



Appendix No. 13

**Findings of Geotechnical Peer Review
Investigations (July 2006) and
Supplementary Geotechnical Advice (March 2010)**

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Adam Dean
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30 August 2006

Dear Adam

**370 OLD NORTHERN ROAD, CASTLE HILL – REVIEW OF GEOTECHNICAL
REPORT BY PELLIS SULLIVAN AND MEYNINK P/L, DATED 3 JULY 2006**

1. Introduction

This peer review of a report by Pellis Sullivan and Meynink (PSM) entitled *Geotechnical investigation and stability assessment, 370 Old Northern Road Castle Hill* (PSM810.R1 Rev 3, dated 3 July 2006) has been jointly prepared for Baulkham Hills Shire Council (BHSC) by Sinclair Knight Merz P/L (SKM) and Snowy Mountains Engineering Corporation (SMEC), acting as Council's Geotechnical Review Panel. We have also been provided with peer reviews of this report by Mr PL Volk of Coffey Geosciences (dated 12 April 2006) and Mr GP Kotze of GHD LongMac (dated 30 September 2005). The present review was carried out in accordance with a SKM proposal dated 1 June 2006, except that a slope risk assessment in that proposal was cancelled by BHSC's Mr Adam Dean in a phone call on 28 June 2006.

The site was inspected on 31 July 2006 by Greg McNally (SKM) and Jeff Hsi and David Malorey (SMEC), in company with Mr Garry Mostyn of Pellis Sullivan and Meynink (PSM), the report's author. The L-shaped site, of area approximately 2.9ha, was walked over as Garry explained the work carried out during the geotechnical investigations and the conclusions drawn by PSM from these results. At the time of the inspection the grass had been recently cut and hence ground features were well-exposed. Some adjacent land, to the south and west, was also briefly inspected to provide a comparison.

We understand that the developers, Lanox P/L and KMSJ P/L, have not yet submitted a subdivision plan for this site to Council. For the purposes of this peer review we have assumed that the development will be a conventional residential layout for single-occupancy dwellings, with minimal cut and fill earthworks.

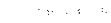
2. Comments on PSM Report

The work undertaken included a review of previous geotechnical investigations on this site and adjacent land. We have not seen these earlier reports and rely on PSM's interpretation of their findings. The PSM investigation confirmed the existence of a near-horizontal slip plane in the shale bedrock, but their report was sceptical of the existence of other signs of slope instability noted previously, including a postulated landslide head scarp below Old Northern Road and the results of borehole inclinometer surveys. The rejected inclinometer results were interpreted by PSM as representing random surface movements due to soil wetting and drying, rather than systematic downslope creep.

Most of PSM's work focussed on the slip plane, which was logged in several unusually deep (6.9-9.3m) test pits and sampled in two boreholes. The results were used in hydrogeological and slope stability modelling of long sections through the site. A geomorphological survey by Professor R Blong from Macquarie University was commissioned to deduce the age of the last slip plane movement, which was estimated to be a minimum of 100,000 years ago. Other observations on the slip plane noted in the PSM report include:

- It appears to be a continuous surface, dipping at 3-4 degrees towards the west (i.e., close to, but slightly steeper than bedding in the shale).
- It was intersected in two PSM test pits (and two earlier test pits), as well as in two boreholes, but it does not visibly 'outcrop' at the ground surface.
- There are no obvious signs of ground instability (such as tension cracks, terracettes, spring lines, bent trees and mounded soil) at the surface within No 370, though some 'hummocky ground' and a possible 1970s landslide are visible in the next property to the south (No 368).
- The available information on the groundwater table indicates that this is currently well below the slip plane, though water tables can and do fluctuate with rainfall patterns (and a rise would be likely following the end of the present drought).
- The proposed development is unlikely to have a greater effect on the groundwater conditions than the existing impacts from the dam and the well-watered garden upslope of the site.
- The slip plane is now drained through undercutting, owing to nearby gully erosion, and hence is unable to sustain the high groundwater pressures which are presumed to have given rise to the landslide in the first place.
- Clay minerals present along the slip plane indicate long-duration weathering along this surface. The absence of slickensides (scratch marks indicative of sliding) also suggests that any such movement occurred long ago.

The slide plane geometry was combined in numerical models with surface topography, a range of groundwater conditions including complete saturation, and a range of possible shear plane strengths including parameters that were in the lowest probability range. It was concluded that



The conclusions of the PSM report, as we read them, are:

- ### 3. Observations during walkover

The bulk of the land surface was well-exposed, following recent grass-cutting. Garry walked us through all of the pit and borehole sites and indicated the projected trace of the slip plane, where this intersected the eroded land surface, though no actual sign of this plane was visible.

The dam adjacent to the site is situated immediately upstream of an existing gully, close to the boundary between No 368 and No 370 Old Northern Road. Its existence is unlikely to impact on the groundwater levels for most of the site, which is located to the north of the dam and gully. Future development of the site could result in increased groundwater recharge from construction, hard standing runoff, vegetation reduction and garden watering, even if it was



only a temporary impact. It is considered that such increased recharge would not be sufficient to cause the failure surface to reactivate.

4. Conclusions

In our opinion the PSM report is in the superior range of geotechnical reports dealing with land proposed for residential development in shale bedrock areas of western Sydney. It is clearly the result of a comprehensive investigation, involving field observations, laboratory testing and a review of the relevant geotechnical engineering literature. The report carefully analyses signs of potential instability and the likely processes acting, and models their effects.

One issue that we have raised with PSM is the possibility that the slip plane is in fact a bedding plane shear of tectonic origin, of a type found in places within the Ashfield Shale bedrock. Were this to be the case, the possibility of a large scale landslide would be even more remote than in the modelled assumptions. Although not specifically raised in the PSM report, we were informed by Garry Mostyn that this possibility had been considered, and rejected because of the presence of deformed bedding – indicating landslide movement rather than tectonic slippage – above the shear plane.

Following our review of the PSM report and our walkover observations, we find that we have no significant objections to the report's technical content or its observations. We note that this is also, broadly, the conclusion of the previous peer reviewers from Coffey and GHD LongMac. We therefore recommend that Council accept the findings of the PSM report. However, we believe that the impact of any proposed future development on the site, details of which are at present unknown, need to be considered in relation to its scale and type.

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Our Ref: PSM810.L13
Date: 23 March 2010

Lanox Pty Ltd & KMSJ Pty Ltd
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ATTENTION: HARLAN HALL

Dear Harlan

RE: APPLICABILITY OF GEOTECHNICAL INVESTIGATION AND STABILITY ASSESSMENT FOR 370 OLD NORTHERN ROAD, CASTLE HILL, TO PROPOSED DEVELOPMENT AS SHOWN IN SUBDIVISION CONCEPT PLAN

1. INTRODUCTION

This letter presents advice regarding the applicability of the recommendations in the PSM report titled:

"Geotechnical Investigation and Stability Assessment, 370 Old Northern Road, Castle Hill" and dated 3 July 2006 (ref. PSM810.R1Rev3) (PSM Report)

to the proposed development of the site as shown on:

Jackson Teece Architecture drawing titled *"Subdivision Concept Plan"* (ref. 2008117 DD01 Issue A) dated 18 March 2010. (Subdivision Concept Plan)

This letter has been prepared at the request of Harlan Hall of Lanox Pty Ltd. We understand that Lanox propose to submit this letter to Council as part of their rezoning submission.

2. GEOTECHNICAL INVESTIGATION AND STABILITY ASSESSMENT

PSM has completed a geotechnical investigation and stability assessment of the land at 370 Old Northern Road, Castle Hill. The details of the work undertaken and the results of the stability assessment are provided in the PSM Report.

Our investigations revealed that the site is underlain by the slide surface of an ancient landslide, this is overlain by a deeply weathered clay and clayey shale profile. We have concluded from further investigation that the last movement on this slide surface occurred more than 100,000 years ago. These investigations are reported in the PSM Report.

We completed an assessment of the risk of further movement using the approaches of both the AGS Guidelines published in 2000 and the Pittwater Council Policy.

We assessed the likelihood of further movement on the ancient landslide as less than one chance in 100,000 years.

Our conclusions and recommendations are provided in Section 10 of the PSM Report and are transcribed below:

"We have assessed the risk of remobilisation of the ancient landslide affecting 370 Old Northern Road and its consequences. Our conclusion is that the risks to life and property are acceptable on the basis of assessments to both AGS 2000 and Pittwater's policy.

There is a very low likelihood of remobilisation of the ancient landslide affecting the site and any movement would be quite gradual and due to high water pressures on the slide surfaces. We assess that there is a very small likelihood of the groundwater conditions required to remobilise the ancient landslide occurring during the next 100 years.

On the above basis, we recommend that no special works be undertaken with respect to the ancient landslide.

Strictly, the site classification in accordance with AS2870 "Residential slabs and footings" is Class P. The standard allows reclassification of such sites. It is our assessment that the existence of an ancient landslide has no significant impact on the design, construction or maintenance of structures on this site. On this basis, we recommend that the design of any structures be based on the reactivity (i.e. shrink/swell) of the subsurface soils.

We recommend that civil engineering and building works be undertaken in accordance with good practice for hillside developments."

3. APPLICABILITY TO PROPOSED SUBDIVISION CONCEPT DESIGN

We have reviewed the details of the Subdivision Concept Design and consider that the recommendations provided in the PSM report and transcribed above are appropriate for the proposed Subdivision Concept Design.

On this basis we confirm that the proposed Subdivision Concept Plan, can be built on the site subject to the recommendations in the PSM report transcribed above.

Please do not hesitate to contact the undersigned if you have any queries.

For and on behalf of
PELLS SULLIVAN MEYNINK



GARRY MOSTYN