

Stockland
Level 26
133 Castlereagh Street
Sydney NSW 2000

Attention: Mr Lucas Flecha
Email: Lucas.Flecha@stockland.com.au

**UPDATED PRELIMINARY GEOTECHNICAL ADVICE
PROPOSED REDEVELOPMENT
CASTLE RIDGE RETIREMENT VILLAGE
350 OLD NORTHERN ROAD, CASTLE HILL, NSW**

1 INTRODUCTION

This letter reports our updated preliminary geotechnical advice for the proposed redevelopment of the Castle Ridge Retirement Resort. We have been provided with the following information:

- Extract from the current 'Castle Ridge Resort Urban Design Report' prepared by Architectus (pp 40-45), that was supplied on 18 August 2020;
- Preliminary survey plan drawings prepared by Norton Survey Partners (Ref. 04322, Sheets 1 to 5, dated 11 August 2015);
- Extract from minutes of 'Ordinary Meeting of Council, Tuesday, 12 December 2017', prepared by The Hills Shire Council (Section 1, Item 5, Clause (e) 'Management of Geotechnical Constraints'), including two paragraphs and Figure 8.

Based on the supplied information, we understand that the proposed redevelopment within the eastern half of the site, adjacent to Old Northern Road, will comprise demolition of all existing buildings, pavements and retaining walls and construction of five, 3 to 6 storey buildings (Buildings A to E). Proposed Buildings A, B, C & E will be stepped down the hillside and will include one, two or three common basement levels, which will accommodate lower level living units and/or car parking. The proposed basements will require excavations to a maximum depth of about 6.5m below existing grade, and will be set back at least 8m from the eastern (Old Northern Road) boundary, at least 12m from the northern boundary, and at least 45m from the southern boundary.

We also understand that the proposed redevelopment within the western half of the site, adjacent to Palisander Place, will comprise demolition of all existing buildings, pavements and retaining walls and





construction of four, 3 to 5 storey buildings (Buildings F to I). Buildings F to I will be underlain by one or two common basement levels, which will accommodate lower level living units and/or car parking. The proposed basement levels will be set back at least 5m from the site boundaries, and will require a maximum excavation depth of about 9m below existing grade.

This letter supersedes our previous 'Preliminary Geotechnical Advice' report, Ref. '29235ZAlet3' dated 7 December 2018.

2 BACKGROUND INFORMATION

The site is located in areas of known hillside instability (ie. creep movement). Our involvement at the site to date is summarised below:

Eastern Half of Site

Between 1983 and 1988, Jeffery and Katauskas Pty Ltd, now trading as JK Geotechnics, completed investigations and stability assessments, and provided geotechnical advice prior to, and during construction of the eastern half of the current retirement resort adjacent to Old Northern Road. In this area, significant earthworks and drainage works (landslide stabilisation measures) were completed. Trench drains were installed into the hillside in a herringbone pattern. Our involvement in this project was published in Jeffery (1987) [Reference 1].

In early 2016, we completed three deep cored boreholes to about 16m depth within the upper reaches of the propose development footprint. All boreholes encountered sub-horizontally bedded (undisturbed) siltstone bedrock (formerly referred to as shale bedrock) at relatively shallow depths.

Western Half of Site

Our involvement in the western half of the site, adjacent to Palisander Place and prior to development, was limited to a preliminary geotechnical investigation and stability assessment in 1987. It was our opinion then that there was a medium to high risk of instability affecting this portion of the site. The backscarp of the previous landslide, which extends through the site, was located in the neighbouring property to the north. We had no further involvement in this area following submission of our 1987 report; that is, we had no involvement during construction of the residential units.

Between 2015 and 2017, we investigated a distressed retaining wall in the rear yards of Units 413 & 414, located on the northern side of the access road off Palisander Place. A cored borehole was completed adjacent to the northern site boundary and encountered weathered siltstone bedrock (disturbed landslide material) from 0.7m to at least 8.4m depth.

In May 2019, JK Geotechnics installed inclinometers and piezometers into five cored boreholes, which were drilled across the western half of the site to depths ranging between 9.6m and 15.3m. All cored boreholes extended through the disturbed landslide material and were terminated within the underlying unaltered 'stable' siltstone bedrock. The inclinometers (one per borehole) were installed to monitor the depth and rate of the landslide movement. The vibrating wire (VW) piezometers (two per borehole at targeted levels) were

installed to monitor groundwater pressures above and below the slide plane. The inclinometer and piezometer monitoring is ongoing.

3 GEOTECHNICAL OPINION

Considering the known hillside instability at the site, we understand that Council is concerned that no detailed geotechnical investigations for the proposed development have been undertaken. For the proposed development within the eastern half of the site, we recommend that additional boreholes be completed to further assess the subsurface conditions.

Jeffery (1987) indicated that the current residential buildings were “*all located on the higher, stable ground*”. We would therefore expect that the proposed new buildings will be predominately positioned and founded in ‘stable’ siltstone bedrock. It is however possible that the western extremities of proposed Buildings A & B will overlie previously stabilised landslide material. During the recommended investigation, if there was any doubt as to the stability of this area, then practical solutions can be engineered. An option would be to remove all landslide materials by over-excavation down to ‘stable’ siltstone bedrock, installation of drainage within the hillside excavation to alleviate any future build-up of groundwater pressure (which is the main trigger for slope instability), and backfilling the excavation with engineered fill. It is therefore our opinion that the proposed redevelopment within the eastern half of the site is feasible from a geotechnical perspective, subject to completion of the geotechnical investigation.

From our limited duration monitoring since June 2019 within the western half of the site and our inspection of Units 413 & 414 and surrounding buildings, we expect that creep movements are still occurring but at a very slow rate; likely $\leq 1\text{mm/year}$. Based on our cored borehole information, the maximum depth of the slide plane within this portion of the site appears to be about approximately 10m. In order to adequately assess the creep movement, it is our opinion that the inclinometer and VW piezometer monitoring period will need to extend for a least two more years, and should include several heavy and prolonged rainfall periods so that a relationship can be established between rainfall and groundwater pressures.

We expect that the slide plane below proposed Buildings F to I, at least partially, extends below the proposed bulk excavation levels. Again, engineering solutions to stabilise and drain the landslide can be devised following completion of the monitoring. An option would be to install cast-insitu retention systems (eg. anchored contiguous pile walls) to support the hillside above the proposed development area, over-excavation down to ‘stable’ siltstone bedrock, installation of drainage within the hillside excavation to alleviate any future build-up of groundwater pressure, and backfilling the excavation up to the design bulk levels with engineered fill.

It is therefore our opinion that the proposed redevelopment within the western half of the site is feasible from a geotechnical perspective, on condition that the monitoring confirms the nature and triggers of the creep movement.

4 GENERAL COMMENTS

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose. If there is any change in the proposed development described in this report then all recommendations should be reviewed. Copyright in this report is the property of JK Geotechnics. We have used a degree of care, skill and diligence normally exercised by consulting engineers in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report. The report shall not be reproduced except in full.

Should you require any further information regarding the above, please do not hesitate to contact the undersigned.

Yours faithfully
For and on behalf of
JK GEOTECHNICS



Andrew Jackaman
Principal Geotechnical Engineer

Reference 1: Jeffery, R.P., (1987) 'A Case Study of Subsurface Drains at Rogans Hill', in Walker, B.F. & Fell, R. (eds.) Soil Slope Instability and Stabilisation, AA Balkema, Netherlands, pp 347-351

© Document copyright of JK Geotechnics

This report (which includes all attachments and annexures) has been prepared by JK Geotechnics (JKG) for its Client, and is intended for the use only by that Client.

This Report has been prepared pursuant to a contract between JKG and its Client and is therefore subject to:

- a) JKG's proposal in respect of the work covered by the Report;
- b) The limitations defined in the Client's brief to JKG;
- c) The terms of contract between JK and the Client, including terms limiting the liability of JKG.

If the Client, or any person, provides a copy of this Report to any third party, such third party must not rely on this Report, except with the express written consent of JKG which, if given, will be deemed to be upon the same terms, conditions, restrictions and limitations as apply by virtue of (a), (b), and (c) above.

Any third party who seeks to rely on this Report without the express written consent of JKG does so entirely at their own risk and to the fullest extent permitted by law, JKG accepts no liability whatsoever, in respect of any loss or damage suffered by any such third party.

At the Company's discretion, JKG may send a paper copy of this report for confirmation. In the event of any discrepancy between paper and electronic versions, the paper version is to take precedence. The USER shall ascertain the accuracy and the suitability of this information for the purpose intended; reasonable effort is made at the time of assembling this information to ensure its integrity. The recipient is not authorised to modify the content of the information supplied without the prior written consent of JKG.