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

Development Application for Darren & Li-Yan Yip
Name of Applicant

Address of site Lot 2, 1110 Barrenjoey Road, Palm Beach, NSW 2108

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

I, Rahsn Witt *on behalf of* Witt Consulting
(Insert Name) (Trading or Company Name)

on this the 5 / 12 / 2019 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
- ə 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.
- ə 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.
- ə 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.
- ə have provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report

Geotechnical Report Details:

Report Title: Geotechnical Report Lot 2, 1110 Barrenjoey Road, Palm Beach, NSW 2108

Report Date: October 2019
:
Author: Tina Gao & Rahsn Witt

Author's Company/Organisation: Witt Consulting

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

Australian Geomechanics Society Landslide Risk Management March 2007
Geotechnical Risk Management Policy for Pittwater - 2009
Site Markups/notes and company records - Witt Consulting

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 ….Rahsn Witt……..

Chartered Professional Status…BE(CEng) MEngSci RINA MIEAust CPEng NPER

Membership No. …2287439……

Company….Witt Consulting……

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

Development Application for Darren & Li-Yan Yip
Name of Applicant
Address of site Lot 2, 1110 Barrenjoey Road, Palm Beach, NSW 2108

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 Report Lot 2, 1110 Barrenjoey Road, Palm Beach, NSW 2108
Report Date: October 2019
Author: Tina Gao & Rahsn Witt
Author's Company/Organisation: Witt Consulting

Please mark appropriate box

- ☑ Comprehensive site mapping conducted 22/08/2019 (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 22/08/2019
- ☑ 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 …Rahsn Witt……..
Chartered Professional Status….BE(CEng) MEngSci RINA MIEAust CPEng NPER
Membership No. ..2287439……..
Company….Witt Consulting……

Witt Consulting Pty Ltd
ABN: 76 102 953 515
mail@witt.com.au
witt.com.au
141 Lawson Street Redfern NSW 2016

Geotechnical Report
Lot 2, 1110 Barrenjoey Road, Palm Beach NSW 2108

Report Number: WittC-CplusC-R-A

Prepared for:
Hayden Co'burn

October 2019

Prepared by:

Tina Gao

Reviewed By:

Rahsn Witt

Table of Contents

1 Introduction

Witt Consulting have prepared this geotechnical report for the property located at Lot 2, 1110 Barrenjoey Road, Palm Beach NSW 2108. The geotechnical site investigation and geotechnical report were undertaken by Witt Consulting at the request of Hayden Co'burn of CplusC Architectural Workshop.

The objective of the geotechnical investigation was to assess the subsurface geotechnical conditions at the site and provide geotechnical advice regarding foundation design at the site.

We have conducted our geotechnical site investigation in general accordance with AS1726(1993) '*Geotechnical Site Investigations'.*

2 Scope of Works

Our scope of works for the desktop geotechnical investigation at Lot 2, 1110 Barrenjoey Road, Palm Beach included the following;

- A Dial Before You Dig (DBYD) search.
- Service location in select locations by Service Locating Company.
- A review of published geological and soil landscape mapping.
- Site inspection carried out by a Geotechnical Engineer.
- Excavation of five (5) boreholes with a hand auger.
- Field assessment of material excavated from the boreholes.
- Slope stability assessment for landslide risks long term post construction.
- Preparation of a geotechnical report outlining the findings of our geotechnical site investigation.

3 Site Identification

Table 1 below summarises the identification, location and setting of the site.

Item	**Details**
Street Address	Lot 2, 1110 Barrenjoey Road, Palm Beach NSW 2108
Legal Property Description	Lot 10 DP1004105
Approximate Site Size	1136 m^2
Approximate Geographic Co-ordinates	33°35'49.7"S 151°19'14.6"E
Local Government Area	Northern Beaches Council
Land Use Zoning	E4 – Environmental Living
Current Land Use	Predominantly Undeveloped

Table 1 – Site Identification, Location and Setting.

The site location is presented in **Appendix A**.

4 Site Description

The site is located mid slope on the western side of a north-south striking ridgeline between Palm Beach to the east and Pittwater to the west. A survey of the site from Hill & Blume Consulting Surveyors, conducted on 10 May 2019, is presented in **Appendix B**. From the survey, the ground level at the site is located between RL 12.10 m and RL 25.00 m. The ground surface at the site generally slopes to the west at a gradient between 21.5° and 22.7°.

Currently at the western end of the site is a driveway and a metal cabin. The ground surface at the site is predominantly covered by turf and dense vegetation with some exposed rock and large sandstone boulders. There are four (4) rock outcrops observed at the site. The largest is by the southern boundary of the site just above the driveway with another large rock outcrop located by the centre of the site. The two smaller rock outcrops are beside each other at the south-eastern corner of the site.

5 Soil Landscape

The NSW Environment & Heritage eSPADE web application identifies the soil landscape at the site as Watagan (9130wn). Watagan soil landscape is characterised as;

> ***Landscape*** *– rolling to very steep hills on fine-grained Narrabeen Group sediments. Local relief 60- 120 m, slopes >25%. Narrow, convex crests and ridges, steep colluvial sideslopes, occasional sandstone boulders and benches. Tall eucalypt open-forest with closed-forest (rainforest) in sheltered positions.*
>
> ***Soils*** *– shallow to deep (30-200 cm) Lithosols/ Siliceous Sands (Uc1.24) and Yellow Podzolic Soils (Dy3.21, Dy3.41, Dy4.11) on sandstones; moderately deep (100-200 cm) Brown Podzolic Soils (Db1.11), Red {Podzolic Soils (Dr2.21) and Gleyed Podzolic Soils (Dg2.21) on shales.*
>
> ***Limitations*** *– mass movement hazard, steep slopes, severe soil erosion hazard, occasional rock outcrop.*

An excerpt of the eSPADE web application showing the location of the site with the associated soil landscapes is presented in **Appendix C**.

6 Geology

The Sydney 1:100,000 Geological Series Sheet 9130 indicates that the site is underlain by Newport Formation and Garie Formation (Rnn) of the Narrabeen group.

The geological series sheets describe the lithology of Newport Formation and Garie Formation as *'interbedded laminite, shale and quartz, to lithic-quartz sandstone; clay pellet sandstone'*.

An excerpt of the 1:100,000 Geological Series Sheet 9130 showing the location of the site is presented in **Appendix D**.

The general stratigraphy in the area is described in Table 2.

Position	Strata	Description
Upper Slope	Hawkesbury Sandstone	Medium to coarse-grained quartz sandstone with minor shale and laminite lenses
Mid Slope	Newport Formation	Interbedded laminite, shale, quartz to lithic-quartz sandstone; minor red claystone
Lower Slope	Garie Formation	Clay pellet sandstone, dark lithic fine sandstone, chocolate claystone bands.

Table 2 – General stratigraphy in the area.

The ground surface at the site is predominantly covered with some exposed rock so visual inspection of the stratigraphy at the site is difficult. However, the general stratigraphy in the area is visible in an escarpment in Mckay Reserve, approximately 200 m south of the site. The general geological profile is shown in Figure 1.

At the base of the escarpment there is an obvious boundary between the Newport Formation and the Garie Formation. Figure 2 shows the boundary between the Newport and Garie formations.

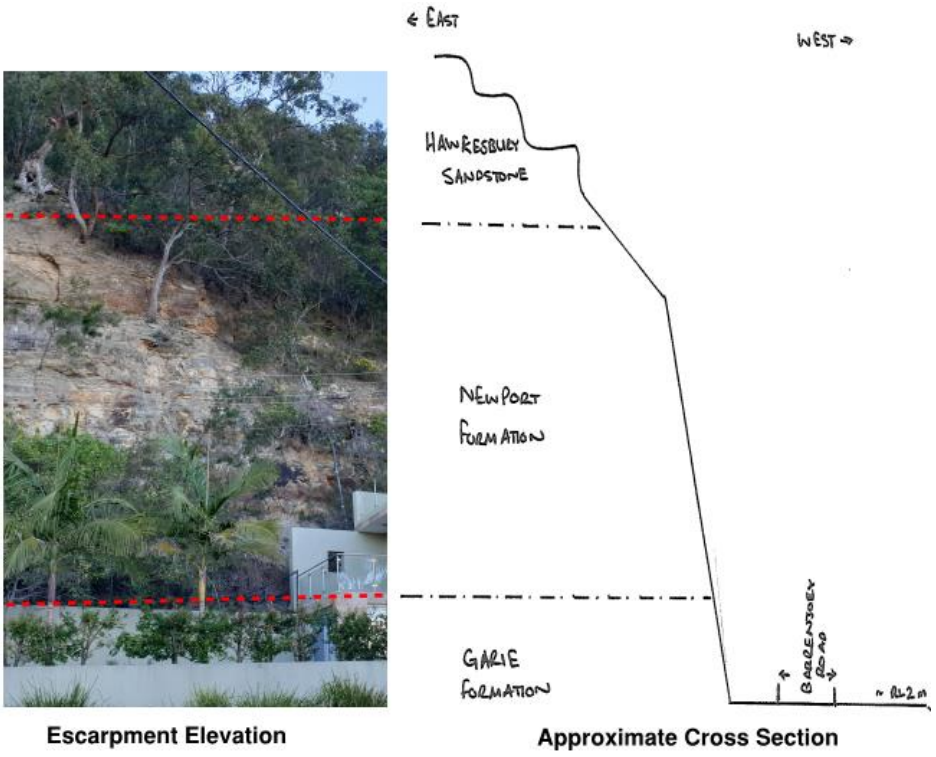


Figure 1 – Typical Stratigraphy McKay Reserve.

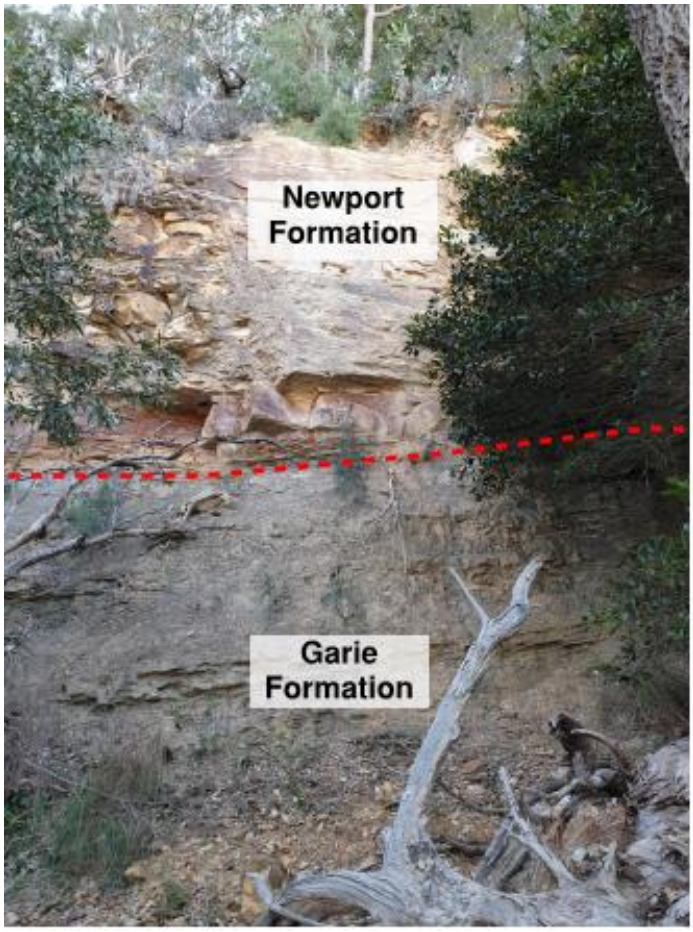


Figure 2 – Boundary between Newport and Garie Formations at MacKay Reserve

7 Acid Sulfate Soils

A review of the Pittwater Local Environmental Plan 2014 maps indicates that the site is located in a zone with an acid sulfate potential classified as Class 5. Areas classified as Class 5 are located within 500 m of adjacent Class 1, 2, 3 or 4 lands. Acid sulfate soils are not typically found in Class 5 areas.

It is our opinion that there is a very low risk that the proposed development will have any adverse impact on adjacent Class 3 and Class 4 land. It is our opinion that there is an extremely low chance that the proposed development would lower the ground water table below 1 m AHD in adjacent Class 1, 2, 3 or 4 lands.

8 Hydrogeology

Based on our assessment of the local topography as well as inspection of the site and surrounding land, we do not anticipate that groundwater would be encountered during works at the site.

9 Fieldwork

Fieldwork was undertaken at the site on 22 August 2019. Fieldwork involved the following:

- Site inspection carried out by a Geotechnical Engineer.
- Excavation of five (5) geotechnical boreholes with a hand auger.
- Field assessment of material excavated from the boreholes.

Due to the steepness of the site, truck mounted and track mounted drilling rigs could not be used to access the proposed house site to complete drilling works. As such boreholes were excavated manually with a hand auger.
A total of five (5) hand augered boreholes were excavated at the site. Boreholes were excavated to the depth at which auger refusal was achieved. Auger refusal was governed by presence of rock, or the stiffness of the ground.

The positions of the borehole locations are presented in **Appendix E**. Borehole logs for the five (5) boreholes excavated are presented in **Appendix F**.

10 Geotechnical Model

The subsurface conditions observed at boreholes at the site consisted of a sandy topsoil, overlying sandy clay residual soils. It is our opinion that the Newport Formation is the likely parent material of the residual soils observed in the boreholes.

It is our opinion that the Hawkesbury sandstone rock outcrops observed at the site are likely boulders that detached from the Hawkesbury Sandstone at the top of the escarpment and slid into their current position.

A cross section showing the observed and inferred geotechnical model at the site is presented in **Appendix G**.

11 Geotechnical Design Parameters

Geotechnical design parameters for the geotechnical units observed at the site are presented in Table 4.

Geotechnical Unit	Unit Weight (kN/m³)	Effective Friction Angle Ø' (°)	Effective Cohesion c' (kPa)	Earth Pressure Coefficients		Elastic Modulus E' (MPa)	Poissons Ratio v
				ka	kp		
Residual Soil	20	26	5	0.39	2.56	30	0.35
Newport Formation	22	100	30	0.33	3.00	500	0.3
Garie Formation	22	30	30	0.33	3.00	300	0.3

Table 4 – Geotechnical Design Parameters

No laboratory testing has been undertaken to confirm the material properties provided above. Witt Consulting provides the design geotechnical parameters based on generally accepted design parameters of Sydney clays, shale, sandstone and our experiences in the region. Geotechnical properties should be confirmed by inspection during construction.

12 Geotechnical Hazard Assessment

The Northern Beaches Council mapping indicates that the site is located in an area identified as Geotechnical Hazard Class H1 in accordance with the Geotechnical Hazard Map, Pittwater Local Environmental Plan 2014.

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

1. Landslip (earth slide <3 m^3) of soils from steep slope in front of proposed structure.
2. Boulder roll/slide from boulders downslope of proposed structure.

Note, the hazard of a boulder roll/slide from boulders in boundaries of properties upslope of proposed structure is negligible as no boulders were observed upslope.

A qualitative assessment of the risk to life and property related to the hazard listed above is presented in the tables in **Appendix H**. The qualitative assessment is based on the methods outlined in Appendix C of the Australian Geomechanics Society (AGS) Guidelines for Landslide Risk Management 2007. AGS terms and their descriptions are provided in **Appendix I**.

Hazard 1 was estimated to have a risk to life of up to 1.26×10^{-5} for a single person, and its risk to property was considered to be 'Low'.

Hazard 2 was estimated to have a risk to life of up to 2.97×10^{-6} for a single person, and its risk to property was considered to be 'Very Low'.

The risk related to these existing hazards is considered to achieve the 'Acceptable' risk level. Where the recommendations of this report are followed, the risk level will remain within the 'Acceptable' risk management criteria of the Northern Beaches Council Geotechnical Risk Management Policy – Council Policy No. 178 for the 50 years design life of the existing development. As the risk level is 'acceptable', the project is considered to be suitable for the site provided that the recommendations of this report are implemented.

13 Design Life

All qualitative assessments of the geotechnical hazards identified in Section 12 of this report were undertaken in accordance with the requirement of a 100 years design project life per Northern Beaches Council Geotechnical Risk Management Policy – Council Policy No. 178.

The maintenance and inspection schedule presented in *Table 4* must be maintained to ensure the requisite design life for the structure is attained. The structures to be maintained and inspected in the schedule were identified due to their potential to affect the stability of ground conditions at the site.

The following assumptions are adopted in the maintenance and inspection schedule,

1. Northern Beaches Council will control the development on neighbouring properties, carry out regular inspections and maintenance of road verges, stormwater systems and large trees on public land adjacent to the site; ensuring stability conditions do not deteriorate with potential increase in risk levels to the site,
2. Respective government departments will maintain public utilities in the form of power lines, water and sewer mains; ensuring leakages which may increase the local groundwater level or landslide potential do not occur,
3. Site conditions do not change from those present at the time this report was prepared, changes consequential from the proposed development are excepted,
4. No changes, due to extraordinary events external to this site, occur to the site and,
5. The site is maintained in good order and in accordance with guidelines set out in,
    a. CSIRO sheet Building Technology File 18,
    b. Australian Geomechanics Society: Practice Note Guidelines for Landslide Risk Management – 2007 and,
    c. AS2870 – 2011: Residential Slabs and Footings.

Structure	Maintenance and/or Inspection Item	Frequency
Stormwater Drains	Owner to inspect and ensure open drains and pipes are free of debris and sediment build up. Owner to clear surface grates and litter.	Annually or following each major rainfall event.
Retaining Walls	Owner to inspect retaining walls for deviation from constructed condition and repair and/or replace as required.	Once every two years or following major rainfall events.
	If deviations observed, owner to replace non-engineered rock or timber retaining walls prior to collapse.	As soon as practical.
Large Trees On/Adjacent to Site	Arborist to check condition of trees and remove as required. Where tree is within steep slopes (>18°) and/or adjacent to structures, inspection by geotechnical engineer required prior to removal.	Once every five years.
Slope Stability	Geotechnical engineer to verify site stability and maintenance.	Once every ten years after proposed construction is completed.

Table 4 – Recommended Maintenance and Inspection Schedule

Where changes to site conditions are identified during the maintenance and inspection program, relevant professionals, including but not limited to the structural engineer, geotechnical engineer or Northern Beaches Council, should be referred.

14 Site Classification

In accordance with AS2870 – 2011, the site classification for the proposed footing design is 'Class P'. The aforementioned site class is classified as '*the site may be subject to mine subsidence, landslip, collapse activity or coastal erosion*' per AS2870 – 2011 Cl 2.1.3.

15 Site Sub-Soil Classification

In accordance with AS1170.4 – 2007, the site sub-soil classification is 'Class B_e - Rock'. Per AS1170.4 – 2007 Cl 4.2.2, the aforementioned site sub-soil class is defined as rock with,

a) *A compressive strength between 1 and 50 MPa inclusive or an average shear-wave velocity, over the top 30 m, greater than 360 m/s,*
b) *Not underlain by materials having a compressive strength less than 0.8 MPa or an average shear wave velocity less than 300 m/s.*

16 Foundations

We recommend that foundations for the proposed structure consist of a grid of micro piles. We recommend that micro piles are constructed in Sandstone (Class V) or better. Micropiles should be designed in accordance with AS 2159 '*Piling – Design and Installation*' using the geotechnical design parameters provided in Table 4.

17 Design and Construction Monitoring

The following design and construction monitoring regime is to be followed,

1. Geotechnical engineer to review and approve the structural design drawings for compliance with the recommendations made in this report.
2. Geotechnical engineer to inspect all footings to confirm compliance with the design assumptions and verify bearing capacities and stability.
3. Geotechnical engineer to inspect completed works to ensure no new geotechnical hazards have been created by site works and that all required stabilisation measures are in place.

The client and builder should be familiar with the requirements set out in this report for inspections during the construction phase. Witt Consulting cannot provide certification if we have not undertaken the required inspections.

18 Conclusion

The site topography is moderately to steeply west dipping. The ground surface is predominantly covered by turf and dense vegetation with some exposed rock and partially curried sandstone boulders. The soil landscape is identified as the Watagan soil landscape. The general stratigraphy consists of an upper slope of Hawkesbury Sandstone, a mid slope of Newport Formation and a lower slope of Garie Formation.

The acid sulfate potential of the site is identified as 'Class 5'. It is our opinion that there is a very low risk of acid sulfate soils impacting the proposed development.

We do not anticipate encountering groundwater during construction of the proposed development works.

The geotechnical model consists of sandy topsoil, overlying clay residual soil likely to be from the parent material of the Newport Formation. All respective geotechnical design parameters are given in *Table 3*.

All existing potential geotechnical hazards were assessed to present risks within the 'Acceptable' risk management criteria of the Northern Beaches Council Policy No. 178. The identified geotechnical hazards may be maintained within the 'Acceptable' risk management criteria provided the recommendations of this report, including the Maintenance and Inspection Schedule presented in *Table 4*, are implemented. It is our opinion that the site will not require further assessment or stabilisation measures concerning the existing geotechnical hazards.

We recommend the foundation system to consist of micro piles, on a grid, founded on Sandstone (Class V) or better. Geotechnical engineer to inspect all footings to confirm compliance with design assumptions and verify bearing capacity and stability.

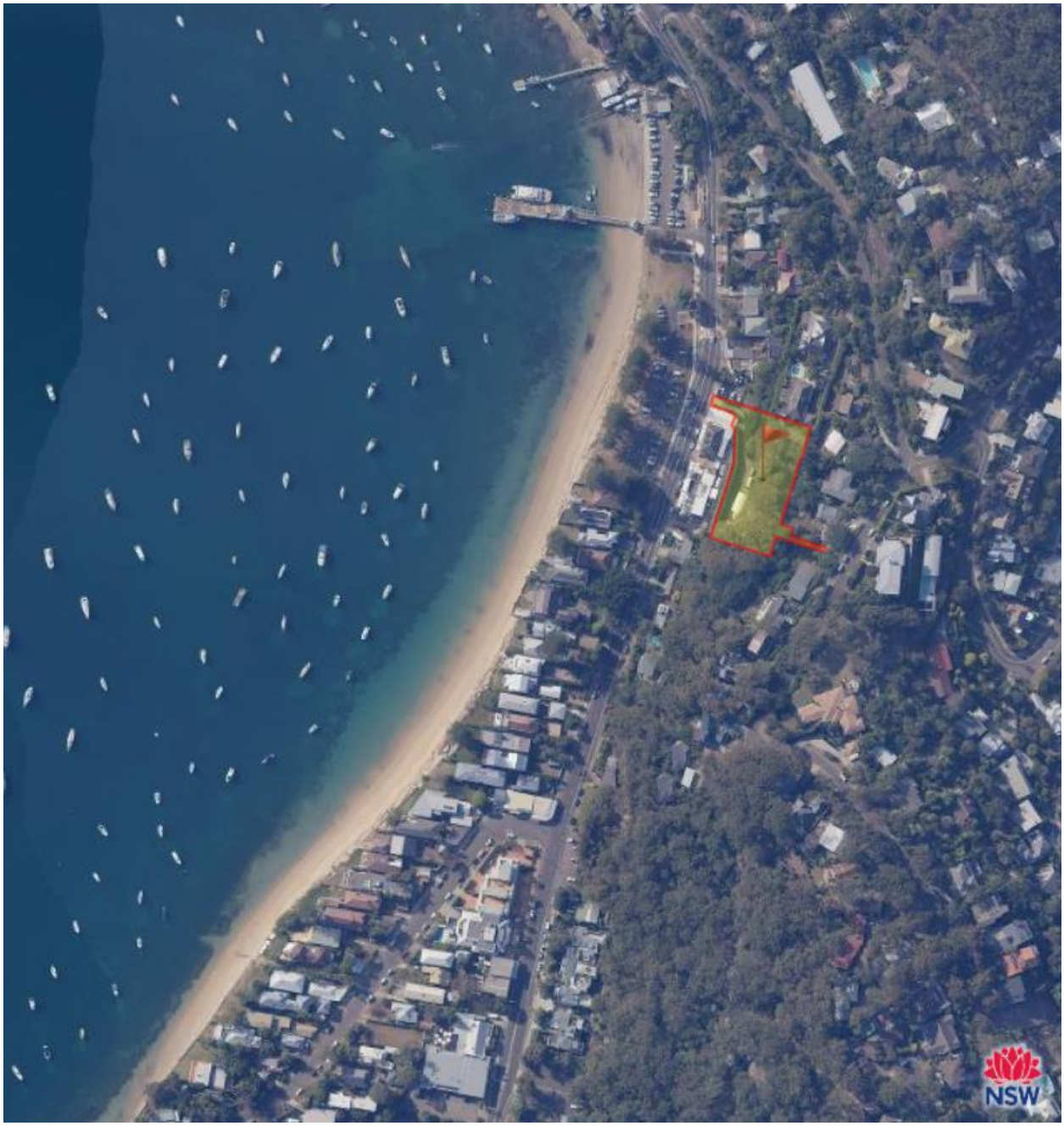
19 Limitations

The recommendations presented in this report include specific issues to be addressed during and after the construction phase of this project. In the event that any of the recommendations presented in the report are not implemented, the general recommendations may become inapplicable and Witt Consulting accept no responsibility for the performance of the structure where recommendations are not implemented in full, inspected and documented.

Subsurface conditions at the site may vary from those anticipated or interpreted. If differences from the conditions interpreted in this report are encountered, we recommend that immediate geotechnical advice is sought. This report provides advice on the geotechnical aspects for the proposed civil and structural design. As part of this documentation stage of this project, Contract Documents and Specifications may be prepared based on our report. However, there may be design features we are not aware of or have not commented on for a variety of reasons. The designers should satisfy themselves that all the necessary advice has been obtained. If required, we could be commissioned to review the geotechnical aspects of the contract documents to confirm the intent of our recommendations has been correctly implemented.

This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other use. If there are any changes to the proposed development described in this report, then the recommendation in this report must be reviewed.

Appendix A. Site Location



Site Location at 1110 Barrenjoey Road, Palm Beach

Appendix B. Site Survey

BARRENJOEY ROAD

'RESTAURANT DINING'

1 STOREY RENDERED BUILDING (METAL ROOF) No.1102 'PALM BEACH FISH & CHIPS'

2 & 3 STOREY BRICK BUILDING (TILE ROOF) 'BARRENJOEY HOUSE'

DP 1004105 3

DP 1004105 2

DP 1004105 1 3741.3m² (BY DP)

DP ? 103 1051m² (BY DPT)

DP ? 101 1190m² (BY DPT)

DP ? 102 1136m² (BY DPT)

BM NAIL IN KERB RL = 2.03 A.H.D.

BUS STOP SHELTER

BRICK PIER

HOARDING FENCE

ELEC. BOX

CONCRETE DRIVEWAY

198°04' 45.105

198°04' 28.50

198°04' 16.98

198°04' 5.36

198°04' 6.00

153°04' 2.83

288°04' 60.5

181°04'10" 10.425

108°04' 13.60

108°04' 60.96

108°04' 8.00

108°04' 10.090

153°04'10" 8.55

198°04' (26.95)

198°04' (60.35)

198°04' 35.335

198°04' 25.015

GRASS BANK

DENSE VEGETATION

TOP OF BUSHES RL8.69

GRASS

CONCRETE

METAL CABIN

COVERED AREA

ROCK OUTCROP

BRANCH 26.89

BRANCH 21.86

BRANCH 22.67

BRANCH 22.52

BRANCH 23.93

DATUM : A.H.D.

0 1 2 3 4 5 10

(1) –COVENANT BY TRANSFER NUMBER C114410.

(2) –SUBJECT TO RESERVATIONS AND CONDITIONS –SEE CROWN GRANT BY DP1004105.

(3) –EXISTING EASMENT TO DRAIN WATER 1.0 WIDE BY DP1004105.

NOTE: BOUNDARIES AND DISTANCES ARE OBTAINED BY AN UNREGISTERED D

ARTIFICIAL GRASS 16.86

BALCONY ABOVE 19.87

COVERED VERANDAH 22.54

2 STOREY RENDERED RESIDENCE (TILE ROOF) No.21A

RENDERED GARAGE (TILE ROOF)

LAWN 22.67

FENCED

APPROX 2°04'37"

APPROX 11°24'

T.N.

S.G.

M M

LEGEND

	Building	BALC	Balcony Height
	Walls	BOL	Bollard
	Kerb Bottom	BS	Bus Stop
	Concrete edge	BW	Bottom of Window
	Kerb top	CHIM.	Chimney Height
	Barrier	ER	Earth Rod
	Hedge	FH	Fire Hydrant
	Fence	FL	Floor Level
	Overhead Powerline	GU	Gully
	Manholes	GFL	Ground Floor Level
△1	Survey Station & Name	GM	Gas Meter
	Bench Mark	GV	Gas Valve
		HT	Height
SAP	Sapling	IC	Inspection Cover
		LGFL	Lower Floor Level
	Tree, 12/0.5/10 (Spread/Trunk/Height)	MH	Manhole
		PARA	Parapet Height
	Area Of Undergrowth	PP	Power Pole
		SFL	Second Floor Level
	Gate	SIL	Sill Height
IC	Inspection chamber	SP	Sign Post
CL	Cover level	SV	Stop Valve
IL	Invert level	SVP	Sewer Vent Pipe
Inv ø0.25	Pipe invert (diameter)	TD	Top of Door
–GU	Gully	TDW	Top of Door/Window
–KO	Back Gully	TEL	Telstra
MH	Manhole	TG	Top of Gutter
		TL	Traffic Light
		TW	Top of Window
		TOF	Top of Fence
		TOW	Top of Wall
		UND	Underside Height
		WM	Water Meter
		W–B	Wall to Boundary

NOTES:

1. ALL DIMENSIONS AND LEVELS SHOULD BE CHECKED ON SITE PRIOR TO DESIGN AND CONSTRUCTION.
2. THE INFORMATION ON THIS SURVEY IS TO BE USED FOR DA PURPOSES ONLY.
3. IF THERE IS ANY POINT OR FEATURE i.e.(FLOOR LEVEL, WALL POSITION, ROOF OR RIDGE HEIGHT ETC) CRITICAL TO THE PREPARATION OF DESIGN PLANS OR CONSTRUCTION, THAT POINT OR FEATURE SHOULD BE MADE KNOWN TO US SO IT'S ACCURACY CAN BE CONFIRMED PRIOR TO THE COMPLETION OF DESIGN PLANS OF COMMENCEMENT OF CONSTRUCTION.
4. SOME STRUCTURES AND FEATURES ARE APPROXIMATE ONLY. IF USED FOR DESIGN CONFIRMATION OF ACCURACY SHOULD BE CONFIRMED.
5. FENCES ARE APPROXIMATE ONLY UNLESS SPECIFICALLY DIMENSIONED TO BOUNDARY.
6. SURVEY MARKS MUST BE PLACED PRIOR TO CONSTRUCTION OR ERECTION OF FENCES.
7. TREE INFORMATION HAS BEEN SURVEYED FROM GROUND LEVEL AND THEREFORE SHOULD BE TREATED AS APPROXIMATE ONLY. THE EXTENT OF THE CANOPY IS APPROXIMATE AND DIAGRAMMATIC ONLY.
8. STAIR RISES, STEPS AND LANDINGS HAVE NOT BEEN INDIVIDUALLY LOCATED AND ARE DIAGRAMMATIC ONLY.
9. THE RECORDS OF THE SERVICE PROVIDERS HAVE NOT BEEN INVESTIGATED, ONLY THOSE SERVICES THAT ARE VISIBLE AND ACCESSIBLE AT THE DATE OF SURVEY HAVE BEEN SHOWN.
10. SERVICES SHOWN ARE INDICATIVE ONLY, OTHER SERVICES MAY EXIST THAT ARE NOT SHOWN. THEREFORE FIELD CONFIRMATION SERVICE LOCATORS SHOULD BE OBTAINED TO CONFIRM EXACT POSITION AND DEPTH.
11. SITE AREA SHOWN HAS BEEN CALCULATED BY SURVEY.
12. A SITE AND BOUNDARY SURVEY HAS BEEN CARRIED OUT.
13. ORIGIN OF LEVELS IS SSM 38192, RL2.50 TO A.H.D
14. BEARINGS ARE ON I.S.G

COPYRIGHT:

DIAL1100 BEFORE YOU DIG

Hill & Blume CONSULTING SURVEYORS
ACN 000 721 004
Hill & Blume Pty Ltd
102 Crown Street
Woolloomooloo
NSW 2011
Tel (02) 9332 4888
Fax (02) 9331 6422
surveyors@hillandblume.com.au

PROJECT

SHOWING SELECTED LEVELS AND DETAIL OVER LOT 1 IN DP 1004105 BEING 1110 BARRENJOEY ROAD, PALM BEACH.

LGA: NORTHERN BEACHES	REGISTERED SURVEYOR:
SCALE: 1:100	DRAWN/PAPER SIZE: DGM/A0
SURVEY DATE: 10/05/19	DRAWING No.: 61313004A

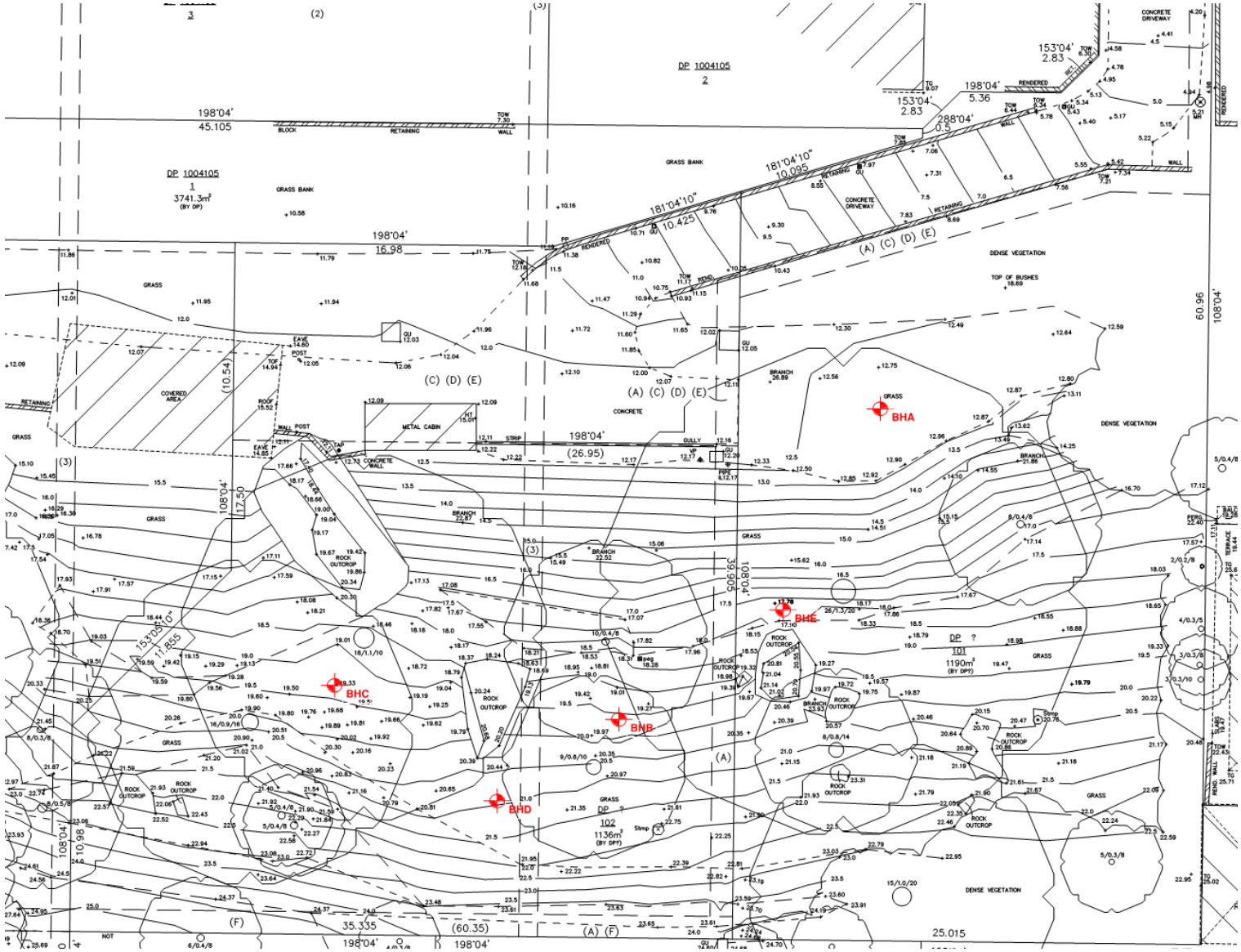
Appendix C. Soil Landscape

Excerpt of eSPADE web application with site location

Appendix D. Geological Mapping Sheet

Excerpt from Sydney 1:100,000 Geological Series Sheet

Appendix E. Boreholes Location Plan



Locations of excavated boreholes

Appendix F. Borehole Logs

WITT Consulting
Witt Consulting Pty Ltd
ABN 76 102 953 515
witt.com.au

Excavation No: BH-A

Sheet: 1 of 1

Borehole Log

Job No: WittC-CplucC-R-A

Client: CplusC
Principal:
Project: Barrenjoey Road Palm Beach
Site location: Lot 2, 1110 Barrenjoey Road Palm Beach NSW 2108

Date commenced: 22/08/2019
Date completed: 22/08/2019
Logged by: NK

Equipment type: Hand Auger
Excavation dimensions: 63 mm Diameter

R.L. surface:
Easting:
Northing:

Vertical datum:
Horizontal datum:

Method	Water	TCR	RQD (SCR)	R.L. (m)	Depth (m)	Graphic Log	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components)	Weathering	Inferred Strength $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)		Average Defect Spacing (mm) (20, 60, 200, 600, 1000)
							TOPSOIL				
					0.50						
					1.00						
					1.50						
					2.00						
					2.50						
					3.00						
					3.50						

WITT Consulting
Witt Consulting Pty Ltd
ABN 76 102 953 515
witt.com.au

Excavation No: BH-B

Sheet: 1 of 1

Borehole Log

Job No: WittC-CplucC-R-A

Client: CplusC
Principal:
Project: Barrenjoey Road Palm Beach
Site location: Lot 2, 1110 Barrenjoey Road Palm Beach NSW 2108

Date commenced: 22/08/2019
Date completed: 22/08/2019
Logged by: NK

Equipment type: Hand Auger
Excavation dimensions: 63 mm Diameter

R.L. surface:
Easting:
Northing:

Vertical datum:
Horizontal datum:

Method	Water	TCR	RQD (SCR)	R.L. (m)	Depth (m)	Graphic Log	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components. ROCK TYPE; weathering, colour, secondary and minor components	Weathering	Inferred Strength $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)		Average Defect Spacing (mm) (20, 60, 200, 600, 1000)
					0.50		SILTY SAND; fine to medium grained, dark brown				
					1.00						
					1.50						
					2.00						
					2.50						
					3.00						
					3.50						

WITT Consulting
Witt Consulting Pty Ltd
ABN 76 102 953 515
witt.com.au

Excavation No: BH-C

Sheet: 1 of 1

Job No: WittC-CplucC-R-A

Borehole Log

Client: CplusC
Principal:
Project: Barrenjoey Road Palm Beach
Site location: Lot 2, 1110 Barrenjoey Road Palm Beach NSW 2108

Date commenced: 22/08/2019
Date completed: 22/08/2019
Logged by: NK

Equipment type: Hand Auger
Excavation dimensions: 63 mm Diameter

R.L. surface:
Easting:
Northing:

Vertical datum:
Horizontal datum:

Method	Water	TCR	RQD (SCR)	R.L. (m)	Depth (m)	Graphic Log	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, colour, secondary and minor components)	Weathering	Inferred Strength $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)		Average Defect Spacing (mm) (20, 60, 200, 600, 1000)
							SILTY SAND; fine to medium grained, dark brown				
					0.50						
					1.00						
					1.50						
					2.00						
					2.50						
					3.00						
					3.50						

WITT Consulting
Witt Consulting Pty Ltd
ABN 76 102 953 515
witt.com.au

Excavation No: BH-D

Sheet: 1 of 1

Borehole Log

Job No: WittC-CplucC-R-A

Client: CplusC
Principal:
Project: Barrenjoey Road Palm Beach
Site location: Lot 2, 1110 Barrenjoey Road Palm Beach NSW 2108

Date commenced: 22/08/2019
Date completed: 22/08/2019
Logged by: NK

Equipment type: Hand Auger
Excavation dimensions: 63 mm Diameter

R.L. surface:
Easting:
Northing:

Vertical datum:
Horizontal datum:

Method	Water	TCR	RQD (SCR)	R.L. (m)	Depth (m)	Graphic Log	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components. ROCK TYPE; weathering, colour, secondary and minor components	Weathering	Inferred Strength $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)		Average Defect Spacing (mm) (20, 60, 200, 600, 1000)
					0.50		SILTY SAND; fine to medium grained, dark brown				
					1.00						
					1.50						
					2.00						
					2.50						
					3.00						
					3.50						

WITT Consulting
Witt Consulting Pty Ltd
ABN 76 102 953 515
witt.com.au

Excavation No: BH-E

Sheet: 1 of 1

Job No: WittC-CplucC-R-A

Borehole Log

Client: CplusC
Principal:
Project: Barrenjoey Road Palm Beach
Site location: Lot 2, 1110 Barrenjoey Road Palm Beach NSW 2108

Date commenced: 22/08/2019
Date completed: 22/08/2019
Logged by: NK

Equipment type: Hand Auger
Excavation dimensions: 63 mm Diameter

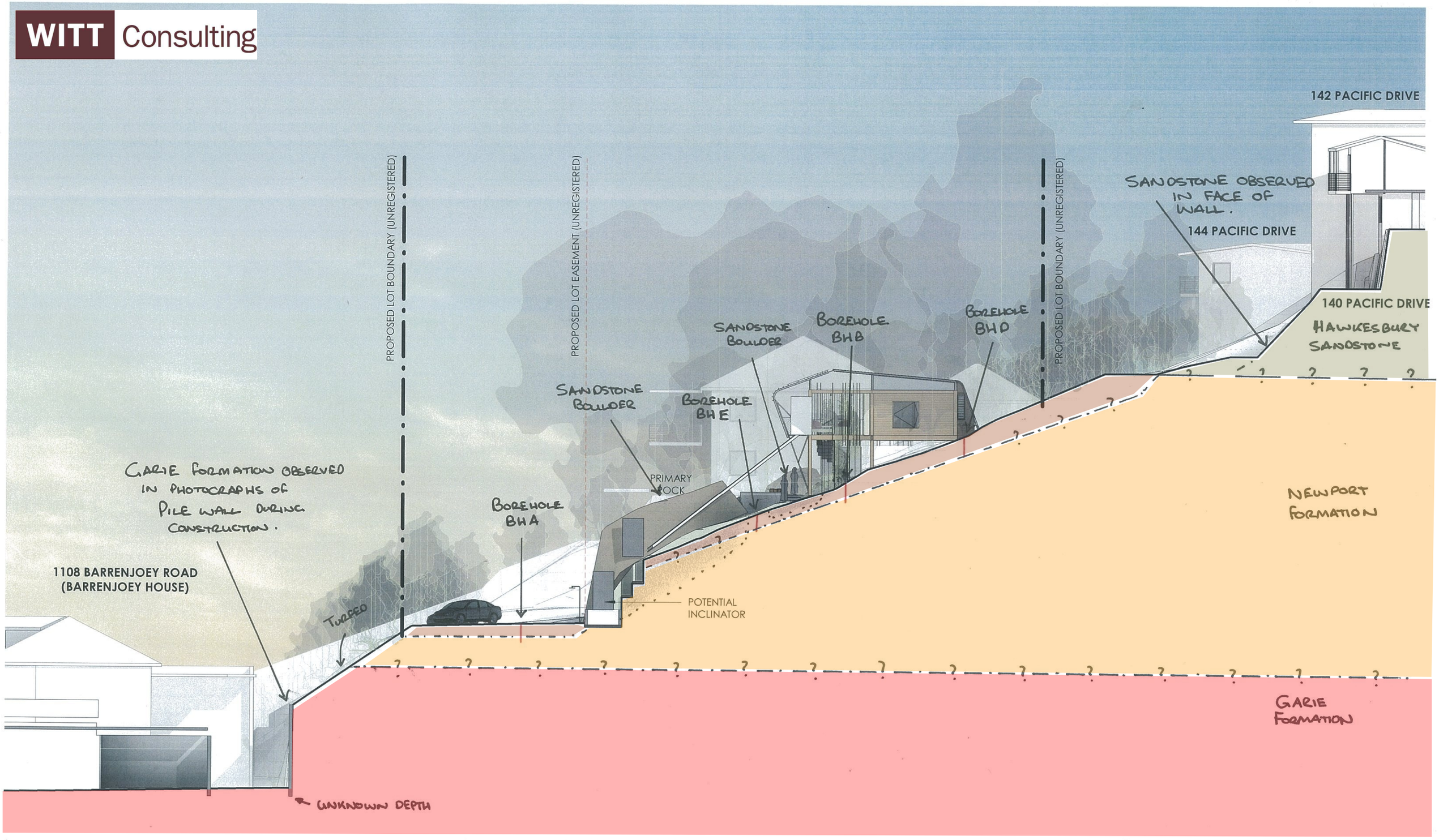
R.L. surface:
Easting:
Northing:

Vertical datum:
Horizontal datum:

Method	Water	TCR	RQD (SCR)	R.L. (m)	Depth (m)	Graphic Log	Material: SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components. ROCK TYPE; weathering, colour, secondary and minor components	Weathering	Inferred Strength $Is_{(50)}$ MPa (VL 0.1, L 0.3, M 1, H 3, VH 10, EH)		Average Defect Spacing (mm) (20, 60, 200, 600, 1000)
					0.50		SAND; fine to medium grained				
					1.00						
					1.50						
					2.00						
					2.50						
					3.00						
					3.50						

Appendix G. Inferred Geotechnical Cross Sections

WITT Consulting



INFERRED GEOTECHNICAL CROSS SECTION

CplusC Architectural Workshop
62 IVY STREET
DARLINGTON NSW 2008
P: +61 2 9690 2211
E: info@cplusc.com.au
W: www.cplusc.com
NOMINATED ARCHITECT 8688

PROJECT 19-011 YIP RESIDENCE			SCALE 1 : 200 @ A3	DRAWING TITLE **PROPOSED SITE SECTION A**	
PROJECT ADDRESS LOT 2, 1110 BARRENJOEY ROAD PALM BEACH NSW 2108	CLIENT DARREN AND LI-YAN YIP	DRAWN BY HC/RN REVIEWED BY CC	REVISION DATE XX/08/2019	REVISION A	DRAWING NUMBER SD 002

FILE PATH: C:\Users\Hayden\Documents\19-011_190627_SD_hayden.coburn@live.com.rvt

PRINTED 31/07/2019 2:06:22 PM

Appendix H. Geotechnical Hazard Risk Assessment

The landslide risk assessment for risk to property is summarised in *Table H.1*.

The below assessment was made in accordance with Australian Geomechanics Society: Practice Note Guidelines for Landslide Risk Management - 2007.

The hazards were considered in the current site condition, without remedial or stabilisation measures. Qualitative expression of likelihood considered both frequency analysis estimates and spatial impact probability estimate as per AGS guidelines. Qualitative measures of consequence to property were assessed per AGS Guidelines for Landslide Risk Management - Appendix C. Indicative costs of damage expressed as a cost of the site development with respect to consequence values per AGS Guidelines for Landslide Risk Management Appendix - C are Catastrophic: 200%, Major: 60%, Medium: 20%, Minor: 5% and Insignificant: 0.5%.

Hazard	Description	Impacting	Likelihood		Consequences		Risk to Property
1.	Landslip (earth slide <3 m^3) of soils from steep slope in front of proposed structure.	a) Proposed residential structure	Unlikely	The event might occur under very adverse circumstances over the design life.	Medium	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.	Low
		b) Western boundary driveway	Unlikely	The event might occur under very adverse circumstances over the design life.	Medium	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.	Low
2.	Boulder roll/slide from boulders downslope of proposed structure.	a) Proposed residential structure	Barely Credible	The event is inconceivable or fanciful over the design life.	Minor	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	Very Low
		b) Western boundary driveway	Unlikely	The event might occur under very adverse circumstances over the design life.	Minor	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	Very Low

Table H.1 – Landslide Risk Assessment for Risk to Property

The landslide risk assessment for risk to life is summarised in *Table H.2*.

The below assessment was made in accordance with Australian Geomechanics Society: Practice Note Guidelines for Landslide Risk Management - 2007.

The hazards were considered in the current site condition, without remedial or stabilisation measures. The likelihood of occurrence was assessed for a design life of 100 years. Evacuation scale from Almost Certain to Not Evacuate: 1.0, Likely: 0.75, Possible: 0.5, Unlikely: 0.25 to Rare to Note Evacuate: 0.01, based on likelihood of person knowing of landslide and completely evacuating area prior to landslide impact. Vulnerability is assessed in accordance with AGS Guidelines for Landslide Risk Management – Appendix F.

Hazard	**Description**	**Impacting**	**Likelihood of Slide**	**Spatial Impact of Slide**		**Occupancy**	**Evacuation**	**Vulnerability**	**Risk to Life**
1.	Landslip (earth slide <3 m^3) of soils from steep slope in front of proposed structure.		Slope is steep (>25°) but does not show signs of previous landslips.	a) Proposed structure to cover approximately 1/4 of slope, impact 75% of structure. b) Driveway to cover approximately 1/5 of slope base, impact 50% of driveway.		a) Person in house 16 hrs/day average. b) Person on driveway 0.5hrs/day average.	a) Almost certain not to evacuate. b) Possible to not evacuate.	a) Person in building, injured only. b) Person in open space, buried.	
			Unlikely	Probability of Impact	Impacted				
		a) Proposed residential structure	0.001	0.25	0.75	0.67	1.0	0.1	**1.26×10^{-5}**
		b) Western boundary driveway	0.001	0.20	0.50	0.02	0.5	1.0	**1.00×10^{-6}**

Table H.2 - Landslide Risk Assessment for Risk to Life

Hazard	Description	Impacting	Likelihood of Slide	Spatial Impact of Slide		Occupancy	Evacuation	Vulnerability	Risk to Life
2.	Boulder roll/slide from boulders downslope of proposed structure.		Boulder partially buried into steep slope.	a) Proposed structure located upslope of boulder, impact is barely credible. b) Driveway directly downslope of boulder, impact likely if failure occurs, impact 33% of driveway		a) Person in house 16 hrs/day average. b) Person on driveway 0.5hrs/day	a) Almost certain not to evacuate. b) Possible to not evacuate.	a) Person in building, injured only. b) Person in open space, buried.	
			Unlikely	Probability of Impact	Impacted				
		a) Proposed residential structure	0.001	Negligible	N/A	0.67	1.0	0.1	**Negligible**
		b) Western boundary driveway	0.001	0.90	0.33	0.02	0.5	1.0	**2.97×10^{-6}**

(continued) Table G.2 - Landslide Risk Assessment for Risk to Life

Appendix I. AGS Qualitative Terminology

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: 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

APPENDIX C: – 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) For 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.