AUSTRALIAN
ENVIRONMENTAL AUDITORS

Expert Hydrogeological Report Addendum

Board of Inquiry, McCrae Landslide

Prepared for
MinterEllison

Prepared by
Australian Environmental Auditors Pty Ltd

Date
11 August 2025

Job No.
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Date of Report:
11 August 2025

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Irrelevant & Sensitive

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1. Introduction

1. On 7 July 2025, I was engaged by MinterEllison (ME) on behalf of Mornington Peninsula Shire Council (Council) to provide an expert hydrogeological report in relation to the Board of Inquiry (BOI) into the McCrae Landslide.
2. I provided a copy of my hydrogeological report dated 21 July 2025 (hereafter referred to as the original report) to ME. The report summarised the hydrogeological data provided to me and opined the source of the water that caused the January 2025 landslides was most likely mains water from the Bayview Road leak.
3. Following my original report I have attended two expert conclaves, the first over 28 and 29 July and the second on 1 August 2025 and subsequently the BOI hearings on 4 and 5 August 2025.
4. This short addendum presents my review of documents that have been submitted after the BOI hearing.

2. Document and Information Provided

5. The following document was provided for my review:

   C M Jewell and Associates Pty Ltd (2025). McCrae Landslide Geochemistry Report. Ref J18121.4R, dated 8 August 2025m and

   Email titled FW: OFFICIAL: Fw: McCrae Board of Inquiry - SMEC Response to Matters in Hearing on 05.07.2025 [ME-ME.FID25707854] received on 9/8/2025 at 4:04pm. This email was forwarded by ME from the BOI that referenced McCrae Board of Inquiry - SMEC Response to Matters in Hearing on 05.07.2025 [TGLAW-Legal.FID4375587]. This email contained additional information about SMEC's flow calculations.

3. Expert Review and Opinions

Geochemical Origin of Water

6. Mr Jewell was asked to provide his opinion on the likely contribution of mains water from the Bayview Road mains water leak to the January 2025 landslides.
7. A summary of his opinions, along with my review, are provided below:
   a. Mr Jewell considers that soils/aquifer material would not contribute chloride to water along the flow path from the Bayview Road breach to the landslide area.

In my opinion this contrasts with his views expressed and documented in the geochemical expert conclave where he acknowledged that aeolian sands could contribute chloride to migrating water. The presence of such sands has been documented by SMEC, PSM and WSP. In addition, evidence of increasing salinity (and hence chloride) along the flow path has been documented by WSP in their causation report ([1]).

8. Mr Jewell refers to modelling that shows that colluvium material cannot contribute chloride due to the long reaction times required.

[1] DPA.0004.0001.0001_WSP_Causal Report, paragraphs 183 and 182g

> In my opinion this conclusion cannot be relied upon as Mr Jewell provides no basis (method, supporting calculations, etc.) for the opinion.

9. Mr Jewell has calculated the flux of chloride (flow of water times the concentration) that comes from the seep at the landslide (noting this is based on two seep samples only). He then calculates the contribution of chloride from four sources (mains water, irrigation, drainage and interface groundwater) and compares this calculated flux to that measured at the landslide seepage location.

> In my opinion I cannot rely on the calculations as the study is incomplete - the flow rate used to calculate the flux was not defined for at least three of the four potential water sources (mains, drainage and interface groundwater).

10. The chloride concentration he adopts to represent interface groundwater is 480 mg/L and based on this the contribution from mains is calculated to be minimal (around 0.5%).

> In my opinion Mr Jewell did not use the correct chloride concentration which skews the results. The concentration which should have been used for the interface groundwater is between 100 – 170 mg/L which is derived from BH3 and BH4 of the SMEC causation report and this is also quoted in the Jewell report as representative of interface groundwater. The 480 mg/L concentration represents deeper groundwater in the granite aquifer that is acknowledged by all experts as not contributing to the landslide seepage.

11. I have made my own calculations using the appropriate chloride concentration range for groundwater interface water (i.e. 100 – 170 mg/L) and adopting all of Mr Jewell's other infiltration rates assumptions for groundwater, drainage and irrigation in his Table 4. I then back-calculated what the mass flux from mains water would be. These calculations are provided below:

Table 1 Mains Water Contribution based on lower bound chloride concentration of 100 mg/L

Source	Chloride Concentration mg/L	Infiltration Rate L/s	Mass Flow mg/s	Comment
Interface groundwater	*100*	0.099	9.9	*Concentration from SMEC BH3 (colluvium aquifer)*
Irrigation (domestic)	20	0.023	0.46	
Drainage	80	0.015	1.2	
Total (A)			**11.56**	
Actual Seepage Mass flux (B)			**49.5**	Actual seepage from flux from Jewell report
Mains water needed to meet actual seepage flux **(C = B – A)**			37.94	
% mains water contribution (C/B)			**77%**	

Note all parameters are the same as that used in Jewell report, only interface groundwater concentration has been reduced from 480 to 100 mg/L.

Table 2 Mains Water Contribution based on upper bound chloride concentration of 170 mg/L

Source	Chloride Concentration mg/L	Infiltration Rate L/s	Mass Flow mg/s	Comment
Interface groundwater	*170*	0.099	16.83	*Concentration from SMEC BH4 (colluvium aquifer)*
Irrigation (domestic)	20	0.023	0.46	
Drainage	80	0.015	1.2	
Total (A)			**18.49**	
Actual Seepage Mass flux (B)			**49.5**	Actual seepage from flux from Jewell report
Mains water needed to meet actual seepage flux **(C = B – A)**			31.01	
% mains water contribution (C/B)			**63%**	

Note all parameters are the same as that used in Jewell report, only interface groundwater concentration has been reduced from 480 to 170 mg/L.

12. Comparing these results using the more appropriate groundwater chloride levels shows a contribution of mains water of between 63% (using the highest representative value) to 77% (using the other representative value) which is in marked contrast to the 0.5% Mr Jewell calculates.

Flow Calculations (informed by additional information in email)

13. SMEC provided the following additional information in their email to the board:
    a. Calculations sheets for the permeameter testing and worksheets reported in Appendix E of their causation report[2];
    b. Calculations sheets for the slug testing reported in Appendix E of their causation report[3]; and
    c. Discussion around how their flow rates were calculated.
14. I have reviewed this information and note the following:
    a. While I agree with the flow equation used (based on Darcy's law) there are issues with the input parameters as presented below:
        i. Permeability - worksheets of the raw data are not provided so the results can't be verified;
        ii. Permeability - the graph in the calculation sheet for BH04 (colluvium) shows only limited recovery of drawdown**,** and
        iii. Porosity - in my opinion the porosity value of 0.2 used in the lower flow calculation is very high (the SMEC logs describe the granite as massive, refer figure 1) and should be around 0.05[4] which would reduce the flow rate significantly (by a factor of 4).

[2] *SEW.0001.0002.4187_SMEC_Expert Report*
[3] *SEW.0001.0002.4187_SMEC_Expert Report*
[4] *Freeze and Cherry (1979) Groundwater*

BH02: 19.40 – 23.40m

Figure 1 - BH02 picture of granite core from screened interval of bore

b. SMEC have provided an additional lower bound flow rate of 0.135m/d (SMEC quote a rate of 2m/day in the earlier causation report) which would mean a travel time of 3444 days from the Bayview Road leak to the landslide escarpment. However, this is based on the permeability results from the granite aquifer some 20m below the surface and flow from this aquifer was agreed in the expert conclave to not be a water source for the January 2025 landslides. The flow rate through the rock is not representative of the flow rate through the shallow soils. Therefore, in my opinion this travel time of 3444 days is not relevant, representative, accurate or applicable to the mechanism of flow to the landslide escarpment.

15. Regarding estimating groundwater flow times, ground conditions in the landslide area change rapidly over small distances and factors such as permeability are one of the most variable parameters in nature (can vary by at least 10 orders of magnitude). It is well known that measurements of this parameter are prone to error and that testing methods and calculations need scrutiny. This means that calculated flows are not precise compared to other engineering measurements and so are typically reported in ranges rather than definitive numbers. In my opinion, I consider that the calculated flow time presented in the SMEC causation report and time between the leak and the landslide are in the same ball park and so do not rule out this mechanism. I also note that the SMEC flow time assumes the only pathway is via the shallow aquifer and flow via trench backfill may well be faster for at least parts of the journey

Conclusions

16. The new geochemical report and additional flow rate information does not alter my original opinion that mains water from the Bayview Road leak is the main contributor to the water at the landslide slip.