WITT Consulting

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Geotechnical Report
1102 Barrenjoey Road, Palm Beach NSW 2108

Report Number: WittC-TMattox-R-A

Prepared for:
Tony Mattox

November 2019

Prepared by:

Nick Kennedy

Reviewed By:

Rahsn Witt

Table of Contents

1 Introduction

Witt Consulting have prepared this geotechnical report for the property located at 1102 Barrenjoey Road, Palm Beach NSW 2108. The geotechnical site investigation and geotechnical report were undertaken by Witt Consulting at the request of Tony Mattox.

The objective of the geotechnical investigation was to assess the subsurface geotechnical conditions, determine the groundwater levels at the site and provide geotechnical advice regarding excavation and 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 geotechnical investigation at 1102 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 three (3) augered boreholes with a track mounted drill rig.
- Installation of three (3) piezometers.
- 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	1102 Barrenjoey Road, Palm Beach NSW 2108
Legal Property Description	Lot 11 DP1207743
Approximate Site Size	1130 m^2
Approximate Geographic Co-ordinates	33°35'50.12"S 151°19'12.97"E
Local Government Area	Northern Beaches Council
Land Use Zoning	B1 – neighbourhood Centre
Current Land Use	Restaurant & Café

Table 1 – Site Identification, Location and Setting.

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

4 Site Description

The side is located at the base of a north-south striking ridgeline between palm beach to the east and Pittwater to the west. The ground surface at the site is relatively flat and between elevations RL 2.00 m at Barrenjoey Road and RL 2.80 m adjacent to the existing soldier pile retaining wall. The existing soldier pile retaining wall was constructed to enable vertical excavation to be cut along the eastern boundary of the site.

The site is occupied by a single storey commercial property currently used as a restaurant. Two shipping containers used for storage have been placed to the east of the restaurant. The ground surface of the site has is predominantly paved. The driveway and parking at the southern end of the site is covered by gravel.

A survey of the site showing the site boundaries and the locations where boreholes were excavated and piezometers were installed is presented in **Appendix B**.

5 Soil Landscape

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

> ***Landscape*** *– level to gently undulating non-tidal beach ridges on marine sands. Local relief <3 m, slopes <5%. Watertable at a depth of <200 cm. Progressive beach ridges in sheltered bays. Extensively cleared closed-scrub and low eucalypt woodland.*
>
> ***Soils*** *– deep (>200 cm) Siliceous Sands (Uc1.22, Uc5.11) and occasional Podzols (Uc2.3) on sandy rises, Humus Podzols (Uc4.2) in poorly drained areas, Calcareous Sands (Uc1.11, Uc1.13) near beaches.*
>
> ***Limitations*** *– permanently high watertables, localised flooding, periodic waterlogging in depressions, very low to low soil fertility, localised areas of high soil erosion hazard.*

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 Australian Stratigaphic Units Data base describe the lithology of Newport Formation as *'interbedded laminite, shale and quartz, to lithic-quartz sandstone; minor red claystone'*, and Garie Formation as '*clay pellet sandstone, dark lithic fine sandstone, chocolate claystone bands*'.

An excerpt of the 1:100,000 Geological Series Sheet 9130 showing the location of the site is presented in **Appendix D**. The geology within the general vicinity of the site is easily observed at MacKay Reserve approximately 200 m south of the site. The typical stratigraphy in the areas is shown in Figure 1 below.

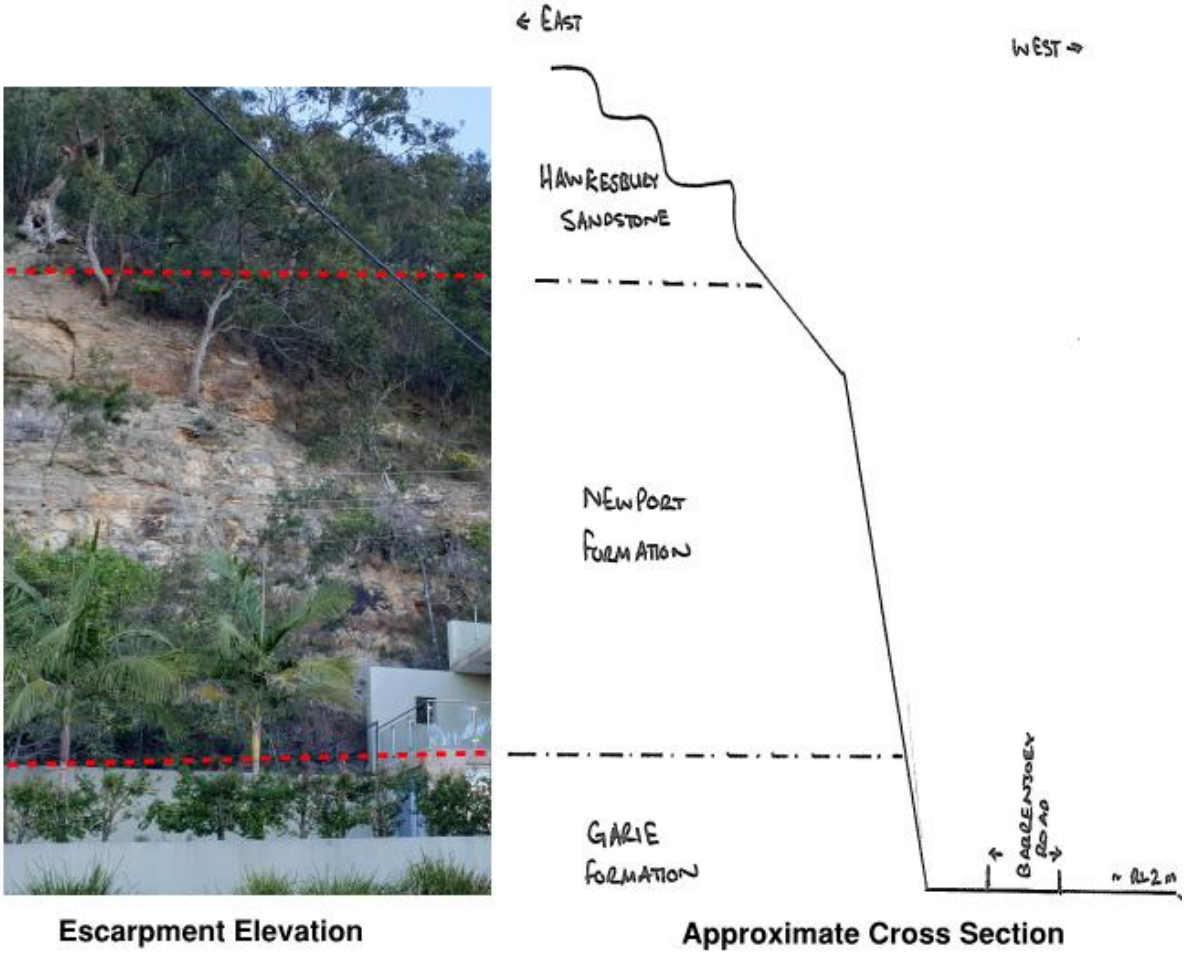

Figure 1 – Typical Stratigraphy McKay Reserve.

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.

8 Fieldwork

Fieldwork was undertaken at the site on 23 September 2019. Fieldwork involved the following:

- Site inspection carried out by a Geotechnical Engineer.
- Excavation of three (3) geotechnical boreholes with a track mounted drilling rig.
- Installation of three (3) piezometers.

Boreholes BH1, BH2, BH3 were drilled to depths of 12.5m, 12m and 4m respectively.

Borehole locations were measured by the surveyor and are shown in the site survey presented in **Appendix B**. Borehole logs for the three (3) boreholes excavated are presented in **Appendix E**.

9 Geotechnical Model

The geotechnical model at along the western boundary of the site appeared to consist of;

- Fill, overlying
- Sand, overlying
- Residual silty clay, overlying,
- Interbedded Siltstone & Sandstone.

The geotechnical model along the eastern boundary of the site consisted of interbedded siltstone and sandstone from the surface. The geotechnical conditions behind the face of the soldier pile wall can be seen in Figure 3 below. Figure 3 is a photo supplied by the owner taken during the construction of the soldier pile wall.

Figure 3, geological conditions behind soldier pile retaining wall on eastern boundary prior to placement of shotcrete infill.

A cross section showing the observed and inferred geotechnical model in the east/west orientation is presented in **Appendix F**. We do not expect that significant variations from the geotechnical model shown in the east west orientation would be observed in the north/south direction.

10 Groundwater

Groundwater was observed at the levels presented Table 2 during our site investigation works.

		Inspection Date	
		23/10/2019	31/10/2019
Borehole	**Surface RL**	**Observed Water Level (m RL)**	
BH1	2.52	0.52	0.57
BH2	2.90	0.82	0.83
BH3	2.90	2.90	3.42

Table 2 – Summary of Groundwater Levels during investigation

10.1 Western Boundary

Standing groundwater was observed in boreholes BH1 and BH2 at the RL's indicated presented in Table 2. In both boreholes the groundwater level was observed to be above the low tide level (0.63 m) and below the high tide level (1.61 m). Given the porosity of the sand observed in the boreholes and the proximity to the Pittwater, we anticipate that the groundwater level along the western boundary of the site would fluctuate with tidal movements.

10.2 Eastern Boundary

Water seepage was observed to occur from the exposed rock mass in the south eastern corner of the site.

We understand that the water seepage from the rock mass at the site is relatively constant. At the time the boreholes were drilled the ground surface at borehole BH3 appeared to be waterlogged and groundwater was observed to be seeping locally from the face of the excavation in the south eastern corner of the site. Given the low permeability of the rock mass and the size of the upslope catchment area, we anticipate that seepage would occurs for long periods following rainfall events.

During the second inspection, the water level in BH3 was observed to be 0.50 m higher than the ground level. It is our opinion that water in the rock mass recharges faster than the rate at which it can seep from the rock mass causing the formation of the pressure gradient that has caused the water to rise above ground level in the piezometer installed in borehole BH3.

During the second inspection the water was bailed out of the piezometer installed in borehole BH3 and the time taken for the water well to recharge was measured. The piezometer was observed to recharge in 3 minutes. The rate of inflow into the piezometer was determined to be 1L/minute.

We anticipate that the water level in the piezometer installed in borehole BH3 would rise following rainfall events as the groundwater level in the rock mass rises.

11 Proposed Development

Witt Consulting have not been provided copies of the proposed development plans. We understand that the proposed development involves the construction of the construction of an underground basement for parking and storage. We understand that the proposed basement level is approximately 0.4 m RL.

12 General Excavation

The proposed development will involve excavation works in rock along the eastern boundary, and in fill and sand along the western boundary. We anticipate that excavation works at the site could be undertaken using a 20T excavator with conventional excavation equipment (i.e toothed bucket and rock hammer).

12.1 Excavation Adjacent to Existing Soldier Pile Wall

We understand that the existing soldier pile retaining wall was designed to work as a cantilevered retaining wall when the ground level on the western side was excavated to the current ground level at approximately RL 2.9 m. We understand that the soldier pile retaining wall was also designed to have the structural capacity to work as an anchored retaining wall should additional excavation works be undertaken on the western side of the wall.

Prior to further excavation works being undertaken at the site, a geotechnical engineer **must** undertake a review of the existing soldier pile retaining wall design and must provide an anchor design. It is likely that one or two rows of anchors will be required to be installed above the current ground surface prior to excavation works commencing.

12.2 Excavation Adjacent to Barrenjoey Road and Adjoining Properties

We anticipate that excavation works adjacent to Barrenjoey Road to the west, Barrenjoey House to the north, and the property at 1100 Barrenjoey Road to the south will require temporary support. We anticipate that temporary support would consist of cantilevered or anchored sheet pile walls or contiguous piled walls.

Should the temporary support system require anchors, permission to install the anchors must be granted by the council and the owner of adjacent properties. The design of anchors must consider the position of underground services adjacent to the excavation.

Construction equipment must be carefully chosen to minimise ground vibrations in adjacent structures. Ground vibrations are discussed in greater detail in Section 15 of this report.

12.3 Dewatering

Construction works at the site will require the installation of temporary dewatering system to control groundwater inflow into the excavation during construction. We anticipate that dewatering using dewatering spears and a sump and pump could be used to dewater the excavation during construction. All water pumped from the site must be treated prior to discharge from the site.

We recommend that dewatering is undertaken during construction only and that no long -term dewatering system is used at the site.

13 Basement Design

We recommend that the basement consist of reinforced concrete footings and piers constructed on weathered rock. We anticipate that the footings could be constructed directly on the weathered rock on the eastern side of the proposed basement and that piers to weathered rock would be required on the western side of the property. We recommend that the structural engineer consider the use of piers found on weathered rock to control settlement of the proposed structure.

We recommend that bearing pressures for footings and piers on weathered rock be limited to 600 kPa. All foundation materials are to be inspected by a geotechnical engineer prior to the placement of reinforcement.

To control long term groundwater inflows, we recommend that the basement is tanked. The tanked basement should be designed for full height water pressures. Design of the basement should also consider the buoyancy forces from full height water pressure.

14 Geotechnical Design Parameters

Witt consulting provide the geotechnical design parameters presented in Table 3 for use in the design of retaining walls, anchors, piers at the site.

Geotechnical Unit	**Unit Weight (kN/m³)**	**Effective Friction Angle Ø' (°)**	**Effective Cohesion c' (kPa)**	**Earth Pressure Coefficients**		**Elastic Modulus E' (MPa)**	**Poissons Ratio v**	**Allowable Anchor Bond Stress (kPa)**
				ka	**kp**			
Fill/Sand	18	30	0	0.33	3.00	10	0.35	-
Residual Soil – Clay	19	25	5	0.41	2.46	30	0.35	-
Weathered Rock	22	30	30	0.33	3.00	200	0.3	150

Table 3 – 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.

15 Vibration Control

We recommend that measures are put in place to limit the likelihood of excavation induced vibrations damaging the structures on the site or on adjacent sites.

Currently there are no Australian Standards for the assessment of building damage caused by vibrational energy. The most relevant available, and widely adopted, standard is the German Standard DIN4150-3:1999-2, Vibration in buildings Part 3: Effects on structures.

DIN4150 provides recommended maximum levels of vibration that reduce the likelihood of building damage caused by vibration. These levels are 'safe limits', up to which no damage due to vibration effects have 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. If such damage is observed without vibration exceeding the 'safe limits' it can be attributed to other causes. DIN 4150 also states that when vibrations higher than the 'safe limits' are present, it does not necessarily follow that damage will occur.

Table 4 below outlines the recommended vibration limits is provided in DIN4150.

It is our opinion that Barrenjoey House is a sensitive (Group 3) structure, as such we recommend that the peak vibration velocity limits for Group 3 structures are adopted for construction works at the site. If these specified peak particle velocity limits are adopted and Barrenjoey House or other adjacent structures, sustains damage during excavation, that damage could reasonably be attributed to other causes.

Group	Type of structure	Peak vibration velocity, mm/s			
		At foundation at a frequency of			Plane of uppermost storey
		Less than 10 Hz	10 Hz to 50 Hz	50 Hz to 100 Hz	All Frequencies
1	Commercial and Industrial Buildings	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 Lines 1 or 2 and have intrinsic value (e.g. buildings that are under a preservation order.	3	2 to 8	8 to 10	8

Table 4 – DIN4150-3 recommended vibration limits for buildings

16 Geotechnical Hazard Assessment

The Northern Beaches Council LEP mapping indicates that the site is located in an area identified as Geotechnical Hazard Class 'H1'. The geotechnical hazard map is presented in **Appendix G.**

Typical signs of geotechnical hazards such as ground movement and underlying geotechnical issues include but are not limited to;

- Evidence or previous slope instability,
- Degradation of existing surface coverings,
- Soil erosion,

- Development of tension cracks or deformation of over adjacent slopes,
- Deformation or obvious movement of existing retaining structures.

We did not observe typical signs of geotechnical hazards during visual inspection of the site.

Excavation of the basement adjacent to the existing soldier pile retaining wall prior to the installation of anchors could lead to instability and/or structural failure of the retaining wall. We understand that the existing soldier pile wall has been designed to accommodate the installation of anchors and the excavation of a basement on the western side of the retaining wall. Prior to the commence of any excavation works at the site;

1. The design of the existing soldier pile retaining wall **must** be reviewed by a geotechnical engineer to determine loading of, and the structural capacity of the existing soldier piles, and
2. A geotechnical engineer is to provide an anchor design and construction sequence.

It is our opinion that the site is suitable for the proposed development subject to engineering review of the existing soldier pile retaining wall, and installation of anchors in the existing solder pile retai ning wall prior to commencing excavation works.

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 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 1102 Barrenjoey Road, Palm Beach

Appendix B. Site Survey Showing Borehole Locations

BARRENJOEY ROAD

PEG
PEG
DRILL HOLE IN CONCRETE
3.21
37.895
(37.39)
(0.29)
5
5
4
PEG
DRILL HOLE IN CONCRETE
(9.3)
(7.05)
BH2
BORE PIPE
(1.5)
BENCH MARK
PEN MARK
R.L. 3.00
NAIL–BDY
(0.23)
(17.6)
PEG
(8.1)
NAIL IN FENCE
41
11
24.1
BENCH MARK
PEN MARK
R.L. 3.00
(8.1)
(8.3)
BH3
(6.4)
BORE PIPE
NAIL IN ROCK
DRILL HOLE IN WALL
DRILL HOLE IN WALL
(7.7)
(0.52)
(6.5)
GRID–BDY
(37.39)
45.48
10
D.P.6746
D.P.1207743
D.P.1207743
BH1
(1.6)
(1.4)
BORE PIPE
INSPECTION COVER
R.L. 2.52
NAIL IN PAVING
GRID–BDY
(0.215)
(17.6)
17.6
2
D.P.1004105
GRID–BDY
(0.215)
20
(6.5)
GRID–BDY
20.52
NORTH

NOTES:

- UNDERGROUND SERVICES HAVE NOT BEEN LOCATED. NOTIFICATION OF ALL RELEVANT AUTHORITIES SHOULD BE UNDERTAKEN. BEFORE CARRYING OUT ANY CONSTRUCTION ACTIVITY IN OR NEAR THE SURVEYED AREA.
- THIS SURVEY HAS BEEN CARRIED OUT FOR INFORMATION PURPOSES ONLY AND SURVEY MARKS SHOULD BE PLACED IF STRUCTURES ARE TO BE ERECTED ON OR NEAR THE BOUNDARIES. BOUNDARIES ARE NOT TO BE ESTABLISHED FROM INFORMATION SHOWN ON DRAWING.
- ORIGIN OF LEVELS: P.M.52391 R.L.2.1 A.H.D.
-
- COVENANTS AND RESTRICTIONS HAVE NOT BEEN INVESTIGATED

ADAM CLERKE SURVEYORS PTY LTD
Incorporating PAUL KEEN & COMPANY
Adam Clerke BSURV (Hons) USQ (REG'D SURV. M.I.S.AUST.)
LAND & ENGINEERING SURVEYORS
38 KEVIN AVENUE, AVALON 2107
TEL...9918 4111
E–MAIL: pkeensvy@bigpond.net.au

SKETCH SHOWING MARKS PLACED FOR PROPOSED BUILDING.

No.1102 BARRENJOEY ROAD, PALM BEACH

DATE... 30/10/19 REF... 20688Q
SCALE...1:150 DATUM... A.H.D

Appendix C. Soil Landscape

Excerpt of eSPADE web application showing approximate site location

Appendix D. Geological Mapping Sheet

Excerpt from Sydney 1:100,000 Geological Series Sheet

Appendix E. Borehole Logs

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Excavation No: BH1

Sheet: 1 of 3

Job No: WittC-MATTOX-R-A

Borehole Log

Client: Tony Mattox
Principal:
Project: Barrenjoey Road Palm Beach
Site location: 1102 Barrenjoey Road Palm Beach NSW 2108

Date commenced: 23/10/2019
Date completed: 23/10/2019
Logged by: NK

Equipment type: Hanjon D&B 8D
Excavation dimensions: 100 mm Diameter

R.L. surface: 2.52 m
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)
SOLID FLIGHT AUGER	▽						PAVING				
							Gravelly SAND, yellow				
					0.50		FILL, silty sand, sandy clay, sandstone fragments, grey to black			Potentially Fill	
					1.00						
					1.50		SAND, yellow, loose, moist				
							saturated at 1.7 m				
	▽				2.00		standing water level observed at 2 m b.g.l				
					2.50		Silty CLAY, red and brown, firm to stiff, moist				
							Interbedded Siltstone & Sandstone, residual soil to extremely weathered, grey and yellow brown, very low strength			Rnn	
					3.00						
					3.50						

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Excavation No: BH1

Borehole Log

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Principal:
Project: Barrenjoey Road Palm Beach
Site location: 1102 Barrenjoey Road Palm Beach NSW 2108

Date commenced: 23/10/2019
Date completed: 23/10/2019
Logged by: NK

Equipment type: Hanjon D&B 8D
Excavation dimensions: 100 mm Diameter

R.L. surface: 2.52 m
Easting:
Northing:

Vertical datum:
Horizontal datum:

Method	Water	TCR	RQD (SCR)	R.L. (m)	Depth (m)	Graphic Log	Material	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)
SOLID FLIGHT AUGER					4.50		continued.....Interbedded Siltstone & Sandstone, residual soil to extremely weathered, grey and yellow brown, very low strength			Rnn	
					5.00						
					5.50						
					6.00						
					6.50						
					7.00						
					7.50						

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Easting:
Northing:

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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)
SOLID FLIGHT AUGER	▽						PAVING				
							Gravelly SAND, yellow				
					0.50		FILL, silty sand, sandy clay, sandstone fragments, grey to black			Potentially Fill	
					1.00						
					1.50		SAND, yellow, loose, moist				
							saturated at 1.7 m				
	▽				2.00		standing water level observed at 2 m b.g.l				
					2.50		Silty CLAY, red and brown, firm to stiff, moist				
							Interbedded Siltstone & Sandstone, residual soil to extremely weathered, grey and yellow brown, very low strength			Rnn	
					3.00						
					3.50						

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Excavation No: BH2

Sheet: 1 of 3

Job No: WittC-MATTOX-R-A

Borehole Log

Client: Tony Mattox
Principal:
Project: Barrenjoey Road Palm Beach
Site location: 1102 Barrenjoey Road Palm Beach NSW 2108

Date commenced: 23/10/2019
Date completed: 23/10/2019
Logged by: NK

Equipment type: Hanjon D&B 8D
Excavation dimensions: 100 mm Diameter

R.L. surface: ~2.9 m
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)
SOLID FLIGHT AUGER	▽				0.50		GRAVEL SAND, coarse yellow			Potentially Fill	
					1.00		Silty SAND, black, trace gravel				
					1.50		Silty SAND, yellow, loose, moist				
					2.00		standing water level observed at 2 m b.g.l				
					2.50						
					3.00		Interbedded Siltstone & Sandstone, residual soil to extremely weathered, grey and yellow brown, very low strength			Rnn	
					3.50						

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Horizontal datum:

Method	Water	TCR	RQD (SCR)	R.L. (m)	Depth (m)	Graphic Log	Material	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)
SOLID FLIGHT AUGER					4.50		continued.....Interbedded Siltstone & Sandstone, residual soil to extremely weathered, grey and yellow brown, very low strength			Rnn	
					5.00						
					5.50						
					6.00						
					6.50						
					7.00						
					7.50						

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Excavation No: BH2

Sheet: 1 of 3

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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)
SOLID FLIGHT AUGER	▽				0.50		GRAVEL SAND, coarse yellow			Potentially Fill	
					1.00		Silty SAND, black, trace gravel				
					1.50		Silty SAND, yellow, loose, moist				
					2.00		standing water level observed at 2 m b.g.l				
					2.50						
					3.00		Interbedded Siltstone & Sandstone, residual soil to extremely weathered, grey and yellow brown, very low strength			Rnn	
					3.50						

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Excavation No: BH3

Sheet: 1 of 1

Job No: WittC-MATTOX-R-A

Borehole Log

Client: Tony Mattox
Principal:
Project: Barrenjoey Road Palm Beach
Site location: 1102 Barrenjoey Road Palm Beach NSW 2108

Date commenced: 23/10/2019
Date completed: 23/10/2019
Logged by: NK

Equipment type: Hanjon D&B 8D
Excavation dimensions: 100 mm Diameter

R.L. surface: 2.9 m
Easting:
Northing:

Vertical datum:
Horizontal datum:

Method	Water	TCR	RQD (SCR)	R.L. (m)	Depth (m)	Graphic Log	Material	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)
SOLID FLIGHT AUGER	0.6 m Above Ground Level				0.50		GRAVEL				
					1.00		Interbedded Siltstone & Sandstone, residual soil to slightly weathered, grey, very low strength			Rnn	
					1.50						
					2.00						
					2.50						
					3.00						
					3.50		End borehole 4 m B.G.L				

Appendix F. Inferred Geotechnical Cross Sections

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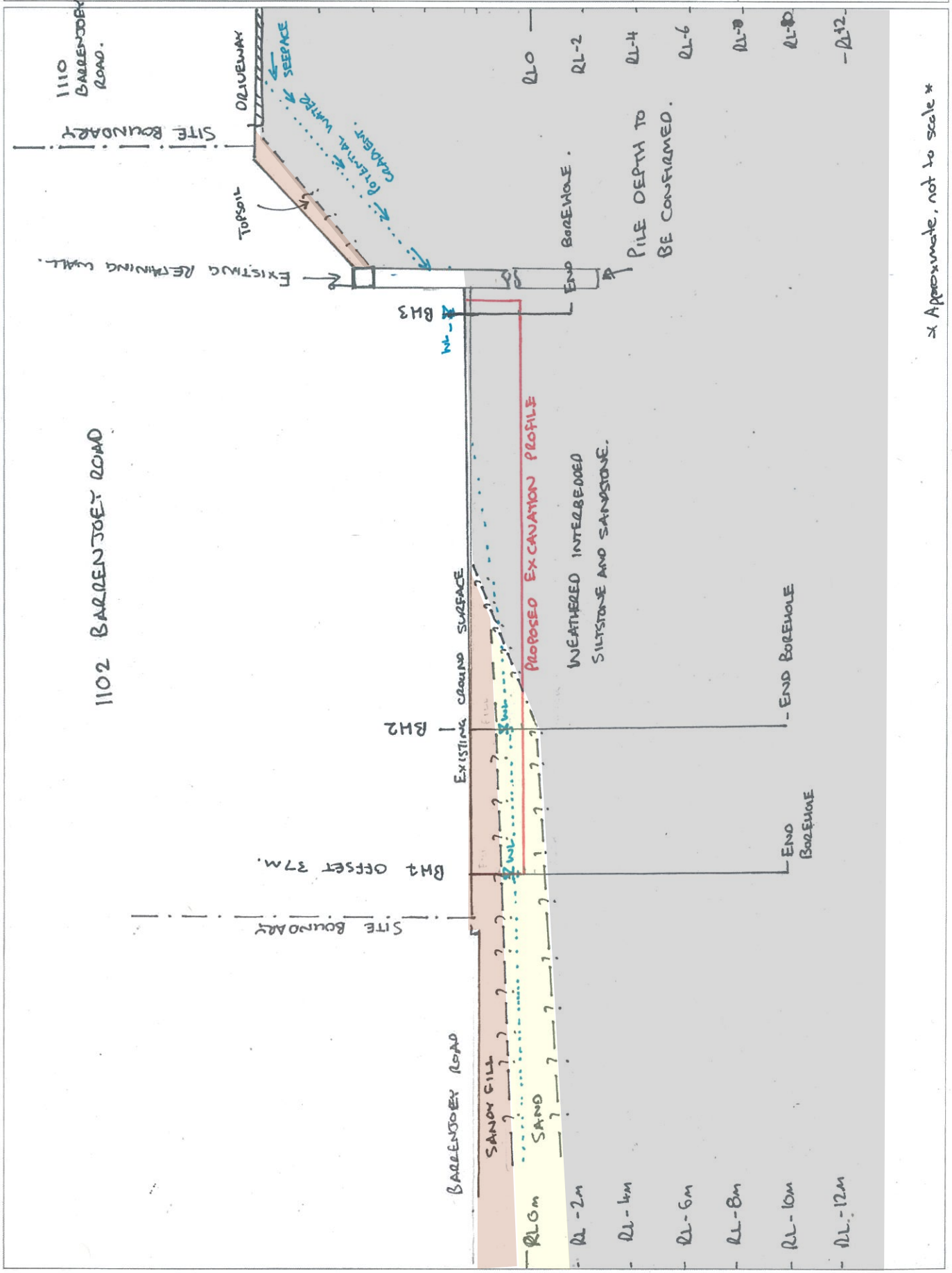
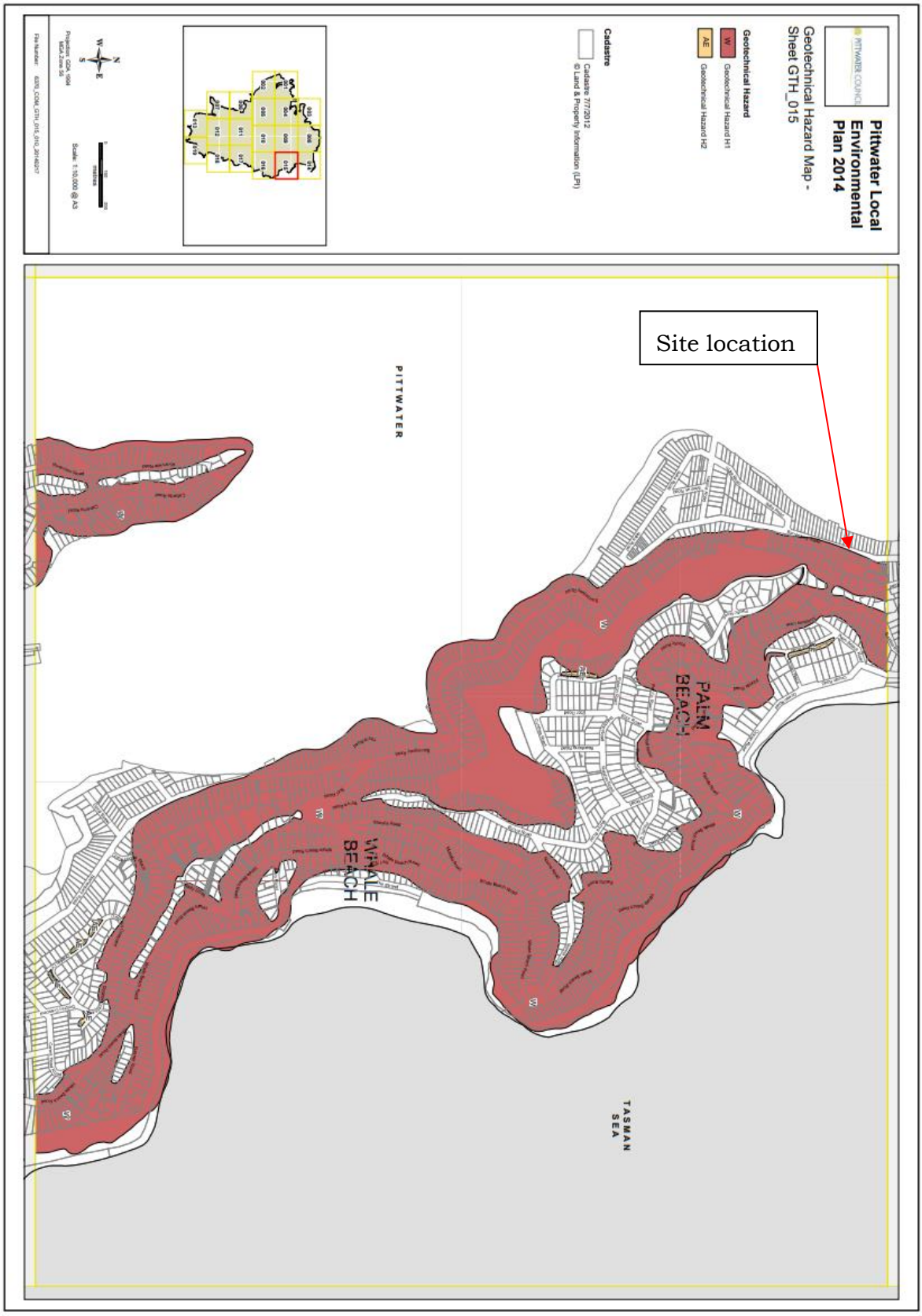
Design Sketch

	Sheet	1 of 1
Client TONY MATTOX - 1102 BARRENJOEY RD PALM BEACH	Date	4.11.19
Description EAST WEST - GEOTECHNICAL CROSS SECTION.	Designed	N.K



Appendix G. Geotechnical Hazard Map



Pittwater Local Environment Plan 2014 - Geotechnical Hazard