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Preliminary Slope Stability Assessment

ON

PROPOSED DEVELOPMENT

AT

LINGARDS ROAD, SLAITHWAITE

FOR

SB HOMES LTD

November 2023

E23/7567/R002

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1.0 INTRODUCTION

- 1.1 The primary objective of this investigation was to satisfy the general requirements of Kirklees Council which requires a slope stability assessment of a proposed development on land to the north of Lingards Road, Slaithwaite in order to determine whether the site is suitable and feasible for development based on the existing and proposed ground conditions. This includes ensuring long term stability for the development works associated with earthwork batters, retaining structures and highways. More specifically, the slope stability analysis covers the southwest area of the site to ensure that the proposed private driveway/parking bays in between plots 36-37 will be stable and safe to construct. This area has been selected as it's the steepest part of the existing site. At the completion of the investigation work an engineering report was prepared which included all the data gathered.

2.0 THE SITE

- 2.1 The site is located on land to the north of Lingards Road, Slaithwaite and lies around OS Grid Reference 407300, 413350. A site location plan is attached in Appendix A at the rear of the report.
- 2.2 The site is irregular in shape, with the southern boundary fronting onto Lingards Road. To the north and east the boundary is formed by the adjacent residential properties. To the west of the site is open field. The site area is approximately 2.1ha including the proposed P.O.S.
- 2.3 The site is divided into four separate grassed fields by dry stone walls with gated access between the fields allowing access throughout site. Access to the site is from Lingards Road in the south east of the site. At the time of the site investigation, the access area has been built up in crushed stone to form a level compound area to allow the access of plant to site, and currently contains a site cabin and some construction materials.
- 2.4 The central largest field is divided in two by an open watercourse in the northern third of the site crossing from west to east. A marshy area is noted in the south west of the field. The two fields to the west of the central field were also noted to have large marshy areas. At the confluence of the three fields there is a mature tree and a partially buried water tank. The small easternmost field contained a stable and was used for horse grazing at the time of the investigation, the remainder of the fields contained no livestock.
- 2.5 The boundaries to the site are formed by a mix of dry stone wall and post and wire fences.
- 2.6 The site initially falls steeply from the southern boundary with Lingards Road before recusing to an average grade of 1 in 4.5 to 1 in 6 towards the northern boundary. A high point of 203.13m AOD is recorded in the south western corner of the site with a low point of 170.65m AOD in the north western corner.
- 2.7 It was noted that there was a ripple effect to the topsoil on the existing slope supporting Lingards Road, indicating small movements within the shallow superficial strata over time.

3.0 SITE GEOLOGY & MINING

- 3.1 The BGS Digital Geological map of Great Britain at 1:50,000 has been consulted and we would report as follows:-
- 3.2 No artificial or superficial deposits are shown directly overlying the site.
- 3.3 The majority of the site is underlain by the Millstone Grit Group consisting of Sandstone, Siltstone and Mudstone. The north east corner of the site is underlain by the East Carlton Formation consisting of Sandstone and Mudstone.
- 3.4 A fault line is shown crossing the site from north to south in the western quarter of the site, roughly following the line of a drystone boundary wall.
- 3.5 The online BGS Geoindex Onshore has been consulted and they have no records of historical landslides associated with the development site, or in the immediate vicinity of the site. Additionally, the Phase 1 Environmental Assessment does not highlight any risk associated with slope stability for the site.
- 3.6 The Phase 1 Environmental Assessment by CoDa Structures includes a Coal Mining Search Report by David Bellis Consulting Surveyors (Report 309290) which states that there are no recorded workings beneath the site and future workings are considered unlikely.
- 3.7 From the Coal Authority Online Interactive Map, the site is shown to lie outside development high risk areas. In addition to this, the site is shown to be outside areas of both past shallow mine working and probable shallow workings.
- 3.8 It is therefore considered that the site is at a low risk from historical coal workings.
- 3.9 There are no detailed deep BGS boreholes recorded in the vicinity of the site.

4.0 SITE INVESTIGATION

- 4.1 Trial pit excavations were undertaken on 10-12 July 2023 using an 8-tonne tracked excavator with 600mm wide bucket. Twenty-three trial pits were undertaken in total. In addition to this, sixteen rotary boreholes were undertaken on site, to depths between 3 and 18m. Materials encountered in the trial pits and boreholes were examined and categorised. Trial pit and borehole logs are contained within Appendix A of the report.
- 4.2 Below the topsoil in all the trial pits there was a 0.3-2.3m thick layer of soft, becoming firmer with depth, brown/grey clay with numerous gravels. TP22 was terminated in this strata at a depth of 0.9m as a blue plastic water supply pipe was encountered. At the lower northern end of the site, beneath the clay a weathered sandstone was encountered at depths of 0.55-2.8m beneath existing ground levels. This was noted to be shallower the further north in the site and rapidly became difficult to excavate.
- 4.3 At the higher southern end of the site, there was a greater depth of clay with a weathered mudstone encountered at 1.4-2.9m below existing ground levels. This was generally excavated as angular shaley gravels, however in TP15, TP17 and TP13 in the southwest of the site, the gravels were noted to be in a clay matrix. The trial pits were terminated in this strata at depths of 2.7-3.8m below existing ground levels. Generally, the rotary boreholes undertaken on site proved up to 2.8m of clays overlying 1.3-12.3m of weathered mudstone, except in the north west of the site where no mudstone was encountered and the clays directly overlaid sandstone. Beneath this, there was a sandstone bedrock encountered at 0.5-14.6m beneath existing ground levels. The depth to the sandstone reduced the further north and west within the site the borehole was.
- 4.4 Determination of shear strength by direct shear was undertaken on samples of the gravelly clay and clayey sand were taken. Each sample was tested under three different normal pressures (60kPa, 80kPa and 100kPa) to replicate the conditions of increasing site levels on the underlying natural strata. The results have been summarised in Table 1 below:

Table 1 – Summary of Shear Box Test Results

SAMPLE LOCATION	PEAK SHEAR STRESS (kPa)			Effective Cohesion (C')	Effective Angle of Friction (ϕ')
	NORMAL PRESSURE (kPa)				
	60	80	10		
TP09	83	55	96	52	17.5
TP15	42	63	68	6	32.5
TP16	34	58	68	3	40
TP17	40	61	74	6	41
TP19	45	74	75	20	37

4.5 The sample from TP09 was noted to have the highest moisture content, highest void ratios, and the lowest bulk and dry densities which contribute towards the lower effective angle of friction recorded compared to the other samples.

4.6 The effective angle of friction used on the model is 37 and was based on the shear testing carried out to the adjacent trial pit 19.

5.0 PROPOSED SITE DEVELOPMENT

- 5.1 The scheme is situated onto a sloppy site and as such a series of split-level properties have been proposed. This will incorporate continuous reinforced concrete retaining walls constructed to the higher level of the plot. All the retaining structures are proposed to be founded on the existing natural sandstone or mudstone strata and designed to support the slope above.

6.0 SLOPE STABILITY ASSESSMENT

- 6.1 The Slope Stability analysis has been carried out in CADS reslope software. At present, two different scenarios have been modelled based on the existing and proposed site levels as requested by Kirklees Council. The soil input data are based on borehole 2 which can be found on Appendix A. For the first scenario, where we checked the slope based on the existing site levels no loads/surcharge were introduced. On the other scenario, where we checked the proposed formation levels a 12kN/m² surcharge has been introduced for the private driveway between plots 36-37 with a 38kN/m vertical line load that refers to the weight of the reinforced concrete wall at the bottom of the driveway. The software has produced a slip circle analysis based on the Bishop method. The partial factors used are based on the Serviceability Limit State. The grid of the centres of circles was taken as 2m for both scenarios. Groundwater was encountered on trial pits 14&19 at a depth of 1.75-1.9m below existing ground level and have also been introduced to both models. The effective angle of friction used for the mudstone on the model is 37 degrees and that was based on the shear testing results to the adjacent trial pit 19.
- 6.2 The results were satisfactory for both existing/proposed site level scenarios. The minimum critical circle stability factors for scenarios 1&2 are 1.64 & 1.86 respectively. Both factors are greater than 1.0 which is above the acceptable limit. No reinforcement or other ground improvements were required to achieve the above stability factors.

7.0 APPROVALS

7.1 These include:

- a) Kirklees Council-Section 38.

Prepared by:

I.Misirakos BEng(Hons)

Checked by:



M. Huddleston. MEng

November 2023

This report is subject to the provisions of the Copyright Acts and is for the sole benefit of SB Homes in respect of the proposals described.

APPENDIX A

Trial Pits

Borehole Details

APPENDIX B

Slope Stability Calculations

APPENDIX C

Site Investigation Plan

TRIAL HOLE NO. 1



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	18/07/2023

0.0		
	0.1	Rough grass over light brown loamy topsoil with occasional gravels. Sample taken at 0.1m.
	0.2	
		Soft/firm very sandy orange brown clay.
0.5	0.5	
		Firm slightly sandy orange brown clay with occasional gravels of sandstone. Sample taken at 0.8m.
	0.8	
1.0		
	1.3	
1.5		Soft/firm grey/brown slightly sandy clay with occasional sandy gravels and cobbles.
	1.7	
		Firm grey boulders clay.
	1.9	
2.0		Firm brown grey clay with occasional gravels of sandstone.
2.5		
		Very weak light grey highly weathered mudstone excavated as small angular gravels.
3.0	3.0	
3.5	3.5	
4.0		

REMARKS:

Ground water encountered during excavation

NO

Sample taken

YES at 0.1 and 0.8m.

Sides of excavation remained stable

YES

Level

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NOTES:

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TRIAL HOLE NO. 2



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	18/07/2023

0.0		
	0.1	Rough grass over dark brown topsoil. Sample taken at 0.1m.
	0.2	
	0.4	Sample taken at 0.4m. Soft/firm light brown sandy clay.
0.5		
1.0		
	1.2	Soft/firm brown slightly sandy clay with occasional sandstone gravels.
1.5		
	1.6	Firm grey boulder clay.
2.0	2.0	
	2.3	Very weak dark grey highly weathered mudstone excavated as sandy angular gravels. Moderately strong sandstone. Unable to excavate further.
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

Land drain encountered in top face of trial pit.

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TRIAL HOLE NO. 3



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	18/07/2023

0.0		
	0.2	Rough grass over light brown very sandy topsoil.
0.5	0.5	Firm light brown very sandy clay. 75mm clay land drain at 500mm.
	0.6	Sample taken at 0.6m. Soft/becoming firm dark brown/mottled grey sandy clay with occasional sandstone gravels and cobbles.
1.0		
1.5		
2.0		
2.5		
	2.9	
3.0		Moderately weak dark grey compact weathered mudstone excavated as small angular gravels.
3.5		
	3.8	
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 4



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	18/07/2023

0.0		
	0.2	Rough grass over dark brown topsoil with occasional roots.
0.5		Firm light brown very sandy clay.
1.0		
	1.4	
1.5		Weak light grey highly weathered mudstone excavated as small angular gravels.
	1.7	Sample taken at 1.7m.
2.0		
2.5		
3.0		
	3.4	
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 5



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	18/07/2023

0.0		
	0.2	Rough grass over dark brown topsoil.
	1.0	Soft/firm light brown very sandy clay with occasional sandstone gravels.
0.5	1.0	Soft/firm light brown very sandy clay with occasional sandstone gravels.
	1.6	Soft/firm grey clay with occasional gravels of sandstone.
1.0	1.6	Soft/firm grey clay with occasional gravels of sandstone.
	2.7	Weak light grey (occasional ironstone) highly weathered mudstone.
1.5	2.7	Weak light grey (occasional ironstone) highly weathered mudstone.
	4.0	
2.0	4.0	
	3.5	
2.5	3.5	
	3.0	
3.0	3.0	
	4.0	
3.5	4.0	
	4.0	
4.0	4.0	

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 6



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5	0.5	Rough grass over dark brown topsoil. Sample taken at 0.2m.
1.0		Soft light brown very gravelly clay with numerous sandstone gravels. Sample taken at 0.8m.
	1.2	
	1.4	Strong becoming very strong light brown sandstone becoming difficult to excavate with depth.
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation

NO

Sample taken

YES at 0.2 and 0.8m.

Sides of excavation remained stable

YES

Level

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NOTES:

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TRIAL HOLE NO. 7



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5	0.5	Rough grass over dark brown topsoil.
1.0		Soft light brown very gravelly clay.
	1.4	
1.5		Soft becoming firm dark grey gravelly clay with numerous sandstone gravels.
	1.9	
2.0		Strong light brown/grey sandstone becoming difficult to excavate with depth.
	2.1	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 8



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.3	Rough grass over dark brown topsoil.
0.5		
1.0		
	1.3	Soft becoming moderately firm light brown gravelly clay.
1.5		
2.0		
	2.3	Moderately firm becoming firm dark grey gravelly clay with occasional mudstone gravels.
	2.4	Strong light brown/grey sandstone becoming difficult to excavate with depth.
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 9



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.3	Rough grass over dark brown topsoil.
0.5	1.0	Soft light brown very gravelly clay.
1.0	1.2	Strong light brown/grey sandstone becoming difficult to excavate with depth.
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 10



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.25	Rough grass over dark brown topsoil.
0.5	0.5	Weak light brown sandstone excavated as gravels within a clay matrix.
	0.85	Soft light brown gravelly clay.
1.0		Strong light brown/grey clayey sandstone becoming difficult to excavate with depth.
	1.2	
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 10



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.3	Rough grass over dark brown topsoil.
0.5		Soft light brown sandy clay with occasional sandstone gravels.
	0.7	
1.0		Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
1.5		
2.0	2.0	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 12



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5	0.55	Soft light brown sandy clay with occasional sandstone gravels.
	1.9	Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 13



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5		
	0.75	Soft light brown sandy clay with occasional sandstone gravels.
1.0		Moderately strong light brown/grey sandstone excavated as angular gravels within a sandy clayey matrix. Occasional large angular sandstone slabs. Becoming difficult to excavate with depth.
1.5		
2.0		
	2.1	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

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TRIAL HOLE NO. 14



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5		
	0.6	Rough grass over dark brown topsoil.
	0.8	Soft light brown/grey gravelly clay.
1.0		Soft to firm grey/dark brown slightly gravelly clay with occasional sandstone gravels.
1.5		
	1.6	
	1.7	Weak black highly weathered coal.
	1.8	Strong brown sandstone becoming difficult to excavate with depth.
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation

YES ingress at 1.75m.

Sample taken

NO

Sides of excavation remained stable

YES

Level

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NOTES:

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TRIAL HOLE NO. 15



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0.0		
	0.4	Rough grass over dark brown topsoil.
0.5		Soft light brown very gravelly clay.
	0.9	Soft to moderately firm dark brown clay.
1.0	1.1	Weak dark grey mudstone within a clayey matrix.
1.5		
2.0		
2.5		
3.0	3.0	
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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0.0REMARKS:

Sample taken NO

Level

NOTES:

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TRIAL HOLE NO. 17



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5	0.5	Rough grass over dark brown topsoil.
1.0		Soft light brown very gravelly clay.
	1.2	
1.5		Weak dark grey mudstone within a clayey matrix.
2.0		
	2.2	
		Strong brown sandstone becoming difficult to excavate with depth.
	2.4	
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 18



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Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5	0.5	Rough grass over dark brown topsoil.
1.0		Soft light brown gravelly clay.
1.5		
	1.6	
2.0		Soft grey/dark brown very gravelly clay with numerous sandstone gravels.
2.5		
	2.8	
	2.9	Strong light brown sandstone becoming difficult to excavate with depth.
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

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TRIAL HOLE NO. 19



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
0.5	0.5	Rough marsh grass/marsh weed over dark brown clayey topsoil.
1.0		Soft dark grey/brown clay.
1.5		
	1.9	Perched ground water entry into trial pit at 1.9m.
2.0		Weak light brown highly weathered mudstone excavated as small angular shale.
2.5		
3.0		
3.5	3.5	
4.0		

REMARKS:

Ground water encountered during excavation YES at 1.9m.
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

.....

TRIAL HOLE NO. 20



Haigh Huddleston & Associates

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.3	Rough grass over dark brown topsoil.
0.5		Soft light brown gravelly clay.
	0.95	
1.0		Moderately soft light brown/grey slightly gravelly clay.
1.5		
	1.9	
2.0		Weak dark grey/brown highly weathered mudstone excavated as small angular shale.
2.5		
3.0		
	3.2	
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

.....
.....

TRIAL HOLE NO. 21



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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5	0.8	Soft light brown gravelly clay.
1.0	1.5	Moderately soft light brown/grey slightly gravelly clay.
1.5	2.8	Weak dark grey/brown mudstone.
2.0	2.9	
2.5	3.5	
3.0	4.0	

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

.....
.....

TRIAL HOLE NO. 22



Haigh Huddleston & Associates

Civil & Structural Engineering Consultants

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5		
	0.9	Soft light brown/grey gravelly clay.
1.0		Trial pit terminated at 0.9m. due to water pipe encountered.
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
 Sample taken NO
 Sides of excavation remained stable YES
 Level

NOTES:

.....

TRIAL HOLE NO. 23



Haigh Huddleston & Associates

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Client :	SB HOMES	Job No :	7567
Site :	LINGARDS ROAD, SLAITHWAITE	Date :	10/07/2023

0.0		
	0.4	Rough grass over dark brown topsoil.
0.5		
1.0		
	1.2	Soft light brown/grey gravelly clay.
1.5		
2.0		
2.5		
3.0		
	3.2	Weak to moderately weak dark grey/brown gravelly mudstone within a clay matrix with occasional sandstone gravels.
3.5		
4.0		

REMARKS:

Ground water encountered during excavation NO
Sample taken NO
Sides of excavation remained stable YES
Level

NOTES:

.....
.....

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Equipment & Methods	Client: SB HOMES						
	Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 01	Ground Level						Date: 10/07/2023
Co-ordinates:							
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests			
				Depth	Sample Type	No.	
Topsoil			0.3 (0.3)				
Clay/sandstone fill			2.8 (2.5)				
Brown sandstone			3.3 (0.5)				
Brown mudstone			7.6 (4.3)				
Grey mudstone with siltstone bands			18.0 (10.4)				
Remarks Soilmec 400							Logged by
							Scale
							FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 02		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.5 (1.5)					
Mudstone			8.5 (7.0)					
Sandstone			9.5 (1.0)					
Remarks Soilmec 400								Logged by Scale FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 02G		Ground Level						Date: 10/07/2023
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.5 (1.5)					
Mudstone			3.0 (1.5)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 2m slotted								Logged by
								Scale
								FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 03		Ground Level						Date: 10/07/2023
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			2.3 (2.3)					
Mudstone			3.3 (1.0)					
Sandstone			4.5 (1.2)					
Remarks Soilmec 400								Logged by
								Scale
								FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 04		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.4 (1.4)					
Mudstone			1.8 (0.4)					
Sandstone			4.0 (2.2)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 3m slotted								Logged by Scale FIG

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Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 05		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			2.2 (2.2)					
Mudstone			4.8 (2.6)					
Sandstone			6.0 (1.2)					
Remarks Soilmec 400								Logged by Scale FIG

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Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 06		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	No.		Test
Clay			1.4 (1.4)					
Mudstone			2.7 (1.3)					
Sandstone			4.0 (1.3)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 3m slotted								Logged by
								Scale
								FIG

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Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 07		Ground Level						Date: 10/07/2023
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample			
					Type	No.		
Clay			1.0			CPT	1,0,1,1,1,1	
Mudstone			2.3 (2.3)				3,4,5,5,5,7	
			2.5					
			4.0					
9.0 (6.7)	CPT	6,7,11,13,14 REFUSAL						
Sandstone			10.0 (1.0)					
Remarks Soilmec 400							Logged by	
							Scale	
							FIG	

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Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 08G		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			2.3 (2.3)					
Mudstone			4.0 (1.7)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 3m slotted								Logged by
								Scale
								FIG

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Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 09		Ground Level						Date: 10/07/2023
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample Type	No.		Test
Clay boulders			2.5 (2.5)					
Mudstone			8.7 (6.2)					
Sandstone			10.0 (1.3)					
Remarks Soilmec 400								Logged by
								Scale
								FIG

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Equipment & Methods	Client: SB HOMES										
	Site: LINGARDS LANE, SLAITHWAITE										
BOREHOLE No. 10	Ground Level						Date: 10/07/2023				
Co-ordinates:											
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests							
				Depth	Sample Type	No.		Test			
Clay			1.8 (1.8)								
Mudstone			3.3 (1.5)								
Sandstone			5.0 (1.7)								
Remarks Soilmec 400											
								Logged by			
								Scale			
FIG											

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Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 11		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.3 (1.3)					
Sandstone			4.0 (2.7)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 3m slotted								Logged by
								Scale
								FIG

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Civil Structural Engineering Consultants

Equipment & Methods	Client: SB HOMES							
	Site: LINGARDS LANE, SLAITHWAITE							
BOREHOLE No. 12	Ground Level						Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample			Test
					Type	No.		
Clay			0.5 (0.5)					
Sandstone			3.0 (2.5)					
Remarks Soilmec 400								Logged by
								Scale
								FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
BOREHOLE No. 13		Site: LINGARDS LANE, SLAITHWAITE						
Co-ordinates:		Ground Level Date: 10/07/2023						
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.0 (1.0)					
Weak sandstone			1.7 (0.7)					
Sandstone			4.0 (2.3)					
Remarks Soilmec 400								Logged by Scale FIG

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Civil Structural Engineering Consultants

Equipment & Methods		Client: SB HOMES						
		Site: LINGARDS LANE, SLAITHWAITE						
BOREHOLE No. 14		Ground Level					Date: 10/07/2023	
Co-ordinates:								
Description	Reduced Level	Legend	Depth (thick)	Sample/Tests				
				Depth	Sample		Test	
					Type	No.		
Clay			1.0 (1.0)					
Sandstone			4.0 (3.0)					
Remarks Soilmec 400 Standpipe fitted 1m plain, 3m slotted								Logged by Scale FIG

	Page No 1 Analysis SS
CADS ReSlope, Version 2.06 Slope stability analysis and design of reinforced soil slopes	Project 7567 File Name existing ground.rsp"
SB Homes - Lingards Road, Slaithwaite Slope Stability to existing ground levels	Engineer IM Date 15/11/2023

Soils input data	Density kN/m3	Phi degrees	Cohesion kN/m2	Ru ratio	Suction m (max)
Gravelly CLAY	19.0	29	0	0.00	0.0
Mudstone	23.0	37	0	0.00	0.0

Soil strata surface points	X m	Y m
Gravelly CLAY	0.00	187.60
	2.00	188.00
	7.48	189.00
	13.04	190.00
	18.23	191.00
	22.59	192.00
	24.53	193.00
	26.01	194.00
	28.97	195.00
	30.45	196.00
	31.93	196.80
Mudstone	0.00	185.30
	2.00	185.70
	7.48	186.70
	13.04	187.70
	18.23	188.70
	22.59	189.70
	24.53	190.70
	26.01	191.70
	28.97	192.70
	30.45	193.70
	31.93	194.50

Water input data Density 9.81 kN/m3

Phreatic surface points	X m	Y m
	-13.00	185.50
	0.00	185.50
	2.00	186.00
	2.00	186.00
	6.50	187.00
	12.50	188.00
	17.50	189.00
	22.00	190.00
	25.00	191.50
	28.50	193.00
	31.00	194.50
	32.50	195.00

Piezometric grid was not enabled

Loading input data
No external loading was specified

No soil reinforcement was specified

	Page No 2 Analysis SS
CADS ReSlope, Version 2.06 Slope stability analysis and design of reinforced soil slopes	Project 7567 File Name existing ground.rsp"
SB Homes - Lingards Road, Slaithwaite Slope Stability to existing ground levels	Engineer IM Date 15/11/2023

Partial factors

Design code referenced	Serviceability Limit State or conventional analysis	
Ramifications of failure	fn	1.00
Soil self weight	ffs	1.00
Imposed loads	fq	1.00
Soil tan(phi) values	fms	1.00
Soil cohesion values	fms	1.00
Reinforcing material strength	fm	1.00
Sliding on reinforcement	fs	1.00
Reinforcement pull-out	fp	1.00

Seismic acceleration

Vertical acceleration factor (x gravity)	0.00
Lateral acceleration factor (x gravity)	0.00

Slip circle definition

Method of analysis used is Bishop simplified (Moment equilibrium)
Minimum number of slices within slip is 10
A valid slip must have a depth greater than 2.00 m
Depth of water filled tension crack is 0.00 m

Grid of centres of circles

X Minimum value	2.0 m
X Maximum value	8.0 m
X Increment value	2.0 m
Y Minimum value	198.0 m
Y Maximum value	204.0 m
Y Increment value	2.0 m

The grid of centres is automatically extended to seek the minimum stability factor

The circles all pass through a line of points defined as follows

X Minimum value	-6.4 m
X Maximum value	12.8 m
X Increment value	6.4 m
Y value	at ground surface

Tabular printout of circular slips

X m	Y m	Radius m	Disturb kNm/m	Restore Soil kNm/m	Restore RForce kNm/m	Stability Factor
2.00	198.00	13.36	1431	7724	0	5.40
4.00	198.00	14.70	3040	15096	0	4.97
6.00	198.00	16.18	5564	26231	0	4.71
8.00	198.00	17.75	9529	42488	0	4.46
10.00	198.00	19.41	16307	65325	0	4.01
12.00	198.00	21.13	26596	95044	0	3.57
14.00	198.00	22.89	35912	132958	0	3.70
16.00	198.00	24.69	46663	180944	0	3.88
18.00	198.00	26.51	57415	239543	0	4.17
20.00	198.00	28.37	67029	308759	0	4.61
22.00	198.00	30.23	78198	391194	0	5.00
2.00	200.00	14.97	1521	7738	0	5.09
4.00	200.00	16.18	3235	15117	0	4.67
6.00	200.00	17.53	5849	25926	0	4.43
8.00	200.00	19.00	10223	41653	0	4.07
10.00	200.00	20.55	17661	63571	0	3.60
12.00	200.00	22.18	28350	91939	0	3.24
14.00	200.00	23.86	39050	128442	0	3.29
16.00	200.00	25.59	48851	173835	0	3.56

	Page No 3 Analysis SS
CADS ReSlope, Version 2.06 Slope stability analysis and design of reinforced soil slopes	Project 7567 File Name existing ground.rsp"
SB Homes - Lingards Road, Slaithwaite Slope Stability to existing ground levels	Engineer IM Date 15/11/2023

Tabular printout of circular slips - continued

X m	Y m	Radius m	Disturb kNm/m	Restore Soil kNm/m	Restore RForce kNm/m	Stability Factor -
18.00	200.00	27.36	60018	229584	0	3.83
20.00	200.00	29.16	69566	295919	0	4.25
22.00	200.00	30.98	80755	374788	0	4.64
2.00	202.00	16.67	1615	7830	0	4.85
4.00	202.00	17.76	3424	15333	0	4.48
6.00	202.00	19.00	6174	26018	0	4.21
8.00	202.00	20.36	11091	41584	0	3.75
10.00	202.00	21.82	19182	62811	0	3.27
12.00	202.00	23.36	30087	90054	0	2.99
14.00	202.00	24.96	40853	125067	0	3.06
16.00	202.00	26.62	51052	168556	0	3.30
18.00	202.00	28.32	62072	222228	0	3.58
20.00	202.00	30.06	71903	285885	0	3.98
22.00	202.00	31.83	83100	361622	0	4.35
2.00	204.00	18.42	1725	8036	0	4.66
4.00	204.00	19.41	3610	15711	0	4.35
6.00	204.00	20.55	6543	26414	0	4.04
8.00	204.00	21.82	11997	41965	0	3.50
10.00	204.00	23.19	20840	62740	0	3.01
12.00	204.00	24.64	31858	89097	0	2.80
14.00	204.00	26.17	42707	122902	0	2.88
16.00	204.00	27.75	52991	165086	0	3.12
18.00	204.00	29.39	64052	216875	0	3.39
20.00	204.00	31.07	75096	278856	0	3.71
22.00	204.00	32.79	85300	351265	0	4.12
2.00	206.00	20.22	1842	8243	0	4.48
4.00	206.00	21.13	3824	16162	0	4.23
6.00	206.00	22.18	6955	27081	0	3.89
8.00	206.00	23.36	12993	42845	0	3.30
10.00	206.00	24.64	22631	63344	0	2.80
12.00	206.00	26.01	33588	89053	0	2.65
14.00	206.00	27.46	44490	122013	0	2.74
16.00	206.00	28.98	55479	163342	0	2.94
18.00	206.00	30.55	65981	213216	0	3.23
20.00	206.00	32.17	77046	273245	0	3.55
22.00	206.00	33.83	87397	343320	0	3.93
2.00	208.00	22.06	1985	8416	0	4.24
4.00	208.00	22.89	4061	16778	0	4.13
6.00	208.00	23.87	7440	27940	0	3.76
8.00	208.00	24.96	14137	44051	0	3.12
10.00	208.00	26.17	24405	64369	0	2.64
12.00	208.00	27.47	35328	89680	0	2.54
14.00	208.00	28.84	46275	122021	0	2.64
16.00	208.00	30.29	57260	162302	0	2.83
18.00	208.00	31.80	67877	210987	0	3.11
20.00	208.00	33.36	78957	269373	0	3.41
22.00	208.00	34.96	89423	337443	0	3.77
2.00	210.00	23.92	2140	8425	0	3.94
4.00	210.00	24.69	4315	17491	0	4.05
6.00	210.00	25.60	8092	29050	0	3.59
8.00	210.00	26.62	15460	45577	0	2.95
10.00	210.00	27.76	26188	65775	0	2.51
12.00	210.00	28.98	37074	90868	0	2.45
14.00	210.00	30.29	48061	122783	0	2.55
16.00	210.00	31.67	59067	162333	0	2.75

	Page No Analysis	4 SS
CADS ReSlope, Version 2.06 Slope stability analysis and design of reinforced soil slopes	Project File Name	7567 existing ground.rsp"
SB Homes - Lingards Road, Slaithwaite Slope Stability to existing ground levels	Engineer Date	IM 15/11/2023

Tabular printout of circular slips - continued

X m	Y m	Radius m	Disturb kNm/m	Restore Soil kNm/m	Restore RForce kNm/m	Stability Factor -
18.00	210.00	33.12	69749	209970	0	3.01
20.00	210.00	34.61	80840	266983	0	3.30
22.00	210.00	36.16	91396	333338	0	3.65
6.00	198.00	12.01	1097	4413	0	4.02
8.00	198.00	13.12	2296	9286	0	4.04
10.00	198.00	14.43	4269	16976	0	3.98
12.00	198.00	15.88	8197	29043	0	3.54
14.00	198.00	17.44	14456	45901	0	3.18
16.00	198.00	19.08	22486	68778	0	3.06
18.00	198.00	20.79	30345	99479	0	3.28
20.00	198.00	22.54	38355	138816	0	3.62
22.00	198.00	24.33	45495	186949	0	4.11
6.00	200.00	13.78	1246	4813	0	3.86
8.00	200.00	14.76	2542	9869	0	3.88
10.00	200.00	15.93	4720	17575	0	3.72
12.00	200.00	17.26	9195	29498	0	3.21
14.00	200.00	18.70	16241	45864	0	2.82
16.00	200.00	20.24	24237	67809	0	2.80
18.00	200.00	21.86	32299	97231	0	3.01
20.00	200.00	23.53	40440	134859	0	3.33
22.00	200.00	25.25	48669	181253	0	3.72
6.00	202.00	15.60	1420	5278	0	3.72
8.00	202.00	16.47	2830	10602	0	3.75
10.00	202.00	17.53	5319	18538	0	3.49
12.00	202.00	18.74	10325	30438	0	2.95
14.00	202.00	20.08	18048	46459	0	2.57
16.00	202.00	21.53	25998	67762	0	2.61
18.00	202.00	23.05	34195	96222	0	2.81
20.00	202.00	24.64	42422	132488	0	3.12
22.00	202.00	26.29	50696	177129	0	3.49
6.00	204.00	17.46	1606	5772	0	3.59
8.00	204.00	18.25	3136	11458	0	3.65
10.00	204.00	19.21	6107	19788	0	3.24
12.00	204.00	20.32	11655	31857	0	2.73
14.00	204.00	21.56	19841	47591	0	2.40
16.00	204.00	22.91	28108	68621	0	2.44
18.00	204.00	24.35	36057	96244	0	2.67
20.00	204.00	25.86	44318	131374	0	2.96
22.00	204.00	27.44	52644	174655	0	3.32
6.00	206.00	19.35	1814	6298	0	3.47
8.00	206.00	20.06	3466	12425	0	3.59
10.00	206.00	20.94	6977	21278	0	3.05
12.00	206.00	21.97	13296	33629	0	2.53
14.00	206.00	23.12	21617	49197	0	2.28
16.00	206.00	24.38	29888	70019	0	2.34
18.00	206.00	25.74	38181	97310	0	2.55
20.00	206.00	27.18	46223	131389	0	2.84
22.00	206.00	28.68	54543	173564	0	3.18
6.00	208.00	21.26	2044	6819	0	3.34
8.00	208.00	21.91	3857	13494	0	3.50
10.00	208.00	22.72	7918	23011	0	2.91
12.00	208.00	23.67	15047	35661	0	2.37
14.00	208.00	24.74	23377	51176	0	2.19
16.00	208.00	25.93	31665	71928	0	2.27
18.00	208.00	27.21	39985	98880	0	2.47

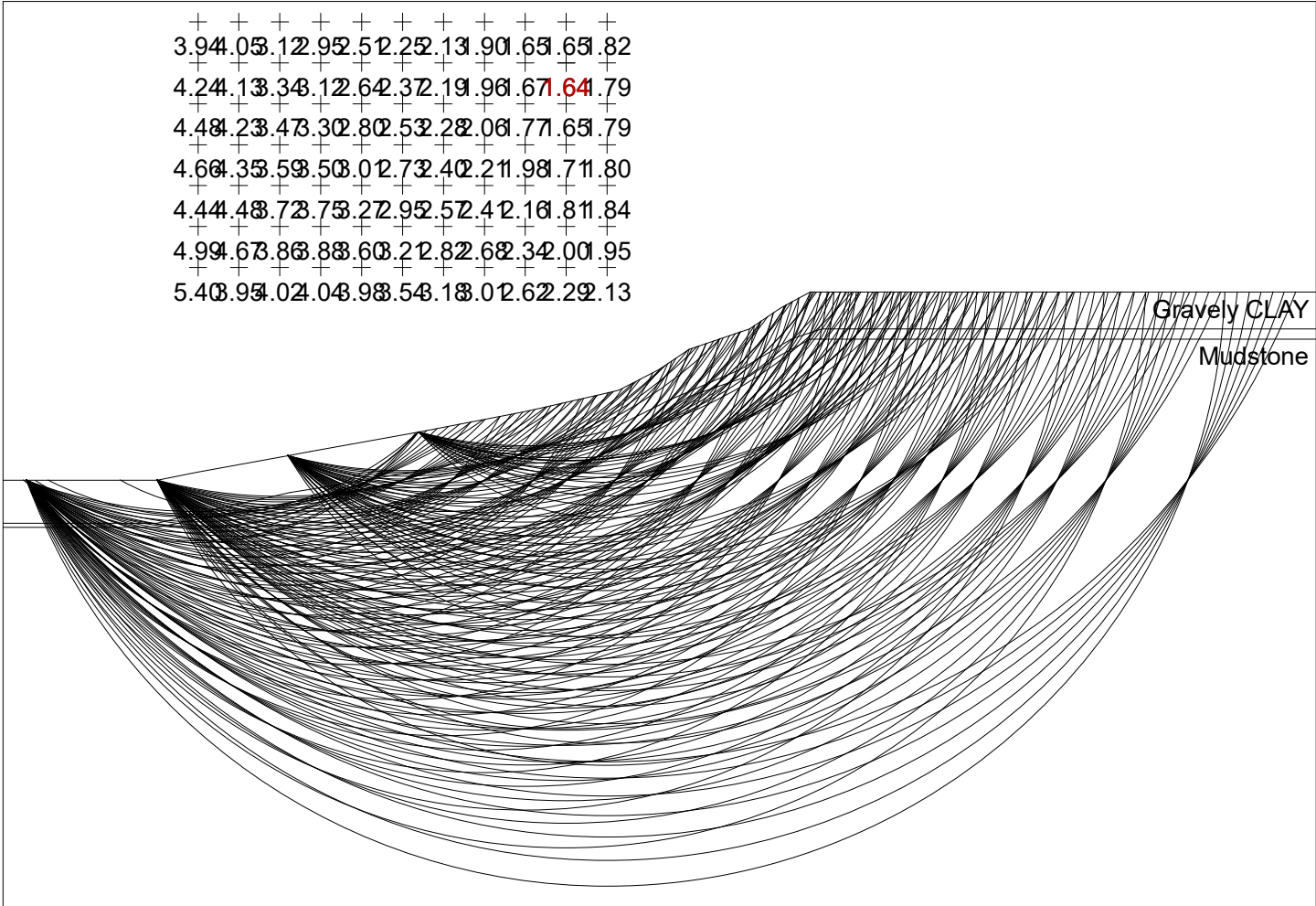
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SB Homes - Lingards Road, Slaithwaite Slope Stability to existing ground levels	Engineer IM Date 15/11/2023

Tabular printout of circular slips - continued

X m	Y m	Radius m	Disturb kNm/m	Restore Soil kNm/m	Restore RForce kNm/m	Stability Factor -
20.00	208.00	28.57	48066	132381	0	2.75
22.00	208.00	30.00	56411	173638	0	3.08
6.00	210.00	23.19	2295	7150	0	3.12
8.00	210.00	23.79	4358	14739	0	3.38
10.00	210.00	24.53	9085	25049	0	2.76
12.00	210.00	25.41	16829	37841	0	2.25
14.00	210.00	26.42	25144	53523	0	2.13
16.00	210.00	27.53	33447	74337	0	2.22
18.00	210.00	28.74	41781	101103	0	2.42
20.00	210.00	30.03	49897	134154	0	2.69
22.00	210.00	31.40	58236	174595	0	3.00
12.00	198.00	10.77	881	3484	0	3.96
14.00	198.00	11.94	2182	8016	0	3.67
16.00	198.00	13.30	5198	15661	0	3.01
18.00	198.00	14.81	10287	26927	0	2.62
20.00	198.00	16.43	15982	43471	0	2.72
22.00	198.00	18.12	21582	66681	0	3.09
12.00	200.00	12.53	1028	3795	0	3.69
14.00	200.00	13.54	2622	8655	0	3.30
16.00	200.00	14.76	6086	16294	0	2.68
18.00	200.00	16.13	11626	27222	0	2.34
20.00	200.00	17.63	17336	43136	0	2.49
22.00	200.00	19.21	23022	65299	0	2.84
12.00	202.00	14.34	1195	4123	0	3.45
14.00	202.00	15.24	3179	9518	0	2.99
16.00	202.00	16.33	7178	17329	0	2.41
18.00	202.00	17.58	12946	28017	0	2.16
20.00	202.00	18.96	18682	43564	0	2.33
22.00	202.00	20.44	24421	64984	0	2.66
12.00	204.00	16.20	1392	4273	0	3.07
14.00	204.00	17.00	3809	10586	0	2.78
16.00	204.00	17.98	8452	18657	0	2.21
18.00	204.00	19.13	14261	29262	0	2.05
20.00	204.00	20.40	20025	44614	0	2.23
22.00	204.00	21.79	25798	65523	0	2.54
12.00	206.00	18.09	1680	4919	0	2.93
14.00	206.00	18.81	4541	11901	0	2.62
16.00	206.00	19.70	9781	20145	0	2.06
18.00	206.00	20.75	15570	30847	0	1.98
20.00	206.00	21.93	21365	46172	0	2.16
22.00	206.00	23.23	27162	66760	0	2.46
12.00	208.00	20.00	2134	5754	0	2.70
14.00	208.00	20.65	5531	13408	0	2.42
16.00	208.00	21.47	11114	21816	0	1.96
18.00	208.00	22.44	16954	32810	0	1.94
20.00	208.00	23.53	22699	48130	0	2.12
22.00	208.00	24.74	28515	68540	0	2.40
12.00	210.00	21.93	2711	6742	0	2.49
14.00	210.00	22.52	6736	15104	0	2.24
16.00	210.00	23.28	12454	23677	0	1.90
18.00	210.00	24.17	18285	35001	0	1.91
20.00	210.00	25.19	24113	50552	0	2.10
22.00	210.00	26.33	29847	70788	0	2.37
2.00	198.00	13.45	1494	8107	0	5.43
4.00	198.00	11.91	830	3274	0	3.95

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Diagram showing all circles



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Soils input data	Density kN/m3	Phi degrees	Cohesion kN/m2	Ru ratio	Suction m (max)
Clay Fill	20.0	28	0	0.00	0.0
Gravely CLAY	19.0	29	0	0.00	0.0
Mudstone	23.0	37	0	0.00	0.0

Soil strata surface points	X m	Y m
Clay Fill	0.00	190.70
	15.64	193.30
	15.65	195.90
	24.53	196.35
	30.45	196.85
Gravely CLAY	0.00	187.60
	2.00	188.00
	7.48	189.00
	13.04	190.00
	18.23	191.00
	22.59	192.00
	24.53	193.00
	26.01	194.00
	28.97	195.00
	30.45	196.00
Mudstone	31.93	196.80
	0.00	185.30
	2.00	185.70
	7.48	186.70
	13.04	187.70
	18.23	188.70
	22.59	189.70
	24.53	190.70
	26.01	191.70
	28.97	192.70
	30.45	193.70
	31.93	194.50

Water input data Density 9.81 kN/m3

Phreatic surface points	X m	Y m
	-13.00	186.00
	0.00	186.00
	4.00	186.50
	9.00	187.50
	15.00	188.50
	20.00	189.50
	24.00	191.00
	31.00	194.50
	32.50	195.00

Piezometric grid was not enabled

Loading input data				
Load type	Magnitude	X Min m	X Max m	Y m
Surcharge	12.0 kN/m2	15.64	31.93	Surface
Line load	38.0 kN/m	15.64		Surface

No soil reinforcement was specified

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Partial factors

Design code referenced	Serviceability Limit State or conventional analysis	
Ramifications of failure	fn	1.00
Soil self weight	ffs	1.00
Imposed loads	fq	1.00
Soil tan(phi) values	fms	1.00
Soil cohesion values	fms	1.00
Reinforcing material strength	fm	1.00
Sliding on reinforcement	fs	1.00
Reinforcement pull-out	fp	1.00

Seismic acceleration

Vertical acceleration factor (x gravity)	0.00
Lateral acceleration factor (x gravity)	0.00

Slip circle definition

Method of analysis used is Bishop simplified (Moment equilibrium)
Minimum number of slices within slip is 10
A valid slip must have a depth greater than 3.00 m
Depth of water filled tension crack is 0.00 m

Grid of centres of circles

X Minimum value	2.0 m
X Maximum value	8.0 m
X Increment value	2.0 m
Y Minimum value	198.0 m
Y Maximum value	204.0 m
Y Increment value	2.0 m

The grid of centres is automatically extended to seek the minimum stability factor

The circles all pass through a line of points defined as follows

X Minimum value	-6.1 m
X Maximum value	12.2 m
X Increment value	6.1 m
Y value	at ground surface

Tabular printout of circular slips

X m	Y m	Radius m	Disturb kNm/m	Restore Soil kNm/m	Restore RForce kNm/m	Stability Factor
						-
2.00	198.00	11.73	1354	9568	0	7.07
4.00	198.00	13.19	3898	21785	0	5.59
6.00	198.00	14.78	8502	39036	0	4.59
8.00	198.00	16.46	13350	61835	0	4.63
10.00	198.00	18.20	18802	90374	0	4.81
2.00	200.00	13.26	1542	9933	0	6.44
4.00	200.00	14.56	4763	22001	0	4.62
6.00	200.00	16.01	9377	38829	0	4.14
8.00	200.00	17.57	14359	60918	0	4.24
10.00	200.00	19.21	19905	88291	0	4.44
2.00	202.00	14.89	1762	10491	0	5.95
4.00	202.00	16.06	5822	22448	0	3.86
6.00	202.00	17.39	10300	39392	0	3.82
8.00	202.00	18.84	15351	61067	0	3.98
10.00	202.00	20.37	21051	87637	0	4.16
4.00	204.00	17.67	6822	22264	0	3.26
6.00	204.00	18.88	11372	40524	0	3.56
8.00	204.00	20.22	16428	62151	0	3.78
10.00	204.00	21.66	22207	88034	0	3.96

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Tabular printout of circular slips - continued

X m	Y m	Radius m	Disturb kNm/m	Restore Soil kNm/m	Restore RForce kNm/m	Stability Factor -
4.00	206.00	19.34	7857	23453	0	2.98
6.00	206.00	20.46	12423	41985	0	3.38
8.00	206.00	21.70	17466	63837	0	3.66
10.00	206.00	23.05	23353	89341	0	3.83
2.00	208.00	20.19	4568	14767	0	3.23
4.00	208.00	21.07	8897	25297	0	2.84
6.00	208.00	22.10	13481	43650	0	3.24
8.00	208.00	23.25	18570	66022	0	3.56
10.00	208.00	24.52	24530	91421	0	3.73
2.00	210.00	22.04	5580	16452	0	2.95
4.00	210.00	22.85	9934	27230	0	2.74
6.00	210.00	23.80	14544	45296	0	3.11
8.00	210.00	24.88	19688	68660	0	3.49
10.00	210.00	26.06	25524	94138	0	3.69
2.00	212.00	23.91	6592	18261	0	2.77
4.00	212.00	24.66	10993	29352	0	2.67
6.00	212.00	25.54	15635	47195	0	3.02
8.00	212.00	26.55	20827	71549	0	3.44
10.00	212.00	27.66	26529	97201	0	3.66
8.00	198.00	11.67	4448	15062	0	3.39
10.00	198.00	13.12	7560	28221	0	3.73
6.00	200.00	12.09	2642	7732	0	2.93
8.00	200.00	13.20	5480	15797	0	2.88
10.00	200.00	14.50	8544	29288	0	3.43
6.00	202.00	13.87	3659	9131	0	2.50
8.00	202.00	14.84	6489	16308	0	2.51
10.00	202.00	16.01	9620	30897	0	3.21
6.00	204.00	15.69	4656	10722	0	2.30
8.00	204.00	16.56	7566	18269	0	2.41
10.00	204.00	17.61	10688	32874	0	3.08
6.00	206.00	17.56	5673	12484	0	2.20
8.00	206.00	18.34	8634	20363	0	2.36
10.00	206.00	19.29	11792	35133	0	2.98
6.00	208.00	19.45	6700	14401	0	2.15
8.00	208.00	20.16	9687	22594	0	2.33
10.00	208.00	21.03	12908	37528	0	2.91
6.00	210.00	21.36	7732	16473	0	2.13
8.00	210.00	22.01	10788	25062	0	2.32
10.00	210.00	22.81	14035	39991	0	2.85
4.00	212.00	22.85	5813	12011	0	2.07
6.00	212.00	23.29	8787	18689	0	2.13
8.00	212.00	23.88	11905	27713	0	2.33
10.00	212.00	24.62	15218	42455	0	2.79
10.00	198.00	9.36	2506	5754	0	2.30
10.00	200.00	11.20	3506	7407	0	2.11
8.00	202.00	12.65	2985	5760	0	1.93
10.00	202.00	13.10	4474	9244	0	2.07
8.00	204.00	14.63	3973	7453	0	1.88
10.00	204.00	15.02	5515	11311	0	2.05
8.00	206.00	16.61	4984	9304	0	1.87
10.00	206.00	16.96	6556	13565	0	2.07
6.00	208.00	18.50	4522	8413	0	1.86
8.00	208.00	18.60	6022	11349	0	1.88
10.00	208.00	18.91	7625	16023	0	2.10
6.00	210.00	20.50	5549	10302	0	1.86

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Tabular printout of circular slips - continued

X m	Y m	Radius m	Disturb kNm/m	Restore Soil kNm/m	Restore RForce kNm/m	Stability Factor -
8.00	210.00	20.59	7077	13558	0	1.92
10.00	210.00	20.87	8716	18657	0	2.14
6.00	212.00	22.50	6582	12332	0	1.87
8.00	212.00	22.58	8143	15982	0	1.96
10.00	212.00	22.84	9836	21461	0	2.18
2.00	198.00	13.26	2224	19830	0	8.92
4.00	198.00	11.80	1693	10821	0	6.39
8.00	198.00	9.47	1815	4919	0	2.71
10.00	198.00	8.78	1964	4153	0	2.11
6.00	200.00	12.18	2764	8118	0	2.94
8.00	200.00	11.30	2782	6308	0	2.27
10.00	200.00	10.72	2931	5748	0	1.96
4.00	202.00	14.94	3777	12982	0	3.44
6.00	202.00	13.94	3787	9523	0	2.51
8.00	202.00	13.18	3764	7893	0	2.10
10.00	202.00	12.69	3906	7545	0	1.93
2.00	204.00	17.72	4803	19955	0	4.15
4.00	204.00	16.65	4816	14407	0	2.99
6.00	204.00	15.76	4785	11109	0	2.32
8.00	204.00	15.09	4780	9656	0	2.02
10.00	204.00	14.66	4921	9567	0	1.94
2.00	206.00	19.39	5795	21384	0	3.69
4.00	206.00	18.42	5819	15992	0	2.75
6.00	206.00	17.62	5805	12879	0	2.22
8.00	206.00	17.02	5798	11598	0	2.00
10.00	206.00	16.64	5953	11774	0	1.98
2.00	208.00	21.12	6816	22940	0	3.37
4.00	208.00	20.23	6819	17723	0	2.60
6.00	208.00	19.50	6835	14811	0	2.17
8.00	208.00	18.97	6858	13731	0	2.00
10.00	208.00	18.63	7004	14172	0	2.02
2.00	210.00	22.89	7836	24644	0	3.14
4.00	210.00	22.07	7854	19641	0	2.50
6.00	210.00	21.41	7863	16880	0	2.15
8.00	210.00	20.92	7922	16019	0	2.02
10.00	210.00	20.62	8083	16742	0	2.07
2.00	212.00	24.70	8873	26525	0	2.99
4.00	212.00	23.94	8890	21707	0	2.44
6.00	212.00	23.33	8921	19108	0	2.14
8.00	212.00	22.88	9001	18494	0	2.05
10.00	212.00	22.61	9191	19499	0	2.12

Critical circle (minimum stability factor) details

Circle centre X coordinate	6.00 m
Circle centre Y coordinate	210.00 m
Circle radius	20.50 m
Disturbing moment	5549 kNm/m
Restoring moment due to soil shear	10302 kNm/m
Restoring moment due to reinforcement	0 kNm/m
Stability factor	1.86

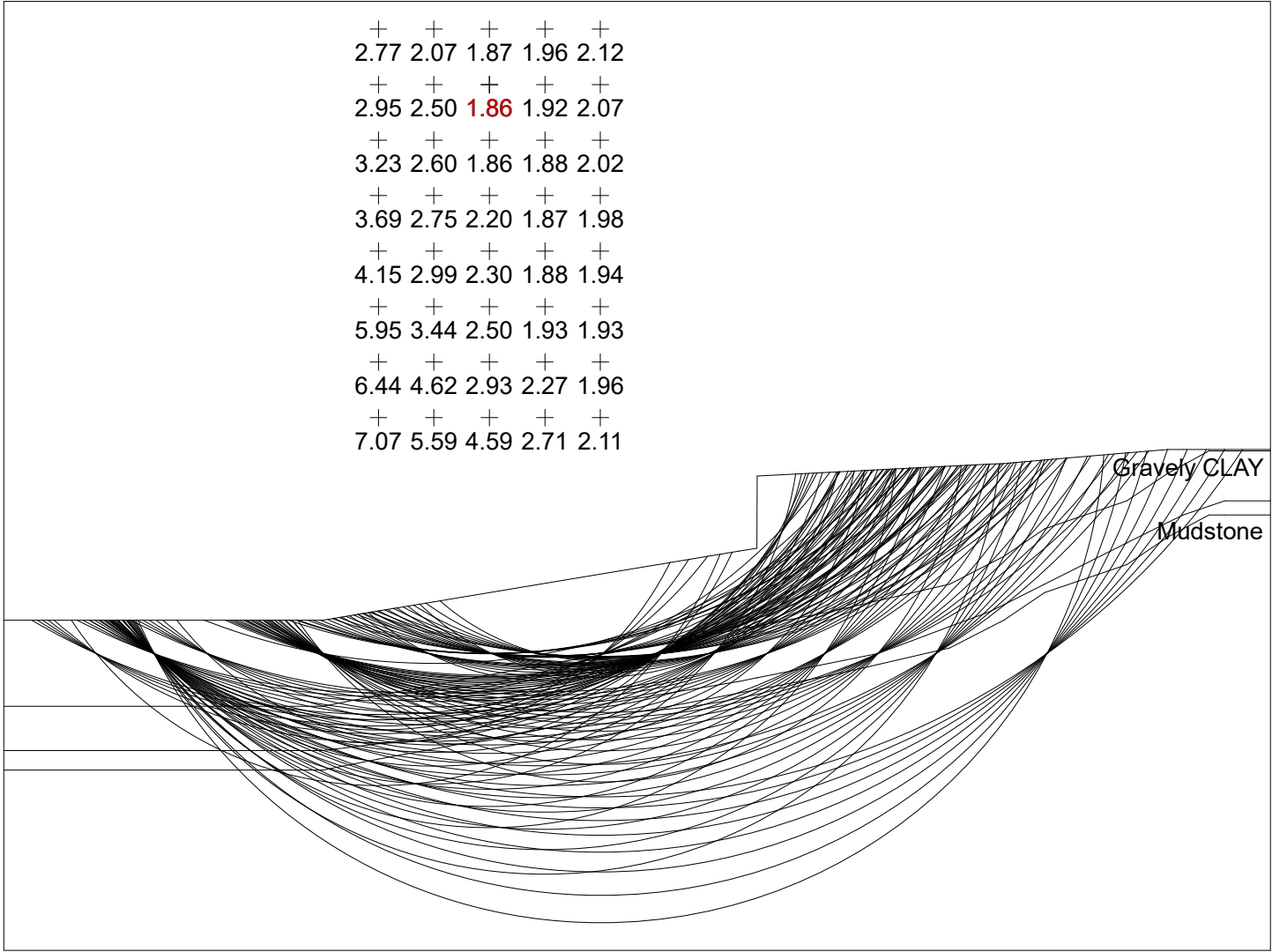
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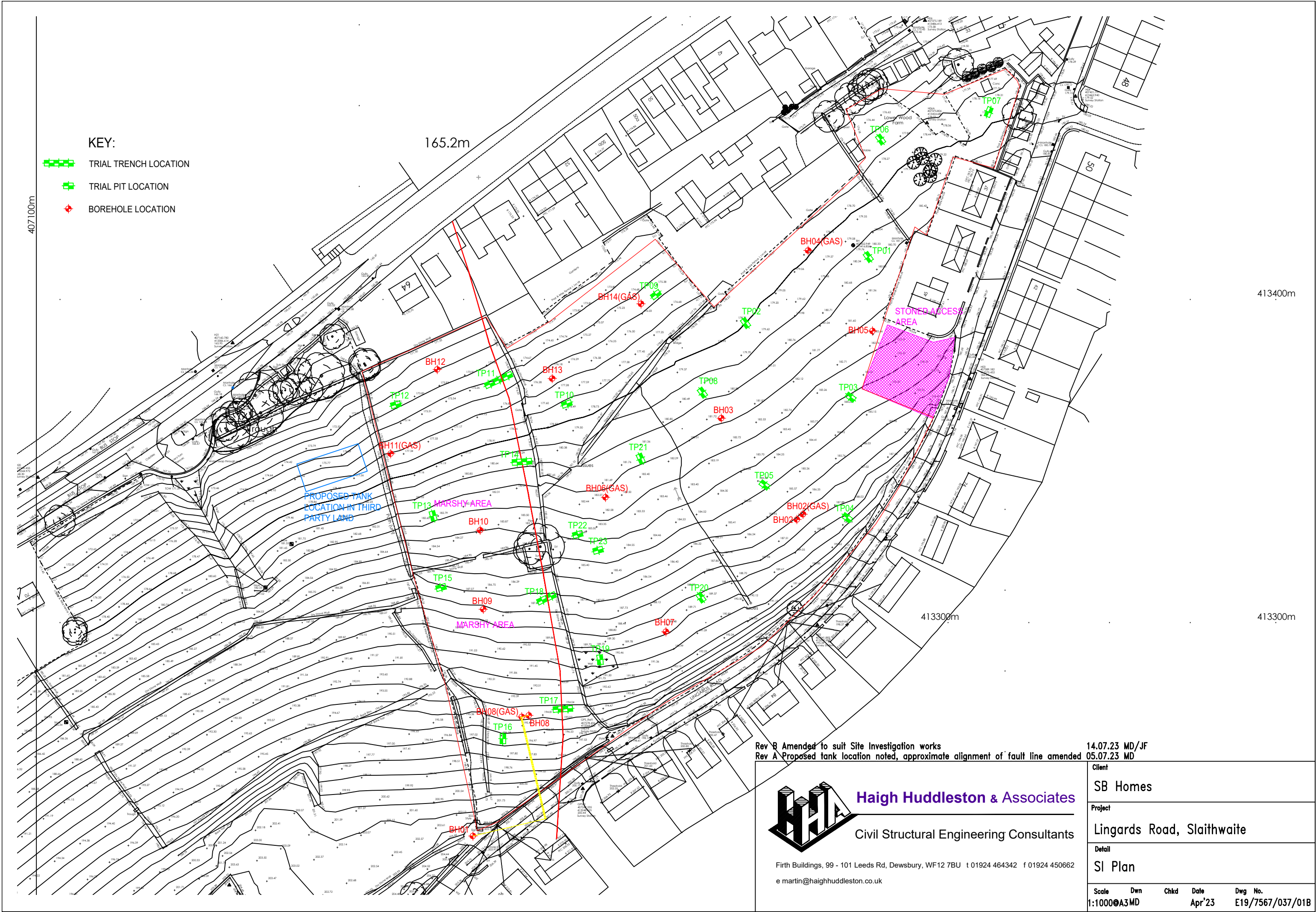
Critical circle slice details

X m	Top Y m	Btm Y m	Base Angle deg.	Soil Cu/C' kN/m2	Soil TanPhi	Total Weight kN	Vert Load kN	Lat' Load kN	Top Water kN/m2	Base Water kN/m2	Normal Force kN
-0.91	190.70	190.70									
0.00	190.70	190.40	-18.4	0.0	0.532	2.8	0.0	0.0	0.0	0.0	3.2
2.00	191.03	189.89	-14.1	0.0	0.532	28.8	0.0	0.0	0.0	0.0	32.0
4.00	191.37	189.60	-8.4	0.0	0.532	58.1	0.0	0.0	0.0	0.0	61.4
5.74	191.65	189.50	-3.2	0.0	0.532	68.2	0.0	0.0	0.0	0.0	69.4
7.48	191.94	189.55	1.7	0.0	0.532	79.0	0.0	0.0	0.0	0.0	78.4
9.00	192.20	189.72	6.3	0.0	0.532	74.0	0.0	0.0	0.0	0.0	72.1
11.02	192.53	190.12	11.3	0.0	0.532	98.7	0.0	0.0	0.0	0.0	95.2
13.04	192.87	190.75	17.1	0.0	0.532	91.5	0.0	0.0	0.0	0.0	88.0
15.00	193.19	191.58	23.1	0.0	0.532	73.2	0.0	0.0	0.0	0.0	70.9
15.64	193.30	191.91	27.0	0.0	0.532	19.2	0.0	0.0	0.0	0.0	18.8
15.65	195.90	191.91	28.1	0.0	0.532	0.5	38.1	0.0	0.0	0.0	38.0
16.94	195.97	192.66	30.2	0.0	0.532	94.0	15.5	0.0	0.0	0.0	108.6
18.23	196.03	193.55	34.4	0.0	0.532	74.6	15.5	0.0	0.0	0.0	91.3
20.00	196.12	195.02	39.8	0.0	0.532	63.3	21.2	0.0	0.0	0.0	88.9
21.14	196.18	196.18	45.3	0.0	0.532	12.5	13.7	0.0	0.0	0.0	28.9

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CADS ReSlope, Version 2.06 Slope stability analysis and design of reinforced soil slopes	Project 7567 File Name 3m proposed.rsp"
SB Homes - Lingards Road, Slaithwaite Slope Stability to Proposed Site Levels	Engineer IM Date 15/11/2023

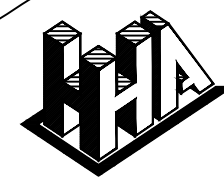
Diagram showing all circles





Rev B Amended to suit Site Investigation works
Rev A Proposed tank location noted, approximate alignment of fault line amended

14.07.23 MD/JF
05.07.23 MD



Haigh Huddleston & Associates

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Client				
SB Homes				
Project				
Lingards Road, Slaithwaite				
Detail				
SI Plan				
Scale	Dwn	Chkd	Date	Dwg No.
1:1000@A3 MD			Apr'23	E19/7567/037/01B