Geotechnical Engineers

Geotechnical Investigation Report

22 & 22A Summit Drive, Mount Albert

For Alan An

Reference: 5057
Date: 11th February 2025
Revision: B

GeoStudio Ltd
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Appendix A: Draft Architectural Plans

Appendix B: Hand Auger Exploratory Hole Logs

1 Summary

Site Descriptions	• Site address: 22 & 22A Summit Drive, Mount Albert. • Proposed development: Two new dwellings. • Subsoil conditions: refer to Section 7. • Groundwater: refer to Section 8.
Geotechnical Hazards	• Slope stability refer to Section 9.1. • Liquefaction and lateral spreading potential refer to Section 9.2. • Expansive soils refer to Section 9.3. • Compressive Soils and Subsidence refer to Section 9.4. • Earthworks refer to Section 9.5.
Geotechnical Recommendations and Design Parameters	• Foundation design recommendations refer to Section 10.1. • Retaining wall design renominations refer to Section 10.2.
Further Works and Geotechnical Construction Monitoring	• For future geotechnical involvement and construction monitoring refer to Section 10.3 & 10.4.

2 Introduction

GeoStudio Ltd has been engaged by Alan An undertake a subsoil investigation and provide geotechnical recommendations for the proposed two new dwellings at 22 & 22A Summit Drive, Mount Albert.

This geotechnical investigation has been conducted to provide recommendations with respect to slope stability and foundation design for the proposed new dwellings. It aims to determine whether the land on which the dwellings has been proposed is likely to be subject to erosion, subsidence, or slippage; or whether the proposed development work itself is likely to accelerate, worsen, or result in instability of the land or any other property; and to recommend adequate provisions to protect the land or the proposed development or other property from instability in accordance with the provisions of the Building Act 2004.

3 Site Description

The site location is indicated on Figure 1. Its legal description is LOT 1 DP 603808 and LOT 2 DP 603808.

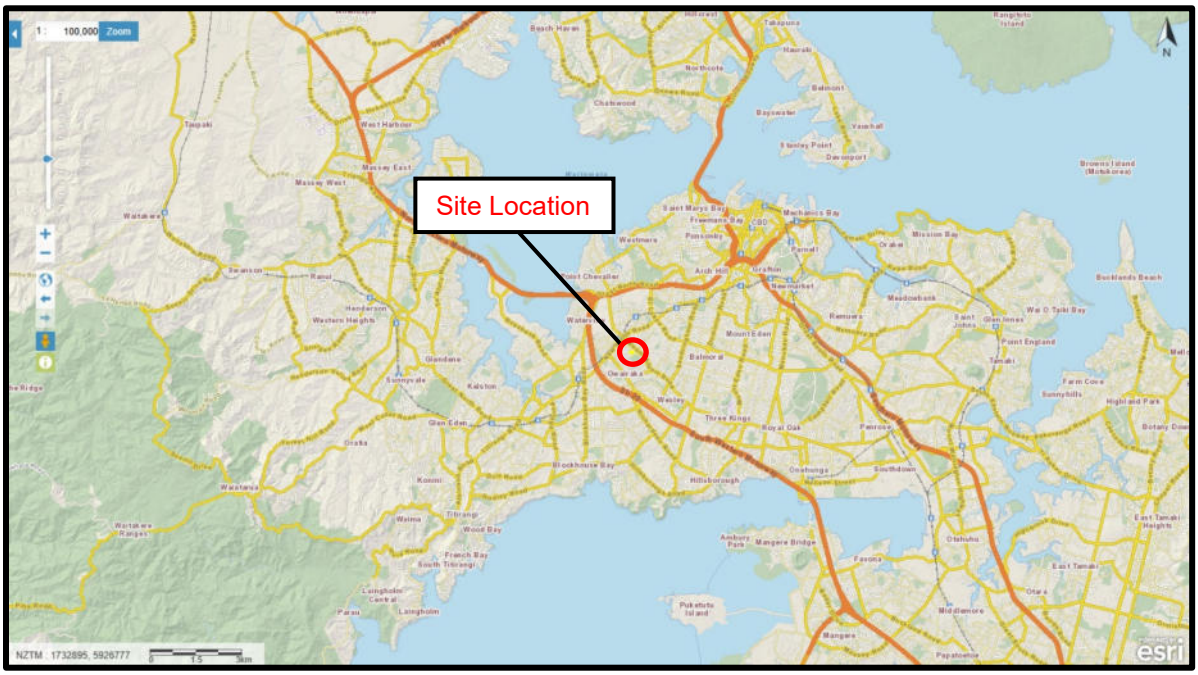

Figure 1: Site Location Plan (Courtesy of Auckland Council Geomaps)

The existing site layout is shown in Figure 2 and Photos 1 to 3.

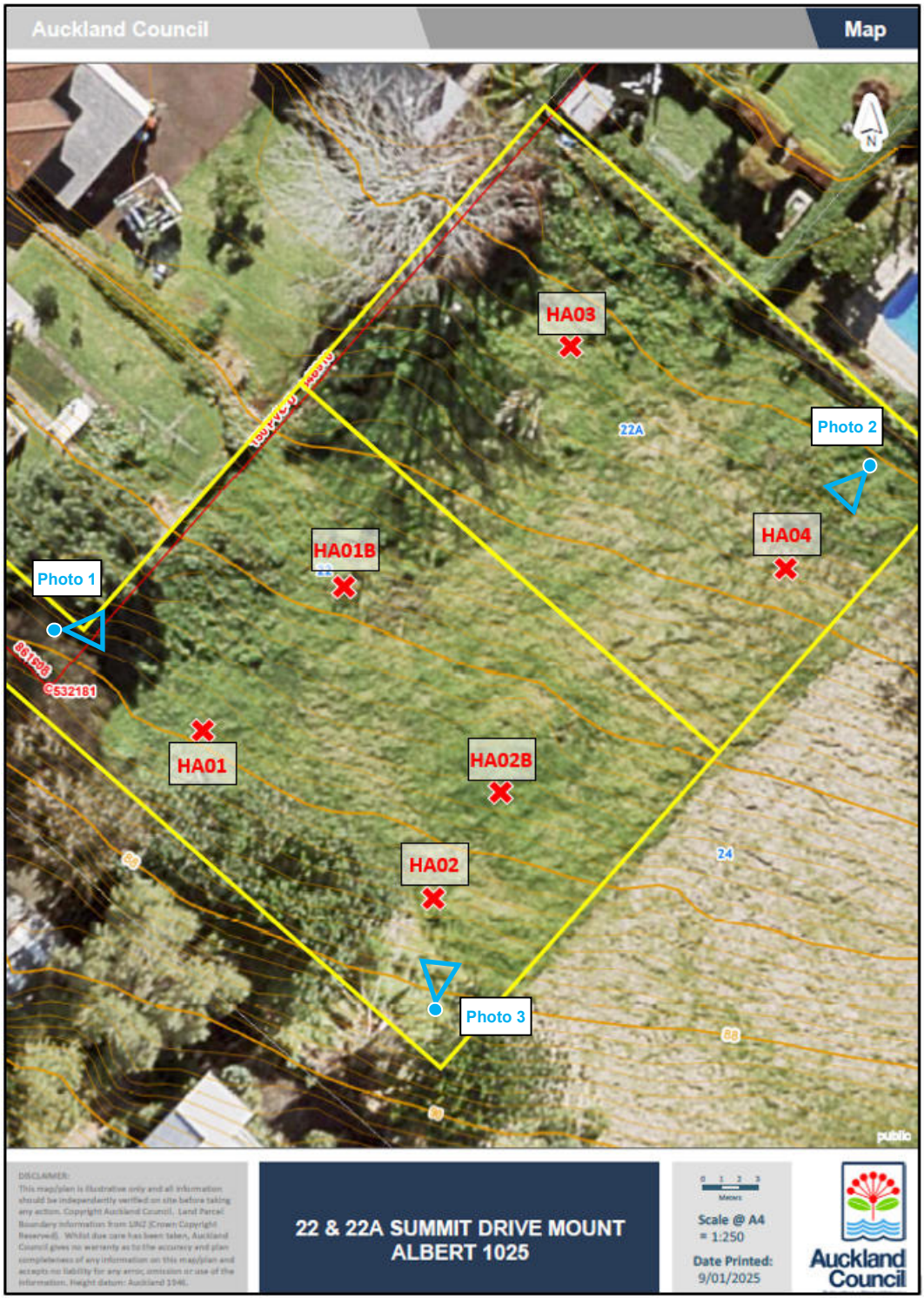

Figure 2: Site Layout and Investigation Plan (courtesy of Auckland Council Geomaps)

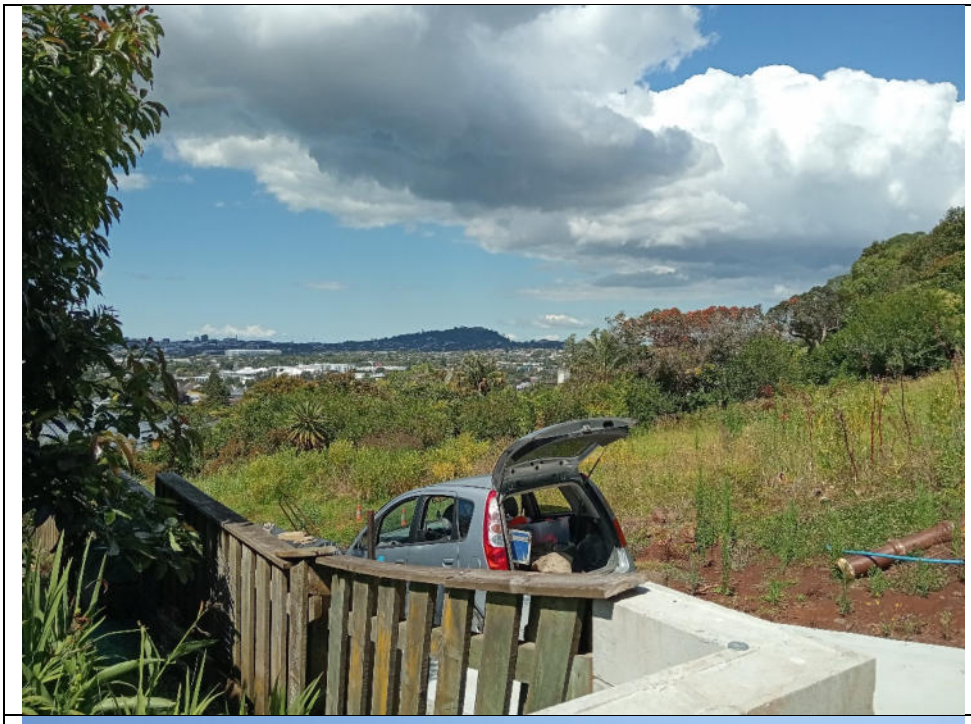	**Photo 1: This photo was taken towards the western corner of the property facing east.**
	**Photo 2: This photo was taken towards the easter corner of the property facing southwest.**

	**Photo 3: This photo was taken towards the southern corner of the property facing north.**

The property can be accessed directly from Summit Drive via common access driveway. At the time of our investigation the property consisted mostly of overgrown vegetation. The ground across the property slopes gently to moderately down to the north at approximately 10°-15°.

4 Proposed Development

According to the architectural plans prepared by 10x10 Architecture (Option 3B, dated 29/01/2025), there will be excavation of down to ≤1.4m and fill of up to ≤1.0m, from the existing ground level, for the construction of two new two-storey dwellings.

The draft architectural plans attached in Appendix A.

5 Geological Map

According to Geological Map of the Auckland Area, 1:250 000 geological map 3 by Institute of Geological and Nuclear Sciences, the site is likely to be underlain by Auckland Volcanic Field; Basalt to basanite ash and lapilli: grey to black, unconsolidated, very angular to rounded, dense to vesicular, sand- to pebble-sized fragments.

The clay rich and cohesive silt soils may also be prone to shrinking and swelling following changes in natural moisture content.

6 Site Investigation

We carried out a site walkover on 9th January 2024. Six 50mm diameter hand augered exploratory holes were carried out in the areas of the proposed new dwelling. The locations of our exploratory holes

(labelled as HA01-HA04) are shown in Figure 2. In-situ Pilcon Shear Vane tests were carried out in the augered holes generally at 0.5m depth intervals.

The graphical hand auger, shear vane and scala penetrometer logs are presented in Appendix B.

7 Subsoil Conditions

The findings from our hand auger investigation are generally consistent with the Geological Map.

During the day of our site investigation, we encountered Auckland Volcanic Field soils from surface level extending down to our hand auger termination depths of 0.6m-3.0m. The AVF soils vary in consistency between ashy silt to ashy clay. Shear vane tests suggest the AVF soils are generally very stiff with measured undrained shear strength of 146kPa to 224+kPa.

Scala penetrometer tests were carried out at the base of HA01-HA02B and HA04. Our results are presented in the table below.

Hand Auger	Scala Blows/100mm	Depth below existing ground level (m)
HA01	20+	0.8
HA01B	20+	1.9
HA02	20+	1.4
HA02B	20+	1.9
HA04	20+	2.8

Results from the scala penetrometer infer a shallow rock layer between 0.8m to 1.9m below ground level near HA01 and HA02 and a deeper rock layer 2.8m around HA04. However, previous excavation photos show the site predominantly underlying volcanic ash with small to medium sized basalt rock deposits.

No topsoil and non-engineered fill were encountered within our hand augers during the day of exploratory drilling. However, any topsoil and non-engineered fill encountered across building platform areas are not considered consistent bearing strata for the proposed development.

8 Groundwater

On the day of our site investigation, no groundwater was encountered in all hand auger locations down to the termination depths. The proposed 1.4m deep excavation will unlikely intercept groundwater.

9 Geotechnical Hazards

9.1 Slope Stability

On the day of our site visit, no obvious signs of global instability were observed. The proposed development will involve cut and fill earthworks supported by specifically engineer designed retaining walls. Based on our site investigation and observations, it is our professional opinion that, provided our recommendations in Section 10 are fully implemented, the building site of the proposed construction is considered stable with a low risk of large-scale ground instability and is unlikely to accelerate, worsen, or result in instability of the land or any other property.

9.2 Liquefaction Potential and Lateral Spreading Potential

Liquefaction only occurs in saturated, sandy soils under cyclic shaking. The subject site was underlain by unsaturated, cohesive (Ash) Auckland Volcanic Field soils. The risk of seismic liquefaction and lateral spreading is considered very low.

9.3 Expansive soils

Based on our past-experience of expansive soil lab testing and our visual classification of the subsoil encountered, the subsoil is conservatively classified as Class H1 as per AS2870: 2011. Specific foundation design recommendations are provided in Section 10.1.

9.4 Compressive Soils and Subsidence

The underlying very stiff AVF soils are not sensitive to minor changes of overburden pressure. The proposed earthwork will unlikely result in excessive settlement which may affect the performance of the proposed foundations and its neighbouring lands and properties.

9.5 Earthworks

The site is on moderately sloping ground. The current expected cut and fill depths of **≤1.4m** & **≤1.0m**, respectively, are based off the provided survey & preliminary architectural plans. Based on our site investigation, the site is likely underlain by volcanic ash with medium to large basalt boulders which can be excavated using suitably sized excavators. Rock breaking using hydraulic hammer is unlikely required for achieving the proposed ground levels.

The underlying very stiff soils are not overly sensitive to settlement. It is our opinion that provided our recommendations in Section 10 are fully implemented the earthworks would be unlikely to cause any significant ground settlement.

10 Geotechnical Recommendations

10.1 Foundations

10.1.1 Concrete Slab Foundations

For the use of concrete slab foundations, our recommendations are as follows:

- For the design of traditional slab-on-ground foundations, all perimeter footings shall have a minimum embedment depth of **750mm** or as per Table 7.4A or 7.4B of Building Code B1/AS1 amendment 2019 based on expansive soil **Class H**, whichever is greater.

- For the design of waffle-slabs, no minimum embedment depth is required provided foundations are specifically designed by a chartered professional engineer for expansive soil **Class H1** in terms of AS2780:2011.

- For design of shallow foundations on competent natural ground, followings geotechnical ultimate bearing capacity (unfactored) may be assumed:

    - Ash and/or basalt rock boulders = **300kPa**

- Based on the investigation results and our experience with similar sites, the site may be classified as subsoil **Class C** – shallow soil in accordance with ASNZS1170.5.

- All unsuitable soils (topsoil, non-engineered fill, soft original soils shall be removed and replaced with compacted engineered fill (GAP40) under all concrete slabs.

10.2 Piled Foundations

- For the use of piled foundations (if required) our recommendations are as follows;
    - Minimum pile depth = **0.6m into stiff original ground.**
    - Geotechnical ultimate bearing capacity (unfactored) = **300kPa,** or **540kPa** if piles are at least **2.5m** deep.
    - Geotechnical ultimate skin friction (unfactored) of **30kPa**. The friction contribution of the upper **0.75m** below ground level should be ignored.

10.3 Retaining Walls

- All new retaining walls shall be specifically designed by a chartered professional engineer for the actual retaining height and any surcharge (i.e. additional load from slopes, upper retaining walls or site boundary).
- Furthermore, we recommend that any vertical cut faces which exceed heights of **1.5m** should be benched at **1V:1H** or to be supported by additional in-ground piles prior to bulk excavation. Along with good practice during construction (covering cut faces, constructing of retaining walls within seven days of excavation), this method is to further ensure safety during works close to, or below cut faces.
- We provide the following general soil parameters for retaining wall design:
    - Bulk unit weight for retaining material 18.0kN/m^3
    - Soil internal friction (φ') 30°
    - Undrained shear strength (s_u) 60kPa
    - Geotechnical ultimate bearing capacity (unfactored) 300kPa
- All retaining wall shall be constructed with appropriate subsoil drainage system discharged as per council's requirements.
- It is the builder's/owner's responsibility to ensure that temporary stability of any soil cut face is maintained during construction of retaining walls. Where possible, all retaining walls should be constructed in dry weather conditions over a short period of time (typically within 10 days) to reduce the risk of temporary instability.

10.4 Future Geotechnical Involvement

- The geotechnical assessment and recommendations provided herein are specifically for the currently proposed development represented in the preliminary architectural design plans prepared by 10x10 (Option 3B, dated 29/01/2025). If major changes are proposed, GeoStudio shall be provided the opportunity to review the new design and shall confirm the validation of our recommendations.

10.5 Construction Monitoring

- All soil subgrade (after stripping of topsoil) below all building foundations shall be inspected by a chartered professional engineer (geotechnical) prior to the commencement of engineered filling (if required).

- The compaction of all Engineered fill (if required) shall be inspected by a chartered professional engineer (geotechnical).

- All foundation pile drill holes (if applicable) shall be inspected by a chartered professional engineer (geotechnical) prior to the installation of timber poles and pouring of concrete.

11 Limitations

This report is the property of our client and GeoStudio Ltd.

Our professional services are performed using a degree of care and skill normally exercised, under similar circumstances, by reputable consultants practicing in this field at this time. No other warranty, expressed or implied, is made as to the professional advice presented in this report; in regard to its accuracy or completeness.

The recommendations and opinions contained in this report are based on our visual reconnaissance of the site, information from geological maps and field investigation(s) at discrete locations. Inferences are made about the nature and continuity of ground conditions away from the investigation(s) which cannot be guaranteed. The descriptions detailed on the exploratory hole logs are based on the field descriptions of the soils encountered at the time of investigation(s).

This report has been prepared for the particular project described to us and no responsibility is accepted for the use of any part of this report in any other context or for any other purposes. Except as required by law, no third party (excluding the local authority) may use or rely upon this report unless authorised by GeoStudio Ltd in writing. To the extent permitted by law, GeoStudio Ltd expressly disclaims and excludes liability for any loss, damage, cost or expense suffered by any third party relating to or resulting from the use of, or reliance upon any information contained in this report. It is the responsibility of third parties to independently make enquiries or seek advice in relation to their particular requirements.

All appendices should be read in conjunction with the main body of the report and this report should not be considered complete without them.

REPORT PREPARED BY:

Kieffer Duran
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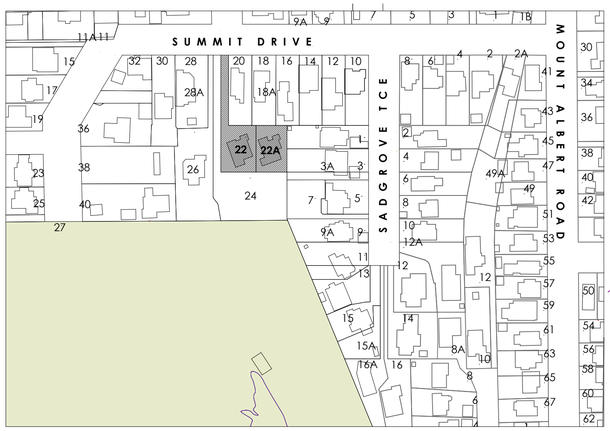
Geotechnical Engineer

REPORT APPROVED BY:

Geoffrey Kang
BE(civil), ME(civil), CPEng, MIPENZ
Director / Geotechnical Engineer

Appendix A

Draft Architectural Plans

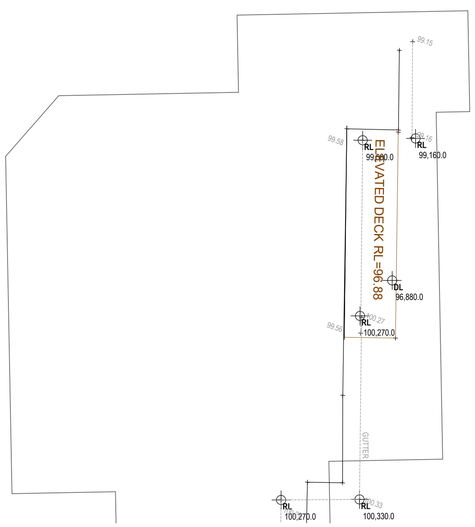


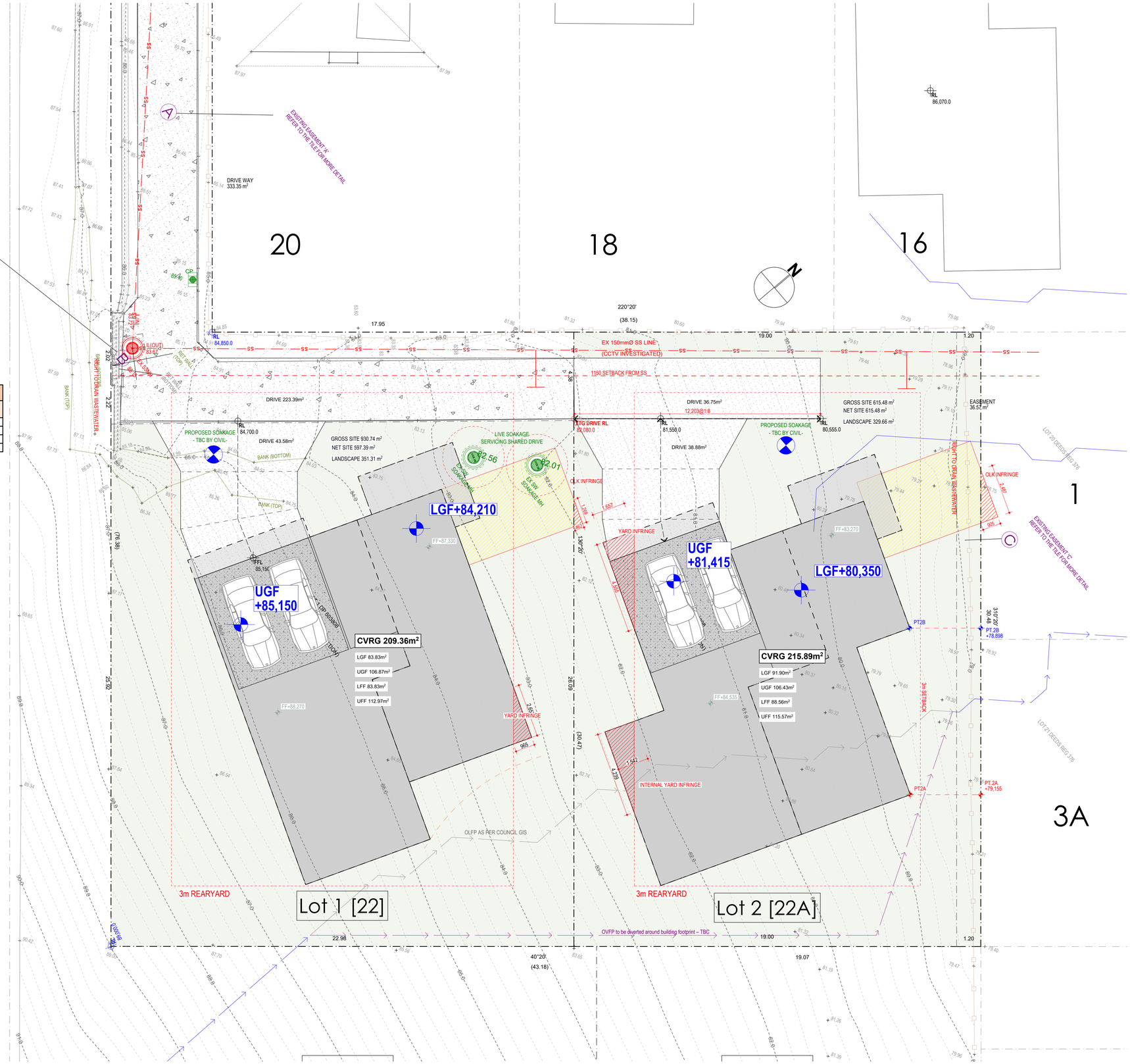
-1. SITE CONTEXT 1:2000

22 SUMMIT DRIVE_MASS STUDIES_OPTION 3_ROTATED (MODIFIED)											
NO.	NET SITE m2	GROSS SITE m2	COVERAGE m2	LGF GFA m2	UGF GFA m2	LFF GFA m2	UFF GFA m2	TOTAL GFA m2	DRIVE	IMPERV. AREA	LANDSCAPE
LOT 1 (No.22)	597.39	932	209.23	83.83	106.87	83.83	112.97	387.5	266.97	476.2	351.31
%			35.0%							51%	59%
LOT 2 (No.22A)	616	616	215.89	91.9	106.43	88.56	115.57	402.46	75.63	291.52	329.66
tot/ %			35.0%					789.96		47%	54%
			/ NETT SITE		TBC					/ GROSS SITE	/ NETT SITE

SITE INFORMATION	
LEGAL DESCRIPTION	LOT 1 & 2 DP 603808
ADDRESS	22 & 22A Summit Drive MOUNT ALBERT 1025
SITE AREA	932 + 616 = 1548 m2
WIND ZONE	HIGH
EXPOSURE ZONE	ZONE C
EARTHQUAKE ZONE	ZONE 1

26





3A

10 x 10 architecture
WWW.10X10.ARCHI INFO@10X10.ARCHI

NZ REGISTERED ARCHITECT

DRAFT
INFORMATION ONLY

JOB: 24014
2 x PROPOSED SINGLE HOUSES
FOR: ALAN WENQIAN AN
AT: 22 & 22A SUMMIT DRIVE MOUNT ALBERT
AUCKLAND 1025

OPTION 3B_SITE PLAN

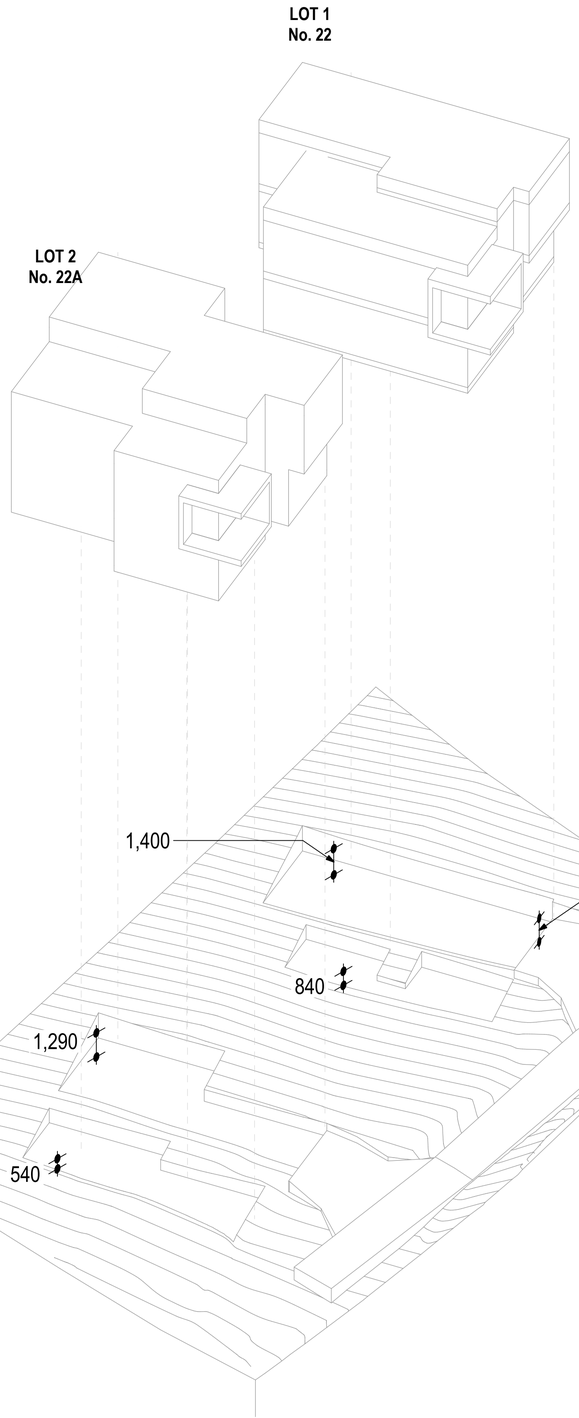
OPTION 3B ROTATED & REFINED

SCALE: 1:100, 1:500, 1:1 @ A1

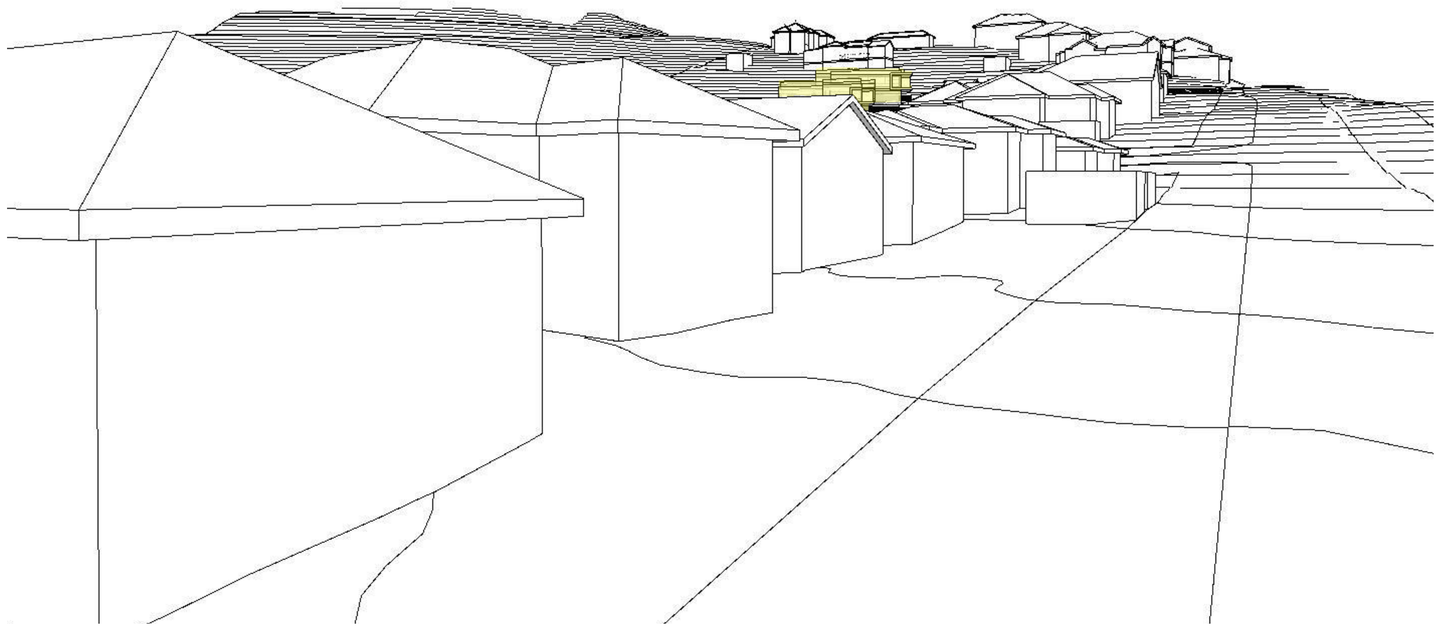
MASS STUDIES
OPTION 3B ROTATED & REFINED

MS3B_01

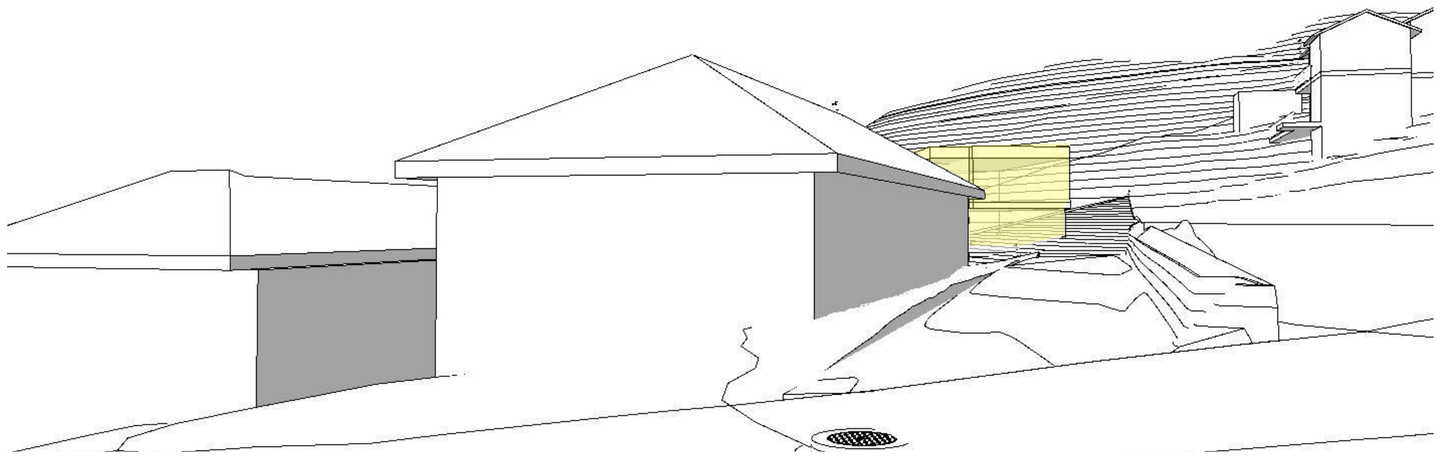
29/01/2025



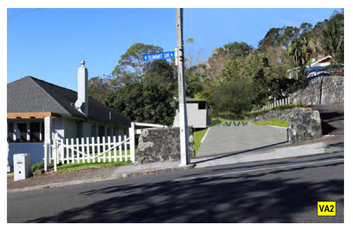
EC EARTHCUT STUDIES



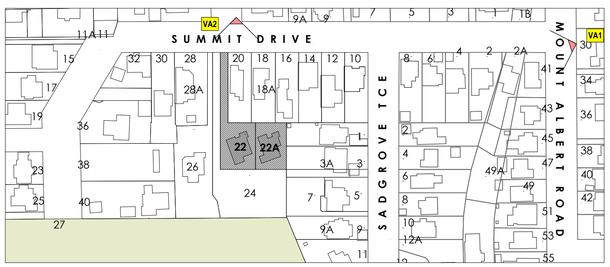
VA1 VISUAL ASSESSMENT 1



VA2 VISUAL ASSESSMENT 2



ABOVE DRAFT VISUAL ANALYSIS ARE INDICATIVE ONLY
PROPER VISUAL ASSESSMENTS ARE TO BE UNDERTAKEN BY LANDSCAPE ARCHITECTS.



10 x 10 architecture
WWW.10X10.ARCHI INFO@10X10.ARCHI

NZ REGISTERED ARCHITECT

DRAFT
INFORMATION ONLY

JOB: 24014
2 x PROPOSED SINGLE HOUSES
FOR: ALAN WENQIAN AN
AT: 22 & 22A SUMMIT DRIVE MOUNT ALBERT
AUCKLAND 1025

OPTION 3B_EARTHCUT AND CONTEXT STUDIES

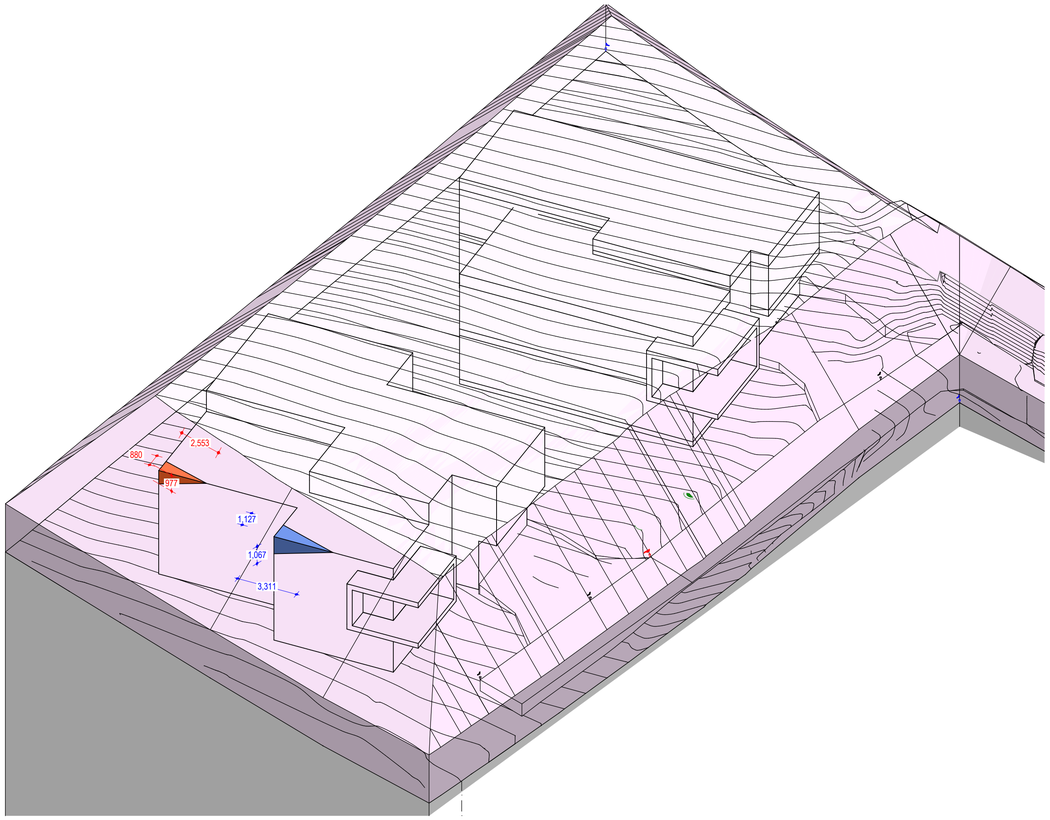
OPTION 3B ROTATED & REFINED

SCALE: 1:500 @ A1

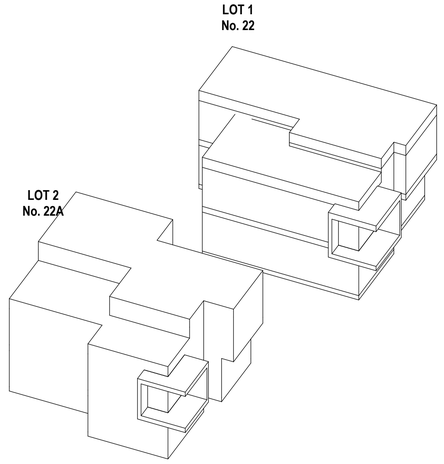
MASS STUDIES
OPTION 3B ROTATED & REFINED

MS3B_02

29/01/2025



3D HIRB INFRING DIMENSIONS



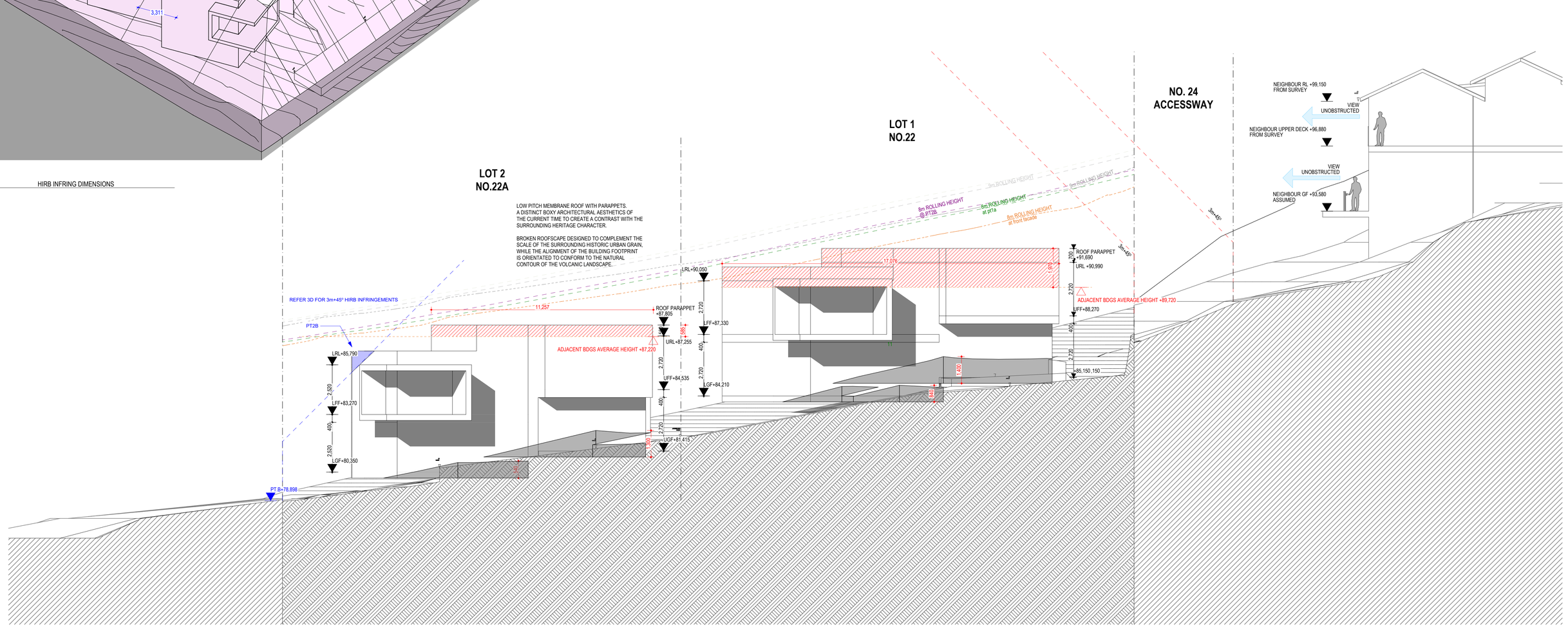
LOT 1
NO.22

LOT 2
NO.22A

NO. 24
ACCESSWAY

LOW PITCH MEMBRANE ROOF WITH PARAPPETS.
A DISTINCT BOXY ARCHITECTURAL AESTHETICS OF THE CURRENT TIME TO CREATE A CONTRAST WITH THE SURROUNDING HERITAGE CHARACTER.

BROKEN ROOFSCAPE DESIGNED TO COMPLEMENT THE SCALE OF THE SURROUNDING HISTORIC URBAN GRAIN, WHILE THE ALIGNMENT OF THE BUILDING FOOTPRINT IS ORIENTATED TO CONFORM TO THE NATURAL CONTOUR OF THE VOLCANIC LANDSCAPE.



W WEST ELEVATION_ BOXED ROOF

10 x 10 architecture
WWW.10X10.ARCHI INFO@10X10.ARCHI

NZ REGISTERED ARCHITECT

DRAFT
INFORMATION ONLY

JOB: 24014
2 x PROPOSED SINGLE HOUSES
FOR: ALAN WENQIAN AN
AT: 22 & 22A SUMMIT DRIVE MOUNT ALBERT
AUCKLAND 1025

OPTION 3B_ELEVATIONS

OPTION 3B ROTATED & REFINED

SCALE: 1:200, 1:100 @ A1

MASS STUDIES
OPTION 3B ROTATED & REFINED

MS3B_03

29/01/2025

Appendix B

Hand Augered Exploratory Hole Logs

GEO STUDIO	**JOB NUMBER:** 5057	**HAND AUGER NO.** **HA01**
	ADDRESS: 22 & 22A Summit Drive, Mount Albert	
	WEATHER: Sunny	SHEET 1 OF 1
	PROJECT: Two New Dwellings	**LOGGED:** KL
	CLIENT: Alan An	**CHECKED:** RB
		DRILL DATE: 9/01/2025

DEPTH (m)	SOIL DESCRIPTION	LEGEND	GROUND WATER	UNDRAINED SHEAR STRENGTH (kPa) 0 50 100 150	SCALA (BLOWS PER 100mm) 0 5 10 15
0	[AUCKLAND VOLCANIC FIELD] SILT and ASH, dark reddish brown, very stiff, moist.			UTP	
	EOB @0.6m Too Stiff to Drill				Scala bouncing at 0.8m bgl (Baslat rock)
1					
2					
3					
4					
5					

NOTES: No groundwater table was encountered

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DIRECTOR: GEOFFREY KANG BE(CIVIL), ME(CIVIL), CPENG, MIPENZ

JOB NUMBER:	**5057**	**HAND AUGER NO.**
ADDRESS:	**22 & 22A Summit Drive, Mount Albert**	**HA01B**
WEATHER:	**Sunny**	SHEET 1 OF 1
PROJECT:	**Two New Dwellings**	**LOGGED:** KL
CLIENT:	**Alan An**	**CHECKED:** RB
		DRILL DATE: 9/01/2025

DEPTH (m)	SOIL DESCRIPTION	LEGEND	GROUND WATER	UNDRAINED SHEAR STRENGTH (kPa) 0 50 100 150	SCALA (BLOWS PER 100mm) 0 5 10 15
	[AUCKLAND VOLCANIC FIELD] ASH with minor gravels, dark reddish brown, very stiff, moist			UTP	
1	EOB @0.6m Too Stiff to Drill				
2					Scala bouncing at 1.9m bgl (Basalt rock)
3					
4					
5					

NOTES: No groundwater table was encountered

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DIRECTOR: GEOFFREY KANG BE(CIVIL), ME(CIVIL), CPENG, MIPENZ

GEO STUDIO	**JOB NUMBER:** 5057	**HAND AUGER NO.** **HA02**
	ADDRESS: 22 & 22A Summit Drive, Mount Albert	
	WEATHER: Sunny	SHEET 1 OF 1
	PROJECT: Two New Dwellings	**LOGGED:** KL
	CLIENT: Alan An	**CHECKED:** RB
		DRILL DATE: 9/01/2025

DEPTH (m)	SOIL DESCRIPTION	LEGEND	GROUND WATER	UNDRAINED SHEAR STRENGTH (kPa) 0 50 100 150	SCALA (BLOWS PER 100mm) 0 5 10 15
1	[AUCKLAND VOLCANIC FIELD] ASH with minor gravels, dark reddish brown, very stiff, moist			UTP UTP	Scala bouncing at 1.4m bgl (Basalt rock)
2	EOB @1.2m Too Stiff to Drill				
3					
4					
5					

NOTES: No groundwater table was encountered

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GEO STUDIO	**JOB NUMBER:** 5057	**HAND AUGER NO.**
	ADDRESS: 22 & 22A Summit Drive, Mount Albert	**HA02B**
	WEATHER: Sunny	SHEET 1 OF 1
	PROJECT: Two New Dwellings	**LOGGED:** KL
	CLIENT: Alan An	**CHECKED:** RB
		DRILL DATE: 9/01/2025

DEPTH (m)	SOIL DESCRIPTION	LEGEND	GROUND WATER	UNDRAINED SHEAR STRENGTH (kPa) 0 50 100 150	SCALA (BLOWS PER 100mm) 0 5 10 15
0	[AUCKLAND VOLCANIC FIELD] ASH with minor gravels, dark reddish brown, very stiff, moist			UTP	
1	EOB @0.9m Too Stiff to Drill				Scala bouncing at 1.9m bgl (Basalt rock)
2					
3					
4					
5					

NOTES: No groundwater table was encountered

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DIRECTOR: GEOFFREY KANG BE(CIVIL), ME(CIVIL), CPENG, MIPENZ

	JOB NUMBER: 5057	**HAND AUGER NO.**
	ADDRESS: 22 & 22A Summit Drive, Mount Albert	**HA03**
	WEATHER: Sunny	SHEET 1 OF 1
	PROJECT: Two New Dwellings	**LOGGED:** KD
	CLIENT: Alan An	**CHECKED:** RB
		DRILL DATE: 9/01/2025

DEPTH (m)	SOIL DESCRIPTION	LEGEND	GROUND WATER	UNDRAINED SHEAR STRENGTH (kPa) 0 50 100 150	SCALA (BLOWS PER 100mm) 0 5 10 15
1	[AUCKLAND VOLCANIC FIELD] clayey SILT, reddish brown, very stiff, moist to wet				
	@0.8m contains traces of volcanic rocks (grits), traces of dark grey				
	@1.0m becomes solid, gritty (rock)			UTP	
	@1.1m becomes clayey SILT, reddish brown				
2	@1.8m contains rocks				
	@2.0m becomes rocks (small & large)				
3	EOB @3.0m Target Depth Reached			UTP	
4					
5					

Pierced through loose rock @1.0m bgl

NOTES: No groundwater table was encountered

GEOSTUDIO LIMITED GEOTECHNICAL ENGINEERS

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DIRECTOR: GEOFFREY KANG BE(CIVIL), ME(CIVIL), CPENG, MIPENZ

JOB NUMBER:	**5057**	**HAND AUGER NO.**
ADDRESS:	**22 & 22A Summit Drive, Mount Albert**	**HA04**
WEATHER:	**Sunny**	SHEET 1 OF 1
PROJECT:	**Two New Dwellings**	**LOGGED:** KD
CLIENT:	**Alan An**	**CHECKED:** RB
		DRILL DATE: 9/01/2025

DEPTH (m)	SOIL DESCRIPTION	LEGEND	GROUND WATER	UNDRAINED SHEAR STRENGTH (kPa) 0 50 100 150	SCALA (BLOWS PER 100mm) 0 5 10 15
1	[AUCKLAND VOLCANIC FIELD] clayey SILT with grit, reddish brown with rtaces of dark grey, volcanic rock, very stiff, moist to wet				
2	@2.0m becomes clayey SILT with some grit, contains traces of basalt rocks @2.5m cantains traces of rocks			UTP	Scala bouncing at 2.8m bgl
3	EOB @2.7m Too Stiff to Drill				
4					
5					

NOTES: No groundwater table was encountered

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