statiker

Geotechnical Investigation Report for Reggie's Residential Design & Drafting At 71 Alexandra Crescent, Bayview, NSW 2104

Job No: G-00182

Date: 23rd March 2021

Revision B, 7th June 2021

Level 8, 269 Bigge St, Liverpool NSW 2170
PO Box 232 Condell Park NSW 2200
Ph: 02 8319 9449
www.statiker.com.au

GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1 – To be submitted with Development Application

Development Application for Mr and Mrs Wakeford
Name of Applicant

Address of site 71 Alexandra Crescent Bayview NSW 2104

Declaration made by geotechnical engineer or engineering geologist or coastal engineer (where applicable) as part of a geotechnical report

I, Krishna Dip Shakya *on behalf of* Statiker Pty Ltd
(Insert Name) (Trading or Company Name)

on this the Geotechnical Investigation Report for Reggie's Residential Design & Drafting At 71 Alexandra Crescent, Bayview, NSW 2104 certify that I am a geotechnical engineer or engineering geologist or coastal engineer as defined by the Geotechnical Risk Management Policy for Pittwater - 2009 and I am authorised by the above organisation/company to issue this document and to certify that the organisation/company has a current professional indemnity policy of at least $10million.

I:
Please mark appropriate box

- ✓ have prepared the detailed Geotechnical Report referenced below in accordance with the Australia Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009
- ✓ am willing to technically verify that the detailed Geotechnical Report referenced below has been prepared in accordance with the Australian Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009
- ✓ have examined the site and the proposed development in detail and have carried out a risk assessment in accordance with Section 6.0 of the Geotechnical Risk Management Policy for Pittwater - 2009. I confirm that the results of the risk assessment for the proposed development are in compliance with the Geotechnical Risk Management Policy for Pittwater - 2009 and further detailed geotechnical reporting is not required for the subject site.
- have examined the site and the proposed development/alteration in detail and I am of the opinion that the Development Application only involves Minor Development/Alteration that does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.
- have examined the site and the proposed development/alteration is separate from and is not affected by a Geotechnical Hazard and does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.
- have provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report

Geotechnical Report Details:

Report Title: Geotechnical Investigation Report for Reggie's Residential Design & Drafting At 71 Alexandra Crescent, Bayview, NSW 2104

Report Date: 7th June 2021
:
Author: Krishna Dip Shakya

Author's Company/Organisation: Statiker Pty Ltd

Documentation which relate to or are relied upon in report preparation:

Site Classification Guidelines, Table 2.1.1 From AS 2870-2011
Herbert C., 1983, Sydney 1:100 000 Geological Sheet 9130, 1st Edition Geological Survey of New South Wales, Sydney
Pittwater Local Environmental Plan; Geotechnical Hazard Map - Sheet Gth_011

I am aware that the above Geotechnical Report, prepared for the abovementioned site is to be submitted in support of a Development Application for this site and will be relied on by Pittwater Council as the basis for ensuring that the Geotechnical Risk Management aspects of the proposed development have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature .....

Name Krishna Dip Shakya

Chartered Professional Status NA

Membership No. MIEAust 4440986

Company Statiker Pty Ltd

GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1(a) - Checklist of Requirements For Geotechnical Risk Management Report for Development Application

Development Application for Mr and Mrs Wakeford
Name of Applicant

Address of site 71 Alexandra Crescent Bayview NSW 2104

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk Management Geotechnical Report. This checklist is to accompany the Geotechnical Report and its certification (Form No. 1).

Geotechnical Report Details:

Report Title: Geotechnical Investigation Report for Reggie's Residential Design & Drafting At 71 Alexandra Crescent, Bayview, NSW 2104

Report Date: 7th June 2021

Author: Krishna Dip Shakya

Author's Company/Organisation: Statiker Pty Ltd

Please mark appropriate box

- ☑ Comprehensive site mapping conducted 23rd February 2021 (date)
- ☐ Mapping details presented on contoured site plan with geomorphic mapping to a minimum scale of 1:200 (as appropriate)
- ☑ Subsurface investigation required
  - ☐ No Justification ……...
  - ☑ Yes Date conducted 23rd February 2021……
- ☐ Geotechnical model developed and reported as an inferred subsurface type-section
- ☑ Geotechnical hazards identified
  - ☑ Above the site
  - ☑ On the site
  - ☑ Below the site
  - ☐ Beside the site
- ☑ Geotechnical hazards described and reported
- ☑ Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
  - ☑ Consequence analysis
  - ☑ Frequency analysis
- ☑ Risk calculation
- ☑ Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☑ Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☑ Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009
- ☑ Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.
- ☑ Design Life Adopted:
  - ☑ 100 years
  - ☐ Other …… (specify)
- ☑ Geotechnical Conditions to be applied to all four phases as described in the Geotechnical Risk Management Policy for Pittwater - 2009 have been specified
- ☑ Additional action to remove risk where reasonable and practical have been identified and included in the report.
- ☐ Risk assessment within Bushfire Asset Protection Zone.

I am aware that Pittwater Council will rely on the Geotechnical Report, to which this checklist applies, as the basis for ensuring that the geotechnical risk management aspects of the proposal have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated, and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature ……..

Name Krishna Dip Shakya……..

Chartered Professional Status NA……

Membership No. MIEAust 4440986……..

Company Statiker Pty Ltd……

GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1 – To be submitted with Development Application

Development Application for Mr and Mrs Wakeford
Name of Applicant

Address of site 71 Alexandra Crescent Bayview NSW 2104

Declaration made by geotechnical engineer or engineering geologist or coastal engineer (where applicable) as part of a geotechnical report

I, Krishna Dip Shakya *on behalf of* Statiker Pty Ltd
(Insert Name) (Trading or Company Name)

on this the Geotechnical Investigation Report for Reggie's Residential Design & Drafting At 71 Alexandra Crescent, Bayview, NSW 2104 certify that I am a geotechnical engineer or engineering geologist or coastal engineer as defined by the Geotechnical Risk Management Policy for Pittwater - 2009 and I am authorised by the above organisation/company to issue this document and to certify that the organisation/company has a current professional indemnity policy of at least $10million.

I:
Please mark appropriate box

- ✓ have prepared the detailed Geotechnical Report referenced below in accordance with the Australia Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009
- am willing to technically verify that the detailed Geotechnical Report referenced below has been prepared in accordance with the Australian Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009
- ✓ have examined the site and the proposed development in detail and have carried out a risk assessment in accordance with Section 6.0 of the Geotechnical Risk Management Policy for Pittwater - 2009. I confirm that the results of the risk assessment for the proposed development are in compliance with the Geotechnical Risk Management Policy for Pittwater - 2009 and further detailed geotechnical reporting is not required for the subject site.
- have examined the site and the proposed development/alteration in detail and I am of the opinion that the Development Application only involves Minor Development/Alteration that does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.
- have examined the site and the proposed development/alteration is separate from and is not affected by a Geotechnical Hazard and does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.
- have provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report

Geotechnical Report Details:

Report Title: Geotechnical Investigation Report for Reggie's Residential Design & Drafting At 71 Alexandra Crescent, Bayview, NSW 2104

Report Date: 23rd March 2021
:

Author: Krishna Dip Shakya

Author's Company/Organisation: Statiker Pty Ltd

Documentation which relate to or are relied upon in report preparation:

Site Classification Guidelines, Table 2.1.1 From As2870-2011
Herbert C., 1983, Sydney 1:100 000 Geological Sheet 9130, 1st Edition Geological Survey of New South Wales, Sydney
Pittwater Local Environmental Plan; Geotechnical Hazard Map - Sheet Gth_011

I am aware that the above Geotechnical Report, prepared for the abovementioned site is to be submitted in support of a Development Application for this site and will be relied on by Pittwater Council as the basis for ensuring that the Geotechnical Risk Management aspects of the proposed development have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature ……..

Name ..Krishna Dip Shakya……..

Chartered Professional Status..N/A……

Membership No. ..MIEAust 4440986……

Company….Statiker Pty Ltd……

GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1(a) - Checklist of Requirements For Geotechnical Risk Management Report for Development Application

Development Application for Mr and Mrs Wakeford
Name of Applicant
Address of site 71 Alexandra Crescent Bayview NSW 2104

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk Management Geotechnical Report. This checklist is to accompany the Geotechnical Report and its certification (Form No. 1).

Geotechnical Report Details:

Report Title: Geotechnical Investigation Report for Reggie's Residential Design & Drafting At 71 Alexandra Crescent, Bayview, NSW 2104
Report Date: 23rd March 2021
Author: Krishna Dip Shakya
Author's Company/Organisation: Statiker Pty Ltd

Please mark appropriate box

- ☐ Comprehensive site mapping conducted _____ (date)
- ☐ Mapping details presented on contoured site plan with geomorphic mapping to a minimum scale of 1:200 (as appropriate)
- ☐ Subsurface investigation required
  - ☐ No Justification ……...
  - ☑ Yes Date conducted 23rd February 2021……
- ☐ Geotechnical model developed and reported as an inferred subsurface type-section
- ☑ Geotechnical hazards identified
  - ☑ Above the site
  - ☑ On the site
  - ☑ Below the site
  - ☐ Beside the site
- ☑ Geotechnical hazards described and reported
- ☑ Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
  - ☑ Consequence analysis
  - ☐ Frequency analysis
- ☐ Risk calculation
- ☑ Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☑ Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☑ Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009
- ☑ Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.
- ☐ Design Life Adopted:
  - ☑ 100 years
  - ☐ Other …… specify
- ☐ Geotechnical Conditions to be applied to all four phases as described in the Geotechnical Risk Management Policy for Pittwater - 2009 have been specified
- ☐ Additional action to remove risk where reasonable and practical have been identified and included in the report.
- ☐ Risk assessment within Bushfire Asset Protection Zone.

I am aware that Pittwater Council will rely on the Geotechnical Report, to which this checklist applies, as the basis for ensuring that the geotechnical risk management aspects of the proposal have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated, and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature ……..
Name …… Krishna Dip Shakya ……..
Chartered Professional Status N/A ……
Membership No. MIEAust 4440986 ……..
Company…… Statiker Pty Ltd ……

Record of Issue

Company	Revision	Date Issued	Method of Delivery	Prepared By	Technical Review
Reggie's Residential Design & Drafting	A (Original)	23rd March 2021	Email	Krishna Shakya	Sam Dennawi
Reggie's Residential Design & Drafting	B (Revised)	7th June 2021	Email	Krishna Shakya	Sam Dennawi

statiker

Table of Contents

Appendices

EXECUTIVE SUMMARY

This executive summary presents a synopsis of the geotechnical investigation for No. 71 Alexandra Crescent, Bayview, NSW 2104 (herein referred to as the "site").

The objective of this Report is to ascertain whether the site presents a risk in terms of geotechnical stability from any past/ present activities at the site or neighbouring properties. The scope of work included a document review of historical records, a site walkover, insitu testing and sampling, laboratory analysis and preparation of this report.

The results of this investigation of the site indicate that the site does not present a risk to human health or the environment and is considered suitable for the proposed development provided the suggestions made in this report is taken into account.

Statiker has prepared this report to provide a geotechnical investigation for the site. The site has a slope profile with an average slope angle of 15^0 downwards in the direction of North East. This is the reason that we have done a Slope Stability Analysis based on practical findings and tactical assessments. Further, the site falls under Hazard Zone (H1) in the Geotechnical Hazard Map, courtesy "Geotechnical Hazard Map - Sheet GTH_011". This I believe is mainly because of the fact that the footprint of the existing structure and the proposed extension is located in one of the ancient landslides exactly in the zone of Main Scarp which has been depicted in the report.

It is understood that the site is to undergo residential construction. According to the available design details at the time of preparing this report, it has come to our attention that significant earthworks with substantial cut and fill will be required.

The geotechnical investigation included excavating two (2) boreholes using an automatic drill rig. In conjunction two DCP tests were done adjacent to these boreholes. Samples were recovered for geotechnical inspection and investigation and later on sent to the lab for further analysis. No tilled land or disturbed soil was observed during the site walk over and obtrusive investigation.

The neighbouring properties are residential and no industrial estates are located within 500m of the subject site. The property in itself is situated at an aerial distance of 250m from the Pitt Water Bay (Gibson Marina), courtesy Google Maps. Based on the Particle Size Distribution Analysis in Lab, according to USCS (Unified Soil Classification System) the underlying soil can be broadly classified as SAND with traces to fractions of clay and silt in it. Further Atterberg's limit from the lab tests indicate that the soil has low to medium Plasticity, which therefore indicates that the reactivity of the soil is moderate. Therefore, based on the geology and depth to bedrock, the modifications, alterations and additions shall be done within the natural soil profile that is classified as **M**, "moderately reactive clay or silt sites which may experience moderate ground movement i.e., 20- 40 mm from moisture changes", following table 2.1.1 from AS2870-2011. This is subject to all earthworks being undertaken in accordance with AS3798 – 2007 'Guidelines on Earthworks for Commercial and Residential Development'.

An overall Undrained Shear Strength of above 200Kpa can be observed consistently from the two boreholes at 2.7m onwards and 2.0m onwards respectively in boreholes 1 and 2. Also in borehole 2 we encountered Sandstone at a depth of 5.5m". Point Load Test of the rock core samples revealed a medium Strength Extremely Weathered Sandstone (XW) of minimum 0.5Mpa Point Load Strength Index with a UCS value around 6 Mpa.

Further based on the correspondence from Northern Beaches Council, in Council's words *"Northern Beaches Council holds no recent information on past landslides for the above property address"*, it is concluded that the site is geo-technically stable and is suitable for the proposed development and that the site and the development proposal can achieve all the relevant points listed in clause 6.5 for the Acceptable Risk Management required under Council's Geotechnical Risk Management Policy provided that suggestions made in this report is taken into account. This is further subject to all recommendations made in this report and all earthworks being undertaken in accordance with AS3798 – 2007 'Guidelines on Earthworks for Commercial and Residential Development'.

1.0 INTRODUCTION

Statiker has undertaken the Geotechnical Investigation of the site at 71 Alexandra Crescent, Bayview, NSW 2104 (herein referred to as the "site". It is understood that the property is proposed to go for an extension towards North East of the existing property. The existing property is a two storeyed dwelling with a basement. The extension is mainly viewed to add a Granny Flat at the front with proposed alterations and extensions- added carport, increased balcony, added pathway to south eastern side of the existing garage, pool added, setbacks increased and setbacks altered. Statiker has prepared this report to reflect the geotechnical findings at the site.

The geotechnical investigation included two (2) boreholes (BHs) using an automated Drill Rig followed by a Dynamic Cone Penetrometer (DCP) Test adjacent to each borehole. Samples were recovered for geotechnical inspection and investigation.

This report provides a geotechnical assessment of the existing soil conditions. The report is based only on the information summed up at the time of its preparation and may not be valid if changes are made to the site or to the construction method.

1.1 Site Details

The following information, presented in Table 1, describes the site.

Table 1: Summary of Site Details Figure 1 – Site Location

Site Address	71 Alexandra Crescent, Bayview, NSW 2104
Lot & DP. No.	Lot 71; DP 11186
Area	1201 m²
Local Government Association	Northern Beaches Council (Previously Pittwater Council)

1.2 Geology

The Sydney 1:100 000 Geological Sheet 9130 **(Appendix H**) Geological Series Map indicates that the subject site is located North east of Yarramalong Syncline, lithologically underlain by Silty to peaty quartz sand, silt and clay with Ferruginous and humic cementation in places with common shell layers of Cainozoic Era. North East of the property is the Bay of Pitt Water.

1.3 Site Description

The subject site is nearly rectangular, covering an area of approximately 1201 square metres. Ground slopes are falling towards the front end of the property (North East 71^0) by approximately 15°. Site features include;

- DBYD (Dial Before You Dig) investigation was carried out within the compound by Statiker, to conclude that the following service providers had their installations close to the south east boundary of the existing property or outside the property boundary not affected by our geotechnical investigation. Service providers affected are namely Ausgrid, Jemena Gas, Sydney Water, Telstra last but not the least NBN. Further no any External Stormwater related features were found within the property from the available Storm Water Map of the Council.
- Three single storey houses located to the direction of the bay at the front, North-East of the property at Nos. 44,46 and 50. Two storey house to the South East at No. 69 and another single storey house towards the North- West at No. 73 **(Appendix M)**,
- The overall platform slope seen varying at approximately 15 degrees down slope towards the front end of the property (Series 6, **Appendix M**). This is justified by the Survey Plan **(Appendix G1)** that shows a difference in elevation from 30.5 by the roadside to 41.15 by the side of proposed swimming pool.
- Front of the property has some medium size to big trees total 5, as well as a stump. It has a thick bush and is vegetated with ornamental plants (**Appendix M**). Back of the property was not investigated as it wasn't within our study for the proposed scope of works.
- Stormwater Drain is located along the South-East boundary of the property (Series 6**, Appendix M**), on the same side next to the drain is the sewer main off the driveway.
- Dry Stone Masonry Retaining Structures are present in two different locations across the slope (Series 3: **Appendix M**). No substantial movements were seen in these.
- There are visible evidences of cracks in existing driveway and the steps up to the existing main entrance of the house (Series 4 & 5, **Appendix M**). The most significant is a 50mm wide crack near to the location of second borehole (**Appendix A**) at the front of the existing property which could be probably due to insufficiently founded concrete block experiencing repetitive vibrating motion as the space was seen to be used as motorcycle parking. Cracks in the driveway however can't be used to indicate any subsurface movement as it could most possibly be as a result of vehicular load and vibrations, or minor piping erosion.
- Attached below is the panoramic picture at every 30^0 starting from North as 0^0.

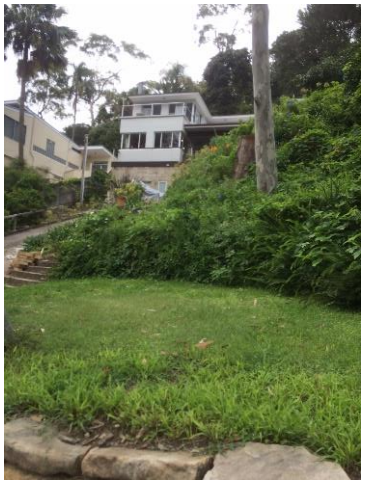
0^0

30^0

60^0

90^0

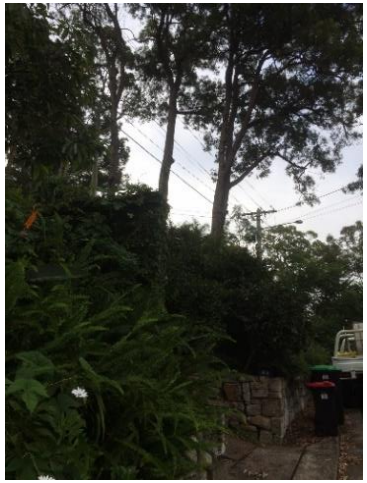
120^0



150^0

180^0

210^0



240^0

270^0

300^0

330^0

2.0 FIELD WORK

Fieldwork was undertaken on the 23rd of February 2021 and involved drilling two boreholes (BH1 & BH2) using a drill rig. Dynamic Cone Penetration (DCP) tests were undertaken adjacent to the boreholes. Borehole locations are shown in **Appendix A**. Samples were recovered for the examination, investigation and laboratory analysis of the soil profile.

2.1 Sampling Methodology and Lab Results

Two different types of vehicle mounted drill rigs, fully automatic and able to be driven and operated with a remote controller was used to drill the two bore holes using a set of solid flight augers. BH1 was drilled to a depth of 8m and BH2 was drilled to a depth of 6.5m. In case of BH2 refusal was assumed at 6.5m after encountering rock at 5.5m. Soil and rock samples were collected in standard sampling bags and core box meeting AS requirements. The requirement of minimum sample masses was followed according to Australian Standard. Further sampling and preparation of soils were done following AS 1289.1.1. Samples were then sent to the lab for the test required namely Electrical Conductivity, Moisture (AS 1289.2.1.1), Particle Size Distribution (AS 1289.3.6.1 and AS 1289.3.6.3), Atterberg Limits (AS 1289.3.1.1/3.2.1/3.3.1/3.4.1), Shrink Swell Index (AS 1289.7.1.1) and Electrical Conductivity (APHA 2510B). Analyses have been done based on the lab results and subsequent reports (attached in Annex C).

2.2 Soil Profiles

The distinct geological units encountered during the field investigation with their approximate depths have been detailed in **Appendix A** with a complete borehole log and field observations.

Borehole 1 was drilled to a depth of 8.0m **(Appendix B**). We didn't encounter any rock underneath. Based on the particle size distribution analysis from the lab test report **(Appendix C)**, underlying soil can be broadly categorised as SAND with varying proportions of silt, clay and gravel according to USCS guidelines **(Appendix F)**. The soil horizons encountered were sequentially A, E and B, i.e., layer of Top Soil followed by Eluviation/ Leaching layer and further continued by a layer of Subsoil according to the guidelines in **Appendix B**. An overall Undrained Shear Strength of above 200Kpa can be observed consistently from the depth of 2.7m onwards.

Borehole 2 was drilled to a depth of 6.5m **(Appendix B)**. We encountered rock, characteristically Sandstone based on the lab test report **(Appendix C)** at a depth of 5.5m". Based on the particle size distribution analysis from the lab test report **(Appendix C)**, again underlying soil can be broadly categorised as SAND with varying proportions of silt, clay and gravel. The soil horizons encountered were sequentially A, E, B and C, i.e., layer of Top Soil followed by Eluviation/ Leaching layer and further continued by a layer of Subsoil and a layer of weathered or broken rock. An overall Undrained Shear Strength of above 200Kpa can be observed consistently from the depth of 2.0m onwards.

2.3 Soil/ Rock Classification

The Soil Classification on this report has been determined based on laboratory testing of the soil. Samples were taken from the two boreholes and laboratory testing was conducted to determine the reactive nature of the soil, in other words the clay content or percentage of fines. Atterberg limits test, Particle Size Distribution Analysis, Shrink Swell Test were carried out on the samples. Further Point Load Test were also performed on the rock core samples so obtained in Borehole No. 2 to classify the so obtained rock.

Depending on the fine fraction and plasticity of the soil so obtained from the lab results **(Appendix C**), soil has been categorised under the classification group **M**, "moderately reactive clay or silt sites which may experience moderate ground movement i.e., 20- 40 mm from moisture changes", following table 2.1.1 from AS2870-2011 **(Appendix E)**. This is also justified by the low shrink swell index of 3.7. Detailed information regarding the classification definitions is included in **Appendix E**. This classification of **M** for the site is justified by the fact that Atterberg analysis of the soil samples from BH 1 as well as BH 2 depicted soils of low to medium plasticity with increasing depth of the soil. Electrical Conductivity (EC) test of the samples exhibited the soil to be non-saline as EC was found in the low range of 26 µS/cm to 230 µS/cm.

Based on Rock Material Weathering Classification and Strength of Rock Material (AS 1726- Table 19) attached under **Appendix D** it was found to be predominantly medium Strength Extremely Weathered Sandstone (XW) of minimum Point Load Index of around 500Kpa with a UCS value around 6 Mpa. The core sample revealed a weaker band of 360 KPa with a UCS value below 6Mpa at around 6.3m.

Field Sampling in this case is limited to a depth of 8m which satisfies the design requirements. Future alterations in the design however can't be guaranteed for its stability. Any modification in the design means, Statiker would need to return to the site, and conduct additional investigation with reciprocating tests, and a new report could be issued.

2.4 Groundwater

Groundwater was not encountered in any of the two boreholes at the proposed location following the completion of drilling works. However, Piezometer observations were not done for the confirmation of ground water table. Detail examination of ground water table and monitoring its dynamic nature may require installation of piezometers. If required, Statiker would need to return to the site, and conduct additional investigation for the comprehensive analysis of groundwater and a new report could be issued.

2.5 Platform Slope

Ground slopes within the site were observed as being fairly variedly sloped towards North East or the front end of the property with the platform slope varying between 14 degrees and 17 degrees at the front part. Altitudinal variation can be seen from 30.62m AMSL at the driveway just next to the road to 41.15m AMSL (ref. Survey Plan **Appendix G1)** close to the existing house. However, no evidence of soft or collapsing soil noted. The back end of the property beyond the structure of existing house hasn't been incorporated in this investigation as practically no any alterations have been proposed to the back that requires additional soil investigation.

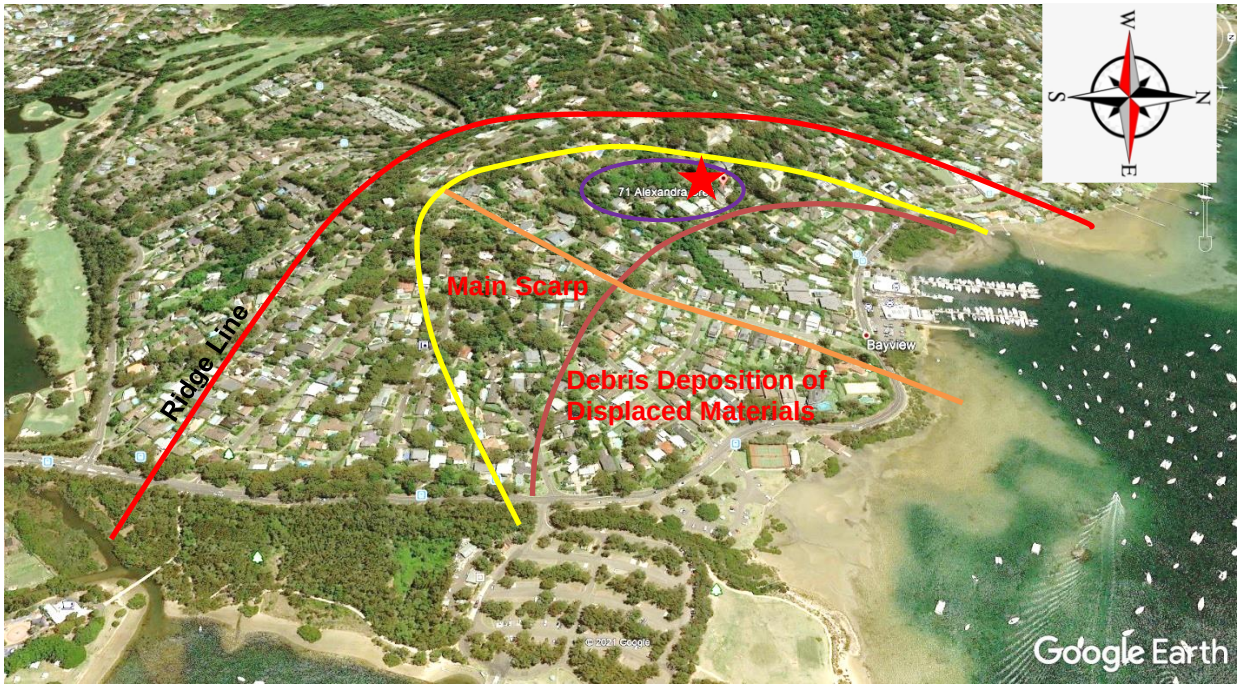
2.6 Site Fill

No major stockpiles of dumped soils were observed. The soil was observed as being well compacted based on the DCP data **(Appendix B)**. Further it didn't contain wood, metal, plastic or any foreign material such as plastic and foam or any other deleterious material. This platform soil is considered to be moderately suitable for geotechnical use within

the site and may need to be stabilized at some parts during bulk earthworks.

2.7 Land Slip Implication

As can be seen from the below snippet obtained courtesy Google earth for the area under investigation, the site is located in an old landslide precisely in the Main Scarp.



With what was visible, no new cracks or signs of movements were seen in the land itself. However, there were limitations in checking all the details as the site was densely vegetated. Within the property, closer view of the driveway and roads depicted cracks, indicating some movement which have been referenced in Series 4 of **Appendix M**. The widest crack has been observed to be 50mm which has been found mainly because of the poorly founded concrete platform with insufficient reinforcement, used for parking two wheelers (motorcycles). This is not representative of the dynamism of the site. As the platform slope is beyond 11degrees and the site falls under the Hazard zone H1 in the Geotechnical Hazard Map **(Appendix I)** a detailed investigation based on the laboratory Analysis and Tactical Analysis was done. Based on the observations, lab tests and bore hole logs for the samples obtained in BH1 and BH2 **(Appendix B**); the underlying soil has been found to be broadly Sand with fines at low to medium plasticity which may experience moderate ground movement.

3.0 SLOPE STABILITY ASSESSMENT

During the course of the inspection, no slip scarps or tension cracks were documented nor was there any visible hummock within the property. This leads to the assumption that no significant slope failures have occurred despite the fact that the site is located in a pre-historic landslide. This is also clear from the Council's Correspondence which in their word says "Northern Beaches Council holds no recent information on past landslides for the above property address". The email correspondence from the council has been attached for reverence in **Appendix J**.

The stability of a site is generally governed by site factors such as slope angles, depth of in-situ soils, and strength of sub-surface material and concentrations of water. The Australian Geomechanics Society recommends that the landslide risk of a site is assessed on the basis of the likelihood of a landslide event and the consequences of that event.

Based on the lab reports and tactical analysis the site has been found to be satisfying the conditions for category **M**. Land Slip can't be denied if advised measures mentioned in the storm water management plan prepared by Statiker aren't taken under consideration at the time of construction, which otherwise would aggravate the moisture profile and destabilise the slope. This statement is based on the fact that during the lab test the natural moisture content of the site has been found to be varying between 9.9% to 20.5% **(Appendix C)**. Further a layer of weak band of Sandstone was found at a depth of 6.3m prompting the potentiality of differential settlement following the inability of incorporating the recommendations made in Statiker's Stormwater Management Plan. For reference, a copy of this plan has been attached in **Appendix G3**.

It is our observation that the site has a mild slope of 15^0 on an average, varying between 14^0 to 17^0. There is a decent vegetation cover on soil slopes (ref- Series 3, **Appendix M**). It is strongly advised to keep the vegetation clearance to a reasonable minimum as it has been eminently seen that the existing trees, and to a lesser extent the existing ornamental smaller vegetation seems to have taken substantial quantities of water out of the ground to keep it stable to the present condition. This in fact has lowered the ground water table which is also clear from the fact that we did not encounter ground water during our investigation). Further it has aided to maintain the stability of the present ground slope despite the soil being of medium plasticity. It is strongly recommended to avoid large scale clearance of vegetation. This may result in a rise in water table from what it is at the present condition with a consequent increase in the likelihood of landslip or a landslide (Geo-Guide LR5).

Keeping this in mind it is highly recommended to follow the proper hillside construction practice. A copy of Australian Geo-guide Lr8 (Construction Practice) showing good and poor hillside construction practice has been attached in **Appendix K1** and a copy of Landslide Risk Management has been attached in **Appendix K2** for reference and adherence to our recommendation.

Based on the field observations and investigations below in Table 2, a Tactical Risk Assessment related to shallow soil slips, near surface slumping and deep-seated landslides has been outlined. Table 3 describes the risk assessment to the property and Table 4 describes the risk assessment This assessment is subject to adherence to our recommendations.

Table 2: Summary of Risk to Property and Life

HAZARD	SOIL CREEP/ SLIP	NEAR SURFACE SLUMPING	ACTIVE OR DEEP-SEATED LAND SLIDE	ROCK FALL (ABOVE DWELLING LOCATION)
Likelihood	Rare	Rare	Rare	Not credible
Consequence to Property and Life	Minor	Medium	Major	Major
Risk to Proposed Development	Low	Low	Low	Very Low
Remarks	None observed	None observed	None observed	None observed

The site is currently in a stable condition, based on a "Low" Risk Level of instability relating to shallow soil slips and active or deep-seated land slide.

With reference to the supplied drawings by Reggie's Residential Design & Drafting, job no. 27352 dated 6th October 2020, it is our assessment that the site is suitable for the proposed extension with swimming pool provided all recommendations presented in this report are adhered to and that construction is carried out in accordance with good engineering and hill slope practices.

To reiterate, it should be noted that the surficial soils may be susceptible to localised erosion and instability could occur if the proposed development is not carried out with care, and if areas of the land disturbed by building activities are not subsequently suitably landscaped.

TABLE 3- RISK ASSESSMENT TO THE PROPERTY

POTENTIAL LANDSLIDE HAZARD	**Under Existing Conditions (No Development)**			**Following Construction**		
	A Instability of undercutsections of slope	**B** Instability of sandstone blocks	**C** Instability of soil slopes	**A** Instability of undercutsections of slope	**B** Instability of sandstone blocks	**C** Instability of soil slopes
Assessed Likelihood	Possible [1]	Possible [1]	Possible [1]	Rare [2 & 3]	Rare [2 & 3]	Unlikely
Assessed Consequences	Possible [1] (neighbouring property at the north west, next to the proposed pool) Minor (neighbouring house at the south east)	Possible [1] (neighbouring property at the north west, next to the proposed pool and neighbouring house at the south east)	Possible [1] (neighbouring property at the north west, next to the proposed pool and neighbouring house at the south east)	Insignificant (proposed house, neighbouring property at the north west, next to the proposed pool) Minor (neighbouring house at the south east)	Insignificant (proposed house, neighbouring property at the north west, next to the proposed pool and neighbouring house at the south east)	Insignificant (neighbouring property at the north west, next to the proposed pool and neighbouring house at the south east)
Risk	Very Low (neighbouring property at the north west, next to the proposed pool) Moderate (neighbouring house at the south east)	Very Low	Very Low	Very Low (proposed house, neighbouring pool to eastand neighbouring house to south	Very Low (proposed house, neighbouring pool to eastand neighbouring house to south	Very Low
Comments	Assumes neighbouring house to the south west not impacted.	Assumes neighbouring house to the south west not impacted.	Assumes localised instability and small volumes of debris potentially impacting the neighbouring sites.	Assumes the proposed addition is designed and constructed in accordance with theadvice presented in this report. Assumes landslide risk management measures described in this report are implemented. Hazard A: Assumes neighbouring house to the north west not impacted.Hazard B: Assumes neighbouring house to the south east not impacted. Hazard C: Assumes localised instability and small volumes (less than $1m^3$) ofdebris potentially impacting the neighbouring sites.		

NOTES

1. Assumes an annual probability of $1x10^{-2}$ of the event occurring and an annual probability of $1x10^{-1}$ of the debris travelling downslope and impacting the neighbouring properties, i.e., a combined annual probability of$1x10^{-3}$ (Possible).

2. Assumes an annual probability of $1x10^{-4}$ of the event occurring (provided the house is designed and constructed in accordance with the advice presented in this report and an annual probability of $1x10^{-1}$ of thedebris travelling downslope and impacting the neighbouring properties, i.e., a combined annual probability of $1x10^{-5}$ (Rare).

3. Provided the house is designed andconstructed in accordance with the advice presented in this report, assessment of 'Insignificant' consequences will remain valid and the assessed risk level would remain at an 'Acceptable' level (Very Low).

TABLE 4- RISK ASSESSMENT TO THE LIFE

	Under Existing Conditions			Following Construction		
POTENTIAL GEOTECHNICAL HAZARD	**A** Instability of undercut sections of slope	**B** Instability of sandstone blocks	**C** Instability of soil slopes	**A** Instability of undercut sections of slope	**B** Instability of sandstone blocks	**C** Instability of soil slopes
Assessed Likelihood	Possible [1]	Possible [1]	Possible [1]	Rare [2]	Rare [2]	Unlikely
Indicative Annual Probability	10^{-3}	10^{-3}	10^{-3}	10^{-5}	10^{-5}	10^{-4}
Persons at Risk	Person in the house to the north west or south east, person in the yard area (north east) Person in the pool area (north west)			Person in the house on the subject site or to the north west and south east, person in the yard area (north east) Person in the pool area (north west)		
Duration of Use of Area Affected (Temporal Probability)	0.35 (bedroom) [3] 0.7 (living area) [3] 0.02 (rear yard) [4] 0.04 (pool) [5]					
Spatial Probability[6]	0.09(neighbouring property to north west) 0.08 (neighbouring house to south east)		0.04	0.28 (proposed alteration) 0.09(neighbouring property to north west) 0.08 (neighbouring house to south east)		0.04
Probability of Not Evacuating Area Affected	0.1 (front yard, house, pool)	0.1 (front yard, house, pool)	0.1 (front yard, house, pool)	0.1 (front yard, house, pool)	0.1 (front yard, house, pool)	0.1 (front yard, house, pool)
Vulnerability to Life if Failure Occurs Whilst Person Present	1	1	0.1	1	1	0.1
Risk for Person Most atRisk	3.2x10-6 Person in the house to the north west 6.3x10-6 Person in the house to the south east 1.8x10-7 (front yard to the north east) 3.6x10-7 (pool to the west)	$3.2x10^{-6}$ Person in the house to the north west $6.3x10^{-6}$ Person in the house to the south east $1.8x10^{-7}$ (front yard to the north east) $3.6x10^{-7}$ (pool to the west)	$1.4x10^{-7}$ Person in the house to the north west $2.8x10^{-6}$ Person in the house to thesouth east $8x10^{-7}$ (front yard to the north east) $1.6x10^{-8}$ (pool to the west)	9.8x10-8 Person in the house after proposed addition 3.2x10-8 Person in the house to the north west 6.3x10-8 Person in the house to the south east 1.8x10-9 (front yard to the north east) 3.6x10-9 (pool to the west)	9.8x10-8 Person in the house after proposed addition 3.2x10-8 Person in the house to the north west 6.3x10-8 Person in the house to the south east $1.8x10^{-9}$ (front yard to the north east) $3.6x10^{-9}$ (pool to the west)	$1.4x10^{-8}$ Person in the houses to the north west and south east $2.8x10^{-8}$ Person in the house after proposed addition $8x10^{-10}$ (front yard to the north east) $1.6x10^{-9}$ (pool to the west)
Comments	Assumes neighbouring house to the south west not impacted.		Assumes neighbouring house tothe south west not impacted. Assumes localised instability and small volumes of debris potentiallyimpacting the neighbouring sites tothe north west and south east.	Assumes the proposed addition is designed and constructed in accordance with the advice presented in this report.Assumes landslide risk management measures described in this report are implemented. Assumes neighbouring house to the south west not impacted by the hazards within the site. Hazard C: Assumes localised instability and small volumes of debris potentially impacting the neighbouring sites.		

Notes

1. Assumes an annual probability of $1x10^{-2}$ of the event occurring and an annual probability of $1x10^{-1}$ of the debris travelling downslope and impacting the neighbouring properties, i.e., a combined annual probability of $1x10^{-3}$ (Possible), provided the house is designed and constructed in accordance with the advice presented in this report, an assessment of 'Insignificant' consequences will remain valid and the assessed risk level would remain at an 'Acceptable' level (Very Low).
2. Assumes an annual probability of $1x10^{-4}$ of the event occurring (provided the house is designed and constructed in accordance with the advice presented in this report) and an annual probability of $1x10^{-1}$ of the debris travelling downslope and impacting the neighbouring properties, i.e. a combined annual probability of $1x10^{-5}$ (Rare).
3. Person in house, occupancy based on 8hrs per day (bedroom): about 0.35 and 16hrs per day (living area): about 0.7,
4. Person in yard, occupancy based on 0.5hrs per day: about 0.02, and
5. Person in pool area, occupancy based on 6hrs per day, 2 days per week and 6 months per year: about 0.04.
6. Spatial Probabilities: Hazard 1 and 2, based on soil debris impacting neighbouring site to the north west and south east.

3.1 Batter Slopes

The footprint of the building after the proposed alteration **(Appendix G2- sheet no A104 and sheet no A110)** indicates approximately 4.1m of maximum cut at the back end of the proposed garage, to allow construction of the proposed structures.

Resultant embankments at any location are advised to comprise of Sand with varying contents of clay silt and gravel fill which stands unsupported for a short period of time. Where personnel are to enter excavations, options for short-term excavations should include benching or battering back of excavations to 1H:1V. It is recommended that long-term excavations in the aforementioned fill should be either battered at 3H:1V or flatter or be supported by engineer designed and suitably constructed retaining walls. Unretained excavations should not extend below the "zone of influence" of adjacent structures. That is, a line drawn 45^0 down from the foundation level of adjacent structures or features, including temporary site sheds etc. If excavations are to extend below this line, or there is insufficient room for batter faces, proposed excavations are to be retained prior to excavation.

3.2 Footing Design

Based on the above principal geotechnical constraints, we would recommend the following allowable bearing pressures and notes during construction;

- It is a general recommendation of 150kPa for footings founded in soils containing hard natural clays, in our case this is 200kPa. Allowable bearing pressure of 400kPa is recommended for footings founded in the extremely weathered rock which in our case is 600kPa
- Footings for the proposed secondary dwelling **(REF Appendix G2- sheet no A105)** are recommended to be socketed into the underlain rock. It is our strong recommendation to incorporate pier footing especially at the point of maximum depth of excavation behind the wall of the proposed new garage, into the rock bed that has been detected during our investigation.
- Footings for the proposed swimming pool **(REF Appendix G2- sheet no A105)** are recommended to be socketed into the underlain rock which has been detected during our investigation.
- Footings should penetrate through any fill that is identified at the time or during the construction
- It is recommended to ensure that all the footings are on a similar material to minimise differential settlements

It is recommended that at the time of construction all footing excavations are inspected by a geotechnical engineer to confirm that founding conditions are consistent with design recommendations. The founding level is recommended to be adjusted if the required founding material is not encountered at the design founding level. A combined storm water catch-drain/subsoil drainage system according to Statiker's Stormwater Management Plan **(Appendix G3)** should be installed to intercept and divert surface flow and seepage away from the high side of the building area. The drains should preferably be installed prior to construction and ultimately connect to the development storm water system.

3.3 Retaining Walls

There is an existing masonry retaining wall front of the existing site at the boundary with the property at No 73, north west of the site which is approximately 2m high and runs approximately 15m along the boundary. Another retaining structure which looks like more of a toe wall approximately 1m high and 5m long runs at the front of the existing property. Proposed new blockwork retaining walls **(REF Appendix G2- sheet no A104)** at the front of the proposed alteration to the north east direction and by the side of the garage to the south east direction is recommended to be designed in consultation with a Geotechnical/Structural Engineer. It is advised that the retaining wall footings should be founded in competent soil following the underlying bearing capacity as pointed out in the Borehole Log **(Appendix B)** of this report to the supervising engineer's direction and approval. Excavations for retaining wall construction should remain stable. Appropriate drainage systems and free draining backfill should be provided to prevent the build-up of hydrostatic pressures behind all retaining walls. To facilitate the site earthworks, it would be prudent to install a temporary catch drain above the proposed excavation to divert surface run-off away from the building area during construction.

4.0 EARTHWORK EXCAVATION RECOMMENDATIONS

It is understood from (**Appendix G2 sheet no A110)** that significant cut to fill is required as a part of the proposed development including removal of some of the existing trees and re-instatement. Slope rendering is required in order to make the front end of the slope stable keeping in mind "Risk Assessment to Property and Life" pointed out in tables 2 to 4. All earthworks should be undertaken in accordance with AS3798-Guidelines on Earthworks for Commercial and Residential Developments.

4.1 Subgrade Preparation

The area on which the fill is to be placed and the area from which the cut is to be removed should be stripped of:

- All vegetation
- Any unsuitable soils
- Uncontrolled filling

These Stripped materials are to be removed from site as General Solid Waste (subject to further assessment at the time of removal).

4.2 Subgrade Inspection

The condition of the stripped surface should be inspected immediately after stripping and prior to filling commencing. Before placing fill, proof roll needs to be done on the exposed sub-grade with a minimum 12 tonnes static smooth steel wheeled roller to detect and remove any soft spots.

4.3 Fill Materials

The naturally occurring soil, and weathered rock seen during the excavation of borehole can be used as engineered fill i.e. site derived material can be utilized as structural fill. Existing material encountered during the borehole excavation appeared to be suitable for re-use which is also proven by the particle size distribution analysis **(Appendix C)**, however a full inspection should be undertaken after it has been excavated. If the material is to be imported from another site it will need to comply with one of the following:

Schedule 1 of the Protection of the Environment and Operations Act 1997 defines virgin excavated material (VENM):

- Material that is not mixed with any other waste;
- Has been excavated from areas that are not contaminated as a result of industrial, commercial, mining or agricultural activities, with manufactured chemicals,
- Does not contain ores with sulphides or soils that consist excavated natural materials that meet such criteria as approved by the DECC.

The Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 – "The Excavated Natural Material Order 2014" prepared by the NSW EPA:

- Excavated Natural Material is naturally occurring rock and soil that has been excavated from the ground and contains 98% by weight natural material and does not meet the VENM.

The Engineered Fill shall be approved by the Geotechnical Inspection and Testing Authority (GITA) as suitable for the proposed use. Excluded materials include:

- Organic soils, such as many topsoils, severely root-affected subsoils and peat
- Materials contaminated through past site usage which may contain toxic substances or soluble compounds harmful to water supply or agriculture
- Materials containing substances which can be dissolved or leached out in the presence of moisture (e.g., gypsum) or which undergo volume change or loss of strength when disturbed and exposed to moisture (e.g., some shales and sandstones) unless these matters are specifically addressed in the design
- Silts, or materials that have deleterious engineering properties of silt
- Other materials with properties that are unsuitable for forming structural fill
- Fill which contains wood, metal, plastic, boulders or other deleterious materials.

Table 5 : Earthworks Specification

DESCRIPTION	SPECIFICATION
Dry or Hilf Density Ratio	98% Standard Compaction (upper limit of 104% Standard if using high plasticity materials)
Moisture Variation	+/- 2% OMC
Frequency of Density/Moisture Testing	1/500m³ or 3 tests per lot, whichever is greater.

4.4 Fill Placement and Testing

Fill placement shall be in near Horizontal Layers of uniform thickness placed systematically across the fill area. The Layer thickness is to be equal to or less than 400mm (loose), if using large rollers over larger area. Compacted Layer thickness should not exceed 300 mm. Maximum particle sizes not to exceed 2/3rd of layer thickness.

Testing is to be undertaken as per the Level 1 requirements of AS3798 – 2007 'Guidelines on Earthworks for Commercial and Residential Development'.

Statiker recommends the placement of engineered fill be carried out in accordance with AS3798- 2007 "Guidelines on Earthworks for commercial and residential developments". In summary, engineered fill should comprise the following:

- Prior to filling, any topsoil, soft material and vegetation should be removed down to a firm base.
- Suitable fill material shall be placed in loose horizontal layers not exceeding 250mm in thickness.
- The fill shall be compacted to a Dry Density Ratio of at least 95% Standard (AS1289: 5.1.1, 5.4.1 or 5.7.1);
- The fill should be compacted to within +/-2% of the soil's optimum moisture content
- The fill material shall not contain greater than 20%, by volume, of particles coarser than 37.5mm and
- No particle over 200mm in any dimension.
- Under no circumstances should any additional fill contain significant amount of organic matter or be a mixture of greatly different particle sizes.

5.0 GEOTECHNICAL RECOMMENDATIONS

Based on the above evaluation, we are able to provide an opinion on a suitable building footprint for the alteration of the existing dwelling in Section 5.1. We have also provided appropriate geotechnical advice to assist in the design and construction of the new house in Section 5.2.

5.1 Suitable Building Footprint

- To achieve the design subgrade levels for the proposed alterations and remain within council's restrictions for this area, consideration may be given to excavation over the northern section of region. It is recommended that at any time an excavation depth of no more than approximately 2m is carried out. This would help in restricting the destabilising of the slope which is otherwise stable. Recommendations for excavation techniques, methodologies, potential vibrations(and how they may be managed) and temporary excavation batter slopes have been outlined under the Section 5.2 below.
- In order to reduce vertical loadings and be capable of supporting the lateral design loads (example wind load) it is considered that a lightweight steel frame structure is suitable for the site, in particular towards the North eastern part close to the road as our excavation did not verify any rock despite excavating to a depth of 8m. However, in our opinion, there are no geotechnical limitations on the selection of building materials close by the proposed swimming pool and south western part of the proposed new footprint. It is recommended that the structure be designed to impose vertical loads close to the location of BH1 and cantilever close to location of BH2 (i.e. no to limited vertical or lateral loadings). However, the final selection of building materials will be a matter for the architectural and structural designers bearing in mind the geotechnical constraints that I have imposed and the advice presented in this report.
- For design of footings, we have provided allowable bearing pressures in Section 5.1 along with earthquake design parameters for the site to inform the structural engineers design (in accordance with AS 1170.4 – 2007 (Document 15). Subsequently design parameters for retaining walls have also been provided.

5.2 Geotechnical Advice

- We recommend that the Contractor prepare an excavation/retention methodology prior to works commencing. The methodology must include, but not be limited to, proposed excavation techniques, the proposed excavation equipment, excavation sequencing,geotechnical inspection intervals or hold points, vibration monitoring procedures, monitor locations, monitor types, contingency plans in case of exceedances. The excavation/retention methodology must be reviewed and approved by the geotechnical engineer. The excavation/retention methodology must be followed.

- Prior to any works commencing on the building, the following measures will need to be implemented in order maintain the stability of the slope during, and following completion of, the works: underpinning the undercuts, removal of potentially unstable blocks along thecrest of the cliff. To achieve this, we recommend the following:
  (i) Vegetation along the front yard at the north east to be removed to allow furthergeotechnical inspection of the slope.
  (ii) Where soil is assessed to be potentially unstable and/or will be impacted by the proposed alteration, floor levels will need to be marked out on site (using string lines)in order to assess their position in relation to the elevation.
  (iii) The proposed building footprint is covered by a number of trees. Some of these will require to be removed specifically the ones around the footprint of proposed alteration. Any portions of tree stumps/root etc that remain must be poisoned in accordance with guidance froman experienced arborist. The purpose of this work is to prevent the 'jacking' action of continuing tree root growth which could potentially lead to instability.
  (iv) A catch fence (at least 1.5m high) must be established downslope of the base of the cliff face to prevent any debris associated with removal of existing slope material rolling downslope and impacting neighbouring properties.
  (v) We recommend that the catch fence comprise galvanised wire netting thatis attached to suitably sized trees (subject to advice from an arborist) using stainless steel 'tie down' straps wrapped around the tree trunks. Further we recommend that the vertical supports be no more than 3m lateral spacing. Where suitable trees are spaced at more than 3m, then I recommend that additional steel postsare installed. The steel posts (such as 60mm diameter 4.5 CHS galvanised posts) must be socketed at least 0.5m into sandstone bedrock of low or higher strength and provided with a concrete footing at least 0.2m diameter.
- Based on bore hole logs the evaluation of the subsurface conditions points to the fact that the proposed excavations will encounter the soil profile and penetrate weathered sandstone bedrock. Topsoil and/or root affected soils are recommended to be stripped and separately stockpiled for re-use in landscape areas as such soils are not suitable for re-use as engineered fill.
- We consider that the excavations be readily completed using small to medium sized trackedexcavators. Excavation of low and higher strength sandstone bedrock may be achieved using rock breakers, rock saws, rock grinders and ripping attachments to the tracked excavator. The resulting dust from using such attachments should be suppressed with water.
- To reduce vibrations associated with sandstone excavation using rock breakers, we recommend that rock saw cuts be made before the use of rock breakers. The base of theslot must be continually maintained below the level at which the rock breaker is being used.
- Where vibrations must be reduced (close to the existing structure), hand held rock splitting techniques is recommended.
- Prior to excavation commencing, we recommend that detailed dilapidation reports becompiled on the neighbouring buildings and structures to the north and south, and the neighbouring properties to the south east and north west. The property owners should be asked to confirm that the reports present a fair record of existing conditions as the reports may assist the Applicant in defending themselves from unfair damage claims.
- Groundwater seepage inflows may occur within the excavations within the soil profile closeto, or at, the contact with the underlying bedrock, particularly after periods of heavy rain. In addition, concentrated flows along defects within the rock mass may also be encountered. In general, it is expected that the inflows will be ephemeral, of small volume and managed by conventional sump and pump techniques. We recommend inspection and monitoring of groundwater seepage during excavations, so that any unexpected conditions, which may be revealed, can be incorporated into the drainage design.
- Eminent from the bore hole logs the soil profile will be of considerable thickness mostly above 1m. We consider that temporary batter slopes through the soil profile no steeper than 1 Vertical (V) in 1 Horizontal (H) are appropriate. Based on the off-sets of the building footprint that we have recommended, such temporary batter slopes will be achievable within the site geometry.

- Based on our evaluation, we consider that competent sandstone bedrock of low or higher strength, may be cut vertically, subject to geotechnical inspection at maximum 1.5m depth increments.
- Based on bore hole findings, potentially unstable clayseams and extremely weathered seams within the sandstone bedrock may be encountered. Such features can adversely affect the stability of the cut faces and/or any footings located close to the crests of cut faces. Such features may require shotcreting and bolting. However, in some cases instant construction of full height retaining walls may remove the need for use of shotcrete and rock bolts, although this would only be confirmed following geotechnical inspection.
- We recommend that all the proposed retaining walls to support potentially unstable soil masses (particularly after excavation), be designed using the following parameters:

i. For design of conventional walls that will be supported by the structure, I recommend the use of a triangular lateral earth pressure distribution with an 'atrest' earth pressure coefficient (k_o) of 0.55 for the soil profile, assuming a horizontal backfill surface.

ii. Where some minor movements of retaining walls may be tolerated (e.g. landscape walls), I recommend that they may be designed using a triangular lateral earth pressure distribution and a coefficient of 'active' earth pressure, (k_a), of 0.3 for the soil, assuming a horizontal backfill surface.

iii. A bulk unit weight of 20kN/m^3 and 22kN/m^3 should be adopted for the retained soil and weathered bedrock profile, respectively.

iv. Any surcharge affecting the walls (e.g. traffic loading, live loading, footings, compaction stresses, etc) should be taken into account in the design using theappropriate earth pressure coefficient from above.

v. Conventional retaining walls should be designed as drained and provision madefor permanent and effective drainage of the ground behind the walls. Subsurface drains should incorporate a non-woven geotextile fabric, such as Bidim A34, to act as a filter against subsoil erosion. The subsoil drains should discharge into the stormwater system.

vi. We recommend that single sized granular material (or 'no fines' gravel) be used asbackfill to retaining walls and this would also act as the drainage behind the walland would only require nominal compaction (with no compaction testing). The drainage material should be wrapped in a non-woven geotextile fabric (e.g. Bidim A34) to act as a filter against subsoil erosion.

vii. For conventional retaining wall footings keyed into the sandstone bedrock belowbulk excavation level, an allowable lateral stress of 200kPa may be adopted forsandstone of at least low strength. The key depth should commence below thebase of any nearby excavations such as for service trenches or footings.

viii. We recommend that all new footings and underpins supporting slope be founded in weathered sandstone bedrock. It is expected that pad or strip footings will be suitable. Footings may be designed for an allowable bearing pressure using a maximum allowable bearing pressure of 600kPa.

- We recommend that the surface water discharging from the new roof and paved areas be diverted to outlets for controlled discharge to the existing stormwater system subject to any Council requirements.
- It is recommended that the effluent system should be piped and discharged to the main sewersystem.
- We recommend that the guidelines for Hillside Construction given in Appendix B should alsobe adopted.
- We recommend that all structural, hydraulic and landscape design drawings be reviewed by the geotechnical engineer who should endorse that the recommendations contained in this report have been adopted in principle during the construction phase.

5.3 Conclusion

Based on the above evaluation, proposed building footprint and additional geotechnical advice (Section 5),this report represents "a geotechnical report addressing the stability of thesubject site" and provides best location for "a suitable building footprint for the alteration of the existing dwelling." It is therefore considered that this report addresses the required geotechnical aspects for the approval of the proposed design. The proposeddevelopment may proceed, from an engineering perspective, provided the specific design, construction and maintenance recommendations presented in Section 5 above,are adopted in full to maintain and reduce the present risk of instability of the site and to control future risks.

This is subject to all earthworks being undertaken in accordance with AS3798 – 2007 'Guidelines on Earthworks for Commercial and Residential Development

6.0 CONDITIONS OF THE RECOMMENDATIONS

7.0 REPORT LIMITATIONS

This report is a geotechnical report only and the classification stated shall not be regarded as an engineering design nor shall it replace a design by engineering principles although it may contribute information for such designs. When this report is to be used as a reference by the engineer or builder or other relevant party, this report must be reproduced in total.

The investigations (as per our commission) addressed in this report are not designed or capable of locating all ground conditions, (which can vary even over short distances). Further, one site may have a variety of ground conditions and, the ground conditions actually identified by the testing articulated in this report may change, even over very short periods of time. Also Bore holes drilled to identify ground conditions have been supplied with approximate coordinates which may vary depending on equipment used.

The advice given in this report is based on the assumption that the test results are representative of the overall ground conditions. However, it should be noted that actual conditions in some parts of the site might differ from those found. If excavations reveal ground conditions significantly different from those shown in our findings, the advice contained in this report may differ significantly and must be revisited, henceforth Statiker must be consulted. If this occurs, Statiker must be consulted before any further work is carried out on the site; Statiker should be engaged for a supplementary report and updated recommendations.

The foundation depths quoted in this report are measured from the surface during our testing and may vary accordingly if any filling or excavation works are carried out. The description of the foundation material has been provided for its easy recognition over the whole building site.

Any sketches in this report should be considered as only an approximate pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions or slope information should not be used for any building cost calculations and/or positioning of the building. Dimensions on logs are correct. The scope and the period of Statiker services are described in the report and are subject to restrictions and limitations. The scope and relevance of the advice provided in the report is subject to restrictions and limitations. Statiker did not perform a complete assessment of all possible conditions or circumstances that may exist on the site. If a service is not expressly indicated that means it has not been provided, and the reader should not assume that it has been. If a matter is not specifically addressed then Statiker has not made a determination in relation to it, and the reader should not assume that it has.

Where data and information has been supplied by the client or a third party, the accuracy of the advice and recommendations in this report is dependent upon the accuracy of that data and information. Statiker is not responsible for verifying the accuracy of data or information provided to it by third parties. Statiker is neither liable nor responsible for inaccurate advice provided upon reliance of incomplete or inaccurate data supplied by third parties.

8.0 ABOUT YOUR REPORT

The methods of description and classification of soils and rocks used in this report are based on Australian Standards AS1726-2017 (Geotechnical Site Investigations) and AS2870-2011 (Residential Slabs and Footings) where appropriate. In general, descriptions cover the following properties – soil, or rock type, colour, strength or density, and moisture. Identification and classification of soil and rock involves judgement and the company infers accuracy only to the extent that it is common in current geotechnical practice. Soil types are described according to the dominant particle size and behaviour as set out in AS 1726-2017.

Cohesive soils are classified on the basis of consistency data as obtained from Atterberg Limits Test performed in lab. Non cohesive soils are classified on the basis of relative density based on insitu testing like DCP's and also particle size distribution. We used **Portable Dynamic Cone Penetrometer,** DCP tests was carried out by driving a set of rods each 1m in length into the ground with a falling weight hammer and measuring the blows for successive 100mm increments. Our DCP composes a Cone of 20mm diameter with 30^0 taper attached to steel rods of 16mm section. The cone end is driven with a 9kg hammer falling 510mm. This test was initially developed for pavement subgrade investigations. Empirical correlations of the test results with Californian Bearing Ratio have been published.

The site classification is determined as per AS2870-2011, and the report provides sufficient information for a qualified person to design footings for structures covered under the standard.

In this report's soil logs where 'topsoil' has been logged, it is defined as "a poorly compacted superficial soil containing some organic matter, usually darker than underlying soils" Good building practice dictates that all heavy organic deposits be scrapped clear of the building envelope during the site preparation stage, and we assume this will be done.

Citing the probability of Land Slip Failure especially in a case where there is failure to the adherence to proper hill side construction, it is strongly recommended that this report must be followed in conjunction with "Hillside Construction Practice" Under **Appendix K1**, "Foundation Maintenance and Footing Performance; A Homeowner's Guide (CSIRO Document – BTF18)", under **Appendix L** and last but not the least "Landslide Risk Management "attached under **Appendix K2**.

9.0 REFERENCES

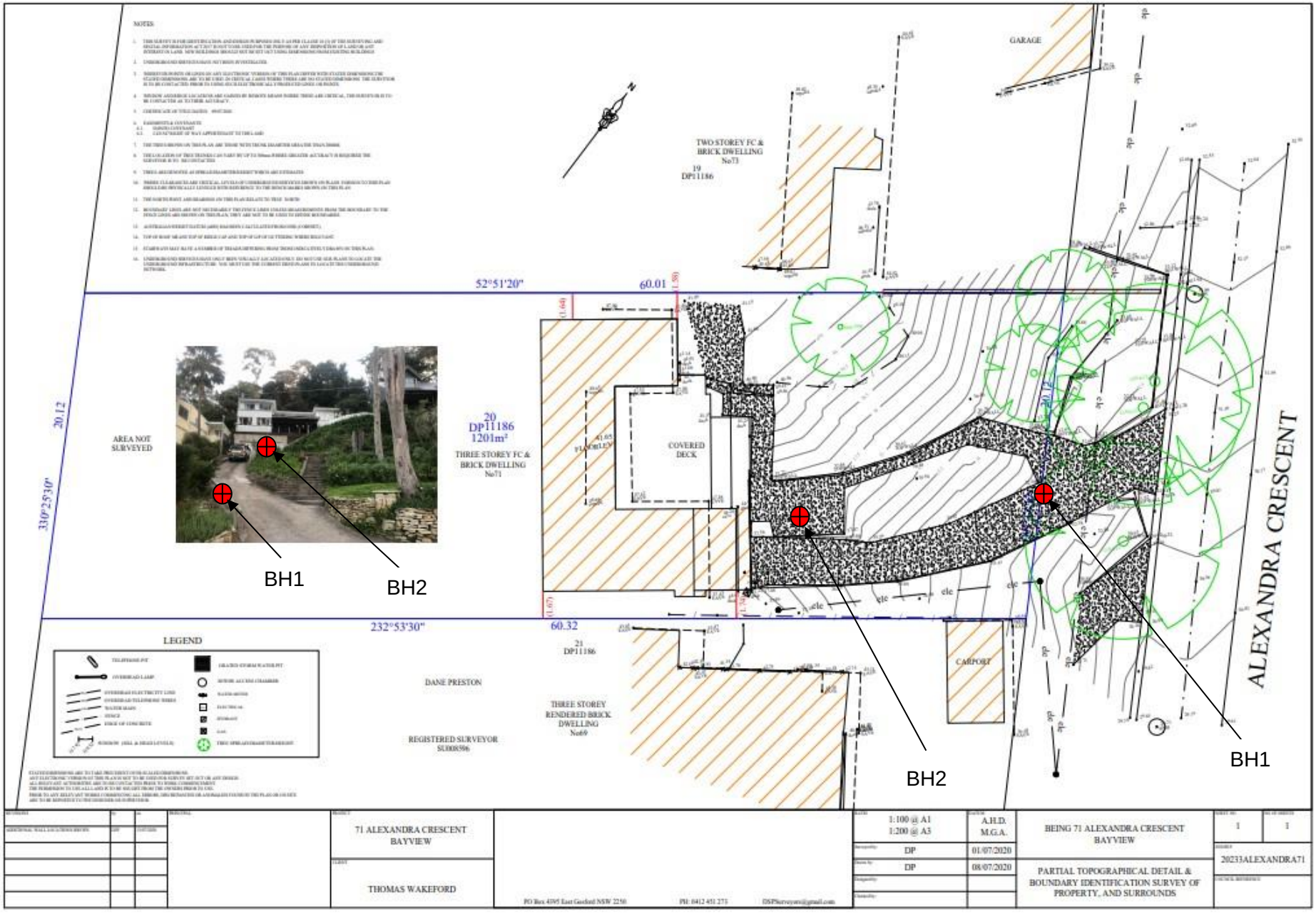
- APHA 2510B, Electrical Conductivity Test
- AS 1289.2.1.1, Moisture Test
- AS 1289.3.1.1/3.2.1/3.3.1/3.4.1, Atterberg Limits Test
- AS 1289.3.6.1 and AS 1289.3.6.3, Particle Size Distribution
- AS 1289.7.1.1, Shrink Swell Index
- AS1726-2017 (Geotechnical Site Investigations)
- AS2870 (2011), Residential Slab and Footings – Construction
- AS3798 – 2007 'Guidelines on Earthworks for Commercial and Residential Development'
- "Foundations of Sandstone and Shale in the Sydney Region" by P.J.N Pells, G.Mostyn & B.F Walker.
- SA NSW Surface Development Guideline 5 | May 2018

For and on behalf of
Statiker

Krishna Dip Shakya
Geotechnical Engineer

MSc.Engg.(Geotech), B.Engg.(Civil), MIEAust
Office: Suite 4/259 Northumberland Street, Liverpool, NSW 2170
Office: Shop 5, 76 Appin Road, Appin, NSW 2560 (By Appointment)
Post: PO Box 232 Condell Park, NSW 2200
P 02 8319 9449 | **M** 0404381507 | **E** k.shakya@statiker.com.au | **W** www.statiker.com.au
CIVIL - GEOTECHNICAL - HYDRAULIC - STRUCTURAL - TRAFFIC ENGINEERING

APPENDIX A APPROXIMATE BORE HOLE LOCATION PLAN


NOTES:
GARAGE
TWO STOREY FC & BRICK DWELLING No73
19 DP11186
52°51'20"
60.01
20.12
330°53'30"
AREA NOT SURVEYED
20 DP11186 1201m²
THREE STOREY FC & BRICK DWELLING No71
COVERED DECK
BH1
BH2
232°53'30"
60.32
21 DP11186
DANE PRESTON
REGISTERED SURVEYOR 5U008596
THREE STOREY RENDERED BRICK DWELLING No69
CARPORT
ALEXANDRA CRESCENT
LEGEND
71 ALEXANDRA CRESCENT BAYVIEW
THOMAS WAKEFORD
1:100 @ A1
1:200 @ A3
A.H.D.
M.G.A.
DP 01/07/2020
DP 08/07/2020
BEING 71 ALEXANDRA CRESCENT BAYVIEW
PARTIAL TOPOGRAPHICAL DETAIL & BOUNDARY IDENTIFICATION SURVEY OF PROPERTY, AND SURROUNDS
2023ALEXANDRA71

APPENDIX B BORE HOLE LOGS

statiker

FIELD LOG

Date: 23/02/2021
Customer Job:
Statiker Job: G-00182
Site Address: 71 Alexandra Crescent, Bayview NSW 2104

Borehole: BH1
Surface RL (approx..): 36.43m
Easting (approx.): 151^{0}17'47"
Northing (approx.): -33^{0}39'38"

Water Table	Depth (m)	DCP counts	Approx. Cu	Density/ Consistency	Classification Code	Material Description	Moisture	Horizon	Fill
Water Table not Encountered	**0.1**	5	100	MD/St	SM	Dark Brown Silty SAND with Gravel and a trace of clay; low plasticity	M	A	
	0.2	7	166	MD/VSt					
	0.3	7	166	MD/VSt					
	0.4	10	>200	D/H					
	0.5	16	>200	VD/H					
	0.6	8	200	MD/VSt		Dark Brown Silty SAND with gravel and a trace of clay, visible signs of leaching: low plasticity	W	E	
	0.7	11	>200	D/H					
	0.8	7	166	MD/VSt					
	0.9	7	166	MD/VSt					
	1.0	15	>200	D/H					
	1.1	5	100	MD/St	SC-SP	Reddish Brown Mottled Yellow and White Clayey SAND to Poorly Graded SAND, traces of gravel and silt	M	B	
	1.2	6	133	MD/VSt					
	1.3	12	>200	D/H					
	1.4	15	>200	D/H					
	1.5	6	133	MD/VSt					
	1.6	5	100	MD/St	SP	Greyish Brown, Mottled White Poorly Graded SAND, traces of clay, silt and gravel			
	1.7	14	>200	D/H					
	1.8	8	200	MD/VSt					
	1.9	4	75	MD/St					
	2.0	7	166	MD/VSt					
	2.1	5	100	MD/St	SP	Reddish Brown, Mottled White Poorly Graded SAND, traces of clay, silt and gravel; medium plasticity and low swell potential			
	2.2	7	166	MD/VSt					
	2.3	16	>200	VD/H					
	2.4	8	200	MD/VSt					
	2.5	5	100	MD/St					
	2.6	5	100	MD/St					
	2.7	14	>200	D/H					
	2.8	21	>200	VD/H					
	2.9	20	>200	VD/H					
	3.0	25	>200	VD/H					
	3.0 - 3.5	DCP terminated at 3.0m			SP-SC	Light Brown, Mottled Grey Poorly Graded SAND- Clayey SAND, traces of silt and gravel			
	3.5 - 4.0				SP-SC	Reddish Brown, Mottled Grey Poorly Graded SAND- Clayey SAND, traces of silt and gravel; medium plasticity			
	4.0 – 4.5								
	4.5 - 5.0								
	5.0 - 5.5				SC	Light Brown to White Clayey SAND with silt and a trace of gravel			
	5.5 - 6.0								
	6.0 - 6.5				SP-SC	Greyish White Poorly Graded SAND- Clayey SAND with silt and a trace of gravel			
	6.5 - 7.0								
	7.0 - 7.5								
	7.5 - 8.0					Grey Mottled Brown Poorly Graded SAND- Clayey SAND with silt and a trace of gravel			

statiker

FIELD LOG

Date: 23/02/2021
Customer Job:
Statiker Job: G-00182
Site Address: 71 Alexandra Crescent, BAYVIEW, NSW 2104

Borehole: BH2
Surface RL (approx.): 43.46m
Easting (approx.): 151^{0}17'47"
Northing: -33^{0}39'38"

Water Table	Depth (m)	DCP Blow Counts	Approx Cu	Density/ Consistency	Classification Code	Material Description	Moisture	Horizon	Fill
	0.1	8	200	MD/VSt	SM	Dark Brown Silty/Clayey SAND and a trace of gravel; low plasticity	M	A	
	0.2	7	166	MD/VSt					
	0.3	7	166	MD/VSt					
	0.4	11	>200	D/H					
	0.5	16	>200	VD/H					
	0.6	9	>200	D/H					
	0.7	9	>200	D/H					
	0.8	13	>200	D/H					
	0.9	15	>200	D/H					
	1.0	8	200	MD/VSt					
	1.1	5	100	MD/St		Dark Brown Silty/Clayey SAND; above Plastic Limit with visible signs of leaching; low plasticity		E	
	1.2	19	>200	VD/H					
	1.3	20	>200	VD/H					
	1.4	22	>200	VD/H					
	1.5	6	133	MD/VSt					
	1.6	8	200	MD/VSt		Dark Brown Silty/Clayey SAND and a trace of gravel; above Plastic Limit with visible signs of leaching			
	1.7	10	>200	D/H					
	1.8	11	>200	D/H					
	1.9	5	100	MD/St					
	2.0	13	>200	D/H					
	2.1	12	>200	D/H		Dark Brown Mottled Yellow Silty/Clayey SAND and a trace of gravel with visible signs of leaching: medium plasticity	W		
	2.2	15	>200	D/H					
	2.3	19	>200	VD/H					
	2.4	25	>200	VD/H					
	2.5	23	>200	VD/H	SP-SC SM	Light Brown to Dark Brown Poorly Graded SAND-Clayey SAND with silt and a trace of gravel		B	
	2.6	28	>200	VD/H					
	2.7	16	>200	VD/H					
	2.8	15	>200	D/H					
	2.9	20	>200	VD/H					
	3.0	27	>200	VD/H					
	3.0 - 3.5	DCP terminated at 3.0m				Dark Brown Mottled Grey Poorly Graded SAND-Clayey SAND with silt and a trace of gravel; medium plasticity	M		
	3.5 - 4.0					Reddish Brown Poorly Graded SAND- Clayey SAND with silt			
	4.0 - 4.5				SM	Reddish Brown Silty/Clayey SAND with a trace of gravel; low plasticity			
	4.5 - 5.0								
	5.0 - 5.5					Reddish Brown Silty/Clayey SAND with a trace of gravel	Insignificant as coring was done with the use of water	C	
	5.5 - 5.7				Point load Index, i~0.5	Extremely Weathered Sandstone (XW with cross bedding at low angle) has Reddish Brown and White Bands			
	5.7 - 5.9								
	5.9 - 6.3								
	6.3 - 6.5				i~0.7				
						Drilling terminated at 6.5m			

INDEX OF SYMBOLS USED IN THE LOG

Water Table | **UTP** - Unable to penetrate | **DCP** - 9kg Dynamic Cone Penetrometer

Density Index vs Approx. Penetrometer results | **SILTS & CLAY** – Cu vs Approx. Penetrometer results | **Soil Classification Symbols** | **Moisture**

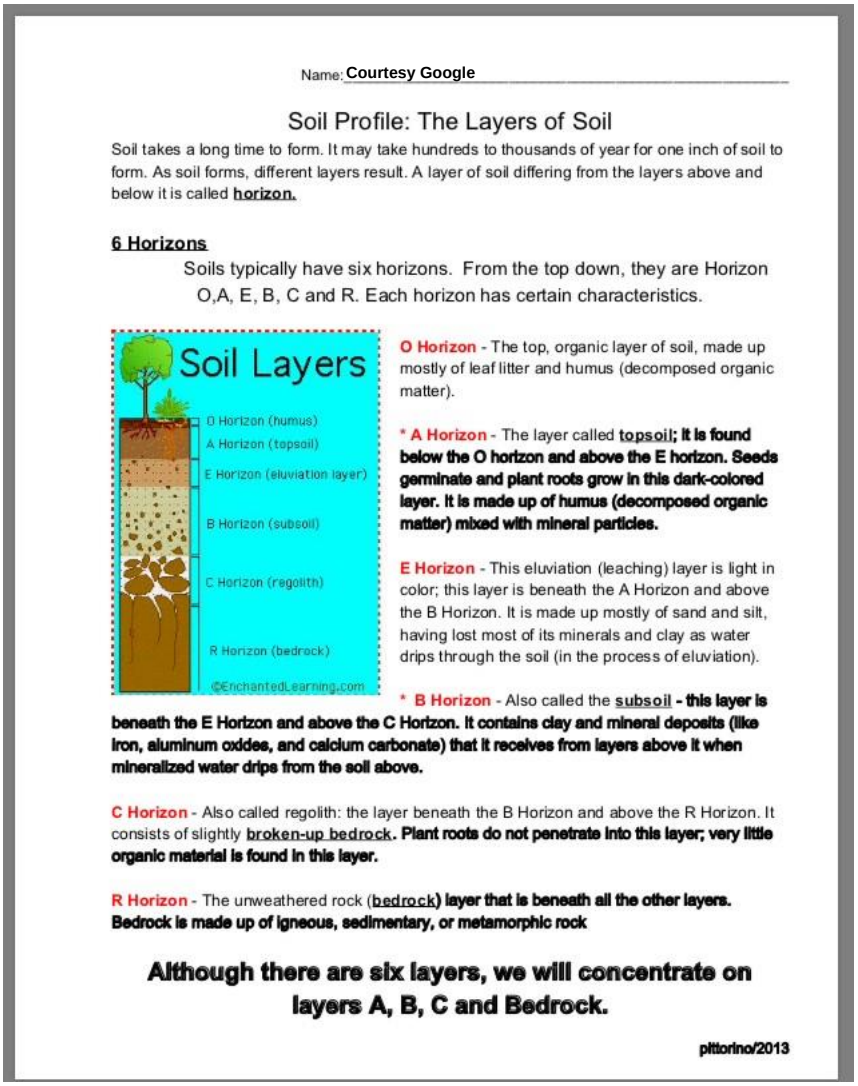
DENSITY		**Density Index**	**DCP Blow Count** (blows/100mm)	**Consistency**		**Undrained Shear Strength** (kPa)	**DCP Blow Counts** (blows/100mm)
VL	Very Loose	< 15 %	< 1	VS	Very Soft	0 – 12	< 1
L	Loose	15 – 35 %	1 – 3	S	Soft	12 – 25	1 – 2
MD	Medium Dense	35 – 65 %	3 – 9	F	Firm	25 – 50	2 – 3
D	Dense	65 – 85 %	9 – 15	St	Stiff	50 – 100	3 – 5
VD	Very Dense	> 85 %	> 15	VSt	Very Stiff	100 – 200	5 – 8
				H	Hard	> 200	> 8

C-CLAY
G-GRAVEL
M-SILT
S-SAND

D	Dry
M	Moist
W	Wet
W_P	Plastic Limit
W_L	Liquid Limit

Classification Code
SC: Clayey SAND
SM: Silty SAND
SP: Poorly Graded SAND
SP-SC: Poorly Graded SAND- Clayey SAND
i: Point Load Index in MPA

Material Description incorporates Table 5.3 USCS with necessary review and suitable modifications according to AS 1726:2017 (Geotechnical Site Investigations)



Name: **Courtesy Google**

Soil Profile: The Layers of Soil

Soil takes a long time to form. It may take hundreds to thousands of year for one inch of soil to form. As soil forms, different layers result. A layer of soil differing from the layers above and below it is called **horizon.**

6 Horizons

Soils typically have six horizons. From the top down, they are Horizon O,A, E, B, C and R. Each horizon has certain characteristics.

O Horizon - The top, organic layer of soil, made up mostly of leaf litter and humus (decomposed organic matter).

*** A Horizon** - The layer called **topsoil; it is found below the O horizon and above the E horizon. Seeds germinate and plant roots grow in this dark-colored layer. It is made up of humus (decomposed organic matter) mixed with mineral particles.**

E Horizon - This eluviation (leaching) layer is light in color; this layer is beneath the A Horizon and above the B Horizon. It is made up mostly of sand and silt, having lost most of its minerals and clay as water drips through the soil (in the process of eluviation).

*** B Horizon** - Also called the **subsoil - this layer is beneath the E Horizon and above the C Horizon. It contains clay and mineral deposits (like iron, aluminum oxides, and calcium carbonate) that it receives from layers above it when mineralized water drips from the soil above.**

C Horizon - Also called regolith: the layer beneath the B Horizon and above the R Horizon. It consists of slightly **broken-up bedrock. Plant roots do not penetrate into this layer; very little organic material is found in this layer.**

R Horizon - The unweathered rock (**bedrock**) **layer that is beneath all the other layers. Bedrock is made up of igneous, sedimentary, or metamorphic rock**

Although there are six layers, we will concentrate on layers A, B, C and Bedrock.

pittorino/2013

APPENDIX C LAB TEST RESULTS

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 263398

Client Details

Client	Reggie's / Statiker
Attention	K Shakya
Address	Level 8, 269 Bigge St, Liverpool, NSW, 2170

Sample Details

Your Reference	**Reggie's/Statiker - G-00182, 71 Alexandra Cres**
Number of Samples	14 Soil
Date samples received	04/03/2021
Date completed instructions received	04/03/2021

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

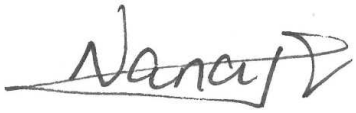
Date results requested by	12/03/2021
Date of Issue	12/03/2021

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		263398-1	263398-2	263398-3	263398-4	263398-5
Your Reference	UNITS	BH1 Bag 1	BH1 Bag 3	BH1 Bag 4	BH1 Bag 7	BH1 Bag 9
Depth		0-0.5	1.0-1.5	1.5-2.0	3.0-3.5	4.0-4.5
Date Sampled		23/02/2021	23/02/2021	23/02/2021	23/02/2021	23/02/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/03/2021	05/03/2021	05/03/2021	05/03/2021	05/03/2021
Date analysed	-	05/03/2021	05/03/2021	05/03/2021	05/03/2021	05/03/2021
Electrical Conductivity 1:5 soil:water	µS/cm	230	66	66	150	110

Misc Inorg - Soil						
Our Reference		263398-6	263398-7	263398-8	263398-9	263398-10
Your Reference	UNITS	BH1 Bag 12	BH1 Bag 15	BH1 Bag 16	BH2 Bag 2	BH2 Bag 4
Depth		5.5-6.0	7.0-7.5	7.5-8.0	0.5-1.0	1.5-2.0
Date Sampled		23/02/2021	23/02/2021	23/02/2021	23/02/2021	23/02/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/03/2021	05/03/2021	05/03/2021	05/03/2021	05/03/2021
Date analysed	-	05/03/2021	05/03/2021	05/03/2021	05/03/2021	05/03/2021
Electrical Conductivity 1:5 soil:water	µS/cm	120	79	51	170	130

Misc Inorg - Soil					
Our Reference		263398-11	263398-12	263398-13	263398-14
Your Reference	UNITS	BH2 Bag 6	BH2 Bag 8	BH2 Bag 10	BH2 Bag 11
Depth		2.5-3.0	3.5-4.0	4.5-5.0	5.0-5.5
Date Sampled		23/02/2021	23/02/2021	23/02/2021	23/02/2021
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	05/03/2021	05/03/2021	05/03/2021	05/03/2021
Date analysed	-	05/03/2021	05/03/2021	05/03/2021	05/03/2021
Electrical Conductivity 1:5 soil:water	µS/cm	34	26	32	35

Moisture						
Our Reference		263398-1	263398-2	263398-3	263398-4	263398-5
Your Reference	UNITS	BH1 Bag 1	BH1 Bag 3	BH1 Bag 4	BH1 Bag 7	BH1 Bag 9
Depth		0-0.5	1.0-1.5	1.5-2.0	3.0-3.5	4.0-4.5
Date Sampled		23/02/2021	23/02/2021	23/02/2021	23/02/2021	23/02/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/03/2021	05/03/2021	05/03/2021	05/03/2021	05/03/2021
Date analysed	-	08/03/2021	08/03/2021	08/03/2021	08/03/2021	08/03/2021
Moisture	%	11	17	16	18	14

Moisture						
Our Reference		263398-6	263398-7	263398-8	263398-9	263398-10
Your Reference	UNITS	BH1 Bag 12	BH1 Bag 15	BH1 Bag 16	BH2 Bag 2	BH2 Bag 4
Depth		5.5-6.0	7.0-7.5	7.5-8.0	0.5-1.0	1.5-2.0
Date Sampled		23/02/2021	23/02/2021	23/02/2021	23/02/2021	23/02/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/03/2021	05/03/2021	05/03/2021	05/03/2021	05/03/2021
Date analysed	-	08/03/2021	08/03/2021	08/03/2021	08/03/2021	08/03/2021
Moisture	%	13	12	12	15	15

Moisture					
Our Reference		263398-11	263398-12	263398-13	263398-14
Your Reference	UNITS	BH2 Bag 6	BH2 Bag 8	BH2 Bag 10	BH2 Bag 11
Depth		2.5-3.0	3.5-4.0	4.5-5.0	5.0-5.5
Date Sampled		23/02/2021	23/02/2021	23/02/2021	23/02/2021
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	05/03/2021	05/03/2021	05/03/2021	05/03/2021
Date analysed	-	08/03/2021	08/03/2021	08/03/2021	08/03/2021
Moisture	%	13	12	8.0	19

Particle Size Distribution in Soils						
Our Reference		263398-1	263398-2	263398-3	263398-4	263398-5
Your Reference	UNITS	BH1 Bag 1	BH1 Bag 3	BH1 Bag 4	BH1 Bag 7	BH1 Bag 9
Depth		0-0.5	1.0-1.5	1.5-2.0	3.0-3.5	4.0-4.5
Date Sampled		23/02/2021	23/02/2021	23/02/2021	23/02/2021	23/02/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	08/03/2021	08/03/2021	08/03/2021	08/03/2021	08/03/2021
Date analysed	-	08/03/2021	08/03/2021	08/03/2021	08/03/2021	08/03/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	6	2	<1	<1	<1
Medium Gravel 6.7-9.5mm	%	3	1	<1	<1	<1
Medium Gravel 4.75-6.7mm	%	5	2	<1	<1	<1
Fine Gravel 2.36-4.75mm	%	9	3	2	11	<1
Very Coarse Sand 1.18-2.36mm	%	5	3	3	<1	<1
Coarse Sand 0.6-1.18mm	%	7	9	9	10	8
Medium Sand 0.425-0.6mm	%	6	9	13	14	23
Medium Sand 0.3-0.425mm	%	13	22	29	25	34
Fine Sand 0.15-0.3mm	%	20	28	39	24	18
Very Fine Sand 0.075-0.15mm	%	10	10	2	12	7
Coarse Silt 0.020-0.075mm	%	8	2	1	1	2
Fine Silt 0.002-0.020mm	%	2	1	<1	<1	2
Clay <0.002mm	%	5	9	3	4	6

Particle Size Distribution in Soils						
Our Reference		263398-6	263398-7	263398-8	263398-9	263398-10
Your Reference	UNITS	BH1 Bag 12	BH1 Bag 15	BH1 Bag 16	BH2 Bag 2	BH2 Bag 4
Depth		5.5-6.0	7.0-7.5	7.5-8.0	0.5-1.0	1.5-2.0
Date Sampled		23/02/2021	23/02/2021	23/02/2021	23/02/2021	23/02/2021
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	08/03/2021	08/03/2021	08/03/2021	08/03/2021	08/03/2021
Date analysed	-	08/03/2021	08/03/2021	08/03/2021	08/03/2021	08/03/2021
Cobbles >75mm	%	<1	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	<1	<1	<1
Medium Gravel 9.5-13.2mm	%	<1	<1	<1	1	<1
Medium Gravel 6.7-9.5mm	%	<1	<1	<1	2	<1
Medium Gravel 4.75-6.7mm	%	<1	<1	<1	1	1
Fine Gravel 2.36-4.75mm	%	<1	<1	1	3	2
Very Coarse Sand 1.18-2.36mm	%	<1	<1	<1	4	4
Coarse Sand 0.6-1.18mm	%	8	2	7	16	14
Medium Sand 0.425-0.6mm	%	13	15	6	12	9
Medium Sand 0.3-0.425mm	%	29	22	13	10	13
Fine Sand 0.15-0.3mm	%	25	42	50	22	24
Very Fine Sand 0.075-0.15mm	%	10	9	11	17	19
Coarse Silt 0.020-0.075mm	%	2	5	5	4	6
Fine Silt 0.002-0.020mm	%	4	2	3	3	3
Clay <0.002mm	%	10	4	4	6	5

Particle Size Distribution in Soils					
Our Reference		263398-11	263398-12	263398-13	263398-14
Your Reference	UNITS	BH2 Bag 6	BH2 Bag 8	BH2 Bag 10	BH2 Bag 11
Depth		2.5-3.0	3.5-4.0	4.5-5.0	5.0-5.5
Date Sampled		23/02/2021	23/02/2021	23/02/2021	23/02/2021
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	08/03/2021	08/03/2021	08/03/2021	08/03/2021
Date analysed	-	08/03/2021	08/03/2021	08/03/2021	08/03/2021
Cobbles >75mm	%	<1	<1	<1	<1
Cobbles/Coarse Gravel 63-75mm	%	<1	<1	<1	<1
Coarse Gravel 37.5-63mm	%	<1	<1	<1	<1
Coarse Gravel 26.5-37.5mm	%	<1	<1	<1	<1
Coarse Gravel 19-26.5mm	%	<1	<1	<1	<1
Medium Gravel 13.2-19mm	%	<1	<1	2	<1
Medium Gravel 9.5-13.2mm	%	<1	1	<1	<1
Medium Gravel 6.7-9.5mm	%	<1	1	1	<1
Medium Gravel 4.75-6.7mm	%	<1	1	<1	<1
Fine Gravel 2.36-4.75mm	%	3	1	<1	2
Very Coarse Sand 1.18-2.36mm	%	5	2	<1	<1
Coarse Sand 0.6-1.18mm	%	11	11	2	3
Medium Sand 0.425-0.6mm	%	8	9	1	1
Medium Sand 0.3-0.425mm	%	12	13	15	11
Fine Sand 0.15-0.3mm	%	35	40	43	44
Very Fine Sand 0.075-0.15mm	%	16	15	18	19
Coarse Silt 0.020-0.075mm	%	4	3	6	7
Fine Silt 0.002-0.020mm	%	1	1	4	4
Clay <0.002mm	%	4	4	8	9

Method ID	Methodology Summary
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-107	Particle Size Distribution using AS1269.3.6.3 and AS1269.3.6.1 and in house INORG-107.

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			05/03/2021	1	05/03/2021	05/03/2021		05/03/2021	[NT]
Date analysed	-			05/03/2021	1	05/03/2021	05/03/2021		05/03/2021	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	1	230	270	16	99	[NT]

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	14	05/03/2021	05/03/2021		[NT]	[NT]
Date analysed	-			[NT]	14	05/03/2021	05/03/2021		[NT]	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	[NT]	14	35	40	13	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

EC
Samples were out of the recommended holding time for this analysis.

AUSTRALIAN SOIL AND CONCRETE TESTING

ASCT Sydney South
Unit 18, 2.8 Daniel Street, Wetherill Park NSW 2164

Telephone: (02) 9725 5842
E-Mail: sydney.south@asct.com.au
Mobile: 0410 609 142
A.B.N. 92 328 384 368

Report on Moisture Content

Client:	Staticker	Report No:	**9**
Client Address:	Level 8, 269 Bigge Street, Liverpool NSW 2170	Report Date:	12/03/2021
Project:	71 Alexandria Crescent, Bayview	Report Page:	Page 1 of 1
Works Component:	Reggies, BH1	Project No:	259
Material Used:	Insitu	Test Request/Order:	G-00182
Material Description:	-	Lot Number:	N/A
Lot Boundaries:	Chainage N/A to N/A. Offsets N/A to N/A.	ITP/PCP Number:	N/A
Lot Comments:	-	Control Line:	N/A

Sample Number:		**40665**	**40666**	**40667**	**40668**	**40669**
Field Sample/Test Date:		23/02/2021	23/02/2021	23/02/2021	23/02/2021	23/02/2021
Lab Test Date:		2/03/2021	2/03/2021	2/03/2021	2/03/2021	2/03/2021
Chainage / Location:	(m)	NA	NA	NA	NA	NA
Offset from control line:	(m)	NA	NA	NA	NA	NA
Level of Test:	(m)	BH1	BH1	BH1	BH2	BH2
Test Depth:	(mm)	0.5-1.0m	2.5-3.0m	4.5-5.0m	0.0-0.5m	1.0-1.5m
Moisture Content (Calculated):	(%)	20.5	15.6	9.9	16.1	20.4
Moisture Content (Corrected):	**(%)**	-	-	-	-	-
Sample Number:		**40670**	**40671**	**40672**	-	-
Field Sample/Test Date:		23/02/2021	23/02/2021	23/02/2021	-	-
Lab Test Date:		-	2/03/2021	2/03/2021	-	-
Chainage / Location:	(m)	NA	NA	NA	-	-
Offset from control line:	(m)	NA	NA	NA	-	-
Level of Test:	(m)	BH2	BH2	BH2	-	-
Test Depth:	(mm)	2.0-2.5m	3.0-3.5m	4.0-4.5m	-	-
Moisture Content (Calculated):	(%)	Ref - 033-R013B-R1-MC	17.0	12.8	-	-
Moisture Content (Corrected):	**(%)**	-	-	-	-	-
Sample Number:		-	-	-	-	-
Field Sample/Test Date:		-	-	-	-	-
Lab Test Date:		-	-	-	-	-
Chainage / Location:	(m)	-	-	-	-	-
Offset from control line:	(m)	-	-	-	-	-
Level of Test:	(m)	-	-	-	-	-
Test Depth:	(mm)	-	-	-	-	-
Moisture Content (Calculated):	(%)	-	-	-	-	-
Moisture Content (Corrected):	**(%)**	-	-	-	-	-

Sampling & Test Methods (Results relate only to the items sampled/tested)	**Report Remarks & Endorsement**
Client: Sample/Test Locations nominated by client **	
Sampled by Customer: Results apply to the sample/s as received. **	
AS 1289.1.1: (2001)Preparation of disturbed soil samples	
AS 1289.2.1.1: (2005) Moisture Content (Oven Drying)	

NATA

Issued By:

	Accredited for compliance with ISO/IEC 17025 - Testing. NATA Accreditation number:	20078	A.Mcgill *Approved Signatory*
(NATA accreditation does not cover the performance of this service)**			*WB056 - Rev 8, 29/09/2020*

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

Illawarra Laboratory
7/3 Hargraves Avenue, Albion Park Rail NSW 2527

Telephone: 02 4256 1684
E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

Report on Moisture Content

Client:	ASCT Sydney South Laboratory	Report No:	**13B-R1**
Client Address:	Unit 18, 2-8 Daniel Street, Wetherill Park NSW	Report Date:	9/03/2021
Project:	Geotechnical Investigation	Report Page:	Page 1 of 1
Works Component:	71 Alexandra Crescent Bayview	Project No:	33
Material Used:	-	Test Request/Order:	G-00182
Material Description:	SMC	Lot Number:	-
Lot Boundaries:	Chainage - to -. Offsets - to -.	ITP/PCP Number:	-
Lot Comments:	-	Control Line:	BH2

Sample Number:		**33075**	**-**	**-**	**-**	**-**
Field Sample/Test Date:		23/02/2021	-	-	-	-
Lab Test Date:		3/03/2021	-	-	-	-
Chainage / Location:	(m)	-	-	-	-	-
Offset from control line:	(m)	-	-	-	-	-
Level of Test:	(m)	BH2	-	-	-	-
Test Depth:	(mm)	2.0 - 2.5	-	-	-	-
Moisture Content (Calculated):	(%)	20.4	-	-	-	-
Moisture Content (Corrected):	**(%)**	**-**	**-**	**-**	**-**	**-**
Sample Number:		**-**	**-**	**-**	**-**	**-**
Field Sample/Test Date:		-	-	-	-	-
Lab Test Date:		-	-	-	-	-
Chainage / Location:	(m)	-	-	-	-	-
Offset from control line:	(m)	-	-	-	-	-
Level of Test:	(m)	-	-	-	-	-
Test Depth:	(mm)	-	-	-	-	-
Moisture Content (Calculated):	(%)	-	-	-	-	-
Moisture Content (Corrected):	**(%)**	**-**	**-**	**-**	**-**	**-**
Sample Number:		**-**	**-**	**-**	**-**	**-**
Field Sample/Test Date:		-	-	-	-	-
Lab Test Date:		-	-	-	-	-
Chainage / Location:	(m)	-	-	-	-	-
Offset from control line:	(m)	-	-	-	-	-
Level of Test:	(m)	-	-	-	-	-
Test Depth:	(mm)	-	-	-	-	-
Moisture Content (Calculated):	(%)	-	-	-	-	-
Moisture Content (Corrected):	**(%)**	**-**	**-**	**-**	**-**	**-**

Sampling & Test Methods (Results relate only to the items sampled/tested)	**Report Remarks & Endorsement**
Sampled by Customer: Results apply to the sample/s as received. ** AS 1289.2.1.1: (2005) Moisture Content (Oven Drying)	
	Accredited for compliance with ISO/IEC 17025 - Testing. NATA Accreditation number: 20656 Issued By: P.Baltoski P.Baltoski *Approved Signatory*
(NATA accreditation does not cover the performance of this service)**	*WB056 - Rev 8, 29/09/2020*

ASCT Sydney South
Unit 18, 2.8 Daniel Street, Wetherill Park NSW 2164

Telephone: (02) 9725 5842
E-Mail: sydney.south@asct.com.au
Mobile: 0410 609 142
A.B.N. 92 328 384 368

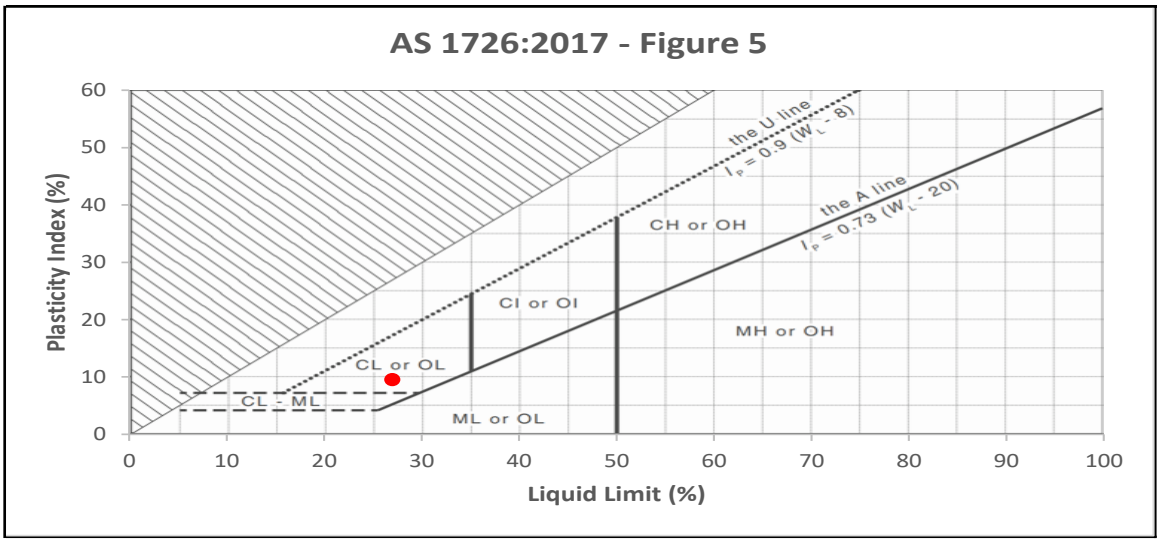
Report on Plastic Properties

Client:	Staticker	Report No:	**1**
Client Address:	Level 8, 269 Bigge Street, Liverpool NSW 2170	Report Date:	9/03/2021
Project:	71 Alexandria Crescent, Bayview	Report Page:	Page 1 of 1
Works Component:	Reggies, BH1	Project No:	259
Material Used:	Insitu	Test Request:	G-00182
Material Description:	-	Lot Number:	N/A
Lot Comments:	-	ITP/PCP Number:	N/A
Lab Test Date/s:	Laboratory testing 08/03/2021	Control Line:	N/A

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
40657	**23/02/2021**	**N/A**	**N/A**	**BH1**	**0.5-1.0m**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**27**		Oven Dried & Dry Sieved
Plastic Limit	%	**17**		Oven Dried & Dry Sieved
Plastic Index	%	**10**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**5.0**		Oven Dried & Dry Sieved. Single/Straight Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil	

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20078

Issued By:

A.Mcgill
Approved Signatory

ASCT Sydney South
Unit 18, 2.8 Daniel Street, Wetherill Park NSW 2164

Telephone: (02) 9725 5842
E-Mail: sydney.south@asct.com.au
Mobile: 0410 609 142
A.B.N. 92 328 384 368

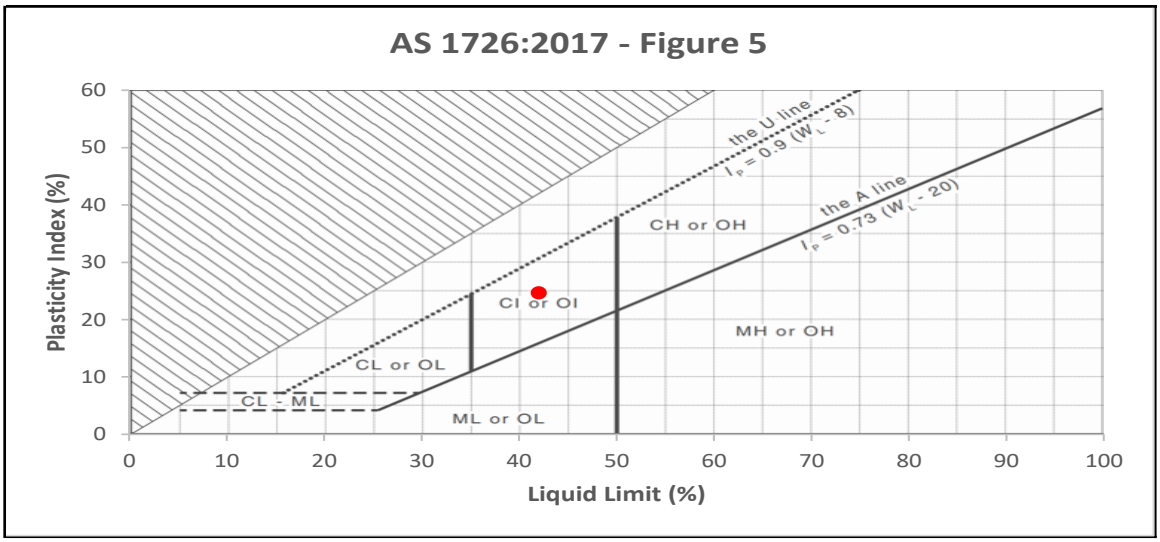
Report on Plastic Properties

Client:	Staticker	Report No:	**2**
Client Address:	Level 8, 269 Bigge Street, Liverpool NSW 2170	Report Date:	9/03/2021
Project:	71 Alexandria Crescent, Bayview	Report Page:	Page 1 of 1
Works Component:	Reggies, BH1	Project No:	259
Material Used:	Insitu	Test Request:	G-00182
Material Description:	-	Lot Number:	N/A
Lot Comments:	-	ITP/PCP Number:	N/A
Lab Test Date/s:	Laboratory testing 08/03/2021	Control Line:	N/A

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
40658	**23/02/2021**	**N/A**	**N/A**	**BH1**	**2.5-3.0m**

Specification Name	

Pretreatment	Units	Result	Specification Limits	Remarks
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**42**		Oven Dried & Dry Sieved
Plastic Limit	%	**17**		Oven Dried & Dry Sieved
Plastic Index	%	**25**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**9.5**		Oven Dried & Dry Sieved. Single/Straight Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil	

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20078

Issued By:

A.Mcgill
Approved Signatory

ASCT Sydney South
Unit 18, 2.8 Daniel Street, Wetherill Park NSW 2164

Telephone: (02) 9725 5842
E-Mail: sydney.south@asct.com.au
Mobile: 0410 609 142
A.B.N. 92 328 384 368

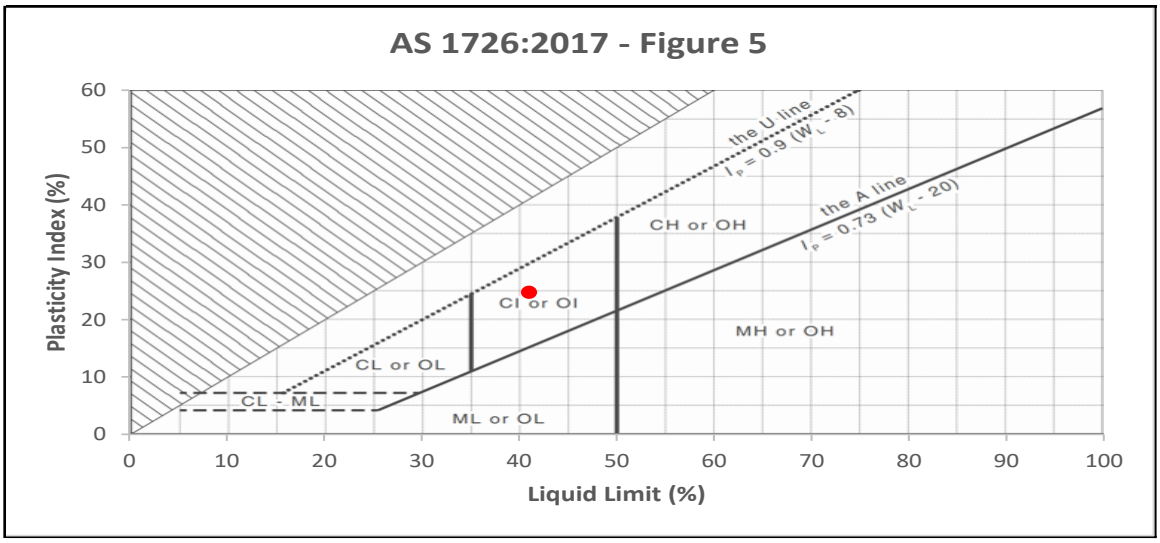
Report on Plastic Properties

Client:	Staticker	Report No:	**3**
Client Address:	Level 8, 269 Bigge Street, Liverpool NSW 2170	Report Date:	9/03/2021
Project:	71 Alexandria Crescent, Bayview	Report Page:	Page 1 of 1
Works Component:	Reggies, BH1	Project No:	259
Material Used:	Insitu	Test Request:	G-00182
Material Description:	-	Lot Number:	N/A
Lot Comments:	-	ITP/PCP Number:	N/A
Lab Test Date/s:	Laboratory testing 08/03/2021	Control Line:	N/A

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
40659	**23/02/2021**	**N/A**	**N/A**	**BH1**	**4.5-5.0m**

Specification Name	

Pretreatment	Units	Result	Specification Limits	Remarks
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**41**		Oven Dried & Dry Sieved
Plastic Limit	%	**16**		Oven Dried & Dry Sieved
Plastic Index	%	**25**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**9.0**		Oven Dried & Dry Sieved. Single/Straight Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil	

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20078

Issued By:

A.Mcgill
Approved Signatory

ASCT Sydney South
Unit 18, 2.8 Daniel Street, Wetherill Park NSW 2164

Telephone: (02) 9725 5842
E-Mail: sydney.south@asct.com.au
Mobile: 0410 609 142
A.B.N. 92 328 384 368

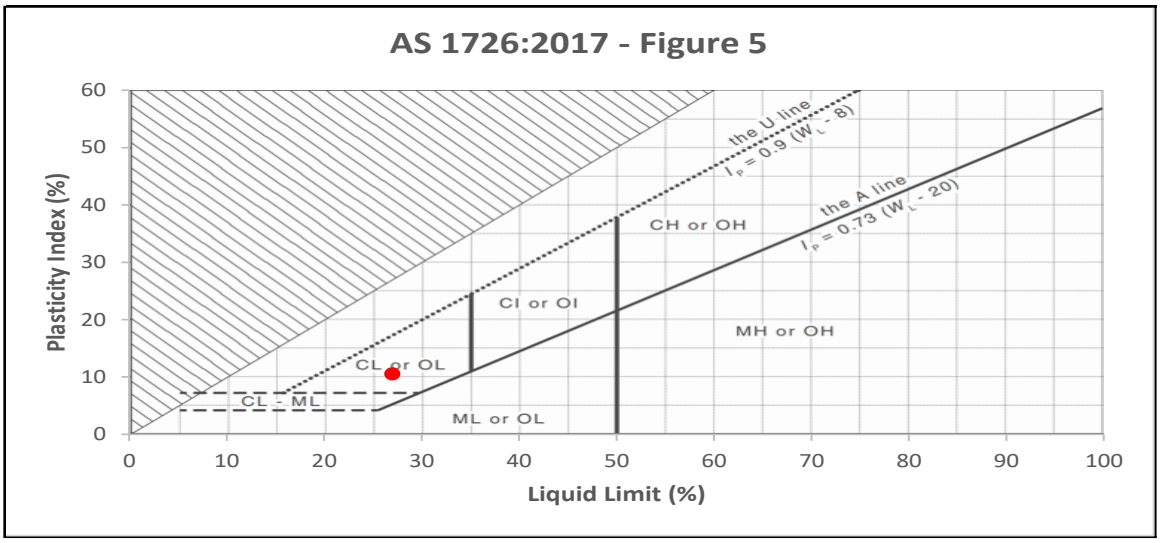
Report on Plastic Properties

Client:	Staticker	Report No:	**4**
Client Address:	Level 8, 269 Bigge Street, Liverpool NSW 2170	Report Date:	9/03/2021
Project:	71 Alexandria Crescent, Bayview	Report Page:	Page 1 of 1
Works Component:	Reggies, BH2	Project No:	259
Material Used:	Insitu	Test Request:	G-00182
Material Description:	-	Lot Number:	N/A
Lot Comments:	-	ITP/PCP Number:	N/A
Lab Test Date/s:	Laboratory testing 08/03/2021	Control Line:	N/A

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
40660	**23/02/2021**	**N/A**	**N/A**	**BH2**	**0.0-0.5m**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**27**		Oven Dried & Dry Sieved
Plastic Limit	%	**16**		Oven Dried & Dry Sieved
Plastic Index	%	**11**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**5.0**		Oven Dried & Dry Sieved. Single/Straight Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil	

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20078

Issued By:

A.Mcgill
Approved Signatory

ASCT Sydney South
Unit 18, 2.8 Daniel Street, Wetherill Park NSW 2164

Telephone: (02) 9725 5842
E-Mail: sydney.south@asct.com.au
Mobile: 0410 609 142
A.B.N. 92 328 384 368

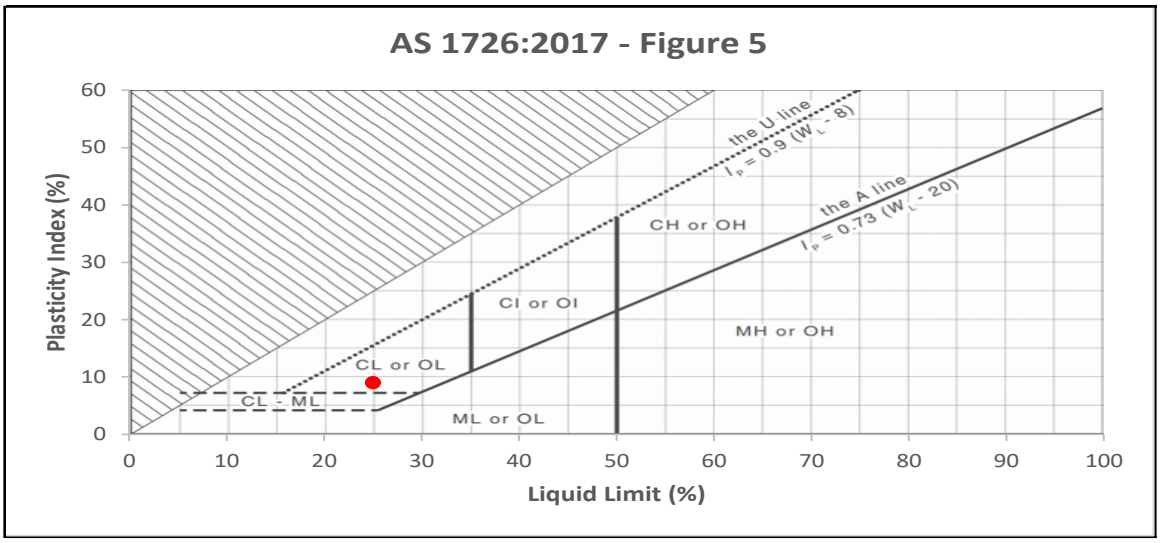
Report on Plastic Properties

Client:	Staticker	Report No:	**5**
Client Address:	Level 8, 269 Bigge Street, Liverpool NSW 2170	Report Date:	9/03/2021
Project:	71 Alexandria Crescent, Bayview	Report Page:	Page 1 of 1
Works Component:	Reggies, BH2	Project No:	259
Material Used:	Insitu	Test Request:	G-00182
Material Description:	-	Lot Number:	N/A
Lot Comments:	-	ITP/PCP Number:	N/A
Lab Test Date/s:	Laboratory testing 06/03/2021	Control Line:	N/A

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
40661	**23/02/2021**	**N/A**	**N/A**	**BH2**	**1.0-1.5m**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**25**		Oven Dried & Dry Sieved
Plastic Limit	%	**16**		Oven Dried & Dry Sieved
Plastic Index	%	**9**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**5.0**		Oven Dried & Dry Sieved. Single/Straight Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil	

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20078

Issued By:

A.Mcgill
Approved Signatory

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

Illawarra Laboratory
7/3 Hargraves Avenue, Albion Park Rail NSW 2527

Telephone: 02 4256 1684
E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

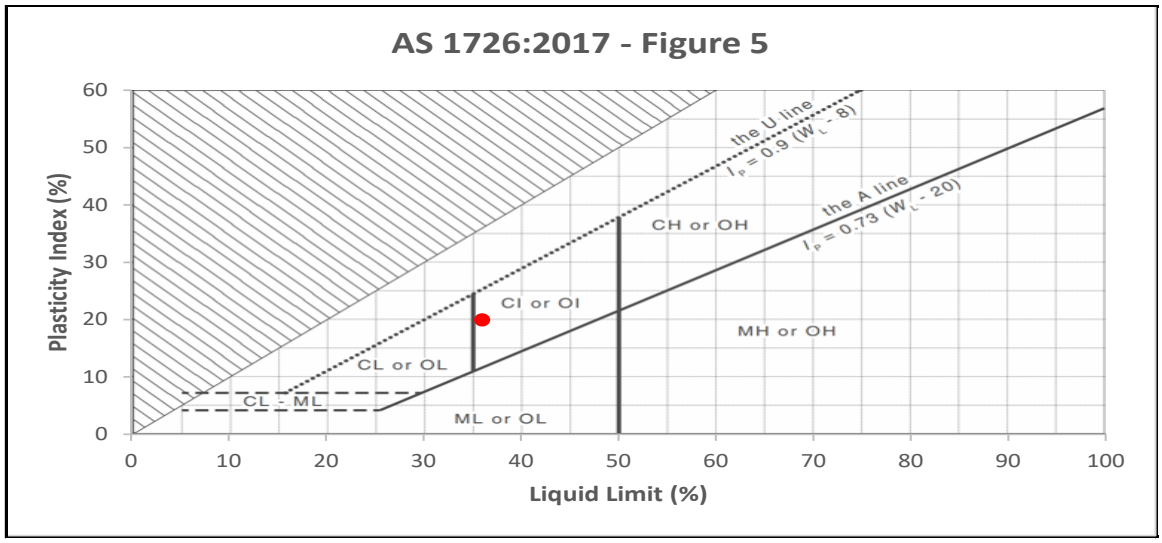
Report on Plastic Properties

Client:	ASCT Sydney South Laboratory	Report No:	**13A-R1**
Client Address:	Unit 18, 2-8 Daniel Street, Wetherill Park NSW	Report Date:	9/03/2021
Project:	Geotechnical Investigation	Report Page:	Page 1 of 1
Works Component:	71 Alexandra Crescent Bayview	Project No:	33
Material Used:	-	Test Request:	G-00182
Material Description:	SMC	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 05/03/2021	Control Line:	BH2

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
33075	**23/02/2021**	**-**	**-**	**BH2**	**2.0 - 2.5**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**36**		Oven Dried & Dry Sieved
Plastic Limit	%	**16**		Oven Dried & Dry Sieved
Plastic Index	%	**20**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**9.5**		Oven Dried & Dry Sieved. Single/Straight Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
Sampled by Customer: Results apply to the sample/s as received. ** AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil	

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: P.Baltoski
P.Baltoski
Approved Signatory

(NATA accreditation does not cover the performance of this service)**

ASCT Sydney South
Unit 18, 2.8 Daniel Street, Wetherill Park NSW 2164

Telephone: (02) 9725 5842
E-Mail: sydney.south@asct.com.au
Mobile: 0410 609 142
A.B.N. 92 328 384 368

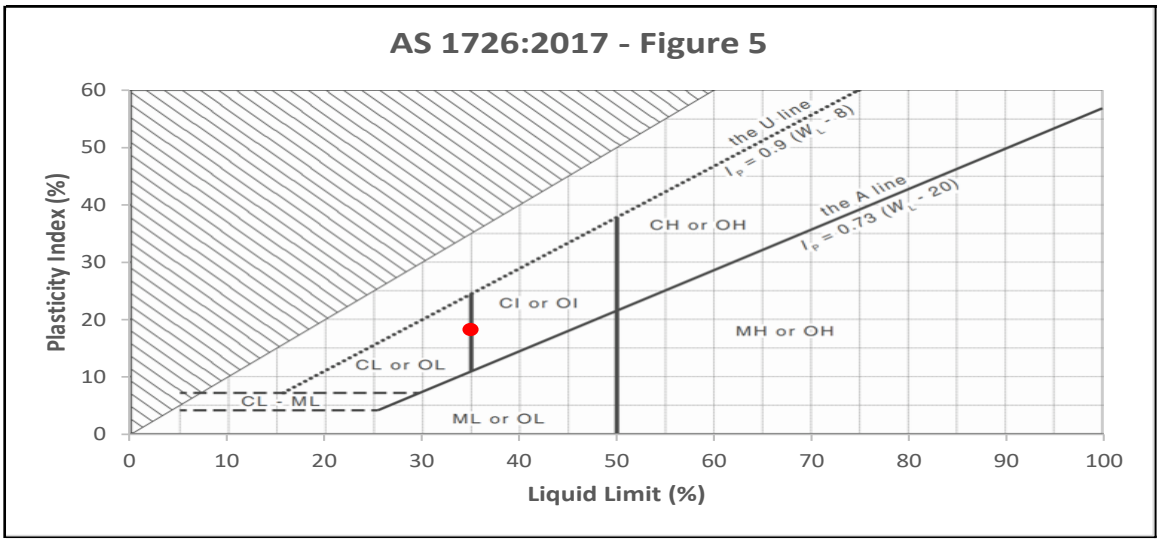
Report on Plastic Properties

Client:	Staticker	Report No:	**7**
Client Address:	Level 8, 269 Bigge Street, Liverpool NSW 2170	Report Date:	9/03/2021
Project:	71 Alexandria Crescent, Bayview	Report Page:	Page 1 of 1
Works Component:	Reggies, BH2	Project No:	259
Material Used:	Insitu	Test Request:	G-00182
Material Description:	-	Lot Number:	N/A
Lot Comments:	-	ITP/PCP Number:	N/A
Lab Test Date/s:	Laboratory testing 08/03/2021	Control Line:	N/A

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
40663	**23/02/2021**	**N/A**	**N/A**	**BH2**	**3.0-3.5m**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**35**		Oven Dried & Dry Sieved
Plastic Limit	%	**17**		Oven Dried & Dry Sieved
Plastic Index	%	**18**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**9.5**		Oven Dried & Dry Sieved. Single/Straight Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil	

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20078

Issued By:

A.Mcgill
Approved Signatory

ASCT Sydney South
Unit 18, 2.8 Daniel Street, Wetherill Park NSW 2164

Telephone: (02) 9725 5842
E-Mail: sydney.south@asct.com.au
Mobile: 0410 609 142
A.B.N. 92 328 384 368

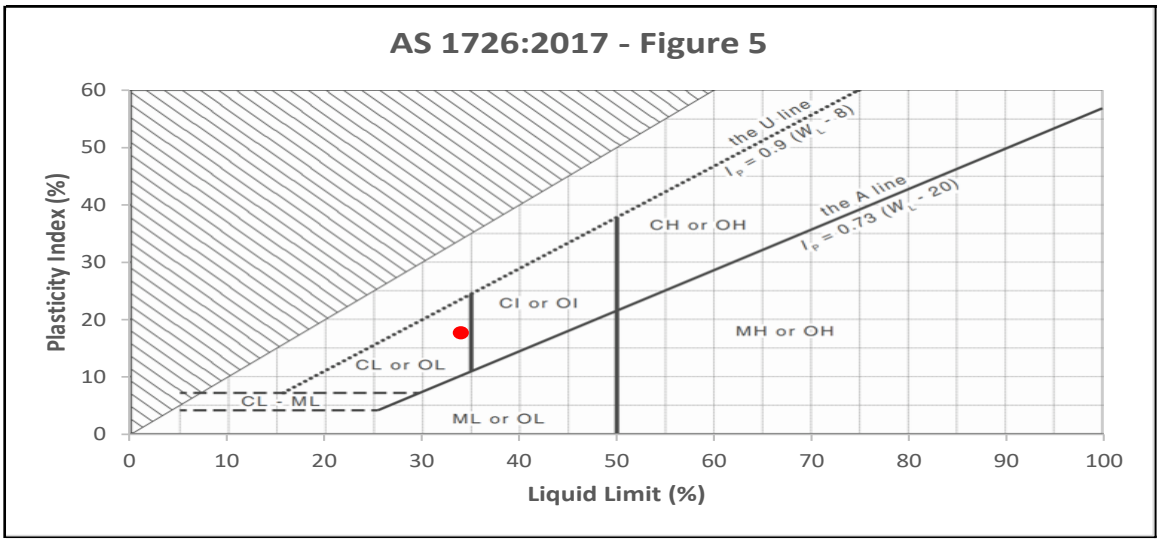
Report on Plastic Properties

Client:	Staticker	Report No:	**8**
Client Address:	Level 8, 269 Bigge Street, Liverpool NSW 2170	Report Date:	9/03/2021
Project:	71 Alexandria Crescent, Bayview	Report Page:	Page 1 of 1
Works Component:	Reggies, BH2	Project No:	259
Material Used:	Insitu	Test Request:	G-00182
Material Description:	-	Lot Number:	N/A
Lot Comments:	-	ITP/PCP Number:	N/A
Lab Test Date/s:	Laboratory testing 08/03/2021	Control Line:	N/A

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
40664	**23/02/2021**	**N/A**	**N/A**	**BH2**	**4.0-4.5m**

Specification Name	

Pretreatment	**Units**	**Result**	**Specification Limits**	**Remarks**
Retained 53.0mm Sieve	%			
Pretreatment by Weathering	--			
Pretreatment by Compaction	--			
Plasticity	**Units**	**Result**	**Specification Limits**	**Remarks**
Liquid Limit	%	**34**		Oven Dried & Dry Sieved
Plastic Limit	%	**16**		Oven Dried & Dry Sieved
Plastic Index	%	**18**		Oven Dried & Dry Sieved
Linear Shrinkage	%	**10.5**		Oven Dried & Dry Sieved. Single/Straight Bar



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.1.1: (2001)Preparation of disturbed soil samples for testing AS 1289.3.1.2: (2009)Liquid Limit, One point Casagrande AS 1289.3.2.1: (2009)Plastic Limit of a soil AS 1289.3.3.1: (2009)Plasticity Index of a soil	

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20078

Issued By:

A.Mcgill
Approved Signatory

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

Illawarra Laboratory
7/3 Hargraves Avenue, Albion Park Rail NSW 2527

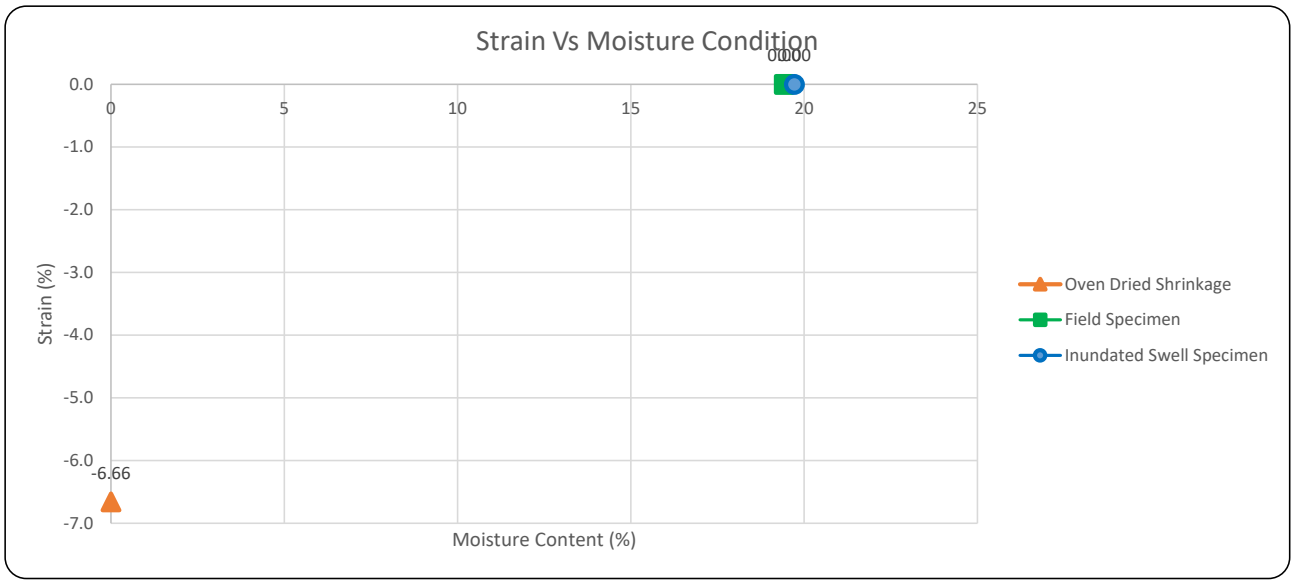
Telephone: 02 4256 1684
E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

Report on Shrink / Swell Index of a Soil

Client:	ASCT Sydney South Laboratory	Report No:	**13-R1**
Client Address:	Unit 18, 2-8 Daniel Street, Wetherill Park NSW	Report Date:	9/03/2021
Project:	Geotechnical Investigation	Report Page:	Page 1 of 1
Works Component:	71 Alexandra Crescent Bayview	Project No:	33
Material Used:	-	Test Request/Order:	G-00182
Material Description:	SMC	Lot Number:	-
Lab Test Date/s:	Testing commenced 03/03/2021 and was completed 04/03/2021.	ITP/PCP Number:	-
Lot Comments:	-	Control Line:	BH2

Sample Number	Sample Date	Chainage/Location	Offset	Level of Test	Test Depth
33075	**23/02/2021**	**-**	**-**	**BH2**	**2.0 - 2.5**

Parameters	Units	Test Results	Soil Description
Shrinkage - Field Moisture Content	%	19.3	CI, CLAY
Swell - Field Moisture Content	%	19.6	
Swell - Inundated Moisture Content	%	19.7	
Inert Inclusions in the soil	%	5	
Extent of Soil Crumbling	-	None	
Extent of Soil Cracking	-	Minor	
Shrink-Swell Index	**%**	**3.7**	



Sampling & Test Methods (Results relate only to the items sampled/tested)	Report Remarks & Endorsement
AS 1289.7.1.1, Cl 4: Shrink Swell Index - Thin wall sampler (U50) AS 1289.7.1.1: Shrink Swell Index of a Soil	

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: P.Baltoski
P.Baltoski
Approved Signatory

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

Illawarra Laboratory
7/3 Hargraves Avenue, Albion Park Rail NSW 2527

Telephone: 02 4256 1684
E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

Report on Rock Core Testing

Client:	**ASCT Sydney South Laboratory**	Report No:	**14**
Client Address:	Unit 18, 2-8 Daniel Street, Wetherill Park NSW	Report Date:	3/03/2021
Project:	**Geotechnical Investigation**	Report Page:	Page 1 of 1
Works Component:	71 Alexandra Crescent Bayview	Project No:	33
Material Used:	-	Test Request:	G-00182
Material Description:	Sandstone	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 03/03/2021	Control Line:	BH2
Sample Date:	23/02/2021	**Sample Number:**	**33076**

Point Load Strength Index	Specimen 1	Specimen 2	Specimen 3	Specimen 4	Specimen 5	Specimen 6	Specimen 7	Specimen 8	Specimen 9	Specimen 10
Client ID Number	**A**	**A**	**A**	**B**	**B**	**B**	**D**	**D**	**D**	
Borehole	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	
Depth										
Lithological Description	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	
Moisture Condition	Moist	Moist	Moist	Moist	Moist	Moist	Moist	Moist	Moist	
Test Type	Diametral	Axial	Axial	Diametral	Axial	Axial	Diametral	Axial	Axial	
Anisotropic Direction										
Failure Mode	1	1	1	1	1	1	1	1	1	
Failure Sketch										
Uncorrected Strength (Mpa)	0.55	0.51	0.30	0.82	0.44	0.26	0.74	0.59	0.75	
Point Load Strength Index (Mpa)	**0.54**	**0.57**	**0.30**	**0.81**	**0.50**	**0.30**	**0.72**	**0.67**	**0.80**	
Descriptive Strength (AS1726, Table 19)	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Medium	
UCS [AS1726, Table 19] (MPa)	6 to 20	6 to 20	6 to 20	6 to 20	6 to 20	6 to 20	6 to 20	6 to 20	6 to 20	
Comments										

MEAN VALUE - Point Load Strength Index (Mpa)	**Normal Direction**	-	**Parallel Direction**	-	**Strength Anisotropy Index [Ia(50)] (Mpa)**	--

Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by 3rd Party: Results apply to the sample/s as received. **
As Received: Samples stored & Tested in as received condition.
AS4133.4.1: (2007) Determination of Point Load Index

(NATA accreditation does not cover the performance of this service)**

Point Load - Failure Mode Descriptions

1	Fracture through fabric, oblique to banding.
2	Fracture along banding.
3	Fracture through rock mass.
4J	Fracture influenced by Joint Plane.
4M	Fracture influenced by Micro-fracture.
4F	Fracture influenced by Foliation.
4V	Fracture influenced by Vein.
5	Invalid Result (Partial fracture, or chip).

Report Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: J.McKillop
Approved Signatory

WB62 - Rev 4, 11/09/2020

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

Illawarra Laboratory
7/3 Hargraves Avenue, Albion Park Rail NSW 2527

Telephone: 02 4256 1684
E-Mail: illawarra@asct.com.au
Mobile: 0497 979 929
A.B.N. 34 635 062 609

Report on Rock Core Testing

Client:	**ASCT Sydney South Laboratory**	Report No:	**15**
Client Address:	Unit 18, 2-8 Daniel Street, Wetherill Park NSW	Report Date:	8/03/2021
Project:	**Geotechnical Investigation**	Report Page:	Page 1 of 2
Works Component:	71 Alexandra Crescent Bayview	Project No:	33
Material Used:	-	Test Request:	G-00182
Material Description:	Sandstone	Lot Number:	-
Lot Comments:	-	ITP/PCP Number:	-
Lab Test Date/s:	Laboratory testing 05/03/2021	Control Line:	BH2
Sample Date:	23/02/2021	**Sample Number:**	**33239**

Point Load Strength Index	Specimen 1	Specimen 2	Specimen 3	Specimen 4	Specimen 5	Specimen 6	Specimen 7	Specimen 8	Specimen 9	Specimen 10
Client ID Number	**C - Top**	**C - Top**	**C - Top**	**C - Middle**	**C - Middle**	**C - Middle**	**Bottom**	**Bottom**	**Bottom**	
Borehole	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	**2**	
Depth										
Lithological Description	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	XW, SANDSTONE	
Moisture Condition	Moist	Moist	Moist	Moist	Moist	Moist	Moist	Moist	Moist	
Test Type	Diametral	Axial	Axial	Diametral	Axial	Axial	Diametral	Axial	Axial	
Anisotropic Direction										
Failure Mode	1	1	1	1	1	1	1	1	1	
Failure Sketch										
Uncorrected Strength (Mpa)	0.86	0.50	0.61	0.73	0.46	0.46	0.50	0.23	0.23	
Point Load Strength Index (Mpa)	**0.84**	**0.58**	**0.69**	**0.71**	**0.54**	**0.54**	**0.49**	**0.29**	**0.30**	
Descriptive Strength (AS1726, Table 19)	Medium	Medium	Medium	Medium	Medium	Medium	Medium	Low	Low	
UCS [AS1726, Table 19] (MPa)	6 to 20	6 to 20	6 to 20	6 to 20	6 to 20	6 to 20	6 to 20	2 to 6	2 to 6	
Comments										

MEAN VALUE - Point Load Strength Index (Mpa)	**Normal Direction**	-	**Parallel Direction**	-	**Strength Anisotropy Index [Ia(50)] (Mpa)**	--

Sampling & Test Methods (Results relate only to the items sampled/tested)

Sampled by 3rd Party: Results apply to the sample/s as received. **
As Received: Samples stored & Tested in as received condition.
AS4133.4.1: (2007) Determination of Point Load Index

(NATA accreditation does not cover the performance of this service)**

Point Load - Failure Mode Descriptions

1	Fracture through fabric, oblique to banding.
2	Fracture along banding.
3	Fracture through rock mass.
4J	Fracture influenced by Joint Plane.
4M	Fracture influenced by Micro-fracture.
4F	Fracture influenced by Foliation.
4V	Fracture influenced by Vein.
5	Invalid Result (Partial fracture, or chip).

Report Endorsement

NATA

Accredited for compliance with ISO/IEC 17025 - Testing.
NATA Accreditation number: 20656

Issued By: P.Baltoski
Approved Signatory

APPENDIX D ROCK DESCRIPTIONS

ROCK DESCRIPTIONS

Rock Material Weathering Classification		
Term	**Symbol**	**Definition**
Residual Soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely weathered rock	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e., it either disintegrates or can be remoulded in water.
Distinctly weathered rock	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.
Slightly weathered rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh Rock	FR	Rock shows no sign of decomposition or staining.

Notes: 1. The above criteria generally apply and variations will be noted on the Engineering Bore logs.
2. Extremely weathered rock is described in terms of soil engineering properties.
3. Highly weathered (HW) and moderately weathered (MW) can be used in place of DW if more weathering detail is applicable.

Strength is based on the point load strength index, corrected to 50mm diameter — Is(50). Field guide is used if no tests are available. (Ref. International Society for Rock Mechanics (ISRM) procedures as described in Int T. Rock Mech. Min. Sci and Geomech. Abstr. Suggested Method for Determining Point Load Strength, Vol.22 No.2 1985 pp.51-60).

Strength of Rock Material (AS 1726- Table 19)			
Term	**Letter symbol**	**Point load index (MPa) I,50**	**Field Guide to Strength**
Extremely low	EL	≤0.03	Easily remoulded by hand to a material with soil properties.
Very low	VL	>0.03 - ≤0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 3cm thick can be broken by finger pressure.
Low	L	>0.1 - ≤0.3	Easily scored with a knife; indentations 1 mm to 3mrn show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 5Ornm diameter may be broken by hand. Sharp edges of core may be friable and break during handling,
Medium	M	>0.3 - ≤1.0	Readily scored with a knife; a piece of core 150 mm long by 50mm diameter can be broken by hand with difficulty.
High	H	>1 - ≤3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very high	VH	>3 - ≤10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely high	EH	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer,

VIBRATION EMISSION DESIGN GOALS

German Standard DIN 4150 – Part 3: 1999 provides guideline levels of vibration velocity for evaluating the effects of vibration in structures. The limits presented in this standard are generally recognised to be conservative.

The DIN 4150 values (maximum levels measured in any direction at the foundation, OR, maximum levels measured in (x) or (y) horizontal directions, in the plane of the uppermost floor), are summarised in Table 1 below.

It should be noted that peak vibration velocities higher than the minimum figures in Table 1 for low frequencies may be quite 'safe', depending on the frequency content of the vibration and the actual condition of the structure.

It should also be noted that these levels are 'safe limits', up to which no damage due to vibration effects has been observed for the particular class of building. 'Damage' is defined by DIN 4150 to include even minor non-structural effects such as superficial cracking in cement render, the enlargement of cracks already present, and the separation of partitions or intermediate walls from load bearing walls. Should damage be observed at vibration levels lower than the 'safe limits', then it may be attributed to other causes. DIN 4150 also states that when vibration levels higher than the 'safe limits' are present, it does not necessarily follow that damage will occur. Values given are only a broad guide.

Table 1: DIN 4150 – Structural Damage – Safe Limits for Building Vibration

Group	Type of Structure	Peak Vibration Velocity in mm/s			
		At Foundation Level at a Frequency of:			Plane of Floor of Uppermost Storey
		Less than 10Hz	10Hz to 50Hz	50Hz to 100Hz	All Frequencies
1	Buildings used for commercial purposes, industrial buildings and buildings of similar design.	20	20 to 40	40 to 50	40
2	Dwellings and buildings of similar design and/or use.	5	5 to 15	15 to 20	15
3	Structures that because of their particular sensitivity to vibration, do not correspond to those listed in Group 1 and 2 and have intrinsic value (eg. buildings that are under a preservation order).	3	3 to 8	8 to 10	8

Note: For frequencies above 100Hz, the higher values in the 50Hz to 100Hz column should be used.

APPENDIX E SITE CLASSIFICATION GUIDELINES

Table 2.1.1 from AS2870-2011

Site Class	Foundation	Characteristic surface movement
A	Most sand and rock sites with little or no ground movement from moisture changes	0mm
S	Slightly reactive clay sites, which may experience only, slight ground movement from moisture changes	0 - 20mm
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes	20 - 40mm
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes	40 - 60mm
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes	60 - 75mm
E	Extremely reactive sites, which may experience extreme ground movement from moisture changes	> 75mm
P	Sites which include filled sites (refer to AS 2870-2011), soft soils, such as soft clay, silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise.	

APPENDIX F UNIFIED SOIL CLASSIFICATION SYSTEM

Unified Soil Classification System

Major division			*Group symbol*	*Typical name*	*Classification criteria*	
Coarse-grained soils (More than 50% retained on No. 200 ASTM	Gravels 50% or more of coarse fraction retained on No. 4 ASTM sieve	Clean gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines.		$U = D_{60}/D_{10}$ greater than 4 $C_c = D^2_{30}/(D_{60} \times D_{20})$ between 1 and 3.
			GP	Poorly-graded gravels and gravel-sand mixtures, little or no fines.	Classification on the basis of percentage of fines. Less than 5% passing No. 200 ASTM sieve GW, GP, SW, SP. More than 12% passing No. 200 ASTM sieve GM, GC, SM, SC. 5% to 12% passing N0. 200 ASTM sieve Border-line classification requiring use of dual symbols.	Not meeting both criteria for GW.
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures.		Atterberg limits plot below A-line or plasticity index less than 4.
			GC	Clayey gravels, gravel-sand-clay mixtures.		Atterberg limits plot above A-line or plasticity index less than 4.
	Sands More than 50% of coarse fraction passes No. 4 ASTM sieve	Clean sands	SW	Well-graded sands and gravelly sands, little or no fines.		U greater than 6 C_c between 1 and 3.
			SP	Poorly-graded sands and gravelly sands, little or no fines.		Not meeting both criteria for SW.
		Sands with fines	SM	Silly sands, and-silt mixtures.		Atterberg limits plot below A-line or plasticity index less than 4.
			SC	Clayey sands, sand-clay mixtures.		Atterberg limits plot above A-line or Plasticity Index Greater than 7.
Fine-grained soils (50% or more passes N0. 200 ASTM Sieve)	Silts and Clays (Liquid limit 50% or less)		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.	Check Plasticity Chart	
			CL	Inorganic clays or low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.		
			OL	Organic silts and organic silty clays of low plasticity.		
	Silts and Clays (Liquid limit greater than		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts elastic silts.		
			CH	Inorganic clays of high plasticity, fat clays.		
			OH	Organic clays of medium to high plasticity.		
Highly organic clays			P_t	Peat, muck and other highly organic soils.	Fibrous organic matter, will char, burn, or glow, Readily identified by colour, odour, spongy feel and fibrous texture.	

Note: Boundary classification: Soils possessing characteristics of two groups are designated by combinations of group symbols - for example, GW-GC, well-graded, gravel sand mixture with clay binder.

APPENDIX G1 SURVEY PLAN

NOTES

1. THIS SURVEY IS FOR IDENTIFICATION AND DESIGN PURPOSES ONLY AS PER CLAUSE 10 (3) OF THE SURVEYING AND SPATIAL INFORMATION ACT 2017 IS NOT TO BE USED FOR THE PURPOSE OF ANY DISPOSITION OF LAND OR ANY INTEREST IN LAND. NEW BUILDINGS SHOULD NOT BE SET OUT USING DIMENSIONS FROM EXISTING BUILDINGS
2. UNDERGROUND SERVICES HAVE NOT BEEN INVESTIGATED.
3. WHEREVER POINTS OR LINES ON ANY ELECTRONIC VERSION OF THIS PLAN DIFFER WITH STATED DIMENSIONS,THE STATED DIMENSIONS ARE TO BE USED. IN CRITICAL CASES WHERE THERE ARE NO STATED DIMENSIONS THE SURVEYOR IS TO BE CONTACTED PRIOR TO USING SUCH ELECTRONICALLY PRODUCED LINES OR POINTS.
4. WINDOW AND RIDGE LOCATIONS ARE GAINED BY REMOTE MEANS WHERE THESE ARE CRITICAL, THE SURVEYOR IS TO BE CONTACTED AS TO THEIR ACCURACY.
5. CERTIFICATE OF TITLE DATED: 09/07/2020
6. EASEMENTS & COVENANTS:
   6.1. D456581 COVENANT
   6.2. C431547 RIGHT OF WAY APPURTENANT TO THE LAND
7. THE TREES SHOWN ON THIS PLAN ARE THOSE WITH TRUNK DIAMETER GREATER THAN 200MM.
8. THE LOCATION OF TREE TRUNKS CAN VARY BY UP TO 300mm.WHERE GREATER ACCURACY IS REQUIRED THE SURVEYOR IS TO BE CONTACTED.
9. TREES ARE DENOTED AS SPREAD/DIAMETER/HEIGHT WHICH ARE ESTIMATES
10. WHERE CLEARANCES ARE CRITICAL, LEVELS OF UNDERGROUND SERVICES SHOWN ON PLANS FOREIGN TO THIS PLAN SHOULD BE PHYSICALLY LEVELED WITH REFERENCE TO THE BENCH MARKS SHOWN ON THIS PLAN
11. THE NORTH POINT AND BEARINGS ON THIS PLAN RELATE TO TRUE NORTH
12. BOUNDARY LINES ARE NOT NECESSARILY THE FENCE LINES UNLESS MEASUREMENTS FROM THE BOUNDARY TO THE FENCE LINES ARE SHOWN ON THIS PLAN, THEY ARE NOT TO BE USED TO DEFINE BOUNDARIES.
13. AUSTRALIAN HEIGHT DATUM (AHD) HAS BEEN CALCULATED FROM GNSS (CORSNET).
14. TOP OF ROOF MEANS TOP OF RIDGE CAP AND TOP OF LIP OF GUTTERING WHERE RELEVANT.
15. STAIRWAYS MAY HAVE A NUMBER OF TREADS DIFFERING FROM THOSE INDICATIVELY DRAWN ON THIS PLAN.
16. UNDERGROUND SERVICES HAVE ONLY BEEN VISUALLY LOCATED ONLY. DO NOT USE OUR PLANS TO LOCATE THE UNDERGROUND INFRASTRUCTURE. YOU MUST USE THE CURRENT DBYD PLANS TO LOCATE THE UNDERGROUND NETWORK.

AREA NOT SURVEYED

330°25'30" 20.12

52°51'20" 60.01 (1.58)

TWO STOREY FC & BRICK DWELLING No73

19 DP11186

GARAGE

20 DP11186 1201m²

THREE STOREY FC & BRICK DWELLING No71

COVERED DECK

41.65 FLOORLEV

37.66 FLOORLEV

CARPORT

(1.64)

(1.67)

(1.74)

232°53'30" 60.32

21 DP11186

DANE PRESTON

THREE STOREY RENDERED BRICK DWELLING No69

REGISTERED SURVEYOR SU008596

409°32'30" 20.12

ALEXANDRA CRESCENT

LEGEND

- TELEPHONE PIT
- OVERHEAD LAMP
- OVERHEAD ELECTRICITY LINE (ELE)
- OVERHEAD TELEPHONE WIRES (TEL)
- WATER MAIN (wm)
- FENCE
- EDGE OF CONCRETE (ECO)
- WINDOW (SILL & HEAD LEVELS) 157.92 158.52
- GRATED STORM WATER PIT
- SEWER ACCESS CHAMBER
- WATER METER
- ELECTRICAL (ELEC)
- HYDRANT
- GAS
- TREE SPREAD/DIAMETER/HEIGHT

STATED DIMENSIONS ARE TO TAKE PRECEDENT OVER SCALED DIMENSIONS.
ANY ELECTRONIC VERSION OF THIS PLAN IS NOT TO BE USED FOR SURVEY SET OUT OR ANY DESIGN.
ALL RELEVANT AUTHORITIES ARE TO BE CONTACTED PRIOR TO WORK COMMENCEMENT.
THE PERMISSION TO USE ALL LAND IS TO BE SOUGHT FROM THE OWNERS PRIOR TO USE.
PRIOR TO ANY RELEVANT WORKS COMMENCING ALL ERRORS, DISCREPANCIES OR ANOMALIES FOUND IN THE PLAN OR ON SITE ARE TO BE REPORTED TO THE DESIGNER OR SUPERVISOR.

REVISIONS	by	on
ADDITIONAL WALL LOCATIONS SHOWN	DJP	13/07/2020

PRINCIPAL

PROJECT: 71 ALEXANDRA CRESCENT BAYVIEW

CLIENT: THOMAS WAKEFORD

PO Box 4395 East Gosford NSW 2250 PH: 0412 451 273 DSPSurveyors@gmail.com

RATIO	1:100 @ A1 1:200 @ A3	
DATUM	A.H.D. M.G.A.	
Surveyed by:	DP	01/07/2020
Drawn by:	DP	08/07/2020
Designed by:		
Checked by:		

BEING 71 ALEXANDRA CRESCENT BAYVIEW

PARTIAL TOPOGRAPHICAL DETAIL & BOUNDARY IDENTIFICATION SURVEY OF PROPERTY, AND SURROUNDS

SHEET NO	NO OF SHEETS
1	1

JOB REF: 20233ALEXANDRA71

COUNCIL REFERENCE

APPENDIX G2 ARCHITECTURAL PLANS

EXTERNAL DOOR SCHEDULE

Mark	Description	Frame Material	Frame Colour	Height	Width	Manufacturer	Glazing	U-Value	SHGC	Room Location	Comments
D1	Stacking Sliding Glass Door (6 Panel)	Aluminium	Surfmist	2400	6250	Stegbar	6.38mm Comfortplus Neutral	4.4	0.45	Living/Kitchen	
D2	Sliding Glass Door (4 Panel)	Aluminium	Surfmist	2400	3610	Stegbar	6.38mm Comfortplus Neutral	4.4	0.45	Bedroom	
D3	Swinging Solid Core Door (-/60/30)	Steel	Surfmist	2400	820	Corinthians	N/A	N/A	N/A	Living/Kitchen	Self closing fire door
D4	Sliding Glass Door (4 Panel)	Aluminium	Surfmist	2400	3610	Stegbar	6.38mm Clear Laminate	6.44	0.75	Bed 6	Size to be confirmed on site prior to ordering
D5	Sliding Glass Door (4 Panel)	Aluminium	Surfmist	2143	3610	Stegbar	6.38mm Comfortplus Neutral	4.4	0.45	Bed 4	Size to be confirmed on site prior to ordering
D6	Sliding Glass Door (4 Panel)	Aluminium	Surfmist	2143	3610	Stegbar	6.38mm Comfortplus Neutral	4.4	0.45	Bed 1	Size to be confirmed on site prior to ordering
D7	Custom Panel-lift Door	Aluminium	Monument	2400	5100	B&D	N/A	N/A	N/A	Garage	Custom Decobatten cladding or similar affixed to monument panel-lift door
D8	Custom Panel-lift Door	Aluminium	Monument	2400	1800	B&D	N/A	N/A	N/A	Store	Custom Decobatten cladding or similar affixed to monument panel-lift door
D9	Swinging Solid Core Door	Steel	Surmist	2400	820	Corinthians	N/A	N/A	N/A	Bin Store	Lockable door with keypad or fingerprint scan lock
D10	Double Swinging Solid Core Doors	Steel	Surfmist	2400	1640	Corinthians	N/A	N/A	N/A	Pool Pump Store	Solid core doors with aluminium vents

WINDOW SCHEDULE

Mark	Description	Material	Frame Colour	Head Height	Height	Width	Manufacturer	Glazing	U-Value	SHGC	Room Location	Comments
W1	Aluminum Fixed Window	Aluminium	Surfmist	2400	1370	490	Stegbar	6.38mm Comfortplus Neutral	4.9	0.41	Living/Kitchen	Sill height to be confirmed prior to installation
W2	Aluminum Fixed Window	Aluminium	Surfmist	1630	600	4100	Stegbar	6.38mm Comfortplus Neutral	4.9	0.41	Living/Kitchen	Sill height to be confirmed prior to installation
W3	Aluminum Awning Window	Aluminium	Surfmist	2143	1200	610	Stegbar	6.38mm Obscure Laminate	6.44	0.75	Ensuite	
W4	Aluminum Fixed Window	Aluminium	Surfmist	2143	1370	850	Stegbar	6.38mm Obscure Laminate	6.44	0.75	Ensuite	Size to be confirmed on site prior to ordering

FLOOR AREA

NAME	AREA
BED 1 BALCONY	15.88 m²
BED 2 BALCONY	6.09 m²
BED 3 BALCONY	8.96 m²
BIN STORE	7.20 m²
GARAGE	116.26 m²
GRANNY FLAT BALCONY	52.57 m²
GRANNY FLAT LIVING	68.39 m²
LOWER LIVING	43.11 m²
MIDDLE FLOOR DECK	70.91 m²
MIDDLE LIVING	129.11 m²
UPPER LIVING	108.85 m²
TOTAL	627.34 m²

GROSS FLOOR AREA

NAME	AREA
GRANNY FLAT GFA	60.00 m²

FLOOR PLAN NOTES:
- WEATHER SEALS TO ALL EXTERNAL DOORS & WINDOWS AS WELL AS ANY DOORS WHICH CONNECT TO A GARAGE AREA
- ANY DOWNPIPE LOCATIONS SHOWN ARE APPROXIMATE ONLY AND ARE TO BE VERIFIED ON SITE BEFORE WORK COMMENCES
- ANY ARTICULATION JOINTS SHOWN ARE APPROXIMATE ONLY AND ARE TO BE POSITIONED AT DOORS OR WINDOWS WHERE POSSIBLE
- REFER TO NATHERS AND BASIX NOTES WHERE APPLICABLE AND ENSURE COMPLIANCE CAN BE ACHIEVED BEFORE WORK COMMENCES
- IT IS RECOMMENDED THAT THE BATHROOM WALLS BE FITTED WITH NOGGINGS TO ALLOW FUTURE INSTALLATION OF HANDRAILS & TOWEL RAILS
- ALL INTERNAL DOORS TO BE 2340mm HIGH IN GRANNY FLAT UNLESS NOTED

NATHERS NOTES: Certificate No: 0005842968-01
1. R2.5 INSULATION TO EXTERNAL WALLS
2. R4.1 INSULATION TO GARAGE CEILING
3. KINGSPAN METAL OUTER LAYER SANDWICH PANEL WITH MIN. R4.1 TOTAL R-VALUE
4. R2.5 INSULATION TO ALL INTERNAL WALLS
5. ALL DOWNLIGHTS INSTALLED ARE TO BE SEALED TO ENABLE INSULATION TO BE UNINTERRUPTED
6. ALL EXHAUST FANS INSTALLED ARE TO BE FITTED WITH A DAMPER
7. ENSURE U-VALUES AND SHGC VALUES FOR ALL WINDOWS AND DOORS ARE COMPLIANT WITH THE NATHERS CERTIFICATE. ANY MODIFICATION OF WINDOW TYPES OR MANUFACTURER WILL REQUIRE THE NATHERS CERTIFICATE TO BE UPDATED

BASIX NOTES: Certificate No: A412632
LIGHTING:
- A MINIMUM OF 40% OF NEW LIGHT FIXTURES TO BE LED OR FLUORO FITTINGS

FIXTURES:
- 3 STAR (<9.0L/min) SHOWERHEADS
- 4 STAR TOILETS
- 4 STAR KITCHEN TAPS
- 4 STAR BATHROOM TAPS

WINDOWS & GLAZED DOORS:
- ALL WINDOWS & GLAZED DOORS TO COMPLY WITH THE GLAZING SCHEDULE IN THE BASIX ASSESSMENT AND THE WINDOW & DOOR SCHEDULES

Heat Alarms to be installed to garage in accordance with NCC 2019 NSW 3.7.5.2 as follows:
(a)Smoke alarms must—
(i)be located in—
(A)Class 1a buildings, excluding any non associated Class 10a *private garages*, subject to (b), in accordance with 3.7.5.3 and 3.7.5.5; and
(B) Class 1b buildings in accordance with 3.7.5.4 and 3.7.5.5; and
(ii)comply with AS 3786, except that in a Class 10a *private garage* where the use of the area is likely to result in smoke alarms causing spurious signals, any other alarm deemed suitable in accordance with AS 1670.1 may be installed provided that smoke alarms complying AS 3786 are installed elsewhere in the Class 1 building; and
(iii)be connected to the consumer mains power where consumer power is supplied to the building; and
(iv)be interconnected where there is more than one alarm.
(b)Heat alarms must be installed in a Class 10a *private garage* that is located beneath a Class 1a dwelling and not associated with that dwelling, in accordance with NSW 1.1.4.

NSW 1.1.4 Heat alarms
(a)A heat alarm must be installed in a *private garage* that is not associated with and located below, a *garage top dwelling*.
(b)A heat alarm required by (a) must—
(i)be located on or near the ceiling; and
(ii)comply with AS 1603.3; and
(iii)be connected to the consumer mains power supplying the *garage top dwelling* where consumer mains power is supplied to the building; and
(iv)be interconnected to and activate the *garage top dwelling* smoke alarms *required* by 3.7.5.3.
(c)Durable notices must be permanently fixed to the *garage top dwelling* and non-associated *private garage* in prominent locations, indicating that—
(i)a heat alarm is installed in the non-associated *private garage*; and
(ii)the heat alarm is interconnected to the *garage top dwelling* smoke alarms.

BASIX NOTES: Certificate No: 1191672S_02
WATER:
LANDSCAPE:
- A MINIMUM OF 90m² OF INDIGENOUS OR LOW WATER USE VEGETATION SPECIES MUST BE PLANTED ACROSS THE SITE

FIXTURES:
- 3 STAR (<9.0L/min) SHOWERHEADS
- 4 STAR TOILETS
- 4 STAR KITCHEN TAPS
- 4 STAR BATHROOM TAPS

ALTERNATIVE WATER:
- MIN. 2000L RAIN WATER TANK WITH A MINIMUM OF 30m² OF ROOF AREA DIVERTED TO IT
- WATER TANK TO BE CONNECTED TO ALL TOILETS PLUS AT LEAST ONE OUTDOOR TAP

POOL & SPA:
- NO POOL GREATER THAN 40KL IS TO BE INSTALLED

THERMAL COMFORT:
- SEE NATHERS CERTIFICATE 0005842968-01

ENERGY:
HOT WATER:
- MIN. 5 STAR GAS INSTANTANEOUS HOT WATER SYSTEM

HEATING & COOLING:
- 1 PHASE AIR CONDITIONING TO ALL LIVING ROOMS AND BEDROOMS (MIN. 3.0 STAR ENERGY RATING - OLD SYSTEM)
- CEILING FANS TO BE INSTALLED TO BEDROOM & KITCHEN/LIVING

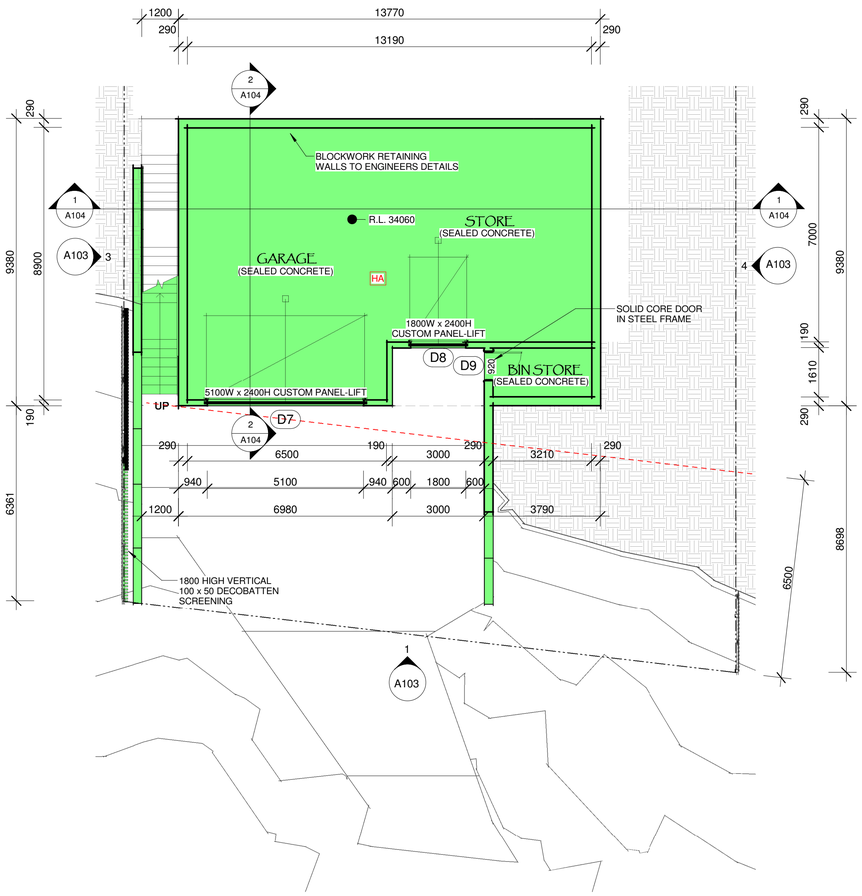
VENTILATION:
- BATHROOM EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH
- KITCHEN EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH
- LAUNDRY EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH

LIGHTING:
- WINDOW AND/OR SKYLIGHT TO BE INSTALLED TO KITCHEN
- NO TOILETS/BATHROOMS NEED TO BE NATURALLY LIT BY EITHER A WINDOW OR SKYLIGHT
- ALL ROOMS IN ALL UNITS TO BE PRIMARILY LIT (MINIMUM 80% OF LIGHT FITTINGS) BY FLUORESCENT OR LED LAMPS

POOL & SPA:
- NO POOL GREATER THAN 40KL IS TO BE INSTALLED

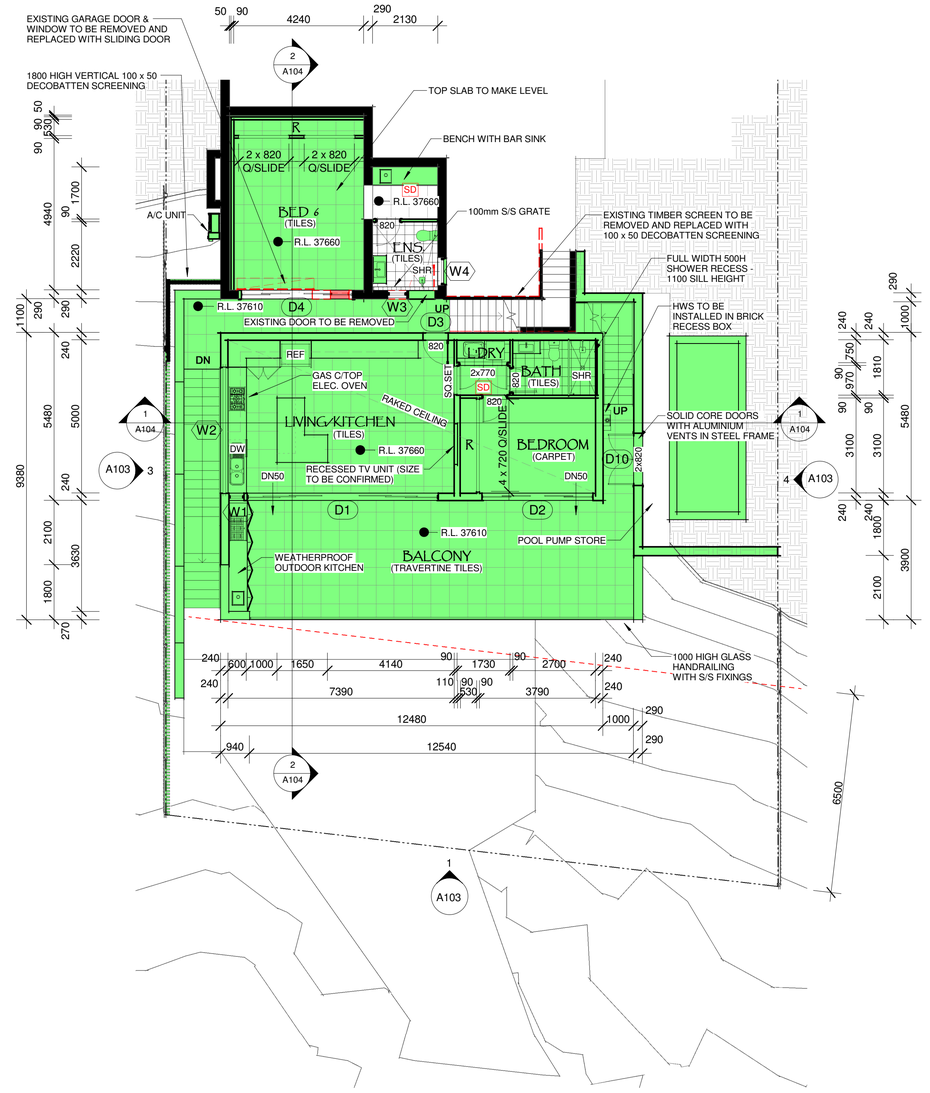
ALTERNATIVE ENERGY:
- A MINIMUM 1.5KW PV SYSTEM TO BE INSTALLED

OTHER:
- GAS COOKTOP & ELECTRIC OVEN
- WELL VENTILATED FRIDGE SPACE IS NOT REQUIRED
- AN OUTDOOR CLOTHESLINE IS NOT REQUIRED
- AN INDOOR/SHELTERED CLOTHESLINE IS NOT REQUIRED



1 PROPOSED GARAGE FLOOR PLAN
1 : 100

SD - SMOKE DETECTORS
HA - HEAT ALARM



2 PROPOSED LOWER FLOOR PLAN
1 : 100

General Notes:
1. LEVELS SHOWN ARE APPROXIMATE ONLY AND SHOULD BE VERIFIED ON SITE BEFORE WORK COMMENCES.
2. FIGURED DIMENSIONS ARE TO BE USED IN PREFERENCE TO SCALING. IF UNSURE OR IF THE DIMENSION YOU ARE SEEKING CANNOT BE FOUND, PLEASE ASK.
3. ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE STATED AND ARE TO BE VERIFIED BEFORE WORK COMMENCES.
4. FINAL DOOR & WINDOW SCHEDULES TO BE VERIFIED BY CLIENT AND BUILDER PRIOR TO ORDERING. IF WINDOWS NEED TO BE MODIFIED, PLEASE ADVISE ASAP AS THIS MAY IMPACT THE NATHERS RATING AND/OR BASIX ASSESSMENT.
5. HOMEGUARD TERMITE BARRIER TO BE USED UNLESS OTHERWISE STATED.
6. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE NATIONAL CONSTRUCTION CODE (NCC) AND ALL RELEVANT AUSTRALIAN STANDARDS.
7. ALL PLANS ARE TO BE READ IN CONJUCTION WITH THE RELEVANT NATHERS HOUSE ENERGY RATING AND/OR BASIX ASSESSMENT.
8. ALL PLANS ARE SUBJECT TO COPYRIGHT AND ARE NOT BE REPRODUCED IN PART OR WHOLE WITHOUT EXPRESS WRITTEN PERMISSION OF REGGIE'S RESIDENTIAL DESIGN & DRAFTING.

ISSUE	DESCRIPTION	DATE
A	Initial Design Concept	7/10/20
B	Revised Design - Carport added & balcony increased. Path added to south eastern side of garage.	19/10/20
C	Revised Design - Pool added, setbacks increased, stairs altered	8/12/20
D	Working Drawings Issue	30/03/21
E	Nathers & BASIX notes added.	7/04/21
F	Roof slope to granny flat reversed. Only tree 1 to be removed now - other previously nominated to be removed are to remain. Garden bed added to northern side of pool.	1/06/21

Client:
MR & MRS WAKEFORD

Project:
PROPOSED ALTERATIONS, GRANNY FLAT & POOL

Address:
71 ALEXANDRA CRESCENT BAYVIEW NSW 2104

Lot:	Sec:	DP:	Area:
20	-	DP11186	1201 m²

LGA:
NORTHERN BEACHES COUNCIL

Sheet No:
A101

Sheet Name:
PROPOSED GARAGE FLOOR PLAN & LOWER FLOOR PLAN

Scale:	Drawn:	Issue:
1 : 100	RH	F

Job No:	Size:	Date:
2752	A1	6/10/2020

REGGIE'S
RESIDENTIAL DESIGN & DRAFTING
"SPECIALISING IN EXCLUSIVE LUXURY HOMES"
PO Box 222, Bargo NSW 2574
Shop 1/66 Railside Avenue, Bargo NSW 2574
Phone: 4684 3747 | Email: design@reggiesdesign.com.au
Web: www.reggiesdesign.com.au | reggiesdesign
ABN: 39 260 639 299

2/06/2021 3:25:35 PM

FLOOR PLAN NOTES:
- WEATHER SEALS TO ALL EXTERNAL DOORS & WINDOWS AS WELL AS ANY DOORS WHICH CONNECT TO A GARAGE AREA
- ANY DOWNPIPE LOCATIONS SHOWN ARE APPROXIMATE ONLY AND ARE TO BE VERIFIED ON SITE BEFORE WORK COMMENCES
- ANY ARTICULATION JOINTS SHOWN ARE APPROXIMATE ONLY AND ARE TO BE POSITIONED AT DOORS OR WINDOWS WHERE POSSIBLE
- REFER TO NATHERS AND BASIX NOTES WHERE APPLICABLE AND ENSURE COMPLIANCE CAN BE ACHIEVED BEFORE WORK COMMENCES
- IT IS RECOMMENDED THAT THE BATHROOM WALLS BE FITTED WITH NOGGINGS TO ALLOW FUTURE INSTALLATION OF HANDRAILS & TOWEL RAILS

NATHERS NOTES: Certificate No: 0005842968-01
1. R2.5 INSULATION TO EXTERNAL WALLS
2. R4.1 INSULATION TO GARAGE CEILING
3. KINGSPAN METAL OUTER LAYER SANDWICH PANEL WITH MIN. R4.1 TOTAL R-VALUE
4. R2.5 INSULATION TO ALL INTERNAL WALLS
5. ALL DOWNLIGHTS INSTALLED ARE TO BE SEALED TO ENABLE INSULATION TO BE UNINTERRUPTED
6. ALL EXHAUST FANS INSTALLED ARE TO BE FITTED WITH A DAMPER
7. ENSURE U-VALUES AND SHGC VALUES FOR ALL WINDOWS AND DOORS ARE COMPLIANT WITH THE NATHERS CERTIFICATE. ANY MODIFICATION OF WINDOW TYPES OR MANUFACTURER WILL REQUIRE THE NATHERS CERTIFICATE TO BE UPDATED

BASIX NOTES: Certificate No: 1191672S_02
WATER:
LANDSCAPE:
- A MINIMUM OF 90m² OF INDIGENOUS OR LOW WATER USE VEGETATION SPECIES MUST BE PLANTED ACROSS THE SITE

FIXTURES:
- 3 STAR (<9.0L/min) SHOWERHEADS
- 4 STAR TOILETS
- 4 STAR KITCHEN TAPS
- 4 STAR BATHROOM TAPS

ALTERNATIVE WATER:
- MIN. 2000L RAIN WATER TANK WITH A MINIMUM OF 30m² OF ROOF AREA DIVERTED TO IT
- WATER TANK TO BE CONNECTED TO ALL TOILETS PLUS AT LEAST ONE OUTDOOR TAP

POOL & SPA:
- NO POOL GREATER THAN 40KL IS TO BE INSTALLED

THERMAL COMFORT:
- SEE NATHERS CERTIFICATE 0005842968-01

ENERGY:
HOT WATER:
- MIN. 5 STAR GAS INSTANTANEOUS HOT WATER SYSTEM

HEATING & COOLING:
- 1 PHASE AIR CONDITIONING TO ALL LIVING ROOMS AND BEDROOMS (MIN. 3.0 STAR ENERGY RATING - OLD SYSTEM)
- CEILING FANS TO BE INSTALLED TO BEDROOM & KITCHEN/LIVING

VENTILATION:
- BATHROOM EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH
- KITCHEN EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH
- LAUNDRY EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH

LIGHTING:
- WINDOW AND/OR SKYLIGHT TO BE INSTALLED TO KITCHEN
- NO TOILETS/BATHROOMS NEED TO BE NATURALLY LIT BY EITHER A WINDOW OR SKYLIGHT
- ALL ROOMS IN ALL UNITS TO BE PRIMARILY LIT (MINIMUM 80% OF LIGHT FITTINGS) BY FLUORESCENT OR LED LAMPS

POOL & SPA:
- NO POOL GREATER THAN 40KL IS TO BE INSTALLED

ALTERNATIVE ENERGY:
- A MINIMUM 1.5KW PV SYSTEM TO BE INSTALLED

OTHER:
- GAS COOKTOP & ELECTRIC OVEN
- WELL VENTILATED FRIDGE SPACE IS NOT REQUIRED
- AN OUTDOOR CLOTHESLINE IS NOT REQUIRED
- AN INDOOR/SHELTERED CLOTHESLINE IS NOT REQUIRED

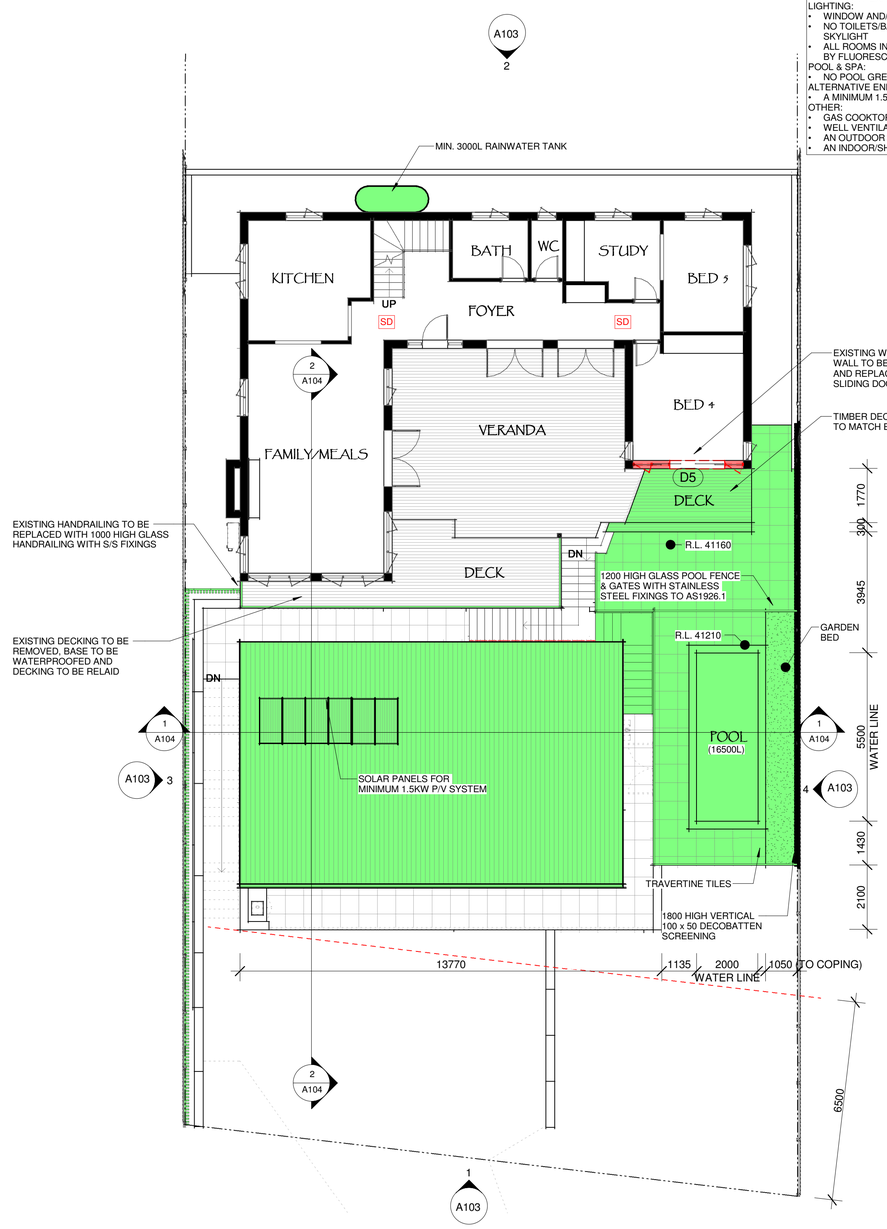
BASIX NOTES: Certificate No: A412632
LIGHTING:
- A MINIMUM OF 40% OF NEW LIGHT FIXTURES TO BE LED OR FLUORO FITTINGS

FIXTURES:
- 3 STAR (<9.0L/min) SHOWERHEADS
- 4 STAR TOILETS
- 4 STAR KITCHEN TAPS
- 4 STAR BATHROOM TAPS

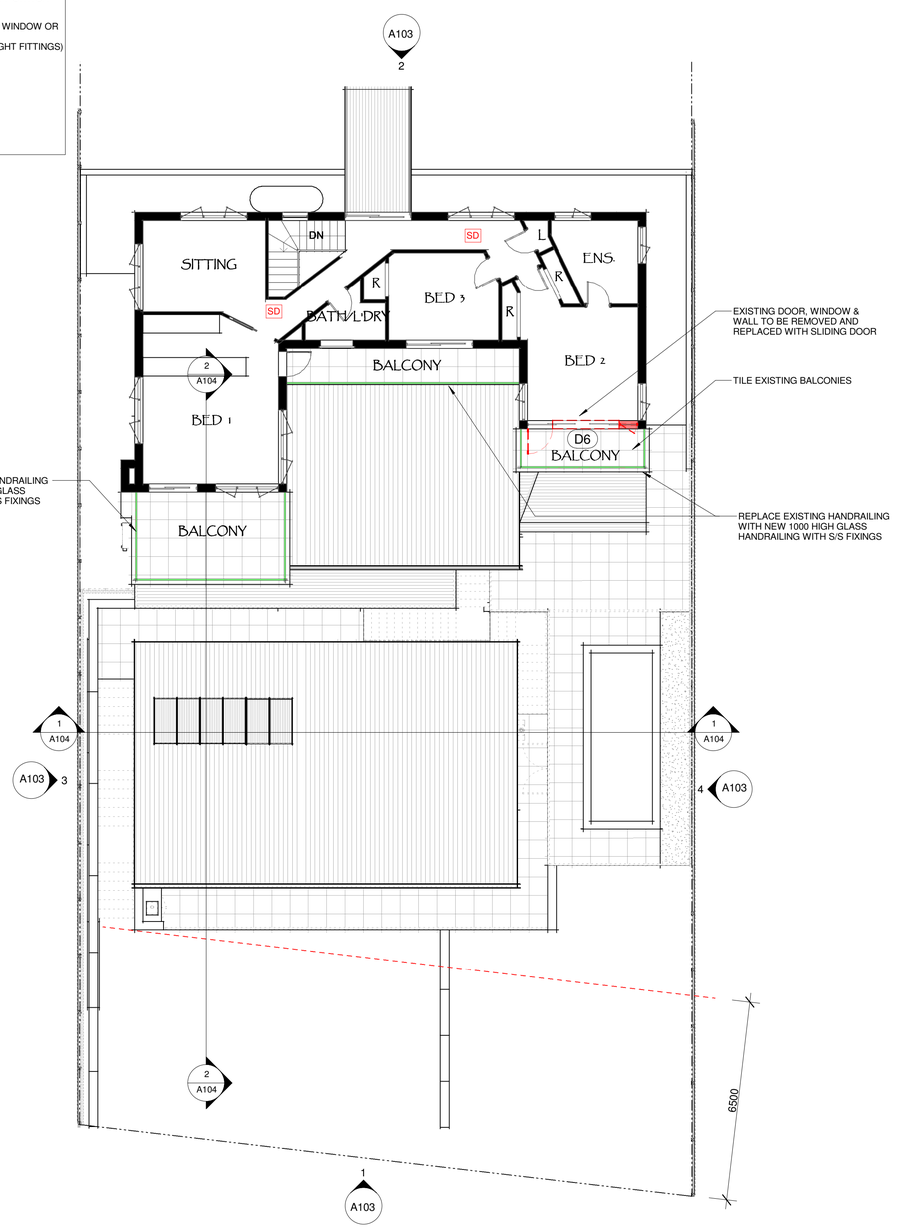
WINDOWS & GLAZED DOORS:
- ALL WINDOWS & GLAZED DOORS TO COMPLY WITH THE GLAZING SCHEDULE IN THE BASIX ASSESSMENT AND THE WINDOW & DOOR SCHEDULES

0005842968-01 07 Apr 2021
5.5 NATIONWIDE HOUSE ENERGY RATING SCHEME
57.7 MJ/m²
www.nathers.gov.au
Assessor Accreditation No. Reginald Hawkins 20012
Address: Unit G/Flat, 71 Alexandra Crescent , Bayview , NSW , 2104
www.hstar.com.au

ABSA Australian Building Sustainability Association
HERS Assessments completed within the accreditation period as part of the ABSA quality and compliance
Accreditation Period 01/04/2020-31/03/2021
Assessor Name Reginald Hawkins
Assessor Number 20012
Assessor Signature
This Accredited Assessor is qualified to rate residential buildings in accordance with the Nationwide House Energy Rating Scheme (NHERS)



1 PROPOSED MIDDLE FLOOR PLAN
1 : 100



2 PROPOSED UPPER FLOOR PLAN
1 : 100

SD - SMOKE DETECTORS

General Notes:
1. LEVELS SHOWN ARE APPROXIMATE ONLY AND SHOULD BE VERIFIED ON SITE BEFORE WORK COMMENCES.
2. FIGURED DIMENSIONS ARE TO BE USED IN PREFERENCE TO SCALING. IF UNSURE OR IF THE DIMENSION YOU ARE SEEKING CANNOT BE FOUND, PLEASE ASK.
3. ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE STATED AND ARE TO BE VERIFIED BEFORE WORK COMMENCES.
4. FINAL DOOR & WINDOW SCHEDULES TO BE VERIFIED BY CLIENT AND BUILDER PRIOR TO ORDERING. IF WINDOWS NEED TO BE MODIFIED, PLEASE ADVISE ASAP AS THIS MAY IMPACT THE NATHERS RATING AND/OR BASIX ASSESSMENT.
5. HOMEGUARD TERMITE BARRIER TO BE USED UNLESS OTHERWISE STATED.
6. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE NATIONAL CONSTRUCTION CODE (NCC) AND ALL RELEVANT AUSTRALIAN STANDARDS.
7. ALL PLANS ARE TO BE READ IN CONJUCTION WITH THE RELEVANT NATHERS HOUSE ENERGY RATING AND/OR BASIX ASSESSMENT.
8. ALL PLANS ARE SUBJECT TO COPYRIGHT AND ARE NOT BE REPRODUCED IN PART OR WHOLE WITHOUT EXPRESS WRITTEN PERMISSION OF REGGIE'S RESIDENTIAL DESIGN & DRAFTING.

ISSUE	DESCRIPTION	DATE
A	Initial Design Concept	7/10/20
B	Revised Design - Carport added & balcony increased. Path added to south eastern side of garage.	19/10/20
C	Revised Design - Pool added, setbacks increased, stairs altered	8/12/20
D	Working Drawings Issue	30/03/21
E	Nathers & BASIX notes added.	7/04/21
F	Roof slope to granny flat reversed. Only tree 1 to be removed now - other previously nominated to be removed are to remain. Garden bed added to northern side of pool.	1/06/21

Client:
MR & MRS WAKEFORD

Project:
PROPOSED ALTERATIONS, GRANNY FLAT & POOL

Address:
71 ALEXANDRA CRESCENT BAYVIEW NSW 2104

Lot:	Sec:	DP:	Area:
20	-	DP11186	1201 m²

LGA:
NORTHERN BEACHES COUNCIL

Sheet No:
A102

Sheet Name:
PROPOSED MIDDLE FLOOR PLAN & UPPER FLOOR PLAN

Scale:	Drawn:	Issue:
1 : 100	RH	F

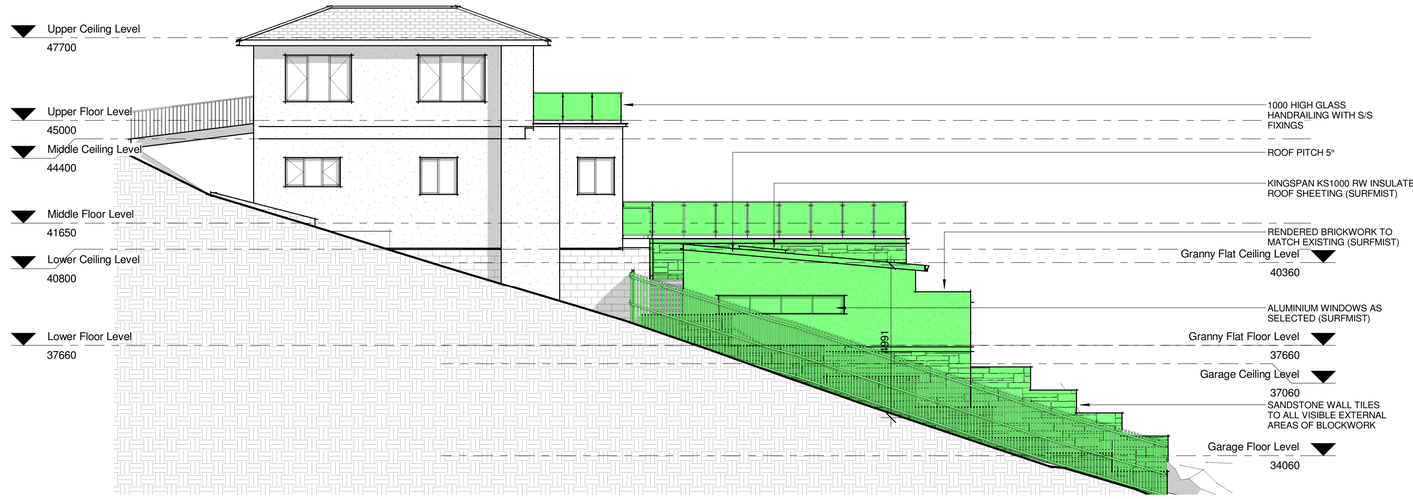
Job No:	Size:	Date:
2752	A1	6/10/2020

REGGIE'S
RESIDENTIAL DESIGN & DRAFTING
"SPECIALISING IN EXCLUSIVE LUXURY HOMES"
PO Box 222, Bargo NSW 2574
Shop 1/66 Railside Avenue, Bargo NSW 2574
Phone: 4684 3747 | Email: design@reggiesdesign.com.au
Web: www.reggiesdesign.com.au | reggiesdesign
ABN: 39 260 639 299

2/06/2021 3:25:37 PM

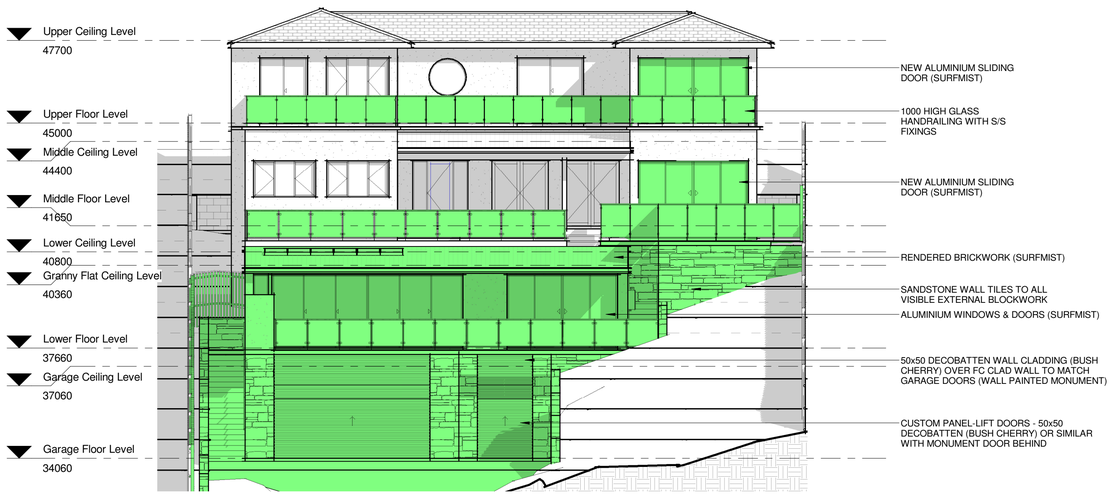
4 PROPOSED NORTH WEST ELEVATION

1 : 100



3 PROPOSED SOUTH EAST ELEVATION

1 : 100

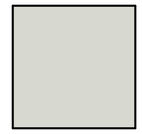


1 PROPOSED NORTH EAST ELEVATION

1 : 100

2 PROPOSED SOUTH WEST ELEVATION

1 : 100


COLORBOND 'SURFMIST'


TEAKWOOD HONED SANDSTONE WALL TILES (600x400x20)


DECOWOOD 'BUSH CHERRY'


30mm TRAVERTINE FLOOR TILES FOR BALCONIES AND POOL DECK - AMBER TILES MVS569 (FRENCH PATTERN)


POOL TILE 'NIEBLA - MID BLUE' OR SIMILAR


COLORBOND 'MONUMENT'

ALL COLOURS SHOWN ARE TO BE VERIFIED BY OWNER & BUILDER PRIOR TO ORDERING OF MATERIALS AND WORK COMMENCING

General Notes:

1. LEVELS SHOWN ARE APPROXIMATE ONLY AND SHOULD BE VERIFIED ON SITE BEFORE WORK COMMENCES.
2. FIGURED DIMENSIONS ARE TO BE USED IN PREFERENCE TO SCALING. IF UNSURE OR IF THE DIMENSION YOU ARE SEEKING CANNOT BE FOUND, PLEASE ASK.
3. ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE STATED AND ARE TO BE VERIFIED BEFORE WORK COMMENCES.
4. FINAL DOOR & WINDOW SCHEDULES TO BE VERIFIED BY CLIENT AND BUILDER PRIOR TO ORDERING. IF WINDOWS NEED TO BE MODIFIED, PLEASE ADVISE ASAP AS THIS MAY IMPACT THE NATHERS RATING AND/OR BASIX ASSESSMENT.
5. HOMEGUARD TERMITE BARRIER TO BE USED UNLESS OTHERWISE STATED.
6. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE NATIONAL CONSTRUCTION CODE (NCC) AND ALL RELEVANT AUSTRALIAN STANDARDS.
7. ALL PLANS ARE TO BE READ IN CONJUCTION WITH THE RELEVANT NATHERS HOUSE ENERGY RATING AND/OR BASIX ASSESSMENT.
8. ALL PLANS ARE SUBJECT TO COPYRIGHT AND ARE NOT BE REPRODUCED IN PART OR WHOLE WITHOUT EXPRESS WRITTEN PERMISSION OF REGGIE'S RESIDENTIAL DESIGN & DRAFTING.

ISSUE	DESCRIPTION	DATE
A	Initial Design Concept	7/10/20
B	Revised Design - Carport added & balcony increased. Path added to south eastern side of garage.	19/10/20
C	Revised Design - Pool added, setbacks increased, stairs altered	8/12/20
D	Working Drawings Issue	30/03/21
E	Nathers & BASIX notes added.	7/04/21
F	Roof slope to granny flat reversed. Only tree 1 to be removed now - other previously nominated to be removed are to remain. Garden bed added to northern side of pool.	1/06/21

Client:
MR & MRS WAKEFORD

Project:
PROPOSED ALTERATIONS, GRANNY FLAT & POOL

Address:
71 ALEXANDRA CRESCENT BAYVIEW NSW 2104

Lot:	Sec:	DP:	Area:
20	-	DP11186	1201 m²

LGA:
NORTHERN BEACHES COUNCIL

Sheet No:
A103

Sheet Name:
PROPOSED ELEVATIONS

Scale:	Drawn:	Issue:
1 : 100	RH	F

Job No:	Size:	Date:
2752	A1	6/10/2020

REGGIE'S
RESIDENTIAL DESIGN & DRAFTING
"SPECIALISING IN EXCLUSIVE LUXURY HOMES"
PO Box 222, Bargo NSW 2574
Shop 1/66 Railside Avenue, Bargo NSW 2574
Phone: 4684 3747 | Email: design@reggiesdesign.com.au
Web: www.reggiesdesign.com.au | reggiesdesign
ABN: 39 260 639 299

2/06/2021 3:25:41 PM

FLOOR PLAN NOTES:
- WEATHER SEALS TO ALL EXTERNAL DOORS & WINDOWS AS WELL AS ANY DOORS WHICH CONNECT TO A GARAGE AREA
- ANY DOWNPIPE LOCATIONS SHOWN ARE APPROXIMATE ONLY AND ARE TO BE VERIFIED ON SITE BEFORE WORK COMMENCES
- ANY ARTICULATION JOINTS SHOWN ARE APPROXIMATE ONLY AND ARE TO BE POSITIONED AT DOORS OR WINDOWS WHERE POSSIBLE
- REFER TO NATHERS AND BASIX NOTES WHERE APPLICABLE AND ENSURE COMPLIANCE CAN BE ACHIEVED BEFORE WORK COMMENCES
- IT IS RECOMMENDED THAT THE BATHROOM WALLS BE FITTED WITH NOGGINGS TO ALLOW FUTURE INSTALLATION OF HANDRAILS & TOWEL RAILS

NATHERS NOTES: Certificate No: 0005842968-01
1. R2.5 INSULATION TO EXTERNAL WALLS
2. R4.1 INSULATION TO GARAGE CEILING
3. KINGSPAN METAL OUTER LAYER SANDWICH PANEL WITH MIN. R4.81 TOTAL R-VALUE
4. R2.5 INSULATION TO ALL INTERNAL WALLS
5. ALL DOWNLIGHTS INSTALLED ARE TO BE SEALED TO ENABLE INSULATION TO BE UNINTERRUPTED
6. ALL EXHAUST FANS INSTALLED ARE TO BE FITTED WITH A DAMPER
7. ENSURE U-VALUES AND SHGC VALUES FOR ALL WINDOWS AND DOORS ARE COMPLIANT WITH THE NATHERS CERTIFICATE. ANY MODIFICATION OF WINDOW TYPES OR MANUFACTURER WILL REQUIRE THE NATHERS CERTIFICATE TO BE UPDATED

BASIX NOTES: Certificate No: A412632
LIGHTING:
- A MINIMUM OF 40% OF NEW LIGHT FIXTURES TO BE LED OR FLUORO FITTINGS

FIXTURES:
- 3 STAR (<9.0L/min) SHOWERHEADS
- 4 STAR TOILETS
- 4 STAR KITCHEN TAPS
- 4 STAR BATHROOM TAPS

WINDOWS & GLAZED DOORS:
- ALL WINDOWS & GLAZED DOORS TO COMPLY WITH THE GLAZING SCHEDULE IN THE BASIX ASSESSMENT AND THE WINDOW & DOOR SCHEDULES

BASIX NOTES: Certificate No: 1191672S_02
WATER:
LANDSCAPE:
- A MINIMUM OF 90m² OF INDIGENOUS OR LOW WATER USE VEGETATION SPECIES MUST BE PLANTED ACROSS THE SITE

FIXTURES:
- 3 STAR (<9.0L/min) SHOWERHEADS
- 4 STAR TOILETS
- 4 STAR KITCHEN TAPS
- 4 STAR BATHROOM TAPS

ALTERNATIVE WATER:
- MIN. 2000L RAIN WATER TANK WITH A MINIMUM OF 30m² OF ROOF AREA DIVERTED TO IT
- WATER TANK TO BE CONNECTED TO ALL TOILETS PLUS AT LEAST ONE OUTDOOR TAP

POOL & SPA:
- NO POOL GREATER THAN 40KL IS TO BE INSTALLED

THERMAL COMFORT:
- SEE NATHERS CERTIFICATE 0005842968-01

ENERGY:
HOT WATER:
- MIN. 5 STAR GAS INSTANTANEOUS HOT WATER SYSTEM

HEATING & COOLING:
- 1 PHASE AIR CONDITIONING TO ALL LIVING ROOMS AND BEDROOMS (MIN. 3.0 STAR ENERGY RATING - OLD SYSTEM)
- CEILING FANS TO BE INSTALLED TO BEDROOM & KITCHEN/LIVING

VENTILATION:
- BATHROOM EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH
- KITCHEN EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH
- LAUNDRY EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH

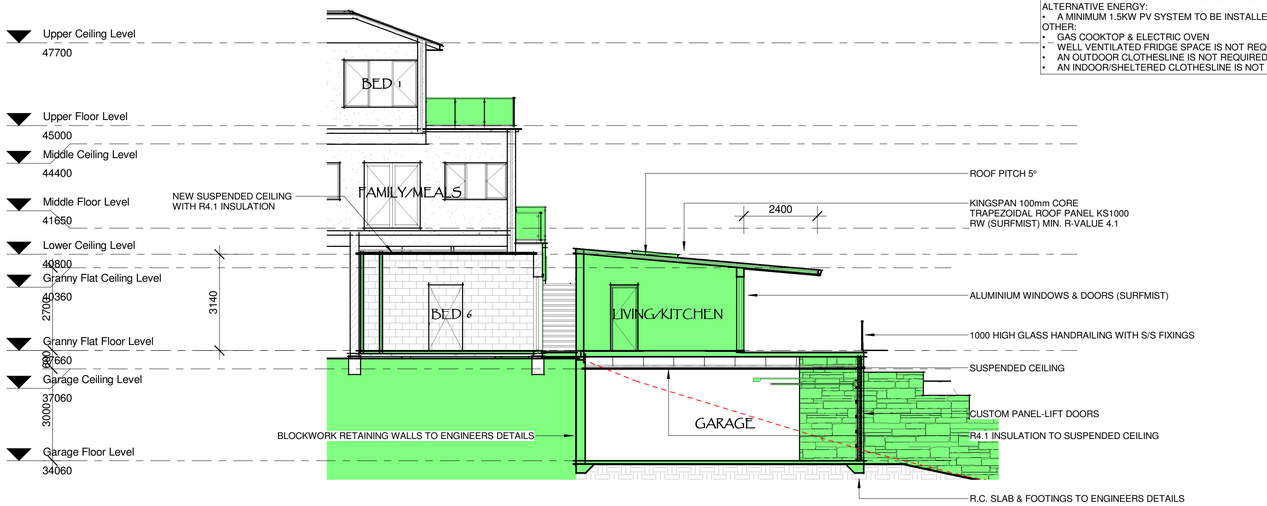
LIGHTING:
- WINDOW AND/OR SKYLIGHT TO BE INSTALLED TO KITCHEN
- NO TOILETS/BATHROOMS NEED TO BE NATURALLY LIT BY EITHER A WINDOW OR SKYLIGHT
- ALL ROOMS IN ALL UNITS TO BE PRIMARILY LIT (MINIMUM 80% OF LIGHT FITTINGS) BY FLUORESCENT OR LED LAMPS

POOL & SPA:
- NO POOL GREATER THAN 40KL IS TO BE INSTALLED

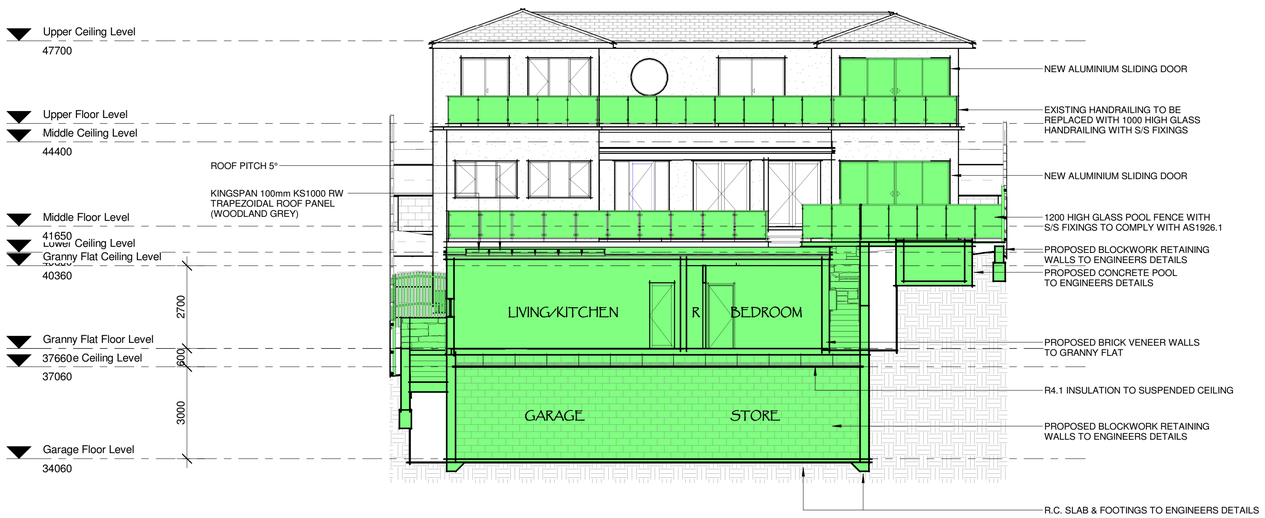
ALTERNATIVE ENERGY:
- A MINIMUM 1.5KW PV SYSTEM TO BE INSTALLED

OTHER:
- GAS COOKTOP & ELECTRIC OVEN
- WELL VENTILATED FRIDGE SPACE IS NOT REQUIRED
- AN OUTDOOR CLOTHESLINE IS NOT REQUIRED
- AN INDOOR/SHELTERED CLOTHESLINE IS NOT REQUIRED

0005842968-01 07 Apr 2021
5.5 NATIONWIDE HOUSE ENERGY RATING SCHEME 57.7 MJ/m² www.nathers.gov.au
Assessor Accreditation No. Reginald Hawkins 20012
Address Unit GFlat, 71 Alexandra Crescent , Bayview , NSW , 2104
www.hstar.com.au
ABSA Australian Building Sustainability Association
HERS Assessor Reginald Hawkins
Accreditation Period 01/04/2020-31/03/2021
Assessor Name Reginald Hawkins
Assessor Number 20012
Assessor Signature



2 SECTION B
1 : 100



1 SECTION A
1 : 100

1. FALLS, SLIPS & TRIPS
a) WORKING AT HEIGHTS
DURING CONSTRUCTION
Wherever possible, components for this building should be prefabricated off-site or at ground level to minimize the risk of workers falling more than two meters. However, construction of this building will require workers to be working at heights where a fall in excess of two meters is possible and injury is likely to result from such a fall. The builder should provide a suitable barrier wherever a person is required to work in a situation where falling more than two meters is a possibility.
DURING OPERATION OR MAINTENANCE
For houses or other low-rise buildings where scaffolding is appropriate:
Cleaning and maintenance of windows, walls, roof or other components of this building will require persons to be situated where a fall from a height in excess of two meters is possible. Where this type of activity is required, scaffolding, ladders or trestles should be used in accordance with relevant codes of practice, regulations or legislations.
For buildings where scaffold, ladders, trestles are not appropriate:
Cleaning and maintenance of windows, walls, roof or other components of this building will require persons to be situated where a fall from a height in excess of two meters is possible. Where this type of activity is required, scaffolding, fall barriers or Personal Protective Equipment (PPE) should be used in accordance with relevant codes of practice, regulations or legislation.

b) SLIPPERY OR UNEVEN SURFACES
FLOOR FINISHES - Specified
If finishes have been specified by designer, these have been selected to minimize the risk of floors and paved areas becoming slippery when wet or when walked on with wet shoes/feet. Any changes to the specified finish should be made in consultation with the designer or, if this is not practical, surfaces with an equivalent or better slip resistance should be chosen.
FLOOR FINISHES - By Owner
If designer has not been involved in the selection of surface finishes, the owner is responsible for the selection of surface finishes in the pedestrian trafficable areas of this building. Surfaces should be selected in accordance with AS HB 197:1999 and AS/NZ 4586:2004.
STEPS, LOOSE OBJECTS AND UNEVEN SURFACES
Due to design restrictions for this building, steps and/or ramps are included in the building which may be a hazard to workers carrying objects or otherwise occupied. Steps should be clearly marked with both visual and tactile warning during construction, maintenance, demolition and at all times when the building operates as a workplace.
Building owners and occupiers should monitor the pedestrian access ways in particular access to areas where maintenance is routinely carried out to ensure that surfaces have not moved or cracked so that they become uneven and present a trip hazard. Spills, loose material stray objects or any other matter that may cause a slip or trip hazard should be cleaned or removed from access ways.
Contractors should be required to maintain a tidy work site during construction, maintenance or demolition to reduce the risk of trips and falls in the workplace. Materials for construction or maintenance should be stored in designated areas away from access ways and work areas.

2. FALLING OBJECTS
LOOSE MATERIALS OR SMALL OBJECTS
Construction, maintenance or demolition work on or around this building is likely to involve persons working above ground level or above floor levels. Where this occurs one or more of the following measures should be taken to avoid objects falling from the area where the work is being carried out onto persons below.
1. Prevent or restrict access to areas below where the work is being carried out.
2. Provide toe boards to scaffolding or work platforms.
3. Provide Protective structure below the work area.
4. Ensure that all persons below the work area have Personal Protective Equipment (PPE).

BUILDING COMPONENTS
During construction, renovation or demolition of this building, parts of the structure including fabricated steelwork, heavy panels and many other components will remain standing prior to or after supporting parts are in place. Contractors should ensure that temporary bracing or other required support is in place at all times when collapse which may injure persons in the area is a possibility.
Mechanical lifting of materials and components during construction, maintenance or demolition presents a risk of falling objects. Contractors should ensure that appropriate lifting devices are used, that loads are properly secured and that access to areas below the load is prevented or restricted.

3. TRAFFIC MANAGEMENT
For building on a major road, narrow road or steeply sloping road:
Parking of vehicles or loading/unloading of vehicles on this roadway may cause a traffic hazard. During construction, maintenance or demolition of this building designated parking for workers and loading areas should be provided. Trained traffic management personnel should be responsible for the supervision of these areas.
For building where on-site loading/unloading is restricted:
Construction of this building will require loading and unloading of materials on the roadway. Deliveries should be well planned to avoid congestion of loading areas and trained traffic management personnel should be used to supervise loading/unloading areas.
For all building:
Busy construction and demolition sites present a risk of collision where deliveries and other traffic are moving within the site. A traffic management plan supervised by trained traffic management personnel should be adopted for the work site.

4. SERVICES
GENERAL
Rupture of services during excavation or other activity creates a variety of risks including release of hazardous material. Existing services are located on or around this site. Where known, these are identified on the plans but the exact location and extent of services may vary from that indicated. Services should be located using an appropriate service (such as Dial Before You Dig), appropriate excavation practice should be used and, where necessary, specialist contractors should be used.
Locations with underground power:
Underground power lines MAY be located in or around this site. All underground power lines must be disconnected or carefully located and adequate warning signs used prior to any construction, maintenance or demolition commencing.
Locations with overhead power lines:
Overhead power lines MAY be near or on this site. These pose a risk of electrocution if struck or approached by lifting devices or other plant and persons working above ground level. Where there is a danger of this occurring, power lines should be, where practical, disconnected or relocated. Where this is not practical adequate warning in the form of bright coloured tape or signage should be used or a protective barrier provided.

5. MANUAL TASKS
Components within the design with a mass in excess of 25kg should be lifted by two or more workers or by mechanical lifting device. Where this is not practical, suppliers or fabricators should be required to limit the component mass.
All material packaging, building and maintenance components should clearly show the total mass of packages and where practical all items should be stored on site in a way which minimizes bending before lifting. Advice should be provided on safe lifting methods in all areas where lifting may occur. Constructions, maintenance and demolition of this building will require the use of portable tools and equipment. These should be fully maintained in accordance with manufacturers specifications and not used where faulty or (in the case of electrical equipment) not carrying a current electrical safety tag. All safety guards or devices should be regularly checked and Personal Protective Equipment should be used in accordance with manufactures specification.

6. HAZARDOUS SUBSTANCE
ASBESTOS
For alterations to a building constructed prior to 1990:
If this existing building was constructed prior to:
1990 - it therefore may contain asbestos.
1986 - it there fore is most likely to contain asbestos.
Either in cladding material or in fire retardant insulation material. In either case, the builder should check and, if necessary, take appropriate action before demolition, cutting, sanding, drilling or otherwise disturbing the existed structure.
POWERED MATERIALS
Many materials used in the construction of this building can cause harm if inhaled in powdered form. Persons working on or in the building during construction, operational maintenance or demolition should ensure good ventilation and wear Personal Protective Equipment including protection against inhalation, cutting or otherwise disturbing or creating powered material.
TREATED TIMBER
The design of this building may include provision for the inclusion of treated timber within the structure. Dust or fumes from this material can be harmful. Persons working on or in the building during construction, operational maintenance or demolition should ensure good ventilation and wear Personal Protective Equipment including protection against inhalation of harmful material when sanding, drilling, cutting or using treated timber in any way that may cause harmful material to be released. Do not burn treated timber.
VOLATILE ORGANIC COMPOUNDS
Many types of glue, solvents, spray packs, paints, varnishes and some cleaning materials and disinfectants have dangerous emissions. Areas where these are used should be kept well ventilated while the material is being used and for a period after installation. Personal Protective Equipment may also be required. The manufacturers recommendations for use must be carefully considered at all times.
SYNTHETIC MINERAL FIBER
Fiberglass, rockwool, ceramic and other material used for thermal or sound insulation may contain synthetic mineral fiber which may be harmful if inhaled or if it comes in contact with the skin, eyes or other sensitive parts of the body. Personal Protective Equipment including protection against inhalation of harmful material should be used when installing, removing or working near bulk insulation material.
TIMBER FLOORS
This building may contain timber floors which have an applied finish. Areas where finishes are applied should be kept well ventilated during sanding and application and for a period after installation. Personal Protective equipment may also be required. The manufacturers recommendations for use must be carefully considered at all times.

7. CONFINED SPACES
EXCAVATION
Construction of this building and some maintenance on the building will require excavation and installation of items within excavation. Where practical, installation should be carried out using methods which do not require workers to enter the excavation. Where this is not practical, adequate support for the excavated area should be provided to prevent collapse. Warning signs and barriers to prevent accidental or unauthorized access to all excavations should be provided.
ENCLOSED SPACES
For buildings with enclosed spaces where maintenance or other access may be required:
Enclosed spaces within this building may present a risk to persons entering for construction, maintenance or any other purpose. The design documentation calls for warning signs and barriers to unauthorized access. These should be maintained throughout the life of the building. Where workers are required to enter enclosed spaces, air testing equipment and Personal Protective Equipment should be provided.
SMALL SPACES
For buildings with small spaces where maintenance or other access may be required:
Some small spaces within this building will require access by construction or maintenance workers. The design documentation calls for warning signs and barriers to unauthorized access. These should be maintained throughout the life of the building. Where workers are required to enter small spaces they should be scheduled so that access is for short periods. Manual lifting and other manual activity should be restricted in small spaces.

8. PUBLIC ACCESS
Public access to construction and demolition sites and to areas under maintenance causes risk to workers and public. Warning signs and secure barriers to unauthorized access should be provided. Where electrical installations, excavations, plant or loose materials are present they should be secured when not fully supervised.

9. OPERATIONAL USE OF BUILDING
RESIDENTIAL BUILDINGS
This building has been designed as a residential building. If it, at a later date, is used or intended to be used as a workplace, the provisions of the Work Health and Safety Act 2011 or subsequent replacement Act should be applied to the new use.

10. OTHER HIGH-RISK ACTIVITY
All electrical work should be carried out in accordance with Code of Practice: Managing Electrical Risks at the Workplace, AS/NZ 3012 and all licensing required.
All work using Plant should be carried out in accordance with Code of Practice: Managing Risks of Plant at the Workplace.
All work should be carried out in accordance with Code of Practice: Managing Noise and Preventing Hearing Loss at Work.
Due to the history of serious incidents it is recommended that particular care be exercised when undertaking work involving steel construction and concrete Placement. All the above applies.

3 BUILDING DESIGN SAFETY NOTES
1 : 100

General Notes:
1. LEVELS SHOWN ARE APPROXIMATE ONLY AND SHOULD BE VERIFIED ON SITE BEFORE WORK COMMENCES.
2. FIGURED DIMENSIONS ARE TO BE USED IN PREFERENCE TO SCALING. IF UNSURE OR IF THE DIMENSION YOU ARE SEEKING CANNOT BE FOUND, PLEASE ASK.
3. ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE STATED AND ARE TO BE VERIFIED BEFORE WORK COMMENCES.
4. FINAL DOOR & WINDOW SCHEDULES TO BE VERIFIED BY CLIENT AND BUILDER PRIOR TO ORDERING. IF WINDOWS NEED TO BE MODIFIED, PLEASE ADVISE ASAP AS THIS MAY IMPACT THE NATHERS RATING AND/OR BASIX ASSESSMENT.
5. HOMEGUARD TERMITE BARRIER TO BE USED UNLESS OTHERWISE STATED.
6. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE NATIONAL CONSTRUCTION CODE (NCC) AND ALL RELEVANT AUSTRALIAN STANDARDS.
7. ALL PLANS ARE TO BE READ IN CONJUCTION WITH THE RELEVANT NATHERS HOUSE ENERGY RATING AND/OR BASIX ASSESSMENT.
8. ALL PLANS ARE SUBJECT TO COPYRIGHT AND ARE NOT BE REPRODUCED IN PART OR WHOLE WITHOUT EXPRESS WRITTEN PERMISSION OF REGGIE'S RESIDENTIAL DESIGN & DRAFTING.

ISSUE	DESCRIPTION	DATE
A	Initial Design Concept	7/10/20
B	Revised Design - Carport added & balcony increased. Path added to south eastern side of garage.	19/10/20
C	Revised Design - Pool added, setbacks increased, stairs altered	8/12/20
D	Working Drawings Issue	30/03/21
E	Nathers & BASIX notes added.	7/04/21
F	Roof slope to granny flat reversed. Only tree 1 to be removed now - other previously nominated to be removed are to remain. Garden bed added to northern side of pool.	1/06/21

Client:
MR & MRS WAKEFORD

Project:
PROPOSED ALTERATIONS, GRANNY FLAT & POOL

Address:
71 ALEXANDRA CRESCENT BAYVIEW NSW 2104

Lot:	Sec:	DP:	Area:
20	-	DP11186	1201 m²

LGA:
NORTHERN BEACHES COUNCIL

Sheet No:
A104

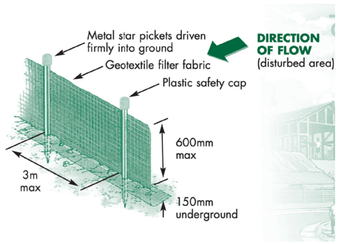
Sheet Name:
SECTIONS & BUILDING DESIGN SAFETY NOTES

Scale:	Drawn:	Issue:
1 : 100	RH	F

Job No:	Size:	Date:
2752	A1	6/10/2020

REGGIE'S
RESIDENTIAL DESIGN & DRAFTING
"SPECIALISING IN EXCLUSIVE LUXURY HOMES"
PO Box 222, Bargo NSW 2574
Shop 1/66 Railside Avenue, Bargo NSW 2574
Phone: 4684 3747 | Email: design@reggiesdesign.com.au
Web: www.reggiesdesign.com.au | reggiesdesign
ABN: 39 260 639 299

2/06/2021 3:25:43 PM



BASIX NOTES: Certificate No: 1191672S_02
WATER:
LANDSCAPE:
- A MINIMUM OF 90m² OF INDIGENOUS OR LOW WATER USE VEGETATION SPECIES MUST BE PLANTED ACROSS THE SITE

FIXTURES:
- 3 STAR (<9.0L/min) SHOWERHEADS
- 4 STAR TOILETS
- 4 STAR KITCHEN TAPS
- 4 STAR BATHROOM TAPS

ALTERNATIVE WATER:
- MIN. 2000L RAIN WATER TANK WITH A MINIMUM OF 30m² OF ROOF AREA DIVERTED TO IT
- WATER TANK TO BE CONNECTED TO ALL TOILETS PLUS AT LEAST ONE OUTDOOR TAP

POOL & SPA:
- NO POOL GREATER THAN 40KL IS TO BE INSTALLED

THERMAL COMFORT:
- SEE NATHERS CERTIFICATE 0005842968-01

ENERGY:
HOT WATER:
- MIN. 5 STAR GAS INSTANTANEOUS HOT WATER SYSTEM

HEATING & COOLING:
- 1 PHASE AIR CONDITIONING TO ALL LIVING ROOMS AND BEDROOMS (MIN. 3.0 STAR ENERGY RATING - OLD SYSTEM)
- CEILING FANS TO BE INSTALLED TO BEDROOM & KITCHEN/LIVING

VENTILATION:
- BATHROOM EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH
- KITCHEN EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH
- LAUNDRY EXHAUST DUCTED TO FACADE/ROOF WITH MANUAL ON/OFF SWITCH

LIGHTING:
- WINDOW AND/OR SKYLIGHT TO BE INSTALLED TO KITCHEN
- NO TOILETS/BATHROOMS NEED TO BE NATURALLY LIT BY EITHER A WINDOW OR SKYLIGHT
- ALL ROOMS IN ALL UNITS TO BE PRIMARILY LIT (MINIMUM 80% OF LIGHT FITTINGS) BY FLUORESCENT OR LED LAMPS

POOL & SPA:
- NO POOL GREATER THAN 40KL IS TO BE INSTALLED

ALTERNATIVE ENERGY:
- A MINIMUM 1.5KW PV SYSTEM TO BE INSTALLED

OTHER:
- GAS COOKTOP & ELECTRIC OVEN
- WELL VENTILATED FRIDGE SPACE IS NOT REQUIRED
- AN OUTDOOR CLOTHESLINE IS NOT REQUIRED
- AN INDOOR/SHELTERED CLOTHESLINE IS NOT REQUIRED

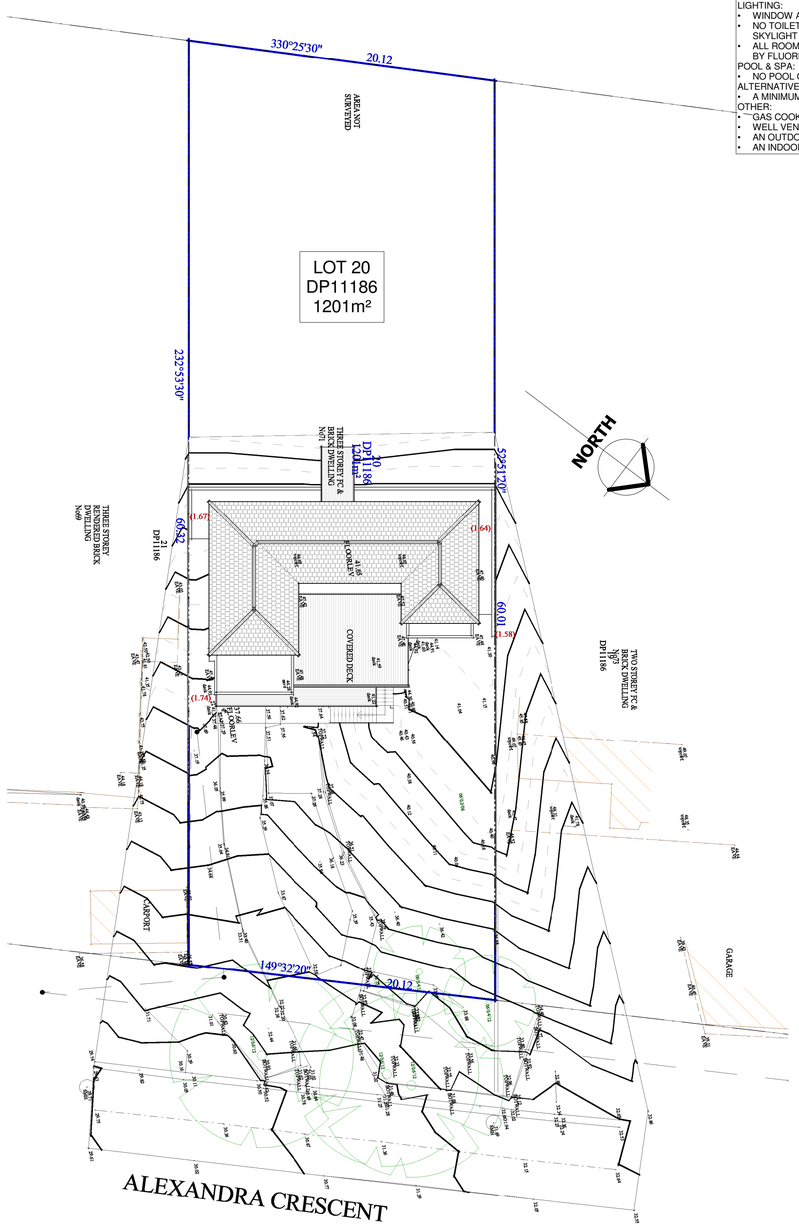
NATHERS NOTES: Certificate No: 0005842968-01
1. R2.5 INSULATION TO EXTERNAL WALLS
2. R4.1 INSULATION TO GARAGE CEILING
3. KINGSPAN METAL OUTER LAYER SANDWICH PANEL WITH MIN. R4.81 TOTAL R-VALUE
4. R2.5 INSULATION TO ALL INTERNAL WALLS
5. ALL DOWNLIGHTS INSTALLED ARE TO BE SEALED TO ENABLE INSULATION TO BE UNINTERRUPTED
6. ALL EXHAUST FANS INSTALLED ARE TO BE FITTED WITH A DAMPER
7. ENSURE U-VALUES AND SHGC VALUES FOR ALL WINDOWS AND DOORS ARE COMPLIANT WITH THE NATHERS CERTIFICATE. ANY MODIFICATION OF WINDOW TYPES OR MANUFACTURER WILL REQUIRE THE NATHERS CERTIFICATE TO BE UPDATED

SITE PLAN NOTES:
- APPROVED SEDIMENT CONTROL MEASURES TO BE IMPLEMENTED ON SITE BEFORE CONSTRUCTION COMMENCES
- SEDIMENT CONTROL MEASURES ARE TO BE MAINTAINED DURING CONSTRUCTION AND RETAINED UNTIL CONSTRUCTION IS COMPLETE
- LOCATION OF WATER TANK IS APPROXIMATE ONLY AND IS TO BE VERIFIED ON SITE
- ALL SETBACKS AND BOUNDARIES TO BE CONFIRMED BY A SURVEYOR BEFORE CONSTRUCTION COMMENCES
- TREES TO BE RETAINED/REMOVED ARE MARKED ON THE LANDSCAPE PLAN

BASIX NOTES: Certificate No: A412632
LIGHTING:
- A MINIMUM OF 40% OF NEW LIGHT FIXTURES TO BE LED OR FLUORO FITTINGS

FIXTURES:
- 3 STAR (<9.0L/min) SHOWERHEADS
- 4 STAR TOILETS
- 4 STAR KITCHEN TAPS
- 4 STAR BATHROOM TAPS

WINDOWS & GLAZED DOORS:
- ALL WINDOWS & GLAZED DOORS TO COMPLY WITH THE GLAZING SCHEDULE IN THE BASIX ASSESSMENT AND THE WINDOW & DOOR SCHEDULES



2 EXISTING SITE PLAN
1 : 200

1 PROPOSED SITE PLAN
1 : 200

General Notes:
1. LEVELS SHOWN ARE APPROXIMATE ONLY AND SHOULD BE VERIFIED ON SITE BEFORE WORK COMMENCES.
2. FIGURED DIMENSIONS ARE TO BE USED IN PREFERENCE TO SCALING. IF UNSURE OR IF THE DIMENSION YOU ARE SEEKING CANNOT BE FOUND, PLEASE ASK.
3. ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE STATED AND ARE TO BE VERIFIED BEFORE WORK COMMENCES.
4. FINAL DOOR & WINDOW SCHEDULES TO BE VERIFIED BY CLIENT AND BUILDER PRIOR TO ORDERING. IF WINDOWS NEED TO BE MODIFIED, PLEASE ADVISE ASAP AS THIS MAY IMPACT THE NATHERS RATING AND/OR BASIX ASSESSMENT.
5. HOMEGUARD TERMITE BARRIER TO BE USED UNLESS OTHERWISE STATED.
6. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE NATIONAL CONSTRUCTION CODE (NCC) AND ALL RELEVANT AUSTRALIAN STANDARDS.
7. ALL PLANS ARE TO BE READ IN CONJUCTION WITH THE RELEVANT NATHERS HOUSE ENERGY RATING AND/OR BASIX ASSESSMENT.
8. ALL PLANS ARE SUBJECT TO COPYRIGHT AND ARE NOT BE REPRODUCED IN PART OR WHOLE WITHOUT EXPRESS WRITTEN PERMISSION OF REGGIE'S RESIDENTIAL DESIGN & DRAFTING.

ISSUE	DESCRIPTION	DATE
A	Initial Design Concept	7/10/20
B	Revised Design - Carport added & balcony increased. Path added to south eastern side of garage.	19/10/20
C	Revised Design - Pool added, setbacks increased, stairs altered	8/12/20
D	Working Drawings Issue	30/03/21
E	Nathers & BASIX notes added.	7/04/21
F	Roof slope to granny flat reversed. Only tree 1 to be removed now - other previously nominated to be removed are to remain. Garden bed added to northern side of pool.	1/06/21

Client:
MR & MRS WAKEFORD

Project:
PROPOSED ALTERATIONS, GRANNY FLAT & POOL

Address:
71 ALEXANDRA CRESCENT BAYVIEW NSW 2104

Lot:	Sec:	DP:	Area:
20	-	DP11186	1201 m²

LGA:
NORTHERN BEACHES COUNCIL

Sheet No:
A105

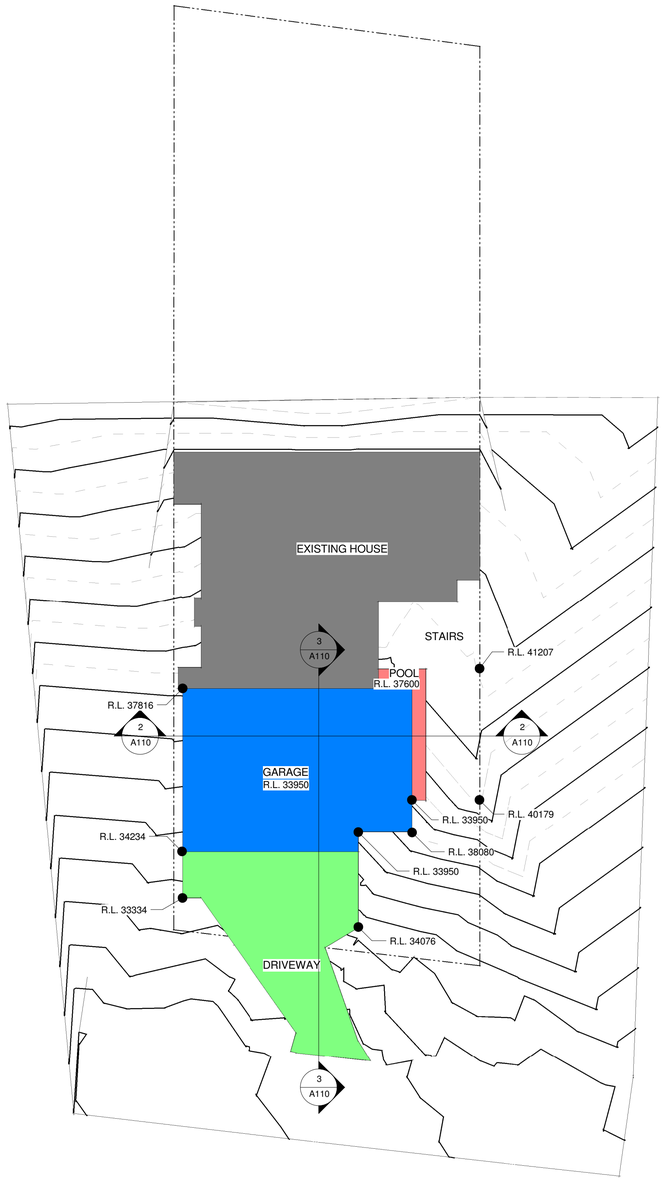
Sheet Name:
EXISTING & PROPOSED SITE PLAN

Scale:	Drawn:	Issue:
1 : 200	RH	F

Job No:	Size:	Date:
2752	A1	6/10/2020

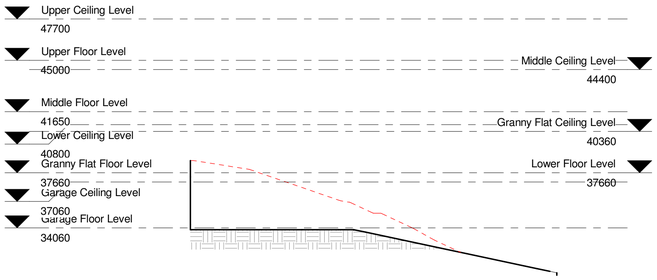
REGGIE'S
RESIDENTIAL DESIGN & DRAFTING
"SPECIALISING IN EXCLUSIVE LUXURY HOMES"
PO Box 222, Bargo NSW 2574
Shop 1/66 Railside Avenue, Bargo NSW 2574
Phone: 4684 3747 | Email: design@reggiesdesign.com.au
Web: www.reggiesdesign.com.au | reggiesdesign
ABN: 39 260 639 299

2/06/2021 3:25:46 PM



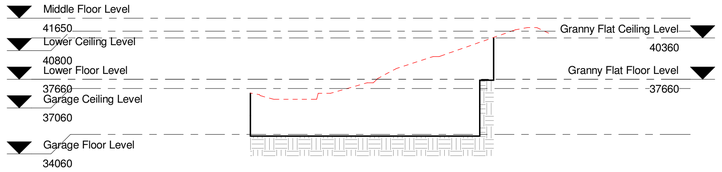
1 CUT & FILL PLAN

1 : 200



3 CUT & FILL SECTION 2

1 : 200



2 CUT & FILL SECTION 1

1 : 200

CUT & FILL TABLE		
AREA	CUT	FILL
DRIVEWAY	0.00 m³	0.00 m³
GARAGE	0.00 m³	0.00 m³
POOL	0.00 m³	0.00 m³
TOTAL	0.00 m³	0.00 m³

General Notes:

1. LEVELS SHOWN ARE APPROXIMATE ONLY AND SHOULD BE VERIFIED ON SITE BEFORE WORK COMMENCES.
2. FIGURED DIMENSIONS ARE TO BE USED IN PREFERENCE TO SCALING. IF UNSURE OR IF THE DIMENSION YOU ARE SEEKING CANNOT BE FOUND, PLEASE ASK.
3. ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE STATED AND ARE TO BE VERIFIED BEFORE WORK COMMENCES.
4. FINAL DOOR & WINDOW SCHEDULES TO BE VERIFIED BY CLIENT AND BUILDER PRIOR TO ORDERING. IF WINDOWS NEED TO BE MODIFIED, PLEASE ADVISE ASAP AS THIS MAY IMPACT THE NATHERS RATING AND/OR BASIX ASSESSMENT.
5. HOMEGUARD TERMITE BARRIER TO BE USED UNLESS OTHERWISE STATED.
6. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE NATIONAL CONSTRUCTION CODE (NCC) AND ALL RELEVANT AUSTRALIAN STANDARDS.
7. ALL PLANS ARE TO BE READ IN CONJUCTION WITH THE RELEVANT NATHERS HOUSE ENERGY RATING AND/OR BASIX ASSESSMENT.
8. ALL PLANS ARE SUBJECT TO COPYRIGHT AND ARE NOT BE REPRODUCED IN PART OR WHOLE WITHOUT EXPRESS WRITTEN PERMISSION OF REGGIE'S RESIDENTIAL DESIGN & DRAFTING.

ISSUE	DESCRIPTION	DATE
A	Initial Design Concept	7/10/20
B	Revised Design - Carport added & balcony increased. Path added to south eastern side of garage.	19/10/20
C	Revised Design - Pool added, setbacks increased, stairs altered	8/12/20
D	Working Drawings Issue	30/03/21
E	Nathers & BASIX notes added.	7/04/21
F	Roof slope to granny flat reversed. Only tree 1 to be removed now - other previously nominated to be removed are to remain. Garden bed added to northern side of pool.	1/06/21

Client:
MR & MRS WAKEFORD

Project:
PROPOSED ALTERATIONS, GRANNY FLAT & POOL

Address:
71 ALEXANDRA CRESCENT BAYVIEW NSW 2104

Lot:	Sec:	DP:	Area:
20	-	DP11186	1201 m²

LGA:
NORTHERN BEACHES COUNCIL

Sheet No:
A110

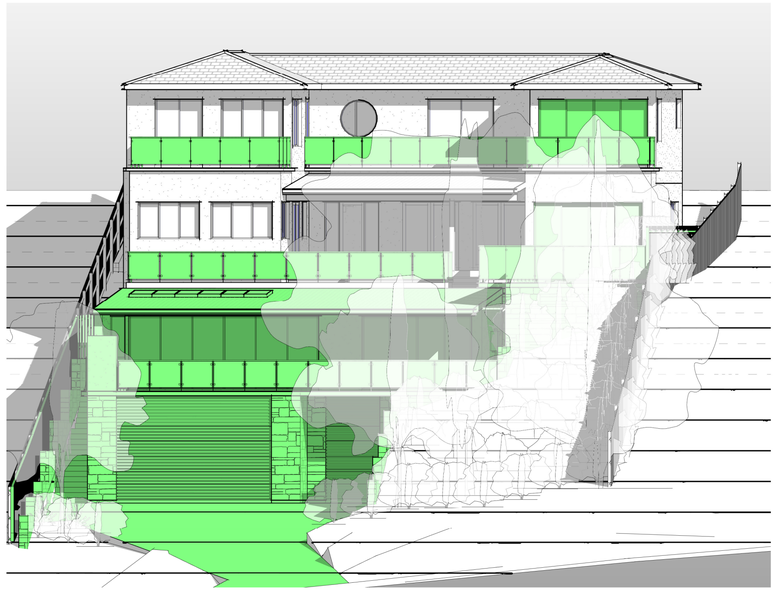
Sheet Name:
CUT & FILL PLAN

Scale:	Drawn:	Issue:
1 : 200	RH	F

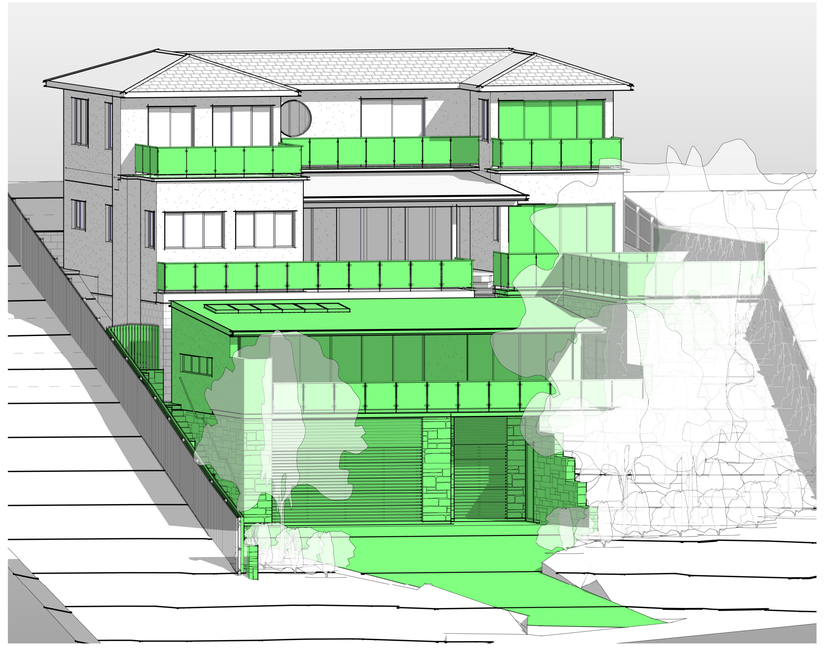
Job No:	Size:	Date:
2752	A1	6/10/2020

REGGIE'S
RESIDENTIAL DESIGN & DRAFTING
"SPECIALISING IN EXCLUSIVE LUXURY HOMES"
PO Box 222, Bargo NSW 2574
Shop 1/66 Railside Avenue, Bargo NSW 2574
Phone: 4684 3747 | Email: design@reggiesdesign.com.au
Web: www.reggiesdesign.com.au | reggiesdesign
ABN: 39 260 639 299

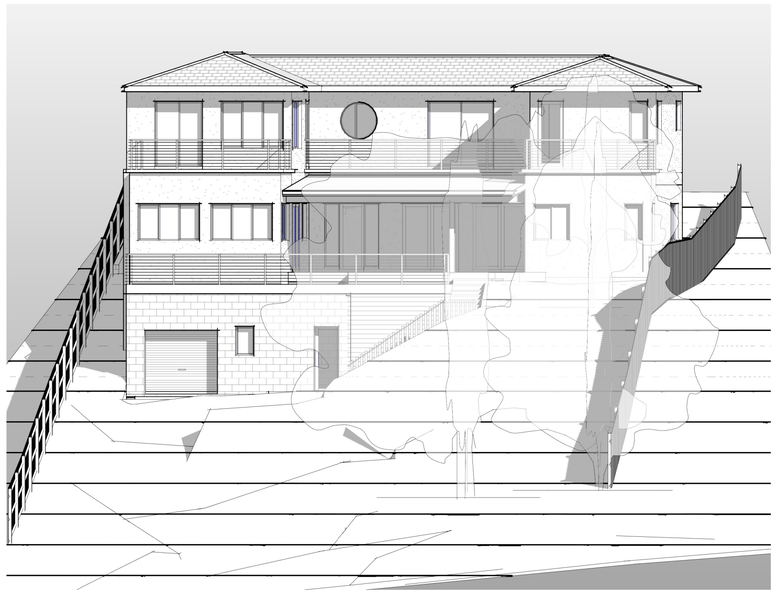
2/06/2021 2:10:18 PM



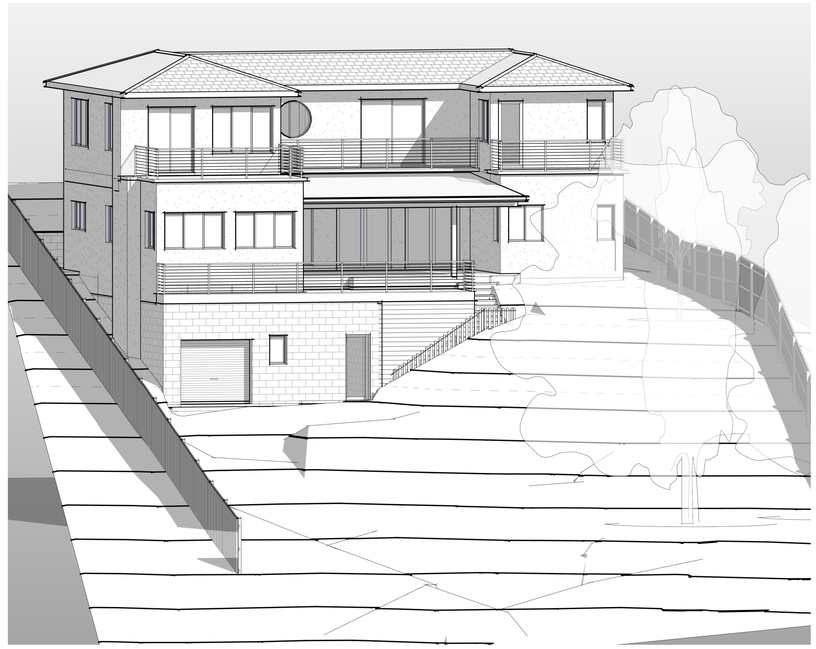
1 3D VIEW 1 - PROPOSED



2 3D VIEW 2 - PROPOSED



4 3D VIEW 1 - EXISTING



3 3D VIEW 2 - EXISTING

General Notes:

1. LEVELS SHOWN ARE APPROXIMATE ONLY AND SHOULD BE VERIFIED ON SITE BEFORE WORK COMMENCES.
2. FIGURED DIMENSIONS ARE TO BE USED IN PREFERENCE TO SCALING. IF UNSURE OR IF THE DIMENSION YOU ARE SEEKING CANNOT BE FOUND, PLEASE ASK.
3. ALL MEASUREMENTS ARE IN MILLIMETRES UNLESS OTHERWISE STATED AND ARE TO BE VERIFIED BEFORE WORK COMMENCES.
4. FINAL DOOR & WINDOW SCHEDULES TO BE VERIFIED BY CLIENT AND BUILDER PRIOR TO ORDERING. IF WINDOWS NEED TO BE MODIFIED, PLEASE ADVISE ASAP AS THIS MAY IMPACT THE NATHERS RATING AND/OR BASIX ASSESSMENT.
5. HOMEGUARD TERMITE BARRIER TO BE USED UNLESS OTHERWISE STATED.
6. ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE NATIONAL CONSTRUCTION CODE (NCC) AND ALL RELEVANT AUSTRALIAN STANDARDS.
7. ALL PLANS ARE TO BE READ IN CONJUCTION WITH THE RELEVANT NATHERS HOUSE ENERGY RATING AND/OR BASIX ASSESSMENT.
8. ALL PLANS ARE SUBJECT TO COPYRIGHT AND ARE NOT BE REPRODUCED IN PART OR WHOLE WITHOUT EXPRESS WRITTEN PERMISSION OF REGGIE'S RESIDENTIAL DESIGN & DRAFTING.

ISSUE	DESCRIPTION	DATE
A	Initial Design Concept	7/10/20
B	Revised Design - Carport added & balcony increased. Path added to south eastern side of garage.	19/10/20
C	Revised Design - Pool added, setbacks increased, stairs altered	8/12/20
D	Working Drawings Issue	30/03/21
E	Nathers & BASIX notes added.	7/04/21
F	Roof slope to granny flat reversed. Only tree 1 to be removed now - other previously nominated to be removed are to remain. Garden bed added to northern side of pool.	1/06/21

Client:
MR & MRS WAKEFORD

Project:
PROPOSED ALTERATIONS, GRANNY FLAT & POOL

Address:
71 ALEXANDRA CRESCENT BAYVIEW NSW 2104

Lot:	Sec:	DP:	Area:
20	-	DP11186	1201 m²

LGA:
NORTHERN BEACHES COUNCIL

Sheet No:
A112

Sheet Name:
3D VIEWS

Scale:	Drawn:	Issue:
	RH	F

Job No:	Size:	Date:
2752	A1	6/10/2020

REGGIE'S
RESIDENTIAL DESIGN & DRAFTING
"SPECIALISING IN EXCLUSIVE LUXURY HOMES"
PO Box 222, Bargo NSW 2574
Shop 1/66 Railside Avenue, Bargo NSW 2574
Phone: 4684 3747 | Email: design@reggiesdesign.com.au
Web: www.reggiesdesign.com.au | reggiesdesign
ABN: 39 260 639 299

2/06/2021 2:10:29 PM

APPENDIX G3 STORM WATER MANAGEMENT PLANS

PROPOSED RESIDENTIL DEVELOPMENTTO
71 ALEXANDRA CRESCENT, BAYVIEW
STORMWATER PLAN

CLIENT

REGGIE'S
RESIDENTIAL DESIGN & DRAFTING
"SPECIALISING IN EXCLUSIVE LUXURY HOMES"

COUNCIL

northern beaches council

LOCATION

SCHEDULE OF DRAWINGS

DRAWING No.	DESCRIPTION
SW-00	GENERAL PLAN
SW-01	DRAINAGE PLANS
SW-02	STORMWATER DETAILS
SW-03	
SW-04	
SW-05	

Rev	Description	By	Date
1	ISSUE FOR DA	Z.N.	04.06.2021

Legend & Notes

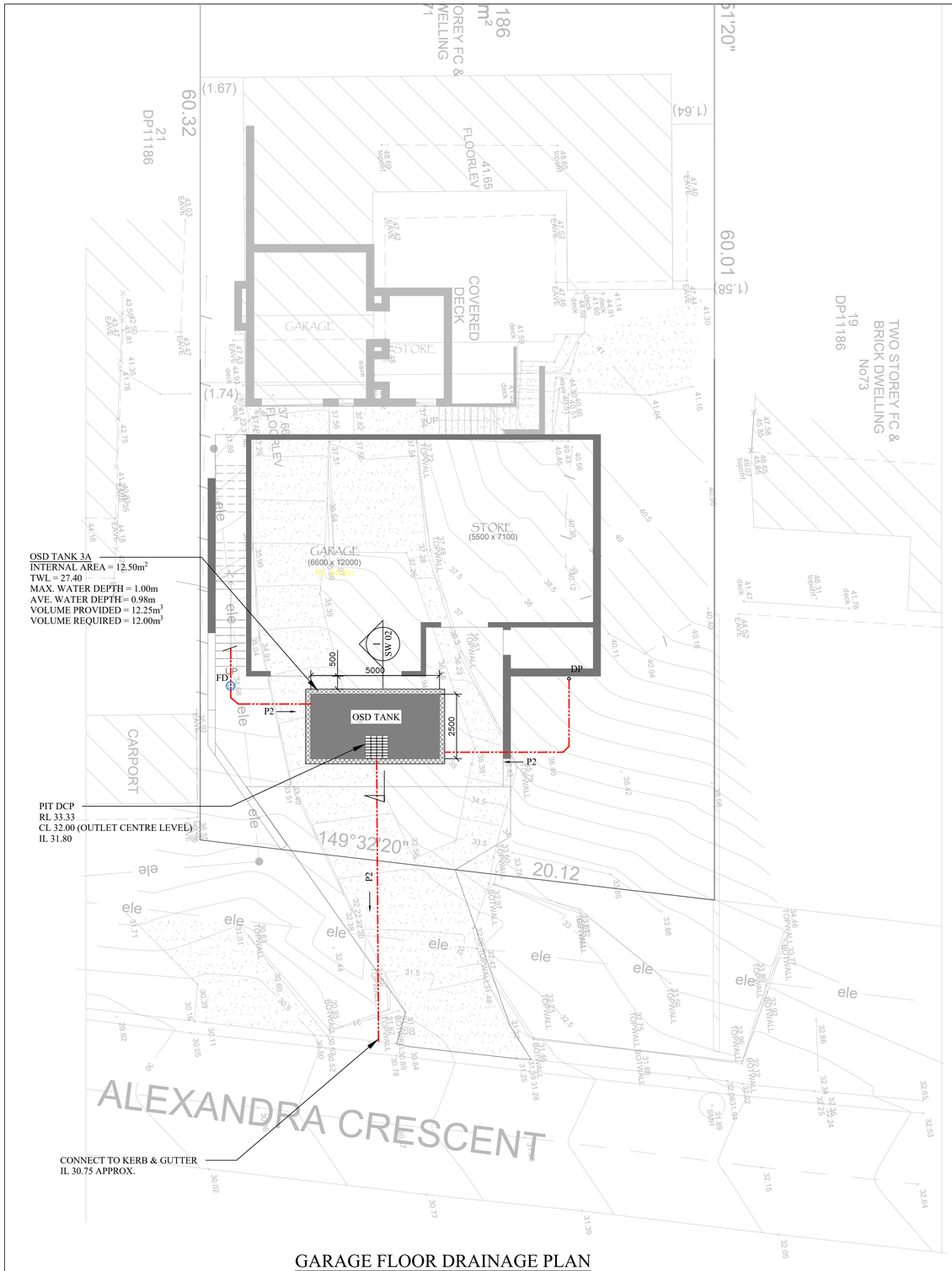
MEASUREMENTS TO BE CONFIRMED ON SITE, NO MEASUREMENTS TO BE SCALED OFF DRAWINGS

statiker
Suite 4/259 Northumberland Street, Liverpool, NSW 2170Ph: 02 8319 9449
info@statiker.com.au www.statiker.com.au

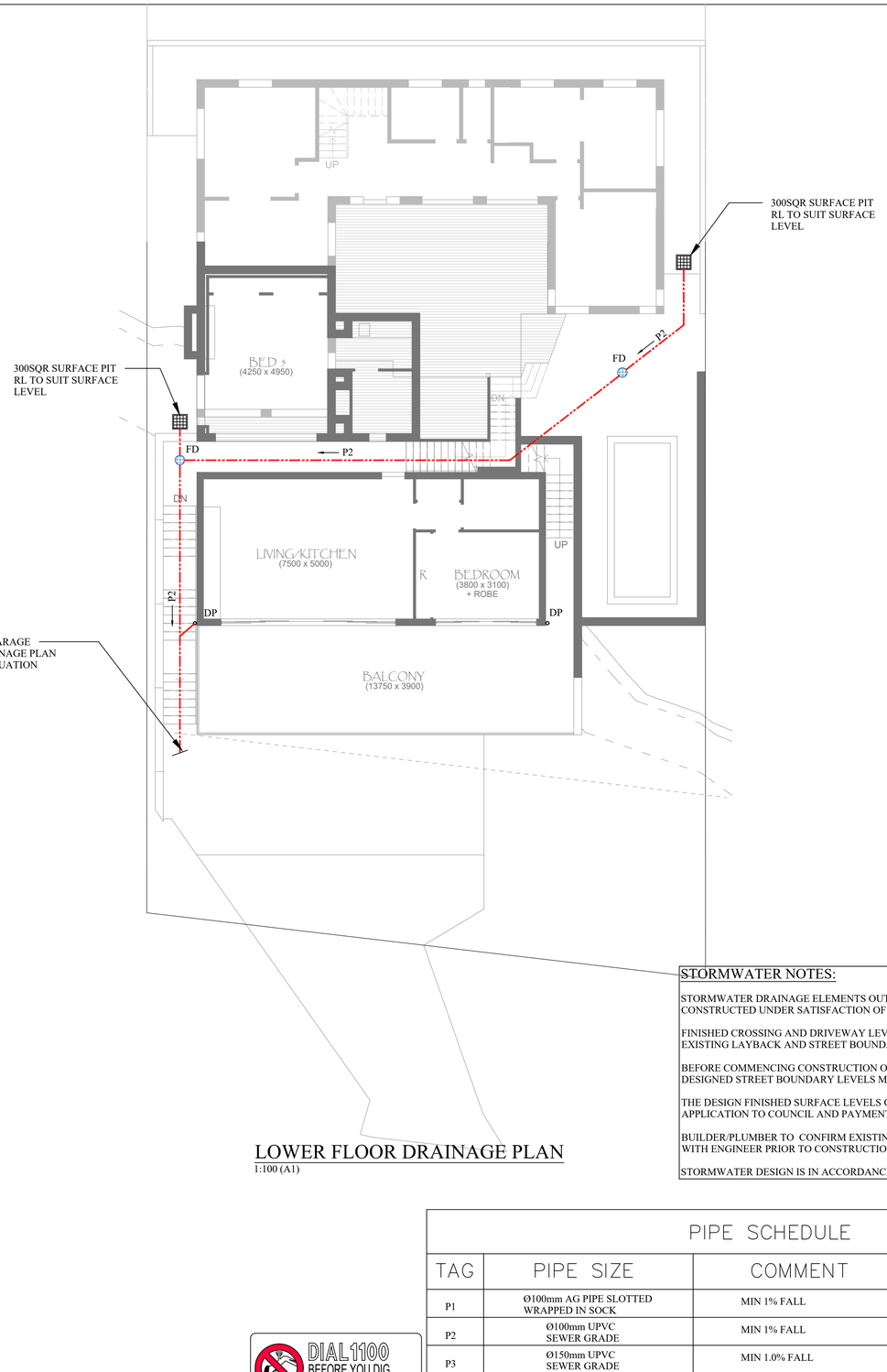
Client
MR & MRS WAKEFORD

Project
71 ALEXANDRA CRESCENT
BAYVIEW

Drawing Title GENERAL PLAN
Designed ZN
Drawn ZN
Checked SD
Scale
Date 04.06.2021
Rev 1
Drawing Number SW–00
Job 21015



GARAGE FLOOR DRAINAGE PLAN
1:100 (A1)



LOWER FLOOR DRAINAGE PLAN
1:100 (A1)

LEGEND

RL	REDUCED LEVEL
CL	COVER LEVEL
IL	INVERT LEVEL
GSIP	GRATED SURFACE INLET PIT
OSD	ON-SITE DETENTION
TWL	TOP WATER LEVEL
BWL	BOTTOM WATER LEVEL
TW	TOP OF WALL
IO	INSPECTION OPENING
RWT	RAINWATER TANK
SP	SEDIMENT PIT
ARI	AVERAGE RECURRENCE INTERVAL
FW	FLOOR WASTE
AHD	AUSTRALIAN HEIGHT DATUM
PSD	PERMISSIBLE SITE DISCHARGE
HED	HIGH EARLY DISCHARGE
RHS	RECTANGULAR HOLLOW SECTION
SS	STAINLESS STEEL
FRC	FIBER REINFORCED CONCRETE
RCP	REINFORCED CONCRETE PIPE
RRJ	RUBBER RING JOINT
U/S	UNDERSIDE OF SLAB
O/F	OVERFLOW
	DROPPER
RWO	RAIN WATER OUTLET
RWH	RAIN WATER HEAD
DP*	- PROPOSED DOWNPIPE (100x50/ 90 DIA. U.N.O.)
DPS*	- PROPOSED DOWNPIPE SPREADER (100x50/ 90 DIA. U.N.O.)
	- PROPOSED PIPE
	- PROPOSED PIPE
	- PROPERTY BOUNDARY
	- SEDIMENT FENCE

STORMWATER NOTES:

STORMWATER DRAINAGE ELEMENTS OUTSIDE THE PROPERTY BOUNDARY SHALL BE CONSTRUCTED UNDER SATISFACTION OF COUNCIL.

FINISHED CROSSING AND DRIVEWAY LEVELS ARE BASED ON SURFACE LEVELS OF THE EXISTING LAYBACK AND STREET BOUNDARY LEVELS.

BEFORE COMMENCING CONSTRUCTION OF THE CROSSING AND DRIVEWAY. COUNCIL'S DESIGNED STREET BOUNDARY LEVELS MUST BE OBTAINED AND USED FOR CONSTRUCTION.

THE DESIGN FINISHED SURFACE LEVELS OF THE STREET BOUNDARY MUST BE OBTAINED BY APPLICATION TO COUNCIL AND PAYMENT OF THE APPROPRIATE FEE TO COUNCIL.

BUILDER/PLUMBER TO CONFIRM EXISTING STORMWATER SYSTEM LOCATION/CONDITION WITH ENGINEER PRIOR TO CONSTRUCTION.

STORMWATER DESIGN IS IN ACCORDANCE WITH COUNCIL'S DCP AND WITH AS3500

PIPE SCHEDULE

TAG	PIPE SIZE	COMMENT	LINETYPE
P1	Ø100mm AG PIPE SLOTTED WRAPPED IN SOCK	MIN 1% FALL	
P2	Ø100mm UPVC SEWER GRADE	MIN 1% FALL	
P3	Ø150mm UPVC SEWER GRADE	MIN 1.0% FALL	
P4	Ø225mm RCP SEWER GRADE	MIN 0.5% FALL	

DIAL 1100 BEFORE YOU DIG
www.1100.com.au

Rev	Description	By	Date
1	ISSUE FOR DA	Z.N.	04.06.2021

Legend & Notes

MEASUREMENTS TO BE CONFIRMED ON SITE, NO MEASUREMENTS TO BE SCALED OFF DRAWINGS

150mm WIDE GRATED DRAIN

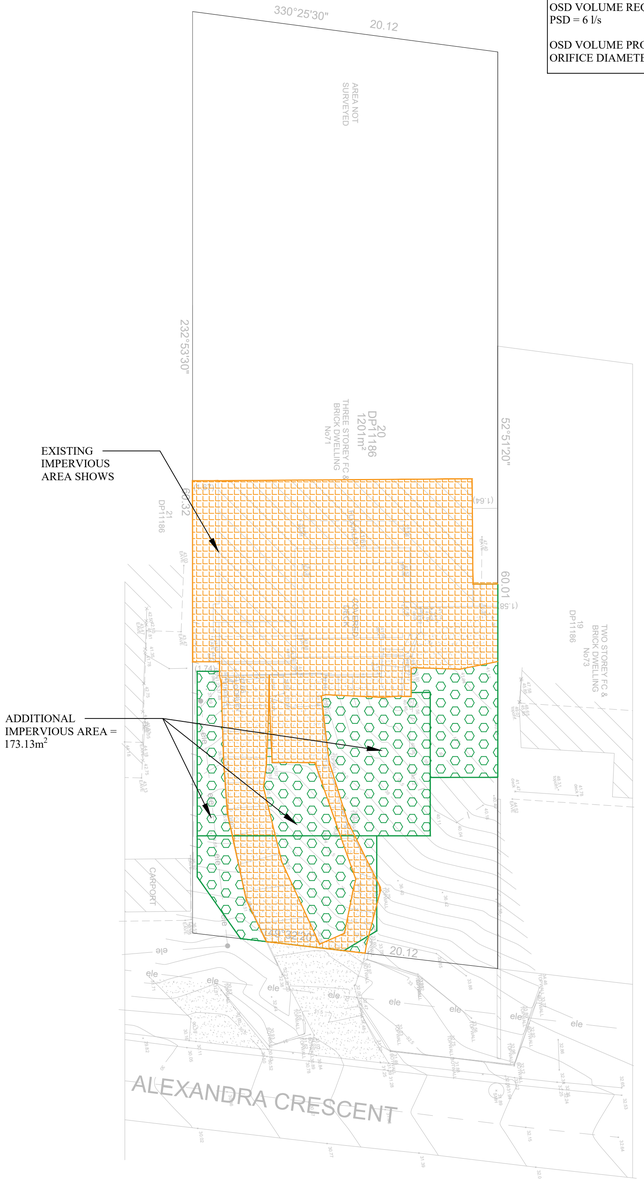
statiker
Suite 4/259 Northumberland Street, Liverpool, NSW 2170Ph: 02 8319 9449
info@statiker.com.au www.statiker.com.au

Client
MR & MRS WAKEFORD

Project
71 ALEXANDRA CRESCENT
BAYVIEW

Drawing Title	DRAINAGE PLANS
Designed	ZN
Drawn	ZN
Checked	SD
Drawing Number	SW–01
Scale	AS SHOWN
Date	04.06.2021
Rev	1
Job	21015

DIAL 1100
BEFORE YOU DIG
www.1100.com.au



ONSITE DETENTION NOTES:

AS PER COUNCIL'S WATER MANAGEMENT POLICY CLAUSE 9.3.1 - TABLE 7

ADDITIONAL IMPERVIOUS AREA = 173.13m²
OSD VOLUME REQUIRED = 12.00m³
PSD = 6 l/s

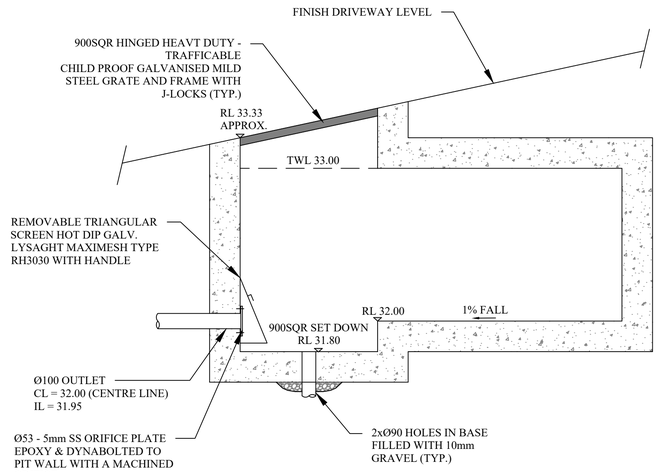
OSD VOLUME PROVIDED = 12.25m³
ORIFICE DIAMETER = 53mm

Orifice Plate Discharge Calculation :

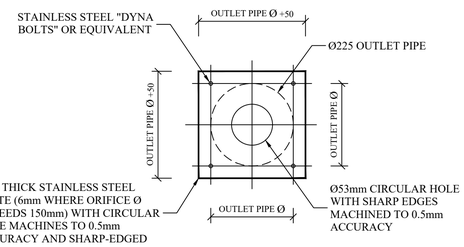
$$Q_{max} = AC_d\sqrt{2gh} \Rightarrow A = \frac{Q_{max}}{C_d\sqrt{2gh}}$$

Q_{max} = 0.006 (m3/s)
h = 1.00 (m)
Cd= 0.61
g = 9.8 m/s2
A = 0.002 m2

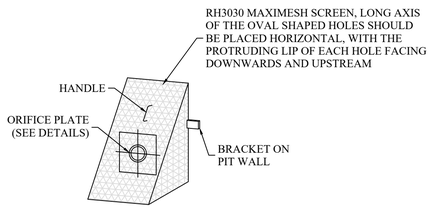
Orifice Diameter $= D = \sqrt{\frac{A \times 4}{\Pi}} =$ **0.053** (m)



OSD TANK SECTION 1
1:20

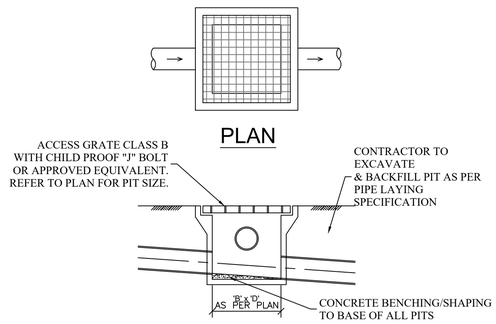


ORIFICE PLATE
1:20 (A1)

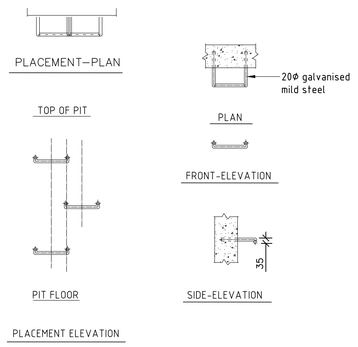


STANDARD TRASH SCREEN
NTS

CONFINED SPACE SIGN TO BE PLACED INSIDE OSD TANK
NTS



TYPICAL SURFACE INLET PIT (NON-TRAFFICE AREA)
NTS



TYPICAL STEP IRONS WHEN DROP MORE THAN 1.2m
NTS

DIAL 1100
BEFORE YOU DIG
www.1100.com.au

Rev	Description	By	Date
1	ISSUE FOR DA	Z.N.	04.06.2021

Legend & Notes

MEASUREMENTS TO BE CONFIRMED ON SITE, NO MEASUREMENTS TO BE SCALED OFF DRAWINGS

150mm WIDE GRATED DRAIN

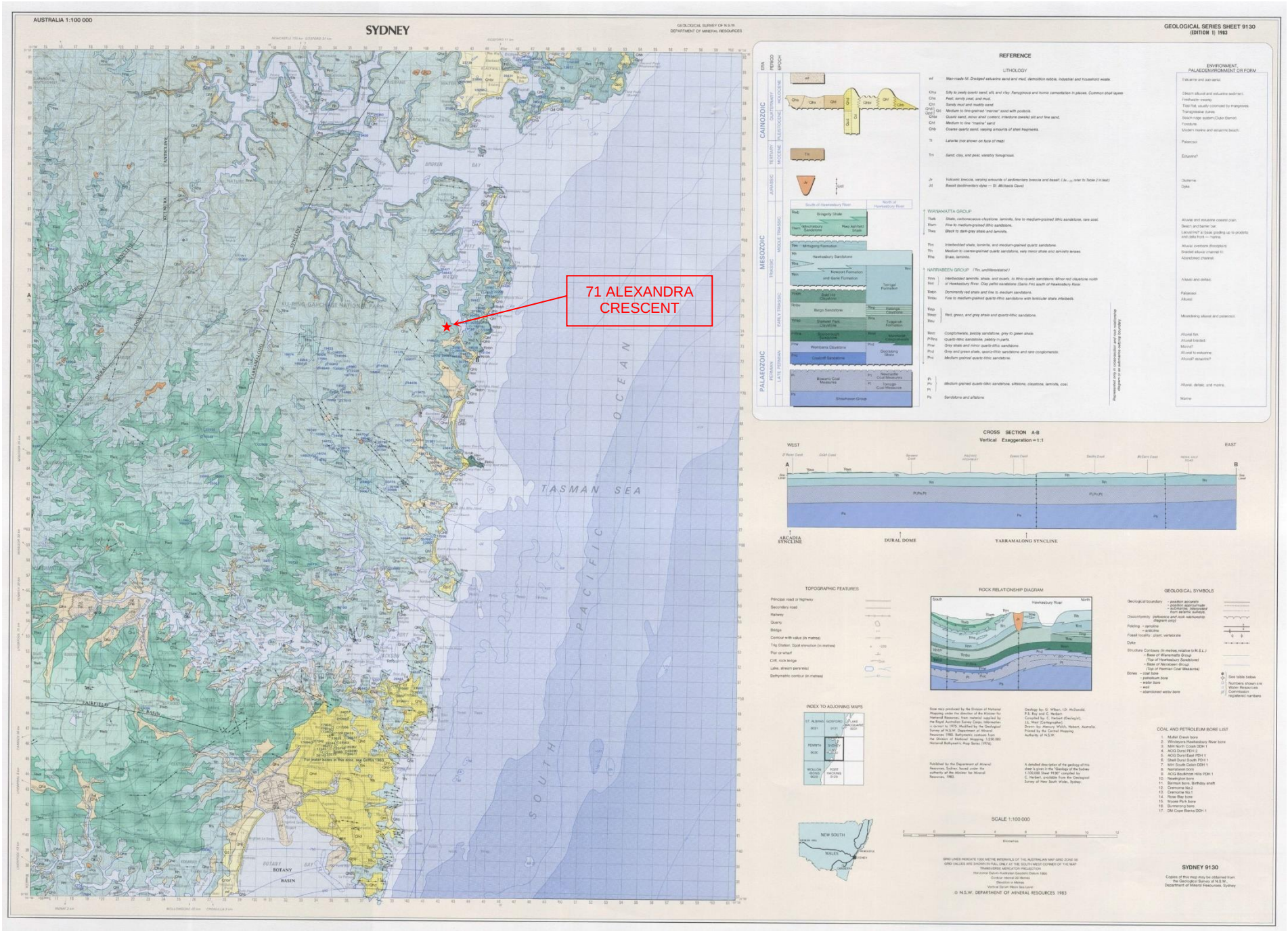
statiker
Suite 4/259 Northumberland Street, Liverpool, NSW 2170Ph: 02 8319 9449
info@statiker.com.au www.statiker.com.au

Client: MR & MRS WAKEFORD

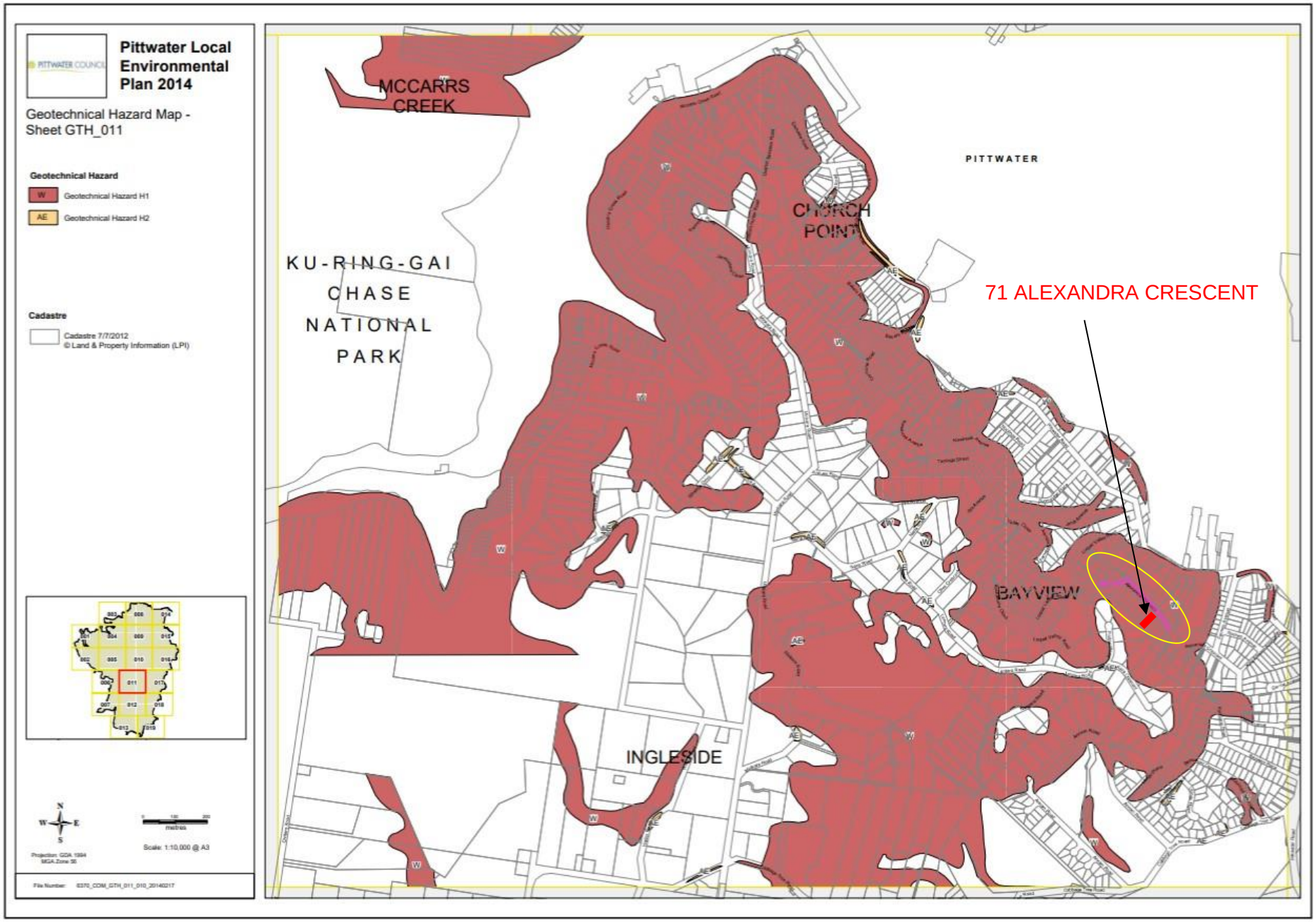
Project: 71 ALEXANDRA CRESCENT BAYVIEW

Drawing Title: STORMWATER DETAILS
Designed: ZN
Drawn: ZN
Checked: SD
Scale: AS SHOWN
Date: 04.06.2021
Rev: 1
Drawing Number: SW—02
Job: 21015

APPENDIX H HERBERT C., 1983, SYDNEY 1:100 000 GEOLOGICAL SHEET 9130, 1ST EDITION. GEOLOGICAL SURVEY OF NEW SOUTH WALES, SYDNEY)


AUSTRALIA 1:100 000
SYDNEY
GEOLOGICAL SURVEY OF N.S.W.
DEPARTMENT OF MINERAL RESOURCES
GEOLOGICAL SERIES SHEET 9130
(EDITION 1) 1983
71 ALEXANDRA CRESCENT
REFERENCE
LITHOLOGY
ENVIRONMENT
PALAEOENVIRONMENT OR FORM
CAINOZOIC
MESOZOIC
PALAEOZOIC
WIANAMATTA GROUP
NARRABEEN GROUP
CROSS SECTION A-B
Vertical Exaggeration = 1:1
WEST
EAST
ARCADIA SYNCLINE
DURAL DOME
YARRAMALONG SYNCLINE
TOPOGRAPHIC FEATURES
ROCK RELATIONSHIP DIAGRAM
GEOLOGICAL SYMBOLS
INDEX TO ADJOINING MAPS
COAL AND PETROLEUM BORE LIST
SCALE 1:100 000
SYDNEY 9130
TASMAN SEA
SOUTH PACIFIC OCEAN
BOTANY BASIN
BROKEN BAY
KU-RING-GAI CHASE NATIONAL PARK
© N.S.W. DEPARTMENT OF MINERAL RESOURCES 1983

APPENDIX I SNIPPET OF PITTWATER LOCAL ENVIRONMENTAL PLAN; GEOTECHNICAL HAZARD MAP - SHEET GTH_011 (*displaying 71 Alexandra Crescent*)


Pittwater Local Environmental Plan 2014
Geotechnical Hazard Map - Sheet GTH_011
Geotechnical Hazard
W Geotechnical Hazard H1
AE Geotechnical Hazard H2
Cadastre
Cadastre 7/7/2012
© Land & Property Information (LPI)
MCCARRS CREEK
KU-RING-GAI CHASE NATIONAL PARK
PITTWATER
CHURCH POINT
71 ALEXANDRA CRESCENT
BAYVIEW
INGLESIDE
Scale: 1:10,000 @ A3

APPENDIX J COUNCIL'S CORRESPONDENCE

statiker

--------- Forwarded message ---------
From: **Sue Davis** <Sue.Davis@northernbeaches.nsw.gov.au>
Date: Tue, Mar 9, 2021 at 5:21 PM
Subject: Informal information request - 71 Alexandra Crescent Bayview
To: engineers@statiker.com.au <engineers@statiker.com.au>

Dear Yanxu,

Northern Beaches Council holds no recent information on past landslides for the above property address.

I would suggest to apply for a 149 Certificate. This information will inform you if you wish to know if it is in a landslip area.

Please click on the below hyperlink to view the online application – at **Planning Certificate** (Section 10.7 or S10.7):
https://www.northernbeaches.nsw.gov.au/council/forms/digital-forms

Kind Regards,

Sue Davis
Access to Information Officer

Information Management
t 02 8495 5407
sue.davis@northernbeaches.nsw.gov.au
northernbeaches.nsw.gov.au

APPENDIX K1 HILLSIDE CONSTRUCTION PRACTICE

SOME GUIDELINES FOR HILLSIDE CONSTRUCTION

	GOOD ENGINEERING PRACTICE	POOR ENGINEERING PRACTICE
ADVICE		
GEOTECHNICAL ASSESSMENT	*Obtain advice from a qualified, experienced geotechnical consultant at early stage of planning and before site works.*	*Prepare detailed plan and start site works before geotechnical advice.*
PLANNING		
SITE PLANNING	*Having obtained geotechnical advice, plan the development with the risk arising from the identified hazards and consequences in mind.*	*Plan development without regard for the Risk.*
DESIGN AND CONSTRUCTION		
HOUSE DESIGN	*Use flexible structures which incorporate properly designed brickwork, timber or steel frames, timber or panel cladding. Consider use of split levels. Use decks for recreational areas where appropriate.*	*Floor plans which require extensive cutting and filling. Movement intolerant structures.*
SITE CLEARING	*Retain natural vegetation wherever practicable.*	*Indiscriminately clear the site.*
ACCESS & DRIVEWAYS	*Satisfy requirements below for cuts, fills, retaining walls and drainage. Council specifications for grades may need to be modified. Driveways and parking areas may need to be fully supported on piers.*	*Excavate and fill for site access before geotechnical advice.*
EARTHWORKS	*Retain natural contours wherever possible.*	*Indiscriminant bulk earthworks.*
CUTS	*Minimise depth.* *Support with engineered retaining walls or batter to appropriate slope.* *Provide drainage measures and erosion control.*	*Large scale cuts and benching.* *Unsupported cuts.* *Ignore drainage requirements.*
FILLS	*Minimise height.* *Strip vegetation and topsoil and key into natural slopes prior to filling.* *Use clean fill materials and compact to engineering standards.* *Batter to appropriate slope or support with engineered retaining wall.* *Provide surface drainage and appropriate subsurface drainage.*	*Loose or poorly compacted fill, which if it fails, may flow a considerable distance (including onto properties below).* *Block natural drainage lines.* *Fill over existing vegetation and topsoil.* *Include stumps, trees, vegetation, topsoil, boulders, building rubble etc. in fill.*
ROCK OUTCROPS & BOULDERS	*Remove or stabilise boulders which may have unacceptable risk.* *Support rock faces where necessary.*	*Disturb or undercut detached blocks or boulders.*
RETAINING WALLS	*Engineer design to resist applied soil and water forces.* *Found on bedrock where practicable.* *Provide subsurface drainage within wall backfill and surface drainage on slope above.* *Construct wall as soon as possible after cut/fill operation.*	*Construct a structurally inadequate wall such as sandstone flagging, brick or unreinforced blockwork.* *Lack of subsurface drains and weepholes.*
FOOTINGS	*Found within bedrock where practicable.* *Use rows of piers or strip footings oriented up and down slope.* *Design for lateral creep pressures if necessary.* *Backfill footing excavations to exclude ingress of surface water.*	*Found on topsoil, loose fill, detached boulders or undercut cliffs.*
SWIMMING POOLS	*Engineer designed.* *Support on piers to rock where practicable.* *Provide with under-drainage and gravity drain outlet where practicable.* *Design for high soil pressures which may develop on uphill side whilst there may be little or no lateral support on downhill side.*	
DRAINAGE		
SURFACE	*Provide at tops of cut and fill slopes.* *Discharge to street drainage or natural water courses.* *Provide generous falls to prevent blockage by siltation and incorporate silt traps.* *Line to minimise infiltration and make flexible where possible.* *Special structures to dissipate energy at changes of slope and/or direction.*	*Discharge at top of fills and cuts.* *Allow water to pond bench areas.*
SUBSURFACE	*Provide filter around subsurface drain.* *Provide drain behind retaining walls.* *Use flexible pipelines with access for maintenance.* *Prevent inflow of surface water.*	*Discharge of roof run-off into absorption trenches.*
SEPTIC & SULLAGE	*Usually requires pump-out or mains sewer systems; absorption trenches may be possible in some areas if risk is acceptable.* *Storage tanks should be water-tight and adequately founded.*	*Discharge sullage directly onto and into slopes.* *Use of absorption trenches without consideration of landslide risk.*
EROSION CONTROL & LANDSCAPING	*Control erosion as this may lead to instability.* *Revegetate cleared area.*	*Failure to observe earthworks and drainage recommendations when landscaping.*
DRAWINGS AND SITE VISITS DURING CONSTRUCTION		
DRAWINGS	*Building Application drawings should be viewed by a geotechnical consultant.*	
SITE VISITS	*Site visits by consultant may be appropriate during construction.*	
INSPECTION AND MAINTENANCE BY OWNER		
OWNER'S RESPONSIBILITY	*Clean drainage systems; repair broken joints in drains and leaks in supply pipes.* *Where structural distress is evident seek advice.* *If seepage observed, determine cause or seek advice on consequences.*	

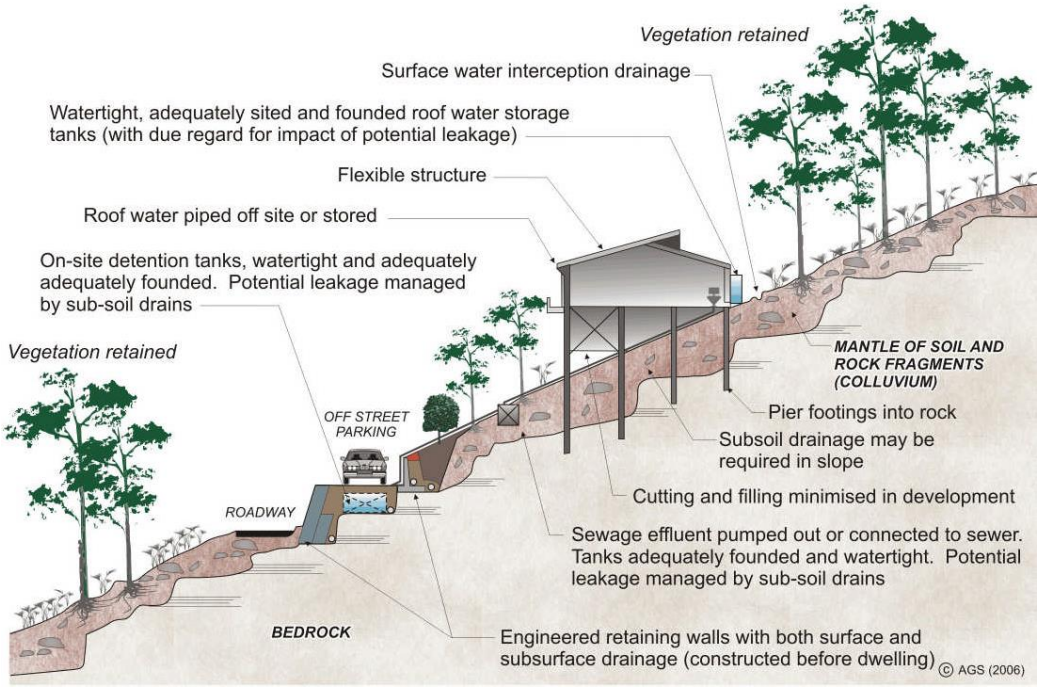
This table is an extract from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in Australian Geomechanics, Vol 42, No 1, March 2007 which discusses the matter more fully.

AUSTRALIAN GEOGUIDE LR8 (CONSTRUCTION PRACTICE)

HILLSIDE CONSTRUCTION PRACTICE

Sensible development practices are required when building on hillsides, particularly if the hillside has more than a low risk of instability (GeoGuide LR7). Only building techniques intended to maintain, or reduce, the overall level of landslide risk should be considered. Examples of good hillside construction practice are illustrated below.

EXAMPLES FOR **GOOD** HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES GOOD?

Roadways and parking areas - are paved and incorporate kerbs which prevent water discharging straight into the hillside (GeoGuide LR5).

Cuttings - are supported by retaining walls (GeoGuide LR6).

Retaining walls - are engineer designed to withstand the lateral earth pressures and surcharges expected, and include drains to prevent water pressures developing in the backfill. Where the ground slopes steeply down towards the high side of a retaining wall, the disturbing force (see GeoGuide LR6) can be two or more times that due to level ground. Retaining walls must be designed taking these forces into account.

Sewage - whether treated or not is either taken away in pipes or contained in properly founded tanks so it cannot soak into the ground.

Surface water - from roofs and other hard surfaces is piped away to a suitable discharge point rather than being allowed to infiltrate into the ground. Preferably, the discharge point will be in a natural creek where ground water exits, rather than enters, the ground. Shallow, lined, drains on the surface can fulfill the same purpose (GeoGuide LR5).

Surface loads - are minimised. No fill embankments have been built. The house is a lightweight structure. Foundation loads have been taken down below the level at which a landslide is likely to occur and, preferably, to rock. This sort of construction is probably not applicable to soil slopes (GeoGuide LR3). If you are uncertain whether your site has rock near the surface, or is essentially a soil slope, you should engage a geotechnical practitioner to find out.

Flexible structures - have been used because they can tolerate a certain amount of movement with minimal signs of distress and maintain their functionality.

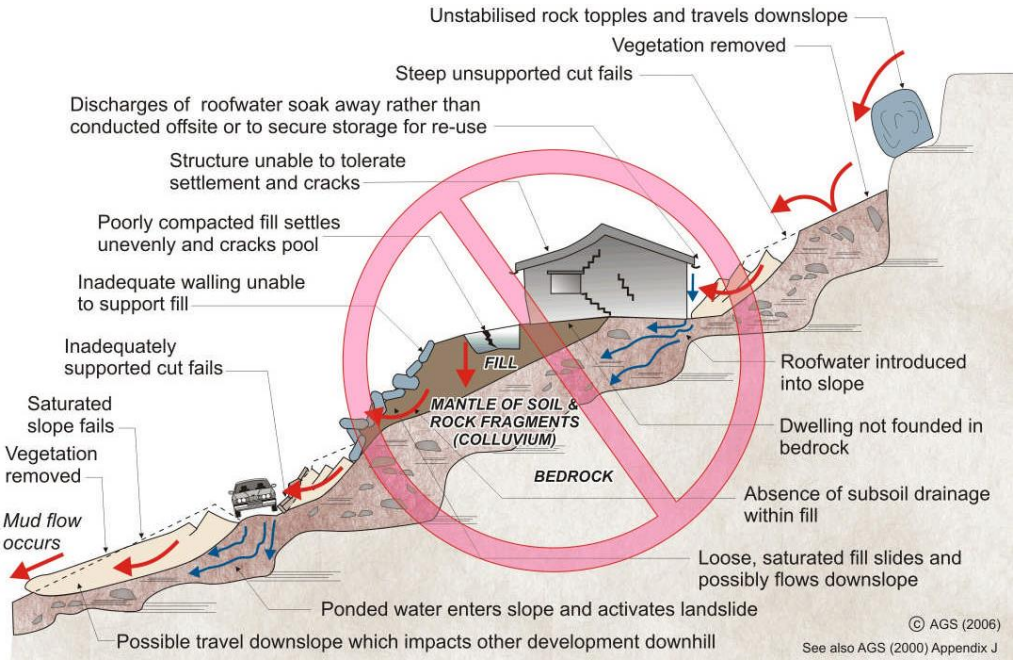
Vegetation clearance - on soil slopes has been kept to a reasonable minimum. Trees, and to a lesser extent smaller vegetation, take large quantities of water out of the ground every day. This lowers the ground water table, which in turn helps to maintain the stability of the slope. Large scale clearing can result in a rise in water table with a consequent increase in the likelihood of a landslide (GeoGuide LR5). An exception may have to be made to this rule on steep rock slopes where trees have little effect on the water table, but their roots pose a landslide hazard by dislodging boulders.

Possible effects of ignoring good construction practices are illustrated on page 2. Unfortunately, these poor construction practices are not as unusual as you might think and are often chosen because, on the face of it, they will save the developer, or owner, money. You should not lose sight of the fact that the cost and anguish associated with any one of the disasters illustrated, is likely to more than wipe out any apparent savings at the outset.

ADOPT GOOD PRACTICE ON HILLSIDE SITES

Extract from Geoguide LR8 – Hillside Construction Practice

EXAMPLES FOR **POOR** HILLSIDE CONSTRUCTION PRACTICE



WHY ARE THESE PRACTICES POOR?

Roadways and parking areas - are unsurfaced and lack proper table drains (gutters) causing surface water to pond and soaks into the ground.

Cut and fill - has been used to balance earthworks quantities and level the site leaving unstable cut faces and added large surface loads to the ground. Failure to compact the fill properly has led to settlement, which will probably continue for several years after completion. The house and pool have been built on the fill and have settled with it and cracked. Leakage from the cracked pool and the applied surface loads from the fill have combined to cause landslides.

Retaining walls - have been avoided, to minimise cost, and hand placed rock walls used instead. Without applying engineering design principles, the walls have failed to provide the required support to the ground and have failed, creating a very dangerous situation.

A heavy, rigid, house - has been built on shallow, conventional, footings. Not only has the brickwork cracked because of the resulting ground movements, but it has also become involved in a man-made landslide.

Soak-away drainage - has been used for sewage and surface water run-off from roofs and pavements. This water soaks into the ground and raises the water table (GeoGuide LR5). Subsoil drains that run along the contours should be avoided for the same reason. If felt necessary, subsoil drains should run steeply downhill in a chevron, or herringbone, pattern. This may conflict with the requirements for effluent and surface water disposal (GeoGuide LR9) and if so, you will need to seek professional advice.

Rock debris - from landslides higher up on the slope seems likely to pass through the site. Such locations are often referred to by geotechnical practitioners as "debris flow paths". Rock is normally even denser than ordinary fill, so even quite modest boulders are likely to weigh many tonnes and do a lot of damage once they start to roll. Boulders have been known to travel hundreds of metres downhill leaving behind a trail of destruction.

Vegetation - has been completely cleared, leading to a possible rise in the water table and increased landslide risk (GeoGuide LR5).

DON'T CUT CORNERS ON HILLSIDE SITES - OBTAIN ADVICE FROM A GEOTECHNICAL PRACTITIONER

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR9 - Effluent & Surface Water Disposal
- GeoGuide LR10 Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

Extract from Geoguide LR8 – Hillside Construction Practice.

APPENDIX K2 Landslide Risk Management

AUSTRALIAN GEOGUIDE LR2 (LANDSLIDES)

What is a Landslide?

Any movement of a mass of rock, debris, or earth, down a slope, constitutes a "landslide". Landslides take many forms, some of which are illustrated. More information can be obtained from Geoscience Australia, or by visiting its Australian landslide Database at www.ga.gov.au/urban/factsheets/landslide.jsp. Aspects of the impact of landslides on buildings are dealt with in the book "Guideline Document Landslide Hazards" published by the Australian Building Codes Board and referenced in the Building Code of Australia. This document can be purchased over the internet at the Australian Building Codes Board's website www.abcb.gov.au.

Landslides vary in size. They can be small and localised or very large, sometimes extending for kilometres and involving millions of tonnes of soil or rock. It is important to realise that even a 1 cubic metre boulder of soil, or rock, weighs at least 2 tonnes. If it falls, or slides, it is large enough to kill a person, crush a car, or cause serious structural damage to a house. The material in a landslide may travel downhill well beyond the point where the failure first occurred, leaving destruction in its wake. It may also leave an unstable slope in the ground behind it, which has the potential to fall again, causing the landslide to extend (regress) uphill, or expand sideways. For all these reasons, both "potential" and "actual" landslides must be taken very seriously. The present a real threat to life and property and require proper management.

Identification of landslide risk is a complex task and must be undertaken by a geotechnical practitioner (GeoGuide LR1) with specialist experience in slope stability assessment and slope stabilisation.

What Causes a Landslide?

Landslides occur as a result of local geological and groundwater conditions, but can be exacerbated by inappropriate development (GeoGuide LR8), exceptional weather, earthquakes and other factors. Some slopes and cliffs never seem to change, but are actually on the verge of failing. Others, often moderate slopes (Table 1), move continuously, but so slowly that it is not apparent to a casual observer. In both cases, small changes in conditions can trigger a landslide with series consequences. Wetting up of the ground (which may involve a rise in groundwater table) is the single most important cause of landslides (GeoGuide LR5). This is why they often occur during, or soon after, heavy rain. Inappropriate development often results in small scale landslides which are very expensive in human terms because of the proximity of housing and people.

Does a Landslide Affect You?

Any slope, cliff, cutting, or fill embankment may be a hazard which has the potential to impact on people, property, roads and services. Some tell-tale signs that might indicate that a landslide is occurring are listed below:

- Open cracks, or steps, along contours
- Groundwater seepage, or springs
- Bulging in the lower part of the slope
- Hummocky ground
- trees leaning down slope, or with exposed roots
- debris/fallen rocks at the foot of a cliff
- tilted power poles, or fences
- cracked or distorted structures

These indications of instability may be seen on almost any slope and are not necessarily confined to the steeper ones (Table 1). Advice should be sought from a geotechnical practitioner if any of them are observed. Landslides do not respect property boundaries. As mentioned above they can "run-out" from above, "regress" from below, or expand sideways, so a landslide hazard affecting your property may actually exist on someone else's land.

Local councils are usually aware of slope instability problems within their jurisdiction and often have specific development and maintenance requirements. **Your local council is the first place to make enquiries if you are responsible for any sort of development or own or occupy property on or near sloping land or a cliff.**

TABLE 1 – Slope Descriptions

Appearance	Slope Angle	Maximum Gradient	Slope Characteristics
Gentle	0° - 10°	1 on 6	Easy walking.
Moderate	10° - 18°	1 on 3	Walkable. Can drive and manoeuvre a car on driveway.
Steep	18° - 27°	1 on 2	Walkable with effort. Possible to drive straight up or down roughened concrete driveway, but cannot practically manoeuvre a car.
Very Steep	27° - 45°	1 on 1	Can only climb slope by clutching at vegetation, rocks, etc.
Extreme	45° - 64°	1 on 0.5	Need rope access to climb slope.
Cliff	64° - 84°	1 on 0.1	Appears vertical. Can abseil down.
Vertical or Overhang	84° - 90±°	Infinite	Appears to overhang. Abseiler likely to lose contact with the face.

Some typical landslides which could affect residential housing are illustrated below:

Rotational or circular slip failures (Figure 1) - can occur on moderate to very steep soil and weathered rock slopes (Table 1). The sliding surface of the moving mass tends to be deep seated. Tension cracks may open at the top of the slope and bulging may occur at the toe. The ground may move in discrete "steps" separated by long periods without movement. More rapid movement may occur after heavy rain.

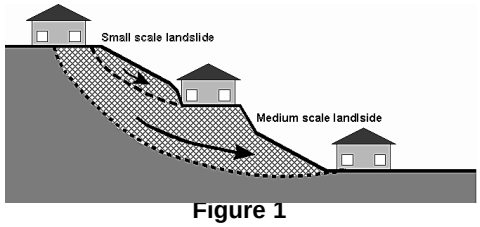


Figure 1

Translational slip failures (Figure 2) - tend to occur on moderate to very steep slopes (Table 1) where soil, or weak rock, overlies stronger strata. The sliding mass is often relatively shallow. It can move, or deform slowly (creep) over long periods of time. Extensive linear cracks and hummocks sometimes form along the contours. The sliding mass may accelerate after heavy rain.

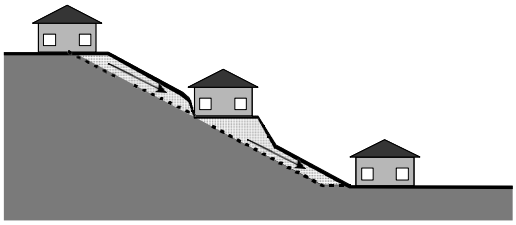


Figure 2

Wedge failures (Figure 3) - normally only occur on extreme slopes, or cliffs (Table 1), where discontinuities in the rock are inclined steeply downwards out of the face.

Rock falls (Figure 3) - tend to occur from cliffs and overhangs (Table 1).

Cliffs may remain, apparently unchanged, for hundreds of years. Collections of boulders at the foot of a cliff may indicate that rock falls are ongoing. Wedge failures and rock falls do not "creep". Familiarity with a particular local situation can instil a false sense of security since failure, when it occurs, is usually sudden and catastrophic.

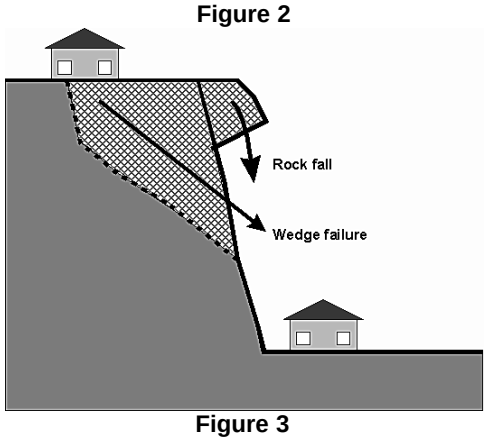


Figure 3

Debris flows and mud slides (Figure 4) - may occur in the foothills of ranges, where erosion has formed valleys which slope down to the plains below. The valley bottoms are often lined with loose eroded material (debris) which can "flow" if it becomes saturated during and after heavy rain. Debris flows are likely to occur with little warning; they travel a long way and often involve large volumes of soil. The consequences can be devastating.

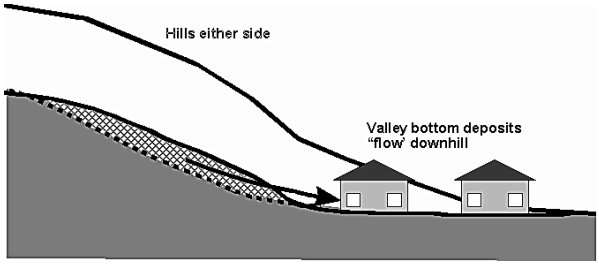


Figure 4

More information relevant to your particular situation may be found in other Australian GeoGuides:

- GeoGuide LR1 - Introduction
- GeoGuide LR3 - Soil Slopes
- GeoGuide LR4 - Rock Slopes
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR7 - Landslide Risk
- GeoGuide LR8 - Hillside Construction
- GeoGuide LR9 - Effluent & Surface Water Disposal
- GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

AUSTRALIAN GEOGUIDE LR7 (LANDSLIDE RISK)

Concept of Risk

Risk is a familiar term, but what does it really mean? It can be defined as *"a measure of the probability and severity of an adverse effect to health, property, or the environment."* This definition may seem a bit complicated. In relation to landslides, geotechnical practitioners (see GeoGuide LR1) are required to assess risk in terms of the likelihood that a particular landslide will occur and the possible consequences. This is called landslide risk assessment. The consequences of a landslide are many and varied, but our concerns normally focus on loss of, or damage to, property and loss of life.

Landslide Risk Assessment

Some local councils in Australia are aware of the potential for landslides within their jurisdiction and have responded by designating specific "landslide hazard zones". Development in these areas is normally covered by special regulations. If you are contemplating building, or buying an existing house, particularly in a hilly area, or near cliffs, then go first for information to your local council. If you have any concern that you could be dealing with a landslide hazard that your local council is not aware of you should seek advice from a geotechnical practitioner.

Landslide risk assessment must be undertaken by a geotechnical practitioner. It may involve visual inspection, geological mapping, geotechnical

investigation and monitoring to identify:

- potential landslides (there may be more than one that could impact on your site);
- the likelihood that they will occur;
- the damage that could result;
- the cost of disruption and repairs; and
- the extent to which lives could be lost.

Risk assessment is a predictive exercise, but since the ground and the processes involved are complex, prediction inevitably lacks precision. If you commission a landslide risk assessment for a particular site you should expect to receive a report prepared in accordance with current professional guidelines and in a form that is acceptable to your local council, or planning authority.

Risk to Property

Table 1 indicates the terms used to describe risk to property. Each risk level depends on an assessment of how likely a landslide is to occur and its consequences in dollar terms. Likelihood is the chance of it happening in any one year, as indicated in Table 2. Consequences are related to the cost of the repairs and perhaps temporary loss of use. These two factors are combined by the geotechnical practitioner to determine the Qualitative Risk.

TABLE 1 – RISK TO PROPERTY

Qualitative Risk		**Significance - Geotechnical engineering requirements**
Very high	VH	**Unacceptable** without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low. May be too expensive and not practical. Work likely to cost more than the value of the property.
High	H	**Unacceptable** without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to acceptable level. Work would cost a substantial sum in relation to the value of the property.
Moderate	M	**May be tolerated** in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as possible.
Low	L	**Usually acceptable** to regulators. Where treatment has been needed to reduce the risk to this level, ongoing maintenance is required.
Very Low	VL	**Acceptable**. Manage by normal slope maintenance procedures.

TABLE 2 – LIKELIHOOD

Likelihood	**Annual Probability**
Almost Certain	1:10
Likely	1:100
Possible	1:1,000
Unlikely	1:10,000
Rare	1:100,000
Barely credible	1:1,000,000

The terms "unacceptable", "tolerable" etc. in Table 1 indicate how most people react to an assessed risk level. However, some people will always be more prepared, or better able, to tolerate a higher risk level than others. Some local councils and planning authorities stipulate a maximum tolerable risk level. This may be lower than you feel is reasonable for your block but it is, nonetheless, a pre-requisite for development. Reasons for this include the fact that a landslide on your block may pose a risk to neighbours and passers-by and that , should you sell, subsequent owners of the block may be more risk averse than you.

Risk to Life

Most of us have some difficulty grappling with the concept of risk and deciding whether, or not, we are prepared to accept it. However, without doing any sort of analysis, or commissioning a report from an "expert", we all take risks every day. One of them is the risk of being killed in an accident. This is worth thinking about, because it tells us a lot about ourselves and can help to put an assessed risk into a meaningful context. By identifying activities that we either are, or are not, prepared to engage in, we can get some indication of the maximum level of risk that we are prepared to take. This knowledge can help us to decide whether we really are able to accept a particular risk, or to tolerate a particular likelihood of loss, or damage, to our property (Table 2).

In Table 3, data from NSW for the years 1998 to 2002, and other sources, is presented. A risk of 1 in 100,000 means that, in any one year, 1 person is killed for every 100,000 people undertaking that particular activity. The NSW data assumes that the whole population undertakes the activity. That is, we are all at risk of being killed in a fire, or of choking on our food, but it is reasonable to assume that only people who go deep sea fishing run a risk of being killed while doing it.

It can be seen that the risks of dying as a result of falling, using a motor vehicle, or engaging in water-related activities (including bathing) are all greater than 1:100,000 and yet few people actively avoid situations where these risks are present. Some people are averse to flying and yet it represents a lower risk than choking to death on food. The data also indicate that, even when the risk of dying as a consequence of a particular event is very small, it could still happen to any one of us today. If this were not so, there would be no risk at all and clearly that is not the case.

In NSW, the planning authorities consider that 1:1,000,000 is the maximum tolerable risk for domestic housing built near an obvious hazard, such as a chemical factory. Although not specifically considered in the NSW guidelines there is little difference between the hazard presented by a neighbouring factory and a landslide: both have the capacity to destroy life and property and both are always present.

TABLE 3 – RISK TO LIFE

Risk (deaths per participant per year)	**Activity/Event Leading to Death** (NSW data unless noted)
1:1,000	Deep sea fishing (UK)
1:1,000 to 1:10,000	Motor cycling, horse riding , ultra-light flying (Canada)
1:23,000	Motor vehicle use
1:30,000	Fall
1:70,000	Drowning
1:180,000	Fire/burn
1:660,000	Choking on food
1:1,000,000	Scheduled airlines (Canada)
1:2,300,000	Train travel
1:32,000,000	Lightning strike

More information relevant to your particular situation may be found in other AUSTRALIAN GEOGUIDES:

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR8 - Hillside Construction
- GeoGuide LR9 - Effluent & Surface Water Disposal
- GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

LANDSLIDE RISK MANAGEMENT

Definition of Terms and Landslide Risk

Risk Terminology	Description
Acceptable Risk	*A risk for which, for the purposes of life or work, we are prepared to accept as it is with no regard to its management. Society does not generally consider expenditure in further reducing such risks justifiable.*
Annual Exceedance Probability (AEP)	*The estimated probability that an event of specified magnitude will be exceeded in any year.*
Consequence	*The outcomes or potential outcomes arising from the occurrence of a landslide expressed qualitatively or quantitatively, in terms of loss, disadvantage or gain, damage, injury or loss of life.*
Elements at Risk	*The population, buildings and engineering works, economic activities, public services utilities, infrastructure and environmental features in the area potentially affected by landslides.*
Frequency	*A measure of likelihood expressed as the number of occurrences of an event in a given time. See also 'Likelihood' and 'Probability'.*
Hazard	*A condition with the potential for causing an undesirable consequence (the landslide). The description of landslide hazard should include the location, volume (or area), classification and velocity of the potential landslides and any resultant detached material, and the likelihood of their occurrence within a given period of time.*
Individual Risk to Life	*The risk of fatality or injury to any identifiable (named) individual who lives within the zone impacted by the landslide; or who follows a particular pattern of life that might subject him or her to the consequences of the landslide.*
Landslide Activity	*The stage of development of a landslide; pre failure when the slope is strained throughout but is essentially intact; failure characterised by the formation of a continuous surface of rupture; post failure which includes movement from just after failure to when it essentially stops; and reactivation when the slope slides along one or several pre-existing surfaces of rupture. Reactivation may be occasional (eg. seasonal) or continuous (in which case the slide is 'active').*
Landslide Intensity	*A set of spatially distributed parameters related to the destructive power of a landslide. The parameters may be described quantitatively or qualitatively and may include maximum movement velocity, total displacement, differential displacement, depth of the moving mass, peak discharge per unit width, or kinetic energy per unit area.*
Landslide Risk	*The AGS Australian GeoGuide LR7 (AGS, 2007e) should be referred to for an explanation of Landslide Risk.*
Landslide Susceptibility	*The classification, and volume (or area) of landslides which exist or potentially may occur in an area or may travel or retrogress onto it. Susceptibility may also include a description of the velocity and intensity of the existing or potential land sliding.*
Likelihood	*Used as a qualitative description of probability or frequency.*
Probability	*A measure of the degree of certainty. This measure has a value between zero (impossibility) and 1.0 (certainty). It is an estimate of the likelihood of the magnitude of the uncertain quantity, or the likelihood of the occurrence of the uncertain future event.* *These are two main interpretations:* *(i) Statistical – frequency or fraction – The outcome of a repetitive experiment of some kind like flipping coins. It includes also the idea of population variability. Such a number is called an 'objective' or relative frequentist probability because it exists in the real world and is in principle measurable by doing the experiment.*

Risk Terminology	Description
Probability *(continued)*	*(ii) Subjective probability (degree of belief) – Quantified measure of belief, judgment, or confidence in the likelihood of an outcome, obtained by considering all available information honestly, fairly, and with a minimum of bias. Subjective probability is affected by the state of understanding of a process, judgment regarding an evaluation, or the quality and quantity of information. It may change over time as the state of knowledge changes.*
Qualitative Risk Analysis	*An analysis which uses word form, descriptive or numeric rating scales to describe the magnitude of potential consequences and the likelihood that those consequences will occur.*
Quantitative Risk Analysis	*An analysis based on numerical values of the probability, vulnerability and consequences and resulting in a numerical value of the risk.*
Risk	*A measure of the probability and severity of an adverse effect to health, property or the environment. Risk is often estimated by the product of probability x consequences. However, a more general interpretation of risk involves a comparison of the probability and consequences in a non-product form.*
Risk Analysis	*The use of available information to estimate the risk to individual, population, property, or the environment, from hazards. Risk analyses generally contain the following steps: scope definition, hazard identification and risk estimation.*
Risk Assessment	*The process of risk analysis and risk evaluation.*
Risk Control or Risk Treatment	*The process of decision-making for managing risk and the implementation or enforcement of risk mitigation measures and the re-evaluation of its effectiveness from time to time, using the results of risk assessment as one input.*
Risk Estimation	*The process used to produce a measure of the level of health, property or environmental risks being analysed. Risk estimation contains the following steps: frequency analysis, consequence analysis and their integration.*
Risk Evaluation	*The stage at which values and judgments enter the decision process, explicitly or implicitly, by including consideration of the importance of the estimated risks and the associated social, environmental and economic consequences, in order to identify a range of alternatives for managing the risks.*
Risk Management	*The complete process of risk assessment and risk control (or risk treatment).*
Societal Risk	*The risk of multiple fatalities or injuries in society as a whole: one where society would have to carry the burden of a landslide causing a number of deaths, injuries, financial, environmental and other losses.*
Susceptibility	*See 'Landslide Susceptibility'.*
Temporal Spatial Probability	*The probability that the element at risk is in the area affected by the land sliding, at the time of the landslide.*
Tolerable Risk	*A risk within a range that society can live with so as to secure certain net benefits. It is a range of risk regarded as non-negligible and needing to be kept under review and reduced further if possible.*
Vulnerability	*The degree of loss to a given element or set of elements within the area affected by the landslide hazard. It is expressed on a scale of 0 (no loss) to 1 (total loss). For property, the loss will be the value of the damage relative to the value of the property; for persons, it will be the probability that a particular life (the element at risk) will be lost, given the person(s) is affected by the landslide.*

NOTE: *Reference should be made to Figure A1 which shows the inter-relationship of many of these terms and the relevant portion of Landslide Risk Management.*

Reference should also be made to the paper referenced below for Landslide Terminology and more detailed discussion of the above terminology.

This appendix is an extract from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in Australian Geomechanics, Vol 42, No 1, March 2007, which discusses the matter more fully.

Ref: – Figure A1 Flowchart for Landslide Risk Management

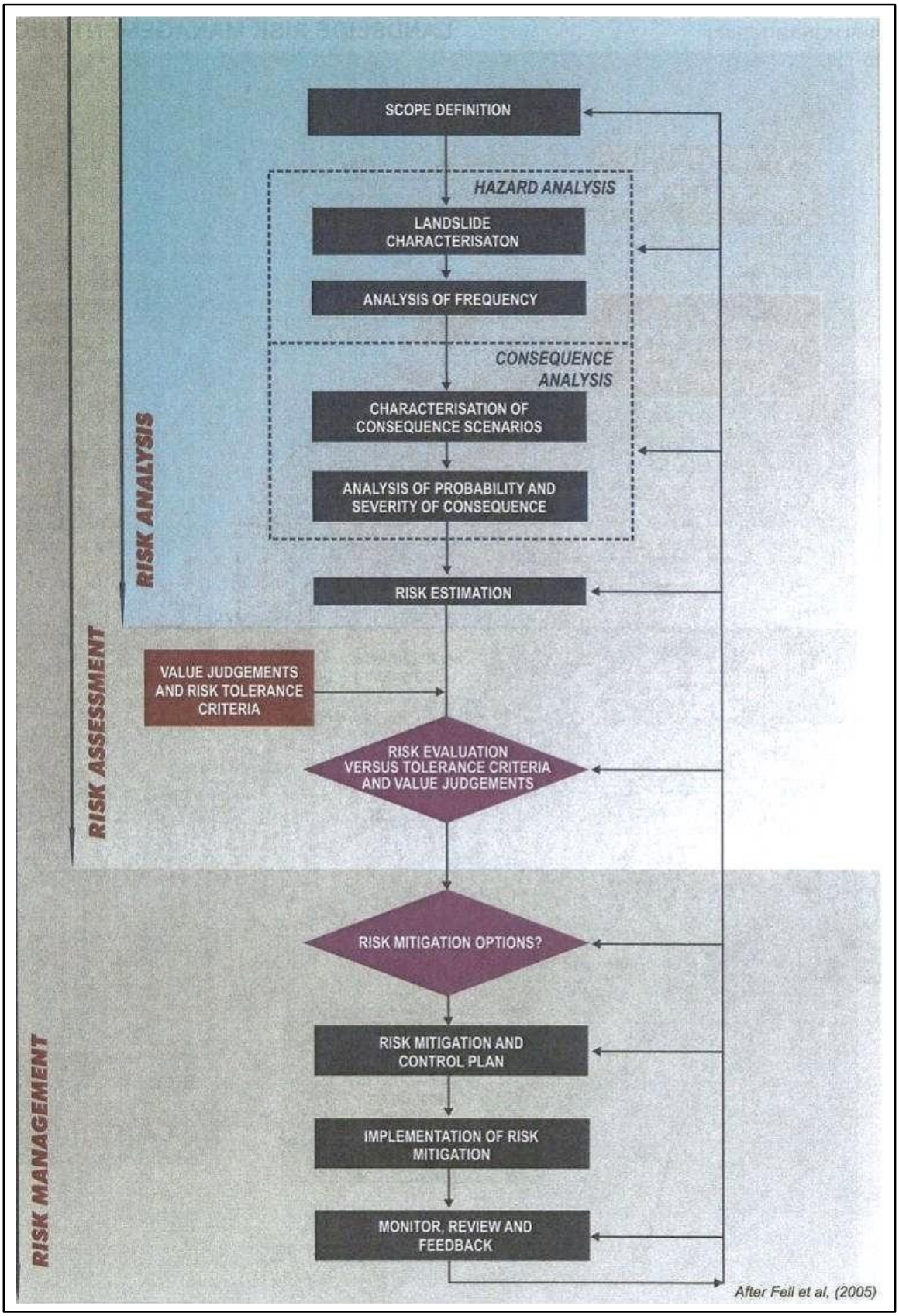


FIGURE A1: *Flowchart for Landslide Risk Management.*

This figure is an extract from GUIDELINE FOR LANDSLIDE SUSCEPTIBILITY, HAZARD AND RISK ZONING FOR LAND USE PLANNING, as presented in Australian Geomechanics Vol 42, No 1, March 2007, which discusses the matter more fully.

TABLE A1: LANDSLIDE RISK ASSESSMENT
QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
Indicative Value	Notional Boundary					
10^{-1}	$5x10^{-2}$	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	$5x10^{-3}$	100 years	200 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	$5x10^{-4}$	1000 years	2000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	$5x10^{-5}$	10,000 years	20,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	$5x10^{-6}$	100,000 years	200,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10^{-6}		1,000,000 years		The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: *(1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not vice versa.*

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate Cost of Damage		Description	Descriptor	Level
Indicative Value	Notional Boundary			
200%	100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%	40%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	10%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%	1%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%		Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

Notes: *(2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.*

(3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.

(4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not vice versa.

Extract from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in Australian Geomechanics, Vol 42, No 1, March 2007, which discusses the matter more fully.

TABLE A1: LANDSLIDE RISK ASSESSMENT
QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (continued)

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	1: CATASTROPHIC 200%	2: MAJOR 60%	3: MEDIUM 20%	4: MINOR 5%	5: INSIGNIFICANT 0.5%
A – ALMOST CERTAIN	10^{-1}	*VH*	*VH*	*VH*	*H*	*M* or **L** *(5)*
B - LIKELY	10^{-2}	*VH*	*VH*	*H*	*M*	**L**
C - POSSIBLE	10^{-3}	*VH*	*H*	*M*	*M*	**VL**
D - UNLIKELY	10^{-4}	*H*	*M*	**L**	**L**	**VL**
E - RARE	10^{-5}	*M*	**L**	**L**	**VL**	**VL**
F - BARELY CREDIBLE	10^{-6}	**L**	**VL**	**VL**	**VL**	**VL**

Notes: *(5) Cell A5 may be subdivided such that a consequence of less than 0.1% is Low Risk.*

(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level		Example Implications *(7)*
VH	*VERY HIGH RISK*	*Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.*
H	*HIGH RISK*	*Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.*
M	*MODERATE RISK*	*May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.*
L	*LOW RISK*	*Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.*
VL	*VERY LOW RISK*	*Acceptable. Manage by normal slope maintenance procedures.*

Note: *(7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.*

Extract from PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT as presented in Australian Geomechanics, Vol 42, No 1, March 2007, which discusses the matter more fully.

APPENDIX L FOUNDATION MAINTENANCE & FOOTING PERFORMANCE: A HOMEOWNER'S GUIDE (CSIRO Document – BTF18);

Foundation Maintenance and Footing Performance:
A Homeowner's Guide

CSIRO

BTF 18 replaces Information Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction
There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion
All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation
This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil
All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure
This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

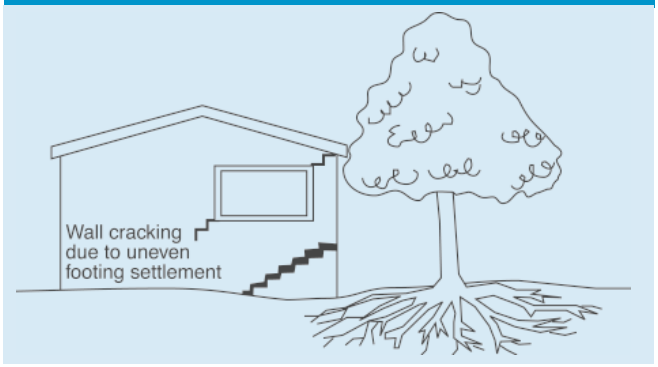
Seasonal swelling/shrinkage in clay

Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage



As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures
Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures
Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.
Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing
Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage
In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

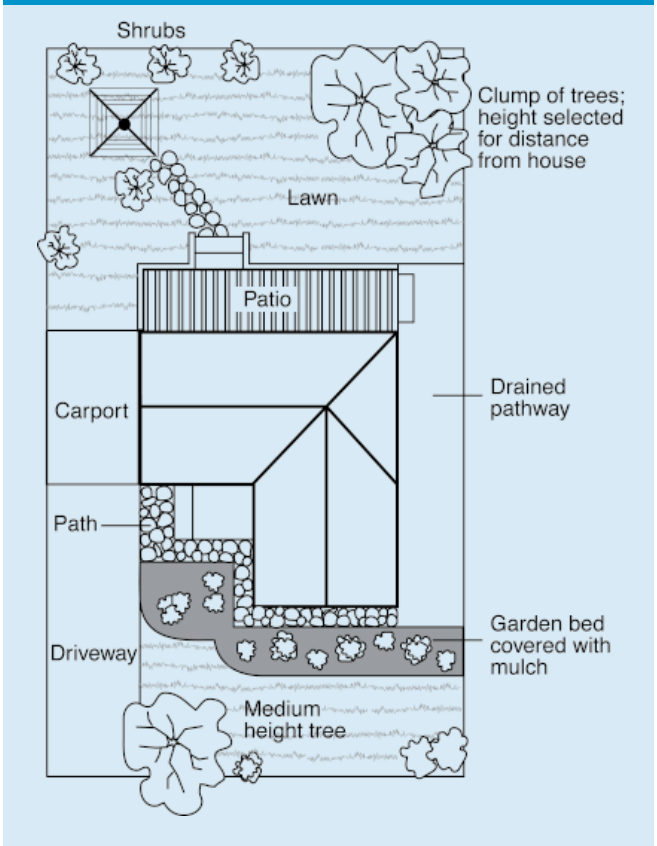
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

Distributed by

CSIRO PUBLISHING PO Box 1139, Collingwood 3066, Australia

Freecall 1800 645 051 Tel (03) 9662 7666 Fax (03) 9662 7555 www.publish.csiro.au

Email: publishing.sales@csiro.au

APPENDIX M PHOTOGRAPHS

Property at No. 69

Border between Properties at
No. 71 and 73

Property at No. 73

Series-1: A view of Entrance and Adjacent Properties to the Property at No. 71 Alexandra Crescent

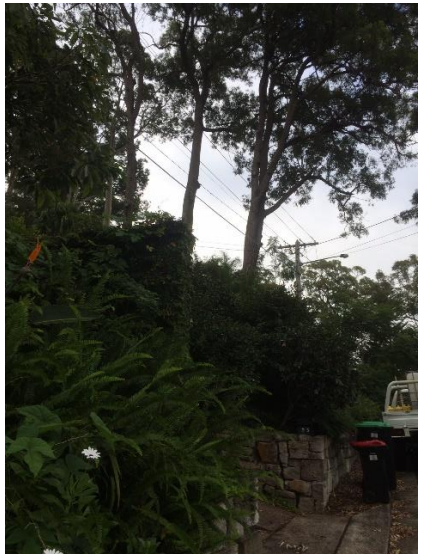
Series-2: View of the Access at the front of the Property

Series-3: A view of the Sloped Profile of the Property

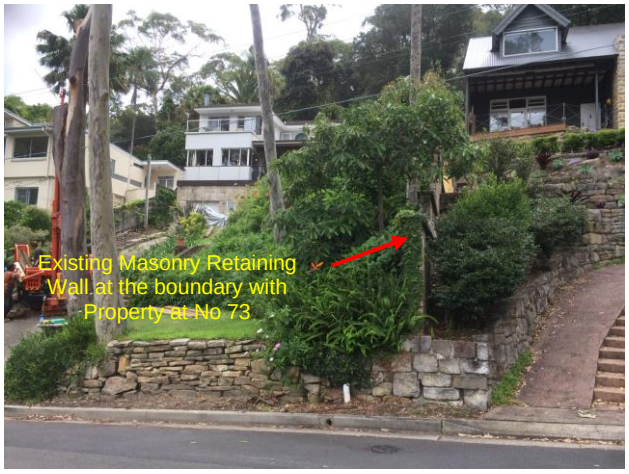
Series-4: Signs of movement in and around the Property

Series-5: Signs of movement in and around the Property (Contd…)

statiker



Series-6: Ground Features of the Property



Series-7: Ground Features of the Property (Contd…)