Geotechnical Retrospective Investigative Report

Prepared for: Julie Marshall

Project Address: 23 Holloway Place, Forest Lake, Hamilton

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Date:7-Jul-25

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REPORT TITLE	Geotechnical Retrospective Investigative Report
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Signature:

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OUTPUT FOR 150mm PILES

OUTPUT FOR 200mm PILES

1 INTRODUCTION

Soil-Eng Ltd was engaged under our proposal letter Q348351 Rev 03 (11 June 2025) to prepare a retrospective geotechnical investigation of the existing dwelling at 23 Holloway Pl, Forest Lake. The objective is to demonstrate, for vendor due diligence under the Sale and Purchase Agreement, that the as-built foundation system is compatible with the sub-surface conditions identified.

2 EXISTING DEVELOPMENT

House and wooden deck plans from 1975 and 2015, respectively, were made available and presented in **Appendices B & C**. This engineer's foundation drawing shows concrete pile foundations without showing the piling depth.

The absence of this piling depth justified the extent of this investigation. The depth to which the piles were constructed was determined using a magnetometer lowered in CPT CPT-driven hole, to detect to depth to which steel in the pile could be detected.

3 SITE DESCRIPTION

The site is legally known as Lot 12 DPS 8449, with an approximate area of 781m² and is accessed from the north-westerly side of Holloway Place, shown in **Figure 1(a) & (b)**.

The site presents mostly gentle slopes. The property is surrounded by residential properties.

Figure 1 (a): Site Location (Waikato MAPI)

Figure 1 (b): Zoomed in Site Location (Waikato MAPI)

4 FIELD INVESTIGATION AND DESKTOP STUDY

Soil-eng Ltd undertook fieldwork in June 2025 to determine the depth of solid ground and to establish the depth of the piles. To establish that the house foundation is sound, we embarked on an investigation to determine the depth of the house's piles and also the depth of stable ground.

The scope of the fieldwork was as follows:

- A walkover survey of the site to assess the general landform and prevailing site conditions;
- Reviewed NZGD logs HA149524 & HA176135; both show ~3.5 m peat over dense pumice sand;
- CPT01 to 20 m (20 t CPT, ASTM D5778), tip resistance qc, sleeve friction fs and pore pressure u2 recorded; results in **Appendix D**;
- Magnetometer probe lowered in CPT hole to detect reinforcing steel; pile toe identified at 3.9–4.0m included in **Appendix D**;

The location of the above test is shown in **Drawing 07-01**. The previous investigations obtained from NZGD at HA149524 & HA176135 coincide with the thickness of peat and sand below the peat that we found with our CPT investigation on this property.

5 GROUND MODEL

5.1 GEOLOGY

The site is underlain by Late Pleistocene alluvial deposits of the Hinuera Formation, which is part of the Tauranga Group and more specifically the Piako Subgroup. These deposits are associated with widespread sedimentation events following major volcanic eruptions and regional fluvial reworking. The Hinuera Formation at this location typically comprises cross-bedded pumiceous sand, with subordinate silt, gravel, and interbedded peat layers. The sediments are largely unconsolidated, poorly sorted, and exhibit variable layering and grain size due to depositional processes within an ancestral braided river environment. The pumiceous nature of the sand and gravel reflects significant input from volcaniclastic sources, primarily from eruptions in the Taupō Volcanic Zone.

These deposits are classified as clastic sediments of sandstone lithology, and their engineering properties can include low density, high compressibility, and moderate to low shear strength, particularly where organic material such as peat is present. The presence of pumice may lead to increased liquefaction susceptibility under seismic loading.

Due to their relatively young age (Late Pleistocene, ~0.0–0.126 million years), these deposits have not undergone significant cementation or lithification and remain geotechnically active under load, requiring detailed site-specific investigation and potential ground improvement measures in certain foundation scenarios. Also see **Figure 2** below.

Figure 2: Regional Geology (GNS Geology in Google Earth)

5.2 STRATIGRAPHY

The stratigraphical layers observed at this site are presented in **Table 1**.

Table 1: Stratigraphical units for the site

Layer Description	Average Depth		Average Layer Thickness	CPT Inferred Values	
	From [m]	To [m]	[m]	qt [MPa]	SPT N_{60}
Topsoil	0	0.1	0.1	0.4	2
Peat Clay	0.1	3.8	3.7	2.5	8
Silty Sand	3.8	9.6	5.8	6	12

Surrounding investigations studied from the New Zealand Geotechnical Database also more or less confirm the occurrence of the layers presented in **Table 1**.

5.3 SEISMIC SITE SUBSOIL CATEGORY

The Seismic Site Subsoil Category (SSC) refers to the classification of near-surface ground conditions based on stiffness and depth of soil layers, which influence earthquake ground motions. Per NZS 1170.5:2004 Table 3.1, the site is classified as Class D due to the depth and stiffness characteristics of underlying soil layers.

5.4 GROUNDWATER

The water table observed during the investigation, in June 2025, was 0.85m below ground level.

6 GEOHAZARDS

6.1 SEISMICITY

The earthquake scenarios of SLS and ULS have their respective PGAs[1] Displayed in **Table 2.**

Table 2: Design Peak Ground Acceleration for various Limit States

Limit State	AEP	R	PGA(g)	$Magnitude_{eff}$
SLS	25	0.25	0.06	5.9
ULS	500	1	0.25	5.9
Note: SLS refers to the serviceability limit state, ULS to the ultimate limit state, and AEP to the annual exceedance probability.				

[1] MBIE Module 1: Overview of the guidelines Building Performance Earthquake Geotechnical Engineering Practice NZ November 2024

6.2 FAULT RUPTURE

Based on the Institute of Geological and Nuclear Science (GNS) 's active fault database, the fault shown in Figure 3 is about 40km northwest of the site location, as shown below. As a result, there is a low risk of a fault rupture affecting the site.

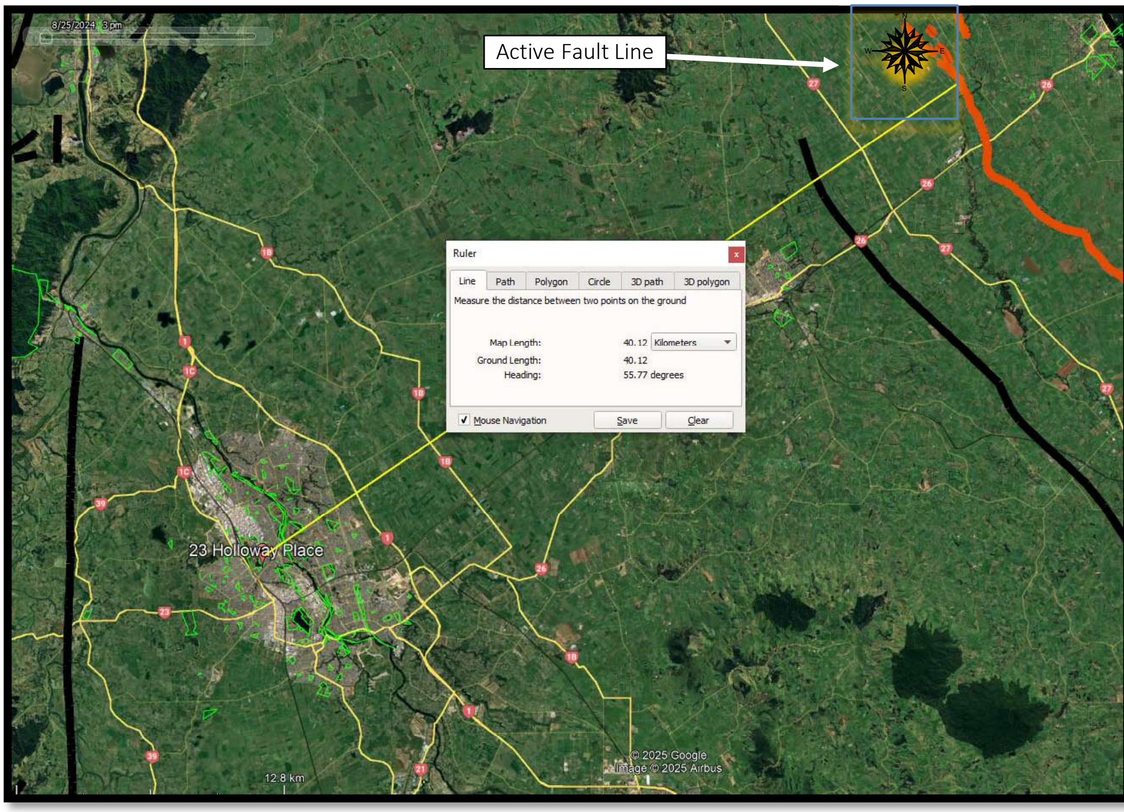


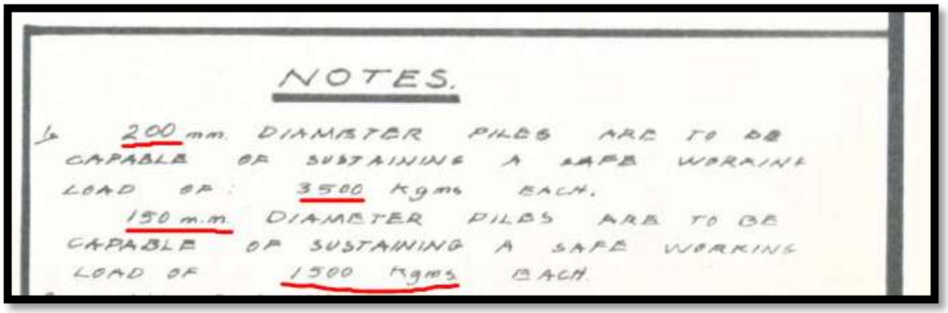
Figure 3: Closest active fault line

6.3 SLOPE STABILITY

Due to a gentle slope and site geology, we consider the risk of slope failure low.

7 CONCLUSIONS

Figure 4 presents the original Structural Engineer's statement of actual safe working loads applied by the 150mm & 200mm Diameter piles that supports the house. The registered engineers' credentials are presented in **Figure 5** below.


NOTES.

1. 200 mm DIAMETER PILES ARE TO BE CAPABLE OF SUSTAINING A SAFE WORKING LOAD OF : 3500 Kgms EACH.

150 m.m. DIAMETER PILES ARE TO BE CAPABLE OF SUSTAINING A SAFE WORKING LOAD OF 1500 Kgms EACH.

Figure 4: Structural Engineer's calculated forces applied by the 150mm & 200mm Diameter piles – taken from the engineers' drawings – Appendix B

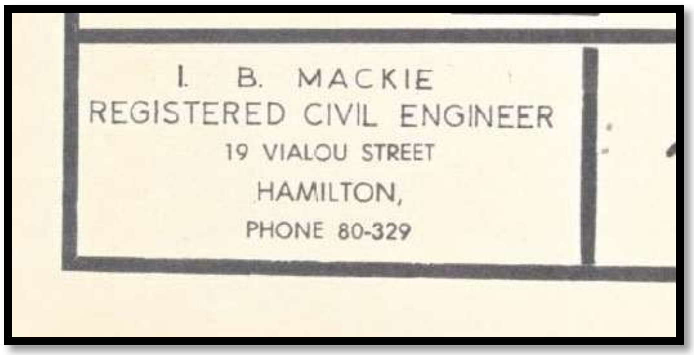

I. B. MACKIE
REGISTERED CIVIL ENGINEER
19 VIALOU STREET
HAMILTON,
PHONE 80-329

Figure 5: Structural Engineer's credentials – as taken from the engineer's drawings

The presented safe working loads of 3.5kN and 1.5kN are equivalent to 3.5 × 3 = Qu = 10.5kN and Qu = 1.5 × 3 = 4.5kN ultimate loads. Which will produce applied ultimate pressures of $q_u = Q_u/(\pi[½D^2])$. The Pile Diameters of 200mm and 150mm will therefore produce applied pressures of 334kPa & 255kPa respectively. Therefore, the maximum expected applied pressure from the piles is 334kPa.

The Magnetometer investigation confirmed that the pile depth is constructed to a depth of 4m. The wooden deck, in front of the house, was also founded at a depth of about 4m, which confirms that the stable ground is found at this depth. The wooden deck plans and design are presented in **Appendix C**.

The ultimate pile base bearing capacity from a depth of 3.8m is in the order of 800kPa and increases to 1,000kPa at a depth of 9.8m. These results are inferred from **Appendix E** for the CPeIT licensed CPT interpretation software pile calculation output, for a 150mm and 200mm Diameter driven pile.

To put the above in perspective, the soil that supports the bottom of the piles and the house can provide three times more resistance than what is required. This is further confirmed by our visual inspection of the house exterior and not finding any indications that the house is currently under foundation stress. Also, see our photo file.

8 LIMITATIONS

Our borings provide an accurate picture of the subsurface conditions at specific locations, which are the basis for our analysis and recommendations. If there are changes in construction details or you encounter different soil conditions, please get in touch with us for further evaluation. This report follows industry-standard methods and procedures. No other warranties are made. Please contact us if you need additional assistance or discussion regarding the report contents or the influence of subsoil conditions on structure design.

USE OF THIS REPORT

Subsurface conditions pose the most significant technical risk in construction projects, surpassing other factors. After reading the geotechnical report, you should have a more precise grasp of its limitations.

To create a proper geotechnical report, you must tailor it to your project's specific criteria.

We have created a geotechnical report tailored to your project's requirements and the relevant area. This involved analysing various factors, such as the structure's nature, size, configuration, location, and underground utility presence. If project changes are made after receiving the report, it's crucial to determine how these modifications could impact the recommendations. Every project and site is unique, and the geotechnical report should not be utilised for other projects.

Subsurface conditions can change.

Subsurface conditions can be natural or artificial. Remember that water levels and fill amounts can fluctuate, and pollutants may also migrate. Reports based on past investigations may not accurately reflect current conditions.

Factual interpretation

Site investigations determine subsurface conditions at sample points. Geotechnical information is interpreted to assess site conditions, potential impact on development, and recommended actions. Professional qualifications don't guarantee accuracy, so actual conditions may differ. Interfaces between materials may be different than assumed. Site conditions cannot be changed.

It is essential to confirm your recommendations during construction, as outlined in your report.

Selective point sampling makes it hard to confirm if site conditions represent the entire area. That's why geotechnical services are recommended throughout the construction process. Variations can be identified, and additional tests can be conducted if needed. Geotechnical designers can also provide solutions to problems encountered. It's essential to have a geotechnical designer with complete background information to ensure the validity of the report's recommendations. If an unfamiliar party uses the report, there's a higher risk of misinterpretation.

A design professional's interpretation

Design professionals must be careful when reading geotechnical reports to avoid costly issues. If they have questions or concerns, they must ask for clarification. Collaborating with other designers who need to consider the report can also help ensure understanding. Before finalising the design plans, a competent Geotechnical Engineer needs to review and explain the report's implications to the design professionals.

DRAWINGS

ECHNICAL DATABASE OBTAINED HAND AUGER BOREHOLE POSITION

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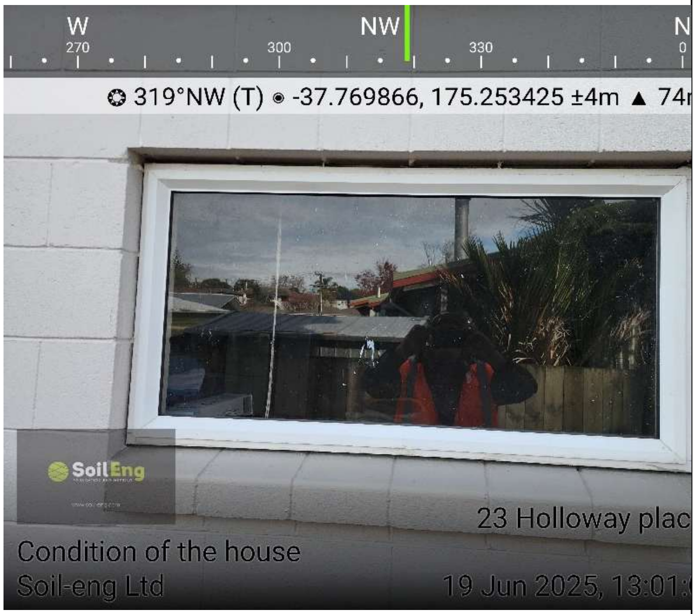
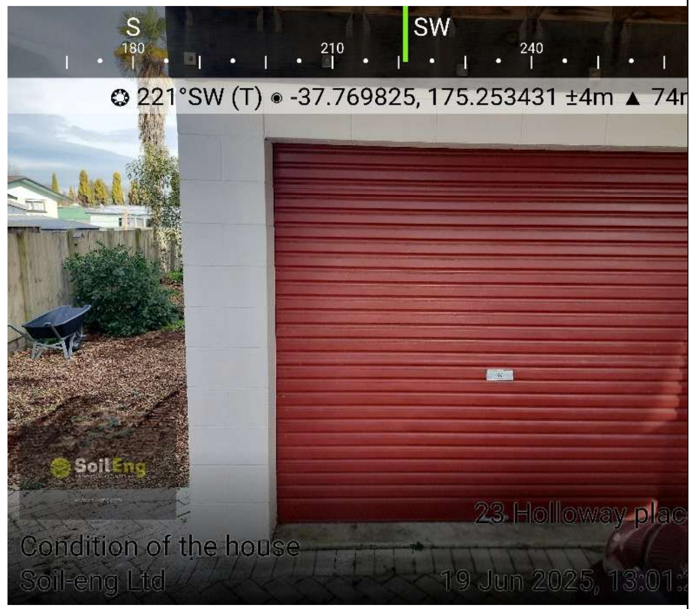
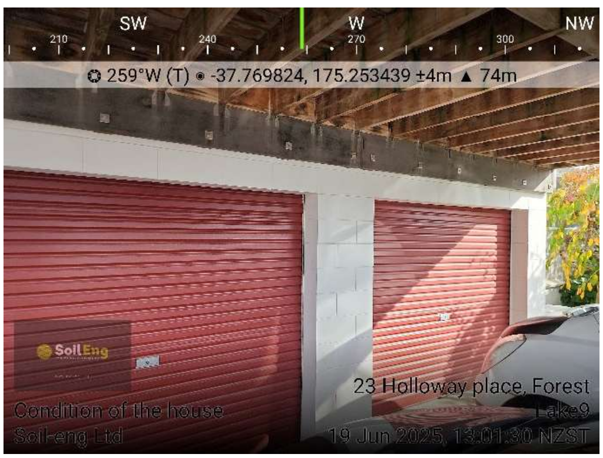
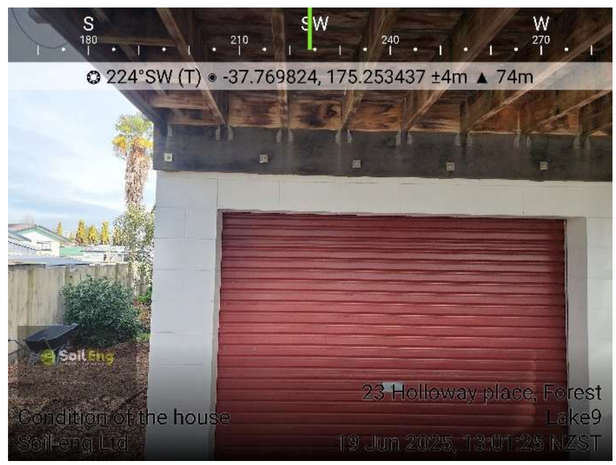
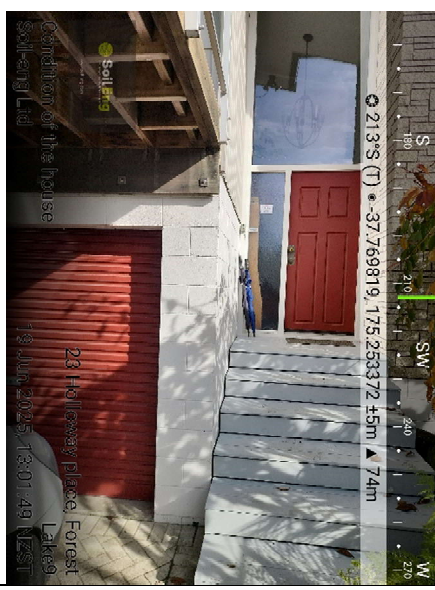
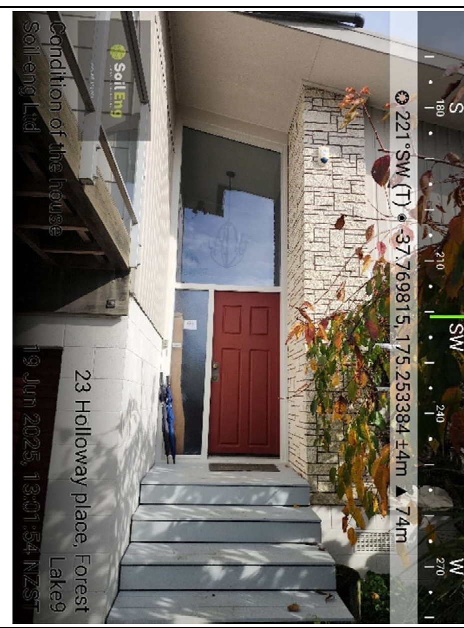
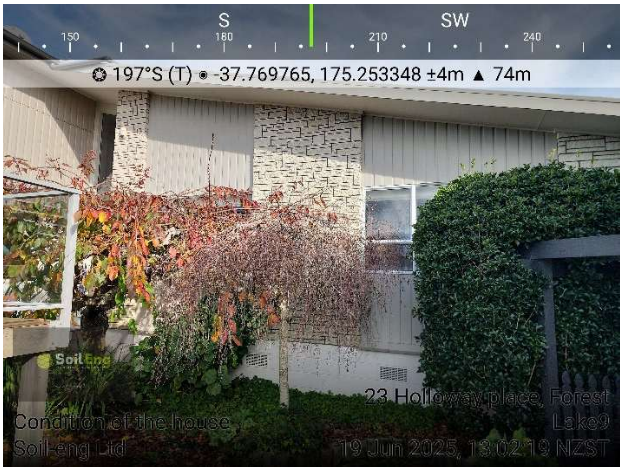
CLIENT

PROJECT

PHOTO FILE

General Site Pictures, in all directions:	
	
	
	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Soil-eng Ltd
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General site pictures
Soil-eng Ltd
23 Holloway place, Forest Lake
19 Jun 2025, 9:02:52 NZST


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Soil-eng Ltd
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Soil-eng Ltd
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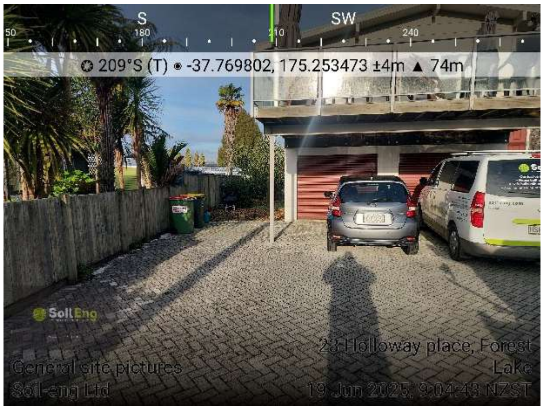	
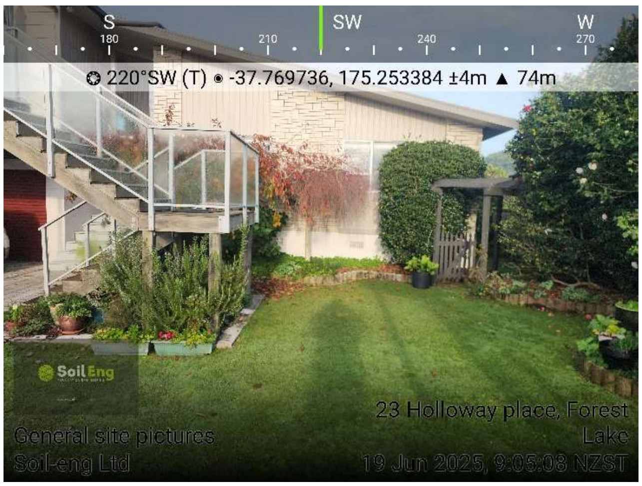	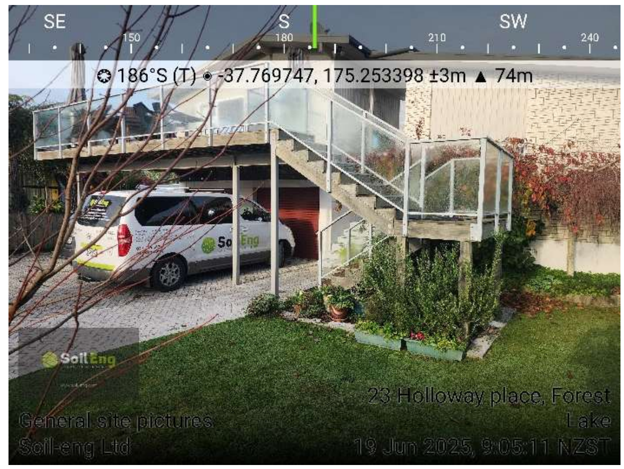
	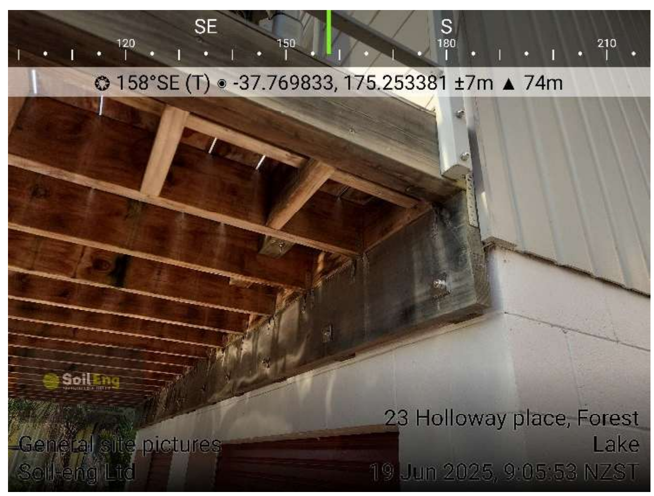

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General site pictures
Soil-eng Ltd

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Soil-eng Ltd
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Soil-eng Ltd
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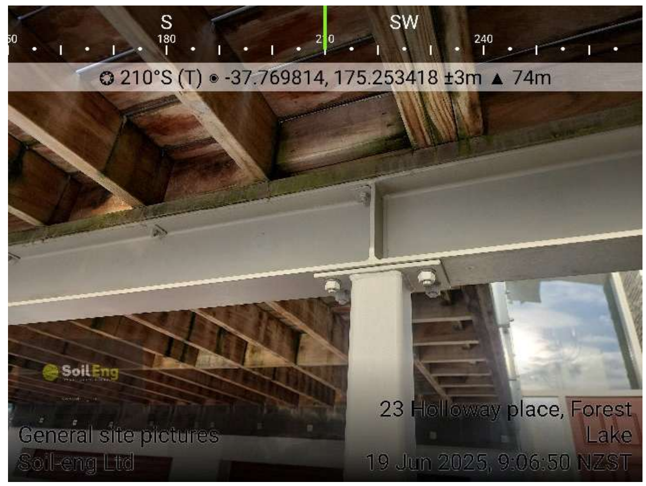
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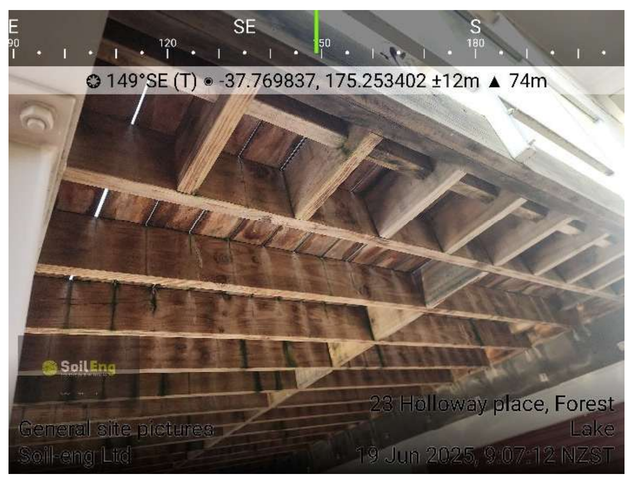
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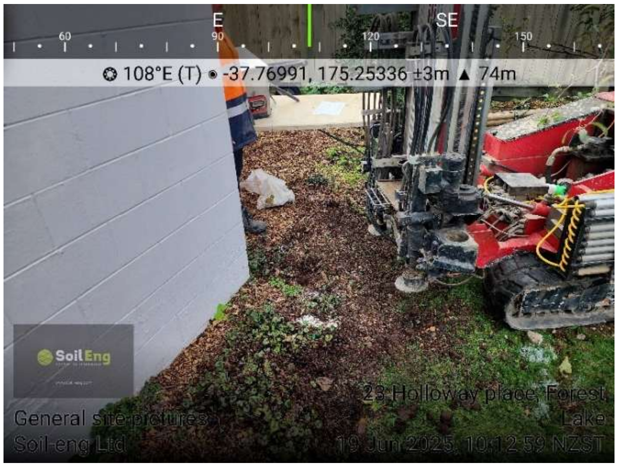

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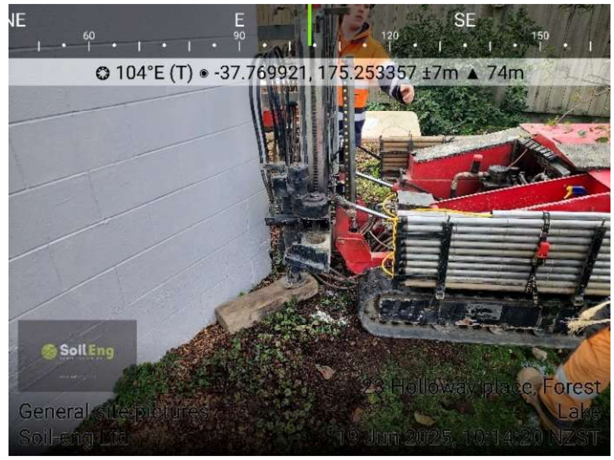
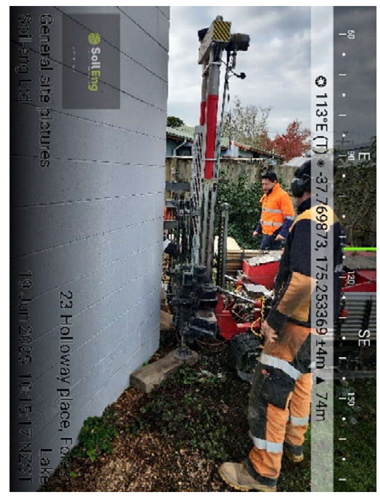


CPT Test

CPT Test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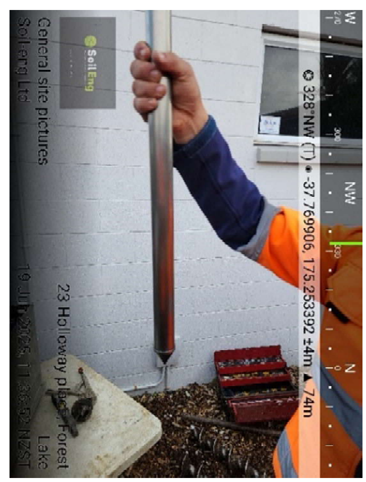
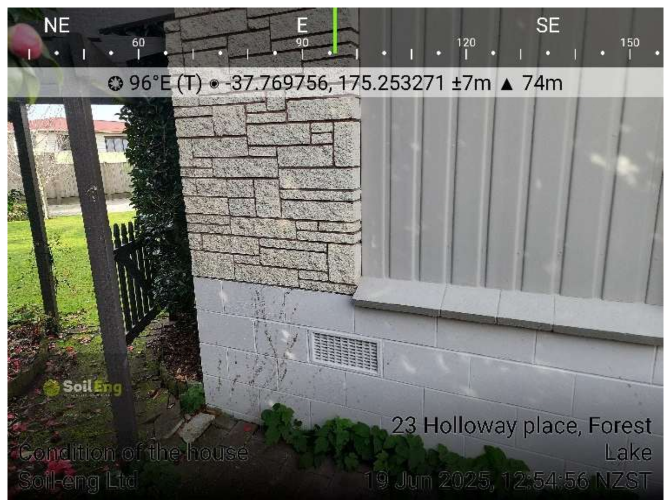
Magnetometer - Readout

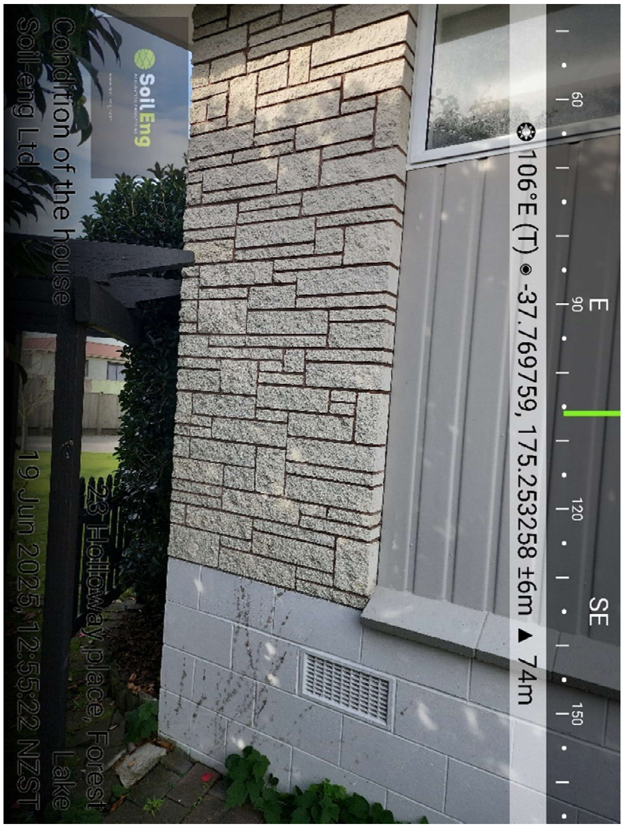

Magnetometer

Magnetometer - Readout

Magnetometer - Readout

Magnetometer - Readout

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Soil-Eng Ltd
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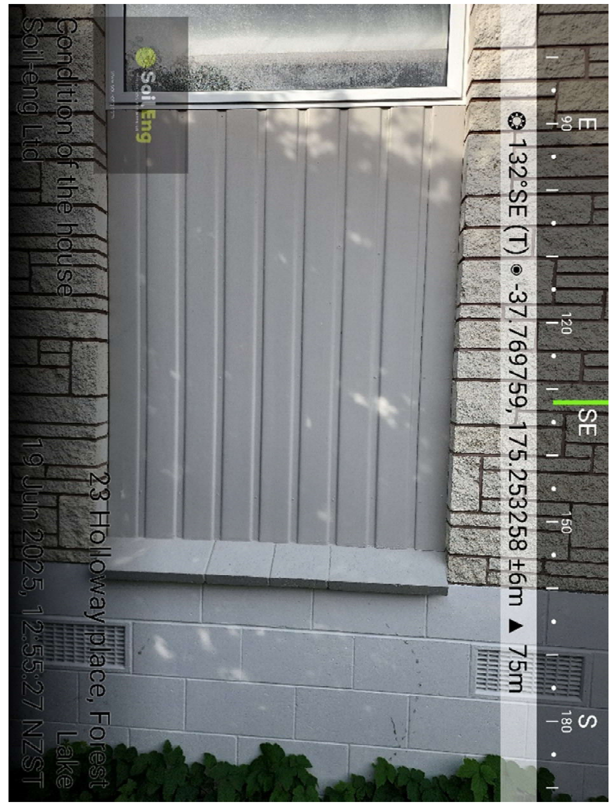
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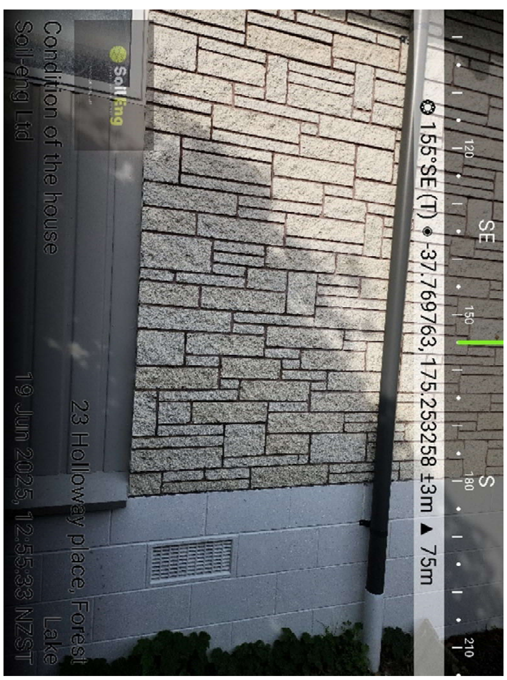
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Soil-Eng Ltd
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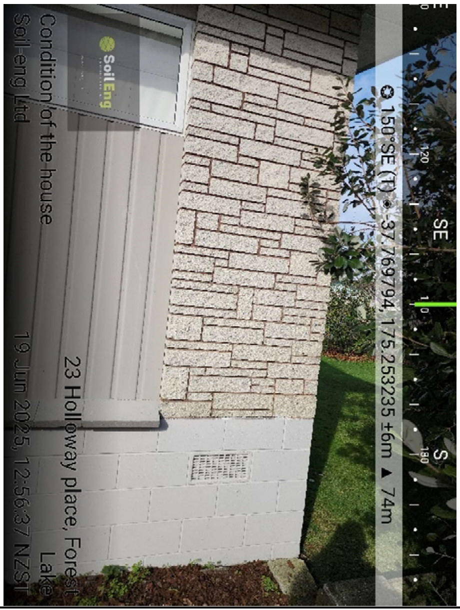
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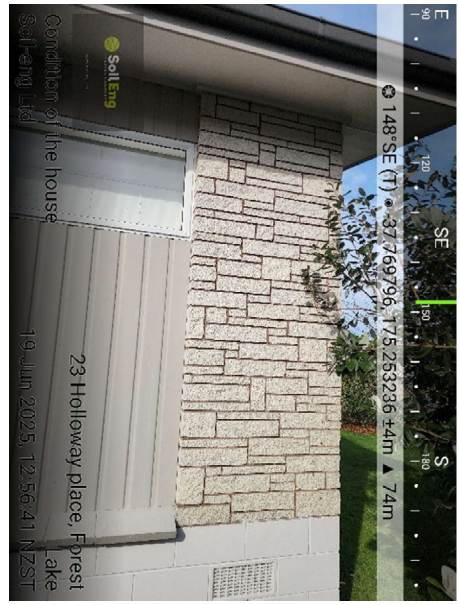
Soil-eng Ltd
SoilEng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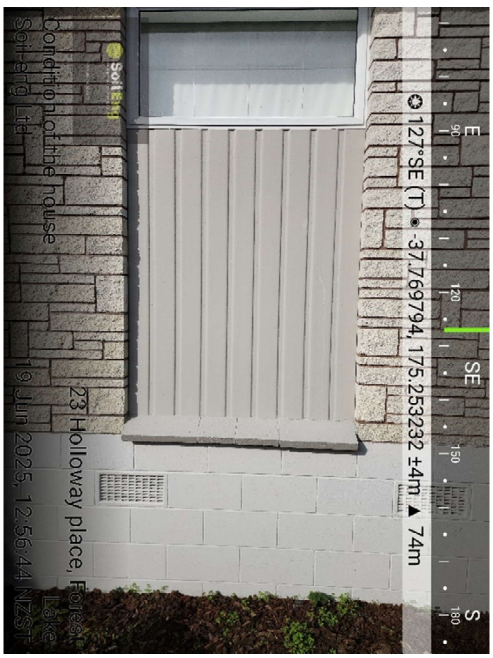
Soil-eng Ltd
SoilEng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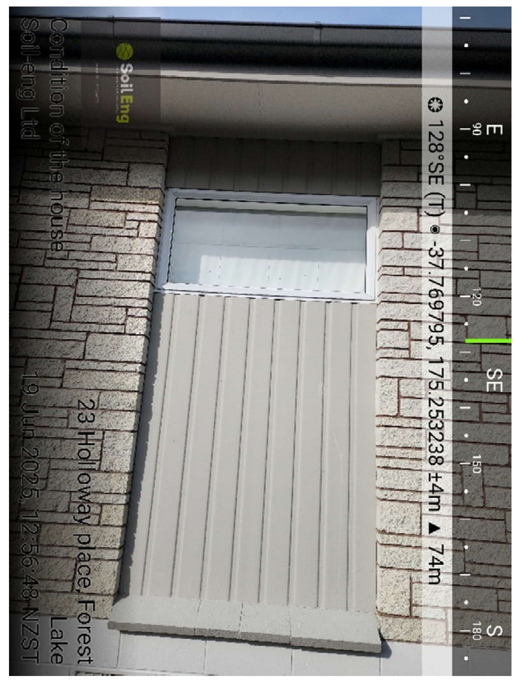
SoilEng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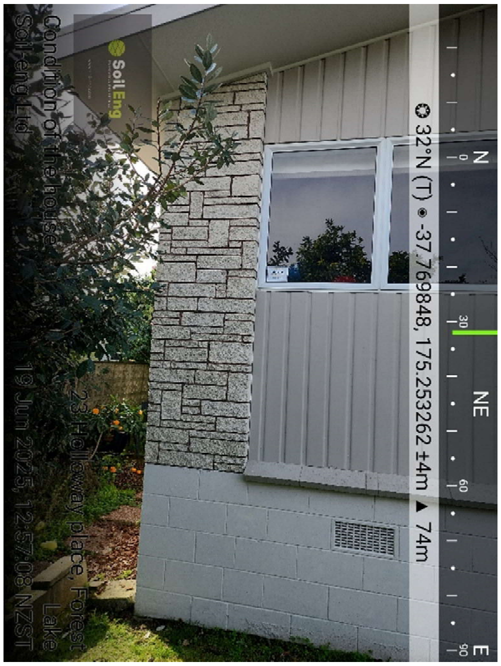
Soil-eng Ltd
SoilEng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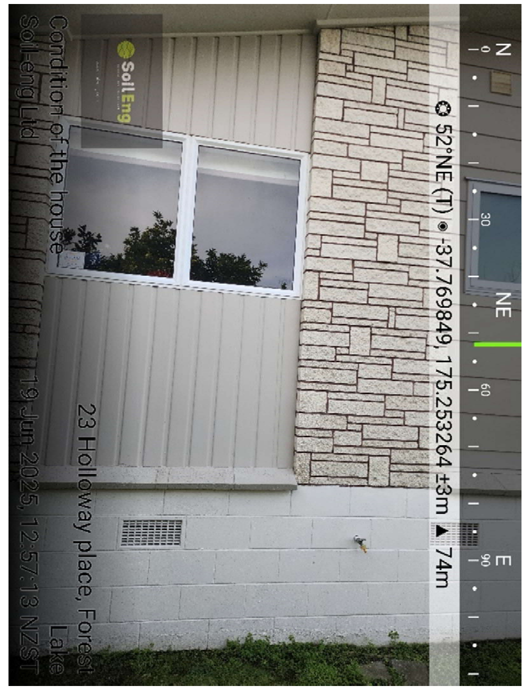
Condition of the house
Soil Eng Ltd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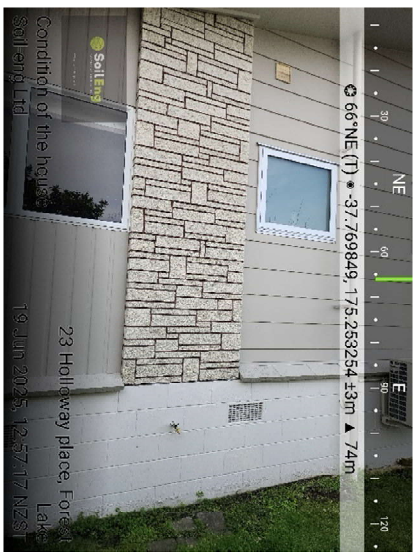
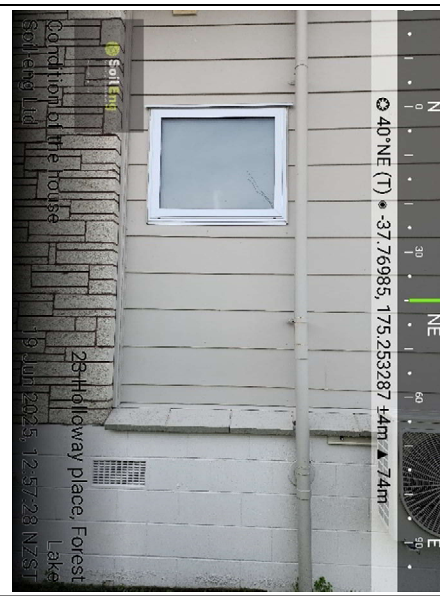
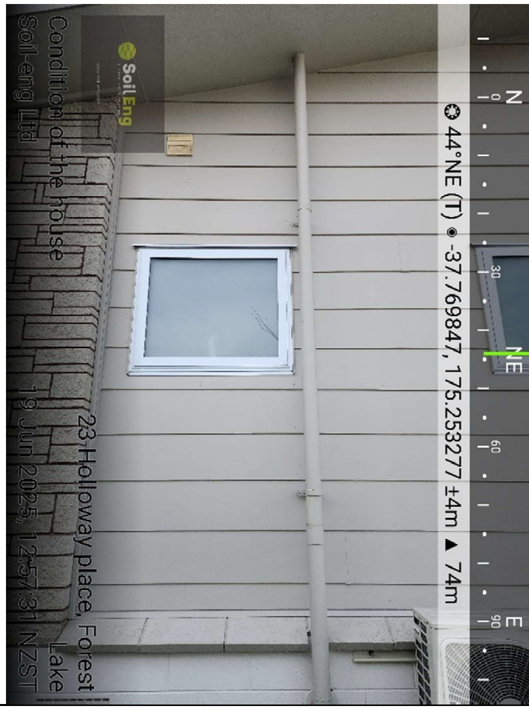
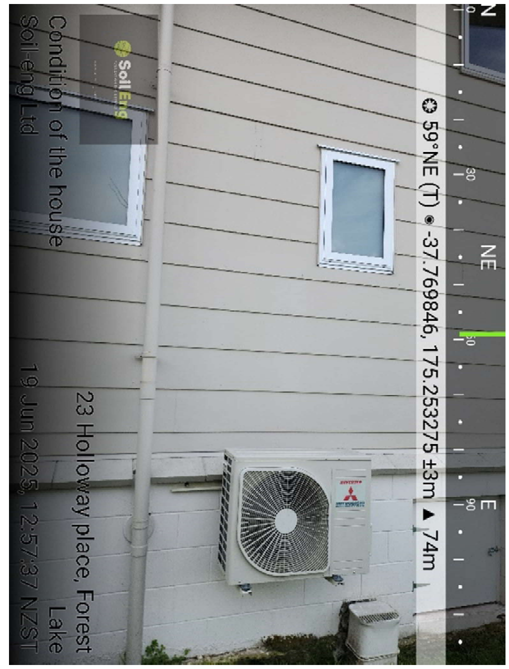
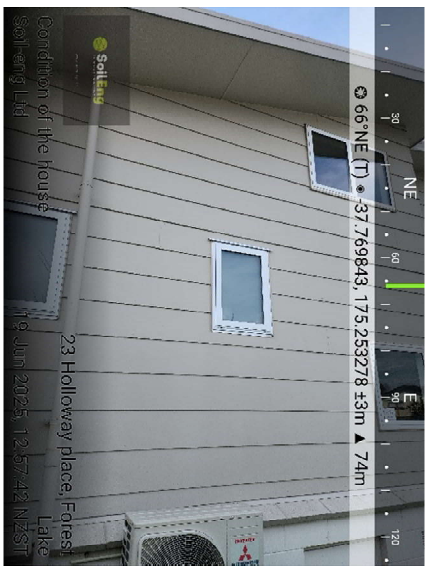
Condition of the house
Soil Eng Ltd

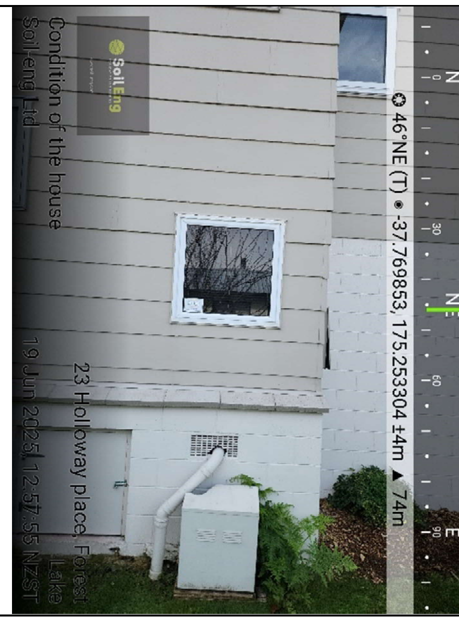

66°NE (T) ● -37.769849, 175.253254 ±3m ▲ 74m
23 Holloway place, Forest Lake
19 Jun 2025, 12:57:17 NZST
Condition of the house
Soil Eng Ltd

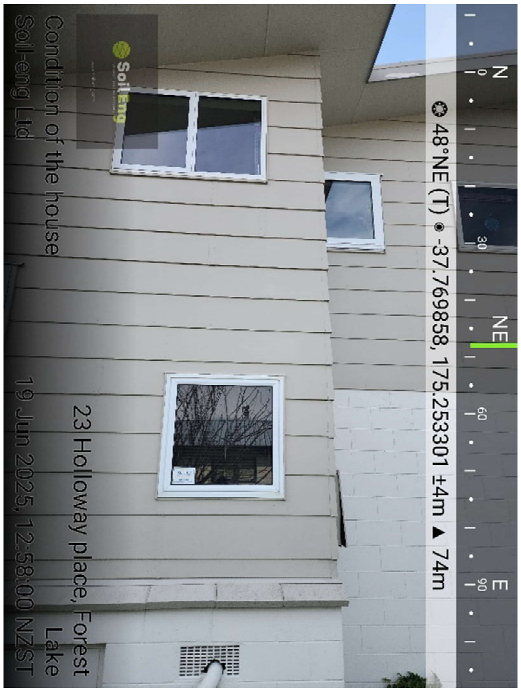

40°NE (T) ● -37.76985, 175.253287 ±4m ▲ 74m
23 Holloway place, Forest Lake
19 Jun 2025, 12:57:28 NZST
Condition of the house
Soil Eng Ltd

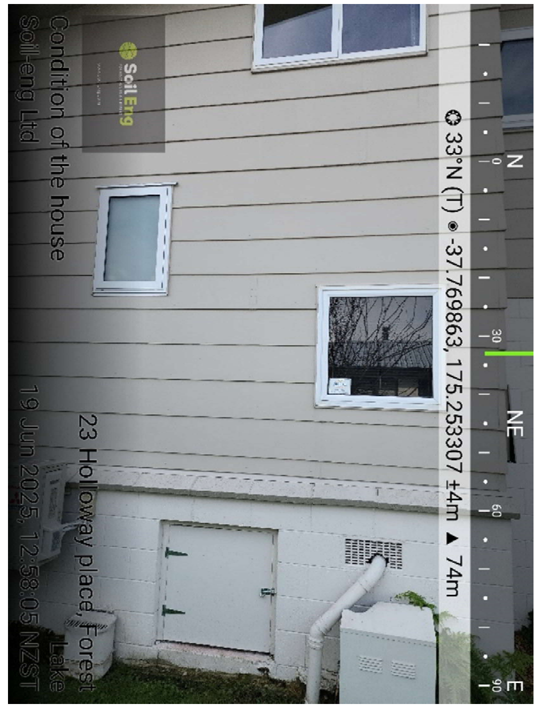

44°NE (T) ● -37.769847, 175.253277 ±4m ▲ 74m
23 Holloway place, Forest Lake
19 Jun 2025, 12:57:31 NZST
Condition of the house
Soil-eng Ltd

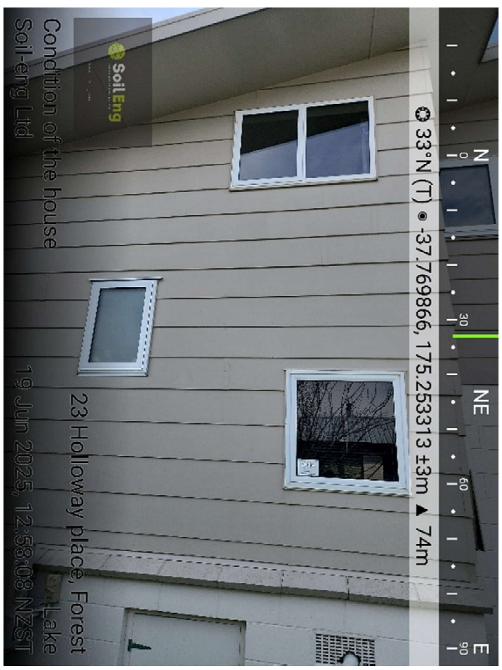

59°NE (T) ● -37.769846, 175.253275 ±3m ▲ 74m
23 Holloway place, Forest Lake
19 Jun 2025, 12:57:37 NZST
Condition of the house
Soil-eng Ltd

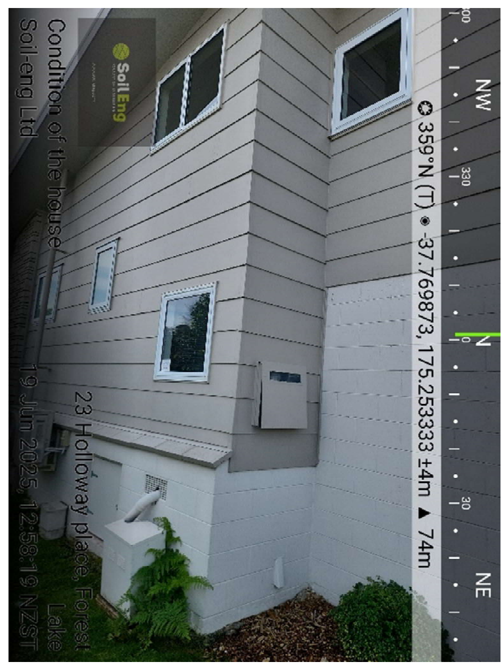

66°NE (T) ● -37.769843, 175.253278 ±3m ▲ 74m
23 Holloway place, Forest Lake
19 Jun 2025, 12:57:42 NZST
Condition of the house
Soil-eng Ltd


46°NE (T) ● -37.769853, 175.253304 ±4m ▲ 74m
23 Holloway place, Forest Lake
19 Jun 2025, 12:57:55 NZST
Condition of the house
Soil-eng Ltd


48°NE (T) • -37.769858, 175.253301 ±4m ▲ 74m
23 Holloway place, Forest Lake
19 Jun 2025, 12:58:00 NZST
Condition of the house
Soil-eng Ltd


33°N (T) • -37.769863, 175.253307 ±4m ▲ 74m
23 Holloway place, Forest Lake
19 Jun 2025, 12:58:05 NZST
Condition of the house
Soil-eng Ltd


33°N (T) • -37.769866, 175.253313 ±3m ▲ 74m
23 Holloway place, Forest Lake
19 Jun 2025, 12:58:08 NZST
Condition of the house
Soil-eng Ltd


359°N (T) • -37.769873, 175.253333 ±4m ▲ 74m
23 Holloway place, Forest Lake
19 Jun 2025, 12:58:19 NZST
Condition of the house
Soil-eng Ltd