations and conveyors. Rail tunnel Super Cor Arch structural fill identification and suitability assessment.

Western Creek to Cape Lambert, WA

71 km railway duplication site investigation for railway upgrade, fibre optic cable geotechnical route assessment, reference conditions, excavatability assessment.

Rail Siding Embankments, WA

Site investigation, construction material availability, embankment foundation design for Churdy Pool and Green Pool 3.5 km sidings.

320MTPA Rail Upgrade, WA

Preliminary Engineering Study for three sections of existing track involving desk top study for rail duplications and triplication over 200 km length.

Wonarah Phosphate Haul Road, NT

Plan and conduct site investigation for 30 km unsealed haul road, airstrip, machine workshop and ancillary buildings. Develop geological model. Assist in pavement design. Factual and evaluation reporting.

BC Iron Haul Road, WA

Site investigation including engineering geological mapping, geological model development, borrow material search/assessment and reporting for 65km unsealed haul road.

MINING / QUARRY PROJECTS

Waste Rock Dump Design, Ok Tedi Mine, PNG

Initial scoping study based on an evaluation of the terrain to identify prospective waste rock dump sites. Delivered the design of a 300 mt waste rock dump in high rainfall mountainous terrain at the chosen position in Upper Sulphide Creek. The dump was designed in stages, the first were descending to access and build a stable toe, then ascending to 500 m above the toe elevation for the final landform.

Yallourn Mine, Latrobe Valley, Victoria

Strategic geotechnical study for rehabilitation of coal mine following closure. Assessment of the landform, geotechnical domains, geological models for the mine slopes up to 100 m deep.

Bougainville Mine, PNG

GIS-based remote sensing study for mine re-entry activities.

Mandalong and Ravensworth Longwall Mine Subsidence Assessment, NSW

Establish geological model for the proposed mined area. Assessment of the impacts to surface infrastructure and archaeological sites for inclusion in Subsidence Management Plans.

Tom Price, Brockman and Paraburdoo Iron Ore Mines, WA

Geotechnical logging, line mapping, structural mapping, Lugeon testing, develop geological models, domain definition, interpreting ground responses to mining through monitoring.

Kimberly Diamond Tailings Storage Facility, WA

Geotechnical investigation and stability assessment for capping of disused TSF.

Kelian River Diversion, Indonesia

Landslide dam hazard analysis for river diversion scheme.

Pilbara 320 MTPA Project, WA

Involved identification of suitable rock borrow sites for ballast quarry.

4.3kp Quarry, Cape Lambert, WA

Quarry site investigation and development of the geological model for seawall armour and core material production including supervision of the block size and blasting fragmentation analysis.

GEOHAZARDS

Geohazard Risk Assessment of Sublime Walking Track, Illawarra, NSW

Quantitative risk assessment of the walking track which was closed to the public after a reported rockfall on the track. Recommendations to reduce the risk to acceptable levels so that it could be reopened.

Landslide Susceptibility, Solomon Mine, WA

Development of a natural slope hazard management system for integration into Fortescue Metals Solomon mining operations in the Pilbara region of WA.

National Park Access Road Rock Fall, Devines Hill, NSW

Site geological mapping and assessment of the rockfall mechanism, remnant risk and remediation options including qualitative appraisal of further rockfall potential.

Seismic Hazard Assessment, NSW

Assessment of seismic hazard for the proposed new airport location, Wilton, NSW.

Rockfall assessment, NSW

Sugarloaf rockfall geotechnical assessment. Causes, risk assessment, risk mitigation.

Rockfall assessment, NSW

Dharug 11 km Walking Track Rockfall risk assessment, National Park service.

Landslide assessment, NSW

Assessment of the risk of further landsliding into the active Kulnura Quarry.

Publications, Articles and Patents

1. Packer, M., Nash, T., Bennett, C., Doe, A. (in press). Establishing Professional Accreditation Pathways for Australian Engineering Geologists in the Civil Design and Construction Industry, Australian Geomechanics Society editorial.
2. Wang, D., Nash, T., Sullivan, T., Thurstun, D (2023). Shear strength and modulus of mine waste rock -large scale laboratory test results. Australian Geomechanics Volume 58: No.4 December 2023
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10. Nash, T., Bertuzzi, R. and de Ambrosis, A., (2019). Deterioration of sandstones and shales in Sydney tunnels. In Australia New Zealand Conference on Geomechanics, 13th, 2019, Perth, Western Australia, Australia.
11. Nash T.R. (2018) Relevance of engineering geological models in modern tunnel design and construction. Australian Geoscience Council Convention, Adelaide, 14-18 October 2018.
12. Nash T.R., Shen B., Bertuzzi R. (2017) Geotechnical Validation for Sydney Tunnels. 16th Australasian Tunnelling Conference 2017, 30 October – 1 November 2017
13. Piccolo D, Nash T. & Mostyn G., (2017). Excavation and rockfall protection adjacent to live rail. Australian Geomechanics, V52, No 2, June, pp45-58.
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17. Nash, T.R. (2003). Engineering Geology of Selected Landslide Dams from the 1929 Murchison and 1968 Inangahua Earthquakes. A Thesis Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science in Engineering Geology, University of Canterbury, New Zealand.

Curriculum Vitae

Ben Rouvray
Principal Engineer

Ben Rouvray is a Principal Geotechnical Engineer with over 25 years of consulting experience.

Benjamin has worked extensively on infrastructure projects including roads, railways, mining, dams, hydro power, residential and industrial development. He has led teams during delivery of all phases of the project life cycle, from inception studies to detailed design, construction supervision through to risk and asset management and forensic investigations. He has also performed a number of technical advisory works, design review and assurance roles for a variety of owner, contractor and client organisations. Recently Ben has also become involved in expert witness assessments. Ben has a strong understanding of contractual aspects of project delivery including strategies to deliver projects from tender through to commissioning to achieve compliance with specified requirements including third party interfaces. He has a broad perspective of scope and delivery requirements for a wide variety of project types and has led the delivery of geotechnical services for a number of major infrastructure projects including interfaces with multi-disciplinary project teams.

Educational Qualifications:

- Bachelor of Engineering (Civil) (Hons), University of New South Wales, 1995
- Master of Engineering Science (Geotechnical), University of New South Wales, 2004

Professional Associations:

- Australian Geomechanics Society
- National Engineering Register (Civil, Geotechnical)
- RPEQ (Civil)
- Professional Engineer Victoria (Civil)

References:

Client Reference:

Stuart Simmonds FIEAust, CPEng

Eastern Tunnelling Package

Design Director

John Holland CPB Contractors Ghella JV

M 0400 881 142

E stuart.simmonds@jcgjv.com.au

Employer Reference:

Garry Mostyn FIEAust, CPEng, RPEQ

PSM

Director

M: 0417 486 325

E: Garry.Mostyn@psm.com.au

Experience:

- May 2012 – Present: Principal, Pells Sullivan Meynink
- December 1996 – April 2012: Graduate to Principal, GHD Geotechnics

Field of Competence:

- Major infrastructure strategy and project delivery
- Interface management
- Site investigation
- Analysis and design of geotechnical structures, including foundations and retaining structures
- Geotechnical instrumentation and monitoring
- Ground-structure interaction
- Geohazard evaluation and mitigation
- Forensic investigation

PROJECTS

Hydro Tasmania, Cethana Pumped Hydro Power Development

Design manager of PSM's role leading the geotechnical, hydrogeological and tunnel primary support scope for reference design. Scope included delivery of a significant geotechnical and groundwater site investigation campaign, design of intake excavations and earthworks, geotechnical advice for upper storage dam, waterway and dry tunnels and underground opening design.

Hydro Tasmania, Tarraleah Hydro Power Redevelopment

Assistance and review of geotechnical model, tunnel and cut slope designs. Lead of geotechnical risk management strategy for contract procurement within both construct only and EPCM procurement models. Includes leading development of GBR framework.

Sydney Metro West, Eastern Tunnelling Package: Tender, Design and Construction

Technical and project management leadership assisting the project manager during delivery. Included direct leadership of the delivery of the Geotechnical and Hydrogeological Interpretive Reports, strategy for managing and mitigating third party interfaces, in particular Sydney Water asset impact assessments. Also assisted on cost, schedule and change management, Assisted in establishing the Design and Construction Phase Services team including management plans.

Suburban Rail Link Package C, Melbourne Victoria

Reviewer of Hydrogeological Interpretive Report that informed the groundwater strategy and compliance. Design of reclamation works of pre-existing brick pit excavation and operating ponds to enable passage of TBM. Rationalisation of cross passage support selection criteria at tender for bid submission.

Nowendoc Road widening, Tamworth Regional Council

Site investigation, geotechnical advice, route development, risk assessment, cost estimation and detailed design for this historic rural road to enable vehicles to pass over full length. This highly constrained road was established with convict era construction to pass over the ranges to the south east of Tamworth with side slopes approaching 40 degrees.

Western Sydney Airport Airside Civil Package, Sydney NSW

Following from the Bulk Earthworks project, PSM was retained by the CPB Acciona JV to provide geotechnical advice to the airside civil package. The major component of scope was providing advice on the subgrade conditions to inform the aircraft pavement. This included utilising the Bulk Earthworks construction records to develop a ground model for pavement design. Scope also included geotechnical advice for ancillary buildings and non-aircraft pavements.

Sydney Metro West, Central and Western Tunnelling Package Tender

PSM's Project Manager during tender of this next section of the Sydney Metro project from the Bays to Sydney Olympic Park. Ben was involved in developing the tender strategy including participating in client interactives within the early contractor involvement tender process. PSM's scope included the geotechnical, hydrogeology, predicted and building effects assessment and tender design of a major service facility saft, cross over cavern and pedestrian tunnel.

Pacific Highway earthworks, NSW

Ben led the technical assessment in support of a claim associated with earthworks performed under the NSW roads specification R44 as part of the Pacific Highway dual carriageway works in northern NSW.

Epping Chatswood Rail Link, Drainage investigation, Sydney NSW

Ben was the project manager for PSM who was engaged Sydney Metro to investigate the drainage system of the Epping Chatswood Rail Link and North West Rail Link projects following a major rainfall event in February 2020. The project included forensic assessment of the drainage system and assessment relative to the documented design.

Western Sydney Airport Bulk Earthworks, Sydney NSW

PSM's Project Director during tender and delivery of this 25 million cubic metre earthworks project to enable the construction of the Western Sydney airport. This represents one of the biggest civil earthworks' projects undertaken in Australia. Ben was involved in developing the tender strategy including participating in client interactives which were critical to developing the successful design solution. The project includes an innovative earthworks specification developed to manage the large scale of earthworks required.

Pitt St Over Station Develop., Sydney NSW

PSM was engaged by the Over Station Development contractor (CPB) to provide geotechnical advice on the permanent shoring, foundation design and interaction with the completed TSE works. PSM were engaged to provide CPB with the benefit of PSM's knowledge from participating in the design and construction of the TSE project works.

Cross River Rail, Brisbane QLD

As PSM's Contract Manager during detailed design Ben has assisted the Project Director with delivery strategy and contract administration for this major project. PSM is the designer for all mined tunnels for this significant project in addition to providing geotechnical, hydrogeological and predicted effects scope. Ben was also a technical lead for ground-structure design including interfacing with other designers within the multi-disciplinary team. Ben also assisted the construction joint venture with the development of their instrumentation and monitoring strategy to align with the

Sydney Metro City and Southwest, Tunnels and Stations Excavations, NSW

Design Manager of PSM's TSE project involvement from tender, through detailed design and construction phase services for this significant rail infrastructure project. Services included provision of the project geotechnical and hydrogeological model, assessment of settlement and predicted effects, primary and permanent support for the large span Victoria Cross station cavern, mined tunnel at stations and ground structure interaction design interface for station excavations and shafts. Particular challenges included advice on tunnel and open excavations around the active Eastern Suburbs Rail Line, TBM traverse over existing tunnels with shallow cover, characterisation of the under harbour TBM traverse through sediments, large shaft excavations next to existing heritage and multi storey buildings and an extensive ground monitoring program. Ben was the nominated Geotechnical Design Representative for the Contract so led the implementation and delivery of the Construction Phase Geotechnical scope.

Woolgoolga to Ballina, Pacific Complete, NSW

Ben was engaged as an earthworks design expert to assist Pacific Complete in developing an alternative approach to earthworks for the Pacific Complete project relative to the standard RMS highway specification R44. This included extensive consultation with key RMS stakeholders, contractors and laboratories to gather an understanding of challenges or opportunities to delivery of the existing specification and appetite for including new technologies and processes for future earthworks. This culminated in performing trials for implementation and the drafting of an alternative earthworks specification process within the existing R44 framework.

Coffs Harbour Bypass, NSW

Ben was the Principal for PSM's contribution to the site investigations performed for the Coffs Harbour Bypass project. PSM was engaged as a tunnelling site investigation expert for the three sections of tunnel within the concept project alignment. The site investigations were particularly focussed on defining the structural geology and rock mass units within the tunnel sections and defining the hydrogeological conditions.

Transmission Gully, Wellington, NZ

Geotechnical Design lead during the PPP tender, detailed design and construction phase for this 24km motorway located north-west of Wellington, New Zealand. The project provides a freeway standard road to perform as a lifeline route in challenging topography and highly seismic conditions. Key design elements included major rock cuttings, liquefaction treatment, peat consolidation, major embankments and numerous bridge structures and associated MSE/RSW walls within one of the most seismically active areas of New Zealand. Ben also contributed significantly to the strategy development for the design and performance criteria considering the ongoing operation and maintenance that was particularly important owing to the PPP delivery of the project.

North West Rail Link Tunnels and Stations Construction, NSW

Project Manager of PSM's detailed design services for this significant rail infrastructure project. The design included provision of the project geotechnical and hydrogeological model, mined tunnels, mined underground openings at stations, and a major span cavern located in low cover in shale bedrock. Ben also established the construction phase services and instrumentation and monitoring strategy for the project.

Puhoi to Warkworth, Auckland, NZ

Geotechnical Project Director for this PPP motorway tender for the motorway link north of Auckland. The project included complex geotechnical units with challenging slope stability design considerations. The project also included soft soil design considerations, earthworks design, and bridge foundation advice including consideration of seismic design criteria.

Southlink F6 Site Investigation, NSW

Ben was Project Director for PSM's delivery of site investigations to RMS for the proposed F6 extension or Southlink project. The investigations included boreholes, in-situ and laboratory testing and groundwater monitoring installation.

Pacific Highway Upgrade, Tintenbar to Ewingsdale

Geotechnical Design lead for this Pacific Highway Upgrade during tender and detailed design. Critical aspects included complex earthworks specification associated with Halloysitic soils, bridges, drainage and retaining walls structures. This tender also included a large volume of geotechnical investigation data which was managed throughout the tender phase to maintain an accurate and reliable geotechnical model for design

advice. Ben was also engaged by the Tunnel designer to advise on the tunnel design for this project.

Sydney Metro Stage 1 and 2, Central to Rozelle and Westmead

Project Manager of the Geotechnical Advisory team that developed the Geotechnical Interpretive Report for the Sydney Metro Stage 1 and 2 prior to project cancellation. Ben provided technical advice regarding site investigations and design challenges including facilitation of constraint and opportunity workshops with the client and designers. Advice on the D&C procurement documents and technical review of D&C tender submissions for the Primary Route Infrastructure contract for the Metro Stage 1.

Mt Arthur Coal Export Tunnel Distress

Project Director and Geotechnical Lead, on this project, that included forensic investigation to and assessment of a cracked arch tunnel to challenge a remedial works strategy that had been developed by others. By adopting a risk based assessment approach, the impact of the tunnel on mine operations enabled the client to consider their expenditure and planning for this critical asset.

Eastern Distributor Cleveland St Cleveland St Underpass Groundwater seepage

Ben was initially lead of a multi-disciplinary team providing advice to the maintenance contractor on investigations for assessment of mitigation options relating to this critical roads asset. Ben was later engaged by the asset owner to design a dewatering system to facilitate pavement resurfacing that required detailed investigations and trials prior to successful implementation.

Monitoring Installations, Epping Chatswood Rail Link (ECRL)

Coordinated and supervised detailed geotechnical investigations and monitoring installations associated with ECRL. Included coordination of traffic control and subcontractors for installation within highly trafficked and densely populated areas including Lane Cove Road for monitoring of the Macquarie Park station cavern, performed under limited night road possessions.

Wollongong Coastal Study

Geotechnical Lead for the investigation and assessment of the Coastal Cliff and Slope risk assessment to inform the Wollongong Coastal Management Study. This included risk assessment utilising GIS database and presentation of the findings to community forums on behalf of Council.

Glenfield Junction Alliance – TCA

The Engineering Assurance (EA) process within TCA is intended to provide assurance of safety, engineering reliability and quality for TCA as a Design Authority. Ben was appointed as a Geotechnical Advisor assisting TCA with EA for a number of projects, most significantly the Glenfield Junction Alliance. This included all aspects of geotechnical engineering from bridge structures, ground modification, earthworks and rail track formation design.

Railcorp Network Antennae Upgrade

Project Director and Geotechnical lead advising UGL on the location, investigation, design and construction validation of over 170 antennae sites throughout the Railcorp network. Sites were located in Sydney, south to Kiama, west to Lithgow and north to Newcastle. Included strategy to address geotechnical constraints via an initial desktop appraisal, hazard identification, generic design and finally site specific assessment prior to construction validation. Also included close liaison with Rail corp to obtain design approval.

Pacific Highway Upgrade, Sapphire to Woolgoolga

led a team providing geotechnical support to proof engineering for this Pacific Highway Upgrade project. The client was particularly pleased with the innovative design approaches incorporated into the proof engineering, to ensure timely response to design modification to minimise construction delays.

Maaden Alumina Mine and Refinery, Saudi Arabia

Project manager for the geotechnical team for 6 months prior to the project cancellation as a result of the global financial crisis. The project included a new Bauxite mine in central Saudi Arabia with a Refinery and associated infrastructure (road, rail, dams, etc) at the east coast. The scope included procuring site investigations and design development for the mine and refinery infrastructure.

Marangaroo Rail Tunnel, Lithgow

Design, planning and supervision of geotechnical investigations for assessment of remedial design options for significant track pumping within an existing rail tunnel.

Bega Bypass Detailed Design

Project director of the geotechnical investigations, interpretive report and geotechnical design to support the Bega Bypass detailed design. The project included earthworks, bridges, culverts and Reinforced Soil Walls being delivered under a Construct Only contract.

Macarthur Turnback - TCA

Geotechnical advisor for detailed design development of retaining walls, earthworks and bridge derailment deflection structures.

Epping to Thornleigh Third Track, NSW

Ben was the interim GHD design manager for the concept design development of this project within a design only joint venture between GHD and PB.

M7 Motorway Shared Path Distress

Retained by Westlink M7 as geotechnical advisor for assessment and rectification works for the pavement distress being encountered by the M7 Shared Path. This included advising on remedial strategy and assessing design solutions.

Warringah Freeway, Bus Layover

Geotechnical lead in investigation, design and construction phase support for rock cutting widening, retaining walls and earthworks adjacent to major freeway to Sydney CBD.

Hornsby Platform 5 and Stabling

The project included numerous cut and fill widenings including at existing bridge abutments, a variety of retaining wall solutions and confined earthworks given the highly constrained site. Included identification, investigation and subsequent design to cater for a volcanic diatreme. Ben was Geotechnical lead during the investigation, design and construction phases of this project.

Alfords Point Widening, RMS, NSW

Geotechnical lead for site investigation and geotechnical design advice for the Alfords Point Bridge approach widening including rock cutting widening strategies and stabilisation.

Lake Endeavour Dam, Parkes

Geotechnical lead in the site investigations and forensic analyses of the existing Lake Endeavour Dam to examine the need for remedial works owing to deformation of the dam embankment that had existed since first filling.

M2 Motorway Geotech Asset Appraisal

led a team to review existing M2 Motorway geotechnical assets for the length proposed for widening (east of Windsor Road). Performed review of existing records and physical inspection of assets to generate a qualitative appraisal of each asset condition and collate an asset inventory.

Pacific Highway Upgrade Oxley Highway to Kempsey and Woolgoolga to Wells Crossing

Ben led the geotechnical investigations and geotechnical design development of these projects from route development to concept design. Culminated in provision of geotechnical reports for progression of the concept design for these projects, including strategies for soft soils, major cuttings and bridge foundations.

Donaldson Coal Mine Haul Road and Dam

Ben was involved as design manager and geotechnical lead for two elements of infrastructure at the Donaldson Coal mine including a haul road from the mine pit to infrastructure area and also a water storage dam. Ben led the site investigations, geotechnical advice and design development.

Jindabyne Dam Spillway, NSW

Ben led the delivery of site investigations to inform the major upgrade of the Jindabyne Dam spillway which included new spillway gates and spillway structure.

Brennans Creek Dam, NSW

Geotechnical site investigation and installation of vibrating wire piezometer monitoring for dam assessment and development of remediation strategies.

F3 Freeway Widening Project, Mt White and Berowra to Cowan

As the RTA's Geotechnical Representative during the construction of these two sections of the F3 widening, Ben provided geotechnical risk management of the widening project performed under full time freeway traffic. Included risk management of rock cutting and "Mohawk" excavation, protection of bridge abutments and design of rock cutting stabilisation treatments.

F3 Rock Cutting Remediation

Ben was associated with the assessment, design and supervision of cutting remediation and stabilisation for over 50 rock cuttings along the F3 freeway during the period from 1998 to 2009.

West Charlestown Bypass, Newcastle

Involved in the Geotechnical design and supervision from detailed design investigations through to construction phase as the RTA's geotechnical representative. His Involvement has generated two technical papers in relation to coal mine workings and complex anchored pile retaining walls

Bengalla Coal Mine, Muswellbrook

As Geotechnical design and supervisor, Ben was involved on all geotechnical aspects from the large scale investigations which led to detailed design followed by construction phase services of the mine infrastructure development, procured as an EPCM project. The project included large volume of earthworks for the mine infrastructure, access roads, haul roads, rail loop and several dams including a major dirty water storage dam.

LECTURING AND TEACHING

Ben has undertaken masters course lecturing for the University of Canterbury, NZ and the University of New South Wales for courses in Slope Stabilisation and Hydrogeology respectively.

Ben has also led a number of internal training courses relating to geotechnical engineering including fieldwork techniques, instrumentation and monitoring. He also led a 2 day internal Major Project Management training module for over 20 staff.

INFRASTUCTURE EXPERIENCE

Road

Various aspects from route studies to detailed design and subsequent asset risk/ condition assessment, forensic investigations and maintenance for projects including Pacific Highway Upgrades for Woolgoolga to Wells Crossing, Oxley Highway to Kempsey, Tintenbar to Ewingsdale and Coffs Harbour Bypass; the West Charlestown Bypass Newcastle; F3/M1 freeway widening at Mt White and Berowra to Cowan; M2 and M7 Motorways; Eastern Distributor; Pacific Highway upgrade and numerous council, private developers and smaller scale RTA/RMS engagements.

Rail

Major projects include cross River Rail Brisbane, Sydney Metro NWRL, TSE and ETP design and construction and tenders for Metro West CTP/WTP packages, Hornsby Platform 5 and Stabling; Macarthur Turnback; several coal mine rail loops in the Hunter Valley and Gunnedah basin, engineering Assurance for numerous TCA projects predominately Glenfield Junction Alliance; and support for numerous small scale Railcorp infrastructure projects (e.g. substations, etc).

Mine

Co-ordinated and performed site investigations, analyses and design for geotechnical aspects of mine operations including infrastructure areas, haul and access roads, water supply and dam storage. Projects include the Mt Arthur, Maaden Alumina project in Saudi Arabia, Boggabri Coal, Bengalla Mine development, Donaldson Coal and numerous ancillary facilities for numerous mines within the Hunter Valley.

Hydropower and Dams

Co-ordinated and performed site investigations including forensic investigations, analyses and design for geotechnical aspects of several hydropower and dams projects including the Cethana pumped hydro and Tarraleah redevelopment, Jindabyne Dam spillway, Brennans Creek Dam, Lake Endeavour Dam, water supply dams at Donaldson Coal and Bengalla Coal Mine, numerous farm and recreational dams including the Vintage Country Club dams in highly dispersive Hunter Valley soils, sediment control and dirty water dams for surface infrastructure projects.

Tunnel

Involved in provision of site investigations, geotechnical and hydrogeological interpretation, instrumentation and monitoring, assessment of settlement and predicted effects, design management, construction phase verification and instrumentation and monitoring for several major tunnelling projects including Tarraleah Hydropower redevelopment, Cross River Rail, Sydney Metro West tender, design and construction of Eastern Tunnel package, City and Southwest and North West rail link sections, Tintenbar to Ewingsdale St Helena tunnel, Epping to Chatswood rail link, Southlink - F6 extension, CBD and West Metro projects.

SITE INVESTIGATIONS

Co-ordinated and supervised several large scale geotechnical investigations including: West Charlestown Bypass, Pacific Highway Upgrade Route Selection; Jindabyne Dam Spillway, Bengalla Coal Mine infrastructure, Lake Endeavour Dam - Parkes, Donaldson Mine Haul Road and Dam, Vintage Country Club, Rouse Hill development, Summerland Way, City West Link Road and the Parramatta Rail Link project. Assisted client with procurement of large scale investigations for Maaden Alumina and Sydney Metro.

INSTRUMENTATION

Designed and supervised installation of geotechnical instrumentation for numerous large scale infrastructure projects including inclinometers, extensometers, piezometers and survey monuments for the Parramatta Rail Link station caverns; the West Charlestown Bypass; Hornsby Platform 5 and Stabling; Lake Endeavour Dam; Jindabyne Spillway; Brennans Creek Dam and several Council and RTA slope stability projects. Involved in the review and assessment of monitoring for numerous major infrastructure projects including Sydney Metro, Transmission Gully and Cross River Rail.

CONSTRUCTION SUPERVISION

Provided or established teams to provide construction phase geotechnical supervision and advice to several complex geotechnical projects. Spent 12 months full time for the excavation and stabilisation of rock cuttings for the F3(M1) widening at Mt White under full traffic. West Charlestown Bypass project including treatment of shallow mine voids and a large cutting within a stress relief environment, supervision of in excess of 50 rock cutting stabilisation works for the RTA and numerous councils; inspection of ground anchors, piling and soil nail construction including land slide remediation works.

Ben has established the delivery of construction phase services for major projects including teams in excess of 25 personnel for Sydney Metro Eastern Tunnel package,

City and Southwest, Sydney Metro North West Rail Link, Transmission Gully and Western Sydney Airport. Ben was nominated as the Geotechnical Design Representative by the JHCPBG Joint Venture in their delivery of the Sydney Metro TSE project works.

SLOPE STABILITY

Soil and Rock Slope Stability

Undertaken geotechnical investigation, analysis, design and construction supervision to assess/remediate soil and rock slope instability at numerous sites including the F3 Freeway; West Charlestown Bypass, Bengalla Colliery infrastructure, M2 Motorway, Lawrence Hargrave Drive, Hornsby Rail Platform 5 and Stabling, Wollongong coastal study, and numerous Council projects particularly for Warringah and Pittwater councils.

Publications

PACKER MEGAN, HE KE, ROUVRAY BEN & DE AMBROSIS ANDREW (2023) “Sydney Metro Martin Place Station South Shaft – back-analysis case study of ground displacements adjacent to existing railway tunnels”, Proceedings of the 14th Australia and New Zealand Conference on Geomechanics, Cairns 2023 (ANZ2023).

MERRITT, A. TEOH, M. POURNAGHIAZAR, M. ROUVRAY, B. and SIMMONDS, S. (2021). Assessment of settlement impacts for the Sydney Metro City & Southwest Tunnel and Station Excavations. Proc. 17th Australasian Tunnelling Conference ATS 2020+1, Melbourne, Australia, pp 432-445.

A. MERRITT, B. ESTRADA, B. ROUVRAY & S. SIMMONDS (2021) “Developing the Ground Model for the Sydney Metro Harbour Crossing Tunnels”, Proceedings of the 20th International Conference on Soil Mechanics and Geotechnical Engineering, Sydney 2021.

PACKER, M.L., ROUVRAY, B. AND DEAMBROSIS, A. (2021) “Sydney Metro Martin Place Station - managing predicted effects on existing tunnels with risk-based design”, The Australasian Tunnelling Conference (ATS2020+1), Melbourne, 10th – 13th May 2021.

CAMMACK R, EGGERS M, ROUVRAY B, RUTHERFORD T (2019) “Torlesse rock mass classification system and structural regimes for rock engineering – Wellington, New Zealand”; 13th Australia New Zealand Conference on Geomechanics, Perth, Western Australia, Australia, 1-3 April 2019.

ROUVRAY B, SWARBRICK G, HENNING J (2015) “Design groundwater levels and depressurisation of the Cleveland St underpass” 2015 AGS Sydney Symposium, Recent Developments and Experiences with Groundwater and Excavation, Friday 13 November 2015, Australian National Maritime Museum, Darling Harbour, Sydney.

ROUVRAY B, TOH J, CAMMACK R, ESTRADA B (2015) “Performance Based Geotechnical Design of a Seismically Resilient Motorway: The Transmission Gully Project, New Zealand”, 6th International Conference on Earthquake Geotechnical Engineering, 1-4 November 2015, Christchurch, New Zealand.

ROUVRAY B, BERTUZZI R, (2014) "Reducing the cost of tunnel design in Australia", 15th Australasian Tunneling Conference, Sydney NSW 17-29 September 2014.

ROUVRAY B, KOTZE G (2010) “Highly Constrained Railway Widening Project within a Previously Unrecorded Diatreme at Hornsby, NSW”, Technical Presentation to the Australian Geomechanics Society, Sydney Chapter, 11 August 2010.

ROUVRAY B, SUKKAR J and HEINRICHS P, (2007) “A coordinated approach to geotechnical investigation and piezometer monitoring systems at Lake Endeavour Dam, Parkes NSW”, ANCOLD conference, Queenstown New Zealand.

ROUVRAY BJ & DAVIES W, (2005) "Case Study: Mine Void Investigation and Remediation for the West Charlestown Bypass, Newcastle", Australian Geomechanics, Vol.40 No 1, pp. 91-100.

ROUVRAY BJ, CHAN KF & STONE PC, (2004) "Monitoring and Back-analysis of a Road Cutting with Locked-in Horizontal Stress Field", Proc. 9th Australia New Zealand Conference on Geomechanics, Auckland, 2004. Vol. 2, pp. 732-738.

Curriculum Vitae

Andrew Wilson
Associate Geotechnical Engineer

Andrew Wilson is an Associate Geotechnical Engineer at PSM. He graduated from the University of Melbourne in 2012 with a Bachelor of Engineering, obtaining first class honours, and completed a Masters of Engineering Science (Geotechnical and Engineering Geology) in 2023. Andrew joined PSM in 2022 and has significant experience in civil infrastructure projects.

Andrew has onsite experience in roles including geotechnical inspections and advice, investigations, construction supervision and management of project design teams.

Andrew is currently based in PSM's Geelong office.

Educational Qualifications:

- Bachelor of Engineering (First Class Honours), University of Melbourne, 2012
- Masters of Engineering Science (Geotechnical and Engineering Geology), University of New South Wales, 2023

Experience:

- 2022 – Current: Associate Geotechnical Engineer, PSM
- 2017 – 2022: Lead Geotechnical Engineer, Department of Transport (formerly VicRoads)
- 2016 – 2017: Senior Geotechnical Engineer, VicRoads
- 2015 – 2016: Pavement Design Engineer, VicRoads
- 2014 – 2015: Project Engineer, VicRoads

Field of Competence:

- Geotechnical site investigation and management
- Geotechnical design including:
  - Deep and shallow foundation design
  - Slope stability analysis and design
  - Retaining structures
- Landslide Risk Assessment and Remediation
- Structural Design
- Numerical modelling
- 2D & 3D CAD modelling
- Pavement investigation and design
- Highway engineering
- Construction supervision and advice

Courses and Certifications:

- Australia Geomechanics Society – Engineering Geology, 2019
- Australia Geomechanics Society – Landslide Risk Assessment, 2019
- Australia Geomechanics Society – Field Mapping & Logging, 2018
- IRATA Level 1 – Industrial Rope Access Technician

CIVIL PROJECTS

Hyland Hwy Landslide Repair, Carrajung VIC

Lead designer of the detailed geotechnical and structural design for the repair of deep-seated landslide through an arterial road fill embankment. Repair works included a solider pile retaining wall with waler and post tensioned ground anchors. Project developed bespoke ground anchor specification and detailed ground anchor testing.

South Gippsland Landslide Repair, VIC

Project and Design manager for tender advice, site investigation and detailed design for design and construct contract for the repair of five landslide affected roads in South Gippsland. Repair works included soldier pile retaining walls, fill reconstruction, deep geogrid reinforced patches, anchored bored pile and capping beam system, pavement construction and drainage works.

Burnley Tunnel Instrumentation, VIC

Investigation and technical support for upgrades to tunnel groundwater instrumentation and monitoring. Inspection and investigation of existing instrumentation. Identification and analysis of available options, including repair, replacement and upgrades. Development of technical specification for replacement works. Provision of owners engineer technical support and on-site support during works.

Department of Transport Slope Stability and Landslide Remediation Works, VIC

Detailed investigation and design of 20+ slope stability and landslide projects for various arterial roads managed by Department of Transport. Remedial works included bored piles, soldier pile retaining walls, earthworks, drainage improvements.

Great Ocean Road Geotechnical Project, VIC

Lead designer for the investigation and detailed design over 100 landslide sites with a wide variety of treatments including earthworks, soil nailing, retaining structures, piling, rock bolting, ground anchors, drainage, armour stone and rockfall netting. This has required all aspects of geotechnical practice including management and supervision of borehole drilling, landslide risk assessments, site mapping, geotechnical and structural design, as well as construction drawings and documentation. Provided proof engineering of designs completed by others.

North East Link Temporary Works, VIC

Providing geotechnical design advice and assessment for temporary works on the North East Link project including numerical modelling of solider pile retaining walls, shallow footings assessment, slope stability assessment, and earthworks advice.

Geelong-Ballan Rd Landslide Stabilisation, VIC

Lead designer for detailed geotechnical and structural design of remedial works for landslide in deep fill embankment. Design works included 2D soil structure analysis (PLAXIS), 3D numerical analysis (Strand7), and structural design to AS5100. Remedial works included reinforced concrete bored piles and capping beam, ground anchors, steel post and concrete panel retaining walls, drainage improvements. Project also included strengthening upgrades to an existing retaining wall involving the structural detailing and design of steel waler and ground anchors.

Highbay Foundation, Truganina VIC

Geotechnical assessment of Highbay warehouse foundation design with extremely tight tolerances Including development of 3D geotechnical model and 3D soil-structure interaction numerical modelling (Strand7) of various ground and loading conditions.

Hamilton Hwy Landslide Stabilisation, VIC

Lead Design Engineer and Design Manager of complex landslide remediation in an urban environment. Required oversight and management of all aspects of project as well design management responsibility for design and investigation. Remedial works included a combination of soil nails, micropiles, drainage, and retaining walls. Provided stakeholder management between key residents and Department of Transport. Significant onsite construction supervision requirements as well as Proof Engineering of designs completed by others.

Port Melbourne Industrial Development, VIC

Geotechnical Investigation and advice for development of industrial warehouse in complex quaternary geology and soft soils.

Princes Hwy Bridge Strengthening Project, VIC

Load rating and strengthening project to upgrade the load ratings of 15 bridges along key national freight route. Requiring the scoping and management of geotechnical investigations (including borehole drilling as well non-destructive testing of existing foundations). Preparation of site condition documents, foundation, and pile capacity assessments, strengthening designs, review of reports and management of staff.

Bacchus Marsh Eastern Link & Ararat Bypass Planning Study, VIC

Provided desktop and preliminary geotechnical assessment of major bypass planning projects.

Stimulus Project - Landslide Prevention, VIC

Investigation and design of 10 high risk landslide sites. Remedial works include, soil nails, reinforced fills, earthworks, rockfall netting, contiguous piles, soldier pile retaining walls. Provided initial scoping and cost estimates, design management and proof engineering of external design consultants work, detailed geotechnical and structural design services, and construction supervision.

Department of Transport Major Project Design Reviews

Reviews of major road project designs for asset owner. Detailed reviews of geotechnical and pavement design to ensure compliance with VicRoads specifications and Australian Standards. Reviews of requests for dispensation and non-conformance.

Wye River & Grey River Bridge, VIC

Replacement of existing bridges in a constrained and geologically difficult environment. Requiring the scoping and management of geotechnical investigations including geophysics, preparation of site condition documents, foundation designs, review of reports and management of staff.

Princes Hwy Overtaking Lanes Project, VIC

Reconstruction and widening of 30+ kilometres of major highway. Provided geotechnical and pavement investigation, design advice for new pavement and earthworks areas and rehabilitation treatments.

Forrest-Apollo Bay Rd, VIC

Investigation and design for solider pile retaining structure and slope stabilization treatments in road widening project, including site inspection, preparation of construction drawings, reporting and technical advice.

Geelong-Bacchus Marsh Rd Widening-Apollo Bay Rd, VIC

Widening of 4 structures requiring the management and supervision of geotechnical investigations, preparation of site condition documents and piled/spread footing foundation designs.

Major Freeway Upgrade Projects, VIC

Site investigation, assessment of existing pavement conditions, deflectometer testing, new pavement designs and pavement rehabilitation designs. Projects include:

- Chandler Highway Upgrade
- Monash Freeway Upgrade
- Thompsons Road Duplication

Monash Freeway Rehabilitation Strategy, VIC

Extensive analysis, development and reporting of data driven pavement treatment options for the Monash Freeway. Represented and advised VicRoads at Business Case development sessions, as well as represented VicRoads in a technical capacity at Early Industry Engagement sessions with Australian Asphalt Pavement Association.

Pavement Impact and Trial Assessments, VIC

Quantitative and qualitative assessments of impacts to pavement conditions as a result of changed conditions, or construction trials. Typically, complex data driven analysis of pavement condition and impact of changes. Specific projects include:

- Footscray Road Freight impact assessment
- Western Freeway resurfacing developer proposal
- Timboon-Colac Road Stabilor Trial Evaluation.

Department of Transport/VicRoads Annual Pavement Rehabilitation Program, VIC

Site investigation and development of rehabilitation treatment options for granular and asphalt pavement rehabilitation projects.

Innovative treatments options included the use and development of foamed bitumen stabilised treatments as well as geogrid stabilised pavements. Designed and developed VicRoads MSE's first foamed bitumen stabilised pavement project.

Curriculum Vitae

Christine Lion
Associate Geospatial Scientist

Christine Lion is a GIS Analyst at Pells Sullivan Meynink. She graduated from the University of Paris 6, France, in 2009 with a Master of Science in physics. Her PhD focused on the applications of Interferometry Synthetic Aperture Radar (InSAR) to study estuaries. Funded by the French Space Agency, she set automatic InSAR processes for hydrogeologists. For 2 years she worked in the US as a postdoctoral Associate to build a world river width database. She worked as a data scientist for two AgTech startups in Sydney, where she developed neural network models.

Christine joined PSM in May 2019. She assists in projects on data-related tasks, from automatization of processes to database build. She also provides insight into satellite data usage for large scale projects.

Educational Qualifications:

- Ph.D., Remote Sensing and Hydrology, CNES and University of Toulouse, Toulouse, France (2012). Modelling SWOT high-resolution data and its applications to study the Amazon River estuary
- M.Sc., Remote Sensing, University of Paris 6 (UPMC Paris 6) (2009)
- B.Sc., Physics, University of Paris 6, Paris, France (2007)

Experience:

- May 2019 – Present, GIS Analyst, Pells Sullivan Meynink, North Ryde, NSW, Australia
- Oct 2018 – Apr 2019, Principal Data Scientist, FluroSat Pty Ltd, Sydney, NSW, Australia
- May 2017 – Sep 2018, Data Scientist, The Yield Technology Solutions Pty Ltd, Sydney, NSW, Australia
- Feb 2015 – Feb 2017, Postdoctoral Associate, Department of Geological Sciences, University of North Carolina at Chapel Hill, Chapel Hill NC, USA
- Feb 2013 – Feb 2015 Research engineer, Laboratory of Geophysical and Oceanographic Studies (LEGOS), Toulouse, France, French Spatial Agency (CNES), Toulouse, France
- Sep 2009 – Dec 2012, Doctoral Student, Laboratory of Geophysical and Oceanographic Studies (LEGOS), Toulouse, France, French Space Agency (CNES), Toulouse, France
- Feb 2009 – Aug 2009, Graduate Research Assistant, Centre for the Study of the Biosphere from Space CESBIO, Toulouse, France

Field of Competence:

- Spatial analysis with GIS: QGIS/GDAL/OGR, ESRI ArcGIS, GRASS, SAGA
- Remote sensing: Satellite data analyses (radar and optics), signal analysis, GPS, altimetry
- Software: Visual Studio, SQL, Power BI, Tableau, Azure, Microsoft Office, Google Earth Engine
- Field survey: GPS, Theodolite, ADCP, spectrometer, echo-bathymetry, LAI, soil moisture
- Programming languages expertise: Python, C, Fortran, Shell, MatLab, Rhino3D and Python in Rhino
- OS systems: Linux/Ubuntu, Windows, MacOS

MAJOR PROJECTS

Rozelle Interchange, Sydney, NSW

Data management and automatic processes – Built SQL database to ingest field records. Automatic generation of summaries of tests performed on site (BH, TP…) and concatenation of laboratory tests.

Develop scripts to analyse and compare InSAR data with in-situ settlement measurements.

Create maps of testing data location.

Fortescue Metals Group Solomon Mining Area, Pilbara, WA – Landslide Hazard Assessment

Develop script to generate a Landslide susceptibility map over 175 km^2 combining in situ data and geological knowledge.

Western Sydney Airport, Sydney, NSW

Prepare geomorphological maps using remote sensing data (LiDAR, DEM).

Prepare geotechnical maps: tests location, change of land use.

Organize collected data on site. Integrate testing data locations (borehole location, cone penetration test sites, wells, buried settlement plates, surface monitoring points) into online mapping services (ex: ArcGIS online) for site engineers.

Develop python tools to generate test density surveys, control fill layers thickness, link fill lots and material placed with source (cut or imported) and layer cake of fill material placed.

Assess potential of InSAR to measure subsidence and relation to fill depth.

Develop automated work flows to improve CPS mapping using MS Sharepoint and Power to Automate.

Mulga Downs Deposit, WA

Develop machine learning model to automate detrital unit identification for geotechnical modelling.

Ichthys LNG, Bladin Point, NT

Review acquisitions methods to generate DEM using GPS and LiDAR data.

Through Google Earth Engine, generate maps of water and vegetation indices to map the evolution of the water infiltration and vegetation.

Ok Tedi Mine, Ok Tedi Mining Limited, PNG

Prepare geomorphological maps using remote sensing data (LiDAR, DEM). Develop tools to analyse prism data.

Jordan Springs, Sydney, NSW

Investigate InSAR data (Sentinel 1) potential to monitor subsidence.

Kouroussa Gold Project, Guinea

Develop tool to analyse slopes in various pits from satellite data.

Inland Rail, Brisbane, QLD

Prepare geomorphological maps using remote sensing data (LiDAR, DEM) with site investigation data.

Morwell River Diversion, Yallourn, VIC

Analyse, interpret and compare InSAR data with in-situ measurements.

Supervised tool development to process in-situ measurements automatically.

Twin Hills evaporation Pond, QLD and AVL water balance study, WA

Generate water masks using Sentinel 2 data to estimate the water elevation of lakes and evaporation pond from 2016 to 2023.

Batu Hijau, Indonesia

Develop script to generate shadow in a pit to assess evaporation reduction due to solar shading.

Nowendoc Road Upgrade, Tamworth, NSW

Extract publicly available data for site investigation and combine with in situ data.

Port Stephens Cutting Investigations, NSW

Analyse and extract data for site investigation (terrain analysis, generate 1:1 profiles).

Metro West - ETP Design, NSW

Extract and analysis data for HIR modelling team.

Generate basements database.

Create figures for data presentation reports.

Exxon, PNG LNG

Create a GoogleEarth project to present all consolidated data to the different stakeholders.

Publications, Articles and Patents

1. Frasson, R. P. d. M., Pavelsky, T. M., Fonstad, M. A., Durand, M. T., Allen, G. H., Schumann, G., Lion, C., Beighley, R.E., Yang X. (2019). Global relationships between river width, slope, catchment area, meander wavelength, sinuosity, and discharge. Geophysical Research Letters, 46, 3252– 3262.
2. Pitcher, L. H, Pavelsky, T. M., Smith, L. C., Moller, D. K., Altenau, E. H., Allen, G. H., Lion, C., Butman, D., Cooley, S. W., Fayne, J .V., Bertram M. (2019). AirSWOT InSAR mapping of surface water elevations and hydraulic gradients across the Yukon Flats Basin, Alaska. Water Resources Research, 55, 937– 953.
3. Frasson, R. P. M., Wei, R., Durand, M., Minear, J. T., Domeneghetti, A., Schumann, G., Williams B. A., Rodriguez E., Picamilh C., Lion C., Pavelsky T., Garambois, P.-A. (2017). “Automated river reach definition strategies: Applications for the surface water and ocean topography mission”. Water Resources Research, 53.
4. Altenau E.H., Pavelsky T.M., Moller D., Lion C., Pitcher L.H., Allen G.H., Bates P.D., Calmant S., Durand M.T., Smith L.C. “Novel AirSWOT measurements of river water surface elevation and slope: Tanana River, AK”. Geophysical Research Letters, 2017.
5. Papa F., Biancamaria S., Lion C., Rossow W.B., “Uncertainties in Mean River Discharge Estimates Associated with Satellite Altimeter Temporal Sampling Intervals: A Case Study for the Annual Peak Flow in the Context of the Future SWOT Hydrology Mission”. IEEE Geoscience and Remote Sensing Letters, 2012, 9 (4), pp. 569-573.
6. Crétaux J.-F., Berge-Nguyen M., Leblanc M., Abarca Del Rio R., Delclaux F., Mognard N., Lion C., Pandey R.-K., Tweed S., Calmant S., Maisongrande P., “Flood mapping inferred from remote sensing data”. International Water Technology Journal, 2011, 1 (1), pp. 48-62.
7. Yésou H., Blumstein D., Crétaux J.-F., Uribe C., Lion C., Daillet S., Gennero M.-C., Huber C., Bergé- Nguyen M ., Giraud H., Studer M., “Hydrologie SWOT Chine” TOSCA (equivalent to ROSES), awarded 2013 (2 years funding)
8. Pourthié N., Fjortoft R., Gaudin J.-M., Durand P., Lion C., “Low incidence bi- and monostatic Interferometry for hydrology” TanDEM-X proposal, awarded 2010.