



25 October 2022

## Lightning Constructions (Aust) Pty Limited

Attention: Steve Djogo

RE: Geotechnical Investigation for Proposed Development  
51 Kalang Road, Elanora Heights NSW 2101  
Report No. 2021031-R2

## 1. INTRODUCTION

At the request of Steve Djogo of Lightning Constructions (Aust) Pty Limited (client), a geotechnical fieldwork investigation was undertaken on 14 October 2022 at 51 Kalang Road, Elanora Heights (site). The investigation was carried out by Rapid Geo Pty Ltd on behalf of Willows Engineering Consultants Pty Ltd (Willows Engineering).

This geotechnical report is intended to be read in conjunction with the Willows Engineering report dated 5 July 2021 (ref: 2021031-R1). The previous report was based on a walkover site inspection on 28 June 2021 and review of the supplied documents.

The purpose of this report is to confirm the subsurface conditions of the site, with reference to the drilling investigation. The borehole logs, location plan and fieldwork summary are attached.

Geotechnical recommendations for engineering design and construction have been updated from the previous report and are presented in Section 4.

## 2. FIELDWORK

The drilling investigation confirmed that the site bedrock is Hawkesbury Sandstone. The bedrock was encountered at depths of 1.3 m and 1.7 m in the boreholes.

It is noted that the interpreted depths of the soil and bedrock may vary. Extremely weathered sandstone bedrock may occur at the soil-bedrock interface. The sandstone bedrock may be encountered in a range of 0.5 m to 1.5 m below the surface levels.

Groundwater seepage was not encountered during the fieldwork. However, seepage is expected to occur at the soil-bedrock interface. The rate of seepage varies depending on the topography, subsurface profile, drainage and preceding weather patterns.

Based on experience, the sandstone bedrock at the site is assessed to be equivalent to Class V sandstone as defined in *"Foundations on Sandstone and Shale in the Sydney Region"* by Pells, Mostyn and Walker (ref: Pells 1998).

The bedrock at the proposed development foundation level is anticipated to be at least equivalent to Class V sandstone. However, the bedrock strength and quality may increase with depth to Class IV sandstone or Class III sandstone.

### **3. SUBSURFACE CONDITIONS**

The site subsurface profile is described in the attached borehole logs for BH1 and BH2 and summarised below:

#### 0 to 0.3m

Topsoil (Clayey SILT - low plasticity, dark brown, full of organics, very moist, soft), overlying

#### 0.3 to 1.3m / 1.7m (variable)

FILL - SAND (low plasticity, pale brown, very moist, loose) and

RESIDUAL SOIL - Silty clayey SAND (low plasticity, pale brown, very moist, firm), overlying

#### 1.3m to 1.7m + (variable)

Sandstone bedrock (low strength, highly weathered, equivalent Pells Class V).

### **4. RECOMMENDATIONS**

Recommendations for design and construction of the proposed development are set out in Sections 4.1 to 4.7, based on the interpreted geotechnical model and fieldwork investigation. These recommendations have been adapted from and supersede the 2021 report recommendations.

#### **4.1. Geotechnical Review**

Geotechnical inspections can be scheduled in conjunction with the builder, to review the exposed conditions following the initial earthworks. The inspections may address items such as temporary surface drainage, excavation batters, benching, shoring and foundation bearing capacity. Visual inspections can be supplemented by on-site penetrometer tests, or laboratory tests if required.

#### **4.2. Surface Drainage**

During construction, temporary drainage is recommended to re-direct surface water within the site by shallow earth mounds, in conjunction with plastic sheets, silt fences, hay bales, etc. at stormwater pits. After excavation, the sandstone bedrock is anticipated to resist erosion by surface water flows.

It is recommended that the permanent drainage system be designed to function by gravity. Surface drainage be designed to operate separately from subsoil drainage (e.g. retaining walls).

#### **4.3. Temporary Earthworks**

Proposed cut and fill earthworks are to be planned and undertaken with appropriate measures to manage stability. It is recommended that a geotechnical engineer inspect the site at suitable construction stages to review and advise on the temporary earthworks and risk management. The surface fill / soil and weathered bedrock can be readily excavated by earthmoving machinery. Excavations in sandstone bedrock adjacent to the northern boundary may require use of a rock saw.

Excavations in sandstone bedrock are expected to remain standing unsupported. Shoring may need to be provided to temporary excavations, subject to geotechnical engineer inspection, or if the excavation is to remain open for an extended period.

For unsupported earthworks, it is recommended that:

- Excavations in soil, or fill placed at the site do not exceed 1.5 metres.
- Sloping soil excavations, or fill slopes do not exceed 1H:1V (45°).
- Benched excavations be planned for 1H:1V, with maximum bench heights of 1 metre.
- Temporary erosion protection be provided over the excavation and fill surfaces.

#### **4.4. Excavation Support**

It is recommended that excavation support be provided by:

- Temporary shoring (e.g. star pickets, timber, etc.), during construction.
- Permanent support (e.g. retaining walls) for the completed structures.

It is recommended that a geotechnical engineer inspect and advise on unsupported excavations and temporary support systems during construction.

#### **4.5. Vibrations**

A nominal vibration limit of 5 mm/s peak particle velocity (ppv) is recommended as a guideline to manage ground vibrations from rock excavations. The nominal vibration limit is expected to be achieved by undertaking excavations with saw cuts and small machinery, under geotechnical review.

Rock excavations should be undertaken with low vibration and low impact techniques, using rock saws, rock picks or grinder excavator attachment. If rock breaking machinery is planned to be used, trial excavations and testing are recommended under geotechnical engineer review, to determine the vibration levels generated and offset limits for the equipment type and excavation method.

#### **4.6. Foundation**

An Allowable Bearing Pressure (ABP) of 1000 kPa is recommended for footing design on sandstone bedrock (Class V, low to medium strength). However, an ABP of 150 kPa can be used for the design of shallow footings, founded on natural soil materials below the fill.

It is recommended that:

- The development footings be founded on sandstone bedrock, free from loose, wet and unsuitable materials. Boulders, topsoil and fill are not suitable.
- The foundation be verified by geotechnical engineer inspection prior to concrete pour.

## 4.7. Retaining Structures

It is recommended that retaining walls be designed by a structural engineer in accordance with the provisions of "AS 4678 – Earth-retaining structures". The engineering design drawings, details and notes should indicate the proposed surface and subsoil drainage, footings and required earthworks.

Geotechnical parameters for engineering design of retaining walls are provided in Table 1:

**Table 1 – Geotechnical Parameters for Retaining Wall Design**

Geotechnical Parameter	Fill	Residual Soil	Sandstone (Class V)
Effective Cohesion $c'$ (kPa)	0	0	5
Effective Friction Angle $\phi'$ (degrees)	20	22	42
Effective Unit Weight $\gamma'$ (kN/m <sup>3</sup> )	16	19	24
'Active' Earth Pressure ( $K_a$ )	0.49	0.45	0.2
'At-rest' Earth Pressure ( $K_0$ )	0.66	0.63	0.33
'Passive' Earth Pressure ( $K_p$ )	2.04	2.2	5.04

Note: Earth pressures have been calculated by the Rankine method, assuming normally consolidated soil and relatively level backfill behind the wall. Refer to AS 4678 – Earth-retaining structures Appendix D for typical soil parameters and Appendix E for information on earth pressure calculation methods.

## 5. LIMITATIONS

This geotechnical report has been prepared for Lightning Constructions (Aust) Pty Limited, for the purposes in the introduction. This geotechnical report is intended to be read in conjunction with the description and photos in the Willows Engineering report dated 5 July 2021 (ref: 2021031-R1).

The commentary and geotechnical recommendations in this report are based on experience with similar developments and regional geology on sloping land and review of the aerial photos, supplied drawings and fieldwork investigation results. Geotechnical inspections are recommended to review and advise on the conditions during the development construction.

To discuss this report, please contact the undersigned.

Regards



David Willows  
BE(Hons), CPEng(Civil), MIEAust, NER, A.CIRCEA

### Attachments:

Rapid Geo Pty Ltd report (ref: RG412-GR-1-1) with results of fieldwork investigation on 14/10/2022.

**WILLOWS ENGINEERING PTY LTD**  
 PO Box 6373  
 Rouse Hill NSW 2155

## GEOTECHNICAL REPORT

### Report Summary

<b>Site Classification Report Number:</b>	RG412-GR-1-1
<b>Project Name:</b>	Geotechnical Report
<b>Site Address:</b>	No. 51 Kalang Road, Elanora Heights NSW
<b>Date of Field Work:</b>	14 <sup>th</sup> October 2022
<b>Site Classification:</b>	"A" In accordance with AS2870-2011
<b>Material Description:</b>	Topsoil / fill and Residual Soil with underlying Bedrock
<b>Borehole IDs:</b>	BH1 (0-1.4m) BH2 (0-1.8m)

### 1. INTRODUCTION

This report presents the findings of a geotechnical investigation carried out by Rapid Geo Pty Ltd (RG) at No. 51 Kalang Road, Elanora Heights NSW (the site).

The purpose of the investigation was to assess the subsurface conditions and provide a 'lot classification' in accordance with the "Residential Slabs and Footings" Code AS2870-2011. Any geotechnical constraints encountered during the investigation have been noted in this report and will contribute to the foundation design of the proposed development.

### 2. SCOPE OF WORK


In order to achieve the project objectives, the following scope of work was carried out:

- Walkover of current site conditions
- Two (2) auger drilled boreholes and two (2) 'Dynamic Cone Penetrometer' (DCP) tests
- Logging and engineering assessment of soil
- Preparation of a geotechnical lot classification report

### 3. DESKTOP STUDY, PROJECT SPECIFIC INFORMATION AND FIELDWORK ACTIVITIES

**Table 3.1 Summary of desktop study, project specific information and fieldwork activities**

<b>Geological Survey</b>	The available 'Geological Survey Maps' showed the site to be underlain by Hawksbury Sandstone. The subsurface profile encountered in the boreholes is consistent with the NSW geological maps.
<b>Site Description</b>	At the time of the inspection the lot had a two-story brick dwelling. The site can be described as slightly sloping towards the rear yard. The property was bounded by residential dwellings on either side of the lot and a car park.

<p><b>Scope of Field Investigation</b></p>	<p>Two (2) boreholes were advanced using a drill rig to refusal below surface level. Two (2) DCP tests were conducted on site near the boreholes.</p>
<p><b>Site Classification in Accordance with AS 2870-2011</b></p>	<p>The site is classed as a 'Class-A' site in accordance with AS 2870-2011. The silty clayey sand soils have an assessed characteristic surface movement (<math>y_s</math>) of 0-20 mm.</p> <p>The site can be considered as 'Class-A' provided that the footings for the proposed development are founded below the residual soils into sandstone bedrock.</p>
<p><b>Allowable Bearing Pressure</b></p>	<p>Based on DCP testing, the ground conditions are suitable for an Allowable Bearing Pressure (ABP) of 150 kPa for shallow footings founded within natural soils below fill.</p> <p>An Allowable Bearing Pressure of 1000 kPa is achievable for footings founded in sandstone bedrock.</p>
<p><b>Limitations</b></p>	<p>The subsurface depths quoted in this report were measured from the surface during our site investigation. The description of the strata materials has been provided for easy recognition in general terms over the site. Attached plans and sketches in this report should be considered approximate.</p> <p>If fill is encountered during the excavation and not described in the field investigation logs, then further advice must be obtained prior to placement of footings. Further geotechnical inspection or boreholes may be required to confirm the site conditions.</p> <p>This report is based on the assumption that the results of selective boreholes and point sampling are indicative of the actual site conditions throughout the area. This assumption can be confirmed by geotechnical review during the earthworks and construction. Where variations in conditions across the site are encountered, further geotechnical advice should be sought.</p>
<p><b>References</b></p>	<ul style="list-style-type: none"> <li>• AS 1726-2017 - Geotechnical Site Investigations</li> <li>• AS 2870-2011 - Residential slabs and Footings</li> </ul>
<p><b>Figures</b></p>	 <p style="text-align: center;"><b>Figure 1 – Location of BH1 and BH2</b></p>

Should you need any further information, please do not hesitate to contact us.  
Regards,

Adrian Gunn  
BE (Bachelor of Engineering – School of Civil and Mining) MIEAust.  
Geotechnical Engineer

A handwritten signature in black ink, appearing to read 'Adrian Gunn', written in a cursive style.

BH No: BH1

Sheet: 1 of 1

Job No:RG413

# Bore Hole

**Client:** Willows Engineering

**Started:** 14/10/22

**Project:** 51 Kalang Road, Elanora Heights

**Finished:** 14/10/22

**Location:** 51 Kalang Road, Elanora Heights

**Borehole Size:** 80mm

**Rig Type:** Drill Rig

**Hole Location:** See Figure 1

**Driller:** A Smith


**Logged:** A Gunn

**RL Surface:**

**Contractor:** A Smith

**Bearing:** ---

**Checked:** D Willows

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency Density Index	Additional Observations
ADT	No Groundwater Observed					TOPSOIL: Clayey SILT, low plasticity, dark brown, full of organics, very moist, soft		M	S	TOPSOIL
			0.5			Silty clayey SAND, low plasticity, pale brown, very moist, firm		Vm	F	RESIDUAL
			1.0			SANDSTONE, white, low strength, highly weathered			Hw	BEDROCK
			1.5			Refusal Borehole BH1 terminated at 1.4m				
			2.0							



BH No: BH2

Sheet: 1 of 1

Job No:RG413

# Bore Hole

Client: Willows Engineering

Started: 14/10/22

Project: 51 Kalang Road, Elanora Heights

Finished: 14/10/22

Location: 51 Kalang Road, Elanora Heights

Borehole Size: 80mm

Rig Type: Drill Rig

Hole Location: See Figure 1

Driller: A Smith


Logged: A Gunn

RL Surface:

Contractor: A Smith

Bearing: ---

Checked: D Willows

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency	Density Index	Additional Observations
ADT	No Groundwater Observed		0.5			TOPSOIL: Clayey SILT, low plasticity, dark brown, full of organics, very moist, soft		M	S		TOPSOIL
						SAND, low plasticity, pale brown, very moist, loose		Vm	L		FILL
						Silty SAND, with some clay and ironstone gravel, low plasticity, pale brown, very moist, stiff		Vm	S		RESIDUAL
						SANDSTONE, white, low strength, highly weathered			Hw		BEDROCK
						Refusal Borehole BH2 terminated at 1.8m					
			2.0								

BOREHOLE / TEST PIT GINT DAVID WILLOWS LIGHTING COMPANY.GPJ GINT STD AUSTRALIA.GDT 25/10/22