

REPORT

HUTT CITY COUNCIL

**Preliminary Geotechnical
Suitability Assessment**

Oakleigh Street, Maungaraki

Report prepared for:

HUTT CITY COUNCIL

Report prepared by:

TONKIN & TAYLOR LTD

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Executive summary

Tonkin and Taylor Ltd (T&T) has been engaged by Hutt City Council (HCC) to undertake an Urban Development and Planning Assessment for strategic sites in Hutt City. T&T has included a geotechnical assessment at each of these proposed sites to determine geotechnical constraints to residential development.

The table below summarises the findings of our geotechnical assessment for Oakleigh Street, Maungaraki.

Geotechnical Summary Information

Site reference	*Potential areas of land suitable for residential development (m ²)	Typical soil profile	Foundation preparation required	Additional foundation preparation cost per lot**
Oakleigh Street, (Site 3)	1,500 (Refer A/B Fig 3)	0- 2m variable fill over rock	Excavate fill and replace	\$10,000
	5,500 (Refer B/C Fig 3)	6m variable fill over rock	Timber piles driven to rock on 2m grid	\$27,500

* This is the most suitable land for residential development at each site, refer Table 1 for full breakdown of available areas.

** Foundation preparation costs for a 10x15m building platform on each lot. These are costs over and above the costs of standard NZS3604 type shallow foundations.

1 Introduction

1.1 General

Tonkin and Taylor Ltd (T&T) has been engaged by Hutt City Council (HCC) to undertake an Urban Development and Planning Assessment for strategic sites in Hutt City.

A key development consideration in this assessment is the potential geotechnical constraints on each site. T&T has undertaken an initial geotechnical investigation at each of the proposed sites.

This report summarises the findings of our geotechnical investigation for Oakleigh Street, Maungaraki (Site 3). The conditions of our engagement are detailed in our proposal dated October 2008.

1.2 Scope of Work

The scope of work for the geotechnical assessment includes:

Desk top study

- Review of 1:50,000 geological map of the area and HCC historic aerial photographs.
- Liaison with service providers to determine if any services extend through the site.
- Liaison with greater Wellington Regional Council to check historic contamination records (SLUR register)

Site Investigation (refer Figure 3 for investigation locations)

- Test Pitting
- Geological mapping

Analysis and reporting

- Review of all subsurface investigation results
- Preparation of factual summary report and zoning maps of foundation suitability.

2 Geotechnical Assessment, Oakleigh Street (Site 3)

The soil profile and depth to rock is inferred from limited test pit investigations. It must be appreciated that the subsurface conditions could vary away from the test locations.

2.1 Site Description

Site 3 is a flat area of land forming a terrace between the school site to the north and the residential area to the south. There is a short (approx 2m high), steep (approx 40 degree) batter slope leading up to the northern Site boundary and access road.

To the south, west and south-east of the flat area are steep 35 to 40 degree batter slopes. The western batter leads down to the Maungaraki Road Reserve. The eastern batter leads down to the existing site access off Oakleigh Street.

The southern and western batter slopes are vegetated but the majority of the site is maintained as a playing field.

The extent of the proposed site (Site 3) is shown on Figure 3 attached. We understand that the reserve area and batter slope to the west of the playing field will be used as an access road corridor. We have not included this area in our detailed investigation. However, we envisage no onerous geotechnical constraints to the construction of an access road across this reserve.

2.2 Site Geology and Soil Profile

The geotechnical investigation at Site 3 comprised 7 test pits to max 5.0m depth. Test pit logs TP1 to TP 7 are presented in Appendix A, Test pit locations can be seen in Figure 3.

The site generally comprises a variable depth of uncontrolled fill over greywacke rock. The fill comprises inter-bedded layers of sandy silt and silty sand with a high proportion of organics through the entire fill column.

On the north eastern portion of the site, rock was encountered at between 1 and 3m depth. Over the remainder of the site the uncontrolled fill extended beyond the base of the test pits (at least 4 to 5m depth).

Based on a review of the site geology and topography it is envisaged that the depth of fill will be approximately 5 to 6m along the northern portion of the site and more than 6m depth along the southern portion of the site.

2.3 Geotechnical Considerations

There is a potential for moderate ongoing differential settlement over the entire site. This is due to uneven decomposition of buried organics and consolidation under additional loading.

Our investigations so far (to a maximum depth of 5.0m) have not located natural ground over the southern portion of the site. Figure 3 shows the different areas of the site classified according to inferred fill depth (and, therefore, foundation preparation requirements). Table 3 summarises the site geology, foundation considerations and expected remedial work.

Where the fill depth is less than 2m we would consider that the unsuitable material could be excavated and replaced at modest expense.

Where the fill is between 3 and 6m in depth it is likely to be uneconomic to excavate and replace the unsuitable material. Timber or steel piles could be used to provide suitable foundation pads or a hardfill raft could be constructed by excavating and replacing the top 2.0m of fill.

Where the fill is greater than 6m in depth the remedial options become more extensive and risk of differential settlements increase. Possible options could include driven steel piles down to rock or a geogrid reinforced hardfill raft.

Further investigation (boreholes) will be required to confirm the fill depth in the north eastern and southern portions of the site if these are to be considered for future residential development.

These foundation recommendations are inferred from limited test pits. It must be appreciated that ground conditions could vary away from these investigation locations.

2.4 Site Geotechnical Summary Information

Table 1: Summary information for Site 3, Oakleigh Street

Geotechnical suitability classification (refer figure 3)	Approximate total area available (m ²)	Typical soil profile	Most appropriate remedial solution	Additional foundation preparation cost per lot*
A/B	1,500	Up to 2m fill over weathered rock	Cut and remove unsuitable fill. Backfill with imported granular hardfill.	\$10,000
B/C	5,500	2-6m fill over weathered rock	Driven timber piles extending to rock. Piles on 2x2m grid (48 no. 8m long piles, 380m total length for each lot).	\$27,500
C	4,500	+6m fill over weathered rock	Excavate 3m depth of fill and replace with geogrid reinforced hardfill raft (450m ³ earthworks with 300m ² geogrid for each lot).	\$47,000

*Foundation preparation costs for a 10x15m building platform on each lot. These are costs over and above the costs of standard NZS3604 type shallow foundations.

3 Applicability

This report has been prepared for the benefit of Hutt City Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

TONKIN & TAYLOR LTD

Environmental and Engineering Consultants

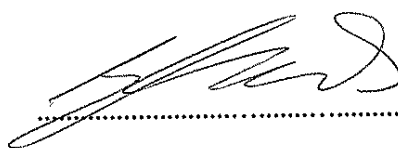
Report prepared by:

Authorised for Tonkin & Taylor by:



Andrew Kennedy

Geotechnical Engineer



Bruce Symmans

Senior Geotechnical Engineer

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Appendix A: Test Pit Logs



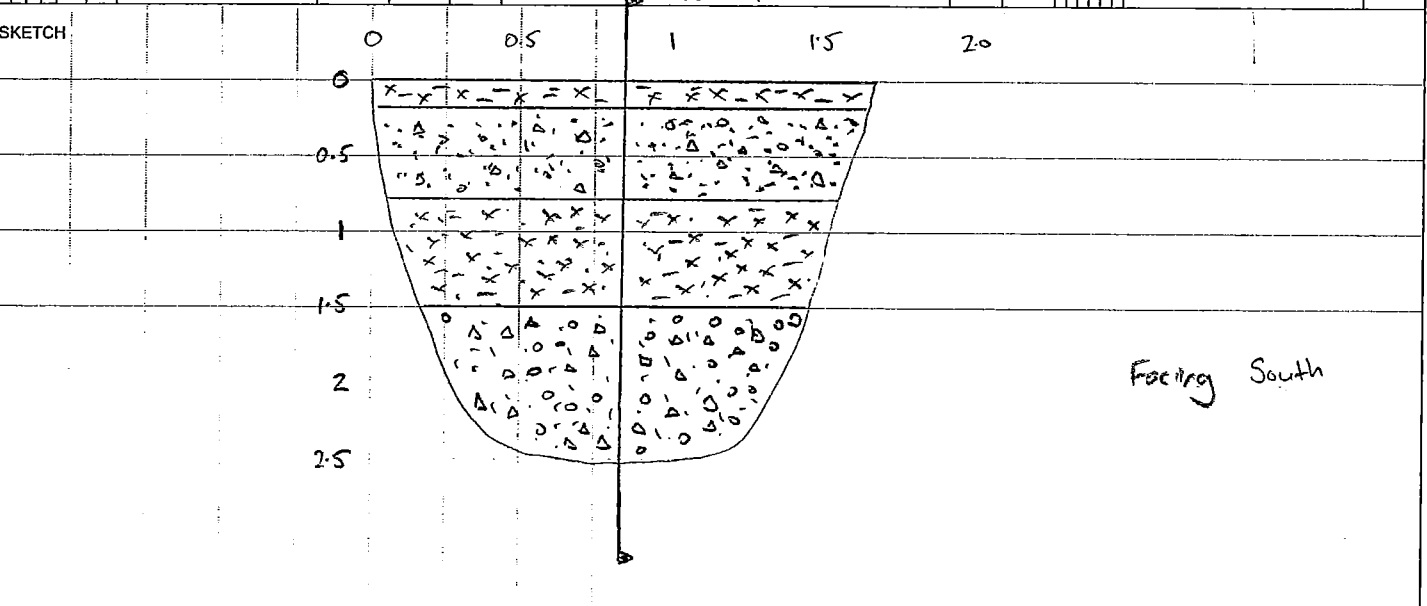
TONKIN & TAYLOR LTD.

EXCAVATION NO: TPI
SHEET 1 OF 1

EXCAVATION LOG

PROJECT: <u>Hutt City Plan</u>	LOCATION: <u>Oakleigh St.</u>	JOB NO: <u>64009.004</u>
CO-ORDINATES: <u>Dit N-S</u>	EXPOSURE TYPE: <u>Test Pit</u>	HOLE STARTED: <u>26/11/08</u>
RL:	EQUIPMENT: <u>12 tone excavator</u>	HOLE FINISHED: <u>26/11/08</u>
DATUM:	OPERATOR: <u>Barry Bellamy</u>	LOGGED BY: <u>MJWW</u>
	EXCAVATION DIMENSIONS: <u>2.2m x 1.6m</u>	CHECKED BY:

EXCAVATION AND TESTS:			ENGINEERING DESCRIPTION:					GEOLOGICAL:					
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
123			pp = pocket penetrometer SV = Shear Vane										
	NOT SEEN						OL	clayey SILT, moderate plasticity, dark brown, organics present (tree roots)	M	VS		Topsoil	
	SEEN			0.5			SW	gravelly SAND yellow/brown, loosely packed, fine-medium, trace of organics, and bricks	D	S		Fill (Non Engineered)	
	N/A		SV = 50kPa (P) = 18 kPa (R)	1			OL	clayey sandy SILT yellow/brown, non plastic, fine-coarse grains		F			
	NOT SEEN		pp = 225 kPa	1.5			GW	sandy GRAVEL yellow/brown, medium-coarse gravels, angular to sub-rounded, manganese staining evident.	D	L		CW greywacke SANDSTONE	
				2									
				2.5				Test Pit terminated @ 2.2m depth.					





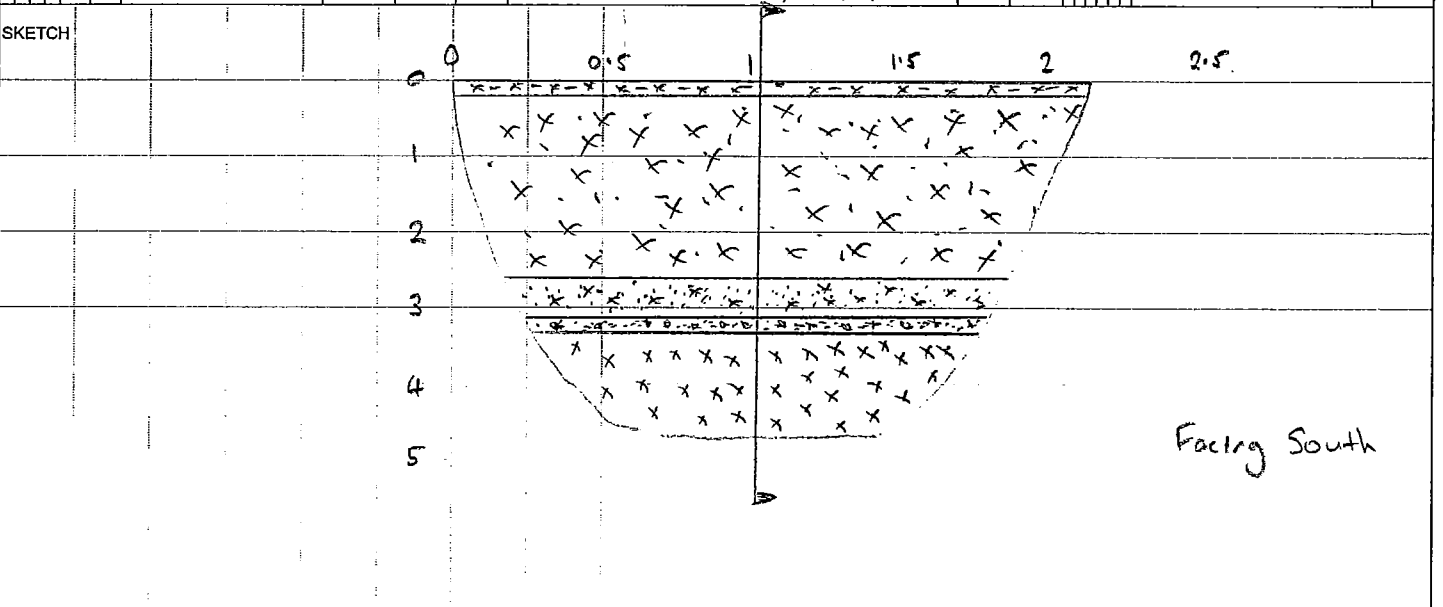
TONKIN & TAYLOR LTD.

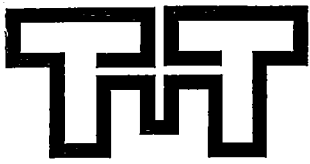
EXCAVATION NO: TP2
SHEET 1 OF 1

EXCAVATION LOG

PROJECT: Hutt City Plan LOCATION: Oakleigh St JOB NO: 84009, 004
 CO-ORDINATES: (N-S) EXPOSURE TYPE: Test Pit HOLE STARTED: 26/11/08
 EQUIPMENT: 12 tone excavator HOLE FINISHED: 26/11/08
 OPERATOR: Barry Bellamy LOGGED BY: MJWW
 DATUM: EXCAVATION DIMENSIONS: 4.8m x 2.1m CHECKED BY:

EXCAVATION AND TESTS:				ENGINEERING DESCRIPTION:				GEOLOGICAL:				
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
123			SV = shear vane	0		OL	Clayey SILT dark brown, organics present.	M	S		Topsot	
			pp = 200 kPa	1		OL	Sandy SILT yellow/brown, non-plastic, fine grains, organics present (logs, tree roots)	M	VS		Fill (non engineered)	
			SV = 150 kPa (P) 50 kPa (R)	2		OL						
			pp = 60 kPa	3		SM	silty SAND grey/white, non-plastic, fine grains,	M	VL			
				3		SP	gravelly SAND orange, fine grains, angular-sub rounded	M	VL			
			pp = 75 kPa	4		OL	Sandy SILT grey/brown, non-plastic, fine grains, manganese staining evident	M	EW		CW greywacke SILTSTONE	
				5			Test pit terminated @ 4.8m depth					





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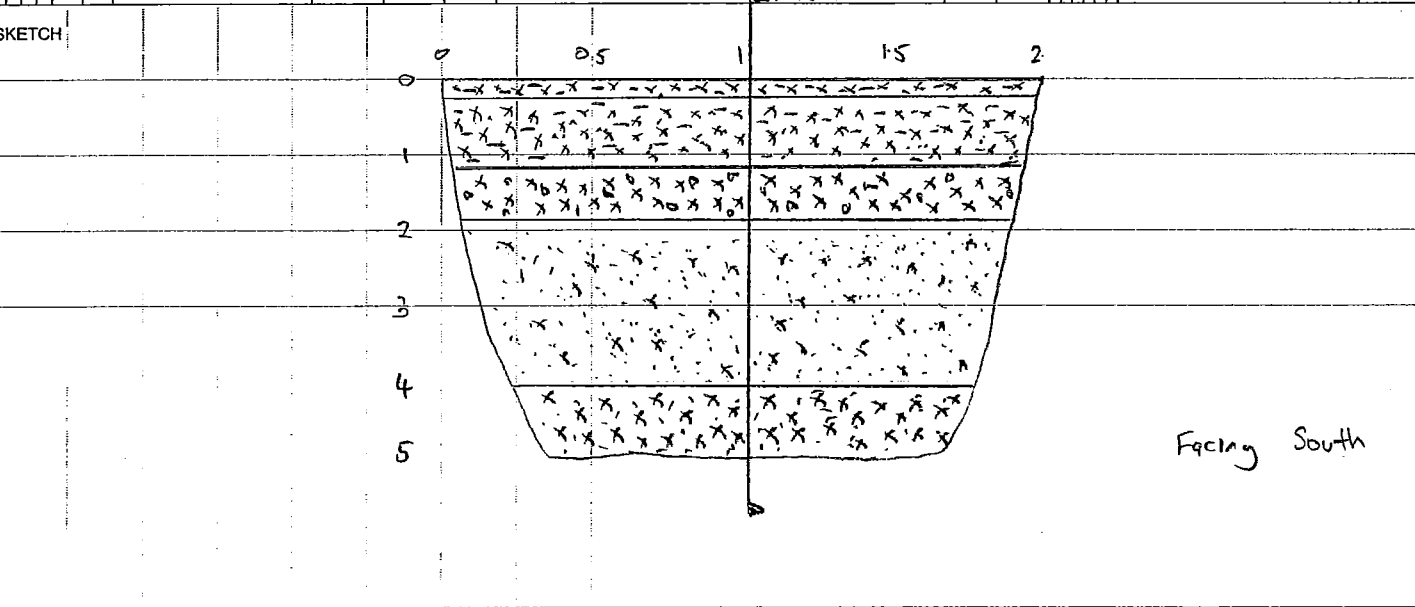
EXCAVATION NO: TP3

SHEET 1 OF 1

EXCAVATION LOG

PROJECT: *Hutt City Plan* LOCATION: *Oakleigh St.* JOB NO: *84009.004*
 CO-ORDINATES: (N-S) EXPOSURE TYPE: *Test Pit* HOLE STARTED: *26/11/08*
 RL: EQUIPMENT: *12 tonne excavator* HOLE FINISHED: *26/11/08*
 DATUM: OPERATOR: *Barry Bellamy* LOGGED BY: *MJW*
 EXCAVATION DIMENSIONS: *5.0m x 2.0m* CHECKED BY:

EXCAVATION AND TESTS:				ENGINEERING DESCRIPTION:					GEOLOGICAL:				
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
123			<i>PP = packet penetrometer</i>										
				0			OL	<i>clayey SILT, grey/brown, organics present, (tree roots etc.)</i>	M	S		<i>Topsoil</i>	
				1			OL	<i>clayey SILT with some sand, yellow/brown, moderate plasticity, fine grains.</i>	M	F		<i>Fill (non engineered)</i>	
			<i>PP = 200kPa</i>	2			OL	<i>SILT with some gravel grey/blue, non plastic, organics present (wood fragments observed)</i>	M	V.St.			
				3			SM	<i>Silty SAND yellow/brown, fine grains, non cohesive silt</i>	M	V.St.			
			<i>PP = 180 kPa</i>	4			OL	<i>Sandy SILT blue/grey, manganese staining present</i>	D	V.St.		<i>(W) SILTSTONE (not naturally occurring, but FILL material)</i>	
			<i>PP = 125 kPa</i>	5				<i>Test pit terminated @ 5.0m</i>					





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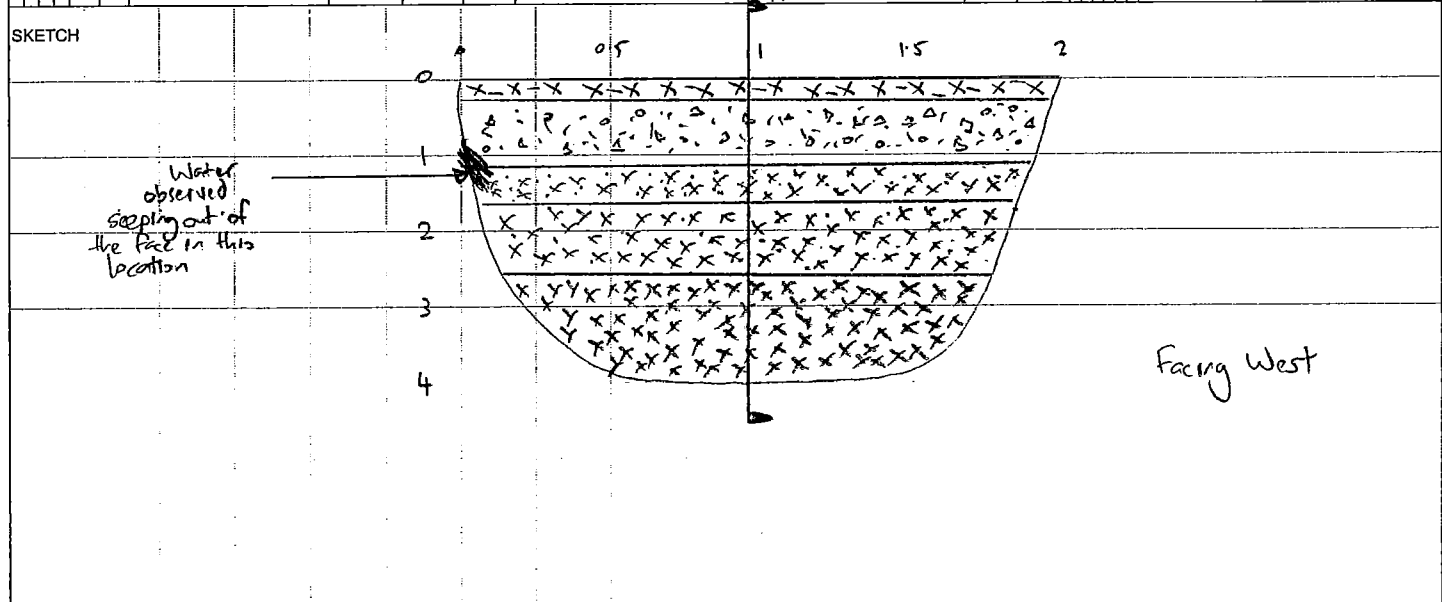
EXCAVATION LOG

EXCAVATION NO: TP4

SHEET 1 OF 1

PROJECT: <u>Hutt City Plan</u>	LOCATION: <u>Oakleigh St.</u>	JOB NO: <u>84009.004</u>
CO-ORDINATES: <u>(W-E)</u>	EXPOSURE TYPE: <u>Test Pit</u>	HOLE STARTED: <u>26/11/08</u>
RL:	EQUIPMENT: <u>12 tonne excavator</u>	HOLE FINISHED: <u>26/11/08</u>
DATUM:	OPERATOR: <u>Barry Bellamy</u>	LOGGED BY: <u>MJWW</u>
	EXCAVATION DIMENSIONS: <u>4.0m x 2.0m</u>	CHECKED BY:

EXCAVATION AND TESTS:				ENGINEERING DESCRIPTION:				GEOLOGICAL:				
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
123			PP = packet penetrometer SV = Shear Vane	0	X X X	OL	Clayey SILT, brown, moderately plastic	M	S		Topsoil	
			pp = 100 kPa	1	o.o.o. x x x	GW	sandy GRAVEL with some silt brown/orange	M	L		Fill (non engineered) Water was observed seeping out of the face at this depth (1.0m)	
			pp = 200 kPa	2	x x x x x x	OL	sandy SILT blue/grey, non-plastic, fine grained	M	V.St.		tree roots & foreign wood (logs) present	
			SV = 70 kPa (P) = 25 kPa (R)	3	x x x x x x x x x	OL	SILT with some sand brown/yellow, non-plastic, fine grained bricks present.	D	St.			
				4	x x x x x x x x x	OL	HW greywacke SILTSTONE. blue/grey, (Fill material from cut slope adjacent to field)	D	VW		Strong smell of organics from test pit wood (logs) within the rock (some still green)	
				4			Test pit terminated @ 4.0m depth.					

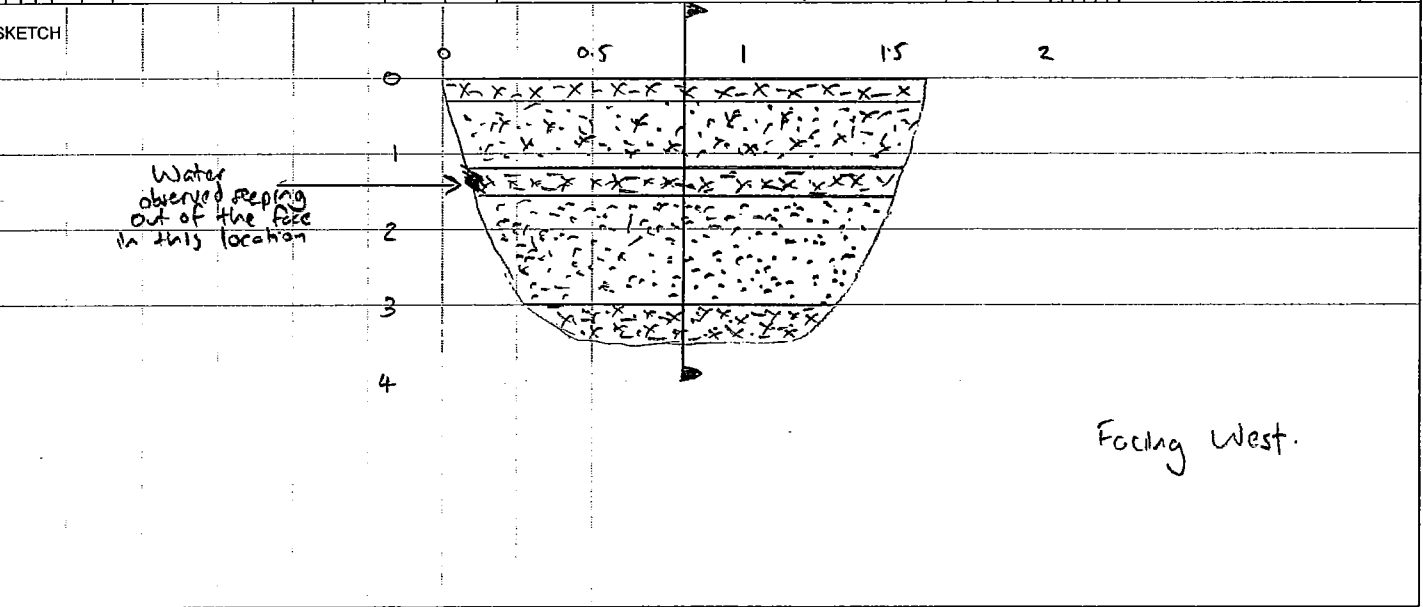




EXCAVATION LOG

PROJECT: Hutt City Plan LOCATION: Oakleigh St JOB NO: 84009.004
 CO-ORDINATES: EXPOSURE TYPE: Test Pit HOLE STARTED: 26/11/09
 EQUIPMENT: 12 tonne operator HOLE FINISHED: 26/11/08
 RL: OPERATOR: Bobby Balleney LOGGED BY: MSW
 DATUM: EXCAVATION DIMENSIONS: 3.4m x 1.6m CHECKED BY:

EXCAVATION AND TESTS:				ENGINEERING DESCRIPTION:					GEOLOGICAL:				
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
123			PP = perfect penetrometer	0		X-X-X-X	OL	clayey SILT, dark brown, organics present	M	S		Topsoil	
			PP = 150 kPa	1		X-X-X-X	SM	silty SAND orange/brown, fine grains, non cohesive	D	L		FILL (non engineered)	
			PP = 200 kPa	2		X-X-X-X	OL	sandy, clayey SILT blue/grey, moderate plasticity, fine grains	M	V.St.		← water observed seeping out of the face at this depth	
			PP = 175 kPa	3		X-X-X-X	SM	Silty SAND with some gravel orange/brown, non-cohesive fine-medium grains (boulders present up to 400mm wide)	M	L			
				4				Test pit terminated @ 3.4m depth					





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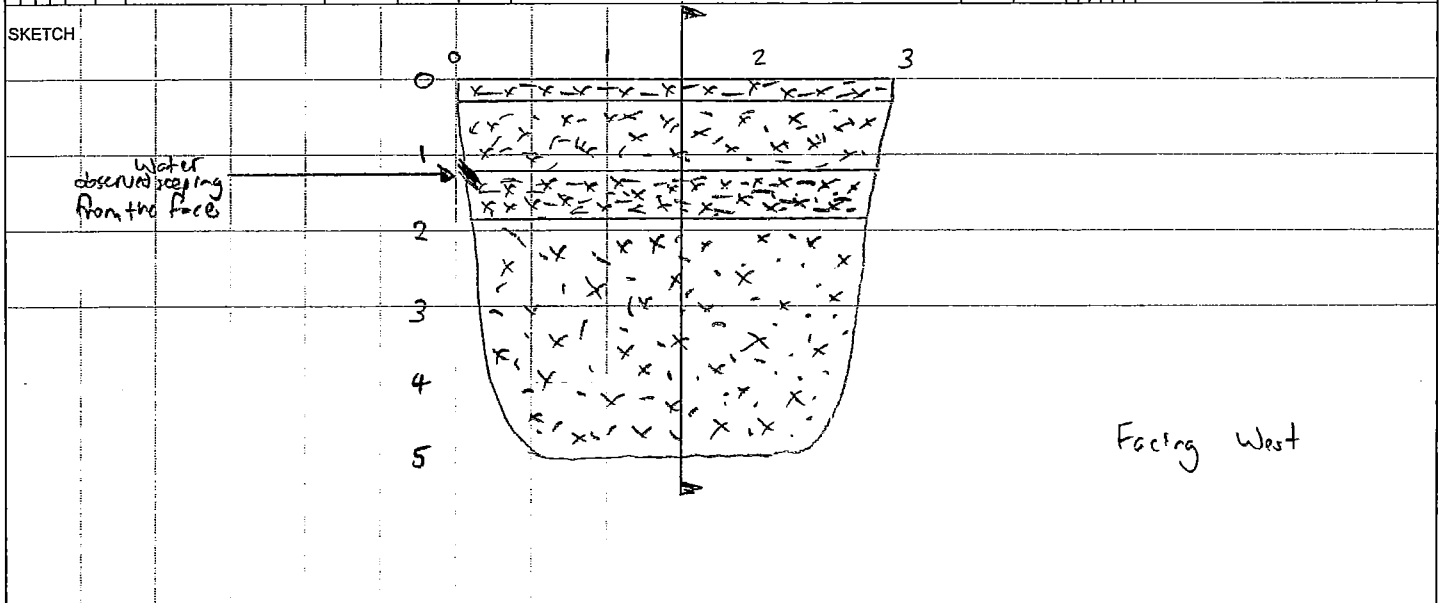
EXCAVATION NO: TP6

EXCAVATION LOG

SHEET | OF |

PROJECT: <u>Hutt City Plan</u>	LOCATION: <u>Oakleigh St.</u>	JOB NO: <u>84009.004</u>
CO-ORDINATES:	EXPOSURE TYPE: <u>Test Pit</u>	HOLE STARTED: <u>26/11/08</u>
RL:	EQUIPMENT: <u>12 tonne excavator</u>	HOLE FINISHED: <u>26/11/08</u>
DATUM:	OPERATOR: <u>Barry Bellamy</u>	LOGGED BY: <u>MJW</u>
	EXCAVATION DIMENSIONS: <u>4.2m x 2.9m</u>	CHECKED BY:

EXCAVATION AND TESTS:				ENGINEERING DESCRIPTION:				GEOLOGICAL:				
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	RL (m) DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
123				0		OL	clayey SILT, dark brown, moderate plasticity, organics present.	M	S		Topsail	
			PP = 200 kPa	1		OL	sandy SILT, orange/brown, non-cohesive, fine grains	D	V.S		Fill (non engineered.)	
			PP = 150 kPa	2		OL	sandy, clayey SILT grey/blue, moderate plasticity fine grains	M	V.S		water observed seeping from face @ this depth	
			PP = 175 kPa	3		SM	Interbedded SILTS and SANDS variable colour: yellow/brown to blue/grey, low plasticity, fine grains. Organics present throughout entire layer. (tree roots + logs)	M	V.S			
				4		OL						
				5			Test pit terminated @ 4.2m depth					





EXCAVATION NO: TP7

EXCAVATION LOG

SHEET 1 OF 1

PROJECT: <u>Hutt City Plan</u>	LOCATION: <u>Oakleigh St</u>	JOB NO: <u>84009.004</u>
CO-ORDINATES:	EXPOSURE TYPE: <u>Test Pit</u>	HOLE STARTED: <u>26/11/08</u>
RL:	EQUIPMENT: <u>12 tone excavator</u>	HOLE FINISHED: <u>26/11/08</u>
DATUM:	OPERATOR: <u>Barry Balleny</u>	LOGGED BY: <u>NSW</u>
	EXCAVATION DIMENSIONS: <u>3.6m x 1.6m</u>	CHECKED BY:

EXCAVATION AND TESTS:				ENGINEERING DESCRIPTION:				GEOLOGICAL:				
PENETRATION	SUPPORT	WATER	SAMPLES, TESTS	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION	SHEAR STRENGTH OR RELATIVE DENSITY	ESTIMATED SHEAR STRENGTH, kPa	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
123			pp = <u>palat penetrometer</u> <u>31 = shear value.</u>	0		OL	clayey SILT, brown, moderately plastic	M	S		Topsail	
				1		SW	gravelly SAND yellow/brown,	D	L		Fill (non engineered)	
			pp = 100 kPa	2		OL	sandy SILT blue/grey, non-cohesive, fine grains	D	St.		Wood fragments exist all through these layers	
			pp = 200 kPa	3		SM + OL	Interbedded SANDS + SILTS yellow/white and blue/grey fine grained, non-cohesive	D	L / St			
			SU = 70 kPa (P) = 25 kPa (A)				Test pit terminated @ 3.6m depth					
			pp = 100 kPa	f								

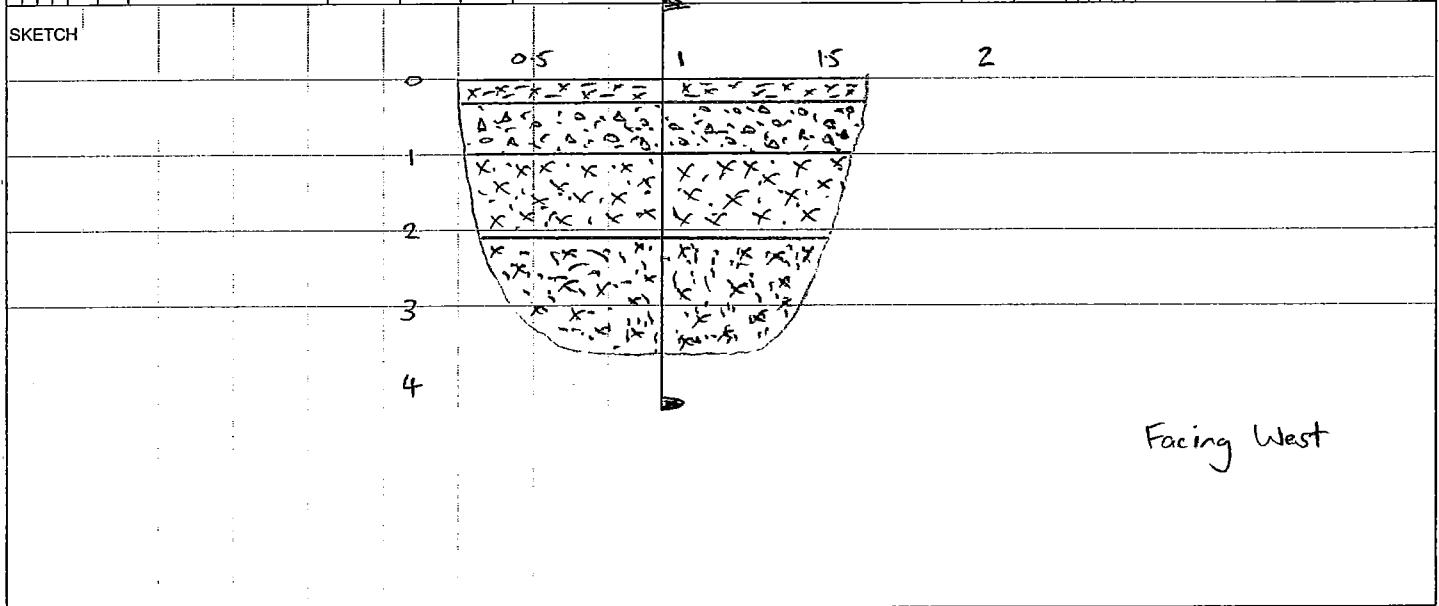


Figure 3: Oakleigh (Site 3)

Geotechnical Suitability Plan

