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Date: 01 September 2025
No. Pages: 5
Project No.: 2024-121

88 Republic of Gladys,
12-14 Gladys Ave,
Frenchs Forest, NSW 2086

Geotechnical Assessment for 12-14 Gladys Avenue, Frenchs Forest

This letter report details the results of a revised preliminary landslip assessment required by Northern Beaches Council to accompany all new Development or Building Certificate Applications. It is a review of the updated design plans following a walk over visual assessment of the stability of the existing property, no in-situ testing was undertaken.

The assessment follows the guidelines as set out in Section E10-Landslip Risk of Warringah Councils 2011 LEP Planning Rules.

It follows previous investigations undertaken at the site by others - White Geotechnical Group, Project No. J4186, Dated: 19/05/2022 & 19/08/2022 and Martens Consulting Engineers, Project No.: P1806545JR01V04, Dated: 07/2020.

1. Landslip Risk Class:

According to Landslip Risk Map sheet _LSR008, the site is located within Landslip Risk Class Areas "A" – Slope <5º, "B" – Flanking Slopes 5° to 25° and "C" – Slopes >25º.

2. Site Location:

The site is located on the northwest side of the road within gentle to steep north dipping topography. It comprises two blocks (12 Gladys Avenue – Lot A/DP393276 and 14 Gladys Avenue – Lot B/DP393276). The combined lots form a roughly trapezoidal shaped block with a long driveway, with the driveway portion of the site approximately 9.40m wide and 31.205m long. The main portion of the site has an eastern boundary of 90.10m, a northern rear boundary sum of 57.91m, and a western boundary of 52.0m, with the site covering an area of approximately 4,704m^2 as referenced from the provided survey plan. The site elevations vary from a high of approximately RL156.73m at the street front to a low of RL130.60m at the northwest corner.

3. Proposed Development:

It is understood the proposed works involve the demolition of existing site structures, the amalgamation of the two lots and construction of a multi-storey seniors living facility consisting of three apartments towers of three to four storeys in height over basement carpark and storage areas. The proposed works will require bulk excavation to a maximum of approximately 9.0m depth that will extend to within 0.20m in one isolated part of the site but are generally located >2.00m from the side boundaries.

4. Existing Site Description:

The site is located on the low northwest side of Gladys Avenue which comprises a bitumen pavement that is gently northeast dipping and contains low concrete gutters along the sides. Between the gutters and front site boundary the road reserve contains a grass lawn and a bitumen driveway. Cracking, ground movement or signs of underlying geotechnical issues were not observed within the road reserve which appeared in good condition.

The full length of the driveway access portion of the site is approximately 30m with grassed sides and some large mature trees adjacent to the driveway, with the area gently north dipping towards the bulk of the site. The driveway opens out to the main portion of the site which is gently north dipping towards the existing site structures.

The structures comprise a single-storey brick and rendered (No.12 Gladys Ave) and a one and two-storey masonry and timber clad (No. 14 Gladys Ave) residential dwellings of estimated construction age of ~60 years. The structures showed signs of superficial aging however there were no visible signs of any significant cracking or settlement to indicate underlying geotechnical issues.

To the rear (north) of the dwellings the sandstone bedrock outcrops in a cliff line that extends roughly east-west across the site and is estimated to be up to ~4.0m high in places. The sandstone was preliminarily assessed as low to medium strength with roughly horizontal bedding parts at approximately 2.0m vertical intervals, with overhangs at the base extending up to ~2.0m horizontally into the slope and 0.60m vertically at the face. The slope above is heavily vegetated, with a pool below the cliff line. Below this pool the site is heavily vegetated however appears to be steeply north sloping and contains boulders of various size up to approximately 1.50m maximum dimension.

5. Neighbouring Property Conditions:

The neighbouring properties to the southwest (No. 10, 10a and 10b Gladys Avenue) contain two-storey brick residential structures set within ~1.0m of the common boundary. The structures appeared to be in good condition without signs of cracking or excessive settlement and have an estimated construction age of ~30 years. There was limited visibility into these properties however these were no indications of geotechnical instability noted during the inspection.

The property to the east (No. 16A Gladys Avenue) comprises a battle axe block with a long driveway adjacent to the site's eastern boundary leading to the main portion of the property which contains a two-storey brick residence positioned northeast of the existing dwelling at No. 14. It was not possible to make a thorough assessment of the structures or ground levels due to the limited visibility however obvious signs of ground movement or underlying geotechnical issues were not observed at the property.

The neighbouring properties to the north (No. 4 Arden Place and No. 66 Epping Drive) were not able to be inspected due to the dense vegetation at the rear (north) of the site preventing visibility. These properties are set lower than the site with separation distances from the proposed works to the shared boundary in excessive of 25m.

6. Assessment:

Based on the above items and on Councils flow chart check list (Page: 2 of 2 in Section E10), i.e., does the present site or proposed development contain:

- History of Landslip — No
- Proposed Excavation/Fill >2m — Yes
- Site developed — Yes
- Existing Fill >1m — No
- Site Steeper than 1V:4H — Yes – To the rear (north) of existing structures
- Existing Excavation >2m — No
- Natural Cliffs >3m — Yes

It is considered that a due to the nature of proposed DA submission and existing site stability, a detailed Landslip Risk Assessment for this Development Application is required. A risk analysis for anticipated geotechnical hazards is presented below along with preliminary design and construction recommendations.

7. Site Specific Landslip Risk Assessment

Based on our site investigation we have identified the following geological/geotechnical landslip hazards which need to be considered in relation to the existing site and the proposed works. The main hazards are:

A. Landslide (earth slide) due to collapse of proposed excavation (<5m^3);
B. Landslide (rock slide) due to poorly oriented defects in the bedrock (<20m^3)
C. Boulder impact from dislodged boulder in steep, vegetated area at rear of site during or following proposed works.

A qualitative assessment of risk to life and property related to these hazards is presented in **Tables A and B**, Appendix: 1, and is based on methods outlined in Appendix: C of the Australian Geomechanics Society (AGS) Guidelines for Landslide Risk Management 2007. AGS terms and their descriptions are provided in Appendix: 2.

The Risk to Life from Hazard **A** was estimated to be up to **1.04 x 10^{-5}** for any person while the Risk to Property was considered to be up to '**Moderate**', which is unacceptable without treatment. Detailed investigation, planning and implementation of treatment options are required to reduce risk to Low.

The Risk to Life from Hazard **B** was estimated to be up to **2.75 x 10^{-5}** for any person while the Risk to Property was considered to be up to '**High**', which is unacceptable without treatment. Detailed investigation, planning and implementation of treatment options are required to reduce risk to Low.

The Risk to Life from Hazard **C** was estimated to be up to **1.05 x 10^{-5}** for any person while the Risk to Property was considered to be '**Moderate**', which is unacceptable without treatment. Detailed investigation, planning and implementation of treatment options are required to reduce risk to Low

The assessments were based on excavations with no support, planning or implementation of engineered retention and with no consideration of vibration limits.

It is considered likely that excavation into the existing cliff line below the residential structures may improve the overall stability of the site, as the overhangs and any boulders within that area would be removed whilst excavation instability can be effectively mitigated by installation of suitable retention systems and regular geotechnical inspection/supervision.

As such, the project is considered suitable for the site provided the recommendations of this report and future assessment/reporting are implemented.

8. Preliminary Geotechnical Assessment and Recommendations

The proposed works involve the demolition of existing site structures and construction of a three to four storey seniors living facility over a basement carpark and storage areas. The proposed works will require bulk excavation to approximately 9.0m depth that will extend to within 0.50m of the south-western side boundary and will be >2.0m from all other side boundaries.

The excavation is anticipated to extend through shallow fill and residual soils to depths up to approximately 2.10m, with the excavation also extending into the very low to medium strength sandstone bedrock.

It is expected that safe batter slopes as outlined below will be possible around the much of the excavation perimeter where the separation to the site boundaries is greater than ~3.0m, however this will need to be confirmed following clearing of the site.

The temporary safe batter slopes are 1V:2H for fill and natural soils, 1V:1H for natural clay soils and 1V:0.5H for low strength and better sandstone, pending geotechnical inspection of the rock mass. Where good quality medium strength sandstone bedrock is exposed then permanent, vertical unsupported batter slopes will be possible.

Pre-excavation support is expected to be required along the southern-western portion of the excavation perimeter to prevent deflection in the neighbouring property as well as anywhere the safe batter slopes provided are not possible within the site boundaries.

Temporary support could comprise soldier piles which may then be incorporated into the completed structure, with shotcrete infill panels, or a steel I beam and whaler system provide design life and risk requirements can be met.

Any retaining structure will need to be designed and constructed in accordance with AS4678-2002 Earth Retaining Structures using the parameters provided in the White (2022) Section 14, an excerpt of which is provided below. It is recommended that 'At Rest' (K_o) values are adopted in the design adjacent to site boundaries.

Unit	Earth Pressure Coefficients		
	Unit weight (kN/m^3)	'Active' K_a	'At Rest' K_0
Fill, Topsoil, Sand	20	0.40	0.55
Residual Clays	20	0.35	0.45
Low Strength Sandstone	24	0.20	0.34
Medium Strength Sandstone	24	0.00	0.01

For rock classes refer to Pells et al "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region". Australian Geomechanics Journal 1978.

Excerpt 1: Table 1 of White Geotechnical Group Report (2022)

Inspections of excavations undertaken through sandstone bedrock will need to be undertaken by a geotechnical engineer in order to assess the rock mass and determine the need for additional stabilisation such as rock bolts or shotcrete.

Deflection in the excavation will occur, even where in medium strength and high quality bedrock. This excavation will generally dissipate at short distance from the excavation crest and is generally highest at the centre of east-west striking excavation faces, therefore this is only a potential hazard at the south-western excavation face. However, this boundary contains a sewer main, likely indicating that a Specialist Engineering Assessment will be required by Sydney Water. One residential dwelling is located adjacent to this boundary however the separation distance (>3.5m) to the excavation indicates low probability of detrimental impact.

Whilst groundwater is not anticipated in any significant volume due to the site location adjacent a ridge crest with steep natural cliff lines and slopes to the rear, seepage should be anticipated. Current standards detail tanking requirements with long term monitoring required where a drained basement design is preferred. This should be considered in design, application and project planning to ensure the required testing can be completed with sufficient timing to reduce delays.

Footings should all extend to the low strength or better sandstone bedrock to reduce the risk of differential settlement, with only ancillary structures founded within the residual sandy clay soil. Footings may be designed for an allowable bearing pressure of 1,000kPa for low strength sandstone and 2,000kPa for medium strength sandstone, although this will require confirmation following further geotechnical investigation including coring of the bedrock to below basement levels.

Provided the recommendations outlined below as well as those outlined in White (2022) are implemented including the installation of the recommended engineered retention of the excavation and consideration of vibration limits and survey of boulders the likelihood of any failure becomes 'Rare' and as such the consequences reduce and risk becomes within 'Acceptable' levels when assessed against the criteria of the AGS 2007.

The following recommendations must be implemented to allow CGC to assist in final certifications:

- Additional geotechnical investigation prior CC stage including cored boreholes to below the proposed depth of excavation to confirm site, bedrock and groundwater characteristics with provision of development specific geotechnical reporting.
- A survey of the lower, northern section of the site for boulders by a geotechnical engineer or engineering geologist, with stabilization where required.
- Installation of engineered retaining structures where required, designed and constructed in accordance with AS4678-2002 Earth Retaining Structures, with the design reviewed by a geotechnical engineer prior CC.
- An assessment of excavation machinery and methodology by a qualified geotechnical engineer to ensure vibration levels do not impact neighbouring properties or boulders, with installation of full time vibration monitoring to neighbouring structures where determined within the potential influence zone.

9. Date of Assessment: 01 September 2025

10. Assessment by:

Troy Crozier
Principal
MIE Aust, CPEng (NER – Geotechnical)

11. References:

- Architectural Drawings – Smith & Tzannes, Project No.: 24_041, Drawings DA-A-000 to DA-A-001 and DA-A-010 to DA-A-015, all Dated 14th May 2025, and DA-A-100 to DA-A-107 and DA-A-200 to DA-A-200 to DA-A-209 all Dated 9th July 2025
- Geotechnical Reports – White Geotechnical Group, Project No. J4186, Dated: 19/05/2022 & 19/08/2022
- Geotechnical Report – Martens Consulting Engineers, Project No.: P1806545JR01V04, Dated: 07/2020

TABLE : A

Landslide risk assessment for Risk to life

HAZARD	Description	Impacting	Likelihood of Slide	Spatial Impact of Slide		Occupancy	Evacuation	Vulnerability	Risk to Life
A	Landslip (earth slide) due to collapse of proposed excavation (<5m^3)		Excavation up to 2.0m depth through soils	excavation within 0.20m of south-west boundary to No. 10, 10a, >2.00m to all other boundaries or to negligible depth		Persons occupancy in 24h period avge over year: within dwelling 20hrs, within pool 0.25hrs, driveway 0.25hrs, backyard 1hrs	Almost Certain to not evacuate dwelling due to visibility Likely to evacuate pool, driveway, backyard due to scale and style of slide		
			Possible	**Prob. of Impact**	**Impacted**				
		a) No. 10 Dwelling	0.001	0.05	0.01	0.8333	1.00	0.05	**2.08E-08**
		b) No. 10a Dwelling	0.001	1.00	0.05	0.8333	1.00	0.25	**1.04E-05**
		c) No. 10b Dwelling	0.001	0.05	0.01	0.8333	1.00	0.05	**2.08E-08**
		d) No. 10b Pool	0.001	1.00	0.50	0.0104	0.25	0.25	**3.26E-07**
		e) No. 16a driveway	0.001	0.25	0.10	0.0104	0.25	0.25	**1.63E-08**
		f) No. 16 Dwelling	0.001	0.05	0.01	0.8333	1.00	0.05	**2.08E-08**
		g) No. 35 Bluegum Cr - Backyard	0.001	0.01	0.01	0.0417	0.25	0.05	**5.21E-11**
		h) No. 35 Bluegum Cr - Pool	0.001	0.01	0.01	0.0104	0.25	0.05	**1.30E-11**
B	Landslip (rock slide) due to intersection of poorly oriented defects in proposed excavation (<20m^3)		Excavation up to 6.0m depth through bedrock below soils, requires intersecting defects	Expected to impact small portion of structure and garden above		Persons occupancy in 24h period avge over year: within dwelling 20hrs, within pool 0.25hrs, driveway 0.25hrs, backyard 1hrs	Almost Certain to not evacuate dwelling due to visibility Possible to evacuate pool, driveway, backyard due to scale and style of slide		
			Unlikely	**Prob. of Impact**	**Impacted**				
		a) No. 10 Dwelling	0.0001	0.10	0.10	0.8333	1.00	0.05	**4.17E-08**
		b) No. 10a Dwelling	0.0001	1.00	0.33	0.8333	1.00	1.00	**2.75E-05**
		c) No. 10b Dwelling	0.0001	0.25	0.05	0.8333	1.00	0.05	**5.21E-08**
		d) No. 10b Pool	0.0001	1.00	1.00	0.2500	0.50	1.00	**1.25E-05**
		e) No. 16a driveway	0.0001	1.00	0.25	0.2500	0.50	1.00	**3.13E-06**
		f) No. 16 Dwelling	0.0001	0.50	0.05	0.8333	1.00	0.05	**1.04E-07**
		g) No. 35 Bluegum Cr - Backyard	0.0001	0.05	0.05	0.0417	0.50	0.05	**2.60E-10**
		h) No. 35 Bluegum Cr - Pool	0.0001	0.01	0.01	0.8333	0.50	0.05	**2.08E-10**
C	Boulder impact from dislodged boulder in steep, vegetated area at rear of site during or following proposed works		Boulders up to ~1.50m maximum dimension in rear of site may be dislodged due to vibration, impact or due to changed surface water conditions eroding around base of boulder	Extent and size of boulders unknown due to dense vegetation a) and b) Boulder may impact small portion of either propoerty c)Boulder may impact small portion of rear garden area		Persons occupancy in 24h period avge over year: within dwelling 20hrs, within pool 0.25hrs, driveway 0.25hrs, backyard 1hrs	Almost Certain to not evacuate dwelling due to visibility Possible to evacuate pool, driveway, backyard due to scale and style of slide	Impact by boulder,	
			Possible	**Prob. of Impact**	**Impacted**				
		a) Outdoor areas and structure No. 4 Arden Place	0.001	0.10	0.01	0.1667	0.50	1.00	**8.33E-08**
		b) Dwelling in No. 66 Epping Drive	0.001	0.25	0.05	0.8333	1.00	1.00	**1.04E-05**
		c) Persons in rear of site	0.001	0.25	0.10	0.1667	0.50	1.00	**2.08E-06**

* hazards considered in current condition and/or without remedial/stabilisation measures
* likelihood of occurrence for design life of 100 years
* Spatial Impact - Probability of Impact referes to slide impacting structure/area expressed as a % (1.00 = 100% probability of slide impacting area if it occurs), Imapcted refers to % of area/strucure impacted if slide occurred
* neighbouring houses considered for bedroom impact unless specified
* considered for person most at risk
* considered for adjacent premises/buildings founded via shallow footings unless indicated
* evacuation scale from Almost Certain to not evacuate (1.0), Likely (0.75), Possible (0.5), Unlikely (0.25), Rare to not evacuate (0.01). Based on likelihood of person knwoing of landslide and completely evacuating area prior to landslide impact.
* vulnerability assessed using Appendix F - AGS Practice Note Guidelines for Landslide Risk Management 2007

TABLE : B

Landslide risk assessment for Risk to Property

HAZARD	Description	Impacting	Likelihood		Consequences		Risk to Property
A	Landslip (earth slide) due to collapse of proposed excavation (<5m3)	a) No. 10 Dwelling	Rare	The event is conceivable but only under exceptional circumstances over the design life.	Minor	Limited Damage to part of structure or site requires some stabilisation or INSIGNIFICANT damage to neighbouring properties.	Very Low
		b) No. 10a Dwelling	Possible	The event could occur under adverse conditions over the design life.	Medium	Moderate damage to some of structure or significant part of site, requires large stabilising works or MINOR damage to neighbouring property.	Moderate
		c) No. 10b Dwelling	Rare	The event is conceivable but only under exceptional circumstances over the design life.	Minor	Limited Damage to part of structure or site requires some stabilisation or INSIGNIFICANT damage to neighbouring properties.	Very Low
		d) No. 10b Pool	Possible	The event could occur under adverse conditions over the design life.	Medium	Moderate damage to some of structure or significant part of site, requires large stabilising works or MINOR damage to neighbouring property.	Moderate
		e) No. 16a driveway	Possible	The event could occur under adverse conditions over the design life.	Medium	Moderate damage to some of structure or significant part of site, requires large stabilising works or MINOR damage to neighbouring property.	Moderate
		f) No. 16 Dwelling	Unlikely	The event might occur under very adverse circumstances over the design life.	Minor	Limited Damage to part of structure or site requires some stabilisation or INSIGNIFICANT damage to neighbouring properties.	Low
		g) No. 35 Bluegum Cr - Backyard	Rare	The event is conceivable but only under exceptional circumstances over the design life.	Minor	Limited Damage to part of structure or site requires some stabilisation or INSIGNIFICANT damage to neighbouring properties.	Very Low
		h) No. 35 Bluegum Cr - Pool	Rare	The event is conceivable but only under exceptional circumstances over the design life.	Minor	Limited Damage to part of structure or site requires some stabilisation or INSIGNIFICANT damage to neighbouring properties.	Very Low
B	Landslip (rock slide) due to intersection of poorly oriented defects in proposed excavation (<20m3)	a) No. 10 Dwelling	Rare	The event is conceivable but only under exceptional circumstances over the design life.	Minor	Limited Damage to part of structure or site requires some stabilisation or INSIGNIFICANT damage to neighbouring properties.	Very Low
		b) No. 10a Dwelling	Possible	The event could occur under adverse conditions over the design life.	Major	Extensive damage to most of site/structures with significant stabilising to support site or MEDIUM damage to neighbouring properties.	High
		c) No. 10b Dwelling	Unlikely	The event might occur under very adverse circumstances over the design life.	Medium	Moderate damage to some of structure or significant part of site, requires large stabilising works or MINOR damage to neighbouring property.	Low
		d) No. 10b Pool	Possible	The event could occur under adverse conditions over the design life.	Major	Extensive damage to most of site/structures with significant stabilising to support site or MEDIUM damage to neighbouring properties.	High
		e) No. 16a driveway	Likely	Event will probably occur under adverse circumstances over the design life.	Medium	Moderate damage to some of structure or significant part of site, requires large stabilising works or MINOR damage to neighbouring property.	High
		f) No. 16 Dwelling	Possible	The event could occur under adverse conditions over the design life.	Minor	Limited Damage to part of structure or site requires some stabilisation or INSIGNIFICANT damage to neighbouring properties.	Moderate
		g) No. 35 Bluegum Cr - Backyard	Unlikely	The event might occur under very adverse circumstances over the design life.	Minor	Limited Damage to part of structure or site requires some stabilisation or INSIGNIFICANT damage to neighbouring properties.	Low
		h) No. 35 Bluegum Cr - Pool	Rare	The event is conceivable but only under exceptional circumstances over the design life.	Minor	Limited Damage to part of structure or site requires some stabilisation or INSIGNIFICANT damage to neighbouring properties.	Very Low
C	Boulder impact from dislodged boulder in steep, vegetated area at rear of site during or following proposed works	a) Outdoor areas and structure No. 4 Arden Place	Possible	The event could occur under adverse conditions over the design life.	Medium	Moderate damage to some of structure or significant part of site, requires large stabilising works or MINOR damage to neighbouring property.	Moderate
		b) Dwelling in No. 66 Epping Drive	Possible	The event could occur under adverse conditions over the design life.	Medium	Moderate damage to some of structure or significant part of site, requires large stabilising works or MINOR damage to neighbouring property.	Moderate
		c) Persons in rear of site	Possible	The event could occur under adverse conditions over the design life.	Minor	Limited Damage to part of structure or site requires some stabilisation or INSIGNIFICANT damage to neighbouring properties.	Moderate

* hazards considered in current condition, without remedial/stabilisation measures and during construction works.
* qualitative expression of likelihood incorporates both frequency analysis estimate and spatial impact probability estimate as per AGS guidelines.
* qualitative measures of consequences to property assessed per Appendix C in AGS Guidelines for Landslide Risk Management.
* Indicative cost of damage expressed as cost of site development with respect to consequence values: Catastrophic : 200%, Major: 60%, Medium: 20%, Minor: 5%, Insignificant: 0.5%.