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Engineer's Report
Lot 1 DP 18348 Bulwer
For
McCauley Family

21 November 2003
Reference 318a/40/CC
Revision 1

Document Control

Connell Wagner

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1	21 November 2003	Issue to Client	AF	AF	CBH	CBH

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Table of Contents

1. Synopsis

1.1 Scope of the Investigation

Mr S McCauley has engaged Connell Wagner Limited to provide advice on the suitability of a proposed building site on the McCauley family property identified as Lot 1 DP 18348

1.2 Summary and Conclusions

Having inspected the site and carried out appropriate geotechnical testing we are confident that the building site identified on Lot 1 DP 18348 is suitable for the construction of a residential dwelling.

Our testing indicates suitable founding conditions are available at varying depths as described herein. We are confident from our inspection and from the testing carried out, that the site is currently stable and has a low risk of future instability, providing the advice within this report regarding earthworks, stormwater control, vegetation cover and foundations is adhered to.

Please note that this report has been prepared solely for the benefit of the McCauley family as our client with respect to the brief. The reliance by other parties on the information or opinions contained in the report shall, without our review and agreement in writing, be at such party's sole risk. This report shall only be reproduced in full and then only with prior written permission.

1.3 Recommendations

We recommend that;

- All stormwater originating on or entering the site should be controlled and discharged clear of the building site and any earthworks.
- The stormwater drainage system (as described in Section 2.6.3 of this report) should be maintained regularly and kept free from debris.
- Building foundations should be designed and constructed as described in Section 2.4 and should be founded upon natural ground, not fill.
- The management plans described in Section 2.7 of this report should be implemented.

2. Report

2.1 Introduction

The McCauley Family has engaged Connell Wagner Limited to provide advice on the stability of Lot 1 DP 18348 and its suitability for construction of a new residential dwelling. The proposed building site was inspected on 26th September by Mr Ari Fon, Registered Engineer of Connell Wagner Limited.

2.2 Site Description

The property is located in the settlement of Bulwer in Waihinau Bay. The settlement is indicated on the topographical map P26, "French Pass" of the NZMS 260 series. Bulwer is located on alluvial flats at the base of the eastward sloping faces below Turner Peak. The property is east facing with views over Waihinau Bay.

From the beach the terrain is gently sloping for a distance of some 75 metres. Beyond this, the ground then rises more steeply at slopes of around 15 to 20 degrees. The proposed dwelling will be located within the gently sloping area.

South of the site is an existing stream draining a gully that rises above the settlement and access road. A small open drain runs alongside the northern boundary of the site. The property is bounded to the east by the foreshore reserve. To the west the property is bounded by an unformed legal road.

Access to the site can be obtained by either boat or road, with vehicular access via a ford across the stream to the south of the property. The property and adjacent land has been substantially cleared with only minor bush cover. The upper slopes are covered in moderately dense regenerating native bush. The proposed building site has no bush cover, with only small stands of bush adjacent to the open drain and between the building site and the beach.

Refer to the topographical map and site plan in Appendix A for further site description. The site is zoned Rural 1 under the Marlborough Sounds Resource Management Plan, and is also identified as being within the Unstable Natural Hazards area.

2.3 Geotechnical Investigations

Geotechnical testing consisted of five Scala Penetrometer tests and inspection of existing cut faces and rock outcrops in the vicinity. The locations of these tests are shown on the attached plan in Appendix A, test results are attached in Appendix B.

A geotechnical desk study has included reference to the Marlborough Sounds geological map, which indicates the site to be some 3.5 kilometres from the northeast/southwest trending Tawhitinui Fault. The geological map indicates the geology of the site as alluvial fan deposits (uQa), consisting of undifferentiated poorly sorted steep fan gravel deposits, overlying bedrock of the Caples Formation.

In recent times the site has been substantially modified through a slip which occurred in 1989. The slip occurred on the east facing slopes below Turner Peak, above the access road leading into Bulwer. It resulted in a significant mudslide into the settlement down the stream channel south of the subject site. During the clean up of the slip debris, a low lying area of swamp and vegetation on the northern side of the subject site was filled with slip material. From photographs taken of the clean up operation it is apparent that little if any vegetation removal or stripping took place prior to the filling operation.

2.4 Geotechnical Assessment

2.4.1 Site Stability

As described above, the proposed building site is on generally flat ground immediately inland of mean high water springs. Inspection above and below the proposed building site indicated no signs of instability that could affect the site.

The major slip which occurred in 1989 was located on the steep upper slopes above the access road into the settlement. Some signs of localised soil movement were noted on the moderately steep slopes at the western edge of the settlement. These sites were located well away from the proposed building site. No other evidence of soil movement was noted.

Based on our investigations we believe that the site is presently stable and has low risk of future instability. Provided the recommendations later in this report are followed regarding drainage, vegetation removal and effluent disposal the proposed development should not compromise the site's stability.

2.4.2 Foundation Conditions

Five penetrometer tests were carried out at the assumed corners and centrally on the proposed building site, in the positions shown on the attached site plan. Penetrometer results have been converted to allowable bearing capacity using formulas derived by Scala and Middlebrooks and Bertram, and then factored up by 3.0 to derive Ultimate bearing capacity.

The five test locations are described separately below, and are summarised in tabular form on the following page.

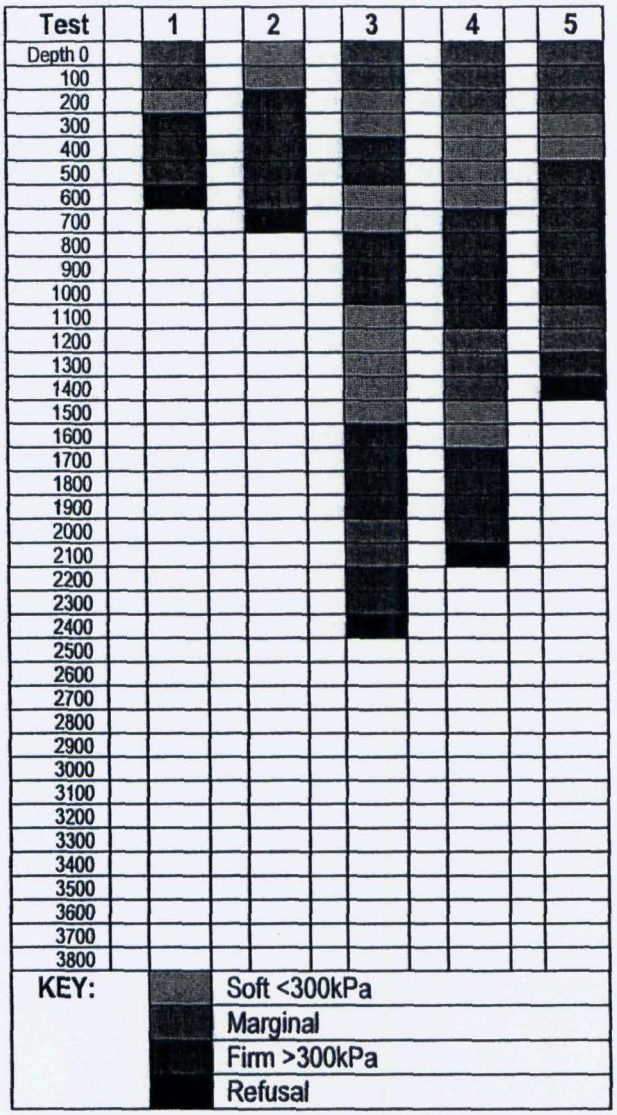
Test 1 – Near the SW corner of the proposed dwelling. Calculated Allowable bearing capacity is greater than 100kPa (300kPa ultimate) throughout. Refusal was encountered at a depth of 500 mm.

Test 2 – Near the SE corner of the proposed dwelling. Calculated Allowable bearing capacity is greater than 100kPa (300kPa ultimate) throughout. Refusal was encountered at a depth of 600 mm.

Test 3 – Near the NE corner of the proposed dwelling. This area was filled by slip debris following the 1989 slip. Calculated Allowable bearing capacity is less than 100kPa (300kPa ultimate) in two distinct softer layers. The first of these at approximately 200 mm depth and the second at 1100 mm. Refusal was encountered at a depth of 2400 mm.

Test 4 – Near the NW corner of the proposed dwelling. This area was also filled by slip debris following the 1989 slip. Calculated Allowable bearing capacity is less than 100kPa (300kPa ultimate) in one softer layer. Refusal was encountered at a depth of 2100 mm.

Test 5 – Near the centre of the proposed dwelling. Calculated Allowable bearing capacity is greater than 100kPa (300kPa ultimate) throughout. Two softer layers were encountered at 300 mm and 800 mm depth though still in excess of 100kPa. Refusal was encountered at a depth of 1300 mm.



Testing revealed a Dark Reddish Brown silt with cobble size angular gravels. Scala Penetrometer testing did not conclusively identify underlying rock in the top 2.3 metres, (the extent of the deepest Scala test). The tests indicated firm ground, and in all instances met with refusal. However, this refusal may have been due to the presence of rocks and boulders within the silt layer rather than reaching underlying bedrock. Tests SP3, SP4 and to a lessor extent SP5, located to the northern end of the proposed dwelling indicate the presence of softer materials at varying depth below the existing ground. This is likely to be the previous existing ground surface which was filled over with slip debris.

It is recommended that the proposed dwelling be founded on pole foundations, embedded an appropriate depth into the sound ground and founded below the slip debris fill indicated above. Driven piles would be a desirable option as depth can be varied for each pile to ensure sound bearing is reached. This would typically be achieved using a pile-driving head fitted to an excavator. However, due to the large size of some of the rock in the slip debris (and in the underlying alluvial material) augered piles may be required.

Please note that the nature and continuity of subsoil conditions away from the test sites are inferred and it must be appreciated that actual conditions could vary considerably from the assumed model.

2.5 Development Impact

The site is zoned Rural 1 under the Marlborough Sounds Resource Management Plan, and is also identified as being within the Unstable Natural Hazards area.

The erection of a single dwelling is permitted on the site. However, as the site is identified as being within a hazard area, resource consent is required for the following matters:

- Construction of any building on a site identified as being a Natural Hazard area.
- Discharge of domestic effluent into or onto land in a Hazard Area. The proposed disposal field must also be no closer than 50 metres from another subsoil disposal field. This aspect is discussed in more detail in Section 2.6.2 below.
- Any land disturbance associated with constructing the dwelling or providing access to any structure requiring a building permit.

The Plan requires that there should be at least one off road vehicle parking space formed and with an all weather surface.

Impact from the proposed development of the site will be relatively minor and the proposed development is similar to surrounding properties.

2.6 Control or Implementation Measures

2.6.1 Access

The existing site access, over the small stream to the south of the proposed cottage will be maintained. It is assumed that future vehicular access to the neighbouring property north of the subject site will be over the legal road south of the proposed cottage.

2.6.2 Effluent Disposal

Soil analysis in the area likely to be used for a disposal field indicates a Dark Reddish Brown Clayey Silt in the top 600mm. The estimated percentage of clay present is around 20 to 30% and in terms of AS/NZS1547: 2000 the soil is classified as Category 4 "Clay Loams ", and is described as imperfectly drained.

The actual disposal field configuration will depend upon the size and configuration of the proposed dwelling. However, the large disposal field areas required for septic tanks with poorly draining soils are generally not practical for a site such as this. Secondary treatment of sewage and disposal of effluent by drip irrigation is considered the more appropriate method. Such treatment is available from a variety of proprietary on-site wastewater treatment plants and must be tailored to the needs of the site.

You have supplied us with details of the Jet Home Sewage Treatment Plant. We have reviewed this information and advise that this system, appropriately designed for your site, could be used.

A detailed design will be required to be completed and submitted to the Marlborough District Council in support of the building consent application. The site is the Unstable Natural Hazards Zone and in close proximity to a stream and the beach. The proposed disposal field area in the garden between the proposed cottage and the beach may not meet the requisite 30m clearance from the beach. This would need to be checked as part of the design. Although the locations and nature of disposal fields on neighbouring properties are not known, observations on site suggest that the required 50 m separation from these should be readily achievable.

2.6.3 Stormwater

Roof and other site stormwater should be collected and discharged to the small open drain alongside the northern boundary of the site. All drains should discharge well clear of the building site and any earthworks and with appropriate attention to scour protection.

2.6.4 Potable Water

A reticulated water supply pumped from a header tank upslope of the settlement supplies water to all the houses. However, the residual pressure available at the house site is not known, neither is the quality or reliability of the supply. Storage requirements will depend upon the reliability, and if insufficient pressure is available, pumping to a header tank may be required.

Assuming that sufficient pressure is available, the preferred system would be to provide a header tank filled from the existing reticulated system and have the house fed by gravity from the tank. The tank should have sufficient capacity to provide 2 or 3 days water in the event of a pump failure. If the reliability of the bore is not known then storage for a longer period would be advisable.

Household water consumption varies widely depending upon individual habits and the presence or absence of water saving measures. For example, recent figures for urban areas indicate household water usage of around 190l/day/person, including outside uses such as car washing and garden watering. A 3000l tank would provide 200 litres per day for 5 people for 3 days.

If the tank cannot be situated to provide sufficient gravity head to run household plumbing, then a pressurised chamber pumping system could be installed.

2.7 Management Plans

To ensure the impact of the development is controlled in the future the property owner should implement the following management plans.

2.7.1 Stormwater Control

Drainage channels should be constructed as described in section 2.6.3 above. This drainage system should be maintained free from debris and other obstructions. In order to ensure this is achieved the owner should regularly inspect and maintain the drains. This should consist, as an absolute minimum, of twice yearly inspection with one inspection immediately prior to the winter months.

2.7.2 Site Stability

In addition to stormwater control as described above, the management plan for site stability should include monitoring of vegetation cover. Vegetation should not be removed without due consideration of stability.

2.7.3 Effluent Disposal

Whichever system of on site wastewater treatment is chosen, both treatment plant and disposal field will require careful and regular maintenance. The manufacturer and/or installer should supply a detailed, specific management plan for the system and this should be closely followed.

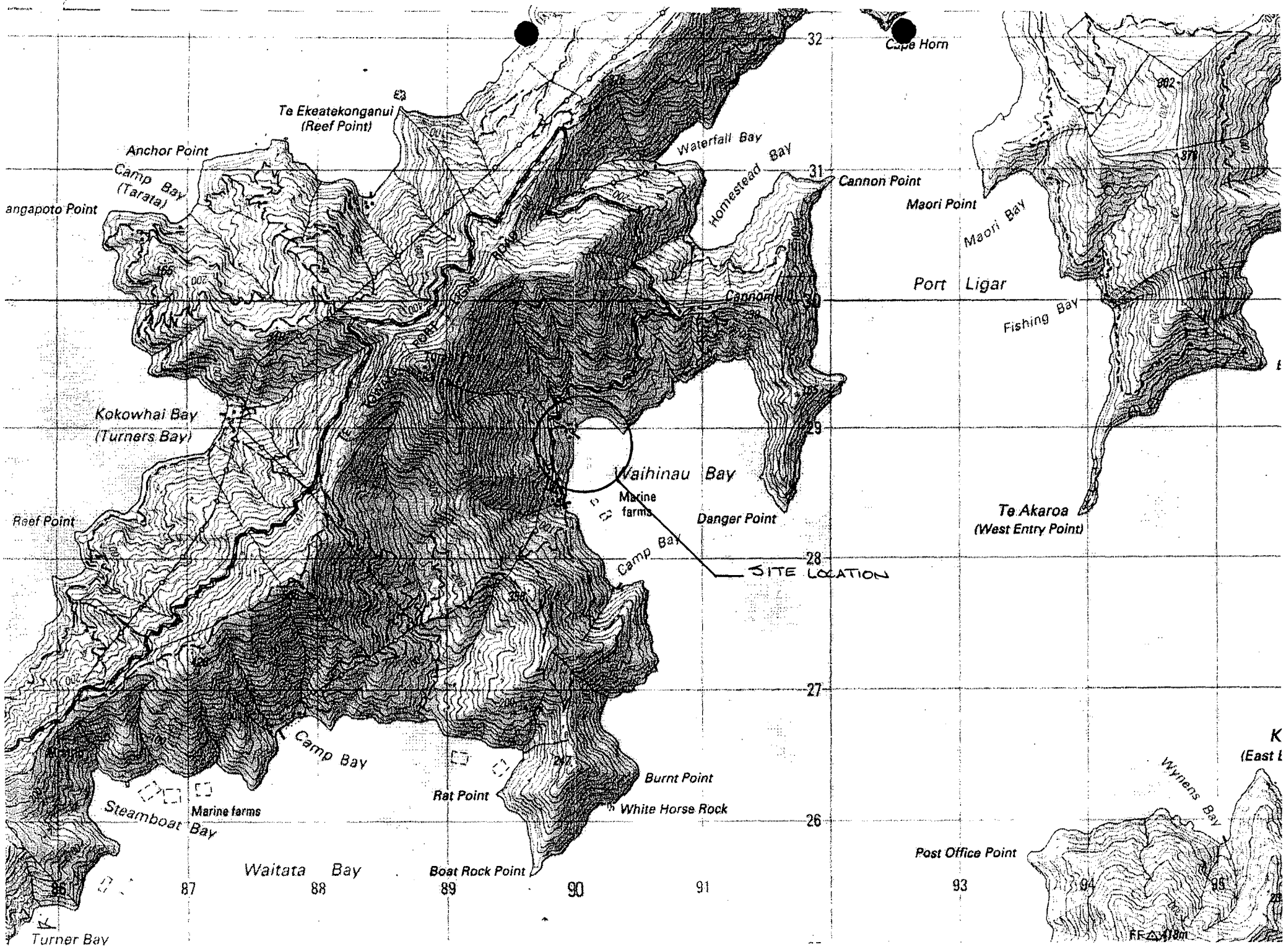
2.8 References

The following sources have been referenced in the preparation of this report:

Marlborough District Council	Requirements for the provision of Geo-technical Reports	March 1999
Marlborough District Council	Marlborough Sounds Resource Management Plan	Feb 2003
NZ Geological Survey	Marlborough Sounds Geological map	1975
NZS3604	Timber Framed Buildings	1999 (amended 2000)
AS/NZS1547	On-site domestic-wastewater management	2000
Building Industry Authority	New Zealand Building Code	1992 (amended 2001)

Appendix A

Location and Site Plans


Cape Horn
Te Ekeatekonganui
(Reef Point)
Anchor Point
Camp Bay
(Tarata)
angapoto Point
Waterfall Bay
Homestead Bay
Cannon Point
Maori Point
Maori Bay
Port Ligar
Fishing Bay
Te Akaroa
(West Entry Point)
Kokowhai Bay
(Turners Bay)
Waihinau Bay
Marine
farms
Danger Point
Reef Point
Camp Bay
SITE LOCATION
Camp Bay
Rat Point
Burnt Point
White Horse Rock
Steamboat Bay
Marine farms
Waitata Bay
Boat Rock Point
Turner Bay
Wynyards Bay
Post Office Point
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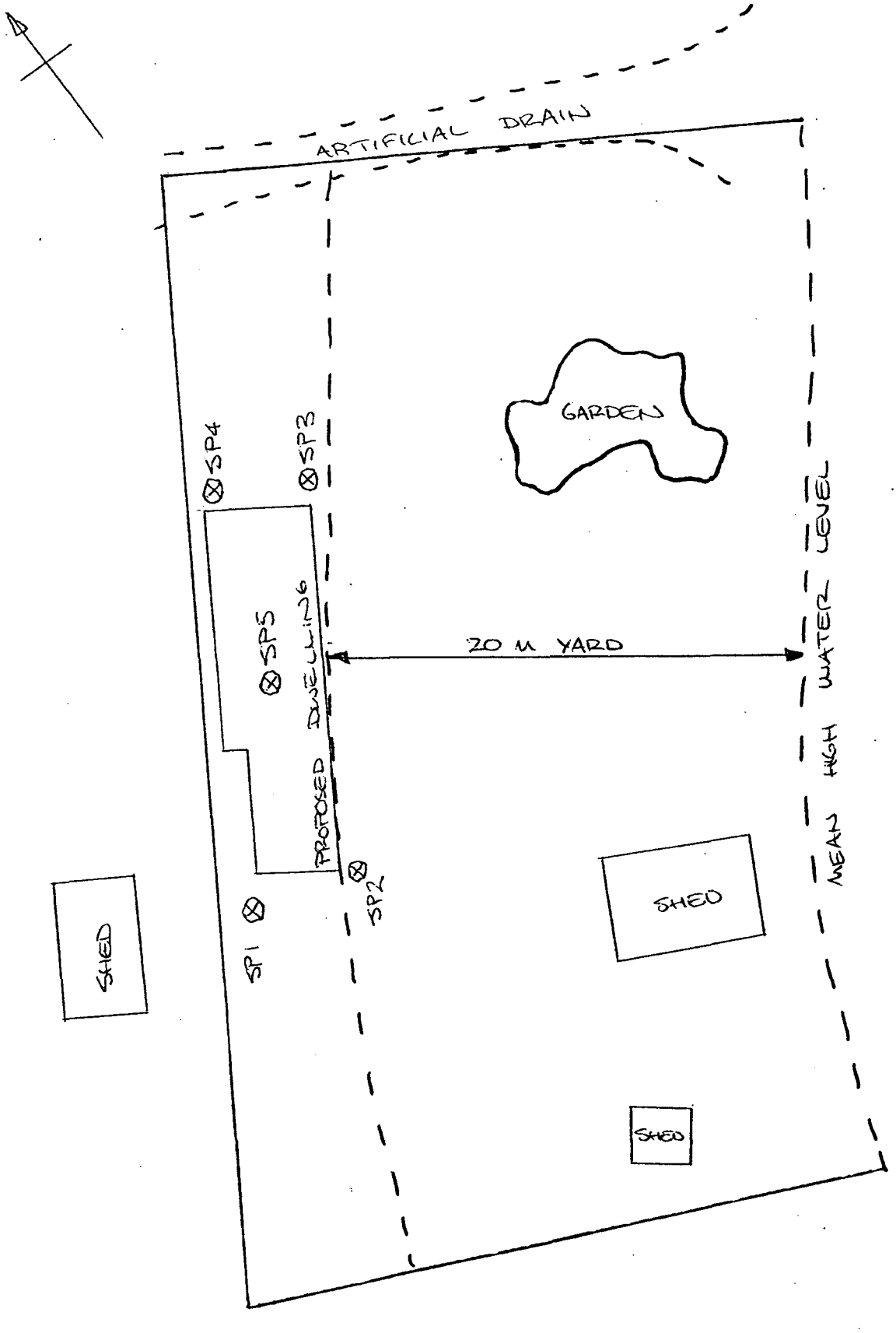

NOTES

1. Scala Penetrometer locations approximate only.
2. Base plan provided by B. McCauley Design, Proposed Cottage, Section 2, Bulwer, Dwg 2, R1' 29/3/00.

LEGEND

⊗ SP1 Scala Penetrometer Test Location No.1

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Client: McCauley Family		SCALA PROBE	
Location: McCauley Residence, Bulwer		No: Site Plan	A4
Tester: AJF	Date: 26 Sep 2003	Job Number: 318A/40/cc	Rev: 1

Appendix B

Test Results

Site Description:

Refer attached site plan.

RL:

Notes:

Depth (mm)	Blows (no.)	Depth (mm)	Blows (no.)
50	2	2300	
100	2	2350	
150	2	2400	
200	2	2450	
250	1	2500	
300	1	2550	
350	2.5	2600	
400	2.5	2650	
450	3.5	2700	
500	3.5	2750	
550	5	2800	
600	5	2850	
650		2900	
700		2950	
750		3000	
800		3050	
850		3100	
900		3150	
950		3200	
1000		3250	
1050		3300	
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1400		3650	
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1500		3750	
1550		3800	
1600		3850	
1650		3900	
1700		3950	
1750		4000	
1800		4050	
1850		4100	
1900		4150	
1950		4200	
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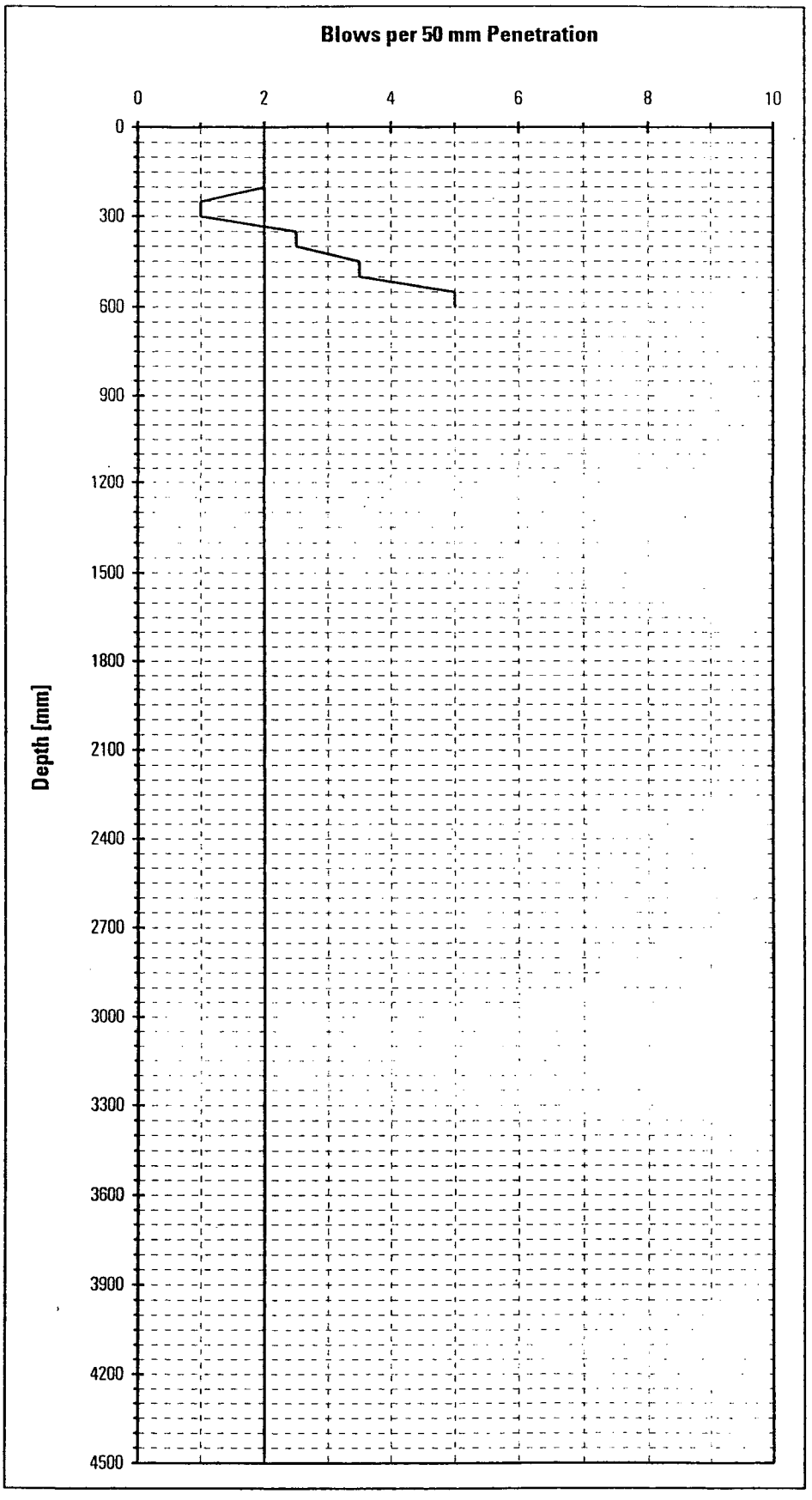
2050		4300	
2100		4350	
2150		4400	
2200		4450	
2250		4500	



PROBE DESCRIPTION:
9 kg Hammer falling half a metre to a steel anvil, driving a 16 mm diameter rod fitted with a 20 mm diameter cone.

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Client: McCauley Family		SCALA PROBE	
Location: McCauley Residence, Bulwer		No: SP 1	A4
Tester: AJF	Date: 26 Sep 2003	Job Number: 318A/40/cc	Rev: 1

Site Description:

Refer attached site plan.

RL:

Notes:

Depth (mm)	Blows (no.)	Depth (mm)	Blows (no.)
50	1	2300	
100	1	2350	
150	1.5	2400	
200	1.5	2450	
250	2.5	2500	
300	2.5	2550	
350	3.5	2600	
400	3.5	2650	
450	3.5	2700	
500	3.5	2750	
550	4	2800	
600	4	2850	
650	4.5	2900	
700	4.5	2950	
750		3000	
800		3050	
850		3100	
900		3150	
950		3200	
1000		3250	
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1900		4150	
1950		4200	
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2150		4400	
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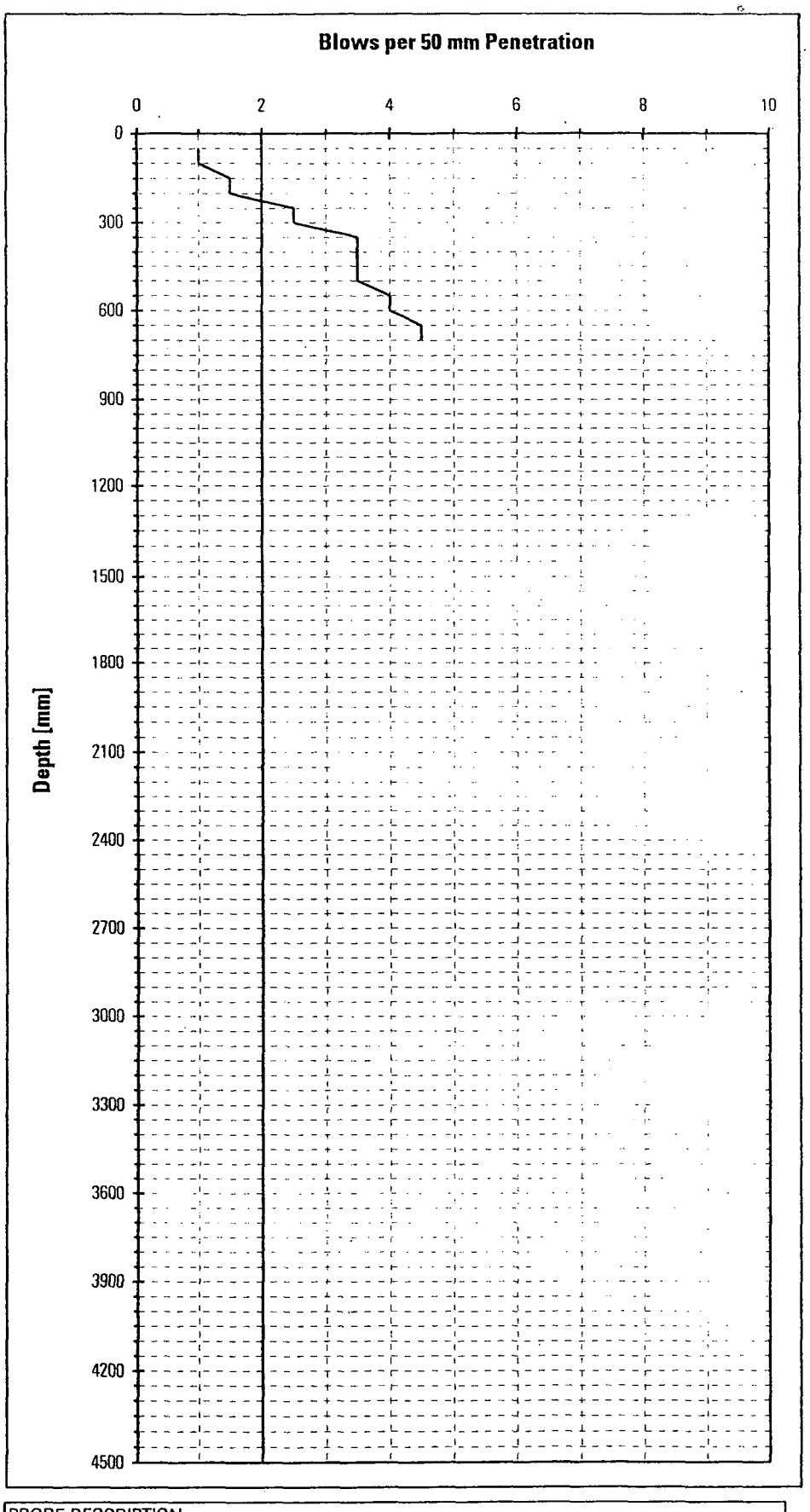

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Client: McCauley Family		SCALA PROBE	
Location: McCauley Residence, Bulwer		No: SP 2	A4
Tester: AJF	Date: 26 Sep 2003	Job Number: 318A/40/cc	Rev: 1

Site Description:

Refer attached site plan.

RL:

Notes:

Depth (mm)	Blows (no.)	Depth (mm)	Blows (no.)
50	2	2300	4.5
100	2	2350	
150	2	2400	
200	2	2450	
250	1	2500	
300	1	2550	
350	1.5	2600	
400	1.5	2650	
450	2.5	2700	
500	2.5	2750	
550	3.5	2800	
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700	1.5	2950	
750	1	3000	
800	1	3050	
850	3	3100	
900	3	3150	
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1000	3	3250	
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1600	2.5	3850	
1650	3.5	3900	
1700	3.5	3950	
1750	5	4000	
1800	5	4050	
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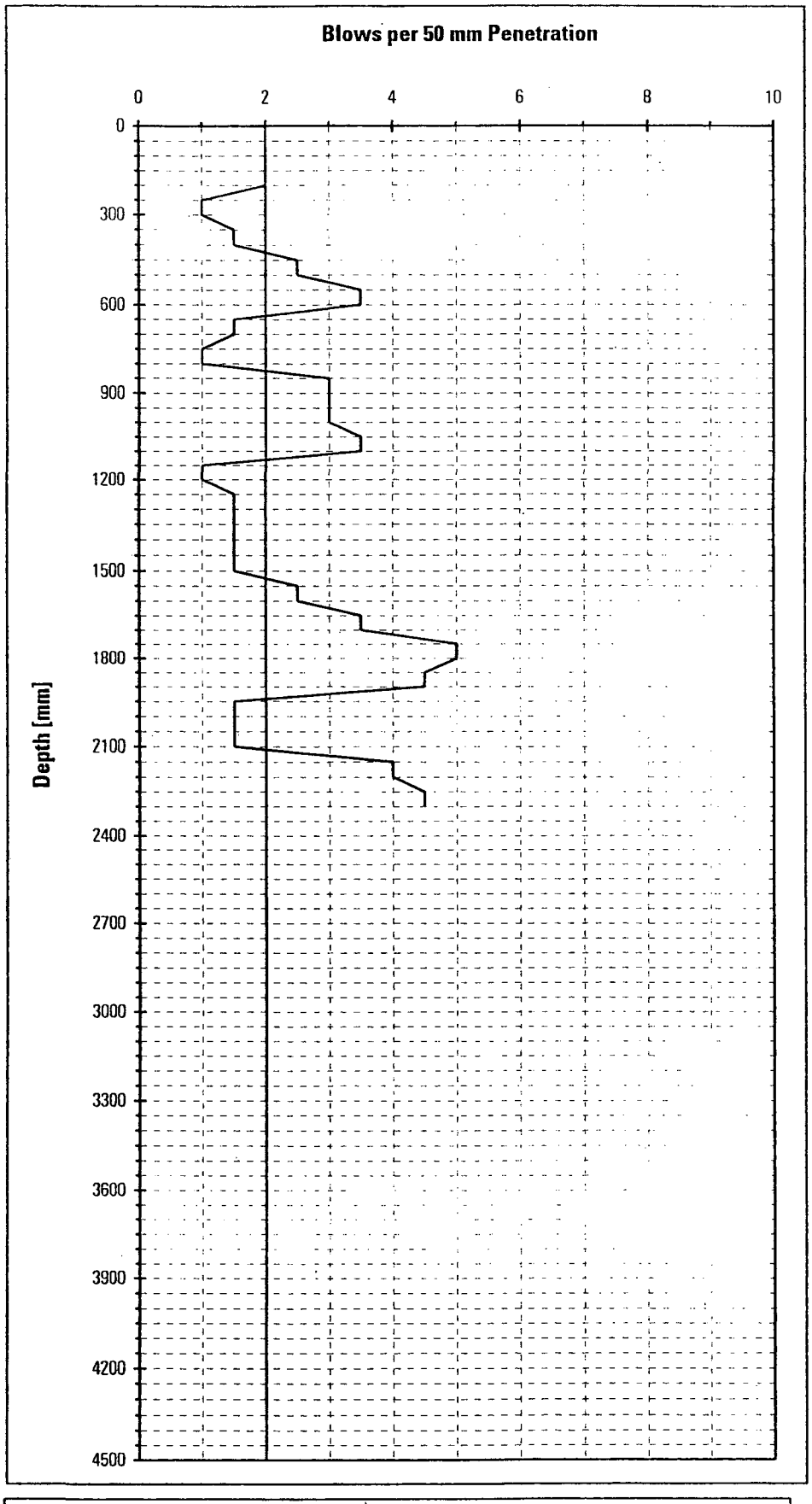

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Client: **McCauley Family**		SCALA PROBE	
Location: **McCauley Residence, Bulwer**		No: **SP 3**	A4
Tester: **AJF**	Date: **26 Sep 2003**	Job Number: **318A/40/cc**	Rev: **1**

Site Description:

Refer attached site plan.

RL:

Notes:

Depth (mm)	Blows (no.)	Depth (mm)	Blows (no.)
50	2	2300	
100	2	2350	
150	2	2400	
200	2	2450	
250	2	2500	
300	2	2550	
350	1	2600	
400	1	2650	
450	1.5	2700	
500	1.5	2750	
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650	1	2900	
700	1	2950	
750	3	3000	
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850	3.5	3100	
900	3.5	3150	
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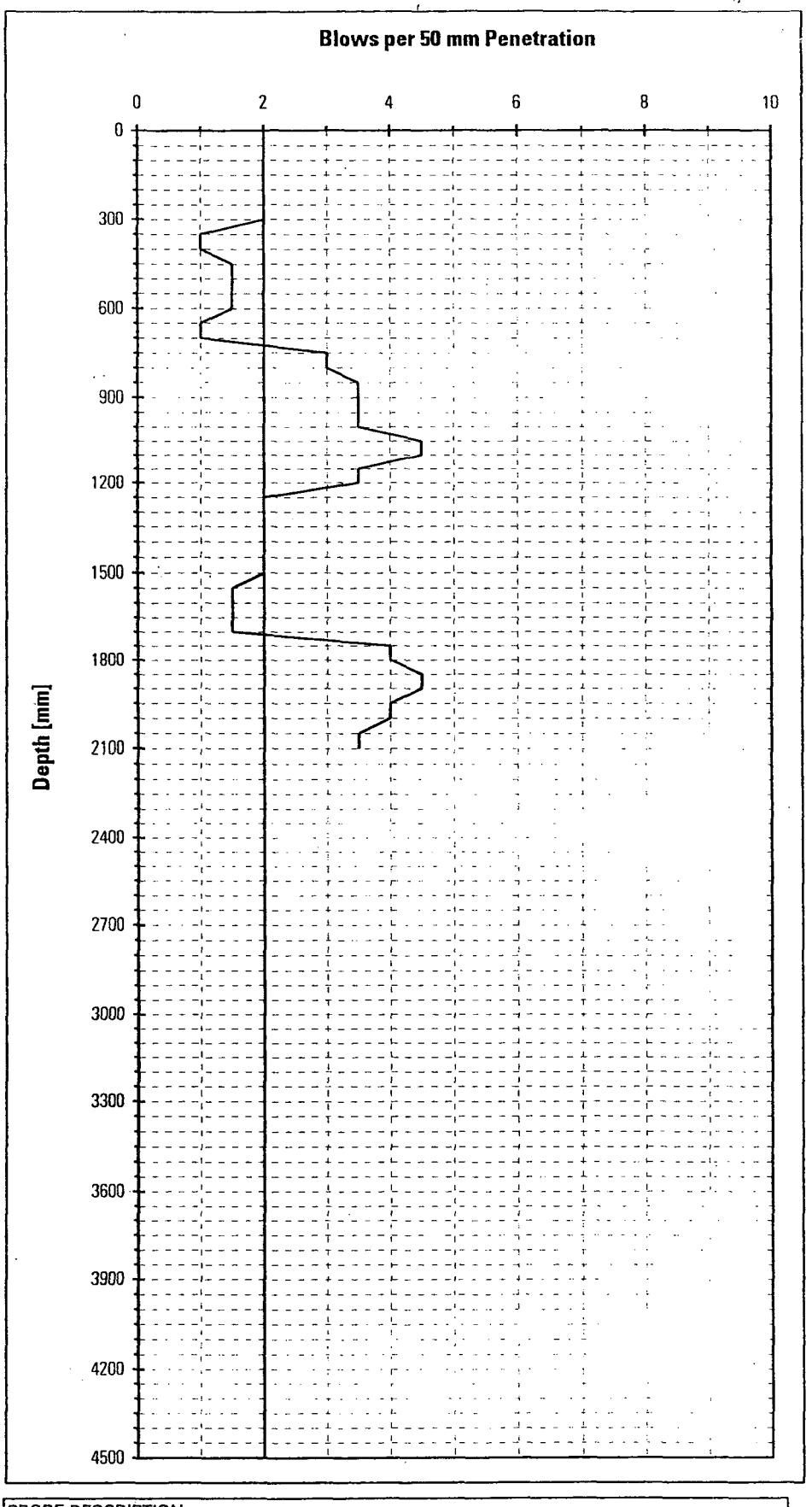

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Client: **McCauley Family**		SCALA PROBE	
Location: **McCauley Residence, Bulwer**		No: **SP 4**	A4
Tester: **AJF**	Date: **26 Sep 2003**	Job Number: **318A/40/cc**	Rev: **1**

Site Description:

Refer attached site plan.

RL:

Notes:

Depth (mm)	Blows (no.)	Depth (mm)	Blows (no.)
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100	2	2350	
150	2	2400	
200	2	2450	
250	2	2500	
300	2	2550	
350	1.5	2600	
400	1.5	2650	
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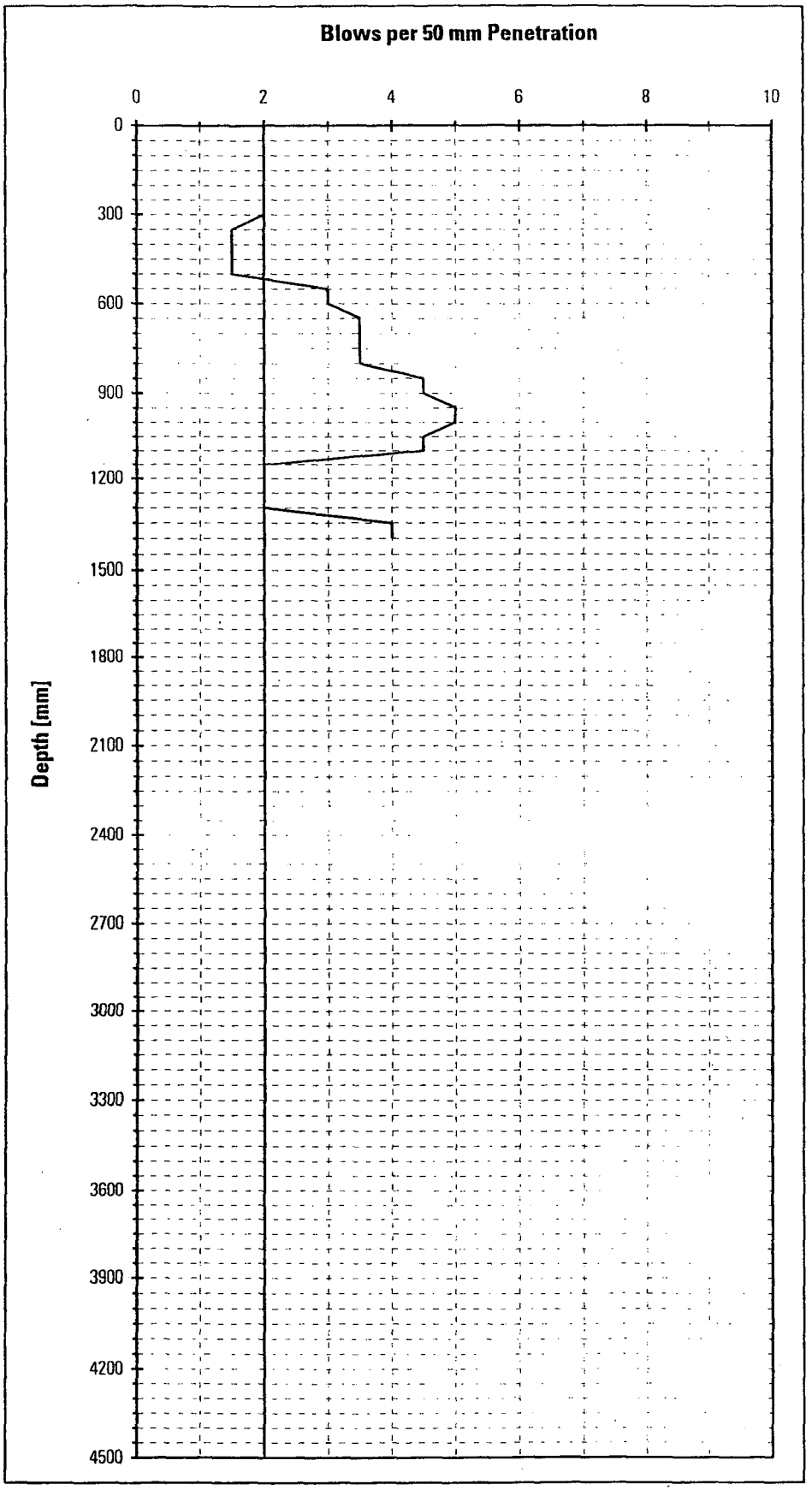

PROBE DESCRIPTION:
9 kg Hammer falling half a metre to a steel anvil, driving a 16 mm diameter rod fitted with a 20 mm diameter cone.

Connell Wagner

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Client: McCauley Family		SCALA PROBE	
Location: McCauley Residence, Bulwer		No: SP 5	A4
Tester: AJF	Date: 26 Sep 2003	Job Number: 318A/40/cc	Rev: 1