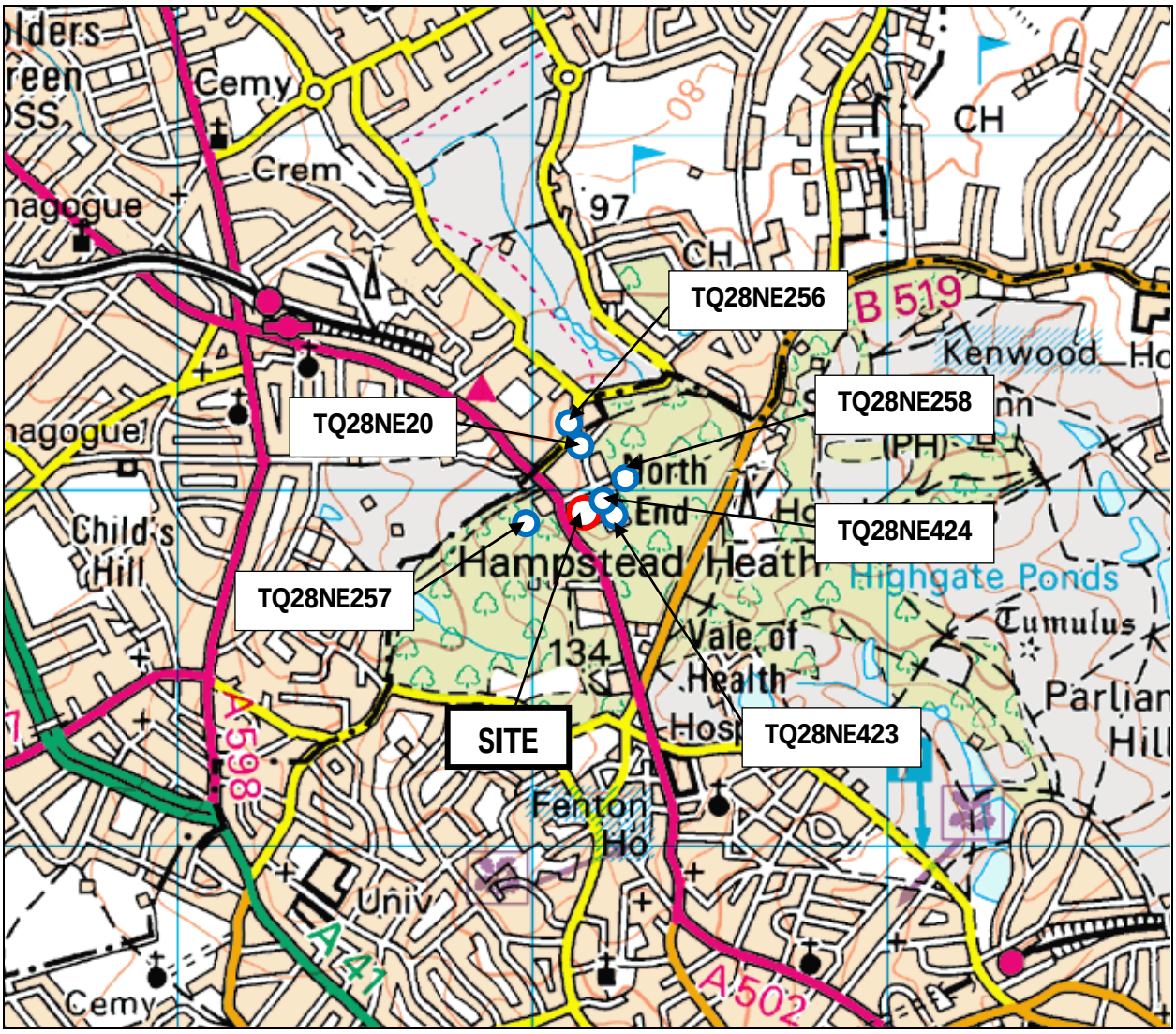
APPENDIX C

BGS boreholes



N

Client	Project	Job No
Cranbrook Basements	**6a North End, Camden**	**CG/08659**
CGL	Title **BGS borehole location plan**	**Appendix C**

WELL BORING at Foot of Golders Hill. NW3. County

Geol. map — in. map New Series — 6 in. map — TQ 28 NE (No 30)

Made by — Date —

Sunk — feet. Bored — feet.

Communicated by L.C.C.

Height above Ordnance Datum ~~433~~ 352' Rest level of water —

Yield

Quality (with copy of analysis on separate sheet)

TQ28NE/20
2608. 8703
256

GEOLOGICAL FORMATION	NATURE OF STRATA	THICKNESS Feet	THICKNESS Inches	DEPTH Feet	DEPTH Inches
	Made Ground	11	—		
	Loam	3	—	14	—
	Clay (Stiff)	156	—	120	—

GEOLOGICAL SURVEY AND MUSEUM,
JERMYN STREET, LONDON, S.W.1.

(50478X) WL. W39733/0181 2,500 4/31 H. J. R. & L., Ltd. Gp. 616

Norwest Holst Soil Engineering Ltd.

Borehole No. **1**

Contract No. F7477
Location Wildwood Grove
Client London Borough of Camden
Method of Boring Percussion
Diameter of Borehole 150mm

BOREHOLE LOG

TQ 28 NE 256
2607 8705

Sheet 1 of 1
Chainage
Ground Level 108.61 m.A.O.D.
Date 4/6/82

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
BITUMINOUS SURFACING		0.10	108.51				
MADE GROUND: Clay, brick rubble & topsoil		1.00	107.61		1.00 (20)		
MADE GROUND: Dark grey organic clay		1.45	107.16				
Soft brown PEAT		4.50	104.11		2.00 (15) 3.00 (20) 4.50 (50)		
Soft black organic gravelly clay		4.95	103.66				
Soft grey silty CLAY with gravel		5.50	103.11	150mm to 6.00m			
Firm grey silty CLAY					6.00 (40) 7.50 (50) 9.00 (60)		
End of borehole		10.00	98.61				

Type of Sample

- Is S.P.T. ■ Undisturbed
- Ic. C.P.T. × Vane
- O Jar △ Water
- ● Bulk ▩ Piezometer

Remarks (Observations of Ground Water etc.) (-) U100 blows

Borehole dry during boring

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Norwest Holst Soil Engineering Ltd.

Borehole No. **2**

BOREHOLE LOG

Contract No. F7477
Location. Wildwood Grove
Client. London Borough of Camden
Method of Boring. Percussion
Diameter of Borehole. 150mm

TQ 28 NE 257
2607 8694

Sheet 1 of 2
Chainage
Ground Level 112.54 m.A.O.D.
Date 29/5/87 - 2/6/87

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
MADE GROUND: Bituminous surfacing, clay and brick rubble		1.00	111.54				28/5
Firm to stiff brown mottled silty gravelly CLAY		2.00	110.54		1.00 (50)		29/5
Brown and grey very silty SAND		3.00	108.54		2.00 (70)		
Orange silty SAND		4.00	108.54		3.00 (50)		
Orange brown clayey SAND		6.00	106.54	150mm to 6.00m	4.50 (40)		29/5
Orange silty SAND		7.00	105.54	29/5	6.00 (40)		1/5
Firm grey silty CLAY					7.50	"11"	
					9.00	"12"	

Type of Sample

- S.P.T. — Undisturbed
- Ic. C.P.T. — Vane
- O Jar — Water
- Bulk — Piezometer

Remarks (Observations of Ground Water etc.)

(-) U100 blows

Overnight standing level 5.70m,
Borehole at 6.00m
Inspection pit dug to 1.00m prior to boring

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Norwest Holst Soil Engineering Ltd.

Borehole No. **2**

Contract No. F7477
Location. Wildwood Grove
Client. London Borough of Camden
Method of Boring. Percussion
Diameter of Borehole. 150mm

BOREHOLE LOG

TQ 28 NE 257

Sheet. 2 of 2
Chainage.
Ground Level. 112.54 m.A.O.D.
Date. 29/5/87 - 2/6/87

Description of Strata	Legend	Depth Below G.L.(m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Firm grey silty CLAY					10.50	"16"	
				150mm Ø 12.00m			
				1/6	12.00 (50)		
					13.50 (60)		
		15.50	97.04		15.00 (60)		1/6

Type of Sample

- Is S.P.T. — Undisturbed
- Ic. C.P.T. — Vane
- O Jar — Water
- Bulk — Piezometer

Remarks (Observations of Ground Water etc.)

(-) U100 blows

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Norwest Holst Soil Engineering Ltd.

Borehole No. **3**

Contract No. F7477
Location Widwood Grove
Client London Borough of Camden
Method of Boring Percussion
Diameter of Borehole 150mm

BOREHOLE LOG

TQ28NE 258
2615 8697

Sheet 1 of 2
Chainage
Ground Level 112.87 m.A.O.D.
Date 2/8/87 - 3/8/87

Description of Strata	Legend	Depth Below G.L. (m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
BITUMINOUS SURFACING		0.10	112.77				
MADE GROUND: Concrete		0.30	112.57				
MADE GROUND: Clay brick rubble and topsoil		1.00	111.87		1.00 (50)		
Soft light brown fine sandy CLAY					2.00	"16"	
		2.80	110.07				
Firm orange and brown very clayey sandy SILT					3.00	"19"	
					4.50	"20"	
		5.00	107.87				
Firm grey silty CLAY				150mm to 6.00m 2/6	6.00 (40)		2/6 3/6
					7.50 (40)		
					9.00 (50)		

Type of Sample

- S.P.T. — Undisturbed
- C.P.T. — Vane
- Jar — Water
- Bulk — Piezometer

Remarks (Observations of Ground Water etc.)

(-) U100 blows

Overnight standing level 3.60m
Borehole at 6.50m

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Norwest Holst Soil Engineering Ltd.

Borehole No. **3**

BOREHOLE LOG

Contract No. F7477
Location. Wildwood Grove
Client. London Borough of Camden
Method of Boring. Percussion
Diameter of Borehole. 150mm

TQ 28 NE 258

Sheet. 2 of 2
Chainage.
Ground Level. 112.87 m.A.O.D.
Date. 2/8/87 - 3/8/87

Description of Strata	Legend	Depth Below G.L. (m)	O.D. Level (m)	Casing Depth at Sampling	Sampling and Coring	"N"/ R.Q.D.%	Daily Progress
Firm grey silty CLAY				150mm to 12.00m 3/8	10.50 (50) 12.00 (60)		
		13.50	99.37				
Grey brown clayey SAND					13.50 (60) 14.50 (60)		
		15.00	97.87				
End of borehole							

Type of Sample

- Is S.P.T. — Undisturbed
- Ic. C.P.T. — Vane
- O Jar — Water
- Bulk — Piezometer

Remarks (Observations of Ground Water etc.)

(-) U100 blows

Water levels are subject to seasonal or tidal variations and should not be taken as constant

Site Analytical Services Ltd.

Site	10 NORTH END, HAMPSTEAD, LONDON, NW3 7HL	**Borehole Number**	BH1
Boring Method	SHELL AND AUGER	**Diameter**	150mm cased to 9.00m
Ground Level (mOD)		**Client**	MR RICHARD SUGARMAN
Job Number	0612578	**Location**	TQ 261 896
Dates	18/10/2006	**Engineer**	DAVID BERLE CONSULTING ENGINEER
Sheet	1/2		

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						0.20	MADE GROUND - concrete		
0.20-0.30	D1					(0.60)	MADE GROUND - grey brown clayey silty sand, fine gravel, brick and concrete fragments		
0.50-0.60	D2								
0.70-0.80	D3					0.80			
1.00-1.10	D4						Firm to stiff becoming stiff mottled brown, orange brown and light grey sandy silty CLAY with pockets and partings of orange brown silty fine sand		
1.50-1.95	SPT N=15	1.50	DRY	3,3/3,4,4,4					
1.50-1.95	D5								
2.50-2.95	SPT N=17	2.50	DRY	2,3/3,4,5,5					
2.50-2.95	D6								
						(4.40)			
3.50-3.95	SPT N=22	3.50	DRY	4,4/5,5,5,7					
3.50-3.95	D7								
4.50-4.60	D8								
5.00-5.45	B1								▼1
5.00-5.45	U1 NR	5.00	DRY	30 blows SEEPAGE (1) at 5.10m, rose to 5.00m in 20 mins.					▼1
						5.20	Firm to stiff grey sandy silty CLAY with some partings and pockets of light brown silty fine sand		
6.00-6.10	D9								
6.50-6.95	SPT N=17	6.00	DRY	3,3/4,4,4,5					
6.50-6.95	D10								
									▼2
7.50-7.60	D11			SEEPAGE (2) at 7.50m, rose to 7.20m in 20 mins.		(4.80)			▼2
8.00-8.45	U2	6.00	7.80	24 blows					
9.00-9.10	D12								
9.50-9.95	SPT N=16	7.50	9.00	3,3/4,4,4,4					
9.50-9.95	D13					10.00			

Remarks
U = Undisturbed 100mm Diameter Sample - NR = No Recovery
S = Standard Penetration Test
D=Disturbed Sample, B = Bulk Disturbed Sample
Excavating from 9.00m to 1.00m for 1.0 hour.

Scale (approx)	Logged By
1:50	DC

Figure No.
0612578.BH1

Site Analytical Services Ltd.

Site	Borehole Number
10 NORTH END, HAMPSTEAD, LONDON, NW3 7HL	BH1

Boring Method	Diameter	Ground Level (mOD)	Client	Job Number
SHELL AND AUGER	150mm cased to 9.00m		MR RICHARD SUGARMAN	0812578
Location	**Dates**	**Engineer**		**Sheet**
TQ 261 896	18/10/2006	DAVID BERLE CONSULTING ENGINEER		2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
							Stiff grey sandy silty CLAY with some partings and pockets of light brown and beige silty fine sand		
10.50-10.50	D14								
11.00-11.45	U3	8.00	10.90	48 blows					
11.45-11.50	D15								
						(3.70)			
12.00-12.10	D16								
12.50-12.95 12.50-12.95	SPT N=24 D17	9.00	12.40	5,5/6,5,6,7					
13.50-13.60	D18								
						13.70	Stiff dark grey brown fissured silty CLAY with occasional partings of light brown silty fine sand and scattered small gypsum crystals		▽3
14.00-14.45	U4	9.00	13.90	32 blows					
14.45-14.50	D19			SEEPAGE (3) at 14.40m, rose to 13.80m in 20 mins.					▽3
15.00-15.10	D20								
15.50-15.95 15.50-15.95	SPT N=23 D21	9.00	WET	4,4/5,6,6,6					
16.50-16.60	D22								
						(6.30)			
17.00-17.45 17.00-17.45	B2 U5 NR	9.00	11.00	69 blows					
18.00-18.10	D23								
18.50-18.95 18.50-18.95	SPT N=25 D24	9.00	15.00	5,6/6,6,8,7					
				18/10/2006;15.00m		20.00			
19.90-20.00	D25								

Remarks	Scale (approx)	Logged By
	1:50	DC
	Figure No.	0812578.BH1

Site Analytical Services Ltd.

Installation Type: MONITORING STANDPIPE	Dimensions: Internal Diameter of Tube [A] = 50 mm; Diameter of Filter Zone = 150 mm	Site: 10 NORTH END, HAMPSTEAD, LONDON, NW3 7HL	Borehole Number: BH1
		Client: MR RICHARD SUGARMAN	Job Number: 0512576
Location: TQ 261 896	Ground Level (mOD)	Engineer: DAVID BERLE CONSULTING ENGINEER	Sheet: 1/1

Description:
- Bentonite Seal
- Slotted Standpipe
- Bentonite Seal
- General Backfill

Groundwater Strikes During Drilling

Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings 5 min	10 min	15 min	20 min	Depth Sealed (m)
18/10/06		5.10	5.00	SEEPAGE				6.00	
18/10/06		7.50	7.50	SEEPAGE				7.20	
19/10/06		14.40	9.00	SEEPAGE				13.80	

Groundwater Observations During Drilling

Date	Start of Shift: Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	End of Shift: Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)
18/10/06				DRY			20.00	9.00	15.00	

Instrument Groundwater Observations

Insl. [A] Type : SINGLE STANDPIPE

Date	Instrument [A]: Time	Depth (m)	Level (mOD)	Remarks
03/11/06		4.24		Gas readings taken
21/11/06		4.18		Gas readings taken

Remarks
Lockable cover set in concrete
Gas valve fitted

Site Analytical Services Ltd.

Site	Borehole Number
10 NORTH END, HAMPSTEAD, LONDON, NW3 7HL	BH2

Boring Method	Diameter	Ground Level (mOD)	Client	Job Number
HAND EXCAVATION CONTINUOUS FLIGHT AUGER	100mm cased to 0.00m		MR RICHARD SUGARMAN	0612578
Location	**Dates**		**Engineer**	**Sheet**
TQ 261 859	18/10/2006		DAVID BERLE CONSULTING ENGINEER	1/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						0.05	MADE GROUND - paving slabs		
0.25	D1						MADE GROUND - grey brown clayey silty sand, fine gravel, brick and concrete fragments		
0.50	D2					(1.25)			
0.75	D3								
1.00 1.00-1.30	D4 M1 49/300					1.30			
1.50 1.50-1.80	D5 M2 64/300						Firm to stiff becoming stiff mottled brown, orange brown and light grey sandy silty CLAY with pockets and partings of orange brown silty fine sand		
2.00 2.00-2.30	D6 M3 84/300								
2.50 2.50-2.80	D7 M4 66/300								
3.00 3.00-3.17	D8 M5 130/165					(3.50)			
3.50 3.50-3.68	D9 M6 112/180								
4.00 4.00-4.11	D10 M7 100/110								
4.50 4.50-4.85	D11 M8 137/155								
						4.80	Firm to stiff grey sandy silty CLAY with some partings and pockets of light brown silty fine sand		
5.00 5.00-5.30	D12 M9 95/300								
				SEEPAGE(1) at 5.80m.					V1
6.00 6.00-6.11	D13 M10 100/110								
7.00 7.00-7.21	D14 M11 129/210					(5.20)			
8.00	D15								
9.00 9.00-9.20	D16 M12 99/200								
						10.00			

Remarks
M = Mackintosh Probe - Blows/Penetration (mm)
D = Disturbed Sample
Borehole collapsed below 3.80m depth on completion
Excavating from 0.00m to 1.00m for 1.0 hour.

Scale (approx)	Logged By
1:50	DC

Figure No.
0612578.BH2

Site Analytical Services Ltd.

Site 10 NORTH END, HAMPSTEAD, LONDON, NW3 7HL			**Borehole Number** BH2
Boring Method HAND EXCAVATION CONTINUOUS FLIGHT AUGER	**Diameter** 100mm cased to 0.00m	**Ground Level (mOD)**	**Client** MR RICHARD SUGARMAN	**Job Number** 0612578
	Location TQ 261 869	**Dates** 18/10/2006	**Engineer** DAVID BERLE CONSULTING ENGINEER	**Sheet** 2/2

Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
10.00	D17						SEE PREVIOUS SHEET		
						(0.30) 10.30	Stiff dark grey brown fissured silty CLAY with occasional partings of light brown silty fine sand and scattered small gypsum crystals		
11.00	D18								
						(2.70)			
12.00	D19								
13.00	D20			19/10/2006 5.80m		13.00	Complete at 13.00m		

Remarks

Scale (approx)	Logged By
1:50	DC

Figure No. 0612578.DH2

APPENDIX D

CPG4 screening extracts

Figure 1. Subterranean (ground water) flow screening chart

The Developer should consider each of the following questions in turn, answering either "yes", "unknown" or "no" in each instance.

Consideration should be given to both the temporary and permanent works, along with the proposed surrounding landscaping and drainage associated with a proposed basement development.

Question 1a: Is the site located directly above an aquifer?

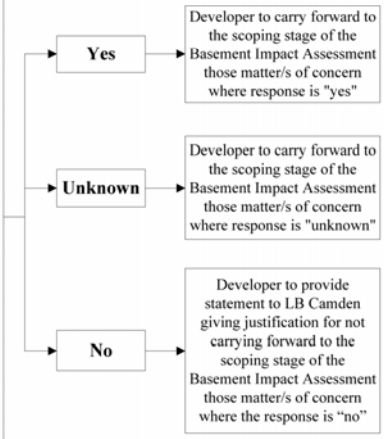
Question 1b: Will the proposed basement extend beneath the water table surface?

Question 2: Is the site within 100m of a watercourse, well (used/disused) or potential spring line?
Question 3: Is the site within the catchment of the pond chains on Hampstead Heath?

Question 4: Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas?

Question 5: As part of the site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS)?

Question 6: Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond (not just the pond chains on Hampstead Heath) or spring line.



Notes / sources of information

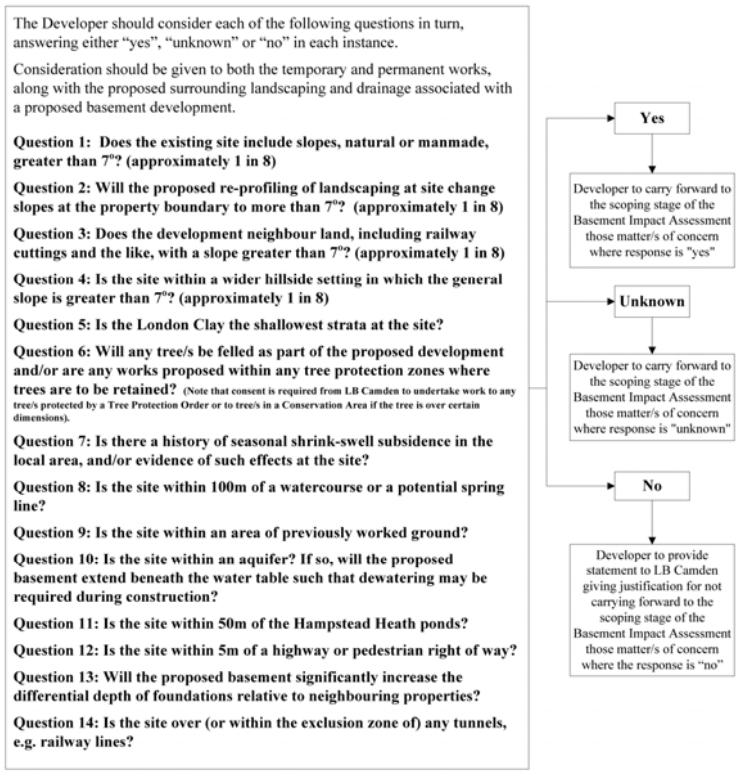
Question 1: In LB Camden, all areas where the London Clay does not outcrop at the surface are considered to be an aquifer. This includes the River Terrace Deposits, the Claygate Member and the Bagshot Formation. The location of the geological strata can be established from British Geological Survey maps (e.g. 1:50,000 and 1:10,000 scale). Note that the boundaries are indicative and should be considered to be accurate to ±50m at best.
Additionally, the Environment Agency (EA) "Aquifer Designation Maps" can be used to identify aquifers. These can be found on the "Groundwater maps" available on the EA website (www.environment-agency.gov.uk) follow "At home & leisure" > "What's in Your Backyard" > "Interactive Maps" > "Groundwater". Knowledge of the thickness of the geological strata present and the level of the groundwater table is required. This may be known from existing information (for example nearby site investigations), however, it may not be known in the early stages of a project. Determination of the water table level may form part of the site investigation phase of a BIA.
Question 2: Watercourses, wells or spring lines may be identified from the following sources:

- Local knowledge and/or site walkovers
- Ordnance Survey maps (e.g. 1:25,000 or 1:10,000 scale). If features are marked (they are not always) the following symbols may be present: W; Spr; water is indicated by blue colouration. (check the key on the map being used)
- British Geological Survey maps (e.g. 1:10,000 scale, current and earlier editions). Current maps will show indicative geological strata boundaries which are where springs may form at the ground surface; of relevance are the boundary between the Bagshot Formation with the Claygate Member and the Claygate Member with the London Clay. Note that the boundaries are indicative should be considered to be accurate to ±50m. Earlier geological maps (e.g. the 1920's 1:10560 scale) maps show the location of some wells.
- Aerial photographs
- "Lost Rivers of London" by Nicolas Barton, 1962. Shows the alignment of rivers in London and their tributaries.
- The British Geological Survey (BGS) GeoIndex includes "Water Well" records. See www.bgs.ac.uk and follow "Online data" > "GeoIndex" > "Onshore GeoIndex".
- The location of older wells can be found in well inventory/catalogue publications such as "Records of London Wells" by G. Barrow and L. J. Wills (1913) and "The Water Supply of the County of London from Underground Sources" by S Buchan (1938).
- The Environment Agency (EA) "Source Protection Zone Maps" can be used to identify aquifers. These can be found on the "Groundwater maps" available on the EA website (www.environment-agency.gov.uk) follow "At home & leisure" > "What's in Your Backyard" > "Interactive Maps" > "Groundwater".
- The EA hold records of licensed groundwater abstraction boreholes. LB Camden is within the North East Area of the Thames Region. Details can be found on the EA website.
- LB Camden Environmental Health department may hold records of groundwater wells in the Borough.

Where a groundwater well or borehole is identified, it will be necessary to determine if it is extending into the Lower Aquifer (Chalk) or the Upper Aquifer (River Terrace Deposits, Bagshot Formation, Claygate Member etc). It is water wells extending into the Upper Aquifer which are of concern with regard to basement development.
Question 3: Figure 14 in the attached study, (prepared using data supplied by the City of London Corporation's hydrology consultant, Haycocks Associates) shows the catchment areas of the pond chains on Hampstead Heath.
Question 4: This will be specific to the proposed development and will be a result of the proposed landscaping of areas above and surrounding a proposed basement.
Question 5: This will be specific to the proposed development and will be a result of the chosen drainage scheme adopted for the property.
Question 6: The lowest point will be specific to the proposed development. Knowledge of local ponds may be taken from

- Local knowledge and/or site walkovers
- Ordnance Survey maps (e.g. 1:25,000 or 1:10,000 scale). If features are marked (they are not always) the following symbols may be present: W; Spr; water is indicated by blue colouration. (check the key on the map being used)
- Aerial photographs

Figure 2. Slope stability screening flowchart



Notes / sources of information

Question 1, 3 & 4: The current surface slope can be determined by a site topographical survey. Slopes may be estimated from 1:25,000 OS maps, however in many urban areas such maps will not show sufficient detail to determine surface slopes on a property-by-property scale, just overall trends. With regard to slopes associated with infrastructure, e.g. cuttings, it should be ensured that any works do not impact on critical infrastructure.

Question 2: This will be specific to the proposed development and will be a result of the proposed landscaping of areas above and surrounding a proposed basement.

Question 5: The plan footprint of the outcropping geological strata can be established from British Geological Survey maps (e.g. 1:50,000 and 1:10,000 scale). Note that the boundaries are indicative and should be considered to be accurate to ±50m at best.

Question 6: this is a project specific determination, subject to relevant Tree Preservation Orders etc.

Question 7: this can be assessed from local knowledge and on-site observations of indicative features, such as cracking. Insurance firms may also give guidance, based on post code. Soil maps can be used to identify high-risk soil types. Relevant guidance is presented in BRE Digest 298 "Low-rise building foundations: the influence of trees in clay soils" (1999); BRE Digest 240 "Low-rise buildings on shrinkable clay soils: part 1" (1993); and BRE Digest 251 "Assessment of damage in low-rise buildings" (1995).

Question 8: Watercourses or spring lines may be identified from the following sources:

- Local knowledge and/or site walkovers
- Ordnance Survey maps (e.g. 1:25,000 or 1:10,000 scale). If features are marked (they are not always) the following symbol may be present "Spr"; water is indicated by blue colouration. (check the key on the map being used)
- Geological maps will show indicative geological strata boundaries which are where springs may form at the ground surface; of relevance are the boundary between the Bagshot Formation with the Claygate Member and the Claygate Member with the London Clay. Note that the boundaries are indicative should be considered to be accurate to ±50m at best. British Geological Survey maps (e.g. 1:10,000 scale, current and earlier editions).
- Aerial photographs
- "Lost Rivers of London" by Nicolas Barton, 1962. Shows the alignment of rivers in London and their tributaries.

Question 9: Worked ground includes, for example, old pits, brickyards, cuttings etc. Information can be gained from local knowledge and/or site walkovers, and from historical Ordnance Survey maps (at 1:25,000 or 1:10,000 scale, or better) and British Geological Survey maps (at 1:10,000 scale, current and earlier editions). Earlier geological maps (e.g. the 1:10560 scale series from the 1920s) include annotated descriptions such as "old pits", "formerly dug", "brickyard" etc.

Question 10: In LB Camden, all areas where the London Clay does not outcrop at the surface are considered to be an aquifer. This includes the River Terrace Deposits, the Claygate Member and the Bagshot Formation. The general footprint of the geological strata can be assessed from British Geological Survey maps (e.g. 1:50,000 and 1:10,000 scale). Note that the boundaries are indicative and should be considered to be accurate to ±50m at best.

The Environment Agency (EA) Aquifer Designation Maps can be used to identify aquifers. These are available from the EA website (www.environment-agency.gov.uk), by clicking on 'At home & leisure' > 'What's in Your Backyard' > 'Interactive Maps' > 'Groundwater'.

Details are required of the thickness of the geological strata present and the level or depth of the groundwater table. This may be known from existing information (for example nearby site investigations); however, it may not be known in the early stages of a project. Determination of the water table level may form part of the site investigation phase of a BIA and may require specialist advice to answer. Depth of proposed development is project specific.

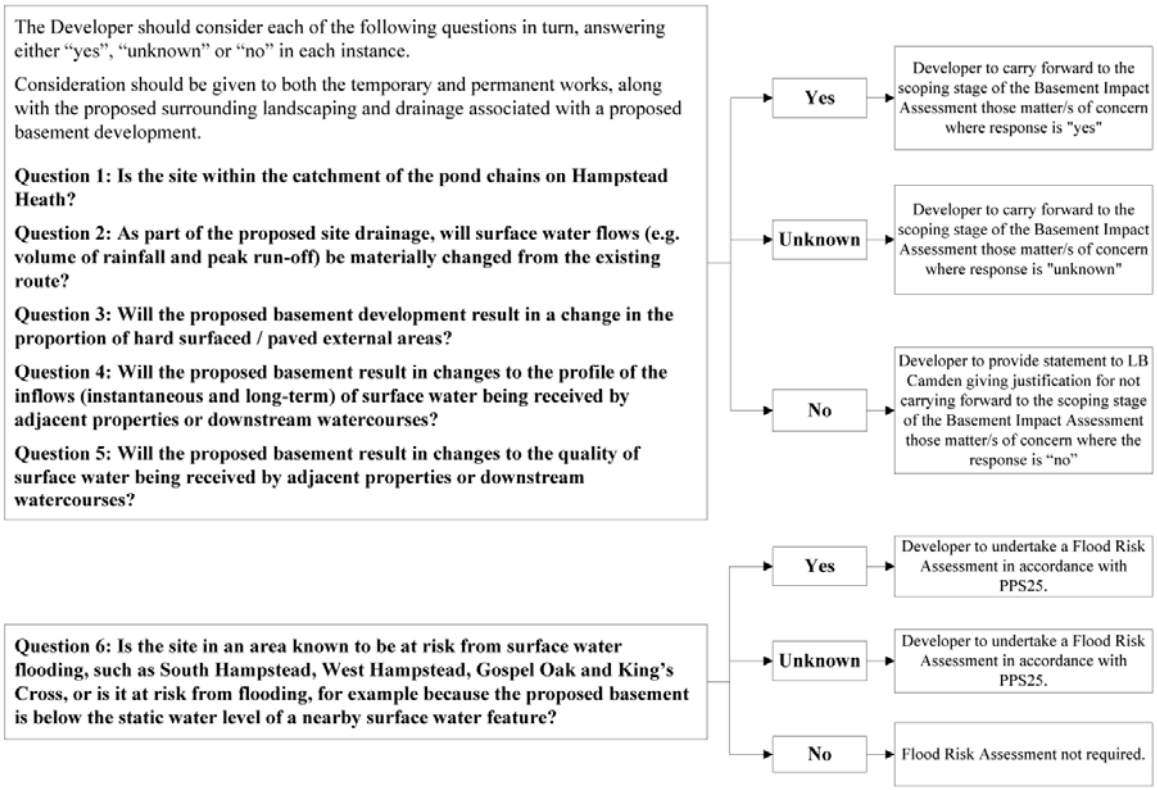
Question 11: From local knowledge and/or site walkovers, and from Ordnance Survey maps (e.g. 1:25,000 or 1:10,000 scale). In relation to the stability and integrity of the pond structures and dams, the guidance of a Panel Engineer should be sought. (Details of Panel Engineers can be found on the Environment Agency website: http://www.environment-agency.gov.uk/business/sectors/64253.aspx). Duty of care needs to be undertaken during any site works in the vicinity of the ponds.

Question 12: From local knowledge and/or site walkovers, and from Ordnance Survey maps (e.g. 1:25,000 or 1:10,000 scale). Any works should not impact on critical infrastructure.

Question 13: From local knowledge and/or site walkovers. May find some details on neighbouring properties from searches of LB Council databases, e.g. planning applications and/or building control records.

Question 14: From local knowledge and/or site walkovers, from Ordnance Survey maps (e.g. 1:25,000 or 1:10,000 scale) and directly from those responsible for tunnels (e.g. TfL or Network Rail). Any works should not impact on critical infrastructure.

Figure 3. Surface flow and flooding screening flowchart



Notes / sources of information

Question 1: Figure 14 in the attached study (prepared using data supplied by the City of London Corporation's hydrology consultant, Haycocks Associates) shows the catchment areas of the pond chains on Hampstead Heath

Question 2: This will be specific to the proposed development and will be a result of the proposed landscaping of areas above and surrounding a proposed basement. The developer should provide documentation of discussion with Thames Water to confirm that the sewers have capacity to receive any increased wastewater flows.

Question 3: This will be specific to the proposed development and will be a result of the chosen drainage scheme adopted for the property

Question 4: This will be specific to the proposed development and will be a result of the proposed landscaping and chosen drainage scheme adopted for the property. SUDS will be required to compensate any increases in peak flow.

Question 5: This will be specific to the proposed development and will be a result of the proposed landscaping and chosen drainage scheme adopted for the property. SUDS will be required to compensate any increases in peak flow.

Question 6: The principles outlined in PPS25 should be followed to ensure that flood risk is not increased.

APPENDIX E

Chelmer site investigation - Factual report

A Factual Report on the

Site Investigation undertaken for

Cranbrook Basments

at

6a North End Road
Camden
London NW3

CSI Ref: 2997

Dated: 26th November 2013

Chelmer Site Investigation Laboratories Ltd. Unit 15 East Hanningfield Industrial Estate, Old Church Road, East Hanningfield, Essex CM3 8AB
Telephone: 01245 400930 Fax: 01245 400933 Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

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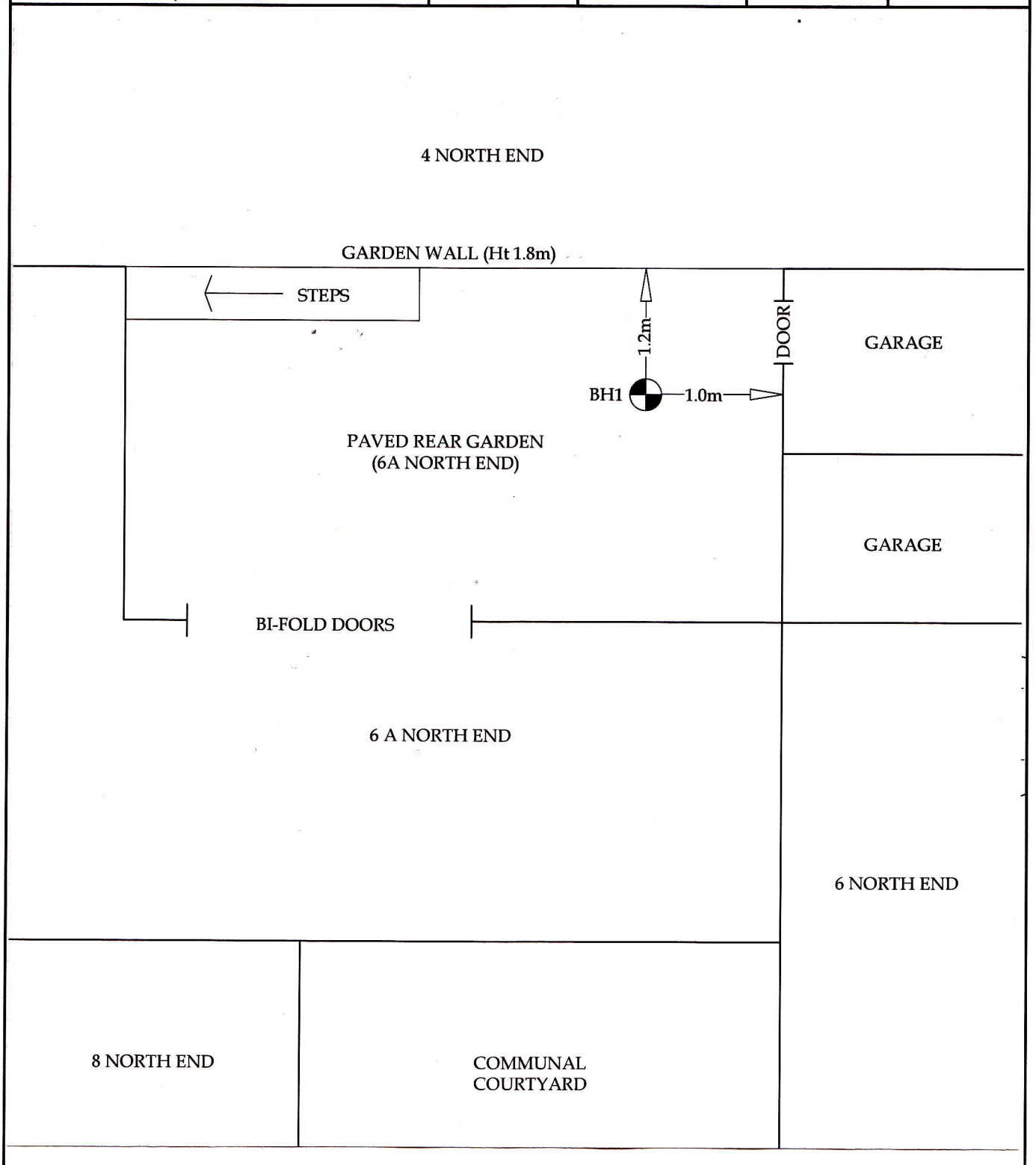
Client:	Cranbrook Basements	**Scale:** N.T.S.	**Sheet:** 1 of 1	**Date:** 26.11.13	
Location:	6a North End Road Camden, London NW3	**Job No:** 2997	**Weather:** Overcast	**Drawn by: JC**	**Checked by: ME**



Notes: RAISED FRONT GARDEN IS APPROX. 1.5m HIGHER THAN FOOTPATH LEVEL.
On site tree identification for guidance only. Not authenticated.

Key:
Tree/Shrub | Borehole | Trial Pit | G Gully | Tree Stump | Rain Water/ Soil Pipe | MH Manhole

Chelmer Site Investigations
Unit 15 East Hanningfield Industrial Estate
Old Church Road, East Hanningfield, Essex CM3 8AB
Telephone: 01245 400930 Fax: 01245 400933
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

Client: Cranbrook Basements	**Scale:** N.T.S.	**Sheet No:** 1 of 1	**Weather:** Hand auger	**Date:** 26.11.13	
Site: 6a North End Road, London NW3	**Job No:** 2997	**Borehole No:** 1	**Boring method:** Hand auger		

Depth Mtrs.	Description of Strata	Thick-ness	Legend	Sample	Test Type	Test Result	Root Information	Depth to Water	Depth Mtrs
G.L.	TOPSOIL	0.3							
0.3	MADE GROUND: medium compact mid brown silty gravelly very sandy clay with numerous brick and concrete fragments.	0.6		D			Roots of live appearance to 5mmØ to 2.2m.		0.5
0.9	Stiff mid brown/orange silty very sandy CLAY.	2.3		D	V	78 82			1.0
				D					1.5
				D	V	88 92	Roots of live appearance to 1mmØ to 3.8m.		2.0
				D					2.5
				D	V	110 108			3.0
3.2	Stiff mid brown grey veined silty CLAY with partings of orange and brown silt and fine sand and crystals.	0.6		D					3.5
3.8	Stiff dense mid brown/orange silty fine SAND.	0.9		D	M	27 29 31 35	No roots observed below 3.8m.		4.0
				D					4.5
4.7	Stiff/medium dense to dense mid brown/ orange laminated CLAY SILT and fine SAND.	0.6		D	M	32 34 37 39			5.0
5.3	Medium dense mid brown slightly clayey very silty fine SAND.	0.4		D				*5.4*	5.5
5.7	Borehole ends at 5.7m Unable to extract samples below 5.5m.								

Drawn by: JC **Approved by:** ME

Remarks: *Water seepage at 5.4m.*
Borehole moist and collapsing on completion.

Key: T.D.T.D. Too Dense to Drive
D Small Disturbed Sample J Jar Sample
B Bulk Disturbed Sample V Pilcon Vane (kPa)
U Undisturbed Sample (U100) M Mackintosh Probe
W Water Sample N Standard Penetration Test Blow Count

Chelmer Site Investigations,
Unit 16, East Hanningfield Industrial Estate, Old Church Road,
East Hanningfield, Essex CM3 8AB
Telephone: 01245 400930 Fax: 01245 400933
Email: info@siteinvestigations.co.uk Website: www.siteinvestigations.co.uk

REPORT NOTES

Equipment Used

Hand tools, Mechanical Concrete Breaker and Spade, Hand Augers, 100mm/150mm diameter Mechanical Flight Auger Rig, GEO205 Flight Auger Rig, Window Sampling Rig, and Large or Limited Access Shell & Auger Rig upon request and/or access permitting.

On Site Tests

By Pilcon Shear-Vane Tester (Kn/m^2) in clay soils, and/or Mackintosh Probe in granular soils or made ground and/or upon request Continuous Dynamic Probe Testing and Standard Penetration Testing.

Note:

Details reported in trial-pits and boreholes relate to positions investigated only as instructed by the client or engineer on the date shown.

We are therefore unable to accept any responsibility for changes in soil conditions not investigated i.e. variations due to climate, season, vegetation and varying ground water levels.

Full terms and conditions are available upon request.

APPENDIX F

MRH Geotechnical - Borehole log

BOREHOLE LOG - M R H GEOTECHNICAL

HOLE NO. BH 2
Sheet 1 of 1

CLIENT	SITE
Mr A. Dodi	4 North End, London NW3 7HL

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
26/01/11 - 26/01/11	1:50	GROUND / AS APPENDIX A	SB/PA	SH	111240

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m²)	Standp/ Piezo	DESCRIPTION OF STRATUM (thickness)	DEPTH	LEGEND
				Topsoil / fill (0.35)	0.35	
0.50	D1			Soft to firm brown sandy CLAY (1.05)		
1.00	D2	(46)				
1.50	D3	(56)		Firm brown sandy CLAY (1.30)	1.40	
2.00	D4	(54)				
2.50	D5	(54)				
3.00 - 3.30	D6	N=12		Medium dense clayey fine SAND (0.60)	2.70	
3.50	D7			Medium dense orange brown SILT (0.30)	3.30	
4.00 - 4.30	D8	N=15		Medium dense orange brown clayey fine SAND with lenses of clay (0.60)	3.60	
4.50	D9			Soft to firm greyish brown silty CLAY (0.40)	4.20	
5.00	D10			Medium dense brown SILT (3.10)	4.60	
5.50 - 5.80	D11	N=16		Water seepage at 5.10m		
6.00	D12					
6.50	D13			Water standing at 6.32m on completion		
7.00 - 7.30	D14	N=16				
7.50	D15					
8.00	D16			Firm dark grey silty CLAY (0.30) Piezometer installed	7.70	
				Borehole ends	8.00	

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
5.10	-	1HOUR	6.32	-	Water standing at 6.32m on completion of borehole

BORING METHOD AND REMARKS

Mechanical auger
Piezometer installed

KEY: D = Disturbed Sample B = Bulk Sample
U = Undisturbed Sample W = Water Sample
All dimensions are in metres unless otherwise stated

BOREHOLE LOG - M R H GEOTECHNICAL

HOLE NO. BH 3
Sheet 1 of 1

CLIENT	SITE
Mr A. Dodi	4 North End, London NW3 7HL

DATE OF FIELDWORK	SCALE	LEVEL/POSITION	OPERATOR	LOGGED BY	JOB NO.
26/01/11 - 26/01/11	1:50	GROUND / AS APPENDIX A	SB/PA	SH	111240

SAMPLE DEPTH	RECORD TYPE	SPT N (Cu-kN/m²)	Standp/ Piezo	DESCRIPTION OF STRATUM (thickness)	DEPTH	LEGEND
				Turf over topsoil (0.30)	0.30	
0.50	D1			Dark grey silty FILL (0.50)	0.80	
1.00	D2	(58)		Firm brown sandy CLAY (1.00)		
1.50	D3	(64)				
2.00	D4	(68)		Firm orange brown sandy CLAY (0.90)	1.80	
2.50	D5	(66)				
3.00	D6	(48)		Soft to firm orange brown sandy CLAY (1.70)	2.70	
3.50	D7	(46)				
4.00	D8	(46)				
4.50 - 4.80	D9	N=12		Medium dense orange brown silty fine SAND (2.60)	4.40	
5.00	D10			Water standing at 5.10m on completion		
5.50	D11					
6.00 - 6.30	D12	N=15		Water seepage at 5.80m		
6.50	D13			Piezometer installed		
7.00	D14			Borehole ends	7.00	

GROUNDWATER AND CASING INFORMATION

DEPTH STRUCK	DEPTH CASED	ELAPSED TIME	WATER LEVEL	DEPTH SEALED	REMARKS ON GROUNDWATER AND CASING
5.80	-	1HOUR	5.10	-	Water standing at 5.10m on completion of borehole

BORING METHOD AND REMARKS

Mechanical auger

KEY: D = Disturbed Sample B = Bulk Sample
U = Undisturbed Sample W = Water Sample
All dimensions are in metres unless otherwise stated

APPENDIX G

WALLAP output

Units: kN,m

INPUT DATA

SOIL PROFILE

Stratum no.	Elevation of top of stratum	Soil types Active side	Passive side
1	0.00	1 MG	1 MG
2	-0.35	6 Bagshot Fm cohesive	6 Bagshot Fm cohesive
3	-2.70	2 Bagshot Fm	2 Bagshot Fm

SOIL PROPERTIES

-- Soil type -- No.	Description (Datum elev.)	Bulk density kN/m3	Young's Modulus Eh,kN/m2 (dEh/dy)	At rest coeff. Ko (dKo/dy)	Consol state. NC/OC (Nu)	Active limit Ka (Kac)	Passive limit Kp (Kpc)	Cohesion kN/m2 (dc/dy)
1	MG	18.00	14000	1.000	NC (0.490)	1.000 (2.389)	1.000 (2.390)	20.00u
2	Bagshot Fm	20.00	27000	0.470	OC (0.200)	0.268 (0.000)	4.964 (0.000)	
3	Claygate .. (-5.20)	18.00	34000 (1.700)	1.000	OC (0.490)	1.000 (2.509)	1.000 (2.510)	68.00u (3.400)
4	Concrete slab	24.00	2.00E+7	0.590	OC (0.490)	0.227 (1.104)	6.680 (8.112)	500.0d
5	Claygate .. (-5.20)	18.00	25000 (1.300)	0.520	OC (0.200)	0.292 (1.276)	3.305 (5.178)	0.0d
6	Bagshot Fm cohesive	20.00	27500	0.577	OC (0.490)	1.000 (2.509)	1.000 (2.510)	55.00u
7	Bagshot cohes-drain	20.00	20625	0.577	OC (0.200)	0.348 (1.399)	3.509 (5.380)	0.0d

Additional soil parameters associated with Ka and Kp

------- Soil type ------- No.	Description	--- parameters for Ka --- Soil friction angle	Wall adhesion coeff.	Back-fill angle	--- parameters for Kp --- Soil friction angle	Wall adhesion coeff.	Back-fill angle
1	MG	0.00	0.500	0.00	0.00	0.500	0.00
2	Bagshot Fm	32.00	0.500	0.00	32.00	0.500	0.00
3	Claygate Beds	0.00	0.750	0.00	0.00	0.750	0.00
4	Concrete slab	35.00	0.665	0.00	35.00	0.670	0.00
5	Claygate - drained	29.00	0.750	0.00	24.00	0.750	0.00
6	Bagshot Fm cohesive	0.00	0.750	0.00	0.00	0.750	0.00
7	Bagshot cohes-drain	25.00	0.750	0.00	25.00	0.750	0.00

GROUND WATER CONDITIONS

Density of water = 10.00 kN/m3

	Active side	Passive side
Initial water table elevation	-5.40	-5.40

Automatic water pressure balancing at toe of wall : No

WALL PROPERTIES

Type of structure = Fully Embedded Wall
Elevation of toe of wall = -3.80
Maximum finite element length = 0.20 m
Youngs modulus of wall E = 3.0000E+07 kN/m2
Moment of inertia of wall I = 2.5000E-03 m4/m run
E.I = 75000 kN.m2/m run
Yield Moment of wall = Not defined

STRUTS and ANCHORS

Strut/ anchor no.	Elev.	Strut spacing m	X-section area of strut sq.m	Youngs modulus kN/m2	Free length m	Inclin -ation (degs)	Pre- stress /strut kN	Tension allowed
1	-0.30	1.20	0.150000	2.000E+08	3.00	0.00	0	No
2	-2.50	1.20	0.150000	2.000E+08	3.00	0.00	0	No
3	-3.70	1.20	0.150000	2.000E+08	3.00	0.00	0	No
4	-0.10	1.20	0.150000	3.000E+07	3.00	0.00	0	No

SURCHARGE LOADS

Surch -arge no.	Elev.	Distance from wall	Length parallel to wall	Width perpend. to wall	Surcharge ----- kN/m2 ----- Near edge	Far edge	Equiv. soil type	Partial factor/ Category
1	0.00	0.00(A)	8.00	9.00	10.00	=	N/A	N/A

Note: A = Active side, P = Passive side

CONSTRUCTION STAGES

Construction stage no.	Stage description
1	Apply surcharge no.1 at elevation 0.00
2	Excavate to elevation -0.40 on PASSIVE side
3	Install strut or anchor no.1 at elevation -0.30
4	Install strut or anchor no.3 at elevation -3.70
5	Excavate to elevation -3.70 on PASSIVE side
6	Install strut or anchor no.4 at elevation -0.10
7	Remove strut or anchor no.1 at elevation -0.30
8	Change properties of soil type 6 to soil type 7 Ko pressures will be reset

FACTORS OF SAFETY and ANALYSIS OPTIONS

Stability analysis:
Method of analysis - Strength Factor method
Factor on soil strength for calculating wall depth = 1.25

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 active side of wall = 20.00 m
Width of excavation on passive side of wall = 20.00 m

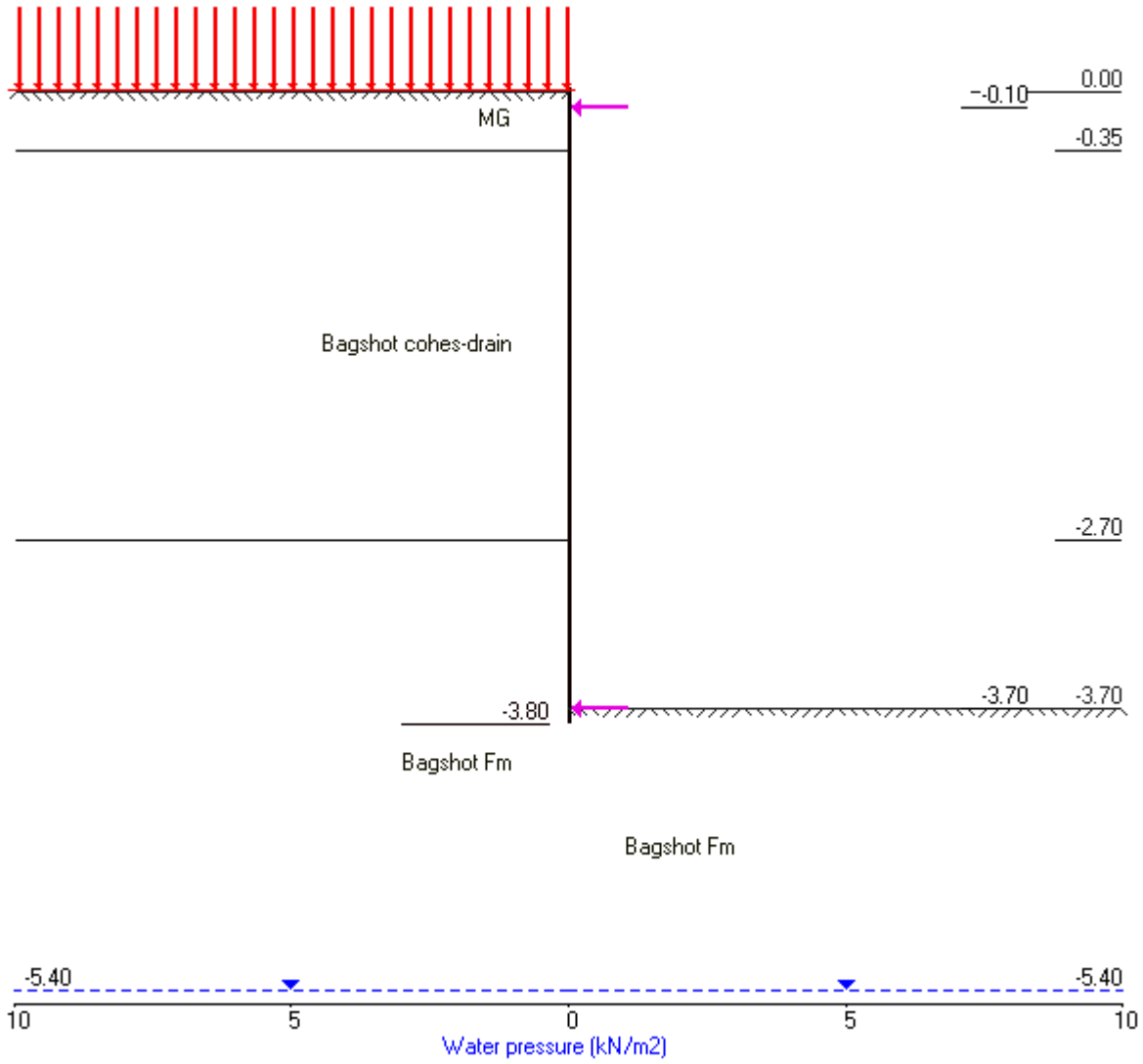
Distance to rigid boundary on active side = 20.00 m
Distance to rigid boundary on passive side = 20.00 m

OUTPUT OPTIONS

Stage no.	Stage description	Output options: Displacement, Bending mom., Shear force	Active, Passive pressures	Graph. output
1	Apply surcharge no.1 at elev. 0.00	Yes	Yes	Yes
2	Excav. to elev. -0.40 on PASSIVE side	No	No	No
3	Install strut no.1 at elev. -0.30	No	No	No
4	Install strut no.3 at elev. -3.70	No	No	No
5	Excav. to elev. -3.70 on PASSIVE side	Yes	Yes	Yes
6	Install strut no.4 at elev. -0.10	No	No	No
7	Remove strut no.1 at elev. -0.30	Yes	Yes	Yes
8	Change soil type 6 to soil type 7	No	No	No
*	Summary output	Yes	-	Yes

Units: kN,m

Stage No.8 Change soil type 6 to soil type 7



Units: kN,m

Stage No. 8 Change properties of soil type 6 to soil type 7
Ko pressures will be reset

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method
Factor of safety on soil strength

Stage No.	G.L. Act.	G.L. Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.250 Toe elev.	Wall Penetr -ation
8	0.00	-3.70		More than one strut			

*** Warning - Weak strata at or below toe of wall:
Active limit (active side) > Passive limit (passive side)
22.39kN/m2 > 9.93kN/m2 at elev. -3.80

The above pressures include water pressure.

*** Warning - Failure and flow of soil BELOW the toe of the wall may occur if the wall is not toed in to a firm stratum. It may occur even when acceptable factors of safety and displacements have been calculated.

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
Open Tension Crack analysis - No

Rigid boundaries: Active side 20.00 from wall
Passive side 20.00 from wall

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
1	0.00	8.84	0.001	-2.89E-04	0.0	0.0	
2	-0.10	8.14	0.001	-2.89E-04	0.8	0.0	34.6
		8.14	0.001	-2.89E-04	-33.7	0.0	
3	-0.30	9.12	0.001	-2.81E-04	-32.0	-6.5	
4	-0.35	9.96	0.001	-2.76E-04	-31.5	-8.1	
		9.20	0.001	-2.76E-04	-31.5	-8.1	
5	-0.40	9.74	0.001	-2.70E-04	-31.0	-9.7	
6	-0.60	11.92	0.002	-2.36E-04	-28.9	-15.7	
7	-0.80	14.11	0.002	-1.87E-04	-26.3	-21.2	
8	-1.00	16.30	0.002	-1.24E-04	-23.2	-26.1	
9	-1.20	18.51	0.002	-4.89E-05	-19.7	-30.4	
10	-1.40	20.72	0.002	3.69E-05	-15.8	-34.0	
11	-1.60	22.95	0.002	1.31E-04	-11.4	-36.7	
12	-1.80	25.20	0.002	2.31E-04	-6.6	-38.6	
13	-2.00	27.46	0.002	3.35E-04	-1.4	-39.4	
14	-2.20	29.73	0.001	4.40E-04	4.4	-39.1	
15	-2.40	32.02	0.001	5.42E-04	10.5	-37.6	
16	-2.55	33.74	0.001	6.15E-04	15.5	-35.7	
17	-2.70	35.47	0.001	6.84E-04	20.6	-33.0	
		20.58	0.001	6.84E-04	20.6	-33.0	
18	-2.85	22.60	0.001	7.47E-04	23.9	-29.7	
19	-3.00	24.67	0.001	8.02E-04	27.4	-25.8	

(continued)

Stage No.8 Change properties of soil type 6 to soil type 7
Ko pressures will be reset

Node no.	Y coord	Nett pressure kN/m2	Wall disp. m	Wall rotation rad.	Shear force kN/m	Bending moment kN.m/m	Strut forces kN/m
20	-3.20	27.49	0.001	8.63E-04	32.6	-19.8	
21	-3.40	30.38	0.001	9.06E-04	38.4	-12.7	
22	-3.55	32.57	0.000	9.26E-04	43.2	-6.6	
23	-3.70	34.77	0.000	9.32E-04	48.2	0.2	52.0
		34.77	0.000	9.32E-04	-3.8	0.2	
24	-3.80	41.16	0.000	9.32E-04	0.0	0.0	

Strut force at elev. -0.10 = 34.56 kN/m run = 41.47 kN/strut
Strut force at elev. -3.70 = 52.00 kN/m run = 62.40 kN/strut

ACTIVE side

Node no.	Y coord	Water press. kN/m2	Effective stresses: Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Soil stiffness coeff. kN/m3
1	0.00	Total>	10.00	0.00	57.80	8.84	8.84	174567
2	-0.10	Total>	11.80	0.50m	59.60	8.14	8.14	4223
3	-0.30	Total>	15.40	1.50m	63.20	9.12	9.12	4223
4	-0.35	Total>	16.30	1.75m	64.10	9.96	9.96	4223
		0.00	16.30	5.66	57.18	9.20	9.20	4375
5	-0.40	0.00	17.30	6.01	60.69	9.74	9.74	4375
6	-0.60	0.00	21.29	7.40	74.68	11.92	11.92	4375
7	-0.80	0.00	25.27	8.78	88.65	14.11	14.11	4375
8	-1.00	0.00	29.24	10.16	102.58	16.30	16.30	4375
9	-1.20	0.00	33.19	11.53	116.46	18.51	18.51	4375
10	-1.40	0.00	37.13	12.91	130.30	20.72	20.72	4375
11	-1.60	0.00	41.06	14.27	144.08	22.95	22.95	4375
12	-1.80	0.00	44.98	15.63	157.81	25.20	25.20	4375
13	-2.00	0.00	48.88	16.99	171.49	27.46	27.46	4375
14	-2.20	0.00	52.76	18.34	185.13	29.73	29.73	4375
15	-2.40	0.00	56.64	19.68	198.72	32.02	32.02	4375
16	-2.55	0.00	59.53	20.69	208.89	33.74	33.74	4375
17	-2.70	0.00	62.43	21.69	219.04	35.47	35.47	4375
		0.00	62.43	16.73	309.86	20.58	20.58	5727
18	-2.85	0.00	65.31	17.50	324.19	22.60	22.60	5727
19	-3.00	0.00	68.20	18.28	338.51	24.67	24.67	5727
20	-3.20	0.00	72.04	19.31	357.57	27.49	27.49	5727
21	-3.40	0.00	75.87	20.33	376.60	30.38	30.38	5727
22	-3.55	0.00	78.75	21.10	390.86	32.57	32.57	5727
23	-3.70	0.00	81.62	21.87	405.11	34.77	34.77	5727
24	-3.80	0.00	83.53	22.39	414.61	43.50	43.50	131285

PASSIVE side

Node no.	Y coord	Water press. kN/m2	Effective stresses: Vertic -al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Soil stiffness coeff. kN/m3
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
2	-0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.0
3	-0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.0
4	-0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.0
5	-0.40	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	-0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
8	-1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
9	-1.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0

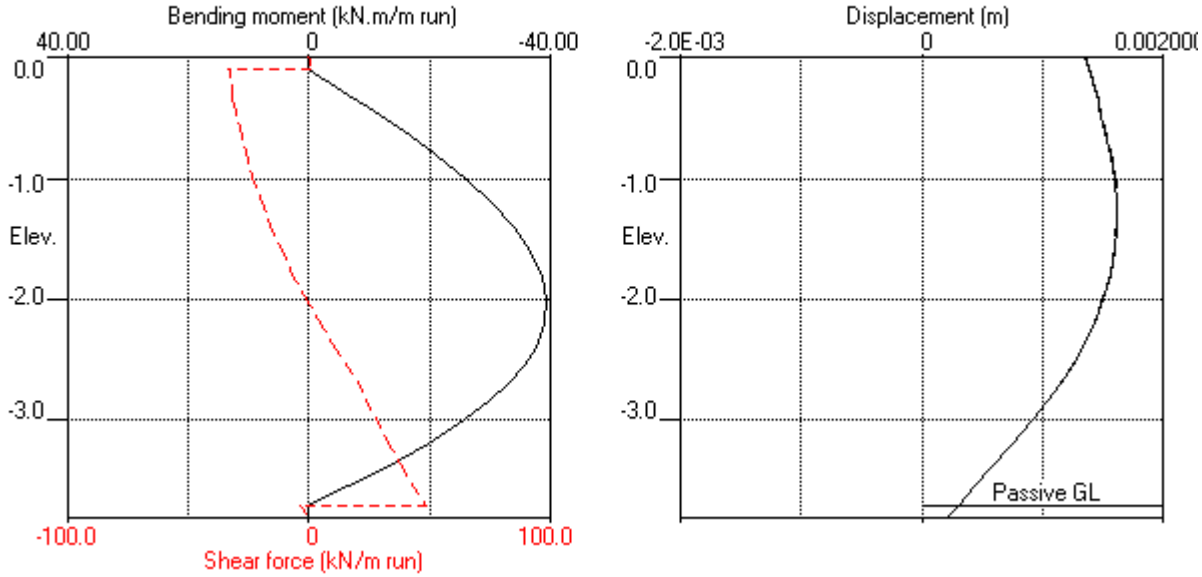
(continued)

Stage No.8 Change properties of soil type 6 to soil type 7
Ko pressures will be reset

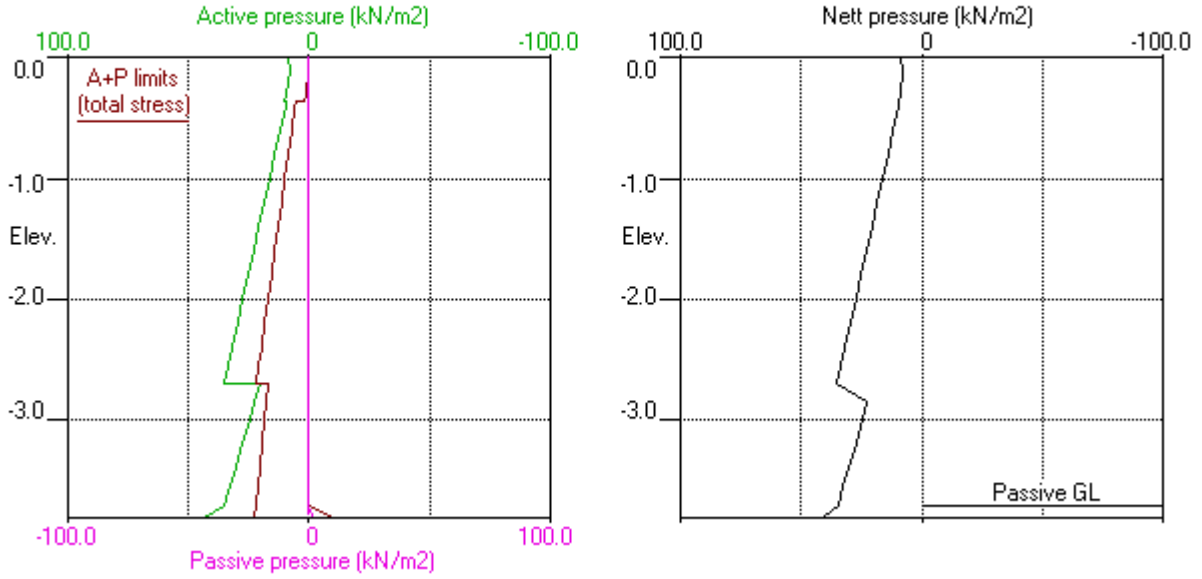
Node no.	Y coord	PASSIVE side: Water press. kN/m2	Effective stresses: Vertic-al kN/m2	Active limit kN/m2	Passive limit kN/m2	Earth pressure kN/m2	Total earth pressure kN/m2	Soil stiffness coeff. kN/m3
10	-1.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
11	-1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.0
12	-1.80	0.00	0.00	0.00	0.00	0.00	0.00	0.0
13	-2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
14	-2.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
15	-2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
16	-2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.0
17	-2.70	0.00	0.00	0.00	0.00	0.00	0.00	0.0
18	-2.85	0.00	0.00	0.00	0.00	0.00	0.00	0.0
19	-3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0
20	-3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.0
21	-3.40	0.00	0.00	0.00	0.00	0.00	0.00	0.0
22	-3.55	0.00	0.00	0.00	0.00	0.00	0.00	0.0
23	-3.70	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	1701781
24	-3.80	0.00	2.00	0.54	9.93	2.34	2.34	131285

Units: kN,m

Stage No.8 Change soil type 6 to soil type 7



Stage No.8 Change soil type 6 to soil type 7



Units: kN,m

Summary of results

STABILITY ANALYSIS of Fully Embedded Wall according to Strength Factor method
Factor of safety on soil strength

Stage No.	--- G.L. --- Act.	Pass.	Strut Elev.	FoS for toe elev. = -3.80 Factor of Safety	Moment equilib. at elev.	Toe elev. for FoS = 1.250 Toe elev.	Wall Penetr -ation
1	0.00	0.00	Cant.	Conditions not suitable for FoS calc.			
2	0.00	-0.40	Cant.	13.804	-3.77	-0.41	0.01
3	0.00	-0.40		No analysis at this stage			

All remaining stages have more than one strut - FoS calculation n/a

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
Open Tension Crack analysis - No

Rigid boundaries: Active side 20.00 from wall
Passive side 20.00 from wall

Bending moment, shear force and displacement envelopes

Node no.	Y coord	Displacement maximum m	Displacement minimum m	Bending moment maximum kN.m/m	Bending moment minimum kN.m/m	Shear force maximum kN/m	Shear force minimum kN/m
1	0.00	0.001	0.000	0.0	0.0	0.0	0.0
2	-0.10	0.001	0.000	0.0	0.0	0.8	-33.7
3	-0.30	0.001	0.000	0.4	-6.5	2.6	-32.0
4	-0.35	0.001	0.000	0.4	-8.1	2.4	-31.5
5	-0.40	0.001	0.000	0.5	-9.7	2.5	-31.0
6	-0.60	0.002	0.000	0.9	-15.7	1.3	-28.9
7	-0.80	0.002	0.000	1.0	-21.2	0.4	-26.3
8	-1.00	0.002	0.000	1.0	-26.1	0.0	-23.2
9	-1.20	0.002	0.000	0.9	-30.4	0.0	-19.7
10	-1.40	0.002	0.000	0.6	-34.0	0.0	-15.8
11	-1.60	0.002	0.000	0.3	-36.7	0.0	-12.3
12	-1.80	0.002	0.000	0.0	-38.6	0.0	-8.9
13	-2.00	0.002	0.000	0.0	-39.4	0.0	-5.0
14	-2.20	0.001	0.000	0.0	-39.1	4.4	-0.7
15	-2.40	0.001	0.000	0.0	-37.6	10.5	-0.0
16	-2.55	0.001	0.000	0.0	-35.7	15.5	0.0
17	-2.70	0.001	0.000	0.0	-33.0	20.6	0.0
18	-2.85	0.001	0.000	0.0	-29.7	23.9	0.0
19	-3.00	0.001	0.000	0.0	-25.8	27.4	0.0
20	-3.20	0.001	0.000	0.0	-19.8	32.6	0.0
21	-3.40	0.001	0.000	0.0	-12.7	38.4	-0.0
22	-3.55	0.000	0.000	0.0	-6.6	43.2	-0.1
23	-3.70	0.000	0.000	0.2	0.0	48.2	-3.8
24	-3.80	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 maximum kN.m/m	Bending moment elev.	Bending moment minimum kN.m/m	Bending moment elev.	Shear force maximum kN/m	Shear force elev.	Shear force minimum kN/m	Shear force elev.
1	0.4	-0.80	-0.4	-2.40	1.1	-0.35	-0.8	-1.60
2	1.0	-0.80	-0.5	-2.40	2.5	-0.40	-1.5	-1.60
3	No calculation at this stage							
4	No calculation at this stage							
5	0.4	-0.30	-28.7	-2.20	41.1	-3.70	-23.3	-0.30
6	No calculation at this stage							
7	0.2	-3.70	-30.3	-2.20	42.1	-3.70	-23.1	-0.10
8	0.2	-3.70	-39.4	-2.00	48.2	-3.70	-33.7	-0.10

Summary of results (continued)

Maximum and minimum displacement at each stage

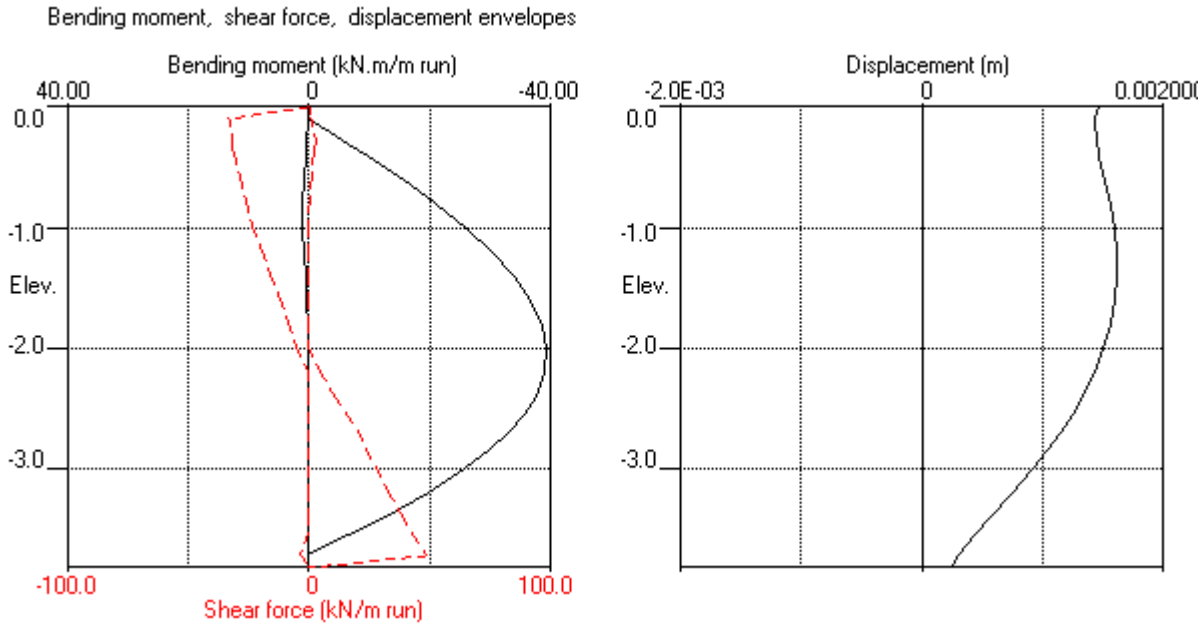
Stage no.	Displacement maximum	elev.	minimum	elev.	Stage description
	m		m		
1	0.001	0.00	0.000	0.00	Apply surcharge no.1 at elev. 0.00
2	0.001	0.00	0.000	0.00	Excav. to elev. -0.40 on PASSIVE side
3	No calculation at this stage				Install strut no.1 at elev. -0.30
4	No calculation at this stage				Install strut no.3 at elev. -3.70
5	0.001	-1.00	0.000	0.00	Excav. to elev. -3.70 on PASSIVE side
6	No calculation at this stage				Install strut no.4 at elev. -0.10
7	0.001	-1.00	0.000	0.00	Remove strut no.1 at elev. -0.30
8	0.002	-1.40	0.000	0.00	Change soil type 6 to soil type 7

Summary of results (continued)

Strut forces at each stage (horizontal components)

Stage no.	Strut no. 1 at elev.-0.30		Strut no. 3 at elev.-3.70		Strut no. 4 at elev.-0.10	
	kN/m run	kN/strut	kN/m run	kN/strut	kN/m run	kN/strut
5	25.88	31.06	44.70	53.64	---	---
7	---	---	45.74	54.89	23.86	28.63
8	---	---	52.00	62.40	34.56	41.47

Units: kN,m


Bending moment, shear force, displacement envelopes
Bending moment (kN.m/m run)
40.00
0
-40.00
0.0
-1.0
Elev.
-2.0
-3.0
-100.0
0
100.0
Shear force (kN/m run)
Displacement (m)
-2.0E-03
0
0.00200
0.0
-1.0
Elev.
-2.0
-3.0