

Your ref:

Our ref: 37472/DMB/MRA

21st December 2018

Claire Tomalin
Principal Planning Officer - Minerals & Waste
Essex County Council
Planning Service
County hall
Chelmsford
Essex CM1 1QH

By email: claire.tomalin@essex.gov.uk

Dear Claire

RE: Land at Woodhouse Lane, Broomfield, Chelmsford, Essex – Minerals Resource Assessment – Addendum Report

Further to our recent communications in respect of the above and following completion of the additional Site Investigation works, please find enclosed within this letter our findings in respect of the Minerals Reserve at the abovementioned site.

This report also provides an update assessment of the volumes of mineral and overburden calculated from this additional information.

As discussed and agreed, this information is intended to be an addendum to the Minerals Resource Assessment Report ref 37472/3504/R3/Rev 1, dated Sept 2018, which you have previously provided comment on, in your letter to PBA of 12 October.

Further discussions have been held between PBA and yourself with regard to the extent of the MRA and the extent to which constraints should be applied. In our most recent communications it was identified by ECC that the Mineral Resource should be assessed to the maximum extent allowable only considering only the boundary 10m and receptor 100m buffers with vertical cut sides to the modelled extraction workings. ECC also identified that the area surrounding, and including, the reservoir should also be included within the modelling of the extent of workings.

The purpose of this addendum report is to demonstrate that the extent of mineral across the site has now been fully established such that the requirements for an MRA have been adequately addressed.

Additional Ground Investigation

A further 3 cable tool boreholes were constructed at the site between 30 Oct and 15 Nov 2018 at the locations shown on the attached Figure 37472/2001/030 reference BH06, BH07 and BH08 and on Figure 37472/2001/032. The previous ground investigation locations are also presented on the Figure. These additional boreholes were undertaken in areas which had previously not been

investigated to the full depth of the mineral. Sections across the site are presented on Figure 37472/2001/031.

The additional cable tool borehole records are presented in Enclosure A of this report.

Table 1, below, provides a summary of the interpreted mineral and overburden thickness from the borehole logs which is as previously presented in Chapter 5.2.1 of the MRA.

Location	Overburden Thickness	Mineral thickness / Base Depth	Base level mOD	Waste Thickness (Description)	Overburden / Waste:Mineral ratio
BH06	7.3m	7.8/15.10m	32.52m	None	0.93:1
BH07	9.3m	7.5/17.90m	37.45m	1.10m (sandy gravelly clay)	1.38:1
BH08	2.4m	9.4/11.80m	34.33m	None	0.25:1

Assessment of Findings

Borehole BH06 is located in the NE area of the site in an area of archaeological constraint. Ground conditions in this area are proven to comprise 7.3m of overburden material over 7.8m of mineral.

The depth of the base of the mineral at 32.52m OD is 3.48m lower than that interpolated in the MRA for volume calculation purposes (36.0mOD).

Borehole BH07 is located in the NW area of the site. Ground conditions have been proven to comprise 9.3m of overburden over 7.5m of mineral with a 1.1m layer of ‘waste’ materials within the sand and gravel deposit.

The depth of the base of the mineral at 37.45m OD is 0.5m higher than that interpolated in the MRA for volume calculation purposes (37.40 mOD).

Borehole BH08 is located to the east of the reservoir. Ground conditions have been proven to comprise 2.4m overburden over 9.4m of mineral. No waste deposits were identified.

The inclusion of this borehole (installed to inform hydrogeological modelling of groundwater at the site) allows more informed extrapolation of the mineral in the area of the reservoir.

For ease of reference the plan and sections with levels of mineral interpolated as previously presented in the MRA is enclosed with this letter in Enclosure B.

Revised Volume Calculations

We have revised the ground model on the basis of the findings of the additional investigations and recalculated volumes for the original area indicated as being workable. We have calculated the workable volumes using the same parameters as used previously (side slope gradient of 1:3) and, as directed, using a vertical side to maximise the potential mineral. As identified during our recent discussions we have not included any archaeological constraints in the modelling. Results compared to previous calculations are set out in Table 2 below:

Description	Overburden volume m3	Mineral volume m3	Ratio
Previously Calculated Volumes	948,030	185,000	4.6:1
Vertical Sides	1,452,816	1,115,879	1.3:1
1:2 Side Slopes	1,332,370	842,288	1.6:1
1:3 Side Slopes	1,272,697	708,111	1.8:1

The model and associated sections are presented in Enclosure C.

Summary Findings and Conclusions

The revised volumes in situ at the site, based on additional information and remodelling of the area, indicate an overburden and waste volume of 1,452,816m³ and mineral volume of 1,115,879m³ giving a ratio of 1.3:1.

We consider that the additional investigation work and this additional assessment have fully demonstrated the in situ volumes of overburden, waste and mineral that are present within the site area taking only site buffer constraints into account.

A Viability Assessment will now be undertaken and provided under separate cover.

Yours sincerely

Oliver Belson

For and on behalf of
PETER BRETT ASSOCIATES LLP

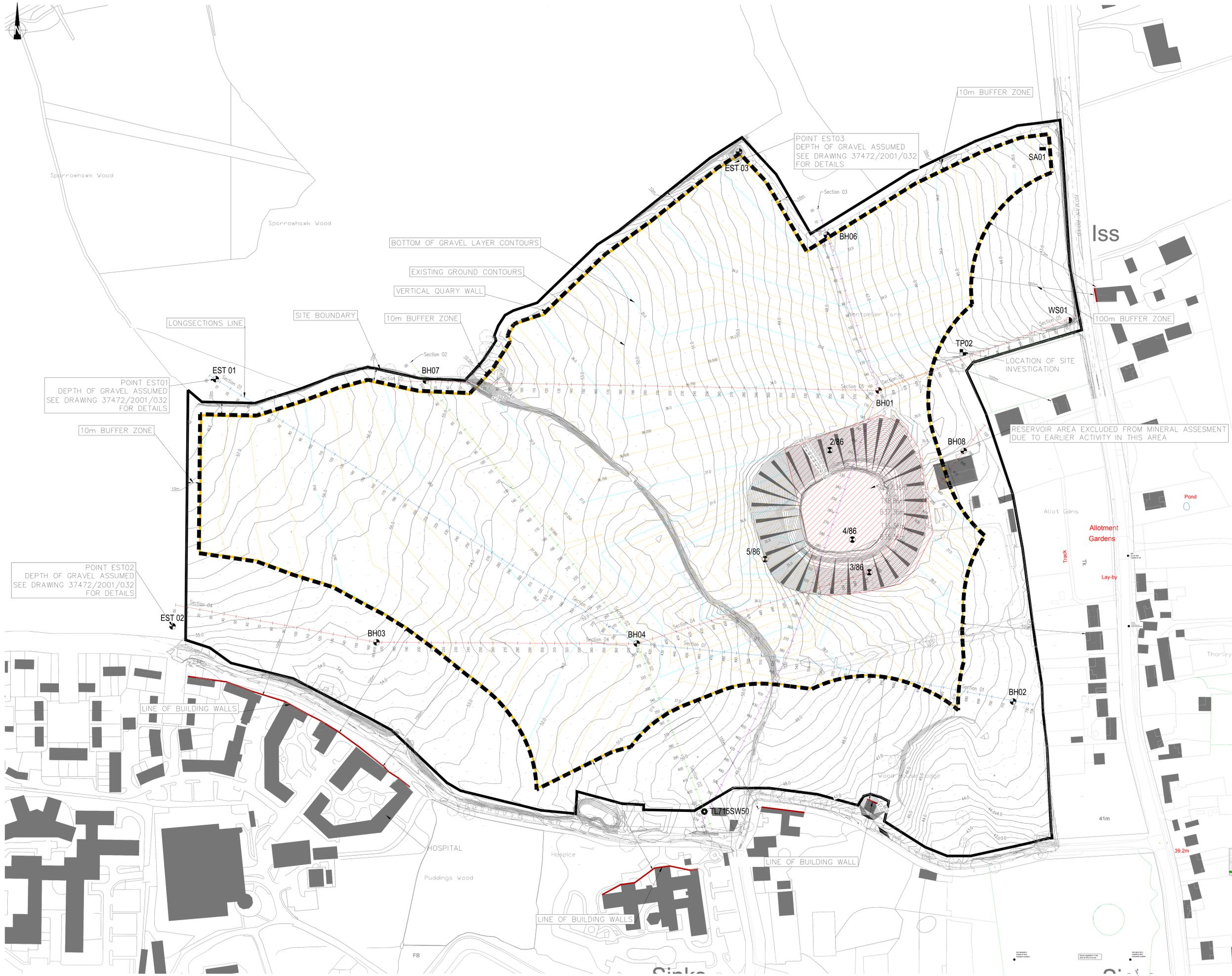
Enc.

Figures

A – Borehole Logs

B – Previous Plans and Sections

Figures



- NOTES**
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 2. ALL LEVELS ARE IN METRES RELATIVE TO ORDNANCE DATUM NEWLYN UNLESS NOTED OTHERWISE.
 3. ALL COORDINATES ARE IN METRES RELATIVE TO ORDNANCE SURVEY NATIONAL GRID.
 4. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING WORK OR PREPARING SHOP DRAWINGS.
 5. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS AND ARCHITECTS DRAWINGS AND SPECIFICATIONS.
 6. FOR LONG SECTIONS SEE DRAWING 37472_2001_031.
 7. FOR LOCATION OF SITE INVESTIGATION BOREHOLES ETC. SEE DRAWING 37472_2001_032.

- LEGEND**
- SITE BOUNDARY
 - EXTENT OF QUARRY VERTICAL WALL
 - RESERVOIR AREA EXCLUDED FROM MINERAL ASSESMENT DUE TO EARLIER ACTIVITY
 - LINE OF LONGSECTION WITH CHANGE
 - EXISTING CONTOURS
 - CONTOURS OF GRAVEL LAYER BED
 - EXPLORATORY BOREHOLE LABEL
 - QUARRY WALL - 1 IN 3 SLOPE

POINT EST01
DEPTH OF GRAVEL ASSUMED
SEE DRAWING 37472/2001/032
FOR DETAILS

POINT EST03
DEPTH OF GRAVEL ASSUMED
SEE DRAWING 37472/2001/032
FOR DETAILS

POINT EST02
DEPTH OF GRAVEL ASSUMED
SEE DRAWING 37472/2001/032
FOR DETAILS

Mark	Revision	Date	Drawn	Chkd	Appd

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty is made as to its accuracy or completeness. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Drawing Issue Status: **PRELIMINARY**

LAND AT BROOMFIELD, CHELMSFORD

PLAN OF EARTHWORKS

Client: **BLOOR HOMES**

Architect: **pba peterbrett**

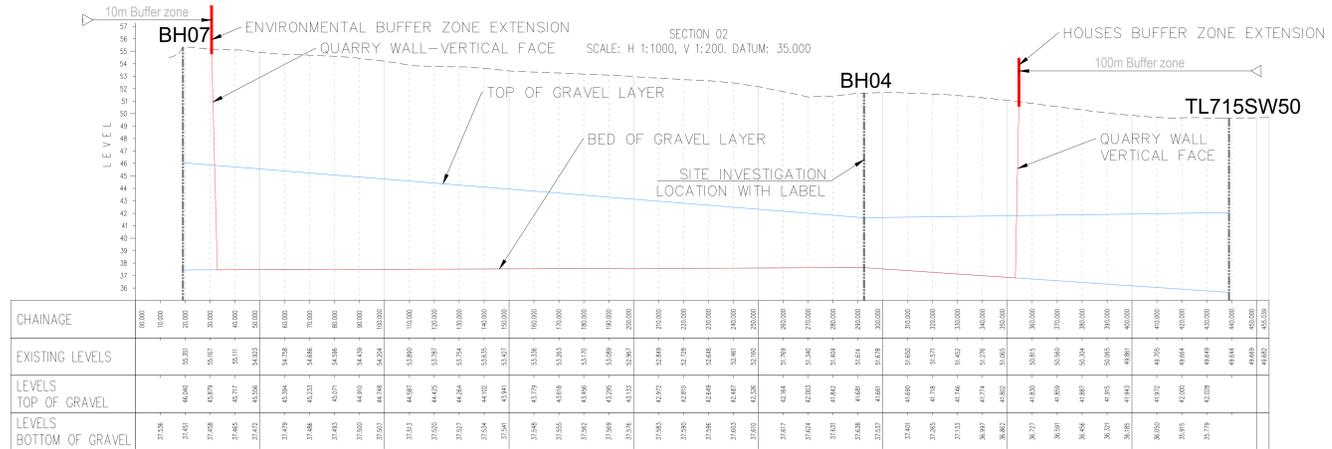
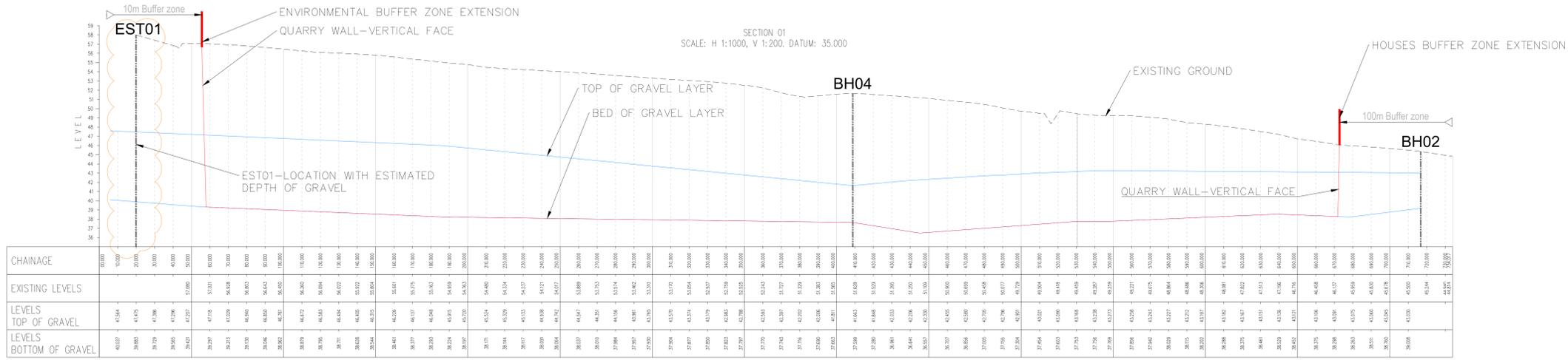
Date of 1st Issue: 28.11.2018	Designed: GIE	Drawn: RZ
All Scale: 1:1000	Checked: OB	Approved: MB
Drawing Number: 37472/2001/030	Revision: P01	

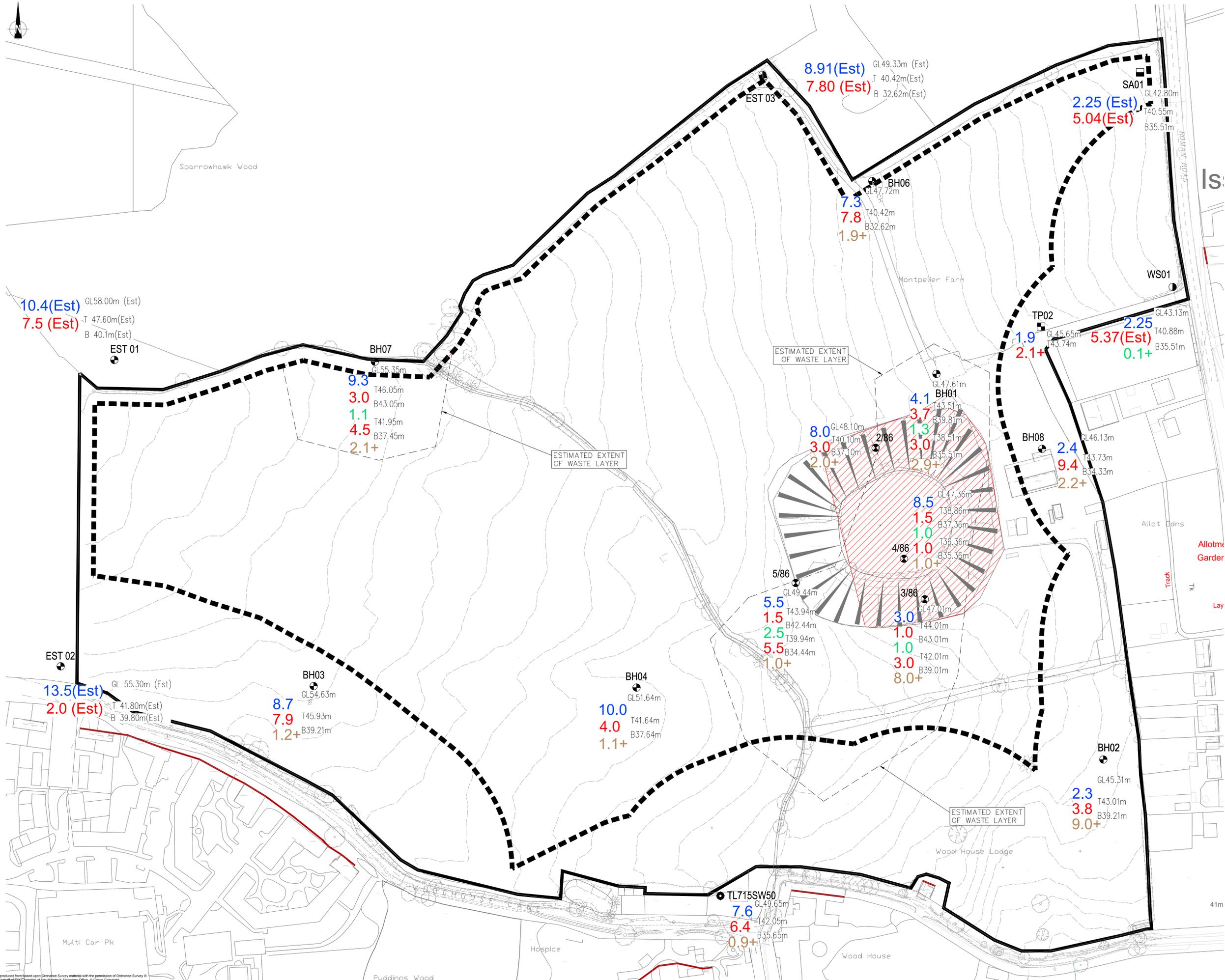
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NOTES

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4. THE CONTRACTOR IS TO VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING WORK OR PREPARING SHOP DRAWINGS
5. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS AND ARCHITECTS DRAWINGS AND SPECIFICATIONS
6. FOR PLAN SEE DRAWING 31472_2001_030
7. FOR SITE INVESTIGATION DETAILS SEE DRAWING 31472_2001_032





- NOTES**
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 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ENGINEERS AND ARCHITECTS DRAWINGS AND SPECIFICATIONS.
 - FOR CROSS SECTIONS SEE DRAWING 37472_2001_031.

LEGEND

- SITE BOUNDARY
- VERTICAL QUARY WALL
- RESERVOIR AREA WITH EARLIER ACTIVITY OF GRAVEL RESOURCING

5/86

- GL 49.44m
- 5.5
- 1.5
- 2.5
- 5.5
- 1.0+

EST 02

- GL 55.30m (Est)
- 13.5 (Est)
- 2.0 (Est)
- T 41.80m (Est)
- B 39.80m (Est)

5/86

- GL 49.44m
- DEPTH OF OVERBURDEN
- TOP OF GRAVEL LAYER
- DEPTH OF WASTE LAYER
- DEPTH OF FIRST GRAVEL LAYER
- BOTTOM OF GRAVEL LAYER
- DEPTH OF SECOND GRAVEL LAYER
- TOP OF SECOND GRAVEL LAYER
- BOTTOM OF SECOND GRAVEL LAYER
- DEPTH OF CLAY LAYER ENCOUNTERED BELOW GRAVEL LAYER
- BOREHOLE TERMINATED

EST 02

- LOCATION WITH ESTIMATED GRAVEL LAYER DEPTH
- GL 55.30m (Est)
- 13.5 (Est)
- 2.0 (Est)
- T 41.80m (Est)
- B 39.80m (Est)

Mark	Revision	Date	Drawn	Chkd	Appd

SCALE NOTE: Do not scale from this drawing. If in doubt, ask.

UTILITIES NOTE: The position of any existing public or private sewers, utility services, plant or apparatus shown on this drawing is believed to be correct, but no warranty is expressed or implied. Other such plant or apparatus may also be present but not shown. The Contractor is therefore advised to undertake their own investigation where the presence of any existing sewers, services, plant or apparatus may affect their operations.

Drawing Issue Status: **PRELIMINARY**

LAND AT BROOMFIELD, CHELMSFORD

SITE INVESTIGATION LOCATIONS

Client: **BLOOR HOMES**

Architect: **pba peterbrett**

Date of 1st Issue: 28.11.2018

AD Scale: 1:800

Drawing Number: 37472/2001/032

Revision: P01

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Enclosure A

Project Name Land North of Woodhouse Lane, Broomfield		Project No: 37472			BOREHOLE		
Client Bloor Homes Eastern		Start Date 30/10/2018	End Date 30/10/2018		BH06		
Contractor Lynch Plant Hire		Ground Level 47.62m OD (OSGB)			Sheet 1 of 2		
Method/Plant Dando 2000/No 2		Coordinates (OSGB) 570483 E 212060 N		Logged By: SC	Scale 1:50		
Checked By: JC							

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
						(0.10)	47.52	TOPSOIL (Brown sandy gravelly CLAY. Gravel is angular to subrounded fine to coarse flint)	
						(0.20)	47.32	[TOPSOIL]	
						(0.90)		Dark brown medium to coarse subangular GRAVEL of brick and macadam.	
1	1.00 - 1.20	B1				1.20	46.42	[MADE GROUND] Stiff brown white gravelly CLAY. Gravel is fine to medium subangular chalk.	
	1.50 - 1.80	B2						[LOWESTOFT FORMATION] Stiff brown silty CLAY with occasional gravel. Gravel is fine to medium subangular chalk.	
2								[LOWESTOFT FORMATION]	
3						(3.30)			
4									
5	4.50 - 5.00	B3				4.50	43.12	Stiff brown white gravelly CLAY. Gravel is fine to medium subangular chalk.	
6						(2.80)		[LOWESTOFT FORMATION]	
7									
8	7.50 - 7.80	B4				7.30	40.32	Medium dense to dense (based on drillers observations) brown sandy GRAVEL. Gravel is fine to medium subangular.	
9						(2.70)		[GLACIOFLUVIAL DEPOSITS]	
10	10.00 - 10.50	B5				10.00	37.62		

General Remarks 1. Location CAT scanned prior to excavation 2. Hand dug inspection pit to 1.20m 3. Groundwater struck at 10.0m and rose to 9.50m as a medium inflow rate 5. 15 litres of water added from 7.3m to 10.0m depth. 6. Standpipe installed to 15.0m depth comprising 8m slotted pipe and 7m plain pipe. 7. Borehole completed at surface with raised steel cover and gas tap.	Boring Progress			Water Strike			Chiselling		
	Date/Time	Depth	Cas. Depth	Strike	Time (mins)	Rose To	From	To	Duration
				10.00	20	9.50	0.00	0.45	01:00

Project Name Land North of Woodhouse Lane, Broomfield		Project No: 37472			BOREHOLE BH06
Client Bloor Homes Eastern		Start Date 30/10/2018	End Date 30/10/2018		
Contractor Lynch Plant Hire		Ground Level 47.62m OD (OSGB)			
Method/Plant Dando 2000/No 2		Coordinates (OSGB) 570483 E 212060 N		Logged By: SC	Sheet 2 of 2
				Checked By: JC	Scale 1:50

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
11								Medium dense to dense (based on drillers observations) brown sandy GRAVEL. Gravel is fine to medium subrounded to subangular. [GLACIOFLUVIAL DEPOSITS]	
12						(4.00)			
13									
14	14.00 - 14.50	B6				14.00	33.62	Medium dense to dense (based on drillers observations) brown sandy GRAVEL. Gravel is fine to medium subrounded to subangular. [GLACIOFLUVIAL DEPOSITS]	
15						(1.10)			
15						15.10	32.52	Stiff dark grey very closely to closely fissured CLAY. [LONDON CLAY FORMATION]	
16	16.00 - 16.50	B7				(1.90)			
17						17.00	30.62	End of Borehole at 17.00m	
18									
19									
20									

General Remarks 1. Location CAT scanned prior to excavation 2. Hand dug inspection pit to 1.20m 3. Groundwater struck at 10.0m and rose to 9.50m as a medium inflow rate 5. 15 litres of water added from 7.3m to 10.0m depth. 6. Standpipe installed to 15.0m depth comprising 8m slotted pipe and 7m plain pipe. 7. Borehole completed at surface with raised steel cover and gas tap.	Boring Progress			Water Strike			Chiselling		
	Date/Time	Depth	Cas. Depth	Strike	Time (mins)	Rose To	From	To	Duration
				10.00	20	9.50	0.00	0.45	01:00

Project Name Land North of Woodhouse Lane, Broomfield		Project No: 37472			BOREHOLE BH07
Client Bloor Homes Eastern		Start Date 14/11/2018	End Date 15/11/2018		
Contractor A.G. Brown Drilling		Ground Level 55.35m OD			
Method/Plant Dando 2000/No 2		Coordinates 570158 E 211942 N		Logged By: AB	Sheet 1 of 2
				Checked By: SC	Scale 1:50

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
0.25						0.25	55.10	Soft black slightly gravelly CLAY. [TOPSOIL]	
0.85						0.85		Stiff brown friable silty CLAY with some fine to medium gravel and roots. [LOWESTOFT FORMATION]	
1.30 - 1.70		B1				1.10	54.25	Stiff brown gravelly CLAY. [LOWESTOFT FORMATION]	
4.00						4.00			
5.40 - 5.80		B2				5.10	50.25	Firm to stiff brown gravelly CLAY. [LOWESTOFT FORMATION]	
4.20						4.20			
9.80 - 10.20		B3				9.30	46.05	Medium dense to dense (drillers description) brown sandy GRAVEL. Sand is coarse and gravel is fine to medium. [GLACIOFLUVIAL DEPOSITS]	

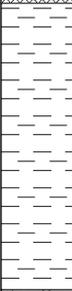
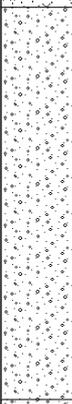
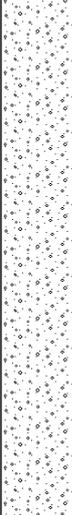
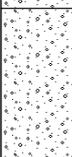
General Remarks 1. Location CAT scanned prior to excavation 2. Hand dug inspection pit to 1.20m 3. Standpipe installed comprising slotted pipe and plain pipe. 4. Borehole advanced to 10.0m depth using 200mm diameter casing. 150mm diameter casing used from 10.0m to depth. 5. Borehole completed at surface with raised steel cover and gas tap.	Boring Progress			Water Strike			Chiselling		
	Date/Time	Depth	Cas. Depth	Strike	Time (mins)	Rose To	From	To	Duration
				15.50	20	-			

Project Name Land North of Woodhouse Lane, Broomfield		Project No: 37472			BOREHOLE BH07
Client Bloor Homes Eastern		Start Date End Date 14/11/2018 15/11/2018			
Contractor A.G. Brown Drilling		Ground Level 55.35m OD		Logged By: AB	Sheet 2 of 2 Scale 1:50
Method/Plant Dando 2000/No 2		Coordinates 570158 E 211942 N		Checked By: SC	

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
11						(3.00)		Medium dense to dense (drillers description) brown sandy GRAVEL. Sand is coarse and gravel is fine to medium. [GLACIOFLUVIAL DEPOSITS]	
12	12.50	D5				12.30 (1.10)	43.05	Stiff brown slightly sandy slightly gravelly CLAY. [GLACIOFLUVIAL DEPOSITS]	
13						13.40 (4.50)	41.95	Medium dense to dense (drillers description) brown slightly sandy GRAVEL. Sand is coarse and gravel is fine to medium. [GLACIOFLUVIAL DEPOSITS]	
14									
15									
16	16.00 - 16.40	B4							
17									
18	18.20	D6				17.90 (0.90)	37.45	Stiff brown varved slightly silty CLAY. [LONDON CLAY FORMATION]	
19	19.50	D7				18.80 (1.20)	36.55	Stiff brown closely fissured CLAY. [LONDON CLAY FORMATION]	
20						20.00	35.35	End of Borehole at 20.00m	

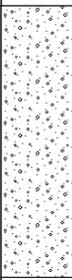
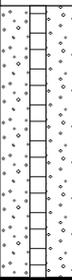
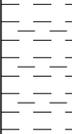
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	Date/Time	Depth	Cas. Depth	Strike	Time (mins)	Rose To	From	To	Duration
				15.50	20	-			

Project Name Land North of Woodhouse Lane, Broomfield		Project No: 37472			BOREHOLE BH08
Client Bloor Homes Eastern		Start Date 14/11/2018	End Date 14/11/2018		
Contractor A.G. Brown Drilling		Ground Level 46.17m OD		Logged By: AB	Sheet 1 of 2
Method/Plant Dando 2000/No 2		Coordinates 570594 E 211885 N		Checked By: SC	Scale 1:50

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
0.50						(0.50)	45.67	Medium dense (drillers description) GRAVEL. Gravel includes brick and concrete fragments. [MADE GROUND]	
1.10 - 1.60	B1					(1.90)		Stiff brown mottled grey CLAY with occasional medium gravel. [LOWESTOFT FORMATION]	
2.50 - 2.80	B2					2.40 (0.50)	43.77	Medium dense (drillers description) brown very silty SAND with occasional medium gravel. [GLACIOFLUVIAL DEPOSITS]	
3.10 - 3.50	B3					2.90	43.27	Medium dense (drillers description) brown sandy GRAVEL. Gravel is fine to medium subangular to subrounded. [GLACIOFLUVIAL DEPOSITS]	
5.80 - 6.20	B4					5.50	40.67	Medium dense brown sandy GRAVEL interbedded with firm clayey GRAVEL. [GLACIOFLUVIAL DEPOSITS]	
9.50 - 9.90	B5					9.00	37.17	Medium dense brown sandy GRAVEL. Sand is coarse and gravel is fine to medium. [GLACIOFLUVIAL DEPOSITS]	

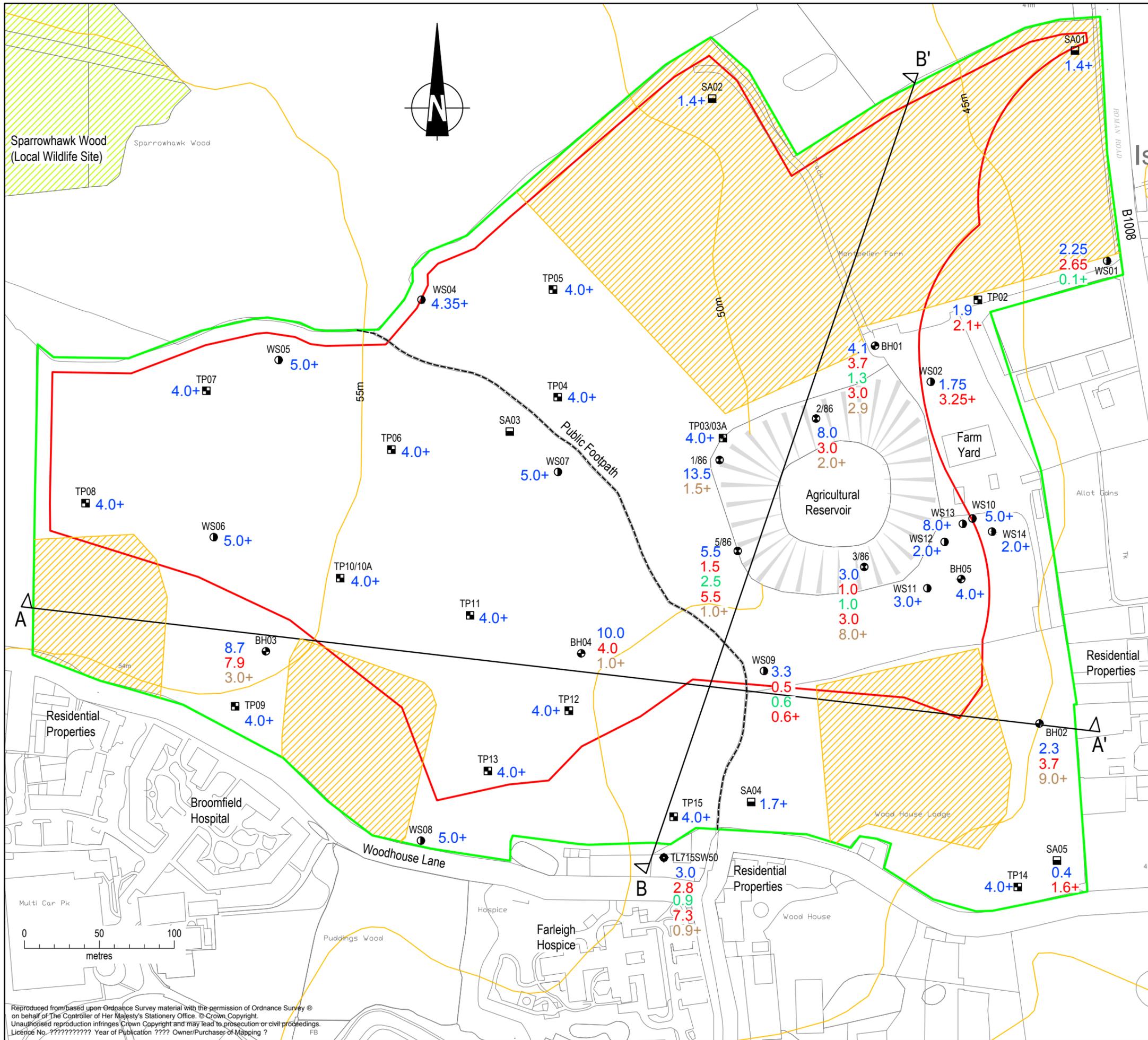
General Remarks 1. Location CAT scanned prior to excavation 2. Hand dug inspection pit to 1.20m 3. Standpipe installed comprising slotted pipe and plain pipe. 4. Borehole advanced to 10.0m depth using 200mm diameter casing. 150mm diameter casing used from 10.0m to depth. 5. Borehole completed at surface with raised steel cover and gas tap.	Boring Progress			Water Strike			Chiselling		
	Date/Time	Depth	Cas. Depth	Strike	Time (mins)	Rose To	From	To	Duration
				9.00	20	-			

Project Name Land North of Woodhouse Lane, Broomfield		Project No: 37472			BOREHOLE BH08
Client Bloor Homes Eastern		Start Date End Date 14/11/2018 14/11/2018			
Contractor A.G. Brown Drilling		Ground Level 46.17m OD		Logged By: AB	Sheet 2 of 2 Scale 1:50
Method/Plant Dando 2000/No 2		Coordinates 570594 E 211885 N		Checked By: SC	

(m)	Samples and Insitu Tests			Water	Legend	Depth (Thickness)	Level (m OD)	Stratum Description	Instrumentation / Backfill
	Depth	Type	Results						
11						(2.80)		Medium dense brown sandy GRAVEL. Sand is coarse and gravel is fine to medium. [GLACIOFLUVIAL DEPOSITS]	
12	12.20	D6				11.80 (1.00)	34.37	Stiff brown CLAY with black specks. [LONDON CLAY FORMATION]	
13						12.80 (1.20)	33.37	Stiff dark grey closely fissured CLAY. [LONDON CLAY FORMATION]	
14	14.00	D7				14.00	32.17	End of Borehole at 14.00m	
15									
16									
17									
18									
19									
20									

General Remarks 1. Location CAT scanned prior to excavation 2. Hand dug inspection pit to 1.20m 3. Standpipe installed comprising slotted pipe and plain pipe. 4. Borehole advanced to 10.0m depth using 200mm diameter casing. 150mm diameter casing used from 10.0m to depth. 5. Borehole completed at surface with raised steel cover and gas tap.	Boring Progress			Water Strike			Chiselling		
	Date/Time	Depth	Cas. Depth	Strike	Time (mins)	Rose To	From	To	Duration
				9.00	20	-			

Enclosure B



- General Key**
- BH01 ● Borehole Location 2018
 - WS01 ● Window Sample Location 2018
 - TP01 ■ Trial Pit Location 2018
 - SA01 ■ Soakaway Test Location 2016
 - TL715SW32 ● Historical Borehole (BGS)

- Approximate Site Boundary
- 50 Ground Level Contours (m OD)
- Line of Sections A-A' and B-B' (See Figure 4)

- Minerals Key**
- 2.0 Overburden Thickness (m)
 - 2.0 Mineral Thickness (m)
 - 2.0 Waste Thickness (m)
 - 2.0 Bedrock Thickness (m)

- Quarry Site Buffer
- Areas of Archaeological Constraint

**LAND AT BROOMFIELD
CHELMSFORD, ESSEX**

OVERBURDEN AND MINERAL THICKNESS

Client
BLOOR HOMES

Date of 1st Issue: 15.06.2018
A3 Scale: 1:2500

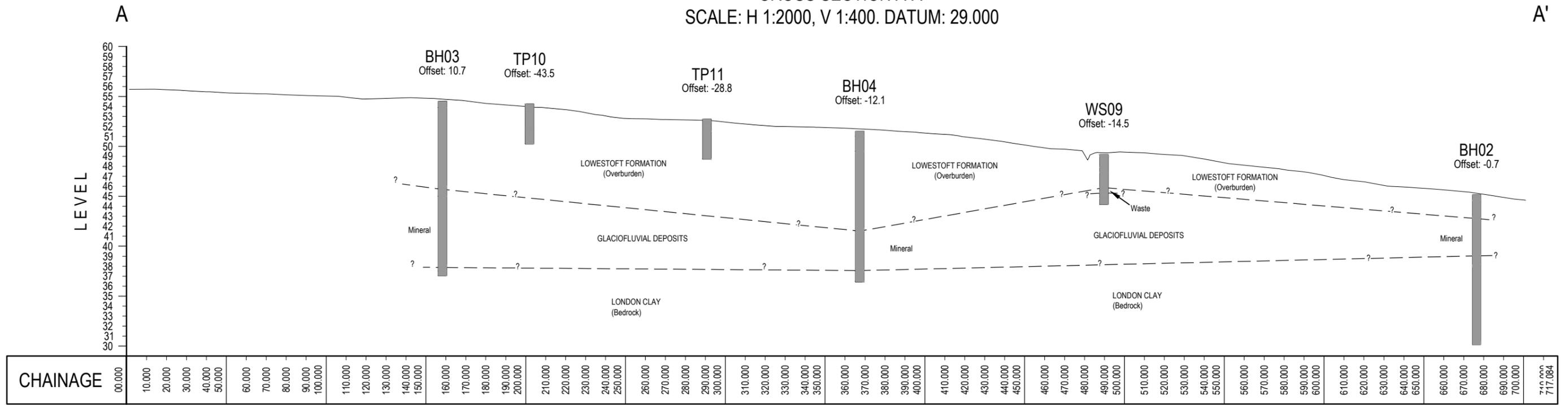
Drawn by: davco
Checked by: LTr

Figure Number
3

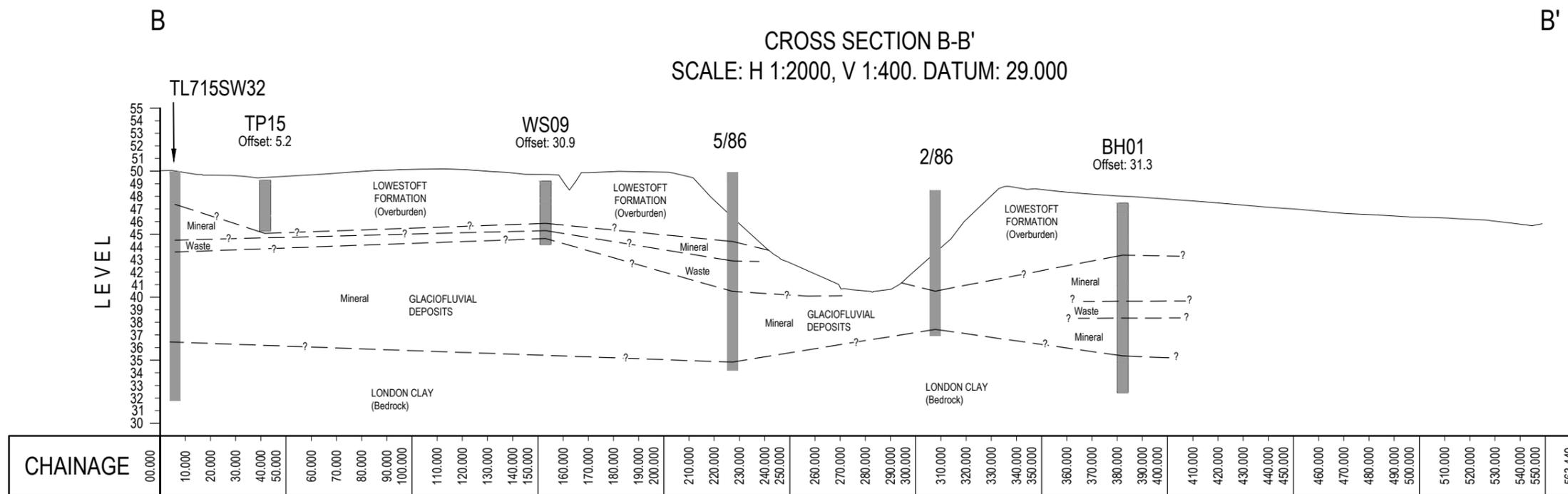
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CROSS SECTION A-A'
SCALE: H 1:2000, V 1:400. DATUM: 29.000



CROSS SECTION B-B'
SCALE: H 1:2000, V 1:400. DATUM: 29.000



5 x VERTICAL EXAGGERATION



Client
BLOOR HOLES

LAND AT BROOMFIELD, CHELMFORD, ESSEX

GEOLOGICAL CROSS SECTIONS

Date 18.06.2018

A3 Scale as shown

Drawn by davco

Checked by LTr

Figure Number

4