Board of Inquiry
into the McCrae landslide

**Inquiry into the McCrae Landslide - Joint report arising from Expert Conclave**

Conclave held at WSP Australia Pty. Ltd. 567 Collins Street Melbourne

28 and 29 July 2025

In attendance:

| Name | Company | Title | On behalf of |
|---|---|---|---|
| Darren Paul | WSP | Technical Director – Engineering Geology | Board of Inquiry |
| Stephen Makin (28 July only) | WSP | Hydrogeologist | Board of Inquiry |
| Dane Pope | PSM | Principal Geotechnical Engineer | Mornington Peninsula Shire Council |
| Phil Hitchcock | Australian Environmental Auditors Pty. Ltd. | Principal Hydrogeologist | Mornington Peninsula Shire Council |
| David Hartley | SMEC | Senior Associate - Geotechnics | South East Water |
| Hugo Bolton | SMEC | Technical Principal - Hydrogeologist | South East Water |

Table 2 sets out the potential preparatory and triggering factors for the landslides that occurred at McCrae in November 2022, and January 2025. Preparatory and triggering factors are defined after Lee and Jones, 2023[1]:

*Preparatory factors* work to make the slope increasingly susceptible to failure without initiating landslide (e.g. the long term effects of erosion at the base of a slope or weathering).

*Triggering factors*[2] actually initiate landslide events (e.g. rainstorm events and earthquakes).

Table 2 also sets out for each expert, an estimate of the relative contribution that the factor has had to causing the landslide and the level of confidence in that assessment. Table 1 sets out the indicators used to communicate the level of contribution and certainty. The qualitative indicators of magnitude of

[1] Lee. E.M., Jones, D.K.C. *Landslide Risk Management, 3rd Edition*, ICE Publishing, 2023

[2] Note that Mr Paul's causation report uses the term causal factors. This has the same meaning as triggering factors as defined here.

contribution and degree of certainty are intended to provide a relative indication with respect to each contributing factor and should not be assumed to provide an accurate or reliable quantitative indication.

Reference are provided in Table 2 to sources of supporting information set out in the expert witness reports. Table 3 provides additional commentary from the expert witnesses to provide further details on reasons for disagreement and a summary is provided at the end of this report setting out the key areas of disagreement.

**TABLE 1 MAGNITUDE AND CERTAINTY DEFINITION OF TERMS**

| Magnitude of Contribution | | Level of Certainty | |
|---|---|---|---|
| Significant | 80% - 100% | Very High | 80% - 100% |
| Major | 30% - <80% | High | 60% - <80% |
| Medium | 10% - <30% | Moderate | 40% - <60% |
| Minor | 1% - <10% | Low | 20% - <40% |
| Insignificant | 0 - <1% | Very Low | 0 - <20% |

**TABLE 2 CONTRIBUTION OF PREPARATORY AND TRIGGERING FACTORS**

| Ref | Potential Preparatory or Triggering Factor | Darren Paul: magnitude of contribution and comments | Darren Paul: confidence | Darren Paul: sources | Dane Pope: magnitude of contribution and comments (Phil Hitchcock)[3] | Dane Pope: confidence | Dane Pope: sources | David Hartley: magnitude of contribution and comments | David Hartley: confidence | David Hartley: sources |
|---|---|---|---|---|---|---|---|---|---|---|
| | **November 2022 Landslide** | | | | | | | | | |
| 1 | Earthquake | Insignificant. | Very High | 8.2 | Insignificant. | Very High | Executive Summary of PSM LRA | | | |
| 2 | Erosion – triggering. | Insignificant. | Very High | 8.3 | Insignificant. | Very High | Table 3 of PSM5226-006R | | | |
| 3 | Erosion of escarpment - preparatory. | Significant | Very High | 7.2 | Major | Very High | Table 3 of PSM5226-006R. S9 of the Pope report | | | |
| 4 | Piping through soils upslope – preparatory. | Significant | Low | 8.7.2 | Minor | Low | Table 3 of PSM5226-006R | | | |
| 5 | Anthropogenic – triggering. | Insignificant. | Moderate | 8.4 | Insignificant. | Moderate | Table 3 of PSM5226-006R | | | |
| 6 | Anthropogenic – preparatory | Minor | Low | | Medium | Moderate | Table 3 of PSM5226-006R<br>S.9 of the Pope report | | | |
| 7 | Water: rainfall - triggering | Significant | Moderate | 8.5 | Major | Very High | Table 3 of PSM5226-006R | | | |
| 8 | Water: ground water from shallow aquifer - triggering | Insignificant | High | 4.4 | Insignificant | High | Table 3 of PSM5226-006R | | | |
| 9 | Water: ground water from shallow aquifer - preparatory | No comment | | | Medium | Moderate | Table 3 of PSM5226-006R | | | |
| 10 | Water: 23 Coburn Avenue leak - triggering | Medium | Low | 8.5 | Unable to comment. | | | | | |
| 11 | Water: domestic usage - triggering | Not assessed | | | Insignificant to minor. | Low | Table 3 of PSM5226-006R<br>S.9 of the Pope report | | | |
| 12 | Loss of vegetation – preparatory | Medium | Very Low | N/A | Medium to Major | High | Table 3 of PSM5226-006R.<br>Figure 11 and Section 4.1.2 of the PSM LRA. | | | |

[3] Mr Hitchcock has only been asked to opine on water sources for the January 2025 landslide events. His responses are shown in red.

| Ref | Potential Preparatory or Triggering Factor | Darren Paul: magnitude of contribution and comments | Darren Paul: confidence | Darren Paul: sources | Dane Pope: magnitude of contribution and comments (Phil Hitchcock)[4] | Dane Pope: confidence | Dane Pope: sources | David Hartley: magnitude of contribution and comments | David Hartley: confidence | David Hartley: sources |
|---|---|---|---|---|---|---|---|---|---|---|
| | **5 January 2025 Landslide** | | | | | | | | | |
| 13 | Earthquake | Insignificant. | Very High | 8.2 | Insignificant | Very High | Executive Summary of PSM LRA | Not assessed. | | |
| 14 | Erosion - triggering | Insignificant. | Very High | 8.3 | Not assessed | | | Not assessed. | | |
| 15 | Erosion - Preparatory | Significant | Very High | 7.2 | Significant | Very High | Section 4.1.2 of the PSM LRA | Significant | Very High | 5.1.3, 5.2.1 |
| 16 | Anthropogenic: retaining wall on 10-12 View Point Rd – Preparatory | Minor | Medium | 7.5.1 | Major | High | Table 17, Section 10.3 and Section 10.4 of the Pope report, Refer to my comments below. | Medium | Low | 4.3 |
| 17 | Old fill - preparatory. | Minor | Moderate | N/A – see note. | Major | High | Table 17 of the Pope report. See table comments. Below. | Medium | Moderate | Appendix H, Figure 3 |
| 18 | Water: rainfall | Minor | Moderate | 8.5 | Minor | High | Table 16 of the Pope report. | Minor | Moderate | 9.1 |
| 19 | Water: ground water from aquifer – preparatory | Medium (moisture condition)<br>Significant (Pathway) | High<br>High | 7.3 | Major | High | Pathway is duplicated/combined triggering factor 14 & 17 above. | Major (moisture condition)<br>Pathway (Significant) | High<br>High | Appendix D, Section 9.4.1 |
| 20 | Water Source: ground water from aquifer – triggering. | Minor | Medium | 8.7.3 | Insignificant to minor<br>Minor | Moderate<br>Moderate | Table 16 Pope report. | Minor | Moderate | Appendix D, Section 11 |
| 21 | Water Source: Bayview Rd Leak | Significant | High | 8.7 | Major<br>Major | High<br>High | Table 16/17 of the Pope report. | Insignificant to Minor | Moderate | 9.4.2, 9.8, Appendix G, Appendix E (Section 7) |
| 22 | Water Source: domestic usage (irrigation) – triggering. | Minor | High | 8.6 | Minor<br>Minor | High<br>Moderate | Table 16/17 of the Pope report. | Medium | Moderate | 9.8, Appendix H |
| 23 | Other proprietary domestic water usage - preparatory | Minor | High | 8.6 | Minor<br>Medium | High<br>High | Table 16/17 of the Pope report. | Medium | High | 9.8 |
| 24 | Stormwater leakage – preparatory. | Medium | Low | 7.3 | Minor<br>Minor | Low<br>Low | Table 16/17 of the Pope report. | Minor – Medium | Moderate | 9.5 Others |
| 25 | Loss of vegetation – preparatory | Minor | Low | 7.4 | Medium | Very High | Table 17 of the Pope report. | Medium | High | 5.2 |

Irrelevant & Sensitive

[4] Mr Hitchcock has only been asked to opine on water sources for the January 2025 landslide events. His responses are shown in red.

| Ref | Potential Preparatory or Triggering Factor | Darren Paul: magnitude of contribution and comments | Darren Paul: confidence | Darren Paul: sources | Dane Pope: magnitude of contribution and comments (Phil Hitchcock)[5] | Dane Pope: confidence | Dane Pope: sources | David Hartley: magnitude of contribution and comments | David Hartley: confidence | David Hartley: sources |
|---|---|---|---|---|---|---|---|---|---|---|
| | **14 January 2025 Landslide** | | | | | | | | | |
| 26 | Earthquake | Insignificant | Very High | 8.2 | Insignificant | Very High | Executive Summary of PSM LRA | Insignificant | Very High | |
| 27 | Erosion – as a triggering. | Minor | High | 8.3 | Significant | High | Section 7.2 of the Pope report | Significant | High | 4.4, 9.1 |
| 28 | Anthropogenic: retaining wall on 10-12 View Point Rd - preparatory | Minor | Moderate | 7.2 | Major | High | Table 17, Section 10.3 and Section 10.4 of the Pope report, Refer to my c 16. 16. Irrelevant & Sensitive | Major | High | 4.3 |
| 29 | Old fill - preparatory | Minor | Moderate | 7.5.1 | Major | High | Table 17 of the Pope report. See table comments. For 16 Irrelevant & Sensitive | Minor | Moderate | |
| 30 | Water: rainfall | Minor | Moderate | N/A – see note. | Minor | High | Table 16 of the Pope report. | Minor | Moderate | 9.1 |
| 31 | Water: ground water from aquifer – preparatory | Medium (moisture condition)<br>Pathway (Significant) | High<br>High | 8.5 | Major | High | Pathway is duplicated/combined triggering factor as ~~above~~ Irrelevant & Sensitive | Medium (moisture condition)<br>Pathway (Significant) | High<br>High | Appendix D, Section 9.4.1 |
| 32 | Water Source: ground water from aquifer – triggering. | Minor | Moderate | 7.3 | Insignificant to minor<br>Minor | Moderate<br>Moderate | Table 16/17 of the Pope report. | Minor | Moderate | 4.4, 9.1 |
| 33 | Water Source: Bayview Rd Leak | Significant | High | 8.7.3 | Major<br>Major | High<br>High | Table 16/17 of the Pope report. | Insignificant to Minor | Moderate | 9.4.2, 9.8, Appendix G, Appendix E (Section 7) |
| 34 | Water Source: domestic usage (irrigation) – triggering. | Minor | High | 8.7 | Minor<br>Minor | High<br>High | Table 16/17 of the Pope report. | Medium | Moderate | 9.8, Appendix H |
| 35 | Other proprietary domestic water usage - preparatory | Minor | High | 8.6 | Minor<br>Medium | High<br>Moderate | Table 16/17 of the Pope report. | Medium | High | 9.8, Appendix H |
| 36 | Stormwater leakage as preparatory factor | Medium | Low | 8.6 | Minor<br>Minor | Low<br>Low | Table 16/17 of the Pope report. | Minor – Medium | Moderate | 9.5 Others |
| 37 | Loss of vegetation – preparatory | Minor | Low | 7.4 | Medium | Very High | Table 17 of the Pope report. | Low | High | 5.2 |

[5] Mr Hitchcock has only been asked to opine on water sources for the January 2025 landslide events. His responses are shown in red.

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**TABLE 3 COMMENTS – CROSS REFERENCE TO TABLE 2**

| Ref | Darren Paul | Dane Pope / Phil Hitchcock | David Hartley |
|---|---|---|---|
| | **November 2022 Landslide** | | |
| 1 | | | |
| 2 | Erosion as a triggering factor – occurring at the time of the landslide. | | |
| 3 | Refers to processes that formed the escarpment and not the cause of the landslide. | This represents geomorphic processes over geological time | |
| 4 | Piping refers to erosion of voids in the soil by water movement. | Natural piping through near surface soils at crest of broader escarpment provide potential flow paths towards escarpment (Refer to pp 48 of the Pope report). Evidence suggests that they strike perpendicular to contour and daylight in exposures on the escarpment. None identified at the 2022 Landslide headscarp. Voids in View Point road could be natural but are more likely associated with collapse settlement in the sewer trench, refer to Table 3 of PSM5226-006R. | |
| 5 | Refers to surcharge fill as a triggering factor, meaning a load placed at the crest of the slope at the time of the landslide. | | |
| 6 | Anthropogenic preparatory factors – includes tree removal and earthworks. | | |
| 7 | | | |
| 8 | Refers to immediate trigger. It is possible that a natural aquifer created moisture conditions that increased susceptibility. | | |
| 9 | No evidence seen for water seepage at the site of the 2022 landslide prior to its occurrence. Unable to offer an opinion on this. | | |
| 10 | | Unable to assess based on available evidence. | |
| 11 | Timing of irrigation line break relative to slide is unknown and so it is not possible to assess its contribution to the landslide. | Refers to initial translational slide on 14th November 2022. Water may have leaked from the irrigation line and contributed to debris flow that occurred on the 15th November 2022 following initial translational landslides on the 14th November 2022. | |
| 12 | This was not assessed in my report. I understand that there was select tree removal from the slope on which the landslide occurred in the years prior, but this was not extensive clearing. Whilst vegetation removal must have some effect on landslide susceptibility, I have very low certainty as to the magnitude of that effect in this case. | | |
| | **5 January 2025 Landslide** | | |
| 13 | | | |
| 14 | Refers to a significant erosion event at the time of the landslide. | Unable to assess local erosion related to the 2022/2024 Retaining Wall (RW) due to insufficient evidence. Drainage outlet of RW as well as geotextile/geomembrane detailing should be assessed if and when the RW is removed. | |
| 15 | Refers to geological processes over time that formed the slope, not erosion immediately prior to the landslide. | Refers to geological processes over time that formed the slope. | Refers to geological processes over time that formed the slope. |
| 16 | I consider the presence of the retaining wall and the surcharge loading it applied at the crest of the slope to be a minor preparatory factor for the 14 January 2025 landslide because:<br>• The landslide of 14 January 2025 is estimated to have displaced about 300 $m^3$ of soil. Of that about 10 $m^3$ is estimated to have derived from behind the retaining wall. The weight of the surcharge load in comparison to that of the entire displaced mass is very small and whilst the effect of surcharge | I observed a significant tension crack beneath the RW on 6/01/2025. This location is where maximum fill was placed behind the RW, where the piles had no socket into XW Granite, Figure 9 and Appendix H of the Pope report and close to the center of mass of the 14 January 2025 Landslide. The tension crack runs sub-parallel to the small gully buried by the 2022/2024 RW, Figure 9 of the Pope report. In my opinion it would be grossly unconservative to ignore the buried geometry at the RW and ignore a 40kPa surcharge especially where there is no pile socket. In my opinion, the landslide behavior needs to be considered in three dimensions and over time. | Based, photos witness statements and analysis by others.<br>The deformation of the retaining wall, as recalled by the landowners in conversation with SMEC, and leading to the subsequent construction of the secondary retaining wall, is likely to suggest the slope is experiencing destabilising forces which are leading to deformation of the wall, and potential for movement of soils downslope, at that point in time. |

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| | is not zero, it is minor compared to the increase in weight caused by water infiltration to the soils below the retaining wall.<br>• The headscarp of the 5 January 2025 landslide was about 2.5 m below and 3 m north of the toe of the base of the retaining wall. This is not within the zone of influence of the retaining wall or the passive wedge i.e. the retaining wall could not have applied load to the soil that displaced in the landslide on 5 January 2025.<br>• Whilst tension cracks and subsidence were observed on 6 January 2025 at the base of the retaining wall, none were observed behind the retaining wall. If surcharge applied by the retaining wall caused the landslide below the retaining wall on 5 January 2025, cracking would be expected above the retaining wall. The observed tension cracks indicate soil moving away from the retaining wall, and are an indicator that the 14 January 2025 landslide was developing at that time.<br>• Despite having some soil removed from the front, the remnants of the retaining wall that remain standing are subject to similar loading but remain standing. The difference between the remnant wall and collapsed wall being undermining caused by a larger landslide that originated downslope on 14 January 2025.<br>• As observed following the retaining wall failure, the seepage into the vicinity of the landslide and soil that became wet was below the passive wedge of the retaining wall (PSM causation report Appendix C28), consistent with a landslide below the wall that caused it to be undermined.<br><br>The larger landslide of 14 January 2025 was progressively developing due to increased moisture in the soil ultimately reaching a tipping point on 14 January 2025 which caused the retaining wall to be undermined and allowing approximately 10 $m^3$ of soil to collapse from behind it. The retaining wall and retaining wall surcharge did not push the soil down slope. | This is not well represented by cutting a cross section exclusively through the 5 January 2025 headscarp, Inset 49 of the Pope report.<br><br><u>Inclined planes</u><br><br>The dip/dip direction of the contact between the COLLUVIUM and the XW Granite is directly related to the seepage flow paths, Inset 46 (pp 51 of the Pope report). When measured in the Pointerra Reality Model this gives a dip/dip direction of 20/330. The slope aspect of the broader escarpment is roughly 320 to 330 (measured from crest to crest on opposing sides of the gully). That is, the contact between the COLLUVIUM/XW Granite is within the kinematic window of failure for planar slide and daylights out of the slope. The friction angle of this contact exceeds 20°. Nonetheless when surcharge loads are applied to inclined planes and groundwater is added driving forces are fundamentally increased and resisting forces are reduced. Both the basal geometry of the FILL to COLLUVIUM and COLLUVIUM/XW Granite contact are unfavourable and provide a more credible mechanism of failure when you consider evidence of past loss of suction in the gully. Refer to my response to 16 regarding suction in general.<br><br><u>Loading of an inclined plane</u><br><br>Mr Pope disagrees with Mr Paul and Mr Hartley that it is a minor contribution. The RW has been built in part like a gravity wall due to the lack of pile socket, Section 7.2 par. [112(d) v] of the Pope report. Although stress in the pile must transfer to the soils immediately in front of the RW, based on engineering principles, the loaded area that should be considered is the zone of recent earthworks (i.e the garden area) not just the pile diameter (0.5 m). The garden area with fill is approximately 30$m^2$ and the centre of the first and last row of planter boxes is approximately 1.5 m and 4.5 m behind the RW respectively.<br><br>This is a large area that applies stresses at least as deep as the base of the headscarp of the landslide and deeper. These stresses increase from approximately 10kPa where FILL is 0.5 m thick to 40 kPa where it is 2 m thick. For context 40 kPa is double what is typically used in industry to assess roadside batter stability for DTP (refer to my CV). Meyerhof (1957) provides simple equations to assess bearing capacity of loaded areas near a slope (an inclined plane). The frictional bearing capacity factor ($N_\gamma$) reduces by two orders of magnitude for a loaded area on a slope compared to a loaded area on flat ground. That is ultimate bearing capacity reduces significantly as the loading approaches the slope.<br><br>**Excerpt from Meyerhof (1957)**<br><br>Mr Pope provided simple limit equilibrium analysis which is similar to a bearing capacity check for the loaded area behind the RW. My analysis shows that the loaded area results in failure at the location of maximum surcharge, where there is | |

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| | | no pile socket and where I observed a significant tension crack on 6 January 2025.<br><br>In simple terms, the nature of RW construction effectively increased the slope angle to 37° degrees, Inset 52 of the Pope report (pp 56) and did not provide effective resisting forces. The increase in groundwater level reduces the effective stresses on the resisting side of the RW and therefore resisting forces must also be reduced. In my opinion:<br><br>• The stresses from the RW and the variation in groundwater levels must be considered in RW design and back analysis.<br><br>• Neither can be ignored in stability analysis (for design or back analysis).<br><br>In my opinion, my facts on which I rely support that there have been multiple instances of increased loading associated with the RW on multiple inclined planes immediately beneath and within influence of the RW and with a decrease in shear strength on the passive side of the wall due to the increase in groundwater levels.<br><br><u>Tension cracking behind the RW</u><br><br>The Rectangular Hollow Section (RHS) tie backs of the 2022 RW and to a lesser extent the near surface geotextile have in my opinion contributed to masking of deformation in areas behind the RW. That is the tie backs attracted significant load in the days leading up to and following the 5 January 2025 Landslide. There is an obvious strain incompatibility between steel tie backs and unrestrained soil on the downhill side of the RW. In simpler terms for the same stress, steel deflects much less than the equivalent soil. Once the pile toes rotated down slope then tension cracks would have appeared behind the wall. The actions of the property owner in the weeks leading up to the failure including the potential topping up of fill behind the RW should be investigated further.<br><br>*<u>Summary</u>*<br><br>Analysis of the RWs and the loading on the passive wedge must consider the unfavorable influence of the inclined planes on the passive side of the RW. I have not observed any facts or interpretation from either geotechnical expert regarding zone of influence of the RW on a steep slope and with inclined planes immediately beneath the RW. In my experience this is a common hazard associated with any amount of fill built over an escarpment or steep slope (refer to my CV). | |
| 17 | Old fill as a preparatory factor for landslide was not addressed in my causation report. I provide the following comments in relation to old fill as a preparatory factor for landslide.<br><br>I consider the landslide mechanism to involve:<br><br>- Water migrating to the slope through natural subsurface pathways at the base of infilled colluvial channels carved into the residual and extremely weathered granite. Under normal conditions, water is discharged at a spring forming a wet area on the slope as indicated in PSM causation report (page 237). The volume of water migrating along those pathways was much greater in January 2025 than it would usually be if subject only to natural or background flows.<br><br>- The capacity of the granular natural subsurface pathways to convey water was exceeded in January 2025 causing water to migrate up into finer soils overlying and surrounding the pathway. The moisture content in finer soils above those pathways that would normally be in an | Refer to Table 17 and Inset 49 of the Pope report.<br><br><u>Supporting evidence for FILL</u><br><br>In my opinion fills are at least 2 m deep at the headscarp. Based on my geotechnical model, the licensed survey and the LiDAR files from 2023/2019 I do not believe the facts support that the fill does not translate down the gully. I accept the uncertainty with aerial photography from the 1970s. I do not accept based on the facts available to myself, that the base the FILL truncates neatly at the edge of the escarpment. This directly conflicts with common bulk earthworks strategies employed in the 1960s/1970s and observed in most of my projects related to remediation of side cast fills on roads in Victoria.<br><br>Regardless of the above, if I assume that the FILL is windblown deposits (Aeolian sands), the mechanism associated with deposition off a cliff by wind or end tipping by man are essentially identical. The risks associated by loading this material (with a RW and bulk earthworks) are the same. In my opinion Mr Paul has not identified either in cross section (pp. 148 of Mr Pauls report) | Nominal difference in slope stability analysis considering either colluvium or fill.<br><br>SMEC notes the off centre nature of the location of the landslide in relation to the line of the gully. We suggest that if a natural flow path is assumed to be the route of the water leading to the landslide, then the 5 January failure should have been located closer to the centre line of the gully. The presence of old fill, creating a variation in factor of safety 'across' the gully, is a plausible reason for the failure off-centre of the line of the gully.<br><br>In response to Mr Pope's comment:<br><br>At the time of analysis, we were looking at a plausible failure mechanism to understand the volume of water needed to trigger the 5 January 2025. Based on information provided by others prior to assessment, this model can be argued as |

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| | unsaturated state and develop strength from high soil suctions (negative pore water pressure) became wetter, therefore becoming heavier and losing strength. There would also be an increased water pressure applied at the base of the colluvial channel. The steep, near vertical sides of the landslide headscarp that have generally remained stable since January 2025 are evidence of the soils comprising the escarpment, including fills, sustaining high suction stresses and is consistent with the northerly aspect of the slope which sees high rates of evapotranspiration.<br><br>- Progressively prior to 5 January 2025 and through until 16 January 2025 the wetting front penetrated further into the finer soils surrounding the natural flowpath. As the wetting front penetrated further, a greater volume of soil became wet and the size of the landslide increased. The area of moistened soil and seepage locations within the finer soils were observed once exposed by the 14 January 2025 landslide are indicative of this (PSM causation report page 237). This progressive wetting from below is why the landslides unfolded over the time frame they did, with movement progressively increasing over the course of at least 9 days between 5 January and 14 January 2025.<br><br>- The elevated moisture content through the soil profile reduced the soil strength to the extent that it was able to flow downslope as a fluid on 14 January 2025 impacting the house at 3 Penny Lane.<br><br>Whether the soils involved in the landslides comprised fill or natural material does not fundamentally affect this model. The displaced material must have involved some fill because fill is exposed in the landslide headscarp. However, most of the headscarp and side scarps appear to expose natural materials and whilst I cannot dismiss the possibility that most of the displaced mass comprised fill, I have not seen physical evidence to indicate a large volume of fill was placed on the escarpment at this location. If up to 260 $m^3$ of fill was tipped over the escarpment in the 1970s, that would have involved something in the order of 25 tip trucks dumping material upslope of a house that then existed at 3 Penny Lane. Whether this activity took place and the source of fill if it did is uncertain and given the lack of evidence improbable.<br><br>I consider that because of progressive wetting of fine grained soils (fill or natural) the landslides of 5 January and 14 January 2025 would have occurred irrespective of whether the soils that became wet were natural or fill materials.<br><br>If further evidence shows there to have been a significant volume of fill within the gully, then the presence of the fill would mean that the size of the landslide could have been larger than if that fill were never placed and therefore the consequences greater. | Borehole HA01 does not have the dark grey fills observed in the headscarp (pp 282 of the Pope report). None of the lab testing from HA01 reports organic or dark grey to grey soils (pp 293 to 297 of the Pope report).This indicates to me that the dark grey fills are steeply dipping, Inset 49 of the Pope report and are likely to have been deposited down the gully.<br><br>I inspected the eastern flank of the Landslide on 16 June 2025 and encountered alluvial clay in a sand matrix and rubbish, supporting my assessment of fill in this area, Figure 13 of the Pope report. This will be validated when appropriate long term access is available.<br><br>Mr Paul has relied on a 2017 LiDAR file supplied by PSM. I note that this LiDAR has very little ground points in the vicinity of the 2022/2024 RW and the gully itself. I ignored this LiDAR due to the lack of ground points. Instead I have relied on:<br><br>• Licensed survey of 2014 (pp 229 of the Pope report) indicates survey points on the crest.<br>• LiDAR of 2019 has a high density of ground points in the immediate area of the 2022 and 2024 RW.<br><br>I did not and would not rely on LiDAR that does not have meaningful data to develop a pre-failure geometry. In my opinion this data quality gap can impact appraisal of fill thicknesses, volumes, and the slope detail on the western side of the gully.<br><br>Fundamentally the gully is out of balance when viewed in elevation cut parallel to the escarpment (Refer to Section 4.1.2 of the PSM LRA and Figure 14 (pp 99 of the Pope report). i.e. it is not broadly symmetrical along the plunge of the gully line as most gullies along the escarpment are, Refer to Inset 9 of the PSM LRA. I have not observed this volume of transported soils on one flank of a gully and not the other in The Eyrie, Coburn Creek or the downstream section of Margaret Street and nor has my colleague Tim Nash (Director, Principal Engineering Geologist) who assisted with the PSM LRA and conducted a significant proportion of the escarpment mapping. On this basis, there must be some other influence on deposition and in my opinion this is anthropogenic.<br><br><u>Technical basis of suction as causation</u><br><br>Suction changes play a role in failure of unsaturated slopes. This is well known and accepted in industry. In my opinion it is industry standard practice to use effective stress parameters in back and forward analysis of slopes. It is not standard industry practice to speculate a suction range to make a slope stable or fail.<br><br>Mr Paul states in his Executive Summary that the RESIDUAL is “clay rich, relatively impermeable soil”. He then in paragraph [88] states that this material will “rapidly lose suction upon an increase in water content and pore water pressure”. In my opinion there is a fundamental technical disconnect between these two statements and this is not technically correct. Based on engineering principles, low permeability soils do not rapidly lose suction over meaningful depths in short periods of time. It is well established in published literature that there is a significant lag in the change in suctions in low permeability clays with the seasons (and available moisture). This is of function of the low permeability which is even lower in an unsaturated state.<br><br>I do not agree that a suction change alone caused the failure. Instead the combination of a steep gully provided an unfavorable basal plane for FILL on top of any COLLUVIUM/XW Granite in place. The groundwater levels reduce | plausible, but in light of further analysis including intrusive works carried out by PSM, could be seen to be not correct. However, the objective of the analysis is to present a plausible volume of water for failure to occur. Our end result of an assessment that only 2000l of water is required, is therefore reasonable. A quick calculation based on the ‘suction model’ detailed by Mr. Paul, assuming the 20m3 volume is correct, a porosity of 30%, and a moisture content uplift of 30% needed to fail, provides 1800l for failure. |

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| | | suction immediately above the basal contact, but this is a cyclical event. The surcharge from a RW is not a cyclical event. That is, the surcharge has been incrementally increased in the past three years.<br><br>Groundwater flows and past seepage in this area would effectively reduce suction to field saturation on any occasion where there is flow and the vadose zone would have lower suction above this point. This concept is displayed in Figure 2.1 of AS2870 (2011). A three-year period of La Nina from 2020 to 2022 and with a rare intensity event towards the end of that period in my opinion provides opportunity for gully flows and loss of suction. Furthermore, I would expect very little suction in May 2023 where the slopes are inferred to be wet (pp. 237 of the Pope report).<br><br>In my opinion Mr Paul's suction variations are speculative and cannot be meaningfully measured. Mr Paul has referenced behavior observed in cuttings at Bogong in his opening appearance at the hearing in May 2025 (line 38 to 45 of his statement on 7 May 2025). I have not observed Mr Paul demonstrate how the behavior of cuttings in granite relates to the behavior of soils at the contact with a buried gully some 3 to 4 m below ground level and well below the zone of atmospheric influence and potentially in contact with ephemeral water flows associated with the gully. I do not see evidence that Mr Paul has considered the long term effects of garden watering or ephemeral water on shifting suction profiles to the wetter side of equilibrium and calibrate this against slope performance in recent times. I do not see evidence of Mr Paul considering the role of the 8 m high gum tree immediately adjacent to the 5 January 2025 landslide and its effects on unsaturated permeability of soils near the gum tree or its influence on suction, shear strength and therefore deformations in that area.<br><br>There is evidence of cementation in the dune sands (refer to Pp 53 of PSM5226-006R and pp 48 of the PSM LRA), some of the colluvium (refer to my HA logs and general exposures documented in the PSM LRA) and the Residual/XW Granite (refer to the CPT plots with very high interpreted friction angle). In my experience, a short-term increase in groundwater is not going to rapidly remove cement and genuine cohesion in a residual soil of this age.<br><br>In my opinion if the volume of RESIDUAL soil failed as indicated in Mr Paul's geotechnical model I would expect far more signs of displacement in adjacent slopes including the original tiled area of 10-12 View Point Road, the perimeter paving and soil slopes immediately adjacent to the headscarp and on 6 View Point Road. These are ancient soils and the loss of them in my experience results in stress redistributions through adjacent residual soils and evidence of deformation.<br><br>The lack of evidence of significant tension cracking in the slopes outside of the filled gully region supports my opinion that the vast majority of material evacuated by the Landslide provided very little support to the flanks of the gully by nature of its top-down deposition.<br><br>In my opinion the XW Granite and Colluvium stability in the current headscarp is maintained by cementation, the complete failure of the steeper dipping contact between Colluvium and XW Granite and some suction in the near surface soils.<br><br>In my opinion the facts that I have gathered at the Site of the 2025 Landslide do not support that residual granite dominates the landform as shown in Mr Paul's "Local Cross Section on pdf page 148). This section does not include Colluvium downslope below RL 28 which is at odds with my photographs, pp 286 of the Pope Report. It follows that landslide behavior being suction controlled in residual granites is not well supported. | |

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| | | Comments on stability<br><br>Mr Pope fundamentally disagrees that the headscarp is "stable" as in Mr Paul's comments *"The steep, near vertical sides of the landslide headscarp that have generally remained stable since January 2025"*. In my opinion this statement should have clear caveats and be supported with timing, weather and groundwater conditions that apply to that statement.<br><br>SMEC Model<br><br>I do not agree with the fundamental geometry of the SMEC model. I have not observed evidence of the modelling of inclined planes in the SMEC stability assessment. For example, pp. 378 of the SMEC report indicates that the contact between the COLLUVIUM and the underlying RESIDUAL is flat. For my reasons expressed above, this is not well supported by the facts shared with all parties (including the Pointerra model). Furthermore, the parameters of c = 2 kPa and phi of 30 degrees for Colluvium does not reflect the interpreted friction from recent CPTs. Refer to pp 290 of the Pope report. Note that PSM properties for the 2022 Landslide should not be relied upon for the 2025 Landslides. They were design strengths for a discrete hazard. The 2022 and 2025 Landslide slopes are different settings, with different groundwater and different in-situ stresses. I note that the strengths adopted by SMEC are more consistent with my view of the basal contact (which governs sliding). | |
| 18 | Refers to direct rainfall. | | |
| 19 | There are natural flow paths with some water. Flow is intermittent. This could be a preparatory factor for landslide because it introduces some water into the soil and provides a flowpath for the water. | Agree with Mr Paul. Groundwater is a pathway for the source of the water<br><br>Mr Pope opines we have duplication of erosion-controlled factors with 14 & 18<br><br>Irrelevant & Sensitive | Shallow perched groundwater tables exist in the area. These feed springs, some of which are found on the escarpment and at the January 2025 landslide site. When the ability of these springs to flow is restricted by slope fill debris cover / fill then groundwater pressure will build up behind.<br><br>This will also spread out the wetted area both behind or underneath the slope fill debris cover / fill and also increase the moisture of the slope fill debris cover / fill as some leakage will occur up through the slope fill debris cover / fill. |
| 20 | There are no long term observations of the rate of flow from springs (most recent is 50 L/day on 16 June 2025). Anecdotal evidence is that the springs are ephemeral and flow in response to rainfall. There is a significant difference between flows in June 2025 (50 L/day) versus flows in January 2025 (0.15 L/sec, or 12,960 L/day). This significant difference suggests that natural base flows represent a minor proportion of the water observed to have been flowing from the escarpment in January 2025. Groundwater monitoring from February 2025 onwards also indicates that natural subsurface flow is localized and minor, for example comparison between Boreholes 1 and 1A which did and did not encounter groundwater respectively. | Agree with Mr Paul. Groundwater in the shallow aquifer is intermittent in the area of the landslide and is unlikely to be a significant contributor to landslide seepage.<br><br>Mr Pope agrees with Mr Paul and notes that the flows measured on 6 January 2025 were between 0.15 and 0.2 L/s (not less than 17 280 litres per day). | Groundwater flow to the springs is expected to fluctuate. This can be affected by prior rainfall recharge events. These rainfall recharge events can take some time to propagate through the shallow perched groundwater system. It should be noted that spring flow may not necessarily fully express itself at surface as it may soak into areas lower in the slope.. |
| 21 | This is the only water source impacting the ground in the vicinity of the landslide at the time that could have had sufficient volume to cause the landslide and to provide the flow rates that were observed to be issuing from the landslide. There are feasible flow paths from the leak site to the landslide through sewer trenches, stormwater pipes and leakage from pipes and through natural soils. | It is acknowledged that groundwater from the shallow aquifer is the most likely pathway for the water to the landslide area. An increase in water flow has triggered the landslide and the Bayview Road mains leak (involving up to 40 ML escaping form the mains line) occurred in the months prior to the landslides. Although this leak did not occur in close proximity to the landslide there are creditable pathways that in my opinion could have led to water from this source flowing to the landslide area. These include flow along stormwater and sewer trenches and bedding material, flow in the surrounding permeable soils and recharge of the shallow aquifer and subsequent groundwater flow. | Laboratory analysis, and analysis of SEW data by others (K. van Zyl 2025) provides a model of the increase in leakage volume, volume infiltrating into underground service trenches, and from there, volume of water upwelling up to the surface over time.<br><br>Appendix H of the supplementary report provides a model which corroborates the flow rates supplied by van Zyl, can result in the deposit of sand over the 'fan' shaped area, |

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| | | Mr Pope agrees with Mr Paul. Mr Pope considers that water from the Bayview Road leak triggered the 2025 Landslides. | located by Mr. Hutchings, SEW and others. This model corroborates that the majority of this water would have flowed into the grate. Infiltration tests carried out provide an indication of the capacity of the overland flow to be infiltrated into the natural geology.<br><br>Test results from samples taken by SEW during December 2024 and January 2025, as well as samples taken during the SMEC investigations of May and June 2025 within stormwater drains and stand pipe piezometers over time, and strongly suggest that the seepage noted and sampled within 24 hrs of the 5 January 2025 slip, is similar to water within the shallow perched aquifer inferred to be encountered by the June 2025 investigations.<br><br>Insitu tests carried out within 'pairs of piezometers', indicate velocities of flow within underground service trenches than the natural material encountered during the drilling of these tests. Further, the 'null' values from the tests carried out in the natural material, supplemented by several permeability and porosity tests indicate a low permeability environment.<br><br>We recognise that although accurate and robust, the in situ data points and number of samples used for us to reach our conclusions is limited at the time of conclave, due to time allowed to collect data, and site constraints. Our 'moderate' confidence level reflects this reality which we consider impacts the majority of this and other conclusions.<br><br>The conclusion being that a flow path direct from the source of the leak is theoretically possible, however based on the results of tests carried out on site, and lab samples received to date, velocity is too slow for infiltrating water to reach the landslide site.<br><br>That a flow path utilising in part sub surface trenches is theoretically possible. However, it is not possible to confirm that mains derived water can pick up the chemical signature of the sample of 6 January 2025 if travelling through trenches.<br><br>We would suggest that the volume of water required for the 5 January failure to occur (calculated as approximately 2000l within our report), is of such a small magnitude that allows for other sources of water to contribute to a level which should not be discounted as insignificant. |
| 22 | Domestic irrigation is typical on the escarpment and could not have caused the significant increase in subsurface flow that was observed around the time of the January 2025 landslides. Furthermore, no flow path has been identified between the irrigation and areas where wet soils were observed following the 14 January 2025 landslide, noting a dry zone of soil between the surface and wet areas. The soils appear to have wet from the bottom up, not top down. | Although domestic irrigation in the landslide area is known to have occurred, given that flows continued after evacuation, its contribution is not likely to be significant.<br><br>Mr Pope agrees with Mr Paul and notes that domestic water usage as reported by SEW in a large proportion of the community upstream of the Landslide is typically an order of magnitude lower (over a quarter) than the water available from the water main failure. | It is proposed that although irrigation water would not be the source of the seepage flow viewed following the landslip, it is plausible that irrigation water infiltrate the material that did slip on the 5 January 2025, contributing at least in part to the soil movement. |
| 23 | There is a higher frequency of leaks in this area compared to elsewhere. Leaking water from mains or domestic pipes could be a source of water that wets material at the escarpment, but is part of | Leakage from mains or domestic pipes is known to occur regularly in the landslide area but there is no reason to suggest that would cause a sudden increase in soil moisture. | Leakages throughout the area, other uses of mains water, including irrigation from remote sources, where not directed into stormwater drainage, are expected to enter the groundwater system in methods and flow paths suggested to |

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| | background flows and could not have caused the significant increase in water observed in January 2025. | Mr Pope opines that based on the 16 June 2025 flow rates at the Landslide there is little evidence to support a significant contribution to base flows at that time. There is very limited information available regarding how long these water main leaks are occurring before they are identified and repaired. In my opinion those leaks which cause pressure loss to dwellings would be identified reasonably quickly (where the dwellings are occupied). This contribution/hazard becomes more significant where the water lines do not directly feed dwellings but reservoirs/tanks/entire regions and where the leak is in difficult access terrain (such as Bayview Road reserve or the Mornington Peninsular Freeway, or suspended across the well vegetated gullies of the Eyre or Coburn Creek as is the 900 Dromana to Portsea main).<br><br>Mr Pope opines that private water main failures such as that of 5 Prospect Hill road should be investigated further and as a minimum include meter readings compared over the past few years as per the rest of the community to inform contribution. | be theoretically possible from the Bayview Road leak, therefore supplying a background source of elevation.<br><br>This includes the private leak at 5 Prospect Hill Road, which is possible was occurring at the time of the failure. |
| 24 | Refers to the general condition of stormwater.<br><br>Whilst stormwater breaches have been observed, at Browne Street and 23 Coburn, there is no information on how much water leaked from the stormwater during the Bayview Road leak event and no evidence of a flow path from the breaches down to the landslide. However, it is a plausible pathway. | Leakage from stormwater infrastructure is a plausible source and some breaches have been documented but there is no information available about their magnitude. In addition, the flow in stormwater should be closely linked to rainfall events and rainfall precedent to the landslide was not considered to be more than normal.<br><br>Mr Pope agrees with Mr Paul. | The condition and leak potential of the stormwater pipe was identified by PSM from onsite analysis. It is possible therefore that leaks from stormwater drainage contribute to the charging of the shallow perched aquifer. The flow of stormwater drains both at Coburn Ave and down View Point Road were noted to be flowing during visits to site on 13, 17 and 20 June 2025, the source of both (upstream of the Boulevard, and the AG drainage system at 7 Prospect Hill Road) would suggest that flow continues irrespective and therefore it is reasonable to consider this a relatively minor, but consistent source of perched groundwater. |
| 25 | There was some loss of vegetation on the slopes on which the landslide occurred in the years prior to the landslide event which would make it more susceptible to landslide. However, the flow path that introduced water to the slope was below the depth of vegetation and suction that could have been provided by the vegetation would have been lost due to water infiltration. Water infiltration softened the soil to the extent that it flowed and this was independent of the presence of vegetation. | Mr Pope agrees with Mr Hartley and disagrees with Mr Paul. Mr Pope notes that there are tree roots observed in the old fill and colluvium in the Pointerra Reality Model, Appendix H of his report. It follows that zone of influence from suction related to those trees must extend to the soils immediately adjacent. It is well established that trees can influence suction (refer to Appendix H of AS2870 (2011) and supporting technical journals (E.g Cameron and O'Malley, 2002)) and groundwater levels in general (Refer to well established Murray Darling long term groundwater level rises due to land clearing). | The historic variation in vegetation cover indicates as noted in 2009 aerial photos, the relative lushness of vegetation within the gully compared to surrounds, but also the progressive denunding of the gully. In places the vegetation is replaced by hardstanding. In places it is replaced by juvenile plants. The impact of the change in vegetation character, is as relevant as structural work, and on balance is probable to have a negative impact on: the ability of near surface materials to maintain strength with varying moisture content (such as elevated ground water levels), the ability of the vegetation to remove elevated moisture from the near surface. |
| **14 January 2025 Landslide** | | | |
| 26 | | | |
| 27 | Refer to response at 14. | Mr Pope opines that the loss of the 5 January 2025 mass, destablised slopes at the eastern extent of the gully where there was significant filling and no effective RW. I consider this type of erosion to be "regression by landsliding" . | SMEC consider the removal of soil of the 5 January 2025 event to be significant in destabilising the gully to the extent where the ravelling back of material between 5 January and 13 January, and 14 January were a direct consequence of the 5 January event. |
| 28 | Refer to response at 16. | Mr Pope - Refer to ~~15~~ 16. | It is possible that the presence of the wall, and surcharge of material behind it has a destabilising effect on slip surfaces activated by the removal of soil during the 5 January event. |
| 29 | Refer to response at 17. | Mr Pope - Refer to 17 | |
| 30 | Refer to response at 18. | Mr Pope - Refer to 18. | Refer to response at 18. |
| 31 | Refer to response at 19. | Mr Pope - Refer to 19. | Refer to response at 19. |

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| | | Refer to response at 19 | |
| 32 | Refer to response at 20. | Mr Pope - Refer to 20<br>Refer to response at 20 | Refer to response at 20. |
| 33 | Refer to response at 21. | Mr Pope - Refer to 21.<br>Refer to response at 21 | Refer to response at 21. |
| 34 | Refer to response at 22. | Mr Pope - Refer to at 22.<br>Refer to response at 22 | Refer to response at 22. |
| 35 | Refer to response at 23. | Mr Pope - Refer to at 23.<br>Refer to response at 23 | Refer to response at 23. |
| 36 | Refer to response at 24. | | Refer to response at 24. |
| 37 | Refer to response at 25. | | |

Board of Inquiry
into the McCrae landslide

**Summary of Key Points of Disagreement**

1. **The use of the terms "preparatory" and "causal" as defined by Mr Paul in Section 3.1 (paragraph [24]) of his report.**

Mr Pope does not accept the definition and assumptions assigned by Mr Paul relating to "preparatory" and "causal" terms and responsible parties in Section 3.1 of his report. Mr Pope adopts "causal factors" as those that contributed to the landslide and in general in a period before the event and the "trigger" as the event that initiated the landslide on the date of the event.

Mr Pope does not agree with Mr Paul's statement on the links between triggers/causes and these being exclusively linked to authorities. Mr Pope provides his opinion on matters relating to planning, design and construction that contributed to the 2025 Landslide in Table 18 and Section 10.3.1.2 of the Pope report.

Mr Pope notes that in his experience a significant number of landslides are triggered by public assets. Mr Pope opines that the triggers/causes of landslides are not always immediately linked to an authority or property owner.

Mr Paul notes that factors that contribute to landslide can be broadly categorized into:

- Features of the landscape that make it susceptible to landslide. An understanding of these features informs where landslides could occur and what might happen if they do. For example, the slope angle or underlying geology.
- Events that trigger landslides which determine when the landslide occurs, for example a rainfall event.

These are referred to in his report as preparatory and causal factors respectively. It is common within landslide literature that the latter are termed the triggering factors or triggering events and either of these terms can be substituted without altering the meaning or purpose of the categorization. To improve clarity, the term triggering factor is used in this report.

The statement made at made at Paragraph 24 of Mr Paul's report communicates that preparatory factors are defined as those that make the landscape susceptible to landslide and conveys factual information that the identification of areas susceptible to landslide would usually be a function of local government planning. In accordance with the Victorian Planning Provisions Clause 44.01-1, this is effected through an erosion management overlay which delineates areas susceptible to landslide and applies planning provisions within those areas. The management of preparatory factors for landslide, for example the minimization of earthworks and vegetation clearance are typical of planning controls implemented by local government through the erosion management overlay, and so landslide management through the planning scheme is linked to preparatory factors. A planning authority would not usually have control over triggering factors, for example rainfall, hence the distinction.

The statement at paragraph 24, does not convey an opinion nor imply responsibility of any party with respect to any matter relating to the landslides at McCrae whatsoever.

2. **The volume of 'old fill' present in the gully prior to the landslide and its role as a preparatory factor for landslide.**

Mr Pope proposes a model for the landslide that involves the placement of approximately 260 $m^3$ of fill into the natural gully at the site of what is now the landslide with the fill inferred to have been end tipped from the top of the escarpment in the vicinity of what is now 6 View Point Road at some time in the 1970s. The eastern portion of the retaining wall at 10-12 View Point Road is inferred to have been founded in this fill and the majority of the displaced landslide mass on 14 January 2025 involved fill materials. The presence of old fill is assessed to be a major preparatory factor.

Mr Paul indicates that whilst historically the tipping of fill over escarpments in an uncontrolled manner was a relatively common practice there is no evidence of this having occurred at this site in the 1970s. For example, survey, aerial photography or other historical records. Furthermore, by the 1970s there had been relatively extensive residential development in the area, including downhill at 3 Penny Lane and it is unlikely that such are large volume of fill would be end tipped into the gully in an uncontrolled manner directly upslope from a house. Notwithstanding this, given there is some fill exposed in the landslide headscarp over the upper 2 m, the January 2025 landslide must have involved some fill, however, it is unlikely to have involved a volume as large as 260 $m^3$. The presence of old fill is assessed to be a minor preparatory factor.

3. **The magnitude of the contribution of the retaining wall constructed in 2022 at 10-12 View Point Road as a preparatory factor for the 5 and 14 January 2025 landslides.**

Mr Hartley opines that the retaining wall constructed at 10-12 View Point Road was a major contributor to the 15 January 2025 landslide and a minor contributor the 5 January 2025 landslide. This is based on a model that involves the 5 January 2025 landslide removing passive support from the retaining wall due to tension cracks that formed at the toe and the loss of support caused by the 5 January 2025 landslide. The retaining wall subsequently failed as a result of losing passive support. The fill behind the retaining wall is inferred to apply a surcharge load of around 40 kPa at the crest of the landslide which was a major trigger of the 15 January 2025 landslide.

Mr Paul opines that the physical evidence is not consistent with a major contribution to the landslide from the retaining wall, including the large discrepancy between the volume of material behind the retaining wall that was involved in the landslide (about 10 $m^3$ behind the retaining wall compared to 300 $m^3$ involved in the landslide), the distance between the retaining wall and the 5 January 2025 landslide, the tension cracks forming in front of the wall (they would be expected to form behind the wall if the retaining wall suffered a passive failure) and the location of the seepage path below and outside of the zone of influence of the retaining wall. Whilst the retaining wall and fill provided some surcharge loading, this was relatively minor, and the retaining wall failed because a landslide occurred on the slopes below it, causing it to be undermined.

Mr Pope opines that if the retaining wall was not present there would have been some movement and ground cracking in January 2025, but not a debris flow as occurred on 15 January 2025. Mr Paul opines that the presence of or otherwise of the retaining wall would have made little to no difference to the occurrence of the debris flow on 15 January 2025.

4. **The magnitude of the contribution of the water leakage from the Bayview Road leak and its role as a causal factor for the 5 and 14 January 2025 landslides.**

Mr Paul, Mr Makin, Mr Hitchcock and Mr Pope opine that the only credible source of water that

could have provided sufficient volume to trigger the January 2025 landslides originated from the burst main at Bayview Avenue and its influence was significant to major. Furthermore, whilst it is not possible to know the exact flow path the water took from the leak site to the landslide, there are credible flow paths including through sewer trenches and permeable shallow aquifers and that as water flowed along these flow paths its chemistry could have been altered which can explain the chemistry of the water measured that issued from the headscarp following the landslides in January 2025.

Mr Hartley and Mr Bolton opine that the water that issued from the landslide headscarp in January 2025 did not derive from the Bayview Road leak on the basis of its chemistry and because there was insufficient residence time during its ~~for it to~~ travel from the leak site to the landslide site to alter the chemistry sufficiently. Irrelevant & Sensitive

**5. The magnitude of the impact of domestic irrigation as the causal source of water**

Mr Paul, Mr Pope and Mr Hitchcock opine that the influence of domestic irrigation in causing the landslide was minor on the basis of the low volume compared to the volume that issued from the escarpment. Domestic irrigation could have feasibly caused some wetting of the soil at the site of the landslide, but this was not sufficient to cause the January 2025 landslides.

Mr Hartley and Mr Bolton opine that domestic irrigation was a major contributor to the water that caused the January 2025 landslides on the basis of the high water usage measured at 4 and 10-12 View Point Road.

**Signatures**

| Name | Signature | Date |
|---|---|---|
| Darren Paul | **Irrelevant & Sensitive** | 31 July 2025 |
| Stephen Makin | **Irrelevant & Sensitive** | 31 July 2025 |
| Dane Pope | **Irrelevant & Sensitive** | 31 July 2025 |
| Phil Hitchcock | **Irrelevant & Sensitive** | 31 July 2025 |
| David Hartley | **Irrelevant & Sensitive** | 31 July 2025 |
| Hugo Bolton | **Irrelevant & Sensitive** | 31 July 2025 |