

Board of Inquiry into the McCrae landslide

**Before: The Chairperson,
Ms Renée Enbom KC**

**County Court of Victoria,
250 William Street, Melbourne, Victoria**

Wednesday, 7 May 2025 at 10.00am

(Day 1)

**Mr M. Costello KC with Mr A. Di Stefano and
Ms A. Kittikhoun appeared as Counsel Assisting.**

**Ms K. Evans KC with Ms E. Pepler and Mr C. McDermott
appeared on behalf of the State of Victoria.**

**Ms K. Foley SC with Ms E. Bateman, Mr C. Viney and
Dr W. Phillips appeared on behalf of the Mornington
Peninsula Shire Council.**

**Ms D. Siemensma appeared on behalf of South East Water
Corporation.**

1 CHAIRPERSON: Good morning, all. This is the first public
2 hearing of the board of inquiry into the McCrae landslide.
3 My name is Renée Enbom, and I have the privilege and
4 responsibility of being the chair of this board of inquiry.
5 This hearing is being held on the lands of the Wurundjeri
6 people of the Kulin nation, and I wish to acknowledge them
7 as traditional owners. I would also like to pay my
8 respects to their elders, past and present, and Aboriginal
9 elders of other communities who may be here today.

10
11 Ms Jones, will you please now read into the record the
12 order in council establishing this board of inquiry.
13
14

15 MS JONES: The Governor in Council, on the recommendation
16 of the Premier, under s53(1) of the Inquiries Act 2014
17 appoints Renée Enbom KC to constitute a board of inquiry to
18 inquire into, report on and make any recommendations
19 considered appropriate in relation to the terms of
20 reference specified in this order. This order comes into
21 effect on the date it is published in the Government
22 Gazette.
23

24 The objectives of this board of inquiry are to
25 determine the causes of the McCrae landslide; determine the
26 adequacy of measures taken to prevent and minimise
27 landslides and landslips in the McCrae area, including
28 reviewing responses to the November 2022 and 5 January 2025
29 landslides and landslips in the area to the extent that
30 this information is available and relevant to the McCrae
31 landslide; and identify measures to be taken for the
32 prevention or mitigation of the risk of similar landslide
33 events to the McCrae landslide occurring in future in the
34 McCrae area.
35

36 Terms of reference. Having regard to the objectives
37 set out above, you are required to inquire into, report on
38 and make any recommendations considered appropriate in
39 relation to the following terms of reference: (a) the
40 causes of the McCrae landslide; (b) the actions (including
41 any inaction) and decisions of connected parties, including
42 actions taken to prevent or mitigate landslides and
43 landslips in the McCrae area, and actions and/or decisions
44 taken that may have contributed to causing the McCrae
45 landslide (including, without limitation, approving and
46 issuing permits, and undertaking building, road, water or
47 other works); (c) the adequacy of any risk assessments

1 undertaken to determine the likelihood and severity of
2 landslides and landslips in the McCrae area before the
3 McCrae landslide; (d) the adequacy of preventative and
4 mitigative measures taken before the McCrae landslide,
5 including actions that could have been but were not taken
6 by connected parties; (e) any barriers to the
7 implementation of measures to prevent or mitigate
8 landslides and landslips in the McCrae area that existed
9 before the McCrae landslide occurred; (f) the regulatory
10 framework, including the responsibilities, powers, duties
11 and functions of all responsible authorities in relation to
12 the prevention and management of landslides and landslips
13 in Victoria; and (g) identify any measures for the
14 prevention or mitigation of the risk of similar landslide
15 events to the McCrae landslide occurring in future in the
16 McCrae area.

17
18 CHAIRPERSON: Thank you, Ms Jones. On 14 January this
19 year a landslide occurred in a residential part of
20 the coastal town of McCrae, which is located within the
21 Mornington Peninsula Shire Council. The landslide followed
22 two previous landslides in the area, one on 5 January this
23 year and the other in November 2022.

24
25 The 14 January landslide sent one man to hospital with
26 serious injuries. I acknowledge the trauma that he has
27 experienced. I also acknowledge the distress suffered by
28 the family whose home has sadly been reduced to rubble.
29 Four months on and their collapsed home still sits to the
30 side of Point Nepean Road. They lost their home, a home
31 that they worked hard over many years to be able to
32 purchase to enjoy with their family and friends, and there
33 is currently no clear path forward in respect of their
34 property.

35
36 I acknowledge the significant stress that the
37 landslide has caused to other residents. Many residents
38 were compelled to leave their homes and to leave their
39 belongings behind at short notice. Some residents have not
40 been able to return home since the earlier landslide in
41 November 2022. Two and a half years on and those residents
42 are still not able to go home and they do not know when
43 they'll be able to do so.

44
45 Shortly after the establishment of this inquiry
46 I visited McCrae and I had the opportunity to speak to many
47 of the residents. They are a community motivated to assist

1 this inquiry in whatever way they can. I thank the
2 residents who attended, and I thank them for the assistance
3 that they have provided and continue to provide. It is
4 time to find the answers to the important questions being
5 asked by the McCrae community.
6

7 I am determined to make findings as quickly as
8 possible as to the cause of the 14 January landslide. The
9 work of the inquiry must be undertaken with care, but it
10 must also be undertaken with speed, given the number of
11 landslides that have occurred in the area and the ongoing
12 impact on residents. I am determined to make
13 recommendations as quickly as possible as to the measures
14 that need to be taken to prevent or mitigate the risk of
15 another landslide. Those residents who have not returned
16 home must be able to do so safely. Those residents who are
17 now back in their homes need to feel safe.
18

19 The work of the inquiry will be undertaken with care
20 and speed, and in a manner that is fair and decent. I ask
21 those organisations who are engaging with this inquiry to
22 adopt the same approach. This inquiry is not an
23 opportunity for grandstanding. It is not a place for
24 litigation type strategy. It is a place for finding
25 answers in the public interest.
26

27 This is the first of several hearing blocks to be
28 held. This week the inquiry will hear some initial
29 evidence from experts. One of the experts has been working
30 for many months on trying to determine the cause of the
31 landslide. He will assist the inquiry with evidence as to
32 the work he's undertaken to date, and the nature and timing
33 of the further work that is proposed. The inquiry will
34 also hear some initial evidence from representatives of the
35 Mornington Peninsula Shire Council and South East Water.
36 Next week affected residents will give evidence. As I said
37 earlier, there will be further hearing blocks at which more
38 detailed evidence will be given by expert witnesses. Shire
39 and South East Water representatives will also be required
40 to give further evidence in a later hearing block.
41

42 Finally, I encourage anyone who is attending today or
43 watching remotely to contact the inquiry if they have
44 information which they believe may assist. Contact details
45 are on the inquiry's website.
46

47 Now, before counsel assisting commences, I'll take

1 appearances from counsel assisting and those parties
2 granted leave to appear.

3
4 MR COSTELLO: Madam Chair, I appear with Mr Alexander
5 Di Stefano and Ms Angela Kittikhoun as counsel assisting.

6
7 CHAIRPERSON: Thanks, Mr Costello.

8
9 MS FOLEY: Madam Chair, pursuant to leave that's been
10 granted on 17 April, I appear on behalf of the Mornington
11 Peninsula Shire Council with my learned friends Ms Bateman
12 and Mr Viney and, today appearing with me Dr Phillips.

13
14 CHAIRPERSON: Thank you, Ms Foley.

15
16 MS EVANS: Madam Chair, I appear with Ms Peppler and
17 Mr McDermott for the State of Victoria, specifically, Madam
18 Chair, the 15 entities that were granted leave from the
19 board of inquiry through correspondence on 2 May.

20
21 CHAIRPERSON: Thank you, Ms Evans.

22
23 MS SIEMENSMA: Madam Chair, I appear on behalf of South
24 East Water. We have also been granted leave to appear.

25
26 CHAIRPERSON: Thank you. Mr Costello.

27
28 MR COSTELLO: Thank you, Madam Chair. Madam Chair, as you
29 are aware, since the inquiry was established there have
30 been a power of work undertaken by those assisting you and
31 by many parties interested in the work of this inquiry.
32 While public hearings of the type we begin today are a very
33 significant aspect of the work of the board of inquiry, a
34 great deal of work occurs outside of public hearings. That
35 work is underway and will continue beyond this hearing
36 block.

37
38 Your counsel and solicitors assisting have sought to
39 be judicious in issuing notices to produce documents and in
40 requesting witness statements from relevant entities. The
41 terms of reference which have now been read into the record
42 limit and focus the work of the inquiry, and the reporting
43 deadline necessitates that decisions be made with a view to
44 efficiency.

45
46 If the slides could be put up now, please, and I could
47 have slide 2. While that comes up, Madam Chair, can

1 I mention that up to the point of this hearing you have
2 caused 20 notices to produce to be issued to various
3 parties, which has resulted in, at least at the start of
4 this week, around 1,300 documents being produced. Some of
5 those documents are short. Others are not. A number of
6 them are expert geotechnical and engineering reports, some
7 of which include annexures with the results of scientific
8 testing. All documents produced to the board of inquiry
9 will be carefully scrutinised by those assisting you.

10
11 Things have rather moved on from even the start of
12 the week, and since then we have received an additional
13 1,610 documents, most of them overnight, which we're now in
14 the process of reviewing.

15
16 As you have already mentioned, Madam Chair, you and
17 those assisting you are concerned to ensure that the local
18 community most directly affected by these events, their
19 friends and family are given full opportunity to
20 participate in the work of the inquiry, and in so doing
21 have their opinions both heard and considered, and have the
22 effects of these events upon them recorded and
23 acknowledged.

24
25 The board's engagement with the local community has
26 been constant. In particular, on 9 April, shortly after
27 the inquiry was called, you, members of the board of
28 inquiry staff and members of the counsel and solicitors
29 assisting teams travelled to McCrae in order to meet with
30 community members and to view so much of the site as was
31 available.

32
33 In order to ensure that the community is aware of the
34 fact of the inquiry and their ability to participate in its
35 work, 1,400 flyers have been distributed to the local
36 community and advertisements have been placed in newspapers
37 and online.

38
39 Since then, the inquiry has had a number of telephone
40 calls with community members and 32 public submissions have
41 been received as at 5 May, some of them from local
42 residents. A number of local residents will give evidence
43 in this hearing block. On behalf of the legal team
44 assisting you, can I thank the local community for their
45 very active engagement, which has materially aided the work
46 of the inquiry.

1 Could I turn then to some uncontroversial facts.
2 McCrae is a suburb on the Mornington Peninsula in Victoria.
3 It's situated 59 kilometres south of the Melbourne central
4 business district and two kilometres from Rosebud. It's
5 located within the shire of Mornington Peninsula local
6 government area and is home to over 3,000 people, as at the
7 most recent Census.

8
9 During the course of this inquiry, Chair, you will
10 hear much evidence about geotechnical matters and the
11 underlying geology of the McCrae area. The site of the
12 2022 and 2025 landslides is underlain by Quaternary raised
13 coastal deposits comprising of siliceous and calcareous
14 sand, shell beds and mud islands at the base of
15 the escarpment. At the elevated terrain, that is behind
16 the escarpment, the landscape is underlain by Paleozoic
17 granodiorite and granite.

18
19 The relevance of soil types to landslide risk is a
20 matter I will address through evidence later today.
21 Topographically, McCrae can be defined by its near
22 continuous coastal escarpment. Along the toe of the
23 escarpment is a low coastal plain featuring small low-lying
24 dunes.

25
26 The McCrae area, as you mentioned, Madam Chair, has
27 experienced several significant landslides in recent times,
28 and there are three landslides referred to in the terms of
29 reference. In fact, there were two landslides in 2022 and
30 two in 2025. In the following section of my opening
31 address I will canvass the key facts concerning the two
32 landslides that occurred in 2022 and the two that occurred
33 in 2025.

34
35 The key dates are as follows. In 2022 an initial
36 landslide occurred on Monday, 14 November at the rear of
37 10-12 View Point Road. In the early hours of the following
38 morning - that is, Tuesday, 15 November 2022 - a subsequent
39 landslide occurred at the same location. In 2025 the
40 initial landslide occurred in the evening of Sunday,
41 5 January. On the morning of Tuesday, 14 January a
42 subsequent, more severe landslide occurred at the same
43 location, this time completely destroying the dwelling at
44 3 Penny Lane.

45
46 Whether or not it's correct to describe the general
47 area within McCrae as landslide prone, it's certainly the

1 case that landslides are not unknown in the area. A
2 significant landslide occurred in the general area in July
3 1952. That landslide, which destroyed eight homes, appears
4 to have occurred near Anthony's Nose, which is an
5 escarpment located between Dromana and McCrae,
6 approximately two kilometres north-east of the site with
7 which this board of inquiry is concerned. The 1952
8 landslide was triggered by significant rainfall. 1952 was
9 a significantly wet year throughout Victoria. In July 1952
10 rainfall was the highest on record for the southern parts
11 of Victoria.
12

13 The region within Victoria that received the
14 highest-on-record rain included the McCrae area. Although
15 the Anthony's Nose landslide in 1952 is two kilometres from
16 the site of the events with which this board of inquiry is
17 concerned, it is of some relevance in understanding the
18 geological and slope conditions, and the effect or
19 potential effect of significant water on those conditions.
20

21 Can I return now to the 2022 landslides. As
22 I mentioned, it's important to note that two separate
23 landslides occurred, the first on 14 November. If we can
24 bring it up, Madam Chair, I'd like to show you a diagram of
25 this area. I think there's a difficulty with the IT
26 system.
27

28 CHAIRPERSON: Would you like me to stand the matter down
29 briefly while we investigate?
30

31 MR COSTELLO: I think that might make it more efficient,
32 if you wouldn't mind.
33

34 **SHORT ADJOURNMENT**

35
36 MR COSTELLO: Chair, I apologise for the delay.
37

38 CHAIRPERSON: Not at all.
39

40 MR COSTELLO: The problem has been remedied, happily. If
41 I might just quickly traverse some of the ground I went
42 over. These are some facts and figures in respect of
43 the community engagement that the board has undertaken
44 since it was established, and some of the data concerning
45 documents obtained and witness statements received and
46 prepared by the board. As I mentioned, overnight the
47 number of documents obtained in response to notices to

1 produce has more than doubled.

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1 with landslides and, as I mentioned, 1952 was an
2 historically wet year. You can see the dark blue shading
3 on the map there is indicative of highest-on-record
4 rainfall, and the entire Mornington Peninsula and a
5 significant portion of Victoria beyond that is shaded in
6 dark blue there.

7
8 Next slide, please. So we move now to the 2022
9 landslides, and if I could have the next slide. What's
10 identified on that map is the affected landslide area. The
11 yellow dotted line takes in 10-12 View Point Road, which is
12 at the top of the hill, and the area to the left of the red
13 arrow is the area where the landslide in 2022 - or
14 landslides, rather, in 2022 occurred.

15
16 If we could move to the next slide, please. In 2022
17 there were site inspections conducted by a senior principal
18 from Stantec. That is a firm of geotechnical engineers.
19 They inspected the site on the afternoon of 15 November
20 2022. There was also an inspection by another consulting
21 engineering firm, Logocon, on 24 November 2022. Those
22 inspections included visual non-invasive investigations,
23 and you'll hear some evidence later today, Madam Chair,
24 about the difference between invasive and non-invasive
25 investigatory techniques in connection with landslide
26 investigation. Independent observations were made. In
27 addition there were discussions with local residents with a
28 view to seeking anecdotal information that might bear upon
29 a proper assessment of the causal factors of the landslide.
30

31 If we move to the next slide, please. Still here in
32 connection with the 2022 landslides, in particular the
33 first of them, the reports of the geotechnical engineers
34 engaged in relation to that landslide suggests that an
35 initial landslide occurred on the afternoon of 14 November;
36 it occurred at the rear of 10-12 View Point Road on the
37 upper slope; it was categorised as a translational
38 landslide - that is in contrast to a rotational landslide,
39 and Mr Paul will give evidence about the difference later
40 today - and it was considered a landslide that was moderate
41 to rapid in nature. Moderate to rapid means that the earth
42 moved in the order of metres per hour to metres per minute.
43

44 If I could have the next slide, please. Of potential
45 relevance, the owners of unit 3/613 Point Nepean Road
46 reported hearing a loud noise at the back of their property
47 early in the morning of 14 November, they think at

1 approximately 6.30 am. However, they did not identify
2 anything visually at that time that indicated that a
3 landslide had occurred.
4

5 Next slide, please. In the early morning of
6 15 November 2022 the second landslide occurred. This
7 landslide manifested as a debris flow from the middle part
8 of the slope down to the toe, resulting in and impacting on
9 3 Penny Lane. Debris also flowed into the backyard of unit
10 3/613 Point Nepean Road. This landslide, in contrast to
11 the first, was considered very rapid to extremely rapid,
12 meaning that the earth moved in the order of metres per
13 second. Inspection of the failed slope indicated the
14 displaced soil was sand. Several properties were evacuated
15 after the 15 November 2022 landslide, including
16 2 Penny Lane, 3 Penny Lane, unit 3/613 Point Nepean Road,
17 10-12 View Point Road and 14-16 View Point Road.
18

19 If I could have the next slide, please. Madam Chair,
20 this image depicts the location of the initial landslide on
21 14 November. You can see 10-12 View Point Road to the top
22 left of the image at the top of the hill. The subsequent
23 debris flowed down the hill on 15 November. That's evident
24 from the middle of the image of the slide. The arrows give
25 you an idea of the impact and effect of each landslide, the
26 first landslide being smaller and settling at about the
27 middle of the hill, and the second landslide, the earth
28 travelling further from the middle of the hill towards the
29 base.
30

31 If we could move to the next slide, please. This
32 image depicts the subsequent debris that impacted the slope
33 leading down to Penny Lane from View Point Road. It shows
34 the view looking up from the base towards 10-12 View Point
35 Road.
36

37 If I could have the next slide, thank you. This is an
38 image of debris flow from the 15 November 2022 landslide.
39 It was taken by the owners of unit 3/613 Point Nepean Road
40 from their garden. As you can see, Madam Chair, the debris
41 flow has damaged the rear of their property but thankfully
42 did not impact the home itself.
43

44 One of the residents of unit 3/613 Point Nepean Road
45 took this image of the escarpment on the morning of
46 15 November 2022 following the landslide. The image
47 indicates the presence of significant water flow down the

1 escarpment at that time. You can see from the image that
2 the debris looks like mud, is largely sodden and that there
3 is open water towards the base of the flow.
4

5 If I - thank you. I mentioned once already that
6 rainfall is an important consideration in connection with
7 investigating causal events leading to landslides. On
8 14 November 2022, that is the date of the first landslide,
9 80 millimetres of rain was recorded by the Bureau of
10 Meteorology rain gauge located at the Rosebud Country Club,
11 which is three to four kilometres away from the site.
12 According to that data, that was the highest single day of
13 rainfall at that rain gauge since February 2005.
14

15 More generally, the monthly precipitation for October
16 and November 2022 was much higher than previous years
17 dating back to 1927. The precipitation for November 2022
18 was triple the historical average.
19

20 If I could have the next slide, please. A land survey
21 was conducted of the slope by GJ Martin Consulting Land
22 Surveyors on 11 November 2022, and a drone topographical
23 survey was conducted by CivilTest on 2 December 2022. The
24 two surveys by GJ Martin and CivilTest have been overlaid
25 in this graph to estimate the extent of the earth flow on
26 15 November 2022. The red line highlights the loss in
27 volume to the face of the escarpment following the two
28 landslides in 2022, and the dotted blue line is a
29 projection of the pre-landslide hillscape.
30

31 One of the matters of relevance to which your
32 attention is specifically drawn in the terms of reference,
33 Madam Chair, is the fact of extant legal proceedings and
34 their relevance to the matters that this board is charged
35 to inquire into. There are current proceedings on foot
36 before the Building Appeals Board relating to the 2022
37 landslides, including with respect to emergency and
38 building orders issued by the Mornington Peninsula Shire
39 Council following the 15 November 2022 landslide and
40 proposed rectification works to stabilise the escarpment
41 and eliminate danger to life and property.
42

43 There are also current proceedings on foot before the
44 Victorian Civil and Administrative Tribunal regarding the
45 15 November 2022 landslide which were commenced by the
46 owners of 10-12 View Point Road against the shire council.
47

1 Last week the Building Appeals Board delivered a
2 determination in proceedings issued by the owners of
3 10-12 View Point Road, and found that the emergency order
4 and building orders issued to them by the shire council
5 were invalid. Proceedings issued by the owners of unit
6 3/613 Point Nepean Road in the Building Appeals Board are
7 still awaiting determination. The solicitors and counsel
8 assisting are giving active consideration to the matters
9 raised in those various proceedings.

10
11 If I could have the next slide, please. If I could
12 return now to the 2025 landslides. As you know,
13 Madam Chair, the first was on 5 January and the second was
14 on 14 January. The 5 January landslide occurred in the
15 evening, and the 14 January landslide occurred at
16 approximately 8.30 am.

17
18 If I could have the next slide, please. This is an
19 aerial image of the landslide site before the - thank you.
20 This is an aerial image of the landslide site after the
21 14 January 2025 landslide. You will note the significant
22 debris. Could we just go back one slide, please; thanks.
23 You'll note the significant debris, and evident at the
24 bottom of the slope is the destroyed property at
25 3 Penny Lane in the centre of the image.

26
27 If we move to the next slide. There are side-by-side
28 before and after images of the relevant site, the first
29 before being before either of the 2025 landslides and the
30 second being after the both of them.

31
32 If we could move to the next slide, please.
33 Madam Chair, you know 3 Penny Lane was destroyed in the
34 second 2025 landslide. It was a three-storey house built
35 in 1999. It sat on an 828 square metre block. It had four
36 bedrooms, two bathrooms and two parking spaces. It had
37 only been purchased by the current owners, Nick and Kelly
38 Moran, in 2023.

39
40 Madam Chair, you will hear evidence from the Morans
41 that 3 Penny Lane was a much-loved holiday home for them
42 and for their immediate and extended family. Nick, Kelly
43 and their children spent the June 2023 school holidays and
44 the September 2023 holidays at 3 Penny Lane, and they often
45 spent weekends at the property, more often than not with
46 extended family and friends.

1 In the weeks leading up to 5 January 2025,
2 3 Penny Lane was rarely vacant. Nick, Kelly and their
3 children were often there and, when they were not, various
4 friends and family stayed at the premises.

5
6 If I could have the next slide, please. The property
7 at 3 Penny Lane was built on a slope that runs roughly from
8 beach level at Point Nepean Road and Penny Lane to the top
9 of McCrae hill on View Point Road, and you can see the
10 property there with the white box around it. To the left
11 of the shot you can see two houses at least on View Point
12 Road. The second house, that is the house without the flat
13 roof, is 10-12 View Point Road, which sits almost directly
14 above 3 Penny Lane.

15
16 Could I have the next slide, please. On 5 January at
17 approximately 7.30 pm the initial landslide impacted
18 3 Penny Lane, McCrae. Kelly Moran and her daughter were
19 inside the property when the first 2025 landslide occurred.

20
21 Could I have the next slide, please. The property
22 sustained structural damage to the rear. It's approximated
23 that 20 to 25 tonnes of material struck the dwelling,
24 causing moderate damage to the external walls and
25 structural piers. The external wall of the centre of
26 the dwelling was deemed unsafe and unstable. The undoubted
27 source of the landslide was upslope towards 10-12 View
28 Point Road.

29
30 Madam Chair, you will hear evidence next week from
31 Kelly Moran as to her experience being in the property at
32 the time of the 5 January landslide. You'll hear that
33 Ms Moran heard a large rumbling sound, which she thought
34 was thunder, and then the whole house began to vibrate.
35 She observed the rear of the second floor of the property
36 being pushed into the house where her and her daughter were
37 standing. Once the vibration stopped she saw that the
38 laundry door and laundry cupboards had been pushed into the
39 hallway of the home, completely blocking all access to the
40 bedrooms in that part of the house.

41
42 Next slide, please. A number of properties were
43 affected by the 5 January landslide, including 10-12 View
44 Point Road, 3 Penny Lane and 607-609 Point Nepean Road,
45 which is located downhill, further downhill of
46 the landslide activity. There were not emergency orders
47 issued to evacuate residents at that time.

1
2 If we move to the next slide, please. It should be
3 noted that rainfall data indicates that there was no
4 rainfall in the month of January preceding the 5 January
5 landslide. That puts the 5 January landslide in a
6 categorically different position to the 2022 landslides and
7 of course the 1952 landslide. More specifically, the graph
8 on the right of the slide shows zero millimetres of rain as
9 at 5 January 2025.

10
11 Could I have the next slide, please. The first
12 rainfall event of the year in McCrae was on 7 January 2025.
13 You can see there, Madam Chair, a recording of 14 mms on
14 7 January. There was also rainfall on 13 January, 9 mms,
15 which is on the moderate to light side.

16
17 If I could have the next slide, please. Temperature
18 data indicates that the weather preceding the landslide was
19 hot and dry in the McCrae area. The graph here - the map
20 here, rather, indicates that the maximum temperature for
21 the first week of January 2025 was between 24 and
22 27 degrees.

23
24 If I could have the next slide, please. Despite the
25 lack of rain, water flow was observed after the landslide.
26 A significant portion of the head scarp was saturated in
27 the week of the 5 January landslide. A measurable flow of
28 water of 0.15 to 0.2 litres a second was observed to be
29 flowing down the hill. The seepage was observed at the
30 point between the surface soils and the underlying natural
31 soils.

32
33 Could I have the next slide, please. Following the
34 5 January landslide, Nick and Kelly Moran vacated
35 3 Penny Lane and removed various items from the property
36 over the coming days. They also attended at the property
37 to meet with various representatives from the shire council
38 and from their insurer. They did not receive a formal
39 evacuation order, though it was plain that they could no
40 longer remain in the premises and came to that conclusion
41 themselves.

42
43 The residents of 10-12 View Point Road and 607-609
44 Point Nepean Road also remained in their respective
45 properties during this period and were not formally
46 evacuated.

1 Can I have the next slide, please. Madam Chair, you
2 are not called upon to make recommendations or findings in
3 connection with the immediate response to the landslide,
4 but it is worth at least noting that the Victorian State
5 Emergency Service were on site within two hours of
6 the landslide. On that day and over the coming days the
7 Victorian SES were focused on diverting water out of
8 the 3 Penny Lane property and assisted the owners in moving
9 and removing furniture from the property.

10
11 South East Water switched off water to 3 Penny Lane
12 shortly after the landslide. Between 5 and 14 January
13 representatives from and on behalf of the shire council,
14 including building surveyors and geotechnical engineers,
15 attended at the property, and representatives from the
16 owners' insurer were also on site at various times and
17 engaged in discussions with some of the other parties on
18 site.

19
20 If I could have the next slide, please. On 14 January
21 at approximately 8.30 am a subsequent landslide destroyed
22 the dwelling at 3 Penny Lane. The collapse shunted the
23 house towards 607-609 Point Nepean Road. It did not impact
24 the building on that property except for some distortion to
25 a rear retaining wall. The source of the landslide was
26 upslope at 10-12 View Point Road.

27
28 Next slide, please. Subsurface water was observed
29 during a geotechnical engineer's visit. That water was
30 discharging from points near the initial landslide area
31 towards the rear of 10-12 View Point Road. The following
32 day approximately 9 millimetres of rainfall occurred in the
33 area.

34
35 Next slide, please. This photograph shows exposed
36 material at the landslide site. Some of the exposed
37 material in the gully is observed to be dark in colour,
38 whereas material exposed in an adjacent slope appear to be
39 pale brown and sandy. The characteristic of soils of those
40 colours is a matter of inquiry.

41
42 If I could have the next slide, please. While failure
43 mechanisms were not able to be identified immediately, it
44 was concluded that the landslide transitioned into a rapid
45 debris flow, with runout extending its reach to below the
46 properties. It is acknowledged that 2 Penny Lane acted as
47 a barrier to slow and stop the debris.

1
2 Could I have the next slide, please. A total of 19
3 properties were originally evacuated on 17 January 2025.
4 Madam Chair, you can see, although it may be a little hard
5 to identify the precise addresses, that this map sets out
6 the addresses of each of the relevantly affected
7 properties, some of which I have spoken of already. You
8 can see at the base of the hill 3 Penny Lane, which is sat
9 behind 607-609 Point Nepean Highway, and directly behind
10 3 Penny Lane is 10-12 View Point Road on the one side and
11 6 View Point Road on the other.
12

13 Of the 19 properties originally evacuated on
14 17 January 2025, 11 had emergency orders lifted on either
15 14, 20 or 21 February or 15 April. Those residents have
16 been allowed to return to their homes, with the exception
17 of course of 3 Penny Lane. Eight properties still remain
18 in the exclusion zone, with residents unable to return to
19 their properties.
20

21 Finally, Madam Chair, I must mention that a Mornington
22 Peninsula Shire Council worker was on site at the time of
23 the 14 January 2025 landslide. He was one of a number of
24 Mornington Peninsula Shire Council officers and staff who
25 had attended from time to time at the property. He was the
26 only person on site at the time of the 14 January
27 landslide, and as a consequence of being in attendance at
28 the site at that time he sustained serious injuries as a
29 result and was taken to hospital. Of course our thoughts
30 are very much with him.
31

32 Madam Chair, those are the factual matters connected
33 with the 2022 and 2025 landslides that I wanted to outline.
34 At this point I intend to move to a different topic, namely
35 erosion management overlays, and I'll then return in some
36 sense to the factual matters I've addressed to identify
37 current lines of inquiry.
38

39 CHAIRPERSON: Thanks, Mr Costello.
40

41 MR COSTELLO: Erosion management overlays are something
42 that you will hear a significant amount of evidence about
43 in the course of this inquiry. An erosion management
44 overlay is the principal planning control for landslide
45 risk in Victoria. Although named "erosion management
46 overlays", they are directed to erosion, landslip and other
47 degradation, and have firmly within the core of their

1 purpose prevention of landslides.

2
3 Erosion management overlays are part of the Victorian
4 planning scheme. In general terms, the regulatory scheme
5 is as follows. Each local government area has a unique
6 planning scheme. That planning scheme will, amongst other
7 things, identify the extent to which an overlay applies to
8 particular land identified with precision by a map.

9
10 Overlays complement but are separate to zoning.
11 Overlays are a method of applying additional subject
12 matter-specific planning controls, for example, with
13 respect to heritage preservation, flood, bushfire or, in
14 the case of an erosion management overlay, landslide
15 management. Not all land in a given local government area
16 will be subject to an overlay, while some land may be
17 subject to various overlays, including an erosion
18 management overlay.

19
20 The overlay information will indicate if a planning
21 permit is required for the construction of a building or
22 other change to the land, and sets out the requirements for
23 subdivision and building works that apply in addition to
24 the requirements of the zoning. An overlay may specify
25 information that must be submitted with an application for
26 a planning permit.

27
28 In broad terms, if an erosion management overlay
29 applies to land it can trigger the requirement for a
30 planning permit for buildings and works, including for
31 types of developments that are ordinarily exempt from
32 planning permits under statewide controls.

33
34 In addition, any application that would ordinarily
35 require a planning permit - to take as one example, a
36 subdivision application - in respect of land affected by an
37 erosion management overlay, that application will be
38 required to demonstrate that the objectives of the overlay
39 are met.

40
41 Where an erosion management overlay applies it is
42 likely to have practical consequences, such as requiring
43 additional stabilisation work in respect of the site or the
44 preparation of specific geotechnical hazard and risk
45 assessment reports, ordinarily to be prepared in accordance
46 with the Australian Geomechanics Society guidelines.

1 There are erosion management overlays within the
2 Mornington planning scheme. Somewhat unusually, the
3 Mornington scheme does not apply a single overlay to
4 identified areas but applies six distinct overlays, the
5 most recent of which was introduced in January of this
6 year. It appears the more common practice in local
7 government areas in Victoria is for there to be a single
8 erosion management overlay in a local government area.
9 That is not to say that there is anything inappropriate
10 about the method employed by the shire here. Indeed, it
11 may be that a multiplicity of erosion management overlays
12 is a better system designed to suit site-specific
13 conditions. These are matters that we will consider in the
14 course of the inquiry.

15
16 For present purposes, I simply note that the method
17 employed by this council is not the universal method
18 employed throughout Victoria.

19
20 Madam Chair, can I take you now to parts of the
21 Mornington Peninsula planning scheme. Could I have
22 document INQ.003.0001.0002. INQ.003.0001.0002. This
23 particular document I think might be in the court book in
24 more than one place, so I might have another document ID
25 I can give. Perhaps I'll try another ID. Can I try
26 INQ.0003.0001.0004. I think they're being moved across
27 into the hearing book. That's fine.

28
29 Madam Chair, I know you wanted to take a morning
30 break. Would now be the appropriate time or would you
31 prefer me to continue?

32
33 CHAIRPERSON: We can do it now.

34
35 MR COSTELLO: All right. Thank you.

36
37 **SHORT ADJOURNMENT**

38
39 **UPON RESUMING**

40
41 CHAIRPERSON: Mr Costello, don't be alarmed by me
42 standing. I'm going to stand from time to time due to a
43 back injury.

44
45 MR COSTELLO: As long as you're happy for me to keep
46 standing, Madam Chair, I've got no objection to it.

1 I was in the thick of describing in a general sense
2 the erosion management overlay system and how it sits
3 within the broader regulatory regime in respect of planning
4 in Victoria:

5
6 I now want to go a little more specifically to some of
7 the particularity of the Mornington planning scheme. Just
8 to acquaint you, Madam Chair, with some aspects of it, this
9 is a topic that I'll take up with Mr Paul, but at least it
10 seems sensible to do it at least in an introductory sense
11 now.

12
13 If I could have on the screen, please,
14 INQ.0003.0001.0001. This is a version of the Mornington
15 Peninsula planning scheme. As you would be aware, Madam
16 Chair, planning schemes within local government areas are
17 not irregularly updated for a variety of reasons. This
18 particular version that is on screen was updated on
19 19 December 2024. That's shortly before the first 2025
20 landslide. As I mentioned, there has been a subsequent
21 amendment to the scheme that is of at least tangential
22 relevance here in that at the time of this scheme there
23 were five erosion management overlays in place in the
24 shire, a sixth was added in January 2025, but I needn't go
25 to the specificity of that for my current purposes at
26 least.

27
28 So this document sets out the planning scheme for the
29 whole of the local government area, and in that sense deals
30 with a great number of topics that are outside the terms of
31 reference of this board of inquiry but, relevantly, deal
32 with erosion management overlays.

33
34 If I could please go to page 85 of that document, and
35 if that could be blown up a little bit. Thank you. You
36 will see here, Madam Chair, this is clause 13.04 of
37 the scheme, and it is addressed to erosion and landslip.
38 It identifies the objectives as being to protect areas
39 prone to erosion, landslip and other land degradation
40 processes, and underneath that it identifies strategies,
41 namely identify areas subject to erosion or instability in
42 planning schemes, and, when considering the use and
43 development of land, prevent inappropriate development in
44 unstable areas or areas prone to erosion, promote
45 vegetation retention, planting and rehabilitation in areas
46 prone to erosion and land instability. So that is the
47 general objective and the general strategies.

1
2 If we could then move to the next page, please. This
3 is a more specific example directed to Mornington and
4 Flinders, and you'll see there that this particular policy
5 applies to land affected by two of the what at this time
6 were five but now six overlays in place. You will see that
7 the strategy identified is to encourage development on land
8 that presents the least risk to property and life. Beneath
9 that there are policy guidelines. Those policy guidelines
10 direct that developments should avoid soakage pits and
11 absorption trenches, significant cut or fill of slopes, the
12 removal of vegetation, including the removal of roots of
13 any felled vegetation, and locating buildings on the public
14 land east of The Esplanade in Flinders.

15
16 There's then something more specific in relation to
17 land in proximity to Tanti Creek, and you'll see the third
18 bullet point: development should be discouraged if a
19 geotechnical hazard and risk assessment shows that the
20 development has a loss of life risk for the person most at
21 risk that exceeds 1 in 100,000 per annum. This is a topic
22 I will take up with Mr Paul and ask him to explain the
23 concept of loss of life risk, the concept of person most at
24 risk, and how these calculations are done so as to identify
25 who is the person most at risk and what the chances of a
26 loss of life of that person are.

27
28 Then you'll see there's more specificity set out in
29 the table below, the far left column being the likelihood
30 of risk, with an indicative value of approximate annual
31 probability, and then there are gradations of risk from
32 catastrophic through to insignificant.

33
34 If we could then move to internal page I think it's
35 755. Yes, thank you. We're now in that part of
36 the planning scheme that concerns the particular erosion
37 management overlays. You will see identified is, in the
38 second line under "Purpose", "to protect areas prone to
39 erosion, landslip and other land degradation or coastal
40 processes by minimising land disturbance and inappropriate
41 development". There's then the objectives and statement of
42 risk. There's then a statement regarding buildings and
43 works. Relevantly, a permit is required to construct a
44 building or to construct or carry out works, including
45 works of the kinds identified there, two specific and then
46 one by reference to a schedule. I needn't trouble you with
47 VicSmart applications. That's an expedited process for

1 simple planning applications of an eligible kind.

2
3 You'll then see at the foot "Vegetation removal",
4 where an EMO applies a permit is required to remove,
5 destroy or lop any vegetation, save for those exceptions to
6 the general principles set out in the three bullet points
7 below.

8
9 If we go over the page you will see that there is a
10 lengthy table of exemptions. Yes; thank you. Now, most of
11 these exemptions are not of particular relevance in the
12 domestic setting, although some of them are. You'll note,
13 for example, planted vegetation, potentially noxious weeds,
14 an exemption in respect of surveying.

15
16 Then if we go over the page you'll see there set out a
17 list of considerations required to be taken into account in
18 the assessment of an application, including whether
19 buildings or works are likely to cause erosion or landslip.

20
21 Now, as I mentioned, the particular scheme within the
22 shire sets out at this point in time five and now six
23 erosion management overlays that start with EM01 being the
24 overlay that applies in respect of areas of least risk and
25 imposes the slighter controls through to areas more prone,
26 to which there are significantly greater restrictions on
27 the potential use of the land and additional hurdles that
28 need to be met in order for any permit to be approved.

29
30 If we could go forward in the document to about
31 page 765. Thank you. If we could go, sorry, one back.
32 You'll see here by way of example, Madam Chair, this is
33 concerned with EM04. The objectives are stated below, and
34 then the statement of risk says that, "Areas susceptible to
35 landslide have been identified to occur along the
36 coastline, creeks and steeper sloped inland parts of the
37 Mornington Peninsula. Inappropriate use and development,
38 including vegetation removal, can exacerbate the risks of
39 landslide to life, property and environment associated with
40 these areas. Problems may include restricted usability;
41 structural stability; cracking and rising damp. Changes in
42 drainage patterns or the water table could also contribute
43 to further instability with associated risks to water
44 quality and the protection of indigenous flora and fauna."

45
46 And then beneath that there are permit requirements.
47 Permits are not required in the particular circumstances

1 set out in the three bullet points there: where the
2 building height isn't to be increased, there's no ground
3 disturbance or no changes to stormwater runoff. If one is
4 in a circumstance where any of those things will be
5 affected, then under EM04 you are in a permit application
6 process, and the application requirements are set out there
7 in clause 4 of schedule 4.

8
9 This, Madam Chair, gives you an idea of the types of
10 impositions imposed upon landowners in connection with the
11 development and use of their land in circumstances where an
12 EMO applies. You will see that these steps are required to
13 be undertaken to the satisfaction of the responsible
14 authority, and the first is a site-specific geotechnical
15 hazard and risk assessment, and that report needs to be
16 prepared by a suitably qualified geotechnical engineer or
17 engineering geologist with experience in landslide risk
18 management. So this isn't a document that can be prepared
19 by any civil engineer. Experience in the subspecialty of
20 geotechnical engineering with specific experience in
21 landslide risk is necessary.

22
23 There are then prescribed aspects of the report that
24 must be included, and you'll see it includes a history of
25 the land use; geological and topographical information; the
26 findings of a detailed inspection of the site; analysis of
27 an historical sequence of aerial photographs; an inventory
28 of the location, nature and extent of individual landslides
29 in the area sourced from the shire's landslide inventory or
30 other relevant historical documents; an assessment of
31 likely groundwater levels, including responses to rainfall
32 events, and at least three boreholes dug to a minimum depth
33 of five metres.

34
35 If we could go over the page, there's then reference
36 to further essential aspects of the geotechnical report,
37 including standard penetrometer testing; application of
38 geotechnical testing by an accredited soil laboratory; the
39 development of a geotechnical model, including the
40 identification of geomorphic processes; and a computer
41 slope stability assessment. That's just one aspect of the
42 permit process here, and you will see that in the bullet
43 points they're under there are others, including
44 geotechnical hazard assessment; if the land is affected by
45 the further EMO, EM05, there are additional requirements of
46 a qualitative risk assessment in accordance with
47 the Australian Geomechanics - sorry, quantitative risk

1 assessment of the site in accordance with the Australian
2 Geomechanics Society's guidelines, and a variety of other
3 things.
4

5 So you can see from this, Madam Chair, that depending
6 on the nature of the particular land in issue the types of
7 regulatory burden the land are subjected to can vary and it
8 can become quite an onerous process to be able to make a
9 change to the buildings on land, even if that change would
10 in ordinary circumstances be of a fairly standard type.
11 What is recognised by the application of an erosion
12 management overlay is that the susceptibility of sites to
13 landslide and landslip necessarily means that a higher
14 degree of investigation is necessary. But not only that.
15 The design of works needs to be conducted so as to mitigate
16 against any risks and perhaps even in the circumstance of a
17 particularly well-designed building operate to reduce the
18 risk that would otherwise have been present.
19

20 Although as at December 2024 there were five EMOs in
21 place within the shire, perhaps surprisingly, particularly
22 given some of the history of this particular land, there
23 was no erosion management overlay in respect of the land
24 the subject of the landslide here, and that remains the
25 case.
26

27 If I could just show you briefly another document.
28 The ID is INQ.0003.0001.0003, and if that could just be
29 zoomed in to the extent you can. It's a little difficult
30 to see, but this map serves a few purposes, Madam Chair.
31 The first is you can see from the shaded portions of the
32 map that the application of the erosion management overlay
33 to particular areas is fairly precisely defined, and areas
34 immediately adjacent to each other may be the subject of
35 different erosion management overlays.
36

37 What this map also demonstrates is the fact that there
38 is no erosion management overlay in respect of the land at
39 the site here. You'll see starting at about a quarter of
40 the way up from the left-hand side and moving diagonally
41 across the screen is the Mornington Peninsula Freeway.
42 It's on the side of the freeway to the top left of the
43 photograph where this landslide occurred and, as you can
44 tell from this map, the whole of that area is unaffected by
45 any environmental management overlay.
46

47 The imposition of an erosion management overlay

1 requires a lengthy process of mapping, consultation, local
2 government approval and ultimately ministerial approval in
3 order for the necessary planning scheme amendment to come
4 into force. It appears that it is not, at least in its
5 ordinary form, a decision that can be taken with haste. No
6 doubt that reflects the potentially significant restraints
7 on the rights of owners of land affected by an erosion
8 management overlay.
9

10 However, in the course of this inquiry and not just in
11 its public hearings we will consider the efficacy of the
12 environmental overlay mechanism generally, whether an
13 overlay ought to have applied in respect of this land and
14 whether the fact of an overlay would likely have altered
15 the course of the events as they occurred. That is to say
16 we will consider both the shire's actions in respect of the
17 land at McCrae and more generally the policy questions
18 arising in respect of landslide prevention. If that map
19 could be brought down now, thank you.
20

21 Can I turn then, Madam Chair, to the future work of
22 the board of inquiry. We have to date identified a number
23 of avenues of enquiry that we are pursuing, some of which
24 will be pursued in this hearing block and others which will
25 be pursued later, all of which will be pursued outside the
26 work of the hearings. Those assisting you have not formed
27 any view on whether or the extent to which any of these
28 issues in fact contributed to the 2025 landslides.
29

30 In general terms, the avenues of enquiry currently
31 being pursued are as follows: the effect of building works
32 on View Point Road; the removal of vegetation from the top
33 of the cliff; the adequacy of stormwater diversion; the
34 role of natural springs in this area; and the role of
35 damaged infrastructure and in particular a burst water
36 main. Might I briefly outline each of those avenues of
37 enquiry.
38

39 The first two avenues of enquiry are not connected
40 with water but, rather, concern anthropogenic factors,
41 namely building works and vegetation removal. As to
42 building works, it's not in dispute that a retaining wall
43 was installed at the rear of the property at 10-12 View
44 Point Road in around December 2020. No permit was issued
45 for those works. Generally, a building permit is required
46 for retaining walls more than one metre high. The evidence
47 of the property owner will be that the retaining wall was

1 less than that height and, given that and that no erosion
2 management overlay applied to the land, no permit was
3 required.
4

5 In November 2022 a reinforcement wall was built
6 30 metres in front of the original retaining wall to
7 structurally strengthen the original retaining wall. It
8 does not appear that those works increased the height of
9 the wall but, rather, were directed to ensuring the
10 efficacy of the original retaining wall. The shire was not
11 advised of the fact of those works at the time they were
12 performed.
13

14 Related to those works is the fact that some of the
15 colluvium, that is the loose sediment at the base of the
16 slope following the landslide, might be capable of being
17 described as fill. You'll hear some evidence today from
18 Mr Darren Paul, a geotechnical engineer engaged to assist
19 the board, that the addition of fill at the top of a slope
20 can affect landslide risk.
21

22 The second non-water-related line of enquiry, although
23 as, you'll hear from Mr Paul it does have a relationship to
24 water, is vegetation removal. Some vegetation was removed
25 from the property at 10-12 View Point Road in December
26 2020. The property owners have described the removal as
27 being limited to dead vegetation and invasive weeds,
28 coupled with the trimming of some large plants at the
29 request of a neighbour. As I have already said, we have
30 formed no view on whether any of those matters contributed
31 to the landslide. But both matters are at least capable of
32 having contributed to the landslide in that they could
33 assist in creating the conditions necessary for a landslide
34 to occur, even if they were not causal, and on that basis
35 we're under an obligation to fully explore them, and we
36 will.
37

38 There are then three water-related potential causes.
39 What will become clear from the evidence of the two
40 geotechnical engineers who will give evidence in this
41 hearing block is that, in the absence of other obvious
42 factors such as major earthworks or an earthquake, a
43 probable causative factor is water. I will adduce evidence
44 from Mr Paul on this later today.
45

46 Put briefly, the extent of water in the soils of a
47 hill increases the magnitude of the risk of a landslide

1 occurring. A variety of factors can contribute to soil
2 saturation levels. Here, there are two lines of enquiry.
3 The first concerns stormwater diversion. Madam Chair, you
4 will hear from Mr Dane Pope, the geotechnical engineer
5 engaged by the shire, that he concluded that one of the
6 most significant, perhaps the most significant,
7 contributing factor to the 2022 landslide was the very
8 significant, indeed historic, rainfall in the days before
9 those landslides occurred.

10
11 One method of reducing the amount of water absorbed by
12 a hill is by stormwater diversion infrastructure. That
13 infrastructure serves to channel the water through safer
14 paths and away from the at-risk areas. Those assisting you
15 are considering the extent and sufficiency of
16 the stormwater infrastructure in and around the area of
17 the landslide. That infrastructure serves to divert both
18 rainwater and springwater.

19
20 That brings me to natural springs. It is well known
21 that the area in and surrounding the landslide area here
22 has a number of natural springs. Such springs are common,
23 particularly in areas of granite rock. One local resident
24 who will give evidence next week will describe a flow of
25 water that appeared to originate and emanate from a spring
26 under two properties located at 1 and 5 Prospect Hill Road
27 between May 2014 and December 2020. He will explain that
28 the flow was intercepted and diverted down a stormwater
29 drain on Prospect Hill Road and into a culvert at the top
30 of View Point Road, and that the culvert was continuously
31 overflowing. He will describe an increasing saturation of
32 the hillside and in particular at the location of the
33 November 2022 landslides, and he will give evidence that
34 the continuous flow did not stop even during dry periods.

35
36 It appears that in mid-2023 new stormwater drains and
37 kerbs were installed on View Point Road. There is evidence
38 to suggest that those works had the effect of reducing the
39 volume of water seeping into the hillside. We are in the
40 process of requesting further information from the shire
41 about the mid-2023 works and about stormwater diversion in
42 the area more generally. It's unlikely that we will fully
43 explore those matters in this hearing block. However, they
44 remain an active line of enquiry.

45
46 The final avenue of enquiry in connection with water
47 is whether a burst water main may have triggered or

1 contributed to the McCrae landslide that occurred on
2 14 January. I'll refer to this as the burst water main
3 theory. Shortly stated, the thesis is that water leaking
4 from a water main located south of the Mornington Peninsula
5 Freeway could have travelled through the stormwater system
6 and trenches surrounding local water infrastructure all the
7 way to the escarpment.
8

9 Excess water was observed in McCrae both before and
10 after the landslide. In the months before the landslide
11 approximately from mid-November local residents observed
12 excess water on the streets uphill of Penny Lane, namely
13 Waller Place, Charlesworth Street, Coburn Avenue and
14 Prospect Hill Road. The water, we have been told, roared
15 in the stormwater drainage system. It emerged through the
16 roads. It pushed up and cracked the asphalt. It created
17 potholes. It flowed down the streets. It saturated nature
18 strips, and it leaked into the kerbs.
19

20 Shortly after the landslide of 5 January, water was
21 seen flowing out of the escarpment above the Morans'
22 property. The flow of water was constant. The water
23 continued to flow on the day of the 14 January landslide
24 and for weeks thereafter. The source of the excess water
25 in McCrae was not immediately obvious to local residents.
26 As I have mentioned, there had been no major rain events in
27 the months leading up to the landslide. Days after the
28 landslide South East Water, the local water authority,
29 advised residents that the water was not coming from its
30 network.
31

32 That created a mystery. Consequently, at the end of
33 January, Mr Kevin Hutchings and Mr John Bolch, both of whom
34 are the members of McCrae Evacuees Residents Group, which
35 has the acronym MERG, were tasked by that group to try and
36 locate the source of the water. MERG was a group formed in
37 late January by local residents affected by the McCrae
38 landslide for the purpose of sharing information and
39 providing mutual support.
40

41 The enquiries of Mr Hutchings and Mr Bolch, both of
42 whom will give evidence in the course of this hearing
43 block, led them to a water main pipe located south of
44 the Mornington Peninsula Freeway near the corner of Bayview
45 Road and Outlook Road. The area around that water main
46 revealed significant signs of saturation. Trees had fallen
47 over, vegetation had been stripped back and the sandy

1 on useful paths of enquiry.

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1 geology at WSP.

2

3 Q. And what is WSP?

4 A. We're an engineering - a global engineering consulting
5 firm, multi-disciplinary consulting firm.

6

7 Q. I see. And do they deal only with geotech
8 engineering?

9 A. No, not just geotech engineering, but other
10 disciplines of engineering as well.

11

12 Q. I see. And could you explain to the chair the types
13 of geotechnical work that you have undertaken in the course
14 of your career?

15 A. Yeah. So, Madam Chair, by - I'm an engineering
16 geologist, so I specialise in the interaction between the
17 built environment and the ground, and my role is to
18 understand how the ground might respond to what happens in
19 the built environment. So part of that is looking at what
20 we call geohazards where the ground might affect the built
21 environment, including landslides, and so my specialty for
22 the last 25 or so years has been in landslides and
23 specifically in landslide planning controls and
24 preventions. I've worked on most of the erosion management
25 overlays in Victoria over that time, but also in landslide
26 response, repair work, mitigation. For example, I worked
27 on the Bongong landslide that happened up at Falls Creek
28 just recently. So my specialty is in landslides. Not
29 exclusively what I do, but it's most of what I do.

30

31 Q. All right. You say your specialty is in landslides
32 but it's not all that you do. Sticking with landslides for
33 the current moment at least, are landslides a common
34 occurrence in Victoria?

35 A. There's - the interesting question is what we - how we
36 define "common". Over my career the frequency of
37 landslides in Victoria has changed and changed in response
38 to climate. So, for example, between 2020 and 2022, when
39 we had three consecutive La Nina events and it was much
40 wetter, frequency of landslide went up, and that rate is
41 the highest I've seen in my career. Historically, we've
42 had high rates of landslides in the 50s and high rates in
43 the late 80s and 90s. It tends to go with what the climate
44 is doing. Then we had a drought from 2000 to late 2010s
45 where we didn't have too many. Is it a common occurrence?
46 You know, common enough that it needs attention might be
47 the way to answer that.

1
2 Q. Now, could you just outline in general terms some of
3 the prior work that you've done in connection with
4 landslides, perhaps to begin with not dealing with the more
5 discrete topic of erosion management overlays, but
6 concerning either landslide mitigation of a non-planning
7 kind or landslide investigation?

8 A. Yeah, that's right. So an area I specialise in is
9 landslide risk assessment, and the process of landslide
10 risk assessment involves understanding a location,
11 understanding the landscape, understanding the processes
12 occurring in that landscape, and then relating those
13 processes to what the risk from landslide might be to
14 perhaps a particular development. So most of my work in
15 landslide would be some form of development is proposed, is
16 there a risk from landslide to this development and, if
17 there is, how serious is it and how might we mitigate it.
18 So that would be the bulk of what I do.
19

20 Now, that process involves a whole lot of stages. You
21 have to go out and gather information about the terrain and
22 you have to gather evidence. You have to undertake
23 investigations, which might include mapping of boreholes
24 or, you know, sometimes remote sensing or geophysics.
25 There's a whole raft of techniques. Then we have to pull
26 all that evidence together, interpret what's going on in
27 the landscape and interpret what the landslide processes
28 might be, what are the factors that make the area
29 susceptible to landslide, what are the factors that might
30 trigger a landslide, and then once we've got a model, we
31 call it - a model refers to an understanding of the
32 processes, understanding of the ground - then you've got a
33 basis upon which to design controls and design mitigations,
34 and that would be the next step, to then say, "We need to
35 design controls to prevent this undesirable event." Maybe
36 that's designing drainage, maybe that's designing retaining
37 walls. It's designing something to mitigate the risks that
38 were identified. And that would be the process we would go
39 through to, say, mitigate landslide risk in a particular
40 development or location.
41

42 Q. Thank you. Is it accurate to describe geotechnical
43 engineering as a subspecialty of civil engineering?

44 A. Yeah, that's reasonable, yes.
45

46 Q. And is there a further subspecialty then of
47 geotechnical engineers that work in the landslide area?

1 A. Yes.

2

3 Q. All right. And how does one come to do that type of
4 work? Is there a professional qualification that you need
5 to seek or is it a matter of experience?

6 A. It's a matter of experience at the moment. There's a
7 whole story behind it, but Professional Engineers Australia
8 and the Australian Geomechanics Society are in a process of
9 developing registration for specialisation in particular
10 fields of geotechnics, one of which might be landslide.
11 There's nothing in place at the moment. So currently it's
12 through experience, and then if you are a chartered -
13 registered Victorian engineer or chartered engineer, an
14 obligation that goes along with that, that you operate
15 within your area of expertise. So the protection we have
16 for people who are non-competent acting in the landslide
17 area is that we need to check they're chartered or
18 registered, and therefore they're bound to operate in their
19 area of expertise.

20

21 Q. You mentioned two professional bodies then. One is
22 the general professional body for all engineers?

23 A. Yes.

24

25 Q. And you also mentioned Geomechanics specifically, and
26 you may have heard in the course of my opening in the
27 section dealing with erosion management overlays there was
28 some reference to some guidelines that that body has put
29 forward. Could you just explain to the chair what that
30 body is, how one becomes a member of it and the type of
31 work that it does?

32 A. Yeah, so the Australian Geomechanics Society - and
33 I'll pre-empt that I'm formerly the chair of the Australian
34 Geomechanics Society - is a technical body that sits under
35 Engineers Australia, and the way Engineers Australia are
36 framed is their technical societies hold the body of
37 knowledge. So the Australian Geomechanics Society hasn't
38 got a role in sort of lobbying or trying to sway policy.
39 The Australian Geomechanics Society's role is they're the
40 technical body of knowledge. So we provide continuing
41 professional development and training in the technical
42 field of geotechnics. That's what we do. And our role is
43 limited to that. If it goes above that - say if the
44 Geomechanics Society wanted to convey an opinion, that
45 would sit with Engineers Australia who would do that, that
46 lobbying. So it's purely a technical society. So as part
47 of that we develop technical guidelines that are used in

1 industry. One of those is the Australian Geomechanics
2 Society guidelines for landslide risk management, which
3 I imagine we'll hear about through the inquiry. So that's
4 sort of what we do.

5

6 Q. Thank you. Can I ask you a further question in
7 connection with that, which may be very obvious to you but
8 I want to make sure that everybody that is in the room and
9 is watching this has some familiarity with the different
10 technical words. So you were speaking about the Australian
11 Geomechanics Society and you also mentioned geotechnics in
12 the course of your answer then.

13 A. Yes.

14

15 Q. Perhaps you could explain what geomechanics is as
16 opposed to other areas within civil engineering, and
17 whether there is any difference between geomechanics and
18 geotechnics?

19 A. No, essentially there is no difference.

20 "Geomechanics" is the name of the society. If I'm honest,
21 it could be updated. But it essentially means the
22 mechanics of the ground, hence a landslide being related to
23 that. That's, you know, the mechanics of the ground.

24

25 Q. Aside from landslide, has the Australian Geomechanics
26 Society produced technical guidelines for other areas?

27 A. Yes, landslide - it would be the main one historically
28 that it has been involved with. Not so much producing
29 standalone technical guidelines, but sitting on, say,
30 Standards Australia committees to develop standards. So
31 it's important to note that the guidelines for landslide
32 risk management are not an Australian Standard, they're a
33 standalone guideline. But the Australian Geomechanics
34 Society has members on Australian Standards committees for
35 things like, say, earthworks or foundation design. They do
36 that.

37

38 Q. I see. And does that mean that as things currently
39 stand there is no Australian Standard that is directly
40 related to landslide risk mitigation?

41 A. No, there's no Australian Standard, no.

42

43 Q. And is there any particular reason you're aware of as
44 to why that's the case?

45 A. It's a topic that's debated. It was put together as a
46 guideline originally, I think probably because with
47 landslide risk management it's difficult to be as

1 prescriptive as what a standard is. So, for example, a
2 standard for designing building foundations will be very
3 specific about the redundancy in the foundation and what
4 you have to do to test them and it's quite specific,
5 whereas in landslide risk management, where we're dealing
6 with different sites, all different characteristics, it's
7 difficult to be as specific.

8
9 Q. Yes.

10 A. But it's - a question that's open for debate is should
11 it be a standard, but currently it's a guideline.

12
13 Q. All right. We'll come back to the guidelines perhaps
14 a little bit latter. Can we start perhaps at a higher
15 level of abstraction on the question of landslides and
16 where and how they might occur. You have explained to me
17 that there are preparatory factors that are in effect the
18 conditions necessary for a landslide to occur. So is it
19 the case that a landslide will invariably occur wherever
20 there is a cliff at some point in time?

21 A. No, that's not necessarily the case. An example
22 I might use is if we looked at the terrain, say, to the
23 east of Melbourne up in the Dandenongs, no cliffs up there.
24 You won't find a slope up there steeper than about two
25 horizontal to one vertical. But if I go out to the west of
26 Melbourne I might well find, you know, some cliffs. If
27 I go down to the Great Ocean Road I'll find some cliffs.

28
29 Now, the reason we see that is because of the type of
30 rock or soil, and different rock or soil has different
31 strength attributes and can stand at different angles and
32 will be unstable at different angles. So it's related to
33 the geology.

34
35 Q. I see. Okay. So you mentioned two things there that
36 I want to explore. One was the angle of the slope, and you
37 mentioned two to one?

38 A. Yes.

39
40 Q. Now, do you want to explain the measurement of angles
41 of slopes and the relative effect that a slope angle has in
42 connection with the possibility at least of landslide?

43 A. Yes. So in a general sense the steeper the slope the
44 more susceptible it might be to sliding. But that
45 threshold at which it becomes unstable is different
46 depending on characteristics like the water in the soil and
47 the type of ground you're dealing with.

1
2 Q. All right. Let's talk then about the geological
3 conditions that are perhaps more prone to landslide than
4 others.

5 A. Yes.

6
7 Q. So particular types of soil and rock will be less
8 stable than other kinds; is that a fair description?

9 A. Yes, that's fair.

10
11 Q. All right. Can you just explain to the chair in
12 general terms perhaps by reference to some areas in
13 Victoria that you're aware of some of the different types
14 of geology that are found and how that geology relates to
15 landslide risk?

16 A. I'll try to summarise this. We could go into a lot of
17 detail here. So in Victoria or in Australia in general we
18 have a very old landscape. It's eroded down a long way.
19 Go back 15,000 years ago and we had an ice age. All around
20 the world the sea levels were dropping and the landscape is
21 getting incised and eroding down; you're cutting down the
22 channels. As those channels cut down, the sides of the
23 valleys sort of slide in.

24
25 So if I look at, say, up in Yarra Valley, the Yarra
26 River has cut down through the terrain. And as it's cut
27 down, slopes have slid in and slid in. Now, if we go up to
28 the Yarra Valley we find landslide deposits all over that
29 area. Now, they are landslides that happened under
30 different conditions than they did today, but there's
31 landslides all up over that valley. It's material that's
32 moved before. It's material that's been disturbed before.
33 And so it's prone to being disturbed or moved again with
34 further landslides.

35
36 If I go out to, say, the west of Melbourne where I've
37 got valleys that have cut down, they've cut down through
38 more rocky type material which hasn't been able to slump
39 in. So we see the cliffs stand. When we go down to the
40 bottom of the valleys we don't see the colluvium. So
41 there's this difference in how the different materials,
42 different grounds respond to those processes.

43
44 Now, if we go to the coastal area, which is more
45 relevant to here, the sea levels were higher about two
46 metres or so 6,000 years ago. And that's caused the back
47 of the coast to regress and cut back. Go around the

1 Victorian coast you'll see things called shore platforms.
2 If you've ever been down to Inverloch, for example, you'll
3 see these big flat rocks and shore platforms which are
4 remnant from when the sea level was higher and cutting back
5 the coast. The sea level has dropped. Now, as that coast
6 has been cutting back it gets eroded, it slides, it gets
7 eroded and it slides. The sea has retreated. Now, we have
8 these kind of relic landslides that are there. So that
9 soil is sitting close to the steepest angle it can, called
10 the angle of repose.

11
12 It's a bit like if you've got a pile of sand and
13 you've poured it out. It's going to sit in that angle of
14 repose. It has been cut back and it's slipped. And that's
15 fine; it can sit there. But it's now susceptible. If we
16 actually change the character or change the forces acting
17 on that, that's where we have the potential to trigger a
18 landslide. So we've got lots of areas where landslides
19 have happened before, and we have disturbed soil in
20 Victoria, and that's a function of the geological history.

21
22 But then we also have areas where slopes have been cut
23 back by anthropogenic means through earthworks and that
24 type of thing that have disturbed it and, again, that is a
25 factor that gives us preparatory factors for landslide. So
26 everything we see as landslide susceptibility is generally
27 a function of the geological history and what sea levels
28 were doing or what water was doing in the past and how
29 soils have eroded in the past and weathered and are now a
30 function of the anthropogenic history and what humans have
31 done to change the natural landscape.

32
33 A long-winded answer. But, to sort of put one more
34 thing on to that, because the Australian landscape is so
35 old and it's cut down and eroded and we've got the
36 landscape we've got, one of the key things for landslide
37 control is to leave it. The less we disturb the landscape,
38 the less chance we might trigger landslides. When we
39 interfere with the natural flow paths, we interfere with
40 the natural slope angles, that's where our susceptibility
41 can go up. A lot to go through there.

42
43 Q. No, that's very useful. Thank you. Can I perhaps
44 bring you on the topic of geology to this area?

45 A. Yes.

46
47 Q. Are you aware of, in general terms, what the

1 geological conditions including soil and rock types are in
2 this area?
3 A. Yes.
4
5 Q. All right. Could you explain those, please?
6 A. Yes. We've got the geology map. We can talk to the
7 geology map.
8
9 Q. If we could bring Mr Paul's slides up, please?
10 A. It's 8.
11
12 Q. Did you say 8?
13 A. Yes, number 8.
14
15 Q. Could we go to slide number 8, please?
16 A. The geology map. Next one.
17
18 Q. Is that the one you're after?
19 A. No.
20
21 Q. Can you see it on the screen in front of you?
22 A. That's the one.
23
24 Q. Is that on the screen in front of you as well?
25 A. No, the screen is blank.
26
27 Q. Okay. I apologise for that.
28 A. I'll look up here. So this is a geology map of the
29 McCrae area, and I'll just point out a few of the features
30 on it. When we describe geology we like to talk from the
31 oldest rock up to the youngest rock in the sequence in
32 which it was formed naturally. The red is granite, and
33 that's Arthurs Seat. You've been up to Arthurs Seat;
34 comprised of granite.
35
36 Then you can see the contours. They slope down
37 towards the top left, and we can see the sort of yellowy
38 material just adjacent to the granite. That is a
39 Pleistocene dune. If you've ever been down to, say, Barwon
40 Heads or Cape Schanck around the coastline of Victoria we
41 see these cemented dunes or cemented sands that are old and
42 sort of greater than 20,000 years, maybe 100,000 years old.
43 Old cemented dunes, that's what we have there.
44
45 And then there's this dashed sort of line, triangular
46 line, adjacent to that. And then on the other side of
47 that line we've got what's sort of the current beach and

1 dune sands. Now, that line through there, that's the
2 Selwyn Fault, which I've labelled there, and that's a major
3 fault that goes up the east side of Port Phillip Bay.
4

5 So in a general sense what we've got here is this
6 granite that's really old, like, it's 300 million years
7 old. Then we've got these Pleistocene dunes that might be
8 no more than sort of 100,000 years old. Then we have the
9 Selwyn Fault. Now, the material on the right has been
10 uplifted. Port Phillip Bay is what we call a sunk land.
11 It's land between faults on either side that has sort of
12 sunk down because those faults have moved with the relative
13 offset.
14

15 So everything on the right-hand side of that has been
16 pushed up through tectonic activity or through faulting,
17 and that's why we've got the Selwyn Fault. Sometimes you
18 get a big earthquake on the Selwyn Fault. But that's why
19 we have the slopes there. It's because of the offset of
20 the fault. So we've got granite. Clinging onto the edge
21 of the granite we have this cemented sand, and then we have
22 this slope which is a clear escarpment on the landscape,
23 and then we have the beach down here. I hope that's enough
24 detail. There's quite a lot we could go into about that.
25

26 Q. No, that's very useful, thank you. Is it fair to say
27 that as you travel from the coastline further inland up to
28 Arthurs Seat you're moving more into the territory of
29 granite rock as you get up --

30 A. That's correct. You're moving up into granite. That
31 is why Arthurs Seat is there, because it is granite, it is
32 harder. It has not only been uplifted; it's less resistant
33 to erosion, and so there it is.
34

35 Q. Just for the avoidance of doubt, the fact of the
36 Selwyn Fault - people may have heard of fault lines in
37 connection with geology and earthquakes, for example, but
38 the fact of the Selwyn Fault here that's of historical
39 interest because it has affected the geology but isn't of
40 direct relevance to a landslide in fact occurring; is that
41 correct?

42 A. Well, I'd say the Selwyn Fault there is the reason we
43 have a slope.
44

45 Q. Yes.

46 A. That's the reason we have a slope.
47

1 Q. Thank you. Now, are you familiar with the gradient of
2 the slopes in this terrain?
3 A. Yes, and we've got contour on there to illustrate.
4
5 Q. And, in general terms, you were describing I think did
6 you say in the Dandenongs rarely more than two to one?
7 A. Yes, two to one is about the maximum natural slope.
8
9 Q. I see. And what type of range are we talking about in
10 this area?
11 A. It's slightly steeper.
12
13 Q. I see.
14 A. So up on the granite it's a bit less. But you can see
15 where the contours get really dense down on that
16 escarpment. That is getting a little bit steeper than two
17 to one down there. You can see the very stark difference.
18 It sort of almost looks like a different shading, but
19 that's the close contours.
20
21 Q. All right. It might be worthwhile here - I'm taking
22 you slightly out of order, but if we could go to the second
23 slide. It might just be useful to get some of this
24 terminology down.
25 A. Yes.
26
27 Q. Sorry, the one after that; the third slide. It might
28 be useful if we try and get some of this terminology
29 understood, otherwise I'll start using the wrong terms.
30 This is a diagram of a landslide that has in fact occurred;
31 is that correct?
32 A. It's a generic diagram for the purposes of
33 communicating the nomenclature.
34
35 Q. But in this diagram there has been a landslide; it's
36 not a cliff?
37 A. Yes.
38
39 Q. All right. Can you just explain what are the sort of
40 central features of the diagram here insofar as they have
41 relevance to the landslide that occurred in McCrae?
42 A. Yes. So these are terms that will come up through the
43 inquiry. On the top left there we see zone of depletion
44 and zone of accumulation. So there is a zone where soil
45 has come from in the act of a landslide. It has then
46 travelled and it has been deposited somewhere. So it's
47 moved from the zone of depletion and it's moved to the zone

1 of accumulation. That's an important thing. When we talk
2 about landslides we want to define where's this stuff come
3 from, what's the area in which the landslide originated and
4 what are the factors that have caused that, and then
5 where's that debris travelled to.

6
7 You might hear terms like the foot or toe of the
8 landslide, referring to the base of it where the debris has
9 got to. And at the other end you might hear terms like
10 scarp or main scarp or head scarp, which is referring to
11 the top of it, where materials come from, and you usually
12 see a steep, quite sharp-breaking slope towards the top.
13 They're the key terms I think to get out. Perhaps on the
14 next slide there are probably two more terms that are
15 useful.

16
17 Q. I mentioned in the course of my opening - if we just
18 go one page further - that the landslide here was a
19 translational landslide.

20 A. Yes.

21
22 Q. Could you explain to begin with what that means and
23 how it contrasts with a rotational landslide?

24 A. Yes. Here's a slide just generically - we categorise
25 types of landslides. Now, with a categorisation like that
26 - this is sort of a discrete categorisation. You can get
27 in between things and it's a bit more of a continuum. But
28 we can characterise a rotational landslide. You can see
29 the surface under that landslide is sort of a deep circular
30 type shape. On the translational landslide that surface is
31 a more linear shape.

32
33 What factors might determine whether we get a
34 translational or rotational landslide lie in the type of
35 ground, lie in the geology. So a uniform clay material,
36 for example, where it's all kind of the same clay might be
37 more rotational. A sandy material might be more
38 translational, or a material or ground in which you've got
39 various layers might be more translational. So the type of
40 landslide relates to the ground.

41
42 Q. Thank you. Are there any other features of this
43 particular slide that you wanted to point out to the chair?

44 A. No, they're probably the relevant ones. In this
45 particular hearing, rockfall and things are not relevant.
46 Perhaps it might be worth mentioning debris flow, as that
47 might come up, or perhaps the bottom one in the middle,

1 earthflow, which refers to a situation where as a landslide
2 occurs that debris is fluid enough, it's got enough water
3 in it and it can sort of flow like a fluid. So an
4 earthflow or a debris flow is that type of landslide. You
5 may hear that come up.
6

7 Q. I don't want to get to water yet, but while we're
8 dealing with geology and rock type is it fair to say that
9 particular types of rock are more likely to have water pass
10 through them through cracks and fissures than other types
11 of rock?

12 A. Yes, absolutely, and you could add rock or soil. So
13 it's what we call the hydraulic conductivity of the ground
14 is what is the ease by which water can be transmitted
15 through that ground, and that's a function of the
16 permeability.
17

18 So, for example, if I had a gravel material, we use
19 gravel for drainage, and if I had a clean gravel with lots
20 of pore spacing between it water can flow through that very
21 easily. If I had clay, water cannot flow through that very
22 easily. So the type of soil and its permeability will
23 transmit water in different volumes and rates.
24

25 Q. I see. Sticking with rock rather than soil for
26 present purposes, we established earlier that as you move
27 up from the bay into the hills we're in granite territory.
28 What's the position with water passing through granite?

29 A. That's right. So a granite like Arthurs Seat has soil
30 and rock. So the top of it is weathered rock, and that
31 weathered rock is a soil. You may be familiar with
32 granitic sands. Sometimes we take granitic sands; it's
33 good for making bars and the like. So you'll have a more
34 impermeable soil over the top.
35

36 And then under that in the rock that rock will usually
37 be jointed, which means it's got defects and
38 discontinuities. Those defects and discontinuities, if
39 they are open, that can transmit water. We call that
40 fracture flow. So we can get water to flow through
41 fractured rock, and that can be more permeable than soil
42 and certainly more permeable than low-fractured rock.
43

44 Q. Thank you. So we're dealing here with what I think
45 you call preparatory factors; is that right?

46 A. That's right.
47

1 Q. Preparatory factors being those factors that need to
2 be present in order for a landslide to occur?

3 A. Yes.

4
5 Q. And so far we've dealt with geological factors. Is
6 there anything else that you want to say in connection with
7 geological preparatory factors before we move on?

8 A. More generally about preparatory factors, they are the
9 features in the landscape that make it susceptible to
10 landsliding, in the broad sense. We distinguish them from
11 the causal factors which is some event, usually, that has
12 happened to cause the landslide. But if you don't have a
13 slope that's susceptible to landslide that trigger wouldn't
14 drive the landslides. You need both.

15
16 Q. Yes.

17 A. So, the preparatory factors, it's the geology. We
18 have talked about the slope angle, but also things like
19 vegetation.

20
21 Q. Right.

22 A. In general, a slope with more vegetation on it can't
23 absorb water as readily. The water pressure cannot build
24 as readily in the slope because the trees are taking water
25 out through evapotranspiration and the vegetation is
26 helping water run off better. So more vegetation you would
27 reduce your susceptibility. But the degree of vegetation
28 I would describe also as a preparatory factor.

29
30 Q. All right. Let me just ask you a couple of questions
31 in connection with vegetation. So to an untrained mind in
32 these matters one might think that the significance of
33 vegetation is that root systems bind the soil and therefore
34 keep it more stable; is that correct?

35 A. That's partially correct to an extent. If you had a
36 soil that's fully grassed with small roots in it, that will
37 have some effect of holding it together. But for
38 particularly larger landslides the main benefit from
39 vegetation is they keep the ground dry. They help prevent
40 water pressure building up through evapotranspiration for
41 one and through allowing water to run off. Think about a
42 vegetated slope with lots of leaf litter and vegetation.
43 The water that gets on to that slope is more likely to run
44 off than soak in.

45
46 Q. Yes.

47 A. If it does soak in, the roots are pulling out the

1 water and helping keep it dry and helping keep a state of
2 partial saturation, which we might get into later as well.

3
4 Q. All right. That probably leads fairly naturally into
5 groundwater conditions. So you've mentioned water now in
6 connection with vegetation and also in connection with some
7 of the geological conditions, including the capacity of
8 different soils to hold water or for water to pass through
9 them. Is it fair then to say that the extent to which
10 soils are saturated is a significant factor in whether or
11 not a landslide is likely to occur?

12 A. Yes, particularly in Victoria.

13
14 Q. Why particularly Victoria?

15 A. So other areas I work on landslides, for example,
16 Papua New Guinea, New Zealand, we would find in those areas
17 one of the main triggers is earthquake because they're
18 sited in active areas. We don't have earthquake of the
19 same magnitude or extent in Victoria. So our landslide
20 triggers would usually be a change in what we call the pore
21 water pressure. A change in the water pressure in the
22 ground would be the main trigger of landslides in Victoria.

23
24 The other trigger might be anthropogenic means,
25 perhaps earthworks or changing the loading on a slope
26 through anthropogenic means. For natural landslides, it
27 would be a change in water pressure in the soil.

28
29 Q. All right. Let's deal with water pressure generally
30 and with water. You mentioned water pressure and I think
31 you said pore pressure.

32 A. M'hmm.

33
34 Q. Perhaps you could explain those concepts to the chair?

35 A. Yes.

36
37 Q. And the significance of them in this area of
38 discourse.

39 A. Okay. So a soil is comprised of three constituents.
40 It has solid particles. Then in between the solid
41 particles that's what we call the pores, and the pores
42 contain water or air in varying proportion. If the pore is
43 completely full of water, we call that saturated. If
44 there's completely no water in there, that would be dry.
45 Most natural soils have water and air.

46
47 When you have water and air you build surface tension

1 in those pores, and that helps pull the soil together. So,
2 if you build a sandcastle, you can't build a sandcastle out
3 of dry sand, you can't build it out of saturated sand. You
4 need to have partially saturated sands. So those pores
5 have water and air in them, and that has an effect of
6 binding the soil together. What we call effective
7 cohesion. It's helping to pull the soil together. So it
8 gives it strength. Now, when we lose that by saturating
9 the soil we lose that effective cohesion, we lose that
10 strength.

11
12 So one of the main mechanisms of landslides in
13 Victoria is we have partially saturated soils and then
14 those pores become saturated, we lose strength, we have a
15 landslide. So an example people might be familiar with:
16 road cuttings. Where I live up near the Dandenongs we have
17 got road cutting up there that have been cut 120 years ago.
18 They're standing very, very steep. But then we get a big
19 rain come through and you come out the next morning and
20 there's soil on the road and the cutting has slumped.
21 That's happened because it's standing there because it's
22 holding this negative pore pressure, we call it, or
23 suction. Then it's lost that suction because it's got wet
24 and it's come down. So think about it like pouring a
25 bucket of water on a sandcastle.

26
27 The finer the soil particles the more that effect in
28 general. So think about gravel with lots of big pore
29 spaces in between it. You pour water on it, it goes
30 straight in. That's not going to build up any suction
31 because the water can just come straight into it. But as
32 we get finer into sands we do build suctions; we can make
33 sandcastles. And get finer again into clays and we can
34 build even more suctions.

35
36 If you have a clay soil, to sort of lose that suction
37 and lose that pore pressure takes a long time because the
38 water can't get in to fill that air and displace that air
39 easily. It takes a long time. So that's why I say
40 cuttings up in the Dandenongs that have been there for
41 120 years, they're only sort of failing now. That's the
42 kind of timeframes it takes for water to infiltrate.

43
44 Q. You mentioned pore pressure and you mentioned suction.

45 A. M'hmm.

46
47 Q. Are suction and pressure relevantly the same thing

1 here or is there some subtle difference?
2 A. Yes, they are. So when I talk about suction I'm
3 talking about a negative pressure, actually negative pore
4 pressure. So when we sort of talk generally about change
5 of pore pressure we might have a soil with a negative pore
6 pressure and, through the introduction of water, that pore
7 pressure rises. Now, it doesn't have to necessarily become
8 positive before we lose strength but, if it were to become
9 positive, then we would lose all that suction strength.

10
11 Q. I see. And so you've already described that different
12 soil types will in effect have a capability of holding
13 different amounts of water depending on that soil type?

14 A. M'hmm.

15
16 Q. So, a granite soil, water will pass through whereas
17 other types of soil will be more likely to hold the water
18 within the soil; is that fair?

19 A. That's right. So that's going back to the
20 permeability and the transmissivity. So we're talking
21 about slightly different things. The ability of the soil
22 or rock to transmit the water through it for it to
23 basically flow through versus the capacity of that soil to
24 absorb the water and how that changes the pore pressures.

25

26 Q. I see.

27 A. Slightly different.

28

29 Q. Relevant to this question of permeability in respect
30 of soil and rock is natural springs?

31 A. M'hmm.

32

33 Q. Is this how natural springs in effect are developed,
34 through water passing through rock fissures?

35 A. That's right, yes. So, for a spring, in essence you
36 need a recharge area which is elevated. So you've got
37 somewhere that water is raining, and water is getting into
38 the ground at a higher elevation. It's infiltrating the
39 ground, and then it finds sort of permeable ground it's
40 able to flow through. Maybe that's fractured rock. It
41 will flow through that. But then, because the slope sort
42 of trends down, that water might infiltrate in. It might
43 then not be able to penetrate further vertically because
44 there's some more impermeable layer there or the rock
45 joints close up. It's going to take the path of least
46 resistant, which then might be to come out sideways and
47 emerge in the slope. That's generally how a spring --

1
2 Q. So a spring is not, for example, necessarily fed from
3 an Artesian basin; it can be fed from elsewhere?
4 A. Absolutely, yes. For example, the foot of Mount
5 Dandenong has springs all around it. All up the coast of
6 Mornington Peninsula there's quite a few springs that
7 I know of and I've been involved with, some that have
8 flowed years ago, some that flow now. They don't all flow
9 continuously.
10
11 Q. I see. So some of them will flow intermittently
12 depending on the extent to which what water is in the
13 recharge area?
14 A. Correct, essentially in response to rainfall is what
15 will cause it. But then there's other factors. Human
16 intervention has sort of changed where springs flow now.
17 But in principle, yes, we have rainfall perhaps further
18 inland which then the water will pass through the soil and
19 it will emerge where that - we call it an aquifer -
20 permeable sort of ground it's flowing through emerges.
21
22 Q. Is an aquifer a build-up of water?
23 A. An aquifer describes strata in the ground that more
24 easily transmits water.
25
26 Q. I see. And how does all of this relate to the concept
27 of a water table?
28 A. Okay. So let's say we start drilling down through the
29 ground we might have partially saturated material, maybe
30 there's potentially to see a bit of saturated material but
31 then we go back into partially saturated material, but
32 eventually it will get to a point where it is saturated and
33 it is saturated - if you continue going down and it remains
34 saturated. The water table is that point at which the
35 ground is now saturated, if that makes sense.
36
37 Q. Yes.
38 A. So the pores are full of water. You don't expect air
39 in those pores. That's the water table.
40
41 Q. It might be useful at this point if I direct you to
42 I think it's the fifth slide. It should be - sorry, yes,
43 that one; thank you.
44 A. No, that one or the --
45
46 Q. Let's start with that one and we'll go to the other
47 one, because you can see here - I should ask you where has

1 this come from?

2 A. This is from a paper by Arja. It is a technical paper
3 about - it's actually about landslides in granite published
4 by a professor from the University of Singapore, I think he
5 is from. A technical publication.

6

7 Q. I see. So this isn't a diagram that is descriptive of
8 the area in McCrae?

9 A. No.

10

11 Q. This is either descriptive of somewhere else or it is
12 generic?

13 A. It's generic.

14

15 Q. I see. Thank you. Just before we finish, there's a
16 line there for the groundwater table, and there's a
17 saturated zone and an unsaturated zone and that's what you
18 were just talking about?

19 A. Exactly. So below the groundwater table that's
20 saturated. The pore spaces are full of water. Above that
21 the pores are part water, part air.

22

23 Q. All right. Can you just explain to the chair the
24 other features of this diagram insofar as they're relevant?

25 A. So this is talking about how a landslide might develop
26 in an unsaturated soil. It's saying essentially for that
27 to happen you need water to infiltrate and displace the air
28 that's in those pores, it's saying water can infiltrate
29 down maybe the tension cracks in the top and the rain can
30 bring this down; the loss of vegetation, because vegetation
31 we talked about before brings the water out through
32 evapotranspiration; loss of vegetation might mean more
33 water gets in than is pulled out by the vegetation; or we
34 might have what's called a wetting front where it saturates
35 up on the surface and, the more rain that gets on it, it
36 saturates and it can't flow off quick enough and the water
37 keeps infiltrating in.

38

39 The Bogong landslide I worked on recently this was the
40 mechanism. We had three years of rain, three years of La
41 Nina, and over that type the water just kept - it sort of
42 infiltrated that wetting front, just kept advancing and
43 kept advancing into the soil. We're losing saturation
44 until we get to a tipping point where the strength is
45 reduced sufficiently to cause a landslide.

46

47 Q. I see. And before we break I might just take you to

1 the next slide as well which relates also to this. This is
2 another diagram. This one I think I'm correct to say comes
3 from a report of Mr Pope, the geotechnical engineer engaged
4 by the council; is that correct?

5 A. That's correct.

6
7 Q. And so this is descriptive of what?

8 A. So this is what's called a model. I heard mentioned
9 before in the opening statement about we're putting a model
10 together. When we investigate a landslide that's the goal:
11 get a model together that communicates what's happening,
12 what are the mechanisms and the processes in the ground.
13 So, what has been communicated here, the purple down the
14 bottom is granite, I believe. The pink above it is this
15 weathered granite I talked about. So this is a more
16 impermeable material in the pink. The dash line down the
17 bottom is the water table, so below which it's saturated.

18
19 What this is saying is if water comes down through
20 that top brownish coloured material, which might be sand, for
21 example, it's able to seep into that fairly readily because
22 it's a sand and it's got open pores and water can get in.
23 But then it can't keep sinking down too far because it hits
24 this barrier, this more impermeable material. So it's
25 going to take the path of least resistance and it's going
26 to migrate sideways. So it has infiltrated in there.

27
28 The source of water could be rainfall, could be a
29 pipe, could be whatever; the ground doesn't care where the
30 water comes from. The water seeps in and then it flows
31 along that, and you can see where it says "seepage" it's
32 coming out of the face. That's a spring. The term we use
33 is "perched water" because it's water that has seeped into
34 this impermeable barrier and then it perches there. It
35 can't go further and it flows out. So that is what that is
36 illustrating, potential flow paths in ground with soils and
37 rocks of different conductivity. Does that make sense?

38
39 MR COSTELLO: Thank you. Madam Chair, would that be a
40 convenient time?

41
42 CHAIRPERSON: Yes, it would. We'll adjourn now for lunch
43 and resume at 2.15.

44
45 **LUNCHEON ADJOURNMENT**

46
47 **UPON RESUMING AT 2.15 PM:**

1
2 CHAIRPERSON: Thanks, Mr Costello.
3

4 MR COSTELLO: Thank you, Madam Chair. Continuing with
5 Mr Paul, and perhaps if we could have Mr Paul's slides back
6 up on the screen whenever convenient, and if we go to the
7 second slide. Is there one before that? No, sorry, could
8 we go to slide number 2; pardon me, that's my fault. Yes,
9 that one. Thank you. Mr Paul, we've been talking through
10 preparatory factors that are relevant to making conditions
11 susceptible to a landslide, and so far we've dealt with
12 geology, slope angle. Immediately before the break we were
13 dealing with the question of water in the soil. Are you
14 comfortable that you've said for now what you would like to
15 say in respect of those three matters?

16 A. Yeah, I think we just summarise it, that the factors
17 that make a slope susceptible to landslide are in the main
18 the type of rock or soil, the angle of the rock or soil is
19 on, to some extent the amount of vegetation on the soil,
20 and the water in the soil.
21

22 Q. Yes, thank you. The fourth point on this first slide
23 is the previous history of landslides. How does that
24 relate to the question of preparatory factors?

25 A. Okay. So some types of landslides what we call
26 reactivate. So the landslide might move a little bit and
27 then it might stop and then it might move a little bit and
28 it might stop, and so it reactivates. So if you can
29 identify there's a landslide in that landscape we know
30 that's a susceptible area. A landslide's happened there
31 before, it may move. Now, there are some types of
32 landslides where, you know, we've had a zone of depletion
33 and the soil might move away from the zone of depletion and
34 go somewhere else, and the site had gone and the event's
35 happened and it can't repeat. But one thing we look at is
36 has there been a landslide before, what can that tell us
37 about the potential for a landslide there again.
38

39 Q. I see. Thank you. You're generally aware, are you,
40 of some of the histories of landslides in this particular
41 area?

42 A. Yes, yes.
43

44 Q. And to what extent are you aware of those matters?

45 A. So I've done works all up that side of Port Phillip
46 Bay, and, you know, not just the McCrae area, but there's
47 landslides in different parts of the escarpment. Say,

1 we're looking at this escarpment in McCrae. There's a
2 similar escarpment, say, in Mornington, further up, there's
3 a similar escarpment in Frankston. And so there are known
4 landslides all the way along. When I say "known", we've
5 got records going back to the 1860s of landslides sort of
6 on an escarpment in Frankston. It's a fairly simple matter
7 to do a search of historical newspapers and records and
8 archives to learn what landslide had happened in the past.
9 In the McCrae area we've got good records of landslides in
10 the 1950s, and then the more recent in the last few years.

11
12 Q. I see.

13 A. So we know landslides happen in this area.
14

15 Q. All right. Well, then that might deal for now at
16 least with the preparatory factors. Can I move then to a
17 different topic, which is controls, by which I really mean
18 what are the mechanisms available to mitigate the risk of
19 landslide occurring. You may have heard in part of my
20 opening I had something to say about erosion management
21 overlays. No doubt they're one control. Would you
22 describe them as the principal control in Victoria?

23 A. Yeah. So the erosion management overlay's about
24 prevention, in a sense. So it's about identifying where do
25 we have the susceptible areas, where do we have these
26 preparatory factors, let's delineate those areas with those
27 factors and then put controls in place to ensure, as the
28 scheme says, appropriate development in those areas from
29 which the risk of landslide is manageable.
30

31 Q. Yes. At the commencement of your evidence I asked you
32 to explain to the chair some of the work that you had done
33 in connection with geotechnical engineering generally and
34 your specific work in connection with landslides but I said
35 "not dealing with EMOs at the moment". Let's come to EMOs
36 now. In the course of your daily work do you regularly
37 give advice in connection with EMOs?

38 A. Yes. Like, almost every day.
39

40 Q. All right. Could you explain the type of work that
41 you're engaged to provide in that process?

42 A. Yeah. So initially in development of the EMO. So
43 undertaking the work to identify the susceptible areas and
44 to recommend where the planning control should be.
45 I advise on what the planning - when you presented the
46 schedules for Mornington before, I advise on what to put in
47 those schedules. I didn't do that for Mornington, but I've

1 done that for six or so - seven or so other local
2 governments around Victoria, and once that's implemented
3 I have a role on behalf of councils to peer review planning
4 applications that are made under the erosion management
5 overlay, because councils generally don't have geotechnical
6 people on staff with the skills. So if, for example, a
7 landslide risk assessment is done in connection with a
8 planning application, they'll send that through to me to
9 undertake review on behalf of council of that application.

10
11 Q. I see. So based on the work that you've done before
12 you feel comfortable giving evidence in connection with
13 the EMO process generally?

14 A. Yes, yes. Yeah, sure.

15
16 Q. All right. Thank you. Can I perhaps zoom out a
17 little bit before we come back to EMOs and delve into the
18 specifics of them. I would describe EMOs as a form of
19 planning control; is that a description you'd be
20 comfortable with?

21 A. That's right, yes.

22
23 Q. And they're a creature that exists by virtue of
24 Victorian legislation. Are you aware at least in general
25 terms if there are equivalents in other states?

26 A. Yes, very much so. There are equivalents in
27 Queensland, in New South Wales. They reside at local
28 government level in Queensland and New South Wales, and of
29 course not every local government area has landslide issues
30 or a control. Tasmania has landslide controls at state
31 levels. The Tasmanian planning scheme is at state level.
32 South Australia has less formal controls, and
33 Western Australia doesn't have too much at all, at least
34 that I'm aware of, which reflects the landslide risk
35 I think in those states.

36
37 Q. I see. At least then along the eastern seaboard there
38 is something that's broadly equivalent to an EMO in New
39 South Wales and Queensland; is that right?

40 A. Yes. Not called EMO. Only Victoria calls it EMO.
41 It's called landslide planning controls in other areas.

42
43 Q. I see. But they are each controls at the planning
44 level?

45 A. Correct, yeah.

46
47 Q. Okay. Thank you. So could we perhaps get a little

1 more specific into EMOs. You have one slide in your pack
2 here, I think it's slide number 9, that's relevant to EMOs.
3 A. Yes.

4
5 Q. In fact, if we go one slide earlier than that even.
6 All right. So here you've outlined some content concerning
7 EMOs. Could you just give your own description of the
8 purpose an EMO is intended to serve?

9 A. Yes. So this is under the Victorian planning
10 provisions, which of course link into the local government
11 planning schemes. So the purpose of the EMO is to - it's
12 probably twofold. It's to protect the land from erosion,
13 and in Victoria we put landslide under the umbrella of
14 erosion, which it is. It's soil moving from one place to
15 another. So it's to protect the land from erosion, but
16 it's also to protect development from erosion and/or
17 landslides.

18
19 Q. I see.

20 A. So it's important to note that, whilst it's called an
21 erosion management overlay, landslide sits under it, and
22 we've been campaigning for a while to get the name changed
23 because it's not clear that erosion encompasses landslide,
24 but it does.

25
26 Q. I see. Do you have a general recollection of when the
27 EMO process came into the planning scheme in Victoria?

28 A. Yes. So initially - I started my career in the late
29 90s, and it was my boss working for the Shire of Lilydale
30 at the time in the 80s, and in the Shire of Lilydale in the
31 80s and up the Yarra and some of those shires around there
32 they'd had landslide issues, they had houses destroyed. So
33 it was the early 90s when the Shire of Lilydale introduced,
34 as far as I'm aware, the first planning control in Victoria
35 for landslide. The first erosion management overlay was
36 the early 2000s, which was the Shire of Yarra Ranges after
37 they merged with - they did an amalgamation in the late
38 90s, and then the Shire of Yarra Ranges put an erosion
39 management overlay control which built on the Lilydale one,
40 and that's the first I sort of know of it being an erosion
41 management overlay in the context it is now. But there'd
42 been really a preceding plan and control.

43
44 Q. Thank you. Are you generally aware of when EMOs came
45 to be used in this local government area, that is
46 Mornington?

47 A. Yes, only in the context of I attended the job to

1 perform it and lost. It was around 2008, 2009 when that
2 occurred.

3
4 Q. Okay. So could you explain to the chair the process
5 for developing an EMO and putting it in place, and the
6 extent to which geotechnical advisers like yourself are
7 involved in that process?

8 A. Yes. Okay. So the key thing is developing the
9 mapping. So we need to identify areas susceptible to
10 landslide. So we need a criteria. There's got to be a
11 criteria for this land is in or out of the overlay. So
12 work has to be done to develop the criteria. The best
13 evidence we have to put a criteria together is what's
14 happened before, and it's a sort of basic principle of
15 geology to look to processes that have occurred in the past
16 and how could those processes occur in the future.

17
18 So step 1 of developing the erosion management overlay
19 is what we call a landslide inventory, and it's just
20 essentially a database of all of the landslides we can find
21 and that we can learn happened historically in that area.
22 Now, we identify it from historical records. Things like
23 council maintenance records are useful, things like
24 newspaper articles are useful. But perhaps the main source
25 now is using sort of digital terrain models, so - are you
26 familiar with LiDAR models, where we can get quite detailed
27 images of the landscape, and from those detailed images of
28 the landscape identify landslides there.

29
30 Going back before LiDAR, which has probably been the
31 last 15 years it's been in common use, you'd try and do the
32 same thing from hard copy air photos, and it wasn't as
33 precise. So now we can get a really good inventory of
34 where are all the landslides. Once you've got all the
35 landslides identified and recorded attributes about them -
36 so what geology have they happened in, what slope angle
37 have they happened in, what are the terrain attributes
38 around it - you then run a process of identifying what are
39 the characteristics in common. So we might learn that we
40 only see landslides in this volcanics geological unit on
41 slope angles steeper than 20 degrees, and that might become
42 a criteria. So then we say if we have slopes, whether a
43 landslide has happened or not, steeper than 20 degrees in
44 this volcanics unit we'll put a plan overlay on, and the
45 evidence is what's happened before. So that's essentially
46 the process of getting the mapping together, and that's
47 called a susceptibility map.

1
2 Now, the AGS guidelines we mentioned earlier set out
3 guidance on how to do it. So it's not - we have an
4 industry standard. It's not a standard - it's an industry
5 guideline with best practice on how to produce the
6 susceptibility map which becomes the overlay. So there's
7 that step 1, put the mapping together, and that's a very
8 important step
9

10 Then it's put the planning provisions against that by
11 developing the schedules to the erosion management overlay,
12 and then we start having to look at, okay, in this
13 particular terrain what type of things might cause a
14 landslide. Maybe inappropriate earthworks might cause a
15 landslide in that area, and maybe we've got historical
16 evidence of that happening, so we need planning controls
17 around earthworks. We're going to limit the extent of
18 earthworks. We're going to require geotechnical advice if
19 we propose earthworks in this landslide-susceptible area.
20 Drainage or water-holding structures, things like dams, we
21 know that a dam can cause water to get into the soil. We
22 will specify in the scheme we want planning controls around
23 dams or pipes or tanks or things that could cause water to
24 get into the soil. Vegetation removal can be a factor that
25 makes a slope more unstable. The schedule will have
26 information about or require planning permits for
27 vegetation removal.
28

29 So that's the thing. So, if you can think of it, the
30 mapping is here is where all the preparatory factors are,
31 and then the schedule is about when we develop in those
32 areas how do we limit the potential for one - for a
33 causative factor.
34

35 Q. Yes.

36 A. And that's a broad way of thinking how the EMO works.
37

38 Q. Thank you.

39 A. Make sense?
40

41 Q. Yes. I've got questions for you in connection with
42 both the mapping and the schedule. Obviously from what
43 you've just said, mapping's absolutely core to having an
44 effective EMO. You've got some examples in your slides.
45 Perhaps if we could go to slide number 12, I think it is.
46 It might be 11, actually. Yes, 11, thanks, the one before
47 that.

1 A. Yeah, 12 - the one - yes.
2
3 Q. So this is an example of a map in connection with the
4 EMO, is it?
5 A. Yes, this is actually the Shire of Lilydale mapping
6 which became the Yarra Ranges EMO. So, yeah, it's from the
7 Yarra Ranges EMO from early 2000s, this map.
8
9 Q. All right. And what does this map tell us in general
10 terms?
11 A. Okay. So it's indicating susceptibility, landslide
12 susceptibility. We can see it's got these areas marked M2,
13 that is medium susceptibility, and there might be areas
14 marked H, which will be high susceptibility. But it is
15 zoning the ground based on its susceptibility to landslide.
16
17 Q. Yes.
18 A. Now, that - - -
19
20 Q. I see, on the left-hand side of the map there there's
21 a shape and it has an "M1" in it, and within the shape
22 there's a smaller shape that's got an "M2" in it. Is that
23 what you're talking about?
24 A. That is right. So what that indicates is that polygon
25 has been given a label M1 susceptibility. That correlates
26 in this case to medium susceptibility. The numbers relate
27 to different geology types. What this is really showing us
28 is these are the areas susceptible to landslide.
29
30 Q. I see. And how was a map like this put together?
31 A. So back then the metropolitan board of works
32 topographic maps - which were these big hard copy sheets
33 that were produced in the 1960s and were put together using
34 aerial photography, photogrammetry techniques with aerial
35 photography. Now, if the criteria here was a geology and a
36 slope angle to say this is susceptible to landslide,
37 someone would sit down with a scale rule on those contours
38 to work out the angle, and then a state-published geology
39 map to know the geology, and then the combination is the
40 susceptible or not. So that's how it was done back then.
41
42 Q. I see. Is it still done in that way now?
43 A. No, we don't do it that way anymore.
44
45 Q. All right. What's the usual method for mapping now?
46 A. Yeah, so now we have LiDAR information.
47

1 Q. Is that the next slide?
2 A. That's the next slide. So just to show you the
3 contrast of how much better of the appreciation we get of
4 the terrain - - -
5
6 Q. If we could just go one slide forward, please.
7 A. So this is showing - this is from Silvan, actually.
8 So you can see on the left there - you know, even to a
9 non-trained eye you can clearly see a different signature
10 or texture in the terrain within the red polygon compared
11 to outside of it. So that's a landslide inside. The
12 reason for the hummocky, bumpy terrain there is because
13 it's been affected by a landslide. Outside of it, where
14 the slopes are smoother, that's not been affected. So we
15 can be quite precise using this as to areas that have been
16 affected by landslide. They're far more precise than what
17 you could have with those old maps.
18
19 Q. Right.
20 A. When LiDAR came along, you know, it was sort of
21 towards 2010, absolute game changer for our industry.
22
23 Q. So as a matter of practicality how does this work?
24 One orders the LiDAR maps for the particular region?
25 A. Yeah. They're sourced from a different area, but the
26 Victorian State Government has very extensive LiDAR
27 libraries now. LiDAR is undertaken for many purposes other
28 than landslide identification.
29
30 Q. Yes.
31 A. So there's quite a lot of good LiDAR data available.
32 Most of Victoria is covered.
33
34 Q. Then who is the person or what is the profession of
35 the person that would then interrogate the photos and
36 insert the polygons like this?
37 A. Yeah, that would be an engineering geologist or
38 perhaps an engineering geomorphologist.
39
40 Q. I see.
41 A. Because they're a science - somebody with the earth
42 science background and earth science skills.
43
44 Q. So do you do this particular work?
45 A. Yes, I do that. Myself and my team do that particular
46 work.
47

1 Q. All right. By your training, you can pick the terrain
2 that's landslide - previously landslide affected?
3 A. Yes.

4
5 Q. And is that what you're looking for? Is it limited to
6 terrain that has been landslide affected, or are you
7 looking also at terrain that may not yet have suffered a
8 landslide but could suffer one?

9 A. So the multi-step process. So first of all we're just
10 saying where have landslides occurred, and doing an
11 activity like this, and then we go to that process of based
12 on where they've occurred where else do we have similar
13 terrain attributes, where could they happen in the future,
14 that's when we develop the susceptibility map.

15
16 Q. I see. And in terms of going through this process
17 with a client, local government area, for example, how does
18 it ordinarily work? Do you identify those areas, produce
19 the polygons, and then is there a discussion with the local
20 government area? Do they typically have expertise within
21 their own staff that would want to discuss this work with
22 you?

23 A. Yeah, they do, but we're usually relied upon to
24 identify this is where the landslides are. They wouldn't -
25 generally the councils don't have people to, you know, say
26 "you haven't done that right" or to scrutinise that. It
27 sometimes gets peer reviewed, so the council may engage
28 their own consultant to review our work.

29
30 Q. I see.

31 A. But most of the discussions with the council might be
32 around things like, "This particular land is administered
33 by Parks Victoria. It doesn't belong in our planning."
34 Essentially, "Take it out." Because when we do this work
35 land status boundaries are irrelevant. We map it all up,
36 and then it might need to be refined to, say, take some
37 areas out, and we'd get advice from council for that.

38
39 Q. I see. So in the way that the process evolves, though
40 there is some discussion, ultimately the areas that are the
41 subject of an EMO are areas that have been identified by a
42 trained professional as being at-risk areas?

43 A. Yeah, or the word we use is susceptible.

44
45 Q. Susceptible areas?

46 A. It's getting the terminology - risk is a different
47 concept to susceptibility. So susceptible to landslide.

1
2 Q. Does this type of LiDAR map tell you anything about
3 the degree of susceptibility?
4 A. Yeah, it can.
5
6 Q. To a trained eye, looking at one as opposed to the
7 other can you say one is more likely to have a landslide
8 than - one area than another area?
9 A. We can. That's what this is actually showing. So you
10 can see there's landslides mapped on the left and the
11 right. You can see on the left much more pronounced.
12 That's telling me that that landslide's probably moved more
13 recently, you know that it's moved, the ground's been
14 deformed and there hasn't been time for that deformation to
15 sort of smooth out with further erosion, whereas the one on
16 the right has. So I would say the left is more active.
17 I'd expect reactivation of the landslide on the left would
18 be more likely than on the right.
19
20 Q. I see.
21 A. But that doesn't mean it can't, the one on the right.
22 It doesn't mean it's not susceptible. It's just less
23 susceptible.
24
25 Q. Yes, I see. I'll ask you another question about the
26 mapping before we get back to the schedules. I think on
27 the next slide you have a map dealing with slope angle?
28 A. Yeah.
29
30 Q. Yes, here. Perhaps if you could just explain to the
31 chair what we're all looking at on this slide?
32 A. Yeah. So what I'm just showing is how we can
33 manipulate the LiDAR data. So on the left is what's called
34 a hillshade, which is - it simulates the sun shining from a
35 particular direction and sort of simulates shadows and it
36 gives you an appreciation of the morphology of the terrain.
37 The one on the right, the pixels are coloured based on the
38 slope angle. So you can see the red is a steeper slope,
39 the blue is flatter. So that second part of the process
40 once we've worked out the criteria for inclusion in the
41 EMO, on the right there we can quite accurately say if the
42 criteria is that it's a slope steeper than 20 degrees we
43 can quite accurately know where that is, and so we would do
44 something like that on the right and then that would feed
45 into what our EMO mapping becomes.
46
47 Q. And this is relevant in part because, as you explained

1 when we were dealing with the preparatory factors, slope
2 angle is one of the tells, if you like, about the degree of
3 landslide susceptibility?
4 Yes.

5
6 Q. Is that a fair way of putting it?

7 A. Yeah, absolutely, yes.

8
9 Q. Okay. This mapping, this is all done for a number of
10 purposes but ultimately in aid of preparing what I think
11 you described as a landslide inventory; is that right?

12 A. Yeah, that's right. So the initial mapping, where are
13 landslides, where have they occurred in the past, that's
14 the landslide inventory.

15
16 Q. Yes.

17 A. Then the next phase, the susceptibility mapping, is
18 given the landslide inventory, given where landslides have
19 happened in the past, where can they happen in the future.

20
21 Q. I see.

22 A. And that's the susceptibility map. It's both mapping,
23 I guess.

24
25 Q. So the first stage of the mapping is the trained eye
26 identifying those areas where there has in fact been a
27 landslide?

28 A. Yes.

29
30 Q. But then there is a second layer of judgment brought
31 to the next stage, which is in the light of the now known
32 information as to landslide history what are the degrees of
33 susceptibility of areas within the mapped region?

34 A. That's right, yeah, yeah.

35
36 Q. I see. If we could just move to the next slide,
37 please. I think this is the final map that you've included
38 in your slides.

39 A. Yes, yes.

40
41 Q. So this is speaking about an area - I think an update
42 to an area that exists within a landslide inventory; is
43 that correct?

44 A. Yes, that's right. This is just to illustrate the
45 benefits we get from the LiDAR information. So on the
46 left - that's the red polygon there on the left - is a
47 landslide that was mapped prior to the LiDAR information,

1 and you can see on the right, you can pick the change in
2 texture there, with the LiDAR information it can be far
3 more precise. You know, we can identify quite clearly that
4 isn't one landslide, it's two sort of separate ones that
5 are a bit separated. So that just is to illustrate what we
6 can go from then to - - -

7

8 Q. I see.

9 A. - - - with the better digital terrain information.

10

11 Q. So, to make sure that I properly understand this at
12 least, on the left on this example there would have been a
13 single landslide placed in the landslide inventory?

14

A. Yes, yes.

15

16 Q. And it was a landslide that occurred somewhere within
17 the polygon on the left?

18

A. Yes. Yes, in fact that sort of whole polygon.

19

20 Q. The whole polygon?

21

A. That whole polygon's a landslide --

22

23 Q. Is a single landslide?

24

A. Yes, that's right.

25

26 Q. Thank you. And then, although that polygon's been
27 placed over what I presume is a LiDAR map --

28

A. No, that would have been - no, that was placed on - so
29 the earlier map we looked at, the contour plan --

30

31 Q. Yes.

32

A. -- that was produced on the basis of that.

33

34 Q. No, sorry, I understand that.

35

A. Yes.

36

37 Q. It was produced on the basis of that, but for the
38 purpose here it's been placed over a LiDAR map?

39

A. Yes.

40

41 Q. So that is in fact a LiDAR map there?

42

A. That is correct.

43

44 Q. In fact it's the same.

45

A. Yes.

46

47 Q. Then LiDAR comes along?

1 A. Yes.
2
3 Q. Somebody takes another look at it and instead of a
4 single landslide they identify, what, four?
5 A. Yes, that's right. There's two there and another one
6 off to the side, correct, yes.
7
8 Q. And those areas identified as landslides on the
9 right-hand side they're not lines that are descriptive of
10 where an EMO might be placed. This is the earlier step of
11 just identifying where landslides have occurred to create a
12 landslide inventory?
13 A. That's right, yes.
14
15 Q. Thank you. Did you say that LiDAR came in 10 or
16 15 years ago?
17 A. I first started using it about 2007.
18
19 Q. I see.
20 A. But that was for an oil company with some good
21 funding. I didn't start using it in Victoria - it would
22 have been sort of early sort of 2010s time, yes.
23
24 Q. I see. And has the quality of LiDAR maps even in that
25 period improved?
26 A. Yes. Yes, a lot. So some of the earlier Victorian
27 stuff which was done as part of sort of climate change
28 studies around the coast and sea level rising impacts was
29 around 2007, and it's got a very coarse resolution or
30 pixelated a lot. But with latter technologies the
31 pixelation is much, much finer. Much better detail, much
32 better imagery.
33
34 Q. So that's the mapping process of the EMO.
35 A. M'hmm.
36
37 Q. You then mention schedules?
38 A. M'hmm.
39
40 Q. So is the general process develop an inventory,
41 identify susceptibility?
42 A. Yes.
43
44 Q. And then move into preparing schedules?
45 A. Correct.
46
47 Q. Now, is a professional like yourself involved in the

1 schedule aspect of EMOs, or does that then go off into a
2 different area of local government and doesn't involve
3 somebody with your expertise?

4 A. Very much I'd usually prepare the first draft of
5 the schedule, but I'm preparing it from the point of view
6 of what type of development should be exempt because, you
7 know, it's unlikely to be at significant risk from
8 landslide. So I help out with the list of exemptions, what
9 type of development should not be exempt because that's
10 going to - you know, perhaps a clear risk or cause
11 landslides. So that's our domain to look at that. But
12 then it also is going to go into the planning scheme, so
13 I need to work with planners, who can put it in the right
14 format and include all the right words that it can be in
15 the planning scheme. So I'd usually start a first draft
16 and then work with the planners at the council to refine
17 it.

18
19 There's then - any new amendment to the planning
20 scheme, it goes through various checks and third party
21 checks and checks at state government level, and there's
22 opportunity for the public to comment. There's planning
23 panel hearings. There's quite a few steps that it goes
24 through before us having the draft schedule and the final
25 that's implemented.

26
27 Q. Yes, okay. I might just call up a schedule. If we
28 could please go to INQ.0003.0001.0001. This is a document
29 that I went to in the course of my opening. This is the
30 Mornington Peninsula planning scheme. Now, you haven't
31 done particular work in connection with this scheme; is
32 that right?

33 A. I've peer reviewed some reports prepared in support of
34 a planning application of a third party reviewer, but I've
35 had no involvement in the development of the scheme.

36
37 Q. I see. I might just show you a schedule so we can all
38 be clear quite what it is that we're talking about.
39 Perhaps if we could go to page 765. Could we go one page
40 earlier, sorry. My maths must be out. All right. Thank
41 you. Is your screen working now?

42 A. Yes, I can see that. It's a little blurry, but I can
43 see it.

44
45 Q. I might just get it made a little larger, thank you.
46 All right. Hopefully that's a little clearer. Is this an
47 example of the type of schedules that you're speaking of?

1 A. It is an example of. Mornington Peninsula's schedules
2 are a little bit different to a lot of the other ones in
3 Victoria.
4

5 Q. All right. Why don't you start by describing what you
6 might call a more ordinary schedule, and then we can move
7 from there into the differences between those and a
8 Mornington Peninsula schedule?

9 A. Yes. So Mornington Peninsula is the only one that has
10 different controls in different areas. So you mentioned at
11 the start EM01, 2, 3, 4, 5, 6, and each one of those is
12 quite different in what it requires. Yarra Ranges puts
13 more back onto the geotech engineer who assesses that
14 development, right? They are the ones who decide the level
15 of severity. We mentioned the reason for EM01 to 5 is
16 there's different levels of susceptibility and it describes
17 what should be done. What other ones in the state do is
18 allow the geotech practitioner to decide that on a
19 case-by-case basis. So it doesn't say, "You must do this
20 number of boreholes or this particular work." It says,
21 "You as a geotechnical practitioner need to use your
22 expertise and competence to assess the risk of this
23 particular development.' So the EM0 is a bimodal thing.
24 You're in or you're out. There's no 1 to 5, right? So it
25 puts - more of these application requirements of what you
26 must do is more to the discretion of the practitioner doing
27 the work.
28

29 Q. I see.

30 A. So there's been about four recent amendments across
31 Victoria. What there's been a move towards is taking the
32 requirements for what the geotech practitioner has to do,
33 how they have to investigate, pull that out of the planning
34 scheme and it's been put into what's called an incorporated
35 document. The reason for that is there was concerns that
36 there was too much language in here in the schedules that
37 was technical and wouldn't be understood by the public. So
38 everything that was in here that was really for the geotech
39 engineer who was going to go out and assess the site got
40 pulled out into a separate related document. So that's
41 been how Yarra Ranges, East Gippsland, Towong, Yarra Ranges
42 have all done - done it that way now.
43

44 Q. I see. So at the heart of the process connected with
45 schedules in those types of areas there is a degree of
46 discretion vested in a geotechnical professional?

47 A. That's right. Yes. Try not to be too prescriptive in

1 here. So, for example, if it says in the schedule, "You
2 must go do four boreholes at 10 metres," well, every site
3 is different, every development is different, the
4 geotechnical conditions at every site are different. So
5 the move is towards, well, don't prescribe that because
6 that might not be appropriate everywhere, leave it to a
7 geotechnical professional to decide how deep the boreholes
8 need to be and how many there needs to be. That's - that
9 different sort of concept.

10
11 Q. And a professional faced with those sorts of questions
12 in connection with the particular proposed development or a
13 particular permit application, would they have regard to
14 some sort of objective standards or criteria like the AGS
15 guidelines, or do the AGS guidelines not speak to that
16 level of specificity?

17 A. No, it does. So in those other schedules it says that
18 the practitioner must undertake an assessment in accordance
19 with the AGS 2007 guidelines. Now, the AGS 2007 guidelines
20 that don't get to that level of "you must do this
21 particular work", it again allows the practitioner to on a
22 case-by-case basis determine what's the appropriate type of
23 work and level of work that needs to be done.

24
25 Q. I see. So appreciating then that you haven't had
26 in-depth involvement with the Mornington Peninsula planning
27 scheme, but insofar as you understand it how does the way
28 that this scheme deals with erosion management overlays
29 differ from what you've described as the more general
30 method?

31 A. Yeah, much more prescriptive is the way I'd put it.
32 It says, "You must do computer analysis." Very
33 prescriptive. It says, "If you are an EM05 you must
34 do ..." Other planning schemes won't say that. They'll
35 say, "If you in the EM0 you must engage a geotechnical
36 practitioner to assess the risk on your site." It won't
37 say how they have to assess it. It says, "You must assess
38 it in accordance with these guidelines," and that's the
39 main difference.

40
41 Q. I see. And might one reason that this method's been
42 adopted rather than another one be a reflection of the fact
43 that there are a broad range of conditions that have been
44 identified as being susceptible in different ways and
45 therefore it's easier in a way to be more prescriptive in
46 relation to specific areas?

47 A. Could be, but that's the basis of the different EM0

1 schedules. It's where we have greater susceptibility let's
2 require a more onerous assessment.

3

4 Q. Yes.

5 A. And that makes sense, that's logical. I think that's
6 how it's evolved. It was put in place late 2000s, and that
7 would have been one of the first two or three in the state,
8 and I think since then we've learned a lot and things have
9 evolved. But that's still sort of similar to what it was
10 in 07/08.

11

12 Q. Does the AGS, either generally or through its
13 guidelines, have anything to say as to a preferred method
14 of scheduling an EMO?

15 A. No. The guidelines speak more generally. It will
16 talk about, you know, factors for landslide, it will talk
17 about good development, poor development on landslides, but
18 not to that level of detail as to what type of
19 investigation should be done.

20

21 Q. Yes.

22 A. It has some information in there about - you know,
23 more generally, you know, these are the sorts of
24 investigation you might do, but not to the specific level
25 of, you know, how big the boreholes have to be, for
26 example.

27

28 Q. So then when you're involved in helping to prepare a
29 schedule in another council area that perhaps adopts the
30 more common method of vesting discretion in the
31 practitioner, is what you're seeking to do primarily by the
32 schedule identify the triggers for a permit application, or
33 is it more than that?

34 A. That's in essence I guess broadly, you know, what - if
35 we're going to develop in a landslide susceptible area,
36 what type of development or what aspects of a development
37 could either cause a landslide or create a landslide risk.
38 We've got to look at both. So things like earthworks might
39 cause a landslide, but if we have a site where we know
40 there's potential for a landslide to occur and we stick a
41 house in front of it we're putting the development at risk
42 from a landslide. So there's the two elements that need to
43 be looked at.

44

45 Q. All right. Is part of this connected with what might
46 be described as good hillside practice?

47 A. Yes.

1
2 Q. All right. Can I show you a slide. I think it's
3 number 10, although I don't think I've got one right yet,
4 so we'll wait and see. If we go back to the slides, thank
5 you. If we could go to slide number 10, please. Bingo.
6 A. It's a bit blurry.

7
8 Q. This is a slide that you asked to be included in your
9 slide deck. Could you explain to the chair what this slide
10 is telling and how it relates to EMOs?

11 A. Apologies it's so blurry, but this is a slide that
12 appears in the back of the AGS 2007 guidelines, and its
13 purpose is to communicate to the public what's good and
14 poor practice on a hillside with, you know, nice pictorial
15 examples. So, in essence, what we're trying to achieve
16 with an EMO is to ensure that development in the landslide
17 susceptible area is on the left; it's the good hillside
18 practice. So that's the development controls that will be
19 in the EMO. So if you look at the one on the right, things
20 like large fill, there's a big fill there, we don't want to
21 put large fills onto the side of the slope with potential
22 to slide. We want to have good drainage controls. We
23 don't want foundations of the type that have got slabs that
24 require us to make a big excavation into the slope to form
25 a level area. We want it up on stilts. So that's what the
26 intention of this is, and I sort of put it in there to try
27 to communicate what's the point of the EMO. The point of
28 the EMO is that our development is on the left good
29 hillside practice less susceptible to the consequences of
30 landslide.

31
32 Q. We might come back to the AGS guidelines in a minute,
33 but they were the questions that I immediately wanted to
34 ask you in connection with EMOs. But before I move to a
35 different topic is there anything else about EMOs that you
36 think it's important that the chair understand?

37 A. I hope that's it. If I think of anything - - -

38
39 Q. If you think of anything, you let me know and - - -

40 A. - - - later I'll sort of come back to it. But I think
41 that in essence sums it up, we're trying to achieve good
42 hillside practice.

43
44 Q. Thank you. So that was connected with EMOs which - as
45 we discussed, for a planning control. So far as your
46 profession is concerned, are they the sole and exclusive
47 planning control in respect of landslide risk?

1 A. In Victoria they are, as a regulatory control.

2

3 Q. Yes.

4 A. Okay? So let's say we didn't have an EMO and under
5 the building requirements you're required to get a soil
6 report done if you were to build a house. Now, if a
7 competent geotechnical practitioner went out there to do a
8 soil report, they might notice a landslide hazard and raise
9 it and ensure it's designed for whether there be an EMO or
10 not. But there's nothing requiring them to do that.

11

12 Q. Yes. And I suppose, similarly, it's possible that
13 there might be discretionary powers in local government, if
14 they're aware of a particular site, to seek additional
15 information or satisfaction in connection with a permit?

16 A. That's right. That happens too. So I've had sites,
17 say, that are not in the EMO but, for example, involve
18 really extensive earthworks, that even though it was not in
19 the EMO, that the earthworks were so extensive the council
20 had some concerns whether that might cause some
21 instability, they've got discretionary powers to say, "We
22 want a geotech assessment for this, please." That
23 sometimes happens.

24

25 Q. So that's planning controls. Is the other principal
26 form of control what you might call building or engineering
27 controls?

28 A. Yes, that's right. So that's sort of what we've
29 touched on here, is if you were in the EMO and we know
30 there's a susceptibility to landslide in that, what do we
31 do and how do we develop the building to ensure that we can
32 manage the consequences or manage the potential for
33 landslide to occur, and that's what we might call
34 engineering controls.

35

36 Q. And in your professional practice you've already said
37 that you're involved advising local government authorities
38 in connection with the development of EMOs. Do you ever do
39 work on the domestic building owners' side where they are
40 seeking to obtain a permit for works in an EMO area? Is
41 that work that you do?

42 A. I've done it occasionally. The bulk of my work is in
43 reviewing it for councils more so than working for the
44 landowner.

45

46 Q. Yes.

47 A. But I have done it - - -

1
2 Q. So you haven't just been involved in the development
3 of EMOs; you've been involved on the council side
4 assessment of permit applications?
5 A. Correct.
6
7 Q. Is that right?
8 A. Assessment of permit applications, yes.
9
10 Q. And the circumstances in which that arises is there's
11 an EMO in place, there's an application for particular
12 works to be undertaken, the landowner's obliged to comply
13 with the EMO requirements that may well include, for
14 example, someone in your profession producing a report and
15 submitting it to the council?
16 A. Correct.
17
18 Q. And then you're called in in those circumstances to
19 evaluate the merit of the report; is that how it works?
20 A. Correct, yes.
21
22 Q. I see. And are you aware of circumstances where a
23 permit has been denied on the basis that it's simply too
24 risky for any works to be done?
25 A. Yes. Oh, yes. Yeah. They usually end up in VCAT,
26 but yeah. Yeah.
27
28 Q. I see. Now, in terms of building or engineering
29 controls, some of those are presumably connected with
30 the physical integrity of the building?
31 A. Yes, in a sense that's right. So you see an image
32 there. If we've got ground that's got potential to move,
33 you could take an approach of can we put engineering in to
34 stop it moving, which is not - it often isn't feasible on
35 the scale of a residential block if the landslide is way
36 bigger than your block.
37
38 Q. Yes.
39 A. So then the control might be, well, can we design the
40 building to accommodate some movement, like it's a flexible
41 structure like the one on the left there.
42
43 Q. Yes.
44 A. In extreme cases, there's some case where the building
45 is designed that if the ground moves underneath it it can
46 be relevelled. So there is various controls, and it really
47 is a case-by-case, site-by-site assessment as to what you

1 would do.

2

3 Q. Does it often involve appropriate controls put in
4 place to divert water?

5 A. Absolutely. The greatest benefit - you know, given in
6 Victoria it's the water that would most likely trigger a
7 landslide, then engineering controls to manage water are
8 probably the best value mitigation you can put in place.

9

10 Q. I see. Does that mean that building controls are
11 necessarily bespoke, or are there standard applications as
12 well?

13 A. In a landslide context, for an application coming
14 through under an EMO they're bespoke because the particular
15 development has its own attributes. It's on a site with
16 particular attributes. So if we were wanting to manage
17 groundwater or manage water on a particular site we need to
18 understand how deep is the groundwater, where's the
19 groundwater coming from. We've got to answer all those
20 questions, which would then feed into what's the
21 appropriate design to manage that groundwater. There's no
22 kind of sort of generic way to cut it. It really involves
23 understanding the detail of that development.

24

25 Q. And so all of this must necessarily mean that proposed
26 works in an area subject to an EMO become very expensive?

27 A. Well, I would say they're usually more expensive than
28 if you were not an EMO, usually. Of course there's many
29 cases where it's not. You might draw a parallel with, say,
30 bushfire controls. If you are in a bushfire area you have
31 a higher standard of building with non-flammable material,
32 so, yes, it costs more to build there. But it's not always
33 the case, right? Controls don't have to - aren't
34 necessarily expensive. Drainage controls aren't usually
35 that expensive. If you were trying to hold the soil back
36 with piles or soil nails or something like that, that is
37 expensive. So that would be more expensive. So I'd sort
38 of say, yes, generally, but not exclusively.

39

40 Q. You mentioned soil nails now?

41 A. Mmm.

42

43 Q. That's probably not a term that most people would
44 understand. Could you explain when a geotechnical engineer
45 might require that soil nails be used in connection with a
46 particular development and what it is that they do?

47 A. Yes, okay. So I suppose a little bit more generally

1 about controls.

2
3 Q. Thanks, yes.

4 A. Yes, building controls. So we know that we've got
5 preparatory factors related to the soil strength. We've
6 got causal factors related to water getting into it. So we
7 can address these things. So if we've got soil strength
8 is a control, well, we can strengthen the soil, and there's
9 ways we can do that mechanically. Soil nails are
10 effectively steel rods that are drilled into the soil and,
11 you know, in a general sense they give it greater strength
12 so that it's more resistant to - if it did get the trigger
13 of a water pressure change, it's more resistant. We've
14 strengthened it. And there's other ways we can strengthen
15 it. We can put piles into it and concrete into it, and
16 there's various ways.

17
18 The other one is keep the water out, which is
19 drainage. There's various forms of drainage. We can
20 install subsurface drains. In some cases - there's spots
21 on the Bellarine Peninsula where we put boreholes down and
22 actively pump water out of the ground or we put drains in
23 to prevent the water getting in in the first place. So you
24 can look at the controls in sort of broadly a couple of -
25 or engineering controls broadly in that we can make the
26 ground stronger or we can keep the water out of it, and
27 ideally we do both.

28
29 Q. I see. Perhaps to round off on this topic of
30 controls, we've mentioned a number of times the AGS
31 guidelines and you've mentioned your own involvement with
32 that organisation and I think in connection with the
33 guidelines themselves?

34 A. Yes, we're revising the guidelines at the moment, and
35 I'm the chair of the committee revising the guidelines.

36
37 Q. All right. Well, you're well placed then perhaps to
38 explain the reason the guidelines were developed and the
39 extent to which they are ordinarily referred to in an EMO
40 process?

41 A. Yes. So it goes back - sort of the first publications
42 in Australia on landslide risk management sort of go back
43 to the mid-80s, various technical papers that did that. It
44 was in the 90s that it started getting a bit more momentum
45 to develop into a guideline. But then in 1997 the Thredbo
46 landslide happened, which very much heightened awareness.
47 Following the inquiries and commissions and the coroner's

1 report into that there was funding, and AGS got funding
2 from Emergency Management Australia, and that sort of
3 kick-started it.
4

5 So the first version of the guidelines came out in
6 2000. There was a revision in 2003; another revision in
7 2007. Each one, I guess, once it gets put out and people
8 practice with it, improvements are identified and it's been
9 changed a few times. It hasn't changed since '07. But
10 with things like, you know, LiDAR technologies and changes
11 that have been since 2007, in fact overdue, it's going
12 through an update now. So that's how it's involved over
13 time.
14

15 Now, the status of it, as I mentioned earlier it's not
16 a standard, it's a guideline. So there is no, you know, to
17 the same standard as Australian Standard; it's normative;
18 you must perform your work to it. It's a guideline.
19 However, for all practical purposes it may as well be a
20 standard because in the schedules to the planning schemes
21 it will say, "You shalt do it in accordance with AGS 2007
22 guidelines." So it represents the best practice to do this
23 work that we have in Australia, and practitioners are
24 required to follow it if they're providing a report that's
25 under an EMO or under a planning scheme. I think most
26 practitioners would be in a position that if you didn't
27 follow what's the recognised best practice guidelines you'd
28 be putting yourself at risk by not doing so. So, whilst
29 it's not a standard, you know, it almost operates as if it
30 is.
31

32 Q. In the schedule that I was showing you before to the
33 Mornington scheme there's reference to quantitative risk
34 assessments of the site being conducted in accordance with
35 the - and then I quote - "practice note guidelines for
36 landslide risk management, Australian Geomechanics Journal,
37 volume 42, number 1, Walker, Davies and Wilson, March
38 2007." Are they the guidelines you're talking about?

39 A. Yes, that's one. That's actually referencing a
40 chapter of the guidelines.
41

42 Q. I see. And the guidelines deal with mapping?

43 A. Yes, they do.
44

45 Q. Do they deal with mapping in both senses of the
46 inventory and susceptibility?

47 A. Yes.

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Q. Do they deal with risk assessment more generally?
A. Yes, they deal with risk assessment.

Q. And do they deal with the types of controls that might be imposed in particular conditions?
A. Yes, to a lesser extent. Yes, to a lesser extent. So it's mainly about sort of assessing the risk and understanding what could happen. But it doesn't get into the specifics of, "Here's how you design a retaining wall." It just might say, "A retaining wall might be a suitable solution." It doesn't get into more detail.

Q. I see. When do you expect the update of the guidelines to be completed by?
A. Our target is for the first draft in April '26, and I'm not going to commit to that. That's our target.

Q. Can I ask you something about the timeline of EMOs.
A. Yes.

Q. Is the mapping the thing that takes the longest?
A. No, it's the regulatory side of it takes longer. So putting the mapping together would take, let's say, six months or something like that, depending on the size of the area we're looking at. Some government areas are bigger than others. The amount of information available, it might take six months to produce a map. It doesn't take too long to produce a schedule, and that's because there's quite a few of them out there and there's good precedent to draw from.

But then once we have our first draft, "Here's the mapping and here's the schedule," there's community consultation, there's consultation with Planning Victoria, there's planning panels and hearings, and there's a protracted process of giving people the opportunity to comment. We may refine it, change it. So the time between, "Here's our first draft and here's the implementation" can take years. I've had some that's taken two years. I'd typically say it takes about a year, unless there's a ministerial intervention. The minister can intervene and fast-track it. But otherwise it's more than a year usually from draft to implementation.

Q. How long does the mapping typically take?
A. About six months, as a general. It varies. Like,

1 I did one for the alpine resorts; did a small area. Didn't
2 take as long. If I'm doing it for all of East Gippsland
3 it's going to take longer.
4

5 Q. Is that really a function of the availability of the
6 particular practitioner?

7 A. It's the function of - yes, well, I suppose it's two.
8 It's a big area. So there's lots to look at. We've got to
9 scan all the LiDAR over a particular area. I guess to some
10 extent it's a function if we've got more people to do it
11 we'll get it done quicker. But I say it's really a
12 function of how much data you've got to go through, how big
13 is the area you've got to scan. So it takes the longest.
14

15 Q. So it's still a very heavily manual process at that
16 level that requires a person with appropriate training,
17 skill and experience to actually turn their eyes to every
18 part of every map?

19 A. That's how we do it, yes. That's how we do it now. I
20 would say that there are - you know, there are parts of the
21 world now where AI techniques are being used to do that
22 instead. That's sort of been coming for a little while.
23 But the ones we have done in Victoria have been done
24 manually, and they involve not just looking at a screen and
25 identifying from the LiDAR but we also go out and
26 ground-truth and that adds time as well. We don't just
27 say, "We'll take what we see on the LiDAR for certain." We
28 go out onto the site and check that what we've interpreted
29 from the LiDAR is consistent with what we see on the
30 ground.
31

32 Q. I see. So there's a physical inspection process to
33 some degree?

34 A. Yes, that's right. That is part of it.
35

36 Q. Okay. I might come back to that in a moment, but just
37 to stay with the maps for now. Are the LiDAR maps
38 expensive?

39 A. No, I have never had to pay for them. The ones we use
40 are owned by the Victorian State Government. They would be
41 expensive if we wanted to buy them from the State
42 Government. But if we're working for a local government
43 they get it from --
44

45 Q. The State makes them available?

46 A. The State makes them available to the local
47 government.

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Q. I see. So the cost of the mapping process is in effect the cost of the expert?

A. Yes, that's right. There's really no cost to it.

Q. I should just seek to properly understand the degree of on-the-ground checking. Is that in connection with the inventory or susceptibility or both?

A. Both.

Q. I see.

A. Both. Usually go out multiple times, yes.

Q. I see. And you'll go out for spot checks? You wouldn't check the entire area?

A. No. So we might have mapped a whole series of landslides, and we'll selectively go out on the ground and make sure that what we've seen in the LiDAR, understand the landslide on the ground and understand has our mapping been reasonable. Then later on in the process, once we've got a susceptibility map and we've identified areas that we think could be susceptible to landslide, we want to go out on site and say - as a manner of validating the criteria we've come up with, go out on site and have a look as well. So you go out at multiple stages in the process.

Q. I see. Two further questions in connection with EMOs. The first is this is a process triggered by a permit application. Once an EMO's in place --

A. Yes.

Q. -- the EMO becomes relevant if there's an application for a landowner to do something.

A. Yes.

Q. And that, I suppose, reflects the fact that the works, either in the doing of them or once done, might increase the susceptibility of a particular slope to landslide; that's the basic theory, is it?

A. Just to sort of pick up on the terminology. It's that the development could be at risk. So I go to the point and say we might put a development there that doesn't change the susceptibility. It's just as likely for a landslide to happen. But by putting a development there and perhaps putting people at risk of that landslide we then increase the risk. So the risk is the likelihood and the consequence. So, our development, we potentially could

1 change the likelihood with poor drainage or earthworks, but
2 we could also change the consequences because we're putting
3 valued assets or people in an area where landslides could
4 occur.

5

6 Q. But as a matter of reality is the case that, even in
7 an area in which there is an erosion management overlay in
8 place, there could be no works undertaken in that area and
9 a landslide can still occur?

10 A. Yes.

11

12 Q. And that happened here?

13 A. Yes, absolutely.

14

15 Q. And in those sorts of circumstances you're not aware
16 of any obligation on the part of the local council or
17 anybody else to be doing anything actively to manage
18 landslide risk; it's all triggered by permit? That's how
19 the process works?

20 A. Yes, and in that sense it's triggered by a permit.
21 But, to sort of add to that, local council also has
22 responsibility for emergency management.

23

24 Q. Yes.

25 A. So if a landslide occurred, EMO or not, if that was
26 presenting a risk to public safety then council would have
27 an obligation to address that.

28

29 Q. Thank you. Is there any requirement for EMOs to be
30 updated?

31 A. There's no requirement that I know of that says they
32 must be updated; not that I'm aware of.

33

34 MR COSTELLO: I see. Thank you. Madam Chair, I'm going
35 to move to another topic now. Mr Paul's been in the box
36 for an hour. Would that be a convenient time to have a
37 short break?

38

39 CHAIRPERSON: Yes. Let's give him a 15-minute break, and
40 give some others a 15-minute break. We'll resume at 3.30.

41

42 **SHORT ADJOURNMENT**

43

44 MR COSTELLO: Thank you, Madam Chair. Mr Paul, having
45 confidently told you that I was moving to another topic,
46 there's one last question concerning EMOs that I wanted to
47 raise with you. Could I perhaps call the Mornington

1 Peninsula planning scheme back up. Thank you. Could the
2 second bullet point perhaps that starts, "If any of the
3 land" - no, the next one down, sorry. If we could just
4 blow one up. It starts, "If any of the land is also
5 affected". Yes, thanks.
6

7 This comes from the schedule that I was discussing
8 with you earlier, and you'll see here there's a particular
9 requirement in connection with land affected by EM05 for a
10 quantitative risk assessment of the sites in accordance
11 with the practice note guidelines for landslide risk
12 management. What's involved in the preparation of a
13 quantitative risk assessment?

14 A. Okay. So what we're trying to achieve with a
15 quantitative risk assessment is an estimate of the
16 probability of loss of life for that particular
17 development. It's a probability of loss of life. That
18 probability then gets compared to a criteria. So we're
19 kind of saying, "Look, we think the probability of somebody
20 might be killed is one in 10,000. The minimum we're going
21 to allow as, say, Mornington Peninsula Shire as the
22 regulatory authority is one in 100,000. Therefore, that's
23 not acceptable."
24

25 The process by which a practitioner would undertake
26 that assessment is initially develop our model, identify
27 what the landslide hazards are, what could happen on this
28 site, what type of landslide, how big might it be, how far
29 might it travel. So that all comes out of that model.
30 Then we look at what's the probability of the landslide
31 happening; what's the probability of the debris travelling
32 to somewhere a person might be; what's the probability a
33 person might be there at the time; and what's the
34 probability they might be impacted.
35

36 So they're called conditional probabilities, but you
37 string together what is the probability of all the things
38 that have to happen between a landslide getting triggered
39 and someone getting killed. That's how you come up with
40 the probability of loss of life, which then gets compared
41 to a criteria. So that's the process.
42

43 Q. Is this also a circumstance in which one is not only
44 looking to the probability of a loss of life but a
45 probability of loss of life of the most at-risk person?

46 A. Yes. That's the next level of detail. So let's say
47 you've got a house and there's four people living in that

1 house. The calculations become more difficult if one
2 person is there for eight hours a day, one person is there
3 for three, they're not there on the weekend. You can take
4 your calculation of probability to a really sort of
5 detailed level. We find that level of detail is not
6 necessary.

7
8 So a simplified way is to say, "Well, of all the
9 people in that house, let's pick the person who's at the
10 highest risk," and we call them the individual most at
11 risk. Usually that would be the person who is there the
12 most, or maybe they're the person who is in a particular
13 part of the building that is the one that is going to
14 likely be impacted. So, instead of trying to assess the
15 probability of somebody getting killed given all the
16 pattern of usage of the building, we just do it for the
17 individual most at risk. We get the probability of loss of
18 life of the individual most at risk. Then the most
19 commonly used criteria - in fact I think all of the
20 Victorian planning schemes, the criteria they will use is
21 the probability of loss of life to the individual most at
22 risk must not exceed, and it will either be one in 10,000
23 or one in 100,000.

24
25 Q. I see. Thank you. That document can come down from
26 the screen, thank you. We've dealt now with preparatory
27 factors and with controls, the relevance of the AGS
28 guidelines. Can I move to a different topic now, which is
29 causal factors.

30 A. M'hmm.

31
32 Q. These are the particular factors that might result in
33 a landslide occurring; is that a fair description?

34 A. Yes, I would use the word "trigger"; trigger the
35 landslide.

36
37 Q. Thank you. And what are the most common causal
38 factors?

39 A. Okay. So it's things like - so something has to
40 change, is sort of more generally. You've got a slope
41 that's sitting there. We know it's susceptible to
42 landslide. But something has to change in that slope for
43 it to actually slide.

44
45 Q. Yes.

46 A. Now, that could be a change in the water pressure.
47 That could be a change in the loading. It could be

1 surcharge loading placed - a bunch of fill, for example,
2 placed on the top. It could be earthworks, for example.
3 We change the loading by removing soil that's buttressing
4 the base of the landslide. It could be an earthquake. So
5 that would be the most common. In Victoria I would say
6 almost overwhelmingly it will be a change in the water
7 pressure that's the thing that triggers it. So we find
8 most landslides in Victoria will happen in response to
9 large rainfall events or some means of water getting into
10 the ground, mostly; not exclusively, but mostly.

11
12 Q. All right. And that gets us back to the concept that
13 you explained earlier about pore pressure?

14 A. That's right. Yes, that's the change. So water gets
15 into the ground causing the pore pressure to increase,
16 therefore causing the soil to lose strength, causing the
17 landslide.

18
19 Q. Yes. When you talk about soil strength here you're
20 talking about the likelihood or capability of the soil to
21 hold in its present location; is that what you mean by soil
22 strength?

23 A. Really I'm talking about - I suppose that's an
24 extension of it in a way, but we're really talking about
25 the internal soil strength. We're getting a bit detailed
26 perhaps. Soil gets strength from a number of mechanisms.
27 It gets strength from the friction between the particles.
28 So if you've got some dry sand and poured it into a pile it
29 would adopt a cone. It is getting strength from the
30 friction between the particles. If you have something like
31 a clay there's electrostatic attraction between the
32 particles sort of pulling it together. That's giving it
33 strength. That's why clays are plastic and sands are not.
34 Then the third one is what we call the apparent cohesion
35 which we talked about earlier of the negative pore
36 pressure. The air and the water partially pulling it
37 together. So soil gets strength from those three things.

38
39 Now, the friction is always the friction. The
40 particles are still going to be the same friction between
41 each other. What we call the cohesion, which is the
42 electrostatic attraction, that's kind of the same. The
43 thing that can change is the water content. When we change
44 the water content we change the strength. Makes sense?

45
46 Q. That's very useful; thank you. In terms of changing
47 the water content the obvious example is rainwater?

1 A. M'hmm.
2
3 Q. Do others include what I think you referred to earlier
4 as hydrogeological features?
5 A. Yes. The source of the water would be, I guess.
6 Rainfall or perhaps there's some aquifers, water migrating
7 through the subsurface and causing an area to become
8 wetter.
9
10 Q. Yes. You mentioned perch water earlier?
11 A. Yes.
12
13 Q. Is that relevant to the question of the pore pressure?
14 A. Yes, it is. I guess there's no limit to the sources
15 of what the water could be.
16
17 Q. Yes.
18 A. Some of the more common ones would be rainfall
19 infiltration and rainfall migrating into the soil, or the
20 diagram we showed where soil stays wet for a long time and
21 a wetting front builds through, or it might be - it can be
22 the groundwater table rises for some reason and that causes
23 the soil above the groundwater table to become wet.
24
25 Q. Yes.
26 A. Or it could be leaking services leaking water into the
27 soil. You can probably invent some more. A leaking tank.
28 The water has to come from somewhere.
29
30 Q. Yes. So there are natural water sources?
31 A. Yes.
32
33 Q. Or then there's human caused factors which might
34 include excessive irrigation?
35 A. Yes. Yes, could be.
36
37 Q. Could include broken infrastructure that's leaking
38 water in?
39 A. Yes.
40
41 Q. And all of those are relevant in terms of - sorry, all
42 of those are relevant because they have the capability, in
43 fact likelihood, of affecting the pore pressure in a way
44 that will make the area more susceptible to a slide?
45 A. Yes, or I would say the way I would frame it is it has
46 the potential to trigger the slide. So the area is already
47 susceptible. Water getting into the soil causes the soil

1 to lose strength. We now that if soil loses strength it's
2 unable to hold itself up. It's internal shear strength is
3 reduced, and then it can slide.

4
5 Q. I see. You're now going to assist the board of
6 inquiry in its investigations into the causes and, from
7 what you know of the geological conditions of this site and
8 what the site was used for, that is it's a residential
9 setting, does that mean water is a very clear line of
10 enquiry from a geotechnical perspective?

11 A. I would say for this case water would seem to almost
12 certainly be involved, and water will almost certainly be
13 the trigger, and a line of enquiry is what might the source
14 of water be.

15
16 Q. Thank you. Can we talk then a bit about landslide
17 investigation. In your professional career have you been
18 involved in landslide investigation?

19 A. Yes.

20
21 Q. That is post event?

22 A. Post event, yes.

23
24 Q. It seems from some of the material that's been
25 provided to the board of inquiry that there are a number of
26 reports that seem to usually be done in this connection.
27 I just want to ask you about them and tell me if it's the
28 ordinary sort of process for an investigation. There's one
29 category of report that appears to be really a factual
30 investigation rather than a causal analysis; is that an
31 ordinary step?

32 A. Yes. In simple terms the first thing we've got to do
33 is gather the evidence before we make any interpretation
34 and scrutinise the evidence. So the factual report is
35 essentially the evidence that's been gathered so far.

36
37 Q. I'll come back to the types of enquiries one would
38 make to do it, but just stay on the current topic. What's
39 the next step? Is it then interpreting that evidence to
40 determine cause?

41 A. That's right, yes. Of course there's no limit to how
42 much evidence we might get. There's a question there about
43 how much do we want to get. But, that's right, once we've
44 got that evidence we would use that to put our model
45 together. The model is essentially a hypothesis. "Based
46 on this evidence, how do we think this happened? How did
47 this landslide occur?"

1
2 Now, that's not a bad way to think of it as a
3 hypothesis, and it should always be subject to further
4 testing. Once we get our first model together, we might
5 think, "Okay, this is what we think has happened, but there
6 are a few more tests we might be able to validate to test
7 that hypothesis." Then once we've got that model together
8 and we've developed what we think is the sort of leading
9 hypothesis, "This is what caused it," that then puts you in
10 a position to be able to make some decisions about how you
11 go from there; mitigation or whatever you might want to go
12 from there.

13
14 Q. Another type of report that sits separately from the
15 mitigation idea that you've just mentioned is a risk to
16 life report.

17 A. M'hmm.

18
19 Q. And that seems to be bear some similarity to what we
20 were just talking about in connection with the report
21 required by the schedule in that there's the risk to life
22 analysis. Is that a report commonly done post event?

23 A. It is. Yes, it is. It can be done before or it can
24 be done after. Now, in this circumstance once we've got
25 all that evidence together and we've got an idea of what
26 might be happening, perhaps the next step might be, "Given
27 what we know about this landslide, what risk to life does
28 it present?" That might then inform decisions to evacuate
29 or whatever the action might be.

30
31 Just to give you another angle on that, immediately
32 after a landslide there will be a position where emergency
33 services needs to get on there. There needs to be rapid
34 decisions made on the risk to life, like, straightaway.
35 Now, you don't have time to go and do a whole bunch of
36 investigation and put a model together. You're making
37 on-the-go decisions, which is absolutely necessary under
38 emergency conditions. So, for that, the same process is
39 sort of followed but just in a more rapid way.

40
41 Q. Do you mean methodologically the same process?

42 A. Yes, methodologically. So we're still saying, "What
43 could happen here? For example, could that landslide get
44 bigger while people are there? What's the likelihood of
45 that? What will be the consequences of that?" If that's
46 unacceptable, we would have to take some action.

1 Q. And how does one determine what the risk tolerances
2 are? Is that just the decision of the particular local
3 government area or is there some guidance about that from
4 AGS or elsewhere?

5 A. Yes, the AGS guidance is it is the appropriate
6 regulatory authority. So in the planning context that's
7 the council. If it was an emergency response context, it
8 might be the police or the SES or whoever's got control on
9 the site.

10

11 Q. I see.

12 A. But it's the relevant regulatory authority.

13

14 Q. All right. And then you mentioned design mitigation.
15 Is that ordinarily part of the process that the person
16 who's done a causal inquiry will be involved with or does
17 that typically go off to somebody else?

18 A. That's right. So you've got your model together.
19 We've identified what could trigger the landslide. Now, we
20 want to develop. We need to design mitigations that
21 prevent as far as practical that trigger occurring; or, if
22 that trigger were to occur, reduce the consequences as far
23 as practical, and that's the process of getting to an
24 acceptable level of risk.

25

26 Q. Yes, thank you. Now, in terms of landslide
27 investigation I suppose that scale is important?

28 A. M'hmm.

29

30 Q. That is, whether you are looking at things in the
31 immediate scale of the area directly affected or if you're
32 extending the scale more broadly than that. How does a
33 professional like you go about determining the causes of a
34 landslide and at what scale do you commence your
35 investigations?

36 A. Yes, it's like anything, not to focus in or sort of
37 focus in on the tree and miss the forest. So in gathering
38 that evidence we want to take a very wide view first. The
39 principle to work on is to take a far field view and narrow
40 it down to near field. Regionally, what's the geology in
41 this region? What processes are occurring elsewhere in the
42 area? You might be looking at, "Okay, we've got Arthurs
43 Seat up behind. We've got granite. What could be
44 happening there? What might be happening with
45 groundwater," and looking at it at large scale. At that
46 point you're starting to build your models and hypotheses
47 and what could be happening.

1
2 Then you start getting to near field. "Here's what I
3 think is going on. If I go do some boreholes there and
4 some boreholes there, that's going to help confirm whether
5 that model I put together at far field is right." So
6 you're then zooming into the next level. We might be
7 saying, "We think we've got some sand over granite, and
8 maybe the water's coming down through the sand, for
9 example." So we'll go do some boreholes through the sand
10 just to check if there is. But, in principle, far field
11 and near field; big picture then the detail in the process.
12

13 Q. And when you're doing far field enquiries are you
14 concerned at that level about geological conditions or are
15 you only concerned with geological conditions closer to the
16 site?

17 A. You're still concerned with geological conditions;
18 it's just the scale you're considering them out.
19

20 Q. I see.

21 A. I could say, "Here I've got this whole lump of
22 granite," or I could say at a next level down, "Here I have
23 this granite and there's residual soil in a part of it and
24 there are joints that are a metre apart." You can look at
25 something in a big picture or you can hone in.
26

27 Q. Looking at things in the big picture, is one in a
28 better position to do that in circumstances where there's
29 an EMO because there's already mapping that's been done
30 that might be relevant to the enquiry?

31 A. Yes, that's right. So we call it our desk study. So
32 going in and doing that far field view you're trying to
33 pull as much information out that exists. So if I was to
34 do a landslide investigation the first thing I'm looking
35 at, the landslide inventory, what data, what evidence, what
36 other landslides are known to have occurred here. I'm
37 looking at the geology map; what's my understanding of the
38 geology. What landslide susceptibility has been mapped in
39 this region before. So I'm looking well beyond the scale
40 of my particular site. Eventually I'll get to looking
41 specifically at the site, but I'll start off by
42 understanding what's happening regionally.
43

44 Q. I see. And then you've mentioned the importance of
45 investigations into water. What type of investigations
46 would one typically undertake in that regard?

47 A. It's a hydrogeological model. I'm trying to

1 understand where water is getting into the soil, where
2 water is getting out of the soil, what the depth to the
3 water table is. Putting together - similar to a geological
4 model, we're putting a hydrogeological model together.
5 Where is water in the soil; where is it coming from; where
6 is it going to.

7
8 Q. Yes, I see. And so once you've done your far field
9 and near field investigations you've developed a model or a
10 concept which is an explanation as to how you think this or
11 what you think triggered this landslide?

12 A. Yes, what are the factors that caused it.

13
14 Q. And then is the next step that it's necessary to
15 somehow test that model?

16 A. Yes. Usually, yes.

17
18 Q. And how is that done in reality?

19 A. So that might be we go to that next level. We might
20 do what we call intrusive investigation, things like
21 boreholes, things like excavations. We're actually looking
22 into the ground. We might install instrumentation to
23 monitor and measure what the groundwater is doing. We
24 might do that in different locations. So that's how you
25 would test the model.

26
27 Q. I might get you to comment on some particular types of
28 testing that can be done by reference to one of Mr Pope's
29 reports in a minute. But, before we get to that, all of
30 this necessarily is an informed opinion as to the trigger
31 and it must carry within it some risk of error. How does
32 one deal with levels of certainty in these types of
33 investigations?

34 A. Yes, it's a good question. There's always uncertainty
35 because we cannot - we don't have x-ray vision to be able
36 to look at everything under the ground and know everything
37 that's going on. When we do try to see what's underground
38 we can do boreholes at discrete locations with lots of
39 spacing between them. There is always uncertainty. And
40 there's different ways of dealing with that uncertainty.

41
42 So one approach might be to bound it, to say, "Well,
43 we don't think the situation could be any more extreme than
44 this based off what we know." There could be some range in
45 between. "We can't be any more extreme than this." And we
46 could take that as our sort of basis, conservative basis,
47 to say, "Not worse than this. Probably isn't quite this

1 bad, but it's not worse than this." If we take that as our
2 basis, we'll be in a conservative position. That might be
3 one way to deal with it.
4

5 Another way is to take what's called an observational
6 approach, sort of continue learning as you go. So you
7 recognise it's uncertain, design a mitigation and say,
8 "Let's say, for example, we're going to install soil nails
9 in this site as our mitigation." As we install those soil
10 nails we will look at the material coming out of the holes.
11 We will check it's consistent with our assumptions. And
12 over here we'll have a contingency to address that if we
13 come across it. That's a bit more of an aggressive way.
14

15 Or we can take a risk based or probabilistic approach
16 to say, "We think the truth sort of lies somewhere in
17 between here and here, and there's a probability
18 distribution that's kind of more likely to be this, less
19 likely to be that." So we might try to operate it at the
20 25th percentile or something like that and we'll say,
21 "We'll assume it to be here relative to what we know," if
22 that makes sense. So there's various ways to deal with
23 uncertainty, but it's always there.
24

25 Q. I suppose that data collection in any landslide
26 investigation necessarily has some sort of time element
27 involved in it. There's the time to actually conduct the
28 tests. But presumably, given environmental conditions
29 change on a day-to-day basis, there must be some level of
30 time that needs to pass in order for results to be
31 meaningful?

32 A. Can be. So if we're trying to understand a
33 time-dependent process then you might need to be measuring
34 or monitoring, you know, over a time scale that's
35 consistent with that process. So if, say, we were
36 concerned about changing water conditions and those
37 changing water conditions in the ground occurred in
38 response to rainfall events or occurred in response to
39 above average years of rainfall, to really understand that
40 you would have to monitor over the time in which that
41 process is going to change or fluctuate. Often that's not
42 possible. So you need to in that case perhaps make an
43 assumption.
44

45 So, for example, to go to somewhere else, an
46 infrastructure project I'm working on at the moment, we
47 have to have a basis of groundwater level to produce the

1 design. But what's uncertain is what that groundwater
2 level will do in the future in response to climate change
3 and those sort of things. So the approach there is to say,
4 "We've measured the groundwater level here, but we're going
5 to say in the next 100 years feasibly the worst it could
6 get is here." So that will be our design basis, and we
7 account for that uncertainty. Even though we haven't got
8 the measurements, we have to make an assumption about what
9 it could be in an extreme or future case.

10
11 Q. Yes, I see. I might just take you to a report of
12 Mr Pope. It's MSC.5007.0004.0078. Madam Chair, this is a
13 document described as McCrae landslide evacuation order
14 area, geotechnical factual report, dated 9 April 2025
15 prepared by Mr Dane Pope, who is an employee of PSM
16 Consulting Services Pty Ltd. I haven't tendered any of the
17 other documents that I've referred to. They can all be
18 tendered in a batch at the end.

19
20 CHAIRPERSON: Yes.

21
22 MR COSTELLO: I think I'm right to say this is in fact an
23 exhibit to a witness statement that will be tendered. So
24 this is finding its way into evidence one way or the other.

25
26 CHAIRPERSON: Yes.

27
28 MR COSTELLO: How would you prefer me to do it?

29
30 CHAIRPERSON: If you could tender all of the documents
31 that you referred to in your opening as a bundle. This
32 document can be tendered at the same time as the witness's
33 report is tendered.

34
35 MR COSTELLO: Thank you.

36
37 CHAIRPERSON: As the witness's witness statement is
38 tendered.

39
40 MR COSTELLO: Witness statement is tendered.

41
42 CHAIRPERSON: Yes.

43
44 MR COSTELLO: Yes, thank you; we'll do it that way.
45 Mr Paul, you know that Mr Dane Pope has been engaged by the
46 Mornington shire council in connection with both the 2022
47 and 2025 landslides?

1 A. Yes.

2

3 Q. And I assume that the pool of geotechnical engineers
4 with experience in landslides in Victoria is sufficiently
5 small that you're at least aware of each other, if you
6 don't know each other?

7 A. Yes, yes. It's a fairly small pool.

8

9 Q. Do you know Mr Pope?

10 A. I do know him, but I don't know in great deal. I've
11 never worked with him, for example.

12

13 Q. All right. So this is a factual report that he's
14 prepared in connection with the 2025 events. I thought it
15 might be easier to ask you questions connected with
16 landslide investigation by reference to this report rather
17 than more generally. If we could move to I think it's
18 page 8; it's 0085. Actually if we could go one page
19 earlier; thank you.

20

21 This is Mr Pope undertaking a factual investigation
22 without identifying causes. You can see here that the
23 third heading in the report is entitled "Geotechnical
24 investigation", and he talks about the period that the
25 investigation was carried out, and the types of
26 investigations that were done here in those first six
27 bullet points. Site walkover is obvious enough. He then
28 mentions geotechnical drilling. If we go over the page
29 you'll see here is a more detailed section on geotechnical
30 drilling where he talks about vertical boreholes being
31 drilled, using a track mounted geoprobe 7822DT drilling
32 rig. What's the purpose of, in general terms, geotechnical
33 drilling in connection with a landslide investigation?

34 A. Gathering evidence to understand the mechanism and to
35 feed into his model.

36

37 Q. And is geotechnical drilling connected both with
38 ascertaining soil type and groundwater?

39 A. It can tell us about soil type, and then we can put
40 instrumentation into the borehole to tell us something
41 about groundwater.

42

43 Q. And in the heading 5.2 there concerning groundwater
44 you can see that he speaks about all eight boreholes were
45 completed by installing either VWP's or standard
46 piezometers?

47 A. Standpipe, yes.

1
2 Q. Is VWP initialisation that you're familiar with?
3 A. Yes, it's a vibrating wire piezometer, but it's
4 measuring pore pressure.
5
6 Q. I see. So it's one type of piesometer?
7 A. Yes, an instrument for measuring pore pressure; yes.
8
9 Q. I see. And that's the standard tool for measuring
10 pore pressure?
11 A. Yes, I would say it's standard. It's not the most
12 basic one. It's got a level of sophistication to it but,
13 yes, very common.
14
15 Q. And as a general proposition is it important to leave
16 piesometers in the ground for a reasonable period so as to
17 ascertain affluxions in pore pressure?
18 A. Yes. As soon as you've installed them there's a
19 requirement to wait a little bit of time because the
20 process of drilling itself introduces water into the
21 ground. Water is used in the drilling process. So you
22 have to allow for that to dissipate, which might be days or
23 weeks. It's not a long time. Then if you want to know
24 what the natural fluctuations in the soil moisture in the
25 ground you've got to leave it there as long as you think
26 those fluctuation cycles might run for.
27
28 Q. And is there anything in the AGS guidelines that gives
29 one guidance about the timeframes necessary in order to
30 obtain statistically valid datasets?
31 A. No, they're just guidelines; wouldn't get to that
32 detail.
33
34 Q. So this is a question for the particular expert?
35 A. Yes.
36
37 Q. Applying their professional training and skill to
38 determine how long you need to leave the piesometers in the
39 ground and have a result that will be worth having?
40 A. That's right. And that expert will be under all sorts
41 of pressures as to when their report is required, which
42 will be another factor. You don't get the luxury to leave
43 it for as long as you prefer.
44
45 Q. Over the page he mentions non-destructive testing, and
46 this was something that you may not have heard it but
47 I mentioned non-destructive testing in the course of my

1 opening. What's non-destructive testing and what's it used
2 for?

3 A. Basically digging a hole. However, it's dug with a
4 particular piece of equipment, which is a vacuum
5 excavation, and you use it to minimise the risk of damaging
6 a service. So if you were just to go in there with backhoe
7 and dig away you'd risk impacting a service. But,
8 non-destructive, it's essentially a giant vacuum and you
9 vacuum the soil out rather than dig it out.

10

11 Q. And you're vacuuming the soil out, what, so that you
12 can do lab analysis of the soil?

13 A. Yes. You can take observations of the soil or perhaps
14 samples of the soil.

15

16 Q. I see. And then the second one there is - perhaps
17 6.1.2 in the paragraph underneath it could be blown up. It
18 says "RD". He speaks of two hand auger holes being
19 excavated to a depth to identify, and then is it re-in
20 drains?

21 A. ReIn drains.

22

23 Q. ReIn drains. What's a ReIn drain?

24 A. ReIn's a brand, actually. But it's what some people
25 might call an agi-pipe. So it's a slotted plastic pipe
26 with holes in it that you would put in a trench filled with
27 gravel, and its purpose is to drain water out of the soil.

28

29 Q. I see. A lot of this is directed to ascertaining
30 groundwater levels. Apart from particular site
31 investigations which we'll come to in this context in a
32 minute, is there publicly available data about groundwater
33 in particular locations?

34 A. There is. So a bore that's put in for the purpose of
35 extracting water from the ground, even if it's just to
36 extract water for a test but, more specifically, if you're
37 extracting water for watering stock or whatever, any bore
38 has to be registered through Southern Rural Water in this
39 area. That information has found its way into a database,
40 which is called the Visualising Victoria's Groundwater
41 database, and you can access that information. There's
42 thousands of boreholes in there. The level of information
43 varies. What's in the database in respect to a particular
44 borehole, particularly older ones, can be very limited.
45 And it's luck of the draw whether there happens to be one
46 in your area of interest. But there is a public database
47 as a matter of course you would look into if you were

1 interested in the groundwater.

2

3 Q. Is the publicly available borehole data less likely to
4 be useful in a heavily residential area?

5 A. It could be useful. It's just you might have less
6 chance that there is actually data.

7

8 Q. Sorry, you're quite right. That's what I mean. Is it
9 less likely that there would be useful data?

10 A. Yes, it would be less likely, I'd say, you'd find it.

11

12 Q. Thank you. If we could go over the page, please.
13 This is still in connection with groundwater. There's talk
14 about NDT holes. Then at section 7 he gets to cone
15 penetration testing. Could you explain cone penetration
16 testing, please?

17 A. Yes. This is where this whiteboard has been sitting.
18 I've been waiting for my chance. So it's a probe that we
19 stick into the ground. So it's a probe with a cone on it,
20 which is why it's called cone penetrometer testing. You
21 push that into the ground, and it goes down. What's in
22 here is a load cell which measures the resistance on the
23 end. So as it goes in we can measure, essentially, how
24 hard the ground is, how much resistance we get on the end.
25 Then it's got through here a sleeve, and it's measuring the
26 friction on the side. Of course more friction, it will
27 receive more load than less friction. So you get this
28 information. You get the resistance. You get the
29 friction.

30

31 But it also usually has a sensor, either up here or
32 down here, which measures the pore pressure. But you have
33 to be very careful because the pore pressure it is
34 measuring is the pore pressure in response to pushing this
35 into the ground. So when you push this into the ground
36 you're causing all that soil to displace around here. You
37 drive something in the ground, that soil doesn't come out
38 the top. It's getting compacted and pushed around the
39 probe. That causes the pore pressure to elevate. It's
40 like getting a sponge or something and squeezing it. The
41 water pressure will rise.

42

43 But it tells you the response. So what that is useful
44 for is if we cause the pore pressure to rise around the
45 cone and then it suddenly dissipates quickly that tells me
46 it's permeable. It tells me that water was able to
47 dissipate quickly. If it causes the pore pressure to rise

1 and it stays risen, it tells me it's low permeability. So
2 from this test we can understand the different layers. We
3 can say is it sand, is it clay, what type of material is
4 it, and we can understand something about the permeability.
5 And you get a continuous profile.
6

7 Q. I see. So in that respect - well, does a piezometer
8 measure only water level or does a piezometer tell you pore
9 pressure as well?

10 A. Okay. So a piezometer --

11
12 Q. Could I ask you to use black pen?

13 A. Sorry.
14

15 Q. Apparently for those watching at home they can't see
16 it in the green pen?

17 A. I'm glad they're interested. So we drill down a hole.
18 There's different types of piezometer. We drill down a
19 hole and we insert PVC plastic pipe into the hole, and then
20 in that pipe there are slots in the end. Those slots allow
21 groundwater to go into that. Once that groundwater goes
22 in, if the pressure out here is higher then the water in
23 that pipe will rise up to whatever the pressure is at that
24 point. That doesn't mean there's groundwater here. It
25 just means the pressure of that groundwater will cause the
26 water to come up, and then we can measure - it gives us an
27 idea then of the pore pressure down here. So that's a
28 standpipe. This sits in a borehole. The pipe's in a
29 borehole. If we're interested in the pore pressure at this
30 depth, you seal it by putting tight clay material down
31 there. So we are measuring the pore pressure at that spot
32 by allowing it to rise up.
33

34 The other form, a vibrating wire, I'll add here. It's
35 an instrument on a cable, and then it sits down the bottom
36 at the depth we're interested in. Then we seal it in, and
37 all this is sealed up, and it's directly reading the
38 pressure. The reason it's a vibrating wire is because it's
39 like a little guitar string. As you change the pressure,
40 the frequency it vibrates at is different. Then you can
41 measure that frequency change up the top, and that is
42 related to the pressure. So different instruments but they
43 kind of give you the same thing. This doesn't give you the
44 in situ pore pressure. These do. Makes sense?
45

46 Q. Yes, thank you. I'm sorry if I have been depriving
47 you of the opportunity to do your drawings. I should have

1 asked you to draw a hill at the start of my opening.
2 Obviously, given the centrality of water as a potential
3 trigger, is it important to ascertain the source of the
4 water?

5 A. Yes. If eventually where we're going to is how are we
6 going to manage the water, then you need a basis to which
7 to pair your design. Where are you going to put your
8 drains? What type of drains? How big do they need to be?
9 So, to get to that point where you can design a mitigation,
10 absolutely you have to know where the water is, how is it
11 flowing, how much. So that's kind of essential design
12 input to designing mitigation.

13
14 Q. I see. If we can go over the page, please, in fact if
15 we could go two pages forward to 0089. You can see here at
16 8.1.2 that Mr Pope sampled surface water on 20 January. It
17 was done, sorry, not by Mr Pope. It was done in the
18 presence of some of his staff, but by JBS&G. And the
19 sampling was conducted at five locations for field water
20 quality testing and laboratory testing. Is laboratory
21 testing of surface water an ordinary and usual test that
22 would be used in a landslide investigation?

23 A. Yes, absolutely. And what the purpose of doing that
24 is to try to understand where the water has come from and
25 to. So you could match the chemistry of the water where
26 you're seeing it coming out to the chemistry of some water
27 that's getting in. That's perhaps evidence to link the
28 two.

29
30 Q. I might then be getting close to trespassing beyond
31 your area of expertise, but if we go a long way forward in
32 that report to page 0263, using the Bates numbering. Could
33 we go back, thanks. Could we go to 0263 on the Bates.
34 Thank you. Then go to one forward. So this is an
35 appendix to the report, and it's said in the part of
36 the report I just took you to that surface water samples
37 have been taken from five sites. You can see the sites
38 indicated here each with an SW notation. You can see
39 there - I think you familiarised yourself with the map of
40 this area, Mr Paul; is that correct?

41 A. Yes.

42
43 Q. So you can see that SW05, that is down towards
44 Point Nepean at the bottom of the slope near the affected
45 Penny Lane property, and the other four surface water
46 samples were taken up high on the slope at View Point Road.
47 And they were then sent off to JBS&G for testing.

1
2 If we could move to 0270. It looks as though this
3 testing was done by Eurofins, and you can see it's
4 addressed to JBS&G. Can you see there that the column
5 starting from the right are SW4, 3, 2 and 1? And
6 unfortunately SW05 is over the page, but I'll take you to
7 that in a moment. Just using the data that's blown up for
8 you there, a testing of the water is done and the levels of
9 different chemicals and minerals are recorded in respect of
10 each of the five sites. Now, is water chemistry something
11 that geotechnical engineers with your subspecialty are
12 interested in in landslide investigation?

13 A. Yes, something we're interested in and I must say we
14 would get a - there are people specialised in this who
15 I would bring in to help. But absolutely we would be
16 interested in.

17
18 Q. Would that be you would bring in a chemist?

19 A. Yes, it would be somebody with the skills in
20 groundwater chemistry, which might be a hydrogeologist with
21 skills in chemistry. It could be a chemist. They tend to
22 come from different backgrounds, people who work in soil
23 water chemistry. Yes, somebody with that skill set.

24
25 Q. Presumably to a trained eye levels of particular
26 chemicals such as fluoride or chloride will immediately be
27 indicative of something?

28 A. Yes, that's a common one is if we're looking, "Did
29 this water come out of mains," you know, there's fluoride
30 usually in mains water and that's one of the things you
31 might look for to see whether it's got fluoride in it as
32 evidence that it might have come out of the mains.

33
34 Q. Can you see the third test is conductivity?

35 A. M'hmm.

36
37 Q. Do you have an understanding of what conductivity
38 means in this circumstance?

39 A. Yes. So it's the electrical conductivity of
40 the water. In general the more ions in it, which is
41 essentially the more saline it is, the higher conductivity.

42
43 Q. More salt means more conductivity?

44 A. Yes, more salt means more conductivity.

45
46 Q. And can you see here that on conductivity there's
47 something dramatic - well, whether it's dramatic or not you

1 can tell me based on the unit of measurement, but at least
2 there's a significant difference between the conductivity
3 of SW01, for example, and SW02, 3 and 4?
4 A. M'hmm.
5
6 Q. They're all at or above 400 and SW01 is at 140?
7 A. Yes.
8
9 Q. And to a geotechnical engineer like yourself does that
10 tell you anything?
11 A. You could say, well, we would have to check, but if
12 that is a salt content or a conductivity higher than you
13 would get out of rainwater it's telling us it has to have
14 spent some time on the ground, travelling through the
15 ground, to pick up the dissolved ions it's got in it.
16
17 Q. Thank you. If we could just go over the page for a
18 moment. You'll see there there's the column for SW05.
19 Now, can you see the conductivity level for SW05 there?
20 A. Yes, 1,200.
21
22 Q. So that is far above that for SW02 to 4, and almost 10
23 times for SW01. Does that tell you anything about that
24 particular sample?
25 A. Without being conclusive, it could be evidence it's
26 been in the ground longer. It's had to pick up these ions
27 from somewhere, which could be from it flowing through the
28 ground.
29
30 Q. I see. It might be, for example, that water that has
31 travelled through the earth a greater distance might end up
32 with a higher conductivity?
33 A. Could do, yes.
34
35 Q. And are there any other particular markers that you
36 would look for to determine whether or not it's likely that
37 water has passed through the earth to any significant
38 degree?
39 A. None of the others. Bicarbonate alkalinity is CoCo_3 ,
40 which appears down the bottom. So that's carbonate. To
41 pick up that it has to flow through something that has
42 carbonate. Carbonate we mean shells, limestone, that sort
43 of material. So that might be indicative of flowing
44 through, for example, the dune deposits we have there, the
45 Pleistocene dunes that we showed on the geological map,
46 have carbonate in them. So to see carbon in the
47 groundwater would be consistent with perhaps it flowing

1 through a soil that we know has carbonate in it.

2

3 Q. I see. And the reading there for bicarbonate
4 alkalinity is 190.

5 A. M'hmm. And that seemed higher --

6

7 Q. Is that milligrams a litre?

8 A. Yes, milligrams per litre.

9

10 Q. I can tell you, but you can't see it because you're on
11 the other page, that for SW01 that same reading was 41, for
12 2 it was 79, for 3 it was 95, and for 4 it was 93. So at
13 this level it's about double the others?

14 A. Yes. So that might indicate it flowed through the
15 ground or that ground with carbonate in it for a longer
16 distance to pick that up.

17

18 Q. All right. If I was to present this data and the
19 balance of the testing to a chemist with particular
20 expertise in water and soil, would you expect that they
21 would be able to analyse these results and draw
22 conclusions?

23 A. Yes. The extent of the conclusions and the level of
24 uncertainty would be there of course but, yes, absolutely.
25 That's what they do.

26

27 Q. I might just ask you two further questions, Mr Paul,
28 and then I'll let you go. If Mr Paul's slides could be
29 brought back up. The final slide that you included in your
30 slide deck concerned Thredbo?

31 A. Yes.

32

33 Q. That's obviously a particularly famous example of a
34 landslide and a landslide investigation within recent
35 Australian history. What's the map that you've put here?

36 A. That's a map from the coronial report on the left -
37 I can talk to it if you like - and that's a photograph of
38 the landslide on the right. That's better, yes. I can
39 explain the reasoning.

40

41 Q. Yes, please.

42 A. So I just put this in because it just helps when we're
43 talking about all these landslide concepts to put it in the
44 context of a case study just as a means to help convey the
45 issues that are relevant here. So we talked about
46 preparatory factors. In Thredbo there were a number of
47 preparatory factors.

1
2 The landslide originated on the road, which was a cut
3 to fill. So the preparatory factor was we had a fill
4 there. The second preparatory factor, that fill was on a
5 very, very steep slope. The lodges that were impacted sat
6 below that steep slope. So those were the preparatory
7 factors: the ground was this fill, which the investigations
8 after suggested wasn't particularly well compacted, and the
9 steep slope.

10
11 The causal factor found by the inquiry was there was a
12 pipe. That pipe was an asbestos pipe that was in the
13 slope. Because that fill was able to consolidate, it
14 wasn't well compacted, it caused the pipe to break. That
15 pipe leaked water into this fill, over what's thought to be
16 a period of several months, causing the fill to become wet
17 and causing the landslide to come down destroying one lodge
18 and a fair bit of another.

19
20 One thing that continually surprises me with Thredbo,
21 if you look at the scale here, you can see here the width
22 of the scar and even to some extent on the right when you
23 look up to the top it's not that big. The volume of soil
24 that came down is not great, but it was enough, being
25 saturated to get momentum up when it flowed and to cause
26 such damage that it killed 18 people and knocked down two
27 buildings.

28
29 So that just distinguishes these preparatory factors -
30 fill, the steep slope - and the causal factors being the
31 water getting into the slope; and then the consequences
32 arising because we had development in this location that
33 could be impacted by it. So I just sort of put that up
34 there to help understand these concepts.

35
36 Zone of depletion up the top. That's what this map is
37 sort of showing. It's depleted up the top and where it
38 deposited down the bottom. Those little arrows are
39 actually showing where elements of the building went from
40 and to. That's what's being communicated there. A lot of
41 good information in the coronial report.

42
43 Q. Thredbo is an example of a landslide, the trigger for
44 which was water?

45 A. Correct.

46
47 Q. And the source of the water was?

1 A. A pipe.

2

3 Q. It was a burst pipe, was it?

4 A. Yes, it was a burst pipe. Not so much a burst; it was
5 thought to have leaked more slowly over time allowing water
6 to accumulate over time in the soil, they think maybe a few
7 months. They don't know for sure when the leak began.

8

9 MR COSTELLO: Thank you, Mr Paul. Madam Chair, I have no
10 further questions for Mr Paul.

11

12 CHAIRPERSON: Thanks, Mr Costello. Are there any
13 applications for leave to cross-examine the witness? No.
14 You're lucky, Mr Paul.

15 A. That's merciful, isn't it.

16

17 CHAIRPERSON: Thank you for your evidence today, which
18 I found to be very helpful. You're excused from this
19 hearing block, but we will need you back during a
20 subsequent hearing block?

21 A. Yes, understood.

22

23 CHAIRPERSON: And the solicitors assisting the inquiry
24 will be in touch with you.

25 A. Excellent. Thank you very much.

26

27 **<THE WITNESS WITHDREW**

28

29 CHAIRPERSON: Mr Costello, let's deal with the exhibits.
30 I'll mark the bundle of documents that you went to in your
31 opening as CA1.

32

33 **EXHIBIT #CA1 BUNDLE OF DOCUMENTS IN OPENING**

34

35 CHAIRPERSON: Given that Mr Pope hasn't yet prepared a
36 report, I'll mark --

37

38 MR COSTELLO: A witness statement.

39

40 CHAIRPERSON: A witness statement, I'm sorry, I'll mark
41 his report exhibit CA2. Can you just give me the title of
42 his report?

43

44 MR COSTELLO: Yes. It is "McCrae landslide, evacuation
45 order area geotechnical factual report, 9 April 2025", and
46 the Bates number is MSC.5007.0004.0078.

47

1 CHAIRPERSON: Thank you. That will be exhibit CA2.

2

3 **EXHIBIT #CA2 REPORT OF MR POPE, MSC.5007.0004.0078**

4

5 Do you want to tender Mr Paul's slides?

6

7 MR COSTELLO: Yes, I think we should.

8

9 CHAIRPERSON: I'll mark those CA3.

10

11 **EXHIBIT #CA3 MR PAUL'S SLIDES**

12

13 CHAIRPERSON: That deals with the documents referred to
14 today.

15

16 MR COSTELLO: It does. Would you like a photograph taken
17 of the whiteboard and would you like me to tender the
18 photograph?

19

20 CHAIRPERSON: Yes, please.

21

22 MR COSTELLO: Perhaps if that could be CA4?

23

24 CHAIRPERSON: Yes.

25

26 MR COSTELLO: I see your associate is attending to it now.
27 So I'm sure that will be uploaded to the court book
28 immediately.

29

30 CHAIRPERSON: Thank you, Ms Moore.

31

32 **EXHIBIT #CA4 PHOTOGRAPH TAKEN OF WHITEBOARD**

33

34 CHAIRPERSON: Are there any other matters today?

35

36 MR COSTELLO: Not for today, thank you.

37

38 CHAIRPERSON: We'll resume tomorrow at 10.15 rather than
39 10 o'clock, and then we'll return to a 10 am start the
40 following day and next week.

41

42 MR COSTELLO: Thank you, Madam Chair.

43

44 **AT 4.23 PM THE HEARING ADJOURNED UNTIL THURSDAY, 8 MAY 2025**

45

46

47

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