RCSAPP

HARRISON GRIERSON

16 October 2006

WHAKATANE DISTRICT COUNCIL
FILE
REG. NO: 33082
17 OCT 2006
ACTIONED DATE
1 Laura S
2
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4

Whakatane District Council
Private Bag 1002
WHAKATANE

Attention Laura Swan

Dear Laura

Thornton - 2B Kowhai Street
HG Ref 1510-011050-01

Please find enclosed a copy of the revised scheme plan, Drawing No. 011050-SC02 Rev A, for this development.

Yours faithfully
Harrison Grierson Consultants Limited

Mark Thomas
Principal

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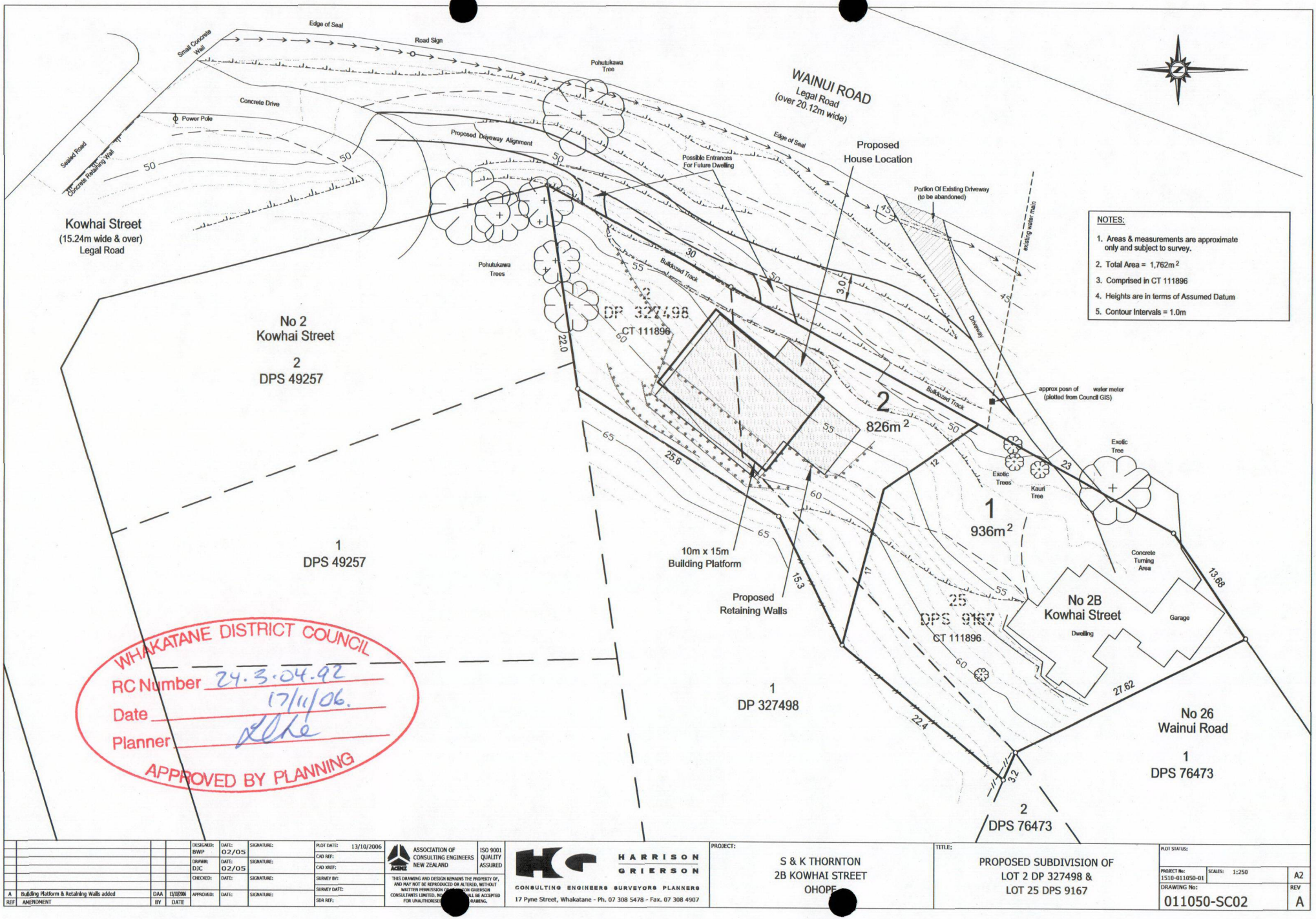

REF	AMENDMENT	BY	DATE
A	Building Platform & Retaining Walls added	DAA	13/10/2006

DESIGNED: BWP 02/05
DRAWN: DJC 02/05
CHECKED:
APPROVED:

PLOT DATE: 13/10/2006
CAD REF:
CAD XREF:
SURVEY BY:
SURVEY DATE:
SDR REF:

ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND
ISO 9001 QUALITY ASSURED

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HARRISON GRIERSON
CONSULTING ENGINEERS SURVEYORS PLANNERS
17 Pyne Street, Whakatane - Ph. 07 308 5478 - Fax. 07 308 4907

PROJECT: S & K THORNTON
2B KOWHAI STREET
OHOPE

TITLE: PROPOSED SUBDIVISION OF
LOT 2 DP 327498 &
LOT 25 DPS 9167

PLOT STATUS:
PROJECT No: 1510-011050-01
SCALES: 1:250
A2
DRAWING No: 011050-SC02
REV A

13/10/06.

RCSAPP 1

Edge of Seal
Small Concrete Wall
Road Sign
Pohutukawa Tree
WAINUI ROAD
Legal Road
(over 20.12m wide)
Concrete Drive
Power Pole
Sealed Road
RT Concrete Retaining Wall
Proposed Driveway Alignment
Edge of Seal
Proposed House Location
Possible Entrances For Future Dwelling
Portion Of Existing Driveway (to be abandoned)
existing water main
Kowhai Street
(15.24m wide & over)
Legal Road
Pohutukawa Trees
Bulldozed Track
Driveway
No 2
Kowhai Street
2
DPS 49257
DP 327498
CT 111896
22.0
Bulldozed Track
approx posn of water meter (plotted from Council GIS)
2
826m²
Exotic Tree
Exotic Trees
Kauri Tree
12
23
1
936m²
Concrete Turning Area
13.68
25.6
10m x 15m Building Platform
Proposed Retaining Walls
15.3
17
25
DPS 9167
CT 111896
No 2B
Kowhai Street
Garage
Dwelling
27.62
1
DPS 49257
1
DP 327498
22.4
3.2
No 26
Wainui Road
1
DPS 76473
2
DPS 76473

NOTES:

1. Areas & measurements are approximate only and subject to survey.
2. Total Area = 1,762m²
3. Comprised in CT 111896
4. Heights are in terms of Assumed Datum
5. Contour Intervals = 1.0m

WHAKATANE DISTRICT COUNCIL
RC Number 24.3.04.92
Date 17/11/06
Planner
APPROVED BY PLANNING

				DESIGNED: BWP	DATE: 02/05	SIGNATURE:	PLOT DATE: 13/10/2006	
				DRAWN: DJC	DATE: 02/05	SIGNATURE:	CAD REF:	
				CHECKED:	DATE:	SIGNATURE:	CAD XREF:	
A	Building Platform & Retaining Walls added	DAA	13/10/2006	APPROVED:	DATE:	SIGNATURE:	SURVEY BY:	
REF	AMENDMENT	BY	DATE				SURVEY DATE:	
							SDR REF:	

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PROJECT:
S & K THORNTON
2B KOWHAI STREET
OHOPE

TITLE:
PROPOSED SUBDIVISION OF
LOT 2 DP 327498 &
LOT 25 DPS 9167

PLOT STATUS:

PROJECT No: 1510-011050-01 | SCALES: 1:250 | A2

DRAWING No: 011050-SC02 | REV A

13/10/06

WHAKATANE DISTRICT COUNCIL
FILE:
REG. No.: G 36031
25 JUL 2006
ACTIONED DATE
1 Jeff J
2
3
4

HARRISON GRIERSON

Facsimile Transmission

To Tonkin and Taylor

Attn John Leeves **Fax No.** 09 307 0265

Copies to Jeff Farrell, WDC 07 307 0718 ; Rueben Hansen MTec 575 2868

From Mark Thomas **Date** 25 July 2006

No. of pages *(including this cover sheet)* 2 **HG Ref.** 1510-011050-01

Re Thornton - 2B Kowhai St, Ohope, Whakatane

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John,

I refer to your phone call and fax dated 24 July 2006, and respond to your points as follows;

1. As discussed, the determination of the actual impact load is very subjective. The area considered most at risk, and hence the need for the debris wall, is a section of slope between 5m and 6m immediately behind the wall, where the slope is almost 40° over this short section. I have made an assessment based on 1.5m^3 per metre of wall, and calculated that the impact load could potentially be as high as 29kN/m, applied 0.5m above the base of the wall. On this basis, I have increased the size of the debris wall to 225 SED poles at 1.5m crs, embedded 3.2m.
2. The anchors have been lengthened, so that the upper anchor extends to the boundary (4m), and the lower anchor is 7m long, which is more than twice the theoretical length required.
3. As previously noted, we have no problems using grouted Reidbars, and have changed the details accordingly. Anchors will be tested during construction.

In addition, we propose that Wall 1 be constructed as a conventional tied back wall, with the boards behind the poles. This is because if there were a slope failure during construction, the neighbouring property would not be affected, as the other walls will already be in place.

I have attached a revised sketch showing the proposed arrangement. If you are happy with the above comments, we will change the drawings accordingly.

Regards,

Mark Thomas

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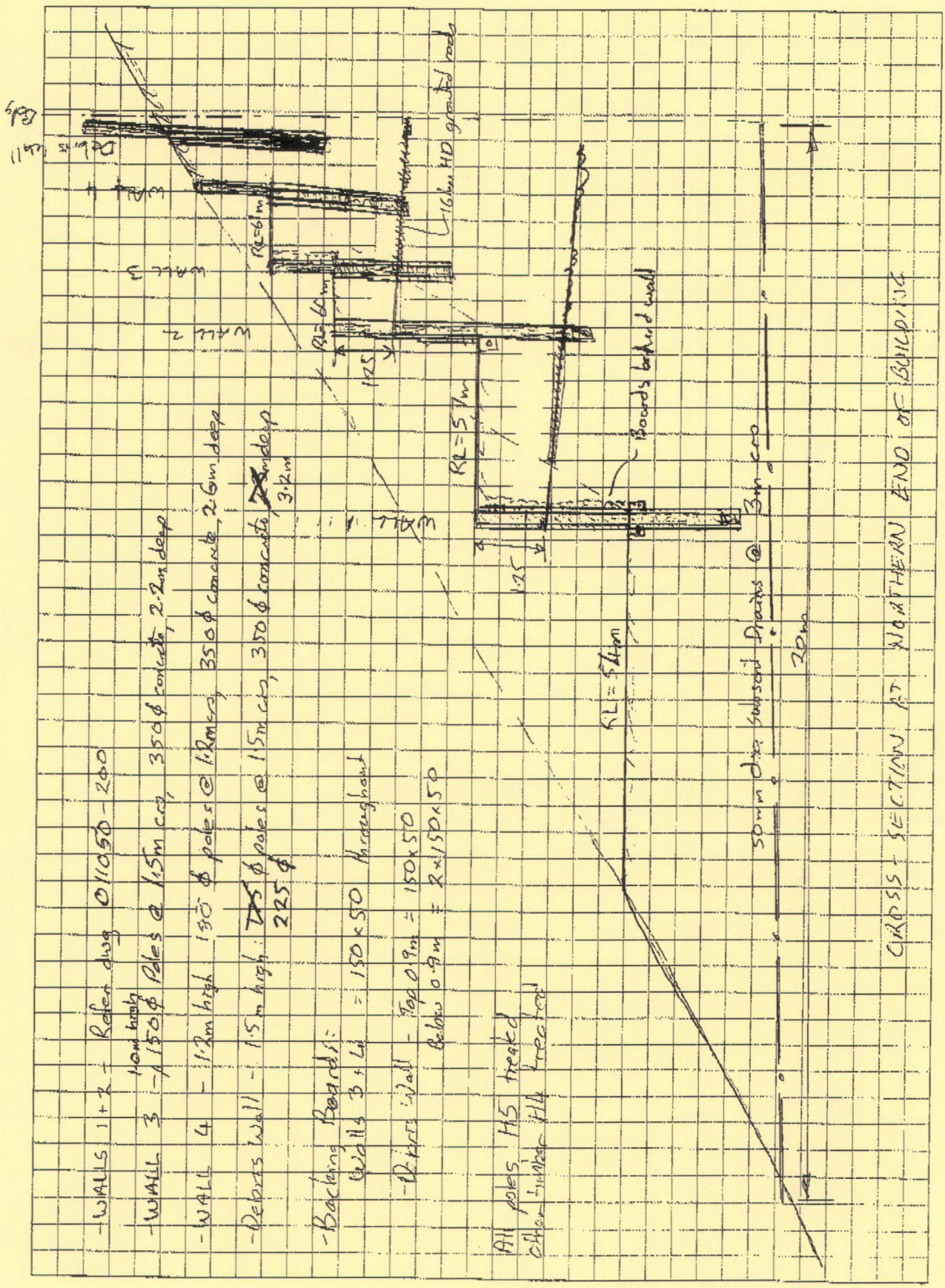
HARRISON GRIERSON

Job Name	28 Waimea Rd, Chapel	Job No.
Client	Thornton	
Page No.	8	Prepared By
Date		Checked By

Work Sheet:



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Facsimile Transmission

To Tonkin and Taylor

Attn John Leeves **Fax No.** 09 307 0265

Copies to Rueben Hansen, MTec 575 2868

From Mark Thomas **Date** 20 June 2006

No. of pages *(including this cover sheet)* 4 **HG Ref.** 1510-01150-01

Re Thornton - 2B Kowhai St, Ohope, Whakatane

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John,

I refer to your fax to Whakatane District Council date 16 May 2006, which was forwarded to us as a s92 request on 24 May 2006.

With respect to your questions, we respond as follows:

1. The debris wall had not been specifically designed for impact loads, however the effect of the impact loads is partially absorbed in the timber design by the use of the k_1 factor. We had used $k_1 = 0.8$ for this wall, for a short to medium duration load, as opposed to 0.6 for permanent loads. For impact loads, $k_1 = 1.0$. The other issue is what is the appropriate impact factor to use. At this site, the debris wall is required to protect the house site from a potential failure of the slope immediately behind the wall that has a factor of safety lower than desired. The potential sliding distance is therefore small (5m or so), so the potential for any significant momentum is small. I have applied an impact factor of 1.5 to the wall loads, and used a k_1 factor of 1.0, this increases the depth of the poles to 2.3m, although the timber sizes remain the same.
2. The coach-bolt connections have been designed to the requirements of the timber design code for coach bolts in withdrawal, with appropriate factors applied for permanent loads. In addition, there is a significant element of overdesign, as the coach bolts have been designed for the worst loads (on the lower boards), while in practice the applied load reduces with the height of the wall. However, to reduce the risk of warping, we will require that 2 coach screws be used at each connection.
3. There will be drainage metal placed behind the walls. Effectively there will be a 250mm thick drainage layer behind the walls, broken only by the poles. This will enable drainage vertically to the subsoil drain constructed at the front of the wall, and we consider that this will provide adequate drainage to effectively drain the walls. I would not expect any significant water pressure to build up in the sandy silts soils behind the undrained strip immediately behind the poles.
4. Water pressures have not been specifically designed for, as we consider that the drainage provided will adequately drain the walls.

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Facsimile To Tonkin and Taylor
From Mark Thomas
Re Thornton - 28 Kowhai St, Ohope, Whakatane

20 June 2006
HG Ref 1510-01150-01

5. I am satisfied that the calculated anchor loads are correct for the design loads. The 42.5kN/m ultimate anchor load for wall 4, compares with the 55.5kN/m total ultimate load applied above the wall. (1.5*(27+10)), where 27kN/m is the active earth pressure, and 10 kN/m is the surcharge active pressure on a 3m high wall. However, it is probably more appropriate, and safer, to use the at-rest coefficient (k_0). We have checked the wall using this, and lowering the location of the anchors to 1.25m below the top of the wall to give an optimum pole size. A 250mm dia pole is still appropriate, with 2.0m embedment, and a 32kN anchor load results. The manta rays selected are based on the manufacturer's recommendations, however I am quite happy to change these to 16mm HD Reid bars grouted into the soil.
6. The anchors were required to extend at least 2m beyond the active soil wedge, measured from the base of the wall.
7. Refer 9. below.
8. We agree that driving will be difficult without pre-boring. As noted on our methodology statement, the poles will need to be drilled. I note the drawing says driven piles, and we will amend this.
9. I have reviewed the wall sizes taking into account the passive pressure from the walls above, including the effect of a full debris wall. The resulting changes are as follows:
    - Wall 4, max height 1.2m. 180 dia poles at 1.2m crs, poles 2.6m deep in 350 dia. concrete.
    - Wall 3, maximum height 1m. 175 dia poles at 1.5m crs, poles 2.2m deep in 350 dia concrete.
    - For wall 2, we had previously used the same design as for Wall 1, which included a 10kPa surcharge. For wall 2 there is no surcharge from any building, but it was recognised that the walls located behind will exert additional loading. A check on the calculations applying the passive load from wall 3, but not including the 10kPa surcharge, results in smaller pole loads and embedment depths than required for wall 1, but a slightly higher anchor load. It is therefore appropriate to use the same design as wall 1.
    - Wall 1 is outside the passive wedge for wall 2.
10. Refer 9. above
11. Horizontal drains will be connected to a piped drainage system, with inspection chambers placed at each horizontal drain.
12. The cross-section is the same as that analysed in the geotechnical investigation report, which you previously reviewed. The global F.O.S. was >1.5 with the proposed drainage measures.
13. We have not included handrails in our design, however we envisage that handrails will be required in locations, particularly where the wall is above the driveway. The location of handrails is best determined at the time of designing the house. It is unlikely that handrails will be required at any of the critical sections for the design of the walls, therefore attaching handrails is unlikely to effect the wall designs.

I have attached a revised cross-section showing the wall sizes corrected as in 9 above, and will give you a call to discuss before changing drawings and forwarding revised calculations.

Facsimile To	Tonkin and Taylor	20 June 2006
From	Mark Thomas	HG Ref 1510-01150-01
Re	Thornton – 2B Kowhai St, Ohope, Whakatane	

Yours faithfully
Harrison Grierson Consultants Limited

Mark Thomas
Engineering Manager

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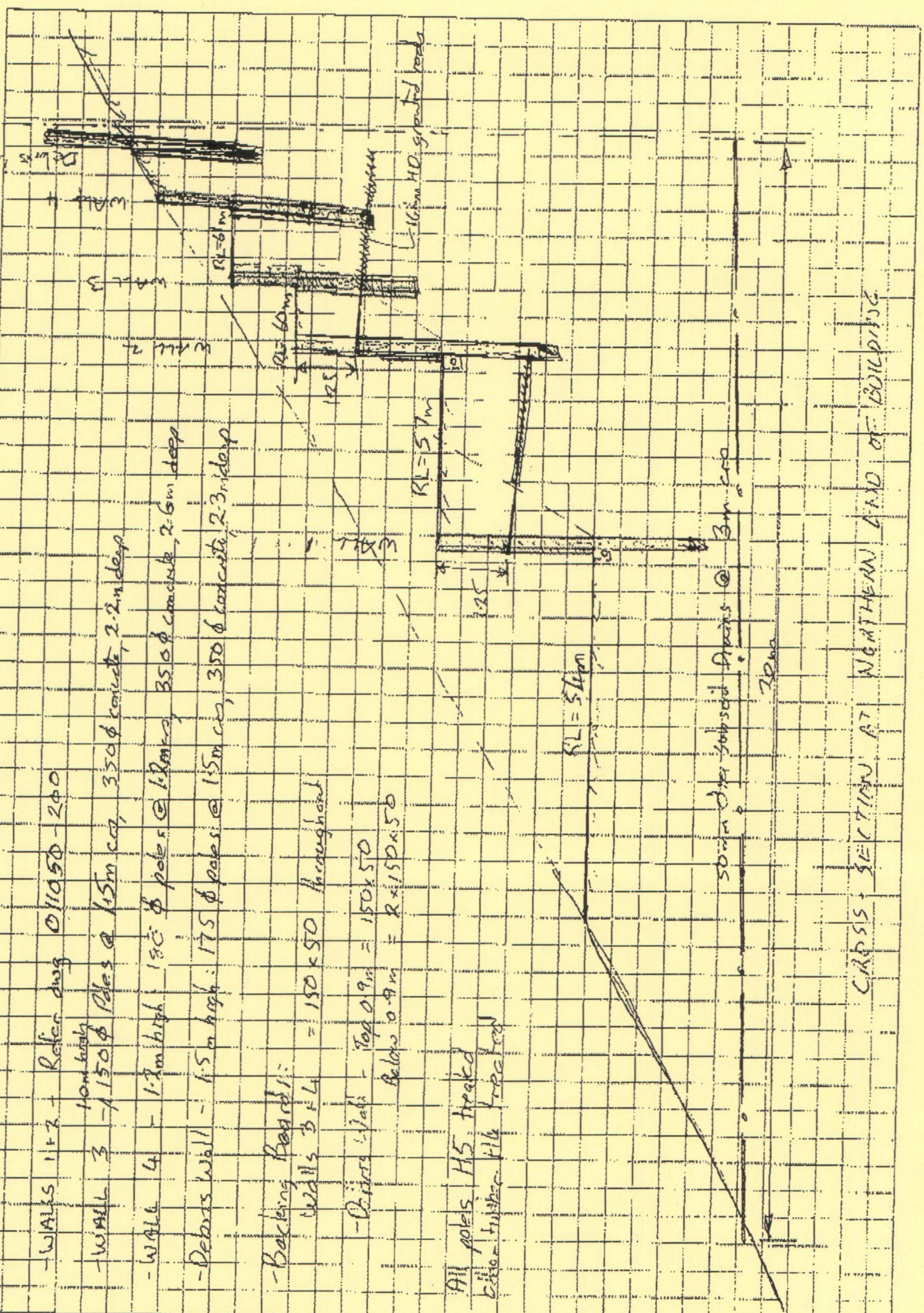
HARRISON GRIERSON

Job Name	26 Wainui Rd, Ohope		Job No.
Client	Thornton		
Page No.	8	Prepared By	
Date		Checked By	

Work Sheet:



24.3.04.92

HARRISON GRIERSON

26 April 2006

WHAKATANE DISTRICT COUNCIL
FILE:
REG. No.: G 33849
28 APR 2006
ACTIONED DATE
1 Jeff
2
3
4

Whakatane District Council
Private Bag 1002
WHAKATANE

Attention Jeff Farrell and Laura Swan

Laura

Dear Jeff and Laura

SA and CA Thornton - 2B Kowhai St, Ohope
HG Ref 1510-011050-01

At the pre-hearing meeting held on 16th March, the principal area of concern related to the stability of the slope during construction, and the provision of a stable building platform.

In order to alleviate this concern, we have prepared a design for a retaining wall system to provide a stable building platform, together with a methodology designed to ensure that the stability of the existing bank is not compromised during construction.

Details of the proposed wall system are shown on our drawing 011050-200, and I have attached details of the proposed construction sequence. The resulting building platform will enable a building structure similar to the concept plan prepared by Brown Day Architects to be constructed on the site, however as the retaining walls will now be self-supporting, the house can be constructed independently of the wall, leaving a small gap between the rear wall of the house and the retaining walls.

The system basically comprises two 3m high walls to form the main building platforms, together with two smaller 1m high walls near the rear boundary. We have designed the walls using timber poles, with the small rear walls and debris retaining wall constructed from conventional poles set in a concrete foundation. The high walls will be constructed from driven piles, which will be supported by ground anchors. The poles would be driven prior to excavation thereby ensuring that the excavated face is always supported. The spacing of the piles has been designed to be four times the pole diameter, which is sufficient to allow soil arching between the piles to provide stability to the face prior to placing drainage metal between the poles and installing facing boards.

The other key factor in the design and construction of the system is to ensure that horizontal drains are installed at the base of the site before any other construction activities commence. The geotechnical report recommended that horizontal drains be drilled from the rear floor level (RL=54m) to the boundary, a length of about 7m, and a 2m deep vertical drain be excavated at the base of the wall. However this drainage

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system could not be constructed until after excavation, therefore an alternative of drilling 20m long horizontal drains from RL=51m is proposed. This will provide a similar groundwater profile to that proposed in the geotechnical report, and will enable the subsoil drainage to be constructed in advance of other construction activities.

The proposed methodology minimises any risk to the stability of the slope, and limits the height of any unsupported faces to no more than 1.5m at one corner of the site, during the construction of the rear pole wall. Construction of the rear pole walls is relatively quick, and could be substantially completed within 2 or 3 days of the excavation being formed. Provided the excavation is carried out during fine weather, the risk to the neighbouring property will be minimal.

I have attached plans and details of the methodology, together with design calculations for the retaining walls to demonstrate their feasibility.

In our site suitability report, we noted that the bulldozer track that had been formed on the lower portion of the site should be filled with compacted inorganic material to reinstate and stabilise the slope, and prevent further localised shallow failures occurring immediately above the track. We did not specify when the track should be backfilled, although noted that it would be appropriate to use material excavated for the house foundations for this, providing the moisture content was appropriate. The track has now been in place for over 2 years, and the risk of any further significant slips occurring above it in the short term is slight. We therefore consider that it would be appropriate that the backfilling of the track is undertaken in conjunction with the construction of the new access driveway, as this will enable proper preparation, placing and compaction of the fill to be undertaken.

Our August 2005 geotechnical report made no reference to a crack that occurred within the road reserve in front of the existing dwelling at 2B Kowhai Street. This crack had occurred behind a steep (near vertical) road cutting during the heavy rain event that hit Whakatane in mid 2004, and was located entirely within the road reserve. Although the bank did not fail, the crack confirms that the slope in this area is only marginally stable, and is at risk of failure occurring. In this area, the toe of the bank is located approximately 15m away from the boundary, and is 5m to 6m below the level of the concrete driveway in front of the house. Based on the geometry of the slope, it is unlikely that any future failure of this bank will extend beyond the property boundary, and we consider that the existing house site is not at risk from any such failure.

I trust that this is sufficient information to enable you to complete the processing of the Resource Consent Application, however if you require any further information, please let me know.

Yours faithfully
Harrison Grierson Consultants Limited

Mark Thomas
Principal

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Thornton – Wainui Road Site
Building Platform Construction Sequence

1. Drill horizontal drains from RL=51m over length of 20m. This will pull the groundwater down to the level desired in the geotechnical report.

2. Construct a temporary surface drain at top of site to direct surface water flows away from the excavation site.

3. Construct bench at RL = 61m

4. Construct top wall (Wall4) and debris retaining wall.

5. Excavate bench at RL = 60m

6. Construct 1m high retaining wall (Wall 3)

7. Drill and install (or drive) poles for the upper wall (Wall 2). Pole spacing to not exceed 4 times pole diameter.

8. Excavate in front of wall to RL=58m

9. Install tie-back anchors

10. Excavate to RL = 57m, place drainage metal, facing boards and subsoil drains.

11. Drill and install (or drive) poles for the lower wall (Wall 1). Pole spacing to not exceed 4 times pole diameter.

12. Excavate in front of wall to RL=55m

13. Install tie-back anchors

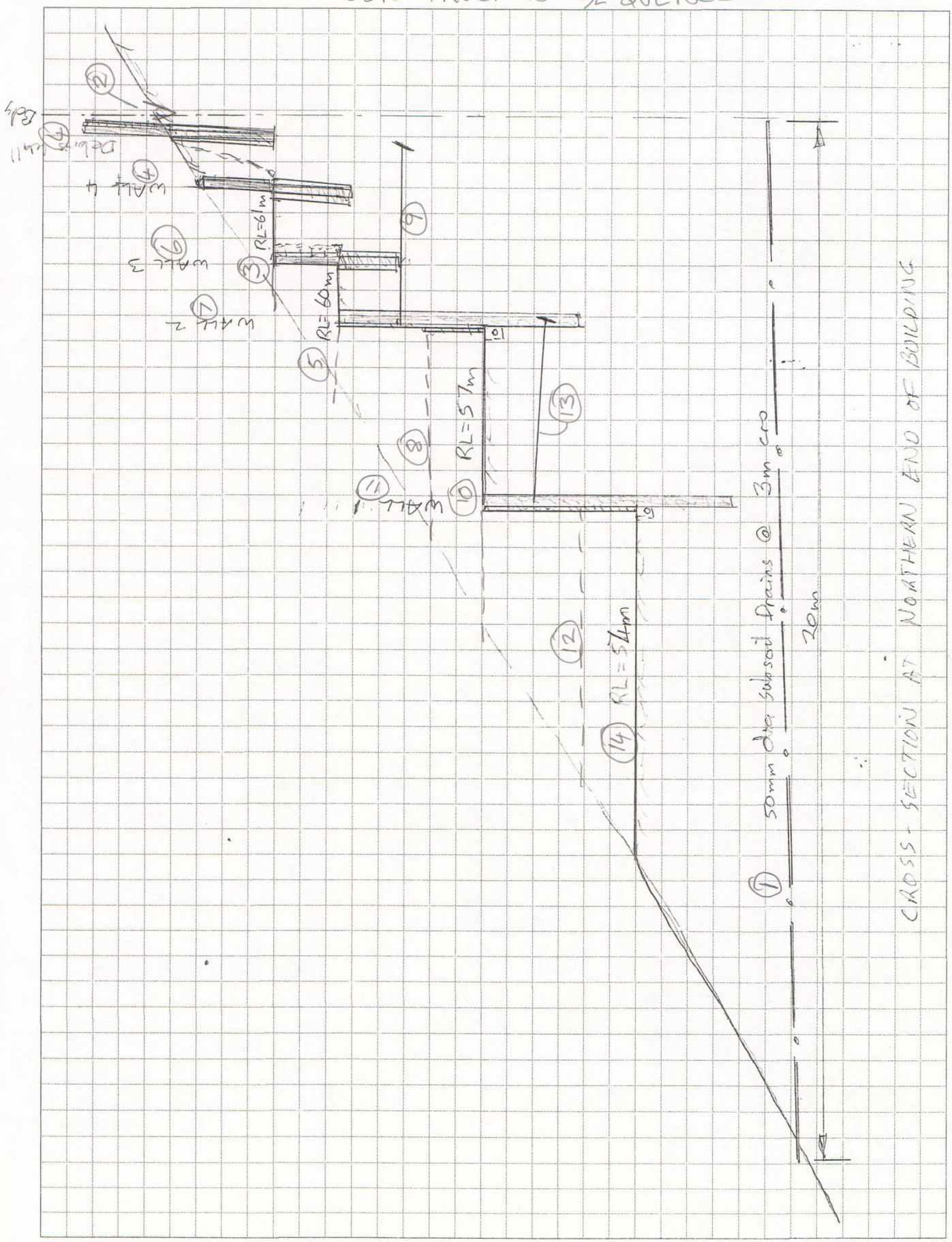
14. Excavate to RL=54m, place drainage metal, facing boards and subsoil drains.

HARRISON GRIERSON

Job Name	28 Wainui Rd, Otaki	Job No.
Client	Thornton	
Page No.		Prepared By
Date		Checked By

Work Sheet:

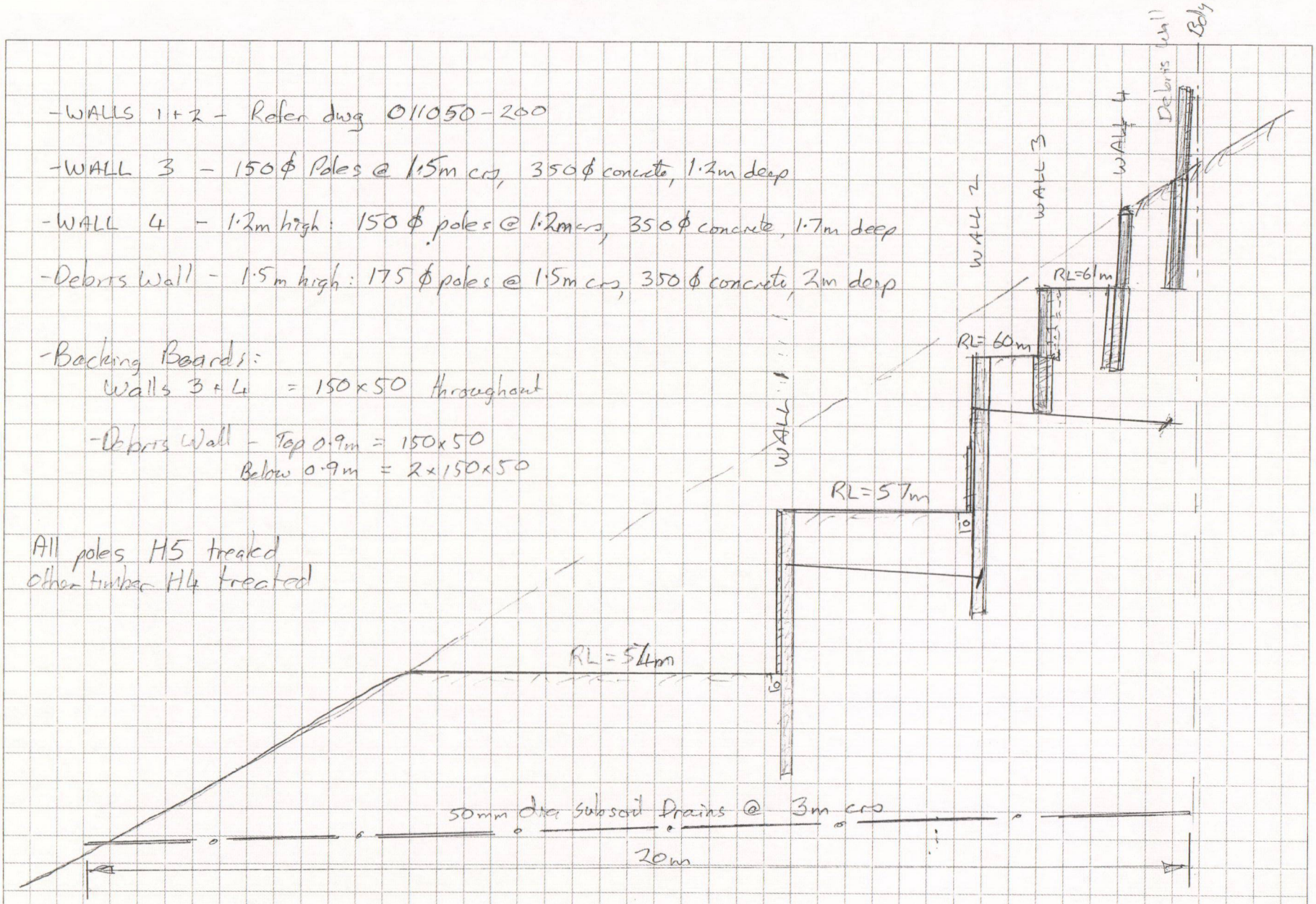
CONSTRUCTION SEQUENCE



- WALLS 1+2 - Refer dwg 011050-200
- WALL 3 - 150ϕ Poles @ 1.5m crs, 350ϕ concrete, 1.2m deep
- WALL 4 - 1.2m high: 150ϕ poles @ 1.2m crs, 350ϕ concrete, 1.7m deep
- Debris Wall - 1.5m high: 175ϕ poles @ 1.5m crs, 350ϕ concrete, 2m deep

- Backing Boards:
  Walls 3 + 4 = 150×50 throughout
  - Debris Wall - Top 0.9m = 150×50
    Below 0.9m = 2×150×50

All poles H5 treated
other timber H4 treated



CROSS-SECTION AT NORTHERN END OF BUILDING

HARRISON GRIERSON

Work Sheet:

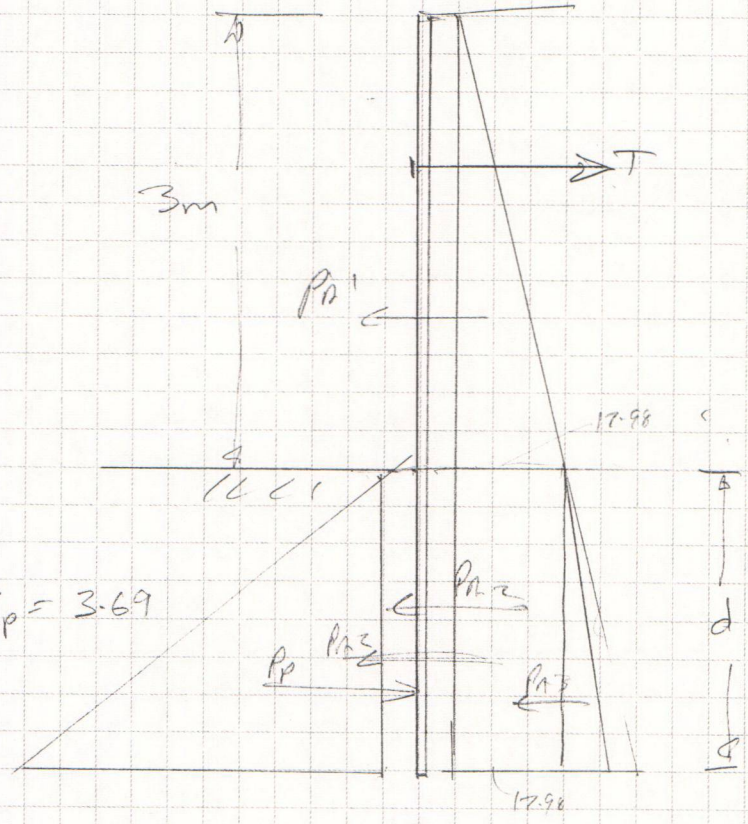
Job Name	26 Wainui Rd, Orope
Client	Thornton
Page No.	
Date	
Prepared By	
Checked By	
Job No.	

HARRISON GRIERSON

Job Name	213 Kawhai St	Job No. 1510 011050-01
Client	S. Thornton	
Page No.	1	Prepared By MRT
Date		Checked By

Work Sheet

3m Tied Back retaining wall



$\theta = 30°$ $\gamma = 18$

$\Rightarrow K_A = 0.33$

$\phi = 35°$ $\gamma = 18$

$\Rightarrow K_A = 0.27$

Surcharge = 10kPa

$\Rightarrow P_S = 0.33 \times 10(3+d)$

$= 9.9 + 3.3d$

$P_{A1} = \frac{1}{2}(0.33)(18)(3)^2 = 26.97$ kN/m

$P_{A2} = 17.98\,d$

$P_{A3} = \frac{1}{2}(0.27)(18)(d)^2 = 2.43d^2$

$P_p = \frac{1}{2}(3.69)(18)(d)^2 = 33.21\,d^2$

Load factor - Static loads = 1.5 $\rightarrow$ 0.8

$\therefore$ Factor Passive by 0.8, Active by 1.5

HARRISON GRIERSON

Job Name		Job No.
Client		
Page No. 2	Prepared By	
Date	Checked By	

Work Sheet

Take Moments about anchor

$$1.5\times\left\{29.67(1.0)+17.98(d)\left(2+\frac{d}{2}\right)+2.43(d)^2\times\left(2+\tfrac{2}{3}d\right)+(9.9+3.3d)\left(\frac{d+2}{2}\right)\right\}$$

$$= 0.8\left\{33.21d^2\times\left(2+\tfrac{2}{3}\right)d\right\}$$

$$\Rightarrow 1.5\left\{29.67+35.96d+8.99d^2+4.86(d)^2+1.62d^3\right\} = 0.8\left(66.42d^2+22.14d^3\right)$$

$$59.35+66.32d+23.25d^2+2.43d^3 = 53.14d^2+17.71d^3$$

$$\Rightarrow 59.35+66.32d-29.89d^2-15.28d^3 = 0$$

- Solving: $d = 1.76$ m - say 1.8 m

$$\Rightarrow P_A = 29.67+17.98(1.8)+2.43(1.8)^2+9.9+3.3(1.8) = 85.74\ \text{kN/m}$$

$$P_p = 33.21(1.8)^2 = 107.6\ \text{kN/m}$$

$$T_{(\text{limit state})} = 1.5P_A - 0.8P_p$$

$$= 1.5(85.74-0.8(107.6))$$

$$= 42.53\ \text{kN/m}$$ Ultimate load / anchor @ 1m crs

- If anchors at 2m centres $\Rightarrow$ 85.06 kN/anchor MK-B

or at 1.5m crs $\Rightarrow$ 63.79 kN/anchor MK1

1.2m crs $\Rightarrow$ 51.04 kN/anchor

Thornton

Formula 59.35+(66.32*d)-(29.89*d^2)-(15.28*d^3)

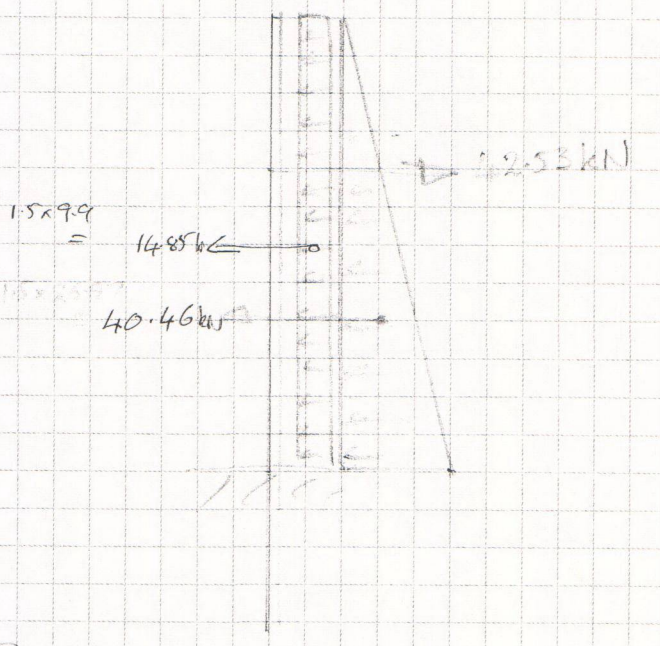
d=	1	2	1.5	1.8	1.76
Soln	80.5	-49.81	40.0075	-7.23056	0.182799

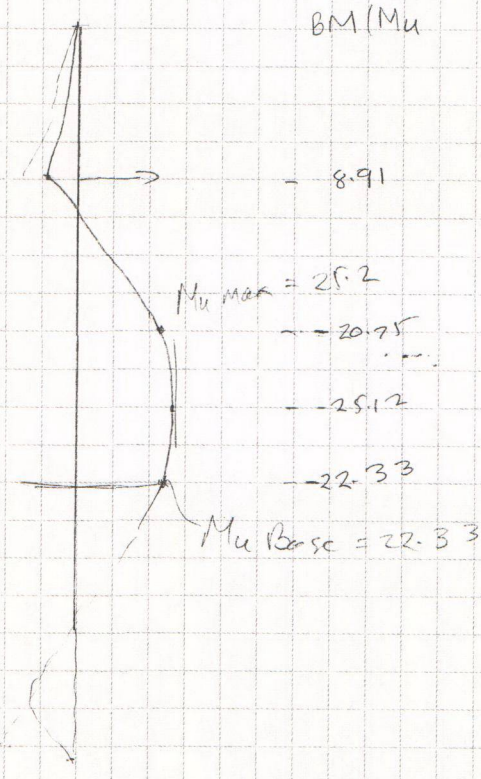
HARRISON GRIERSON

Job Name		Job No.
Client		
Page No. 3	Prepared By	
Date	Checked By	

Work Sheet

Check embedment





Broms

$H_u = 40.46 + 14.85 - 42.53$

$= 12.78\ kN$

$f = \frac{M_u}{H_u} = \frac{22.33}{12.78} = 1.74m$

From Broms: $D_s = \frac{H_u \cdot 3 \cdot (L+f)}{K_p L^3 \gamma} = \frac{12.78(2)(18+1.74)}{3.69(18)^3(18)} = 0.234$

- Say 250mm min dia

Check bending in pole

for 265 ϕ, $Z = 1.827 \times 10^{+6}\ mm^3$

ϕ k_1 k_{20} k_{21} f_b

$\phi M_n = 0.8 \times 0.6 \times 0.9 \times 0.85 \times 38 \times 1.827$

$= 25.49\ kN-m$

HARRISON GRIERSON

Job Name		Job No.
Client		
Page No. 4	Prepared By	
Date	Checked By	

Work Sheet:

Taper on poles between 1/300 and 1/190, ∴ pole diameter will be between 10mm and 15mm greater than SED at a point 2m from end

∴ 250 SED driven piles will be OK.
- Spacing = 1.0m crs.
Tie Back ultimate load = 42.5 kN

Railings: - Refer attached spreadsheets:

From Top to 1.7m - Use 150x50 slats

From 1.7m to 3m - Use 2 x 150x50 slats

Railings to be bolted to the face of the poles, therefore will have coach screws in withdrawal load.

At 2.9m, load/join = 4.54 kN = N*

At 1.7m, load/join = 2.96 kN = N*

J5 timber: $\phi = 0.7$, $k_1 = 0.6$, $k_{green} = 0.7$

for	10mm ϕ = 107 N/mm	⇒ ϕkQk = 31 N/mm
	12mm ϕ = 118 N/mm	= 35 "
	16mm ϕ = 136 N/mm	= 40 "

For 4.54 kN ⇒ 130mm x 12mm ϕ ⇒ Use 220mm long coach screws

2.96 kN ⇒ 85mm x 12mm ϕ – Use 160mm long coach screws

p5

Timber Pole Vertical Retaining Wall

Job No:	71.011050.1		
DESIGN:	3.0m Retaining wall behind house driven piles		21-Apr-06
CLIENT:	Steve Thornton		
		Prepared by:	MRT
ADDRESS:	24 Wainui Road, Ohope.	Checked by:	

Step 1 :Input Design Parameter

Surcharge	10	kPa			
Wall Height	**2.9**	m	Ka	0.33302458	
Gamma	**18**	kN/m3	Kp	3	
Phi	**30**				
Degree	0.524				
Lateral Force	25.207	**kN/m**			
Surcharge	9.658	**kN/m**			

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Load factor	Moment (kNm)	Moment * LF
Soil pressure	25.207	0.9666667	1.5	24.37	36.555
Surcharge	9.658	1.45	1.5	14	21
Total	**34.865**	**2.417**		**38.37**	**50.555**

Step 5 :Check for Slats

fb (MPa) = 38

	width	depth			
Use	**0.146**	**0.047**	Z section	53752.33333	mm3
Force btw board =		**4.536472**	kN/m		
Moment in btw spacing=		0.453647	kN-m		

M*<0.8*Mn **Mn =0.8*K1*K4*K5*K8*fb*Z**

0.8Mn=	0.301873	kN-m
M*=	0.453647	
Design is	NOT OK!	

2x 150x50 => 0.604

ok

K1	**0.6**
K4	**1**
K5	**1**
K8	**1**
fb (MPa) =	**11.7**

Remarks :

Slat Design

pb

Timber Pole Vertical Retaining Wall

Job No: 71.011050.1

DESIGN: 3.0m Retaining wall behind house driven piles 21-Apr-06

CLIENT: Steve Thornton

Prepared by: MRT

ADDRESS: 24 Wainui Road, Ohope. Checked by:

Step 1 :Input Design Parameter

Surcharge	10 kPa			
Wall Height	**1.7** m	Ka	0.33302458	
Gamma	**18** kN/m3	Kp	3	
Phi	**30**			
Degree	0.524			
Lateral Force	8.662 **kN/m**			
Surcharge	5.661 **kN/m**			

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Load factor	Moment (kNm)	Moment * LF
Soil pressure	8.662	0.5666667	1.5	4.91	7.365
Surcharge	5.661	0.85	1.5	4.81	7.215
Total	**14.323**	**1.417**		**9.72**	**12.175**

Step 5 :Check for Slats

fb (MPa) = 38

	width	depth			
Use	**0.146**	**0.047**	Z section	53752.33333	mm3
Force btw board =		**2.961009**	kN/m		
Moment in btw spacing=		0.296101	kN-m		

M*<0.8*Mn **Mn =0.8*K1*K4*K5*K8*fb*Z**

0.8Mn=	0.301873	kN-m
M*=	0.296101	
Design is	OK!	

K1 0.6
K4 1
K5 1
K8 1
fb (MPa) = 11.7

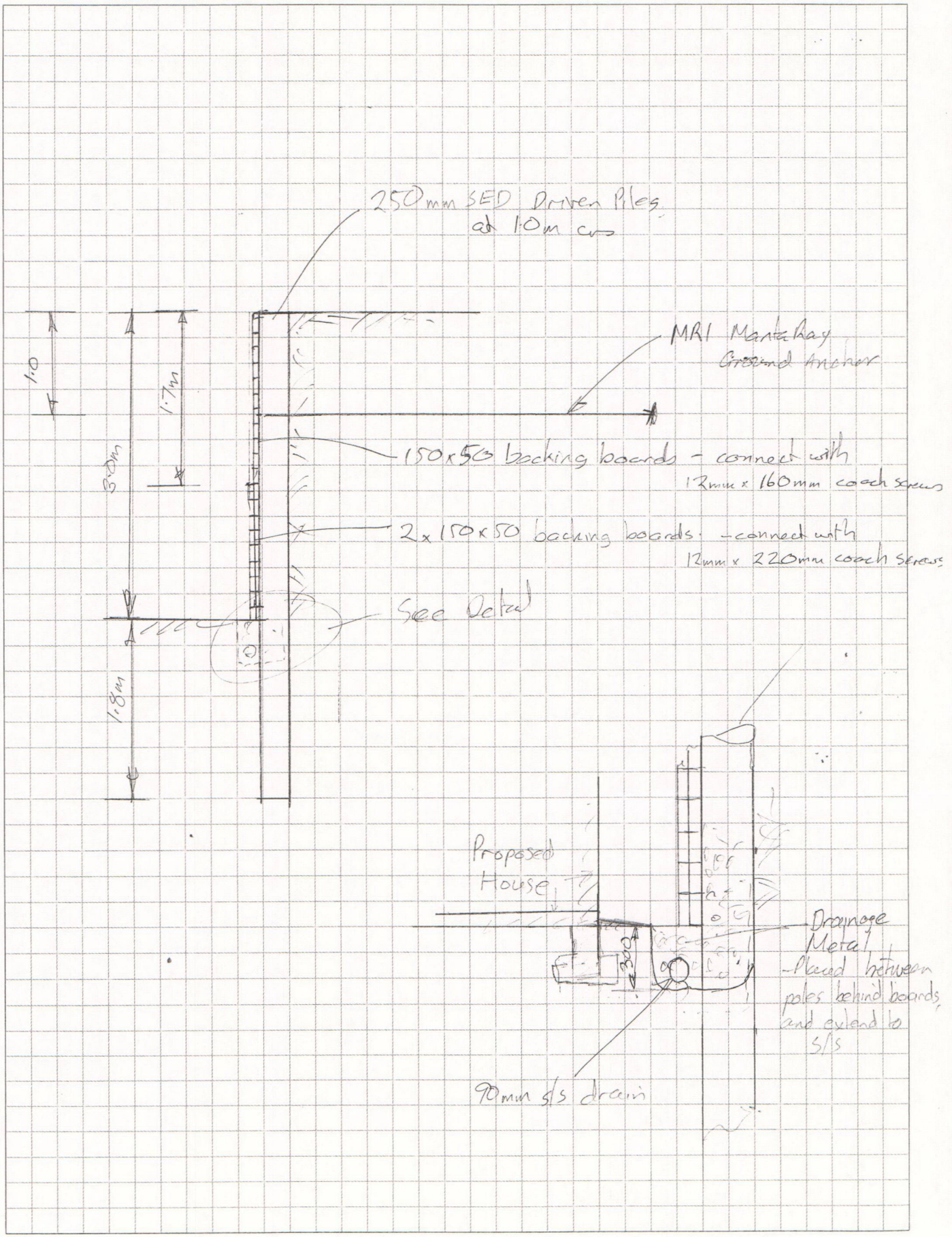
Remarks :

Slat Design

HARRISON GRIERSON

Job Name		Job No.
Client	Thornton	
Page No.	7	Prepared By
Date		Checked By

Work Sheet:



HARRISON GRIERSON

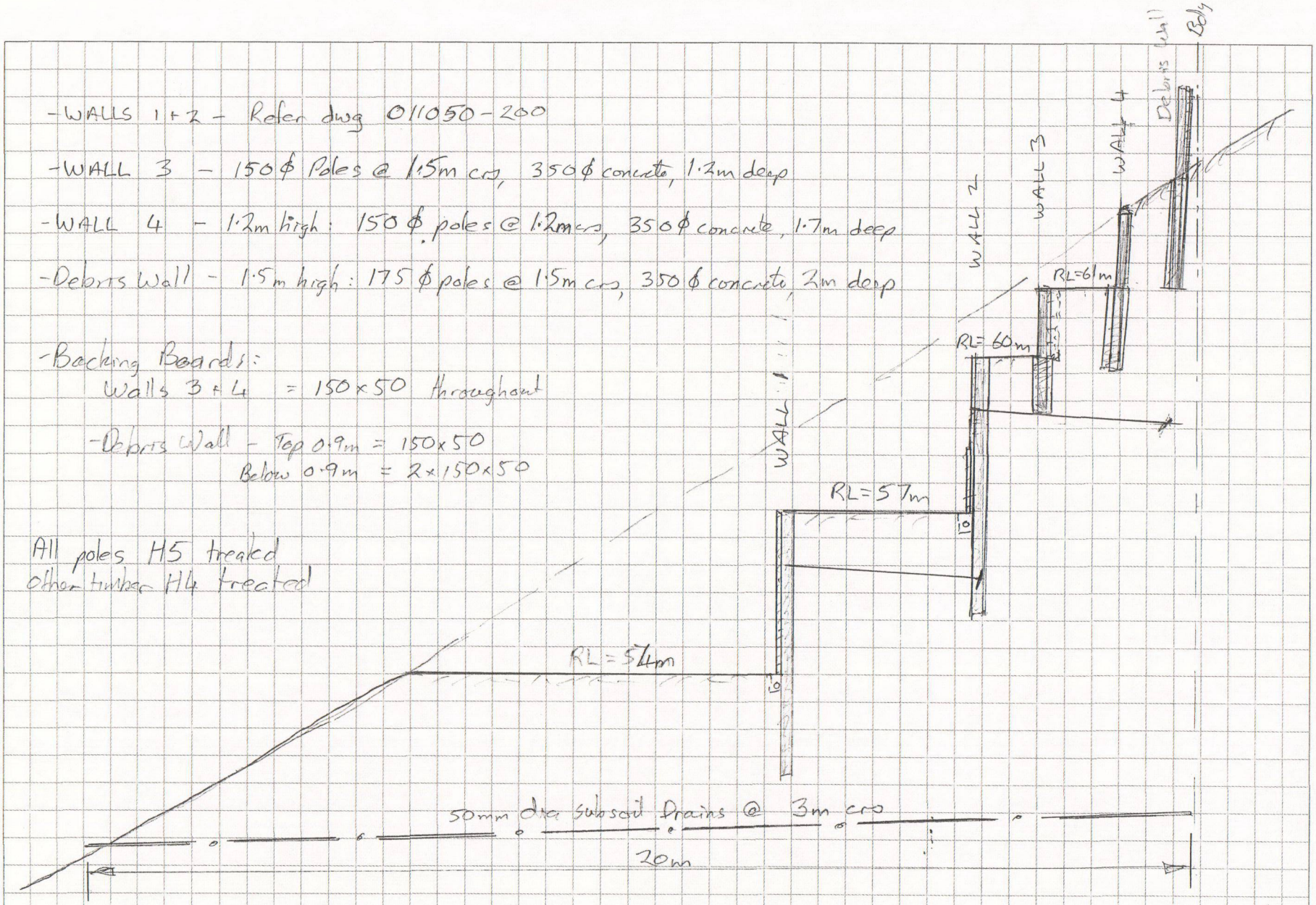
Work Sheet:

Job Name	26 Wainui Rd, Otaki
Client	Thornton
Page No.	8
Date	
Prepared By	
Checked By	
Job No.	

- WALLS 1+2 - Refer dwg 011050-200
- WALL 3 - 150ϕ Poles @ 1.5m crs, 350ϕ concrete, 1.2m deep
- WALL 4 - 1.2m high: 150ϕ poles @ 1.2m crs, 350ϕ concrete, 1.7m deep
- Debris Wall - 1.5m high: 175ϕ poles @ 1.5m crs, 350ϕ concrete, 2m deep

- Backing Boards:
  Walls 3 + 4 = 150x50 throughout
  - Debris Wall - Top 0.9m = 150x50
    Below 0.9m = 2x150x50

All poles H5 treated
other timber H4 treated



CROSS-SECTION AT NORTHERN END OF BUILDING

Timber Pole Vertical Retaining Wall

Job No:	71.011050.1		
DESIGN:	1.0m wall (Wall 3)		24-Apr-06
CLIENT:	Steve Thornton		
		Prepared by:	MRT
ADDRESS:	24 Wainui Road, Ohope.	Checked by:	

Step 1 :Input Design Parameter

Surcharge	0	kPa			
Wall Height	**1**	m	Ka	0.33302458	
Gamma	**18**	kN/m3	Kp	3	
Phi	**30**				
Degree	0.524				
Lateral Force	2.997	**kN/m**			
Surcharge	0	**kN/m**			

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Load factor	Moment (kNm)	Moment * LF
Soil pressure	2.997	0.3333333	1.5	1	1.5
Surcharge	0	0.5	1.5	0	0
Total	**2.997**	**0.833**		**1**	**1.5**

c	0.334		Pole Spacing (crs)		**1.5**
Resultant Moment(M*)	1.5	kN-m	Pile spacing factor		**1.00**
Resultant Force(H*)	4.496	kN			

Step 3 :Check by Brohms Method

Depth of Embedment, L	**1.2**	m				
Pole embedment dia	**0.35**	m			H*	
Brohms	H*<0.5Hu		**0.5Hu=**	**5.323**	4.496	**OK!**
Comment:	***Use*** **0.35**	**m dia with**	**1.2**	**m embed. depth**		**1.5 m apart**

Step 4 :Check for Pole bending

SED pole dia	**150**	mm	Z section	331339.85	mm3
	M*<0.8*Mn		**Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21**		
0.8Mn=	4.623	kN-m			
M*=	1.5	kN-m	**K20 = 0.9**		
Design is	**OK!**		**K21 = 0.85**		

K1 = 0.6
K4 = 1
K5 = 1
K8 = 1
fb (MPa) = 38

Step 5 :Check for Slats

	width	depth			
Use	**0.15**	**0.05**	Z section	62500	mm3
Force btw board =	**1.34865**	kN/m			
Moment in btw spacing=	0.303446	kN-m			
	M*<0.8*Mn		**Mn =0.8*K1*K4*K5*K8*fb*Z**		
0.8Mn=	0.351	kN-m			
M*=	0.303446				
Design is	**OK!**				

K1 0.6
K4 1
K5 1
K8 1
fb (MPa) = 11.7

Remarks :

p10

Timber Pole Vertical Retaining Wall

Job No:	71.011050.1		
DESIGN:	1.2m wall (Wall 4)		24-Apr-06
CLIENT:	Steve Thornton		
			Prepared by: MRT
ADDRESS:	24 Wainui Road, Ohope.		Checked by:

Step 1 :Input Design Parameter

Surcharge	0	kPa			
Wall Height	**1.2**	m	Ka	0.45	**(Sloping Backfill)**
Gamma	**18**	kN/m3	Kp	3	
Phi	**30**				
Degree	0.524				
Lateral Force	5.832	**kN/m**			
Surcharge	0	**kN/m**			

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Load factor	Moment (kNm)	Moment * LF
Soil pressure	5.832	0.4	1.5	2.33	3.495
Surcharge	0	0.6	1.5	0	0
Total	**5.832**	**1**		**2.33**	**3.495**

c	0.4	Pole Spacing (crs)		**1.2**
Resultant Moment(M*)	3.495 kN-m	Pile spacing factor		**0.86**
Resultant Force(H*)	8.748 kN			

Step 3 :Check by Brohms Method

Depth of Embedment, L	**1.7**	m			
Pole embedment dia	**0.35**	m		H*	
Brohms	H*<0.5Hu	**0.5Hu=**	**9.475**	8.748	**OK!**

Comment: ***Use*** **0.35 m dia with 1.7 m embed. depth 1.2 m apart**

Step 4 :Check for Pole bending

SED pole dia	**150**	mm	Z section	331339.85 mm3
	M*<0.8*Mn		**Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21**	
0.8Mn=	4.623	kN-m		
M*=	3.495	kN-m	**K20 = 0.9**	**K1 = 0.6**
Design is	**OK!**		**K21 = 0.85**	**K4 = 1**
				K5 = 1
				K8 = 1
				fb (MPa) = 38

Step 5 :Check for Slats

	width	depth		
Use	**0.15**	**0.047**	Z section	55225 mm3
Force btw board =		**2.187**	kN/m	
Moment in btw spacing=		0.314928	kN-m	
	M*<0.8*Mn		**Mn =0.8*K1*K4*K5*K8*fb*Z**	
0.8Mn=	0.310144	kN-m		
M*=	0.314928			
Design is	**NOT OK!**	-Very close ∴ ok.		

K1	**0.6**
K4	**1**
K5	**1**
K8	**1**
fb (MPa) =	**11.7**

Remarks :

p11

Timber Pole Vertical Retaining Wall

Job No: 71.011050.1

DESIGN: Debris Wall 24-Apr-06

CLIENT: Steve Thornton

ADDRESS: 24 Wainui Road, Ohope. Prepared by: MRT Checked by:

Step 1 :Input Design Parameter

Surcharge	0	kPa			
Wall Height	**1.5**	m	Ka	0.45	**(Sloping Backfill)**
Gamma	**18**	kN/m3	Kp	3	
Phi	**30**				
Degree	0.524				
Lateral Force	9.113	**kN/m**			
Surcharge	0	**kN/m**			

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Load factor	Moment (kNm)	Moment * LF
Soil pressure	9.113	0.5	1.5	4.56	6.84
Surcharge	0	0.75	1.5	0	0
Total	**9.113**	**1.25**		**4.56**	**6.84**

c	0.5	Pole Spacing (crs)		**1.5**
Resultant Moment(M*)	6.84 kN-m	Pile spacing factor		**1.00**
Resultant Force(H*)	13.67 kN			

Step 3 :Check by Brohms Method

Depth of Embedment, L	**2** m				
Pole embedment dia	**0.35** m			H*	
Brohms	H*<0.5Hu	**0.5Hu=**	**15.12**	13.67	**OK!**

Comment: ***Use*** **0.35 m dia with 2 m embed. depth 1.5 m apart**

Step 4 :Check for Pole bending

SED pole dia **175** mm Z section 526155.41 mm3

M*<0.8*Mn **Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21**

0.8Mn= 9.789 kN-m

M*= 6.84 kN-m

Design is **OK!**

K20 = 0.9
K21 = 0.85

K1 = 0.8
K4 = 1
K5 = 1
K8 = 1
fb (MPa) = 38

Step 5 :Check for Slats

	width	depth		
Use	**0.15**	**0.047**	Z section	55225 mm3
Force btw board =		**2.7339**	kN/m	
Moment in btw spacing=		0.615128	kN-m	

M*<0.8*Mn **Mn =0.8*K1*K4*K5*K8*fb*Z**

0.8Mn= 0.413525 kN-m

M*= 0.615128

Design is **NOT OK!**

K1 0.8
K4 1
K5 1
K8 1
fb (MPa) = 11.7

2 x 2 = 0.82 - ok

∴ Use double 150x50 boards

Remarks :

Timber Pole Vertical Retaining Wall

Job No: 71.011050.1

DESIGN: Debris Wall 24-Apr-06

CLIENT: Steve Thornton

ADDRESS: 24 Wainui Road, Ohope. Prepared by: MRT Checked by:

Step 1 :Input Design Parameter

Surcharge	0	kPa			
Wall Height	**0.9**	m	Ka	0.45	**(Sloping Backfill)**
Gamma	**18**	kN/m3	Kp	3	
Phi	**30**				
Degree	0.524				
Lateral Force	3.281	**kN/m**			
Surcharge	0	**kN/m**			

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Load factor	Moment (kNm)	Moment * LF
Soil pressure	3.281	0.3	1.5	0.98	1.47
Surcharge	0	0.45	1.5	0	0
Total	**3.281**	**0.75**		**0.98**	**1.47**

c	0.299	Pole Spacing (crs)		**1.5**
Resultant Moment(M*)	1.47 kN-m	Pile spacing factor		**1.00**
Resultant Force(H*)	4.922 kN			

Step 3 :Check by Brohms Method

Depth of Embedment, L	**2** m				
Pole embedment dia	**0.35** m			H*	
Brohms	H*<0.5Hu	**0.5Hu=**	**16.442**	4.922	**OK!**

Comment: ***Use*** **0.35 m dia with 2 m embed. depth 1.5 m apart**

Step 4 :Check for Pole bending

SED pole dia	**175** mm	Z section	526155.41 mm3	
	M*<0.8*Mn	**Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21**		**K1 = 0.8**
0.8Mn=	9.789 kN-m			**K4 = 1**
M*=	1.47 kN-m	**K20 = 0.9**		**K5 = 1**
Design is	**OK!**	**K21 = 0.85**		**K8 = 1**
				fb (MPa) = 38

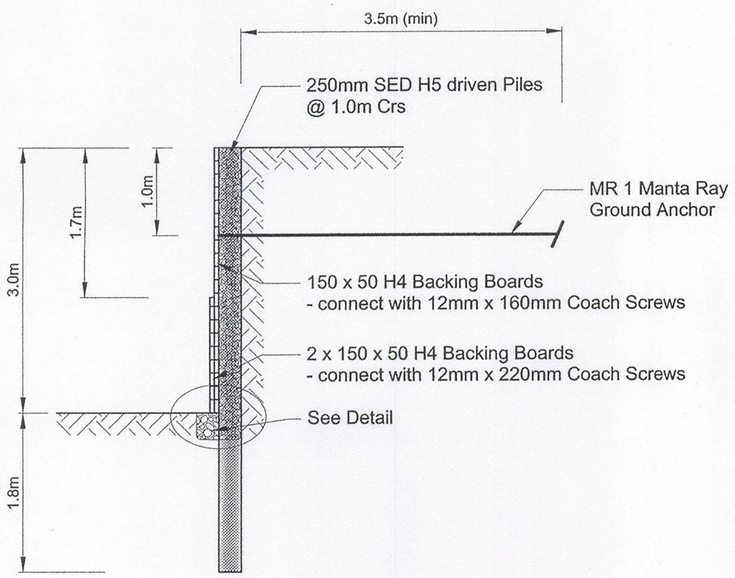
Step 5 :Check for Slats

	width	depth			
Use	**0.15**	**0.047**	Z section	55225 mm3	
Force btw board =		**1.6405** kN/m			
Moment in btw spacing=		0.369113 kN-m			
	M*<0.8*Mn		**Mn =0.8*K1*K4*K5*K8*fb*Z**		**K1 0.8**
0.8Mn=	0.413525 kN-m				**K4 1**
M*=	0.369113				**K5 1**
Design is	**OK!**				**K8 1**
					fb (MPa) = 11.7

Remarks :

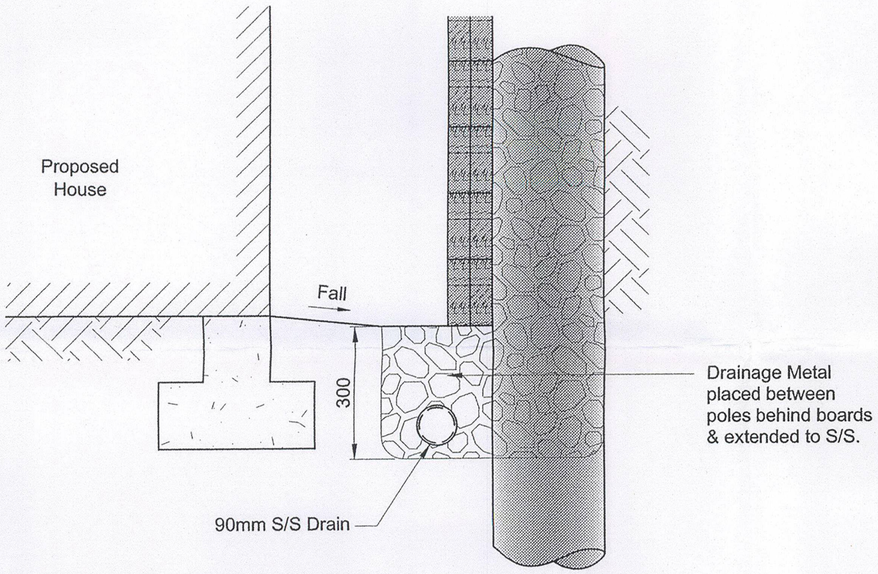
150 x 50 slats OK to 0.9m below top of wall

RCSAPP 2



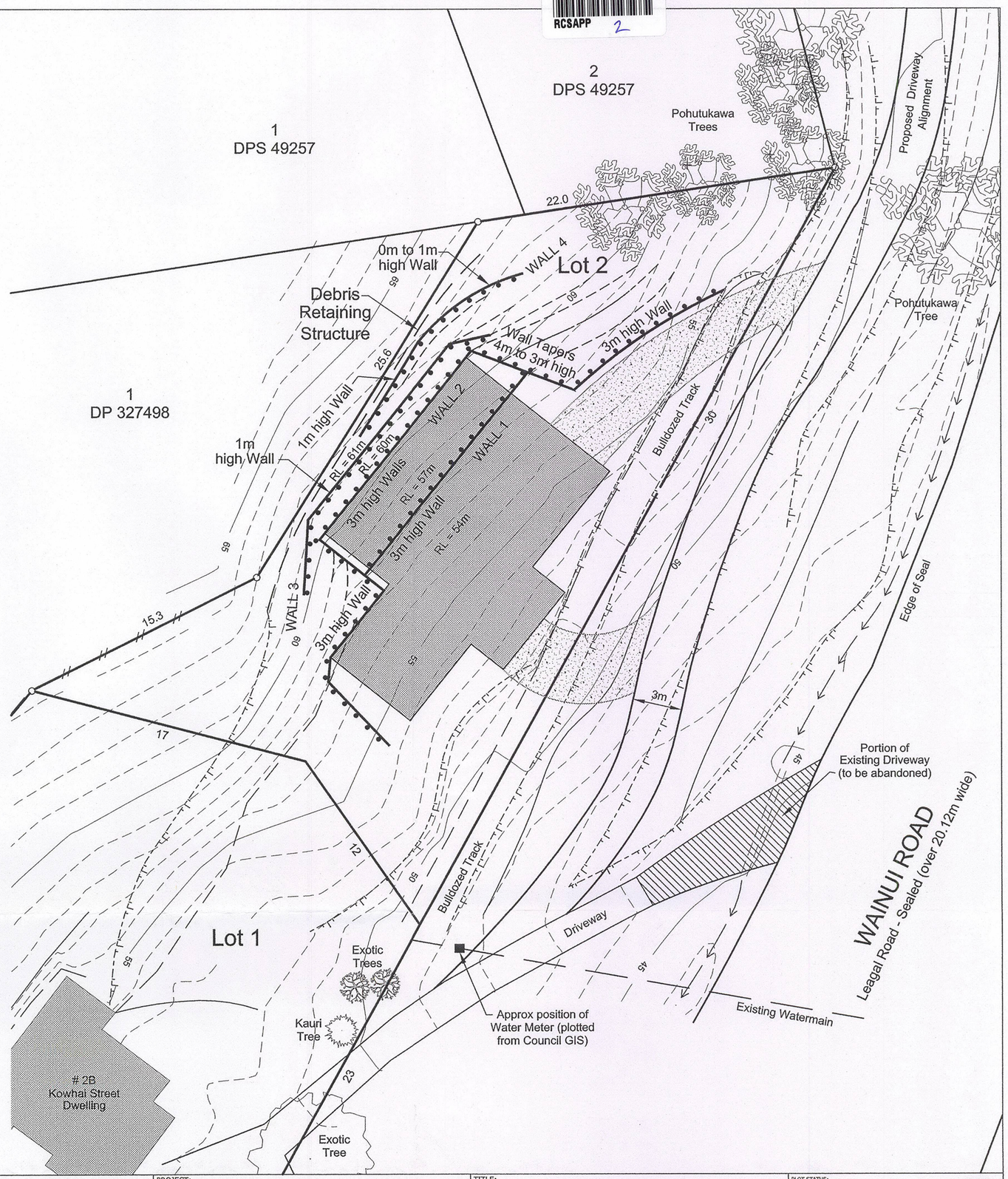
RETAINING WALL SECTION

Scale 1:50



DETAIL

Scale 1:10



REF	AMENDMENT	BY	DATE

DESIGNED: MRT	DATE: 21/04/2006	SIGNATURE:	PLOT DATE: 26/04/2006
DRAWN: DAA	DATE: 24/04/2006	SIGNATURE:	CAD REF: 1510-011050-200
CHECKED: MRT	DATE:	SIGNATURE:	CAD XREF:
APPROVED:	DATE:	SIGNATURE:	SURVEY BY:
			SURVEY DATE:
			SDR REF:

ACENZ ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND

ISO 9001 QUALITY ASSURED

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HARRISON GRIERSON
CONSULTING ENGINEERS SURVEYORS PLANNERS
17 Pyne Street, Whakatane - Ph. 07 308 5478 - Fax. 07 308 4907

PROJECT:
S & K THORNTON
2B KOWHAI STREET
OHOPE

TITLE:
RETAINING STRUCTURES
LAYOUT PLAN & DETAILS

PLOT STATUS: DESIGN

PROJECT No:	SCALES:	
1510-011050-01	1:250	A2
DRAWING No:		REV
011050-200		

Faxed Colin Keemays
07575 2868.

HARRISON
GRIERSON

WHAKATANE DISTRICT COUNCIL
FILE:
REG. NO: 9 32872
-2 MAR 2006
ACTIONED DATE
1 Tony B
2
3
4

24 February 2006

Whakatane District Council
Private bag 1002
WHAKATANE

Attention Tony Bullard

Dear Sir

Thornton - 2A Kowhai Street - Request for Further Information
HG Ref 1510-011050-01

Your request for further information dated 2 February 2006 refers.

The stability analyses provided with the geotechnical report, and with the additional information requested by the peer reviewer, clearly show that the overall stability of the slope will be improved by the development, particularly with the recommended drainage measures constructed. Therefore, when completed, the risk of failures occurring on the slope, and affecting Mr Robison's property, will actually be less than the present situation.

The risks to the Robison's property are greatest during construction, and these risks can be minimised by controls on the construction activities and design details. However, as the detailed design of the building has not yet been undertaken, and the applicant does not wish to do this until he has some certainty that the subdivision application will be approved, it is more appropriate that conditions be placed on the subdivsion consent placing specific requirements on the detailed design and construction methodology. Specific requirements are included in the geotechnical report, however we suggest that they be expanded to provide greater security to the Robison's property.

We suggest that the following conditions be attached to safeguard the Robisons property:

1. That construction of retaining walls and subsoil drains should be in accordance with the recommendations of the Site Suitability Report.
2. That a construction methodology be prepared with the detailed design of the foundations for the house, that clearly describes the order in which work is to be completed, and the measures that will be undertaken to ensure that the stability of the site is not unduly compromised. The design and construction methodology are to be peer reviewed prior to issuing a Building Consent.
3. A bond or other form of security, could be taken out by the owner to cover any damage that may occur during the construction period.

Design and construction methods that can be utilised to minimise any risks of slopes failure during construction include the following:

- Existing slips and driveway excavation should be first backfilled, and appropriate surface drainage controls installed, to divert surface runoff away from the construction area.
- Horizontal subsoil drains could be installed prior to excavation commencing.
- The lower bench is to be excavated first, with the vertical drain excavated ahead of the main excavation. This will ensure that the ground water levels are controlled at all times.
- The width of the area opened for excavation could be limited.
- Precast panels could be used for walls to speed up the construction process, and/or sheet piles could be placed behind the excavations.
- Construction should be limited to summer months, and under no circumstances should work be allowed to commence during prolonged wet weather periods.
- If heavy rain is forecast during construction, appropriate shoring of the excavations should be undertaken.

I trust that this is sufficient information to enable further processing of the application.

The applicant has confirmed that he is willing to have a meeting with the submitter to clarify the proposal, and hopefully resolve any outstanding issues, and has requested that I attend the meeting.

Please confirm whether or not you require further details at this stage.

Yours faithfully
Harrison Grierson Consultants Limited

Mark Thomas
Principal

N:\1510\011050\Phase 1\300 Comms\L05 WDC Further Info 2.doc

Cc: Steve Thornton
2B Kowhai Street
Ohope

Cc: Gavin Smith
HGCL Whakatane

WHAKATANE DISTRICT COUNCIL
FILE:
REG. No.: 931204
22 NOV 2005
ACTIONED DATE
1 David B
3
4

Application for shared use of access

To whom it may concern
Whakatane Council
Planning Department
Commerce Street
Whakatane

Ref. **Lot 25 DPS 9167** - **Lot 2 DPS 49257**
2 B kowhai Street Ohope — 2 Kowhai Street Ohope

I, Jonathon Bisdell Blenheim of 2 ~~Kowhai Street, Ohope~~ have been approached by the owners of the adjoining section Lot 25 DPS 9167 (Mr & Mrs S Thornton) with regard to their application for consent to build a new entrance roadway into their property. The reason given is to improve safe access into their property.
The Thorntons' section adjoins Lot 2 DPS 49257, of which I am part owner

Any costs incurred and the building of this new entrance, to WDC specifications, will be the responsibility of Mr & Mrs S Thornton, 2B Kowhai Street Ohope.

I, Jonathon Bisdell of Blenheim agree to give my approval for the proposed roadway, sharing the entrance to 2 B Kowhai Street Ohope via 2 Kowhai Street Ohope.

Dated: 28-10-05

Whakatane District Council

24.3.04.92
2080/0002/B00

28 July 2004

RECEIVED 30-7-04

COPY FOR YOUR INFORMATION

S A and C A Thornton
C/- Harrison Grierson
P O Box 336
WHAKATANE

Attention: Duncan Thomson

Dear Sir/Madam

RESOURCE CONSENT APPLICATION – TWO LOT SUBDIVISION, THORNTON, 2B KOWHAI STREET, OHOPE

Request for Further Information

Under Section 92 of the Resource Management Act 1991, the Whakatane District Council needs further information for your application for a resource consent to subdivide land at 2B Kowhai Street.

This further information is detailed below. It will help us to better understand your proposed activity, its effect on the environment and the ways any adverse effects on the environment might be mitigated.

1. Please provide a geotechnical report addressing the suitability of Lot 2 for building, the suitability of the proposed accessway to Lots 1 and 2 and any land instability issues relating to proposed Lot 1. If any vegetation contributes to any land stability, an arboriculturalist report will be required. It is noted that substantial slips have occurred on both proposed Lots 1 and 2 as well as the road reserve over which access is proposed.

2. Please provide written consents from the owners/occupiers of following adjacent properties or further information explaining why these properties are not adversely affected.

AB requested. — 2nd Owners permission enclosed

- 2 Kowhai Street (Lot 2 DPS 49257)
- 8B Kowhai Street (Lot 1 DP 327498)

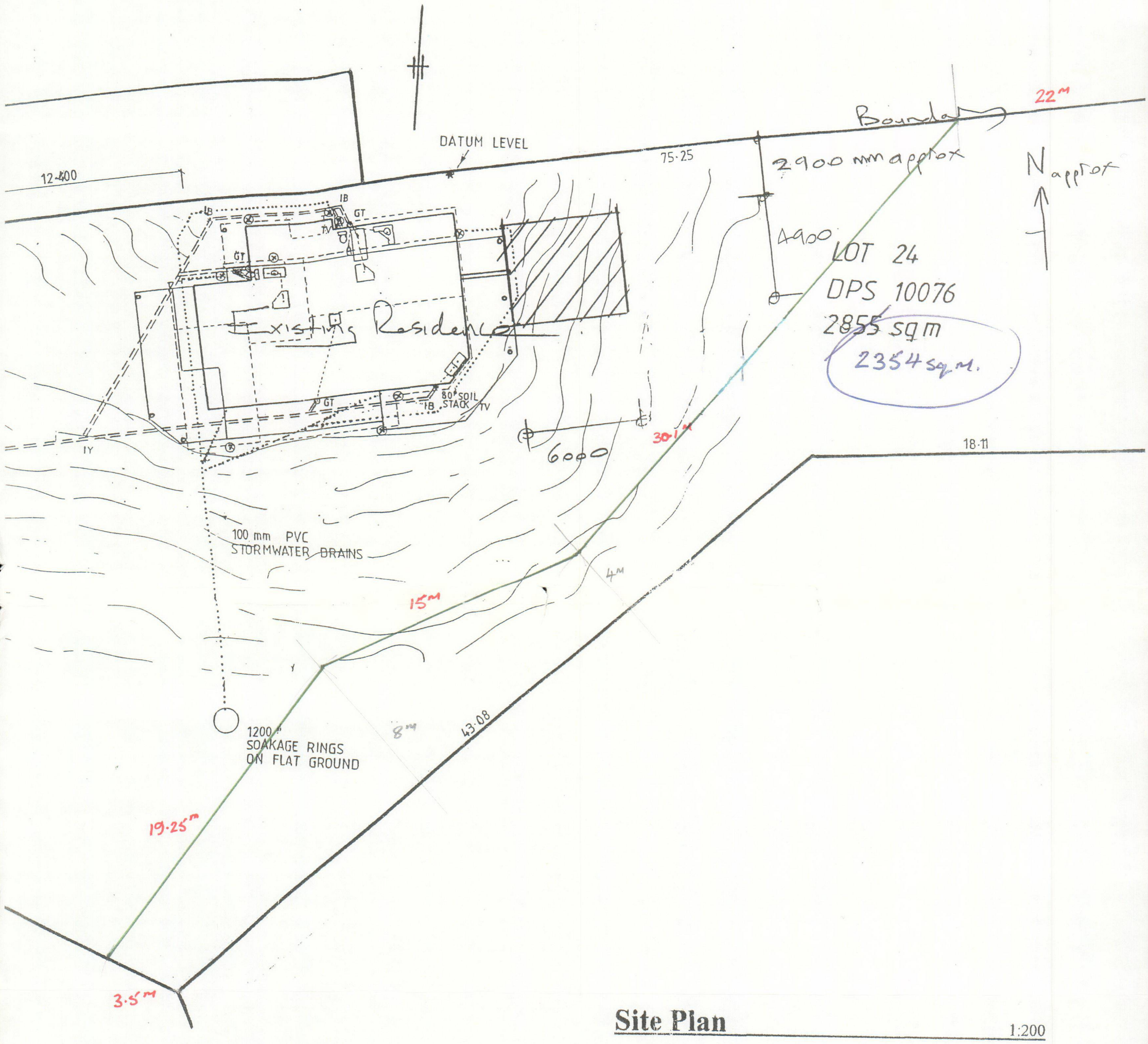
2 Kowhai Street maybe potentially affected as the same vehicle accessway is being used. This may issues relating to the ongoing maintenance of this accessway. 8B Kowhai Street may be potentially affected due to any development on proposed Lot 2 and the potential effects this may have on land stability of this lot.

3. Please address any traffic safety related issues involved in obtaining new access off Kowhai Street. It is noted that Council's roading staff have not been able to

Address all correspondence to: The Chief Executive **Whakatane District Council** Private Bag 1002 Whakatane 3080 New Zealand
Telephone +64 7 306 0500 Facsimile +64 7 307 0718 Email information@whakatane-dc.govt.nz

Received from applicant 21/10/05.

Plan showing location of stormwater soakage



Site Plan 1:200

WHAKATANE DISTRICT COUNCIL
FILE:
REG. No. G 30195
- 6 OCT 2005
ACTIONED DATE
1 Laura S
2
3
4

HARRISON GRIERSON

Facsimile Transmission

To Whakatane District Council

Attn Laura Swan Fax No. 07 307 0718

Copies to Tonkin and Taylor, Attention: John Leeves, fax 09 307 0265

From Gavin Moore Date 6 October 2005

No. of pages (including this cover sheet) 9 Project No. 1510 011050 01

Re Resource Consent Application - Two Lot Subdivision Thornton, 2B Kowhai Street Ohope.

Confidentiality: The information contained in this facsimile message (and any accompanying documents) may be legally privileged and confidential. The information is intended solely for the recipient named in this message. If the reader of this message is not the intended recipient you are notified that any use, disclosure, copying or distribution of the information is prohibited. If you have received this message in error please notify us immediately by calling collect to the person and number as shown and destroy the original message. Thank you.

Laura,

We have carried out the additional analysis required by the Tonkin and Taylor facsimile of 27 September 2005, and your Section 92 request of 29 September 2005 (received 4 October 2005).

We have remodelled the typical cross section through the proposed dwelling with the top 1m of the upper layer saturated and analysed three different parts of the site to determine factors of safety for slope stability.

Our client who built the dwelling at 8B Kowhai Street, above the proposed lot 2, has advised that stormwater from 8B Kowhai street has been piped away from this slope.

The upper portion of the site above the proposed dwelling has a factor of safety of 0.92, with the upper 1m saturated, and the lower layer saturated with subsoil drains installed. Indicating this portion of the slope could fail if saturated, and highlights the need for a debris protection wall above the proposed dwelling, as recommended in our report of August 2005. The slope behind the proposed dwelling will not be altered by the proposal.

The "global" stability of the cross section with the upper 1m saturated, and the lower layer saturated with subsoil drains installed has a factor of safety of 1.15 which is slightly lower than the ideal, although still stable. Analyses of the existing slope using the same scenario (upper 1m saturated) and same soil parameters, gives a minimum factor of safety of 0.85. The factor of safety of 1.15 is a 35% improvement over the existing, indicating the risk of failure will be slight.

The lower portion of the site below the proposed dwelling has a factor of safety of 1.35, with the upper 1m saturated, and the lower layer saturated with subsoil drains installed. Indicating this portion of the slope has an acceptable factor of safety under extreme conditions.

CONSULTING ENGINEERS SURVEYORS PLANNERS

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PO Box 1199
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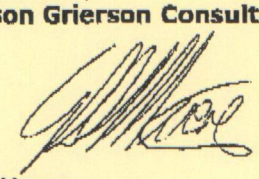
Email tauranga@harrisongrierson.com
www.harrisongrierson.com
ISO9001 Quality Assured

Facsimile To	Whakatane District Council	6 October 2005
From	Gavin Moore	Reference 1510 011050 01
Re	Resource Consent Application - Two Lot Subdivision Thornton, 2B Kowhai Street Ohope.	

Please contact us if you have any further queries.

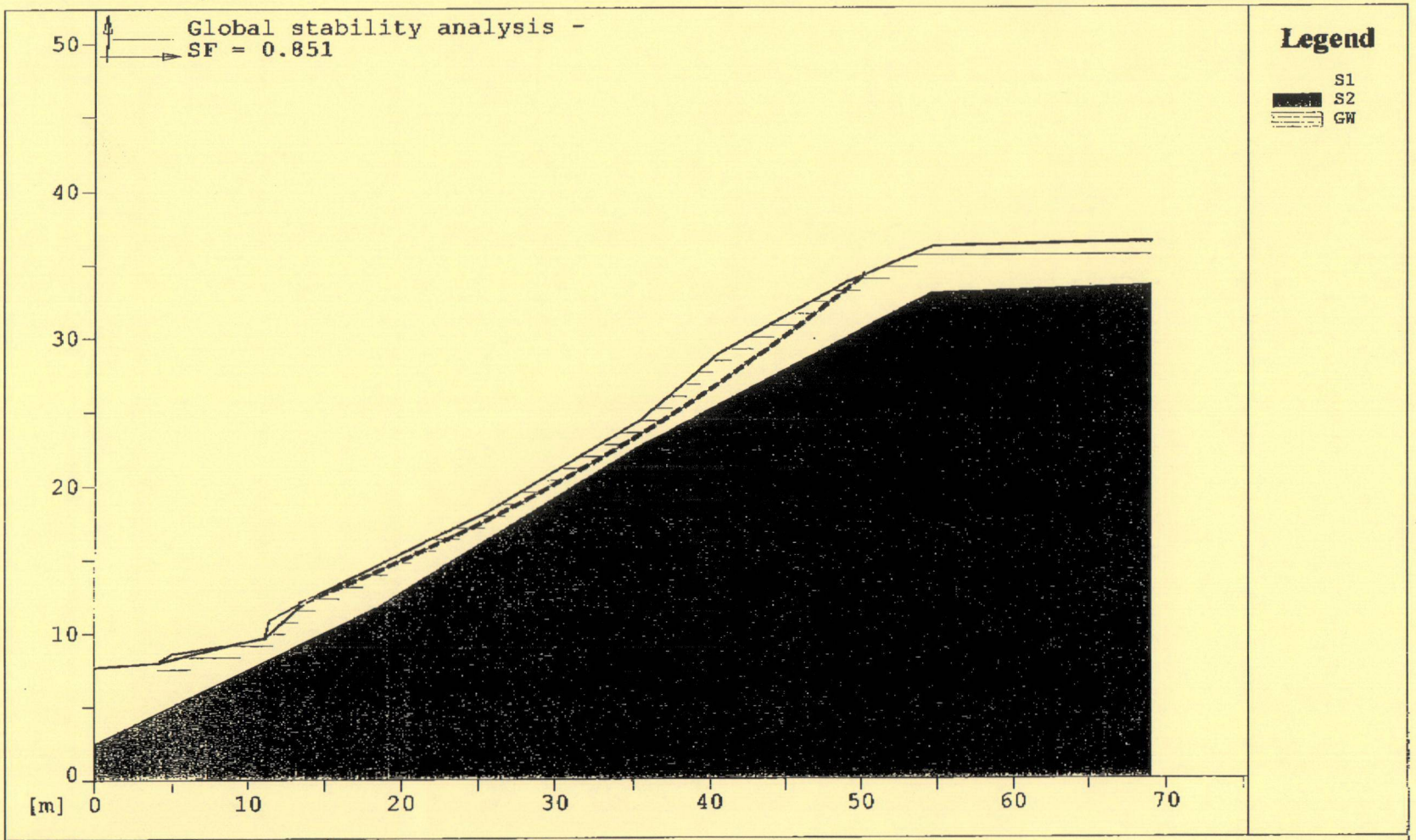
Yours faithfully
Harrison Grierson Consultants Limited



Gavin Moore
Senior Engineer

N:\1510\011050\Phase 1\300 Comms\F11 WDC T and T, Thornton Upper layers saturated .doc

06/10/2005 11:10 NO.900 003

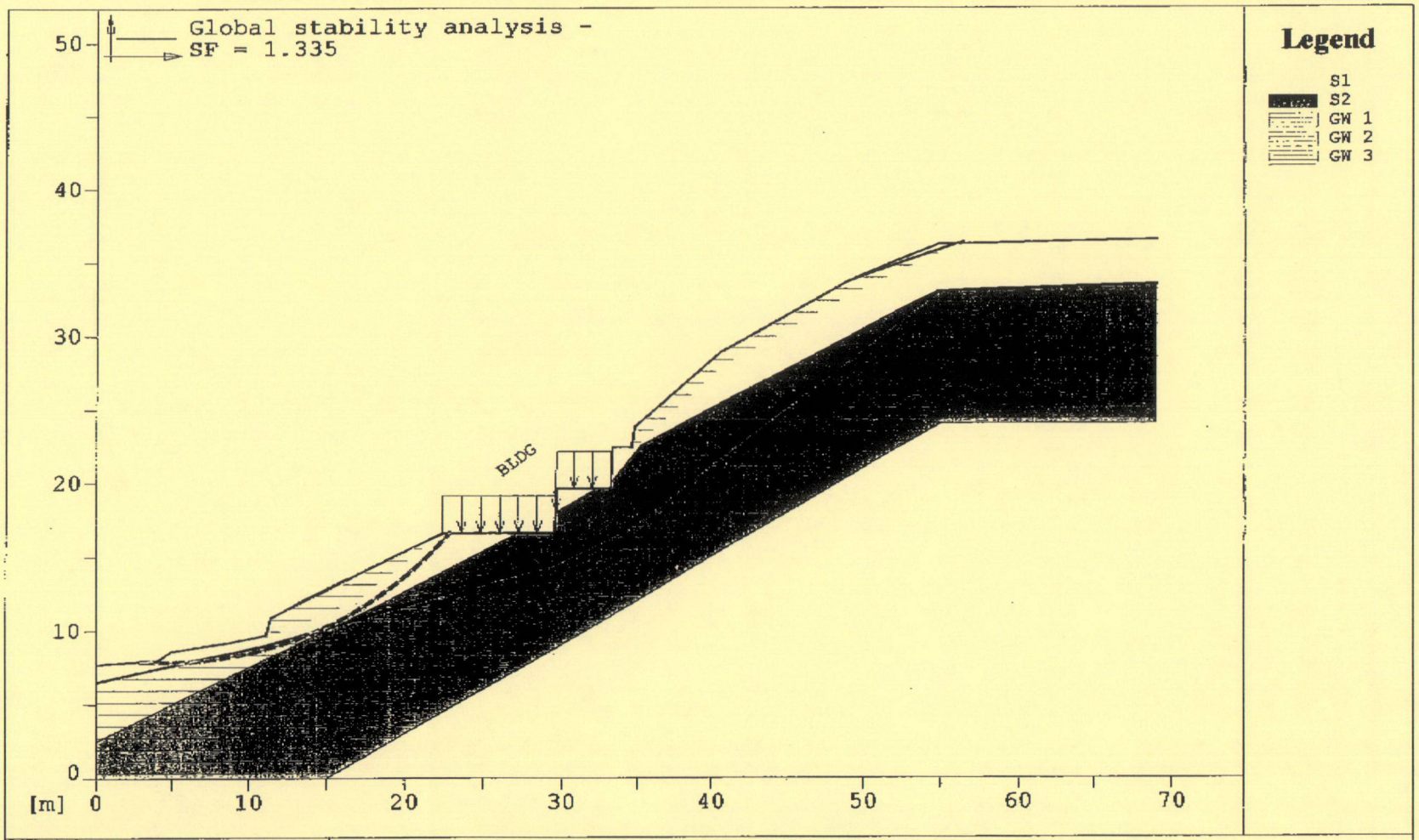


MacStARS 2000
Maccaferri
Stability Analysis
of Reinforced Slopes

Date: 10/05/2005
Folder:

Project Title: S Thornton - House Site

CrossSection: Section 7 - Existing
Site: 24 Wainui Road **File:** Sec 7 base Upper 1m sat.mac



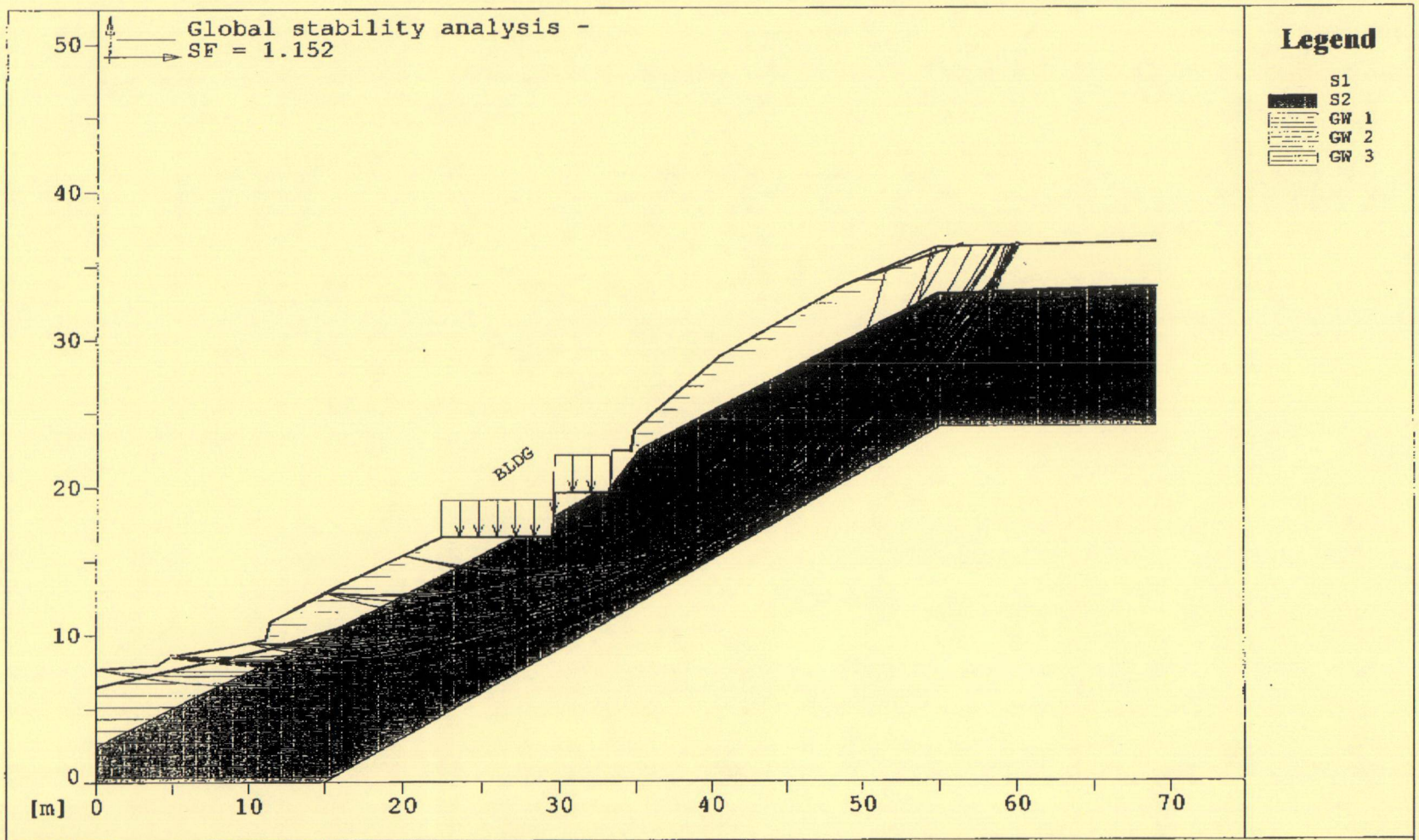
MacStARS 2000
Maccaferri
Stability Analysis
of Reinforced Slopes

Date: 10/04/2005
Folder:

Project Title: S Thornton - House Site Stability Analysis

CrossSection: Section 7 - Developed with Subsoil Drainage

Site: 24 Wainui Road, Ohope **File:** Sec 7 Developed Raised GW a.mac



MacStARS 2000
Maccaferri
Stability Analysis
of Reinforced Slopes

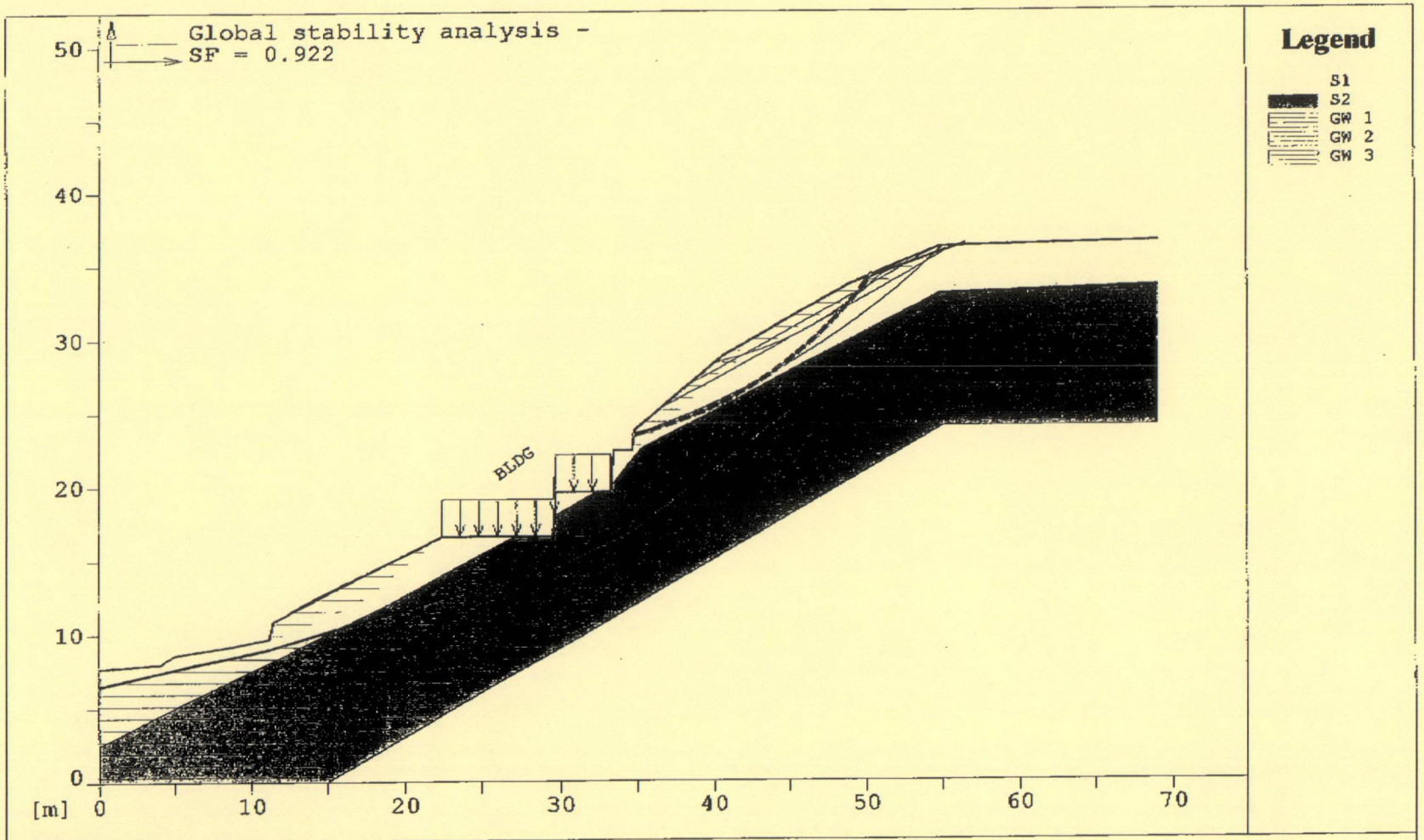
Date: 10/04/2005
Folder:

Project Title: S Thornton - House Site Stability Analysis

CrossSection: Section 7 - Developed with Subsoil Drainage

Site: 24 Wainui Road, Ohope **File:** Sec 7 Developed Raised GW a.mac

06/10/2005 11:10 NO.900 P05



MacStARS 2000
Maccaferri
Stability Analysis
of Reinforced Slopes

Project Title: S Thornton - House Site Stability Analysis

Date: 10/04/2005
Folder:

CrossSection: Section 7 - Developed with Subsoil Drainage
Site: 24 Wainui Road, Ohope **File:** Sec 7 Developed Raised GW a.mac

06/10/2005 11:10 NO.900 P06

MAC.ST.A.R.S 2000 – Rel. 2.1

MACcaferri STability Analysis of Reinforced Soils
Officine Maccaferri S.p.A.Via Agresti 6, 40123 Bologna
Tel. 051.6436000 - Fax 051.236507

Harrison Grierson Tauranga

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Developed with Subsoil Drainage

Site: 24 Wainui Road, Ohope

Folder:

File: Sec 7 Developed Raised GW a.mac Date : 10/04/2005

Checks according to: New Zealand Limit Equilibrium
Static design 120 years

SOIL PROPERTIES

Soil: S1 Description: Upper Soils - Weaker sandy silts

Cohesion Class ..... : Soil material factor c'			
Cohesion	[kN/m²]	:	5.00
Friction Angle :	[°]	:	30.00
Ru value.....		:	0.00
Weight Class ..... : Soil unit mass			
Bulk unit weight - above GWT	[kN/m³]	:	18.00
Bulk unit weight - below GWT	[kN/m³]	:	18.00
Elastic Modulus	[kN/m²]	:	0.00
Poisson's ratio		:	0.30

Soil: S2 Description: Deeper Firm Soils

Cohesion Class ..... : Soil material factor c'			
Cohesion	[kN/m²]	:	20.00
Friction Angle Class : Soil material factor phi			
Friction Angle :	[°]	:	40.00
Ru value.....		:	0.00
Weight Class ..... : Soil unit mass			
Bulk unit weight - above GWT	[kN/m³]	:	18.00
Bulk unit weight - below GWT	[kN/m³]	:	18.00
Elastic Modulus	[kN/m²]	:	0.00
Poisson's ratio		:	0.30

STRATA PROFILES

Stratum: A Description: Developed Surface

Soil : S1

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
0.00	7.70	4.10	8.00	5.00	8.60	8.80	9.20
11.10	9.70	11.40	10.90	13.90	12.30	22.40	16.60
29.50	16.60	29.70	19.60	33.20	19.60	33.40	22.40
34.60	22.40	34.80	23.80	35.50	24.40	40.50	28.80

48.90	33.70	54.80	36.20	69.00	36.50

Stratum: B Description: Stiffer Soils
Soil : S2

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
0.00	2.50	18.50	11.80	27.10	16.55	29.50	16.55
29.60	18.00	32.20	19.55	33.20	19.55	33.25	20.00
35.20	22.50	54.70	33.00	69.00	33.50		

Stratum: ROCK Description: Assumed Base Rock
Soil : Bedrock

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
15.00	0.00	55.00	24.00	69.00	24.00		

WATER TABLE PROFILES

WATER TABLE: GW 1 Description: Upper Surface Saturated

X [m]	Y [m]	Y [m]	P [kN/m²]	X [m]	Y [m]	Y [m]	P [kN/m²]
11.10	9.70	9.70		11.40	10.90	9.70	
16.90	13.80	12.00		22.40	16.60	16.60	

WATER TABLE: GW 2 Description: Top Upper Surface Saturated

X [m]	Y [m]	Y [m]	P [kN/m²]	X [m]	Y [m]	Y [m]	P [kN/m²]
34.60	22.40	22.40		34.80	23.80	22.40	
40.50	28.80	27.80		48.90	33.70	32.70	
56.40	36.40	36.40					

WATER TABLE: GW 3 Description: Raised Groundwater

X [m]	Y [m]	Y [m]	P [kN/m²]	X [m]	Y [m]	Y [m]	P [kN/m²]
0.00	6.50			11.10	9.00		
26.00	13.50			29.50	14.50		
34.50	17.00			54.80	33.00		
69.00	33.50						

SURCHARGE LOADS

Distributed Loads : **BLDG** Description : Proposed House
Class : Load factor
Magnitude . [kN/m²] = 10.00 Inclination angle [°] = 0.00
Abscissa .. [m] : from = 22.40 To = 33.20

CHECKS RESULTS

Global Stability Check :
Multiplier combination : Limit Equilibrium
Reinforcements active Forces according to Rigid Method
Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor ..... : 1.152

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
0.00	20.00	36.00	60.00

Number of starting point on the starting segment : 5
Total number of trial surfaces ..... : 105
Minimum base length of slices..... [m] : 1.00
Superior limit search angle..... [°] : 0.00
Inferior limit search angle..... [°] : 0.00

Multiplier	Class
1.00	Soil material factor phi
1.00	Soil unit mass
1.00	Stability factor
1.00	Load factor
1.00	Pullout factor
1.00	Reinforcement breakage
1.00	Soil material factor c'

Maccaferri assumes no responsibilities for the drawings and calculations it provides, as they must be intended as general indications to suggest the proper use of its product.

HARRISON
GRIERSON

WHAKATANE DISTRICT COUNCIL
FILE
REG. No. 629409
-1 SEP 2005
ACTIONED DATE
1 Tony B
2
3
4

31 August 2005

Whakatane District Council
Private Bag 1002
WHAKATANE

Attention Tony Bullard

Dear Tony

Resource Consent Application - Two lot Subdivision
Thornton, 2b Kowhai Street, Ohope
Your Reference 2080/0002/B00

Further to the original consent application and in reply to your request for further information of 28 July 2004. Please find our response to the items raised in your request below, we have repeated your requests in italic;

Item 1)

"Please provide a geotechnical report addressing the stability of Lot 2 for building,..."

A geotechnical report is enclosed addressing the stability of lot 2, based on details of a proposed dwelling for lot 2.

" *...the suitability of the proposed accessway to Lots 1 and 2 and....*

Our earlier geotechnical report of June 2004 addressing the suitability of the proposed access way for lot 1 and 2 is appended to the enclosed report. The formation of the access to the proposed lots 1 and 2 will increase the stability of the slope below the access, by reducing soil weight from a portion of the slope. The slope above the driveway will be stabilised by retaining walls constructed for the accessway.

".....any instability issues relating to lot 1."

A shallow failure has occurred above the bull dozer formed track, where the support of the softer upper soil layers has been removed by the formation of the track, near the proposed boundary between lot 1 and lot 2 and below the lot 1 boundary. We have made recommendations in both geotechnical reports to fill the bull dozer formed track with compacted inorganic material to reinstate and stabilise the track above the proposed driveway. In addition the lower portion of lot 1 will be stabilised by the construction of retaining walls forming the accessway.

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Ph 07 578 0023 Fax 07 577 9557
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ISO9001 Quality Assured

If any vegetation contributes to any land stability, an aborculturalist report will be required.

Some vegetation has been removed from the proposed lot 2 area, and is regenerating. The proposed lot 2 dwelling, incorporating retaining walls, will cover and stabilise the area where vegetation has been removed. No significant trees which contribute to land stability are proposed to be removed.

It is noted that substantial slips have occurred on both proposed Lots 1and 2 as well as the road reserve over which access is proposed.

No substantial slips have occurred on this site or below this site on the road reserve where access is proposed. However a shallow failure has occurred above the bull dozer formed track, where the support of the softer upper soil layers has been removed by the formation of the track. We have made recommendations to repair this slip in both the lot 2 dwelling and accessway geotechnical reports. A substantial slip did occur in mid 2004 on the opposite side of Wainui Road.

Item 2

Please provide written consents from the owners/occupiers of following adjacent properties or further information explaining why these properties are not adversely affected.

- *2 Kowhai Street (Lot 2 DPS 49257)*

"2 Kowhai street maybe potentially affected as the same vehicle accessway is being used. This may issues relating to the ongoing maintenance of this accessway."

Please find enclosed written consent from the owners of 2 Kowhai street, regarding the access.

- *8B Kowhai Street (Lot 1 DP 327498)*

"8B Kowhai street may be potentially affected due to any development on proposed Lot 2 and the potential affects this may have on land stability of this lot."

The land stability of 8B Kowhai street will not be adversely affected by the proposed dwelling for lot 2. Specific geotechnical analysis has been undertaken to confirm this, details of this analysis are included in the enclosed Site Suitability for Subdivision report.

Item 3

Please address any traffic safety related issues involved in obtaining new access off Kowhai Street. It is noted that Council's roading staff have not been able to fully assess your proposal due to other priorities relating to the Civil Defence Emergency. Once this has been done, further information may be requested from you.

Please find enclosed two Traffic Assessment drawings showing the proposed access for lots 1 and 2 off Kowhai Street and Wainui Road.

The first drawing shows the intended access off Kowhai Street. Vehicles going to Lots 1 and 2 from Ohope will carry out a right turn manoeuvre off Wainui Road, onto Kowhai Street and into the existing driveway for number 2 Kowhai Street. We have measured

the available site distance for this manoeuvre at 90m. The Austroads Guide to Geometrical Design of Rural Roads, table 6.2, gives a Safe Stopping Site Distance off 70m for a 70km/hr speed. The Kowhai Street intersection is located just inside a 70km/hr speed restriction area. At present all vehicles entering Kowhai street carry out this manoeuvre.

Vehicles exiting the proposed lot 1 and 2, and travelling to Ohope via Kowhai street enter onto Wainui road from the existing Kowhai Street intersection. We have measured the available site distance for this manoeuvre at 80m. The Austroads Guide to Geometrical Design of Rural Roads, table 6.2, gives a Safe Stopping Site Distance off 70m for a 70km/hr speed. The Kowhai Street intersection is located inside a 70km/hr speed restriction area. At present all vehicles exiting Kowhai street carry out this manoeuvre.

The second drawing shows the existing vehicle entrance for 2B Kowhai street. At present vehicles leaving 2B Kowhai Street going towards Ohope have 50m sight distance. Our client intents to abandon this entrance, and have it permanently blocked off once approval is granted for the new accessway.

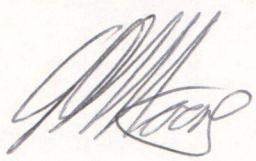
Given the sight distance for the proposed access will increase from the existing situation, the existing access off Wainui Road with poor sight distance will be abandoned, and the access to Wainui road off Kowhai street is existing. It is our opinion that the proposal to utilise Kowhai Street and the Kowhai street entrance onto Wainui road is an improvement on the existing situation. We are satisfied the above comments satisfy any traffic issues for the proposed subdivision.

It is unclear at this stage what works may be required on Wainui Road in relation to recent slips that have occurred down slope of the proposed subdivision. This may have some bearing on vehicle access to the new lots. Hence it is suggested that further consultation is done with Council's roading staff to address any traffic/access related issues.

No slips occurred down slope of the proposed subdivision on the road reserve. Please find enclosed copies of correspondence to and from Council regarding the proposed entranceway, and a full copy of calculations and "to scale" drawings and calculations for the proposed accessway.

Please contact us if you have any queries regarding the above additional information. We will contact you by phone to discuss this application once you have received it.

Yours faithfully
Harrison Grierson Consultants Limited



Gavin Moore
Chartered Professional Engineer

N:\1510\011050\Phase 1\300 Comms\L05 WDC Further information.doc

Application for shared use of access.

To whom it may concern
Whakatane District Council
Planning Department
Commerce Street
Whakatane

Ref. Lot 25 DPS 9167 - Lot 2 DPS 49257
24 Wainui Road Ohope 2 Kowhai Street Ohope

I Gilda Monica Reid of 2 Kowhai Street Ohope, have been approached by the owners of the adjoining section Lot 25 DPS 9167 (Mr & Mrs S. Thornton) with regard to their application for consent to build a new entrance roadway into their property. The reason given is to improve safe access into their property.

The Thorntons' section adjoins Lot 2 DPS 49257, of which I am the legal owner.

Any costs incurred and the building of this new entrance, to WDC specifications, will be the responsibility of Mr & Mrs S. Thornton 24 Wainui Road Ohope.

I Gilda Monica Reid of 2 Kowhai St Ohope agree to give my approval for the proposed roadway sharing the entrance to 24 Wainui Road Ohope via 2 Kowhai Street Ohope

Dated: 19-3-04

On straight roads in inland areas of Australia where sight distances are long and speeds high, reaction times may be well in excess of 2.5 seconds. In such cases of unconstrained sight distance, the stopping sight distance calculation involving reaction time is largely irrelevant.

6.5.3 Longitudinal Deceleration

Recent tests at ARRB have found that, on good, dry pavements modern passenger cars can consistently achieve deceleration rates in excess of *1.0g* (Samuels & Jarvis 1978). However, the values used for design purposes should allow for the degradation of pavement skid resistance when wet, and for a reasonable amount of surface polishing. The coefficient of longitudinal deceleration values assumed are given in Table 6.1. The lower values assumed for the higher speeds reflect the reduction in wet pavement skid resistance with increasing speed and the need for lateral vehicle control over the longer braking distances.

6.5.4 Stopping Sight Distance

The assumed values of reaction time and coefficient of longitudinal deceleration enable a notional stopping distance to be calculated from a given initial speed. If the design speed is used as the initial speed, the stopping distance would be covered by a vehicle travelling at the 85th percentile speed for the road section whose driver elected to stop after perceiving a hazard on the road ahead. This distance is considered to be the minimum sight distance that should be available to a driver. The values calculated from the assumed R_T and d values, and the design speed are listed in Table 6.2.

It is not possible to specify design values of R_T and d which are absolutely correct, or which are likely to be correct for all situations. For design purposes, a minimum stopping sight distance is used which is considered reasonable in terms of the limited empirical evidence available. When combined with the assumed line of sight parameter values (see Section 6.4), these values lead to design standards which are in accord with most Australian State Road Authority experience and have been found to be satisfactory over several decades of operational experience.

Table 6.2 lists the normal minimum values and lower limits for restricted situations using shorter reaction time.

6.6 Equivalent Manoeuvre Time

The design speed of a vertical curve is determined by the terrain and the horizontal alignment of the road in the vicinity. The centre ordinate of a parabolic crest vertical curve (which partly determines the depth of cut) varies as the square of the length of the vertical curve. Hence, a few extra metres of stopping sight distance can make a significant difference to earthwork quantities. This is particularly evident in certain combinations of terrain and alignment, eg relatively gentle horizontal alignments in undulating to mountainous country or isolated major crests in otherwise flat country.

A more cost effective solution can sometimes be obtained by considering that, in any case, a driver is more likely to avoid a hazard through lateral manoeuvring than to bring his vehicle to a halt. Therefore, an alternative to the provision of stopping sight distance in difficult cases is to ensure:

- that the carriageway is wide enough to provide a reasonable space for evasive action (which normally means ensuring such a crest is not combined with minimum traffic lane and shoulder widths),
- that the driver can perceive a hazard (using the normal sight distance geometry, ie 1.15 m to 0.2 m) in sufficient time to take evasive action. Times from about 3 seconds at 50 km/h to 5 seconds at 100 km/h appear to provide reasonable values (the speeds being the design speeds of the corresponding horizontal geometry).

Table 6.1
Assumed Values Of Longitudinal Deceleration

Initial Speed (km/h)	Coefficient of Longitudinal Deceleration
50	0.52
60	0.48
70	0.45
80	0.43
90	0.41
100	0.39
110	0.37
120	0.35
130	0.33

Table 6.2 Stopping Sight Distances

Design Speed (km/h)	Stopping Sight Distance (m) *		
	Normal Design †		Restricted Situations‡
	R_T=2.5s	R_T=2.0s	R_T=1.5s
50		45	40
60		65	55
70		85	70
80	115	105	
90	140	130	
100	170		
110	210		
120	250		
130	300		

* Using assumed sight distance parameter values in Section 6.3.

† Notional stopping distance (rounded) using values from Sections 6.5.2 and 6.5.3. **Note:** 1.4 times these values produces same crest vertical curve as reducing object cut off height to zero - see Section 6.4.

‡ See Section 6.5.2. Applies to both horizontal and vertical geometry - driver assumed in alerted state - not used for isolated geometric features.

18 February 2004

Whakatane District Council
Private Bag 1002
WHAKATANE

Attention: Satish Busapala

Dear Sir

PROPOSED DRIVEWAY: S & C THORNTON – 24 WAINUI ROAD – OHOPE

On behalf of our clients, we request Whakatane District Council support to the proposed driveway as outlined below.

Our clients, S & C Thornton own 22 & 24 Wainui Road, Ohope (both sections currently held in one title). At present there is only a dwelling and access to 24 Wainui Road. Access to the dwelling is via a steep driveway from Wainui Road. The concern regarding this existing driveway is that it has very little sight line distances causing entering and exiting the driveway to be unsafe (see attached plan). As an indication of the safety of the driveway, NZ Post refuses to deliver mail to the letterbox located beside Wainui Road.

A new and considerably safer driveway is proposed. The first section of the proposed driveway will utilise the lower half of the existing concrete driveway to 2 Kowhai Street (over legal road). The second section of proposed driveway will be constructed from the existing concrete driveway of 2 Kowhai Street to the dwelling at 24 Wainui Road (see attached plan). It is expected that the proposed driveway will cross the south-eastern boundary of 2 Kowhai Street. The owners of 2 Kowhai Street are in support of the proposed drive. An option for our clients in the future is to subdivide 22 & 24 Wainui Road creating a building site on 22 Wainui Road, which would also utilise the proposed driveway.

Before our clients undertake the cost of survey work and engineering design for the new driveway, we request the Whakatane District Council provide in writing their support of this proposal and any issues that the Council foresees.

Should you require any further information or wish to visit the site, please contact the undersigned.

Looking forward to your favourable response.

Yours faithfully
Harrison Grierson Consultants Limited

Duncan Thomson
Manager

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Whakatane District Council

Private Bag 1002
WHAKATANE 3080

Telephone: +64-7-306-0500
Fax: +64-7-307-0718
Email: satishs@whakatane.govt.nz

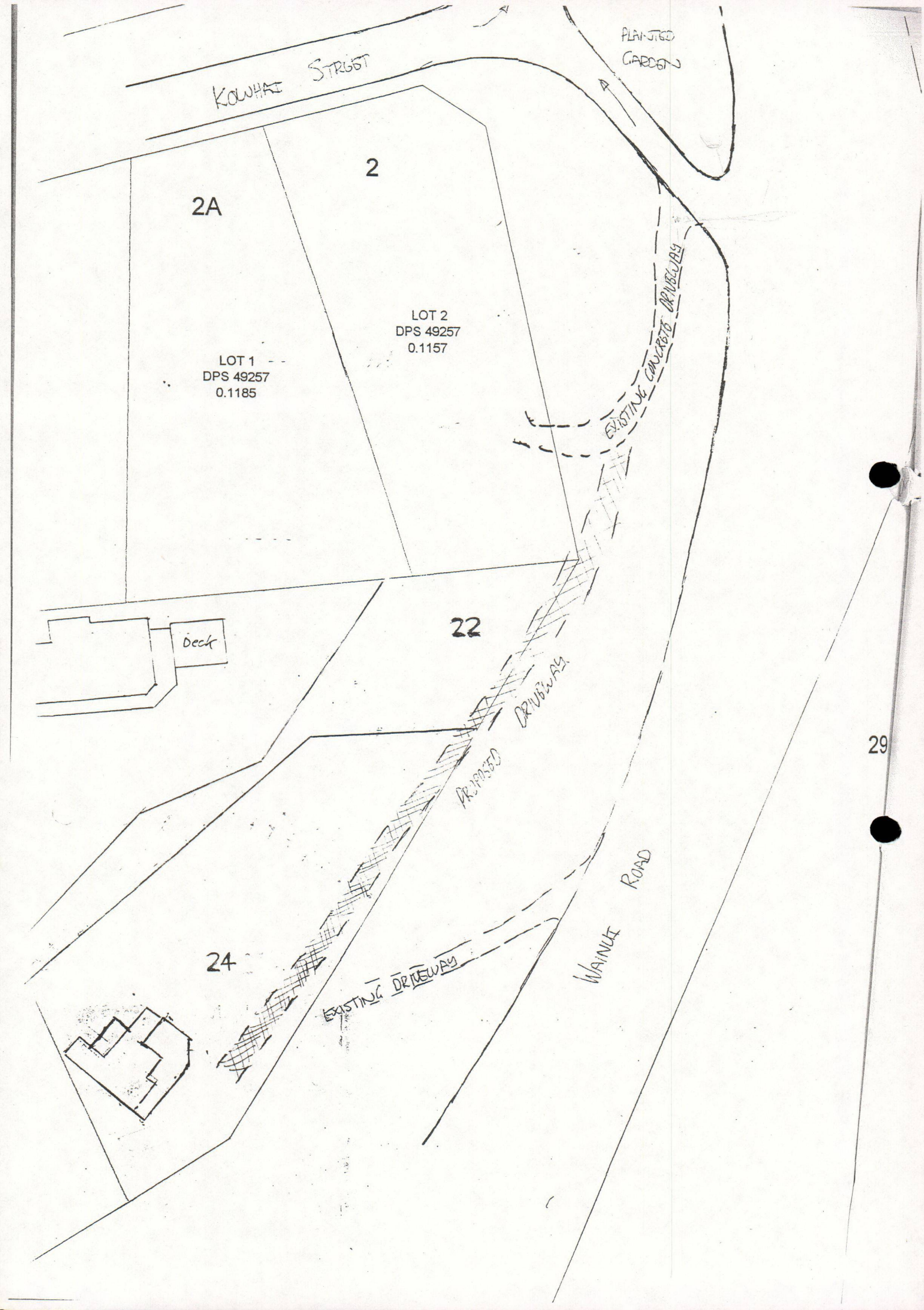
Date:	8 March 2004		No of pages sent:	1
To:	Fax number:	07 308 4907		
	Name of person:	Duncan Thomson		
	Company name:	Harrison Grierson		
From:	Satish			
Subject:	PROPOSED DRIVEWAY - #24, WAINUI ROAD. OHOPE			

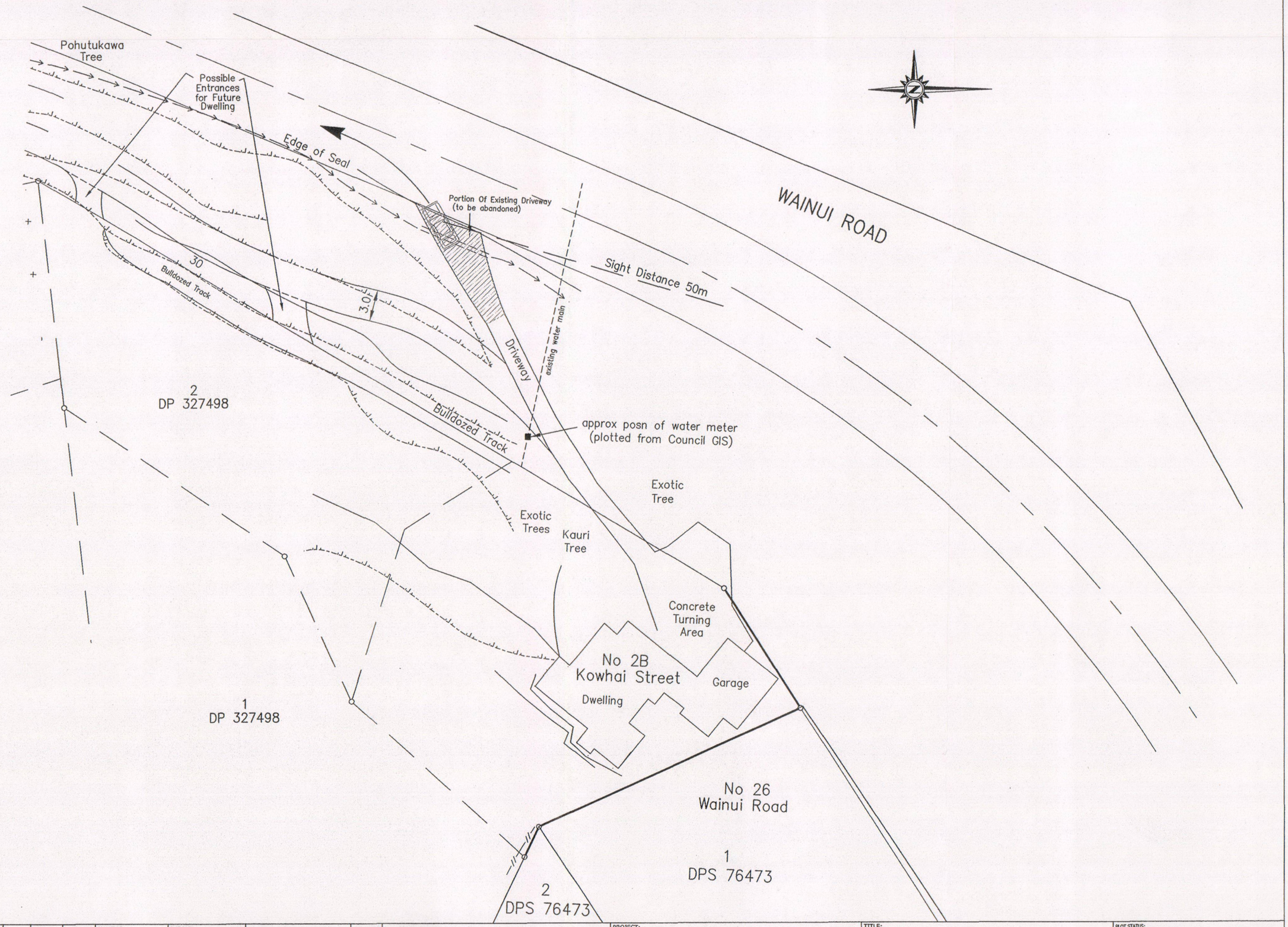
Further to discussion with Roelof regarding the proposed relocation of driveway to property #24, Wainui Road from the existing location, it is stated that the new proposal is acceptable to Council in principle subject to the following additional information being submitted prior to approval;

- The consent of the adjoining neighbour to the proposal.
- Submission of 'to scale' design drawings of the proposed new driveway including the construction standards.
- Any necessary Geo-technical investigations required to establish the suitability of the land for the proposal is to be carried out at the expense of the applicant and the report submitted to Council along with the design drawings.
- That part of the existing Vehicle entrance/ driveway of #2, Kowhai Street proposed to be utilised in the new proposal may be required to be upgraded (so as) to be in accordance with the standards of Council's Engineering Code of Practice.

Reg

Satish
Project Engineer - Development


KOWHAI STREET
PLANTED GARDEN
2
2A
LOT 2
DPS 49257
0.1157
LOT 1
DPS 49257
0.1185
EXISTING CONCRETE DRIVEWAY
Deck
22
DRIVEWAY
PROPOSED DRIVEWAY
29
24
EXISTING DRIVEWAY
WAINUI ROAD



REF	AMENDMENT	BY	DATE

DESIGNED: GDM	DATE: 8/2005	SIGNATURE:	PLOT DATE: 31/8/205
DRAWN: DAA	DATE: 31/8/2005	SIGNATURE:	CAD REF: 1510 011050-INT02
CHECKED: GDM	DATE: 8/2005	SIGNATURE:	CAD XREF:
APPROVED:	DATE:	SIGNATURE:	SURVEY BY:
			SURVEY DATE:
			SOR REF:

ACENZ ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND

ISO 9001 QUALITY ASSURED

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CONSULTING ENGINEERS SURVEYORS PLANNERS
17 Pyne Street, Whakatane - Ph. 07 308 5478 - Fax. 07 308 4907

PROJECT:
S & K THORNTON
2B KOWHAI STREET
OHOPE

TITLE:
TRAFFIC ASSESSMENT

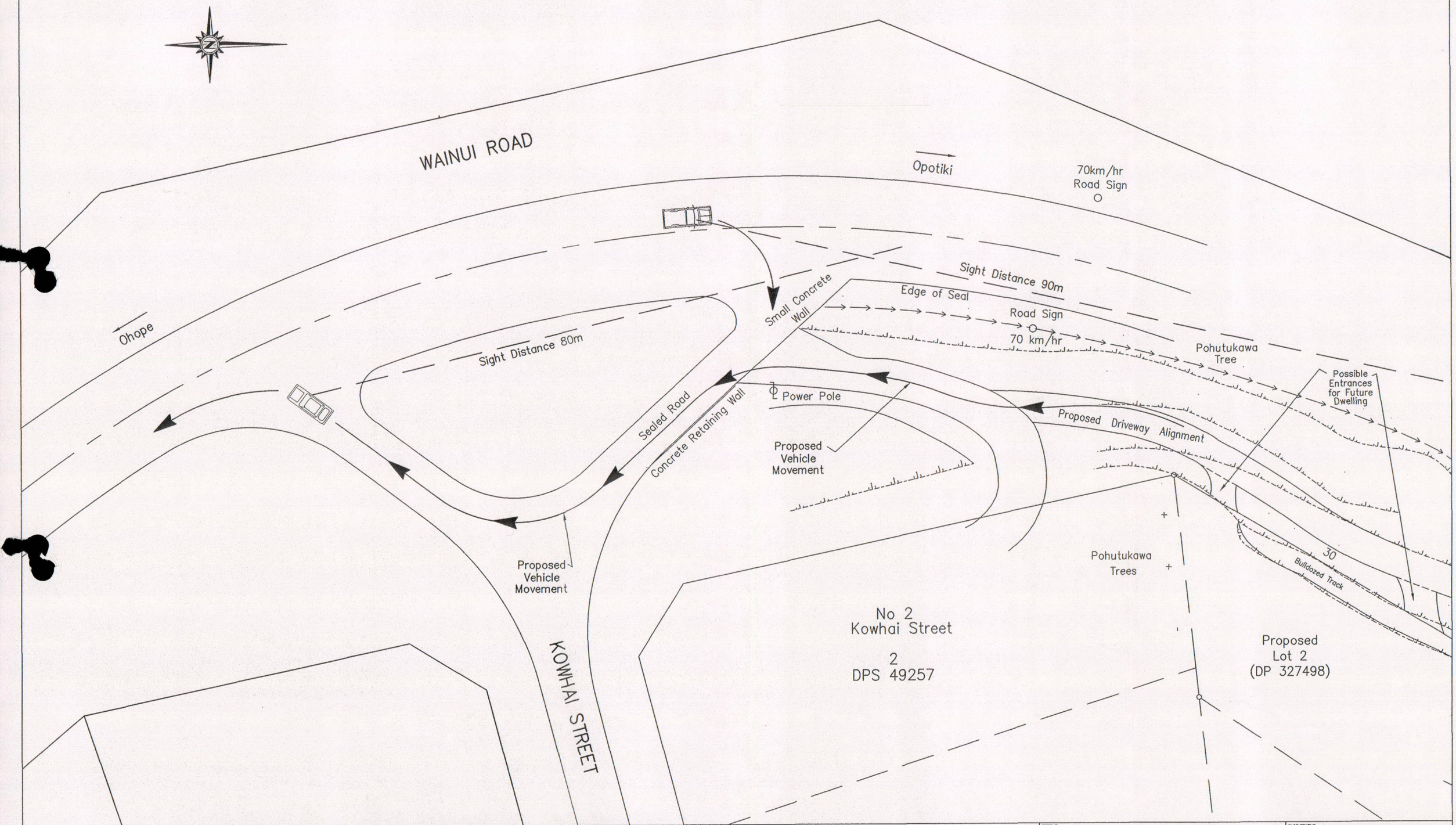
PLOT STATUS: INTERSECTION ASSESSMENT

PROJECT No: 71 011050-INT01

SCALES:

DRAWING No: 011050-INT02

REV



REF	AMENDMENT	BY	DATE

DESIGNED: GDM	DATE: 8/2005	SIGNATURE:	
DRAWN: DAA	DATE: 30/8/2005	SIGNATURE:	
CHECKED: GDM	DATE: 8/2005	SIGNATURE:	
APPROVED:	DATE:	SIGNATURE:	

PLOT DATE:	31/8/205
CAD REF:	1510 011050-INT01
CAD XREF:	
SURVEY BY:	
SURVEY DATE:	
SDR REF:	

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REV

HARRISON GRIERSON

STEVEN THORNTON

Site Suitability Report for Subdivsion of Wainui Road Property

Wainui Road, Ohope

August 2005
Reference 1510 011050 01

HARRISON GRIERSON CONSULTANTS LIMITED

Document Control Record

Client	STEVEN THORNTON
Project	Site Suitability Report for Subdivsion of Wainui Road Property
Project No.	1510 011050 01
Document	Wainui Road, Ohope

ISSUE AND REVISION RECORD

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STEVEN THORNTON

Site Suitability Report for Subdivsion of Wainui Road Property

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DRAWINGS
Survey Plan
Brown Day Architects Drawings

1.0 INTRODUCTION

It is proposed to subdivide lot 5 DPS 9167, located on Wainui Road Ohope, near the intersection of Kowhai Street, into two titles as shown on Harrison Grierson drawing number 11050 SC02.

The purpose of this report is to assess geotechnical conditions for the proposed dwelling for lot 2, and provide recommendations on measures required to stabilise the slope above and below the proposed dwelling.

In June 2004 a brief report was prepared by Harrison Grierson Consultants Ltd for the construction of a driveway across the lower portion of the site, including a slope stability analysis and recommendations for retaining walls.

The Site Survey Plan the proposed dwelling schematic drawings by Brown Day Architects, and the June 2004 Harrison Grierson Consultants Ltd report are appended to this report.

2.0 SITE DESCRIPTION

2.1 TOPOGRAPHY

The site is located on the side of the eastern end of the escarpment above the main portion of Ohope Beach.

A topographical survey has been undertaken which shows the site contours. Brown Day Architects have shown the proposed dwelling footprint on the existing contours, entitled Proposed Site Plan, drawing S10.02, site contours are also shown on the Harrison Grierson drawing number 11050-01, entitled Proposed Driveway Plan and Typical Section.

The site falls to the east by 13m, and in the area of the proposed dwelling has slopes ranging from to 16° to 45°.

A narrow track has been bulldozed across the site below the proposed dwelling and above the proposed retaining walls. The track has been formed sometime between our initial site visit to examine possible driveway positions and the time of our topographical survey of the site. During the period of heavy rain (Mid 2004) that caused many landslides in the Ohope area, a shallow slip less than 10m wide occurred above the track partially blocking it.

2.2 EXISTING DEVELOPMENT

The site has an existing driveway dwelling, garage and turning area on the proposed lot 1 at the southern end of the site. The existing house is accessed directly off Wainui road.

2.3 VEGETATION

At the time of our initial visit in early 2004 the portion of the site which will become lot 2 was vegetated with low level native plantings, these have since been cut to allow survey and are now beginning to regenerate.

2.4 GEOLOGY

We have used the following geological map to assess the geology of the site:

- Geological Map of New Zealand Sheet 5. Published by the Department of Scientific and Industrial Research, New Zealand 1975 Scale 1:250,000.

According to this map the site is underlain by the Pleistocene age marine sandstones with conglomerates and interbedded pumaceous tuffs. The map also shows fluviatile sands and silts overlay the sandstone layers. These sands and silts are present on the site below the topsoil layer.

3.0 INVESTIGATIONS UNDERTAKEN

3.1 TESTING

Three hand augered borelogs (labelled HA 3 to HA 5) have been undertaken along a section through the centre of the proposed dwelling with depths ranging from 2.0m to 2.7m. Shear vane tests were undertaken at 0.5m and 1.0m intervals in the boreholes. Borelogs, HA 1, HA 2, undertaken north of the proposed dwelling during driveway investigations in may 2004, have been included with the appended driveway alignment report.

Three scala penetrometer tests were undertaken alongside the borelogs to 4m deep.

Borelogs and test results are appended.

3.2 SUBSURFACE CONDITIONS

The boreholes show the subsurface conditions at borehole locations comprise 0.2m to 0.6m of topsoil. HA 4 and HA 1 show some filling has been placed over topsoil in the construction of the bulldozer track. Beneath the topsoil various layers of silts and sands were encountered to depths of 2.0m and 2.4m in HA 1 and HA 2. Gravels were encountered in the silt and sand layers in HA 3 and in HA 1.

A light brown sand silt layer underlies the various silt and sand layers in HA 1 and HA 4 this layer is located immediately below topsoil in HA 5 at depths of 2.0m to 2.5m and is too hard for the hand auger to penetrate.

Scala penetrometer tests show soil bearing capacities increasing with depth.

No groundwater was encountered in the borelogs undertaken through the centre of the proposed dwelling. However the previous borelog undertaken during driveway investigations shows groundwater was encountered at 2m deep.

In summary the investigations reveal that the upper 1m is relatively loose the next 1m is moderately dense to 2.0m deep and below 2m soils are very dense. This would account for the fact that the relatively steep site, and the escarpment itself appear stable on this site. The looser upper layers, together with probable saturation in mid 2004, and cutting into the slope without providing support would account for the shallow slip above the bulldozer track

Borelogs with shear vane results and scala penetrometer results are appended.

4.0 PROPOSED DEVELOPMENT

It is proposed that the existing dwelling remains and a second dwelling is constructed on lot 2. A conceptual design for the proposed dwelling is shown on the Brown Day Architects drawings S10.02, S30.06, and S20.01.

The proposed dwelling to be constructed on lot 2 will be set into the side of the hill, and will include decking and cantilevered floors, as per Brown Day Architects design. Refer appended cross section drawing S30.06.

The structure will need to be designed to retain the slope and these retaining structures incorporated into the house construction. The design of the retaining walls will need to account for the surcharge applied from the slope behind the house. The piles shown on the Brown Day Architect drawings are conceptual only and may or may not be necessary.

5.0 SLOPE STABILITY

Before the proposed dwelling can be constructed on the proposed new lot the overall ground stability must be verified. Determination of the stability of a slope can be influenced by many factors and variables. A frequently used requirement is to have a minimum factor of safety against sliding of 1.5 for a slope under normal conditions, and a minimum of 1.2 for wet conditions.

Using the critical cross section determined from the topographical survey information through the centre of the proposed dwelling, an assessment of soil parameters and slope stability has been made. The assessments have involved undertaking a back analysis of the existing slopes to determine the soil

properties below the site taking into consideration the results from our site investigation and a range of likely ground water conditions. The analyses have been undertaken using circular stability analysis.

5.1 EXISTING SLOPE

Our investigations demonstrate that the strengths of materials beneath the slope increase with depth. Based on these investigations we have modelled the existing slope with a looser upper layer over the first 2m and a denser lower layer below 2m deep.

In our analysis we have given the upper and lower layers the following values to reflect their relative strengths. Upper layer c=5 kPa, ϕ = 30° and γ = 18 kN/m^3 and the lower layer c=20 kPa, ϕ= 40 and γ = 18 kN/m^3. These properties have been determined by carrying out a back analysis on the existing slope to arrive at a factor of safety of 1 with the groundwater level raised to just below the upper layer. During recent rainfall events where the groundwater level would have been relatively high the slope has remained stable as a whole.

During the period of heavy rain (Mid 2004) that caused many landslides in the Ohope area a shallow failure occurred in the softer upper layers above the bulldozer formed track where the support for the softer upper layers had been removed when the track was formed. This indicates that the upper layers could be prone to localised shallow failures when wet. The proposed dwelling will need to be designed to retain the upper layers and the existing steep portion of the slope behind the proposed dwelling on the adjoining lot could be prone to shallow failures of the upper loose layer.

5.2 DEVELOPED SITUATION

The dwelling to be constructed on lot 2, will be set into the slope. With the structure designed to retain the slope and these retaining structures incorporated into the house construction. We have modelled this situation with the soil parameters determined as described above.

Our analyses indicate that under drained conditions, the overall slope will have an acceptable stability, with the exception of a small section of slope immediately above the proposed building. With raised groundwater conditions, the overall slope stability becomes marginal if no subsurface drainage measures are implemented. However it will be possible to achieve acceptable stability criteria if appropriate subsoil drainage systems are installed to control groundwater levels

In order to control the ground water levels we recommend that the following be constructed:

1) Horizontal drains be constructed from the lower floor level (shown as FFL 54.0m) back to the rear (western) lot boundary. Spacing of the drainage holes will depend on their design.

2) In addition a 2m deep vertical drain, is to be constructed across the rear of the dwelling below the lower floor level (shown as FFL 54.0m) at the rear of the building to drain potential groundwater.

3) The drains will need to be combined and connected to discharge into the stormwater reticulation system.

Construction of the subsoil drainage system will be difficult and require specialised equipment.

In order to protect the dwelling from potential failure of the section at the existing upper portion of the slope that could be prone to shallow failures, the construction of a debris retaining/deflection wall behind the proposed dwelling will be required.

6.0 STORMWATER DISPOSAL

Introducing water to the ground has the potential to raise the porewater pressure and consequently lead to a loss of shear strength of soils, increasing the risk of slope failure. Our analyses have shown the slope is sensitive to groundwater levels.

It is therefore recommended that stormwater runoff from roofs and paved areas is collected via a piped system and discharged to the base of the slope below the proposed driveway.

7.0 EARTHWORKS CONSIDERATIONS

To construct the proposed dwelling it will be necessary to excavate into the existing slope. Excavated material should be either removed from the site or carefully placed on the site in a manner that will not decrease the existing slope stability.

The bulldozer formed track which has been constructed in the lower portion of the site should be filled with compacted inorganic material to reinstate and stabilise the slope, to prevent further localised shallow failures occurring immediately above this track. It may be possible to use some of the material excavated from the house site for this, however the nature of this material is such that it may not be suitable if it has a high insitu moisture content. The time of year earthworks activities are undertaken may influence the viability of using this material.

All earthworks operations, and construction of retaining walls, on this site will need to be undertaken over a short time period and preferably during dry weather to ensure cuttings and slopes remain stabile during construction.

The possible placement on site or use of material excavated from the proposed dwelling site should be undertaken under the guidance of a Chartered Professional Engineer experienced Geotechnical Engineering.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The proposed Lot 2 is suitable for the construction of the dwelling shown on Brown Day Architects drawing numbers S10.02, S30.06,and S20.01, subject to the following:

1. The Lot 2 dwelling will need to be designed to retain the slope and retaining structures incorporated into the house construction.

2. A debris wall should be constructed behind the proposed Lot 2 dwelling, at the approximate position marked on a copy of Brown Day's drawings.

3. Horizontally drilled, lined drainage pipes, should be constructed from the lower floor level (shown as FFL 54.0m), to the western boundary, to drain potential groundwater. The position of these has been marked on a copy of Brown Day's drawings. Spacing of the drainage pipes will depend on their design. Drainage pipes should be connected to the stormwater reticulation.

4. A 2m deep vertical drain, across the rear of the dwelling below the lower floor level (shown as FFL 54.0m) at the rear of the building should be constructed to drain potential groundwater. The position of this drain has been marked on a copy of Brown Day's drawings.

5. Stormwater runoff from subsoil drains, roofs, and paved areas be collected via a piped system and discharged to the base of the slope below the proposed driveway.

6. Material from the dwelling excavation should be taken off the site or, placed on the site where it will not decrease slope stability. These activities should be undertaken under the guidance of a Chartered Professional Engineer experienced in Geotechnical Engineering.

9.0 LIMITATIONS

The recommendations and opinions contained in this report are based on our visual reconnaissance of the site, information from geological maps, and the data from the field investigation. Inferences about the nature and continuity of sub surface conditions away from and beyond the exploratory borehole logs are

made, but cannot be guaranteed. The descriptions detailed on the exploratory borehole logs are based on the NZ Geotechnical Society Guidelines for the Field Description of Soils and Rocks for Engineering Purposes.

During construction, an engineer competent to judge whether the conditions are compatible with the assumptions made in this report should examine the site. In all circumstances, if variations in the sub surface conditions occur which differ from those described or assumed to exist, then the matter should be referred back to Harrison Grierson Consultants Limited.

This report has been prepared for the particular project described to us, and its extent is limited to the scope of work agreed between the client and Harrison Grierson Consultants Limited, and no responsibility is accepted by Harrison Grierson Consultants Limited or its directors, servants, agents, staff, or employees for the use of any part of this report in any other context or for any other purposes. No responsibility is accepted by Harrison Grierson Consultants Limited for the accuracy of information provided by third parties.

This report is for the use by Steven Thornton only, and should not be used or relied upon by any other person or entity or for any other project.

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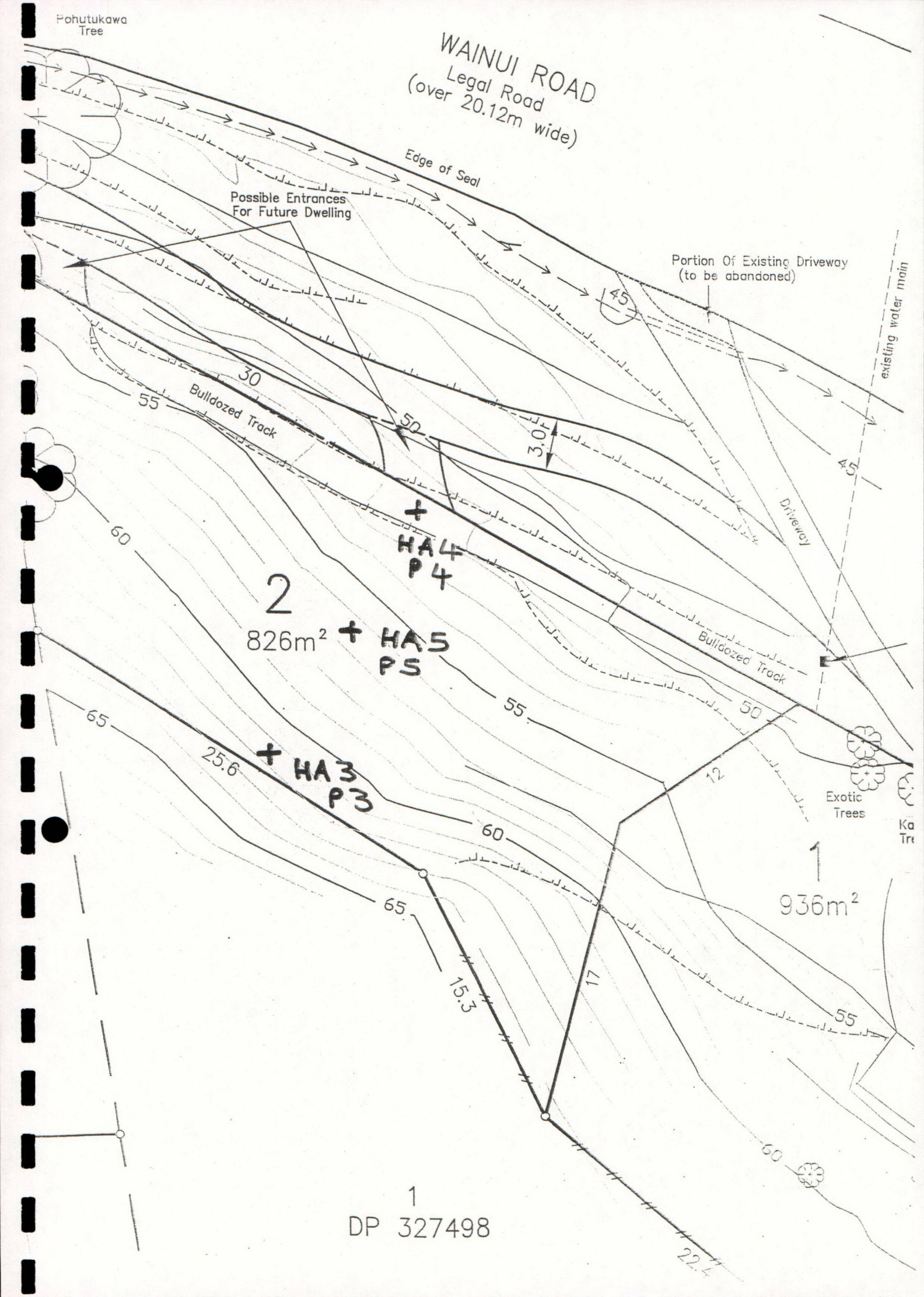
APPENDIX 1

Borelogs and Scala Penetrometers


Pohutukawa Tree
WAINUI ROAD
Legal Road
(over 20.12m wide)
Edge of Seal
Possible Entrances For Future Dwelling
Portion Of Existing Driveway (to be abandoned)
existing water main
Driveway
Bulldozed Track
Bulldozed Track
3.0m
45
30
55
50
60
65
25.6
15.3
17
12
22.7
+ HA4 P4
+ HA5 P5
+ HA3 P3
2
826m²
1
936m²
Exotic Trees
1
DP 327498

geolab
air, soil & water
laboratory services

CLIENT: Steve Thornton

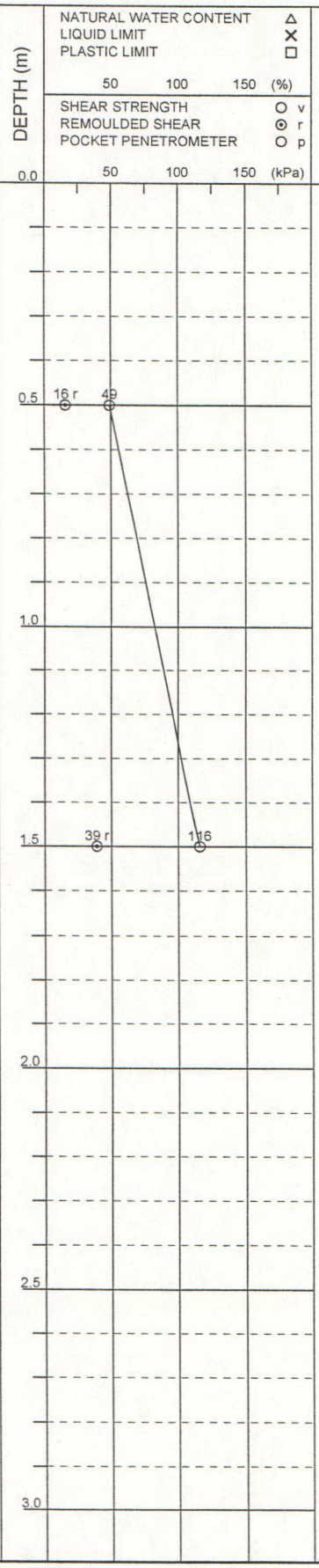
PROJECT: , Subdivison of Lot DP 327498, Wainui Rd, Ohope

BOREHOLE No: HA 3

Sheet 1 of 1

Drill Type:	50 mm Hand Auger	Project No:	1510 011050 01	Logged By:	MAC
Drilled By:	MAC	Coordinates:		Checked By:	
Date Started:	26/5/05	Ground Elevation:		Shear Vane No:	
Date Finished:	26/5/05	Water Level:			

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering
	0.0		TOPSOIL black soft
	0.5		SAND silt with rusty brown patches, (fg) light brown, moist
	1.0		Gravel hit therefore shear vane not possible to penetrate effectively
	1.5		SILT sand with gravels minor rusty brown surface staining, (Gravels some circular and subangular 10mm in longest dimension) light brown,
	2.0		SILT sand with minimal gravels 5mm subangular, wet, light brownish white
	2.5		SAND silt, firming up at 2.0, moist, hard to auger and very hard to remove auger. Light brown, Cannot penetrate shear at 2.0 and 2.5m
	3.0		END OF BORE. 2.5 METRES. Minimial Recovery, Too Hard to Remove Hard Auger



LABORATORY TESTS

SOIL BH2.GPJ GEOLAB.GDT 24/08/05

geolab
air, soil & water
laboratory services

CLIENT: Steve Thornton

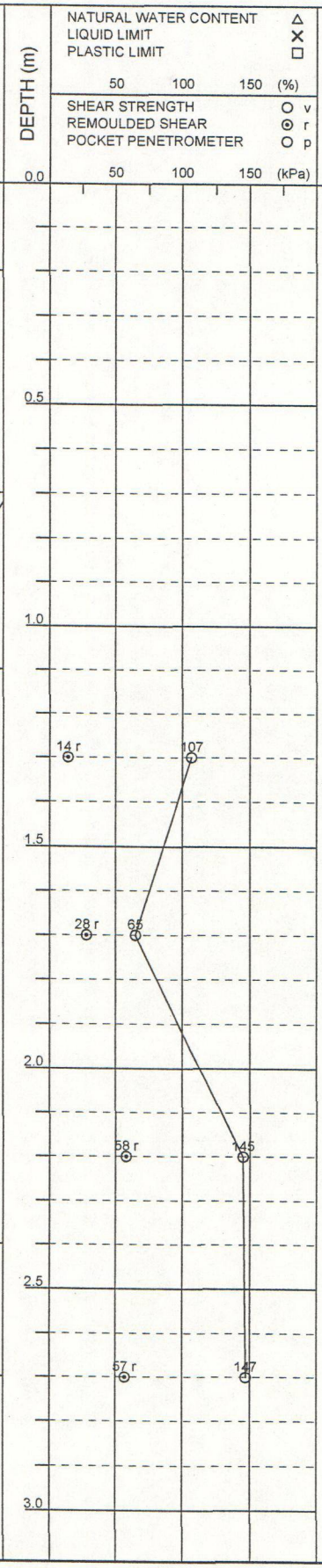
PROJECT: , Subdivison of Lot DP 327498, Wainui Rd, Ohope

BOREHOLE No: HA 4

Sheet 1 of 1

Drill Type:	50 mm Hand Auger	Project No:	1510 011050 01	Logged By:	MAC
Drilled By:	MAC	Coordinates:		Checked By:	
Date Started:	26/5/05	Ground Elevation:		Shear Vane No:	
Date Finished:	26/5/05	Water Level:			

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering
	0.0		TOPSOIL
	0.5		SAND with topsoil (fg) grey
	1.0		SAND with topsoil greyish light brown TOPSOIL black moist soft
	1.5		SAND silt with topsoil odour, grey
	2.0		
	2.5		SILT sand light brown, bands occourring at 2.4m becoming more consistent at 2.5m END OF BORE. 2.5 METRES. Minimial Recovery, Too Hard to Remove Hard Auger
	3.0		



LABORATORY TESTS

SOIL BH2.GPJ GEOLAB.GDT 24/08/05

geolab
air, soil & water
laboratory services

CLIENT: Steve Thornton

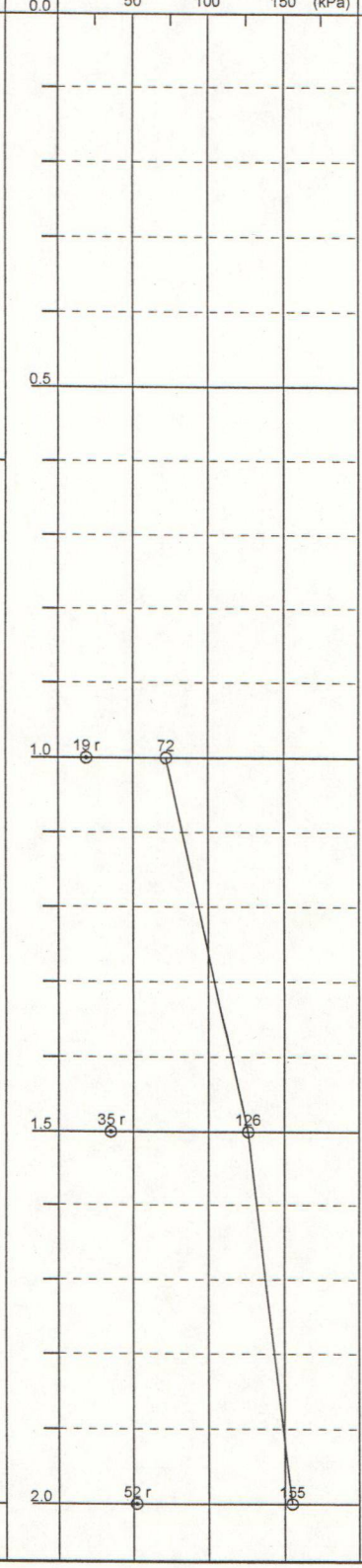
PROJECT: , Subdivison of Lot DP 327498, Wainui Rd, Ohope

BOREHOLE No: HA 5

Sheet 1 of 1

Drill Type:	50 mm Hand Auger	Project No:	1510 011050 01	Logged By:	MAC
Drilled By:	MAC	Coordinates:		Checked By:	
Date Started:	26/5/05	Ground Elevation:		Shear Vane No:	
Date Finished:	26/5/05	Water Level:			

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering
	0.0		TOPSOIL black, moist
	0.5		SAND silt light brown (fg) moist
	1.0		
	1.5		
	2.0		END OF BORE. 2.0 METRES. Minimial Recovery, Too Hard to Remove Hard Auger



LABORATORY TESTS

SOIL_BH2.GPJ GEOLAB.GDT 24/08/05

HARRISON GRIERSON CONSULTANTS LTD

SCALAPENETROMETER RESULT SHEET

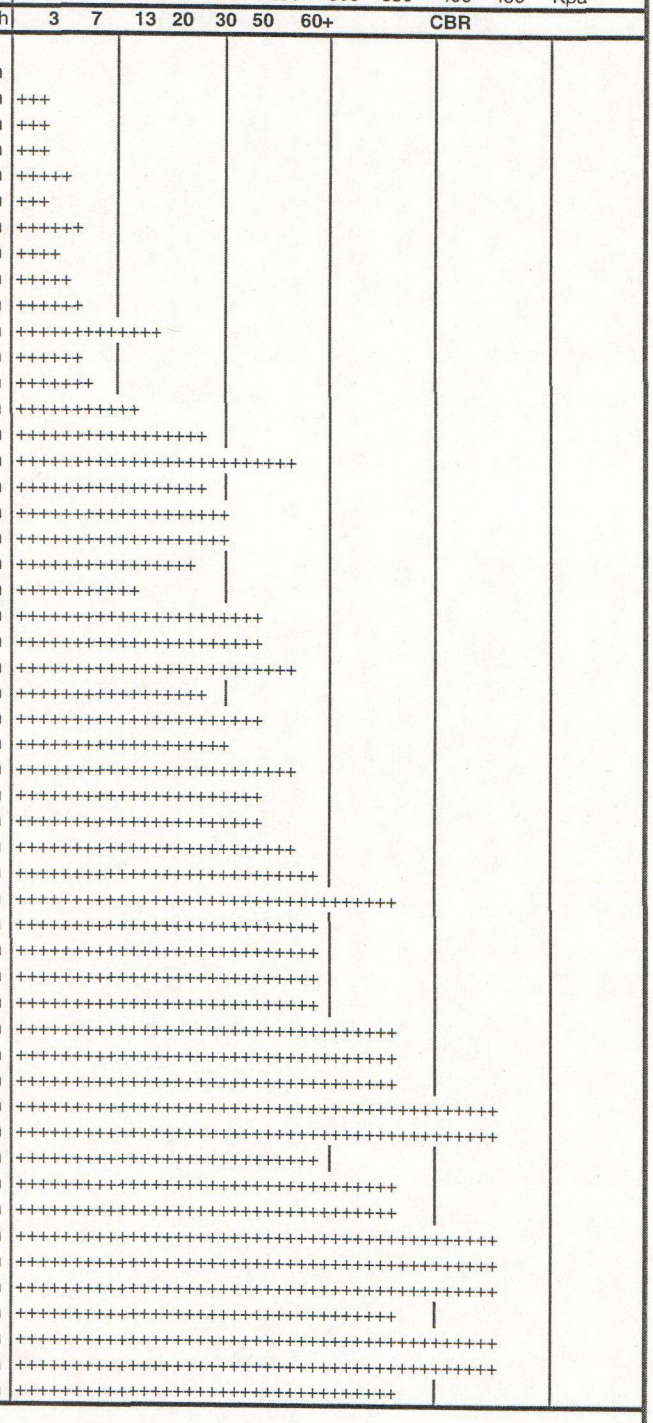
CLIENT: Steve Thornton

PROJECT: Soil Investigation, Wainui Rd, Ohope

File No 1510 011050
Date tested 27/05/05
Tested by MC
Printed

NB safety factor 1.6 -- 5. depending on soil type

Reading	Blows	diff	Pen/blow	Bearing	Depth
P3					
1.64	0		ROD		0.00 m
1.53	1	0.110	110 mm	34 kPa	0.11 m
1.40	1	0.130	130 mm	30 kPa	0.24 m
1.27	1	0.130	130 mm	30 kPa	0.37 m
1.20	1	0.070	70 mm	50 kPa	0.44 m
1.10	1	0.100	100 mm	37 kPa	0.54 m
1.05	1	0.050	50 mm	68 kPa	0.59 m
0.97	1	0.080	80 mm	44 kPa	0.67 m
0.90	1	0.070	70 mm	50 kPa	0.74 m
0.80	2	0.100	50 mm	68 kPa	0.84 m
0.75	2	0.050	25 mm	135 kPa	0.89 m
0.69	2	0.110	55 mm	63 kPa	0.95 m
0.60	2	0.090	45 mm	75 kPa	1.04 m
0.51	3	0.090	30 mm	110 kPa	1.13 m
0.46	3	0.050	17 mm	175 kPa	1.18 m
0.43	3	0.030	10 mm	250 kPa	1.21 m
0.36	4	0.070	18 mm	170 kPa	1.28 m
0.30	4	0.060	15 mm	190 kPa	1.34 m
1.22	0	NEW	ROD	190 kPa	1.34 m
1.14	4	0.080	20 mm	160 kPa	1.42 m
1.08	2	0.060	30 mm	110 kPa	1.48 m
1.02	5	0.060	12 mm	225 kPa	1.54 m
0.96	5	0.060	12 mm	225 kPa	1.60 m
0.90	6	0.060	10 mm	250 kPa	1.66 m
0.83	4	0.070	18 mm	170 kPa	1.73 m
0.77	5	0.060	12 mm	225 kPa	1.79 m
0.62	10	0.150	15 mm	190 kPa	1.94 m
0.52	10	0.100	10 mm	250 kPa	2.04 m
0.39	10	0.130	13 mm	225 kPa	2.17 m
1.31	0	NEW	ROD	225 kPa	2.17 m
1.21	10	0.100	10 mm	250 kPa	2.27 m
1.13	10	0.080	8 mm	275 kPa	2.35 m
1.06	10	0.070	7 mm	340 kPa	2.42 m
0.98	10	0.080	8 mm	275 kPa	2.50 m
0.90	10	0.080	8 mm	275 kPa	2.58 m
0.82	10	0.080	8 mm	275 kPa	2.66 m
0.74	10	0.080	8 mm	275 kPa	2.74 m
0.68	10	0.060	6 mm	340 kPa	2.80 m
0.61	10	0.070	7 mm	340 kPa	2.87 m
0.54	10	0.070	7 mm	340 kPa	2.94 m
0.49	10	0.050	5 mm	430 kPa	2.99 m
1.29	0	NEW	ROD	430 kPa	2.99 m
1.17	15	0.120	8 mm	275 kPa	3.11 m
1.04	20	0.130	6 mm	340 kPa	3.24 m
0.95	15	0.090	6 mm	340 kPa	3.33 m
0.85	20	0.100	5 mm	430 kPa	3.43 m
0.80	10	0.050	5 mm	430 kPa	3.48 m
0.73	15	0.070	5 mm	430 kPa	3.55 m
0.64	15	0.090	6 mm	340 kPa	3.64 m
0.57	15	0.070	5 mm	430 kPa	3.71 m
0.50	15	0.070	5 mm	430 kPa	3.78 m
0.40	15	0.100	7 mm	340 kPa	3.88 m



This spreadsheet has been developed with reference to the following publication

"DETERMINATION OF ALLOWABLE BEARING PRESSURE UNDER SMALL STRUCTURES"

Author : M,J, Stockwell B,E, C,ENG. M.I.C.E. (Member)
Published by New Zealand Engineering (32,6) 15 June 1977

HARRISON GRIERSON CONSULTANTS LTD

SCALAPENETROMETER RESULT SHEET

CLIENT: Steve Thornton

PROJECT: Soil Investigation, Wainui Rd, Ohope

NB safety factor 1.6 -- 5. depending on soil type

File No 1510 011050
Date tested 27/05/05
Tested by MC
Printed

Reading	Blows	diff	Pen/blow	Bearing	Depth	50 100 150 200 250 300 350 400 450 Kpa 3 7 13 20 30 50 60+ CBR
P4						
1.74	0		ROD		0.00 m	
1.55	1	0.190	190 mm	< 10kPa	0.19 m	
1.20	1	0.350	350 mm	< 10kPa	0.54 m	
1.04	1	0.160	160 mm	< 10kPa	0.70 m	
0.86	1	0.180	180 mm	< 10kPa	0.88 m	
0.71	1	0.150	150 mm	27 kPa	1.03 m	++
0.60	2	0.110	55 mm	63 kPa	1.14 m	++++++
0.35	2	0.250	125 mm	31 kPa	1.39 m	+++
0.26	2	0.090	45 mm	75 kPa	1.48 m	+++++++
1.16	0	NEW	ROD	75 kPa	1.48 m	+++++++
1.06	3	0.100	33 mm	98 kPa	1.58 m	+++++++++
1.00	3	0.060	20 mm	160 kPa	1.64 m	++++++++++++++++
0.91	5	0.090	18 mm	170 kPa	1.73 m	++++++++++++++++++
0.86	4	0.050	13 mm	225 kPa	1.78 m	++++++++++++++++++++++
0.80	5	0.060	12 mm	225 kPa	1.84 m	++++++++++++++++++++++
0.74	5	0.060	12 mm	225 kPa	1.90 m	++++++++++++++++++++++
0.65	6	0.090	15 mm	190 kPa	1.99 m	++++++++++++++++++
0.59	5	0.060	12 mm	225 kPa	2.05 m	++++++++++++++++++++++
0.50	6	0.090	15 mm	190 kPa	2.14 m	++++++++++++++++++
0.41	6	0.090	15 mm	190 kPa	2.23 m	++++++++++++++++++
0.35	4	0.060	15 mm	190 kPa	2.29 m	++++++++++++++++++
1.22	0	NEW	ROD	190 kPa	2.29 m	++++++++++++++++++
1.16	4	0.060	15 mm	190 kPa	2.35 m	++++++++++++++++++
1.10	5	0.060	12 mm	225 kPa	2.41 m	++++++++++++++++++++++
1.00	10	0.100	10 mm	250 kPa	2.51 m	+++++++++++++++++++++++++
0.95	5	0.050	10 mm	250 kPa	2.56 m	+++++++++++++++++++++++++
0.86	10	0.090	9 mm	275 kPa	2.65 m	++++++++++++++++++++++++++
0.78	11	0.080	7 mm	340 kPa	2.73 m	+++++++++++++++++++++++++++++++++
0.69	10	0.090	9 mm	275 kPa	2.82 m	++++++++++++++++++++++++++
0.60	10	0.090	9 mm	275 kPa	2.91 m	++++++++++++++++++++++++++
0.51	10	0.090	9 mm	275 kPa	3.00 m	++++++++++++++++++++++++++
0.42	10	0.090	9 mm	275 kPa	3.09 m	++++++++++++++++++++++++++
0.34	10	0.080	8 mm	275 kPa	3.17 m	++++++++++++++++++++++++++
1.00	0	NEW	ROD	225 kPa	3.17 m	++++++++++++++++++++++
0.93	10	0.070	7 mm	340 kPa	3.24 m	+++++++++++++++++++++++++++++++++
0.81	10	0.120	12 mm	225 kPa	3.36 m	++++++++++++++++++++++
0.75	10	0.060	6 mm	340 kPa	3.42 m	+++++++++++++++++++++++++++++++++
0.68	10	0.070	7 mm	340 kPa	3.49 m	+++++++++++++++++++++++++++++++++
0.60	10	0.080	8 mm	275 kPa	3.57 m	++++++++++++++++++++++++++
0.52	10	0.080	8 mm	275 kPa	3.65 m	++++++++++++++++++++++++++
0.46	10	0.060	6 mm	340 kPa	3.71 m	+++++++++++++++++++++++++++++++++
0.40	10	0.060	6 mm	340 kPa	3.77 m	+++++++++++++++++++++++++++++++++
0.35	10	0.050	5 mm	430 kPa	3.82 m	+++
0.32	5	0.030	6 mm	340 kPa	3.85 m	+++++++++++++++++++++++++++++++++

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CLIENT: Steve Thornton

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File No 1510 011050
Date tested 27/05/05
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NB safety factor 1.6 -- 5. depending on soil type

Reading	Blows	diff	Pen/blow	Bearing	Depth	50 100 150 200 250 300 350 400 450 Kpa 3 7 13 20 30 50 60+ CBR
P5						
1.57	0		ROD		0.00 m	
1.38	1	0.190	190 mm	< 10kPa	0.19 m	
1.15	1	0.230	230 mm	< 10kPa	0.42 m	
1.02	1	0.130	130 mm	30 kPa	0.55 m	+++
0.90	1	0.120	120 mm	32 kPa	0.67 m	+++
0.78	1	0.120	120 mm	32 kPa	0.79 m	+++
0.71	1	0.070	70 mm	50 kPa	0.86 m	+++++
0.65	1	0.060	60 mm	58 kPa	0.92 m	+++++
0.61	1	0.040	40 mm	85 kPa	0.96 m	+++++++++
0.58	1	0.030	30 mm	110 kPa	0.99 m	++++++++++++
0.52	2	0.060	30 mm	110 kPa	1.05 m	++++++++++++
0.44	3	0.080	27 mm	125 kPa	1.13 m	++++++++++++
0.36	3	0.080	27 mm	125 kPa	1.21 m	++++++++++++
1.18	0	NEW	ROD	125 kPa	1.21 m	++++++++++++
1.00	10	0.180	18 mm	170 kPa	1.39 m	++++++++++++++++++
0.86	10	0.140	14 mm	200 kPa	1.53 m	++++++++++++++++++++++
0.72	10	0.140	14 mm	200 kPa	1.67 m	++++++++++++++++++++++
0.56	10	0.160	16 mm	180 kPa	1.83 m	++++++++++++++++++
0.50	5	0.060	12 mm	225 kPa	1.89 m	++++++++++++++++++++++++
0.42	5	0.080	16 mm	180 kPa	1.97 m	++++++++++++++++++
0.36	5	0.060	12 mm	225 kPa	2.03 m	++++++++++++++++++++++++
1.27	0	NEW	ROD	225 kPa	2.03 m	++++++++++++++++++++++++
1.11	12	0.160	13 mm	225 kPa	2.19 m	++++++++++++++++++++++++
0.98	10	0.130	13 mm	225 kPa	2.32 m	++++++++++++++++++++++++
0.87	10	0.110	11 mm	238 kPa	2.43 m	+++++++++++++++++++++++++
0.79	6	0.080	13 mm	225 kPa	2.51 m	++++++++++++++++++++++++
0.67	10	0.120	12 mm	225 kPa	2.63 m	++++++++++++++++++++++++
0.55	10	0.120	12 mm	225 kPa	2.75 m	++++++++++++++++++++++++
0.44	10	0.110	11 mm	238 kPa	2.86 m	+++++++++++++++++++++++++
0.34	10	0.100	10 mm	250 kPa	2.96 m	++++++++++++++++++++++++++
1.25	0	NEW	ROD	250 kPa	2.96 m	++++++++++++++++++++++++++
1.14	10	0.110	11 mm	238 kPa	3.07 m	+++++++++++++++++++++++++
1.05	10	0.090	9 mm	275 kPa	3.16 m	++++++++++++++++++++++++++++
0.97	10	0.080	8 mm	275 kPa	3.24 m	++++++++++++++++++++++++++++
0.89	10	0.080	8 mm	275 kPa	3.32 m	++++++++++++++++++++++++++++
0.83	10	0.060	6 mm	340 kPa	3.38 m	+++++++++++++++++++++++++++++++++++
0.79	10	0.040	4 mm	430 kPa	3.42 m	+++
0.73	10	0.060	6 mm	340 kPa	3.48 m	+++++++++++++++++++++++++++++++++++
0.70	5	0.030	6 mm	340 kPa	3.51 m	+++++++++++++++++++++++++++++++++++
0.67	5	0.030	6 mm	340 kPa	3.54 m	+++++++++++++++++++++++++++++++++++
0.62	5	0.050	10 mm	250 kPa	3.59 m	++++++++++++++++++++++++++
0.57	5	0.050	10 mm	250 kPa	3.64 m	++++++++++++++++++++++++++
0.52	5	0.050	10 mm	250 kPa	3.69 m	++++++++++++++++++++++++++
0.48	5	0.040	8 mm	275 kPa	3.73 m	++++++++++++++++++++++++++++
0.45	3	0.030	10 mm	250 kPa	3.76 m	++++++++++++++++++++++++++
0.42	3	0.030	10 mm	250 kPa	3.79 m	++++++++++++++++++++++++++
0.38	5	0.040	8 mm	275 kPa	3.83 m	++++++++++++++++++++++++++++
0.35	5	0.030	6 mm	340 kPa	3.86 m	+++++++++++++++++++++++++++++++++++

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APPENDIX 2

Stability Analysis Printouts

Existing Situation (Drained).

MAC.ST.A.R.S 2000 - Rel. 2.0

MACcaferri STability Analysis of Reinforced Slopes
Harrison Grierson Tauranga

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Existing

Site: 24 Wainui Road, Ohope

Folder: Date : 08/01/2005

File: Section 7 Base 2.mac

Checks according to: New Zealand Limit Equilibrium
Static design 120 years

SOIL PROPERTIES

Soil: S1 Description: Upper Soils - Weaker sandy silts

Cohesion Class ..... : Soil material factor c'			
Cohesion	[KN/m²]	:	5.00
Friction Angle Class : Soil material factor phi			
Friction Angle :	[°]	:	30.00
Ru value.....		:	0.00
Weight Class ..... : Soil unit mass			
Bulk unit weight - above GWT	[KN/m³]	:	18.00
Bulk unit weight - below GWT	[KN/m³]	:	18.00
Elastic Modulus	[KN/m²]	:	0.00
Poisson's ratio		:	0.30

Soil: S2 Description: Deeper firm soils

Cohesion Class ..... : Soil material factor c'			
Cohesion	[KN/m²]	:	20.00
Friction Angle Class : Soil material factor phi			
Friction Angle :	[°]	:	40.00
Ru value.....		:	0.00
Weight Class ..... : Soil unit mass			
Bulk unit weight - above GWT	[KN/m³]	:	18.00
Bulk unit weight - below GWT	[KN/m³]	:	18.00
Elastic Modulus	[KN/m²]	:	0.00
Poisson's ratio		:	0.30

STRATA PROFILES

Stratum: A Description: Existing Surface

Soil : S1

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
0.00	7.70	4.10	8.00	5.00	8.60	8.80	9.20
11.10	9.70	11.40	10.90	13.90	12.30	25.50	18.20
35.50	24.40	40.50	28.80	48.90	33.70	54.80	36.20
69.00	36.50						

Stratum: B Description: Stiffer Soils

Soil : S2

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
0.00	2.50	18.50	11.80	35.20	22.50	54.70	33.00
69.00	33.50						

CHECKS RESULTS

Global Stability Check :
Multiplier combination : Limit Equilibrium
Reinforcements active Forces according to Rigid Method
Stability analysis with circular surfaces according to Bishop's Method
Evaluated Safety Factor ..... : 1.549

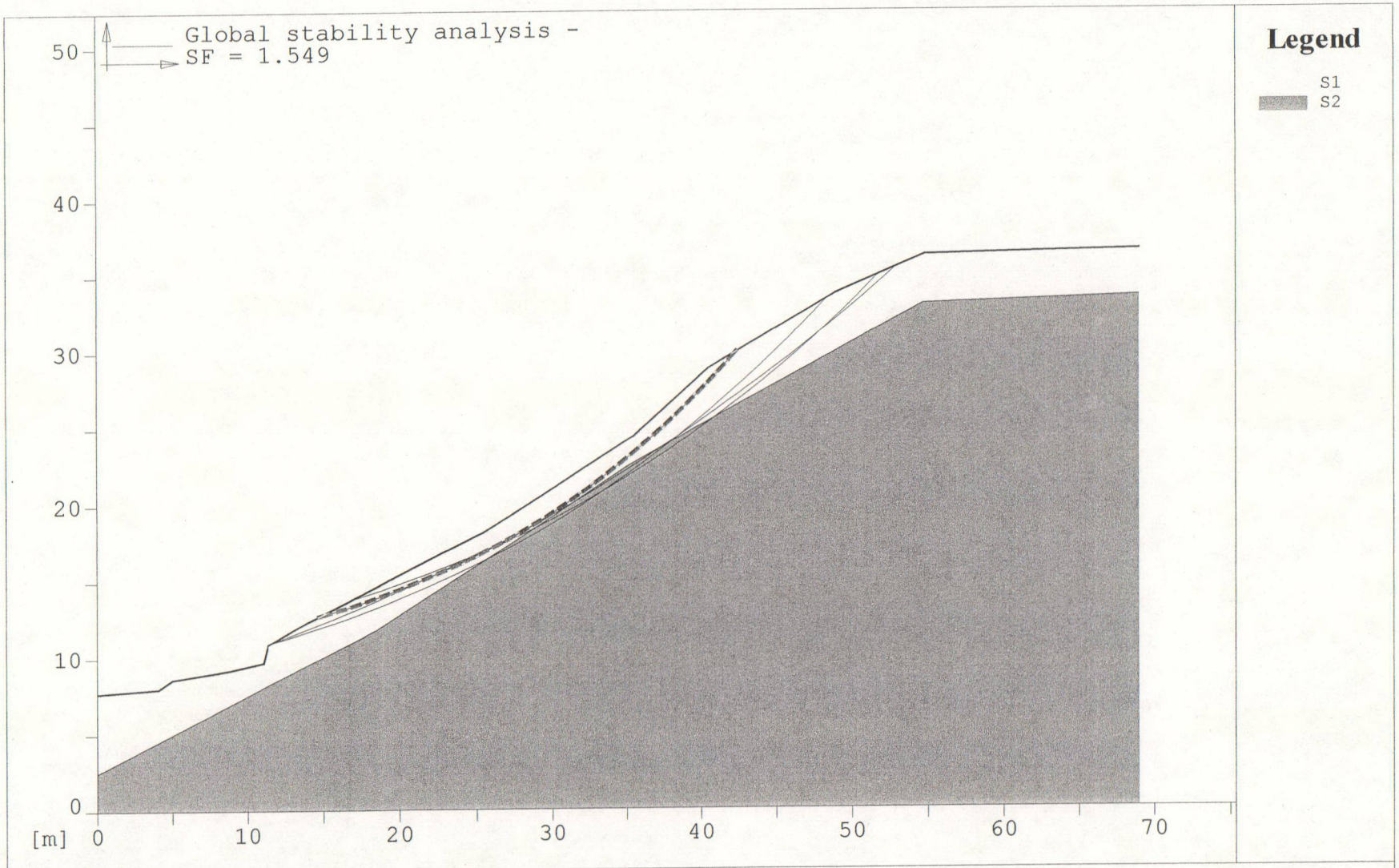
Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
0.00	20.00	36.00	69.00

Number of starting point on the starting segment : 20
Total number of trial surfaces ..... : 420
Minimum base length of slices..... [m] : 1.00
Superior limit search angle..... [°] : 0.00
Inferior limit search angle..... [°] : 0.00

Multiplier	Class
1.00	Soil material factor phi
1.00	Soil unit mass
1.00	Stability factor
1.00	Pullout factor
1.00	Reinforcement breakage
1.00	Soil material factor c'

Maccaferri assumes no responsibilities for the drawings and calculations it provides, as they must be intended as general indications to suggest the proper use of its products.



MacStARS 2000
Release 2.0 - Maccaferri
Stability Analysis
of Reinforced Slopes

Date: 08/01/2005
Folder:

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Existing

Site: 24 Wainui Road, Ohope **File:** Section 7 Base 2.mac

Existing situation
raised G.W.

MAC.ST.A.R.S 2000 - Rel. 2.0

MACcaferri STability Analysis of Reinforced Slopes
Harrison Grierson Tauranga

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Existing

Site: 24 Wainui Road, Ohope

Folder: Date : 08/01/2005

File: Section 7 Base-Raised gw rock 2.mac

Checks according to: New Zealand Limit Equilibrium
Static design 120 years

SOIL PROPERTIES

Soil: S1 Description: Upper Soils - Weaker sandy silts

Cohesion Class ..... : Soil material factor c'			
Cohesion	[KN/m²]	:	5.00
Friction Angle Class : Soil material factor phi			
Friction Angle :	[°]	:	30.00
Ru value.....		:	0.00
Weight Class ..... : Soil unit mass			
Bulk unit weight - above GWT	[KN/m³]	:	18.00
Bulk unit weight - below GWT	[KN/m³]	:	18.00
Elastic Modulus	[KN/m²]	:	0.00
Poisson's ratio		:	0.30

Soil: S2 Description: Deeper firm soils

Cohesion Class ..... : Soil material factor c'			
Cohesion	[KN/m²]	:	20.00
Friction Angle Class : Soil material factor phi			
Friction Angle :	[°]	:	40.00
Ru value.....		:	0.00
Weight Class ..... : Soil unit mass			
Bulk unit weight - above GWT	[KN/m³]	:	18.00
Bulk unit weight - below GWT	[KN/m³]	:	18.00
Elastic Modulus	[KN/m²]	:	0.00
Poisson's ratio		:	0.30

STRATA PROFILES

Stratum: A Description: Existing Surface

Soil : S1

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
0.00	7.70	4.10	8.00	5.00	8.60	8.80	9.20
11.10	9.70	11.40	10.90	13.90	12.30	25.50	18.20
35.50	24.40	40.50	28.80	48.90	33.70	54.80	36.20
69.00	36.50						

Stratum: B Description: Stiffer Soils

Soil : S2

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
0.00	2.50	18.50	11.80	35.20	22.50	54.70	33.00
69.00	33.50						

Stratum: ROCK Description: Assumed base rock

Soil : Bedrock

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
15.00	0.00	55.00	24.00	69.00	24.00		

WATER TABLE PROFILES

WATER TABLE: GW1 Description: Lower Strata Saturated

X [m]	Y [m]	Y [m]	P [KN/m²]	X [m]	Y [m]	Y [m]	P [KN/m²]
0.00	2.50			18.50	11.80		
35.20	22.50			54.70	33.00		
69.00	33.50						

CHECKS RESULTS

Global Stability Check : Raised Groundwater Soil 2 parameters to give F=1 under present conditions

Multiplier combination : Limit Equilibrium
Reinforcements active Forces according to Rigid Method
Stability analysis with circular surfaces according to Bishop's Method
Evaluated Safety Factor ..... : 0.943

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
0.00	20.00	25.00	69.00

Number of starting point on the starting segment : 5
Total number of trial surfaces ..... : 230
Minimum base length of slices..... [m] : 1.00
Superior limit search angle..... [°] : 0.00
Inferior limit search angle..... [°] : 0.00

Multiplier	Class
1.00	Soil material factor phi
1.00	Soil unit mass
1.00	Stability factor
1.00	Pullout factor
1.00	Reinforcement breakage
1.00	Soil material factor c'

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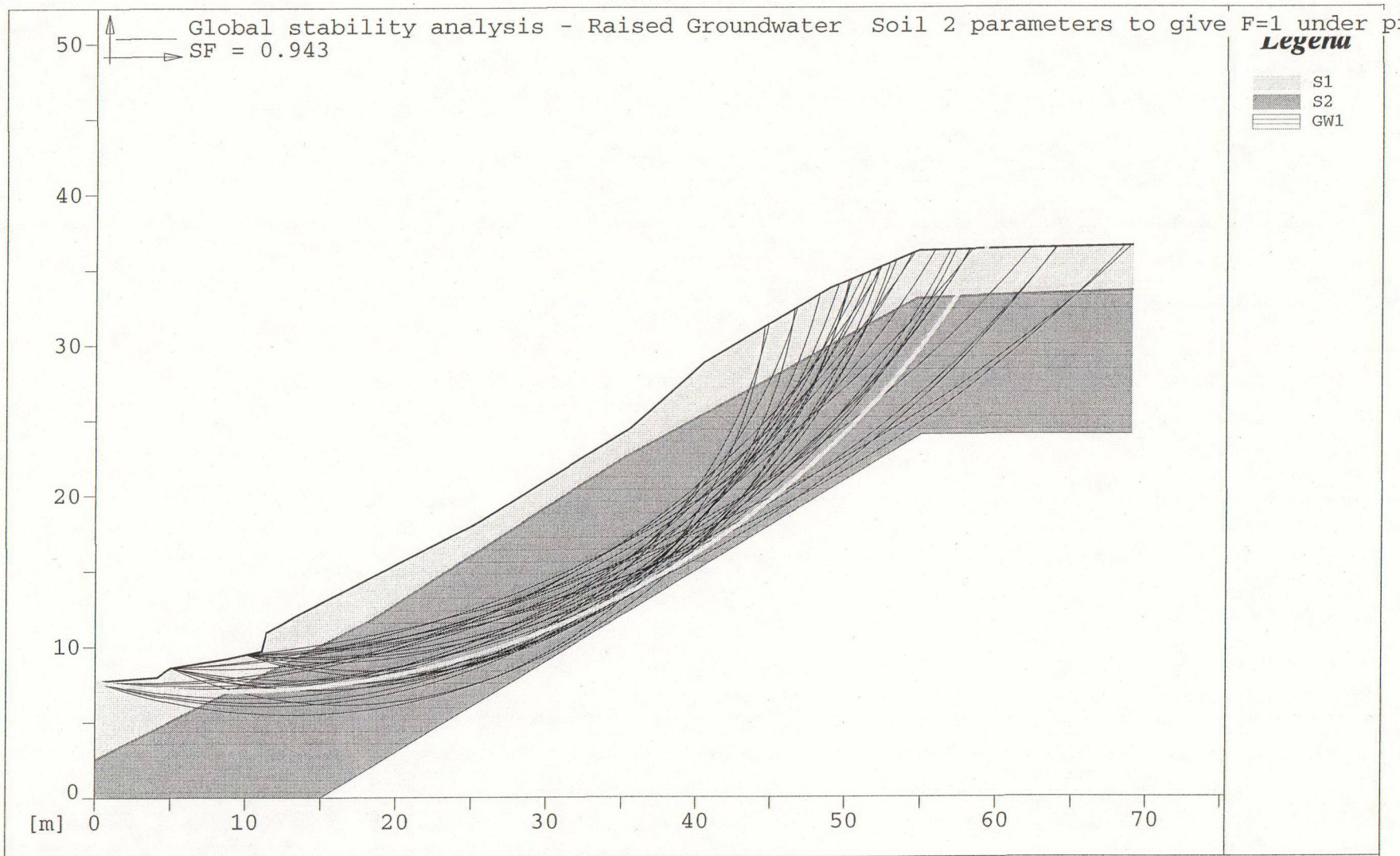

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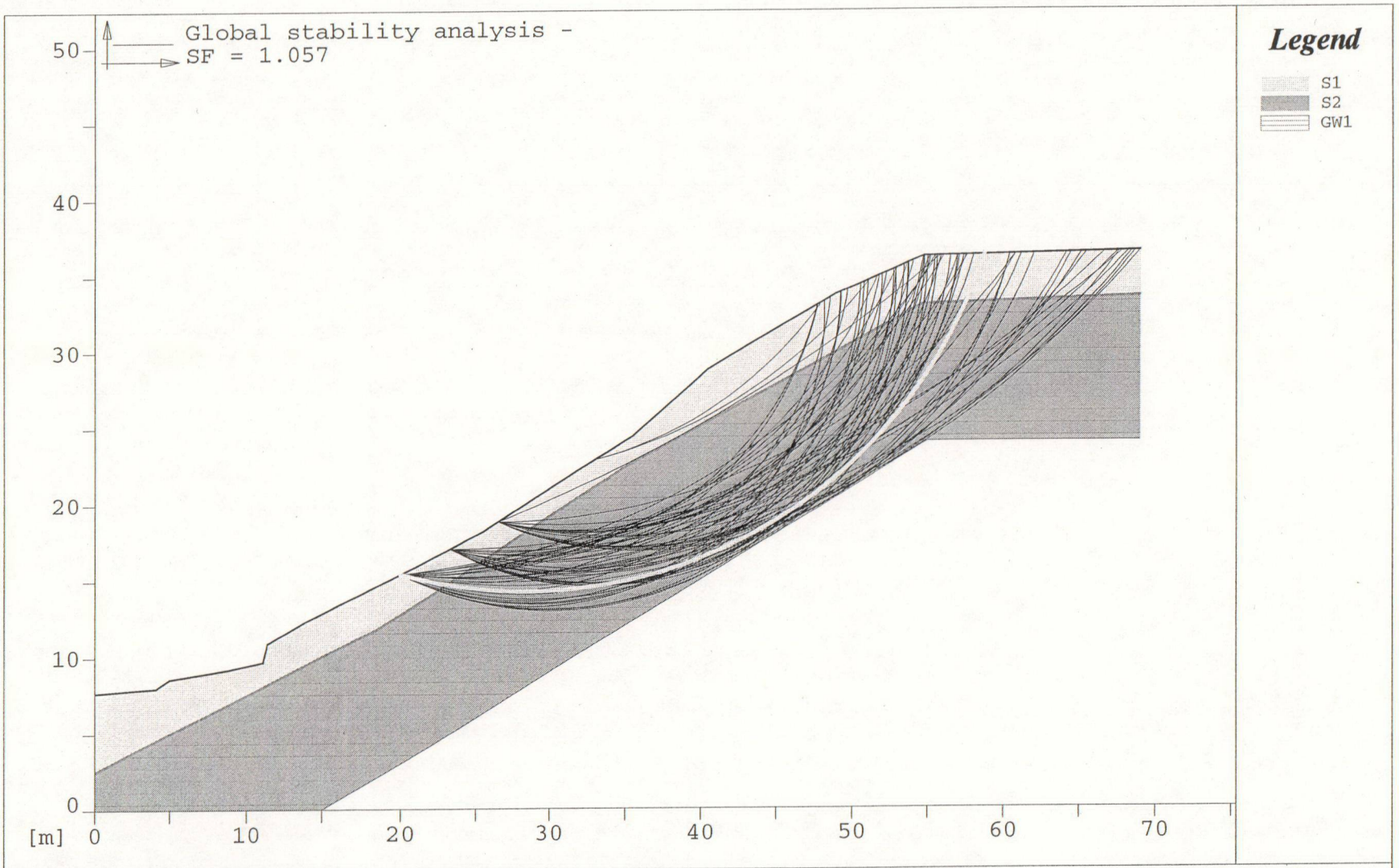
Release 2.0 - Maccaferri
Stability Analysis
of Reinforced Slopes

Date: 08/01/2005
Folder:

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Existing
Site: 24 Wainui Road, Ohope **File:** Section 7 Base-Raised gw rock.mac



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Release 2.0 - Maccaferri
Stability Analysis
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Date: 08/01/2005
Folder:

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Existing
Site: 24 Wainui Road, Ohope **File:** Section 7 Base-Raised gw rock.mac

Developed Situation, raised G.W with drainage.

MAC.ST.A.R.S 2000 - Rel. 2.0

MACcaferri STability Analysis of Reinforced Slopes
Harrison Grierson Tauranga

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Developed with subsoil drainage

Site: 24 Wainui Road, Ohope

Folder: Date : 08/01/2005

File: Section 7 Developed- Controlled GW3 w rock 2.mac

Checks according to: New Zealand Limit Equilibrium
Static design 120 years

SOIL PROPERTIES

Soil: S1 Description: Upper Soils - Weaker sandy silts

Cohesion Class ..... : Soil material factor c'			
Cohesion	[KN/m²]	:	5.00
Friction Angle Class : Soil material factor phi			
Friction Angle :	[°]	:	30.00
Ru value.....		:	0.00
Weight Class ..... : Soil unit mass			
Bulk unit weight - above GWT	[KN/m³]	:	18.00
Bulk unit weight - below GWT	[KN/m³]	:	18.00
Elastic Modulus	[KN/m²]	:	0.00
Poisson's ratio		:	0.30

Soil: S2 Description: Deeper firm soils

Cohesion Class ..... : Soil material factor c'			
Cohesion	[KN/m²]	:	20.00
Friction Angle Class : Soil material factor phi			
Friction Angle :	[°]	:	40.00
Ru value.....		:	0.00
Weight Class ..... : Soil unit mass			
Bulk unit weight - above GWT	[KN/m³]	:	18.00
Bulk unit weight - below GWT	[KN/m³]	:	18.00
Elastic Modulus	[KN/m²]	:	0.00
Poisson's ratio		:	0.30

STRATA PROFILES

Stratum: A Description: Developed Surface

Soil : S1

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
0.00	7.70	4.10	8.00	5.00	8.60	8.80	9.20
11.10	9.70	11.40	10.90	13.90	12.30	22.40	16.60
29.50	16.60	29.70	19.60	33.20	19.60	33.40	22.40
34.60	22.40	34.80	23.80	35.50	24.40	40.50	28.80
48.90	33.70	54.80	36.20	69.00	36.50		

Stratum: B Description: Stiffer Soils

Soil : S2

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
0.00	2.50	18.50	11.80	27.10	16.55	29.50	16.55
29.60	18.00	32.20	19.55	33.20	19.55	33.25	20.00
35.20	22.50	54.70	33.00	69.00	33.50		

Stratum: ROCK Description: Assumed Base rock

Soil : Bedrock

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
15.00	0.00	55.00	24.00	69.00	24.00		

WATER TABLE PROFILES

WATER TABLE: GW 1 Description: Raised Groundwater

X [m]	Y [m]	Y [m]	P [KN/m²]	X [m]	Y [m]	Y [m]	P [KN/m²]
0.00	6.50			11.10	9.00		
26.00	13.50			29.50	14.50		
34.50	17.00			54.80	33.00		
69.00	33.50						

SURCHARGE LOADS

Distributed Loads : **BLDG** Description : proposed house

Class : Load factor

Magnitude . [KN/m²] = 10.00 Inclination angle [°] = 0.00

Abscissa .. [m] : from = 22.40 To = 33.20

CHECKS RESULTS

Global Stability Check :

Multiplier combination : Limit Equilibrium

Reinforcements active Forces according to Rigid Method

Stability analysis with circular surfaces according to Bishop's Method

Evaluated Safety Factor ..... : 1.196

Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
0.00	20.00	36.00	60.00

Number of starting point on the starting segment : 5

Total number of trial surfaces ..... : 105

Minimum base length of slices..... [m] : 1.00

Superior limit search angle..... [°] : 0.00

Inferior limit search angle..... [°] : 0.00

Multiplier	Class
1.00	Soil material factor phi
1.00	Soil unit mass
1.00	Load factor

1.00	Stability factor
1.00	Pullout factor
1.00	Reinforcement breakage
1.00	Soil material facto cu
1.00	Soil material factor c'

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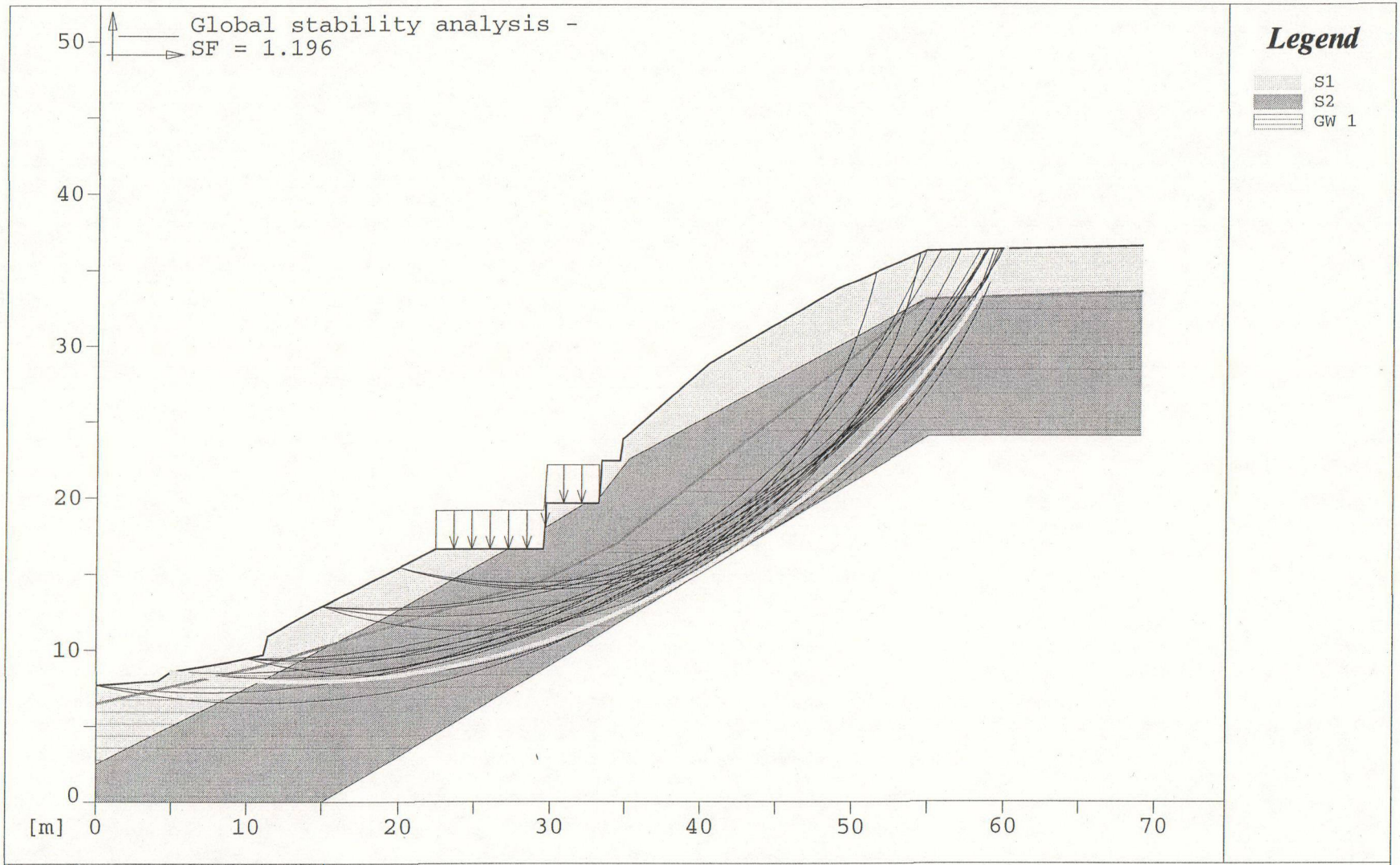

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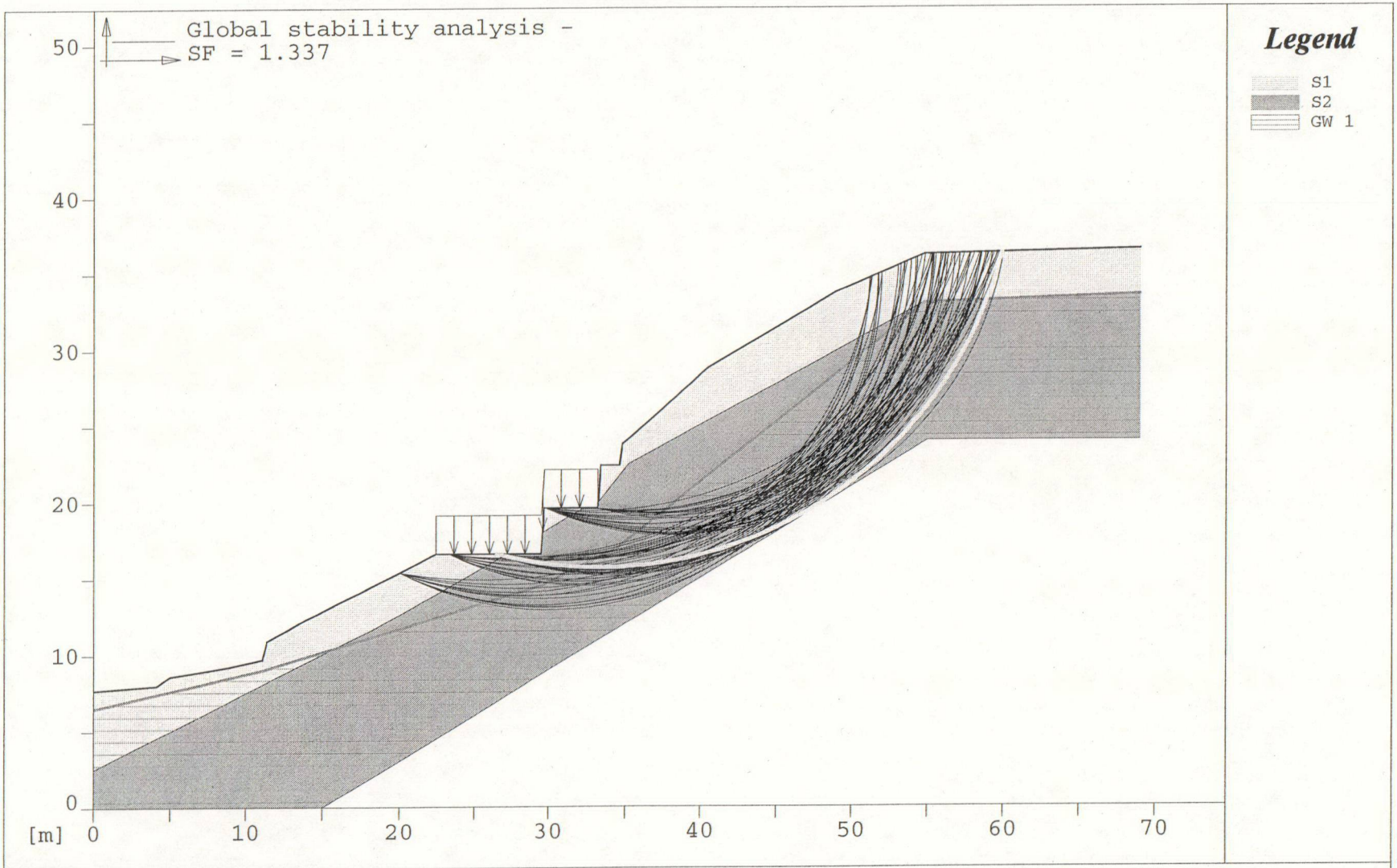
Stability Analysis
of Reinforced Slopes

Date: 08/01/2005
Folder:

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Developed with subsoil drainage
Site: 24 Wainui Road, Ohope **File:** Section 7 Developed- Controlled GW3 w rock 2.mac



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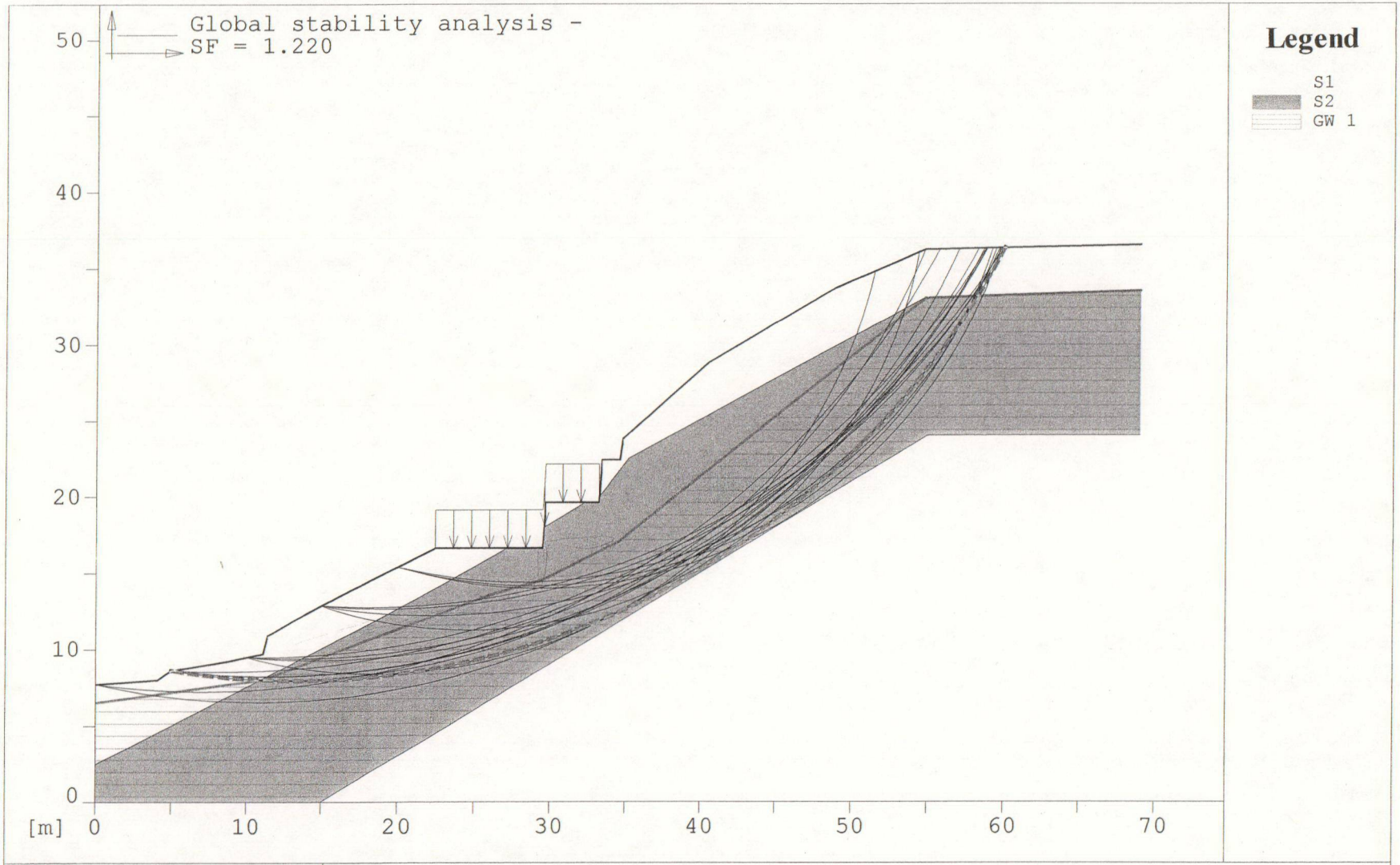
Cross Section: Section 7 - Developed with subsoil drainage

Site: 24 Wainui Road, Ohope **File:** Section 7 Developed- Controlled GW3 w rock 2.mac



MacStARS 2000
Release 2.0 - Maccaferri
Stability Analysis
of Reinforced Slopes

Date: 08/01/2005
Folder:

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Developed with subsoil drainage

Site: 24 Wainui Road, Ohope **File:** Section 7 Developed- Controlled GW3 w rock 2.mac

Developed situation (Drained)

MAC.ST.A.R.S 2000 - Rel. 2.0

MACcaferri STability Analysis of Reinforced Slopes
Harrison Grierson Tauranga

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Developed

Site: 24 Wainui Road, Ohope

Folder: Date : 08/01/2005

File: Section 7 Developed 2.mac

Checks according to: New Zealand Limit Equilibrium
Static design 120 years

SOIL PROPERTIES

Soil: S1 Description: Upper Soils - Weaker sandy silts

Cohesion Class ..... : Soil material factor c'		
Cohesion	[KN/m²] :	5.00
Friction Angle Class : Soil material factor phi		
Friction Angle :	[°] :	30.00
Ru value.....	:	0.00
Weight Class ..... : Soil unit mass		
Bulk unit weight - above GWT	[KN/m³] :	18.00
Bulk unit weight - below GWT	[KN/m³] :	18.00
Elastic Modulus	[KN/m²] :	0.00
Poisson's ratio	:	0.30

Soil: S2 Description: Deeper firm soils

Cohesion Class ..... : Soil material factor c'		
Cohesion	[KN/m²] :	20.00
Friction Angle Class : Soil material factor phi		
Friction Angle :	[°] :	40.00
Ru value.....	:	0.00
Weight Class ..... : Soil unit mass		
Bulk unit weight - above GWT	[KN/m³] :	18.00
Bulk unit weight - below GWT	[KN/m³] :	18.00
Elastic Modulus	[KN/m²] :	0.00
Poisson's ratio	:	0.30

STRATA PROFILES

Stratum: A Description: Developed Surface
Soil : S1

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
0.00	7.70	4.10	8.00	5.00	8.60	8.80	9.20
11.10	9.70	11.40	10.90	13.90	12.30	22.40	16.60
29.50	16.60	29.70	19.60	33.20	19.60	33.40	22.40
34.60	22.40	34.80	23.80	35.50	24.40	40.50	28.80
48.90	33.70	54.80	36.20	69.00	36.50		

Stratum: B Description: Stiffer Soils
Soil : S2

X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]	X [m]	Y [m]
0.00	2.50	18.50	11.80	27.10	16.55	29.50	16.55
29.60	18.00	32.20	19.55	33.20	19.55	33.25	20.00
35.20	22.50	54.70	33.00	69.00	33.50		

SURCHARGE LOADS

Distributed Loads : **BLDG** Description : proposed house
Class : Load factor
Magnitude . [KN/m²] = 10.00 Inclination angle [°] = 0.00
Abscissa .. [m] : from = 22.40 To = 33.20

CHECKS RESULTS

Global Stability Check :
Multiplier combination : Limit Equilibrium
Reinforcements active Forces according to Rigid Method
Stability analysis with circular surfaces according to Bishop's Method
Evaluated Safety Factor ..... : 1.872

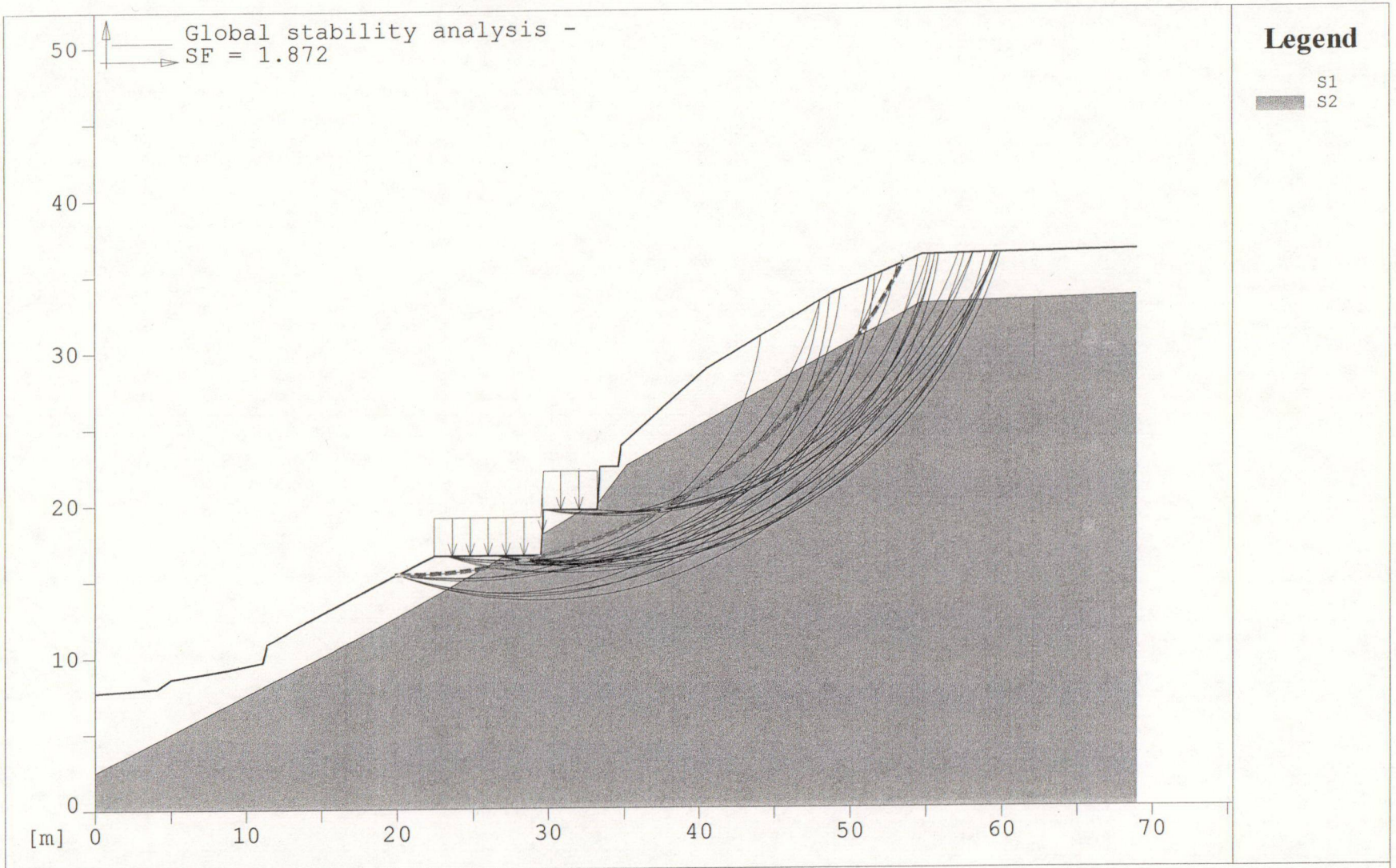
Surfaces searching range

Starting range, abscises [m]		Arrival range, abscises [m]	
First point	Second point	First point	Second point
20.00	33.00	36.00	60.00

Number of starting point on the starting segment : 5
Total number of trial surfaces ..... : 105
Minimum base length of slices..... [m] : 1.00
Superior limit search angle..... [°] : 0.00
Inferior limit search angle..... [°] : 0.00

Multiplier	Class
1.00	Soil material factor phi
1.00	Soil unit mass
1.00	Load factor
1.00	Stability factor
1.00	Pullout factor
1.00	Reinforcement breakage
1.00	Soil material facto cu
1.00	Soil material factor c'

Maccaferri assumes no responsibilities for the drawings and calculations it provides, as they must be intended as general indications to suggest the proper use of its products.



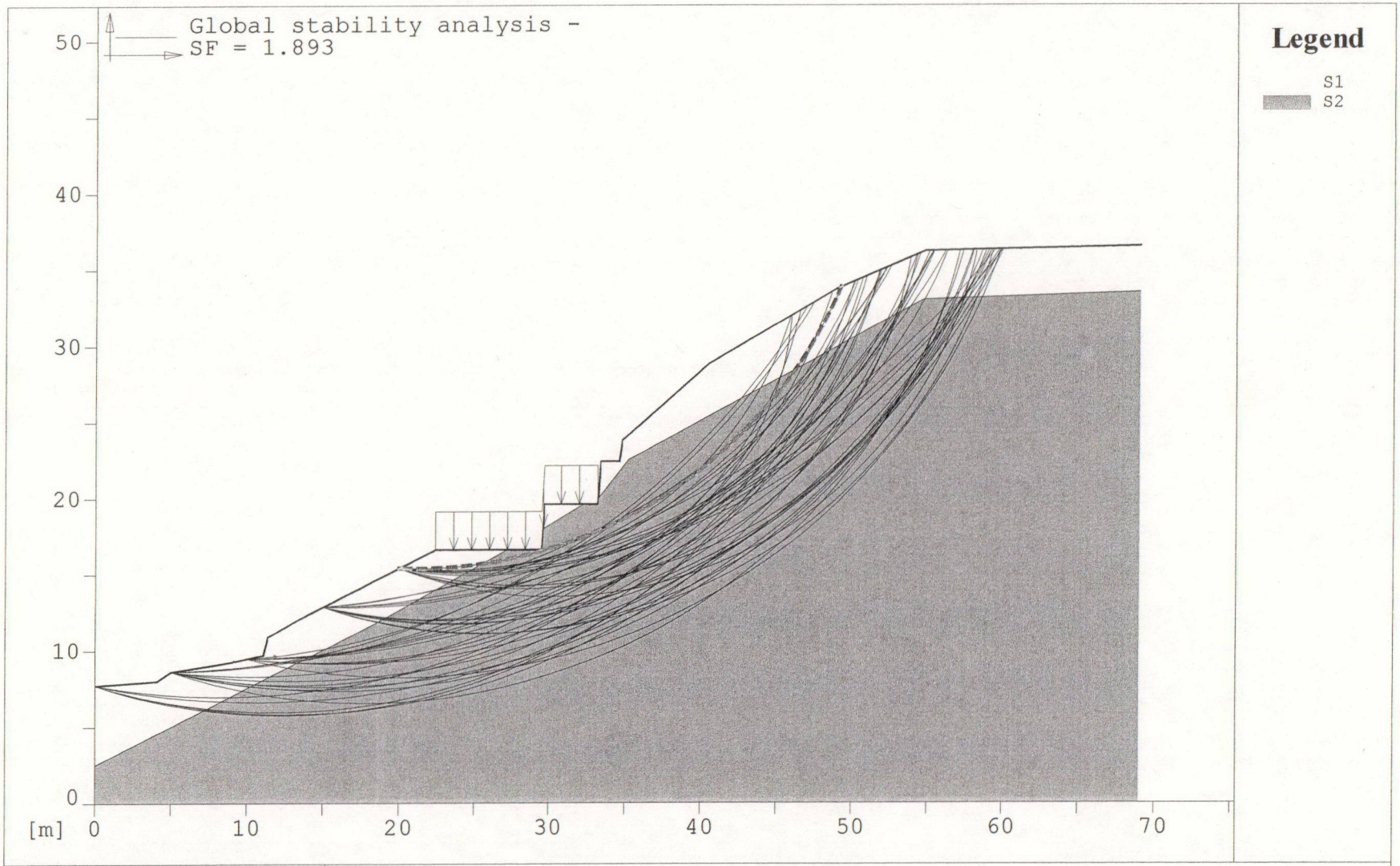
MacStARS 2000
Release 2.0 - Maccaferri
Stability Analysis
of Reinforced Slopes

Date: 08/01/2005
Folder:

Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Developed

Site: 24 Wainui Road, Ohope **File:** Section 7 Developed 2.mac



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Project Title: S Thornton - House Site Stability Analysis

Cross Section: Section 7 - Developed

Site: 24 Wainui Road, Ohope **File:** Section 7 Developed 2.mac

APPENDIX 3

June 2004 Harrison Grierson Driveway Report

HARRISON
GRIERSON

14 June 2004

Mr Steve Thornton
PO Box 3109
OHOPE

Dear Steve

Driveway Alignment and Retaining Walls
24 Wainui Road, Ohope

Please find enclosed our calculations, construction details, driveway plan and cross sections for the above project. A geotechnical investigation of the slope above the proposed driveway at cross section 4 has been undertaken.

Geotechnical Investigation

We have walked over the site above the proposed driveway and undertaken a topographical survey of the hillside. During our walkover we observed areas where small localised surface failures have occurred and that a track has been pushed into the side of the hill since our initial site visit.

Soil investigations comprising of two hand augured boreholes and five Scala Penetrometer tests along and adjacent to cross section 4 were undertaken, as shown on the enclosed site sketch. In addition a borelog and penetrometer previously undertaken on a neighbouring site were reviewed.

Borelog 1, (20/5/04), approximately 10m west of cross section 4 shows topsoil overlying sand and silt layers which overlay another topsoil layer at 0.7m deep followed by sandy silts containing gravel particles. Similarly, borelog 2 shows topsoil overlying sandy silts which overlay another topsoil layer at 1.1m deep followed by silt containing gravel particles.

Penetrometers 1, 2 and 3 indicate layers which have low to medium bearing strength in the upper 0.5m to 1.0m with bearing strength increasing below 1m. Penetrometer 4 has similar results with low bearing strength in the upper 1.8m including an area of lower bearing strength at 1.6m indicating a possible layer of topsoil.

Based on the above soil investigations, our survey and walkover of the site we conclude that the hillside has layers in the upper 0.5m to 1.0m with low bearing strength followed by firmer layers below this depth. This is highlighted by the presence of areas of shallow failure. The borelogs and penetrometer results also indicate some areas of the slope,

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ISO9001 Quality Assured

and the proposed driveway alignment, have been subject to either uncontrolled earthworks and/or have slip debris overlying original topsoil layers.

We have carried out an assessment of the proposed cutting to construct the driveway at the steepest part of the hillside, cross section 4, to determine the minimum embedment depth for a timber pole retaining wall to have an acceptable stability.

Our analysis considered the slope face in both dry and saturated conditions. If the slope were to remain dry at cross section 4 it would be necessary to have a 2.5m embedment for a 2.0m high wall to provide an acceptable slope stability, the retaining wall we have designed has a pole embeddment of 3.9m. If the upper soil layers were to become saturated, the slope would also have an acceptable global stability. However if the lower layers were to become saturated our analysis shows the slope stability would not be acceptable.

An analysis for overtopping of the proposed retaining walls was also undertaken and found that the slope has an unacceptable stability in the unsaturated condition, indicating overtopping of the wall may occur. Any overtopping of the wall could cause slips onto the proposed driveway, which will need to be cleared as part of the ongoing maintenance of the driveway.

Construction of the proposed driveway retaining walls will increase the overall slope stability, above that of its existing condition.

Our analysis of the slope above the driveway retaining walls has been carried out for the purpose of determining driveway retaining walls. Further slope stability analysis and a Geotechnical report will be required taking into account any future proposal cross sections, as part of any further development above the retaining wall.

Stabilising the upper low bearing strength soil layers above the retaining wall should be undertaken in conjunction with any proposed future development on the slope above the driveway.

Retaining Walls and Driveway Construction

We have carried out retaining wall designs for various heights, both above and below the proposed driveway alignment. The walls above the driveway require heavier members to support the slope than the walls which directly support the driveway.

Wall heights for design have been determined from the enclosed cross sections. The actual length of various height walls will need to be determined on site when earthworks operations are underway as will the position of stormwater cesspits and the final longitudinal gradients of the driveway. Our Whakatane office will be able to set out the proposed driveway centreline, and approximate design centreline levels if required.

During construction of the walls, soft layers caused by previous uncontrolled fillings or slips and/or topsoil may be encountered, necessitating the need to deepen piles. This is less likely to occur where retaining walls are positioned in cut situations.

In conjunction with construction activities the track above the proposed driveway alignment should be filled with compacted inorganic material to reinstate and stabilise the slope above the driveway.

Where filling is required topsoil and loose material should be stripped, slopes benched and inorganic fill compacted in layers in dry conditions.

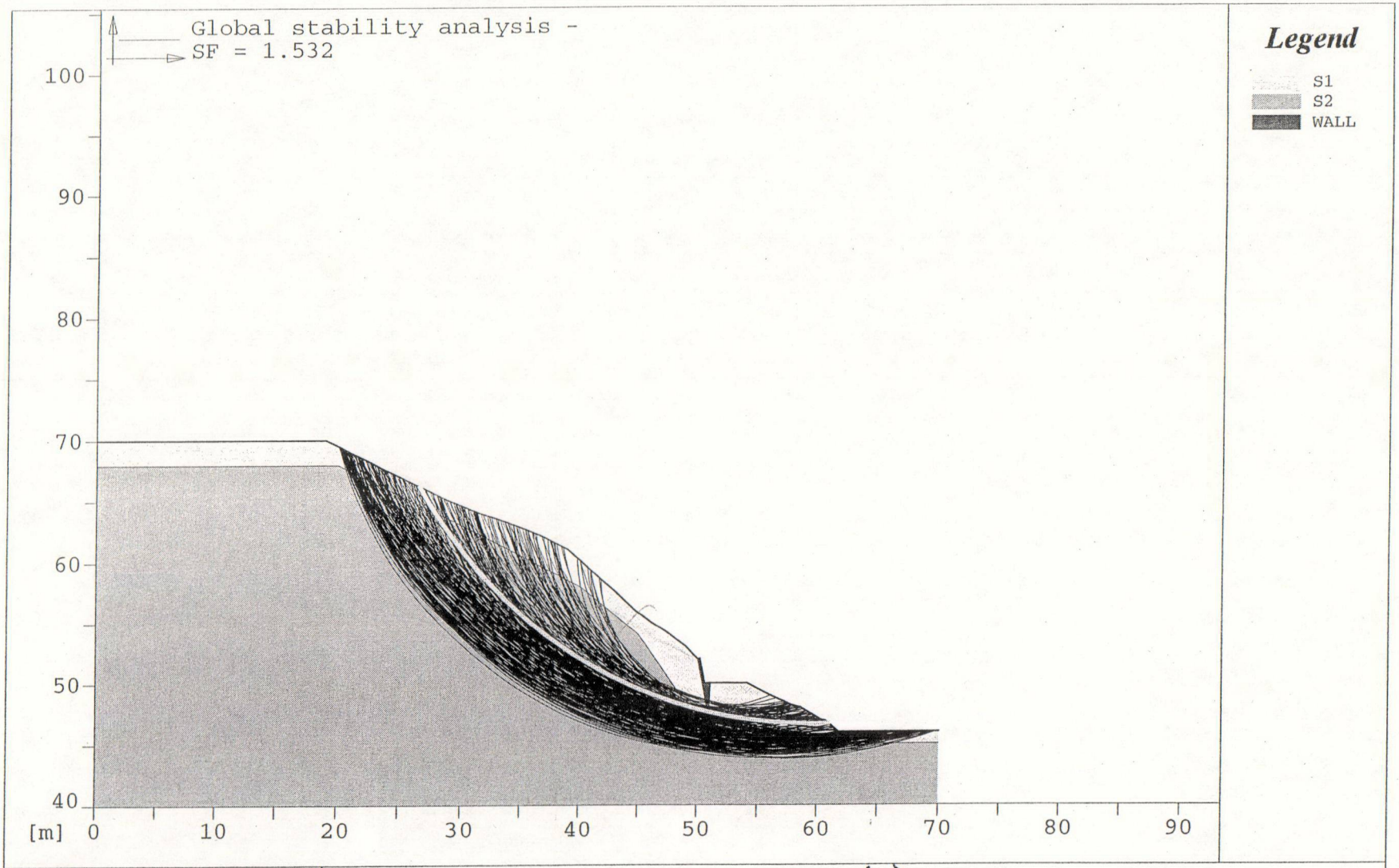
Should you have any queries, please contact us.

Yours faithfully
Harrison Grierson Consultants Limited

Gavin Moore
Senior Engineer

N:\71\11050\Phase 1\300 Comms\L02 Thornton.doc

Geotechnical Analysis and Soil Investigations



MacStARS 2000
Release 2.0 - Maccaferri
Stability Analysis
of Reinforced Slopes

Date: 05/26/2004

Folder:

Project Title: Dry condition.

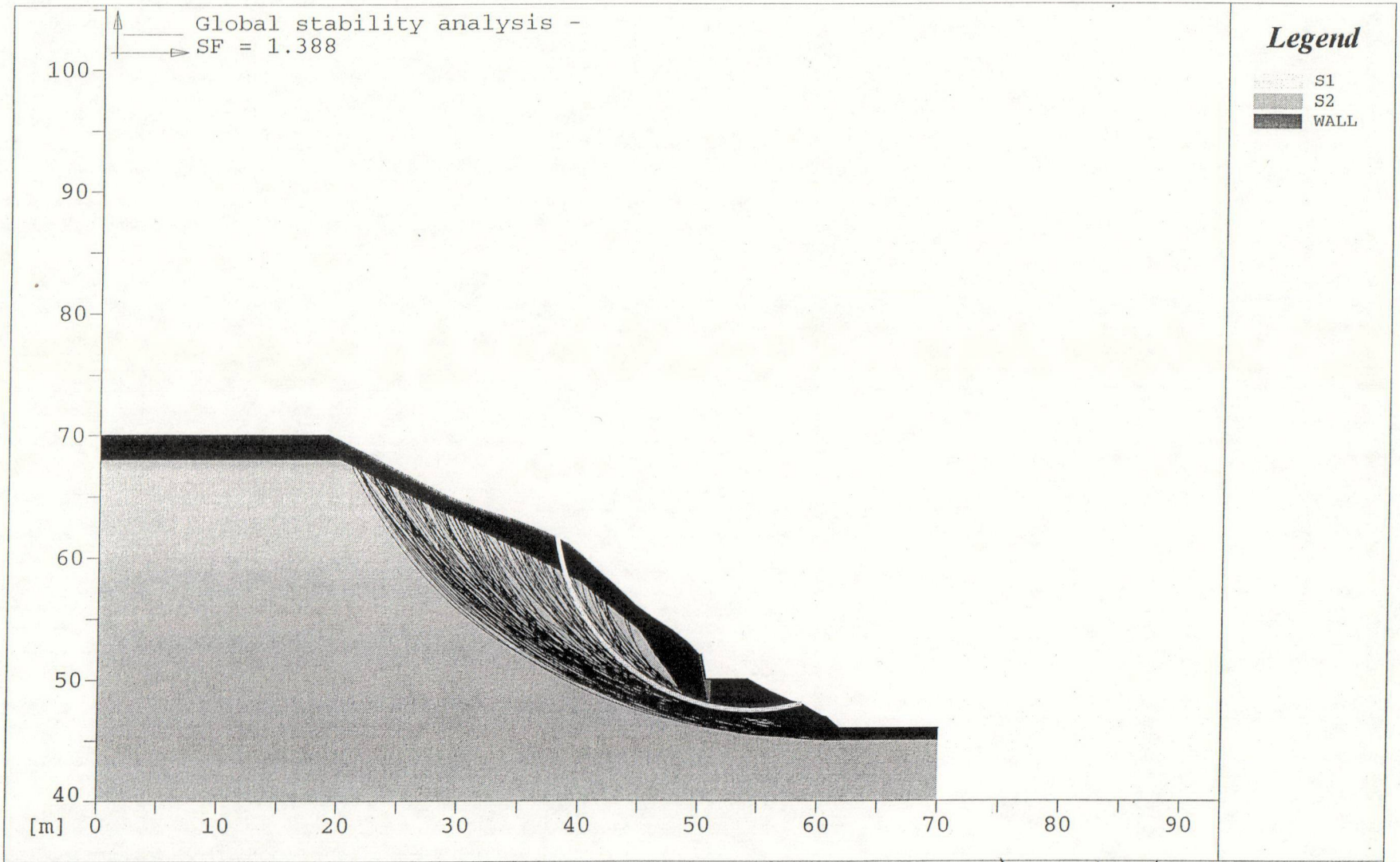
$\phi = 30^\circ$

$c = 5$

$\gamma = 18\ kN/m^3$.

Cross Section:

File: dway4DRY2.mac

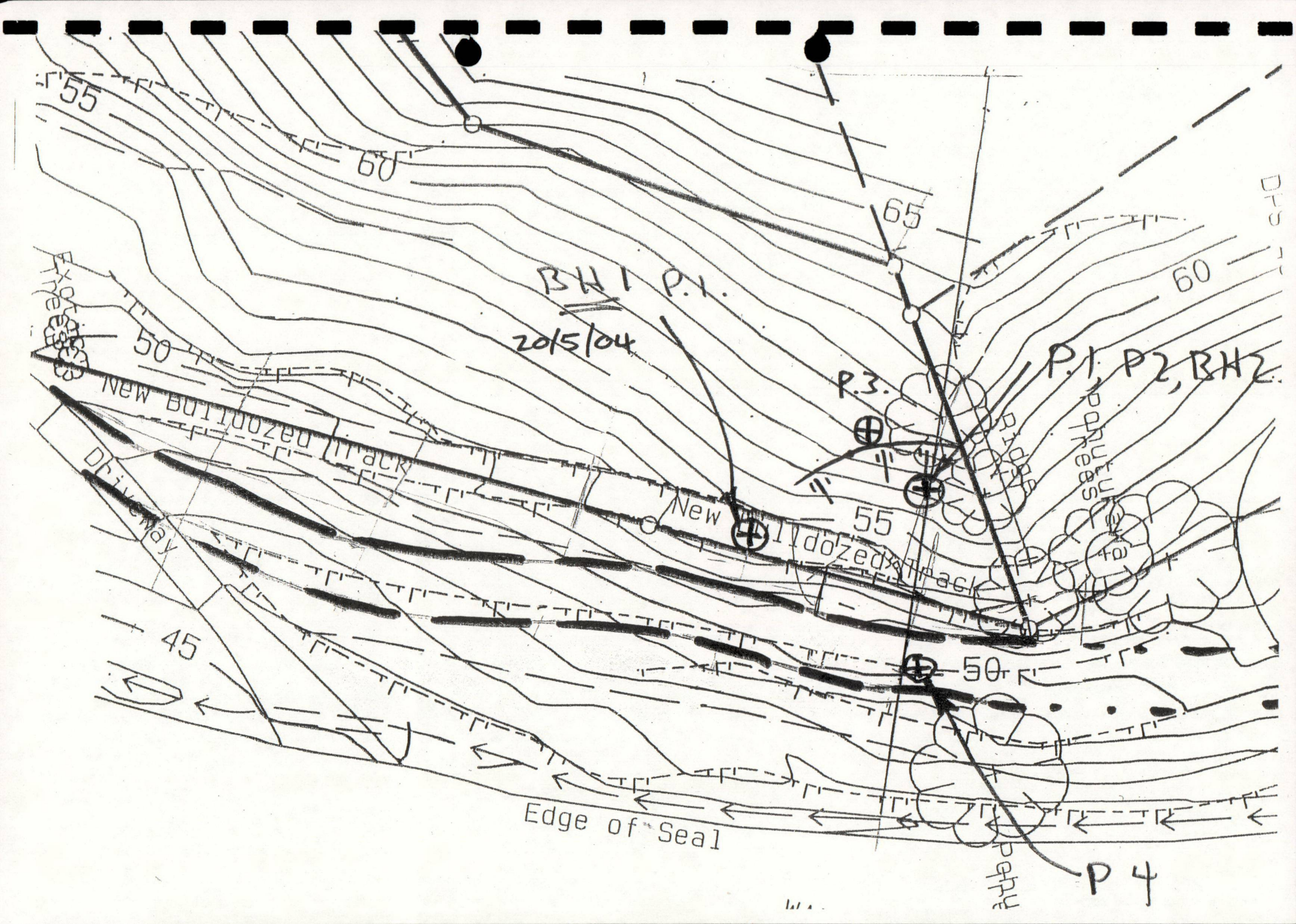


MacStARS 2000
Release 2.0 - Maccaferri
Stability Analysis
of Reinforced Slopes

Date: 05/26/2004
Folder:

Project Title: Top layer saturated.
$\phi = 30°$
$c = 5$
$\gamma = 18\ kN/m^3$

Cross Section:
File: dway4DRY2.mac


55
60
65
60
50
BH1 P.1
2015/04
P.3.
P.1, P2, BH2
New Bulldozed Track
New Bulldozed Track
Driveway
55
50
45
Edge of Seal
P 4

geolab
air, soil & water
laboratory services

CLIENT: Thornton

PROJECT: , 24 Wainui Road, Ohope

BOREHOLE No: HA1

Sheet 1 of 1

Drill Type:	Exposed cut and 50mm hand auger	Project No:		Logged By:	MAC
Drilled By:	Mike	Coordinates:		Checked By:	
Date Started:	20/5/04	Ground Elevation:		Shear Vane No:	
Date Finished:	20/5/04	Water Level:	2.0m		

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering
	0.0		TOPSOIL, black moist, with root fragments
			silt SAND (fg) light brown to brown
	0.5		sand SILT, with rusty brown patches surrounding soft rock
			TOPSOIL, black and moist with root fragments
			sand SILT, (fg) light brown
	1.0		
			At 1.2m rusty brown patches were present
			At 1.3m orangey brown, sand SILT (fg) with traces of angular 5mm soft rock gravels, which could be crushed with finger nails
	1.5		At 1.5m mixied gravels from 5mm to 10mm angular shape, grey could not be crushed by fingers
			At 1.7m rusty bown, patches present
Groundwater Hit	2.0		At 2.2m on removal < 10% of core remained and was hard too auger
			END OF BORE. 2.2 METRES. Groundwater hit, too hard to hand auger
	2.5		
	3.0		

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)
SHEAR STRENGTH O v
REMOULDED SHEAR ⊙ r
POCKET PENETROMETER O p
50 100 150 (kPa)

LABORATORY TESTS

SOIL BH.GPJ GEOLAB.GDT 20/05/04

, . Phone: 07 578 0023

geolab
air, soil & water laboratory services

CLIENT: Thornton

PROJECT: , 24 Wainui Road, Ohope

BOREHOLE No: HA 2

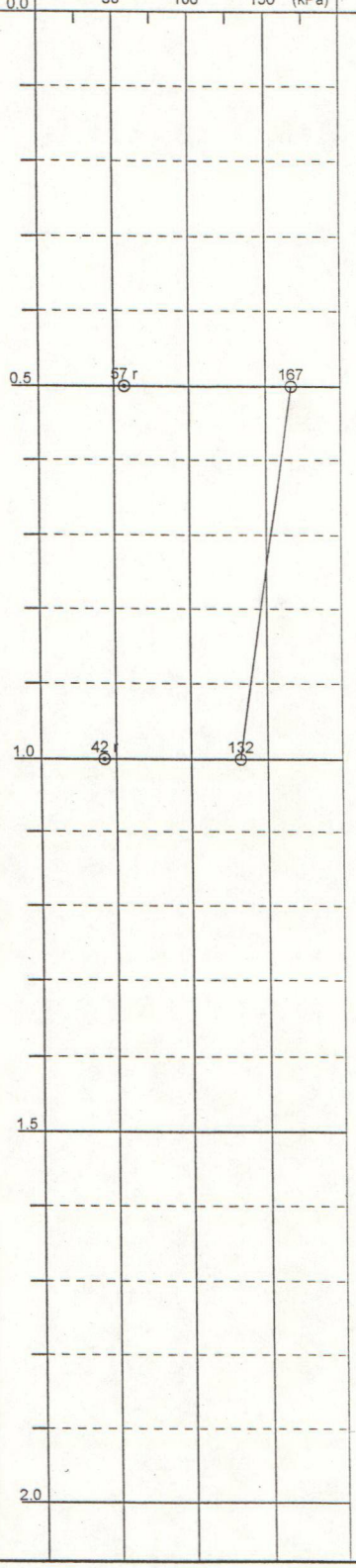
Sheet 1 of 1

Drill Type:	50 mm Hand Auger	Project No:		Logged By:	MAC
Drilled By:	Mike	Coordinates:		Checked By:	
Date Started:	27/5/04	Ground Elevation:		Shear Vane No:	
Date Finished:	27/5/04	Water Level:			

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering
	0.0		TOPSOIL, dark black, moist
			sandy SILT, slightly moist, low plasticity, crumbly
	0.5		
	1.0		topsoil SILT, light brown, with some traces of topsoil, and tree roots ranging from 30mm to 10mm in length
			SILT with traces of 5mm gravels (angular) light brown, crumbly
			with a large gravel 20mm in length (smooth) and specks of white mouable sand (fg) SILT
	1.5		END OF BORE. 1.5 METRES. Something. solid hit, too hard too penetrate
	2.0		

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH ○ v
REMOULDED SHEAR ⊙ r
POCKET PENETROMETER ○ p
50 100 150 (kPa)



LABORATORY TESTS

SOIL BH GPJ GEOLAB.GDT 28/05/04

HARRISON GRIERSON CONSULTANTS LTD

SCALAPENETROMETER RESULT SHEET

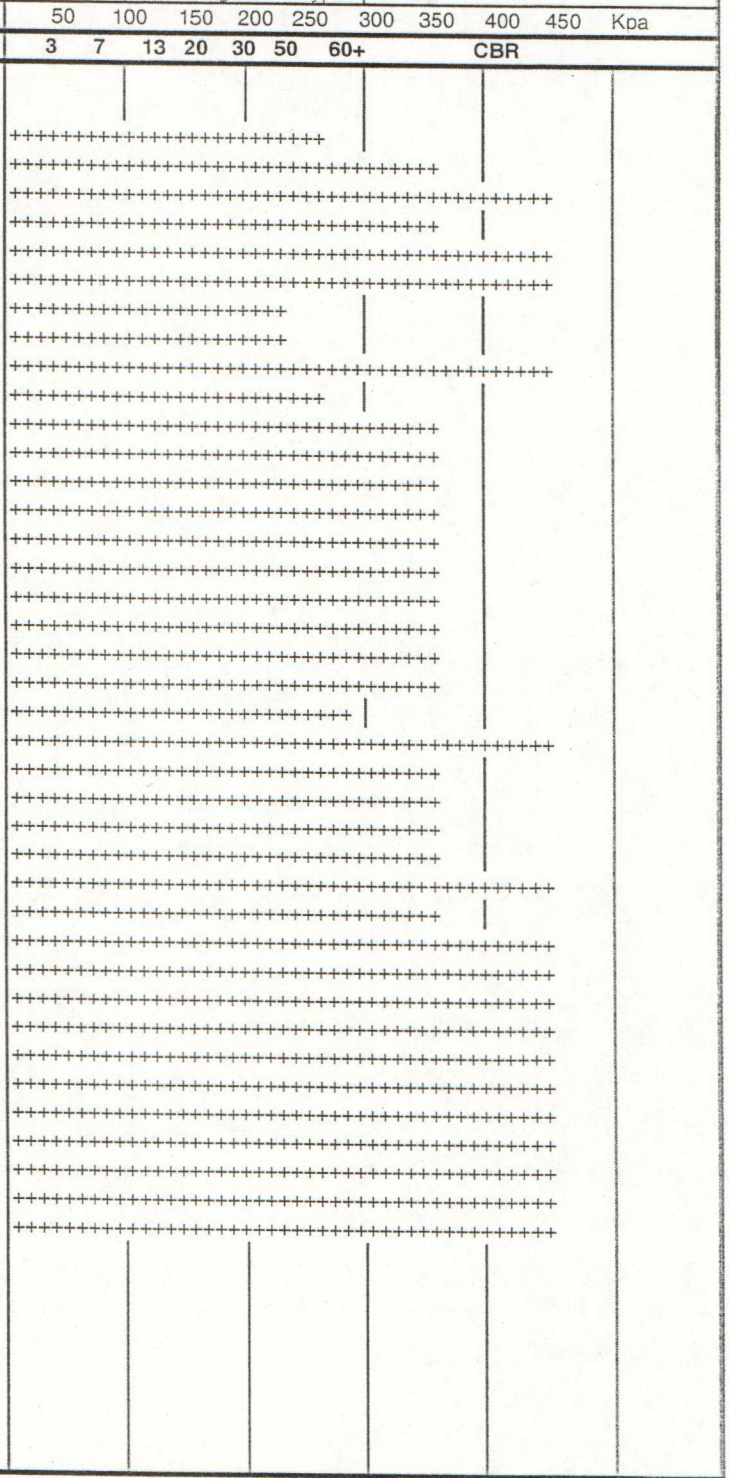
CLIENT: Thornton

PROJECT: 24 Wainui Road

File No 71 11050
Date tested 20/05/04
Tested by MC
Printed

NB safety factor 1.6 -- 5. depending on soil type

Reading	Blows	diff	Pen/blow	Bearing	Depth
P1 at 1m					
0.86	0		ROD		1.00 m
0.76	10	0.100	10 mm	250 kPa	1.10 m
0.65	20	0.110	6 mm	340 kPa	1.21 m
0.56	20	0.090	5 mm	430 kPa	1.30 m
0.43	20	0.130	7 mm	340 kPa	1.43 m
0.33	20	0.100	5 mm	430 kPa	1.53 m
1.40	0	NEW	ROD	430 kPa	1.53 m
1.17	20	0.230	12 mm	225 kPa	1.76 m
0.92	20	0.250	13 mm	225 kPa	2.01 m
0.92	1	0.005	5 mm	430 kPa	2.02 m
0.71	20	0.205	10 mm	250 kPa	2.22 m
0.59	20	0.120	6 mm	340 kPa	2.34 m
0.40	30	0.190	6 mm	340 kPa	2.53 m
0.27	20	0.130	7 mm	340 kPa	2.66 m
1.27	0	NEW	ROD	340 kPa	2.66 m
1.14	20	0.130	7 mm	340 kPa	2.79 m
0.96	30	0.180	6 mm	340 kPa	2.97 m
0.84	20	0.120	6 mm	340 kPa	3.09 m
0.66	30	0.180	6 mm	340 kPa	3.27 m
0.55	20	0.110	6 mm	340 kPa	3.38 m
1.55	0	NEW	ROD	340 kPa	3.38 m
1.39	20	0.160	8 mm	275 kPa	3.54 m
1.28	20	0.110	5 mm	430 kPa	3.65 m
1.16	20	0.120	6 mm	340 kPa	3.77 m
1.04	20	0.120	6 mm	340 kPa	3.89 m
0.93	20	0.110	6 mm	340 kPa	4.00 m
0.81	20	0.120	6 mm	340 kPa	4.12 m
0.71	20	0.100	5 mm	430 kPa	4.22 m
0.60	20	0.110	6 mm	340 kPa	4.33 m
0.50	20	0.100	5 mm	430 kPa	4.43 m
0.40	20	0.100	5 mm	430 kPa	4.53 m
0.30	20	0.100	5 mm	430 kPa	4.63 m
1.10	0	NEW	ROD	430 kPa	4.63 m
0.94	30	0.160	5 mm	430 kPa	4.79 m
0.85	20	0.090	5 mm	430 kPa	4.88 m
0.75	20	0.100	5 mm	430 kPa	4.98 m
0.65	20	0.100	5 mm	430 kPa	5.08 m
0.55	20	0.100	5 mm	430 kPa	5.18 m
0.46	20	0.090	5 mm	430 kPa	5.27 m
0.37	20	0.090	5 mm	430 kPa	5.36 m



This spreadsheet has been developed with reference to the following publication

"DETERMINATION OF ALLOWABLE BEARING PRESSURE UNDER SMALL STRUCTURES"

Author : M,J, Stockwell B,E, C,ENG. M.I.C.E. (Member)
Published by New Zealand Engineering (32,6) 15 June 1977

HARRISON GRIERSON CONSULTANTS LTD

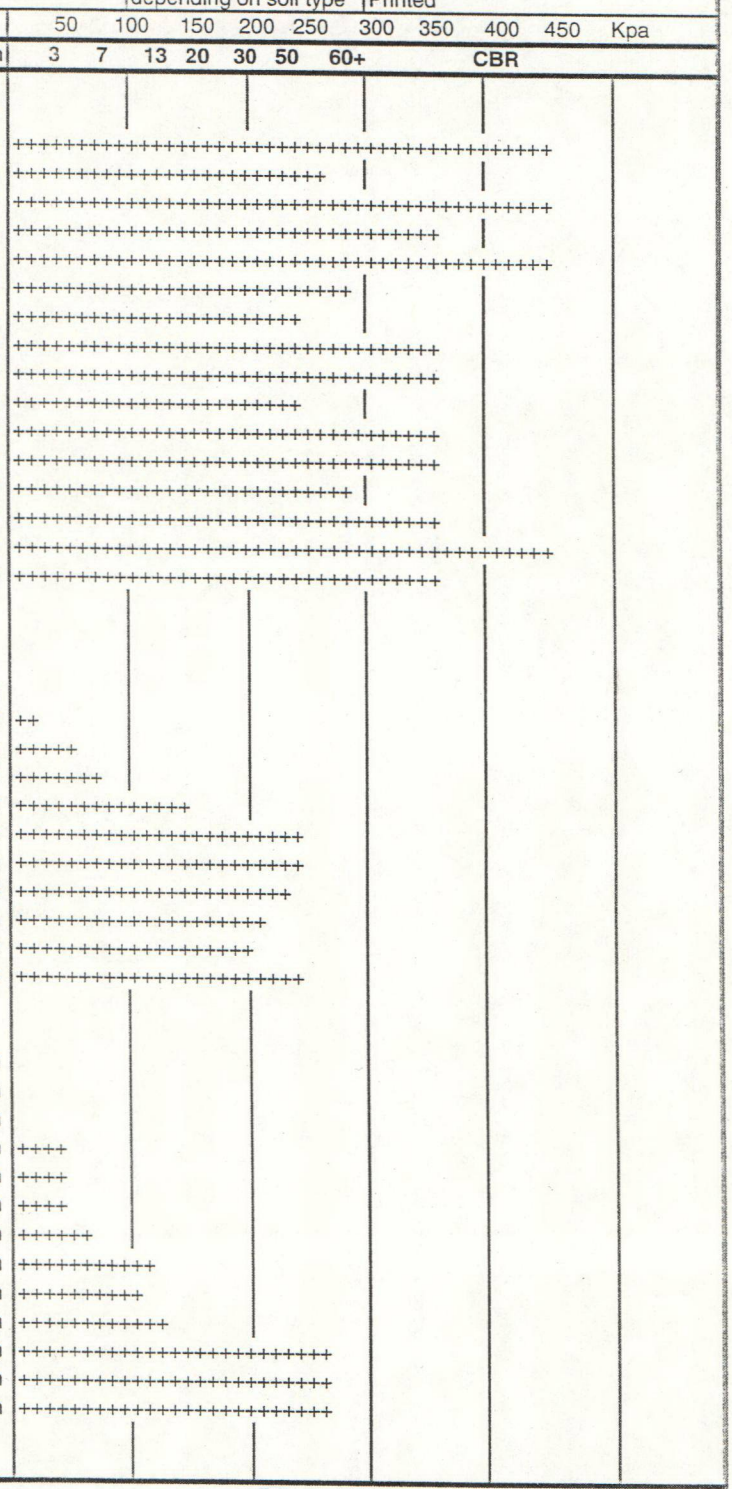
SCALAPENETROMETER RESULT SHEET

File No 71 11050
Date tested 27/05/04
Tested by MC
Printed

CLIENT: Thornton
PROJECT: 24 Wainui Road

NB safety factor 1.6 -- 5. depending on soil type

Reading	Blows	diff	Pen/blow	Bearing	Depth
P1 at 1.5m					
0.40	0		ROD		1.50 m
0.35	10	0.050	5 mm	430 kPa	1.55 m
0.25	10	0.100	10 mm	250 kPa	1.65 m
1.25	0	NEW	ROD	430 kPa	1.55 m
1.13	20	0.120	6 mm	340 kPa	1.67 m
1.05	20	0.080	4 mm	430 kPa	1.75 m
0.88	20	0.170	9 mm	275 kPa	1.92 m
0.67	20	0.210	11 mm	238 kPa	2.13 m
0.54	20	0.130	7 mm	340 kPa	2.26 m
0.43	20	0.110	6 mm	340 kPa	2.37 m
0.27	15	0.160	11 mm	238 kPa	2.53 m
0.24	5	0.030	6 mm	340 kPa	2.56 m
1.24	0	NEW	ROD	340 kPa	2.56 m
1.00	30	0.240	8 mm	275 kPa	2.80 m
0.82	30	0.180	6 mm	340 kPa	2.98 m
0.72	20	0.100	5 mm	430 kPa	3.08 m
0.55	30	0.170	6 mm	340 kPa	3.25 m
P2 alongside P1					
0.88	0		ROD		0.00 m
0.73	1	0.150	150 mm	27 kPa	0.15 m
0.66	1	0.070	70 mm	50 kPa	0.22 m
0.53	3	0.130	43 mm	78 kPa	0.35 m
0.41	5	0.120	24 mm	140 kPa	0.47 m
0.30	10	0.110	11 mm	238 kPa	0.58 m
1.30	0	NEW	ROD	238 kPa	0.58 m
1.24	5	0.060	12 mm	225 kPa	0.64 m
1.03	15	0.210	14 mm	200 kPa	0.85 m
0.80	15	0.230	15 mm	190 kPa	1.08 m
0.63	15	0.170	11 mm	238 kPa	1.25 m
P3 above P1 at top of scarp					
0.80	0		ROD		0.00 m
0.60	1	0.200	200 mm	< 10kPa	0.20 m
0.40	1	0.200	200 mm	< 10kPa	0.40 m
0.32	1	0.080	80 mm	44 kPa	0.48 m
0.24	1	0.080	80 mm	44 kPa	0.56 m
1.15	0	NEW	ROD	44 kPa	0.56 m
0.90	5	0.250	50 mm	68 kPa	0.81 m
0.58	11	0.320	29 mm	115 kPa	1.13 m
0.42	5	0.160	32 mm	100 kPa	1.29 m
0.26	6	0.160	27 mm	125 kPa	1.45 m
0.25	1	0.010	10 mm	250 kPa	1.46 m
0.24	1	0.010	10 mm	250 kPa	1.47 m
0.23	1	0.010	10 mm	250 kPa	1.48 m



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HARRISON GRIERSON CONSULTANTS LTD

SCALAPENETROMETER RESULT SHEET

CLIENT: Thornton

PROJECT: 24 Wainui Road

File No 71 11050
Date tested 27/05/04
Tested by MC
Printed

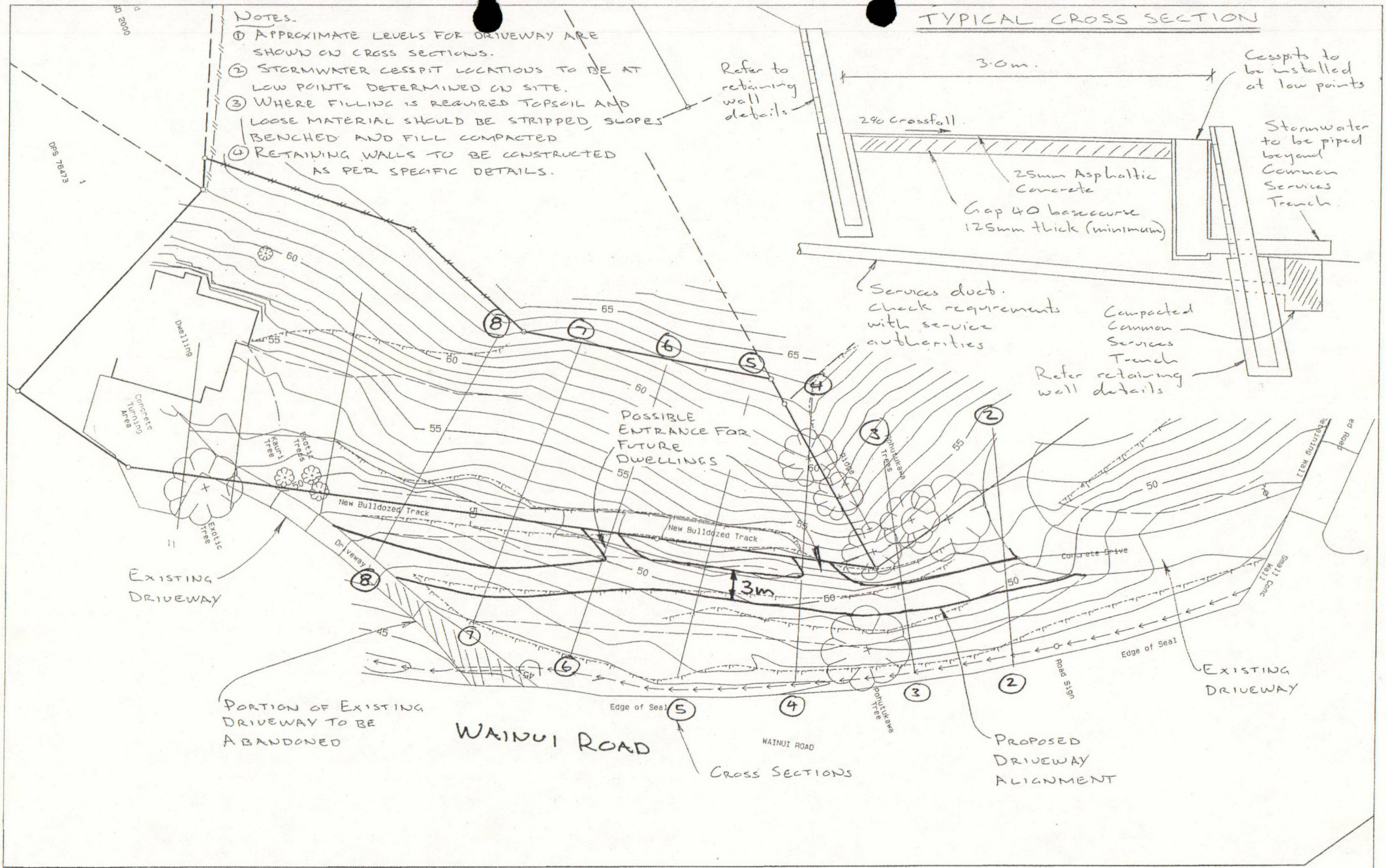
NB safety factor 1.6 -- 5. depending on soil type

Reading	Blows	diff	Pen/blow	Bearing	Depth	50 100 150 200 250 300 350 400 450 Kpa 3 7 13 20 30 50 60+ CBR
P4 below P1 at top of scarp						
0.93	0		ROD		0.00 m	
0.80	1	0.130	130 mm	30 kPa	0.13 m	+++
0.69	1	0.110	110 mm	34 kPa	0.24 m	+++
0.42	3	0.380	127 mm	31 kPa	0.51 m	+++
0.22	3	0.200	67 mm	51 kPa	0.71 m	+++++
1.22	0	NEW	ROD	51 kPa	0.71 m	+++++
0.94	5	0.280	56 mm	62 kPa	0.99 m	++++++
0.55	9	0.390	43 mm	78 kPa	1.38 m	+++++++
0.39	7	0.160	23 mm	145 kPa	1.54 m	+++++++++++++++
0.32	1	0.070	70 mm	50 kPa	1.61 m	+++++
0.28	1	0.040	40 mm	85 kPa	1.65 m	++++++++
1.28	0	NEW	ROD	85 kPa	1.65 m	++++++++
1.08	10	0.200	20 mm	160 kPa	1.85 m	++++++++++++++++
1.01	5	0.070	14 mm	200 kPa	1.92 m	++++++++++++++++++++
0.87	10	0.140	14 mm	200 kPa	2.06 m	++++++++++++++++++++
0.75	10	0.120	12 mm	225 kPa	2.18 m	++++++++++++++++++++++
0.72	2	0.030	15 mm	190 kPa	2.21 m	++++++++++++++++++++
0.68	2	0.040	20 mm	160 kPa	2.25 m	++++++++++++++++
0.66	2	0.020	10 mm	250 kPa	2.27 m	++++++++++++++++++++++++++

This spreadsheet has been developed with reference to the following publication

"DETERMINATION OF ALLOWABLE BEARING PRESSURE UNDER SMALL STRUCTURES"

Author : M,J, Stockwell B,E, C,ENG. M.I.C.E. (Member)
Published by New Zealand Engineering (32,6) 15 June 1977


NOTES.
① APPROXIMATE LEVELS FOR DRIVEWAY ARE SHOWN ON CROSS SECTIONS.
② STORMWATER CESSPIT LOCATIONS TO BE AT LOW POINTS DETERMINED ON SITE.
③ WHERE FILLING IS REQUIRED TOPSOIL AND LOOSE MATERIAL SHOULD BE STRIPPED, SLOPES BENCHED AND FILL COMPACTED
④ RETAINING WALLS TO BE CONSTRUCTED AS PER SPECIFIC DETAILS.
TYPICAL CROSS SECTION
3.0m.
Cesspits to be installed at low points
2% Crossfall
Refer to retaining wall details
Stormwater to be piped beyond Common Services Trench
25mm Asphaltic Concrete
Gap 40 basecourse 125mm thick (minimum)
Services duct. Check requirements with service authorities
Compacted Common Services Trench
Refer retaining wall details
POSSIBLE ENTRANCE FOR FUTURE DWELLINGS
EXISTING DRIVEWAY
PORTION OF EXISTING DRIVEWAY TO BE ABANDONED
WAINUI ROAD
CROSS SECTIONS
PROPOSED DRIVEWAY ALIGNMENT
EXISTING DRIVEWAY
Dwelling
Concrete Turning Area
Exotic Tree
Kauri Tree
Exotic Trees
New Bulldozed Track
Driveway
Pohutukawa Tree
Concrete Drive
Small Concrete Wall
Edge of Seal
Road sign
3m
DPS 76473
SURVEYED BY:
DRAWN BY:
DATE SURVEYED:
DATE PLOTTED: 11 JUN 2004
SORMAP REF: 676
CAD REFERENCE:
CAD XREF'S:
DESIGNED:
APPROVED:
CHECKED:
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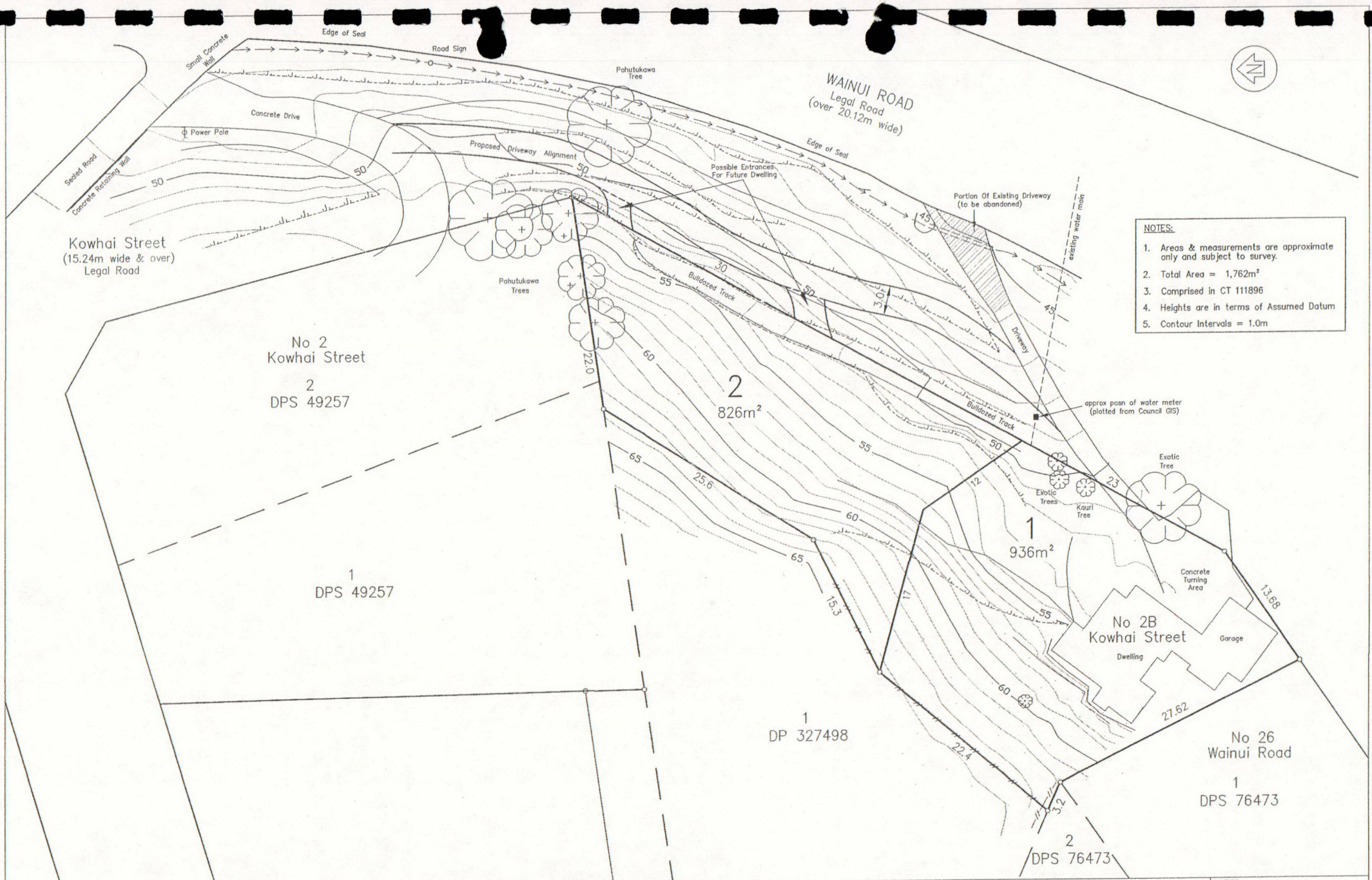
CONSULTING ENGINEERS SURVEYORS PLANNERS
PROJECT: THORNTON
24 WAINUI ROAD
OHOPE.
TITLE: PROPOSED DRIVEWAY
PLAN AND TYPICAL SECTION
REF AMENDMENTS BY DATE
PROJECT No: 7111050
DRAWING No: 11050-01
REV
ORIGINAL SCALE: 1:250
A2
REDUCED SCALE:

DRAWINGS

Survey Plan
Brown Day Architects Drawings



REF	AMENDMENT	BY	DATE

DESIGNED: BWP DATE: 02/05 SIGNATURE:
DRAWN: DJC DATE: 02/05 SIGNATURE:
CHECKED: DATE: SIGNATURE:
APPROVED: DATE: SIGNATURE:

PLOT DATE: 01 FEB 2005
CAD REF:
CAD XREF:
SURVEY BY:
SURVEY DATE:
SDR REF:

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CONSULTING ENGINEERS SURVEYORS PLANNERS
17 Pyne Street, Whakatane - Ph. 07 308 5478 - Fax. 07 308 4907

PROJECT:
S & K THORNTON
2B KOWHAI STREET
OHOPE

TITLE:
PROPOSED SUBDIVISION OF
LOT 2 DP 327498 &
LOT 25 DPS 9167

PLOT STATUS:
PROJECT No: 7111050
SCALES: 1:250
A2
DRAWING No: 11050-SC02
REV

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ORIGINAL DRAWING SIZE IN MM.

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17/06/2005

WAINUI ROAD
Legal Road
(over 20.12m wide)

Portion Of Existing Driveway (to be abandoned)

existing water main

Edge of Seal

Ohutukawa Tree

45

45

Driveway

approx posn of water meter (plotted from Council GIS)

50

50

45.2

BOUNDARY

Bulldozed Track

31.5

Bulldozed Track

55

2000

50

Exotic Trees

Kauri Tree

12.0 BOUNDARY

Ohutukawa Trees

BOUNDARY

6001

1045m[2]

60

22.0

60

55

BOUNDARY

25.6

2099

17.0 BOUNDARY

65

65

BOUNDARY

7.7

(15.36)

7.7

60

22.4

BROWN · DAY
ARCHITECTS

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PH (09) 638 8989 Fax (09) 638 8982
E-mail: architects@brownday.co.nz

Project:
PROPOSED HOUSE
AT
24 WAINUI ROAD
OHOPE

DRAWING TITLE:
PROPOSED SITE PLAN

DESIGN:	JOB NO:	SCALE: (A1 SIZE DWG)
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DRAWN:	CAD FILE:	SCALE: (A3 SIZE DWG)
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DRAWING:		REVISION:
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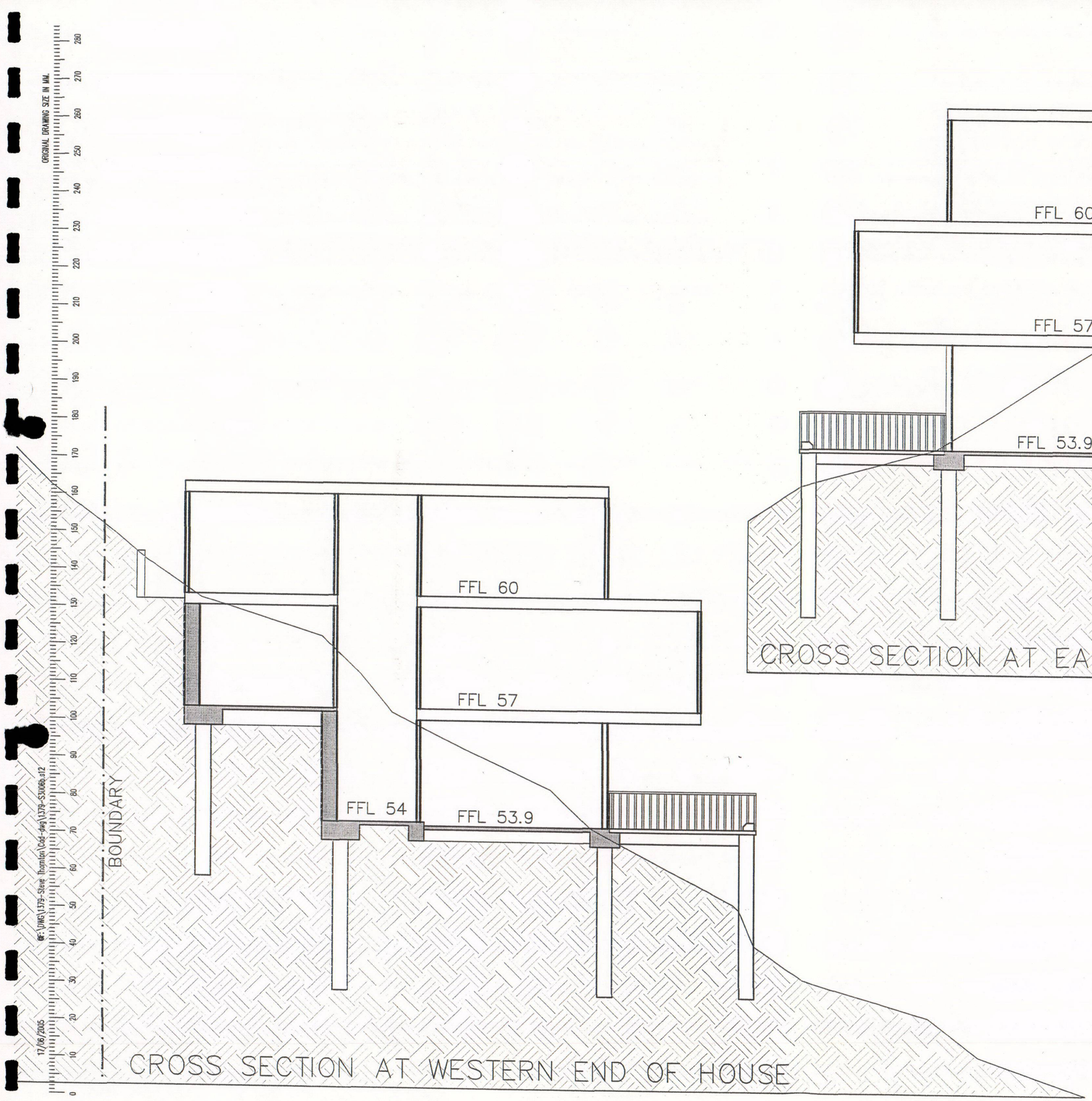
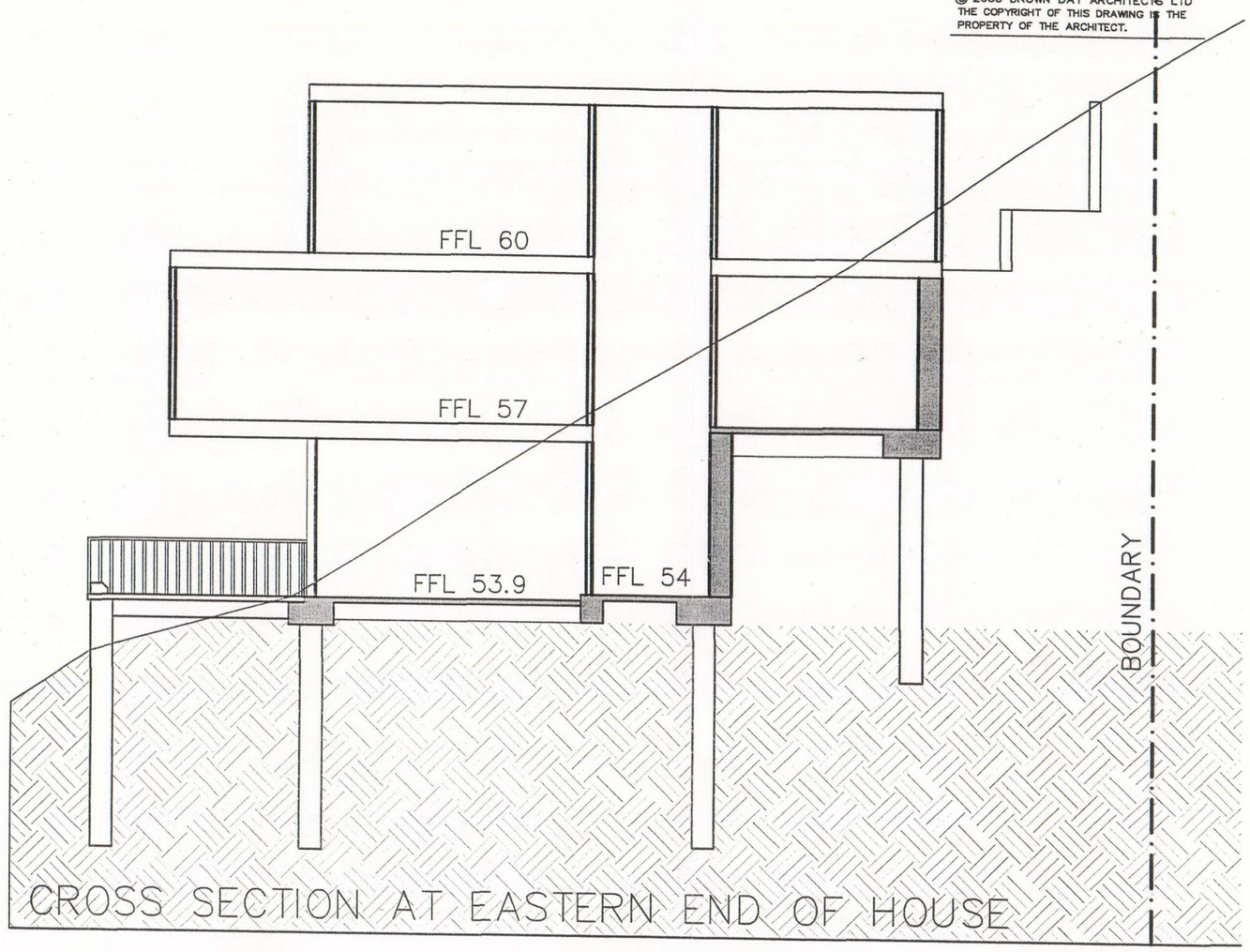


CROSS SECTION AT WESTERN END OF HOUSE



CROSS SECTION AT EASTERN END OF HOUSE

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Project:

PROPOSED HOUSE
AT
24 WAINUI ROAD
OHOPE

DRAWING TITLE:

CROSS SECTIONS

DESIGN:	JOB NO:	SCALES: (A1 SIZE DWG)
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DRAWN:	CAD FILE:	SCALES: (A3 SIZE DWG)
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DRAWING: S30.06 REVISION: (-)

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17/06/2005

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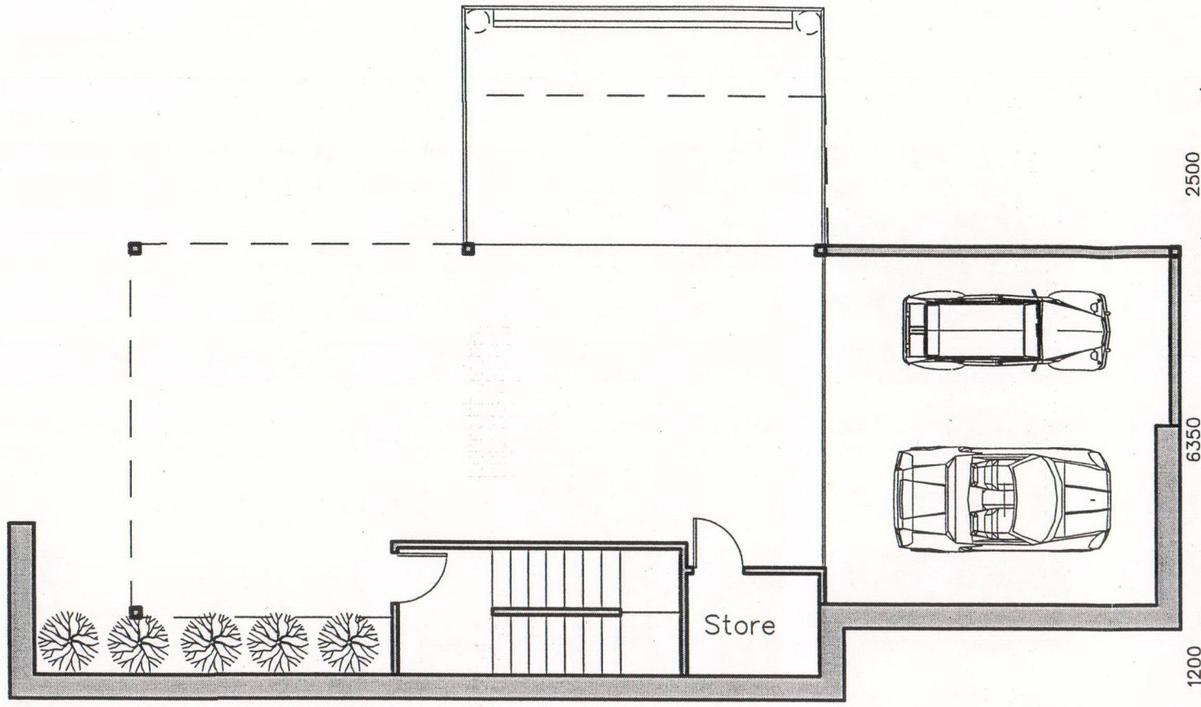
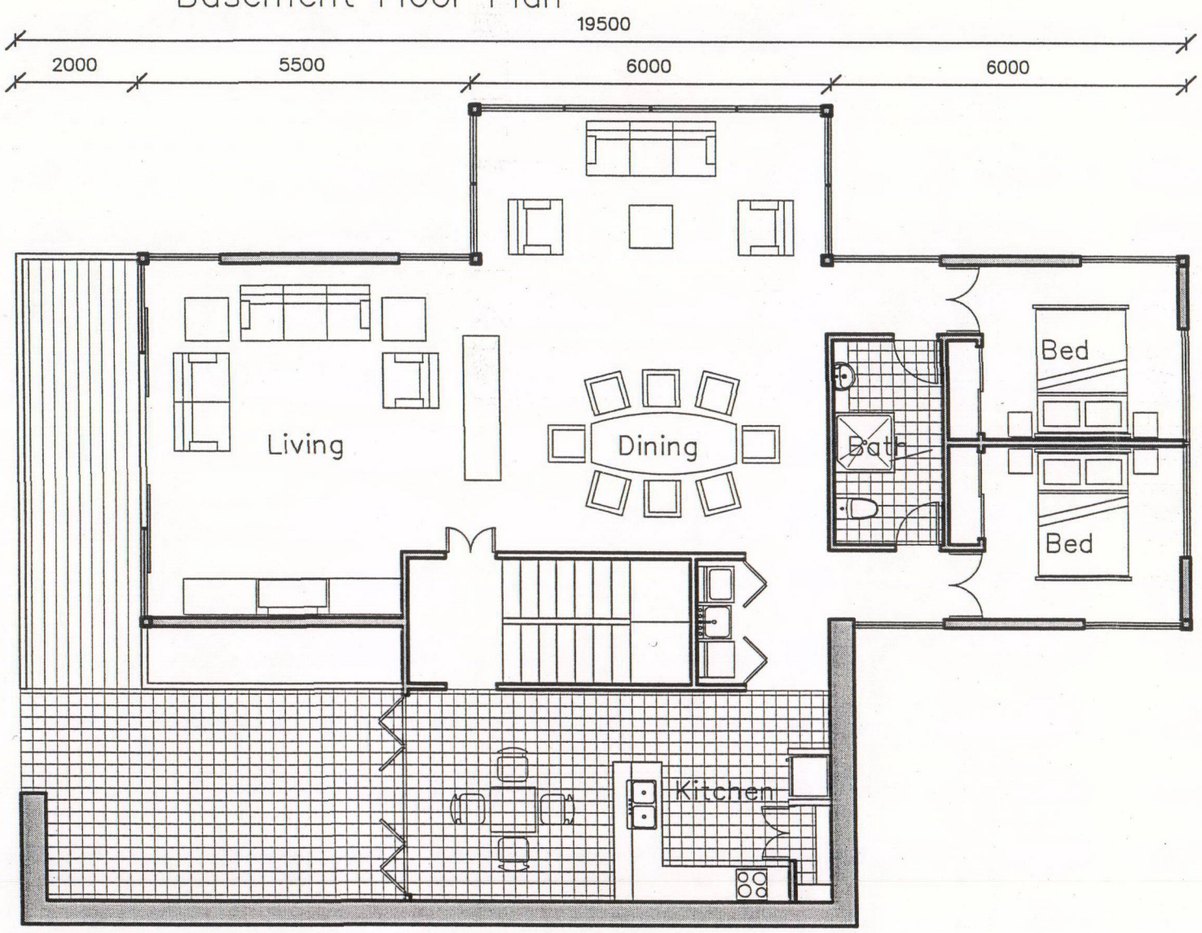
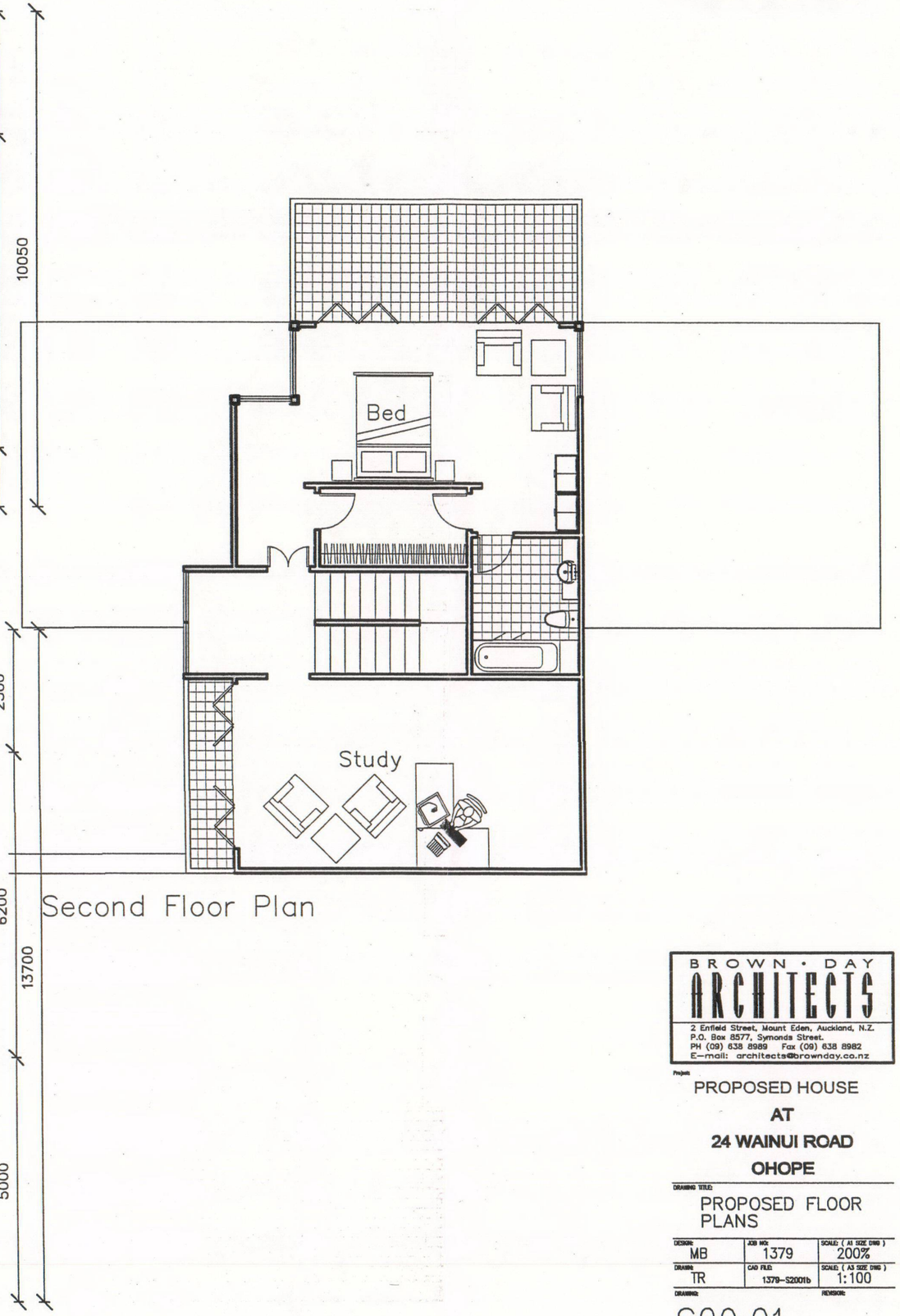
17/06/2005



Basement Floor Plan



First Floor Plan



Second Floor Plan

19500
2000
5500
6000
6000

2500
10050
6350
1200
2500
6200
13700
5000

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E-mail: architects@brownday.co.nz

Project:
PROPOSED HOUSE
AT
24 WAINUI ROAD
OHOPE

DRAWING TITLE:
PROPOSED FLOOR PLANS

DESIGN:	JOB NO:	SCALE: (A1 SIZE DWG)
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DRAWING: S20.01 REVISION: (-)

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ORIGINAL DRAWING SIZE IN MM.

WAINUI ROAD
Legal Road
(over 20.12m wide)

Drawings to Show
- Debris wall position
- Drain positions.

Portion Of Existing Driveway (to be abandoned)
existing water main
Edge of Seal
Shutukawa Tree
45
45
Driveway
approx posn of water meter (plotted from Council GIS)
50
50
45.2
BOUNDARY
Bulldozed Track
31.5
Bulldozed Track
55
BOUNDARY
Exotic Trees
Kauri Tree
50
12.0 BOUNDARY
Shutukawa Trees
60
6001
1045m[2]
22.0
60
55
BOUNDARY
25.6
4099
65
65
BOUNDARY
7.7
(15.36)
17.0 BOUNDARY
60
Debris Wall
22.4

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E-mail: architects@brownday.co.nz

Project:
PROPOSED HOUSE
AT
24 WAINUI ROAD
OHOPE

DRAWING TITLE:
PROPOSED SITE PLAN

DESIGN:	JOB NO:	SCALE: (A1 SIZE DWG)
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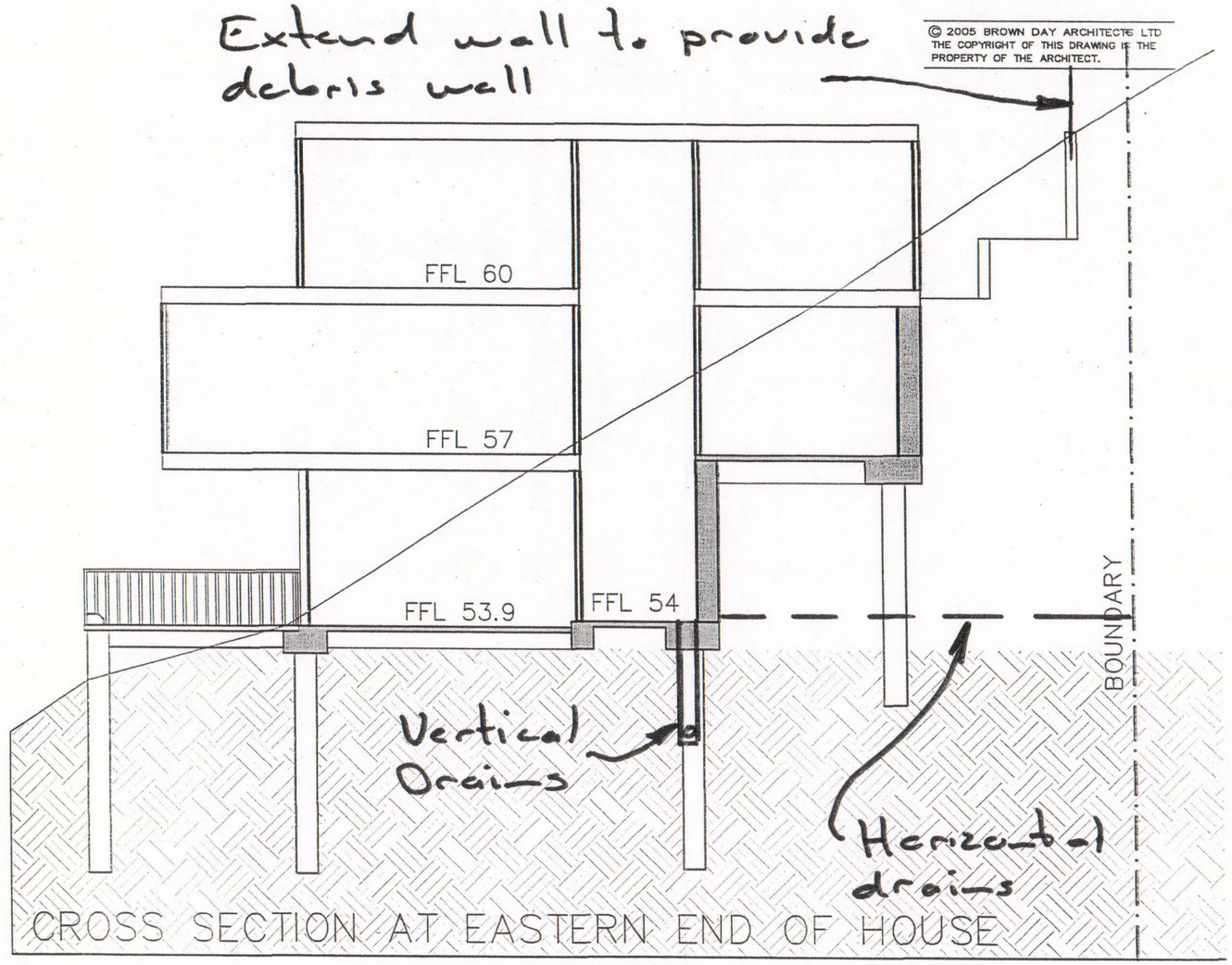
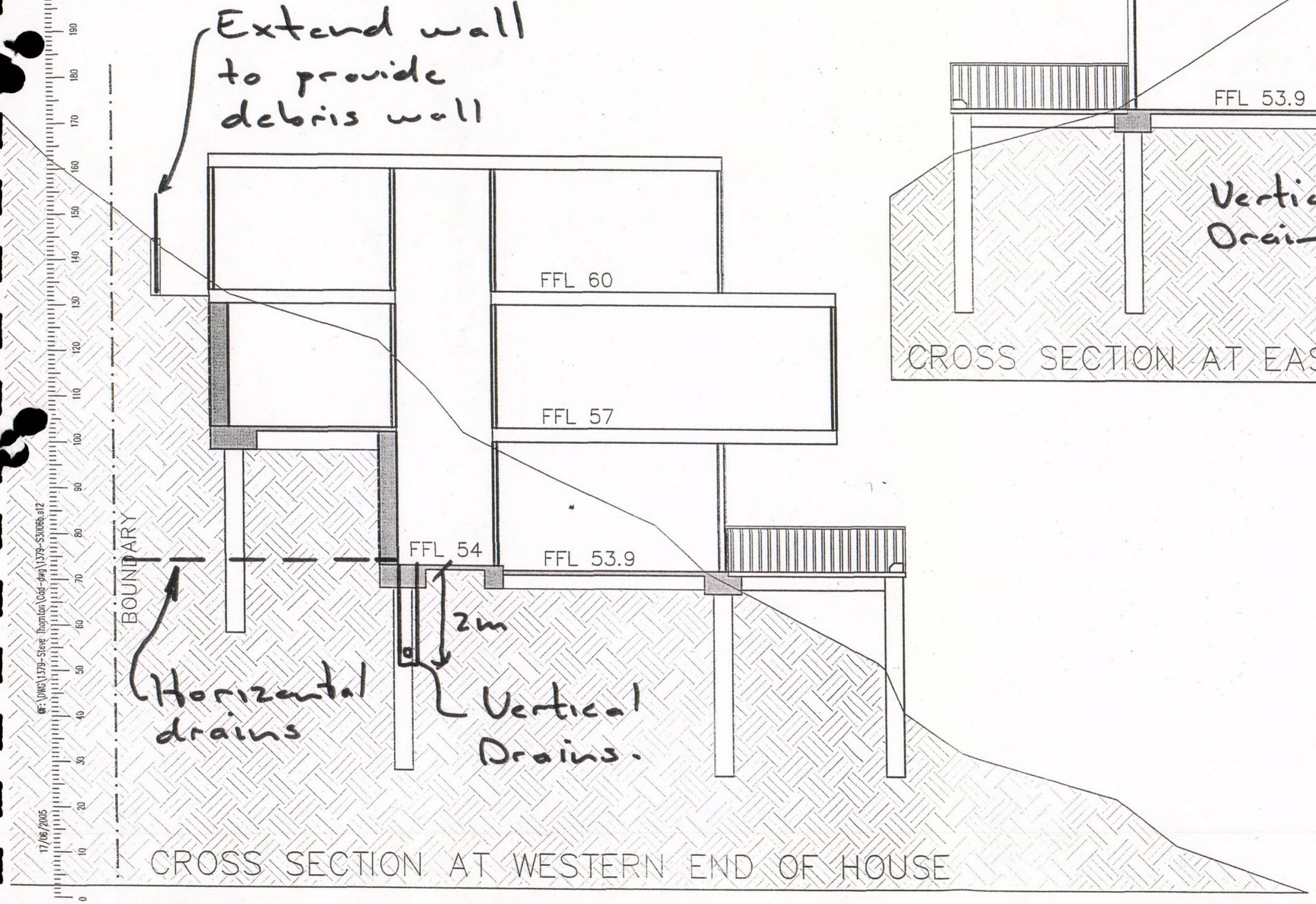


CROSS SECTION AT EASTERN END OF HOUSE



CROSS SECTION AT WESTERN END OF HOUSE

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Project:
PROPOSED HOUSE
AT
24 WAINUI ROAD
OHOPE

DRAWING TITLE:
CROSS SECTIONS

DESIGN:	JOB NO:	SCALE: (A1 SIZE DRG)
MB	1379	200%
DRAWN:	CAD FILE:	SCALE: (A3 SIZE DRG)
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DRAWING: S30.06 REVISION: (-)

ORIGINAL DRAWING SIZE IN MM.
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17/06/2005
DIR: \DWG\1379-Steve Thornton\Cad-dwg\1379-S3006b.sl2

FORM 5
(Section 88 Reg 8[1])

APPLICATION FOR RESOURCE CONSENT

To: The Chief Executive, Whakatane District Council, Private Bag 1002, WHAKATANE 3080 (Attention: District Planner)

APPLICATION DETAILS

I, *(full name of applicant)* Stephen Thornton & Cornelia Thornton hereby apply for

☐ Land Use Consent ☑ Subdivision Consent

Acting as Agent on behalf of: **Harrison Grierson Consultants Limited**

Postal address: _____ Email: _____

Phone (day): _____ Cellphone: _____ Fax: _____

Address for service *(if different from above)*: **P O Box 336, Whakatane**

DESCRIPTION OF ACTIVITY *(See Note 1)*

Describe clearly the proposal: To subdivide a residential allotment into two lots as shown on plan 11050-SC01.

LOCATION OF ACTIVITY/SITE ADDRESS *(See Note 2)*

The site to which this application relates is described as:

No: 2B Street: Kowhai Street Locality: Ohope

Legal description: Lot 2 DP 327498 & Lot 25 DPS 9167

Certificate of Title: 111896

ADDITIONAL RESOURCE CONSENT APPLICATIONS *(See Note 3)*

Are resource consent(s) required from Environment B·O·P for this proposal? ☐ Yes ☑ No

If yes, please detail which consents are required:

☐ Coastal Permit ☐ Water Permit ☐ Discharge Permit ☐ Land Use Consent

Has consent been granted? ☐ Yes ☐ Declined ☐ Not yet applied for

OWNER OF THE SITE THAT IS THE SUBJECT OF THIS APPLICATION

State the name(s) and address of the owner(s) of the site described above.
If these are the same as for the applicant, tick this box: ☑

Name: _____

Postal address of owner(s): _____

Phone (day): _____ Cellphone: _____ Fax: _____

INVOICES FOR EXTRA CHARGES *(See Note 4)*

If extra charges are incurred in processing this application, please send invoices to:

☐ Applicant ☐ Owner ☑ Other party as detailed below:

Name: **C/- Harrison Grierson Consultants Limited, P O Box 336, Whakatane**

Phone: **308 5478** Fax: **308 4907**

CONSULTATION *(See Note 5)*

Have you talked to a Council Planner about your application (pre-application meeting)? ☑ Yes ☐ No

Have you consulted with any potentially affected or interested party? ☐ Yes ☑ No

If yes, who did you consult with?

Name	Address

Did they have any concerns? ☐ Yes ☑ No *(If yes, please provide details)*

How have you addressed these concerns?

APPROVAL OF AFFECTED PARTIES *(See Note 5)*

I/We have obtained the written approval of the following affected persons: **See Enclosed Report**

Name	Address	Owner *(tick if applicable)*	Occupier *(tick if applicable)*

(Continue on a separate sheet where necessary)

Please note: Written approval forms (available from the Council) are to be completed by affected persons and are to be attached to this application form.

ASSESSMENT OF ENVIRONMENTAL EFFECTS (AEE) *(See Note 6)*

What are the effects of your proposal on the environment? **See Enclosed Report**

(Continue on a separate sheet where necessary)

ANNEXURES

I attach ☑ Deposit fee of $ 500.00

☑ Written explanation of what is proposed and reasons for application.

☑ Details of consultation with affected parties/written consents of affected parties. *(See Note 5.)*

☑ Assessment of Environmental Effects *(See Note 6)*

☑ Plans (eg, site plan, elevation details)

☐ Other information *(See Note 7)*

Please note that all of the above information is required to be submitted with your application. Failure to include all of this information will mean the Council is unable to begin to process your application.

SIGNATURE

I hereby certify that, to the best of my knowledge and belief, the information given in this application is true and correct. I undertake to pay all actual and reasonable application costs incurred by the Whakatane District Council.

Signature of the Applicant: _____ Date: _____

NOTES:

1. Give a full description of the activity you are proposing to undertake. Continue on a separate paper if necessary.
3. Describe the location in a manner which will allow it to be readily identified, eg, the street address, the legal description, the name of any relevant stream, river, or other water body to which the application may relate, proximity to any well-known landmark, the grid reference (if known), etc.
3. Some activities require more than one resource consent. Although it is not mandatory to make all applications at once, in some circumstances Council can decide not to proceed with an application until another resource consent has been obtained. In some cases a joint hearing or combined hearing may be required.
4. The initial lodgement deposit paid on application may not cover the total cost of processing this application. The Council charges for receiving, processing and granting of consents on an actual cost basis. You may receive a refund or an account for additional costs.
5. Some types of applications require you to have consulted with, and if possible obtain the written consent of, any party who may be adversely affected by the proposal. This may include individuals such as your neighbours, or organisations such as the Department of Conservation, Transit New Zealand or iwi. Consultation should occur prior to an application being received. The written consent of affected parties will be required for some applications for resource consent to avoid the Council publicly notifying the application for submissions.
6. **Assessment of Environmental Effects (AEE)** – An AEE is an essential part of the application. If no AEE is provided, Council will not start processing the application. The AEE should discuss all the actual and potential effects (both positive and negative) on the environment arising from this proposal. The amount of detail provided must reflect the nature and scale of the development and its likely effects. For example, if there are major effects arising from the proposal, a detailed analysis and discussion of these effects should be included in the AEE. Information from specific experts such as a geotechnical engineer, acoustic consultant or traffic engineer may be required. If the effects of the proposal are very minor, then a less detailed AEE can be submitted.
7. The District Plan will require specific information to be submitted with most applications. Copies of the Plan are held in the District Council offices (Whakatane and Murupara) and the district libraries. The Resource Management Act and Regulations 1991 and regional plans may also specify additional information that is required. It is important to check out these requirements before lodging your application.

Staff at the Planning Section will be happy to assist you in completing your application.

24.3.04.92

WHAKATANE DISTRICT
30 JUN 2004
COUNCIL

HARRISON
GRIERSON

28 June 2004

Whakatane District Council
Private Bag 1002
WHAKATANE

Attention: Tony Bullard

Dear Tony

RESOURCE CONSENT (SUBDIVISION) APPLICATION:
S & C THORNTON – 2B KOWHAI STREET, OHOPE

We enclose for your consideration by council an application for subdivision on behalf of the above. For the purposes of the application we enclose the following:

- 5 copies of the Resource Consent Application plan
- Resource Consent Application on Form 5 RMA 1991
- A cheque in the sum of $500.00 as the fee deposit.
- A copy of the Certificate of Title

GENERAL PROPOSAL

This application is for the subdivision of an existing residential property into two allotments. The existing dwelling and garage on the property is located near the southern boundary of proposed Lot 1.

LOCATION & ZONING

The subject land is located at 2B Kowhai Street (formerly 24 Wainui Road) Ohope, being on the western side of the road and one property from the intersection with Kowhai Street. The land is zoned Residential A (Map No. 29) of the Transitional District Plan and Residential 1 (Map No. 50) of the Proposed Whakatane District Plan.

LEGAL DESCRIPTION

The property is described as Lot 2 DP 327498 and Lot 25 DPS 9167 and is held in CT 111896. The registered owner is listed as S.A. and C.G.A. Thornton. There is an Appurtenant easement registered on this certificate of title.

GENERAL DESCRIPTION

The property slopes generally in an east-west direction. The slopes range from average through to steep. A dwelling and garage are located beside the southern boundary of Lot 1. With only the boundary between the subject property and Lot 1 DP 327498 being fenced. Approximately one quarter of Lot 1 and most of Lot 2 is covered with scrub and young native growth.

Harrison Grierson Consultants Limited
Ground Floor Concordia House
17 Pyne Street, Whakatane
PO Box 336, Whakatane, New Zealand
Ph 07 308 5478 Fax 07 308 4907
Email whakatane@harrisongrierson.com
www.harrisongrierson.com
ISO9001 Quality Assured

TRANSITIONAL DISTRICT PLAN RULES

The subdivision rules for the residential zone relevant to this application are:

Minimum area:	- 400m² (with provision to reduce to 350m²)
Minimum frontage:	- 4 metres
Shape factor:	- 18m diameter circle (with provision to reduce to 14m for existing allotments).
Building platform:	- 7m × 10m clear of existing legal and physical impediments.
Access width:	- 4.5m for two lots (with provision to reduce).

TRANSITIONAL DISTRICT PLAN YARD REQUIREMENTS

The relevant rules to this application are:

Front lots:	Rear yard	- 3.0m
	Side yards	- 3.0m (but with provision to reduced to 1.5m on one yard).

PROPOSED WHAKATANE DISTRICT PLAN RULES

Minimum area:	- 400m^2
Shape factor:	- 15m diameter circle minimum
Minimum frontage:	- 4.0m or legal access to a formed road over an accessway
Access width:	- 4.5m for two lots (3.0m min carriageway)
Maximum height:	- 9.0 metres

PROPOSED DISTRICT PLAN YARD REQUIREMENTS

Front yard:	4.0 metres minimum
Side/Rear yard:	1.5m from one nominated side yard, 3.0m other side yard, and 3.0m rear yard.

PROPOSED LOT 1

Transitional District Plan Rules
This allotment complies with the above subdivision criteria, utilizing the provision to reduce the southern side yard to 1.5m.

Proposed District Plan Rules
The subdivision criteria are all met. The southern boundary is the nominated 1.5m side yard.

PROPOSED LOT 2

Transitional District Plan Rules
This lot also complies with the above subdivision criteria.

Proposed District Plan Rules
Lot 2 similarly complies with all of the requirements of the new document.

ACTIVITY STATUS

The proposed subdivision is a Controlled Activity as both lots meet the Council requirements.

RESERVES CONTRIBUTION

With this subdivision the provision of land for recreational reserves is impractical and therefore we anticipate that a cash contribution will be required. This will be based upon 4.5% of the value of proposed Lot 2.

EXISTING AND PROPOSED SERVICES

All normal residential services are presently provided to the existing dwelling located on Lot 1.

PROPOSED LOT 1

Power & Telephone
Overhead/Underground electricity and telephone cables service the existing dwelling.

Water
An existing meter box is located near the Wainui Road frontage as shown on the Resource Consent Application plan. This will be utilised for Lot 1.

Sewerage
The sewerage is connected into the system contained within Wainui Road.

Stormwater
The dwelling appears to disposes of its roof-water by means of a ground soakage system.

Access
Access to Lot 1 will be via a new vehicle accessway that will be construction from Kowhai Street. The owner of 2 Kowhai Street is supportive of the proposed accessway. This new vehicle accessway is shown on attached plan.

Trees
A kauri and a exotic tree is located close to the road boundary of Lot 1 as shown on attached plan.

PROPOSED LOT 2

This lot will require a full reticulation of services for the purpose of a future dwelling. It is expected that the majority of the services will be provided from Wainui Road.

Power & Telephone
Overhead/Underground electricity and telephone cables are located within the road berms of Wainui Road.

Water
A water main and meter box is located in the berm adjacent to Lot 1. A service connection with a meter box can be provided to new Lot 2 boundary with a service lead.

Sewerage
A new sewer connection is to be connected into the system contained within Wainui Road.

Stormwater
Should the soil be inadequate for stormwater to be disposed of by means of a ground soakage system, a connection to the Council's stormwater drain in the Wainui Road berm can be made.

Access
Access to Lot 2 will also be via the new vehicle accessway that will be constructed from Kowhai Street.

Site Suitability
A geotect report is to be prepared for the assessment of Lot 2. This report will be forward the Council once it comes to hand.

Tree
A pohutukawa tree is located close to the northern boundary of Lot 2 as shown on attached plan.

ENVIRONMENTAL ASSESSMENT

The fourth schedule of the Resource Management Act 1991 requires the following matters to be considered for a subdivision of this nature.

(a) Effect on Neighbourhood

The effect on the immediate and wider community should be relatively minor as the proposed allotments meets Council requirements. Therefore the overall density of dwelling that will be created by this subdivision is typical of the recent type of development that has been occurring in Ohope.

(b) Physical Effects

The actual subdivision will result in a few physical effects including excavation for a new dwelling and associated services which will be of a temporary nature.

The potential effects will include the construction of the new dwelling, excavation of trenches for services, construction of fences etc. The new dwelling will be governed by the normal yard, bulk and daylight plane requirements imposed by the Whakatane District Council building consent rules.

SUMMARY

Both allotments comply with the prescribed requirements of both the Transitional and Proposed District Plans. The area surrounding the proposed subdivision is typified by a variety of similar sized allotments. The immediate neighbourhood therefore should not be affected by this proposal.

We also believe that any adverse environmental effects that may actually or potentially

result from the subdivision are likely to be minor or remedied or mitigated by the conditions of the resource consent. We also consider that the proposal is in accordance with Part II of the RMA 1991 as it relates to sustainable management of land resource and efficient use of physical resource.

We look forward in due course to receiving your councils' favourable response.

Yours faithfully
Harrison Grierson Consultants Limited

P.P.

Duncan Thomson
Office Manager

N:\71\1050\rca-wdc-1.doc

COMPUTER FREEHOLD REGISTER
UNDER LAND TRANSFER ACT 1952

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**111896**
Land Registration District	**South Auckland**
Date Issued	25 November 2003

Prior References
SA15C/827 SA16A/202

Estate	Fee Simple
Area	1762 square metres more or less
Legal Description	Lot 2 Deposited Plan 327498 and Lot 25 Deposited Plan South Auckland 9167

Proprietors
Stephen Anthony Thornton and Cornelia Geertruda Adriana Thornton

Interests

Appurtenant to Lot 2 DP 327498 is a right of way specified in Easement Certificate S362256

The easements specified in Easement Certificate S362256 are subject to Section 37 (1) (a) Counties Amendment Act 1961

Subject to Section 241(2) and Section 242(1) Resource Management Act 1991(affects DP 327498)

5921174.2 Mortgage to Bank of New Zealand - 4.3.2004 at 9:00 am

HARRISON
GRIERSON

13/7

14 June 2004

Mr Steve Thornton
PO Box 3109
OHOPE

Dear Steve

Driveway Alignment and Retaining Walls
24 Wainui Road, Ohope

Please find enclosed our calculations, construction details, driveway plan and cross sections for the above project. A geotechnical investigation of the slope above the proposed driveway at cross section 4 has been undertaken.

Geotechnical Investigation

We have walked over the site above the proposed driveway and undertaken a topographical survey of the hillside. During our walkover we observed areas where small localised surface failures have occurred and that a track has been pushed into the side of the hill since our initial site visit.

Soil investigations comprising of two hand augured boreholes and five Scala Penetrometer tests along and adjacent to cross section 4 were undertaken, as shown on the enclosed site sketch. In addition a borelog and penetrometer previously undertaken on a neighbouring site were reviewed.

Borelog 1, (20/5/04), approximately 10m west of cross section 4 shows topsoil overlying sand and silt layers which overlay another topsoil layer at 0.7m deep followed by sandy silts containing gravel particles. Similarly, borelog 2 shows topsoil overlying sandy silts which overlay another topsoil layer at 1.1m deep followed by silt containing gravel particles.

Penetrometers 1, 2 and 3 indicate layers which have low to medium bearing strength in the upper 0.5m to 1.0m with bearing strength increasing below 1m. Penetrometer 4 has similar results with low bearing strength in the upper 1.8m including an area of lower bearing strength at 1.6m indicating a possible layer of topsoil.

Based on the above soil investigations, our survey and walkover of the site we conclude that the hillside has layers in the upper 0.5m to 1.0m with low bearing strength followed by firmer layers below this depth. This is highlighted by the presence of areas of shallow failure. The borelogs and penetrometer results also indicate some areas of the slope,

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ISO9001 Quality Assured

and the proposed driveway alignment, have been subject to either uncontrolled earthworks and/or have slip debris overlying original topsoil layers.

We have carried out an assessment of the proposed cutting to construct the driveway at the steepest part of the hillside, cross section 4, to determine the minimum embedment depth for a timber pole retaining wall to have an acceptable stability.

Our analysis considered the slope face in both dry and saturated conditions. If the slope were to remain dry at cross section 4 it would be necessary to have a 2.5m embedment for a 2.0m high wall to provide an acceptable slope stability, the retaining wall we have designed has a pole embeddment of 3.9m. If the upper soil layers were to become saturated, the slope would also have an acceptable global stability. However if the lower layers were to become saturated our analysis shows the slope stability would not be acceptable.

An analysis for overtopping of the proposed retaining walls was also undertaken and found that the slope has an unacceptable stability in the unsaturated condition, indicating overtopping of the wall may occur. Any overtopping of the wall could cause slips onto the proposed driveway, which will need to be cleared as part of the ongoing maintenance of the driveway.

Construction of the proposed driveway retaining walls will increase the overall slope stability, above that of its existing condition.

Our analysis of the slope above the driveway retaining walls has been carried out for the purpose of determining driveway retaining walls. Further slope stability analysis and a Geotechnical report will be required taking into account any future proposal cross sections, as part of any further development above the retaining wall.

Stabilising the upper low bearing strength soil layers above the retaining wall should be undertaken in conjunction with any proposed future development on the slope above the driveway.

Retaining Walls and Driveway Construction

We have carried out retaining wall designs for various heights, both above and below the proposed driveway alignment. The walls above the driveway require heavier members to support the slope than the walls which directly support the driveway.

Wall heights for design have been determined from the enclosed cross sections. The actual length of various height walls will need to be determined on site when earthworks operations are underway as will the position of stormwater cesspits and the final longitudinal gradients of the driveway. Our Whakatane office will be able to set out the proposed driveway centreline, and approximate design centreline levels if required.

During construction of the walls, soft layers caused by previous uncontrolled fillings or slips and/or topsoil may be encountered, necessitating the need to deepen piles. This is less likely to occur where retaining walls are positioned in cut situations.

In conjunction with construction activities the track above the proposed driveway alignment should be filled with compacted inorganic material to reinstate and stabilise the slope above the driveway.

Where filling is required topsoil and loose material should be stripped, slopes benched and inorganic fill compacted in layers in dry conditions.

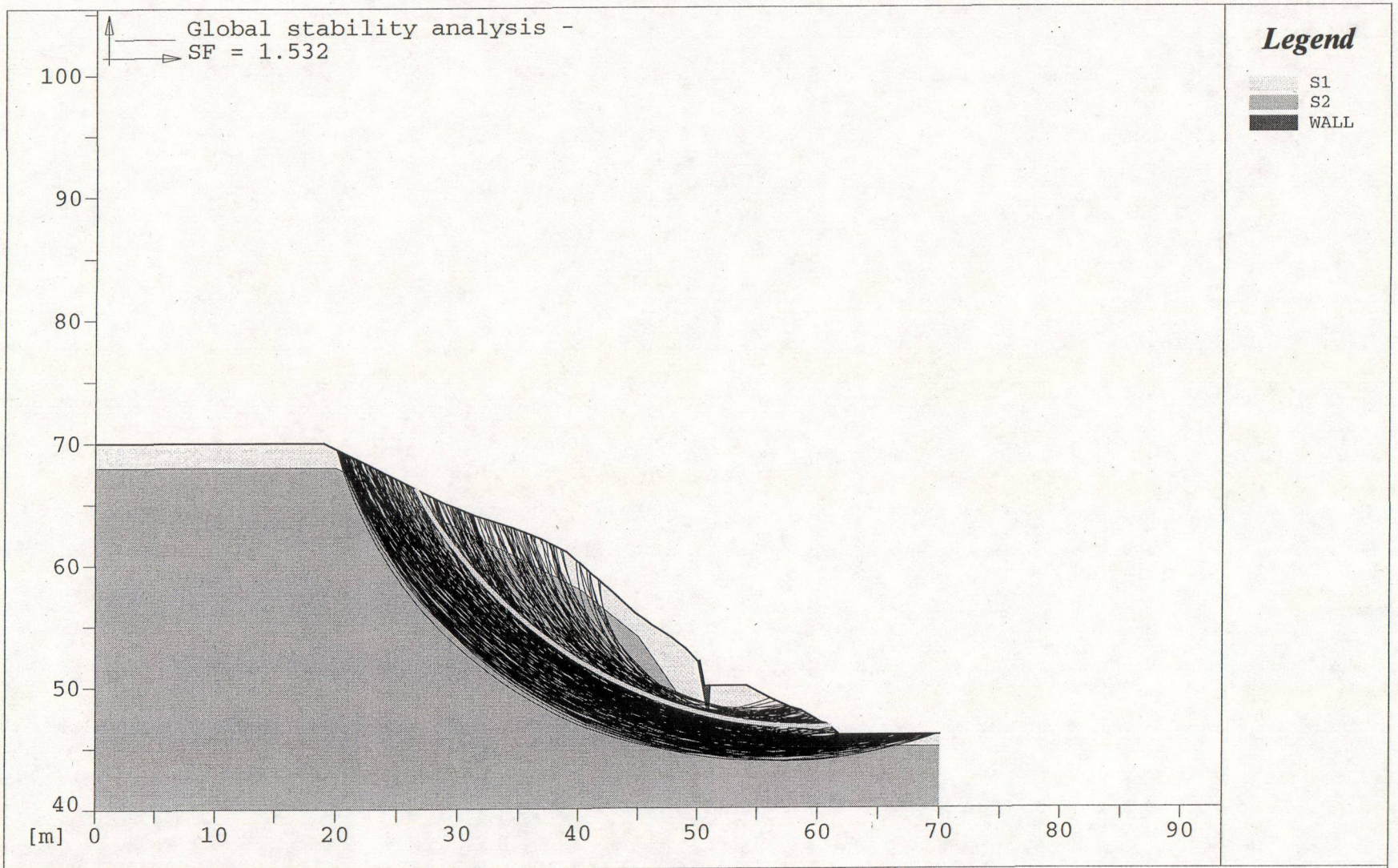
Should you have any queries, please contact us.

Yours faithfully
Harrison Grierson Consultants Limited

Gavin Moore
Senior Engineer

N:\71\11050\Phase 1\300 Comms\L02 Thornton.doc

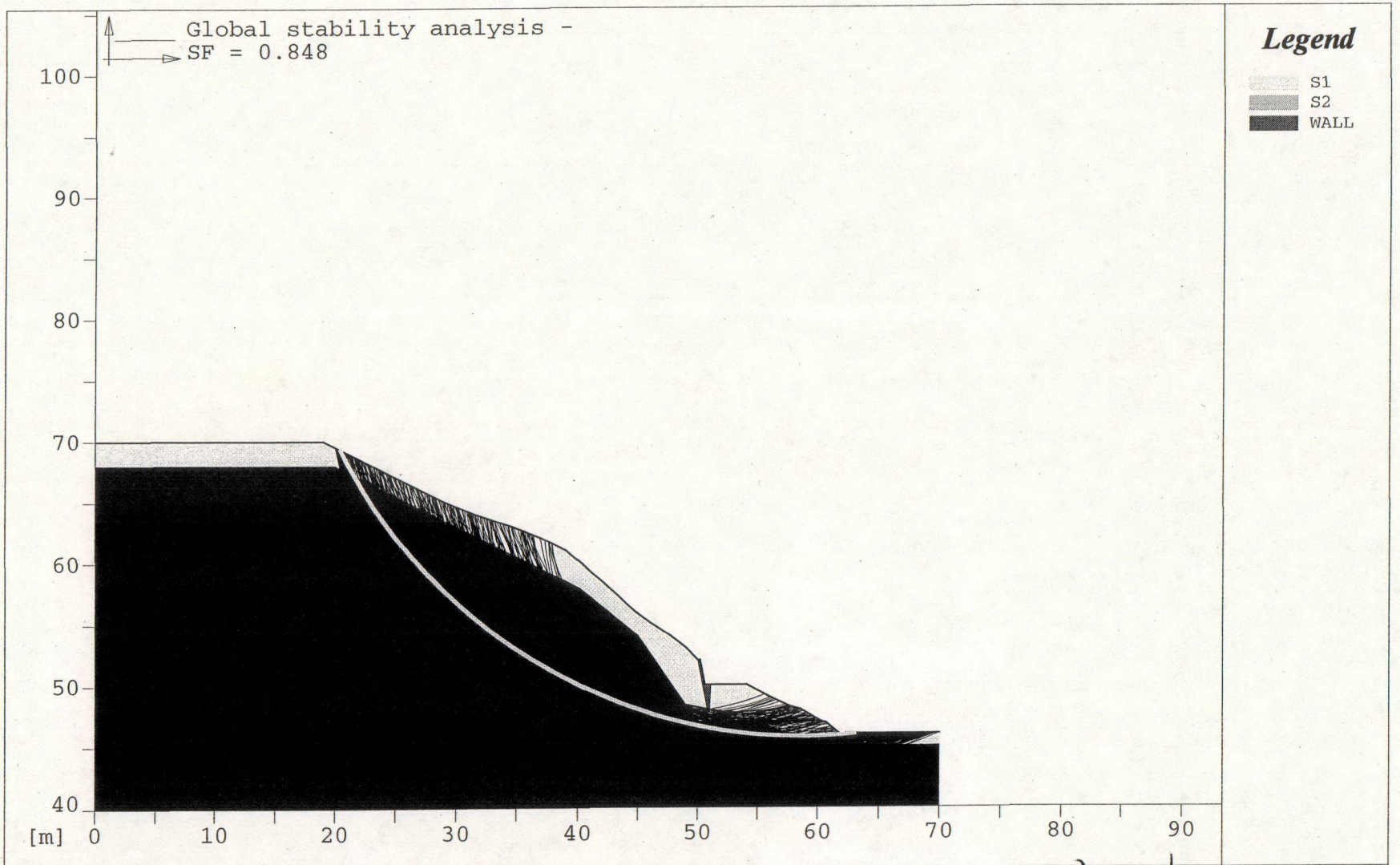
Geotechnical Analysis and Soil Investigations



MacStARS 2000
Release 2.0 - Maccaferri
Stability Analysis
of Reinforced Slopes

Date: 05/26/2004
Folder:

Project Title: Dry condition.
$\phi = 30^\circ$
Cross Section:
$c = 5$
File: dway4DRY2.mac
$\gamma = 18\ kN/m^3$.



MacStARS 2000
Release 2.0 - Maccaferri
Stability Analysis
of Reinforced Slopes

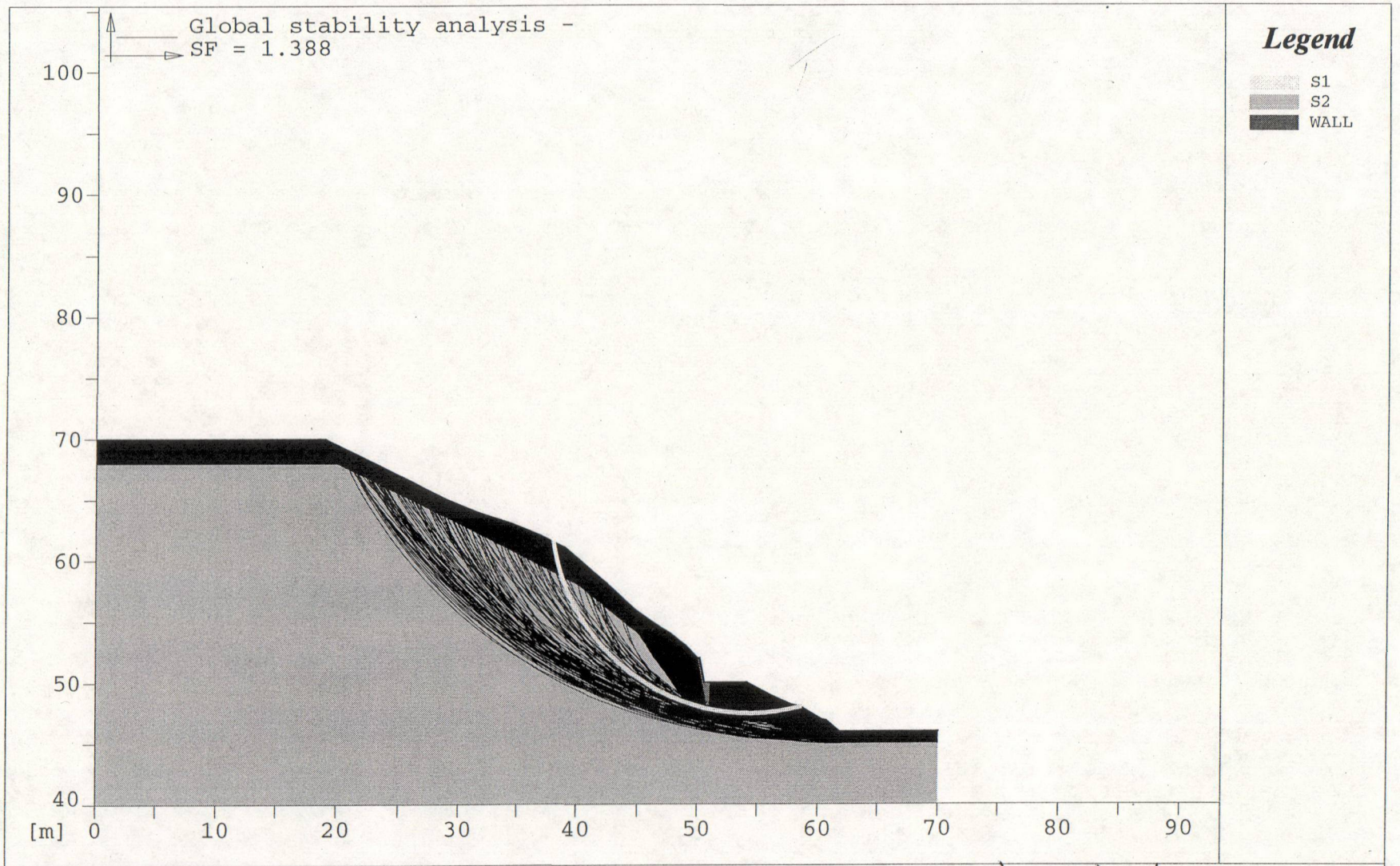
Date: 05/26/2004

Folder:

Project Title: Lower layer Saturated
$\phi = 30°$
$c = 5$
$\gamma = 18\ kN/m^3$

Cross Section:

File: dway4DRY2.mac



MacStARS 2000
Release 2.0 - Maccaferri
Stability Analysis
of Reinforced Slopes

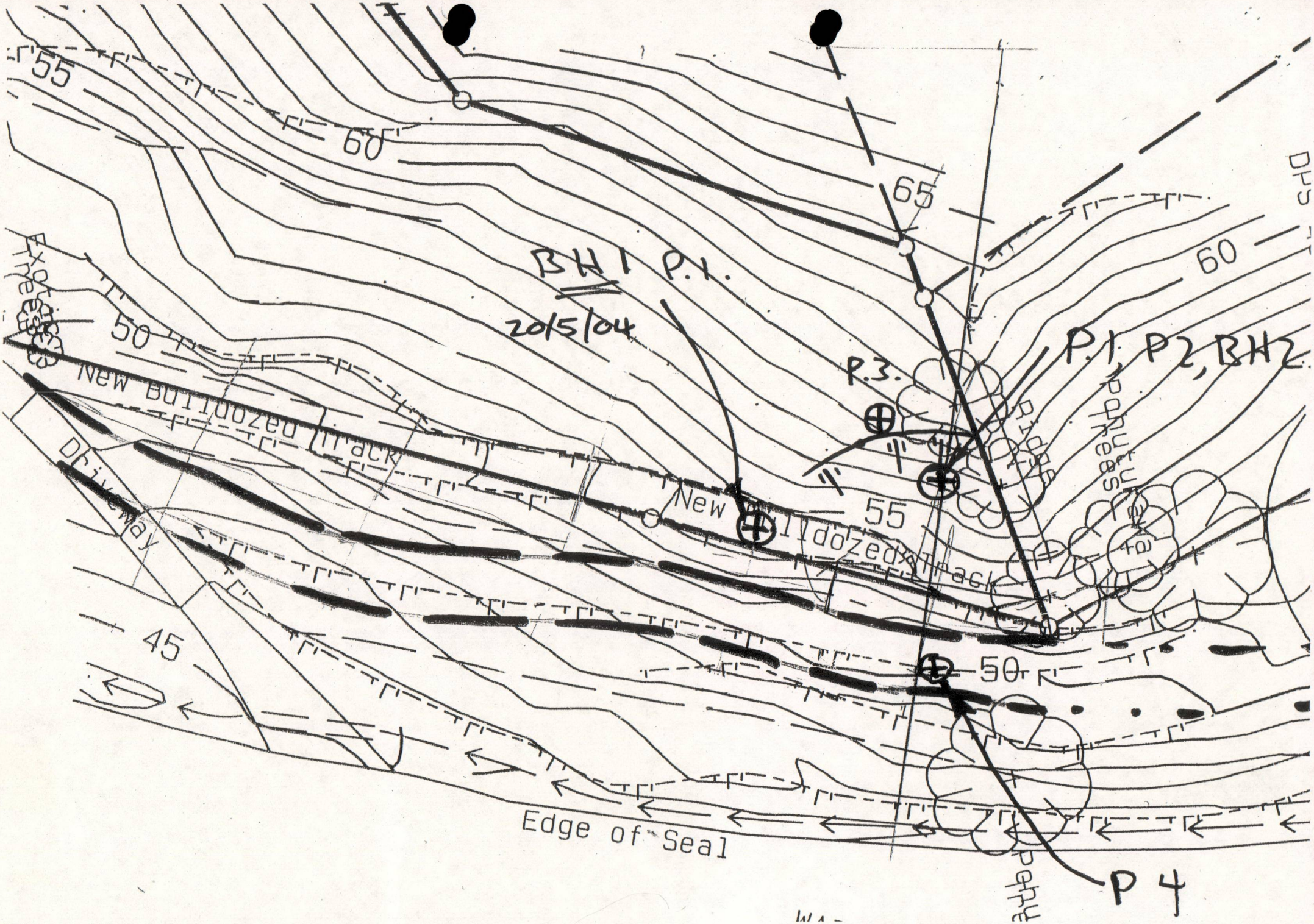
Date: 05/26/2004

Folder:

Project Title: Top layer saturated.
$\phi = 30°$
$c = 5$
$\gamma = 18\ kN/m^3$

Cross Section:

File: dway4DRY2.mac


55
60
65
60
50
55
45
50
BH1 P.1.
2015/04
P.3.
P.1, P2, BH2
New Bulldozed Track
New Bulldozed Track
Driveway
Edge of Seal
P 4

geolab
air, soil & water laboratory services

CLIENT: Thornton

PROJECT: , 24 Wainui Road, Ohope

BOREHOLE No: HA 2

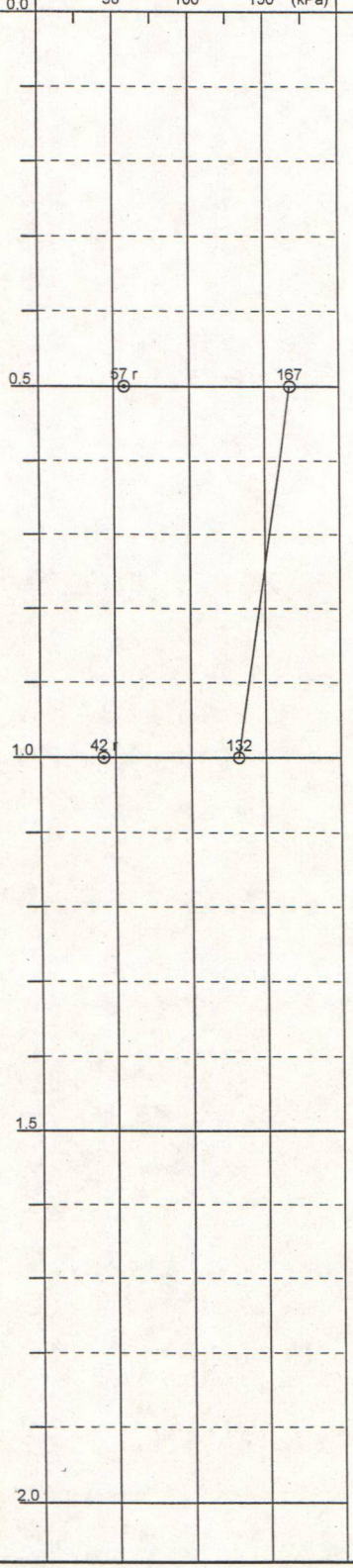
Sheet 1 of 1

Drill Type:	50 mm Hand Auger	Project No:		Logged By:	MAC
Drilled By:	Mike	Coordinates:		Checked By:	
Date Started:	27/5/04	Ground Elevation:		Shear Vane No:	
Date Finished:	27/5/04	Water Level:			

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering
	0.0		TOPSOIL, dark black, moist
			sandy SILT, slightly moist, low plasticity, crumbly
	0.5		
	1.0		
			topsoil SILT, light brown, with some traces of topsoil, and tree roots ranging from 30mm to 10mm in length
			SILT with traces of 5mm gravels (angular) light brown, crumbly
			with a large gravel 20mm in length (smooth) and specks of white mouable sand (fg) SILT
	1.5		END OF BORE. 1.5 METRES. Something. solid hit, too hard too penetrate
	2.0		

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)

SHEAR STRENGTH O v
REMOULDED SHEAR ⊙ r
POCKET PENETROMETER O p
50 100 150 (kPa)



LABORATORY TESTS

SOIL BH.GPJ GEOLAB.GDT 28/05/04

geolab
air, soil & water
laboratory services

CLIENT: Thornton

PROJECT: , 24 Wainui Road, Ohope

BOREHOLE No: HA1

Sheet 1 of 1

Drill Type:	Exposed cut and 50mm hand auger	Project No:		Logged By:	MAC
Drilled By:	Mike	Coordinates:		Checked By:	
Date Started:	20/5/04	Ground Elevation:		Shear Vane No:	
Date Finished:	20/5/04	Water Level:	2.0m		

GROUND WATER	DEPTH (m)	GRAPHIC LOG	SOIL DESCRIPTION MAIN\minor components, strength, colour structure, weathering
	0.0		TOPSOIL, black moist, with root fragments
			silt SAND (fg) light brown to brown
	0.5		sand SILT, with rusty brown patches surrounding soft rock
			TOPSOIL, black and moist with root fragments
			sand SILT, (fg) light brown
	1.0		At 1.2m rusty brown patches were present
			At 1.3m orangey brown, sand SILT (fg) with traces of angular 5mm soft rock gravels, which could be crushed with finger nails
	1.5		At 1.5m mixied gravels from 5mm to 10mm angular shape, grey could not be crushed by fingers
			At 1.7m rusty bown, patches present
Groundwater Hit	2.0		At 2.2m on removal < 10% of core remained and was hard too auger
			END OF BORE. 2.2 METRES. Groundwater hit, too hard to hand auger
	2.5		
	3.0		

DEPTH (m) 0.0 0.5 1.0 1.5 2.0 2.5 3.0

NATURAL WATER CONTENT △
LIQUID LIMIT ×
PLASTIC LIMIT □
50 100 150 (%)
SHEAR STRENGTH O v
REMOULDED SHEAR ⊙ r
POCKET PENETROMETER O p
50 100 150 (kPa)

LABORATORY TESTS

SOIL BH.GPJ GEOLAB.GDT 20/05/04

, . Phone: 07 578 0023

HARRISON GRIERSON CONSULTANTS LTD

SCALAPENETROMETER RESULT SHEET

CLIENT: Thornton

PROJECT: 24 Wainui Road

NB safety factor 1.6 -- 5. depending on soil type

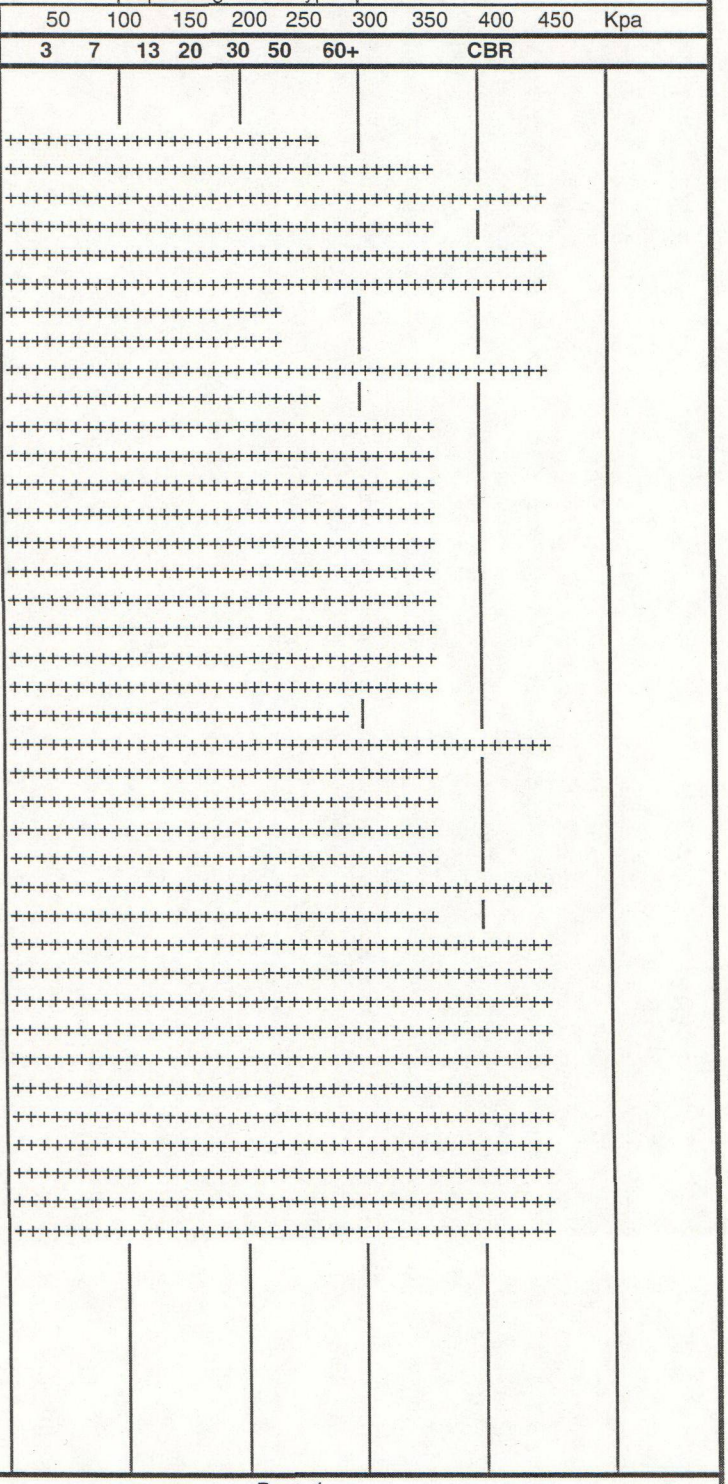
File No 71 11050

Date tested 20/05/04

Tested by MC

Printed

Reading	Blows	diff	Pen/blow	Bearing	Depth
P1 at 1m					
0.86	0		ROD		1.00 m
0.76	10	0.100	10 mm	250 kPa	1.10 m
0.65	20	0.110	6 mm	340 kPa	1.21 m
0.56	20	0.090	5 mm	430 kPa	1.30 m
0.43	20	0.130	7 mm	340 kPa	1.43 m
0.33	20	0.100	5 mm	430 kPa	1.53 m
1.40	0	NEW	ROD	430 kPa	1.53 m
1.17	20	0.230	12 mm	225 kPa	1.76 m
0.92	20	0.250	13 mm	225 kPa	2.01 m
0.92	1	0.005	5 mm	430 kPa	2.02 m
0.71	20	0.205	10 mm	250 kPa	2.22 m
0.59	20	0.120	6 mm	340 kPa	2.34 m
0.40	30	0.190	6 mm	340 kPa	2.53 m
0.27	20	0.130	7 mm	340 kPa	2.66 m
1.27	0	NEW	ROD	340 kPa	2.66 m
1.14	20	0.130	7 mm	340 kPa	2.79 m
0.96	30	0.180	6 mm	340 kPa	2.97 m
0.84	20	0.120	6 mm	340 kPa	3.09 m
0.66	30	0.180	6 mm	340 kPa	3.27 m
0.55	20	0.110	6 mm	340 kPa	3.38 m
1.55	0	NEW	ROD	340 kPa	3.38 m
1.39	20	0.160	8 mm	275 kPa	3.54 m
1.28	20	0.110	5 mm	430 kPa	3.65 m
1.16	20	0.120	6 mm	340 kPa	3.77 m
1.04	20	0.120	6 mm	340 kPa	3.89 m
0.93	20	0.110	6 mm	340 kPa	4.00 m
0.81	20	0.120	6 mm	340 kPa	4.12 m
0.71	20	0.100	5 mm	430 kPa	4.22 m
0.60	20	0.110	6 mm	340 kPa	4.33 m
0.50	20	0.100	5 mm	430 kPa	4.43 m
0.40	20	0.100	5 mm	430 kPa	4.53 m
0.30	20	0.100	5 mm	430 kPa	4.63 m
1.10	0	NEW	ROD	430 kPa	4.63 m
0.94	30	0.160	5 mm	430 kPa	4.79 m
0.85	20	0.090	5 mm	430 kPa	4.88 m
0.75	20	0.100	5 mm	430 kPa	4.98 m
0.65	20	0.100	5 mm	430 kPa	5.08 m
0.55	20	0.100	5 mm	430 kPa	5.18 m
0.46	20	0.090	5 mm	430 kPa	5.27 m
0.37	20	0.090	5 mm	430 kPa	5.36 m



This spreadsheet has been developed with reference to the following publication

"DETERMINATION OF ALLOWABLE BEARING PRESSURE UNDER SMALL STRUCTURES"

Author : M,J, Stockwell B,E, C,ENG. M.I.C.E. (Member)

Published by New Zealand Engineering (32,6) 15 June 1977

HARRISON GRIERSON CONSULTANTS LTD

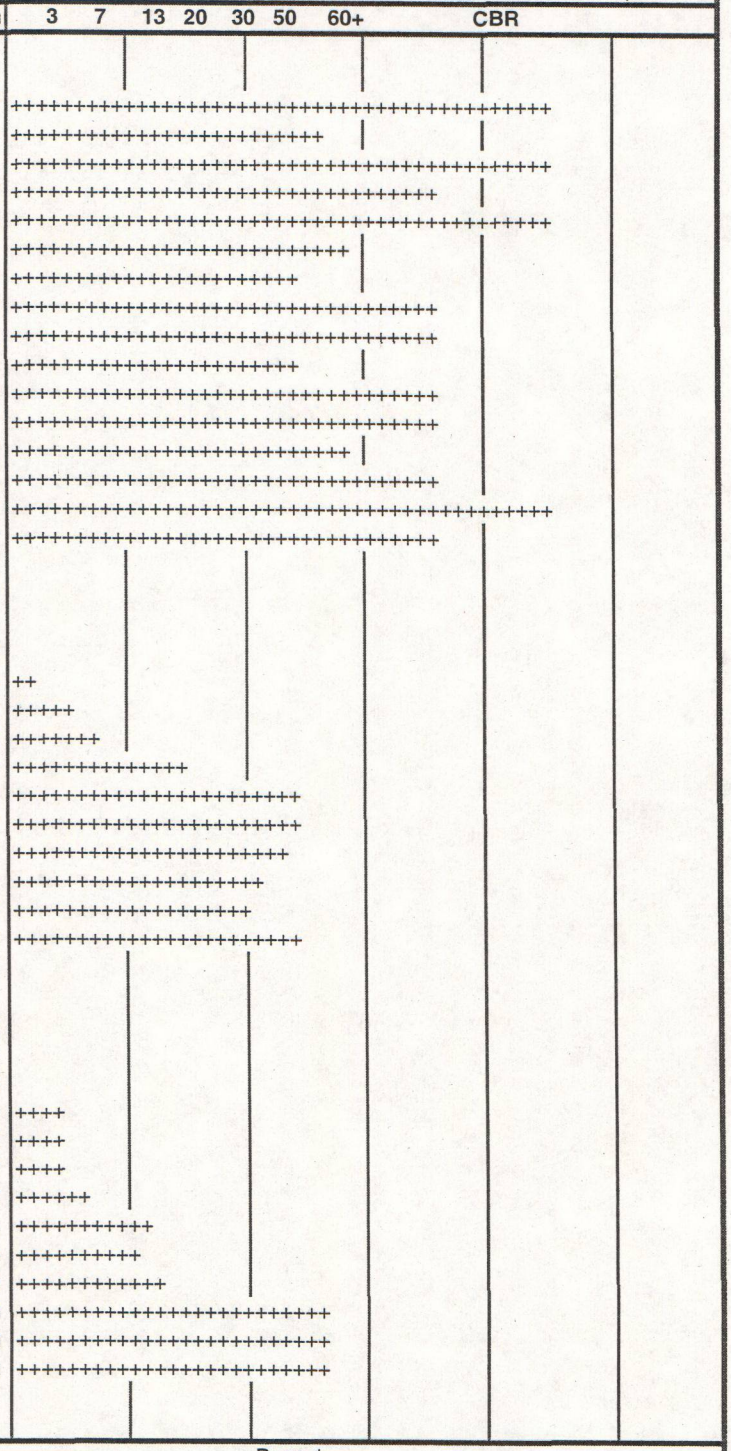
SCALAPENETROMETER RESULT SHEET

CLIENT: Thornton
PROJECT: 24 Wainui Road

File No 71 11050
Date tested 27/05/04
Tested by MC
Printed

NB safety factor 1.6 -- 5. depending on soil type

Reading	Blows	diff	Pen/blow	Bearing	Depth
P1 at 1.5m					
0.40	0		ROD		1.50 m
0.35	10	0.050	5 mm	430 kPa	1.55 m
0.25	10	0.100	10 mm	250 kPa	1.65 m
1.25	0	NEW	ROD	430 kPa	1.55 m
1.13	20	0.120	6 mm	340 kPa	1.67 m
1.05	20	0.080	4 mm	430 kPa	1.75 m
0.88	20	0.170	9 mm	275 kPa	1.92 m
0.67	20	0.210	11 mm	238 kPa	2.13 m
0.54	20	0.130	7 mm	340 kPa	2.26 m
0.43	20	0.110	6 mm	340 kPa	2.37 m
0.27	15	0.160	11 mm	238 kPa	2.53 m
0.24	5	0.030	6 mm	340 kPa	2.56 m
1.24	0	NEW	ROD	340 kPa	2.56 m
1.00	30	0.240	8 mm	275 kPa	2.80 m
0.82	30	0.180	6 mm	340 kPa	2.98 m
0.72	20	0.100	5 mm	430 kPa	3.08 m
0.55	30	0.170	6 mm	340 kPa	3.25 m
P2 alongside P1					
0.88	0		ROD		0.00 m
0.73	1	0.150	150 mm	27 kPa	0.15 m
0.66	1	0.070	70 mm	50 kPa	0.22 m
0.53	3	0.130	43 mm	78 kPa	0.35 m
0.41	5	0.120	24 mm	140 kPa	0.47 m
0.30	10	0.110	11 mm	238 kPa	0.58 m
1.30	0	NEW	ROD	238 kPa	0.58 m
1.24	5	0.060	12 mm	225 kPa	0.64 m
1.03	15	0.210	14 mm	200 kPa	0.85 m
0.80	15	0.230	15 mm	190 kPa	1.08 m
0.63	15	0.170	11 mm	238 kPa	1.25 m
P3 above P1 at top of scarp					
0.80	0		ROD		0.00 m
0.60	1	0.200	200 mm	< 10kPa	0.20 m
0.40	1	0.200	200 mm	< 10kPa	0.40 m
0.32	1	0.080	80 mm	44 kPa	0.48 m
0.24	1	0.080	80 mm	44 kPa	0.56 m
1.15	0	NEW	ROD	44 kPa	0.56 m
0.90	5	0.250	50 mm	68 kPa	0.81 m
0.58	11	0.320	29 mm	115 kPa	1.13 m
0.42	5	0.160	32 mm	100 kPa	1.29 m
0.26	6	0.160	27 mm	125 kPa	1.45 m
0.25	1	0.010	10 mm	250 kPa	1.46 m
0.24	1	0.010	10 mm	250 kPa	1.47 m
0.23	1	0.010	10 mm	250 kPa	1.48 m



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HARRISON GRIERSON CONSULTANTS LTD

SCALAPENETROMETER RESULT SHEET

CLIENT: Thornton

PROJECT: 24 Wainui Road

File No 71 11050
Date tested 27/05/04
Tested by MC
Printed

NB safety factor 1.6 -- 5. depending on soil type

50 100 150 200 250 300 350 400 450 Kpa

3 7 13 20 30 50 60+ CBR

Reading	Blows	diff	Pen/blow	Bearing	Depth
P4 below P1 at top of scarp					
0.93	0		ROD		0.00 m
0.80	1	0.130	130 mm	30 kPa	0.13 m
0.69	1	0.110	110 mm	34 kPa	0.24 m
0.42	3	0.380	127 mm	31 kPa	0.51 m
0.22	3	0.200	67 mm	51 kPa	0.71 m
1.22	0	NEW	ROD	51 kPa	0.71 m
0.94	5	0.280	56 mm	62 kPa	0.99 m
0.55	9	0.390	43 mm	78 kPa	1.38 m
0.39	7	0.160	23 mm	145 kPa	1.54 m
0.32	1	0.070	70 mm	50 kPa	1.61 m
0.28	1	0.040	40 mm	85 kPa	1.65 m
1.28	0	NEW	ROD	85 kPa	1.65 m
1.08	10	0.200	20 mm	160 kPa	1.85 m
1.01	5	0.070	14 mm	200 kPa	1.92 m
0.87	10	0.140	14 mm	200 kPa	2.06 m
0.75	10	0.120	12 mm	225 kPa	2.18 m
0.72	2	0.030	15 mm	190 kPa	2.21 m
0.68	2	0.040	20 mm	160 kPa	2.25 m
0.66	2	0.020	10 mm	250 kPa	2.27 m

This spreadsheet has been developed with reference to the following publication

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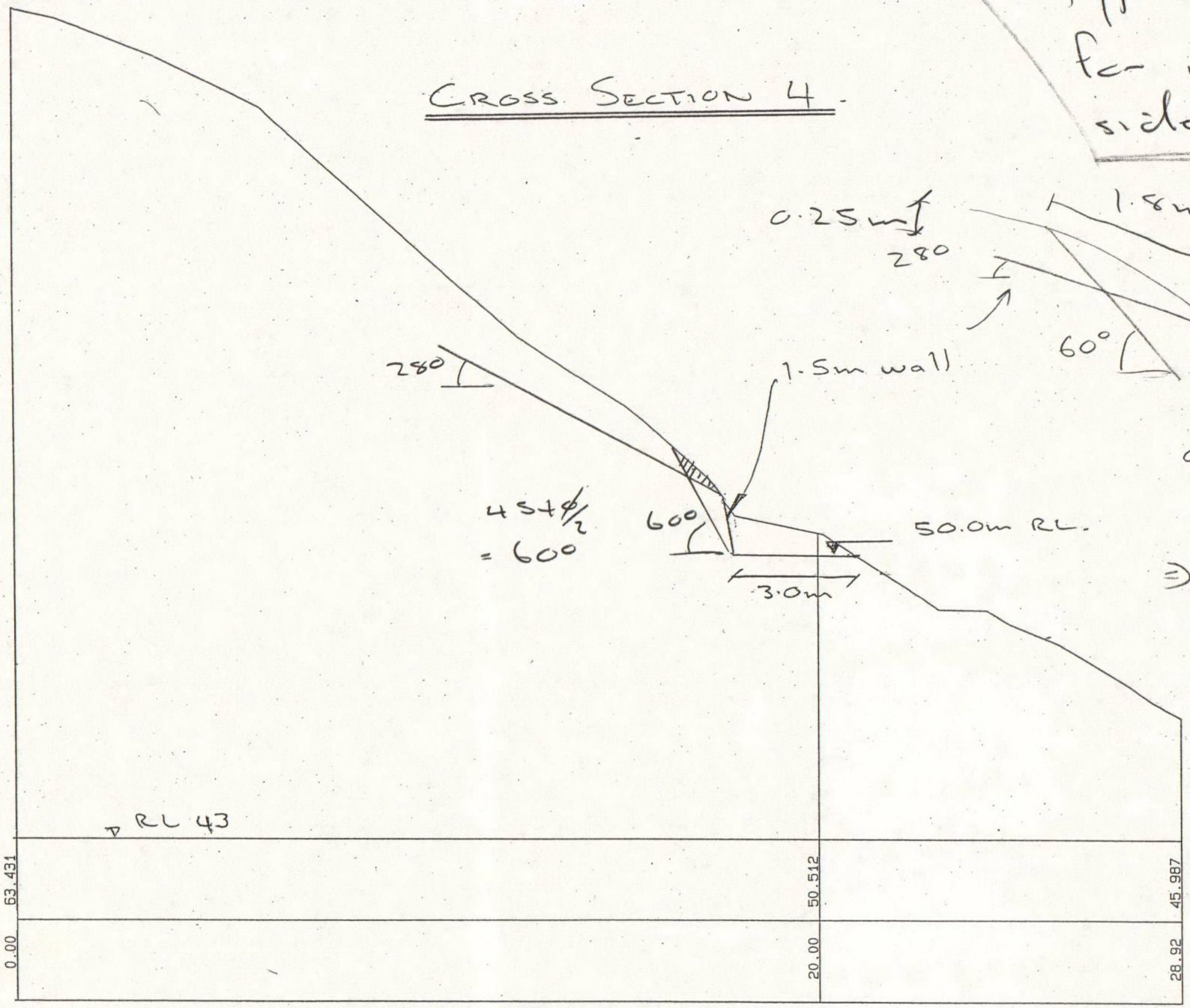
Author : M,J, Stockwell B,E, C,ENG. M.I.C.E. (Member)
Published by New Zealand Engineering (32,6) 15 June 1977

Retaining Wall Designs, Details and Drawings.

- Typical loadings
- Walls above Driveway
  - 0.5m high
  - 1.0m high
  - 1.5m high
  - 2.0m high
- Walls below Driveway
  - 0.5m high
  - 1.0m high
  - 1.5m high
- Cross Sections
- Plan and Typical Cross Section

Typical Loading for walls on uphill side of driveway

Cross Section 4.



$0.5 \times 1.8 \times 0.25 \times 18$

$4.05\,kN$

$\Rightarrow \frac{4.05}{1.8 \times 1} = 2.25\,kN/m^2$

Say 2 kPa surcharge.

Timber Pole Vertical Retaining Wall

Job No: 71;11050.1

DESIGN: Timber Retaining Wall, Sloping Backfill, 2KPa Surcharge above driveway

CLIENT: Steve Thornton

Prepared by: gdm

ADDRESS: Wainui Road

Checked by:

Step 1 :Input Design Parameter

Surcharge	2	kPa			
Wall Height	0.5	m	Ka	0.61	based on back slope of 28 degrees
Gamma	18	kN/m3	Kp	3	
Phi	30				
Degree	0.524				

Lateral Force 1.373 **kN/m**

Surcharge 0.61 **kN/m**

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Moment (kNm)	Moment * 1.6
Soil pressure	1.373	0.1666667	0.23	0.368
Surcharge	0.61	0.25	0.15	no factor for surcharge
Total	**1.983**	**0.417**	**0.38**	**0.518**

c 0.192

Pole Spacing (crs) 1.8

Resultant Moment(M*) 0.932 kN-m Pile spacing factor 0.75

Resultant Force(H*) 5.052 kN

Step 3 :Check by Brohms Method

Depth of Embedment, L 1 m

Pole embedment dia 0.6 m

H*

Brohms H*<0.5Hu **0.5Hu=** **5.096** 5.052 **OK!**

Comment: ***Use* 0.6 m dia with 1 m embed. depth 1.8 m apart**

Step 4 :Check for Pole bending

SED pole dia 150 mm Z section 331339.85 mm3

Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21

0.8Mn= 4.623 kN-m

M*= 0.932 kN-m

Design is **OK!**

K20 = 0.9

K21 = 0.85

K1 = 0.6
K4 = 1
K5 = 1
K8 = 1
fb (MPa) = 38

Step 5 :Check for Slats

	width	depth		
Use	0.146	0.05	Z section	60833.33333 mm3

Force btw board = **0.463229** kN/m

Moment in btw spacing= 0.150086 kN-m

M*<0.8*Mn **Mn =0.8*K1*K4*K5*K8*fb*Z**

0.8Mn= 0.43216 kN-m

M*= 0.150086

Design is **OK!**

K1 0.6
K4 1
K5 1
K8 1
fb (MPa) = 14.8

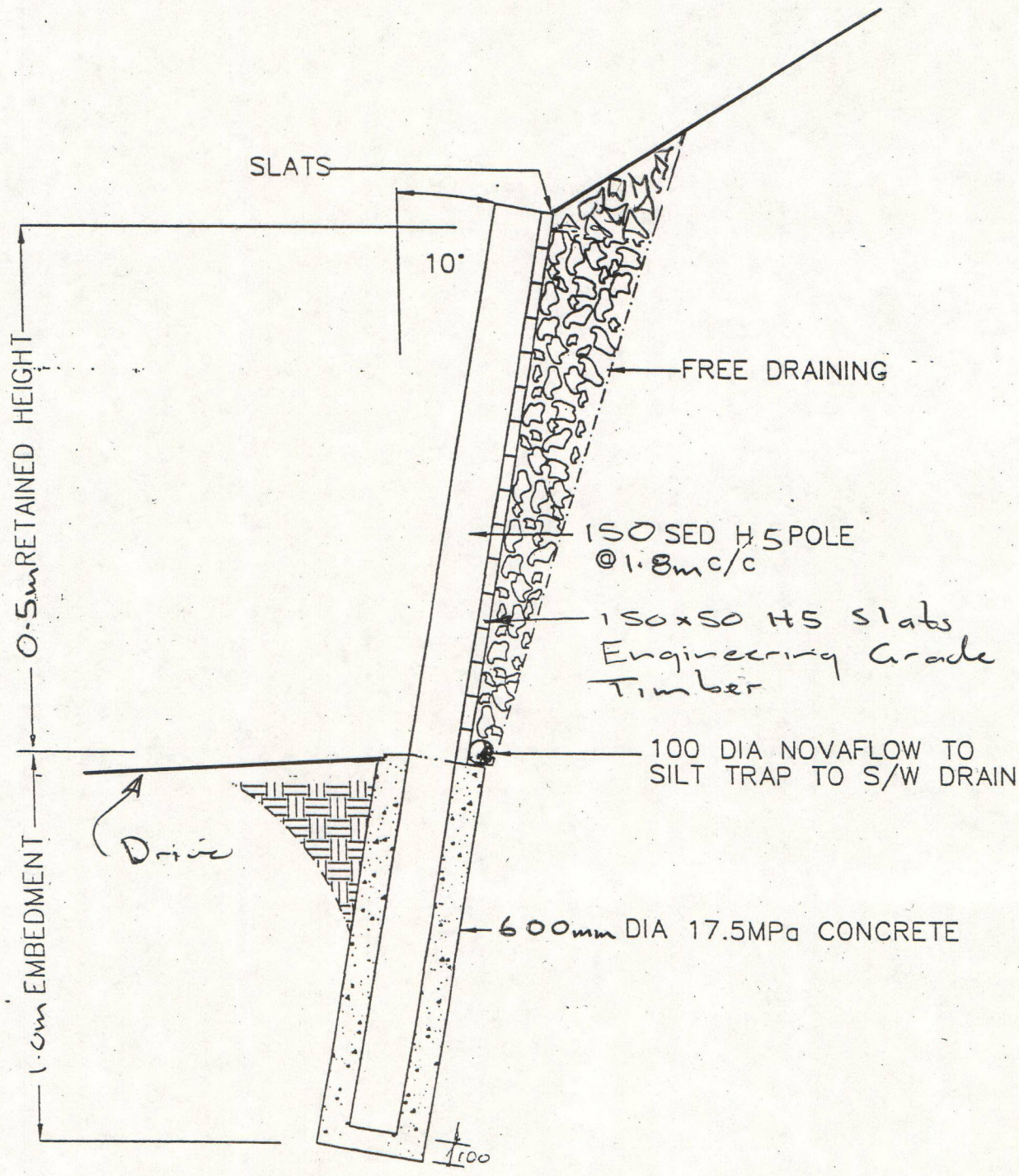
Remarks :

HARRISON GRIERSON

Job Name Thornton		Job No. 7111050.1
Client S Thornton		
Page No.	Prepared By GDM	
Date 6/04	Checked By	

Work Sheet

0.5m Wall Uphill of Driveway.



RETAINING WALL

Timber Pole Vertical Retaining Wall

Job No: 71;11050.1

DESIGN: Timber Retaining Wall, Sloping Backfill, 2KPa Surcharge above driveway

CLIENT: Steve Thornton

ADDRESS: Wainui Road

Prepared by: gdm
Checked by:

Step 1 :Input Design Parameter

Surcharge	2 kPa				
Wall Height	1 m	Ka	0.61	based on back slope of 28 degrees	
Gamma	18 kN/m3	Kp	3		
Phi	30				
Degree	0.524				

Lateral Force 5.49 **kN/m**
Surcharge 1.22 **kN/m**

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Moment (kNm)	Moment * 1.6
Soil pressure	5.49	0.3333333	1.83	2.928
Surcharge	1.22	0.5	0.61	no factor for surcharge
Total	**6.71**	**0.833**	**2.44**	**3.538**

c 0.364
Resultant Moment(M*) 6.368 kN-m
Resultant Force(H*) 18.007 kN

Pole Spacing (crs) 1.8
Pile spacing factor 0.75

Step 3 :Check by Brohms Method

Depth of Embedment, L 1.9 m
Pole embedment dia 0.6 m

Brohms	H*<0.5Hu	**0.5Hu=**	**18.405**	H* 18.007	**OK!**
Comment:	***Use*** **0.6**	**m dia with**	**1.9**	**m embed. depth**	**1.8 m apart**

Step 4 :Check for Pole bending

SED pole dia 175 mm
Z section 526155.41 mm3
Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21

0.8Mn= 7.342 kN-m
M*= 6.368 kN-m
Design is **OK!**

K20 = 0.9
K21 = 0.85

K1 = 0.6
K4 = 1
K5 = 1
K8 = 1
fb (MPa) = 38

Step 5 :Check for Slats

	width	depth		
Use	0.146	0.05	Z section	60833.33333 mm3

Force btw board = 1.567456 kN/m
Moment in btw spacing= 0.507856 kN-m
M*<0.8*Mn
Mn =0.8*K1*K4*K5*K8*fb*Z

0.8Mn= 0.58692 kN-m
M*= 0.507856
Design is **OK!**

K1 0.6
K4 1
K5 1
K8 1
fb (MPa) = 20.1

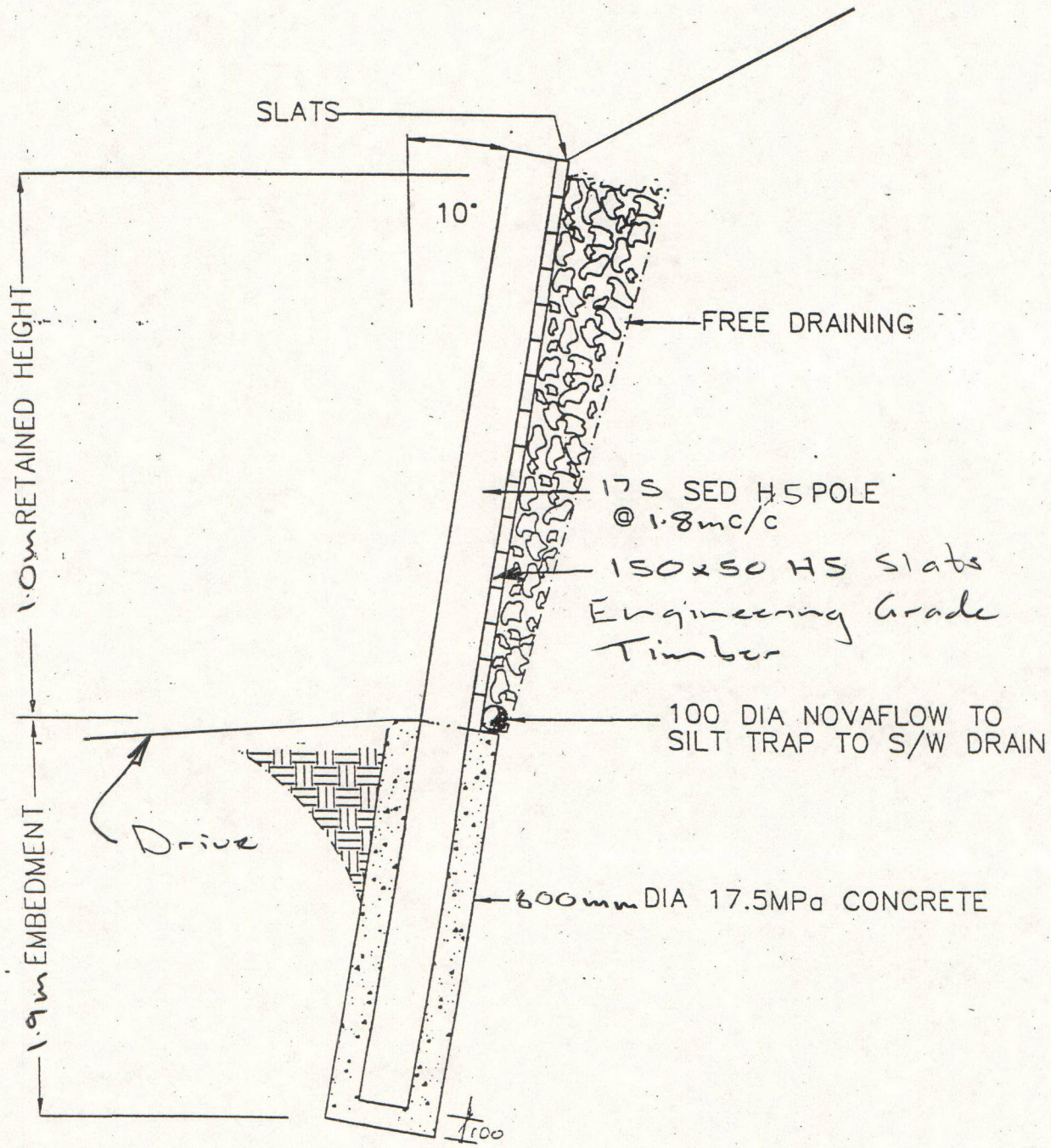
Remarks :

HARRISON GRIERSON

Job Name	Thornton	Job No. 7111050
Client	S Thornton	
Page No.		Prepared By GDM
Date	6/04	Checked By

Work Sheet

1.0m Wall Uphill of Driveway.



RETAINING WALL

Timber Pole Vertical Retaining Wall

Job No: 71;11050.1

DESIGN: Timber Retaining Wall, Sloping Backfill, 2KPa Surcharge above driveway

CLIENT: Steve Thornton

Prepared by: gdm

ADDRESS: Wainui Road

Checked by:

Step 1 :Input Design Parameter

Surcharge	2	kPa			
Wall Height	1.5	m	Ka	0.61	based on back slope of 28 degrees
Gamma	18	kN/m3	Kp	3	
Phi	30				
Degree	0.524				

Lateral Force 12.353 **kN/m**

Surcharge 1.83 **kN/m**

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Moment (kNm)	Moment * 1.6
Soil pressure	12.353	0.5	6.18	9.888
Surcharge	1.83	0.75	1.37	no factor for surcharge
Total	**14.183**	**1.25**	**7.55**	**11.258**

c 0.532

Pole Spacing (crs) 1.8

Resultant Moment(M*) 20.264 kN-m Pile spacing factor 0.75

Resultant Force(H*) 38.871 kN

Step 3 :Check by Brohms Method

Depth of Embedment, L 2.8 m

Pole embedment dia 0.6 m

Brohms	H*<0.5Hu	**0.5Hu=**	**40.024**	H* 38.871	**OK!**
Comment:	***Use*** **0.6**	**m dia with**	**2.8**	**m embed. depth**	**1.8 m apart**

Step 4 :Check for Pole bending

SED pole dia 250 mm

Z section 1533980.788 mm3

Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21

0.8Mn= 21.405 kN-m

M*= 20.264 kN-m

Design is **OK!**

K20 = 0.9

K21 = 0.85

K1 = 0.6

K4 = 1

K5 = 1

K8 = 1

fb (MPa) = 38

Step 5 :Check for Slats

	width	depth		
Use	0.146	0.075	Z section	136875 mm3

Force btw board = 3.313149 kN/m

Moment in btw spacing= 1.07346 kN-m

M*<0.8*Mn

Mn =0.8*K1*K4*K5*K8*fb*Z

0.8Mn= 1.32057 kN-m

M*= 1.07346

Design is **OK!**

K1 0.6

K4 1

K5 1

K8 1

fb (MPa) = 20.1

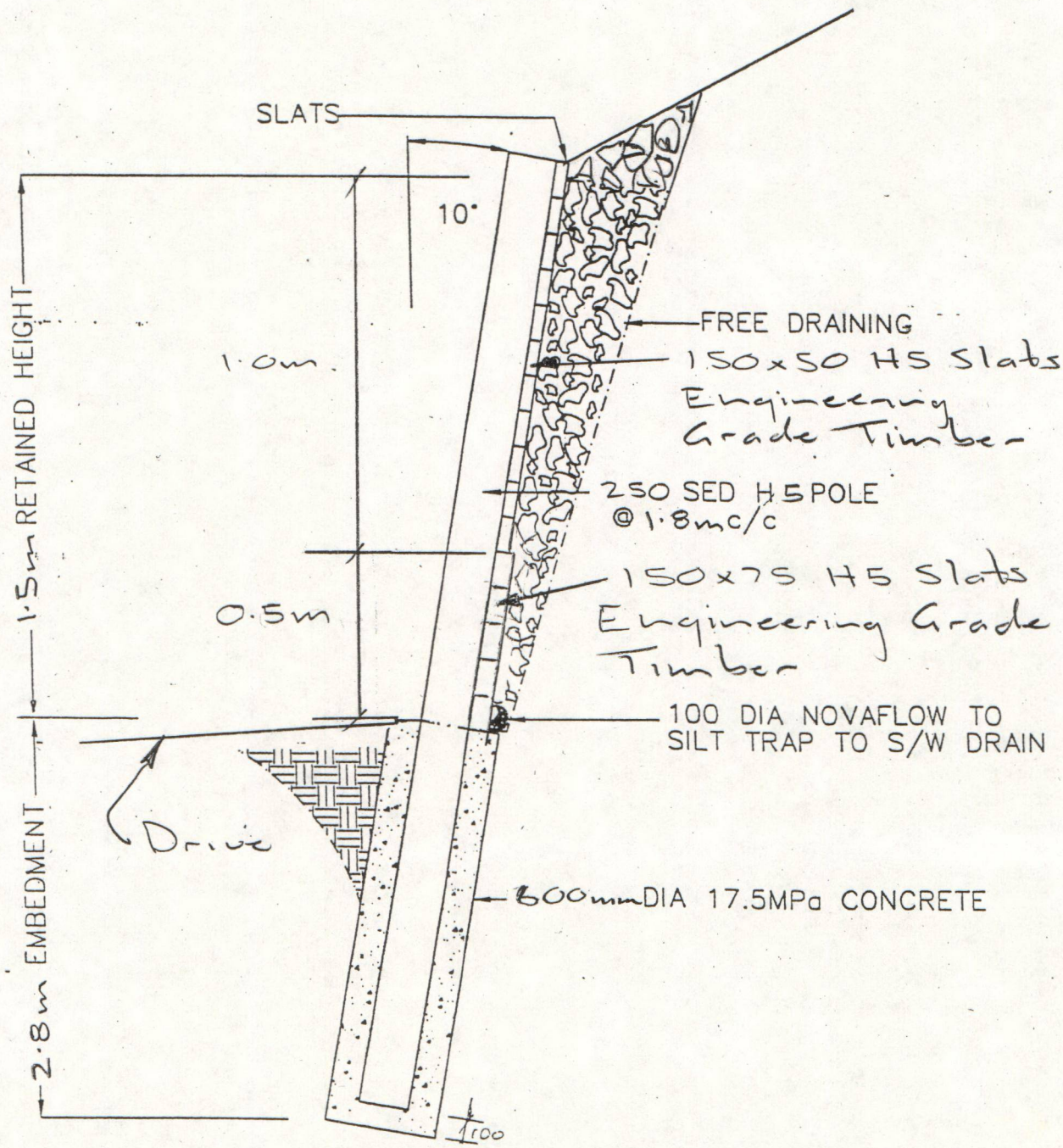
Remarks :

HARRISON GRIERSON

Job Name Thornton		Job No. 711050
Client S Thornton		
Page No.	Prepared By GDH	
Date 6/04	Checked By	

Work Sheet

1.5m Wall Uphill of Driveway.



RETAINING WALL

Timber Pole Vertical Retaining Wall

Job No: 71;11050.1

DESIGN: Timber Retaining Wall, Sloping backfill, 4KPa Surcharge above driveway

CLIENT: Steve Thornton

Prepared by: gdm

ADDRESS: Wainui Road

Checked by:

Step 1 :Input Design Parameter

Surcharge	4 kPa				
Wall Height	**2** m	Ka	0.61	based on back slope of 28 degrees	
Gamma	**18** kN/m3	Kp	3		
Phi	**30**				
Degree	0.524				
Lateral Force	21.96 **kN/m**				
Surcharge	4.88 **kN/m**				

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Moment (kNm)	Moment * 1.6
Soil pressure	21.96	0.6666667	14.64	23.424
Surcharge	4.88	1	4.88	no factor for surcharge
Total	**26.84**	**1.667**	**19.52**	**28.304**

c	0.727	Pole Spacing (crs)		**1.8**	
Resultant Moment(M*)	50.947 kN-m	Pile spacing factor		**0.75**	
Resultant Force(H*)	72.029 kN				

Step 3 :Check by Brohms Method

Depth of Embedment, L	**3.9** m				
Pole embedment dia	**0.6** m			H*	
Brohms	H*<0.5Hu	**0.5Hu=**	**77.883**	72.029	**OK!**
Comment:	***Use* 0.6**	**m dia with**	**3.9**	**m embed. depth**	**1.8 m apart**

Step 4 :Check for Pole bending

SED pole dia **350** mm Z section 4209243.282 mm3

Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21

0.8Mn=	58.734 kN-m	**K20 = 0.9**	**K1 = 0.6**
M*=	50.947 kN-m	**K21 = 0.85**	**K4 = 1**
Design is	**OK!**		**K5 = 1**
			K8 = 1
			fb (MPa) = 38

Step 5 :Check for Slats

	width	depth		
Use	**0.146**	**0.095**	Z section	219608.3333 mm3
Force btw board =		**6.269824**	kN/m	
Moment in btw spacing=		2.031423	kN-m	

M*<0.8*Mn **Mn =0.8*K1*K4*K5*K8*fb*Z**

0.8Mn=	2.118781 kN-m	**K1 0.6**
M*=	2.031423	**K4 1**
Design is	**OK!**	**K5 1**
		K8 1
		fb (MPa) = 20.1

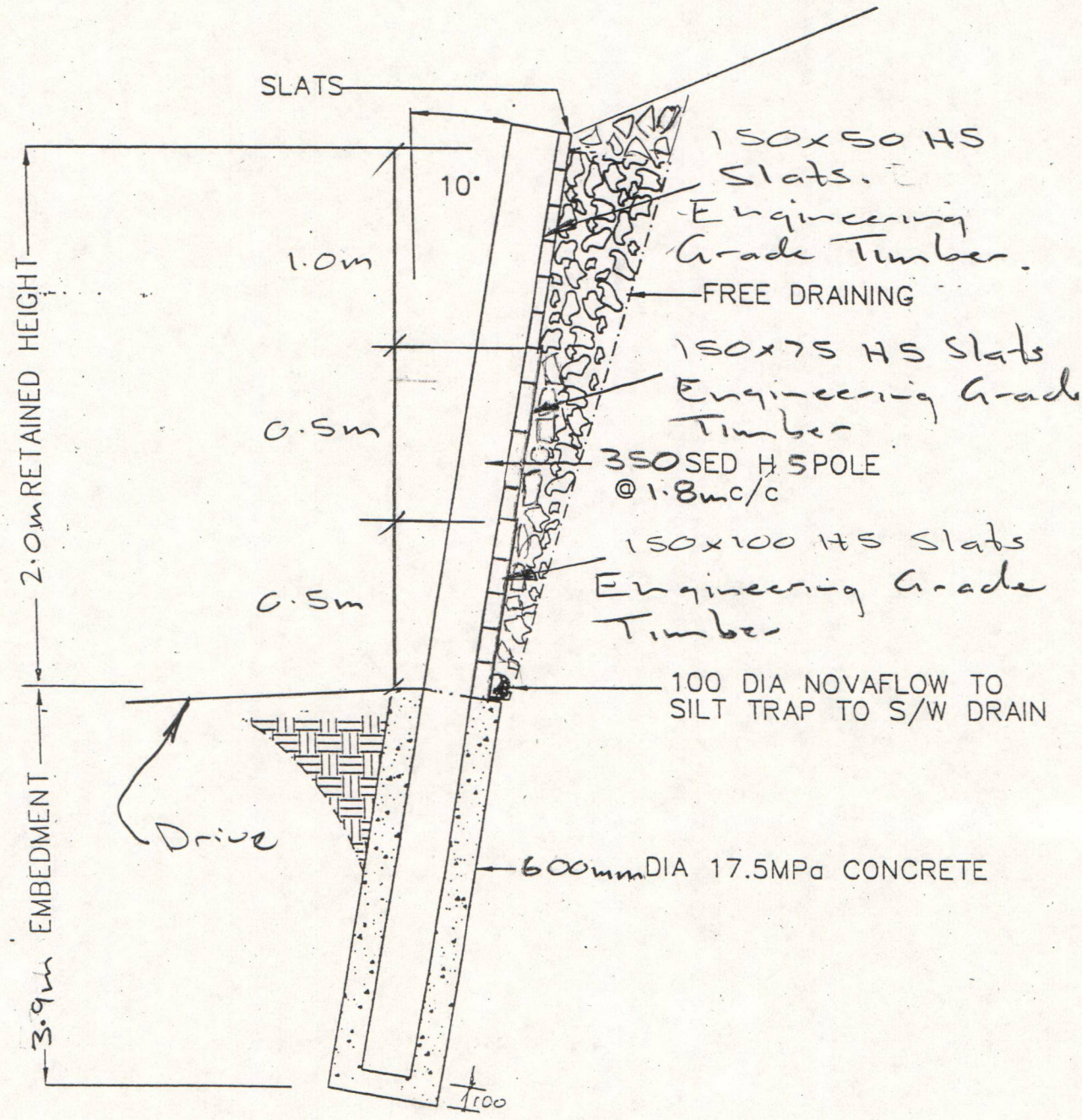
Remarks :

HARRISON GRIERSON

Job Name Thornton		Job No. 11050
Client S Thornton		
Page No.	Prepared By GDM	
Date 6/04	Checked By	

Work Sheet

2.0m Wall Uphill of Driveway



RETAINING WALL

Timber Pole Vertical Retaining Wall

Job No: 71.10635.1

DESIGN: 0.5m Retaining wall supporting driveway, level backfill. 8-Jun-04

CLIENT: Steve Thornton

ADDRESS: 24 Wainui Road, Ohope.

Prepared by: GDM
Checked by:

Step 1 :Input Design Parameter

Surcharge	5	kPa			
Wall Height	0.5	m	Ka	0.33302458	
Gamma	18	kN/m3	Kp	3	
Phi	30				
Degree	0.524				
Lateral Force	0.749	**kN/m**			
Surcharge	0.833	**kN/m**			

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Moment (kNm)	Moment * 1.6
Soil pressure	0.749	0.1666667	0.12	0.192
Surcharge	0.833	0.25	0.21	no factor for surcharge
Total	**1.582**	**0.417**	**0.33**	**0.402**

c	0.209	Pole Spacing (crs)		1.8
Resultant Moment(M*)	0.724 kN-m	Pile spacing factor		0.75
Resultant Force(H*)	3.657 kN			

Step 3 :Check by Brohms Method

Depth of Embedment, L	0.9	m			
Pole embedment dia	0.6	m		H*	
Brohms	H*<0.5Hu	**0.5Hu=**	**3.993**	3.657	**OK!**
Comment:	***Use* 0.6**	**m dia with**	**0.9 m embed. depth**		**1.8 m apart**

Step 4 :Check for Pole bending

SED pole dia 150 mm Z section 331339.85 mm3

M*<0.8*Mn **Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21**

0.8Mn=	4.623 kN-m		**K1 = 0.6**
M*=	0.724 kN-m	**K20 = 0.9**	**K4 = 1**
Design is	**OK!**	**K21 = 0.85**	**K5 = 1**
			K8 = 1
			fb (MPa) = 38

Step 5 :Check for Slats

	width	depth		
Use	0.146	0.049	Z section	58424.33333 mm3
Force btw board =		**0.349933**	kN/m	
Moment in btw spacing=		0.113378	kN-m	

M*<0.8*Mn **Mn =0.8*K1*K4*K5*K8*fb*Z**

0.8Mn=	0.415046 kN-m	**K1 0.6**
M*=	0.113378	**K4 1**
Design is	**OK!**	**K5 1**
		K8 1
		fb (MPa) = 14.8

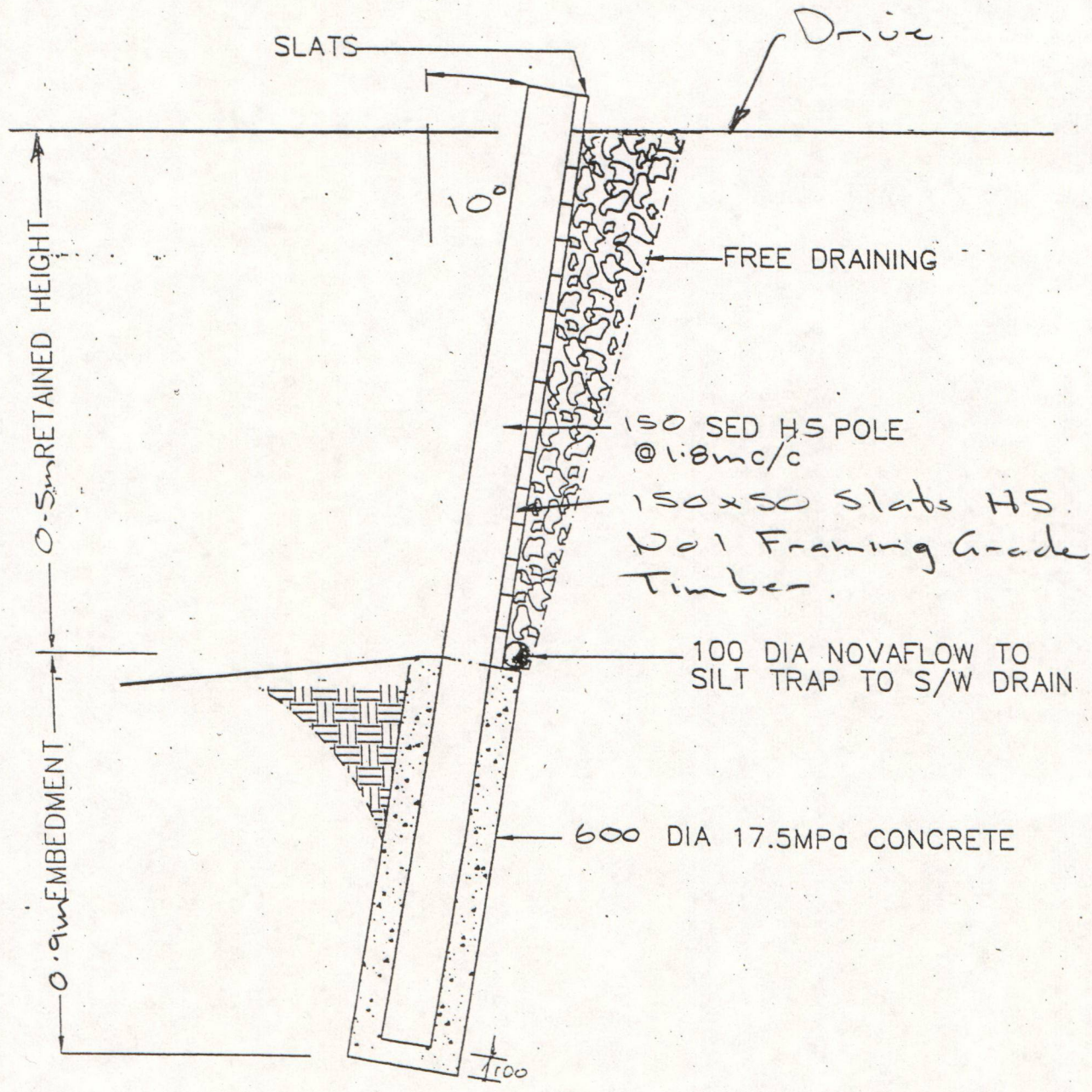
Remarks :

HARRISON GRIERSON

Job Name	Thornton	Job No. 7111050 1
Client	S Thornton	
Page No.		Prepared By GDM
Date 6/04		Checked By

Work Sheet

0.5m Wall Below Driveway.



RETAINING WALL

Timber Pole Vertical Retaining Wall

Job No: 71.10635.1

DESIGN: 1.0m Retaining wall supporting driveway, level backfill. 8-Jun-04

CLIENT: Steve Thornton

ADDRESS: 24 Wainui Road, Ohope.

Prepared by: GDM
Checked by:

Step 1 :Input Design Parameter

Surcharge	5	kPa			
Wall Height	1	m	Ka	0.33302458	
Gamma	18	kN/m3	Kp	3	
Phi	30				
Degree	0.524				
Lateral Force	2.997	**kN/m**			
Surcharge	1.665	**kN/m**			

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Moment (kNm)	Moment * 1.6
Soil pressure	2.997	0.3333333	1	1.6
Surcharge	1.665	0.5	0.83	no factor for surcharge
Total	**4.662**	**0.833**	**1.83**	**2.43**

c	0.393	Pole Spacing (crs)		1.8
Resultant Moment(M*)	4.374 kN-m	Pile spacing factor		0.75
Resultant Force(H*)	11.628 kN			

Step 3 :Check by Brohms Method

Depth of Embedment, L	1.6	m			
Pole embedment dia	0.6	m		H*	
Brohms	H*<0.5Hu	**0.5Hu=**	**12.485**	11.628	**OK!**
Comment:	***Use* 0.6**	**m dia with**	**1.6 m embed. depth**		**1.8 m apart**

Step 4 :Check for Pole bending

SED pole dia	150 mm	Z section	331339.85 mm3	
	M*<0.8*Mn	**Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21**		**K1 = 0.6**
0.8Mn=	4.623 kN-m			**K4 = 1**
M*=	4.374 kN-m	**K20 = 0.9**		**K5 = 1**
Design is	**OK!**	**K21 = 0.85**		**K8 = 1**
				fb (MPa) = 38

Step 5 :Check for Slats

	width	depth			
Use	0.146	0.075	Z section	136875 mm3	
Force btw board =		**1.400198** kN/m			
Moment in btw spacing=		0.453664 kN-m			
	M*<0.8*Mn		**Mn =0.8*K1*K4*K5*K8*fb*Z**		**K1 0.6**
0.8Mn=	0.97236 kN-m				**K4 1**
M*=	0.453664				**K5 1**
Design is	**OK!**				**K8 1**
					fb (MPa) = 14.8

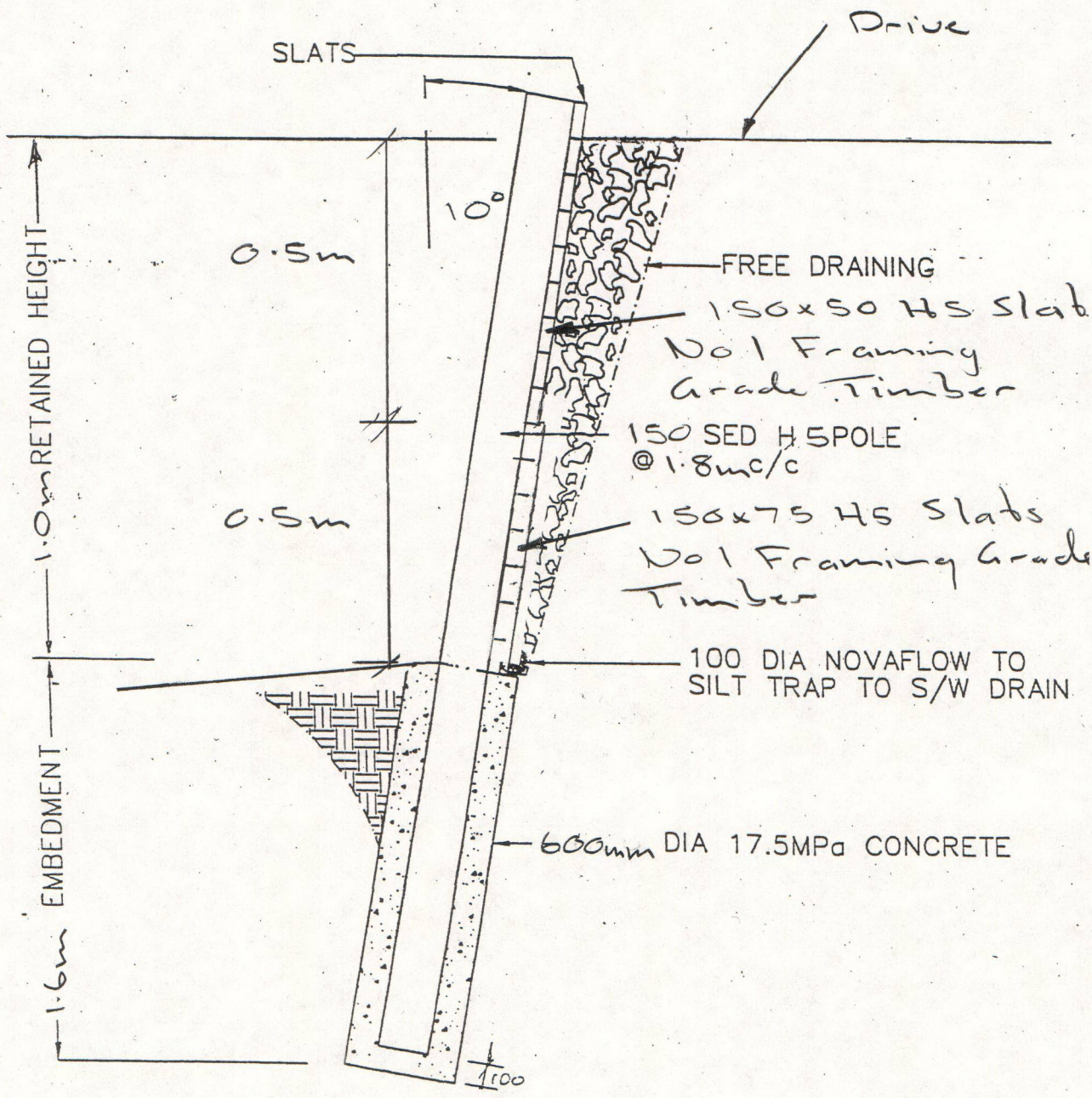
Remarks :

HARRISON GRIERSON

Job Name Thornton		Job No. 7111050
Client S Thornton		
Page No.	Prepared By GDM	
Date 6/04.	Checked By	

Work Sheet

1.0m Wall Below Driveway:-



RETAINING WALL

Timber Pole Vertical Retaining Wall

Job No: 71.10635.1

DESIGN: 1.5m Retaining wall supporting driveway, level backfill. 8-Jun-04

CLIENT: Steve Thornton

ADDRESS: 24 Wainui Road, Ohope. Prepared by: GDM Checked by:

Step 1 :Input Design Parameter

Surcharge	5 kPa			
Wall Height	1.5 m	Ka	0.33302458	
Gamma	18 kN/m3	Kp	3	
Phi	30			
Degree	0.524			
Lateral Force	6.744 **kN/m**			
Surcharge	2.498 **kN/m**			

Step 2 :Determine Both Resultant Force * Moment

	Forces(KN)	Arm(m)	Moment (kNm)	Moment * 1.6
Soil pressure	6.744	0.5	3.37	5.392
Surcharge	2.498	0.75	1.87	no factor for surcharge
Total	**9.242**	**1.25**	**5.24**	**7.262**

c	0.567	Pole Spacing (crs)		1.8
Resultant Moment(M*)	13.072 kN-m	Pile spacing factor		0.75
Resultant Force(H*)	23.919 kN			

Step 3 :Check by Brohms Method

Depth of Embedment, L	2.3 m				
Pole embedment dia	0.6 m			H*	
Brohms	H*<0.5Hu	**0.5Hu=**	**25.781**	23.919	**OK!**
Comment:	***Use* 0.6**	**m dia with**	**2.3 m embed. depth**		**1.8 m apart**

Step 4 :Check for Pole bending

SED pole dia	225 mm	Z section	1118271.994 mm3
	M*<0.8*Mn	**Mn =0.8*K1*K4*K5*K8*fb*Z*k20*k21**	
0.8Mn=	15.604 kN-m		
M*=	13.072 kN-m		
Design is	**OK!**		

K1 = 0.6
K4 = 1
K5 = 1
K8 = 1
fb (MPa) = 38

K20 = 0.9
K21 = 0.85

Step 5 :Check for Slats

	width	depth		
Use	0.146	0.095	Z section	219608.3333 mm3
Force btw board =		3.150797	kN/m	
Moment in btw spacing=		1.020858	kN-m	
	M*<0.8*Mn		**Mn =0.8*K1*K4*K5*K8*fb*Z**	
0.8Mn=	1.560098 kN-m			
M*=	1.020858			
Design is	**OK!**			

K1 0.6
K4 1
K5 1
K8 1
fb (MPa) = 14.8

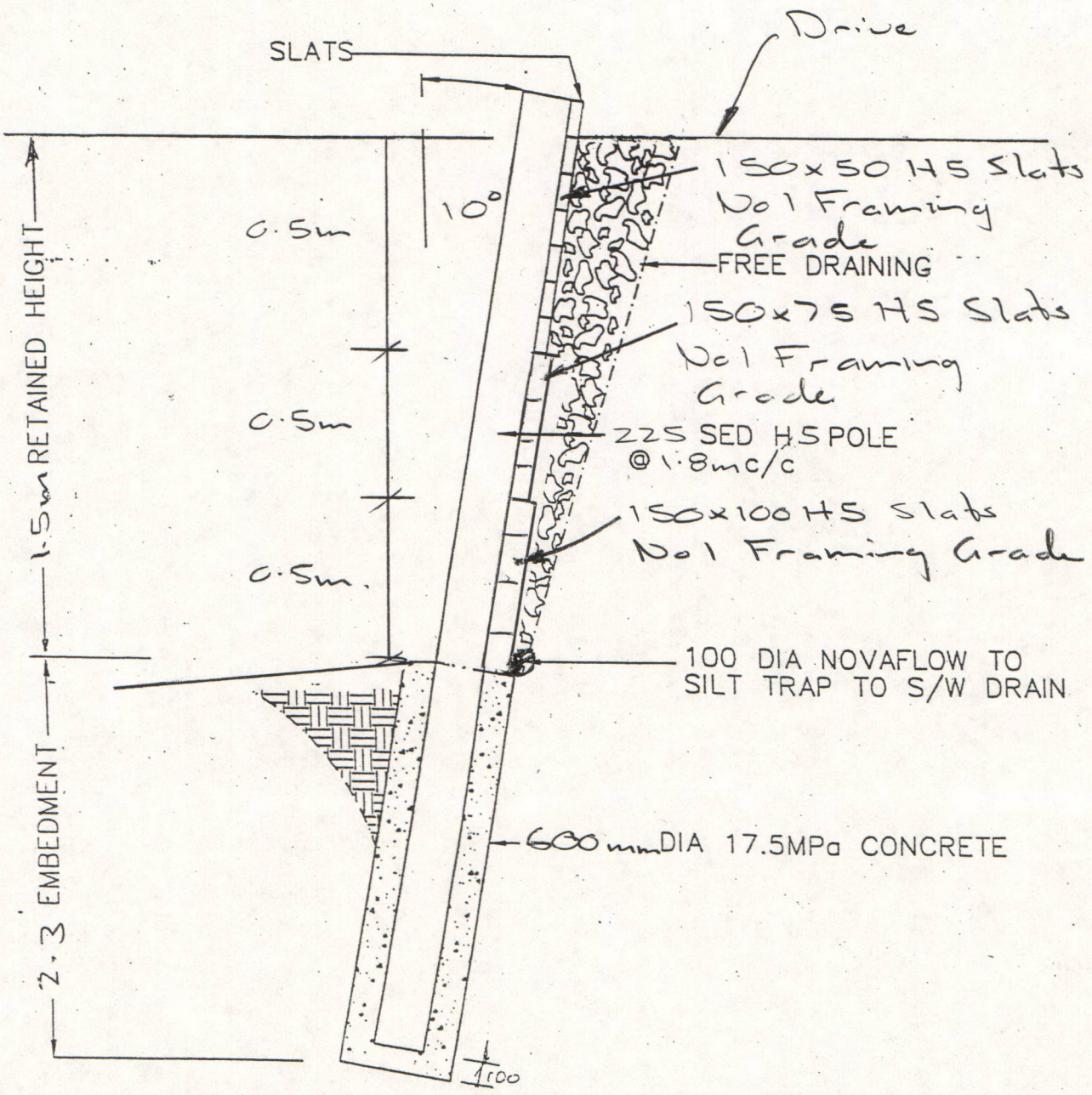
Remarks :

HARRISON GRIERSON

Job Name	Thornton	Job No.
Client	S Thornton	7111050
Page No.		Prepared By GDM
Date	6/04	Checked By

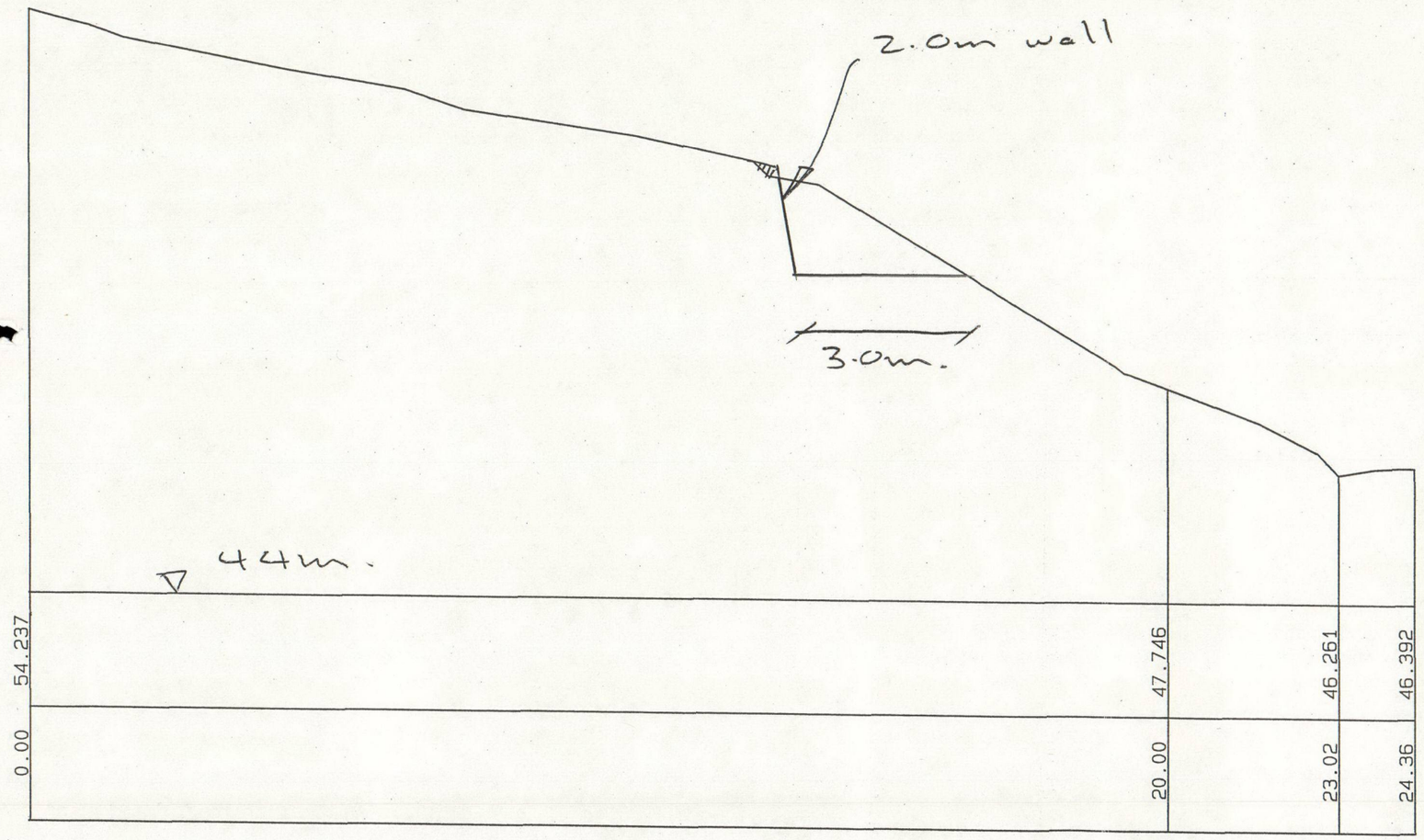
Work Sheet

1.5m Wall Below Driveway



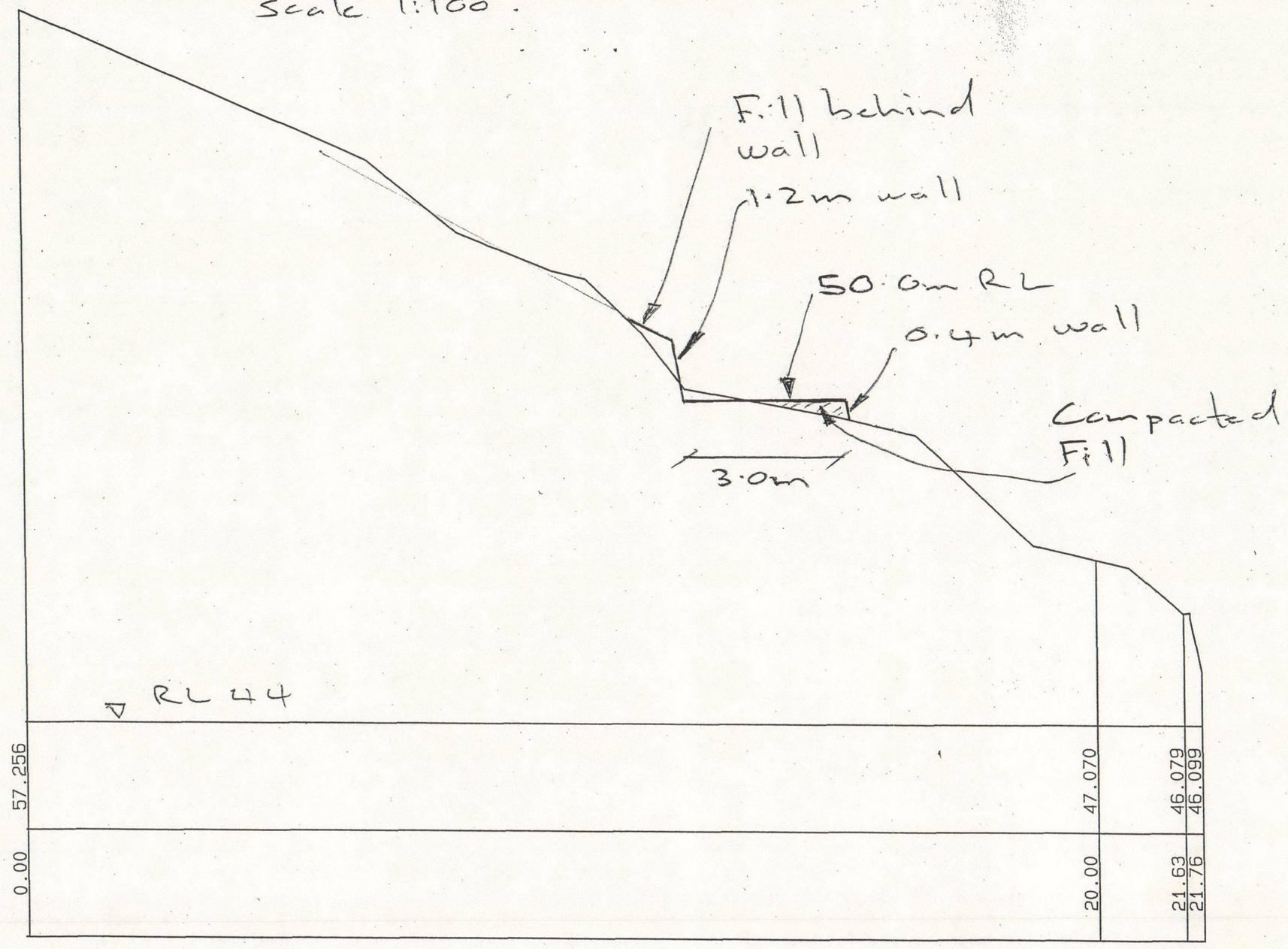
RETAINING WALL

Cross Section 2.
Scale 1:100.



Cross Section 3.

Scale 1:100.



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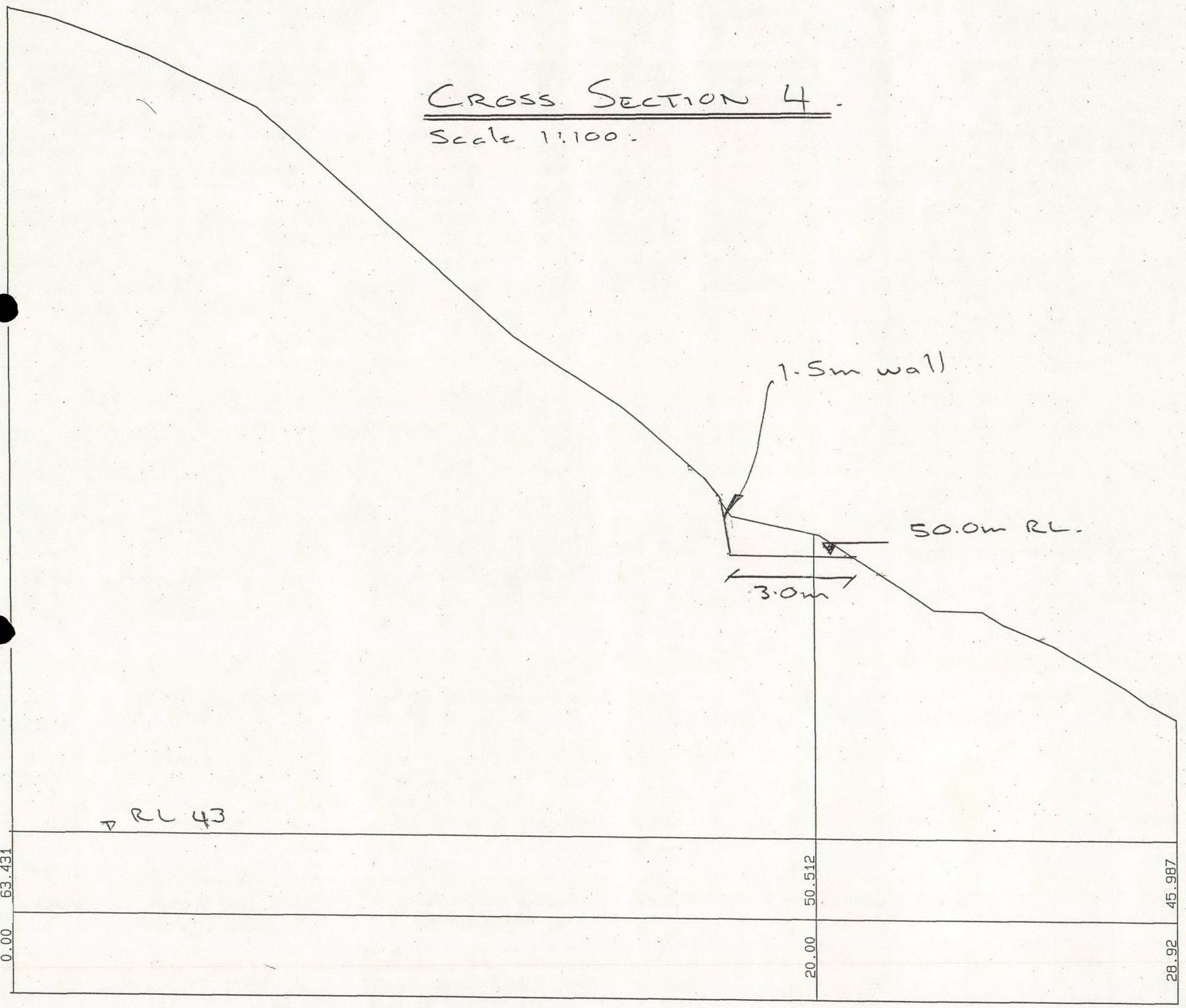
Scale 1:100.



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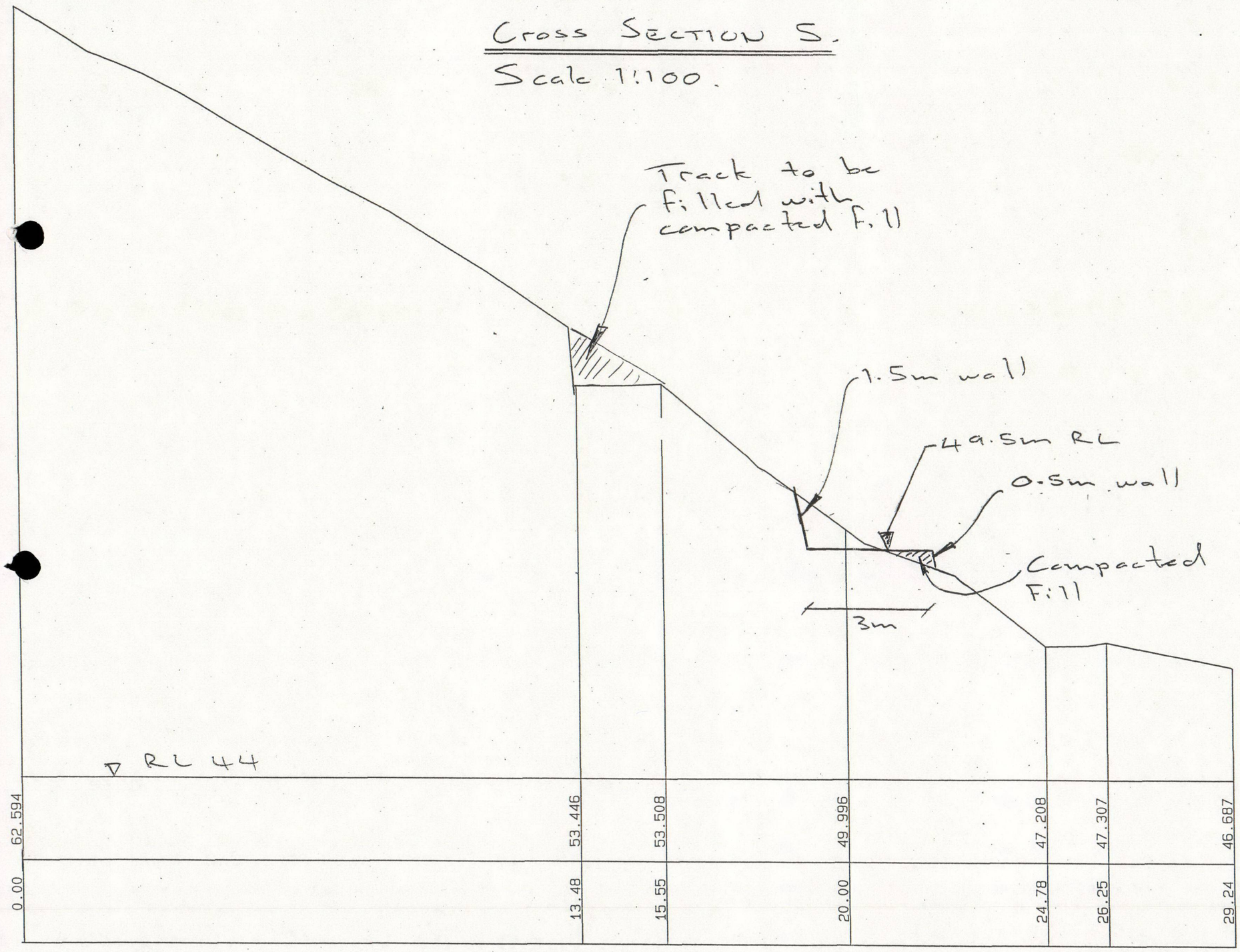
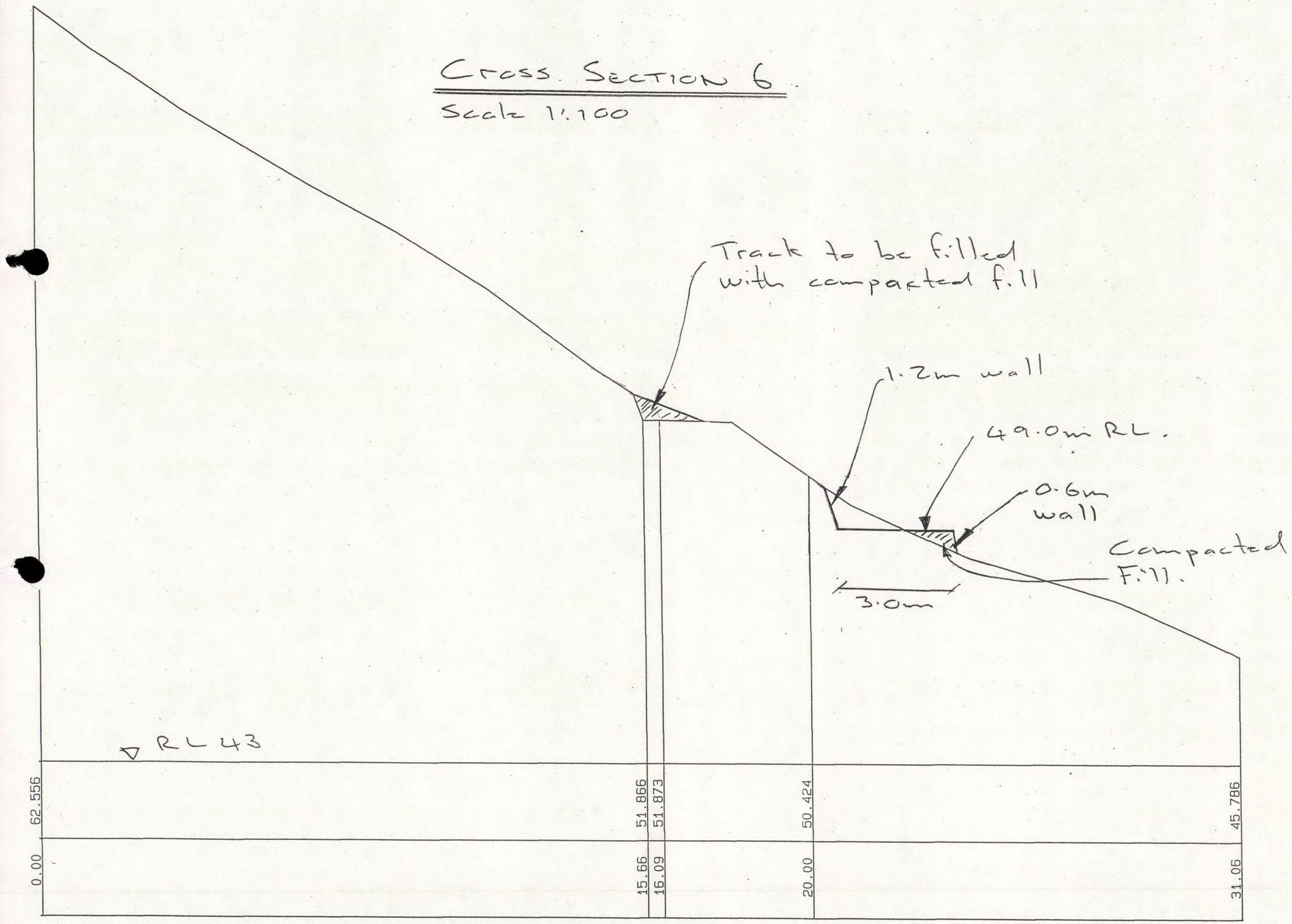


Cross Section 6

Scale 1:100



Cross Section 7.

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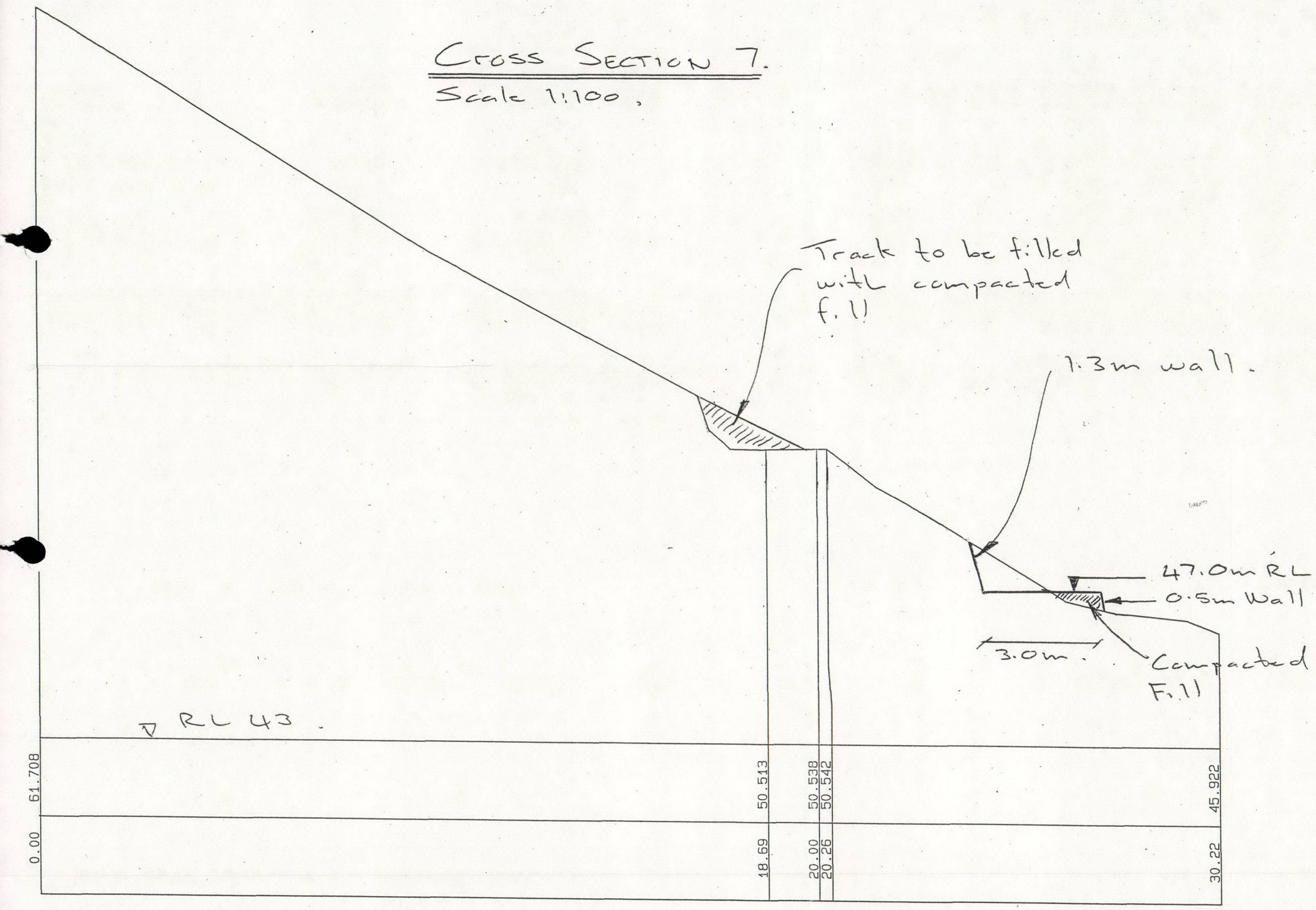
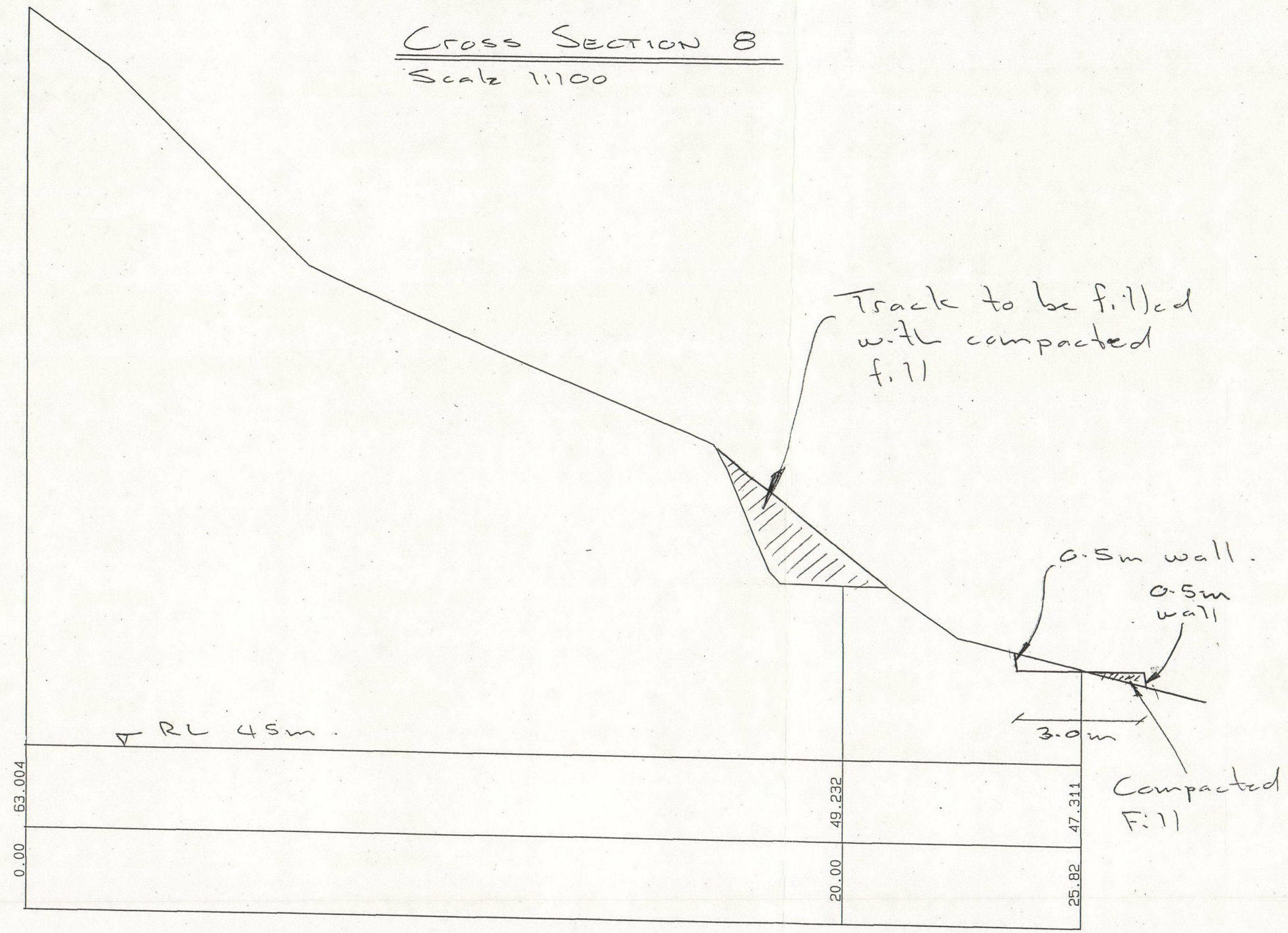


Cross Section 8

Scale 1:100

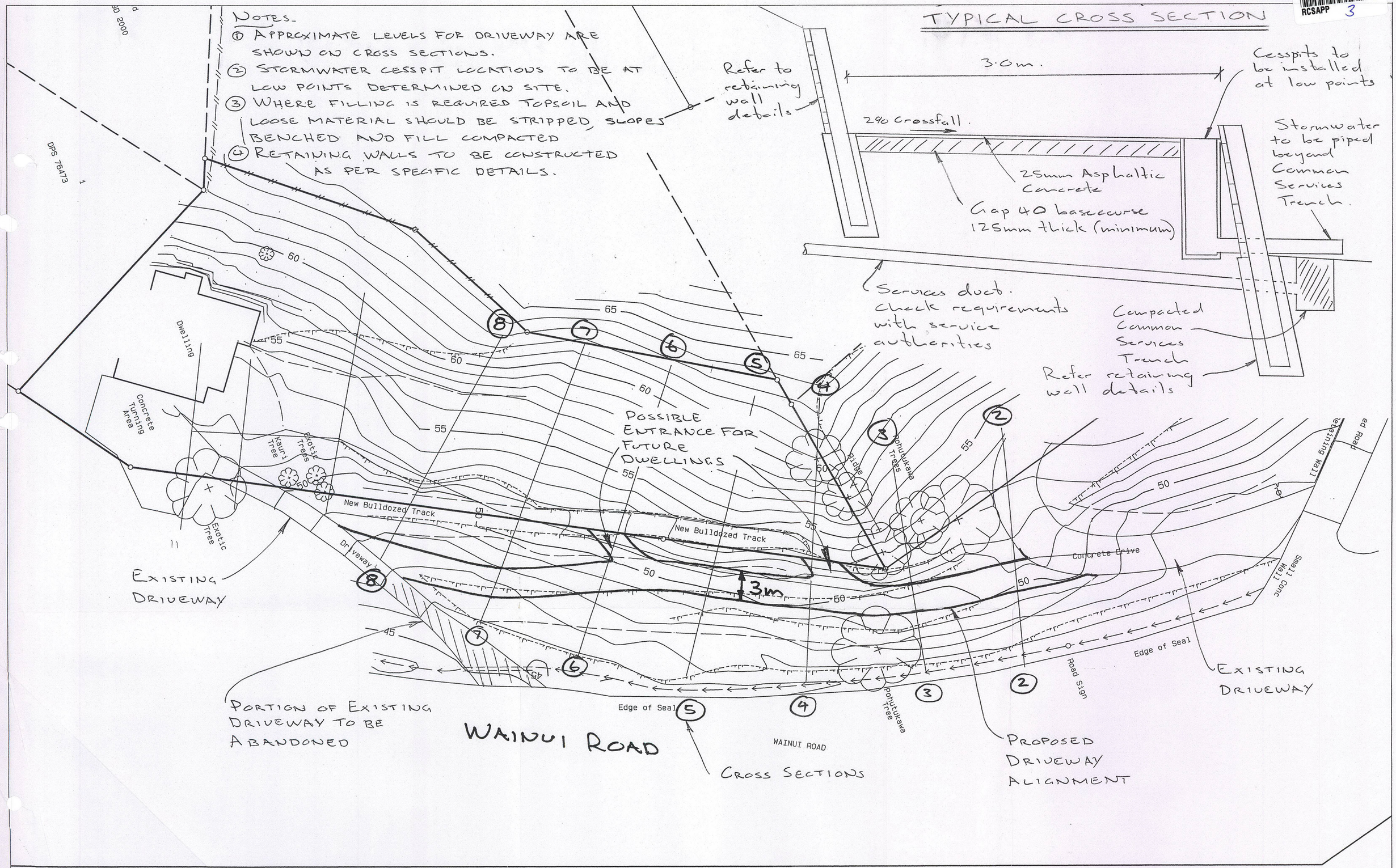


RCSAPP 3

NOTES.

1. APPROXIMATE LEVELS FOR DRIVEWAY ARE SHOWN ON CROSS SECTIONS.
2. STORMWATER CESSPIT LOCATIONS TO BE AT LOW POINTS DETERMINED ON SITE.
3. WHERE FILLING IS REQUIRED TOPSOIL AND LOOSE MATERIAL SHOULD BE STRIPPED, SLOPES BENCHED AND FILL COMPACTED
4. RETAINING WALLS TO BE CONSTRUCTED AS PER SPECIFIC DETAILS.

TYPICAL CROSS SECTION



SURVEYED BY:		DRAWN BY:	
DATE SURVEYED:		DATE PLOTTED:	11 JUN 2004
SO/RMAP REF:	616	CAD REFERENCE:	
		CAD XREF'S:	
DESIGNED:		APPROVED:	
CHECKED:			

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HARRISON GRIERSON
HG
CONSULTING ENGINEERS SURVEYORS PLANNERS

PROJECT: THORNTON
24 WAINUI ROAD
OHOPE.

TITLE: PROPOSED DRIVEWAY PLAN AND TYPICAL SECTION

REF	AMENDMENTS	BY	DATE

PROJECT No:	7111050
DRAWING No: 1	REV
ORIGINAL SCALE: 1:250	A2
REDUCED SCALE:	