BG &E

Project No: B16097

19 January 2018

NSW Department of Primary Industries Level 11 323 Castlereagh Street SYDNEY NSW 2000

Attention: Mitchell Isaacs

Dear Sir

CASUARINA TOWN CENTRE RESPONSE TO INFORMATION REQUEST DATED 30 MARCH 2016

Please find herein DPI Water's information request items and our responses. Where necessary we have attached supporting information to address the information request.

1. Groundwater

The modification seeks to replace the existing deep swale that traverses the site with a major stormwater pipe network. Modelling has been undertaken to determine the appropriate size of the proposed drainage system in accordance with Council requirements. Whilst DPI Water is not opposed to the piping of the swale, the report does not outline if groundwater will be intercepted as a result of these works. If there is the potential to intercept groundwater the proponent should contact DPI Water immediately. The proponent may be required to obtain a licence to account for any dewatering of groundwater associated with the works.

Please refer to the attached Acid Sulphate Soil Investigation Report prepared by Geotech Investigations PTY LTD on 18 July 2016. Section 4.2 states "Groundwater seepage was observed in boreholes BH 9 to BH 16 at between approximately 1.4 m and 2.1 m depth." BH 9 to BH 16 are all taken from the base of the existing swale in question. The base of the proposed culvert generally follows the existing base level of the swale. The downstream invert level of the culvert is RL3.12. Therefore we do not anticipate groundwater interception.

2. Acid Sulphate Soils

The document outlines that the subject site is mapped as containing Class 4 Acid Sulfate Soils. Pursuant to Clause 7.1 of the Tweed Local Environmental Plan an Acid Sulfate Soils Management Plan should be developed if works will disturb 2 metres below the natural ground surface or if works occur where the watertable is likely to be lowered more than 2 metres below the natural ground surface. The site is



proposed to be filled and minor works carried out as part of the development are not expected to exceed below 2 metres of the existing ground level.

Please refer to the attached Acid Sulphate Soil Investigation Report prepared by Geotech Investigations PTY LTD on 18 July 2016 which concludes no actions are required. The current development finished design levels do not exceed a depth of 2m below natural surface levels as shown in the survey model provided to BG&E by Newton Denny Chappelle Surveyors on 09 November 2016.

Yours faithfully for BG&E Pty Limited

Ben Keith

Pheith

Senior Civil Engineer

enc.



P 07 5523 3979 F 07 5523 3981 admin@geotechinvestigations.com

Our Ref: HT:jw: GI 2785-a

18 July 2016

Hutchinson Builders
PO Box 7056
TWEED HEADS SOUTH NSW 2486

REPORT ON ACID SULFATE SOILS INVESTIGATION
"CASUARINA TOWN CENTRE MOD10" CASUARINA WAY, CASUARINA

1. INTRODUCTION

This report details the results of an acid sulfate soils (ASS) investigation for the proposed residential subdivision "Casuarina Town Centre MOD10" at Casuarina Way, Casuarina. The proposed development is understood to comprise 92 residential and larger commercial allotments.

Earthworks for the development comprise the filling of the existing swale drain that traverses along the northern and western extremities of the site, requiring up to 4 m depth of fill, and bulk earthworks over the rest of the allotment to achieve the design levels typically between RL 6.5 m AHD and RL 9 m AHD. Stormwater and sewer pipelines are proposed to be installed along the existing swale, requiring installation excavations of between 1.5 m up to 5.5 m depth.

The scope of the services provided by Geotech Investigations Pty Ltd (GI) was to provide an assessment for the presence and severity of ASS, risk assessment for the disturbance of ASS (if any) and suggested management options.

The assessment for the presence of ASS has been undertake using the Acid Sulfate Soil Manual (Ref 1), "Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) In Queensland 1998" (Ref 2) and Laboratory Methods Guidelines (Ref 3).

2. SITE DESCRIPTION

The site is located on the eastern side of Casuarina Way, opposite the intersection with Grand Parade, and covers a plan area of 8.93 ha. The property is bounded to the east by the Pacific Ocean, and to the north and south by residential buildings. A 3 m to 5 m deep swale drain exists along the northern extremity of the site, traversing is general south to south western direction to Casuarina Way.



The site occupied by a stockpile of soil from previous stages of the Casuarina estate development, with approximately 100,00 m3 of soil covering the majority of the site, with a covering of unmaintained greases and shrubs.

3. REGIONAL GEOLOGY AND ACID SULFATE SOILS RISK MAPPING

Reference to geological mapping by the Geological Survey of New South Wales Coastal Quaternary Geology 1:100,000 series for Tweed Heads Area indicates the site is underlain by "Qhbd – Holocene dune ("marine sand)".

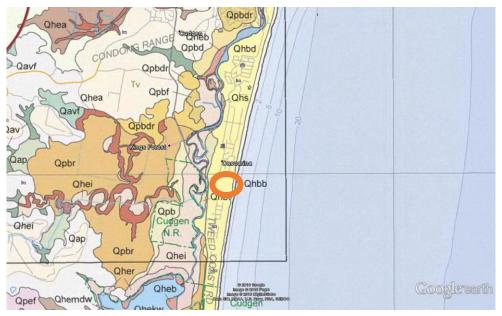


Figure 2: Excerpt from Coastal Quaternary Geology for Tweed Heads Region

Reference to the Acid Sulfate Soils Risk Map, Edition 2, for Cudgen region indicates the site is located within an area of "Disturbed Terrain with an elevation of >4m AHD.

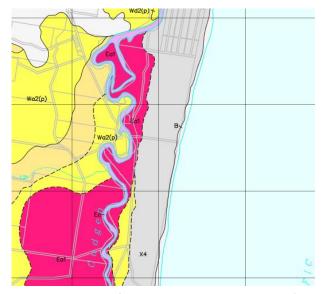


Figure 3: Excerpt from ASS Risk Map Edition 2 'Cudgen'





4. SITE INVESTIGATION

4.1 Field Work Methodology

Fieldwork was undertaken on the 21st to 24th of June 2016, and comprised the drilling and sampling of 21 boreholes, designated BH 1 to BH 21, using a 4wd mounted drill rig to the terminated depths between 3 m and 5.5 m depth.

Sampling locations were selected along the proposed pipeline alignment, being a lineal disturbance, at approximate 100 m intervals, with additional sampling locations on a grillage across the remainder of the site in order to comply with the suggested sampling locations in Acid Sulfate Soils Manual (i.e. 2 BHs/ha). Sampling depths were selected to generally achieve 1 m depth below the proposed excavation depth along the pipeline traverse, and a minimum of 3 m in other areas to account for near surface disturbances. Sampling through the existing stockpile was undertaken as this will be the source of the fill material for bulk earthworks.

Samples were carefully collected directly from the auger flights at approximately 0.5 m intervals of depth, and then sealed into plastic bags and placed on ice, before being delivered to the Tweed Heads South laboratory of Mazlab Pty Ltd for testing and analysis. The approximate location of the boreholes are shown on Site Plan S01 attached in Appendix A.

This investigation has been carried out generally in accordance with AS 1726 – 1993¹ in terms of soil description. The fieldwork was carried out by experienced geotechnical personnel, who positioned and logged the materials encountered in the boreholes, and collected the samples. At the completion of drilling, the boreholes were backfilled loosely with drill spoil.

4.2 Field Work Results

The results of the fieldwork are described in the form of Engineering Logs in Appendix B, along with explanatory notes. In summary, the subsurface conditions encountered in the boreholes can be described as **fill** comprising sand and silty sand over **alluvial** sands. Groundwater seepage was observed in boreholes BH 9 to BH 16 at between approximately 1.4 m and 2.1 m depth. Groundwater is affected by climatic conditions, varying soil permeability, and possibly tidal influences and the depth to groundwater will vary over time.



¹ Australian Standard AS 1726-1993 'Geotechnical site investigations', Standards Australia



5. LABORATORY TESTING

Laboratory screening tests for ASS were carried out in accordance with the Laboratory Methods Guidelines (Ref 3). samples recovered from the boreholes were screened by measurement of pH after the addition of water and then peroxide.

A Field pH test (pH_F) is the pH of a paste of soil mixed with distilled water, which indicates if oxidation of sulfides has occurred in the past. It does not detect any remaining sulphide material that may not have oxidised. Field Peroxide (pH_{FOX}) is used to identify an un-oxidised sulfate or sulfides. To test the oxidation potential of a soil, 30% hydrogen peroxide is added to the soil:water paste and the pH measured after reaction, with the reaction rate also recorded from nil to very high. More rigorous laboratory analysis by the Chromium Suite of tests then completed on selected samples.

Certificates of test results for screening ($pH_F \& pH_{FOX}$) and laboratory testing for the Chromium suite of tests carried out are attached as Appendix B.

6. COMMENTS

6.1 Discussion on Results

In accordance with the ASS Sampling and Analysis Guidelines:-

- pH_F <4 is considered to be an actual acid sulfate soil (AASS). Screening results for the 167 samples tested indicate pH_F ranged from 5.8 to 8.8 pH units, indicating that no previous oxidisation of sulfides had occurred, and the soil is not AASS;
- pH_{FOX} <3, as well as a change in pH between pH_F and pH_{FOX} of greater than 1 pH unit, and a strong reaction with peroxide, strongly indicates the presence of potential acid sulfate soil (PASS). pH_{FOX} values ranged between 3.6 and 7.0 pH units. Reaction rates were recorded as nil. These values indicate that none of the soil samples should be PASS.

The action criterion that triggers a requirement for ASS disturbance to be managed is derived when the existing acidity plus the potential acidity is greater than or equal to 18 mol H+/t or 0.03%S for all disturbances of sand. The analysis of the existing and potential acidity is derived from the results of laboratory analysis. In this case, Chromium suite of tests has been completed on 85 selected samples.

These results indicate the following results:-

- Potential Acidity is assessed as Chromium Reducible Sulfur (S_{CR}), with results on all samples
 tested were less than the reportable limit, and the action criteria was not exceeded, which
 indicates there is no oxidisable sulfur; and
- Existing Acidity is assessed from the Total Actual Acidity (TAA), and values ranged up to 0.02%S, with the action criteria not exceeded on any of the samples tested.





6.2 Presence and Likely Disturbance of ASS

The results indicate Acid Sulfate Soils have not been encountered at the locations sampled, in either the stockpile, existing filled soils or natural soils, and no specific management for the disturbance of ASS or acidic soils is required.

7. LIMITS OF INVESTIGATION

Recommendations given in this brief report are provided to assist the client with design decisions, and are based on the limited information supplied regarding the proposed construction in conjunction with the findings of this preliminary investigation. Any change in the construction type or building location may require additional testing and/or make recommendations invalid.

If you should require any further information or clarification, please do not hesitate to contact this office.

Yours faithfully For and on behalf of

Geotech Investigations Pty Ltd

<u>**Heath Thomas**</u> AdvDipEng(Civil), AMIEAust

Geotechnical Engineering Associate

James Walle RPEQ (15701), RPEng (Civil), B.Eng (Civil)

Senior Geotechnical Engineer

Appendix A: Site Plan S01

Appendix B: Engineering Logs - Borehole Profile BH 1 to BH 21

Geotechnical Report Standard Notes

Appendix C: Laboratory Test Results - Mazlab Pty Ltd



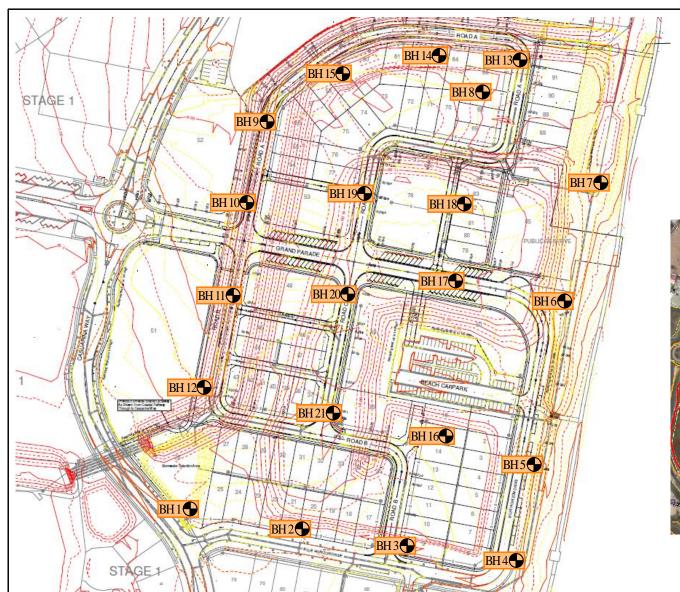


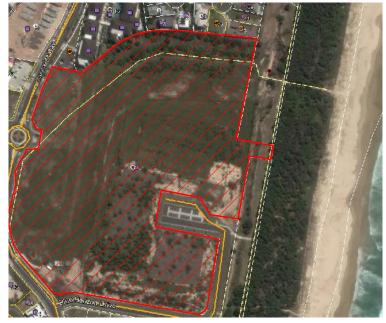


APPENDIX A

SITE PLAN S01







LOCALITY IMAGE

Locality Image courtesy of Google Earth & NSW Globe



Unit 3 / 42 Machinery Drive PO Box 6885 Tweed Heads South NSW 2486 PH: 0755 233 979 FAX: 0755 233 981

EMAIL: admin@geotechinvestigations.com WEB: www.geotechinvestigations.com

CLIENT: HUTCHINSON BUILDERS

PROPOSED RESIDENTIAL SUBDIVISION AT CASUARINA TOWN CENTRE MOD 10 -LOT 15 CASUARINA WAY, CASUARINA

DRAWING REF: S01: SITE PLAN

Borehole and Dynamic Cone Penetrometer Location

Site Plan provided by Newton Denny Chapelle Ref No.: 13054

APPROXIMATE NORTH

DATE: 21-24.06.2016

> OUR REF / JOB No.: GI 2785-a sp

DRAWN BY: DJB

Drawing not to scale. Printed dimensions only





APPENDIX B

HT:jw: GI 2785-a

ENGINEERING LOGS - BOREHOLE PROFILE BH 1 TO BH 21
GEOTECHNICAL REPORT STANDARD NOTES



Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

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Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

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Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

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Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

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Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

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Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

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		-														
		4.0_														
		_														
		-														
		4.5_														
BH		ERMINA METHOD	TED AT		· LIMIT (ATHERIN			ATION CONSISTENCY /	DENSITY /	BUCh	STRENG	TH.			SVIVI	PLES / TESTS
AD		Auger I	_	EW	Extrem		VS	Very Soft	D		Dense		U()		sturbe	d (size in mm)
C MS	;	Casing Mud St		HW DW	Highly Distinc	tlv	S F	Soft Firm	VD Fb		/ery De Friable	nse	D BS	Distu Bulk	irbed Sample	2
ΝN	ΛLC	Rock Co	oring	MW	Moder	ately	St	Stiff	ELv	v	Extreme		DCP	Dyna	mic Co	one Penetrometer
RR TC		Rock Ro Tri Cor		SW F	Slightly Fresh	′	VSt Hd	Very Stiff Hard	VLv Lw		/ery Lov .ow	N	SPT N			enetrometer Test blows for SPT / 300mm
WE	3	Wash E					VL	Very Loose	М		Medium	ı	VS	Vane	Shear	·
,		WATER Water Le	vel				L MD	Loose Medium Dens	H se VH		∃igh ∕ery Hig	gh	A PP			e Sample etrometer (kPa)
Ì		Water Se		Logge	d By:	DAW		Date:	21/06,			ecked By:	HT		Dat	
Form	n GI 00	3a Issue 2	2	- 86*					_, _,		1				1	,,

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

LIVOII	VLLKIIV	g LOG	- BOKE	HOLE P	KOFILL	-		GPS:	N:				E:
CLIEN	r : HUTCH	INSON E	BUILDERS					01 3.	141		BOREH		I. D. : BH 7
PROJE	CT: CASU	ARINA 1	OWN CEN	TRE MOD	10						JOB No	o.: GI	2785-a
			IDTECH 50			HOLF DIA	METER: 110	lmm			PAGE	: 1 of	1
1	1012101 11		101261130			HOLE DIA	WILLILIA II			1	IAGE	. 101	_
Water Method	Depth (m)	Graphic Log			Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows	Structure and additional observation
AD				ty SAND: Fi Dark grey	ine to coa	rse sand, With f	ine to mediu	m gravel,	,				FILL
	0.5_									A	\		
	- - -												
	1.0_		(SP) SAN	ND: Fine sa	nd, Moist	, Pale orange/bi	rown			Α	`		
	1.5_									Δ.			
	-		(SP) SAN	ND: Fine sa	nd, Moist	, Pale orange/bi	rown						ALLUVIUM
	2.0_									Α	۸		
	- 2.5_									A	λ		
	- - -												
	3.0_									Д	١		
	-												
	_												
	3.5_												
	4.0_												
	- - 4.5												
BH 7		TED AT	3.0m – LII										
AD C MS NMLC RR	METHOD Auger Casing Mud St Rock C Rock R	upport oring	HW H DW D MW M	HERING extremely ighly istinctly loderately ightly	VS S F St VSt	CONSISTENCY / D Very Soft Soft Firm Stiff Very Stiff	DENSITY / ROC D VD Fb ELW VLW	K STRENG Dense Very Der Friable Extreme Very Lov	nse ly Low	U() D BS DCP SPT	Distu Bulk S Dyna	sturbed rbed Sample mic Co	PLES / TESTS d (size in mm) e one Penetrometer enetrometer Test
TC WB	Tri Cor Wash E WATER	ne Bore		resh	Hd VL L	Hard Very Loose Loose	Lw M H	Low Medium High	ı	N VS A	Numl Vane Acid S	ber of Shear Sulfate	blows for SPT / 300mm
▼	Water Le Water Se	F	Lace: 15	5	MD	Medium Dense	VH	Very Hig		PP	Pocke		etrometer (kPa)
	003a Issue 2		Logged B	y: DAW	v	Date:	22/06/16	Che	ecked By:	НТ		Dat	e: 28/06/16

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

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				IOLE P		_		GPS:	N:				E:
CLIEN	T : HUTCH	INSON E	BUILDERS					013.	14.		BOREH		I. D. : BH 8
PROJE	CT: CASU	ARINA 1	OWN CENT	RE MOD :	10						JOB No	o.: GI	2785-a
			DTECH 500			HOLE DIAN	/JETER: 11(lmm			PAGE		
T T	T T		1			HOLL DIAN	ALILIA. II.	'''''	1.		1 AGE	. 101	
Water	Depth (m)	Graphic Log			Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows	Structure and additional observation
AD	_ 		(SM) Silty Moist, Da		ne to coa	arse sand, With fi	ne to mediu	m gravel,					FILL
	0.5_									А			
	- - -												
	1.0_		(SP) SANE): Fine sar	nd, Moist	t, Pale orange/bro	own			A	`		
	- 1.5_									А			
	_ 		(SP) SANE): Fine sar	nd, Moist	t, Pale orange/bro	own						ALLUVIUM
	2.0_									А			
	- -												
	2.5_									А	\		
	3.0									А			
	_												
	-												
	3.5_												
	- 4.0_												
	- - -												
	4.5_												
BH 8 1	TERMINA METHOD	TED AT	3.0m – LIM WEATHE			ATION CONSISTENCY / DE	ENSITY / ROC	K STRFNG	TH			SAME	PLES / TESTS
AD C MS	Auger Casing Mud Si		EW Ext	remely	VS S F	Very Soft Soft Firm	D VD Fb	Dense Very Der Friable		U() D BS	Distu	sturbe	d (size in mm)
NMLC RR TC	Rock C Rock R Tri Cor	oring oller	MW Mo	derately htly	St VSt Hd	Stiff Very Stiff Hard Very Loose	ELw VLw Lw	Extreme Very Low Low Medium	v	DCP SPT N	Dyna Stand Numl	mic Co dard Pe ber of I	one Penetrometer enetrometer Test blows for SPT / 300mm
WB ▼	Wash E WATER Water Le	vel			VL L MD	M H VH	h	VS A PP	Acid S		e Sample etrometer (kPa)		
•	Water Se	epage	Logged By:	DAW	<u> </u>	Date:	22/06/16	Che	cked By:	НТ		Dat	e: 28/06/16

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

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LIV	JIIV	LLINIIN	g LOG	- 501	\LI IOL	E PROF	ILL			G	SPS:	N:			1	E:
CLI	ENT:	: HUTCH	INSON E	BUILDERS	 S						JF 3.	IV.		BORE		I. D. : BH 9
					ENTRE M	OD 10										2785-a
		ΛΕΝΤ ΤΥ						HOLE DIA	METER: 110)mm	<u> </u>			PAGE		
				1												
Method	Water	Depth (m)	Graphic Log			N	Material [Description				Consistency / Rel. Density	Test	Sample /	DCP Blows	Structure and additional observation
AD		_		(SP) S	AND: Fin	e sand, M	oist, Pale	orange/br	rown							ALLUVIUM
		-														
		0.5_											F	۸		
		_														
		_														
		1.0_											A	4		
		_														
		_														
		1.5_											A	١		
	•	-														
	•	_		(SP) S	AND: Fin	e sand, W	et, Pale o	orange/bro	wn							
		2.0_											Å	.		
		_														
		-														
		2.5_											A	١		
		_														
		_														
		3.0_											A	١		
		_														
		-														
		3.5_											A	4		
		-														
		_														
		4.0_											Å	4		
		_														
													,			
ВН	9 TE	4.5_ RMINA	TED AT	4.5m –	LIMIT O	F INVEST	IGATIO	N					P	١	ļ	
AD	ľ	METHOD Auger (THERING		CONS		ENSITY / ROC	K STF Den			U()	المما ا		PLES / TESTS d (size in mm)
С		Casing	_	HW	Highly	S	Soft		VD	Ver	y Dense		D	Distu	rbed	
MS NM		Mud St Rock Co		DW MW	Distinctly Moderate		Firm Stiff		Fb ELw	Fria Extr	ible remely Lo	ow	BS DCP		Sample mic Co	e ine Penetrometer
RR		Rock Ro	oller	SW	Slightly	VSt	Very	Stiff	VLw	Ver	y Low		SPT	Stand	dard Pe	enetrometer Test
TC WB	3	Tri Cor Wash E		F	Fresh	Hd VL	Hard Very	Loose	Lw M	Low Med	v dium		N VS		ber of l Shear	blows for SPT / 300mm
_		WATER Water Le				L MD	Loos	e lium Dense	H VH	Higl Ver	h y High		A PP			Sample etrometer (kPa)
*		Water Le		Logged	Вv: г	DAW	Da		22/06/16	V C1	Checke	ed Bv:	HT	1 0000	Dat	
Form	GI 00	3a Issue 2	<u> </u>	00-4	-,				, 55, 10						1 - 46	

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EIN	GIN	IEEKIIN	g LOG	– во	REHOL	E Pr	OFIL	Ē		GPS:	N:				E:
CI	IFNT	: HUTCH	INSON P	LUII DEI	RS					GF3.	IV.		BORFI		I.D.: BH 10
					CENTRE M	OD 1	0								2785-a
-						001									
EC	JUIP	MENT TY	PE: MAI	DIECH	1 500			HOLE DIA	METER: 11	Umm			PAGE	: 1 of	2
Method	Water	Depth (m)	Graphic Log				Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation
AD		_		(SP)	SAND: Fin	e san	d, Mois	t, Pale orange/br	own						ALLUVIUM
		_													
		_													
		0.5_										A	١		
		_													
		_													
		1										Δ.			
		1.0_											`		
		_													
		_													
		1.5_										Д	١		
		_													
	•	_		(SD)	SAND: Ein	o can	d Wat	Pale orange/bro	w/n						
				(31)	SAND. TIII	C Sain	u, wet,	raie orange/bro	vvii						
		2.0_										Α.	١.		
		_													
												_			
		2.5_										Α	١		
		_													
		_													
		3.0_										Д	١		
		_													
		_													
		-													
		3.5_										Д	١		
		_													
		-													
		4.0_										Α	١		
		-													
		_													
		_ 4.5_										A	١		
Со		ied on Pa	ge 2								1			·	
AD		METHOD Auger (Orillina.	WE EW	ATHERING Extremel		VS	CONSISTENCY / D Very Soft	ENSITY / ROO D	CK STRENGTH Dense	1	U()	المما ا		PLES / TESTS d (size in mm)
C	,	Casing	-	HW	Highly	У	v 3 S	Soft	VD	Very Dense	2	D D		ırbed	u (size iii iiiii)
MS		Mud St	upport	DW	Distinctly		F C+	Firm	Fb	Friable		BS		Sample	
NN RR	ИLC	Rock Co Rock Ro		MW SW	Moderat Slightly	ely	St VSt	Stiff Very Stiff	ELw VLw	Extremely Very Low	LOW	DCP SPT			one Penetrometer enetrometer Test
TC		Tri Cor		F	Fresh		Hd	Hard	Lw	Low		N	Num	ber of	blows for SPT / 300mm
W	В	Wash E	Bore				VL L	Very Loose Loose	M H	Medium High		VS A		Shear	e Sample
,	•	WATER Water Le	vel				MD	Medium Dense	VH	Very High		PP			etrometer (kPa)
	>	Water Se	<u> </u>	Logge	ed By:	DAW		Date:	22/06/16	Check	ed By:	HT		Dat	
Forn	n GI 0	03a Issue 2	<u> </u>	30	•			1	, -,		•				, · · · , · ·

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	JIIV	ILLIXIIA	G LOG	Ю	\LIIO	LL F	ROFILE	-		GPS:	N:				E:
CL	IENT	: HUTCH	INSON E	BUILDERS						GF3.	IV.		BORE		I.D.: BH 10
		CT: CASU				MOD	10								2785-a
						IVIOD		HOLE DIAM	4FTFD: 11/	D					
EC	UIPI	MENT TY	PE: IVIA	T TECH S	500			HOLE DIAM	VIETER: 110	Jmm			PAGE	: 2 of	2
Method	Water	Depth (m)	Graphic Log				Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation
AD		_		(SP) S	SAND: F	ine sar	nd, Wet,	Pale orange/brov	vn						ALLUVIUM
		_													
		5.0_											4		
		_													
		_													
		5.5_													
		_													
		_													
		_													
		6.0_													
		_													
		-													
		6.5_													
		_													
		_													
		_													
		7.0_													
		_													
		_													
		7.5_													
		_													
		_													
		8.0_													
		_													
		_													
		8.5_													
		_													
		_													
		9.0_													
BH		TERMIN	ATED A												
AD		METHOD Auger	Drilling	WEA EW	THERIN Extrem		VS	CONSISTENCY / DI Very Soft	ENSITY / ROC D	CK STRENGTH Dense	i	U()	Und		PLES / TESTS d (size in mm)
С		Casing		HW	Highly	-	S	Soft	VD	Very Dense	9	D	Dist	urbed	
MS NN	i 1LC	Mud Si Rock C		DW MW	Distinc Moder		F St	Firm Stiff	Fb ELw	Friable Extremely	Low	BS DCP		Sample amic Co	e one Penetrometer
RR		Rock R	oller	SW	Slightly		VSt	Very Stiff	VLw	Very Low		SPT	Stan	dard Pe	enetrometer Test
TC WE	3	Tri Cor Wash E		F	Fresh		Hd VL	Hard Very Loose	Lw M	Low Medium		N VS		iber of e Shear	blows for SPT / 300mm
		WATER					L MD	Loose	H VH	High		A PP			e Sample
\ \		Water Le Water Se		Logge	I D	DAVA		Medium Dense		Very High	rad Dv	HT		Dat	etrometer (kPa)
		03a Issue 2		Logged	і ру:	DAW		Date:	22/06/16	Спеск	ed By:	ні		Dat	e: 28/06/16

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Ph: 0755 233 979 Fax: 0755 233 981

CLIENT: HUTCHINSON BUILDERS	GPS: N: E:
PROJECT: CASUARINA TOWN CENTRE MOD 10	JOB No.: GI 2785-a
EQUIPMENT TYPE: MAIDTECH 500 HOLE DIAMETER: 13	
Method Water Water Method Method Method Material Description	Consistency Consistency Rel. Density Consistency Rel. Density Rel. Den
(SP) SAND: Fine sand, Trace of silt, Moist, Grey	FILL
(SP) SAND: Fine sand, Moist, Pale orange/brown	ALLUVIUM
0.5_	A
1.0_	A
► 1.5_ (SP) SAND: Fine sand, Wet, Pale orange/brown	A A
(SP) SAND. Fille Salid, Wet, Pale Grange/brown	
-	
2.0_	Α
-	
2.5_	A
3.0_	A
3.5_	A
-	
4.0_	Α
4.5	A
BH 11 Continued on Page 2	
METHOD WEATHERING CONSISTENCY / DENSITY / RO AD Auger Drilling EW Extremely VS Very Soft D	CK STRENGTH SAMPLES / TESTS Dense U() Undisturbed (size in mm)
C Casing HW Highly S Soft VD	Very Dense D Disturbed
MS Mud Support DW Distinctly F Firm Fb NMLC Rock Coring MW Moderately St Stiff ELw	Friable BS Bulk Sample Extremely Low DCP Dynamic Cone Penetrometer
RR Rock Roller SW Slightly VSt Very Stiff VLw	Very Low SPT Standard Penetrometer Test
TC Tri Cone F Fresh Hd Hard Lw	Low N Number of blows for SPT / 300mm
WB Wash Bore VL Very Loose M	Medium VS Vane Shear
WATER L Loose H	High A Acid Sulfate Sample
▼ Water Level MD Medium Dense VH	Very High PP Pocket Penetrometer (kPa)
► Water Seepage Logged By: DAW Date: 22/06/16	Checked By: HT Date: 28/06/16
orm GI 003a Issue 2	- 1

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

EIN	GIN	IEERIN	G LOG	– во	KEHC)LE P	KUFILI			GPS:	N:				E:
CLI	IENT	: HUTCH	IINSON I	BUILDEF	RS					GF3.	IV.		BORE		I.D.: BH 11
		CT: CASU				MOD	10								2785-a
						IVIOD		HOLE DIAM	4FTFD: 11/	D					
EQ	UIPI	MENT TY	PE: IVIA	IDIECH	500			HOLE DIAN	METER: 110	Jmm			PAGE	: 2 of	
Method	Water	Depth (m)	Graphic Log				Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation
AD		_		(SP)	SAND: I	ine sar	nd, Wet,	Pale orange/brov	vn						ALLUVIUM
		_													
-		5.0_										/	4		
		_													
		_													
		5.5_													
		_													
		_													
		_													
		6.0_													
		_													
		_													
		6.5_													
		_													
		_													
		_													
		7.0_													
		_													
		_													
		7.5_													
		_													
		-													
		_													
		8.0_													
		-													
		8.5_													
		_													
		_													
		_													
ВН	11	9.0_ TERMIN	ATED A	 T 5.0m	– LIMI	T OF II	NVESTIG	GATION							
		METHOD		WE	ATHERII	NG	(CONSISTENCY / DI			ł				PLES / TESTS
AD C		Auger Casing		EW HW	Extrer Highly	-	VS S	Very Soft Soft	D VD	Dense Very Dense	2	U() D		isturbed urbed	d (size in mm)
MS		Mud Si	upport	DW	Distin	ctly	F	Firm	Fb	Friable		BS	Bulk	Sample	
NIV RR		Rock C Rock R	_	MW SW	Mode Slightl		St VSt	Stiff Very Stiff	ELw VLw	Extremely Very Low	Low	DCP SPT			one Penetrometer enetrometer Test
TC		Tri Cor		F	Fresh	7	Hd	Hard	Lw	Low		N	Num	ber of	blows for SPT / 300mm
WB	3	Wash E	Bore				VL L	Very Loose Loose	M H	Medium High		VS A		Sulfate	e Sample
•	,	WATER Water Le	vel				MD	Medium Dense	VH	Very High		PP			etrometer (kPa)
•	•	Water Se		Logge	d By:	DAW	l	Date:	22/06/16	Check	ed By:	HT		Dat	e: 28/06/16
Form	GI 00	03a Issue 2	2					1		1	•				

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			- BOREHO	/LL		_		GPS:	N:				E:
CLIEN	T: HUTCH	INSON BL	ILDERS						<u>I</u>		BORE	HOLE I	. D. : BH 12
PROJE	CT: CASU	ARINA TO	WN CENTRE	MOD :	10						JOB N	o. : GI	2785-a
EQUIF	PMENT TY	PE: MAID	TECH 500			HOLE DIAI	METER: 11	0mm			PAGE	: 1 of	1
Water	Depth (m)	Graphic Log			Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation
<u> </u>	_ _		(SM) Silty SA Moist, Dark		ne to coa	arse sand,With fi	ne to mediu	m gravel,					FILL
	0.5_ - -		(SP) SAND:	Fine sar	nd, Moist	t, Pale orange/br	own			A	A		ALLUVIUM
	1.0_ - - -									A	A		
•	1.5_ - -		(SP) SAND:	Fine sar	nd, Moist	t, Pale orange/br	own			A	A		
	- 2.0_ - -									F	A		
	- 2.5_ - -									A	A		
	3.0_ - - -									F	A		
	3.5_ - -									A	A		
	4.0_ - - -									A	A		
BH 12	4.5_ TERMINA	ATED AT	4.5m – LIMI	IT OF IN	NVESTIC	GATION				F	A		
AD C MS NMLC RR TC WB	METHOD Auger IC Casing Mud Su Rock Cc Rock Rc Tri Con Wash B WATER Water Lev	Orilling E Inpport E Oring N Oller S e F oore	WEATHERII W Extrer W Highly DW Distin WW Mode W Slight	NG mely / ctly erately ly		CONSISTENCY / D Very Soft Soft Firm Stiff Very Stiff Hard Very Loose Loose Medium Dense	ENSITY / ROO D VD Fb ELW VLW LW M H VH	CK STRENGTH Dense Very Dense Friable Extremely I Very Low Low Medium High Very High	:	U() D BS DCP SPT N VS A	Distu Bulk Dyna Stan Num Vane Acid	sturbed Sample Sample amic Co dard Pe ber of l Shear Sulfate	PLES / TESTS d (size in mm) e one Penetrometer enetrometer Test blows for SPT / 300mm e Sample etrometer (kPa)
•	Water See		ogged By:	DAW		Date:	23/06/16		ed By:	HT		Dat	

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

CLII	FNT	: HUTCH	INSON F	RIIII DE	RS					GPS:	N:		BORE		E: I.D.: BH 13
					CENTRE MO	OD 10									2785-a
						JD 10									
QU	UIPN	MENT TY	PE: MA	IDTECH	1 500			HOLE DIAN	IETER: 11)mm	<u> </u>	1	PAGE	: 1 of	1
	Water	Depth (m)	Graphic Log				Mater	rial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation
				(SP)	SAND: Fine	sand, N	∕loist,	Dark grey							FILL
		_													
		0.5_										,	4		
				(SP)	SAND: Fine	sand, N	∕loist,	Pale orange/bro	wn						ALLUVIUM
		_													
		1.0_										,	Д		
		_													
		_													
		1.5_										,	Δ.		
		_													
		_													
		2.0_										,	4		
	•	2.0_										'	٦.		
		_		(SP)	SAND: Fine	sand, V	Vet, Pa	ale orange/brow	'n						
													_		
		2.5_										<i>'</i>	4		
		_													
		_													
_		3.0_										,	4		
		_													
		_													
		3.5_													
		_													
		_													
		4.0_													
		_													
		4.5_													
вн		TERMIN	ATED A		– LIMIT O	F INVE									
٩D	ľ	METHOD Auger [Orilling	EW	EATHERING Extremely	, VS		DNSISTENCY / DE Very Soft	NSITY / ROC D	K STRENO Dense	STH	U()	Undi		PLES / TESTS d (size in mm)
2		Casing	_	HW DW	Highly Distinctly	S F	9	Soft Firm	VD Fb	Very De Friable	ense	D BS	Dist	urbed Sample	
MS NM	LC	Mud Su Rock Co	oring	MW	Moderate	ely St	9	Stiff	ELw	Extreme		DCP	Dyna	amic Co	one Penetrometer
RR FC		Rock Ro Tri Con		SW F	Slightly Fresh	VS ¹ Hd		Very Stiff Hard	VLw Lw	Very Lo	w	SPT N			enetrometer Test blows for SPT / 300mm
WB		Wash B		•	116311	VL	`	Very Loose	М	Mediun	n	VS	Vane	e Shear	
•		WATER Water Le	vel			L M		Loose Medium Dense	H VH	High Very Hig	gh	A PP			e Sample etrometer (kPa)
•		Water Se		Logge	d Bv:	AW		Date:	23/06/16	1	ecked By:	HT		Dat	

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

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ENGI	NEERIN	G LOG	- bUi	KEHU	LE P	KUFILI	=			GPS:	N:				E:
CLIEN	I T : HUTCH	IINSON E	BUILDER	S						dr3.	14.		BORE	I	I.D.: BH 14
	ECT: CASU				MOD :	10									2785-a
							HOLE D	IANAET	ED: 11)mm				: 1 of	
EQUI	PMENT TY	PE: IVIA	T T	500			HOLE D	IAIVIEI	EK: 110	ווווווו		<u> </u>	PAGE	101	1
Water	Depth (m)	Graphic Log				Mat	erial Descriptio	on			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation
AD	_		(SP) S	SAND: F	ine sar	nd, Moist	, Pale orange/	brown'							ALLUVIUM
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	_		(SP) S	SAND: F	ine sar	nd, Wet,	Pale orange/b	rown							
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BH 14	4 TERMIN METHOD	ATED A		- LIMIT ATHERIN			CONSISTENCY /	/ DFNSI	TY / ROO	K STRFNGTI	H			SAME	PLES / TESTS
AD	Auger	Drilling	EW	Extrem	nely	VS	Very Soft		D	Dense		U()		isturbe	d (size in mm)
C MS	Casing Mud S	g upport	HW DW	Highly Distinc		S F	Soft Firm		VD Fb	Very Dens Friable	e	D BS		urbed Sample	9
NMLC	Rock C	oring	MW	Moder	rately	St	Stiff		ELw	Extremely	Low	DCP	Dyna	amic Co	one Penetrometer
RR TC	Rock R Tri Co		SW F	Slightly Fresh	У	VSt Hd	Very Stiff Hard		VLw Lw	Very Low Low		SPT N			enetrometer Test blows for SPT / 300mm
WB	Wash					VL	Very Loose		M	Medium		VS	Vane	e Shear	
•	WATER Water Le	evel				L MD	Loose Medium Dens	se	H VH	High Very High		A PP			e Sample etrometer (kPa)
>	Water Se		Logged	l By:	DAW	,	Date:	23	/06/16		ked By:	HT		Dat	
orm GI	003a Issue	2	30	•			1								

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

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INGII	NEERIN	G LOG	- DUN	EHU	LE PI	NOFILE				GPS:	N:				E:
CLIEN	T : HUTCH	IINSON E	UILDERS	;						GF3.	14.		BORE		I.D.: BH 15
	CT: CASU				MOD 1	10									2785-a
					VIOD .	10	11015.0		FD. 44						
EQUIF	PMENT TY	PE: MA	DIECH 5	00			HOLE D	IAIVIEI	ER: 110	Jmm 			PAGE	: 1 of	1
Water	Depth (m)	Graphic Log				Mat	erial Descriptio	on			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation
<u>A</u>	_		(SP) S/	AND: Fi	ne sar	nd, Moist	, Pale orange	/brown							ALLUVIUM
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	_		(SP) S/	AND: Fi	ne sar	nd, Wet,	Pale orange/b	rown							
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BH 15	METHOD	ATED A		LIMIT THERING			CONSISTENCY	/ DENICI	TV / DO	V CTDENICT	<u> </u>	1		CANAF	PLES / TESTS
AD	Auger	Drilling		Extreme		VS	Very Soft	, DENSI	D D	Dense	1	U()	Undi		d (size in mm)
C	Casing			Highly	.lv	S	Soft		VD Th	Very Dens	e	D	Dist	urbed	
MS NMLC	Mud Si Rock C			Distinct Modera		F St	Firm Stiff		Fb ELw	Friable Extremely	Low	BS DCP		Sample amic Co	e one Penetrometer
RR	Rock R	oller	SW	Slightly		VSt	Very Stiff		VLw	Very Low		SPT	Stan	dard Pe	enetrometer Test
TC WB	Tri Cor Wash I		F	Fresh		Hd VL	Hard Very Loose		Lw M	Low Medium		N VS		nber of e Shear	blows for SPT / 300mm
VVD	WATER	אטופ				L	Loose		Н	High		Α	Acid	Sulfate	e Sample
▼	Water Le					MD	Medium Den	se	VH	Very High		PP			etrometer (kPa)
•	Water Se	epage	Logged	Ву:	DAW	1	Date:	23	/06/16	Chec	ked By:	НТ		Dat	:e: 28/06/16
rm GI	003a Issue	<u> </u>					1				-			1	

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

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			G – BC						G	PS: N:				E:
CLIEN	IT: H	IUTCHINSO	N BUILDE	RS								BORE	HOLE	I.D.: BH 16
PROJI	ECT:	CASUARIN	A TOWN	CENTRE	MOD :	10						JOB N	lo.: GI	2785-a
EQUI	PME	NT TYPE: N	1AIDTECH	1 500			HOLE DIAI	METER: 1	10mm			PAGE	: 1 of	2
		ا ا								/ _F C				
Water		Graphic Log Depth (m)				Mat	terial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additiona observation
;		_	(SP)	SAND:	Fine sar	nd, Mois	t, Pale orange/br	own						FILL
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		2.5_	(SP)) SAND: I	Fine sar	id, Wet,	Orange/brown					A		ALLUVIUM
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		_	(SP)	SAND:	Fine sar	nd, Wet,	Pale orange/bro	wn				•		
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DU 16		4.5_ tinued on Po	100 3									A		
<u> </u>		THOD	-	EATHERII	NG		CONSISTENCY / D	ENSITY / RO	OCK STR	ENGTH			SAME	PLES / TESTS
AD C		Auger Drilling Casing	EW HW	Extrer Highly		VS S	Very Soft Soft	D VD	Den: Verv	se , Dense	U() D		isturbed urbed	d (size in mm)
MS	ı	Mud Support	DW	Distin	ctly	F	Firm	Fb	Frial	ole	BS	Bulk	Sample	
NMLC RR		Rock Coring Rock Roller	MW SW	Mode Slightl	rately Iv	St VSt	Stiff Very Stiff	ELw VLw		emely Low v Low	DCP SPT			one Penetrometer enetrometer Test
TC	-	Tri Cone	F	Fresh		Hd	Hard	Lw	Low		N	Num	ber of	blows for SPT / 300mm
WB		Wash Bore ATER	4			VL L	Very Loose Loose	M H	Med High	lium ı	VS A		Shear Sulfate	e Sample
•	Wa	ater Level				MD	Medium Dense	VH	_	· · High	PP			etrometer (kPa)
>	Wa	ater Seepage	Logge	ed By:	DAW	'	Date:	23/06/1	6	Checked By:	НТ		Dat	e: 28/06/16

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

EING	IIIVI	EEKIN	G LOG	- bC	KEHU	ILE P	NOFILE	1		Г	GPS:	N:				E:	
CLIE	NT:	HUTCH	INSON	BUILDE	RS					`	JF 3.	IV.		BOREI		I.D.: BH 1	 ĵ
		T: CASU				MOD 1	10									2785-a	
						WIOD .		HOLEDIA	NACTED: 11/	· · · · · ·							
EQU	JIPIV	IENT TY	PE: IVIA	TOTECH	1 500			HOLE DIA	METER: 110	JMIT				PAGE	: 2 of	2	
Method	Water	Depth (m)	Graphic Log				Mate	erial Description				Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm		and additional ervation
AD		_		(SP)	SAND: F	ine sar	nd, Wet, F	Pale orange/bro	wn							ALLUVIUM]
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ВН			ATED A				VESTIG										
AD	Ν	ΛΕΤΗΟD Auger	Drillinø	WE EW	EATHERIN Extren		VS (CONSISTENCY / D Very Soft	ENSITY / ROC D	K STI Der			U()	Undi		PLES / TESTS d (size in mm)
С		Casing		HW	Highly		S	Soft	VD	Ver	y Dense		D	Distu	ırbed		,
MS NMI	C	Mud Si Rock C		DW MW	Distino Mode		F St	Firm Stiff	Fb ELw		able remely Lo	ow	BS DCP		Sample mic Co	e one Penetron	neter
RR		Rock R	oller	SW	Slightl		VSt	Very Stiff	VLw	Ver	y Low		SPT	Stan	dard Pe	enetrometer	Test
TC WB		Tri Cor Wash E		F	Fresh		Hd VL	Hard Very Loose	Lw M	Lov Me	v dium		N VS		ber of Shear	blows for SP	Γ / 300mm
VVD	,	WATER	יטופ				L	Loose	Н	Hig	h		Α	Acid	Sulfate	Sample	
V		Water Le					MD	Medium Dense	VH	Ver	y High		PP			etrometer (k	
>		Water Se		Logge	ed By:	DAW		Date:	23/06/16		Checke	d By:	HT		Dat	e:	28/06/16
Form (GI 00	3a Issue 2	2														

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

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										G	iPS: N:				E:
CLIE	NT:	: HUTCHI	NSON B	UILDER	S								BORE	HOLE	I. D. : BH 17
PRO	JEC	T: CASUA	RINA T	OWN C	ENTRE	MOD:	10						JOB N	lo.: GI	2785-a
FOU	JIPN	MENT TYP	E: MAII	DTECH	500			HOLE DIAM	METER: 1	0mm			PAGI	E: 1 of	2
1	,	J		T CIT				HOLE DIAI	VILILIA I	.0111111			1 40.	1	
No+bod	Water	Depth (m)	Graphic Log				Ma	terial Description			/ Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additiona observation
		_		(SP) S	SAND: I	Fine sar	nd, Mois	t, Orange/brown							FILL
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BH 1	17 C	ontinued o	on Page	2							L				
	N	METHOD			ATHERII		\ (C	CONSISTENCY / DI							PLES / TESTS
AD C		Auger Dr Casing	rilling	EW HW	Extrer Highly	-	VS S	Very Soft Soft	D VD	Der Ver	ise y Dense	U()		listurbe urbed	d (size in mm)
MS		Mud Sup	port	DW	Distin		F	Firm	Fb	Fria		BS		Sample	2
NML	.C	Rock Cor	ring	MW	Mode	rately	St	Stiff	ELw		emely Low	DCP			ne Penetrometer
RR		Rock Rol		SW F	Slightl Fresh	У	VSt Hd	Very Stiff Hard	VLw Lw	Ver Low	y Low ,	SPT N			enetrometer Test blows for SPT / 300mm
ΓC WB		Tri Cone Wash Bo		1	116211		VL Ha	Very Loose	M		<i>'</i> dium	VS		nber of e Shear	
		WATER					L	Loose	Н	Hig	h	Α	Acid	l Sulfate	Sample
▼		Water Leve	_				MD	Medium Dense	VH	Ver	y High	PP	Pocl	ket Pen	etrometer (kPa)
ightharpoons		Water See	page	Logged	d By:	DAW	/	Date:	24/06/1	5	Checked B	y: H	Т	Dat	e: 28/06/16

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

	UIIV	EEKIN	G LOC		ILLIO	LL 1 1	VOI ILL	-		T (GPS:	N:				E:	
CLI	IENT:	: HUTCH	IINSON I	BUILDER	RS						JF 3.	14.		BOREI		. D. : BH 1	 17
PR	OJEC	T: CASU	JARINA ⁻	TOWN (CENTRE	MOD :	10									2785-a	
		MENT TY						HOLF DIA	METER: 110	lmr	า				: 2 of		
				T				HOLL DIA	WILLIEM, II	,,,,,,				TAGE			
Method	Water	Depth (m)	Graphic Log				Mate	erial Description				Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm		and additional servation
AD		_		(SP)	SAND: F	ine sar	ıd, Moist	, Orange/brown	I							FILL	
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ВН		TERMIN. METHOD	ATED A		– LIMIT ATHERIN			CONSISTENCY / D	ENCITY / POO	ע כדי	DENICTU	1			CANAF	PLES / TESTS	•
AD		Auger	-	EW	Extrem		VS	Very Soft	D	Dei	nse		U()		sturbe	d (size in m	
C MS	:	Casing Mud Si		HW DW	Highly Distinc	tlv	S F	Soft Firm	VD Fb		ry Dense able		D BS		irbed Sample	2	
NM	1LC	Rock C	oring	MW	Moder	ately	St	Stiff	ELw	Ext	remely Lo	ow	DCP	Dyna	mic Co	ne Penetro	
RR TC		Rock R Tri Cor		SW F	Slightly Fresh	′	VSt Hd	Very Stiff Hard	VLw Lw	Ver Lov	ry Low w		SPT N			enetromete blows for SI	r Test PT / 300mm
WE	3	Wash E					VL	Very Loose	М	Me	edium		VS	Vane	Shear		,
•		WATER Water Le	vel				L MD	Loose Medium Dense	H VH	Hig Ver	gh ry High		A PP			Sample etrometer (l	kPa)
•		Water Se		Logge	d Bv:	DAW		Date:	24/06/16	1	Checke	ed By:	HT		Dat		28/06/16
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Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

FIN	GIN	IEERIN	g rog	– вс	KEHU	LE P	KUFILI	<u> </u>		GPS:	N:				E:
CLI	ENT	: HUTCH	INSON E	BUILDE	RS					urs.	14.		BOREI		I. D. : BH 18
		CT: CASU				MOD	10								2785-a
						IVIOD .	10								
EQ	UIPI	MENT TY	PE: MA	DIECH	500			HOLE DIA	METER: 110	Jmm]	PAGE	: 1 of	2
Method	Water	Depth (m)	Graphic Log				Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation
AD		_		(SP)	SAND: F	ine sar	nd, Moist	t, Orange/brown							FILL
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5,1		METHOD	J r uge		ATHERIN	lG		CONSISTENCY / D	ENSITY / ROC	CK STRENGTH	l				PLES / TESTS
AD		Auger	_	EW	Extrem	•	VS	Very Soft	D	Dense		U()			d (size in mm)
C MS		Casing Mud Si		HW DW	Highly Distinc		S F	Soft Firm	VD Fb	Very Dense Friable	:	D BS		irbed Sample	2
NM	1LC	Rock C	oring	MW	Moder	rately	St	Stiff	ELw	Extremely I	Low	DCP	Dyna	mic Co	ne Penetrometer
RR TC		Rock R		SW F	Slightly Fresh	У	VSt Hd	Very Stiff Hard	VLw Lw	Very Low Low		SPT N			enetrometer Test blows for SPT / 300mm
WE	3	Wash E		•	116311		VL	Very Loose	M	Medium		VS	Vane	Shear	•
		WATER					L	Loose	Н	High		A			Sample
V		Water Le Water Se	F		.l. F	D ***	MD,	Medium Dense	VH	Very High		PP	POCK		etrometer (kPa)
		03a Issue 2		Logge	a By:	DAW	<u>'</u>	Date:	24/06/16	Check	ed By:	HT		Dat	e: 28/06/16
OLLU	יטו טו	osa issue i	<u>.</u>												

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Ph: 0755 233 979 Fax: 0755 233 981

LING	1141	LLIVIIV	d LOC	- 50	MLIIC	/LL P	KOFILE	-		Г	GPS:	N:				E:		
CLIE	NT:	HUTCH	INSON I	BUILDE	RS					`	JF 3.	14.		BORE		. D. : BH	18	
		T: CASU				MOD 1	10									2785-a		
						10100		HOLEDIA	NACTED: 110) ma ma								
EQU	IPIV	IENT TY	PE: IVIA	TOTECH	1 500			HOLE DIA	METER: 110	ımırı				PAGE	: 2 of			
Method	Water	Depth (m)	Graphic Log				Mate	erial Description				Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm		e and additic oservation	onal
AD		_		(SP)	SAND: F	ine sar	nd, Moist	, Pale orange/br	own							FILL		
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BH 1	L8 T		ATED A	T 5.5m	– LIMI	T OF II	NVESTIG	ATION							<u> </u>			
		/ETHOD		WE	ATHERIN	NG	(CONSISTENCY / D					1			LES / TEST		
AD C		Auger I Casing	-	EW HW	Extren Highly		VS S	Very Soft Soft	D VD	Der Ver	nse ry Dense		U() D		sturbed Irbed	d (size in m	ım)	
MS	_	Mud St	upport	DW	Distino	ctly	F	Firm	Fb	Fria	able		BS	Bulk	Sample			
NML RR	С	Rock Co Rock Ro	_	MW SW	Mode Slightl		St VSt	Stiff Very Stiff	ELw VLw		remely L y Low	ow	DCP SPT			ne Penetre enetromete		
TC		Tri Cor	ne	F	Fresh	•	Hd	Hard	Lw	Lov	v		N	Num	ber of	blows for S	SPT / 300mm	1
WB	,	Wash E	Bore				VL L	Very Loose Loose	M H	Me Hig	dium h		VS A		Shear Sulfate	Sample		
•		WATER Water Le	vel				MD	Medium Dense	VH	_	y High		PP			etrometer	(kPa)	
•	١	Water Se	epage	Logge	d By:	DAW	1	Date:	24/06/16		Checke	ed By:	НТ		Dat	e:	28/06/16	6
Form G	1 003	3a Issue 2	2					1							1			

Unit 3/42 Machinery Drive, Tweed Heads South NSW 2486

Fax: 0755 233 981 Ph: 0755 233 979

EIN	GIN	EERING	ı LOG	- BO	KEHU	ILE P	KOFILE			GPS:	N:				E:
CL	IENT:	: HUTCHI	NSON E	BUILDE	RS					GI 3.	14.		BOREH		. D. : BH 19
		T: CASU				MOD :	10								2785-a
		/IENT TYP						HOLE DIAN	METER: 110)mm			PAGE:		
	(0	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			300			HOLE DIA	VILILIA: II	,,,,,,,	1.		TAGE.	. 10.	
Method	Water	Depth (m)	Graphic Log				Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows	Structure and additional observation
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AD		METHOD Auger D	rilling	WE EW	ATHERIN Extren		VS	CONSISTENCY / DI Very Soft	ENSITY / ROC D	K STRENG ⁻ Dense	TH	U()	Undis		PLES / TESTS d (size in mm)
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RR		Rock Ro	ller	SW	Slightl		VSt	Very Stiff	VLw	Very Low		SPT	Stand	lard Pe	enetrometer Test
TC WE		Tri Con Wash B		F	Fresh		Hd VL	Hard Very Loose	Lw M	Low Medium		N VS		ber of l Shear	blows for SPT / 300mm
VVE		WATER	ore				L	Loose	Н	High		Α	Acid S	Sulfate	Sample
1	7	Water Lev					MD	Medium Dense	VH	Very High		PP	Pocke	et Pene	etrometer (kPa)
		Water See		Logge	d By:	DAW	<u> </u>	Date:	24/06/16	Che	cked By:	HT		Dat	e: 28/06/16
Form	n GI 00	3a Issue 2													

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NGINEERING LOG – BOREHOLE PROFILE	GPS:	N:		E:		
CLIENT: HUTCHINSON BUILDERS	14.	BOREHOLE	I.D.: BH 19			
PROJECT: CASUARINA TOWN CENTRE MOD 10		JOB No.: GI 2785-a				
EQUIPMENT TYPE: MAIDTECH 500 HOLE DIAMET		PAGE: 2 of				
		_		<u>-</u>		
Depth (m) Depth (m) Material Description		Test Consistency / Rel. Density	DCP Blows /100mm Sample /	Structure and additional observation		
(SP) SAND: Fine sand, Moist, Pale orange/brown	1			FILL		
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BH 19 TERMINATED AT 5.5m – LIMIT OF INVESTIGATION METHOD WEATHERING CONSISTENCY / DENSI	ITY / ROCK STRENIGTH		MAZ	PLES / TESTS		
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C Casing HW Highly S Soft MS Mud Support DW Distinctly F Firm	VD Very Dense Fb Friable	D BS	Disturbed Bulk Sampl	٩		
MS Mud Support DW Distinctly F Firm NMLC Rock Coring MW Moderately St Stiff	ELw Extremely Lo			e one Penetrometer		
RR Rock Roller SW Slightly VSt Very Stiff	VLw Very Low	SPT		enetrometer Test		
TC Tri Cone F Fresh Hd Hard	Lw Low	N		blows for SPT / 300mm		
WB Wash Bore VL Very Loose	M Medium	VS	Vane Shear			
WATER L Loose	H High	Α	Acid Sulfate			
▼ Water Level MD Medium Dense	VH Very High	PP		etrometer (kPa)		
.	1/06/16 Checke	ed By: HT	Da	te: 28/06/16		
m GI 003a Issue 2	-, JO, 10 CHECKE	.ч ру. 171	Da	20/00/10		

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Ph: 0755 233 979 Fax: 0755 233 981

		IEEKING								G	iPS: N:				E:
CLIENT: HUTCHINSON BUILDERS												BORE	HOLE	I.D.: BH 20	
PROJECT: CASUARINA TOWN CENTRE MOD 10											JOB No.: GI 2785-a				
EQI	UIPI	MENT TYP	E: MAI	DTECH	500			HOLE DIAI	METER: 1	L10mm			PAG	E: 1 of	2
1														1	
Method	Water	Depth (m)	Graphic Log		Material Description						/ Rel. Density	Test	Sample /	DCP Blows /100mm	Structure and additional observation
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AD		METHOD Auger D	rilling	WE/	ATHERII Extrer		VS	CONSISTENCY / D Very Soft	ENSITY / R D	OCK STF Der		U()	Und		PLES / TESTS d (size in mm)
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TC		Tri Cone	е	F	Fresh		Hd	Hard	Lw	Low		N	Nun	nber of	blows for SPT / 300mm
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▼		WATER Water Lev	el				MD	Medium Dense	VH	_	y High	PP			etrometer (kPa)
		Water See	page	Logge	d Bv:	DAW	1	Date:	24/06/	16	Checked B	v: H	Г	Dat	te: 28/06/16

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ENGINEERING LOG – BOREHOLE PROFILE

EINC	ואווכ	EENIIN	g LOG	- bC	KEHC	ILE P	NOFILE	-		Г	GPS:	N:				E:		
CLIENT: HUTCHINSON BUILDERS BOREHOLE I.D.: BH 20																		
PROJECT: CASUARINA TOWN CENTRE MOD 10 JOB No.: GI 2785-a																		
						10100		HOLEDIA	NACTED: 110) ma ma								
EQUIPMENT TYPE: MAIDTECH 500 HOLE DIAMETER: 110mm											PAGE	: 2 of	2					
Method	Water	Depth (m)	Graphic Log			Material Description					Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm		e and addition oservation	nal	
AD		_		(SP)	SAND: F	ine sar	nd, Moist	, Orange/brown								FILL		
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RR	-	Rock R	oller	SW	Slightl		VSt	Very Stiff	VLw	Ver	y Low		SPT	Stan	dard Pe	enetromet	er Test	
TC WB		Tri Cor Wash E		F	F Fresh Hd Hard Lw Low			v dium		N VS		ber of Shear		SPT / 300mm				
WD		WATER	JUI C				L	Loose	Н	Hig	h		Α	Acid	Sulfate	Sample		
V		Water Le					MD	Medium Dense	VH	Ver	y High		PP			etrometer		
		Water Se		Logge	ed By:	DAW	<u> </u>	Date:	24/06/16		Checke	ed By:	HT		Dat	e:	28/06/16	i
Form (GI 00	3a Issue 2	2															

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ENGINEERING LOG – BOREHOLE PROFILE

LIN	GIIV	IEEKIN	3 LUG	- 60	KEHC	/LE P	KOFILI	=		GPS:	N:				E:	
CL	CLIENT: HUTCHINSON BUILDERS								1		BORE	-	I.D.: BH 21			
		CT: CASU				MOD	10									
						IVIOD .	10			_			JOB No.: GI 2785-a			
EC	UIPI	MENT TY	PE: MA	DTECH	500			HOLE DIAN	ИЕТЕК : 11	0mm	1	PAGE: 1 of 2				
Method	Water	Depth (m)	Graphic Log				Mat	erial Description			Consistency / Rel. Density	Test	Sample /	DCP Blows / 100mm	Structure and additional observation	
AD		_		(SP)	SAND: F	ine sar	nd, Moist	, Grey/brown							FILL	
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		METHOD		WE	ATHERIN			CONSISTENCY / DE			Н				PLES / TESTS	
AD C)	Auger I Casing	_	EW HW	Extren Highly		VS S	Very Soft Soft	D VD	Dense Very Dens	e	U() D		isturbei urbed	d (size in mm)	
MS		Mud St	ipport	DW	Distin	ctly	F	Firm	Fb	Friable		BS	Bulk	Sample		
NN RR	ЛLC	Rock Co Rock Ro		MW SW	Mode Slightl		St VSt	Stiff Very Stiff	ELw VLw	Extremely Very Low	LOW	DCP SPT			one Penetrometer enetrometer Test	
TC		Tri Cor	ie	F	Fresh	•	Hd	Hard	Lw	Low		N	Num	ber of	blows for SPT / 300mm	
WE	В	Wash E	ore				VL L	Very Loose Loose	M H	Medium High		VS A		Shear Sulfate	e Sample	
1	7	Water Le	vel				MD	Medium Dense	VH	Very High		PP			etrometer (kPa)	
•	•	Water Se	epage	Logge	d By:	DAW	1	Date:	24/06/16	Chec	ked By:	НТ		Dat	e: 28/06/16	
Form	n GI 00	03a Issue 2	,					1			-					

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ENGINEERING LOG – BOREHOLE PROFILE

ROJECT: CASUARINA TOWN CENTRE MOD 10 DOB No.: G1 2785-3	NOINELINING LO	6 – BOREHOLE PROFILE		GPS: N:	T	E:		
A	 Client: Hutchinson	BUILDERS		GI 3. N.	BOREHOLE	l .		
A	PROJECT: CASUARINA	TOWN CENTRE MOD 10			JOB No.: GI	OB No.: GI 2785-a		
Material Description			HOLE DIAMETER: 110n					
SP SAND: Fine sand, Moist, Pale orange/brown		1011300	11012 20 111111111111111111111111111111					
5.0	Graphic Log Depth (m) Water	Material	Description	Consistency / Rel. Density	DCP Blows /100mm Sample /	Structure and additional observation		
SAMPLES / TESTS SAMPLES /	; –	(SP) SAND: Fine sand, Moist, Pal	le orange/brown			FILL		
SAMPLES / TESTS SAMPLES /								
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T7.5_ R8.0_ R8.0_ R8.5_ R8.5_ R8.5_ R8.5_ R8.5_ R8.6_ R8.6_ R8.6_ R9.0_ MATHERING Casing Casi								
# 21 TERMINATED AT 5.5m — LIMIT OF INVESTIGATION METHOD METHOD WeATHERING CONSISTENCY / DENSITY / ROCK STRENGTH SAMPLES / TESTS	7.0_							
# 21 TERMINATED AT 5.5m — LIMIT OF INVESTIGATION METHOD METHOD WeATHERING CONSISTENCY / DENSITY / ROCK STRENGTH SAMPLES / TESTS								
# 21 TERMINATED AT 5.5m — LIMIT OF INVESTIGATION METHOD METHOD WeATHERING CONSISTENCY / DENSITY / ROCK STRENGTH SAMPLES / TESTS	_							
## 21 TERMINATED AT 5.5m — LIMIT OF INVESTIGATION METHOD Auger Orilling Casing HW Highly S Soft VD Very Dense D Disturbed Size in mm)	7.5_							
## 21 TERMINATED AT 5.5m — LIMIT OF INVESTIGATION METHOD D Auger Drilling Casing MS Mud Support MC								
H 21 TERMINATED AT 5.5m − LIMIT OF INVESTIGATION METHOD Mauger Drilling Casing Mud Support Mud Moderately St Stiff ELw Extremely Low DCP Dynamic Cone Penetrometer St Stiff ELw Extremely Low DCP Dynamic Cone Penetrometer St Stiff Student St Stiff Student St Stiff Student St Standard Penetrometer St Standard Penetrometer								
H 21 TERMINATED AT 5.5m − LIMIT OF INVESTIGATION METHOD D Auger Drilling Casing MS Mud Support MIC Rock Coring R R Rock Roller R Rock Roller C Tri Cone MS Mash Bore WATER WATER Water Level MD METHOD L WEATHERING CONSISTENCY / DENSITY / ROCK STRENGTH D D D D D D D D D D D D D	8.0_							
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H 21 TERMINATED AT 5.5m − LIMIT OF INVESTIGATION METHOD D Auger Drilling Casing MS Mud Support MIC Rock Coring R R Rock Roller R Rock Roller C Tri Cone MS Mash Bore WATER WATER Water Level MD METHOD L WEATHERING CONSISTENCY / DENSITY / ROCK STRENGTH D D D D D D D D D D D D D	8.5							
H 21 TERMINATED AT 5.5m − LIMIT OF INVESTIGATION METHOD	-							
H 21 TERMINATED AT 5.5m − LIMIT OF INVESTIGATION METHOD MET								
METHOD Auger Drilling Casing MW Highly MS Mud Support MLC Rock Coring R R Rock Roller C Tri Cone WB Wash Bore WATER WATER WATER WATER WATER WATER WATER MD WEATHERING CONSISTENCY / DENSITY / ROCK STRENGTH D Dense U() Dense U() Undisturbed (size in mm) D Disturbed BS Bulk Sample BS Bulk Sample DCP Dynamic Cone Penetrometer SPT Standard Penetrometer Test VLw Very Low N N Number of blows for SPT / 300mm VL Very Loose M M Medium Dense VH Very High PP Pocket Penetrometer (kPa)								
D Auger Drilling Casing HW Highly S Soft D Dense U() Undisturbed (size in mm) MS Mud Support DW Distinctly F Firm Fb Friable BS Bulk Sample MMC Rock Coring R Rock Roller SW Slightly VSt Very Stiff VLw Very Low SPT Standard Penetrometer Test C Tri Cone WB Wash Bore WATER Water Level W Extremely Low DCP Dynamic Cone Penetrometer WB Lw Low N N Number of blows for SPT / 300mm VL Very Loose M Medium VS Vane Shear L Loose H High A Acid Sulfate Sample WHO Medium Dense VH Very High PP Pocket Penetrometer (kPa)				STRENGTH	SAM	PLES / TESTS		
Mud Support DW Distinctly F Firm Fb Friable BS Bulk Sample MLC Rock Coring R Rock Roller SW Slightly VSt Very Stiff VLw Very Low SPT Standard Penetrometer Test MUSTER Tri Cone F Fresh Hd Hard Lw Low N Number of blows for SPT / 300mm MUSTER VST Very Loose H High A Acid Sulfate Sample MUSTER MD Medium Dense VH Very High PP Pocket Penetrometer (kPa)	AD Auger Drilling	EW Extremely VS Ver	ry Soft D [Dense U()	Undisturbe			
MLC Rock Coring R Rock Roller SW Slightly VSt Very Stiff VLw Very Low SPT Standard Penetrometer Test VL Very Lone VB Wash Bore WATER Water Level MD Medium Dense VH Very High PP Pocket Penetrometer (kPa)		<u> </u>				0		
R Rock Roller C Tri Cone VB Wash Bore WATER Water Level Wash Bore Water Level Wash Bore WATER Water Level Word SPT Standard Penetrometer Test VLw Very Low N Number of blows for SPT / 300mm VL Very Loose M Medium VS Vane Shear A Acid Sulfate Sample MD Medium Dense VH Very High PP Pocket Penetrometer (kPa)		, ,						
C Tri Cone								
VB Wash Bore VL Very Loose M Medium VS Vane Shear WATER L Loose H High A Acid Sulfate Sample Water Level MD Medium Dense VH Very High PP Pocket Penetrometer (kPa)		,		,				
WATER L Loose H High A Acid Sulfate Sample ▼ Water Level MD Medium Dense VH Very High PP Pocket Penetrometer (kPa)								
Water Level MD Medium Dense VH Very High PP Pocket Penetrometer (kPa)		<u> </u>		High A				
		MD Me	edium Dense VH \	/ery High PP				
water seepage Logged By: DAW Date: 24/06/16 Checked By: HT Date: 28/06/16		Logged By: DAW D			IT Dat	te: 28/06/16		



SCOPE These standard notes may be of assistance when understanding terms and recommendations given in this report. These notes are for general conditions and not all terms given may be of concern to the report attached. The descriptive terms adopted by Geotech Investigations Pty Ltd are given below and are largely consistent with Australian Standards AS1726-1993 'Geotechnical Site Investigations'.

CLIENT can be described and is limited to the financier of this geotechnical investigation.

LEGALITY and privacy of this document is based on communication between Geotech Investigations Pty Ltd and the client. Unless indicated otherwise the report was prepared specifically for the client involved and for the purposes indicated by the client. Use by any other party for any purpose, or by the client for a different purpose, will result in recommendations becoming invalid and Geotech Investigations Pty Ltd will hold no responsibility for problems which may arise.

GEOTECHNICAL REPORTS are predominantly derived using professional estimates determined from the results of fieldwork, in-situ and laboratory testing and experience from previous investigations in the area, from which geotechnical engineers then formulate an opinion about overall subsurface conditions. The client must be made aware that the investigations are undertaken to ensure minimal site impact using testpits or small diameter boreholes and soil conditions on-site may vary from those encountered during the investigation.

CLIENTS RESPONSIBILITY to notify this office should there be adjustments in proposed structure/location or inconsistencies with material descriptions given in this report and those encountered on site. Geotech Investigations Pty Ltd is able to provide a range of services from on-site inspections to full project supervision to confirm recommendations given in the report.

CSIRO Publication BTF 18 'Foundation Maintenance and Footing Performance: A Homeowner's Guide' explains how to adequately maintain drainage during and post construction which lies as the responsibility of the client. Suitable drainage ensures recommendations given in this report remain valid.

INVESTIGATION METHODS adopted by Geotech Investigations Pty Ltd are designed to incorporate individual project-specific factors to obtain information on the physical properties of soil and rock around a site to design earthworks and foundations for proposed structures. The following methods of investigation currently adopted by this company are summarised below:-

HAND AUGER – investigations enable field work to be undertaken where access is limited. The materials must have sufficient cohesion to stand unsupported in an unlined borehole and there must be no large cobbles boulders or other obstructions which would prevent rotation of the auger.

TEST-PITS – investigations are carried out with an excavator or backhoe, allowing a visual inspection of sub-surface material in-situ and from samples removed. The limit of investigation is restricted by the reach of the excavator or backhoe.

CONTINUOUS SPIRAL FLIGHT AUGERING TECHNIQUES – investigations are advanced by pushing a 100mm diameter spiral into the sub-surface and withdrawing it at regular intervals to allow sampling or testing as it emerges.

WASH BORING – investigations are advanced by removing the loosened soil from the borehole by a stream of water or drilling mud issuing from the lower end of the wash pipe which is worked up and down or rotated by hand in the borehole. The water or mud carries the soil up the borehole where it overflows at ground level where the soil in suspension is allowed to settle in a pond or tank and the fluid is re-circulated or discharged to waste as required.

NON-CORE ROTARY DRILLING – investigations are advanced using a rotary bit with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from feel and rate of penetration.

ROTARY MUD DRILLING – is carried out as above using mud as support and circulating fluid for the borehole drilling. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling.

CONTINUOUS CORE DRILLING — investigations are carried out in rock material, specimens of rock in the form of cylindrical cores are recovered from the drill holes by the means of core barrel. The core barrel is provided at its lower end with a detachable core bit which carries industrial diamond chips in a matrix of metal. Rotation of the barrel by means of the drill rods causes the core bit to cut an annulus in the rock, the cuttings being washed to the surface by a stream of pumped down the hollow drill rods.



TESTING METHODS adopted by Geotech Investigations Pty Ltd to determine soil properties include but not limited to the following:-

U50 – Undisturbed samples are obtained by inserting a 50mm diameter thin-walled steel tube into the material and withdrawing with a sample of the soil in a moderately undisturbed condition.

PP – Pocket Penetrometer tests are commonly used on thin walled tube samples of cohesive soils to evaluate consistency and approximate unconfined compressive strength of saturated cohesive soils. They may also be used for the same purpose in freshly excavated trenches.

VS – Vane Shear test are commonly used in-situ or on thin walled tube samples of cohesive soils by introducing the vane into the material where the measurement of the undrained shear strength is required. Then the vane is rotated and the torsional force required to cause shearing is calculated.

DCP – Dynamic Cone Penetrometer tests are commonly used in-situ to measure the strength attributes of penetrability and compaction of sub-surface materials.

SPT – Standard Penetration Tests are commonly uses to determine the density of granular deposits but are occasionally used in cohesive material as a means of determining strength and also of obtaining a relatively undisturbed sample. Samples and results are obtained by driving a 50mm diameter split tube through blows from a slide hammer with a weight of 63.5kg falling through a distance of 760mm. Blow counts are recorded for 150mm intervals with the sum of the number of blows required for the second and third 150mm of penetration is termed the "standard penetration resistance" or the "N-value".

GEOLOGICAL ORIGINS of sub-surface material plays a considerable role in the development of engineering parameters and have been summarised as follows:-

FILL – materials are man made deposits, which may be significantly more variable between test locations than naturally occurring soils.

RESIDUAL – soils are present in a region as a result of weathering over the geological time scale.

COLLUVIAL – soils have been deposited recently, on the geological time scale, as soils being transported slowly down slope due to gravitational creep.

ALLUVIAL – soils have been deposited recently, on the geological time scale, as water borne materials.

AEOLIAN – soils have been deposited recently, on the geological time scale, as wind borne materials.

SOIL DESCRIPTION is based on an assessment of disturbed samples, as recovered from boreholes and excavations, and from undisturbed materials. Soil descriptions adopted by Geotech Investigations Pty Ltd are largely consistent with AS 1726-1993 *'Geotechnical Site Investigation'*. Soil types are described according to the predominating particle size, qualified by the grading of other particles present on the following bases detailed in Table 1.

COHESIVE SOILS ability to hold moisture known as its liquid limit is the state of a soil when it goes from a solid state to a liquid state described in Table 2

TABLE 1

 Soil Classification
 Particle Size

 Clay
 < 0.002 mm</td>

 Silt
 0.002 – 0.06 mm

 Sand
 0.06 – 2.00 mm

 Gravel
 2.00 – 60.0 mm

TABLE 2

Descriptive Type	Range of Liquid Limit %
Of low plasticity	≤ 35
Of medium plasticity	> 35 ≤ 50
Of high plasticity	> 50

Furthermore to soil description cohesive soils are described on their strength (assessed in conjunction with penetration tests) and liquid limit. Non-cohesive soil strengths are described by their density index. With descriptions for cohesive and non-cohesive soils summarised in Table 3.

TABLE 3

.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					
	COHESIVE SOILS	NON-COHESIVE SOILS			
Term	Undrained Shear Strength kPa	Term	Density Index %		
Very soft	≤ 12	Very Loose	≤15		
Soft	> 12 ≤25	Loose	> 15 ≤35		
Firm	> 25 ≤50	Medium Dense	> 35 ≤65		
Stiff	> 50 ≤100	Dense	> 65 ≤85		
Very Stiff	> 100 ≤200	Very Dense	> 85		
Hard	> 200				



Description of terms used to describe material portion are summarised in Table 4.

TABLE 4

	COARSE GRAINIED SOILS	FINE GRAINED SOILS			
% Fines	% Fines Modifier		Modifier		
≤ 5	Omit or 'trace'	≤ 15	Omit or 'trace'		
> 5 ≤12	Describe as 'with'	> 15 ≤30	Describe as 'with'		
> 12	Prefix soil as 'silty/clayey'	> 30	Prefix soil as 'sandy/gravelly'		

ROCK DESCRIPTIONS are determined from disturbed samples or specimens collected during field investigations. A rocks presence of defects and the effects of weathering are likely to have a great influence on engineering behaviour.

Rock Material Weathering Classification is summarised in Table 5.

TABLE 5

Term	Symbol	Definition
Residual Soils	-	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	XW	Rock is weathered to such an extent that it has 'soil' properties, i.e. it
Weathered Rock		either disintegrates or can be remoulded, in water
Distinctly	DW	Rock strength usually changed by weathering. The rock may be highly
Weathered Rock		discoloured, usually by iron staining. Porosity may be increased by
		leaching, or may be decreased due to decomposition of weathering
		products in pores
Slightly Weathered	SW	Rock is slightly discoloured but shows little or no change of strength from
Rock		fresh rock
Fresh rock	FR	Rock shows no signs of decomposition or staining

Rock Material Strength Classification is summarised in Table 6.

TABLE 6

Term	Symbol	Point load index (MPa) I _s 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 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling
Medium	М	>0.3 ≤1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty
High	Н	>1.0 ≤3.0	A piece of core 150mm long by 50mm 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	>3.0 ≤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



Rock Material Defect Shapes are summarised in Table 7.

TABLE 7

Term	Description
Planar	The defect does not vary in orientation.
Curved	The defect has a gradual change in orientation
Undulating	The defect has a wavy surface
Stepped	The defect has one or more well defined steps.
Irregular	The defect has many sharp changes of orientation
Smooth	The defect has a flat even finish
Rough	The defect has a irregular disoriented finish

Rock Material Texture and Fabric are summarised in Table 8.

TABLE 8

Geological	Mass	ive	Layered		
Description			(Bedded foliate cleaved)		
Diagram		7			
Fabric Type	Effectively homogenous and isotropic. Bulky or equi-dimensional grains uniformly distributed	Effectively homogeneous and isotropic. Elongated	Effective homogeneous with planar anisotropy. Elongated or tabular grains or pores in a layered arrangement		

Rock Material Defect Type is summarised in Table 9

TABLE 9

Term	Definition	Diagram
Bedding	Signifying existence of beds or laminate. Planes dividing sedimentary rocks of the same or different lithology. Structure occurring in granite and similar rocks evident in a tendency to split more or less horizontally to the land surface	
Cross Bedding	Also called cross-lamination or false bedding. The structure commonly present in granular sedimentary rocks, which consists of tabular, irregularly lenticular or wedge-shaped bodies lying essentially parallel to the general stratification and which them selves show pronounced lamination structure in which the laminae are steeply inclined to the general bedding.	
Crushed Seam	A fracture at a more or less acute angle to applied force generally with some pulverized material along its surface	
Joint	A fracture in rock, generally more or less vertical or transverse to bedding, along which no appreciable movement has occurred.	
Parting	A small joint in rock or a layered rock where the tendency of crystals to separate along certain planes that are not true cleavage planes.	
Sheared Zone	A fracture that results from stresses which tend to shear one part of a specimen past the adjacent part	



APPENDIX C

HT:jw: GI 2785-a

LABORATORY TEST RESULTS - MAZLAB PTY LTD





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Project: Casaurina Town Centre Mod 10 (GI 2785-a)

Mazlab Job No: GTI 2686

Date: 3/07/2016

<u>LABORATORY TEST RESULTS</u> Certificate of Test Results – ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H ₂ O ₂	Reaction to HCL	pHf	pH fox
38759	BH1-0.50	SAND(SP) grey brown	Nil	Nil	7.0	4.8
38760	BH1-1.00	SAND(SP) pale orange brown	Nil	Nil	6.7	5.0
38761	BH1-1.50	SAND(SP) pale orange brown	Nil	Nil	6.7	4.9
38762	BH1-2.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.0
38763	BH1-2,50	SAND(SP) pale orange brown	Nil	Nil	6.6	5.4
38764	BH1-3.00	SAND(SP) pale orange brown	Nil	Nil	6.7	5.5
38765	BH2-0.50	SAND(SP) pale orange brown	Nil	Nil	6.8	5.3
38766	BH2-1.00	SAND(SP) pale orange brown	Nil	Nil	6.7	5.4
38767	BH2-1.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.1
38768	BH2-2.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.4
38769	BH2-2.50	SAND(SP) pale orange brown	Nil	Nil	6.9	5.7
38770	BH2-3.00	SAND(SP) pale orange brown	Nil	Nil	8.1	6.3
38771	BH3-0.50	SAND(SP) pale orange brown	Nil	Nil	7.3	5.2
38772	BH3-1.00	SAND(SP) pale orange brown	Nil	Nil	6.9	4.3
38773	BH3-1.50	SAND(SP) pale orange brown	Nil	Nil	6.6	4.7
38774	BH3-2.00	SAND(SP) pale orange brown	Nil	Nil	6.6	4.9
38775	BH3-2.50	SAND(SP) pale orange brown	Nil	Nil	6.6	5.1
38776	BH3-3.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.3

Checked By:

Date:

3/7/16.

Laboratory Test Methods follow procedures described in : QASSIT - Acid Sulphate Soils Laboratory Methods Guidelines - Version 2.1 June 2004



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Sample No.	Client I.D	Soil Description (truncated)	Reaction to H ₂ O ₂	Reaction to HCL	pHf	pH fox
38777	BH4-0.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.2
38778	BH4-1.00	SAND(SP) pale orange brown	Nil	Nil	6.6	4.7
38779	BH4-1.50	SAND(SP) pale orange brown	Nil	Nil	6.6	5.2
38780	BH4-2.00	SAND(SP) pale orange brown	Nil	Nil	6.7	4.6
38781	BH4-2.50	SAND(SP) pale orange brown	Nil	Nil	6.7	4.7
38782	BH4-3.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.0
38783	BH5-0.50	SAND(SP) pale orange brown	Nil	Nil	6.5	5.3
38784	BH5-1.00	SAND(SP) pale orange brown	Nil	Nil	6.6	4.5
38785	BH5-1.50	SAND(SP) pale orange brown	Nil	Nil	6.5	5.3
38786	BH5-2.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.5
38787	BH5-2.50	SAND(SP) pale orange brown	Nil	Nil	6.6	5.2
38788	BH5-3.00	SAND(SP) pale orange brown	Nil	Nil	6.9	5.8
38789	BH6-0.50	SAND(SP) pale orange brown	Nil	Nil	6.8	4.7
38790	BH6-1.00	SAND(SP) pale orange brown	Nil	Nil	6.6	3.7
38791	BH6-1.50	SAND(SP) pale orange brown	Nil	Nil	6.5	4.7
38792	BH6-2.50	SAND(SP) pale orange brown	Nil	Nil	7.8	6.0
38793	BH6-3.00	SAND(SP) pale orange brown	Nil	Nil	8.6	6.9

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LABORATORY TEST RESULTS

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Sample No.	Client I.D	Soil Description (truncated)	Reaction to H ₂ O ₂	Reaction to HCL	<u>pHf</u>	pH fox
38794	BH7-0.50	Silty SAND(SM) dark grey	Nil	Nil	8.0	5.8
38795	BH7-1.00	Silty SAND(SM) dark grey	Nil	Nil	8.4	6.3
38796	BH7-1.50	SAND(SP) pale orange brown	Nil	Nil	8.6	6.7
38797	BH7-2.00	SAND(SP) pale orange brown	Nil	Nil	8.8	7.0
38798	BH7-2.50	SAND(SP) pale orange brown	Nil	Nil	8.8	6.9
38799	BH7-3.00	SAND(SP) pale orange brown	Nil	Nil	8.7	6.6
38800	BH8-0.50	Silty SAND(SM) dark grey	Nil	Nil	8.5	6.4
38801	BH8-1.00	Silty SAND(SM) dark grey	Nil	Nil	8.4	6.5
38802	BH8-1.50	SAND(SP) pale orange brown	Nil	Nil	8.7	7.0
38803	BH8-2.00	SAND(SP) pale orange brown	Nil	Nil	8.6	6.7
38804	BH8-2.50	SAND(SP) pale orange brown	Nil	Nil	8.4	6.5
38805	BH8-3.00	SAND(SP) pale orange brown	Nil	Nil	8.5	6.5
38806	BH9-0.50	SAND(SP) pale orange brown	Nil	Nil	7.7	5.4
38807	BH9-1.00	SAND(SP) pale orange brown	Nil	Nil	7.4	5.1
38808	BH9-1.50	SAND(SP) pale orange brown	Nil	Nil	7.2	5.1
38809	BH9-2.00	SAND(SP) pale orange brown	Nil	Nil	7.1	5.0
38810	BH9-2.50	SAND(SP) pale orange brown	Nil	Nil	6.9	5.1
38811	BH9-3.00	SAND(SP) pale orange brown	Nil	Nil	6.8	5.1
38812	BH9-3.50	SAND(SP) pale orange brown	Nil	Nil	6.9	5.2
38813	BH9-4.00	SAND(SP) pale orange brown	Nil	Nil	6.8	5.2
38814	BH9-4.50	SAND(SP) pale orange brown	Nil	Nil	6.8	5.1

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Sample No.	Client I.D	Soil Description (truncated)	Reaction to H ₂ O ₂	Reaction to HCL	pHf	pH fox
38815	BH10-0.50	SAND(SP) pale orange brown	Nil	Nil	6.8	5.2
38816	BH10-1.00	SAND(SP) pale orange brown	. Nil	Nil	6.7	5.0
38817	BH10-1.50	SAND(SP) pale orange brown	Nil	Nil	6.6	4.7
38818	BH10-2.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.4
38819	BH10-2.50	SAND(SP) pale orange brown	Nil	Nil	6.6	5.3
38820	BH10-3.00	SAND(SP) pale orange brown	Nil	Nil	7.3	6.1
38821	BH10-3.50	SAND(SP) pale orange brown	Nil	Nil	7.2	5.6
38822	BH10-4.00	SAND(SP) pale orange brown	Nil	Nil	6.8	5.4
38823	BH10-4.50	SAND(SP) pale orange brown	Nil	Nil	6.9	5.3
38824	BH10-5.00	SAND(SP) pale orange brown	Nil	Nil	6.8	5.1
38825	BH11-0.50	SAND(SP) grey	Nil	Nil	6.6	4.7
38826	BH11-1.00	SAND(SP) pale orange brown	Nil	Nil	6.5	4.6
38827	BH11-1.50	SAND(SP) pale orange brown	Nil	Nil	6.5	5.1
38828	BH11-2.00	SAND(SP) pale orange brown	Nil	Nil	6.4	5.0
38829	BH11-2.50	SAND(SP) pale orange brown	Nil	Nil	6.5	5.0
38830	BH11-3.00	SAND(SP) pale orange brown	Nil	Nil	7.5	6.1
38831	BH11-3.50	SAND(SP) pale orange brown	Nil	Nil	7.4	5.8
38832	BH11-4.00	SAND(SP) pale orange brown	Nil	Nil	7.2	5.7
38833	BH11-4.50	SAND(SP) pale orange brown	Nil	Nil	7.2	5.5
38834	BH11-5.00	SAND(SP) pale orange brown	Nil	Nil	7.2	5.7

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LABORATORY TEST RESULTS

Certificate of Test Results - ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H ₂ O ₂	Reaction to HCL	pHf	pH fox
38835	BH12-0.50	Silty SAND(SM) dark grey	Nil	Nil	7.8	6.1
38836	BH12-1.00	SAND(SP) pale orange brown	Nil	Nil	8.2	6.2
38837	BH12-1.50	SAND(SP) pale orange brown	Nil	Nil	7.5	5.8
38838	BH12-2.00	SAND(SP) pale orange brown	Nil	Nil	7.2	5.8
38839	BH12-2.50	SAND(SP) pale orange brown	Nil	Nil	7.1	5.5
38840	BH12-3.00	SAND(SP) pale orange brown	Nil	Nil	7.0	5.7
38841	BH12-3.50	SAND(SP) pale orange brown	Nil	Nil	7.1	5.5
38842	BH12-4.00	SAND(SP) pale orange brown	Nil	Nil	7.2	5.8
38843	BH12-4.50	SAND(SP) pale orange brown	Nil	Nil	7.1	5.1
38444	BH13-0.50	Silty SAND(SM) dark grey	Nil	Nil	7.0	5.4
38845	BH13-1.00	SAND(SP) pale orange brown	Nil	Nil	6.9	5.3
38846	BH13-1.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.1
38847	BH13-2.00	SAND(SP) pale orange brown	Nil	Nil	6.8	5.3
38848	BH13-2.50	SAND(SP) pale orange brown	Nil	Nil	7.0	5.7
38849	BH13-3.00	SAND(SP) pale orange brown	Nil	Nil	6.9	5.6
38850	BH14-0.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.0
38851	BH14-1.00	SAND(SP) pale orange brown	Nil	Nil	6.5	4.9
38852	BH14-1.50	SAND(SP) pale orange brown	Nil	Nil	6.5	4.6
38853	BH14-2.00	SAND(SP) pale orange brown	Nil	Nil	6.4	4.7
38854	BH14-2.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.9
38855	BH14-3.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.7

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Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004

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Date:



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Date: 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results - ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H ₂ O ₂	Reaction to HCL	pHf	pH fox
38856	BH15-0.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.8
38857	BH15-1.00	SAND(SP) pale orange brown	Nil	Nil	6.4	4.8
38858	BH15-1.50	SAND(SP) pale orange brown	Nil	Nil	6.4	4.9
38859	BH15-2.00	SAND(SP) pale orange brown	Nil	Nil	6.4	5.1
38860	BH15-2.50	SAND(SP) pale orange brown	Nil	Nil	6.3	5.1
38861	BH15-3.00	SAND(SP) pale orange brown	Nil	Nil	6.4	4.9
38908	BH16-0.50	SAND(SP) pale orange brown	Nil	Nil	6.3	7.2
38909	BH16-1.00	SAND(SP) pale orange brown	Nil	Nil	7.5	6.4
38910	BH16-1.50	SAND(SP) pale orange brown	Nil	Nil	7.9	6.4
38911	BH16-2.00	SAND(SP) pale orange brown	Nil	Nil	7.8	6.4
38912	BH16-2.50	SAND(SP) pale orange brown	Nil	Nil	7.7	6.1
38913	BH16-3.00	SAND(SP) orange brown	Nil	Nil	7.4	5.9
38914	BH16-3.50	SAND(SP) orange brown	Nil	Nil	7.3	5.5
38915	BH16-4.00	SAND(SP) orange brown	Nil	Nil	7.4	5.4
38916	BH16-4.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.6
38917	BH16-5.00	SAND(SP) pale orange brown	Nil	Nil	7.0	5.4
38918	BH16-5.50	SAND(SP) pale orange brown	Nil	Nil	6.9	5.2

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Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004



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<u>LABORATORY TEST RESULTS</u> Certificate of Test Results – ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H ₂ O ₂	Reaction to HCL	pHf	pH fox
38919	BH17-0.50	SAND(SP) orange brown	Nil	Nil	6.5	4.8
38920	BH17-1.00	SAND(SP) orange brown	Nil	Nil	6.7	5.2
38921	BH17-1.50	SAND(SP) orange brown	Nil	Nil	6.6	5.3
38922	BH17-2.00	SAND(SP) orange brown	Nil	Nil	6.6	5.3
38923	BH17-2.50	SAND(SP) orange brown	Nil	Nil	6.6	4.9
38924	BH17-3.00	SAND(SP) orange brown	Nil	Nil	6.6	5.0
38925	BH17-3.50	SAND(SP) orange brown	Nil	Nil	6.5	3.9
38926	BH17-4.00	SAND(SP) orange brown	Nil	Nil	6.3	3.7
38927	BH17-4.50	SAND(SP) orange brown	Nil	Nil	6.3	3.7
38928	BH17-5.00	SAND(SP) orange brown	Nil	Nil	6.3	5.5
38929	BH17-5.50	SAND(SP) orange brown	Nil	Nil	6.0	3.7
38930	BH18-0.50	SAND(SP) orange brown	Nil	Nil	6.1	4.3
38931	BH18-1.00	SAND(SP) pale orange brown	Nil	Nil	6.2	4.3
38932	BH18-1.50	SAND(SP) pale orange brown	Nil	Nil	6.2	4.6
38933	BH18-2.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.6
38934	BH18-2.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.5
38935	BH18-3.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.2
38936	BH18-3.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.2
38937	BH18-4.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.3
38938	BH18-4.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.4
38939	BH18-5.00	SAND(SP) pale orange brown	Nil	Nil	6.4	4.2
38940	BH18-5.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.3

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Eaboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004



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Project: Casaurina Town Centre Mod 10 (GI 2785-a)

Mazlab Job No: GTI 2686

Date: 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results - ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H ₂ O ₂	Reaction to HCL	pHf	pH fox
38941	BH19-0.50	SAND(SP) pale orange brown	Nil	Nil	6.1	4.1
38942	BH19-1.00	SAND(SP) pale orange brown	Nil	Nil	6.1	4.6
38943	BH19-1.50	SAND(SP) pale orange brown	Nil	Nil	5.8	3.6
38944	BH19-2.00	SAND(SP) pale orange brown	Nil	Nil	6.0	4.0
38945	BH19-2.50	SAND(SP) pale orange brown	Nil	Nil	6.2	4.3
38946	BH19-3.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.4
38947	BH19-3.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.6
38948	BH19-4.00	SAND(SP) pale orange brown	Nil	Nil	6.4	4.8
38949	BH19-4.50	SAND(SP) pale orange brown	Nil	Nil	6.4	4.8
38950	BH19-5.00	SAND(SP) pale orange brown	Nil	Nil	6.3	4.1
38951	BH19-5.50	SAND(SP) pale orange brown	Nil	Nil	6.3	3.6
38952	BH20-0.50	SAND(SP) pale orange brown	Nil	Nil	6.4	5.6
38953	BH20-1.00	SAND(SP) pale orange brown	Nil	Nil	6.6	5.2
38954	BH20-1.50	SAND(SP) pale orange brown	Nil	Nil	6.7	5.3
38955	BH20-2.00	SAND(SP) pale orange brown	Nil	Nil	7.0	5.0
38956	BH20-2.50	SAND(SP) pale orange brown	Nil	Nil	6.8	4.9
38957	BH20-3.00	SAND(SP) pale orange brown	Nil	Nil	6.3	5.0
38958	BH20-3.50	SAND(SP) pale orange brown	Nil	Nil	6.3	4.7
38959	BH20-4.00	SAND(SP) pale orange brown	Nil	Nil	6.2	3.6
38960	BH20-4.50	SAND(SP) orange brown	Nil	Nil	6.1	3.9
38961	BH20-5.00	SAND(SP) orange brown	Nil	Nil	6.3	4.4
38962	BH20-5.50	SAND(SP) orange brown	Nil	Nil	5.9	3.8

Checked By

Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004



ACN 151 684 436

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Client: Geotech Investigations

Project: Casaurina Town Centre Mod 10 (GI 2785-a)

Mazlab Job No: GTI 2686

Date: 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results - ASS Screenings

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H ₂ O ₂	Reaction to HCL	pHf	pH fox
38963	BH21-0.50	SAND(SP) grey brown	Nil	Nil	6.6	4.7
38964	BH21-1.00	SAND(SP) grey brown	Nil	Nil	7.8	5.2
38965	BH21-1.50	SAND(SP) grey brown	Nil	Nil	8.1	5.1
38966	BH21-2.00	SAND(SP) grey brown	Nil	Nil	8.5	6.1
38967	BH21-2.50	SAND(SP) grey brown	Nil	Nil	8.1	5.4
38968	BH21-3.00	SAND(SP) pale orange brown	Nil	Nil	8.1	5.2
38969	BH21-3.50	SAND(SP) pale orange brown	Nil	Nil	7.9	5.4
38970	BH21-4.00	SAND(SP) pale orange brown	Nil	Nil	7.5	5.4
38971	BH21-4.50	SAND(SP) pale orange brown	Nil	Nil	7.5	5.5
38972	BH21-5.00	SAND(SP) pale orange brown	Nil	Nil	7.3	5.3
38973	BH21-5.50	SAND(SP) pale orange brown	Nil	Nil	7.3	6.0

Checked By:

Date:

te: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004



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Client: Geotech Investigations

Project: Casaurina Town Centre Mod 10

(GI 2785-a)

Mazlab Job No: GTI 2686

Date: 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results - Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH kcl	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	MOI (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/t)
38759	BH1-0.50	SAND(SP) grey brown	5.8	<2 <0.01%	13		-	13	Nil
38761	BH1-1.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38763	BH1-2.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	3 01		3	Nil
38765	BH2-0.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	-		NA	<2	Nil
38767	BH2-1.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	A #4	-	<2	Nil
38769	BH2-2.50	SAND(SP) pale orange brown	6.7	<2 <0.01%	-	-	NA	<2	Nil
38771	BH3-0.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	=	(-	3	Nil
38773	BH3-1.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38775	BH3-2.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	=	-	<2	Nil
38777	BH4-0.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38779	BH4-1.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	e 2	=	NA	<2	Nil
38781	BH4-2.50	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	-	+	3	Nil
38783	BH5-0.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	=	5	-	<2	Nil
38785	BH5-1.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	- 0/	<2	Nil
38787	BH5-2.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38789	BH6-0.50	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	*	=	3	Nil

Checked By:

Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004



ACN 151 684 436

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Client: Geotech Investigations

Project: Casaurina Town Centre Mod 10

(GI 2785-a)

Mazlab Job No: GTI 2686

Date: 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results - Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH kcl	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	MNC mol (H+/t) NA= Ser< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/t)
38791	BH6-1.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3		-	3	Nil
38793	BH6-3.00	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38795	BH7-1.00	Silty SAND(SM) dark grey	7.8	<2 <0.01%	-	S	NA	<2	Nil
38797	BH7-2.00	SAND(SP) pale orange brown	8.4	<2 <0.01%	-	=	NA	<2	Nil
38799	BH7-3.00	SAND(SP) pale orange brown	7.0	<2 <0.01%	-	1 70	NA	<2	Nil
38801	BH8-1.00	Silty SAND(SM) dark grey	8.6	<2 <0.01%	-	a	NA	<2	Nil
38803	BH8-2.00	SAND(SP) pale orange brown	7.4	<2 <0.01%	-		NA	<2	Nil
38805	BH8-3.00	SAND(SP) pale orange brown	7.2	<2 <0.01%	=	-	NA	<2	Nil
38807	BH9-1.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	=	NA	<2	Nil
38809	BH9-2.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	=	NA	<2	Nil
38811	BH9-3.00	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	12	=	<2	Nil
38813	BH9-4.00	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	=		<2	Nil
38815	BH10-0.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38817	BH10-1.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	- 11	NA	<2	Nil
38819	BH10-2.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38821	BH10-3.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	=	=	<2	Nil

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Laboratory Test Methods follow procedures described in : QASSIT - Acid Sulphate Soils Laboratory Methods Guidelines -Version 2.1 June 2004



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Project: Casaurina Town Centre Mod 10

(GI 2785-a)

Mazlab Job No: GTI 2686

Date: 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results - Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH kcl	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	mol (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/t)
38823	BH10-4.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-		¥	<2	Nil
38825	BH11-0.50	SAND(SP) grey	6.4	<2 <0.01%	3	=	-	3	Nil
38827	BH11-1.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38829	BH11-2.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	51 1 <u>2</u> 5	-	-	<2	Nil
38831	BH11-3.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38833	BH11-4.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3		-	3	Nil
38835	BH12-0.50	Silty SAND(SM) dark grey	6.6	<2 <0.01%	-	1=	NA	<2	Nil
38837	BH12-1.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	:=	l a.	NA	<2	Nil
38839	BH12-2.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38841	BH12-3.50	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	-	-	3	Nil
38843	BH12-4.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3		-	3	Nil
38845	BH13-1.00	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	=	-	3	Nil
38847	BH13-2.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38849	BH13-3.00	SAND(SP) pale orange brown	6.5	<2 <0.01%	7		-	<2	Nil
38851	BH14-1.00	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	1 = 2	-	3	Nil
38853	BH14-2.00	SAND(SP) pale orange brown	6.3	<2 <0.01%	. 3	s= \$	_	3	Nil

Checked By

Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT - Acid Sulphate Soils Laboratory Methods Guidelines - Version 2.1 June 2004



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Project: Casaurina Town Centre Mod 10

(GI 2785-a)

Mazlab Job No: GTI 2686

Date: 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results - Chromium Reducible Sulphur

Sample No.	Client L.D	Soil Description (truncated)	pH KCL	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	mol (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/dry/t)
38855	BH14-3.00	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	5	-	3	Nil
38857	BH15-1.00	SAND(SP) pale orange brown	6.5	<2 <0.01%	_	-	-	<2	Nil
38859	BH15-2.00	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	= .	-	3	Nil
38861	BH15-3.00	SAND(SP) pale orange brown	6.3	<2 <0.01%	3	-	-	3	Nil
38908	BH16-0.50	SAND(SP) pale orange brown	6.6	<2 <0.01%	1=	-	NA	<2	Nil
38910	BH16-1.50	SAND(SP) pale orange brown	6.8	<2 <0.01%		-	NA	<2	Nil
38912	BH16-2.50	SAND(SP) pale orange brown	6.8	<2 <0.01%			NA	<2	Nil
38914	BH16-3.50	SAND(SP) orange brown	6.8	<2 <0.01%	(=)	1 -	NA	<2	Nil
38916	BH16-4.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	3	-	NA	<2	Nil
38918	BH16-5.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	-	NA	<2	Nil
38920	BH17-1.00	SAND(SP) orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil
38922	BH17-2.00	SAND(SP) orange brown	6.5	<2 <0.01%	= -	-	-	<2	Nil
38924	BH17-3.00	SAND(SP) orange brown	6.5	<2 <0.01%	-	170		<2	Nil
38926	BH17-4.00	SAND(SP) orange brown	6.4	<2 <0.01%	3	-	-	3	Nil
38928	BH17-5.00	SAND(SP) orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38930	BH18-0.50	SAND(SP) orange brown	6.5	<2 <0.01%	-	-	-	<2	Nil

Checked By

Date: 3/7/16



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(GI 2785-a)

Mazlab Job No: GTI 2686

Date: 3/07/2016

LABORATORY TEST RESULTS

Certificate of Test Results - Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH kcl	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	MOI (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/t)
38932	BH18-1.50	SAND(SP) pale orange brown	8.8	<2 <0.01%	-	-	NA	<2	Nil
38934	BH18-2.50	SAND(SP) pale orange brown	7.6	<2 <0.01%	-	-	NA	<2	Nil
38936	BH18-3.50	SAND(SP) pale orange brown	7.0	<2 <0.01%	-	8=	NA	<2	Nil
38938	BH18-4.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	82 <u>4</u>	NA	<2	Nil
38940	BH18-5.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	9 -	NA	<2	Nil
38942	BH19-1.00	SAND(SP) pale orange brown	6.7	<2 <0.01%	-	15	NA	<2	Nil
38944	BH19-2.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	= 1	NA	<2	Nil
38946	BH19-3.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38948	BH19-4.00	SAND(SP) pale orange brown	6.6	<2 <0.01%	-	-	NA	<2	Nil
38950	BH19-5.00	SAND(SP) pale orange brown	6.8	<2 <0.01%	-	12.	NA	<2	Nil
38952	BH20-0.50	SAND(SP) pale orange brown	6.8	<2 <0.01%	=	Œ	NA	<2	Nil
38954	BH20-1.50	SAND(SP) pale orange brown	6.5	<2 <0.01%	= -	022		<2	Nil
38956	BH20-2.50	SAND(SP) pale orange brown	6.6	<2 <0.01%		25	NA	<2	Nil
38958	BH20-3.50	SAND(SP) pale orange brown	6.4	<2 <0.01%	3	92	-	3	Nil
38960	BH20-4.50	SAND(SP) orange brown	6.3	<2 <0.01%	3	0 -	-	3	Nil
38962	BH20-5.50	SAND(SP) orange brown	6.5	<2 <0.01%	-	: *	-	<2	Nil

Checked By:

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Date: 3/7/16

Laboratory Test Methods follow procedures described in : QASSIT – Acid Sulphate Soils Laboratory Methods Guidelines – Version 2.1 June 2004



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Project: Casaurina Town Centre Mod 10

(GI 2785-a)

Mazlab Job No: GTI 2686

Date: 3/07/2016

LABORATORY TEST RESULTS

<u>Certificate of Test Results - Chromium Reducible Sulphur</u>

Sample No.	Client I.D	Soil Description (truncated)	pH KCL	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S	MOI (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ drv/t)
38964	BH21-1.00	SAND(SP) grey brown	6.9	<2 <0.01%	-	-	- NA	<2	Nil
38966	BH21-2.00	SAND(SP) grey brown	7.9	<2 <0.01%	-	20	NA	<2	Nil
38968	BH21-3.00	SAND(SP) pale orange brown	7.2	<2 <0.01%	-	50 JB	NA	<2 .	Nil
38970	BH21-4.00	SAND(SP) pale orange brown	7.0	<2 <0.01%	-	=	NA	<2	Nil
38972	BH21-5.00	SAND(SP) pale orange brown	6.8	<2 <0.01%	10 N=	-	NA	<2	Nil

Checked By:

Date: 3/7/16

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