

Nick Tompkins  
Retaining Wall Replacement  
170 Kawaha Point Road  
Geotechnical Statement for Retaining Wall Design



Statement Prepared by:  
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*BE (Hons)*

BSK REF: 24493  
22 September 2022

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**APPROVED BUILDING CONSENT**  
**BC23-010204**  
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## EXECUTIVE SUMMARY

Nick Tompkins is proposing to replace an existing retaining wall at 170 Kawaha Point Road. The existing wall is of block construction and has failed. It is proposed to replace it with a timber pole retaining wall, 2.0m in height. The wall is surcharged by a driveway on the upper level.

Our scope of works includes:

Ground Investigation	2x hand augers with associated scala penetrometer tests
Assessment and design	Deflection based retaining wall design
Report	Geotechnical Statement
Drawings	Site Location Plan Cross Sections

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## 1 GROUND INVESTIGATIONS

Site investigations were undertaken on the 01<sup>st</sup> of September 2022 by BSK. These investigations consisted of the following:

- Two hand augers with associated Scala penetrometers,

The test locations are presented on the test location plan in Appendix A, with the test results presented in Appendix B.

## 2 RETAINING WALL DESIGN

### 2.1 Design Philosophy

Our design philosophy for the design of the timber wall is based on the following:

- Limiting deflection at the top of the wall;
- Allowing the wall to undergo limited permanent deformation during an ultimate limit state (ULS) seismic event;
- All aspects to remain sufficiently robust and ductile to accommodate the calculated permanent displacements.
- Pole centre to centre spacing based on three times the diameter of the bored hole filled with concrete. This is because soil arching between the posts will enable the posts to act as a near continuous structure both for passive resisting loads in front of the wall and active loads applied behind the wall.

### 2.2 Design Standards & Guidelines

We have utilized the following standards and design guidelines during the detailed design of the timber wall remediation option:

- NZ Transport Agency Bridge Manual SP/M/022, Third Edition, October 2018.
- NZS 1170.0:2002. Australia/New Zealand Standard, Structural Design Actions, Part 0: General Principals. Standards New Zealand, Wellington, New Zealand.
- NZS 1170.5:2002. Australia/New Zealand Standard, Structural Design Actions, Part 5: Earthquake Actions - New Zealand. Standards New Zealand, Wellington, New Zealand.
- MBIE / NZGS (2021). Earthquake geotechnical engineering practice. Module 1: Overview of the guidelines. NZ Geotechnical Society Inc., Wellington, New Zealand. (Module 1)
- MBIE / NZGS (2021). Earthquake Engineering Geotechnical Practice. Module 6: Earthquake resistant retaining wall design. NZ Geotechnical Society Inc., Wellington, New Zealand. (Module 6)



- Eurocode EN1997-1. Eurocode 7: Geotechnical design - Part 1: General rules. EUROPEAN COMMITTEE FOR STANDARDIZATION COMITE EUROPEEN DE NORMALISATION.

## 2.3 WALLAP Software Design

The design of the timber wall has been undertaken using the 2D retaining wall modelling software WALLAP. The subgrade reaction models for the static and seismic analyses respectively were used to calculate the maximum bending moments, shear forces, displacements of the proposed timber wall. The WALLAP results and calculations are presented within Appendix C. Other design assumptions that have been incorporated into our design are as follows:

- Maximum exposed retained height = 2.0m;
- Angle of toe slope = 0°
- Angle of upslope = 0°
- Design calculations assume effective conditions behind the wall;
- Wall friction of  $2/3\phi$  is assumed to develop on the active soil-wall interface;
- A 5kPa traffic load is applied directly behind the wall in the static case.
- Traffic load below the wall has not been applied;
- Wall modelled with a 3 degree lean back into the slope which is beyond the capability of the software, however the raking adds greater capacity to the overall design, therefore the design may be slightly more conservative.
- We have adopted the ULS design load cases as per Module 6 as we consider this recent approach is more relevant to the design of retaining structures and in some respects is considered conservative. This includes the live load of the traffic. This live load has been reduced by  $2/3$  for the seismic case.
- The pole centre to centre spacing is based on keeping the post holes at or within three times the hole diameter. This is to ensure the wall acts as a single structural member using principals of soil arching between the posts to generate a continuous passive resistance, as per the New Zealand Building Code, B1/VM4 for lateral pile loads and spacing.

### 2.3.1 Analysis Staging

The following sequence in Table 3 has been used to assess the various actions on the wall.

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Stage	Action
1	Fill to 2.0m behind wall
2	Apply traffic load of 5kPa and analyse
3	Remove 5kPa traffic load
4	Reset displacements
5	Apply 1/3 of 5kPa traffic load to apply during seismic loading
6	Apply seismic acceleration as pseudo-dynamic loading

Table 1: Sequence of Construction and Loading

The results of our design calculations are summarised below in Table 4. This is for the greatest retained height. Checks on the bending and shear capacity are provided in Appendix C1.

Stage	Displacement (mm)	FoS on Embedment	Largest Bending Moments kN.m/m	Largest Shear Forces (kN/m)
3	77	1.665	13.4	9.4
6	18	1.385	16.0	14.5

Table 2: WALLAP Analyses Output Summary (unfactored)

### 2.3.2 Design Summary

The design summary for the proposed timber wall is presented within Table 5 below. The products listed have a 50-year design life as long as correct construction tolerances are adhered to.

Wall Details	Wall Summary
Approximate wall length	Approximately 20m
Pole spacing c/c	1.2m
Max designed retained height	2.0m
Timber pole small end diameter (SED)	250mm
Minimum pole length	5.5m

Pole auger hole diameter	450mm
Moment of Inertia per unit Length	$1.598 \times 10^{-4} \text{ m}^4 \text{ per linear m}$
Timber Young's Modulus	$7.852 \times 10^6 \text{ kN/m}^2$
Hole Concrete	20MPa
Timber Lagging (Lagging to span at least 3 poles)	50mm thick from top of wall down to 1.3m below the top of wall. 100mm thick from 1.3m below the top of wall down to the ground level.
Backfill	40/20 Drainage Metal
Drainage (Consider drainage outlet to access road or stormwater system)	Bidim A19, Duraforce AS410 or equivalent with 100mm perforated PVC pipe with filter sock.

Table 3: Timber Wall Design Summary

A value of a 1/10 lean into the slope is proposed to provide further stability and conservatism to the wall construction.

## 2.4 Safety from Falling

A fence is required at the top of the wall to comply with the New Zealand Building Code to prevent falling from height. Each end of the wall must be inaccessible. We have provided a design for both a fence and a barrier for this site. Either of these two designs or an off the shelf product may be used, provided it has the required documentation and is designed for the correct load.

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### 3 REFERENCES

- Henderson, D. (2013). The performance of House Foundations in the Canterbury Earthquakes. Department of Civil and Natural Resources Engineering, University of Canterbury, Christchurch, New Zealand.
- Ishihara, K. (1985). Stability of natural soil deposits during earthquakes. International Conference on Soil Mechanics and Foundation Engineering, 321-376.
- MBIE (2012). Ministry of Business, Innovation & Development (MBIE). Repairing and rebuilding houses affected by the Canterbury earthquakes, Part A Technical Guidance. ISBN: 978-0-478-39908-0 (online).
- MBIE (2016). Ministry of Business, Innovation & Development (MBIE) & New Zealand Geotechnical Society (NZGS), Earthquake Geotechnical Engineering Practice, Module 3: Identification, assessment, and mitigation of liquefaction hazards. ISBN: 978-0-947497-50-7 (online).
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- MBIE (2017). Ministry of Business, Innovation & Development (MBIE) & Ministry for the Environment (MfE). Planning and engineering guidance for potentially liquefaction-prone land. ISBN: 978-1-98851770-4 (online).
- MBIE AS/VM B1 (2019). Ministry of Business, Innovation & Employment (MBIE). Acceptable Solutions and Verification Methods for New Zealand Building Code Clause B1 Structure. Amendment 18.
- NZS 3604:2011. Timber Framed buildings. Standards New Zealand.
- Youd, T. L. 2018, Application of MLR Procedure for Prediction of Liquefaction-Induced Lateral Spread Displacement, Journal of Geotechnical and Environmental Engineering 144(6), ASCE.

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## APPENDIX A – SITE PLAN

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**LEGEND**  
HA Hand Auger and Scala Penetrometer

ISSUE:	DATE:	DESCRIPTION:
<div><div><div>BSK</div><div>Consulting Engineers</div></div><div><div><div>P.O. BOX 23, 314 Malfroy Rd, Rotorua, New Zealand Phone: (07) 348 5394 Email: admin@bsk.co.nz Web: www.bsk.co.nz</div><div><div>ACENZ</div></div></div></div></div>		
PROJECT: 170 Kawaha Point Road Rotorua		
CONTENTS: Site Investigation Location Plan		
SCALES: N/A	DATE: 29/07/2022	
DESIGNED: A George	JOB REF No:	24493
DRAWN: A George	SHEET No: 1	OF: 1
APPROVED: N/A		
CHECKED: L K		



## APPENDIX B – GEOTECHNICAL INVESTIGATION DATA

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## APPENDIX C – WALLAP DESIGN OUTPUT

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Units: kN,m

# INPUT DATA

## SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types	
		Left side	Right side
1	0.00	1 Silty Sand	1 Silty Sand
2	-1.50	2 Sandy Silt	2 Sandy Silt

## SOIL PROPERTIES

-- Soil type --	Bulk density	Young's Modulus	At rest coeff.	Consol state.	Active limit	Passive limit	Cohesion
No. Description	kN/m3	Eh, kN/m2	Ko	NC/OC	Ka	Kp	kN/m2
(Datum elev.)		(dEh/dy )	(dKo/dy)	( Nu )	( Kac )	( Kpc )	( dc/dy )
1 Silty Sand	18.00	8000	0.531	OC	0.309	4.132	
				(0.200)	(0.000)	( 0.000)	
2 Sandy Silt	18.00	10000	0.500	OC	0.283	4.701	2.000d
				(0.200)	(1.241)	( 6.411)	

## Additional soil parameters associated with Ka and Kp

--- parameters for Ka ---				--- parameters for Kp ---			
Soil	Wall	Back-	Soil	Wall	Back-	Soil	Wall
friction	adhesion	fill	friction	adhesion	fill	friction	adhesion
angle	coeff.	angle	angle	coeff.	angle	angle	coeff.
1 Silty Sand	28.00	0.670	0.00	28.00	0.670	0.00	0.00
2 Sandy Silt	30.00	0.670	0.00	30.00	0.670	0.00	0.00

## GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Left side	Right side
Initial water table elevation	-10.00	-10.00

Automatic water pressure balancing at toe of wall : No

## WALL PROPERTIES

Type of structure = Fully Embedded Wall  
 Elevation of toe of wall = -3.00  
 Maximum finite element length = 0.30 m  
 Youngs modulus of wall E = 8.7000E+06 kN/m2  
 Moment of inertia of wall I = 1.6000E-04 m4/m run  
 E.I = 1392.0 kN.m2/m run  
 Yield Moment of wall = Not defined

## HORIZONTAL and MOMENT LOADS/RESTRAINTS

Load no.	Horizontal load	Moment load	Moment restraint	Partial factor
Elevation	kN/m run	kN.m/m run	kN.m/m/rad	(Category)
1 2.00	0	0.7500	0	N/A

## SURCHARGE LOADS

Surch- arge	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge		Equiv. soil type	Partial factor/Category
no.	Elev.			Near edge	Far edge		
1	2.00	0.00 (L)	20.00	7.00	5.00	=	1 N/A
2	2.00	0.00 (L)	20.00	7.00	1.67	=	1 N/A

Note: L = Left side, R = Right side

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## CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Fill to elevation 2.00 on LEFT side with soil type 1
2	Apply surcharge no.1 at elevation 2.00
3	Remove surcharge no.1 at elevation 2.00
4	Change EI of wall to 1392 kN.m2/m run Reset wall displacements to zero at this stage
5	Apply surcharge no.2 at elevation 2.00
6	Apply seismic loading: 0.108g horizontal Line of action of quasi-static seismic force = 0.333 Seismic loading model: Quasi-static loading

## FACTORS OF SAFETY and ANALYSIS OPTIONS

### Stability analysis:

Method of analysis - Strength Factor method  
Factor on soil strength for calculating wall depth = 1.25  
Active limit pressures calculated by Wedge Stability  
Passive limit pressures calculated by Wedge Stability

### Parameters for undrained strata:

Minimum equivalent fluid density = 5.00 kN/m3  
Maximum depth of water filled tension crack = 0.00 m

### Bending moment and displacement calculation:

Method - Subgrade reaction model using Influence Coefficients  
Open Tension Crack analysis? - No  
Non-linear Modulus Parameter (L) = 0 m

### Boundary conditions:

Length of wall (normal to plane of analysis) = 1000.00 m

Width of excavation on Left side of wall = 20.00 m  
Width of excavation on Right side of wall = 20.00 m

Distance to rigid boundary on Left side = 20.00 m  
Distance to rigid boundary on Right side = 20.00 m

## OUTPUT OPTIONS

Stage no.	Stage description	Displacement Bending mom. Shear force	Active, Passive pressures	Graph. output
1	Fill to elev. 2.00 on LEFT side	Yes	Yes	Yes
2	Apply surcharge no.1 at elev. 2.00	Yes	Yes	Yes
3	Remove surcharge no.1 at elev. 2.00	No	No	No
4	Change EI of wall to 1392kN.m2/m run	Yes	Yes	Yes
5	Apply surcharge no.2 at elev. 2.00	Yes	Yes	Yes
6	Quasi-static Seismic load: 0.108g(H)	Yes	Yes	Yes
*	Summary output	Yes	-	Yes

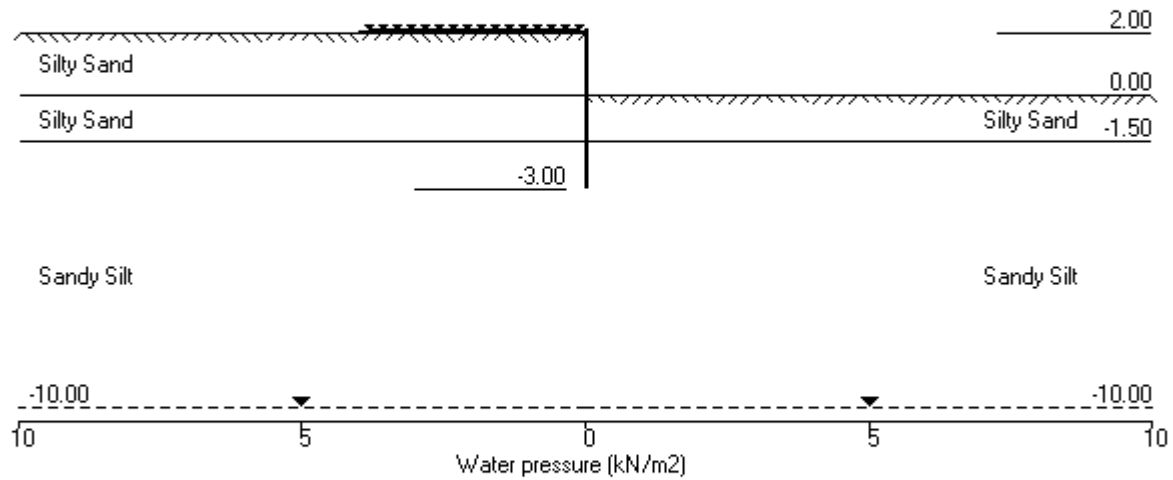
Program WALLAP - Copyright (C) 2020 by DL Borin, distributed by GEOSOLVE  
150 St. Alphonsus Road, London SW4 7BW, UK [www.geosolve.co.uk](http://www.geosolve.co.uk)

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Units: kN,m

Stage No.6 Quasi-static Seismic load: 0.108g(H)



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Units: kN,m

Stage No. 1 Fill to elevation 2.00 on LEFT side with soil type 1

**STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method**

Factor of safety on soil strength

Active limit pressures calculated by Wedge Stability

Passive limit pressures calculated by Wedge Stability

<u>Stage</u> <u>No.</u>	<u>Ground level</u>		<u>Prop</u> <u>Elev.</u>	<u>FoS for toe</u> <u>elev. = -3.00</u>		<u>Toe elev. for</u> <u>FoS = 1.250</u>		<u>Direction</u> <u>of</u> <u>failure</u>
	<u>Act.</u>	<u>Pass.</u>		<u>Factor</u> <u>of</u> <u>Safety</u>	<u>Moment</u> <u>equilib.</u> <u>at elev.</u>	<u>Toe</u> <u>elev.</u>	<u>Wall</u> <u>Penetr</u> <u>-ation</u>	
1	2.00	0.00	Cant.	1.665	-2.63	-2.10	2.10	L to R

**BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall**

**Analysis options**

Length of wall perpendicular to section = 1000.00m

Subgrade reaction model - Boussinesq Influence coefficients

Soil deformations are elastic until the active or passive limit is reached

Active limit pressures calculated by Wedge Stability

Passive limit pressures calculated by Wedge Stability

Open Tension Crack analysis - No

Rigid boundaries: Left side 20.00 from wall

Right side 20.00 from wall

<u>Node</u> <u>no.</u>	<u>Y</u> <u>coord</u>	<u>Nett</u> <u>pressure</u> kN/m2	<u>Wall</u> <u>disp.</u> m	<u>Wall</u> <u>rotation</u> rad.	<u>Shear</u> <u>force</u> kN/m	<u>Bending</u> <u>moment</u> kN.m/m	<u>Prop</u> <u>forces</u> kN/m
1	2.00	0.00	0.054	1.89E-02	0.0	0.0	
2	1.75	1.36	0.049	1.89E-02	0.2	0.0	
3	1.50	2.71	0.044	1.88E-02	0.7	0.1	
4	1.20	4.34	0.038	1.88E-02	1.7	0.5	
5	0.90	5.96	0.033	1.86E-02	3.3	1.2	
6	0.60	7.59	0.027	1.82E-02	5.3	2.5	
7	0.30	9.22	0.022	1.75E-02	7.8	4.4	
8	0.00	10.85	0.017	1.62E-02	10.8	7.2	
9	-0.30	-11.10	0.012	1.43E-02	10.8	10.6	
10	-0.60	-31.71	0.008	1.17E-02	4.4	13.7	
11	-0.90	-18.14	0.005	8.77E-03	-3.1	13.5	
12	-1.20	-8.70	0.003	6.04E-03	-7.1	11.8	
13	-1.50	-2.42	0.002	3.77E-03	-8.8	9.3	
		-5.28	0.002	3.77E-03	-8.8	9.3	
14	-1.80	2.59	0.001	2.07E-03	-9.2	6.4	
15	-2.10	6.64	0.000	9.78E-04	-7.8	3.8	
16	-2.40	8.40	0.000	3.81E-04	-5.6	1.7	
17	-2.70	9.19	-0.000	1.43E-04	-2.9	0.5	
18	-3.00	10.23	-0.000	9.43E-05	0.0	-0.0	

**LEFT side**

<u>Node</u> <u>no.</u>	<u>Y</u> <u>coord</u>	<u>Water</u> <u>press.</u> kN/m2	<u>Effective stresses</u>				<u>Total</u> <u>earth</u> <u>pressure</u> kN/m2	<u>Coeff. of</u> <u>subgrade</u> <u>reaction</u> kN/m3
			<u>Vertic</u> <u>-al</u> kN/m2	<u>Active</u> <u>limit</u> kN/m2	<u>Passive</u> <u>limit</u> kN/m2	<u>Earth</u> <u>pressure</u> kN/m2		
1	2.00	0.00	0.00	0.00	0.00	0.00	0.00	2472
2	1.75	0.00	4.50	1.36	19.52	1.36	1.36a	2472
3	1.50	0.00	9.00	2.71	39.04	2.71	2.71a	2472
4	1.20	0.00	14.40	4.34	62.46	4.34	4.34a	2472

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(continued)

Stage No.1 Fill to elevation 2.00 on LEFT side with soil type 1

LEFT side								
Node no.	Y coord	Effective stresses					Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
5	0.90	0.00	19.80	5.96	85.88	5.96	5.96a	2472
6	0.60	0.00	25.20	7.59	109.31	7.59	7.59a	2472
7	0.30	0.00	30.60	9.22	132.73	9.22	9.22a	2472
8	0.00	0.00	36.00	10.85	156.15	10.85	10.85a	2472
9	-0.30	0.00	41.40	12.47	179.57	12.47	12.47a	2472
10	-0.60	0.00	46.80	14.10	203.00	14.10	14.10a	2472
11	-0.90	0.00	52.20	15.73	226.42	15.73	15.73a	2472
12	-1.20	0.00	57.60	17.35	249.84	17.35	17.35a	2472
13	-1.50	0.00	63.00	18.98	273.26	19.47	19.47	2472
		0.00	63.00	15.29	332.04	17.66	17.66	3089
14	-1.80	0.00	68.40	16.82	359.32	23.03	23.03	3089
15	-2.10	0.00	73.80	18.34	386.60	27.10	27.10	3089
16	-2.40	0.00	79.20	19.86	413.88	30.40	30.40	3089
17	-2.70	0.00	84.60	21.39	441.16	33.39	33.39	15627
18	-3.00	0.00	90.00	22.91	468.44	36.61	36.61	15627

RIGHT side								
Node no.	Y coord	Effective stresses					Total earth pressure	Coeff. of subgrade reaction
		Water press.	Vertic -al	Active limit	Passive limit	Earth pressure		
		kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m2	kN/m3
1	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	0.00	0.00	0.00	4820
9	-0.30	0.00	5.40	1.62	23.58	23.58	23.58p	4820
10	-0.60	0.00	10.80	3.24	47.15	45.81	45.81	4820
11	-0.90	0.00	16.20	4.85	70.73	33.86	33.86	4820
12	-1.20	0.00	21.60	6.47	94.30	26.06	26.06	4820
13	-1.50	0.00	27.00	8.09	117.88	21.89	21.89	4820
		0.00	27.00	5.21	146.62	22.94	22.94	6025
14	-1.80	0.00	32.40	6.76	173.25	20.44	20.44	6025
15	-2.10	0.00	37.80	8.30	199.88	20.46	20.46	6025
16	-2.40	0.00	43.20	9.84	226.52	22.00	22.00	6025
17	-2.70	0.00	48.60	11.39	253.15	24.21	24.21	15627
18	-3.00	0.00	54.00	12.93	279.79	26.39	26.39	15627

Note: 17.35 a Soil pressure at active limit  
23.58 p Soil pressure at passive limit

**APPROVED BUILDING CONSENT**  
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Units: kN,m

Stage No. 6 Apply seismic loading:  
0.108g horizontal  
Line of action of quasi-static seismic force = 0.333  
Seismic loading model: Quasi-static loading

#### STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength  
Active limit pressures calculated by Wedge Stability  
Passive limit pressures calculated by Wedge Stability

Stage No.	Ground level Act.	Level Pass.	Prop Elev.	FoS for toe elev. = -3.00		Toe elev. for FoS = 1.250		Direction of failure
				Factor of Safety	Moment at elev.	Toe elev.	Wall Penetration	
6	2.00	0.00	Cant.	1.385	-2.70	-2.58	2.58	L to R

#### BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

##### Analysis options

Length of wall perpendicular to section = 1000.00m  
Subgrade reaction model - Boussinesq Influence coefficients  
Soil deformations are elastic until the active or passive limit is reached  
Active limit pressures calculated by Wedge Stability  
Passive limit pressures calculated by Wedge Stability  
Open Tension Crack analysis - No

Rigid boundaries: Left side 20.00 from wall  
Right side 20.00 from wall

\*\*\* Wall displacements reset to zero at stage 4

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Prop forces kN/m
1	2.00	0.02	0.018	5.10E-03	0.0	0.0	
2	1.75	1.21	0.017	5.10E-03	0.2	0.0	
3	1.50	4.06	0.016	5.10E-03	0.8	0.1	
4	1.20	6.11	0.014	5.12E-03	2.3	0.6	
5	0.90	8.17	0.013	5.13E-03	4.5	1.6	
6	0.60	10.22	0.011	5.16E-03	7.2	3.3	
7	0.30	12.27	0.010	5.16E-03	10.6	6.0	
8	0.00	14.33	0.008	5.12E-03	14.6	9.7	
9	-0.30	-5.00	0.007	5.00E-03	16.0	14.5	
10	-0.60	-24.33	0.005	4.74E-03	11.6	19.4	
11	-0.90	-40.49	0.004	4.23E-03	1.9	21.7	
12	-1.20	-21.05	0.003	3.53E-03	-7.4	20.4	
13	-1.50	-7.47	0.002	2.79E-03	-11.6	17.3	
		-15.51	0.002	2.79E-03	-11.6	17.3	
14	-1.80	-4.46	0.001	2.08E-03	-14.6	13.1	
15	-2.10	4.63	0.000	1.49E-03	-14.6	8.5	
16	-2.40	12.00	0.000	1.08E-03	-12.1	4.4	
17	-2.70	20.35	-0.000	8.74E-04	-7.3	1.3	
18	-3.00	27.99	-0.000	8.24E-04	0.0	-0.0	

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(continued)

Stage No.6 Apply seismic loading:  
0.108g horizontal  
Line of action of quasi-static seismic force = 0.333  
Seismic loading model: Quasi-static loading

LEFT side								
Node no.	Y coord	Water press. kN/m2	Effective stresses				Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
			Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	2.00	0.00	1.67	0.02	6.90	0.02	0.02a	2099
2	1.75	0.00	6.17	1.21	27.27	1.21	1.21a	2099
3	1.50	0.00	10.67	4.06	50.23	4.06	4.06a	2099
4	1.20	0.00	16.07	6.11	75.65	6.11	6.11a	2099
5	0.90	0.00	21.47	8.17	101.06	8.17	8.17a	2099
6	0.60	0.00	26.86	10.22	126.47	10.22	10.22a	2099
7	0.30	0.00	32.26	12.27	151.87	12.27	12.27a	2099
8	0.00	0.00	37.65	14.33	177.26	14.33	14.33a	2099
9	-0.30	0.00	43.04	16.38	202.64	16.38	16.38a	2099
10	-0.60	0.00	48.43	18.43	228.01	18.43	18.43a	2099
11	-0.90	0.00	53.82	20.48	253.37	20.48	20.48a	2099
12	-1.20	0.00	59.20	22.53	278.72	22.53	22.53a	2099
13	-1.50	0.00	64.59	24.57	304.07	24.57	24.57a	2099
		0.00	64.59	20.13	367.76	20.13	20.13a	2624
14	-1.80	0.00	69.97	22.07	397.16	22.07	22.07a	2624
15	-2.10	0.00	75.35	24.01	426.55	26.70	26.70	2624
16	-2.40	0.00	80.72	25.94	455.93	32.37	32.37	2624
17	-2.70	0.00	86.10	27.58	471.36	39.14	39.14	9977
18	-3.00	0.00	91.47	29.18	485.10	45.66	45.66	9977

RIGHT side								
Node no.	Y coord	Water press. kN/m2	Effective stresses				Total earth pressure kN/m2	Coeff. of subgrade reaction kN/m3
			Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2		
1	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	1.75	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	0.90	0.00	0.00	0.00	0.00	0.00	0.00	0.0
6	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
7	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
		0.00	0.00	0.00	0.00	0.00	0.00	3689
9	-0.30	0.00	5.40	1.30	21.38	21.38	21.38p	3689
10	-0.60	0.00	10.80	2.61	42.76	42.76	42.76p	3689
11	-0.90	0.00	16.20	3.91	64.13	60.97	60.97	3689
12	-1.20	0.00	21.60	5.22	85.51	43.58	43.58	3689
13	-1.50	0.00	27.00	6.52	106.89	32.05	32.05	3689
		0.00	27.00	3.95	134.84	35.64	35.64	4612
14	-1.80	0.00	32.40	5.12	159.33	26.52	26.52	4612
15	-2.10	0.00	37.80	6.29	183.83	22.07	22.07	4612
16	-2.40	0.00	43.20	7.46	208.32	20.37	20.37	4612
17	-2.70	0.00	48.60	8.63	232.81	18.79	18.79	9977
18	-3.00	0.00	54.00	9.80	257.31	17.67	17.67	9977

Note: 22.07 a Soil pressure at active limit  
42.76 p Soil pressure at passive limit

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Units: kN,m

### Summary of results

### STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method

Factor of safety on soil strength

Active limit pressures calculated by Wedge Stability

Passive limit pressures calculated by Wedge Stability

<u>Stage</u> <u>No.</u>	<u>Ground level</u>		<u>Prop</u> <u>Elev.</u>	<u>FoS for toe</u> <u>elev. = -3.00</u>		<u>Toe elev. for</u> <u>FoS = 1.250</u>		<u>Direction</u> <u>of</u> <u>failure</u>
	<u>Act.</u>	<u>Pass.</u>		<u>Factor</u> <u>of</u> <u>Safety</u>	<u>Moment</u> <u>equilib.</u> <u>at elev.</u>	<u>Toe</u> <u>elev.</u>	<u>Wall</u> <u>Penetr</u> <u>-ation</u>	
1	2.00	0.00	Cant.	1.665	-2.63	-2.10	2.10	L to R
2	2.00	0.00	Cant.	1.519	-2.62	-2.35	2.35	L to R
3	2.00	0.00	Cant.	1.665	-2.63	-2.10	2.10	L to R
4	2.00	0.00	No analysis at this stage					
5	2.00	0.00	Cant.	1.614	-2.63	-2.17	2.17	L to R
6	2.00	0.00	Cant.	1.385	-2.70	-2.58	2.58	L to R

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Units: kN,m

## Summary of results

### BENDING MOMENT and DISPLACEMENT ANALYSIS of Fully Embedded Wall

#### Analysis options

Length of wall perpendicular to section = 1000.00m  
 Subgrade reaction model - Boussinesq Influence coefficients  
 Soil deformations are elastic until the active or passive limit is reached  
 Active limit pressures calculated by Wedge Stability  
 Passive limit pressures calculated by Wedge Stability  
 Open Tension Crack analysis - No

Rigid boundaries: Left side 20.00 from wall  
 Right side 20.00 from wall

### Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement		Bending moment		Shear force	
		maximum	minimum	maximum	minimum	maximum	minimum
		m	m	kN.m/m	kN.m/m	kN/m	kN/m
1	2.00	0.018	0.000	0.0	0.0	0.0	0.0
2	1.75	0.017	0.000	0.0	0.0	0.2	0.0
3	1.50	0.016	0.000	0.1	0.0	1.0	0.0
4	1.20	0.014	0.000	0.6	0.0	2.5	0.0
5	0.90	0.013	0.000	1.7	0.0	4.5	0.0
6	0.60	0.011	0.000	3.4	0.0	7.2	0.0
7	0.30	0.010	0.000	6.0	0.0	10.6	0.0
8	0.00	0.008	0.000	9.7	0.0	14.6	0.0
9	-0.30	0.007	0.000	14.5	0.0	16.0	0.0
10	-0.60	0.005	0.000	19.4	0.0	11.6	0.0
11	-0.90	0.004	0.000	21.7	0.0	1.9	-3.1
12	-1.20	0.003	0.000	20.4	0.0	0.0	-8.1
13	-1.50	0.002	0.000	17.3	0.0	0.0	-11.6
14	-1.80	0.001	0.000	13.1	0.0	0.0	-14.6
15	-2.10	0.000	0.000	8.5	0.0	0.0	-14.6
16	-2.40	0.000	0.000	4.4	0.0	0.0	-12.1
17	-2.70	0.000	-0.000	1.3	0.0	0.0	-7.3
18	-3.00	0.000	-0.000	0.0	-0.0	0.0	0.0

### Maximum and minimum bending moment and shear force at each stage

Stage no.	Bending moment				Shear force			
	maximum kN.m/m	elev.	minimum kN.m/m	elev.	maximum kN/m	elev.	minimum kN/m	elev.
1	13.7	-0.60	-0.0	-3.00	10.8	0.00	-9.2	-1.80
2	18.8	-0.90	-0.0	-3.00	14.0	-0.30	-13.0	-1.80
3	18.7	-0.90	-0.0	-3.00	13.9	-0.30	-13.0	-1.80
4	No calculation at this stage							
5	18.7	-0.90	-0.0	-3.00	13.9	-0.30	-13.0	-1.80
6	21.7	-0.90	-0.0	-3.00	16.0	-0.30	-14.6	-1.80

### Maximum and minimum displacement at each stage

Stage no.	Displacement				Stage description
	maximum m	elev.	minimum m	elev.	
1	0.054	2.00	-0.000	-3.00	Fill to elev. 2.00 on LEFT side
2	0.078	2.00	-0.001	-3.00	Apply surcharge no.1 at elev. 2.00
3	0.077	2.00	-0.001	-3.00	Remove surcharge no.1 at elev. 2.00
4	Wall displacements reset to zero				
5	0.000	2.00	0.000	2.00	Change EI of wall to 1392kN.m <sup>2</sup> /m run
6	0.018	2.00	-0.000	-3.00	Apply surcharge no.2 at elev. 2.00
					Quasi-static Seismic load: 0.108g(H)

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Run ID. surchargedwallABLK  
170 Kawaha Point Road  
Retaining Wall for Driveway

| Sheet No.  
| Date:19-09-2022  
| Checked :

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**Summary of results      (continued)**

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Retaining Wall Location, approximately 20m in length

2.5m side yard buffer zone being encroached on by proposed wall replacement

Driveway approx. 3.3m in width

Site Location

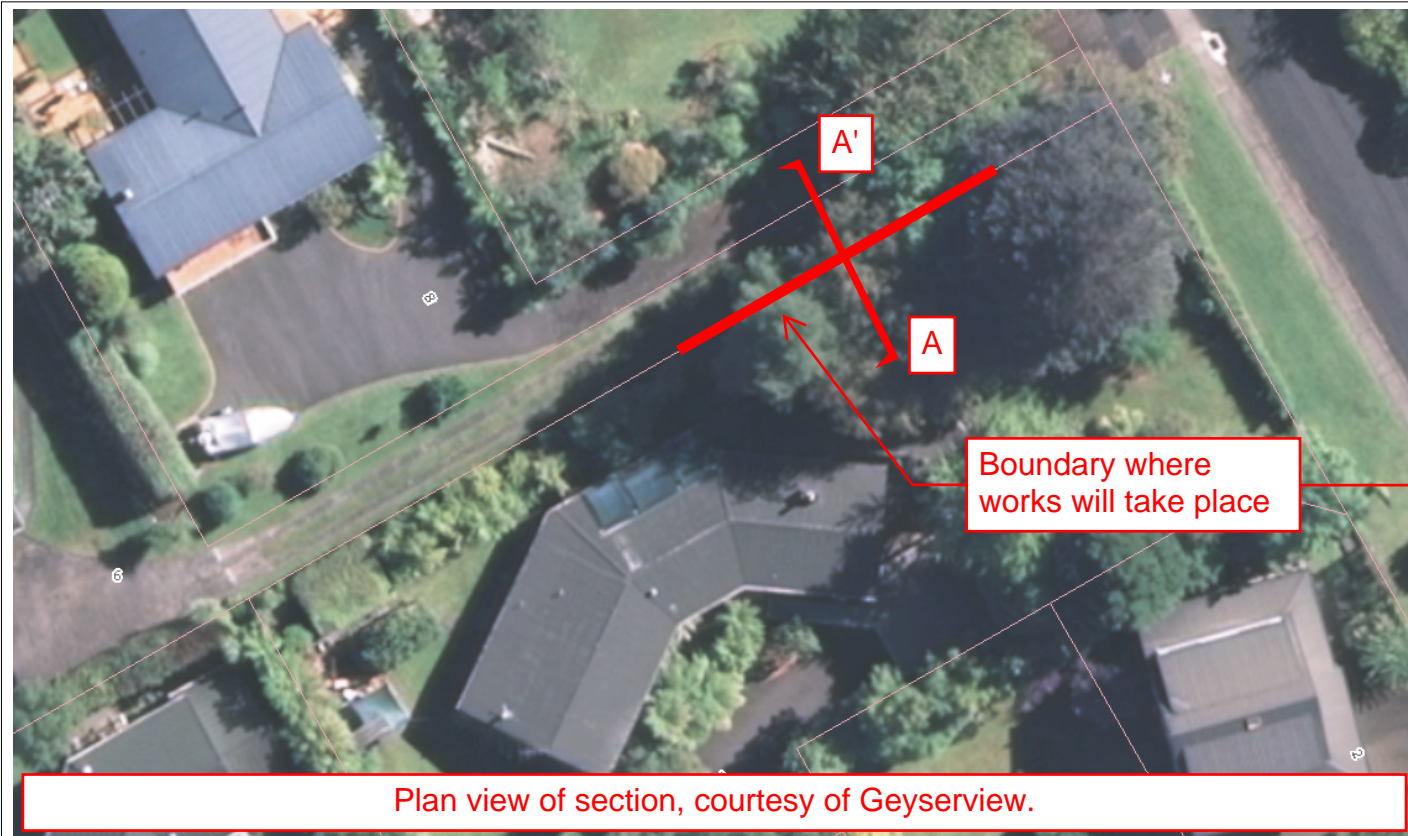


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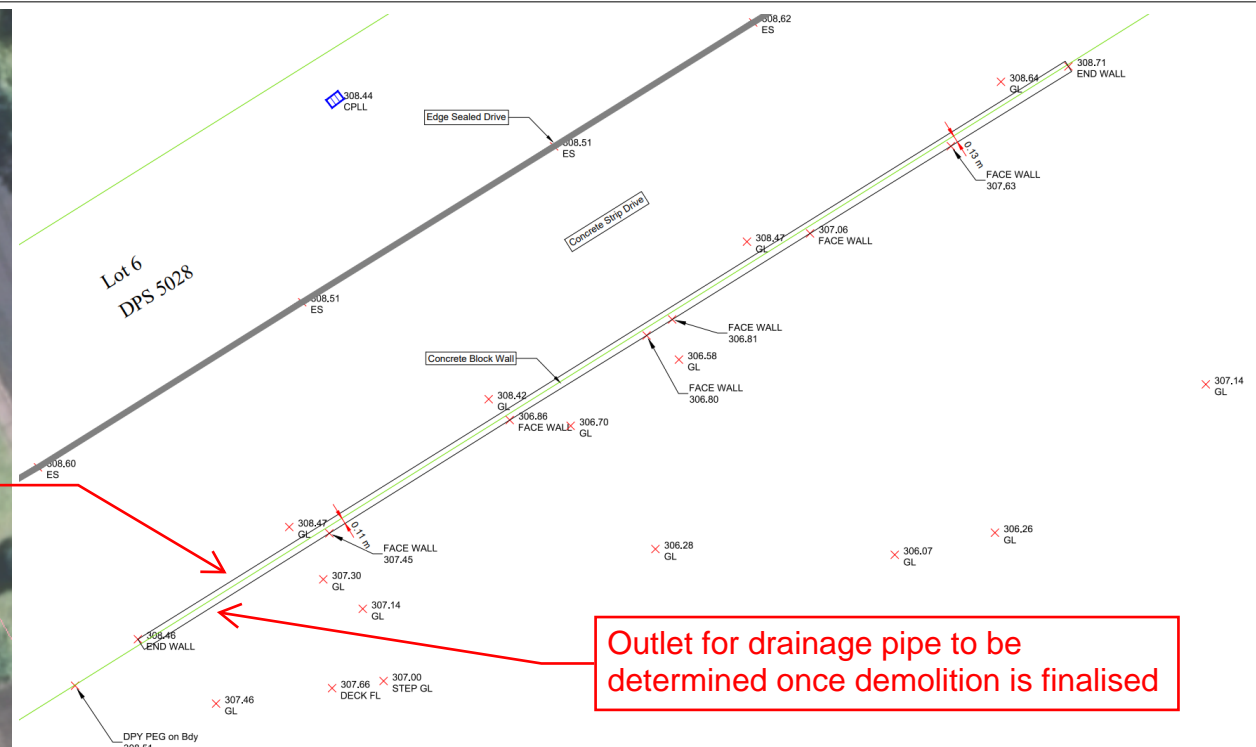
LEGEND	
HA	Hand Auger and Scala Penetrometer

Rev A	19/05/23	Revised as per discussions
ISSUE:	DATE:	DESCRIPTION:
<div><div>BSK</div><div>Consulting Engineers</div></div> <div><div>P.O. BOX 23, 314 Malfroy Rd, Rotorua, New Zealand Phone: (07) 348 5394 Email: admin@bsk.co.nz Web: www.bsk.co.nz</div><div></div></div>		
PROJECT:		
170 Kawaha Point Road Rotorua		
CONTENTS:		
Site Investigation Location Plan		
SCALES:		DATE: 29/07/2022
N/A		JOB REF No: 24493
DESIGNED:	LK	SHEET No: SK1 OF 5
DRAWN:	LK	
APPROVED:	AB	
CHECKED:	LK	



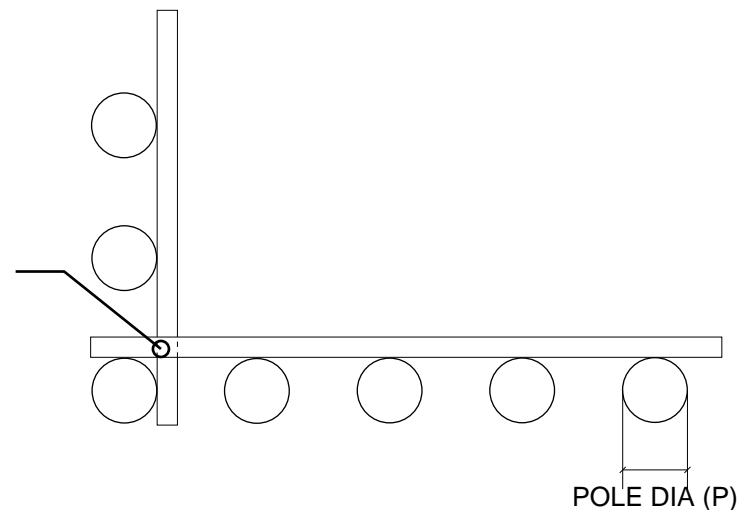


Plan view of section, courtesy of Geyserview.



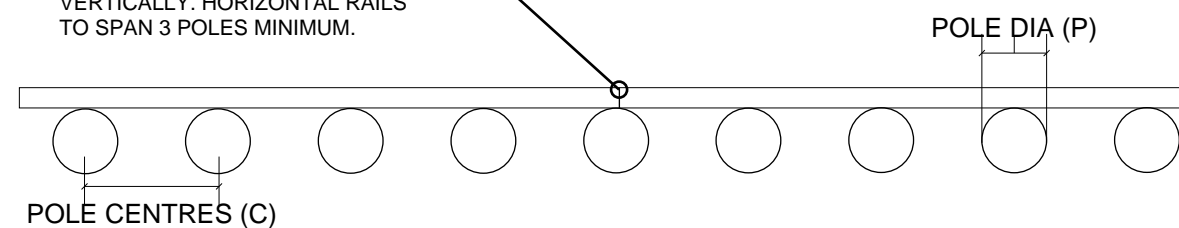
Survey of boundary in question, courtesy of Landhelp Ltd.

CORNER JOINTS IN HORIZONTAL RAILS TO BE LOCATED AT POLE CENTRES. OVERLAPS TO BE STAGGERED VERTICALLY.



TYPICAL PLAN  
DETAIL - CORNER  
NOT TO SCALE

BUTT JOINTS IN HORIZONTAL RAILS TO BE LOCATED AT POLE CENTRES AND STAGGERED VERTICALLY. HORIZONTAL RAILS TO SPAN 3 POLES MINIMUM.



POLE CENTRES (C)

TYPICAL PLAN  
DETAIL - LINEAR  
NOT TO SCALE

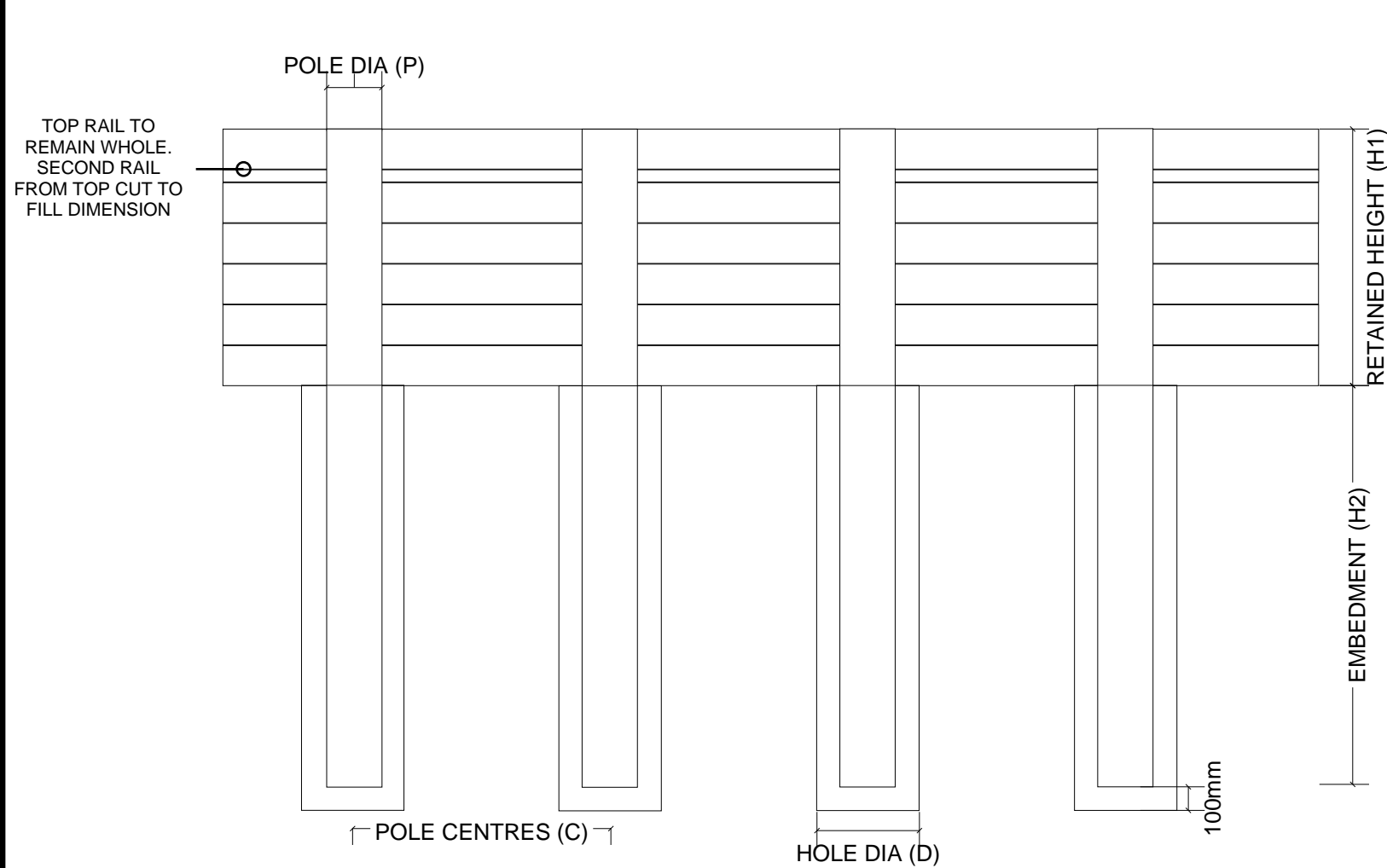
#### NOTES

- THE WALL HAS BEEN DESIGNED FOR NO SLOPES ABOVE OR BELOW ACTING TO SURCHARGE THE WALL.
- THE WALLS HAS BEEN DESIGNED FOR A VEHICULAR SURCHARGE OF 5kPa.
- IF THE EXPECTED SURCHARGE OR SLOPE CHANGES, BSK MUST BE NOTIFIED SO THE WALL CAN BE RE-DESIGNED TO INCLUDE THIS.

- POLES TO BE INSTALLED WITH THEIR SMALL END DIAMETERS AT THE TOP OF THE WALL.
- USE 200x50 ROUGH SAWN H4 RAILS BEHIND THE POLES. STAGGER THE JOINTS IN THE RAILS AND USE LENGTHS TO SPAN A MINIMUM OF 3x POLE SPACING .
- RAILS FIXED TO POLES WITH 2x3.75MM FH GALVANISED NAILS. DOUBLE RAILS PROGRESSIVELY NAILED.
- ANY CUTTING OF POLES OR RAILS IS TO BE GENEROUSLY COATED WITH A CONCENTRATED SOLUTION OF COPPER NAPHTHALENE ENEAL OR EQUIVALENT CONCENTRATED PRESERVATIVE.
- IT IS RECOMMENDED THAT A FILTER FABRIC (E.G. BIDIM A14 OR EQUIVALENT) IS USED AS A SEPARATION LAYER BETWEEN THE DRAINAGE MATERIAL AND THE BACKFILLING. WRAP OVER THE TOP OF THE DRAINAGE MATERIAL AT THE TOP BEFORE PLACING TOPSOIL OR PAVEMENTS. PLACE 100MM TOPSOIL OVER BACKFILLING.
- SLOTTED PIPE TO BE FILTER FABRIC WRAPPED AND PLACED AT BASE OF WALL CONNECTED AND DRAINING INTO STORMWATER SOAKAGE.
- DRAINAGE MATERIAL TO BE CLEAN 5-40MM GRAVEL OR PUMICE WITH LOW FINES. MATERIAL TO BE COMPACTED AS PER ENGINEERS SPECIFICATION.
- TIMBER RAILS TO HAVE A 45 DEGREE CHAMFER (10MM IN LENGTH) ON VISIBLE SIDE.

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ISSUE:	DATE:	DESCRIPTION:
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PROJECT: 170 Kawaha Point Road Rotorua		
CONTENTS: Site Investigation Location Plan		
SCALES: N/A	DATE: 29/07/2022	
DESIGNED: LK	JOB REF No: 24493	
DRAWN: LK	SHEET No: SK2 OF: 5	
APPROVED: AB		
CHECKED: LK		



TYPICAL ELEVATION  
NOT TO SCALE

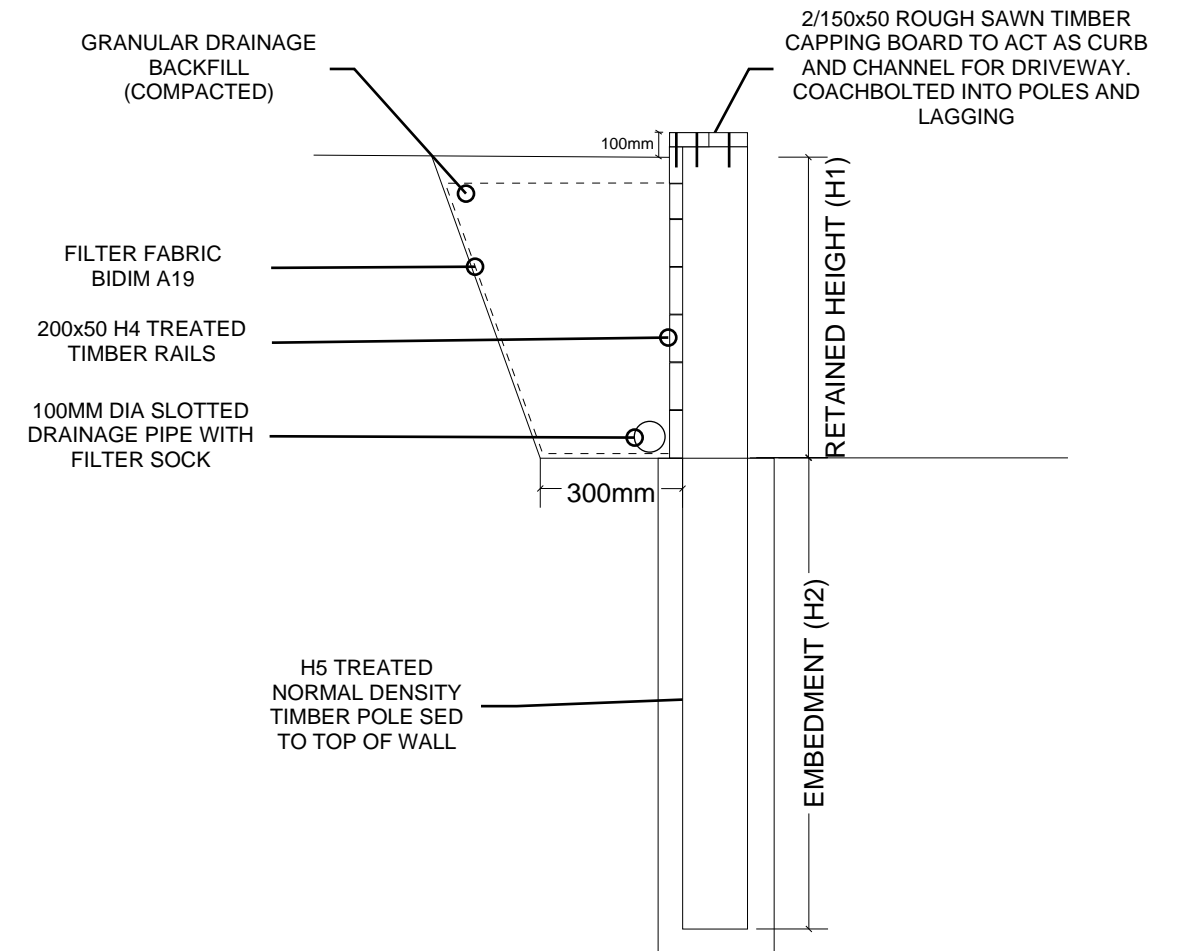
H1	H2	P	D	C
Maximum Retained Height	Required Embedment Depth	Pole Diameter	Hole Diameter (20MPa Concrete)	Hole Centres
2.0m	3.0m	250mm	450mm	1.2m

WALL SIZING

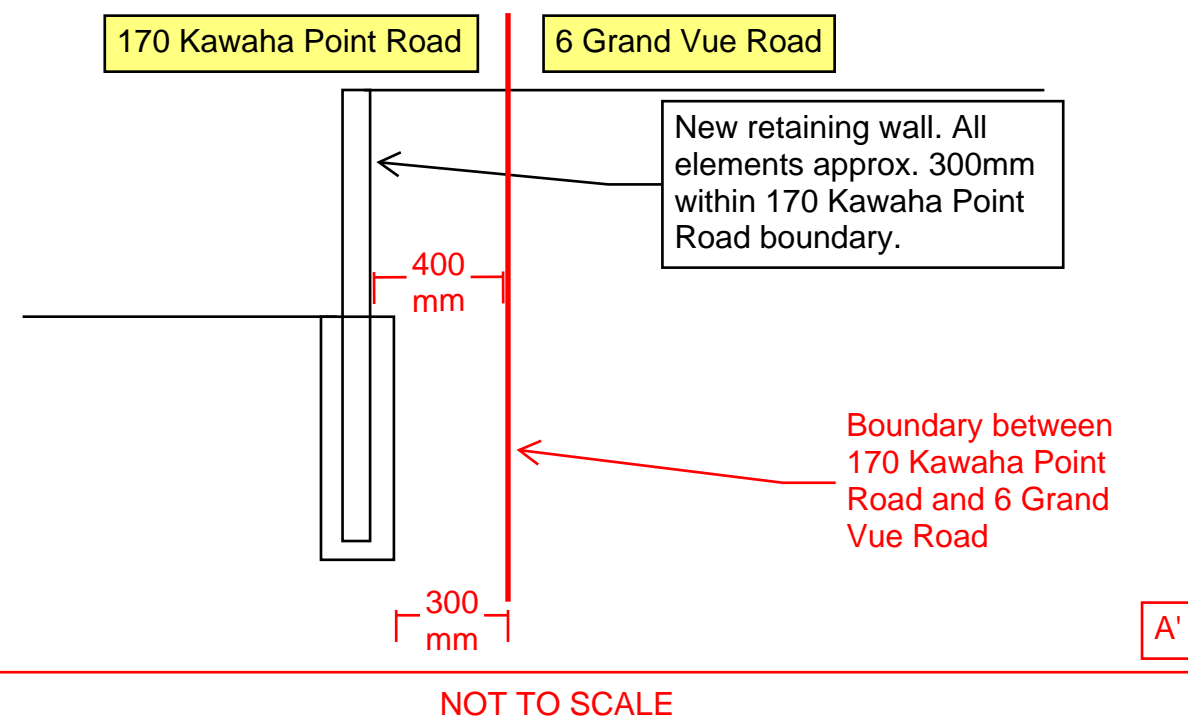
#### INSPECTION SCEDULE

The following hold points shall be observed prior to or during construction. No further work shall proceed until the Engineer is satisfied that each hold point has been fulfilled.

- Set-out detail
- Certification of timber pole and timber lagging
- Pole hole depths and pole installation
- Subsoil drain pipe location, lagging, filter cloth



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<b>BSK</b> Consulting Engineers P.O. BOX 23, 314 MALFROY RD, ROTORUA, NEW ZEALAND PHONE: (07) 348 5394 EMAIL: admin@bsk.co.nz WEB: www.bsk.co.nz <b>ACENZ</b>		
PROJECT:		
170 Kawaha Point Road Rotorua		
CONTENTS:		
Site Investigation Location Plan		
SCALES:	DATE: 29/07/2022	
N/A	JOB REF No: 24493	
DESIGNED: LK	SHEET No: SK3 OF: 5	
DRAWN: LK		
APPROVED: AB		
CHECKED: L K		



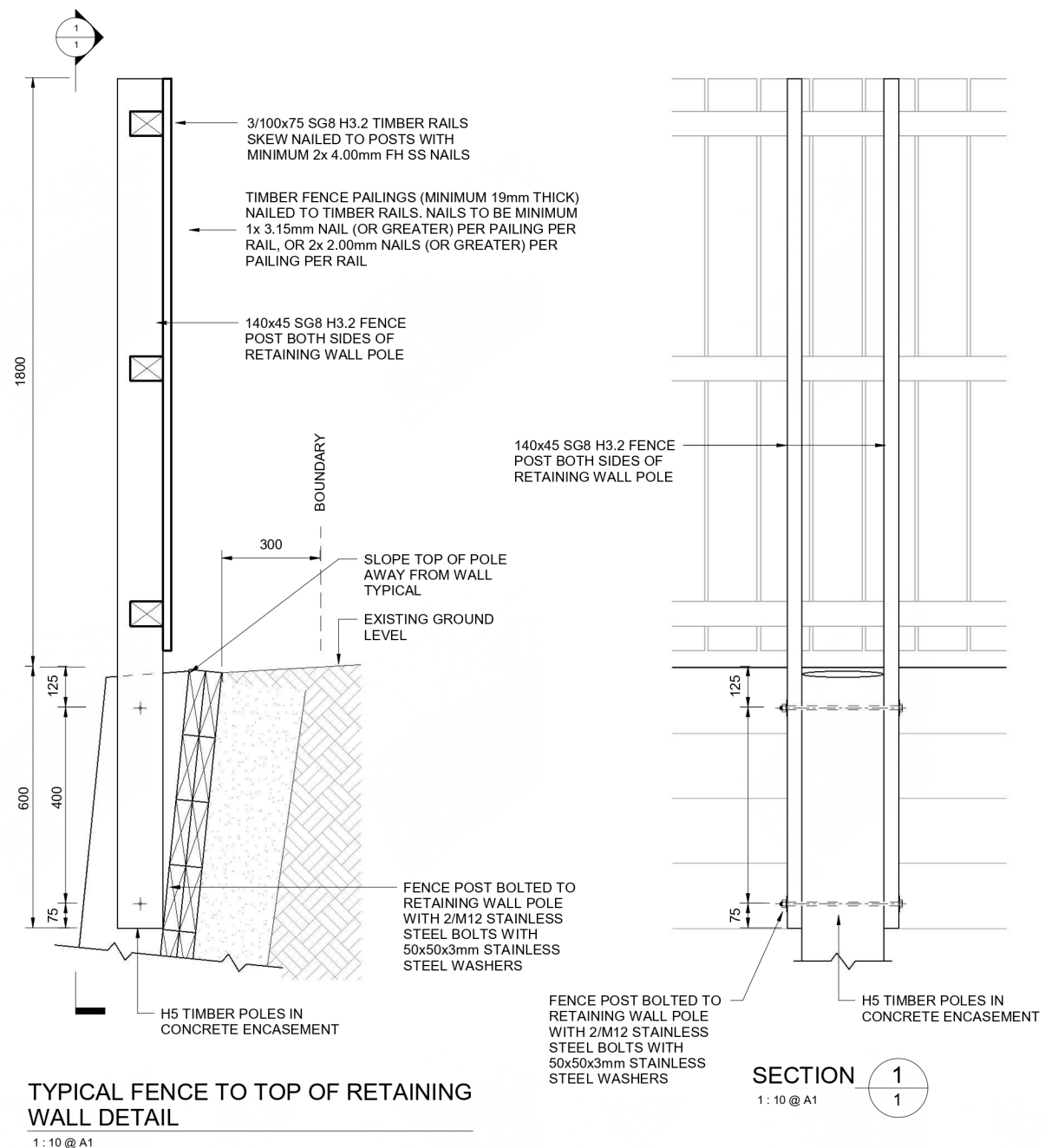


- Type A Barrier - Fence
- Type B Barrier - Handrail

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ISSUE:	DATE:	DESCRIPTION:
<div><div>BSK</div><div>Consulting Engineers</div></div> <div><div><div>P.O. BOX 23, 314 Malfroy Rd, Rotorua, New Zealand Phone: (07) 348 5394 Email: admin@bsk.co.nz Web: www.bsk.co.nz</div><div></div></div></div>		
PROJECT: 170 Kawaha Point Road Rotorua		
CONTENTS: Type of fall from height barrier		
SCALES: N/A		DATE: 29/07/2022
DESIGNED:	LK	JOB REF No: 24493
DRAWN:	LK	SHEET No: SK1 OF: 5
APPROVED:	AB	
CHECKED:	LK	



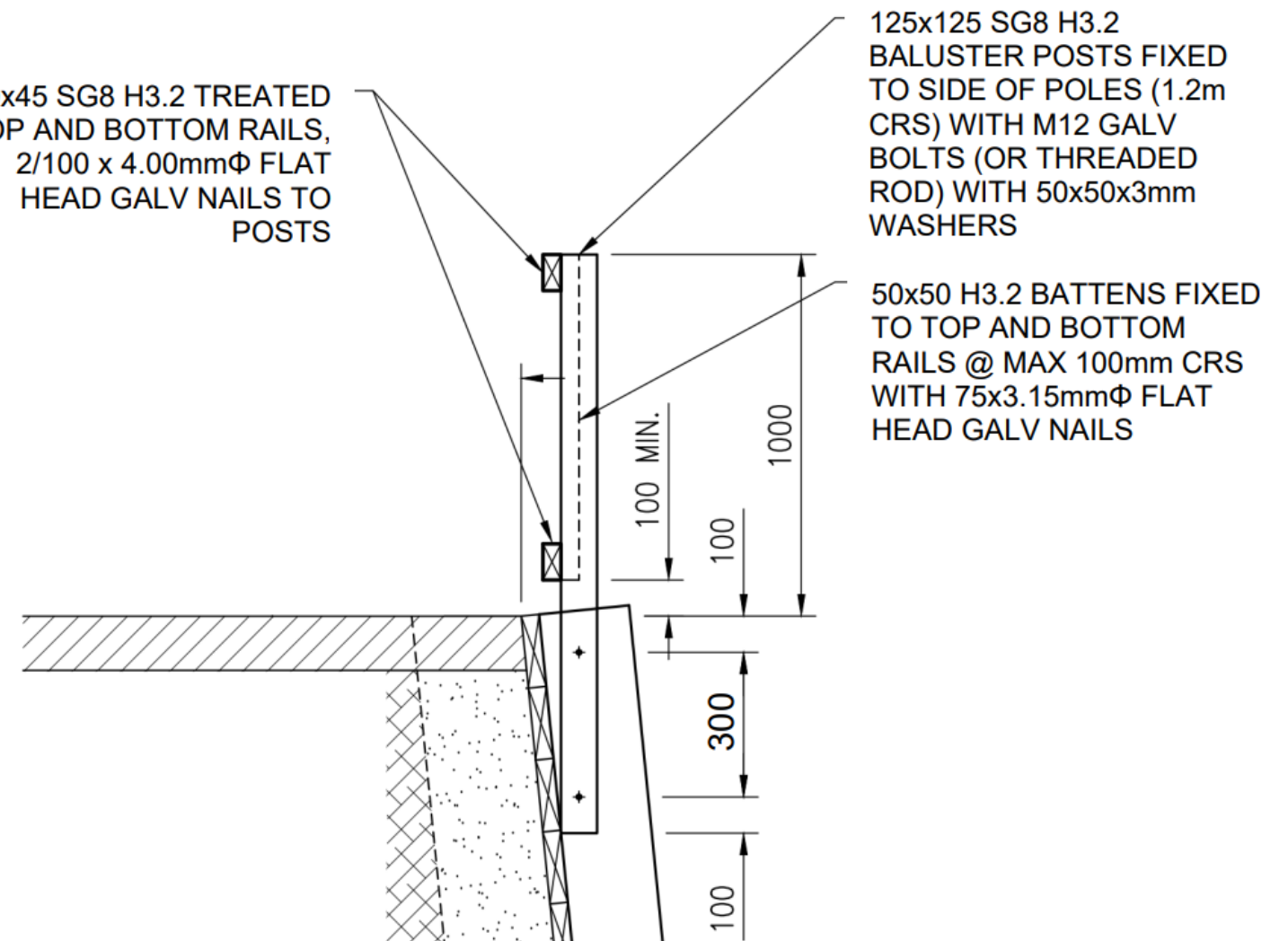


TYPICAL FENCE TO TOP OF RETAINING  
WALL DETAIL

1 : 10 @ A1

## Type A Barrier - Fence

90x45 SG8 H3.2 TREATED  
TOP AND BOTTOM RAILS,  
2/100 x 4.00mmΦ FLAT  
HEAD GALV NAILS TO  
POSTS



## Type B Barrier - Handrail

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ISSUE:	DATE:	DESCRIPTION:
<b>BSK</b> Consulting Engineers P.O. BOX 23, 314 Malfroy Rd, Rotorua, New Zealand PHONE: (07) 348 5394 EMAIL: admin@bsk.co.nz WEB: www.bsk.co.nz <b>ACENZ</b>		
PROJECT:		
170 Kawaha Point Road Rotorua		
CONTENTS:		
Protection from fall		
SCALES:	DATE: 29/07/2022	
N/A	JOB REF No: 24493	
DESIGNED: LK	SHEET No: SK4 OF: 5	
DRAWN: LK		
APPROVED: AB		
CHECKED: L K		

Form 2A

## Memorandum from licensed building practitioner: Certificate of design work

### Section 45 and Section 30C, Building Act 2004

Please fill in the form as fully and correctly as possible.

If there is insufficient room on the form for requested details, please continue on another sheet and attach the additional sheet(s) to this form.

#### THE BUILDING

Street address: 170 Kawaha Point Road

Suburb: Kawaha Point

Town/City: Rotorua

Postcode: 3010

#### THE OWNER

Name(s): Laura Tompkins

Mailing address:

Suburb:

PO Box/Private Bag:

Town/City:

Postcode:

Phone number:

Email address: nicnlolo@gmail.com

#### BASIS FOR PROVIDING THIS MEMORANDUM

I am providing this memorandum in my role as the: Please tick the option that applies (✓)	
( )	<b>sole</b> designer of all of the RBW design outlined in this memorandum – I carried out all of the RBW design myself – no other person will be providing any additional memoranda for the project
( )	<b>lead</b> designer who carried out some of the RBW design myself but also supervised other designers – this memorandum covers their RBW design work as well as mine, and no other person will be providing any additional memoranda for the project
<input checked="" type="checkbox"/>	<b>lead</b> designer for all but specific elements of RBW – this memorandum only covers the RBW design work that I carried out or supervised and the other designers will provide their own memoranda relating to their specific RBW design
( )	<b>specialist</b> designer who carried out specific elements of RBW design work as outlined in this memorandum – other designers will be providing a memorandum covering the remaining RBW design work

#### IDENTIFICATION OF DESIGN WORK THAT IS RESTRICTED BUILDING WORK (RBW)

I Ashley John Bowtell supervised the following design work that is restricted building work

#### PRIMARY STRUCTURE: B1

Design work that is restricted building work	Description	Carried out/supervised	Reference to plans and specifications
Tick (✓) if included  Cross (X) if excluded	[If appropriate, provide details of the restricted building work]	[Specify whether you carried out this design work or supervised]	[If appropriate, specify references]

	<i>someone else carrying out this design work]</i>	
--	--	--

#### Primary structure

All RBW Design work relating to B1 ( )		( ) Carried out ( ) Supervised	
Foundations and subfloor framing ( )		( ) Carried out ( ) Supervised	
Walls ( )		( ) Carried out ( ) Supervised	
Roof ( )		( ) Carried out ( ) Supervised	
Columns and beams ( )		( ) Carried out ( ) Supervised	
Bracing ( )		( ) Carried out ( ) Supervised	
Other ( )	- Structural timber retaining wall (2.0m max retained height, 450mm diameter holes, 250mm max SED timber poles).	( ) Carried out <input checked="" type="checkbox"/> Supervised	BSK Details, job number 24493

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#### EXTERNAL MOISTURE MANAGEMENT SYSTEMS: E2

All RBW design work relating to E2 ( )		( ) Carried out ( ) Supervised	
Damp proofing ( )		( ) Carried out ( ) Supervised	
Roof cladding or roof cladding system ( )		( ) Carried out ( ) Supervised	
Ventilation system (for example, subfloor or cavity) ( )		( ) Carried out ( ) Supervised	
Wall cladding or wall cladding system ( )		( ) Carried out ( ) Supervised	
Waterproofing ( )		( ) Carried out ( ) Supervised	
Other ( )		( ) Carried out ( ) Supervised	

#### FIRE SAFETY SYSTEMS: C1 – C6

Emergency ( )		( ) Carried out	
---------------	--	-----------------	--

warning systems, evacuation and fire service operation systems, suppression or control systems, or other		( ) Supervised	
--	--	----------------	--

**Note:** The design of fire safety systems is only restricted building work when it involves small-to-medium apartment buildings as defined by the Building (Definition of Restricted Building Work) Order 2011.

**Note:** continue on another page if necessary.

### WAIVERS AND MODIFICATIONS

Waivers or modifications of the building code are required ( ) Yes ( ) No

If Yes, provide details of the waivers or modifications below:

Clause	Waiver/modification required
<i>[List relevant clause numbers of building code]</i>	<i>[Specify nature of waiver or modification of building code]</i>

**Note:** continue on another page if necessary.

### ISSUED BY

Name: Ashley John Bowtell	LBP or Registration number: 1018456
The practitioner is a: ( ) Design LBP ( ) Registered architect <input checked="" type="checkbox"/> Chartered professional engineer	
Design Entity or Company (optional): BSK Consulting Engineers Ltd	
Mailing address (if different from below):	
Street address / Registered office: 314 Malfroy Road	
Suburb:	Town/City: Rotorua
PO Box/Private Bag: 23	Postcode: 3040
Phone number: 07 3485394	Mobile:
After Hours:	Fax:
Email address: ash@bsk.co.nz	Website:

### DECLARATION

I Ashley John Bowtell *[name of practitioner]*, LBP,

state that I have applied the skill and care reasonably required of a competent design professional in carrying out or supervising the Restricted Building Work (RBW) described in this form, and that based on this, I also state that the RBW:

- Complies with the building code; or
- Complies with the building code subject to any waiver or modification of the building code recorded on this form.

Signature:



Date: 21/09/22

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21 September 2022

Rotorua Lakes Council  
Private Bag 3029  
Rotorua Mail Centre  
**ROTORUA 3046**

Telephone 07 348 5394  
Email [admin@bsk.co.nz](mailto:admin@bsk.co.nz)  
314 Malfroy Road  
PO Box 23 Rotorua 3040  
[www.bsk.co.nz](http://www.bsk.co.nz)

**Attention: Building Consents Department**

**RE: PROPOSED DWELLING AT 170 KAWAHA POINT ROAD, ROTORUA –  
DURABILITY COMPLIANCE**

**OUR REF: 24493**

The purpose of this letter is to discuss structural performance with regards to Clause B2 of the Building Code – Structural Durability

We are not able to provide a design Producer Statement – PS1 for clause B2 as there is no effective verification method for B2 contained within the Building Code.

However, we can confirm the following for the structural elements shown in our documentation.

Timber

Timber treatment has been selected in accordance with Table 1A of B2/AS1.

Concrete

Concrete covers have been selected in accordance with NZS3101, Part 1, Section 3.

We trust this provides the information required.

Please contact the undersigned if you wish to discuss this matter further.

Yours faithfully,



L Kelly  
BE Civil (Hons), CEngNZ  
**BSK CONSULTING ENGINEERS LTD**

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21 September 2022

Telephone 07 348 5394  
Email [admin@bsk.co.nz](mailto:admin@bsk.co.nz)  
314 Malfroy Road  
PO Box 23 Rotorua 3040  
[www.bsk.co.nz](http://www.bsk.co.nz)

## 170 KAWAHA POINT ROAD, PROPOSED RETAINING WALL – INSPECTION REGIME

The following table outlines the proposed inspections to be carried out by BSK Consulting Engineers Ltd (BSK). Note that additional inspections will be required by the local Building Consent Authority.

INSPECTION	STAGE OF INSPECTION	TYPE OF INSPECTION	INSPECTED BY
Retaining Wall Holes (depth and diameter)	Once all piles holes are dug or bored	Visual	BSK
Retaining Wall Timber	Once installed	Visual	BSK
Retaining Wall Filter Cloth and Backfill	Once installed	Visual	BSK
Handrail Structural Elements and Connections	Once installed	Visual	BSK

Please provide a minimum of 48 hours notice for all inspections.

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association of  
consulting and  
engineering



## PRODUCER STATEMENT – PS1 DESIGN

**BUILDING CODE CLAUSE(S):** B1/F4

**JOB NUMBER:** 24493

**ISSUED BY:** BSK CONSULTING ENGINEERS LTD  
(Engineering Design Firm)

**TO:** LAURA TOMPKINS  
(Owner/Developer)

**TO BE SUPPLIED TO:** ROTORUA LAKES COUNCIL  
(Building Consent Authority)

**IN RESPECT OF:** TIMBER POLE RETAINING WALL  
(Description of Building Work)

**AT:** 170 KAWAHA POINT ROAD, ROTORUA  
(Address, Town/City)

**LEGAL DESCRIPTION:** LOT 2 DP47200

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N/A ☐

We have been engaged by the owner/developer referred to above to provide (Extent of Engagement):

STRUCTURAL DESIGN OF TIMBER POLE RETAINING WALL AND HANDRAIL

in respect of the requirements of the Clause(s) of the Building Code specified above for Part only, as specified in the Schedule, of the proposed building work.

The design carried out by us has been prepared in accordance with:

- ☒ Compliance documents issued by the Ministry of Business, Innovation & Employment (Verification method/acceptable solution) B1/F4 and/or;
- ☒ Alternative solution as per the attached Schedule.

The proposed building work covered by this producer statement is described on the drawings specified in the Schedule, together with the specification, and other documents set out in the Schedule.

**On behalf of the Engineering Design Firm, and subject to:**

- Site verification of the following design assumptions: As per drawings and design report
- All proprietary products meeting their performance specification requirements;

**I believe on reasonable grounds that:**

- the building, if constructed in accordance with the drawings, specifications, and other documents provided or listed in the Schedule, will comply with the relevant provisions of the Building Code and that;
- the persons who have undertaken the design have the necessary competency to do so.

I recommend the CM 2 level of **construction monitoring**.

I, (Name of Engineering Design Professional) ASHLEY JOHN BOWTELL, am:

- ☒ CPEng number 1018456

and hold the following qualifications MSc Engineering Geology, CPEng

The Engineering Design Firm holds a current policy of Professional Indemnity Insurance no less than \$200,000

The Engineering Design Firm is ☒ a member of ACE New Zealand.

**SIGNED BY (Name of Engineering Design Professional):** ASHLEY JOHN BOWTELL

(Signature below):

Ashley John Bowtell

Digitally signed by Ashley John Bowtell  
DN: C=NZ, E=Ash@bsk.co.nz, O=BSK Consulting  
Engineers Limited, OU=Geotechnical, CN=Ashley John  
Bowtell  
Location: Tauranga  
Reason: I am the author of this document  
Contact Info: 0279390003  
Date: 2022.09.21 16:49:00+12'00'

**ON BEHALF OF (Engineering Design Firm):** BSK CONSULTING ENGINEERS LTD

Date: 21/09/22

**Note:** This statement has been prepared solely for the Building Consent Authority named above and shall not be relied upon by any other person or entity. Any liability in relation to this statement accrues to the Engineering Design Firm only. As a condition of reliance on this statement, the Building Consent Authority accepts that the total maximum amount of liability of any kind arising from this statement and all other statements provided to the Building Consent Authority in relation to this building work, whether in tort or otherwise, is limited to the sum of \$200,000.

This form is to accompany **Form 2 of the Building (Forms) Regulations 2004** for the application of a Building Consent.

## **SCHEDULE to PS1**

Please include an itemised list of all referenced documents, drawings, or other supporting materials in relation to this producer statement below:

BSK Structural Calculations and Site Plan (ref: 24493)

MBIE Module 1 and 6 used for methods, limits and design approach  
Alternative method is the use of WALLAP software for wall design.

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## GUIDANCE ON USE OF PRODUCER STATEMENTS

Information on the use of Producer Statements and Construction Monitoring Guidelines can be found on the Engineering New Zealand website

<https://www.engineeringnz.org/engineer-tools/engineering-documents/producer-statements/>

Producer statements were first introduced with the Building Act 1991. The producer statements were developed by a combined task committee consisting of members of the New Zealand Institute of Architects (NZIA), Institution of Professional Engineers New Zealand (now Engineering New Zealand), Association of Consulting and Engineering New Zealand (ACE NZ) in consultation with the Building Officials Institute of New Zealand (BOINZ). The original suite of producer statements has been revised at the date of this form to ensure standard use within the industry.

The producer statement system is intended to provide Building Consent Authorities (BCAs) with part of the reasonable grounds necessary for the issue of a Building Consent or a Code Compliance Certificate, without necessarily having to duplicate review of design or construction monitoring undertaken by others.

**PS1 DESIGN** Intended for use by a suitably qualified independent engineering design professional in circumstances where the BCA accepts a producer statement for establishing reasonable grounds to issue a Building Consent;

**PS2 DESIGN REVIEW** Intended for use by a suitably qualified independent engineering design review professional where the BCA accepts an independent design professional's review as the basis for establishing reasonable grounds to issue a Building Consent;

**PS3 CONSTRUCTION** Forms commonly used as a certificate of completion of building work are Schedule 6 of NZS 3910:2013 or Schedules E1/E2 of NZIA's SCC 2011<sup>2</sup>

**PS4 CONSTRUCTION REVIEW** Intended for use by a suitably qualified independent engineering construction monitoring professional who either undertakes or supervises construction monitoring of the building works where the BCA requests a producer statement prior to issuing a Code Compliance Certificate.

This must be accompanied by a statement of completion of building work (Schedule 6).

The following guidelines are provided by ACE New Zealand and Engineering New Zealand to interpret the Producer Statement.

### Competence of Engineering Professional

This statement is made by an engineering firm that has undertaken a contract of services for the services named, and is signed by a person authorised by that firm to verify the processes within the firm and competence of its personnel.

The person signing the Producer Statement on behalf of the engineering firm will have a professional qualification and proven current competence through registration on a national competence-based register such as a Chartered Professional Engineer (CPEng).

Membership of a professional body, such as Engineering New Zealand provides additional assurance of the designer's standing within the profession. If the engineering firm is a member of ACE New Zealand, this provides additional assurance about the standing of the firm.

Persons or firms meeting these criteria satisfy the term "suitably qualified independent engineering professional".

### Professional Indemnity Insurance

As part of membership requirements, ACE New Zealand requires all member firms to hold Professional Indemnity Insurance to a minimum level.

The PI Insurance minimum stated on the front of this form reflects standard practice for the relationship between the BCA and the engineering firm.

### Professional Services during Construction Phase

There are several levels of service that an engineering firm may provide during the construction phase of a project (CM1-CM5 for engineers<sup>3</sup>). The building Consent Authority is encouraged to require that the service to be provided by the engineering firm is appropriate for the project concerned.

### Requirement to provide Producer Statement PS4

Building Consent Authorities should ensure that the applicant is aware of any requirement for producer statements for the construction phase of building work at the time the building consent is issued as no design professional should be expected to provide a producer statement unless such a requirement forms part of the Design Firm's engagement.

### Refer Also:

- 1 Conditions of Contract for Building & Civil Engineering Construction NZS 3910: 2013
- 2 NZIA Standard Conditions of Contract SCC 2011
- 3 Guideline on the Briefing & Engagement for Consulting Engineering Services (ACE New Zealand/Engineering New Zealand 2004)
- 4 PN01 Guidelines on Producer Statements

[www.acenz.org.nz](http://www.acenz.org.nz)  
[www.engineeringnz.org](http://www.engineeringnz.org)

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Consulting Engineers

Structural - Engineering - Solutions

Telephone 07 348 5394

Email admin@bsk.co.nz

314 Malfroy Road

PO Box 23 Rotorua 3040

www.bsk.co.nz

26 July 2023

N & L Tompkins  
nicnlolo@gmail.com

Dear Nick and Laura,

RE: LETTER OF AUTHORISATION TO ACT AS AGENT FOR BUILDING CONSENT

OUR REF: 24493

This letter is to confirm that Nick Tompkins and Laura Forlong, as the owners of the property at 170 Kawaha Point Road, Rotorua, give authorisation for BSK Consulting Engineers Ltd to act as the agent for the Building Consent application relating to the proposed retaining wall.

Please sign and date below confirming that you agree to the above.

Name NICK TOMPKINS

Signed 

Date 26/07/23

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Regards,

Liam Kelly

Providing the services of  
Chartered Professional Engineers

