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By email
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Dear Jonathon

Wolgan Road Project - Gap Slope Risk Assessment

In January 2023, WSP Australia Pty Ltd conducted a Slope Risk Assessment Update for Wolgan Road, detailed in WSP report PS129742-SYD-GEO-REP-002-Rev0 dated 17 February 2023. The assessment revealed that the level of risk to the community from potential landslides and rock falls along the existing road was at a level that would normally be considered unacceptable. We calculated that even with considerable investment, it could be impractical and possibly uneconomic to improve the existing road to a standard that would make it safe and reliable in the long-term.

In 2025, at the request of Lithgow City Council, GHD Pty Ltd prepared a report “Review of Wolgan Gap Slope Risk Assessments” dated 5 March 2025 commenting on WSP’s 2023 slope risk assessment. Further to GHD’s report, in this letter WSP provides information to clarify the basis of our 2023 assessment methodology and results.

For nearly 20 years, WSP (formerly as Golder Associates Pty Ltd) has assisted Lithgow City Council in managing slope instability risks along Wolgan Road. Over this period, we have developed a comprehensive understanding of the slope instability hazards above and below the road. Due to landslides and rockfalls triggered by heavy rainfall in 2021 and 2022, the road was permanently closed as an access thoroughfare in November 2022. Since early 2023, WSP has been collaborating with Lithgow City Council to provide the Wolgan Valley community with a permanent, safe, and reliable access into the valley.

Risk is a measure of the probability of potential harm, in this case to road users, if there was a landslide or rockfall. It is normally the responsibility of an asset owner to determine the level of risk that would be tolerable to users of their asset. In this case, it is Lithgow City Council who makes that decision. As the road is their asset, they have a responsibility for public safety, and they know what measures they can put in place to manage the risk. To help Lithgow City Council, we have informed them about the levels of risk that are typically tolerated by society in different circumstances.

To assess the level of risk, WSP identified potential landslides and rockfalls and assessed the likelihood of these impacting the road.

We estimated the risk using the industry accepted method described in the Practice Note Guidelines for Landslide Risk Management, published in Volume 42 No. 1 March 2007 of the Journal of the Australian Geomechanics Society (AGS 2007c). The estimation of risk requires judgement, which introduces some subjectivity and uncertainty. Like all assessments of probability, exactly what will happen and when is uncertain. It should be expected that different geotechnical professionals may estimate different levels of risk, even if those geotechnical professionals have identified and assessed the same hazards. We based our estimate on site conditions and available information at the time of the assessment. We applied the benefit of our site-specific knowledge from the past 20 years to support our assessment, including evidence of landslide and rockfall events that have been reported over the last 75 years, with some examples shown in Figure 1.



Figure 1 Newspaper reports of landslides on Wolgan Road in 1950

We estimated the risk of loss of life by combining the risk, for the person most at risk, from our list of known and possible landslide hazards. It is important to be aware that the combined risk to an individual increases with the number of hazards.

There are other methods that can be used to assess risk from landslide hazards. For example, the TfNSW Guide to Slope Risk Analysis, Version 4.1 (RMS 2014) is a “rapid assessment” method developed specifically to rank landslide risks at different locations. The RMS method is used as the basis for prioritizing slope risk management programs. The assessments are largely based on rapid visual inspection of the slope, and there may be limited available information about the underlying ground conditions, and previous history of landslides. We had the benefit of information we have gathered about landside hazards along Wolgan Road for many years. Our knowledge was supplemented with aerial photography and inspections upslope, where there is evidence of potential larger scale landslide hazards that would be missed from rapid road level inspections. The amount of information and knowledge available to us was better suited to the use of the AGS 2007 approach and it allowed us to consider the combined risk from multiple hazards. The RMS method is not ideally suited to determining the combined risk when a user is exposed to multiple hazards.

An example of an upslope landslide in November 2022 is shown in the aerial photograph (from March 2024) in Figure 2 below. The landslide is more than 70 m in length, with a back scarp approximately 50 m upslope of Wolgan Road. In Figure 2 we have provided references to other photographs which are appended to this document in Attachment A, that show conditions before and after the development of the landslide, along with photographs of some individual rock blocks which were released from the landslide debris.

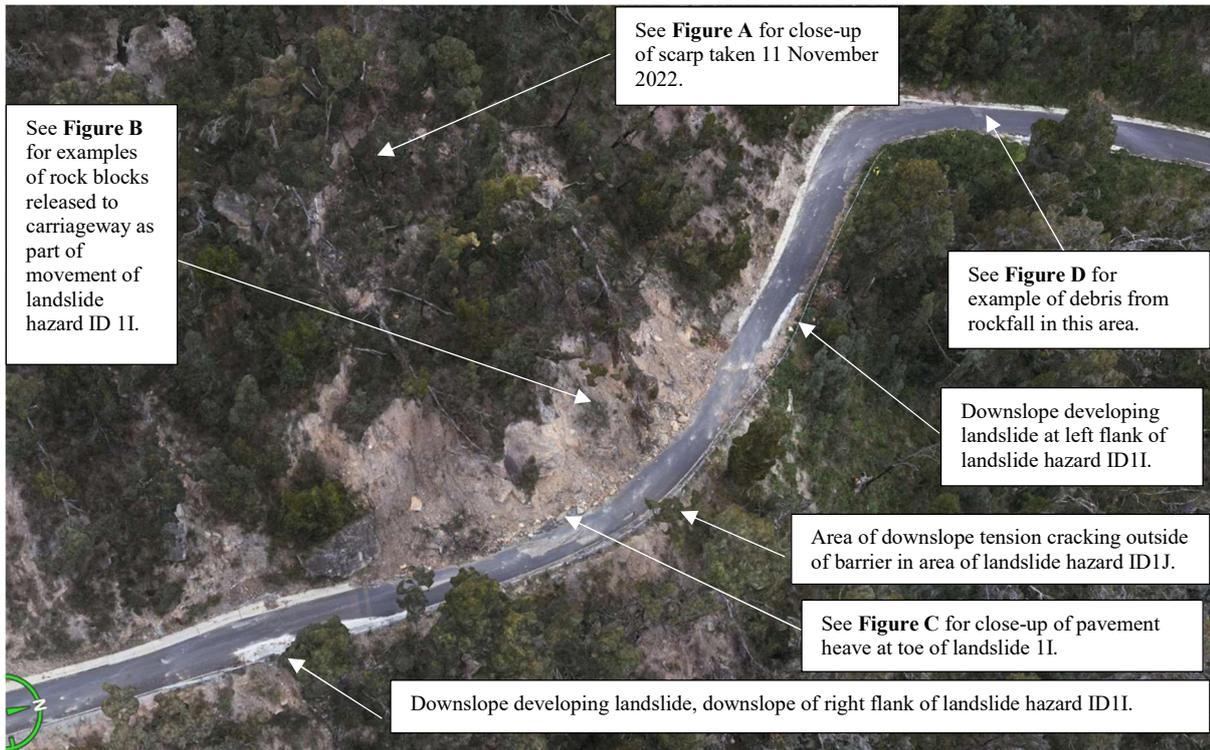


Figure 2 Landslide hazard 1I further development of scarp evident since November 2022 – aerial image March 2024

A defining characteristic of the Wolgan Road site is the high cliff line as shown in Figure 3 below.

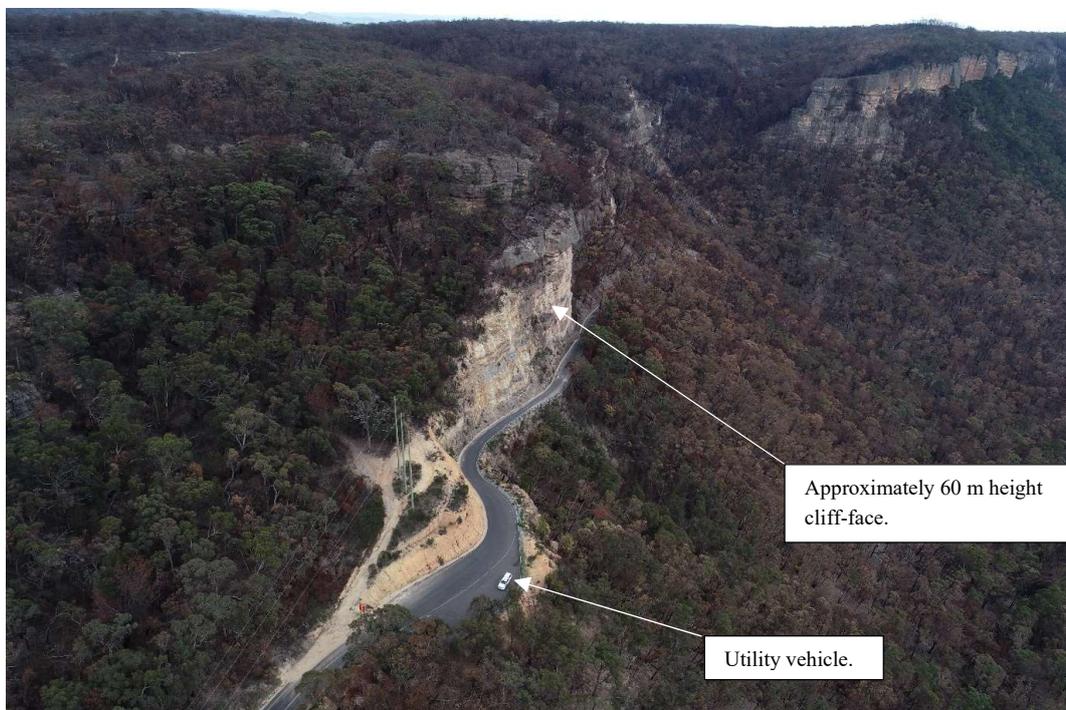
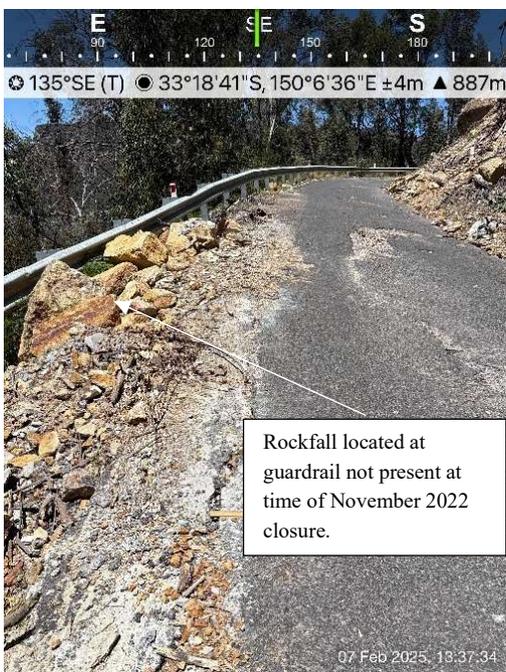


Figure 3 View looking north at Wolgan Gap showing high cliff line and potential significant fall height and impact velocity – aerial imagery February 2020

The fall height and size of rockfall debris have a significant influence on their destructive effect. Rock blocks with large fall height and/or large size will present greater safety risks than small rocks and low fall heights. The high cliff lines above Wolgan Road have a history of producing some large rock falls. Some examples are shown in the photographs in Attachment A.

The key driver for landslide activity along Wolgan Road is rainfall, which can vary significantly from year to year, hence there can be corresponding variability in the landslide and rockfall activity. Over the period from January 2022 to December 2022 over 1200 mm of rainfall was recorded at the nearby Lidsdale Bureau of Meteorology weather station (BOM 63132) whereas for the following year January to December 2023 less than 700 mm was recorded at the same station. By 2024 ephemeral water seepages at some landslide hazard locations had ceased flowing.

Access to the road since it was closed in November 2022 has been restricted and Council’s inventory of rockfalls has not been kept up to date. However, in February 2025 WSP team members working on the design of the new road walked along the closed road. We have compared our observations of rockfall debris in 2025 with photographs at the same locations in late 2022, and with aerial photographs since 2022. We have inferred that in the 2 to 3 years since the road was closed, rocks have continued to fall onto the road and some of those are now up against the guard rail as shown in the photograph in Figure 4 below. However, the number of rocks that have fallen to the road appears to be less than we had anticipated based on conditions observed in January 2023.



Rockfall located at guardrail not present at time of November 2022 closure.

Figure 4 Rockfall against guard rail below landslide hazard ID11 – February 2025

The observed rockfall frequency and landslide hazards still indicates risk at a level that is normally considered unacceptable for permanent unrestricted access.

The team currently working on the design of a new road into the valley has identified that use of the existing road for temporary access for residents during the construction of the new road could bring important benefits. The route for the new road could use parts of the Donkey Steps alignment and construction traffic could also use Donkey Steps, potentially reducing the time to build the new road.

With the benefit of the observed changes in the condition of the road over the past 2 years, it would be possible to reassess the risks based on use of the existing road as a temporary access for the community to the valley during the construction of a new road. However, the presence of numerous landslides and rockfall hazards at varying states of activity, and the potential increase in that activity in response to rainfall, would require careful consideration in developing an appropriate Interim Access Strategy using the existing road.

Temporary access would have to be under strict access conditions to be determined by Council, similar to Browns Gap Road, likely with a traffic light-controlled contraflow system, restrictions on some vehicle types, and periods when the road might have to be closed in response to heavy rain. Contingencies to respond to the possibility of the road becoming unpassable, for example as a result of landslide and/or rockfall activity, and wet weather events, would also need to be agreed.



Use of the existing road would be temporary only. The new road would provide a permanent, reliable and safe long-term access route into the valley for the community, businesses and visitors.

Photographs of some of the landslide hazards which exist and landslides which have occurred along Wolgan Road are provided in the attachment to this document.

Yours sincerely

Graham Scholey
WSP Technical Director

Attachment A
Selected photographs of selected
hazard locations at Wolgan Road



Figure A Close-up of an accessible portion of landslide hazard 11, with backscarp – 11th November 2022



Figure B Landslide hazard 11 – debris lodged on carriageway includes blocks greater than 1 m minimum dimension – 10 November 2022



Figure C Landslide hazard 11 – ‘shoving’/heave of asphalt at toe of cut batter – 09 November 2022



Figure D Rockfall between hazard ID1 and hazard ID2B, following partial clean-up – August 2020

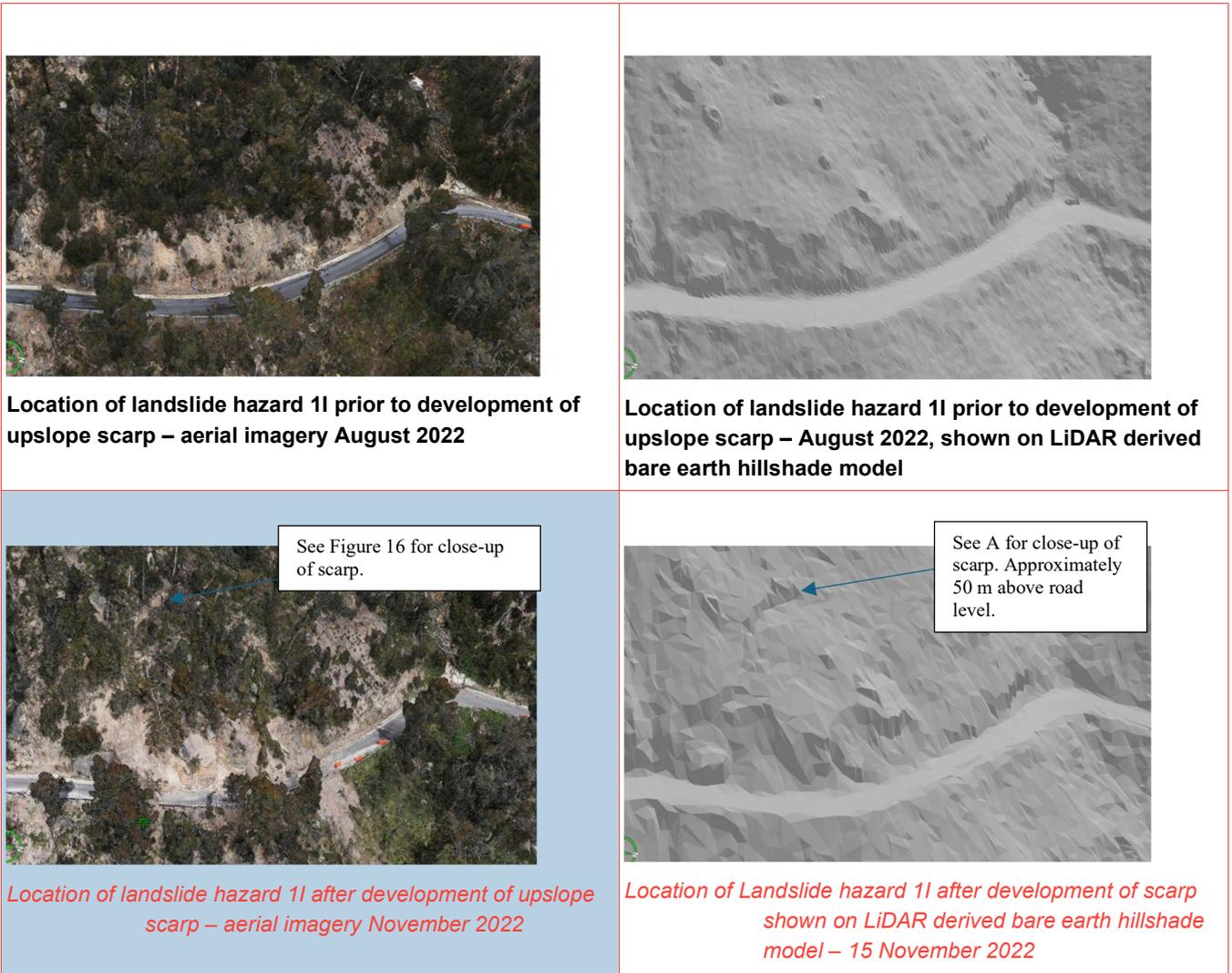


Figure E Aerial photographs and LiDAR images of Landslide hazard 11, showing backscarp development.



Figure F View looking north at Wolgan Gap showing some of the rockfall debris remaining at road level following an event in September 2008



Landslide scar in area shown in Figure F (i.e. below rock topple hazard 6A).

Figure G 1969 aerial photograph of Wolgan Gap showing landslide scar in area shown in Figure F.

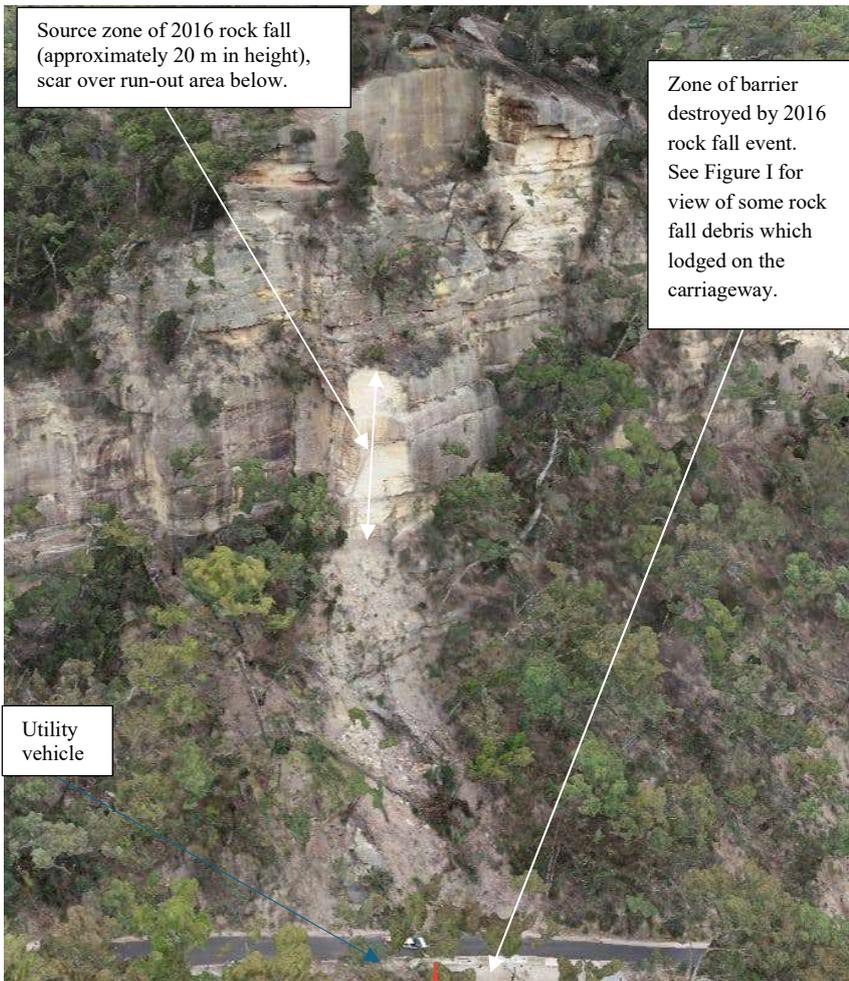


Figure H Aerial view of source zone and run-out scar to road level and barrier damage from 2016 rock topple and rock slide event shown on February 2019 aerial imagery



Figure I View from inside vehicle showing portion of landslide debris which lodged on the carriageway at the time of the 2016 rock topple and rockfall event.



Figure J: Landslide hazard 3C during clean-up showing size of rock blocks within debris a proportion of which crossed the carriageway without lodging there and the zone of developing downslope landslide with crest within southbound lane – November 2022



Figure K: Rock block with minimum dimension > 1 m embedded within colluvium of landslide hazard 4D – December 2021