6. Result of Topographical and Geological Survey on the Project Site



Our Ref: 750321 14 May 2001

Azusa Sekkei Co., Ltd. Mitsui-Seimei Gotanda Bldg., 2-27-3 Nishi-Gotanda, Shinagawa-ku, Tokyo 141-8536 Japan

Attention: Mr Koike

Dear Sir

Golf Link Rd, Vatuwaqa, Fiji Geotechnical Investigation Report

1.0 Introduction

Tonkin & Taylor (Fiji) Ltd was engaged by Mr Yamamoto of Azusa Sekkei Co., Ltd. (Japan) to undertake geotechnical investigations for the development of the proposed Fiji Pharmaceutical Services Centre at Vatuwaqa, Suva, Fiji. The scope of the geotechnical investigations and analysis included the following:

- A general assessment of site conditions and local geology of the area
- Four hand-augered boreholes with in-situ strength testing and soil logging
- Two Scala Penetrometer Tests
- Four Machine Drilled boreholes and associated strength testing
- Engineering Analysis and preparation of the geotechnical report.

The purpose of the investigation work was to provide geotechnical recommendations and design parameters for the proposed building.

Our investigations concluded that the site is suitable for the proposed development. Foundation solutions include driven or bored piles, with shallow footings possible for lightly loaded foundations.

2.0 Site Conditions

The site proposed for development is a grassed, level area located on Golf Link Road, Vatuwaqa. The site is presently used as a playing field area and, at the time of inspection, had

large amounts of surface water and ponding across the site. Golf Link Road borders the site to the east, while the western edge of the site is at the toe of an east-facing slope. Open channel drains surround the area (as shown on Drawing 750321-01) which are in turn connected to the sea.

The site and land bordering the site is noticeably higher (1.0m to 2.0m) in elevation than the surrounding land to the east and south. We understand that the site was previously a mangrove swamp that has been filled to create the playing field area. The fill is likely to have been placed 6 to 10 years ago and derives from excavations to construct nearby infrastructure.

3.0 Proposed Development

We understand the proposed development consists of the construction of a large warehouse structure approximately 66m by 80m in plan area, along with associated carparking to service the development. The warehouse is to be of steel beam and column construction, with steel panel walls and roof.

4.0 Published Geology

Published geology of the area¹ and information from the Tonkin & Taylor geotechnical database indicates that the dominant rock type in the Suva Peninsula area is Suva Marl, a sedimentary formation belonging to the Mendrausuthu Group (of Miocene – Pliocene age). The Suva Marl (known locally as soapstone in the past) comprises grey very weak thinly interbedded siltstone with thin mudstone, fine grained sandstone and thin sandy tuff beds. While the tuff beds are commonly found as weakly cemented silts and fine sands, the tuffs are in places coarser grained and the degree of cementation is also noted to vary. The wet marl was known as soapstone for its tendency to become slippery when wet. Geological maps also show deposits of alluvium to be present underlying regions along the eastern coast of the Suva Peninsula.

5.0 Site Investigations

The two-phase investigation involved field testing undertaken by an engineer from Tonkin and Taylor, followed by the drilling of four deep machine boreholes. Testing locations are shown on the attached Drawing 750321-01.

Four hand augered boreholes were put down at the locations indicated on the attached site plan. Undrained shear strength testing was undertaken at regular intervals and all soils encountered were logged. Borehole depths ranged from 3.5 to 3.9 m below existing ground level. Summary borehole logs are appended to this report. Subgrade CBR testing, comprising

¹ From R.B. Band (1968).

a total of two (2) Scala Penetrometer tests, was also carried out to the east of the proposed building footprint.

A total of 4 machine drilled boreholes were each drilled to a depth of 20 metres. Soil testing comprised Standard Penetration Tests (SPT) at regular intervals in the boreholes.

All soils have been described in accordance with the NZ Geomechanics guidelines on soil and rock description. Copies of the borehole logs are appended.

6.0 Subsurface Conditions

Field investigation data indicates the site is underlain by a layer of FILL, overlying recent alluvial sediments, and Suva Marl which becomes less weathered with depth. Our investigations generally confirm the published geology and records for the area.

FILL overlies the site to depths of 1.5 to 2.2 metres and comprises soils which are likely to have originated from a local borrow area of Suva Marl. The fill generally comprised red, brown and grey clays and silts, with weathered siltstone gravels generally in the range 1mm to 50mm in diameter. The fill was found to be stiff to very stiff, with undrained shear strength measurements of 180 to over 210 kPa, and SPT 'N' values of 1 to 6. Scala Penetrometer testing carried out in the fill found the upper layers (up to 0.5m) of fill to be loose / soft to firm with 0 to 1 blows per 50mm. Generally readings were in the range 2 to 4 blows per 50mm.

The alluvial sediments underlying the fill material were generally found to be soft to firm organic SILTS, with varying clay and sand content. The sediments were generally dark brown / grey, wet and odorous, with frequent root and decomposing wood inclusions throughout the stratum. Undrained shear strength measurements undertaken within the alluvial sediments ranged between 30 kPa and 80 kPa, with SPT 'N' values of 0 to 3. The alluvium was found to extend to a depth of 3 to 9 metres, deepening to the south-east of the site. Odorous grey sandy silts with varying organic content were encountered underlying the softer silts in HA3 and HA4 which are also likely to be alluvial materials.

A mantle of weathered Suva Marl soils (approximately 2 metres in thickness) comprising hard grey silts were encountered underlying the alluvium that exhibited undrained shear strength measurements of over 200kPa. These silts became harder with depth and graded to extremely weak to weak, unweathered Suva Marl comprising blue/grey SILTSTONE. The less weathered Suva Marl exhibited SPT 'N' values ranging from 10 to over 50, generally increasing with depth.

Groundwater levels were found to be between 0.5m and 1.2m depth.

7.0 Geotechnical Issues

7.1 General

Recommendations and opinions contained in this report are based on field tests at the four borehole locations. The nature and continuity of the subsoil away from these locations is inferred but it must be appreciated that actual conditions may vary from the assumed model.

7.2 Settlement

The alluvial sediments have a high water content, are compressible and typically significant consolidation settlement of the material can be expected.

We expect significant consolidation of the alluvial soils has already occurred following placement of the fill between 6 to 10 years ago. It is unknown whether an adequate drainage blanket has been constructed below the fill material, and the permeability of the underlying dense Suva Marl is likely be low; accordingly the rate of consolidation is likely to be low. We estimate that the alluvium could take between 5 and 15 years from the time of fill placement to reach 90% consolidation. Accordingly, in some areas the consolidation settlements will be essentially complete (i.e. where deep deposits of alluvium are present) while elsewhere consolidation settlement may be ongoing (albeit at a reducing rate).

Consolidation settlements in the order of 50mm may be expected following the construction of the warehouse. This assumes a 20kPa loading due to the development, and accounts for estimated ongoing settlement due to previous fill placement. Differential settlements are also likely to be high due to the variation in thickness of alluvium across the site but current investigation data does not allow this to be quantified.

Further analysis and laboratory testing of fill material could be carried out if specific settlement estimates are required.

7.3 Foundations

We expect settlement issues may require the use of piled foundations, which would need to be embedded in competent Suva Marl underlying the site. We expect the most appropriate solution to be driven steel piled foundations, given the varying depth of founding rock and potential for settlement of the alluvial sediments. Shallow foundations may be used for footings with light loads provided they are founded on an adequate depth of the hard / dense fill. In any case, we recommend the use of piles for heavily loaded foundations. Piled foundations may either be driven steel or precast concrete piles, or bored cast in-situ concrete piles. We consider that piled foundations can be founded in the hard / dense Suva Marl that occurs at depths of approximately 4 to 10 metres.

7.3.1 Driven Pile Design

We recommend the following end bearing and skin friction capacities for driven pile design.

	Driven Pi	Table 1 ile Design Parameters	
Soil type		Ultimate end bearing capacity (kPa)	Ultimate skin friction (kPa)
Fill		-	-
Recent Alluviu	m	-	-
Suva Marl (N>	50)	8,000	200

Appropriate Factors of Safety for driven piles are 3.0 and 2.2 when compared with working (Serviceability Limit State) loads or factored (Ultimate Limit State) loads respectively.

It is recommended that the pile capacity be designed in part with an appropriate pile driving formula (e.g. wave equation or Hiley) and confirmed on site by pile testing. Both end of drive and redrive tests should be undertaken on at least 10 percent of piles to confirm capacity and determine whether less conservative geotechnical strength reduction factors may be used for design. PDA (Pile Dynamic Analyser) equipment could be used with at least 2 tests on each pile type.

7.3.2 Bored Pile Design

An alternative pile foundation option involves bored cast in situ concrete piles. We expect casings would be required for excavation through the materials above the Suva Marl.

The following end bearing capacities and skin friction values are recommended for bored pile design (Table 2).

Bored Cast In S	Table 2 Situ Pile Design Param	eters The Land
Soil type	Ultimate end bearing capacity (kPa)	Ultimate skin friction (kPa)
Fill	-	-
Recent Alluvium	-	-
Suva Marl (N>50)	6,000	200

The piles should be embedded a minimum depth of 3D (D - diameter of pile) into the less weathered Suva Marl.

Based on the fieldwork results and adjacent site information, we expect that drilled pile lengths are likely to vary greatly due to the ground conditions. Pile lengths would need to be confirmed by site inspection. Appropriate safety factors to be applied to the design capacities are as follows:

For comparison with working loads (Serviceability Limit State), apply safety factors of 3.0 and 2.0 for end bearing and skin friction respectively.

For comparison with factored loads (Ultimate Limit State), apply safety factors of 2.2 and 1.5 for end bearing and skin friction respectively.

7.3.3 Shallow Foundations

Shallow foundations may be utilised provided an adequate depth of fill is proven to underlie the foundations. We recommend at least 1 metre of hard / dense fill should be present below the underside of shallow footings.

We recommend an Ultimate Bearing Capacity of 300 kPa for isolated shallow foundations, which corresponds to Factored (Ultimate Limit State) and Working (Serviceability Limit State) bearing capacities of 150 kPa and 100 kPa respectively.

Local strengthening of soft zones of subsoils may be required, and could be achieved by way of subexcavation and backfilling with engineered hardfill. We also recommend proof rolling across the full building footprint before the foundation construction commences to highlight potential soft spots.

Inspection will be required following excavation for the footings to confirm subsurface conditions and the above design bearing capacities.

7.4 Pavement Design

Our investigations indicate the upper 0.5m of fill material is loose. We recommend stripping of this loose material, followed by replacement with suitable hardfill compacted to engineered standards. Subgrade conditions should be checked when the site is opened up to confirm actual CBR values, and to ascertain the extent of stripping required.

For the car park pavement design following this remedial work, a preliminary subgrade CBR of 5% can be assumed.

8.0 Applicability

This report has been prepared for the benefit of Azusa Sekkei Co., Ltd. with respect to the particular brief given to us and may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

During construction, the site should be examined by an engineer competent to judge whether exposed subsoils are compatible with those inferred in this report. Tonkin & Taylor would be happy to provide this service and believe your project would benefit from the continuity.

We trust this report covers your present requirements. If you have any further queries please feel free to contact David Linton or the undersigned on 355-6000.

Yours faithfully

TONKIN & TAYLOR (FIJI) LTD

Nick Rogers for Pratap Singh

MANAGING DIRECTOR

Appendices: Site Plan

Machine Borehole Logs Hand Auger Borehole Logs Scala Penetrometer Test Results

Photographs

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BOREHOLE No: BH1
Hole Location: Refer to Site Plan

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BOREHOLE LOG

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BOREHOLE LOG

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						• N=25+			13 -	× × × × × × × × × × × × × × × × × × ×								- - 13 - - - -
				CORE					-	× × × × × × × × × × × × × × × × × × ×								14-
			A/X	ROTARY CORE	N/A	• N=23			-	x x x x x x x x x x x x x x x x x x x								15 - - - - - 16 -
						9 20 for 100n hammer bouncing	m		16	× × × × × × × × × × × × × × × × × × ×		sw						-
									}	X X								- - -
						• 16 15 for 80mm hammer bouncing	n		18-	(18 -
		:				• 15 19 3 for 20mm hammer bouncing			19	× × × × × × × × × × × × × × × × × × ×								END OF BOREHOLE AT 20.0m



BOREHOLE No: BH3 Hole Location: Refer to Site Plan

SHEET__1_ OF__2_

CO-ORIONATES IN INC. RECOLOGICAL THEFT BY BY BY BY BY BY BY BY BY BY BY BY BY	ano isot										100	\AT!^	Al. C	-10*	L.P.		17		_		LOD No.
PRILL METHOD. Machine Auge PORTLE FUED. NA. LOGGED BY Radial Delicing DRILLE DUE. No. LOGGED BY Radial CHECKED. RECOGNICAL RECOGNICAL RECOGNICAL STATES AND AND AND AND AND AND AND AND AND AND	<u> </u>		vel	opm	ent											ad,	∨at	uwa	_	ц С	JOB No: 750321
DRILL FLUD: MA DRILL FLUD: NA COGGED AY Registal OFHICKED: MA REGORDAL MR. REGORD														-							
SECUCIONAL SECRETARIO DE SCRUPTION SERVICAME SECRETARIO DE SCRUPTION SERVICAME SERVICAME SECRETARIO DE SCRUPTION SERVICAME SER		m													chine	e A	uge	r	f	DR	RILLED BY: Radial Drilling
NECONOMICAL PROPERTY Property Proper	DATUM	Ī									DRI	LL FL	UID:	N/A		E	ال ال	MET			
Section Sect		+-	Т	Τ	Ī	1		1	1				9]	T	T	NOI	NE E			
ALLUVIUM Partition of the state of the stat	GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY	МЕТНОВ	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)			MOISTURE		1	ı				i	Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
ALLUVIUM A N=6	FILL									-	x i	ML	М	VSt					\parallel		SILT, clayey, orange/brown/red.
ALLUVIUM A N=6																					
VEATHERED SUVA ARRL							2				х		M/W			Ш	$\ \ $	Ш			
VEATHERED SUVA ARARL VEATHERED SUVA ARARL	ALLUVIUM						4 N=6				<u>*</u> -×	OL		5/r							
VEATHERED SUVA ARAL VEATHERED SUVA ARAL									ĺ		×		i	S						П	
VEATHERED SUVA 4 N										٠, -											
1 1 2 2 2 2 3 3 4 4 4 4 4 4 4 4										-	×	ML		Н		1					SILT, sandy, hard, odourous with trace of clay, with minor organic flecks.
SILTSTONE [SUVA MARL] light grey, 6-	WEATHERED SUVA MARL		i				1			4-	× × ×		нжв	Wk/W	 						
9 8 - × × × × × × × × × × × × × × × × × ×				N/A	ROTARY CORE	N/A				5	× × × × × × × × × × × × × × × × × × ×										5 -
9 8 - x x x x x x x x x x x x x x x x x x							11			6-	× × × × × × × × × × × × × × × × × × ×										SILISTONE [SUVA MARL] right grey, weak.
9							9			8-	^										8
10 × ×								90.		9-	× × × × × × × × × × × × × × × × × × ×	LODGE TO	f								9
						Ц,				10	××]	Ш						BORELOG 750321_M GPJ 05/06/01



BOREHOLE No: BH3
Hole Location: Refer to Site Plan

SHEET_ _2 _ OF _ _2 _

PROJECT: Warehou	use De	vei	opm	ent					LO	CATIC	N: Go	olf Lin	k Ro	ad,	Vat	uwa	qa		JOB No: 750321
CO-ORDINATES	mN								DR	ILL TY	PE:	HQT	Ţ						DLE STARTED: 16/05/01
R.L.	mE m								DR	ILL ME	THOE): Ma	achin	e A	uge	r			OLE FINISHED: 17/05/01 ULLED BY: Radial Drilling
DATUM	111								DŔ	ILL FL	UID:	N/A							GGED BY: Radial CHECKED:
GEOLOGICAL									Ι					ΕI	NGI	NEE			DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY	METHOD	CASING	YESTS	SAMPLES	R.L. (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE WEATHERING	STRENGTHOENSITY	SHEAF	۱	COMPRESSIVE		DEFE	(mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
	= =	3	18	¥	5	8	₹,	2	5 x x		¥ 8	ਲ ਹ	21¢31	a≌Ř. 	-	H ₩	88) 	ĕŘ. HH	гоодинава, милд.
						10 14 N=24		11 -	× × × × × × × × × × × × × × × × × × ×										11 -
						• 9 16 10 for 80mm hammer bouncing	n	12 -	* * * * * * * * * * * * * * * * * * *										-becoming stronger, light grey.
)R.E		• 14 7 for 70mm hammer bouncing		14 – 14 –	× × × × × × × × × × × × × × × × × × ×										- - - 14 - -
			A/A	ROTARY CORE	N/A	• 16			× × × × × × × × × × × × ×										15 - - - - 16
						16 7 for 60mm hammer bouncing		- - 17 — -	******************										17
						12 14 16 for 120m hammer bouncing	m.	19 —	××××××××××××××××××××××××××××××××××××××										becomes dark grey.
						15 21 for 140mr hammer bouncing	n	-	× × × × × × × × ×									,	END OF BOREHOLE AT 20.0m BORELOG 750321_M.GPJ 05/06-01



BOREHOLE No: BH4 Hole Location: Refer to Site Plan

SHEET__1_ OF__2_

PROJECT: Warehous	م∩ م	مامي	ner-	101					inc	ΑΤΙΛ	N: G	olf I in	k Daa	, I	/ation	202	JOB No: 750321
CO-ORDINATES	mN	10	PHIC	.1(1							PE:			٠	. utuw		OLE STARTED: 18/05/0[
OT OTHER PROPERTY.	mE											•					OLE STARTED: 18/05/01 OLE FINISHED: 19/05/01
R.L.	m								DKIL	L ME	THO	J: Ma	ichine	: Ai	iger	D	RILLED BY: Radial Drilling
DATUM									DRIL	L FL	UID:	N/A			OU :=		OGGED BY: Radial CHECKED:
GEOLOGICAL	+					_	Т		 		J (n	Τ-	Т	EN	GINE	ERIN	G DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY	метнор	TESTS	SAMPLES	R.L. (m)	DЕРТН (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH		STRENGTH (MP.)	DEFECT SPACING	ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Yype, inclination, thickness.
FILL	르	- ₹	ŭ	ž	3	19	<u> </u>	<u> </u>	×	ML	Σŏ	ัด ฮ VSt	1111	╫	_88 <u>88</u>	888 1111	SILT, clayey, stiff to very stiff with fine to
ÄLLUVIUM					•0 0 1 N=1				× × × × × × × × × × × × × × × × × × ×	OL	W	VSt			in the second se		coarse weathered siltstone gravels, brown/grey/red. SILT (organic) with minor clay and some sand, very soft, dark brown with fibrous rootlets and shell fragments.
WEATHERED SUVA MARL								3 -	× _ x _ x _ x _ x _ x _ x _ x _ x _ x _	ML	нW	Н	100				SILT, clayey, hard, blue/grey.
			V/VI	KOLAKY CORE	• 9 14 15 for 110n hammer bouncing	nm		5	- X		MW						-becomes light grey.
					•6 15 19 N=34				* *********		В	Wk/W					-grading to extremely weak to weak SILTSTONE [SUVA MARL] light grey.
					• 7 11 12 N=23			- 13	*********								8 - 9 -



BOREHOLE LOG

BOREHOLE No: BH4 Hole Location: Refer to Site Plan

SHEET___2_ OF__2_

PROJECT: Warehou	se De	evel	opm	ent					LOC	CATIO	N: Go	olf Lia	ık Ro	oad,	Vatuv	waqa		JOB No: 750321	
CO-ORDINATES	mN										PE:						но	LE STARTED: 18/05/01	
R.L.	mE m								DRI	LL ME	THOE): м	achir	ne A	uger			LE FINISHED: 19/05/01	
DATUM	m								DRI	LL FL	UID:	N/A						LLED BY: Radial Drilling GGED BY: Radial CHECKED:	R
GEOLOGICAL														E١	IGINE			DESCRIPTION	- W
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	ĸ	CORE RECOVERY	8	ō	TESTS	LES	л) Н (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE WEATHERING	STRENGTH/DENSITY	SHEAR STRENGTH	(KPs)	COMPRESSIVE STRENGTH (MPs)	DEFECT SPACING	(mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or perficie size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components.	
	FLUID	WATER	CORE	METHOD	CASING		SAMPLES				MOIST	STRE	288	288.	R88	8 8 F	88	Defects: Type, inclination, thickness, roughness, filling.	
				CORE	N/A	• 9 for 100mm hammer bouncing • 10 for 120mm hammer bouncing		11 13 14 15 13	**************************************		20	is of	8	3.	00			-becomes blue/green. difficult to drill due to high strength.	11 - 12 - 13 - 14 - 15 - 17 - 18 - 19 - 19 - 19 - 19 - 19 - 19 - 19
						10 for 90min hammer bouncing		×	×								E	ND OF BOREHOLE AT 20.0m BORELOG 750321_M GPJ	05/06·C



BOREHOLE LOG

BOREHOLE No: HA1 Hole Location: Refer to Site Plan

SHEET___!__ OF___!__

PROJECT: Warehou	se De	evel	орп	ent	l					LO	CATIC)N: G	iolf Lii	ık R	oac	d, V	/atu	vaq	а	JOB No: 750321
CO-ORDINATES	mN mE									DR	ILL TY	PE:	50m	n di	am	eter	r Au	ger		OLE STARTED: 23/04/01
R.L.	me m									DRI	ILL ME	ETHO	D: H	anda	uge	er				OLE FINISHED: 23/04/01 RILLED BY: D.G.L
DATUM										DR	ILL FL	UID:	N/A							DGGED BY: D.G.L CHECKED: 🔨
GEOLOGICAL	1	.,			.,-		7				· · · · · · ·	,	_	_	E	N	GIN	ΕE	RIN	G DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY	МЕТНОО	CASING	TESTS	SAMPLES	R.L.(m)	ОЕРТН (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE WEATHERING	STRENGTH/DENSITY	19 SHEAR STRENGTH		1	SO STRENGTH	١	DEFECT SPACING	ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness.
FILL	<u> </u>	ŕ	Ť	Ť	1		Ť	<u> </u>		× _ ×	ML	М	St/H		\dagger	Ш	Ш	Ħ	Ш	FILL, clay, silty, red/brown, stiff to very
		1 23/04/01				• UTP • 204+kPa • 204+kPa		THE TRANSPORT	- - 1	(*********	GP	w	H	***************************************						-with fine course, hard siltstone gravels (orange to brown to grey) in a light brown silt matrix. -with sand, (fine to medium) and large dark grey siltstone (20mm diameter) fragments, wet.
ALLUVIUM			N/A	HANDAUGER	N/A	195/9kPa79/47kPa204+kPa			2 - -	X X X X X X X X X X X X X X X X X X X	OL ML	M	VSfVS							SILT with some clay, soft to firm, dark brown with minor fine sand and fibrous root inclusions, organic, odourous. SILT, grey, with minor clay, very stiff to hard with large siltstone fragments.
			2 47.0			• UTP • 204+kPa • UTP			3 -	* X X X X X X X X X X X X X X X X X X X										-with hard bands and bands of very stiff grey SILT.
										× ×				Щ	Щ	Щ	Щ	\parallel	Щ	END OF BOREHOLE AT 4.0m
									-											BORELOG 750321.GPJ 05/06/01



BOREHOLE LOG

BOREHOLE No: HA2 Hole Location: Refer to Site Plan

SHEET__1_ OF__1_

		-								100	AT.C	Nt	161.	L 22	,	.,			lon M.
PROJECT: Warehous		vel	opm	ent							OITA								JOB No: 750321
CO-ORDINATES	mN mE									DRI	LL TY	PE:	50mn	n diam	nete	er Au	iger		DLE STARTED: 23/04/01 DLE FINISHED: 23/04/01
R.L.	m									DRI	LL ME	THOE): Ha	ndaug	ger				RILLED BY: D.G.L
DATUM										DRI	LL FLI	JID:	N/A		_				OGGED BY: D.G.L CHECKED:
GEOLOGICAL				,			,								E١	IGIN	EE	RIN	G DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.	FLUID LOSS	WATER	CORE RECOVERY	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEРТН (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH	ı	COMPRESSIVE	- 1	DEFECT SPACING	Defects: Type, inclination, tyickness.
FILL	로	≥	8	3	3		3	er;		~ -	ML	ž ŏ D/M	ับ ซี VSt		Ĥ	111	- N	***** 	SILT/CLAY, stiff to very stiff, red/brown
FILL		23/04/01				• 184/43kPa • 204kPa • UTP	2			xxxxxxxxxxxxx	GP	M	D						with grey gravels, disturbed appearance, light brown silt inclusions. -becomes grey/brown gravel with large grey siltstone fragments and some grey SILT.
ALLUVIUM			N/A	HANDAUGER	N/A	• UTP • 73/17kPa • 29/17kPa	3		2-	**************************************	OL	M	F						SILT with some clay (organic) with some sand, firm with root/wood inclusions, moist, odourous.
							1.		3-	× × × × × ×									-very little sample recovered.
						● 47/17kPa			3	<	!								-recovered as soft wet, dark brown silt.
						• 73kPa	5		4-	* X X X X X X									4
									-										Pushed Shear Vane to 5.2m. Still soft to firm.
-		!					1					L		1111	-	ш	ш	111	BORELOG 750321 GPJ 05 0601



BOREHOLE LOG

BOREHOLE No: HA3 Hole Location: Refer to Site Plan

SHEET__1_ OF__1_

PROJECT: Warehous	e De	velo	pm	ent						LO	CATIC	N: G	olf Lin	k Ro	oad	, Va	tuw	aqa	a	JOB No: 750321
CO-ORDINATES	mΝ									DR	ILL TY	PE:	50mn	n dia	ıme	ter	Aug	er	н	DLE STARTED: 24/04/01
	mЕ									DR	ILL ME	ETHO	D: Ha	nda	llge	r				DLE FINISHED: 24/04/01
I	m														-B-	•				RILLED BY: D.G.L
DATUM	_									DR	ILL FL	UID:	N/A		_	MO	IAIC	-		GGED BY: D.G.L CHECKED:
GEOLOGICAL	╢		r	1	1	T	Т	1		├	 	(1	T-	Τ.	-	ואוט	IINE	Т		G DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME,		1									豆	WEATHERING		SHEAR STRENGTH		뿔	r	1	DEFECT SPACING	SOIL DESCRIPTION Soil type minor commonents planticity or
ORIGIN,			L								S	¥.	È	II.	(RPR)	RESS		ģ	(EE	Soil type, minor components, plasticity or particle size, colour.
MINERAL COMPOSITION.			CORE RECOVERY			TESTS				8	CLASSIFICATION SYMBOL	_	STRENGTHODENSITY	13	٠	d d	STRENGTH (MPa)	1	<u>,</u> E	ROCK DESCRIPTION
	FLUID LOSS		RECO	Q			E	_	Ē	GRAPHIC LOG	5	MOISTURE	A 5	2		٥		å	5	Substance: Rock type, particle size, colour, minor components.
	QIO	WATER	ORE	METHOD	CASING		SAMPLES	R.L. (m)	DEPTH (m)	\$	l ss	OIST OND	Lk RE	0.00	. 88	ļ 3. 8	មន្តិវ	,	888	Defects: Type, inclination, thickness, roughness, filling.
FILL	=	3	ŏ	2	3		9	×		× ×	ML	M	VSt	Hii	Ĥ	Ή̈́	"T"	Ĥ	111	SILT, clayey, orange/brown/red.
I III										I^		1		Ш	Ш		Щ	$\ $	Ш	one it, enayey, orange or own pred.
İ				Ì					_	× ~				Ш	Ш			II	$\ \ $	
]	107								×				Ш	Ш		Ш	II	Ш	
		24/04/01			1	• UTP		ĺ	-	X -X	GP		D	111			1		Ш	-becomes grey with fine to coarse, hard
1		2								\$ \$			-	Ш	Ш	ļ	Ш	II		siltstone gravels.
			1						7	x x x x]			Ш	Ш	Ш	Ш			1
		÷				• UTP				**************************************	}				$\ \ $					
						*011			1	х х х х	1					H				
							ŀ		1-	X X	1				Ш	Ш	Ш	I	Ш	1
			1		ΙÌ					XX				-	111		$\ \ $	II	[]]	· •
					ļ	• UTP			-	XX	Ì	W			Ш	Ш	Ш	I	Ш	4
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		i			Ιí					x x			ŀ			Ш	Ш	П		
									- 1	x x x x	ĺ			Н	Ш	Ш	Ш	П	Ш	
ļ				li		• UTP			+	x x					Ш	Ш	Ш		Ш	-
										XX					Ш	Ш	Ш			
		ĺ		ER					4	XX			ĺ		∥	Ш	Ш			1
			_	S	ا برا					88						Ш	Ш	Ш		_ 1
 -	1		ž	ΙDΑ	ž	• UTP			2	×	ML	M/W	Н		\parallel	Ш	Ш	Ш		SILT, hard, brown.
				HANDAUGER	.					×					Ш	Ш	Ш	Ш	III	
ALLUVIUM	1]			-					1	××	OL	M/W	S/F		Ш		Ш	Ш		SILT, organic with some clay, soft to firm,
									1	× ×					Ш	$\ \ $	ili	Ш	Ш	frequent roots/wood inclusions, odourous.
			ı							<u>۴</u> ــــــــــــــــــــــــــــــــــــ					$\ \mathbf{i} \ $	$\parallel \parallel$	Ш	Ш		
	H					• 73/44kPa			_[<u>×</u> ×					Ш	Ш	Ш	Ш		1
						75,7112				~ *					П	Ш	Ш	Ш	Ш	
									-	≟× ×					П	Ш				-becomes SILTY/SANDY.
										×			1		П	Ш		Н		-occomes sill 1/SAND 1.
			- 1			• 47/20kPa			3-	x X			S	Ш				Ш		3-
			İ		ŀ				ļ	ž.						Ш	Ш	Ш	11.	-becomes softer, lots of roots.
							- 1		f	, X.						Ш		Ш		· 1
		-							ŀ	ζ ζ.	İ									
	1	- 1	-			• UTP	ŀ		1	<u>.</u> 2	ML		Н					Ш		SILT, sandy, hard, odourous with trace of
		-							ļ	~ x						$\ \ $				clay, with minor organic flecks.
			İ						1	. ×					$\ \ $					1
				-		• UTP	ļ		1	××										
•				ļ		- 541			ľ	×	1									
·	$\vdash \downarrow$	-	\dashv	4	_				→	×				#	#		Щ	Щ	44	END OF BOREHOLE AT 4.0m
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															_					BORELOG 750321.GPJ 05/06/01



BOREHOLE LOG

BOREHOLE No: HA4 Hole Location: Refer to Site Plan

SHEET. 1 OF 1

PROJECT: Warehou	ise De	velo	pm	ent			_			LO	CATIC	N: G	olf Lin	k Ro	oad	, Vatu	ıwa	qa	JOB No: 750321
CO-ORDINATES	mN									DR	ILL TY	PE:	50mn	n dia	ıme	ter A	ugei		OLE STARTED: 25/04/01
R.L,	mE m									DR	LL M	ETHO	D: Ha	ındaı	uge	r			OLE FINISHED: 25/04/01 RILLED BY: D.G.L
DATUM	OI.									DR	LL FL	UID:	N/A						OGGED BY: D.G.L CHECKED:
GEOLOGICAL						~~····						.,			Ē	NGIN	VEE	RIN	G DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION. FILL	FLUID LOSS	WATER	CORE RECOVERY	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG "	CLASSIFICATION SYMBOL	MOISTURE WEATHERING	STRENGTH/DENSITY	SHEAR STRENGTH		S COMPRESSIVE	1	1 200 DEFECT SPACING	ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.
TILL		1 25/04/01				• UTP • UTP			-		GP	W	Y 31						SILT, with some clay, very stiff with fine loose gravels, brown/grey/red. -mainly large (soapstone) gravels in a silt matrix (up to 40mm diameter)
ALLUVIUM		4 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	N/A	HANDAUGER	N/A	• 35/15kPa • 44/26kPa	6		2-	ر مې ایم ایم کې یې خایج ایم ایم کې یې خایج ایم	OL	М	Vsoft						-very hard, likely to be a large rock. SILT, organic with minor clay and some sand, soft, dark brown with frequent fibrous root inclusions, odourous.
						● 58/32kPa ■ 80/29kPa				*									-with pockets of medium grain grey/blue sand.
🕶 🕶						• UTP	7		3	x	ML	1	н '						SILT, hard, clayey, grey, slight odour.
		į		į		• UTP			- ×	- x - x - x - x - x - x - x - x - x - x									-becomes very hard silt extremely weak rock.
								-	4—	and district the control									BORELOG 750321 GPJ 05/06/01



TONKIN & TAYLOR LTD SCALA PENETROMETER LOG

19 MORGANIST NEWMARKET AUCKLAND NEW ZEALAND TELEPHONE (09) 3556000 FAX (09) 3070265

Site :		k Road, Va		Job No.: 750321 402:1988 Test 6.5.2 Dynamic Cone Penetrometer
Т	est No.:	· · · · · · · · · · · · · · · · · · ·	NZQ 44	1000 165t 0.0.2 Dynamic Cone Feliationieter
mm	No.	mm	No.	R.L. of ground surface: (m)
Driven	Blows	Driven	Blows	Depth from ground surface
50	0	2050		to commencement of penetration: 0.0 (m)
100	0.5	2100		Location plan : Refer Site Plan.
150	0.5	2150		
200	0.5	2200	•	
250	0.5	2250		
300	3	2300		
350	4	2350		7
400	3	2400		7
450	2	2450		
500	2	2500		_
550	3	2550		0.00
600	2	2600		
650	2.5	2650		
700	2.5	2700		-0.25
750	4	2750		et e tage tage : de la completa del completa de la completa de la completa del completa de la completa del la completa de la c
800	2	2800		
850	2	2850		-0.50
900	2	2900		
950	3	2950		
1000	2	3000		-0.75
1050	3	3050		
1100	3	3100		T E L
1150	2	3150		
1200	2	3200		Oepth (m) 1.00
1250	1	3250		
1300	2	3300		-1.25
1350	3	3350		
1400	3	3400		
1450	2	3450		-1.50
1500	2	3500		
1550	2	3550		
1600	2	3600		
1650	3	3650		-1.75
1700	4	3700		
1750	5	3750	_	
1800	3	3800		-2.00
1850	3	3850		No. of blows per 50mm
1900	3	3900		-
1950		3950		-
2000		4000		-
ested by:	DGI	Date: 25/04	1/01	Checked by: D.G.L Date: 08/05/01
colou by.	٠٠٠٠ ا	-uic . 23/0°		Chocker of a Date a Colonial

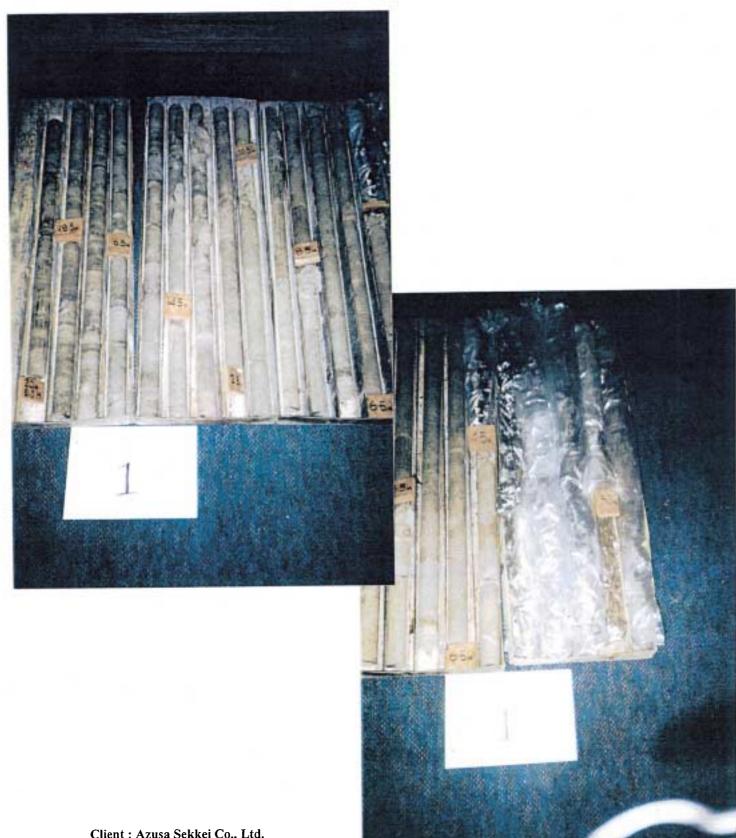


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			ED :NZS 44	02:1988 Test 6.5.2 Dynamic Cone Penetrometer
T	est No.:	,		
_mm	No.	mm	No.	R.L. of ground surface: (m)
Driven	Blows	Driven	Blows	Depth from ground surface
50	1	2050		to commencement of penetration: 0.0 (m)
100	0.25	2100		Location plan : Refer Site Plan.
150	0.25	2150		
200	0.25	2200		
250	0.25	2250		
300	0.25	2300		
350	0.25	2350		
400	0.25	2400		
450	1	2450		
500	1	2500		
550	1	2550		0.00
600	1	2600		
650	2	2650		
700	4	2700		-0.25
750	3	2750		The state of the s
800	2	2800		
850	4	2850		-0.50
900	3	2900		
950	3	2950		
1000	2	3000		-0.75
1050	3	3050		
1100	3	3100		
1150	3	3150		☐1.00
1200	3	3200		Depth (m) 1.00
1250	3	3250		
1300	3	3300	·····	-1.25
1350	4	3350	<u></u>	
1400	3	3400		
1450	3	3450		-1.50
1500	2	3500		
1550	3	3550		
1600	2	3600		-1.75
1650	4	3650		
1700	4	3700		
1750	5	3750		
1800	3	3800		-2.00 0 2 4 6 8 10
1850	3	3850		No. of blows per 50mm
1900	3	3900		⁻
1950		3950		┪
2000		4000		7
ested by:	D.G.L	Date : 25/04	4/01	Checked by: D.G.L Date: 08/05/01





Client : Azusa Sekkei Co., Ltd. Proposed Fiji Pharmaceutical Services Centre

Job Number: 750321











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