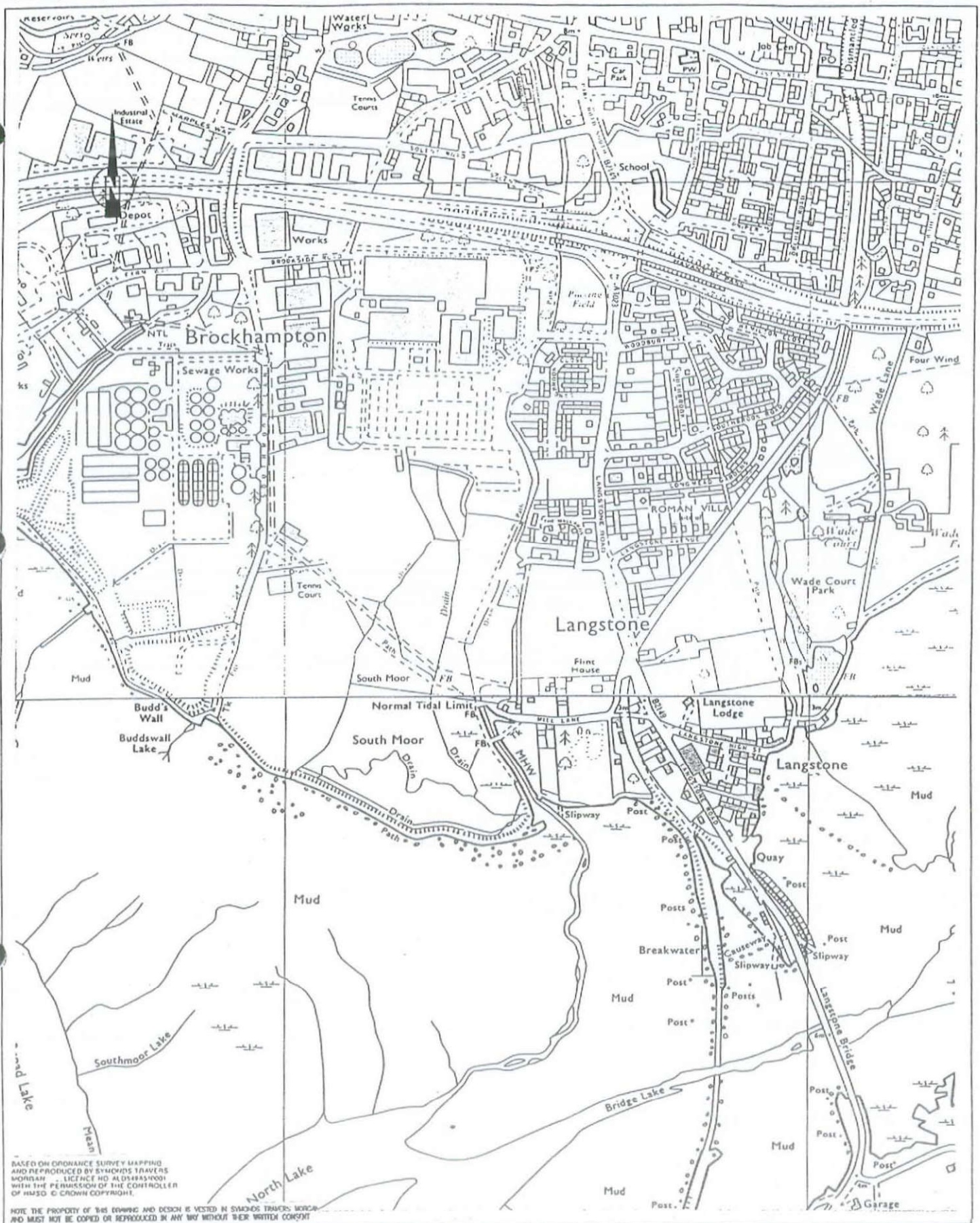


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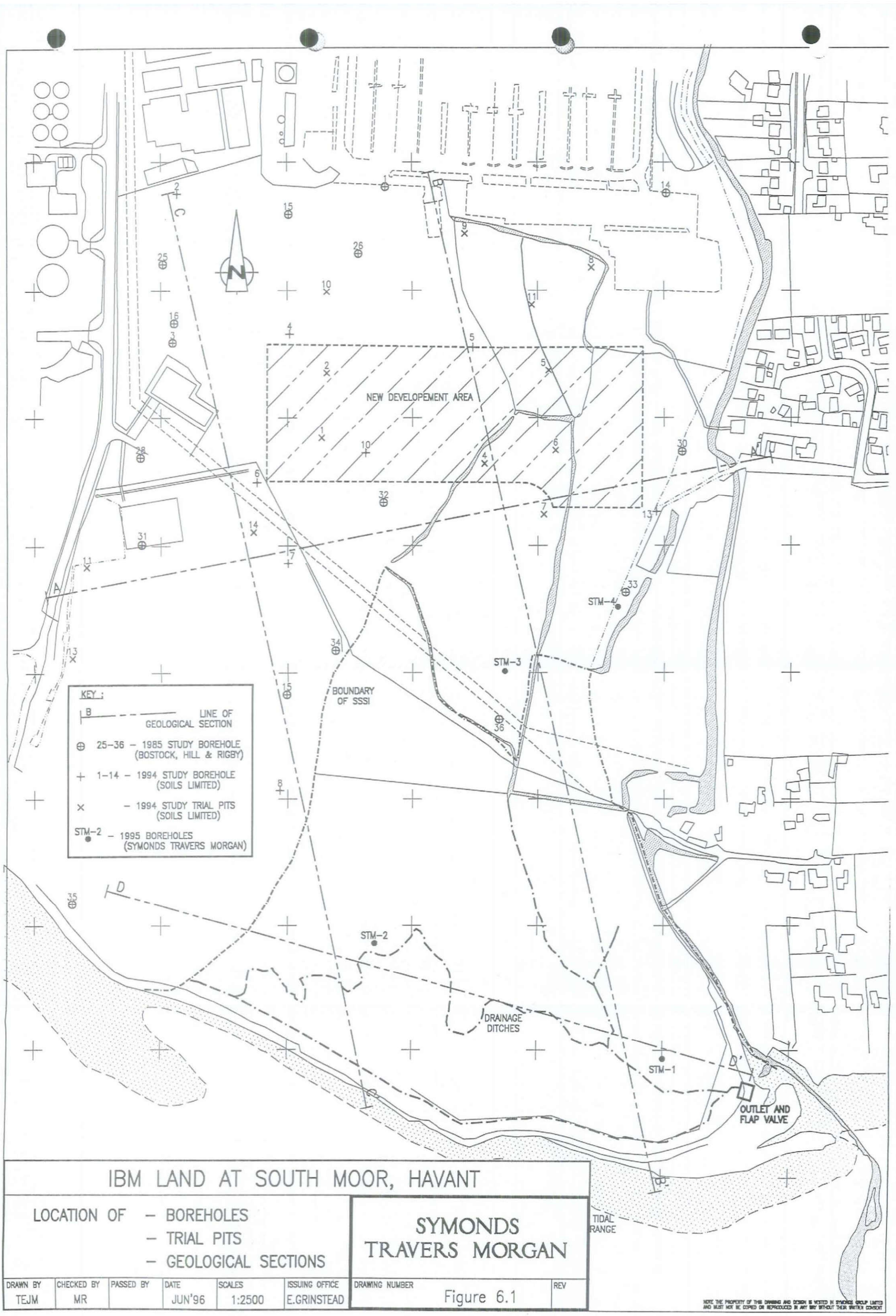
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HISTORICAL MAPPING 1972

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KT			JUNE 96	1:10 000	E.Grinstead	FIGURE 2.6	



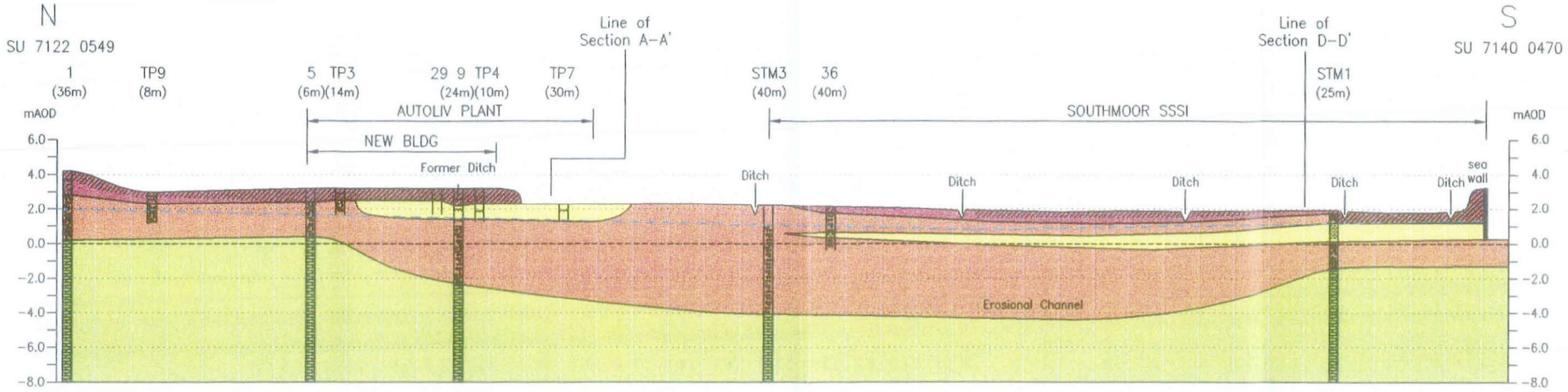
IBM LAND AT SOUTH MOOR, HAVANT

LOCATION OF – BOREHOLES
– TRIAL PITS
– GEOLOGICAL SECTIONS

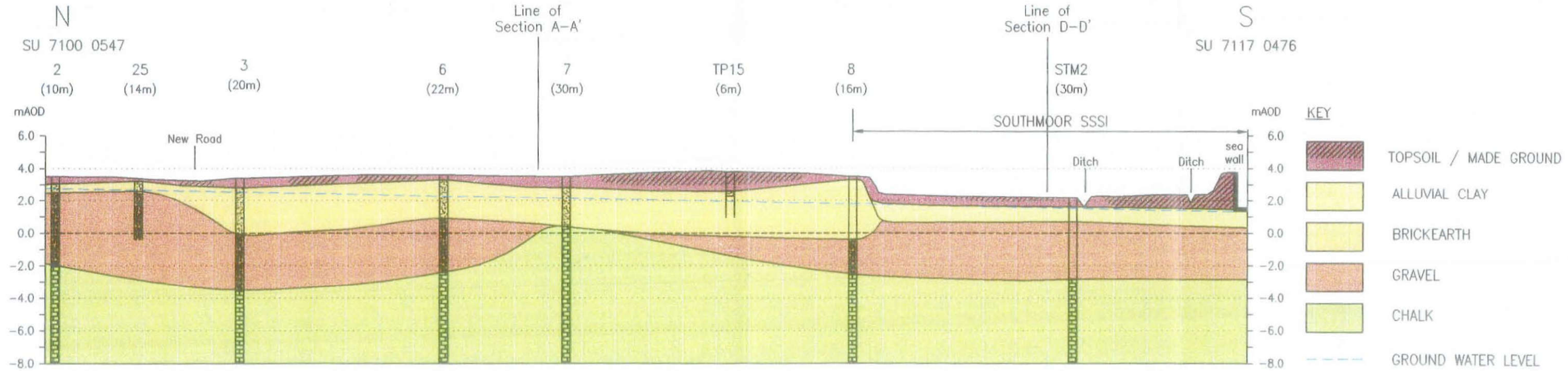
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TEJM	MR		JUN'96	1:2500	E.GRINSTEAD	Figure 6.1	

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SECTION B-B'



SECTION C-C'

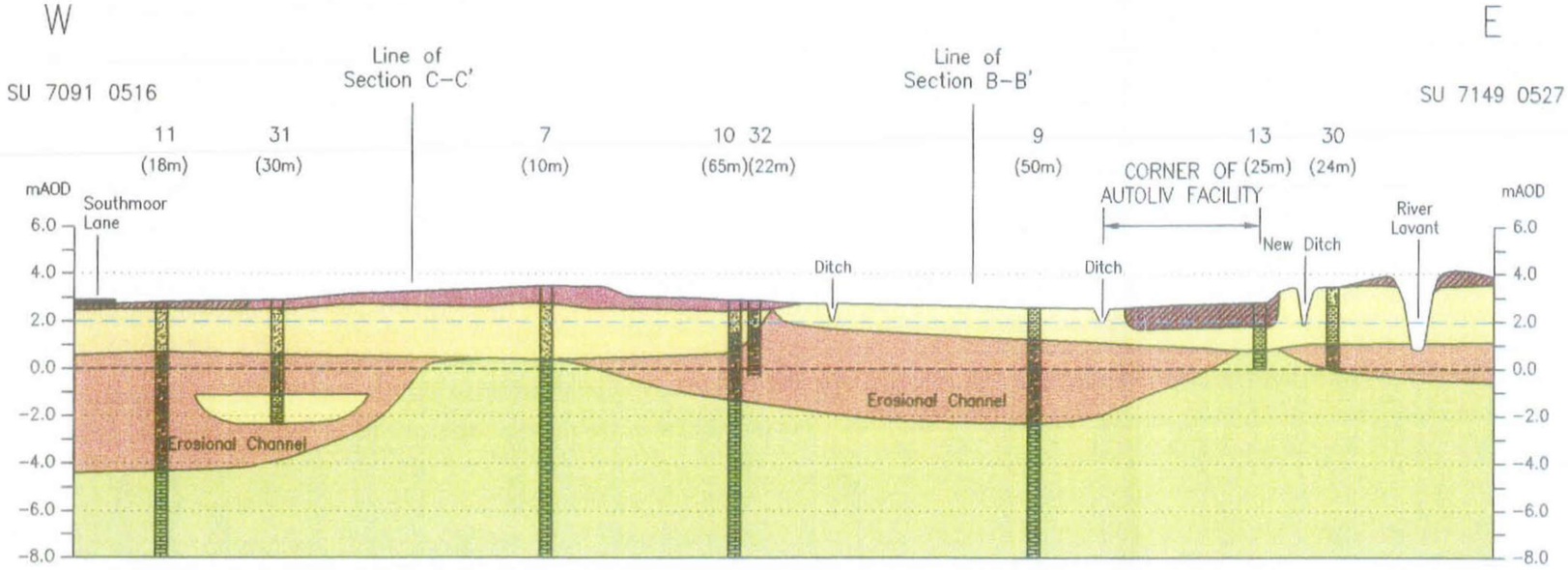
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GEOLOGICAL CROSS SECTIONS

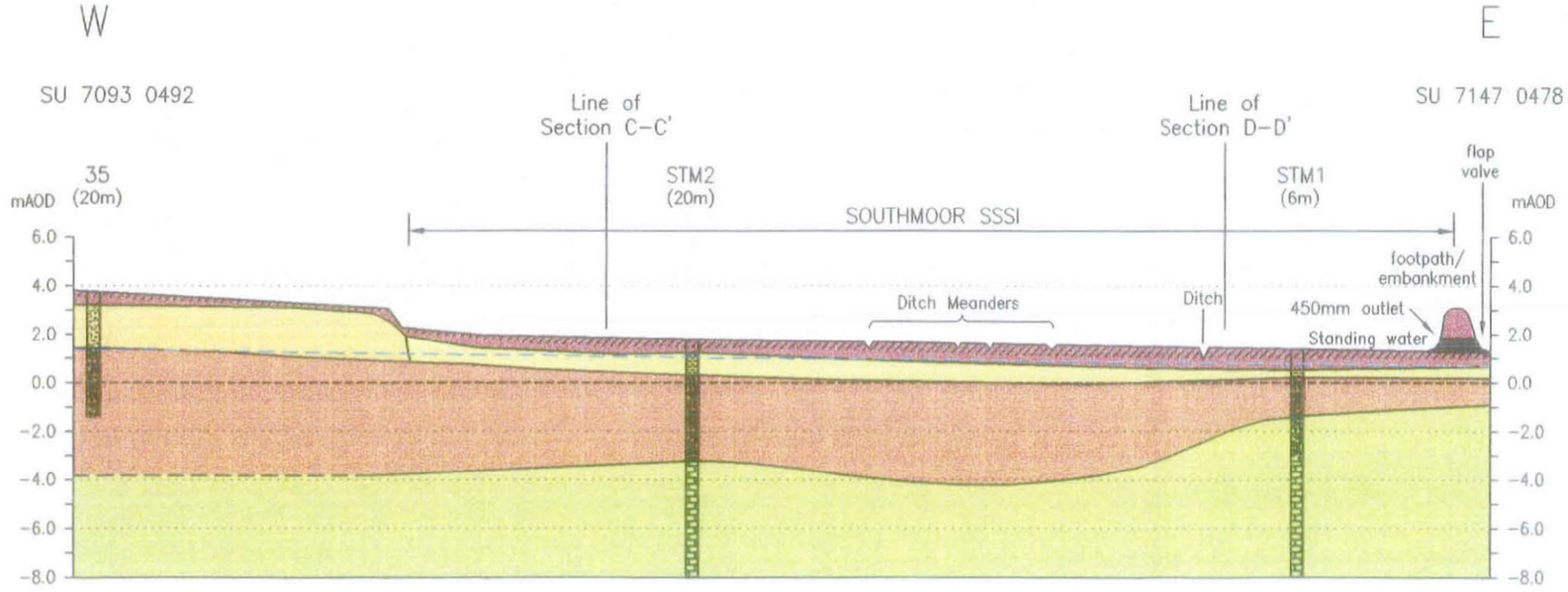
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KRD			MAY'96	1:2500 HORIZ 1:250 VERT	E.Grinstead	FIGURE 6.2	

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SECTION A–A'



SECTION D–D'

KEY

- TOPSOIL / MADE GROUND
- ALLUVIAL CLAY
- BRICKEARTH
- GRAVEL
- CHALK
- GROUND WATER LEVEL

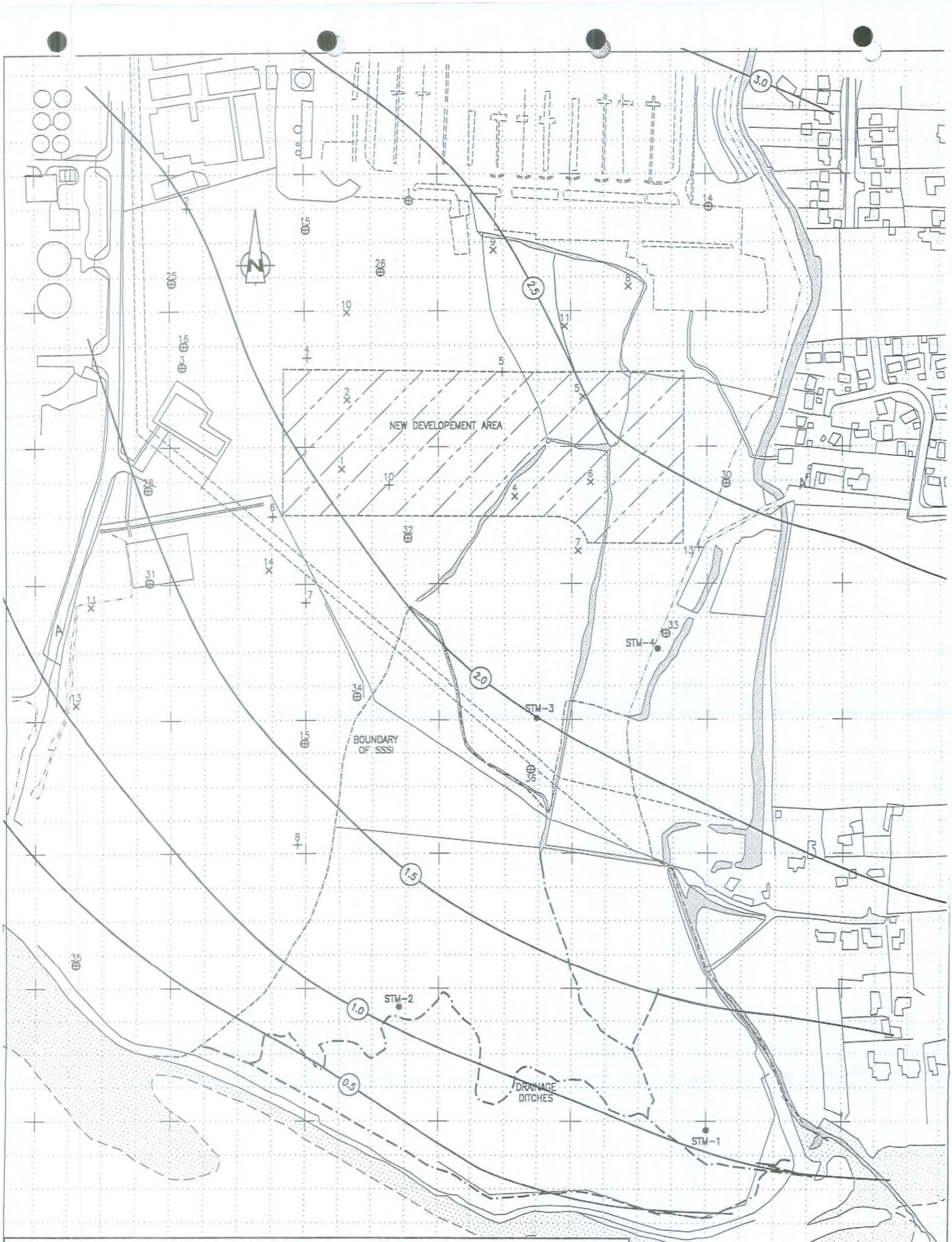
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GEOLOGICAL CROSS SECTIONS

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES	ISSUING OFFICE	DRAWING NUMBER	REV
KRD			MAY'96	1:2500 HORIZ 1:250 VERT	E.Grinstead	FIGURE 6.3	

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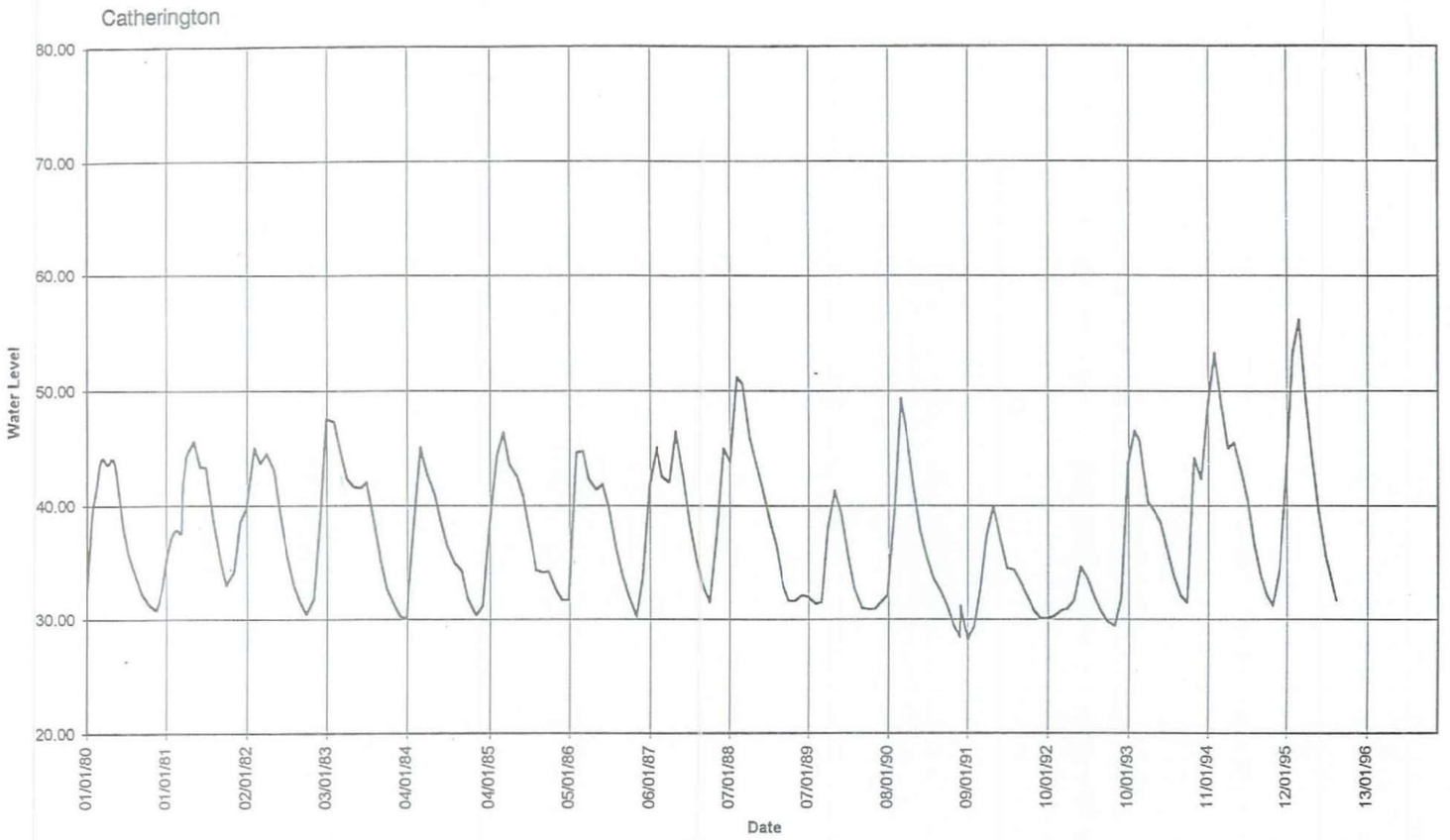
GROUNDWATER LEVEL CONTOURS

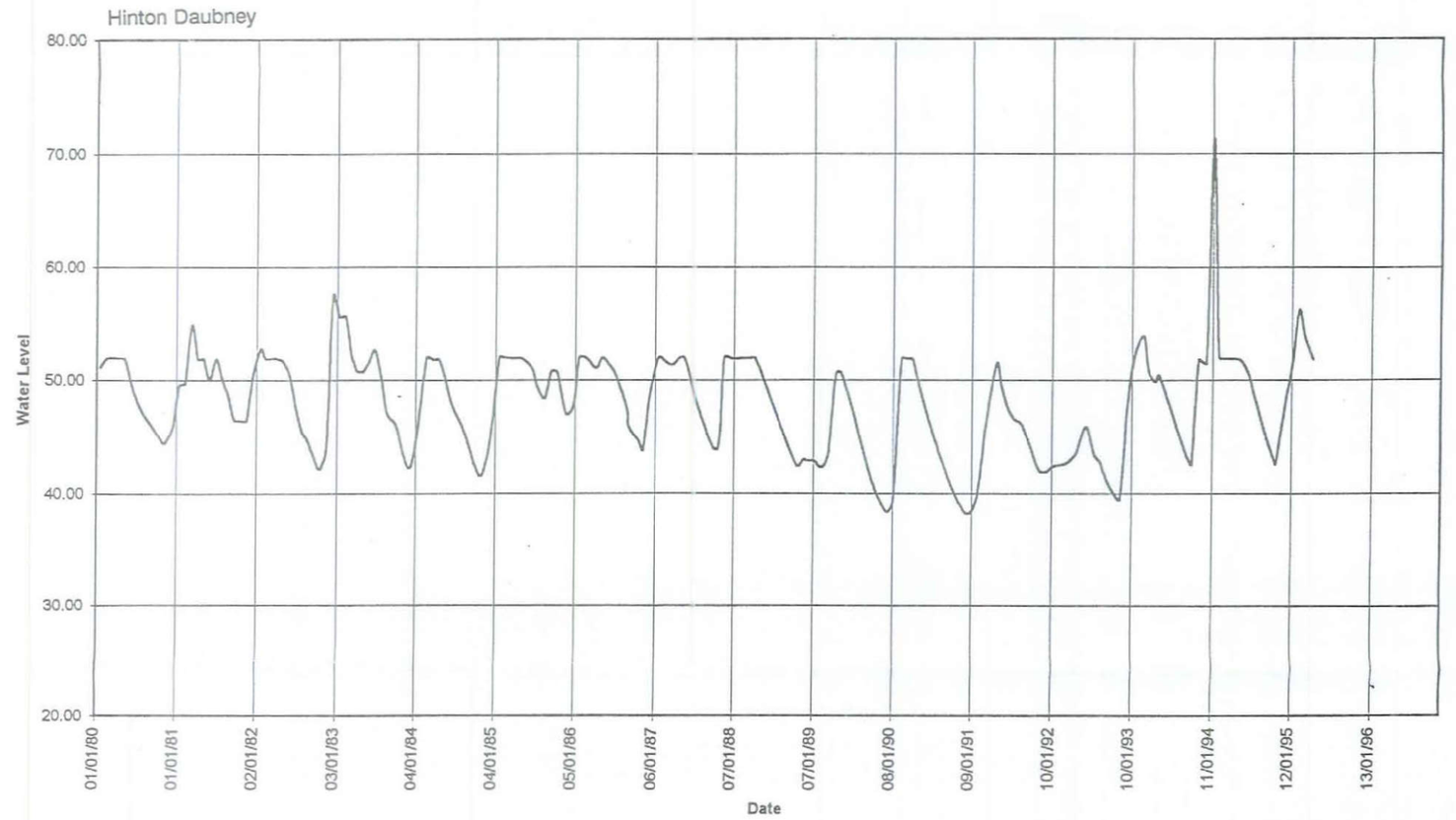
SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES	ISSUING OFFICE	DRAWING NUMBER	REV
TEJM	MR		JUN'96	1:2500	E.GRINSTEAD	Figure 7.2	

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NRA Monitoring Well Hydrographs at Catherington and Hinton Daubney.

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TK	-		June'96			Figure 7.3	



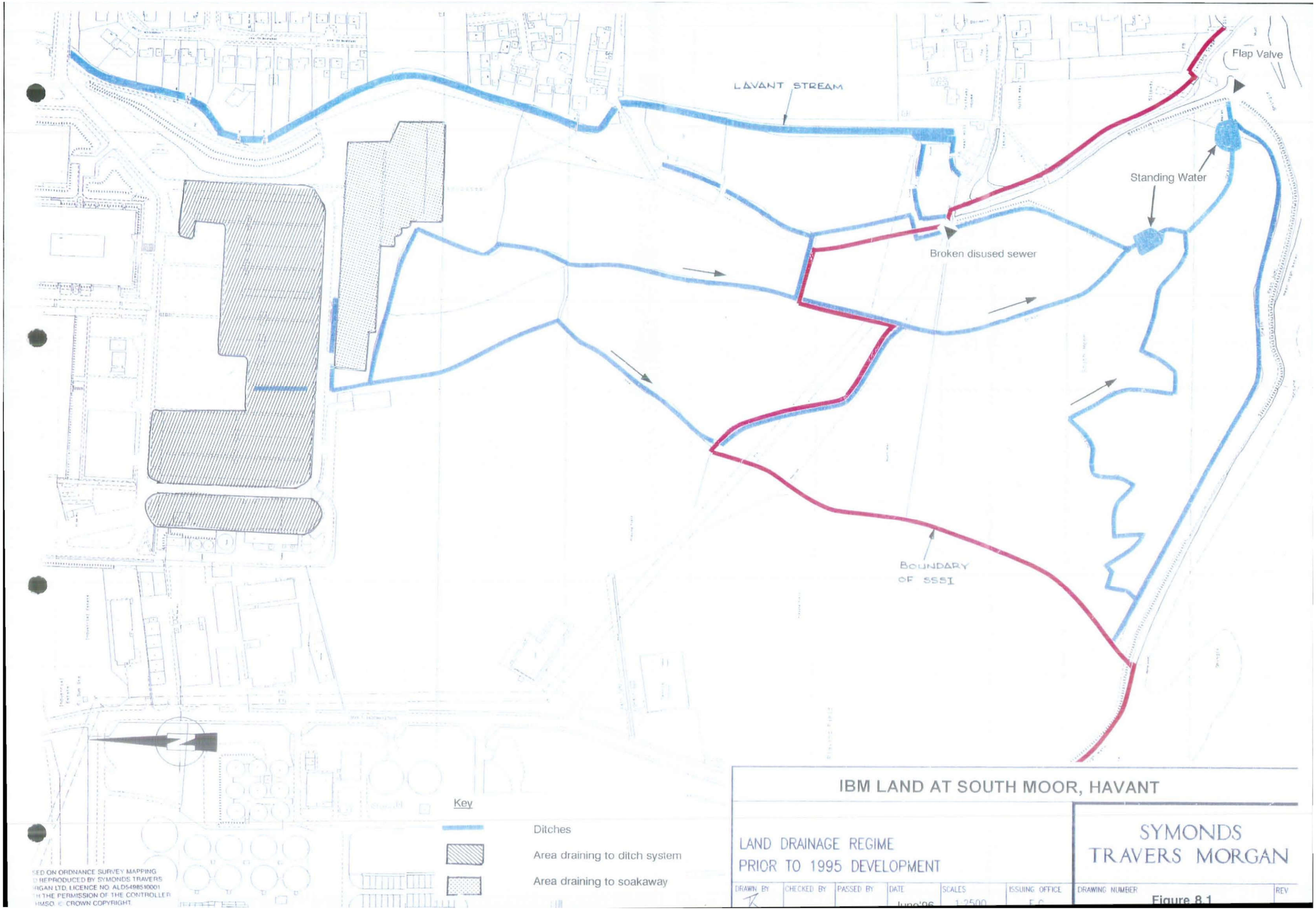
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Location of NRA Monitoring Wells.

SYMONDS
TRAVERS MORGAN

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TK	-		June'96	1:50 000		**Figure 7.4**	

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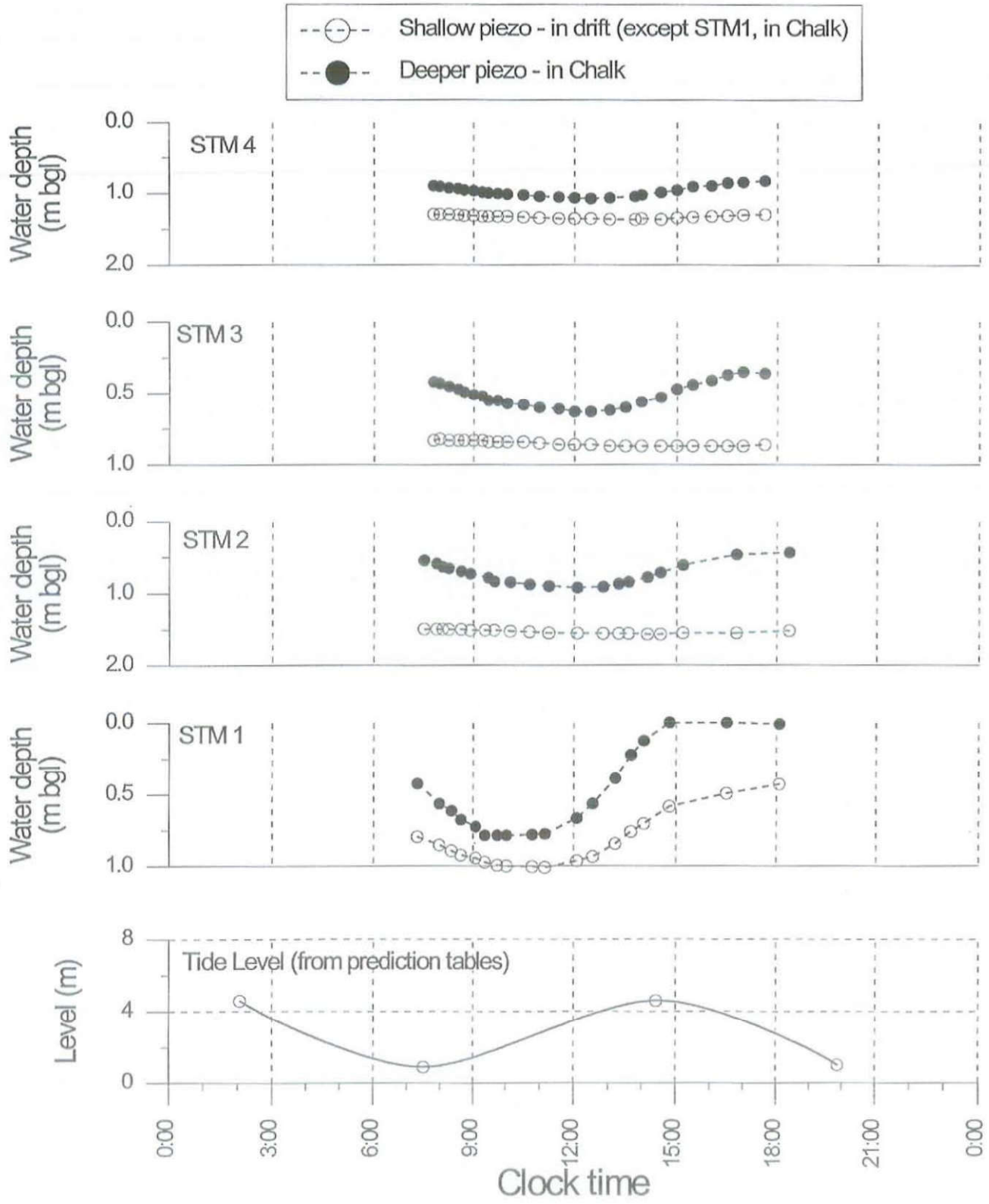


IBM LAND AT SOUTH MOOR, HAVANT

LAND DRAINAGE REGIME
PRIOR TO 1995 DEVELOPMENT

SYMONDS TRAVERS MORGAN

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K			June'96	1:2500	F.C.	Figure 8.1	



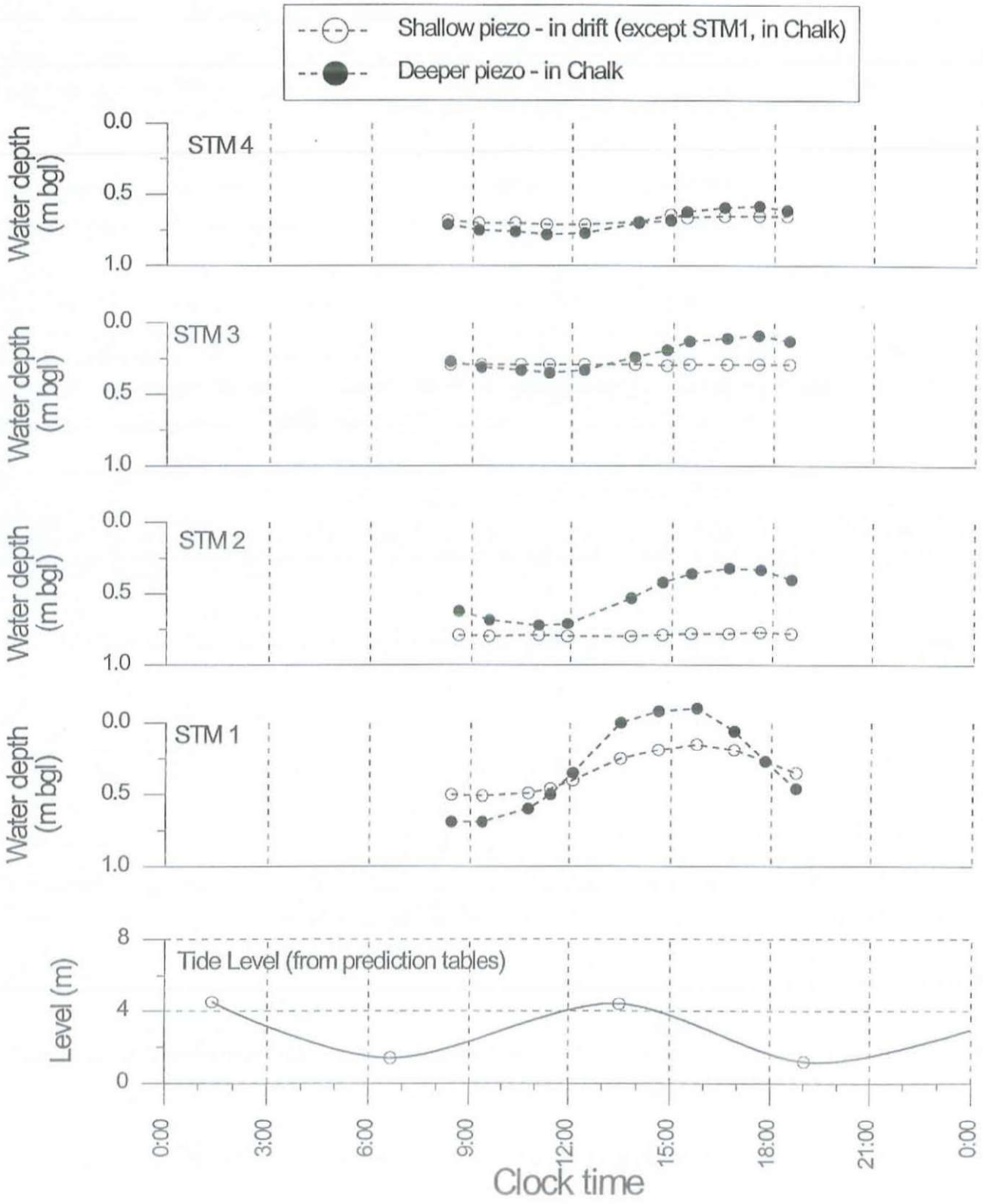
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Groundwater levels in STM boreholes on 31 August 1995

SYMONDS TRAVERS MORGAN

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PHE			AUG 1996			Figure 7.7	



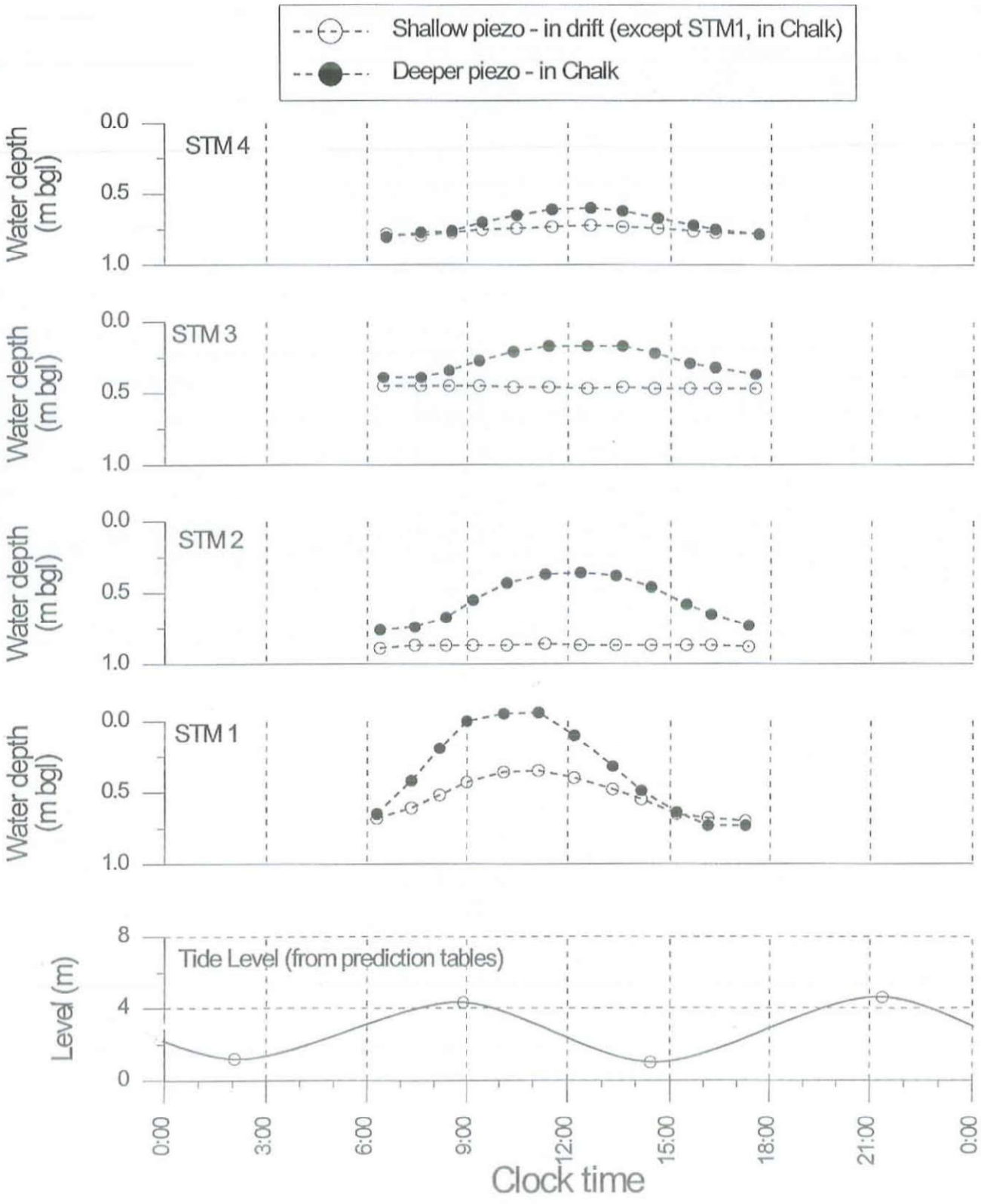
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Groundwater levels in STM boreholes on 11 December 1995

SYMONDS TRAVERS MORGAN

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PHE			AUG 1996			Figure 7.8	



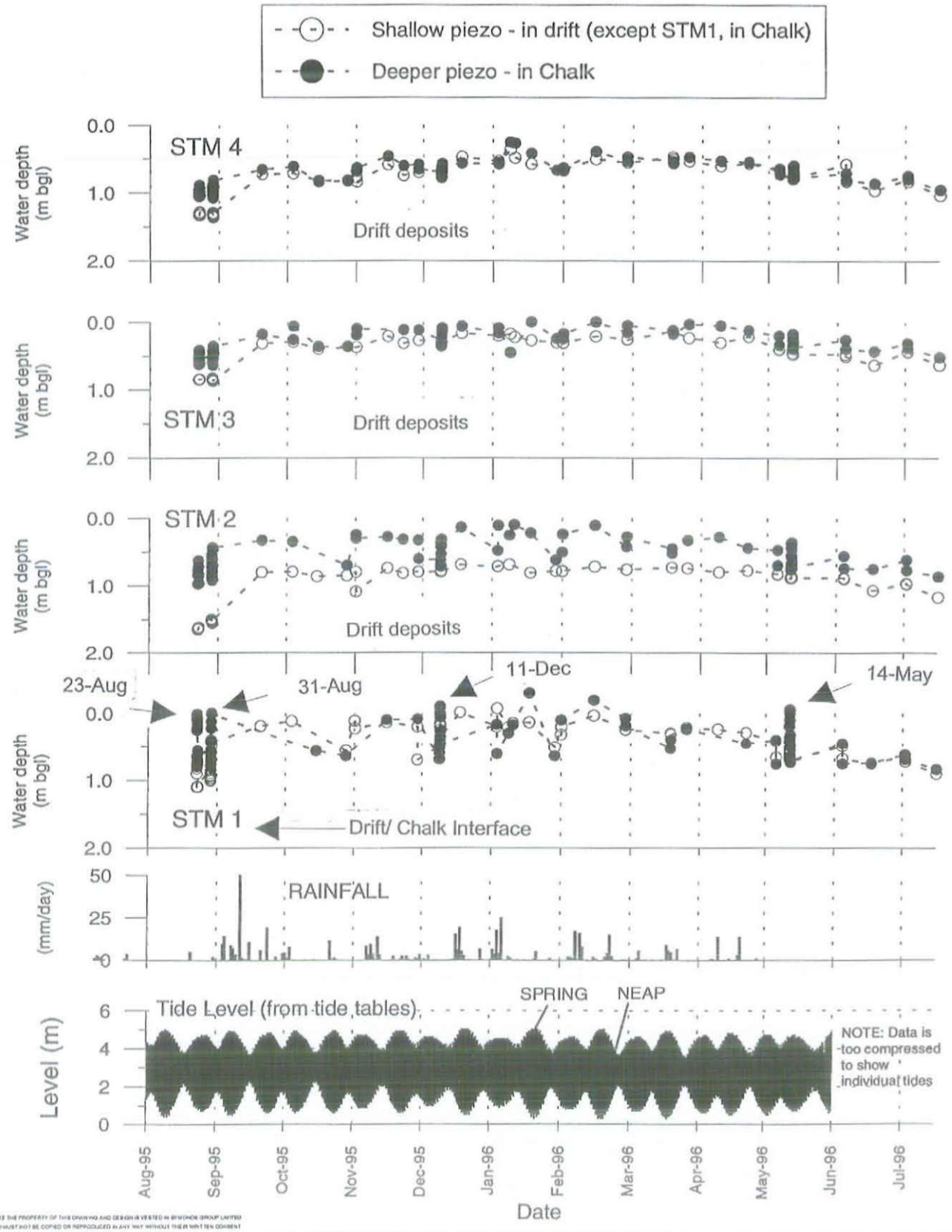
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Groundwater levels in STM boreholes on 14 May 1996

SYMONDS TRAVERS MORGAN

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PHE			AUG 1996			Figure 7.9	



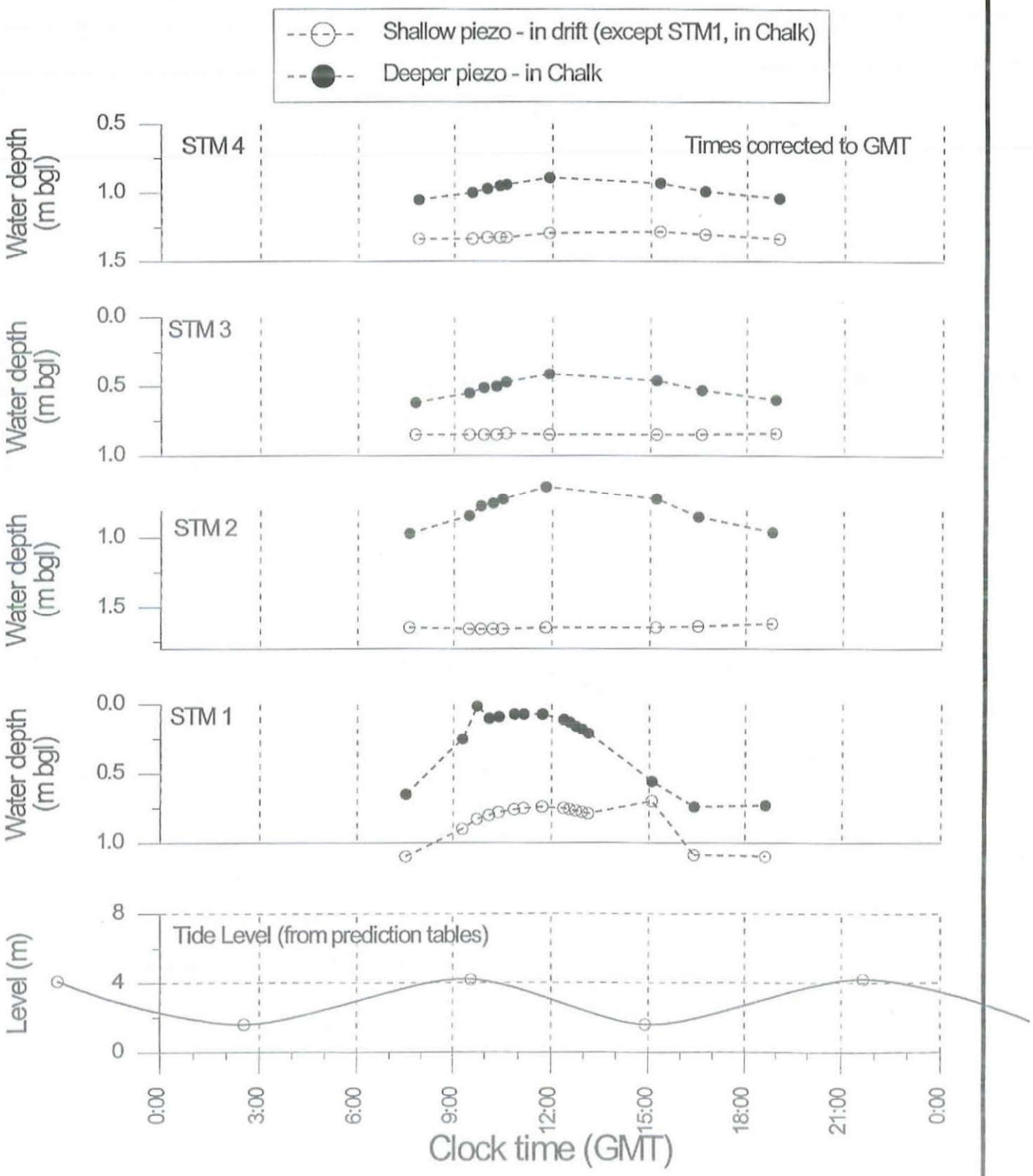
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Groundwater levels in STM boreholes throughout period of study

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PHE			9/8/96		EG	Figure 7.5	



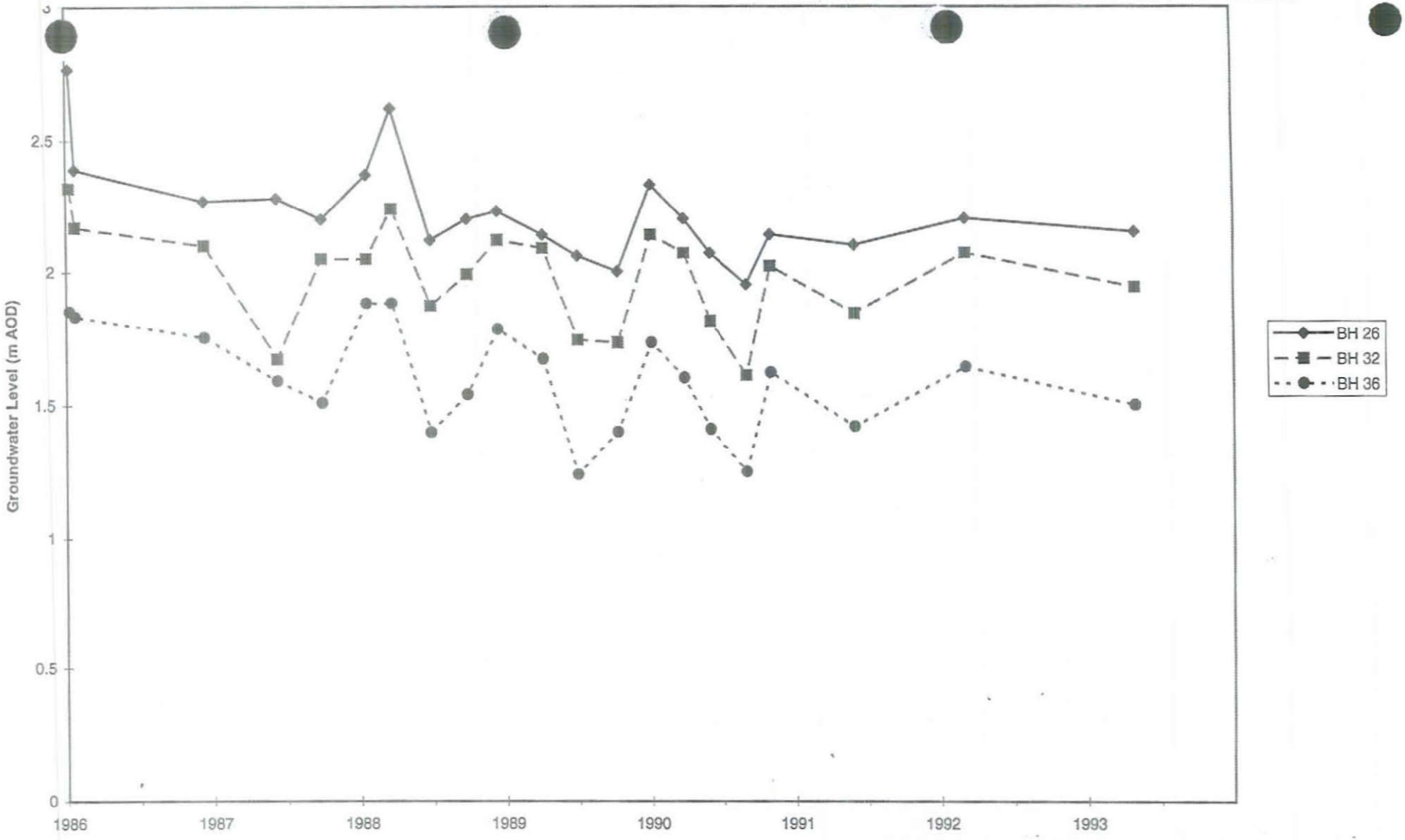
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Groundwater levels in STM boreholes on 23 August 1995

SYMONDS TRAVERS MORGAN

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PHE			AUG 1996			Figure 7.6	



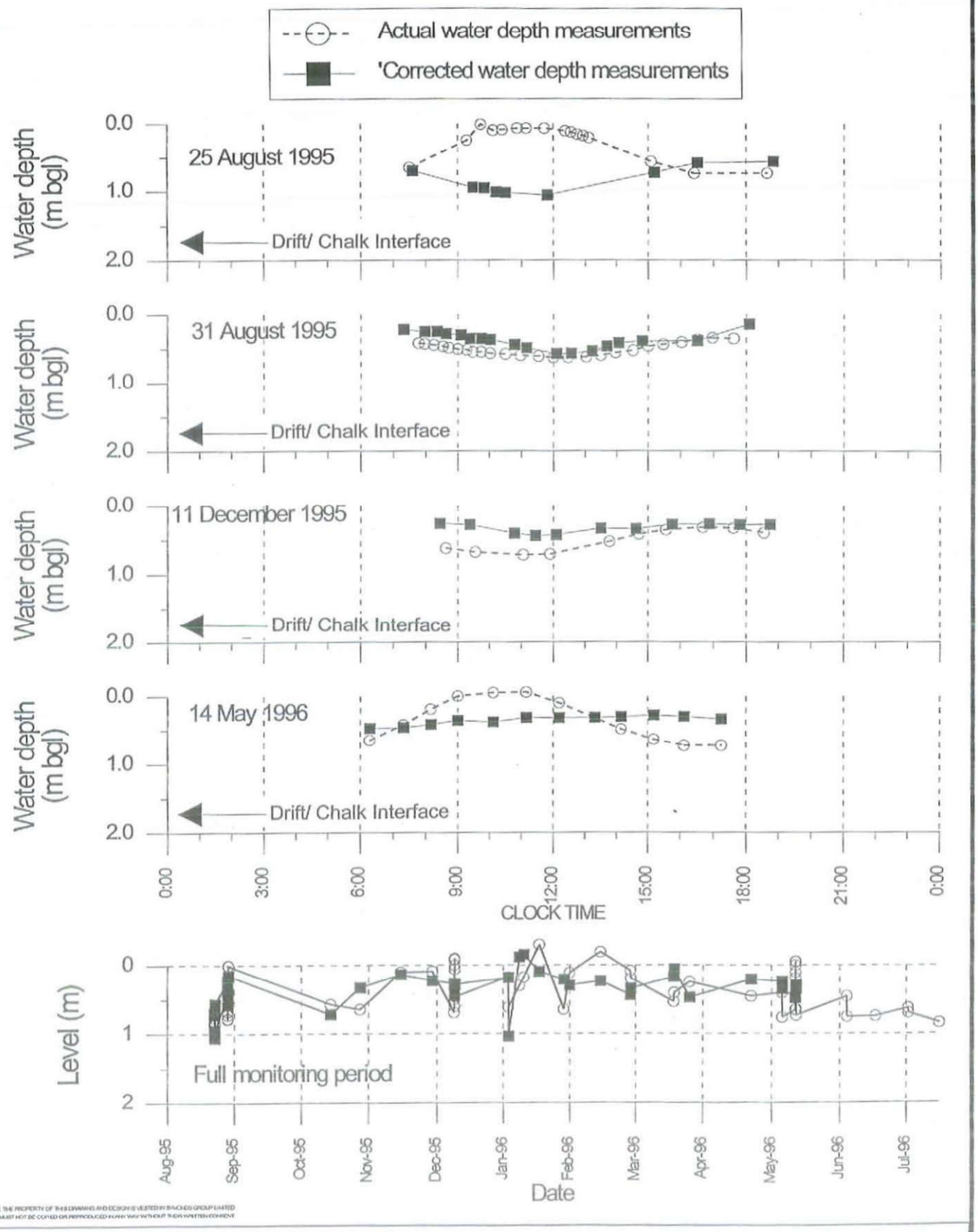
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Groundwater Level Fluctuation
1985 - 1993 to the North of SSSI

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TC			June'96			Figure 7.1	

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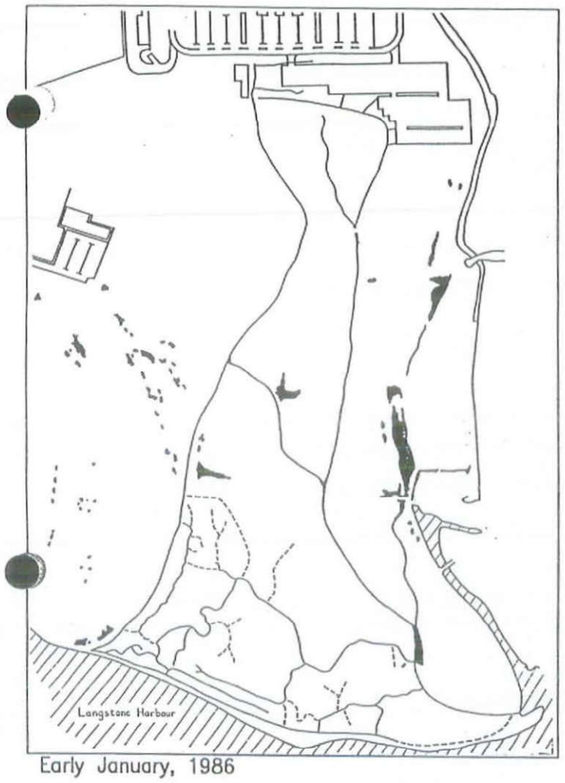
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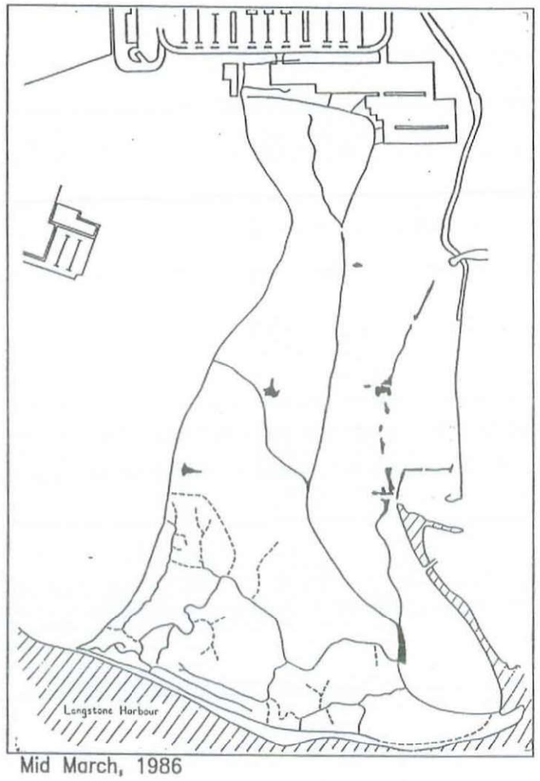
Actual and 'Corrected' Groundwater levels in STM1shallow piezo

SYMONDS TRAVERS MORGAN

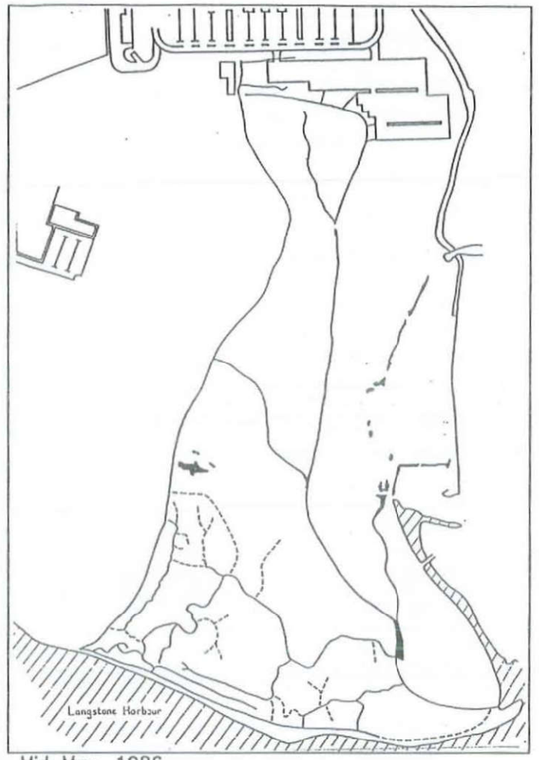
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PHE			AUG 1996			Figure 7.10	



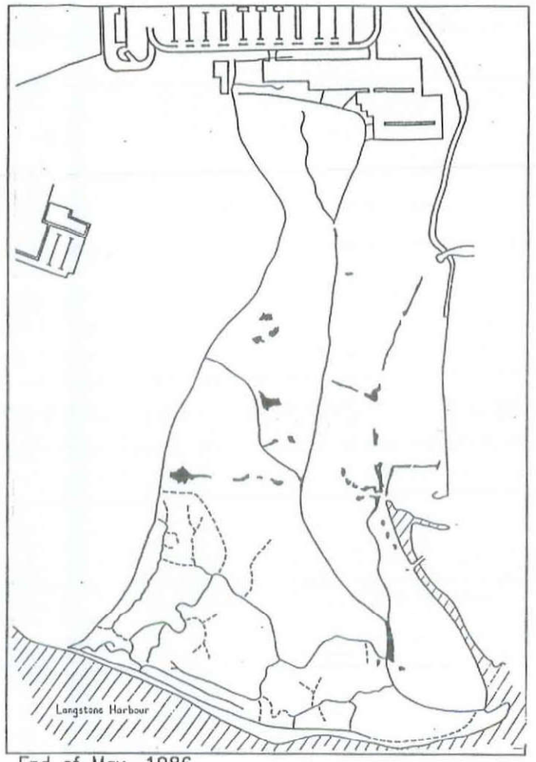
Early January, 1986



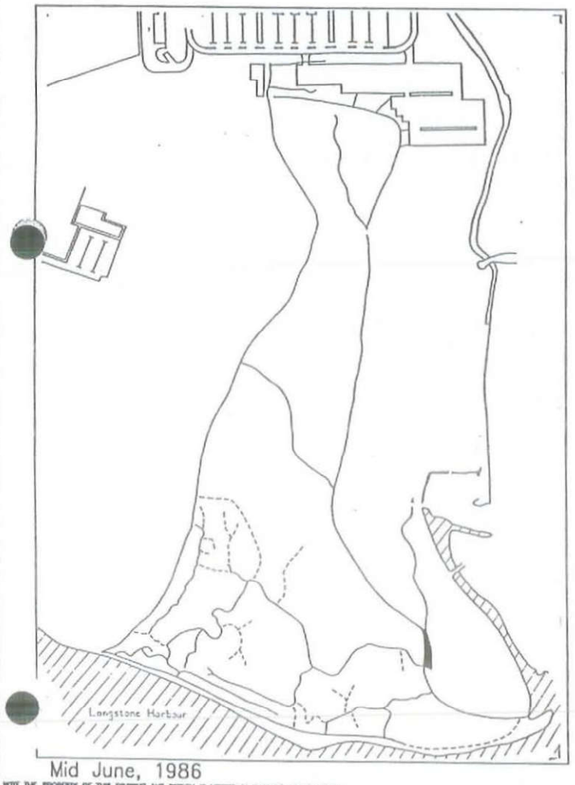
Mid March, 1986



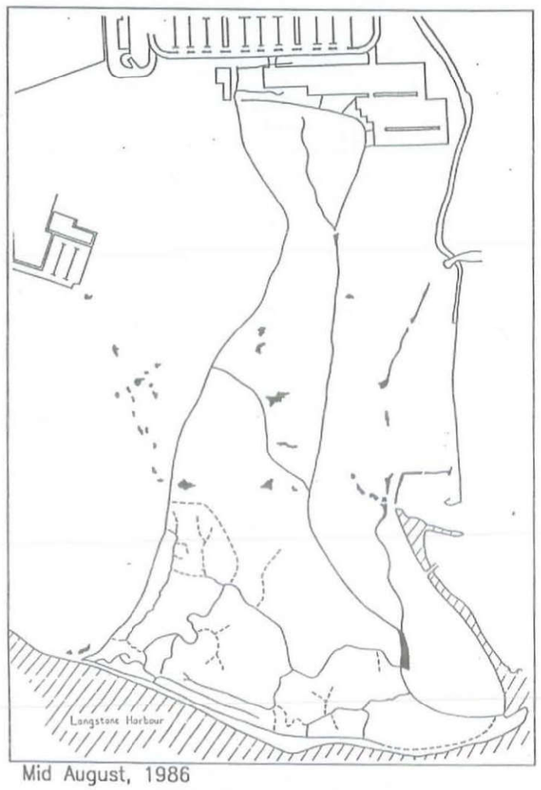
Mid May, 1986



End of May, 1986



Mid June, 1986



Mid August, 1986

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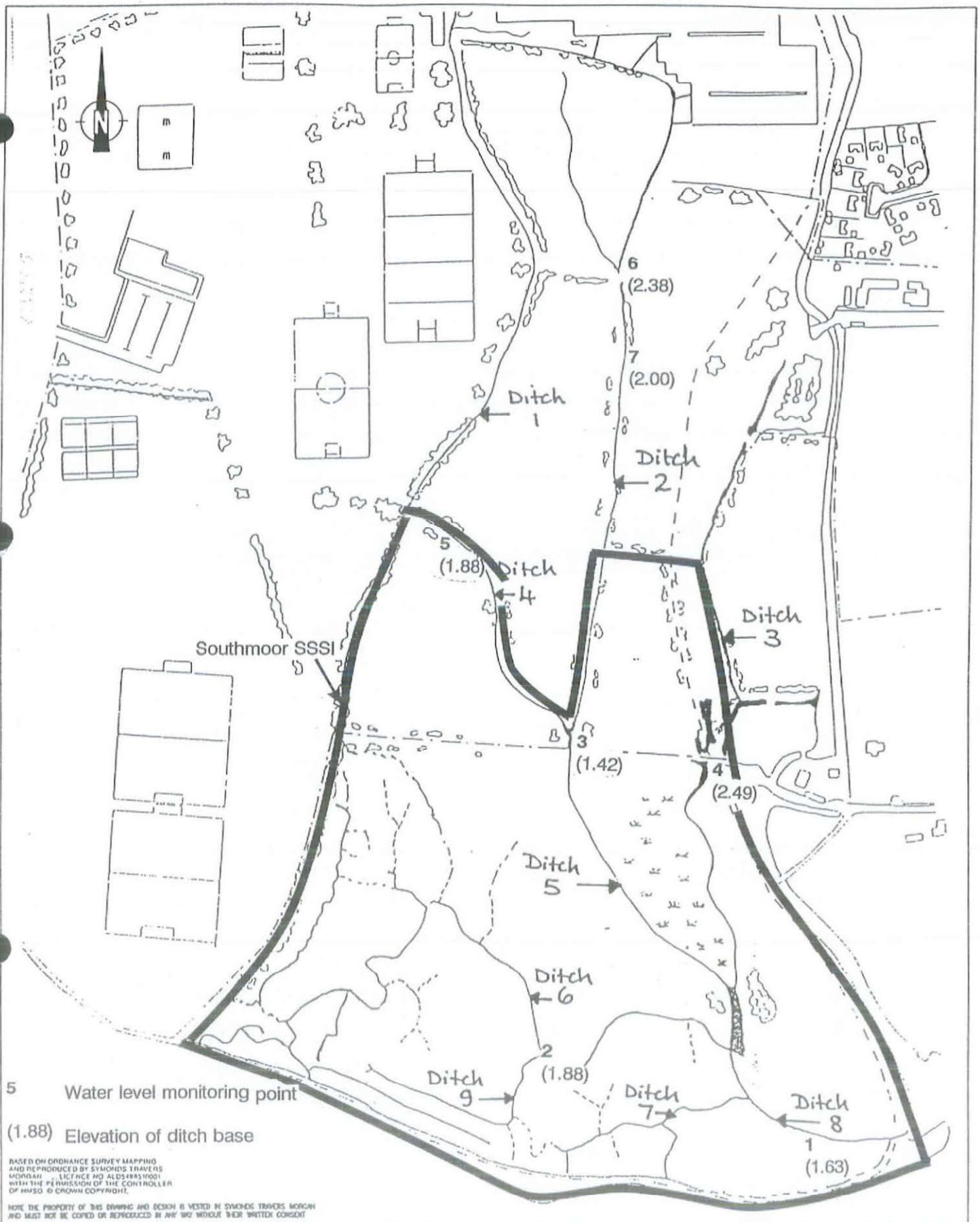
Reproduced from Bostock, Hill and Rigby IBM Havant Report 1987

IBM LAND AT SOUTH MOOR, HAVANT

Variations in Standing Water Distribution - 1986.

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TEJM	MR		JUN'96	AS SHOWN	E.GRINSTEAD	**Figure 8.2**	



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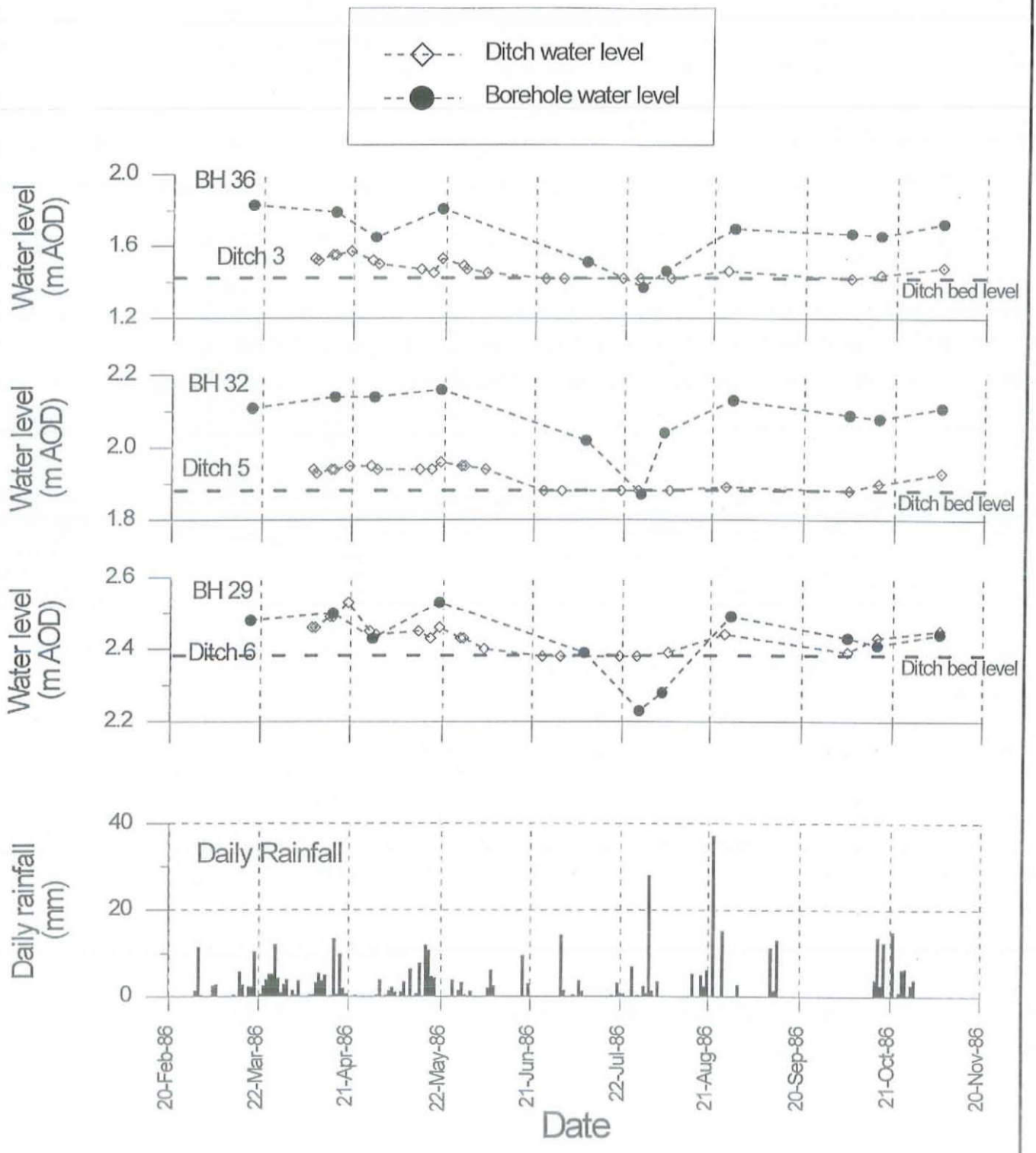
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Ditch Level Monitoring Points in Bostock, Hill and Rigby Study. (Different from STM designations, Figure 9.1)

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K			June'96			Figure 8.3a	



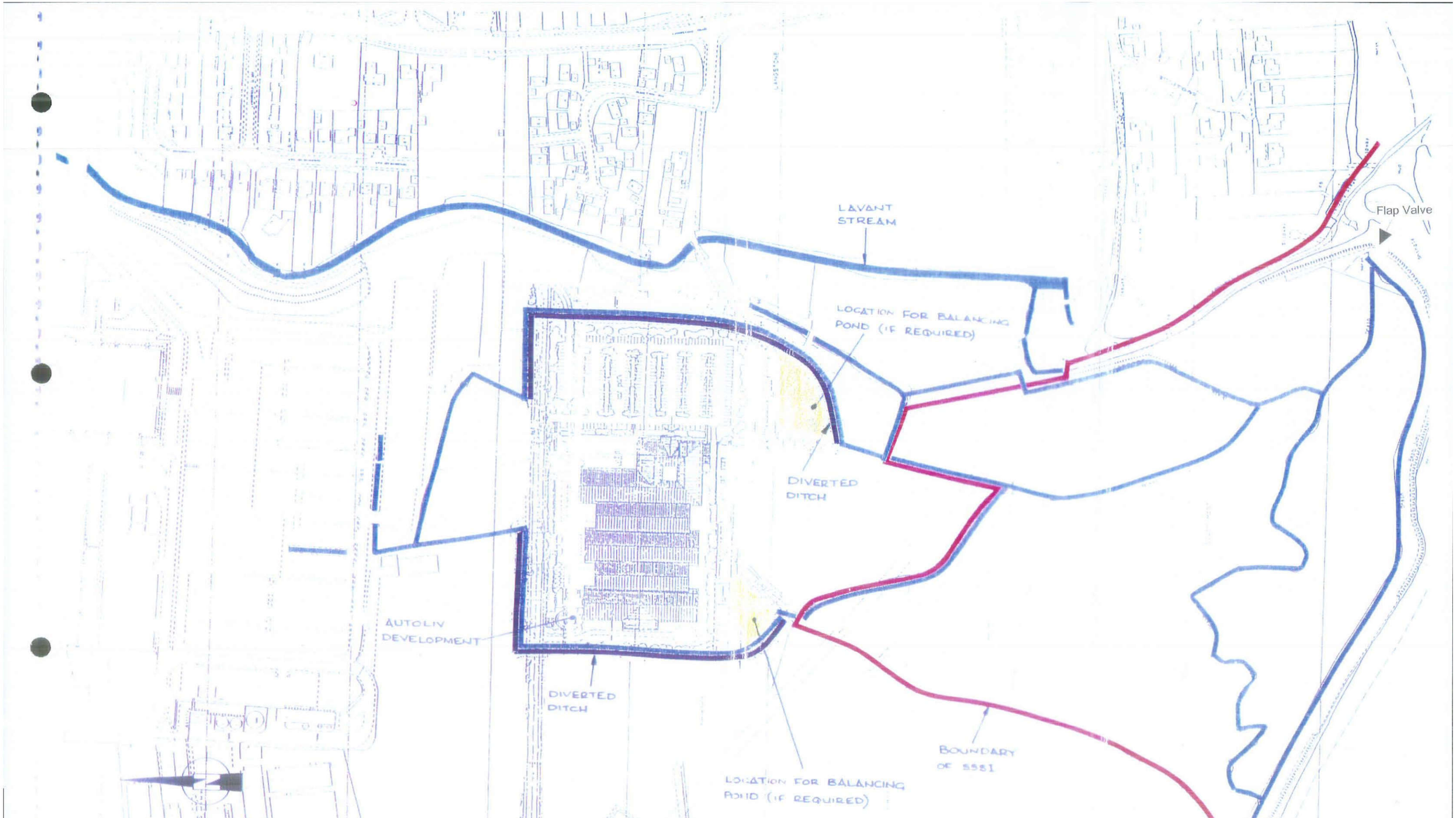
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Comparison of borehole and ditch water levels
(after Bostock, Hill and Rigby, 1986)

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PHE			Aug 96		EG	Figure 8.3 b	



LAND AT SOUTHMOOR

STRATEGIC DRAINAGE REVIEW -
LAND DRAINAGE REGIME FOLLOWING
IMPLEMENTATION OF AUTOLIV DEVELOPMENT

IBM UK LTD

SYMONDS TRAVERS MORGAN

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GC			10/11/95	1:2500	E.G.	Figure 8.4	

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...PRODUCED BY SYMONDS TRAVERS
...UNDER LICENCE NO. AL054985100D1
...THE PERMISSION OF THE CONTROLLER

LAYANT STREAM

Existing Development

BOUNDARY OF SSSI

KEY

EXISTING TO BE RETAINED

EXISTING TO BE ABANDONED

PROPOSED

NOTE
SOLID LINE – OPEN CHANNEL
BROKEN LINE – CULVERTED WATERCOURSE

EXISTING SYSTEM		PROPOSED SYSTEM	
LENGTH OF OPEN CHANNEL (m)	LENGTH OF CULVERT (m)	LENGTH OF OPEN CHANNEL (m)	LENGTH OF CULVERT (m)
610	30	675	210

LENGTH OF EXISTING CHANNEL & WATERCOURSE TO BE RETAINED = 350m

ORDNANCE SURVEY MAPPING
PRODUCED BY SYMONDS TRAVERS
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STRATEGIC DRAINAGE REVIEW –
PROPOSED STRATEGY FOR
PROVISION OF WATERCOURSES

SYMONDS TRAVERS MORGAN

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KRD			June'96	1:2500	EG	Figure 8.5	

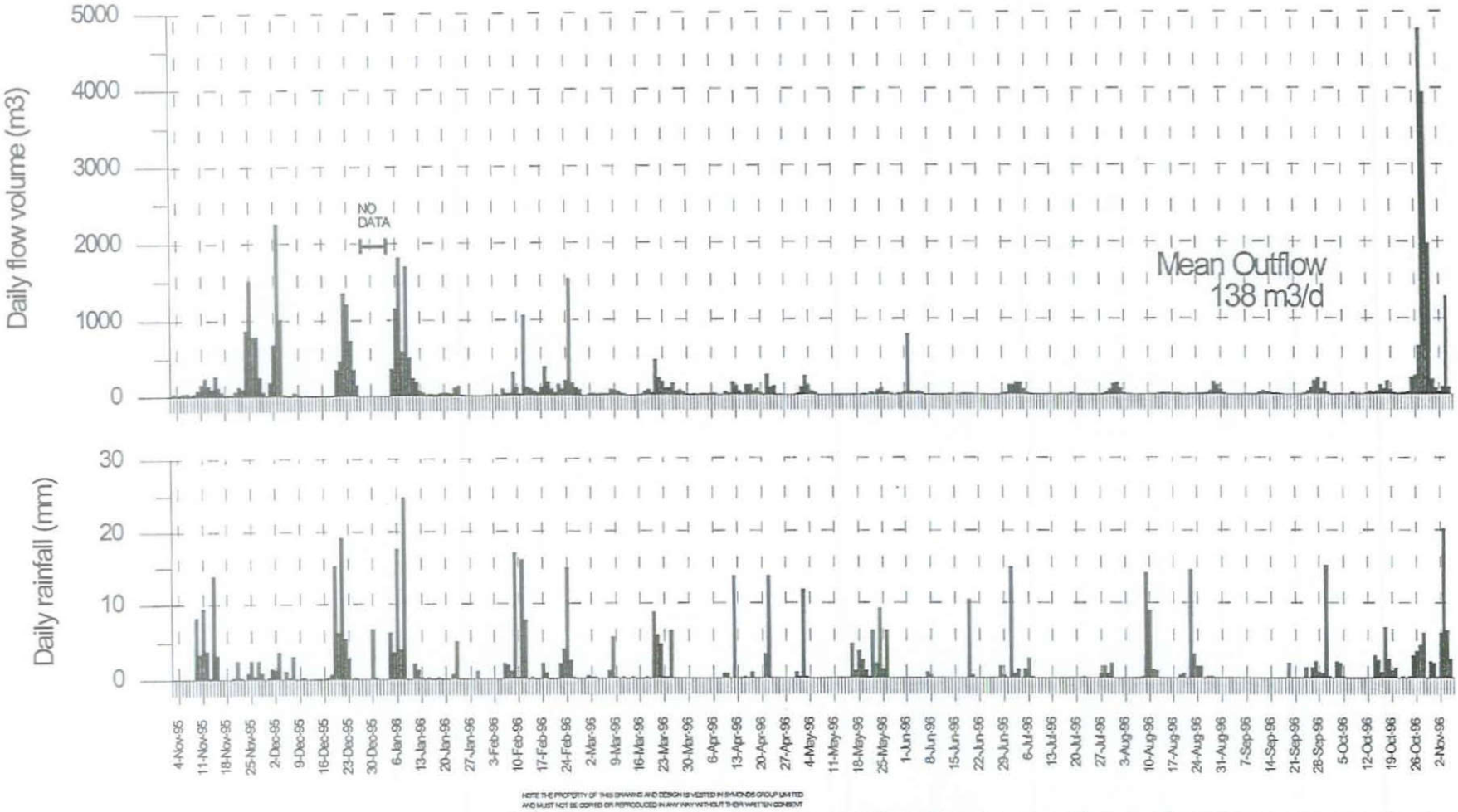
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Outlet valve water depth and flow rates January 1996

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PHE			AUG 1996			Figure 8.6	



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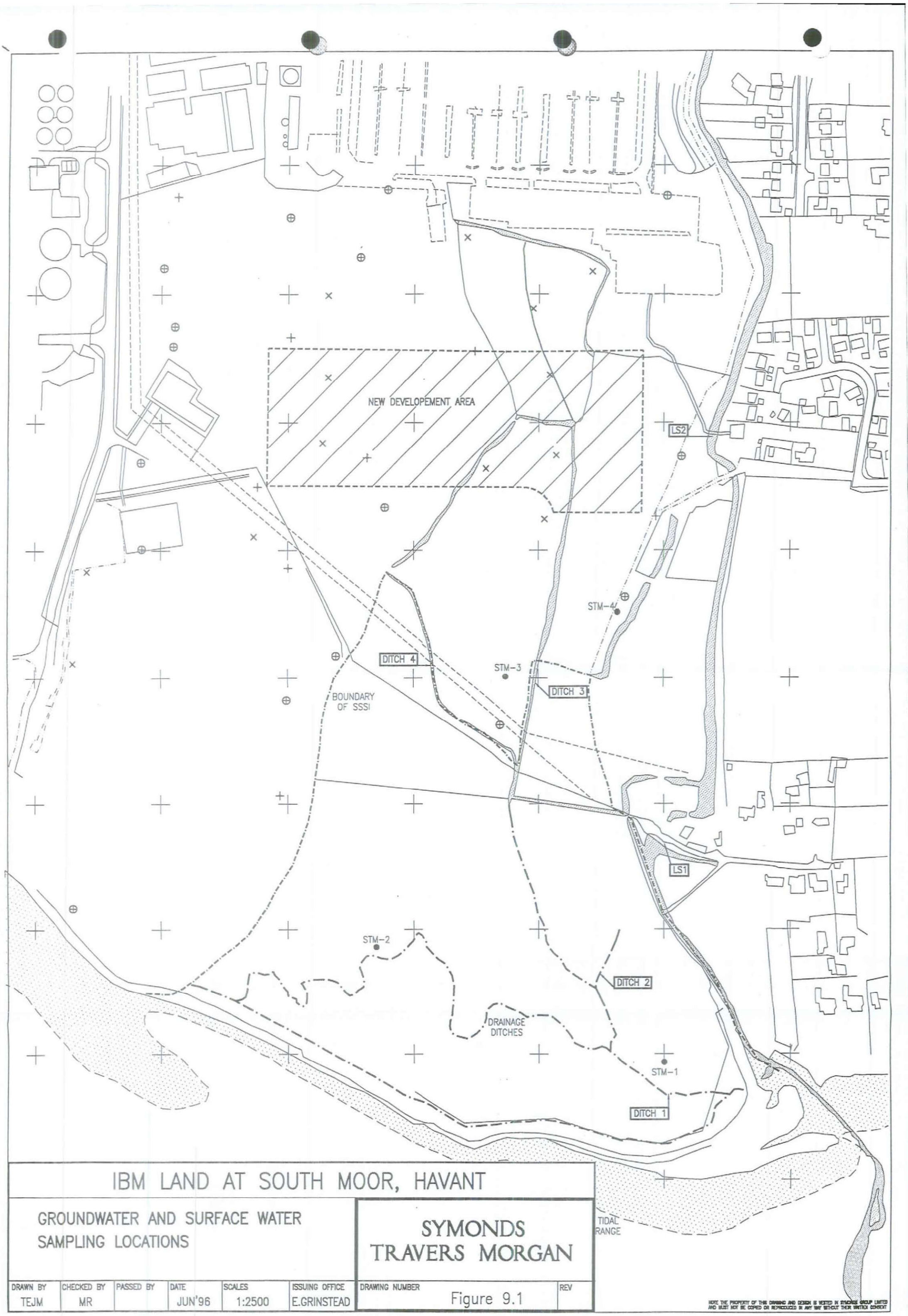
IBM LAND AT SOUTH MOOR, HAVANT

Outlet valve daily flow volumes and rainfall

SYMONDS TRAVERS MORGAN

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PHE			Nov 96		EG	Figure 8.7	

file: FLOWVOL.GRF



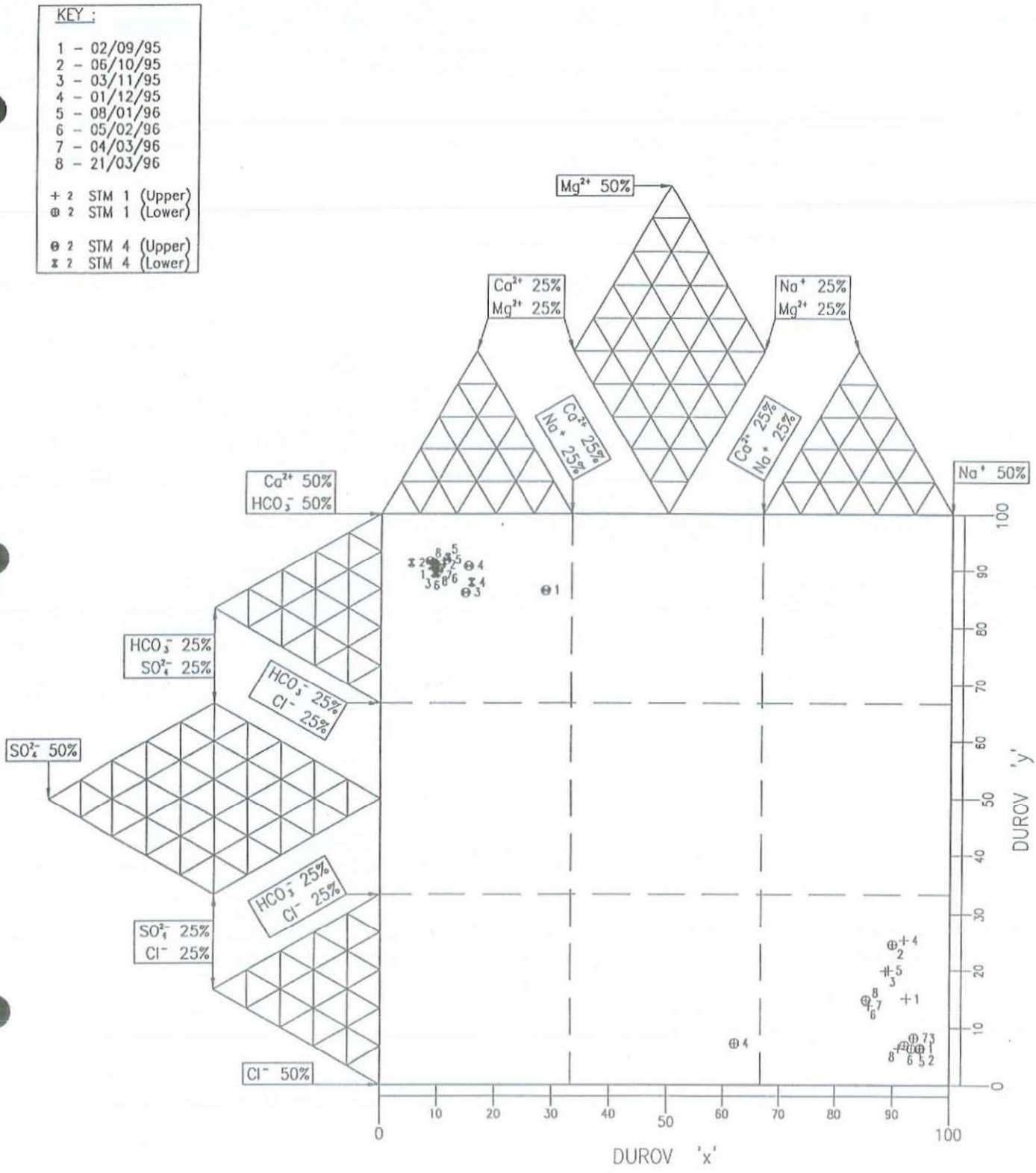
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GROUNDWATER AND SURFACE WATER SAMPLING LOCATIONS

SYMONDS TRAVERS MORGAN

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TEJM	MR		JUN'96	1:2500	E.GRINSTEAD	Figure 9.1	

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HYDROCHEMISTRY
DUROV PLOT FOR BOREHOLES
STM 1 AND STM 4

SYMONDS TRAVERS MORGAN

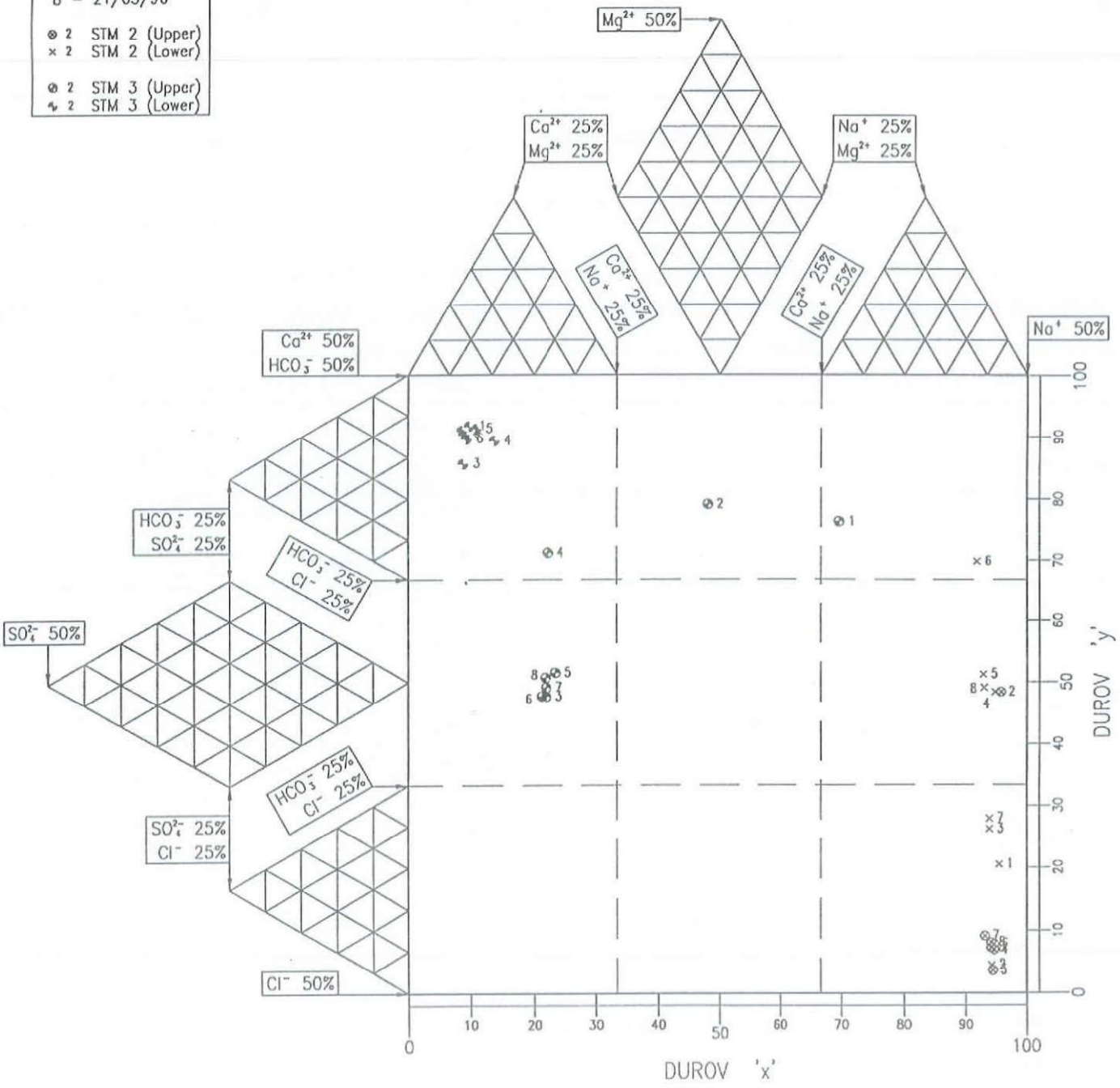
DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A4	ISSUING OFFICE	DRAWING NUMBER	REV
TEJM	MR		JUN.'96	–	E.GRINSTEAD	Figure 9.2	

KEY :

1 – 02/09/95
2 – 06/10/95
3 – 03/11/95
4 – 01/12/95
5 – 08/01/96
6 – 05/02/96
7 – 04/03/96
8 – 21/03/96

⊗ 2 STM 2 (Upper)
× 2 STM 2 (Lower)

⊘ 2 STM 3 (Upper)
∿ 2 STM 3 (Lower)



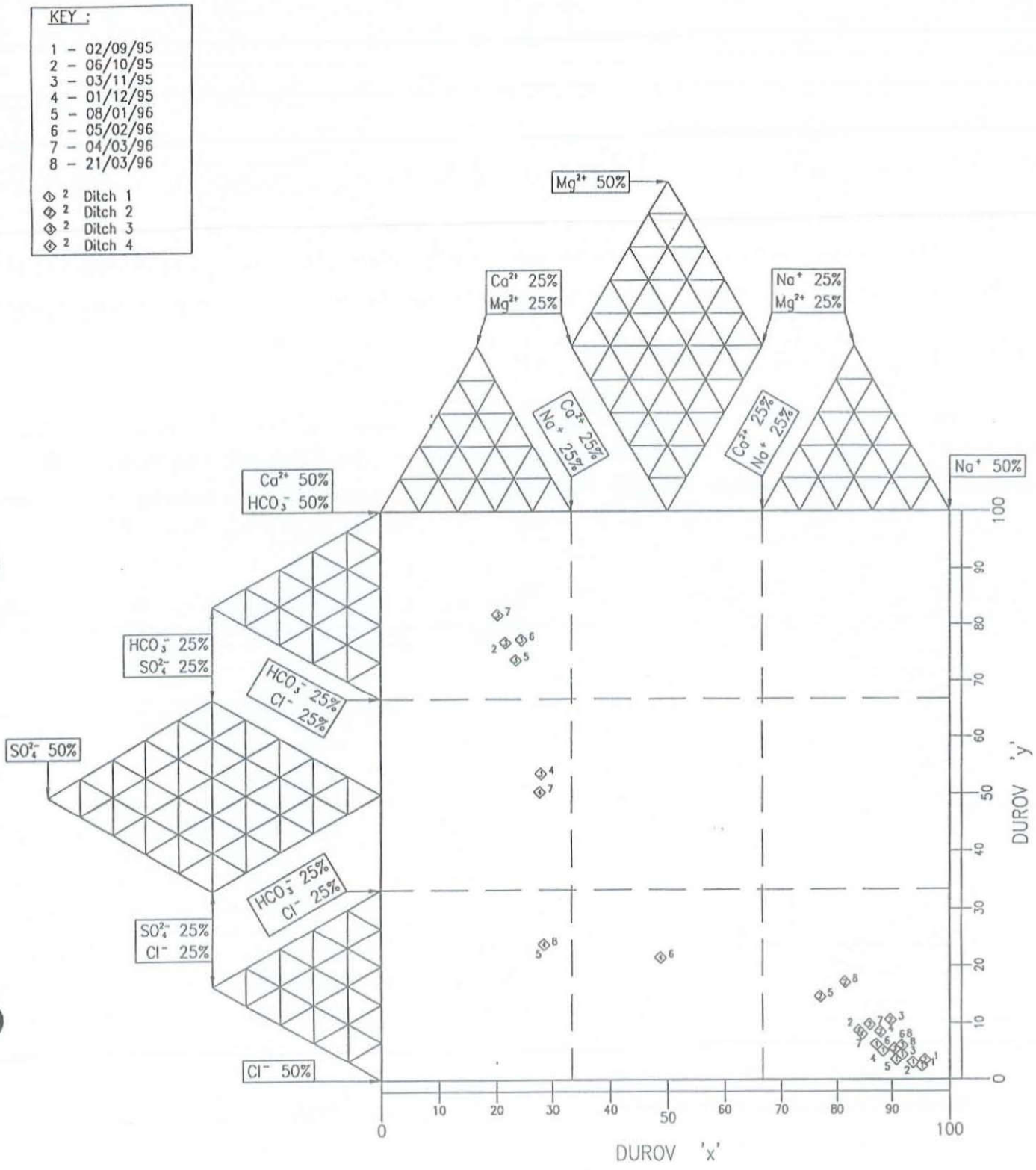
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IBM LAND AT SOUTH MOOR, HAVANT

HYDROCHEMISTRY
DUROV PLOT FOR BOREHOLES
STM 2 AND STM 3

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A4	ISSUING OFFICE	DRAWING NUMBER	REV
TEJM	MR		JUN.'96	–	E.GRINSTEAD	Figure 9.3	



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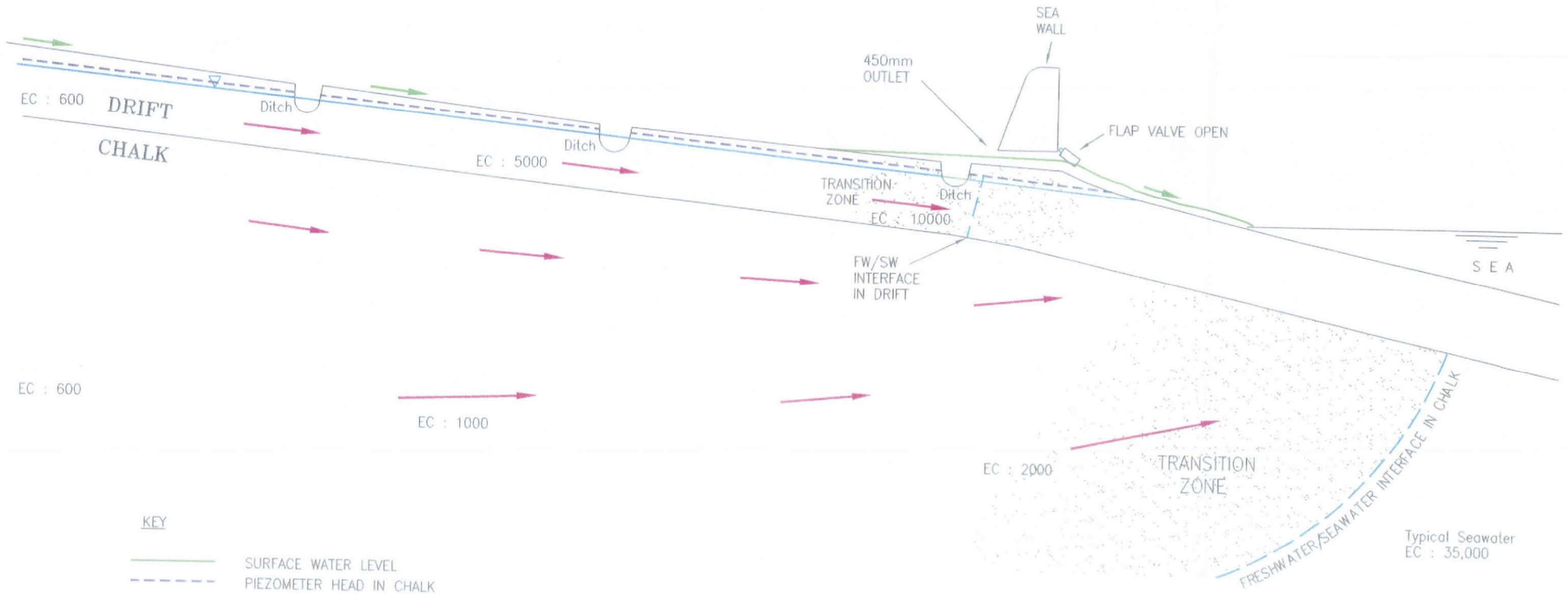
HYDROCHEMISTRY
DUROV PLOT FOR DITCH STATIONS D1, D2, D3 AND D4

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A4	ISSUING OFFICE	DRAWING NUMBER	REV
TEJM	MR		JUN.'96	–	E.GRINSTEAD	Figure 9.4	

N

S



KEY

- SURFACE WATER LEVEL
- PIEZOMETER HEAD IN CHALK
- WATER TABLE IN DRIFT
- GROUNDWATER FLOW
- SURFACE WATER RUNOFF
- FRESHWATER/SEAWATER INTERFACE
- TRANSITION ZONE
- EC : 600 ELECTRICAL CONDUCTIVITY (microSiemens/cm)

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IBM LAND AT SOUTH MOOR, HAVANT

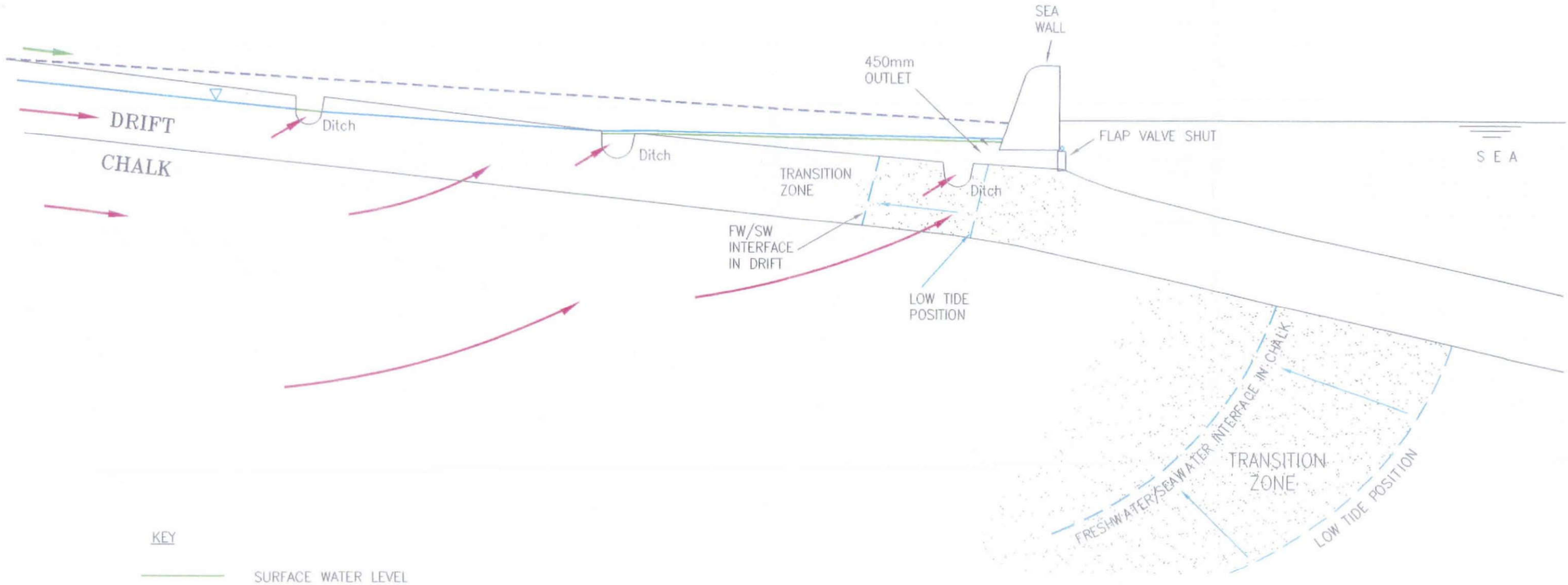
CONCEPTUAL HYDROGEOLOGICAL MODEL
LOW TIDE CONDITION

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
KRD			AUG'96	N.T.S.	E.Grinstead	Figure 10.1	

N

S



KEY

- SURFACE WATER LEVEL
- PIEZOMETER HEAD IN CHALK
- WATER TABLE IN DRIFT
- GROUNDWATER FLOW
- SURFACE WATER RUNOFF
- FRESHWATER/SEAWATER INTERFACE
- TRANSITION ZONE

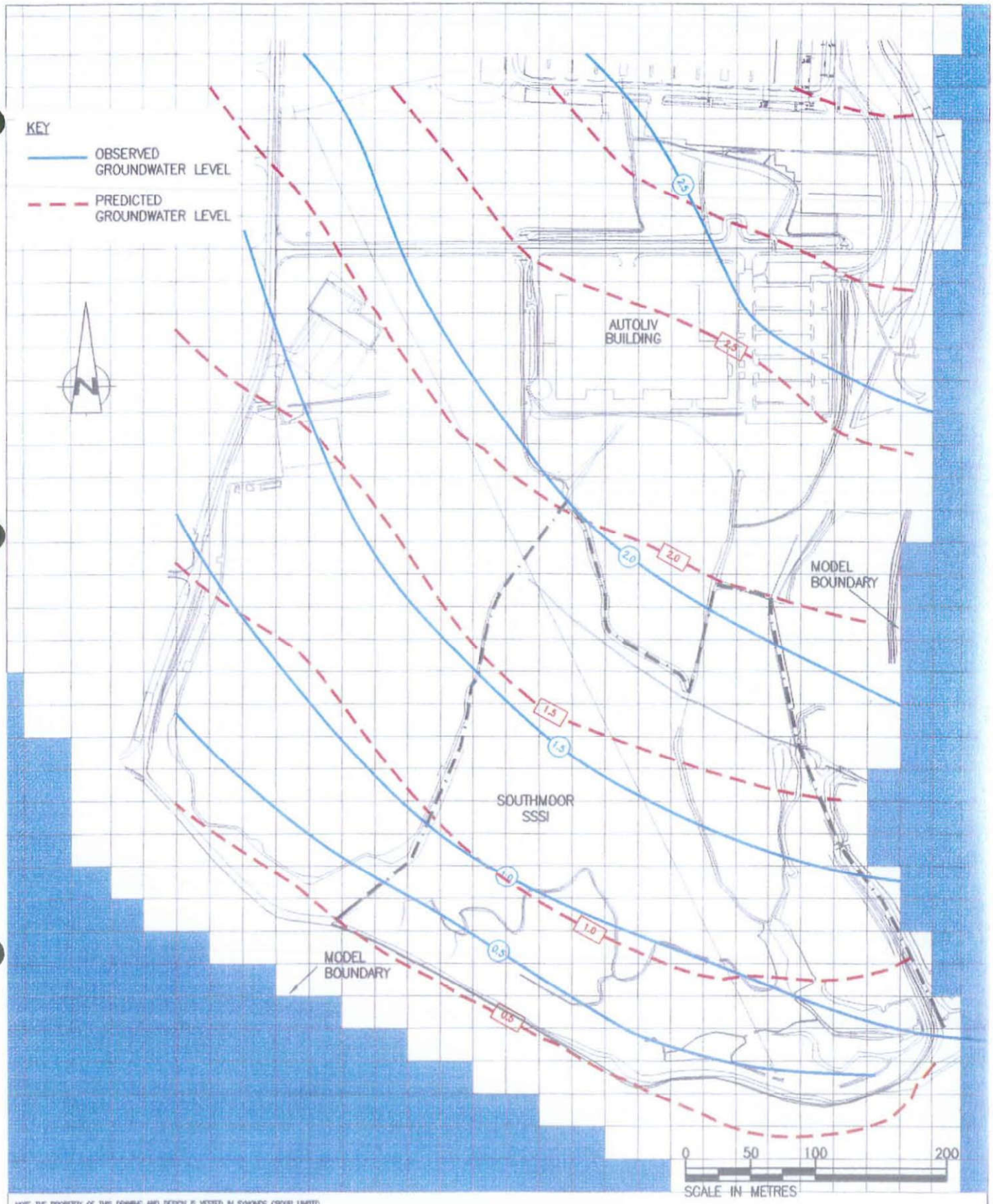
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IBM LAND AT SOUTH MOOR, HAVANT

CONCEPTUAL HYDROGEOLOGICAL MODEL
HIGH TIDE CONDITION

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
KRD			AUG'96	N.T.S.	E.Grinstead	Figure 10.2	



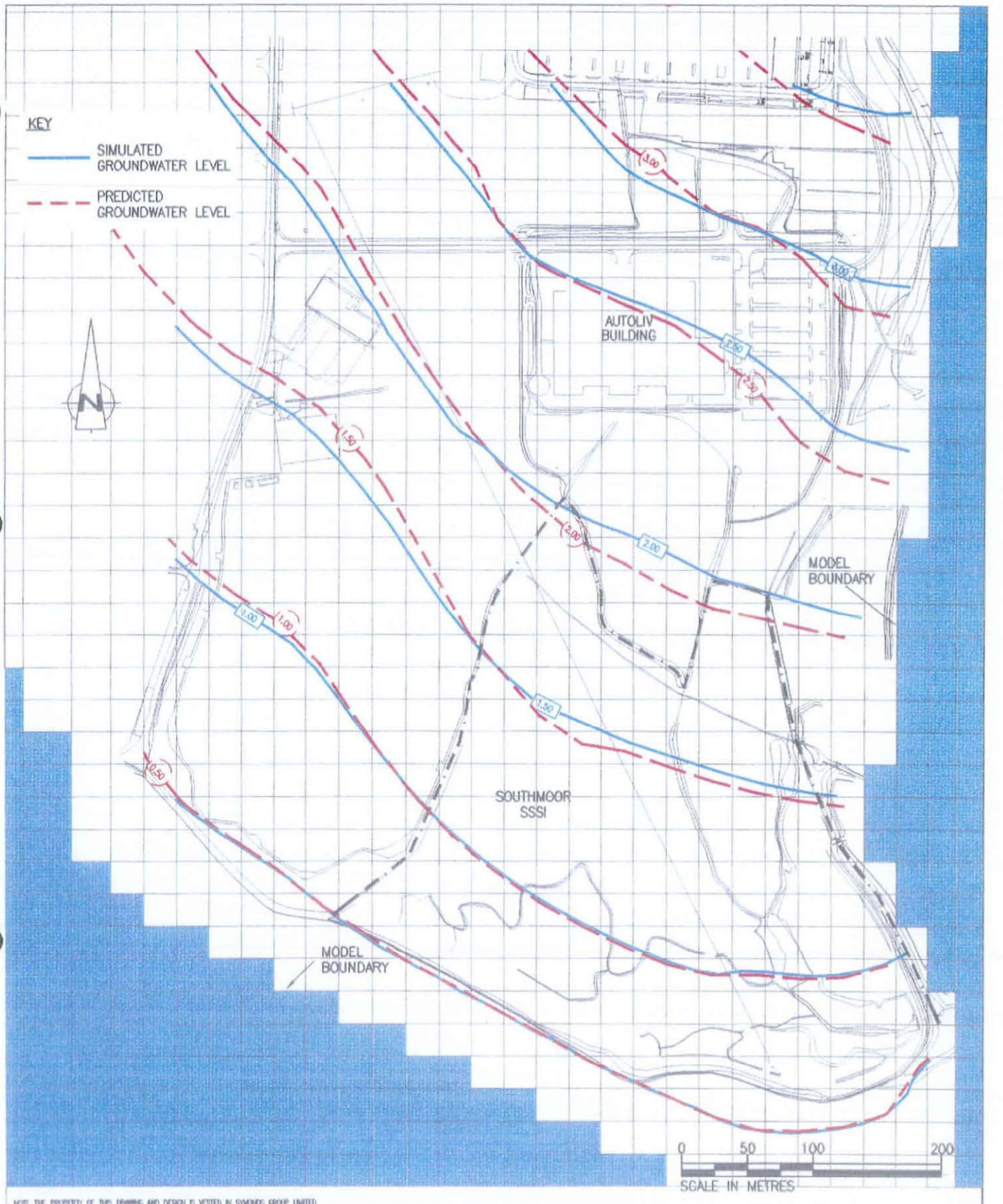
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IBM LAND AT SOUTHMOOR, HAVANT

SIMULATED AND OBSERVED GROUNDWATER CONTOURS

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A4	ISSUING OFFICE	DRAWING NUMBER	REV
GC			17/1/96		E.Grinstead	Figure 11.1	



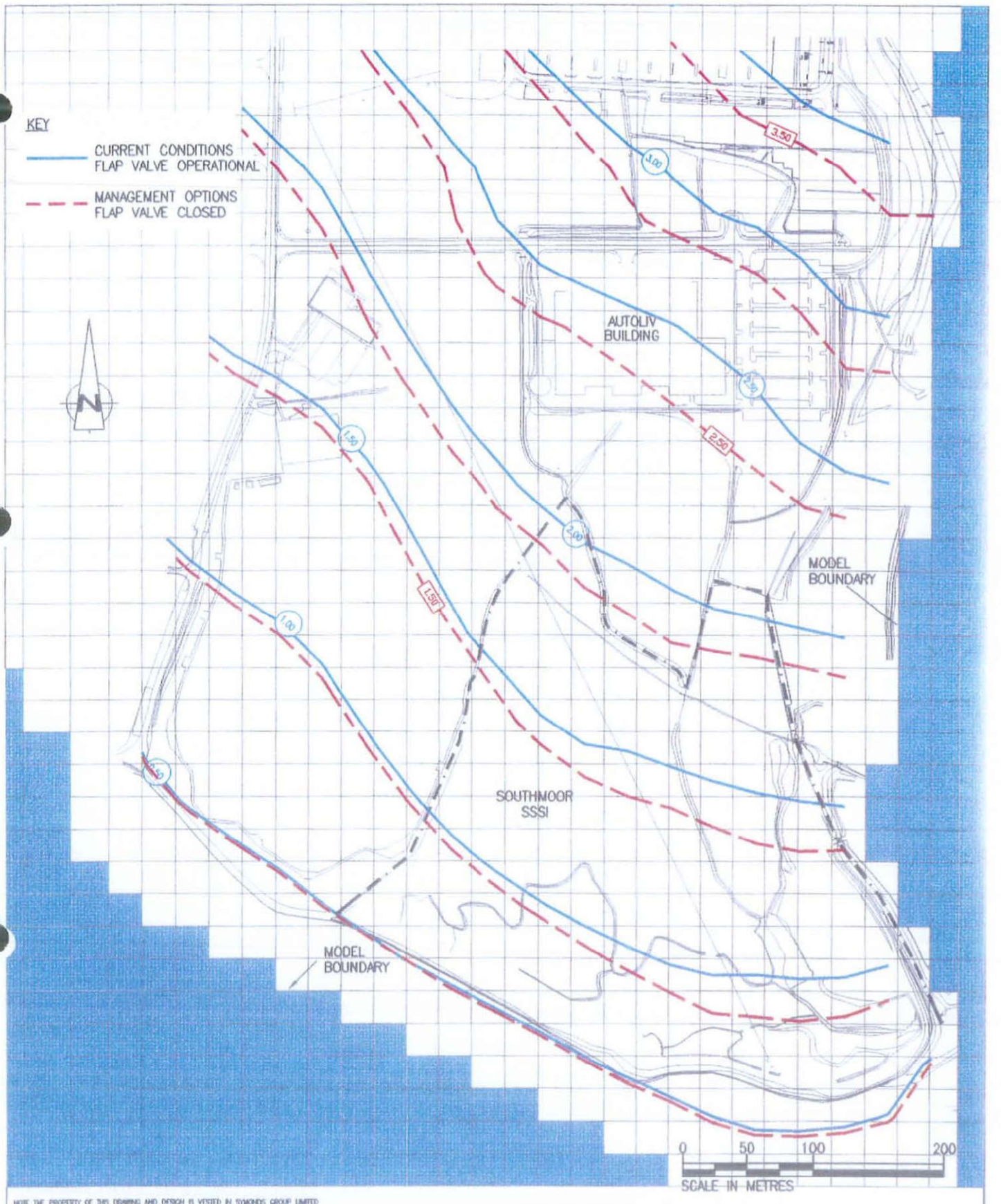
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IBM LAND AT SOUTHMOOR, HAVANT

SIMULATED GROUNDWATER LEVELS AND PREDICTED POST DEVELOPMENT WATER LEVELS

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A4	ISSUING OFFICE	DRAWING NUMBER	REV
GC			17/1/96		E.Grinstead	Figure 11.2	



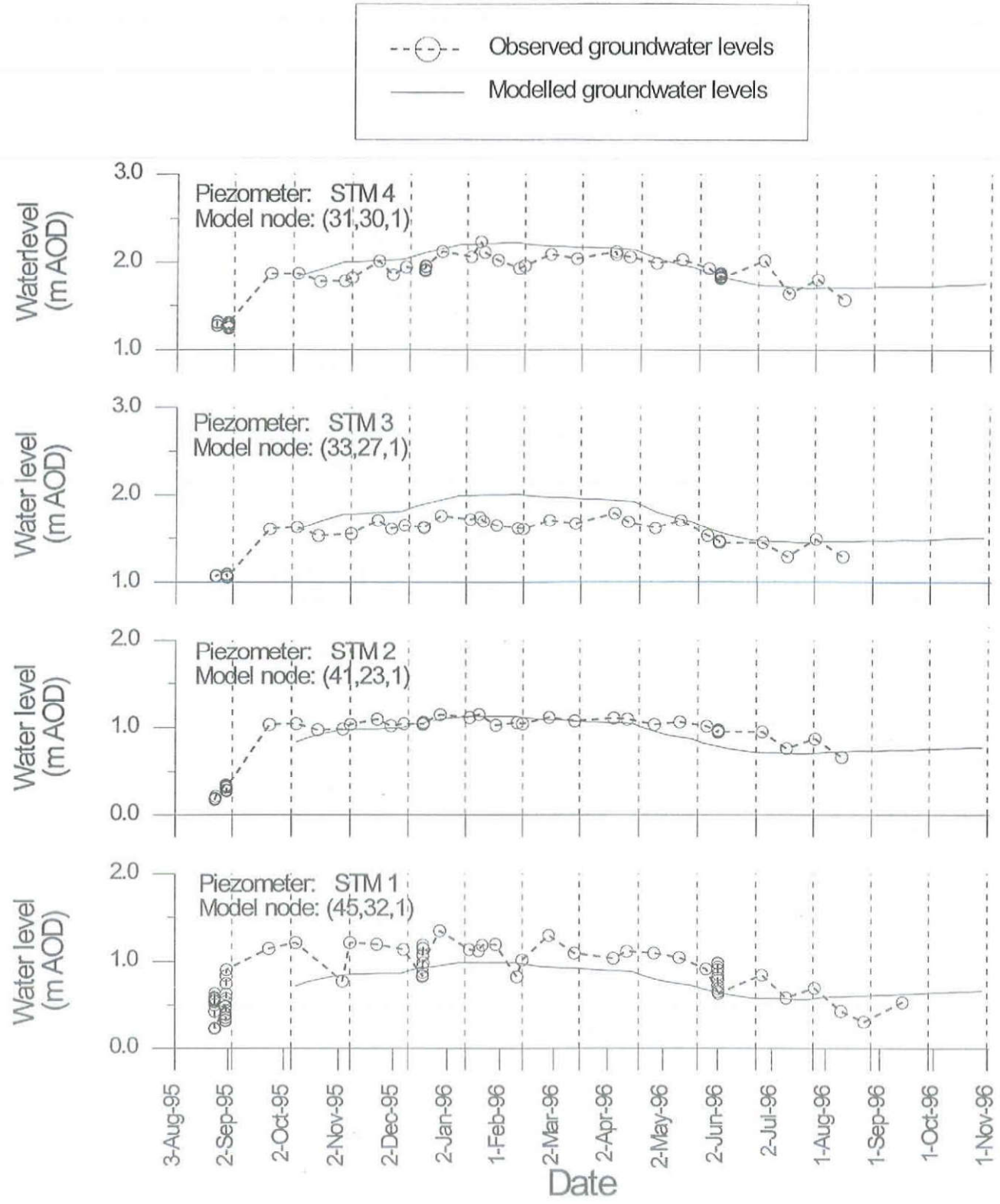
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IBM LAND AT SOUTHMOOR, HAVANT

PREDICTED POST DEVELOPMENT GROUNDWATER LEVELS WITH CLOSED VALVE OPTION

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A4	ISSUING OFFICE	DRAWING NUMBER	REV
GC			24/2/96		E.Grinstead	Figure 11.2B	



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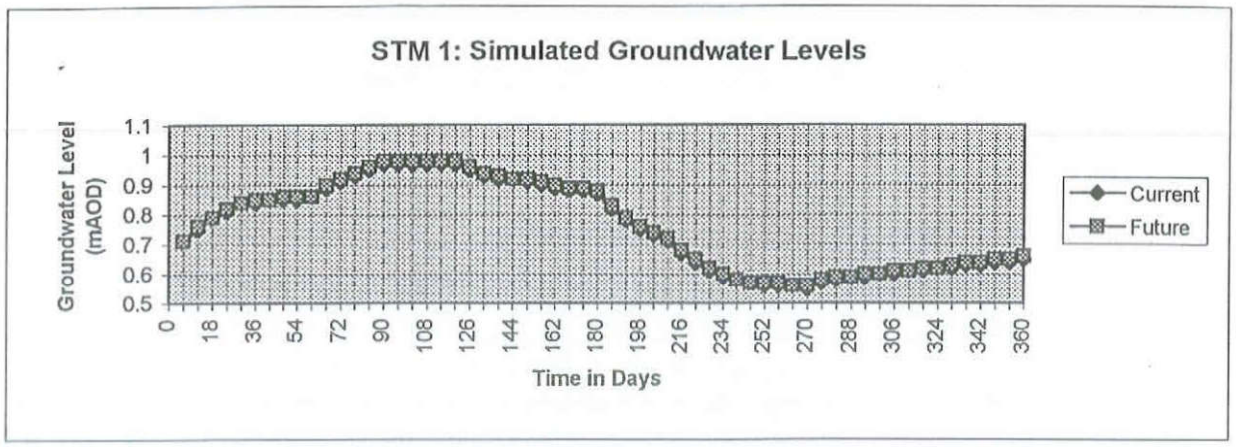
IBM LAND AT SOUTH MOOR, HAVANT

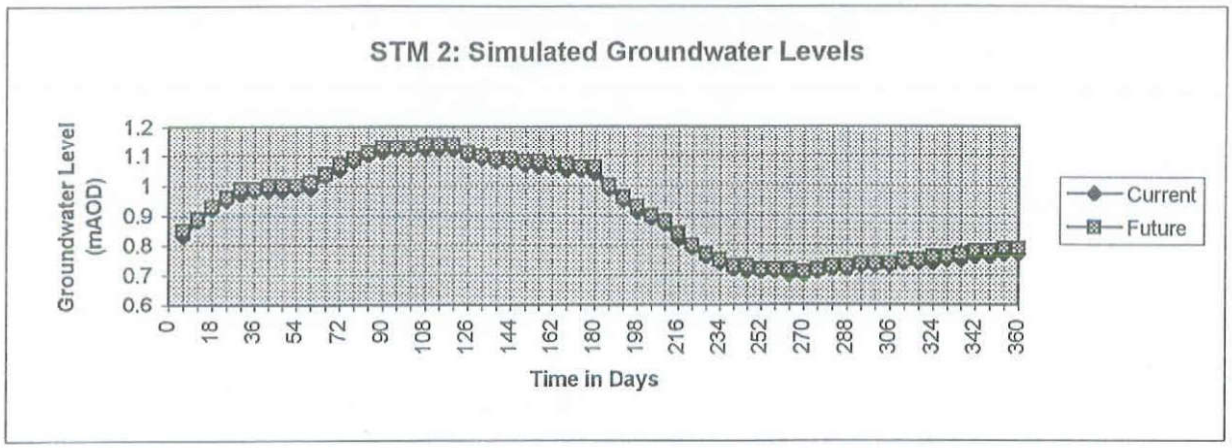
Observed and modelled groundwater levels in the Drift (Layer 1)

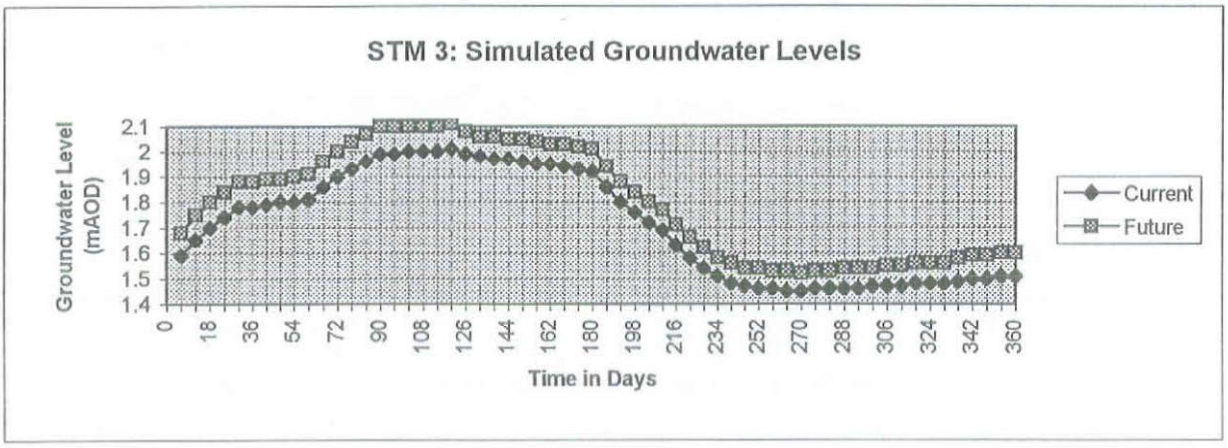
SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A4	ISSUING OFFICE	DRAWING NUMBER	REV
PHE			Dec 96		EG	Figure 11.3	

40004/data/model/mod_11-3.grf







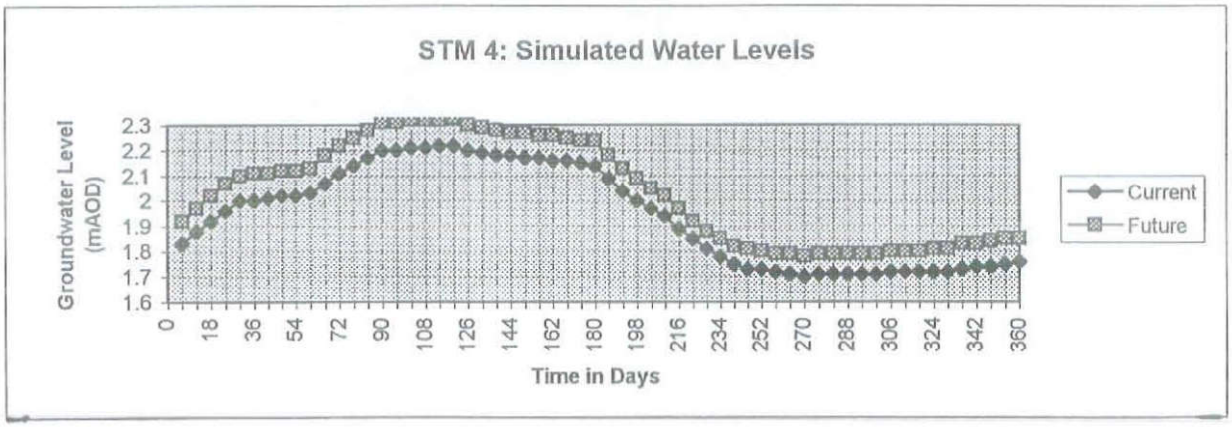
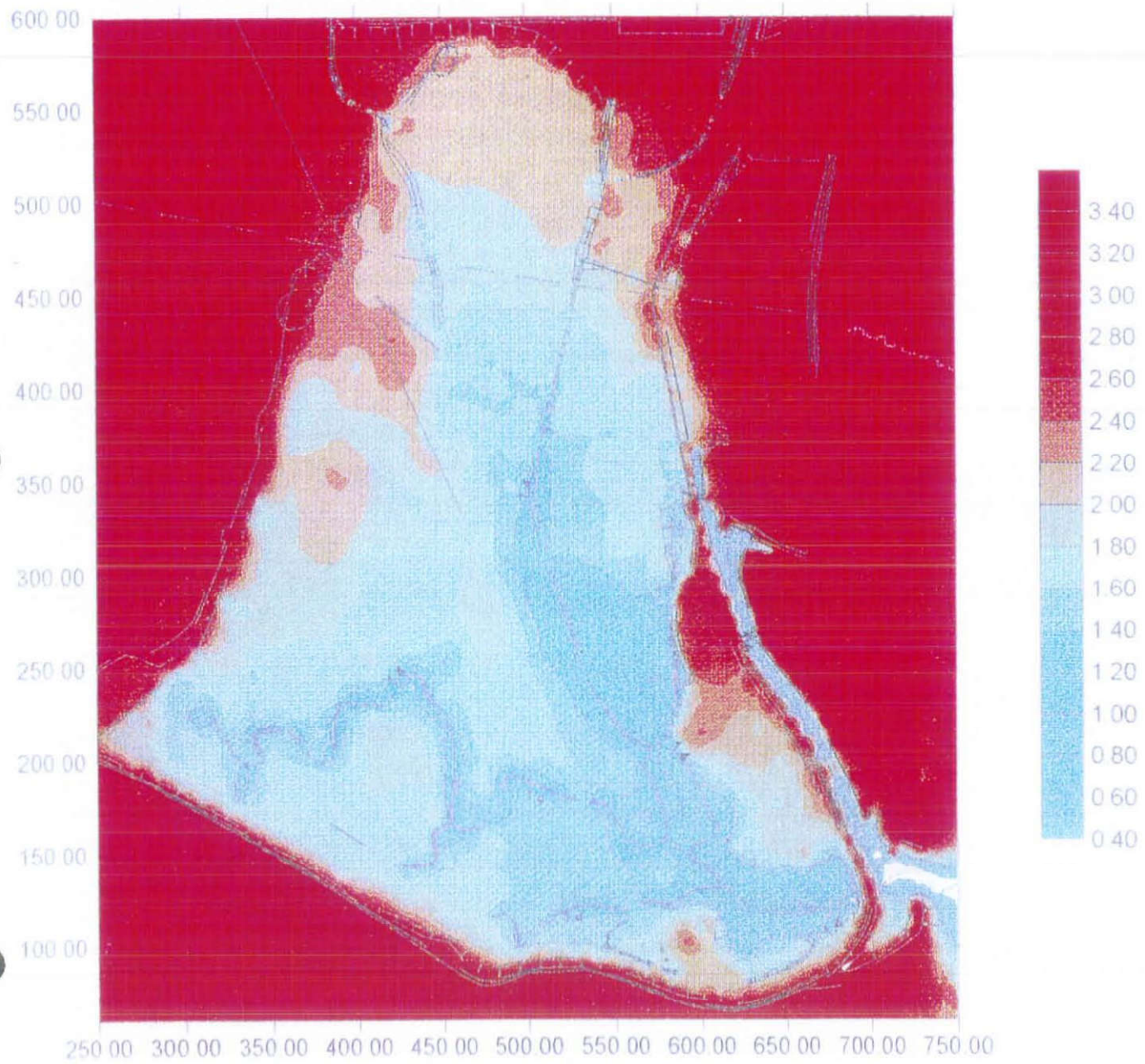


Figure 11.4: Simulated Current and Future Groundwater Levels

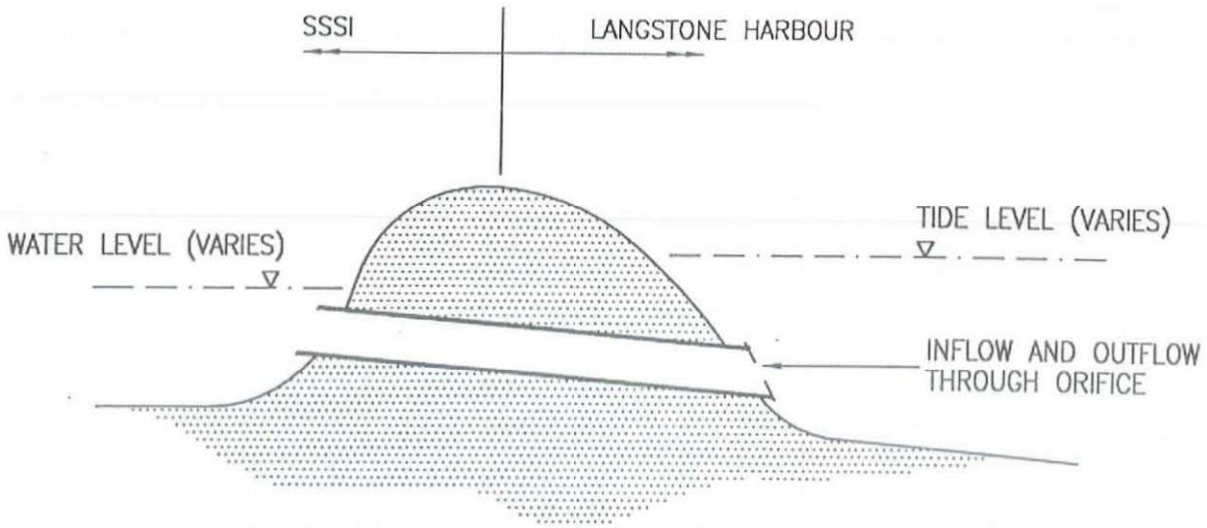


LAND AT SOUTH MOOR - WETLAND STUDY

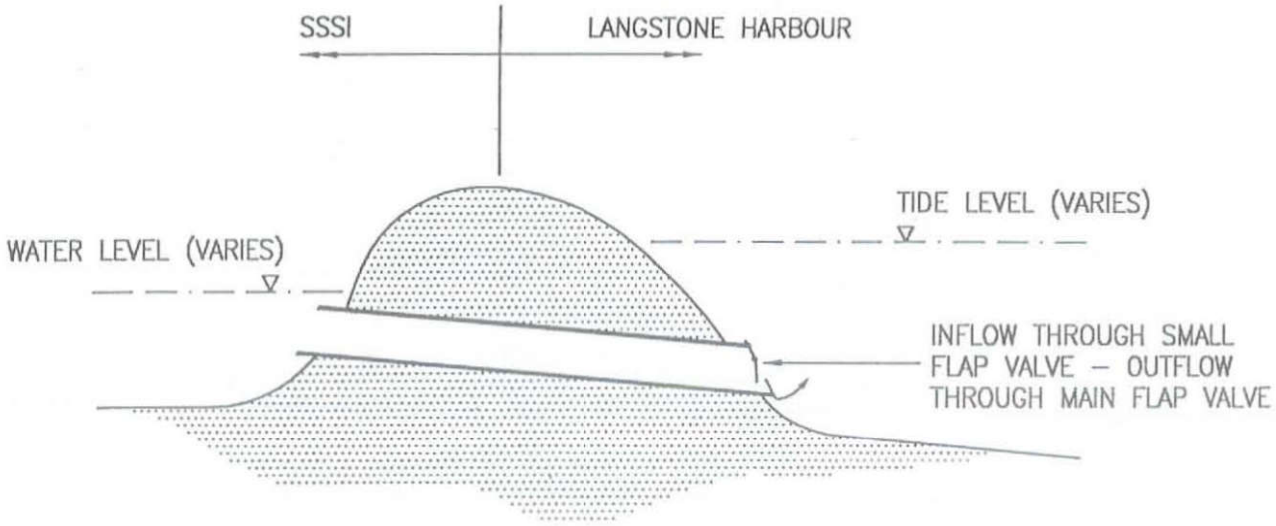
Management Options - Peak water level at spring tide (1 4m) with existing 450mm outlet pipe and no flap valve Extent of ponding shown in pale blue and contoured

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PROJECT NO	DATE	SCALE @ A4	DRAWING STATUS	DRAWING NUMBER	REV
MKR			03/97		EG	FIGURE 12 1	



OPTION 1 – MAIN FLAP VALVE MODIFIED TO INCLUDE A SIMPLE ORIFICE



OPTION 1 – MAIN FLAP VALVE MODIFIED TO PERMIT INFLOW ONLY THROUGH ORIFICE

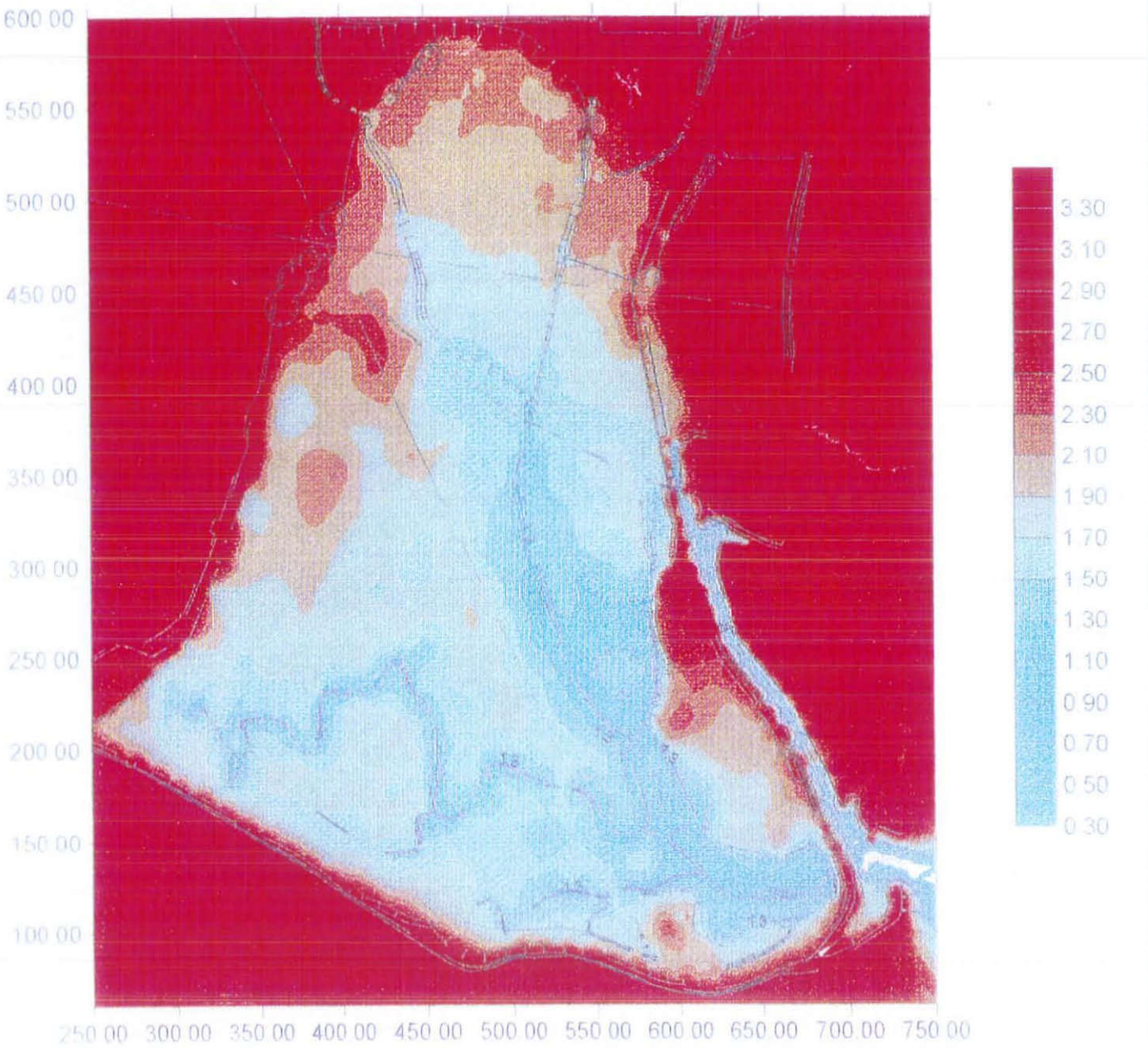
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LAND AT SOUTHMOOR, HAVANT

SCHEMATIC PROPOSALS FOR MODIFICATION OF FLAP VALVE

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A4	ISSUING OFFICE	DRAWING NUMBER	REV
GC			MAR'97	N.T.S	E.Grinstead	FIGURE 12.2	

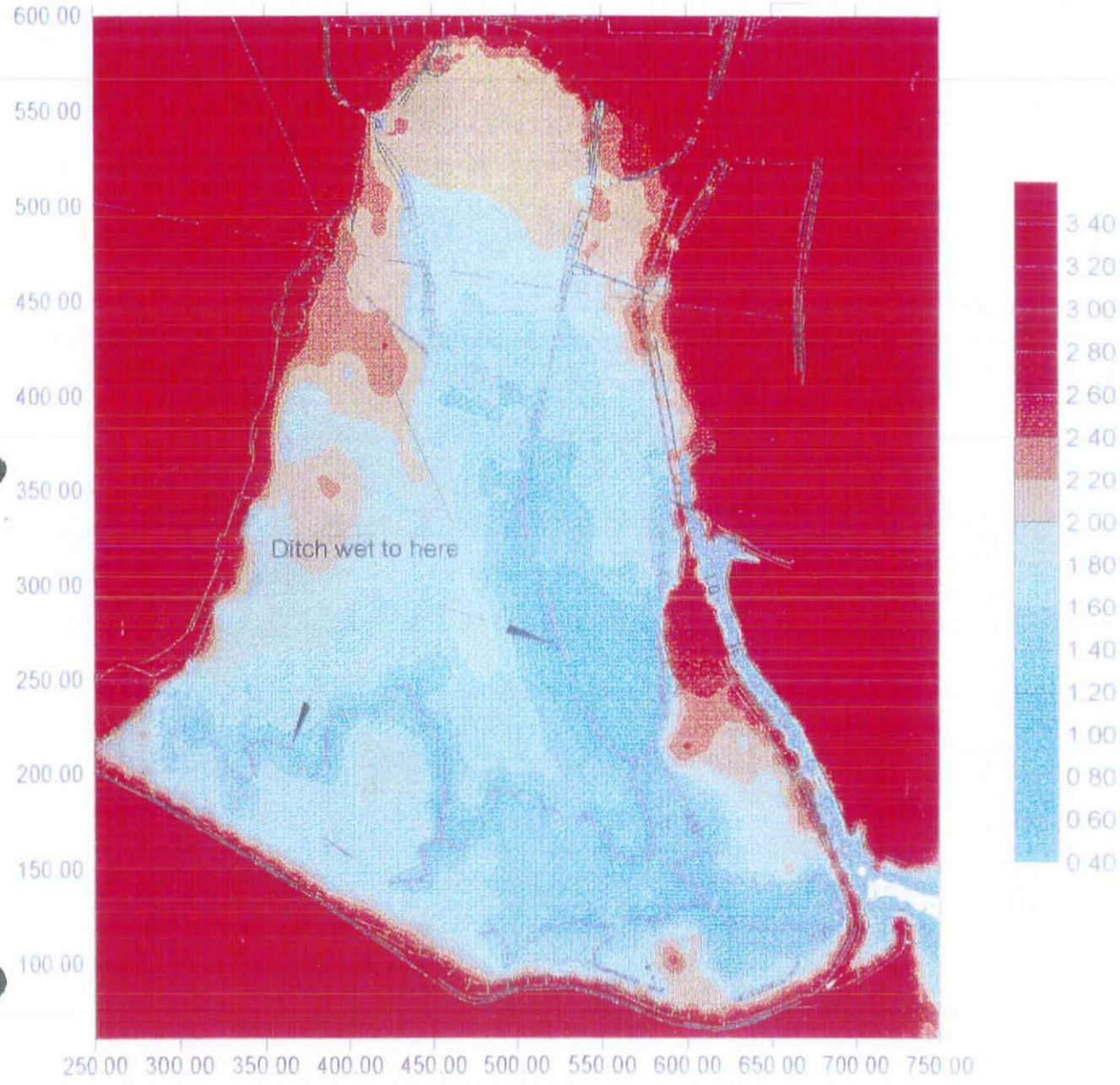


LAND AT SOUTH MOOR - WETLAND STUDY

Management Options - Peak water level at spring tide (1 30m) with 320mm inlet flap within larger diameter reverse flap Extent of ponding shown in pale blue and contoured

SYMONDS TRAVERS MORGAN

DRAWN	DESIGNED	CHECKED	DATE	SCALE @ A3	DRAWING STATUS	DRAWING NUMBER	REV
MHR			03/97		EG	FIGURE 12 3	

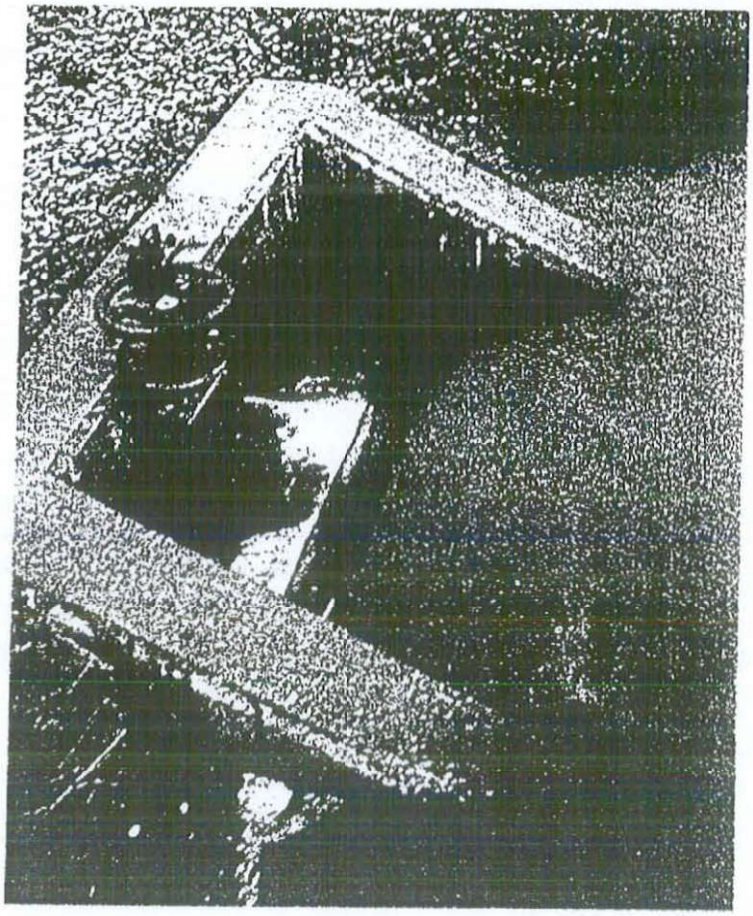


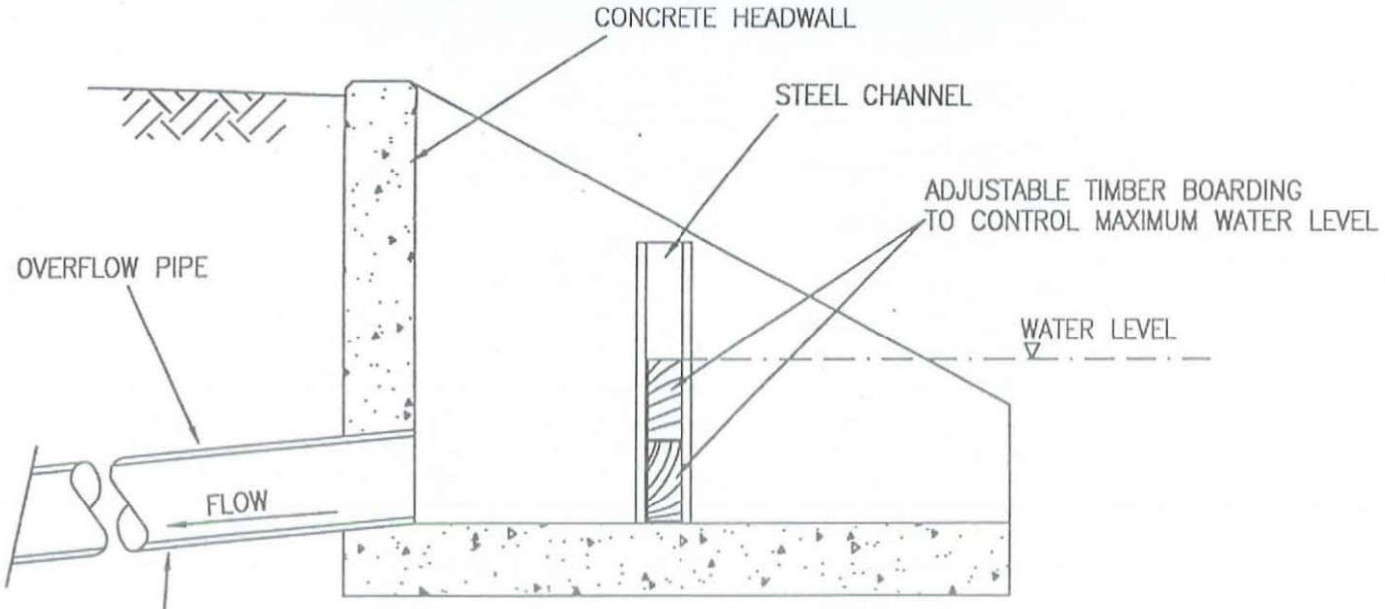
LAND AT SOUTH MOOR - WETLAND STUDY

Management Options - Peak water level at spring tide (0.99m) with 150mm inlet flap and larger reverse flap
Extent of ponding shown in pale blue and contoured

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A1	SOURCE FILE	DRAWING NUMBER	REV
MKR			03/97		EG	FIGURE 12.4	





SCHEMATIC SECTION THROUGH
OUTFALL STRUCTURE

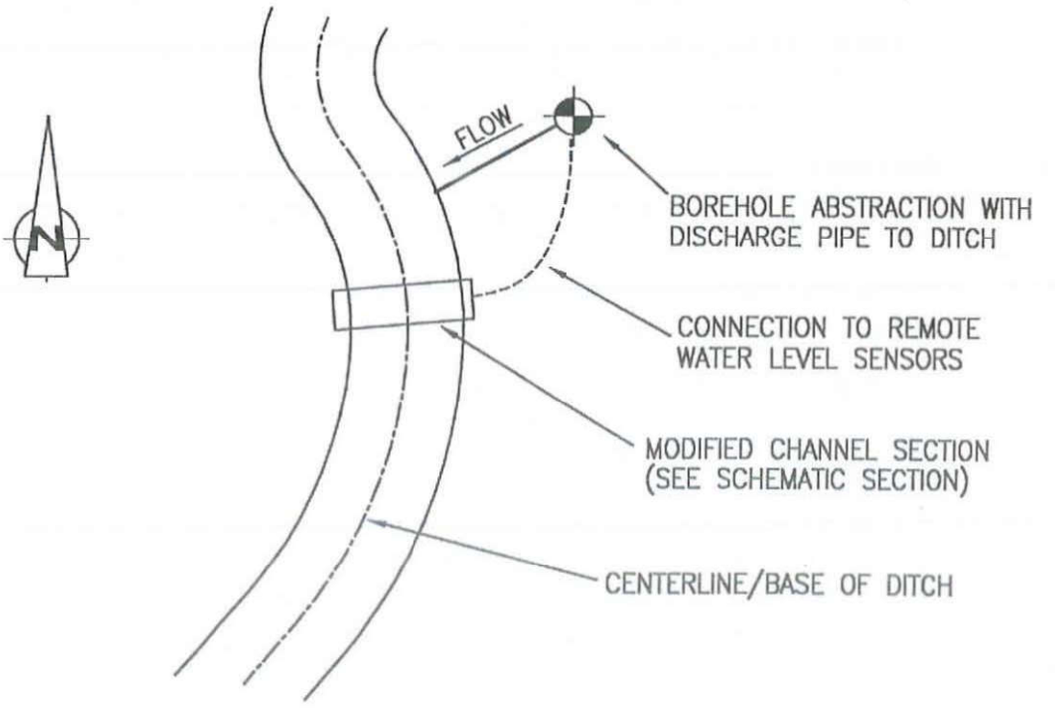
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LAND AT SOUTHMOOR, HAVANT

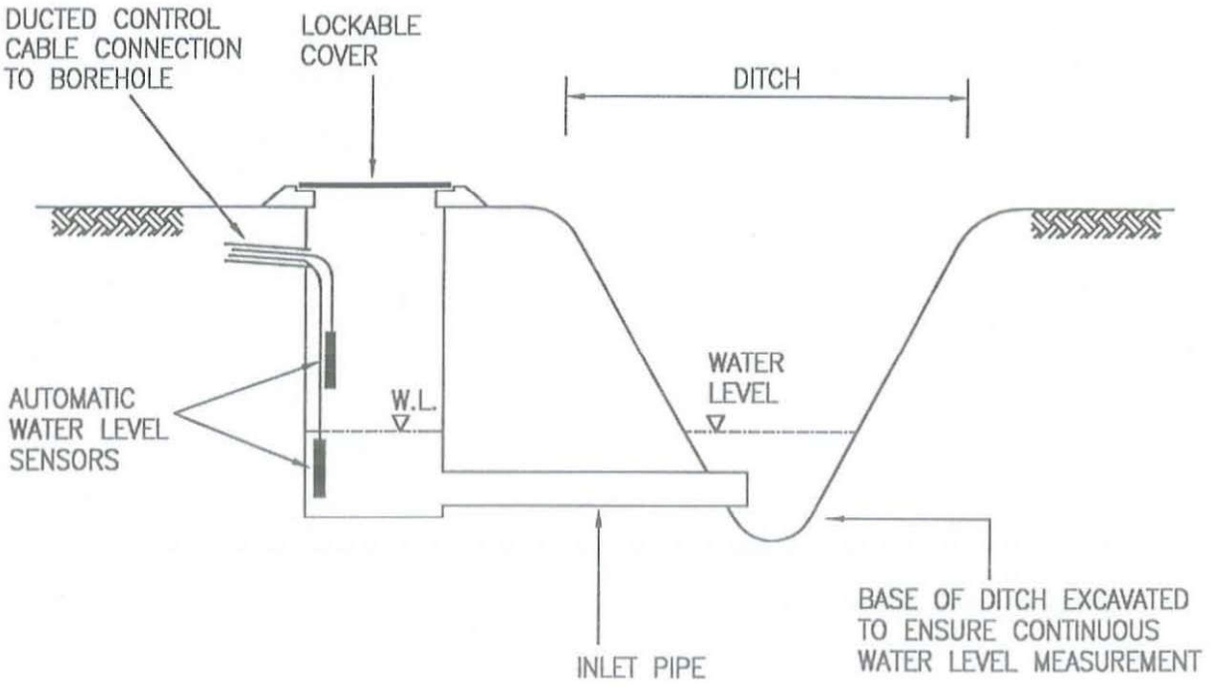
PROPOSED STRUCTURE TO
MAINTAIN WATER LEVELS

SYMONDS
TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A4	ISSUING OFFICE	DRAWING NUMBER	REV
GC			MAR'97	N.T.S	E.Grinstead	FIGURE 12.5	



SCHEMATIC PLAN ON DITCH



SCHEMATIC SECTION THROUGH DITCH AND LEVEL SENSOR CHAMBER

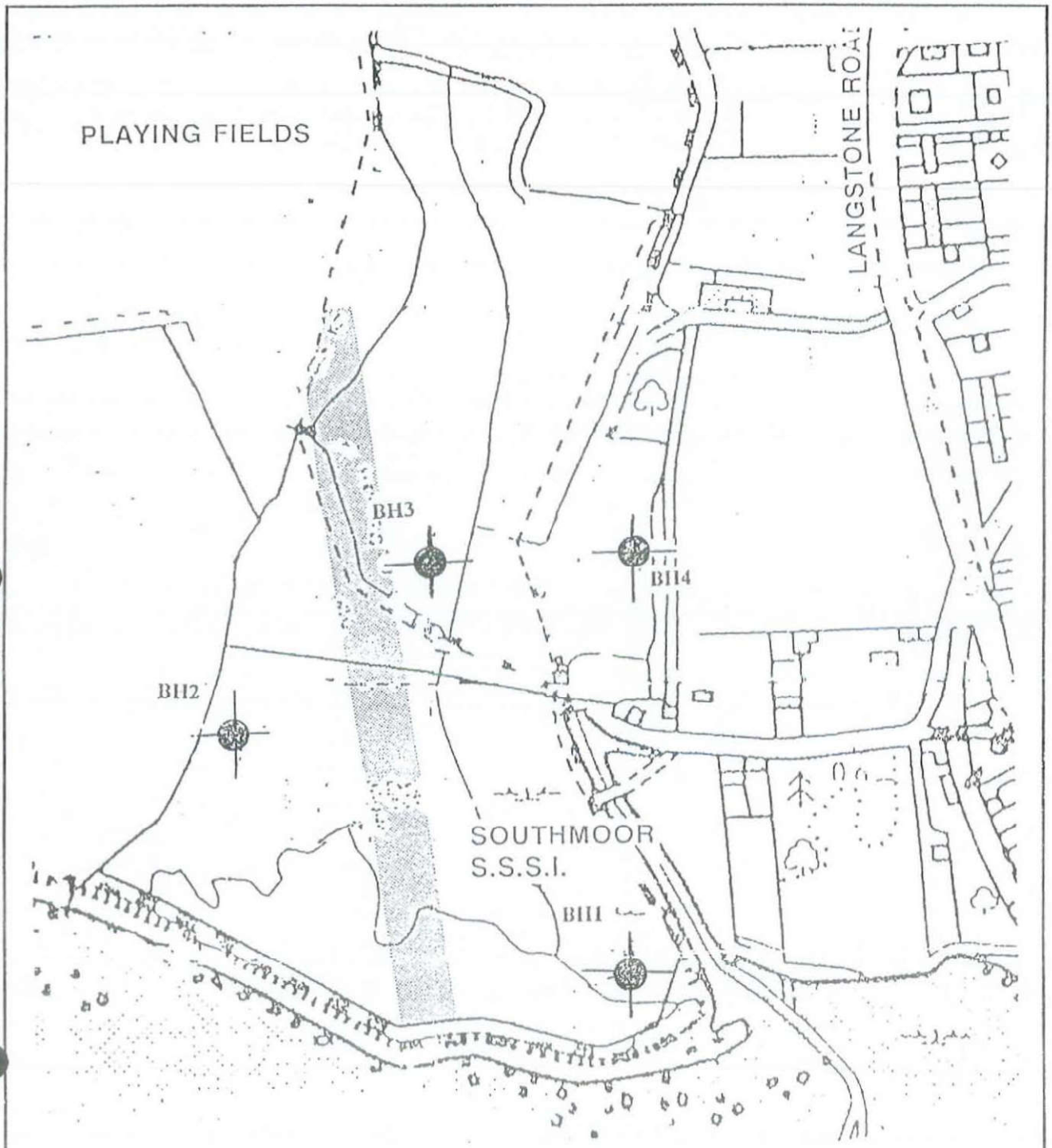
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LAND AT SOUTHMOOR, HAVANT

SCHEMATIC BOREHOLE PLAN WITH DITCH AMENDED FOR LEVEL MONITORING

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A4	ISSUING OFFICE	DRAWING NUMBER	REV
GC			MAR'97	N.T.S	E.Grinstead	FIGURE 12.6	



PROJECT South Moor SSSI, Havant	DATE September 1995	PLANT SHELL & AUGER BOREHOLE
CLIENT Symonds Travers Morgan		
Borehole Location	REF: J4014	Fig. No. 1

SAMPLING/IN-SITU TESTING								DESCRIPTION OF STRATA	STRATA			
Depth (m)	Type	Penetration Blows					N		Legend	Reduced Level	Depth m	Thick-ness m
										1.292		
.2	B							Grass over clayey topsoil		1.092	.2	.2
								Brown clayey GRAVEL		0.542	.75	.55
1.8	B							Soft brown grey mottled silty CLAY with some fine to medium gravel.		-0.508	1.8	1.05
								Light grey chalky clayey sandy well-graded GRAVEL		-1.708	3	1.2
3.5	B							Grey remoulded CHALK with fragments of intact chalk and occasional flints		-3.208	4.5	1.5
								Off-white CHALK with occasional flints				5.5
								Borehole terminated at 10m.bgl		-8.708	10	

Notes: Double standpipe installed to 2.9m & 4.3m Rising head test undertaken to Engineers instruction

Ground Water Record

Date	Time	B-Hole (m)	Casing (m)	Strike (m)	Stand (m)	Time
07-08-95	am	5.9	5.0	5.9	3.34	30min
07-08-95	pm	10.0	8.00	-	8.8	20b

Chiselling Record

T (hrs)	From (m)	To (m)

Casing

Diam.	Depth (m)
150mm	8.0

PROJECT South Hoor SSSI, Havant	DATE August 1995	DIAM 150mm
CLIENT Symonds Travers Morgan	REF J4014	BH 1 (STM1) SHEET 1 OF 1
Cable Percussion BH Log	OJ: 38: 00100: 0SPT	Engineer / Checked

SAMPLING/IN-SITU TESTING								DESCRIPTION OF STRATA	STRATA			
Depth (m)	Type	Penetration Blows					N		Legend	Reduced Level	Depth m	Thick -ness m
										1.753		
								Grass over clayey topsoil				.6
										1.153	.6	
								Firm brown grey mottled silty CLAY				.8
1.5	B									0.353	1.4	
										0.253	1.5	.1
2	B							Grey brown silty CLAY with some flint gravel				
								Light grey chalky sandy very silty medium to coarse flint GRAVEL with medium to coarse fragments of intact chalk				3.5
3	B									-3.247	5	
								Off-white CHALK with occasional flints				5
										-8.247	10	
								Borehole terminated at 10m.bgl				

Notes: Twin standpipes installed at 8.5m & 4.7m.bgl Rising and falling head tests undertaken to engineers instruction

Ground Water Record

Date	Time	B-Hole(m)	Casing(m)	Strike(m)	Stand(m)	Time
08-08-95	am	2.0	none	2.0	1.75	30min
08-08-95	pm	8.8	7.0	8.8	8.8	30min
08-08-95	eob	10.0	8.50	-	9.1	

Chiselling Record

T(hrs)	From(m)	To(m)

Casing

Diam.	Depth(m)
150mm	8.5

PROJECT South Hoor SSSI, Havant	DATE August 1995	DIAM 150mm
CLIENT Symonds Travers Morgan	REF J4014	BH 2 (STM2) SHEET 1 OF 1
Cable Percussion BH Log	OJ: 38: 00100: 06PT	Engineer / Checked

SAMPLING/IN-SITU TESTING							DESCRIPTION OF STRATA	STRATA			
Depth (m)	Type	Penetration Blows				N		Legend	Reduced Level	Depth m	Thick-ness m
									1.952		
							Grass over claybound gravel				1.2
1	B								0.652	1.2	
1.5	B						Brown clayey sandy very silty flint GRAVEL		0.252	1.6	.4
2.1	B								-0.348	2.2	.6
							Pale grey chalky sandy very silty clayey well-graded GRAVEL				
3	B						Pale grey chalky silty clayey sandy well-graded GRAVEL				3
									-3.348	5.2	
							Off-white CHALK with occasional flints				4.8
									-8.148	10	
							Borehole terminated at 10m.bgl				

Notes: Twin standpipes installed at 9.8m & 1.7m.bgl Rising head tests made at 1.7m & 9.8m to Engineers instruction

Ground Water Record

Date	Time	B-Hole(m)	Casing(m)	Strike(m)	Stand(m)	Time
09-08-95	am	1.7	none	1.7	0.66	30min
09-08-95	pm	9.8	9.0	9.8	5.4	30min
09-08-95	eob	10.0	9.0	-	5.4	eob

Chiselling Record

T(hrs)	From(m)	To(m)
1	0	1

Casing

Diam.	Depth(m)
150mm	9.0

PROJECT South Hoor SSSI, Havant

DATE August 1995

DIAM 150mm

CLIENT Symonds Travers Morgan

REF J4014

BH 3 (STM3)

SHEET 1 OF 1

Cable Percussion BH Log

OJ: 4B: 0U100: 0SPT

Engineer

Checked

SAMPLING/IN-SITU TESTING			DESCRIPTION OF STRATA	STRATA			
Depth (m)	Type	Penetration Blows N		Legend	Reduced Level	Depth m	Thick -ness m
					2.561		.5
			Grass over clayey gravel		2.061	.5	.9
			Brown grey mottled clayey GRAVEL		1.161	1.4	.5
1.4	B		Light brown sandy very silty clayey GRAVEL		0.661	1.9	1.3
			Brown grey mottled silty CLAY with fine flint gravel and fragments of chalk		-0.639	3.2	.9
			Grey chalky silty CLAY with occasional flint gravel and fragments of intact chalk		-1.539	4.1	1.3
4.1	B		Pale grey chalky sandy very silty clayey well-graded flint GRAVEL		-2.839	5.4	4.6
			Off-white CHALK with occasional flints		-7.439	10	
			Borehole terminated at 10m.bgl				

Notes: Twin standpipes installed at 5.0m & 9.5m.bgl Falling & rising head tests unmade at 1.65m & 4.2m to Engineers instruction

Ground Water Record

Date	Time	B-Hole(m)	Casing(m)	Strike(m)	Stand(m)	Time
10-08-95	am	4.2	4.0	4.2	3.35	30min
10-08-95	pm	8.8	7.0	8.8	6.8	30min
10-08-95	eob	10.0	9.0	-	8.3	eob

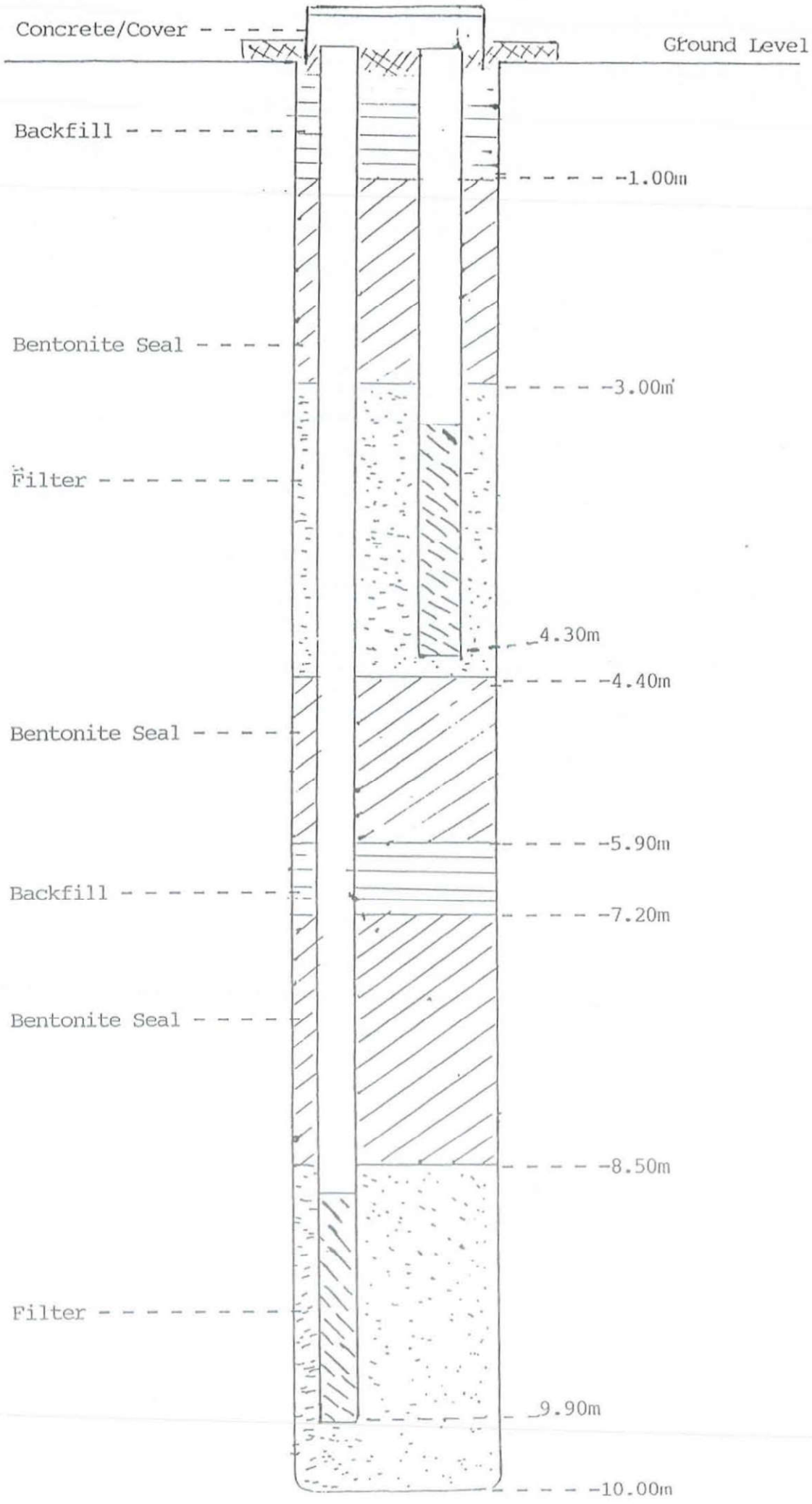
Chiselling Record

T(hrs)	From(m)	To(m)
1	0	1

Casing

Diam.	Depth(m)
150mm	9.0

PROJECT South Hoor SSSI, Havant	DATE August 1995	DIAM 150mm
CLIENT Symonds Travers Morgan	REF J4014	BH 4 (STM 4) SHEET 1 OF 1
Cable Percussion BH Log	OJ: 28: 00100: 06PT	Engineer / Checked



SURREY KT20 5SR TEL 073 781 4221

m | w | th | s | su

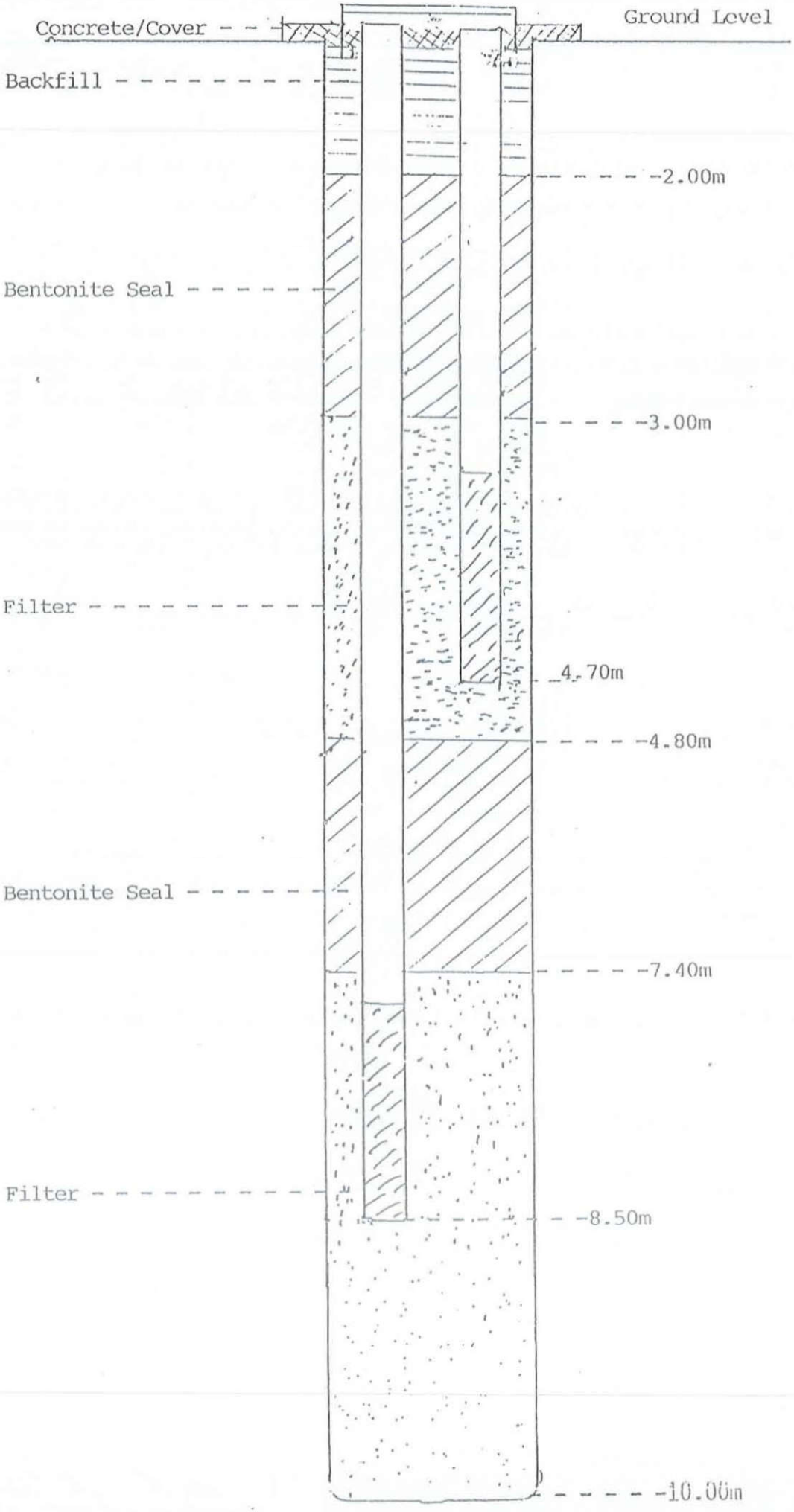
HAVANT

SITE NAME, ADDRESS, JOB NUMBER

SHEET

BOREHOLE NO.

CROSS ROAD TADWORTH
SURREY KT20 5SR TEL 073 781 4221



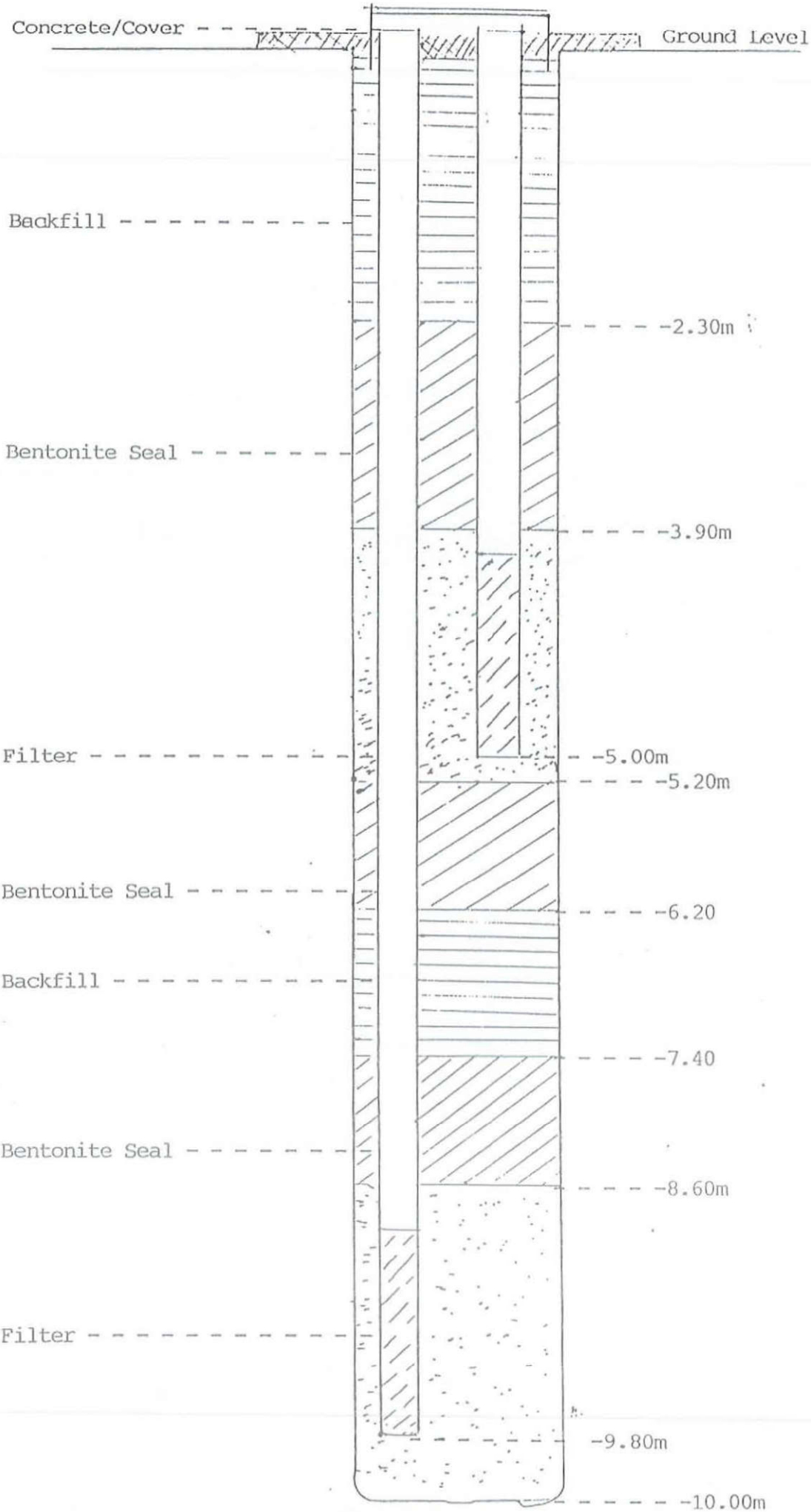
m | t | w | th | f | s | su |

SITE NAME, ADDRESS, JOB NUMBER
HAVANT

SHEET

BOREHOLE NO.
2

CROSS ROAD TADWORTH
SURREY KT20 5SR TEL 073 781 4221



m | t | w | th | f | s | su

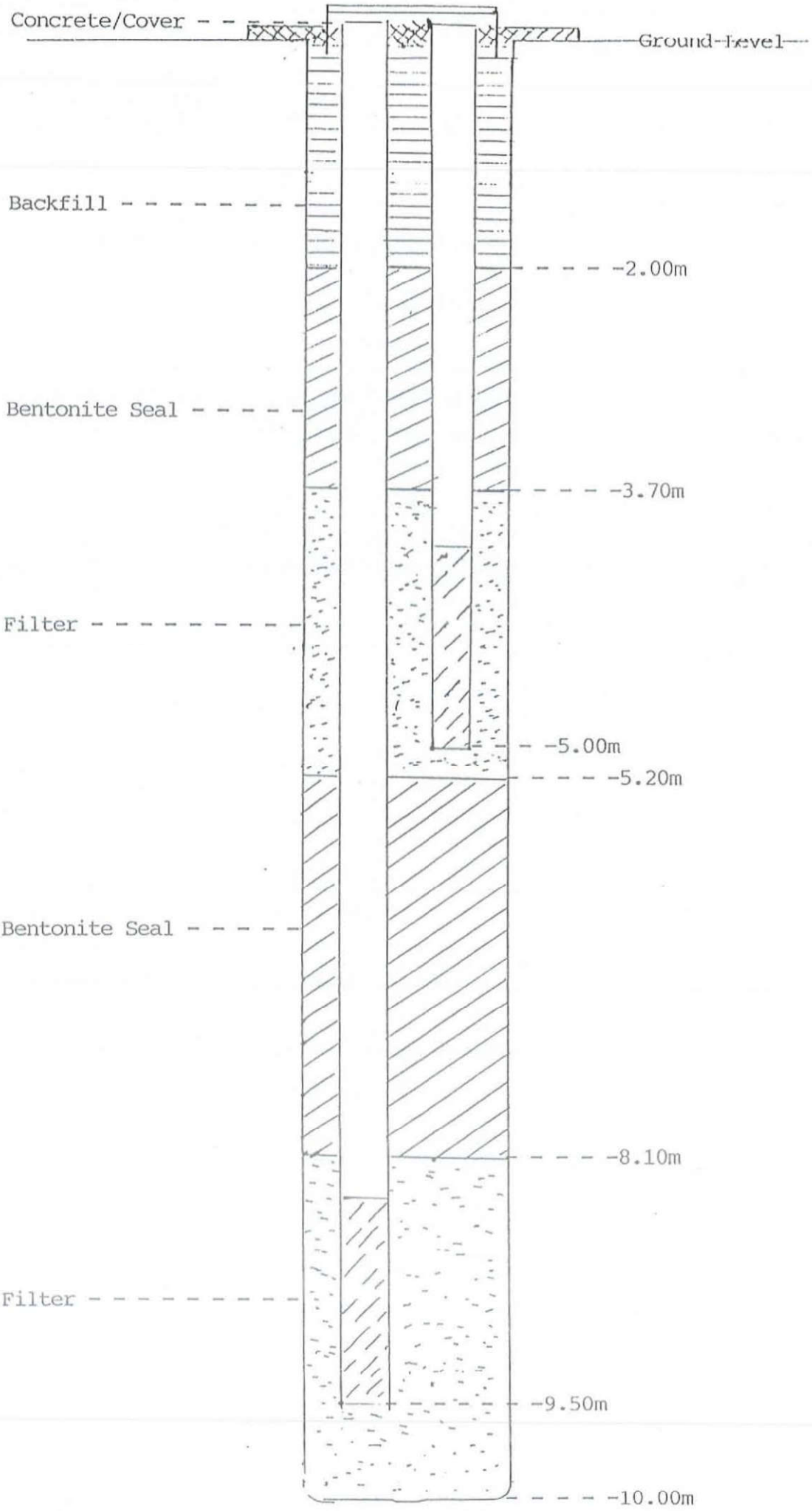
SITE NAME, ADDRESS, JOB NUMBER

HAVANT

SHEET

BOREHOLE NO.

3



SURREY KT3 5SR TEL 073 781 4221

m | mm | cm

SITE NAME, ADDRESS, JOB NUMBER

HAVANT

SHEET

BOREHOLE NO.

4

APPENDIX II

Geophysical Surveys Carried Out At South Moor S.S.S.I. to Investigate Saline Intrusions and Geology

Havant, Hampshire

Carried out for: Symonds Travers Morgan Ltd.

August / September 1995

Survey by:
TerraDat (UK) Ltd. - Geophysics
PO Box 319
Cardiff
South Glamorgan
CF1 3UJ
Telephone: 01222 874485

1. Introduction

TerraDat (UK) were contracted by Symonds Travers Morgan to carry out geophysical surveys on a SSSI site to complement an overall study of the wetland environment. The aims of the geophysics were as follows:

- Investigate the extent of saline intrusion within the site in relation to tidal influences.
- Identify geological structures of significance.

The survey methods included ground conductivity mapping, electrical resistivity imaging and self potential. The survey data provided conclusions that correlated between the individual methods as well as observations on site from visual inspection and borehole monitoring.

2. Survey Procedure / Data Processing

2.1 Ground Conductivity Survey

The aim of this survey was to characterise lateral changes in conductivity that may be attributable to changes in geology or salinity. The survey was carried out in such a way that the influence on conductivity at the extremes of the tidal cycle could be qualified.

A 250 x 250 metre grid with 10 metre-spaced nodes was established over the site. Measurements of conductivity were collected during three-hour time windows centred on high and low tide. We were fortunate in that the survey was carried out during some of the highest tides, and when high tide occurred during daylight hours. A limitation on the northern extent of this survey was imposed by the overhead high voltage power lines.

A Geonics EM34-3 conductivity instrument was used with a 20m spaced horizontal dipole configuration. This was chosen as this orientation gives the best response to lateral changes in conductivity, and was ideally suited to the depth of the site bearing in mind attenuation due to high conductivities. A detailed description of this method is given in the technical appendix.

The data was processed using the GEOSOFT mapping system to produce colour contour plans of the conductivity data and the differences between the high and low tide datasets.

2.2 Resistivity Imaging Survey

The aim of this survey was to investigate anomalies identified from the conductivity survey, and to produce 2-Dimensional electrical cross sections of the subsurface. A CAMPUS Imager 50 resistivity system was used for the surveys. Details of its operation are given in the technical appendix.

The survey was aided by the very dry ground conditions that reduced signal attenuation, however extensive watering of electrodes was required in order to bring the contact resistance down to a satisfactory level.

The raw field data was processed using the RES2DECO software enabling colour sections of model resistivity versus depth to be produced.

2.3 Self Potential Survey

One traverse down the baseline of the conductivity grid was carried out using porous copper-copper sulphate electrodes.

3. Discussion of Results

3.1 Ground Conductivity Survey

Figure 1 shows a colour contour image of the apparent conductivity data collected at low tide. The scale bar shows the conductivity ranging from 18 to 190 mS.m. The highest values are confined to a zone about 50-55 metres wide immediately adjacent to the sea. This elevation in value is due to the influence of sea water affecting the site and it is likely that this represents the area affected *overall* i.e. by spring tides, water coming over the sea defence and subsurface tidal incursion (see later). The green zone (50-80 m.S.m) is thought to represent areas of the subsurface that are still affected by saline water, but to a lesser extent due to their being further from the sea. There is an

increase in conductivity, but to a lesser extent adjacent to the tidal inlet to the east of the site, again due to the presence of saline water.

The lower conductivity values (18-30 mS.m) represented in blue are interpreted as being closer to the true conductivity of the geology without so much influence of sea water. As would be expected, this area is confined to the middle of the area surveyed.

The data was affected by the presence of a ?sewer pipeline running approximately north-south. This has been shown on Figure 1, and its effect has been enhanced by the shadow-relief imaging of the data.

The borehole logs show a fairly uniform depth to bedrock (Chalk) beneath the site of around 5 metres b.g.l. The highly variable nature of the material overlying the Chalk is known from the other geophysical surveys and field observations. The influences of this material on the conductivity dataset is minimised by the chosen configuration of the conductivity instrument (i.e. there was more influence from the chalk and seawater than near-surface geology).

Figure 3 shows the same data described above, however it has been presented as a 3D perspective view looking towards Langstone Harbour. The relative amplitudes of the conductivity values are more apparent from this.

Figure 2 shows the difference between the high tide and low tide conductivity datasets. The low tide data was subtracted from the high tide data in order to give positive anomalies in areas that are more conductive at high tide due to the presence of saline water. The conductivity difference is shown on the scale bar which has been adjusted to remove subtle variations in conductivity caused by slightly inaccurate repositioning of the instrument for the second survey. Therefore areas coloured green may be considered not to have any significant influence from tidal changes (during the periods sampled).

As expected, the largest zones of change in conductivity occur adjacent to the sea and the tidal inlet. The area adjacent to the inlet has an average width of 25 metres from

the bank apart from one area that extends up to 70 metres into the site. This anomalous area shows has a raised appearance on the surface, and it possibly represents a trench that has been backfilled and would therefore be more permeable. This is labelled a "1" on the interpretative map. The zone adjacent to the sea shows a less than expected zone of change. There is a large zone centred on 0,100 that coincides with the position of the pipeline and may therefore be due to this feature providing a conduit into the site.

The interpreted position of the pipeline has a series of both positive and negative anomalies associated with it centred on 25,75 / 85,90 / 135,110. These anomalies are interpreted as sea water that has moved up the pipe (either inside or outside) and produced anomalies at joints that are spaced approximately 60 metres apart.

Three negative anomalies (indicating that more sea water is present at *low tide*) are evident at 150,50 / 145,200 and 140,240. These anomalies are labelled "2" on the interpretative map of the site. It can be seen that these are located on the dykes that meander over the site. Sea water was observed to spring up in these locations on the turning tide thus providing an explanation for this initially strange geophysical phenomenon.

The result of the Self-Potential traverse along the 0m baseline is superimposed on Figure 2. Note that areas affected by saline intrusion show highly variable self-potentials, whereas areas without significant sea water activity are more stable.

3.2 Resistivity Survey

The locations of the 8 Imager lines are shown on the A3 diagram which is intended for positioning only; the sections in detail are presented on the pages following the map. Where possible, the same colour scales were used in order to enable correlation between lines. Different scales were used for lines 2 and 8 because the maximum resistivity was much lower than the other traverses. The coloured images represent 2-dimensional sections beneath each line; the horizontal scale referring to metres along the surface, the vertical scale modelled depth below ground level. The highest values

of resistivity are shown in purple and the lowest values in blue. Boundaries have been defined on the basis of cut-off resistivities and where possible geological labels have been applied. These labels are based on the geophysical interpretation. Final interpretation must be based on the on-going correlation of the data with actual physical observations

In general terms, the resistivity survey provided information about the following:

- Extent of saline intrusion laterally and vertically into the site.
- Changes in geology
- Lenses of electrically resistive material associated with a possible erosional channel.
- Anomalies from buried service(s).

Features of interest on the sections have been annotated and also translated onto the final interpretative map. Lines 4,5 and 6 show an undulation in the topography of the chalk which appears to be a channel feature. This is most noticeable on line 5 where the interpreted width of this feature is 50 metres and its depth, around 12 metres. The material infilling this feature becomes less resistive towards the tidal inlet suggesting that this may be due to saline water migrating along it. It is interesting to note the change in shape of the inlet directly opposite the location of this feature (see map). The high resistivity of this feature in line 6 would suggest that it contains quantities of resistive gravel or other dry, unconsolidated material.

The topography of the chalk is represented well on lines 2, 6, 7 and 8. It shows a mean depth of around 5-6 metres below ground level, but shows undulations on line 2. The position of the top of the chalk is complicated on lines with their ends near the areas affected by tidal movement due to the sea. This has the effect of lowering the overall resistivity and blurring the boundary. This does however provide a useful indication of the extent of incursion laterally into the site (such as line 2, 6, 7 and 8). The extent of this zone based on these results agrees with the extent defined by the conductivity survey.

Line 8 has a resistive high anomaly at 144 metres and around 7-9 metres depth. It is interesting to note that this correlates with an area beneath a dyke that shows groundwater activity on the receding tide. It may represent a more porous horizon that facilitates migration.

5. Conclusion

Integrated geophysical surveying at South Moor SSSI has produced information about the geology and hydrogeology of the site that complements the overall study aimed at assessing the impact of these factors on the wetland environment.

Ground conductivity surveying provided information about the extent of saline intrusion into the site, and also provided data suggesting that there is a complex relationship between tidally induced pressure within the site and groundwater movement.

Resistivity surveying yielded data that identified possible geological structures within the site, and also backed up the interpretations derived from the ground conductivity survey.

FOLLOW UP WORK

This survey has achieved its aims, however if required, there remains considerable scope for carrying out further work to obtain additional information about the site. This may include: ground conductivity mapping configured to target the shallow subsurface geology (changes above the chalk); resistivity monitoring with time to investigate the primary flow paths into the site; self potential gridding to investigate abnormal groundwater movement at low tide; seismic refraction to accurately map the topography of the bedrock.

conductivity. This effect is more severe for the vertical dipole mode. For ground conductivities in excess of 700 mmho/m the indicated conductivity in the vertical mode falls to zero, and for greater conductivity becomes negative.

Resistivity Imaging

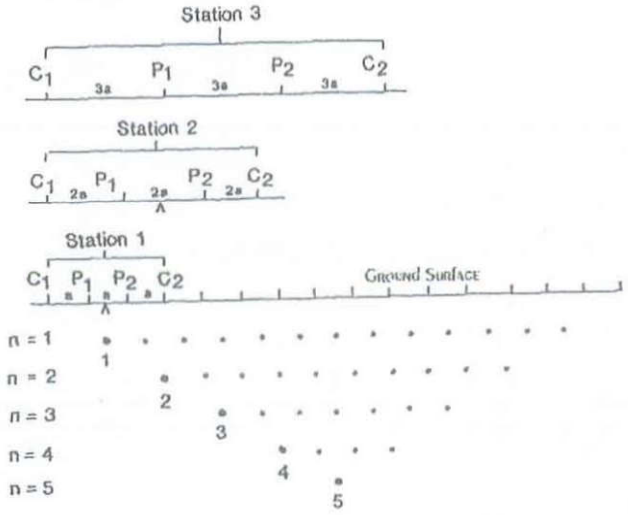
Electrical imaging (tomography) is a survey technique recently developed for the investigation of areas of complex geology where the use of resistivity sounding and other techniques is unsuitable. Electrical imaging involves measuring a series of constant separation profiles with the electrode separation being increased with each successive traverse. Since increasing separation leads to information from greater depth, the measured apparent resistivities may be plotted as a pseudo-section, a contoured section that reflects qualitatively the spatial variation in resistivity in the cross-section. Length of profile, depth penetration and resolution determine the unit electrode spacing which can be anywhere from 1 m to 50m or more.

For electrical imaging with electrode spacings of less than 1m it is convenient to use single multi-core cables such as Campus Imager cables to which all the electrodes are connected at takeouts moulded on at predetermined positions. The cables are connected to a switching module in the GEOPULSE resistivity meter that is controlled by a computer through an RS232 port.

The control software is designed to carry out a series of constant separation traverse along the array, with increasing electrode spacing at each traverse.

Alternatively a 'roll-along' technique may be used. Here, measurement commences at one end of the line using electrodes 1, 2, 3 and 4. The spacing is then doubled without moving on, the active electrodes being 1, 3, 5 and 7. At each measurement, spacing is increased by one unit until the maximum spacing is reached (n = 6 for a 20 electrode array), after which the sequence is repeated starting with electrodes 2, 3, 4 and 5. As measurements involving particular reels are completed they can be moved, normally in groups of 3 or 4, to the forward end of the line.

The resulting pseudosection may be modelled using a two-dimensional finite element or finite difference program. Commercially available soft-ware such as RES2DECO enable complex modelling to be carried out on a PC. Alternatively the pseudosection can be inverted automatically to provide an image of true resistivity.



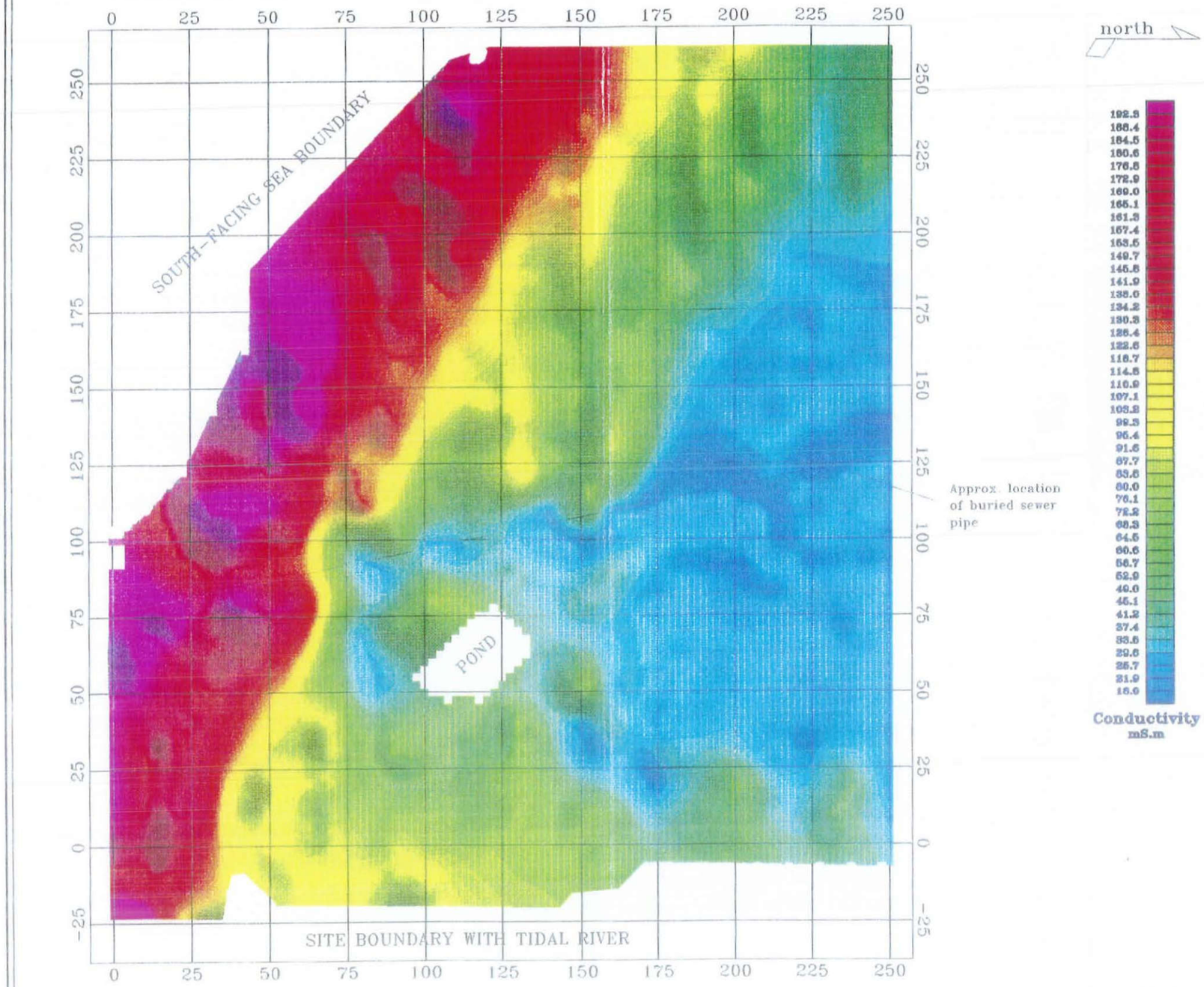


Plan of South Moor SSSI, Havant showing the integrated results of the geophysical surveys. The main features are summarised on the key below:

1. Zone of marine incursion at high tide
2. Areas where more saline water is present at low tide than high tide (more conductive at low tide)
3. Interpreted channel anomaly (based on 3 resistivity lines) - sea water present near tidal inlet
4. Inland extent of land affected by sea water (based on EM34 and resistivity)

Features specific to individual survey / lines are described in main report.

Figure 1.



Scale 1:1500

25 0 25 50

(metres)

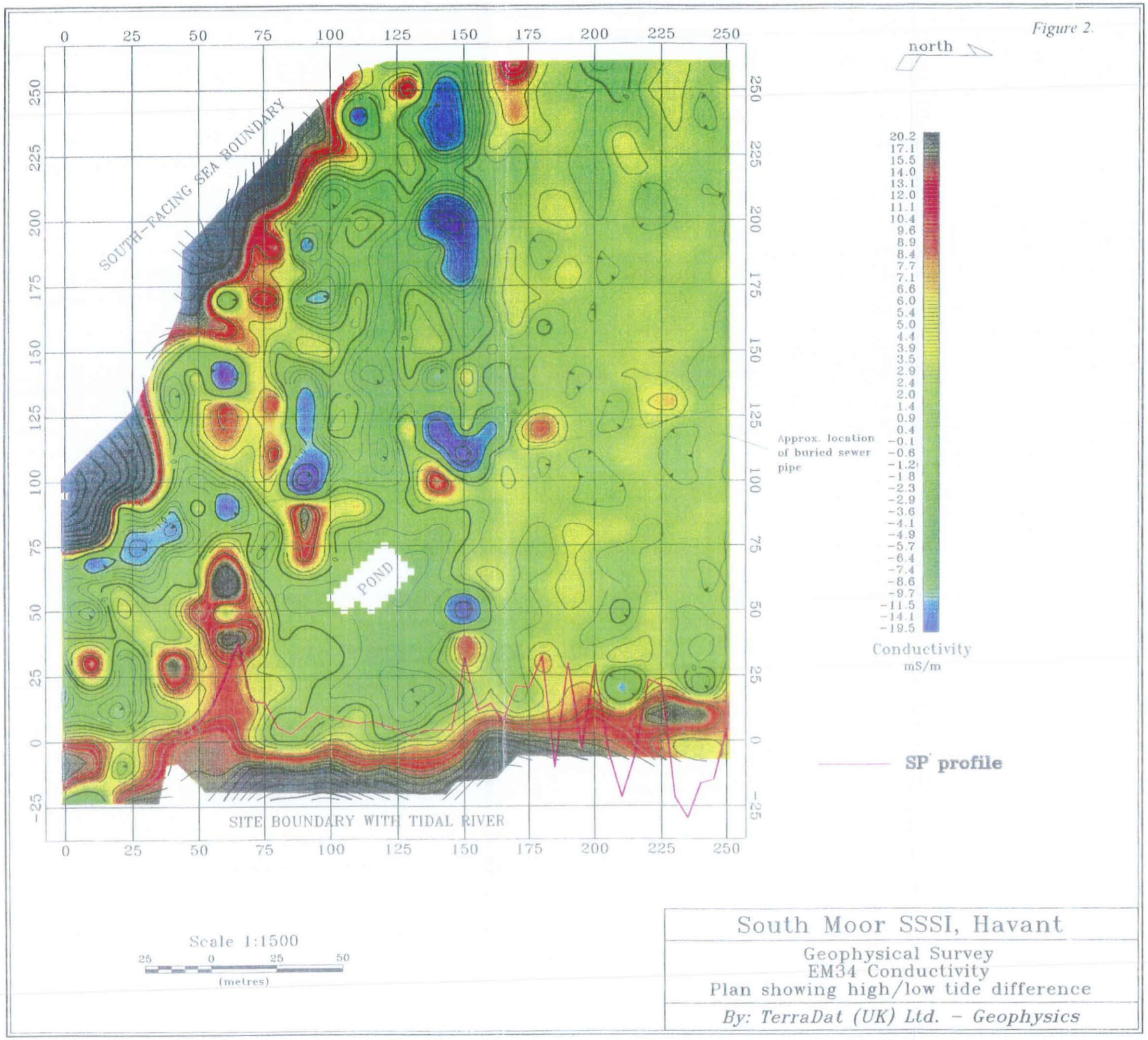
South Moor SSSI, Havant

Geophysical Survey
EM34 Conductivity
Plan showing conductivity

20m coils, horizontal dipole
August 1995

By: TerraDat (UK) Ltd. – Geophysics

Figure 2.

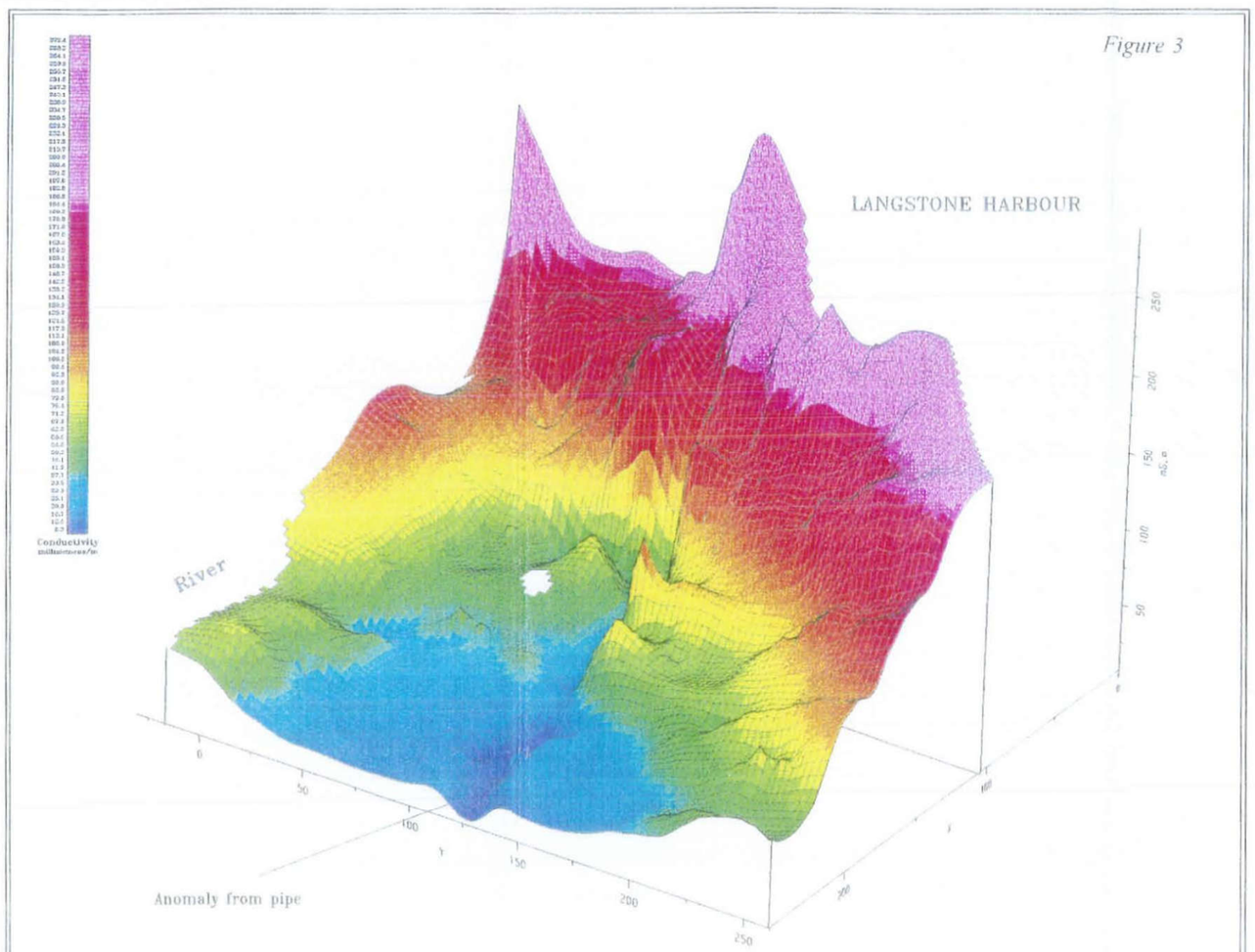


South Moor SSSI, Havant

Geophysical Survey
EM34 Conductivity
Plan showing high/low tide difference

By: TerraDat (UK) Ltd. – Geophysics

Figure 3



South Moor SSSI, Havant

3D Perspective Conductivity Data

View from NW looking SE

25 0 25 50 75

(metres)

SOUTH MOOR SSSI, GEOPHYSICAL SURVEY
RESISTIVITY SECTIONS
August 1995

LINE 3



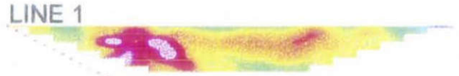
N

LINE 4





LINE 1



LINE 6



LINE 5



Line positions and modeled sections. Refer to individual sections for interpretations. Colour scales same for all sections excluding Lines 2 / 8.

Shaded green area represents extent of gravel observed on surface

LINE 2



LANGSTONE HARBOUR

LINE 7

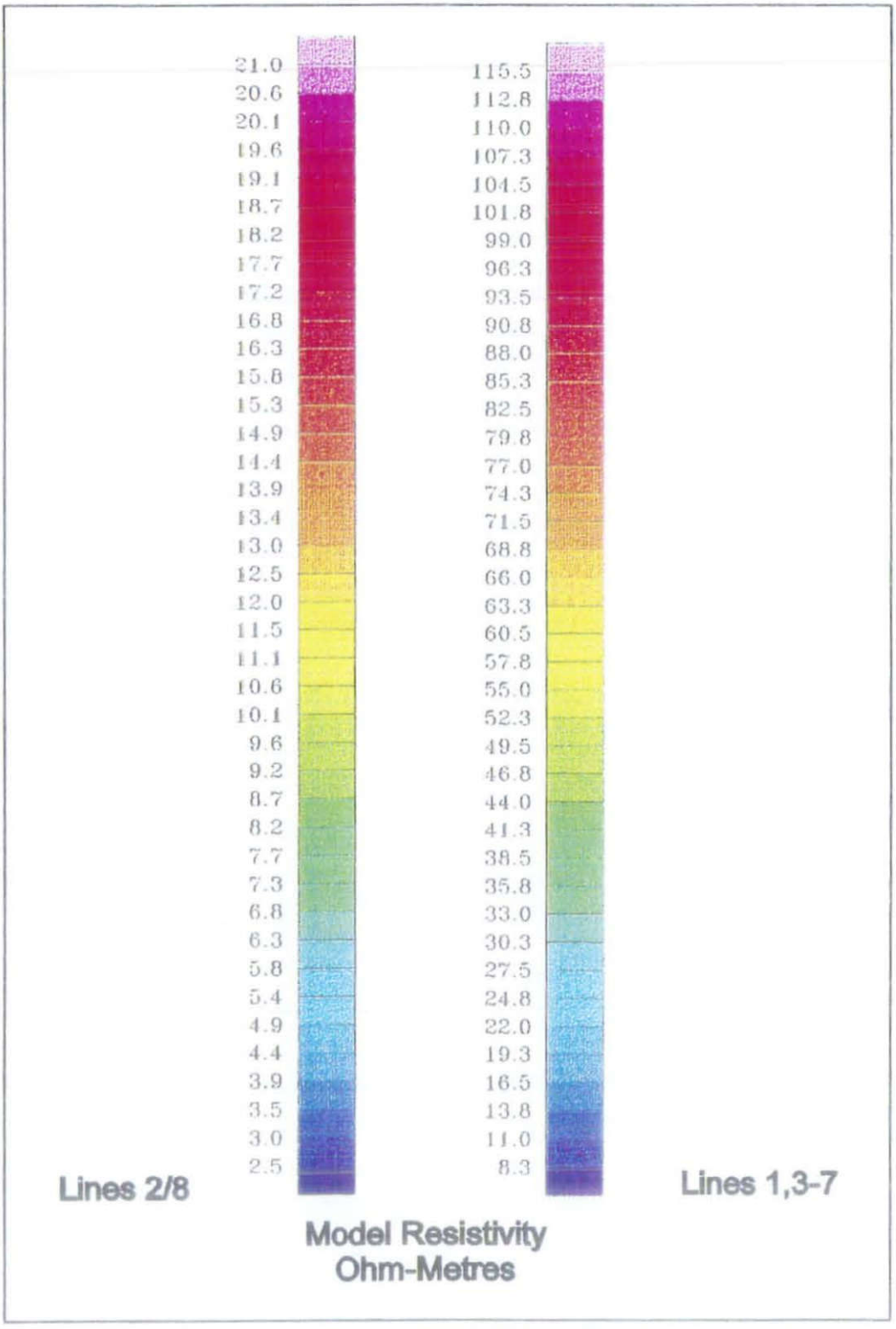


LINE 8



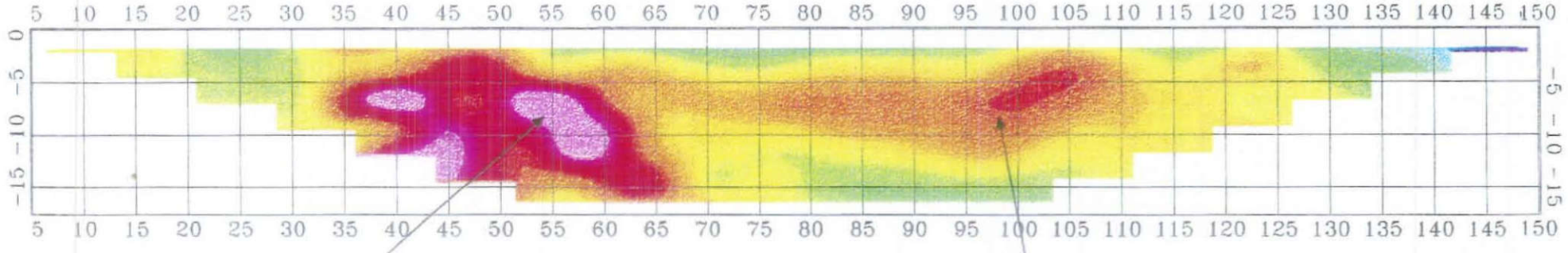
TERRA DAT
engineering & environmental geophysics

SOUTH MOOR SSSI
COLOUR SCALE BARS FOR RESISTIVITY SECTIONS



Resistivities are coloured on the pseudosections according to their values i.e. highest values = purple, lowest = blue. In terms of this site, higher resistvities are attributed to the chalk and gravel in relation to the overlying clay, or sediments that are saturated by saline water which have lower apparent resistivities.

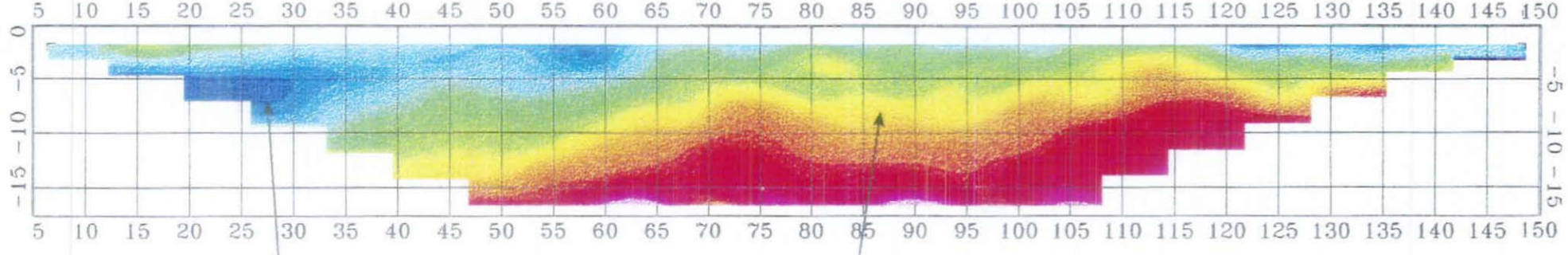
Line 1



Anomalously high resistivities
(buried pipe?)

Intermediate layer of higher
resistivity

Line 2



Low resistivity area due
to presence of sea water

Chalk topography

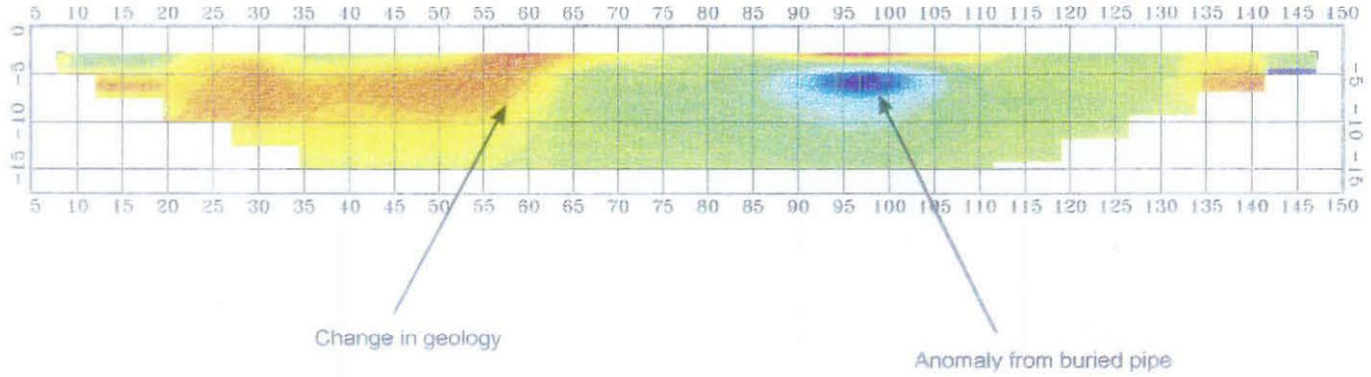
South Moor SSSI, Havant, Hampshire

Resistivity Imager Sections
Equipment: Campus Imager 50 and multicore cables
Date: August / September 1995

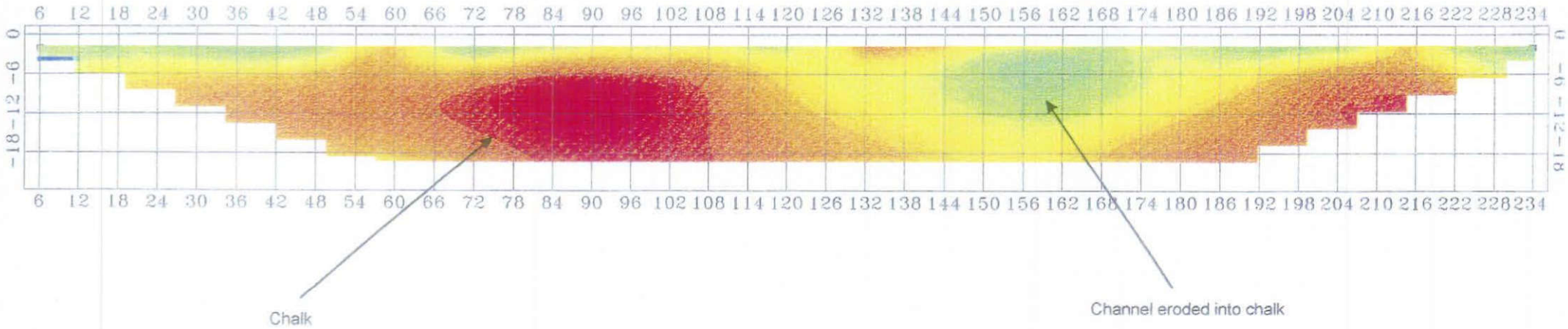
Survey carried out for IBM/Symonds Travers Morgan

TERRA DAT

Line 3



Line 4

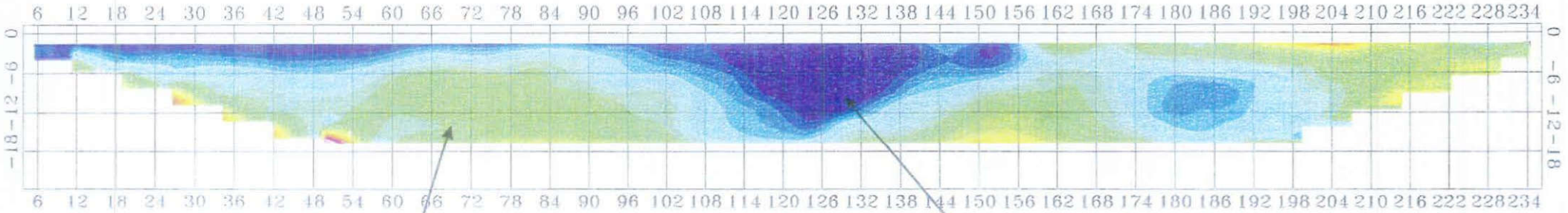


South Moor SSSI, Havant, Hampshire

Resistivity Imager Sections
Equipment: Campus Imager 50 and multicore cables
Date: August / September 1995

TERRADAT

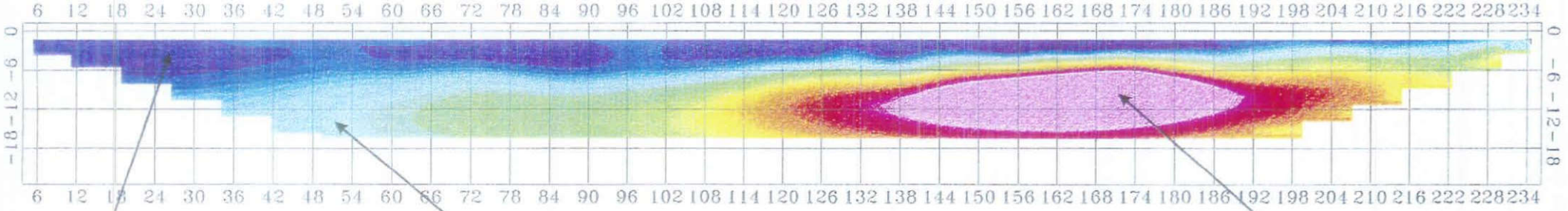
Line 5



Chalk

Channel feature (same as feature identified further into site on Line 4)

Line 6



Near-surface resistivity lowered by influence of saline water

Boundary of material influenced at depth by sea water

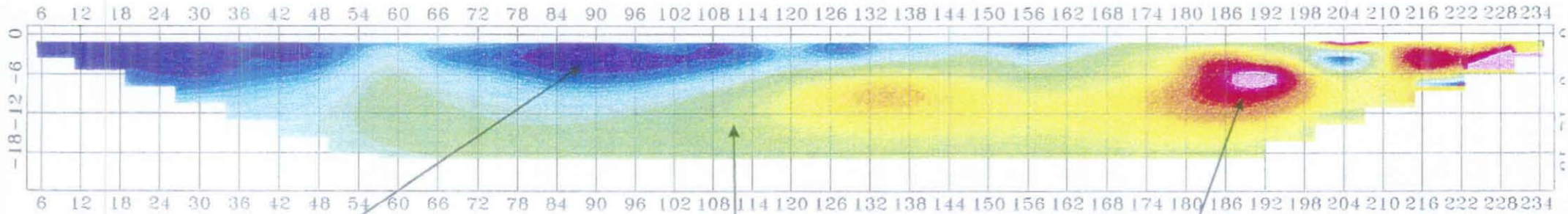
Resistive lens in chalk (gravel or dry/fractured chalk)

South Moor SSSI, Havant, Hampshire

Resistivity Imager Sections
Equipment: Campus Imager 50 and multicore cables
Date: August / September 1995

TERRA DAT

Line 7

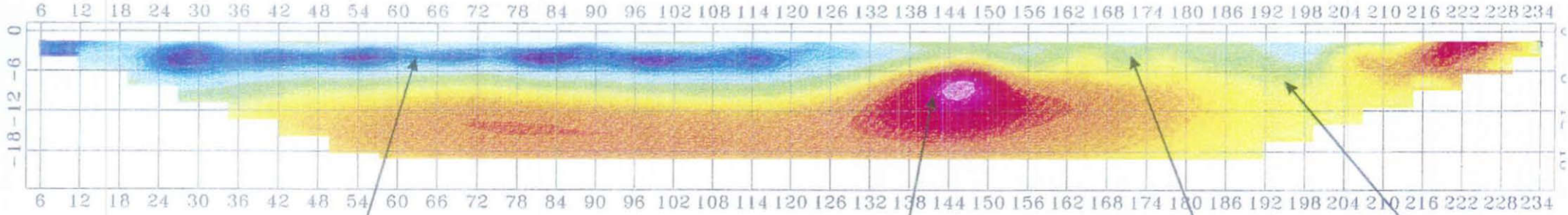


Areas affected by sea water (correlation with EM34 data)

Chalk

Resistive lens in chalk

Line 8



Low resistivity area affected by sea water: corresponds with conductive 'front' identified from EM34 survey

Resistive lens in chalk

near-surface layer of clay

undulation in chalk topography

South Moor SSSI, Havant, Hampshire

Resistivity Imager Sections

Equipment: Campus Imager 50 and multicore cables

Date: August / September 1995

TERRADAT

APPENDIX III

Certificate No: SL/95/1246 Date: 9/10/95

ANALYSIS OF SOIL AND WATER SAMPLES

Date received 2/9/95
Client ref 3T40004
Our ref 176-59

SOIL SAMPLES

Determinand	Clint ID / Lab ID	LS1SED 45482	LS2SED 45483	DITCH 1SED 45484	DITCH 2SED 45485
Total solids % *		60.2	13.1	75.7	22.0
Volatile solids (LOI) % #		4.6	18.3	10.9	26.7
Sulphide #		130	46	140	570
Sulphate as %SO4 #		0.18	0.15	0.52	1.0
Total phosphorus #		830	1300	910	1500
Kjeldahl nitrogen #		1680	5460	2800	7140
Phosphate as P #		37	53	34	25
Iron #		0.62%	0.95%	0.71%	2.21%
Zinc #		140	570	85	120
Copper #		65	150	20	30
Nickel #		15	35	15	20
Lead #		120	460	70	170
Chromium #		35	50	20	20
Cadmium #		3.1	14.9	0.5	1
Manganese #		1.20%	1.30%	1.10%	2.30%
Molybdenum #		8.4	13	13	16
Vanadium #		23	34	36	44
Beryllium #		<1	<1	<1	<1
Barium #		30	10	10	20
Strontium #		30	25	30	25
Mercury #		10.7	<0.10	0.18	<0.10
Arsenic #		8	6	9	10
% Loss on drying		33.5	68.9	44.3	72.9

All concentrations are in mg/Kg unless otherwise stated
Analysis carried out on "air dried" sample
* Analysis carried out on "as received sample

Certificate No: SL/95/1246

Date: 9/10/95

ANALYSIS OF SOIL AND WATER SAMPLES

Date received 2/9/95
Client ref 3T40004
Our ref 176-59

WATER SAMPLES

Determinand / Client ID / Lab ID	BH2 U 45493	BH2 L 45494	BH3 U 45495	BH3 L 45496	BH4 U 45497	BH4 L 45498
Chloride	6080	403	94	24	44	29
Sodium	3855	350	110	18	78	19
Potassium	96	25	3.7	2.1	3.1	2.1
Sulphate	1220	80	70	11	50	13
Bicarbonate	530	280	330	340	390	380
Calcium	120	12	81	110	93	123
Magnesium	241	15	7	2.9	7	3.4
COD	28	11	20	4	21	<4
BOD	-	-	-	-	-	-
Nitrate	<1	<1	<1	3	<1	2
Ammonia	0.6	<0.1	<0.1	<0.1	0.6	<0.1
Phosphate(P)	<0.05	0.10	<0.05	<0.05	<0.05	<0.05
Iron	<0.01	<0.01	3.34	0.04	0.02	0.02
Zinc	<0.01	0.05	0.05	0.03	<0.01	0.02
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Lead	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	0.77	0.74	0.42	0.63	1.74	0.67
Molybdenum	0.08	<0.05	<0.05	<0.05	<0.05	<0.05
Vanadium	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
Beryllium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	0.08	0.03	0.04	0.07	0.06	0.04
Strontium	0.51	0.34	0.43	0.31	0.30	0.28
Mercury	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

All results are in mg/l

Certificate No: SL/95/1246

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ANALYSIS OF SOIL AND WATER SAMPLES

Date received 2/9/95
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Our ref 176-59

WATER SAMPLES

Determinand / Client ID / Lab ID	LS 1 45486	LS 2 45487	DITCH 1 45489	DITCH 2 45490	BH1 U 45491	BH1 L 45492
Chloride	105	18	23400	23800	2831	600
Sodium	71	10	13945	14440	1755	433
Potassium	3.2	1.1	301	345	63	24
Sulphate	20	10	2130	1370	120	93
Bicarbonate	300	260	200	300	440	260
Calcium	94	94	373	403	50	28
Magnesium	7.9	1.9	747	580	114	31
COD	<4	<4	210	200	20	19
BOD	<1	1.6	3.2	9.39	-	-
Nitrate	18	20	<1	<1	<1	<1
Ammonia	<0.1	<0.1	0.4	1.9	0.5	1.2
Phosphate(P)	<0.05	<0.05	0.25	0.95	0.10	0.20
Iron	0.31	1.23	0.94	5.59	<0.01	0.03
Zinc	0.02	0.13	0.02	0.01	0.02	0.04
Copper	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Nickel	<0.01	<0.01	<0.01	0.02	<0.01	<0.01
Lead	0.01	0.06	0.01	0.02	<0.01	<0.01
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Manganese	0.01	0.06	0.03	0.16	1.3	0.85
Molybdenum	<0.05	<0.05	<0.05	0.15	0.05	<0.05
Vanadium	0.02	<0.01	0.07	0.07	0.04	0.03
Beryllium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Barium	0.01	0.02	<0.01	0.04	0.04	0.04
Strontium	0.38	0.27	0.62	0.65	0.43	0.40
Mercury	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

All results are in mg/l

Certificate No: SL/95/1246

Date: 9/10/95

ANALYSIS OF WATER SAMPLES

Recd date : 02/09/1995
Our Ref : 176-59
Your Ref :

For VOC's By Purge & Trap GC/MS

SAMPLE ID / Client ID / Lab ID	LS1 45486	LS2 45487	DITCH 1 45489	DITCH 2 45490	BH1U 45491	BH1L 45492
DETERMINAND (ug/l)						
Dichloromethane	<25	<25	<25	<25	<25	<25
Chloroform	<1	<1	<1	<1	<1	<1
1,1,1 - Trichloroethane	<5	<5	<5	<5	<5	<5
Carbon tetrachloride	<1	<1	<1	<1	<1	<1
Benzene	<1	<1	<1	<1	<1	<1
1,2 Dichloroethane	<1	<1	<1	<1	<1	<1
Trichloroethene	<1	2	<1	<1	<1	<1
Bromodichloromethane	<1	<1	<1	<1	<1	<1
Dibromochloromethane	<1	<1	<1	<1	<1	<1
1,1,2,2 - Tetrachloroethane	<1	<1	<1	<1	<1	<1
Freon - 113	<10	<10	<10	<10	<10	<10
Toluene	<1	<1	<1	<1	<1	<1
Tetrachloroethene	<1	<1	<1	<1	<1	<1
Chlorobenzene	<1	<1	<1	<1	<1	<1
Ethylbenzene	<1	<1	<1	<1	<1	<1
m/p Xylenes	<1	<1	<1	<1	<1	<1
o Xylene	<1	<1	<1	<1	<1	<1
Hexachlorobutadiene	<1	<1	<1	<1	<1	<1
4-Chlorotoluene	<1	<1	<1	<1	<1	<1
2-Chlorotoluene	<1	<1	<1	<1	<1	<1
Isopropyl benzene	<1	<1	<1	<1	<1	<1
Bromoform	<1	<1	<1	<1	<1	<1
Styrene	<1	<1	<1	<1	<1	<1
1,3,5 - Trichlorobenzene	<1	<1	<1	<1	<1	<1
1,2,3 - Trichlorobenzene	<1	<1	<1	<1	<1	<1
1,2,4 - Trichlorobenzene	<1	<1	<1	<1	<1	<1
1,2 - Dichlorobenzene	<1	<1	<1	<1	<1	<1
1,3 - Dichlorobenzene	<1	<1	<1	<1	<1	<1
1,4 - Dichlorobenzene	<1	<1	<1	<1	<1	<1
alpha-Methyl Styrene	<1	<1	<1	<1	<1	<1
1,1 - Dichloroethane	<1	<1	<1	<1	<1	<1
1,1,2 - trichloroethane	<1	<1	<1	<1	<1	<1
1,1 - Dichloroethene	<50	<50	<50	<50	<50	<50
trans 1,2 - Dichloroethene	<1	<1	<1	<1	<1	<1
cis 1,2 - Dichloroethene	<1	<1	<1	<1	<1	<1
tert-butyl Methyl Ether	<1	<1	<1	<1	<1	<1
Tetrahydrofuran*						*

*Non-target, water miscible compound. Quantification would be unreliable due to very low purge efficiency.

Certificate No: SL/95/1525

Date: 7/12/95

ANALYSIS OF WATER SAMPLES

Recd : 7/10/95
Our ref : 176-62
Your ref: 3T 40004

Client ID	BH1 U	BH1 L	BH2 U	BH2 L	BH3 U	BH3 L	BH4 U	BH4 L	DITCH 1	DITCH 2	LS1	DITCH 3
Lab ID	47441	47442	47443	47444	47445	47446	47447	47448	47449	47450	47451	47452
DETERMINAND												
Sodium	300	1767	328	3650	99	15	20	7.7	13000	1300	6900	75
Potassium	21	68	23	104	4.2	2.2	1.7	2.3	296	42	148	3.7
Calcium	28	53	9.9	116	100	108	106	123	352	267	231	149
Magnesium	29	104	14	258	11	2.7	3.8	3.5	1128	164	571	12
Chloride	382	2940	280	6210	98	25	29	26	22850	2375	11600	174
Sulphate	<20	<20	57	412	39	12	5	12	2833	588	1269	92
Nitrate	<20	<20	<1	<20	<1	<1	<1	<1	<20	<20	<1	<1
Bicarbonate	380	445	435	500	400	320	335	345	160	280	215	290

Concentrations expressed in mg/L (ppm) unless otherwise stated

IC3

Certificate No: SL/95/1494

Date: 7/12/95

ANALYSIS OF WATER SAMPLES

Recd: 6/11/95
Our ref: 176 - 64
Your ref: 3T 40004

Client ID	BH1 U	BH1 L	BH2 U	BH2 L	BH3 U	BH3 L	BH4 U	BH4 L	DITCH 1	DITCH 2	LS 1	LS 2
Lab ID	49248	49249	49250	49251	49252	49253	49254	49255	49256	49257	49258	49259
DETERMINAND												
Sodium	1805	266	3930	244	83	16	30	18	8619	4700	113	13
Potassium	78	20	107	23	3.5	2.4	2.2	2.2	261	132	5.1	2.0
Calcium	52	29	119	11	160	112	104	125	344	385	99	105
Magnesium	109	30	263	16	12	2.8	4.9	3.3	1033	549	16	2.3
Sulphate	304	70	1290	51	97	11	7	12	2890	1160	37	12
Chloride	3420	381	5920	262	206	46	49	32	15900	4000	217	43
Bicarbonate	450	250	410	280	300	310	330	380	200	680	260	270
Nitrate	<10	<1	<10	<1	<1	<1	<1	<1	<10	<10	12	5

All concentrations expressed as mg/L unless otherwise stated.

IC

ANALYSIS OF WATER SAMPLES

Recd: 2/12/95
Our ref: 176 - 68
Your ref: 3T 40004

Client ID	BH1 U	BH1 L	BH2 U	BH2 L	BH3 U	BH3 L	BH4 U	BH4 L	DITCH 1	DITCH 2	DITCH 3	LS 1
Lab ID	51559	51560	51561	51562	51563	51564	51565	51566	51567	51568	51569	51570
DETERMINAND												
Chloride	<1	379	5750	270	157	30	30	41	6880	5280	190	150
Sodium												
Potassium												
Sulphate	270	68	1130	64	75	12	3	14	1160	880	87	42
Bicarbonate												
Calcium												
Magnesium												
Nitrate	<1	<10	<10	<10	<1	<1	<1	<1	<1	<10	<1	3

All concentrations expressed as mg/L (ppm) unless otherwise stated.

This data will be subjected to final QC clearance before confirmation

ROBERTSON LABORATORIES

ANALYSIS OF WATER SAMPLES

Rec'd : 8/1/96
Our ref : 176-72
Your ref : 3T/40004

DETERMINAND	CLIENT ID LAB ID	BH1 U 53235	BH1 L 53236	BH2 U 53237	BH2 L 53238	BH3 U 53239	BH3 L 53240	BH4 U 53241	BH4 L 53242	DITCH 1 53243	DITCH 2 53244	DITCH 3 53245	DITCH 4 53246
Sodium		1200	367	2900	236	93	19	21	25	8300	815	93	123
Potassium		70	30	139	31	5.7	5.1	4.8	6.7	384	85	10	8.7
Calcium		52	37	92	13	162	109	108	128	386	301	164	152
Magnesium		93	41	216	19	11	2.7	3.5	4.0	1152	247	11	13
Sulphate		270	75	860	46	70	14	4	14	2000	850	100	83
Chloride		2000	515	4400	210	200	25	28	27	15800	1700	145	300
Bicarbonate		200	350	550	390	380	340	360	420	310	430	420	260
Nitrate		<10	<10	<10	<10	<10	<1	<1	<1	<10	<10	10	<10

Concentrations expressed as mg/L (ppm) unless otherwise stated

KJ

ROBERTSON LABORATORIES

ANALYSIS OF WATER SAMPLES

Rec'd : 5/2/96
Our ref : 176-83
Your ref : 3T/40004

DETERMINAND	CLIENT ID / LAB ID	BH1 U 56003	BH1 L 56004	BH2 U 56005	BH2 L 56006	BH3 U 56007	BH3 L 56008	BH4 U 56009	BH4 L 56010	DITCH 1 56011	DITCH 2 56012	DITCH 3 56013	DITCH 4 56014
Sodium		1200	240	2840	220	100	17	19	20	1450	2900	89	220
Potassium		92	29	112	30	3.3	2.3	1.7	2.3	52	55	8.7	4.8
Calcium		55	38	81	14	200	110	110	130	190	170	150	210
Magnesium		130	38	190	21	12	2.8	3.9	3.4	180	360	19	21
Sulphate		340	77	850	44	89	22	17	28	440	680	96	130
Chloride		2000	440	4200	190	260	28	30	33	2700	5200	120	460
Bicarbonate		200	160	490	400	380	330	340	380	220	390	460	330
Nitrate		<10	<10	<10	<10	<10	<1	<1	<1	<10	<10	<10	<10

Concentrations expressed as mg/L (ppm) unless otherwise stated

ROBERTSON LABORATORIES

ANALYSIS OF WATER SAMPLES

Rec'd : 4/3/96
Our ref : 176-84
Your ref : 3T/40004

DETERMINAND	CLIENT ID / LAB ID	BH1 U 58400	BH1 L 58401	BH2 U 58402	BH2 L 58403	BH3 U 58404	BH3 L 58405	BH4 U 58406	BH4 L 58407	DITCH 1 58408	DITCH 2 58409	DITCH 3 58410	DITCH 4 58411
Sodium		2080	240	2460	250	105	18	18	22	800	1100	79	120
Potassium		105	30	120	32	3.3	2.4	1.1	2.4	35	44	6.4	3.6
Calcium		69	37	88	10	200	120	115	130	150	170	175	150
Magnesium		170	40	230	19	12	2.7	3.4	3.5	110	145	11	8.0
Sulphate		450	67	880	63	72	15	5	18	280	280	75	50
Chloride		3300	430	3700	260	260	30	29	37	1500	2000	98	210
Bicarbonate		550	160	530	310	420	350	360	390	200	430	530	370
Nitrate		<10	<10	<10	<10	<10	<1	<1	3	<10	<10	<10	<10

Concentrations expressed as mg/L (ppm) unless otherwise stated

KJ

ROBERTSON LABORATORIES

ANALYSIS OF WATER SAMPLES

Rec'd : 22/3/96
Our ref : 176-88
Your ref : 3T/40004/Mon

DETERMINAND	CLIENT ID / LAB ID	BH1 U 60160	BH1 L 60161	BH2 U 60162	BH2 L 60163	BH3 U 60164	BH3 L 60165	BH4 U 60166	BH4 L 60167	DITCH 1 60168	DITCH 2 60169	DITCH 3 60170	DITCH 4 60171
Sodium		240	1100	2960	246	110	18	17	22	1730	400	2500	120
Potassium		29	89	112	32	2.8	2.7	1.1	2.6	53	13	77	4.4
Calcium		40	56	91	13	210	125	120	135	140	116	140	107
Magnesium		39	141	225	20	12	3.0	3.3	3.5	168	39	243	16
Sulphate		62	303	951	52	70	15	5	14	470	135	590	52
Chloride		430	2010	4620	235	250	31	29	37	3070	675	4170	260
Bicarbonate		180	190	420	380	450	370	370	410	190	340	350	210
Nitrate		<10	<10	<10	<10	<10	<1	<1	<1	<10	<10	<10	<10

Concentrations expressed as mg/L (ppm) unless otherwise stated

KJ

ROBERTSON LABORATORIES

ANALYSIS OF WATER SAMPLES

Rec'd : 12/4/96
Our ref : 176-92
Your ref : Waterlooville

DETERMINAND	CLIENT ID / LAB ID	BH1 B 61857	BH1 F 61858	BH2 B 61859	BH2 F 61860	BH3 B 61861	BH3 F 61862	BH4 B 61863	BH4 F 61864	DITCH 1 61865	DITCH 2 61866	DITCH 3 61867
Sodium		246	1240	244	1750	115	18	17	21	690	416	54
Potassium		29	87	31	113	2.9	2.5	1.2	2.5	44	15	2.9
Calcium		38	52	13	88	200	114	113	130	150	134	148
Magnesium		37	120	19	223	12	2.9	3.2	3.4	122	41	6.8
Sulphate		63	322	50	580	76	16	5	20	262	140	63
Chloride		374	2095	235	2970	340	34	40	32	1480	700	64
Bicarbonate		240	190	350	380	320	340	340	390	170	340	430
Nitrate		<10	<10	<10	<10	<10	<1	<1	<1	<10	<10	<10

Concentrations expressed as mg/L (ppm) unless otherwise stated

IC J

ROBERTSON LABORATORIES

ANALYSIS OF WATER SAMPLES

Rec'd : 9/5/96
Our ref : 176-98
Your ref : Waterlooville

DETERMINAND	CLIENT ID / LAB ID	BH1 U 63603	BH1 L 63604	BH2 U 63605	BH2 L 63606	BH3 U 63607	BH3 L 63608	BH4 U 63609	BH4 L 63610	DITCH 1 63611	DITCH 2 63612	DITCH 3 63613	LS1 63614
Sodium		1310	300	2560	239	115	18	17	21	7900	3960	55	18
Potassium		81	28	113	31	3.8	2.5	1.1	2.5	170	103	1.9	1.9
Calcium		53	39	90	13	200	115	110	130	240	210	124	104
Magnesium		103	38	214	19	12	2.8	3.1	3.5	578	369	6.8	2.9
Sulphate		380	65	590	56	75	14	5	10	4340	2770	65	14
Chloride		2100	510	4200	230	360	30	26	40	11010	5200	73	26
Bicarbonate		190	250	540	360	300	350	340	380	430	450	340	320
Nitrate		<10	<10	<10	<10	<10	<1	<1	<1	<10	<10	<10	13

Concentrations expressed as mg/L (ppm) unless otherwise stated

IcJ

ANALYSIS OF WATER SAMPLES

Rec'd : 7/6/96
Our ref : 176-103
Your ref : Langstone Harbour 3T/40004

DETERMINAND	CLIENT ID / LAB ID	BH1 U 65676	BH1 L 65677	BH2 U 65678	BH2 L 65679	BH3 U 65680	BH3 L 65681	BH4 U 65682	BH4 L 65683	DITCH 1 65684	DITCH 2 65685	LS1 65686	LS2 65687
Sodium		1550	230	2700	240	65	17	19	17	14000	5400	17	14
Potassium		95	22	120	30	3.5	2.2	1.1	2.0	290	150	1.2	1.1
Calcium		50	43	130	13	150	115	105	120	220	190	90	80
Magnesium		95	38	280	19	11	2.8	3.7	3.6	410	210	3.1	2.5
Sulphate		240	56	927	57	53	12	<1	11	2720	940	9	<1
Chloride		2560	350	4440	224	190	27	29	31	20840	8530	21	18
Bicarbonate		170	280	510	360	280	350	350	370	390	400	270	270
Nitrate		<10	<10	<10	<10	<10	<1	<1	<1	<10	<10	<1	<1

Concentrations expressed as mg/L (ppm) unless otherwise stated

This data will be subjected to final QC clearance before confirmation

ROBERTSON LABORATORIES

ANALYSIS OF WATER SAMPLES
SITE:- Langstore Harbour
Rec'd: 5-7-96
Our ref:- 176-109
Your ref:- 40004

CLIENT I.D. / LAB ID	BH1U 68019	BH1L 68020	BH2U 68021	BH2L 68022	BH3U 68023	BH3L 68024	BH4U 68025	BH4L 68026	DITCH1 68027	DITCH2 68028	LS1 68029	LS2 68030
DETERMINAND												
Sodium	2200	230	2850	255	113	18	16	23	12000	7500	17	19
Potassium	76	27	116	31	3.2	2.5	1.0	2.3	359	307	1.2	1.4
Calcium	42	40	91	14	177	110	110	118	412	372	101	102
Magnesium	97	37	222	20	9.5	2.8	3.1	3.6	1140	767	2.5	2.6
Sulphate	203	51	875	57	81	17	<1	17	4080	2350	12	14
Chloride	3570	293	4350	217	215	31	29	39	20120	13240	30	28
Bicarbonate	250	400	520	400	400	320	340	350	190	225	290	290
Nitrate	<10	<10	<10	<10	<10	<1	<1	4	<10	<10	9	20

Concentrations expressed as mg/L (ppm) unless otherwise stated

ROBERTSON LABORATORIES

ANALYSIS OF WATER SAMPLES

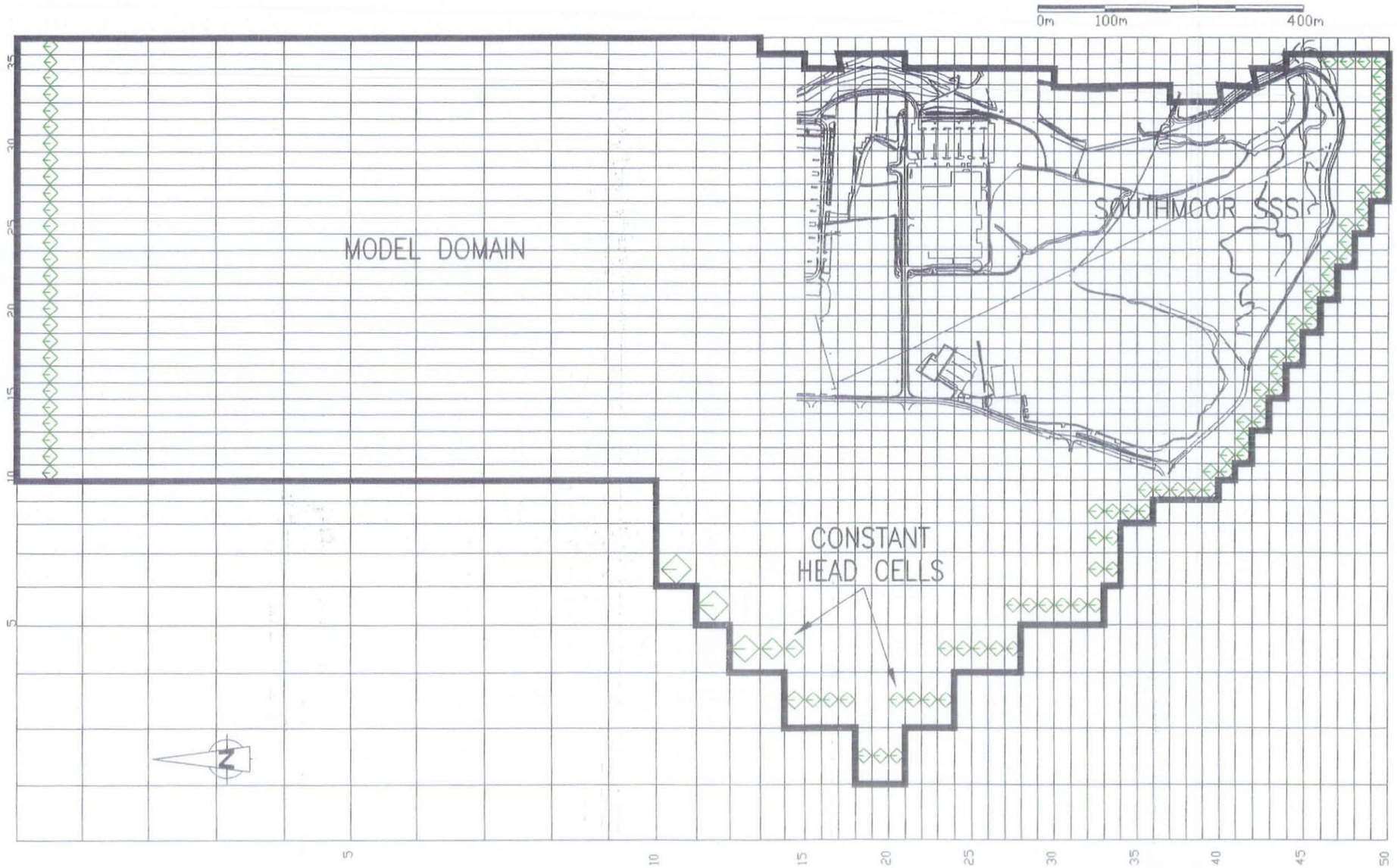
Rec'd : 20/8/96
Our ref : 176-119
Your ref : Langstone Harbour 40004/KT

DETERMINAND	CLIENT ID LAB ID	BH1 U 70897	BH1 L 70898	BH2 U 70899	BH2 L 70900	BH3 U 70901	BH3 L 70902	BH4 U 70903	BH4 L 70904	DITCH 1 70905	LS1 70906	LS2 70907
Sodium		1210	121	2880	205	70	17	16	24	15000	12	11
Potassium		68	24	114	31	3.1	2.5	1.4	2.4	430	1.6	1.4
Calcium		37	40	88	16	160	105	105	115	400	88	93
Magnesium		85	35	220	21	8.2	2.9	3.1	3.8	1480	2.3	2.2
Sulphate		197	34	920	44	62	14	4	16	3250	7	10
Chloride		1850	160	4360	180	147	28	23	33	26025	19	20
Bicarbonate		480	350	520	410	380	310	330	350	260	260	270
Nitrate		<10	<10	<10	<10	<1	<1	<1	5	<10	14	14

Concentrations expressed as mg/L (ppm) unless otherwise stated

APPENDIX IV

APPENDIX V



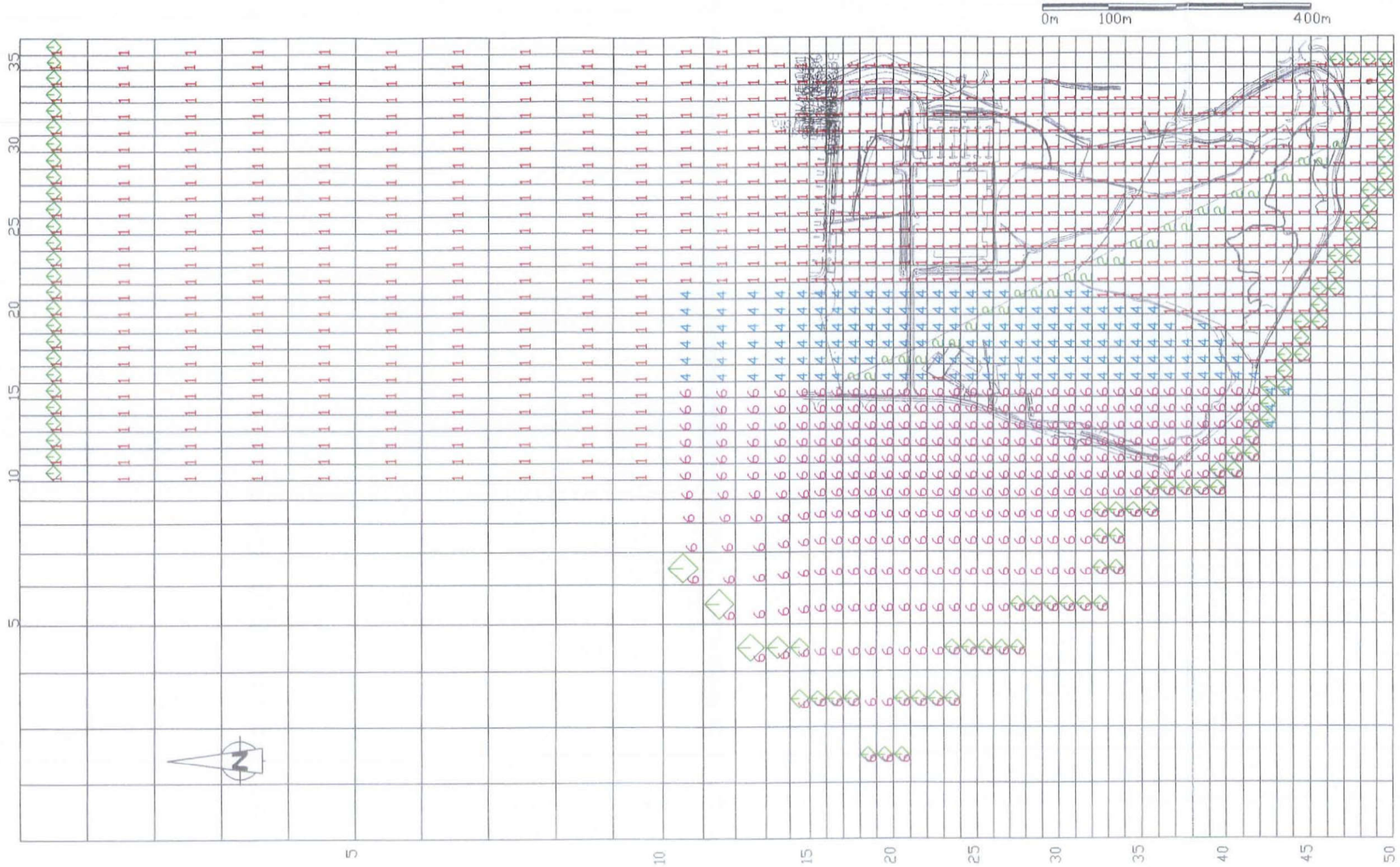
IBM LAND AT SOUTHMOOR, HAVANT

MODELLING PARAMETERS:
MODEL DOMAIN

SYMONDS
TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
GC			APR'97	N.T.S	E.Grinstead	1	

NOTE THE PROPERTY OF THIS DRAWING AND DESIGN IS VESTED IN SYMONDS GROUP LIMITED AND MUST NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THEIR WRITTEN CONSENT



Key to permeability zones

zone	Horizontal Permeability (m/day)	Vertical Permeability (m/day)
1	15	0.015
2	50	5
3	10	0.1
4	15	0.015
5	10	0.1
6	40	0.04

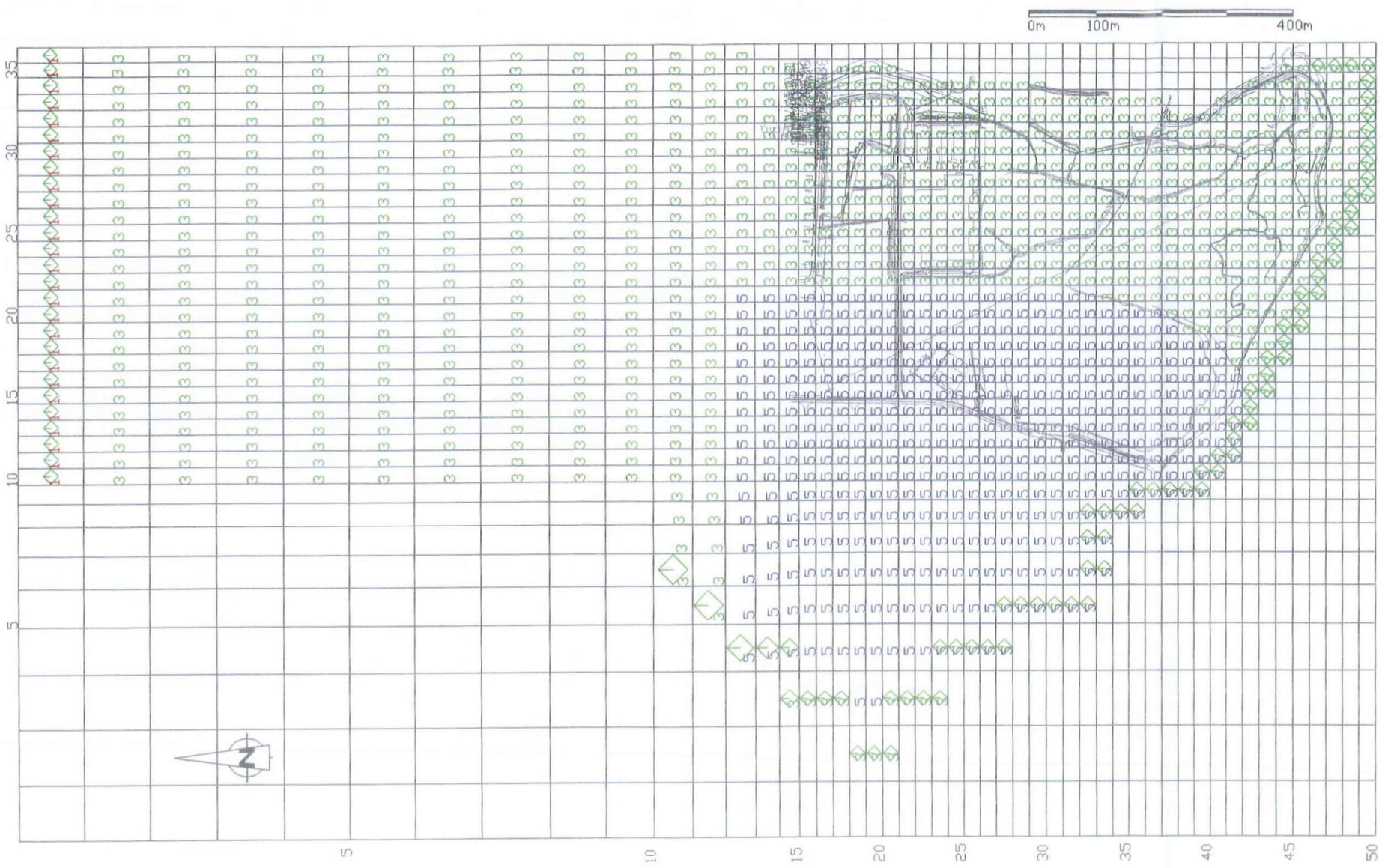
IBM LAND AT SOUTHMOOR, HAVANT

MODELLING PARAMETERS
PERMEABILITY – LAYER 1

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
GC			APR'97	N.T.S	E.Grinstead	11	

NOTE THE PROPERTY OF THIS DRAWING AND DESIGN IS VESTED IN SYMONDS GROUP LIMITED AND MUST NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THEIR WRITTEN CONSENT



Key to permeability zones

zone	Horizontal Permeability (m/day)	Vertical Permeability (m/day)
1	15	0.015
2	50	5
3	10	0.1
4	15	0.015
5	10	0.1
6	40	0.04

NOTE THE PROPERTY OF THIS DRAWING AND DESIGN IS VESTED IN SYMONDS GROUP LIMITED AND MUST NOT BE COPIED OR REPRODUCED IN ANY WAY WITHOUT THEIR WRITTEN CONSENT

IBM LAND AT SOUTHMOOR, HAVANT

MODELLING PARAMETERS
PERMEABILITY – LAYER 2

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
GC			APR'97	N.T.S.	E.Grinstead	III	

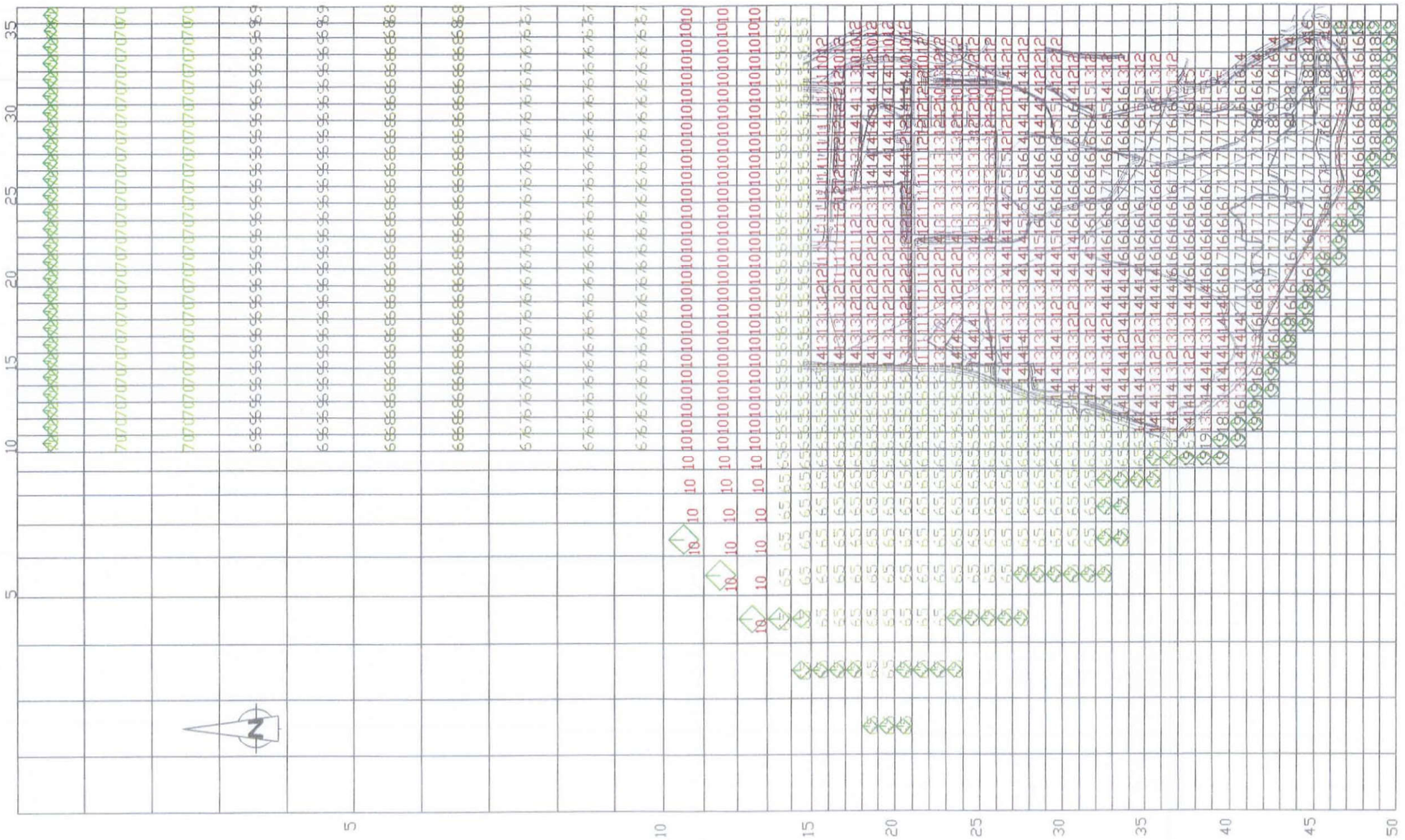
KEY TO ELEVATIONS

Key to elevations (top layer1)

zone	elevation (mAOD)	zone	elevation (mAOD)	zone	elevation (mAOD)	zone	elevation (mAOD)	zone	elevation (mAOD)	zone	elevation (mAOD)	zone	elevation (mAOD)
1	0	11	4.5	21	-0.5	31	-3	41	0	51	-10	61	0
2	0.5	12	4	22	-1	32	-2.9	42	-1.9	52	-9	62	1
3	1	13	3.5	23	-1.5	33	-2.8	43	-1.8	53	-8	63	2
4	1.5	14	3	24	-2	34	-2.7	44	-1.7	54	-7	64	3
5	2	15	2.5	25	-2.5	35	-2.6	45	-1.6	55	-6	65	4
6	2.5	16	2	26	-3	36	-2.5	46	-1.5	56	-5	66	5
7	3	17	1.5	27	-3.5	37	-2.4	47	-1.4	57	-4	67	6
8	3.5	18	1	28	-4	38	-2.3	48	-1.3	58	-3	68	7
9	4	19	0.5	29	-4.5	39	-2.2	49	-1.2	59	-2	69	8
10	5	20	0	30	-5	40	-2.1	50	-2	60	-1	70	9

Key to elevations (bottom layer1)

zone	elevation (mAOD)	zone	elevation (mAOD)	zone	elevation (mAOD)	zone	elevation (mAOD)	zone	elevation (mAOD)	zone	elevation (mAOD)	zone	elevation (mAOD)
1	0	11	4.5	21	-0.5	31	-3	41	0	51	-10	61	0
2	0	12	4	22	-1	32	-2.9	42	-1.9	52	-9	62	1
3	0	13	3.5	23	-1.5	33	-2.8	43	-1.8	53	-8	63	2
4	0	14	3	24	-2	34	-2.7	44	-1.7	54	-7	64	3
5	0	15	2.5	25	-2.5	35	-2.6	45	-1.6	55	-6	65	4
6	0	16	2	26	-3	36	-2.5	46	-1.5	56	-5	66	5
7	0	17	1.5	27	-3.5	37	-2.4	47	-1.4	57	-4	67	6
8	0	18	1	28	-4	38	-2.3	48	-1.3	58	-3	68	7
9	0	19	0.5	29	-4.5	39	-2.2	49	-1.2	59	-2	69	8
10	5	20	0	30	-5	40	-2.1	50	-2	60	-1	70	9



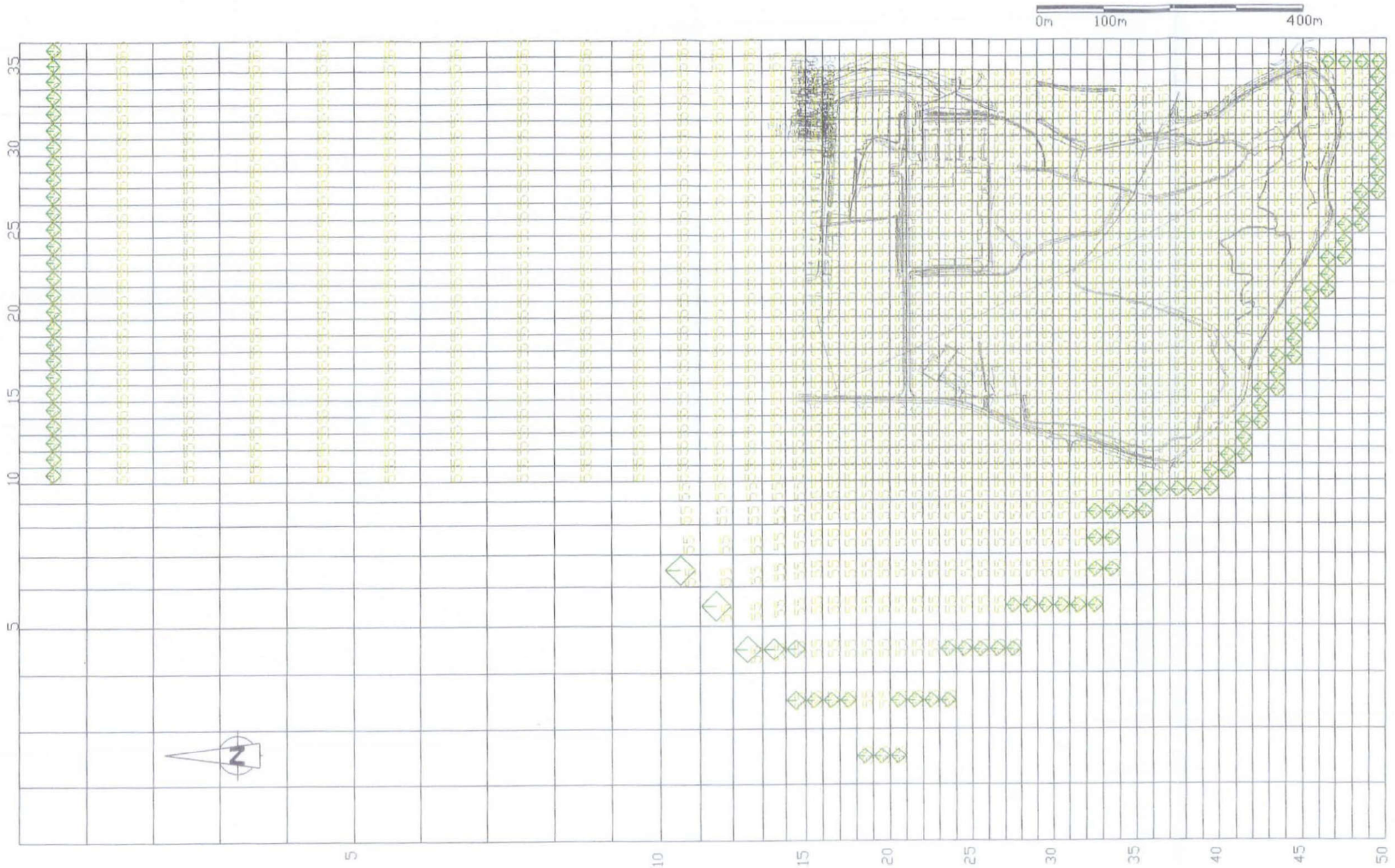
IBM LAND AT HAVANT, SOUTHMOOR

MODELLING PARAMETERS:
TOP ELEVATION OF LAYER 1

SYMONDS TRAVERS MORGAN

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MODELLING PARAMETERS:
BOTTOM ELEVATION OF
LAYER 2

SYMONDS
TRAVERS MORGAN

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RECHARGE AND EVAPOTRANSPIRATION IN THE TRANSIENT STATE

Key to recharge (m/day) - Transient state (pre development)

zone	Time step											
	1	2	3	4	5	6	7	8	9	10	11	12
	October	November	December	January	February	march	April	may	June	July	August	September
1	0.0029	0.0023	0.0029	0.0026	0.0019	0.0021	0.0015	0.0013	0.0014	0.0016	0.0016	0.002
2	0.000145	0.000115	0.000145	0.00013	0.000095	0.00011	0.000075	0.000065	0.00007	0.00008	0.00008	0.0001
3	0.0068	0.0058	0.0068	0.0062	0.0051	0.0054	0.0045	0.0042	0.0044	0.0046	0.0046	0.0055
4	0.0015	0.0012	0.0015	0.0013	0.00095	0.0011	0.00075	0.00065	0.0007	0.0008	0.0008	0.001

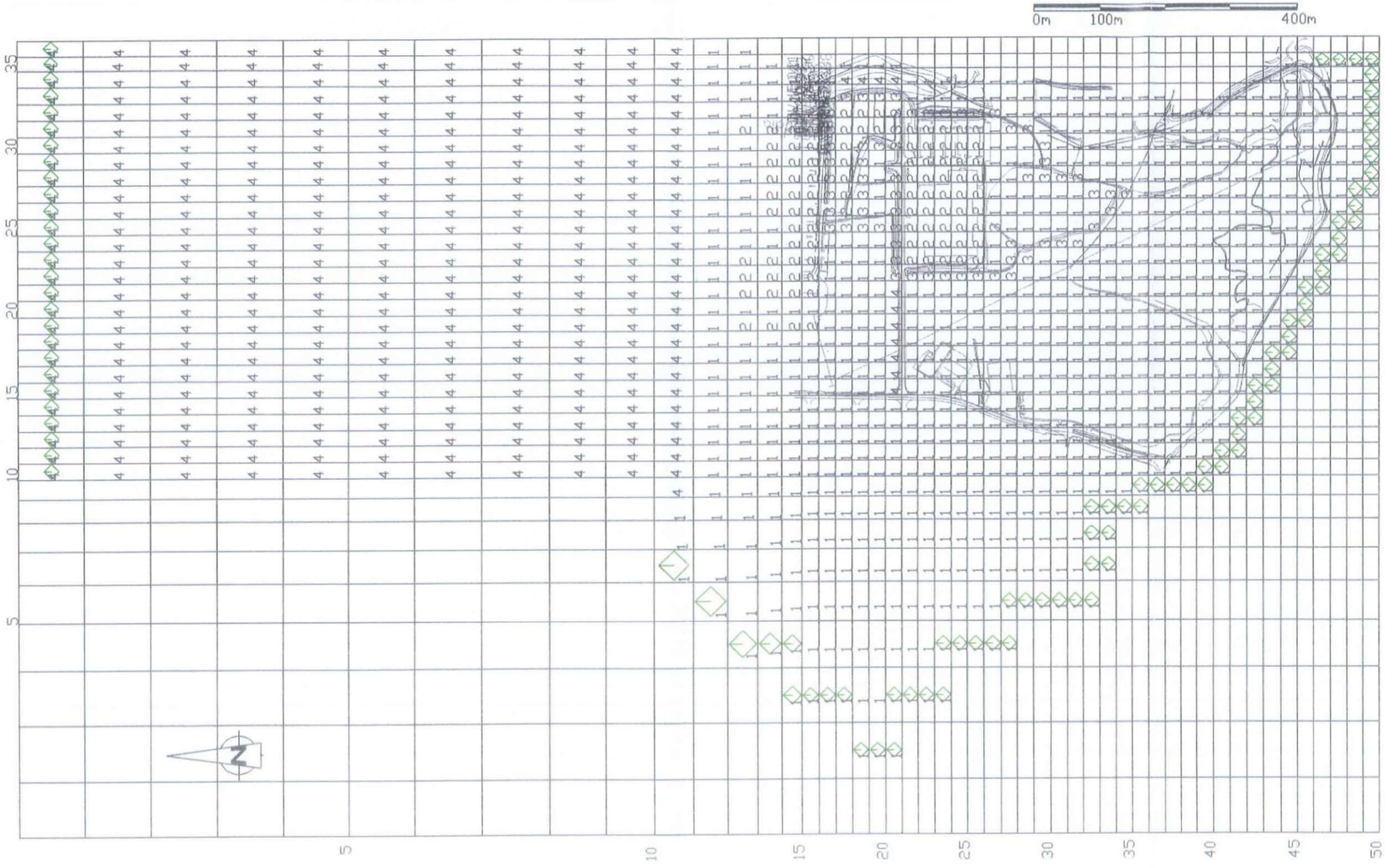
Key to recharge (m/day) - Transient state (post development)

zone	Time step											
	1	2	3	4	5	6	7	8	9	10	11	12
	October	November	December	January	February	March	April	May	June	July	August	September
1	0.0029	0.0023	0.0029	0.0026	0.0019	0.0021	0.0015	0.0013	0.0014	0.0016	0.0016	0.002
2	0.000145	0.000115	0.000145	0.00013	0.000095	0.00011	0.000075	0.000065	0.00007	0.00008	0.00008	0.0001
3	0.0102	0.0087	0.0102	0.0093	0.00765	0.0081	0.00675	0.0063	0.0066	0.0069	0.0069	0.00825
4	0.0015	0.0012	0.0015	0.0013	0.00095	0.0011	0.00075	0.00065	0.0007	0.0008	0.0008	0.001

Key to evapotranspiration (m/day) - Transient state

zone	Time step											
	1	2	3	4	5	6	7	8	9	10	11	12
	October	November	December	January	February	March	April	May	June	July	August	September
1	0.0018	0.0063	0.00043	0.00046	0.00059	0.00174	0.00195	0.00284	0.00283	0.00194	0.00169	0.00198
2	0.0014	0.00105	0.00072	0.00077	0.00098	0.00163	0.00279	0.00355	0.00354	0.00243	0.00211	0.00248
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0.00059	0.000315	0.000215	0.00023	0.000295	0.00057	0.000975	0.00142	0.00142	0.00097	0.000845	0.00099

Note The zonal values of evapotranspiration do not vary between the transient (pre development and post development cases



Key to recharge zones - pre development

zone	Recharge (m/day)
1	0.0019
2	0.000095
3	0.0053
4	0.00095

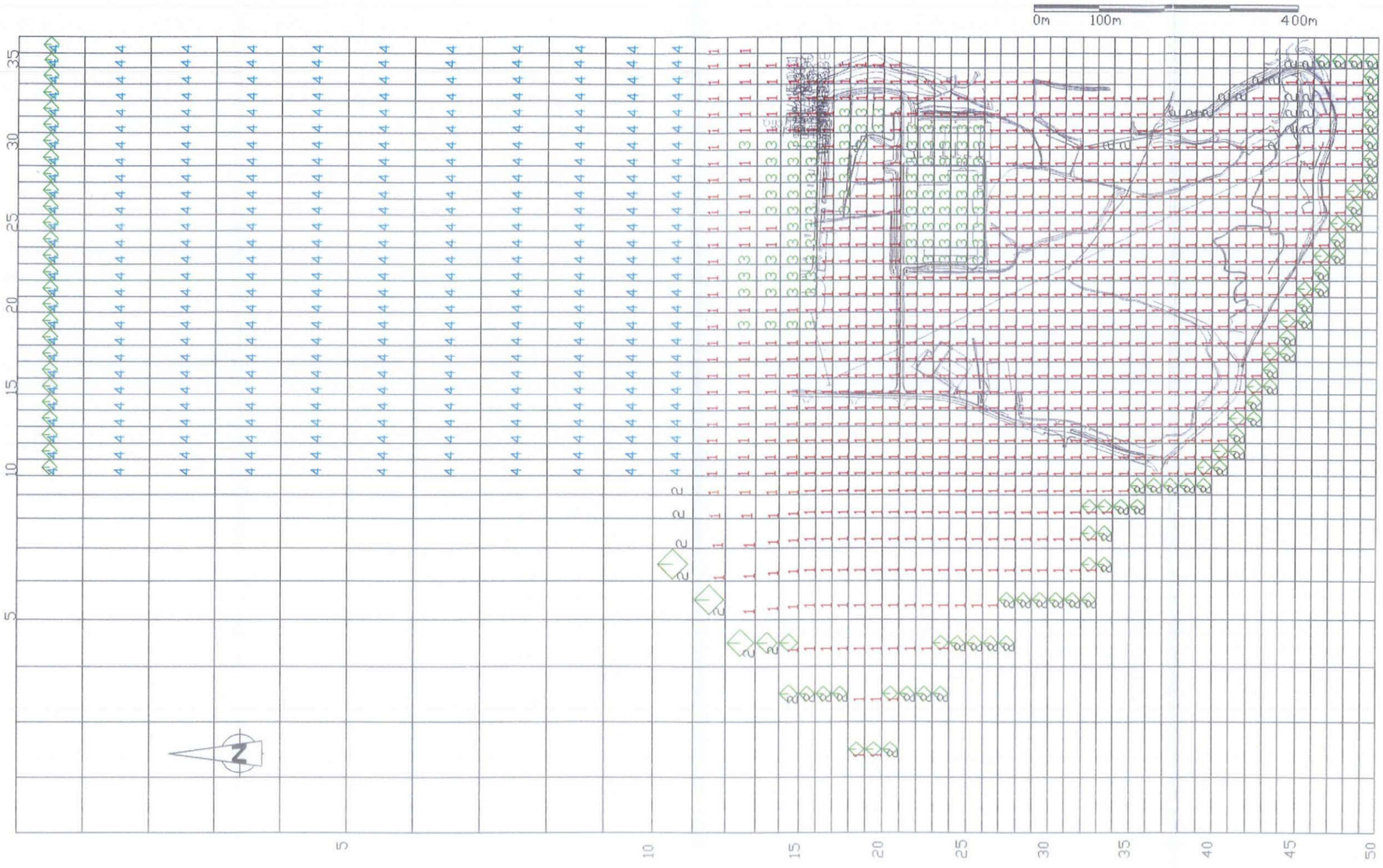
IBM LAND AT SOUTHMOOR, HAVANT

MODELLING PARAMETERS:
RECHARGE (LAYER 1)

SYMONDS TRAVERS MORGAN

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Key to evapotranspiration

zone	Evapotranspiration (m/day)
1	0.00147
2	0.0021
3	0
4	0.000735

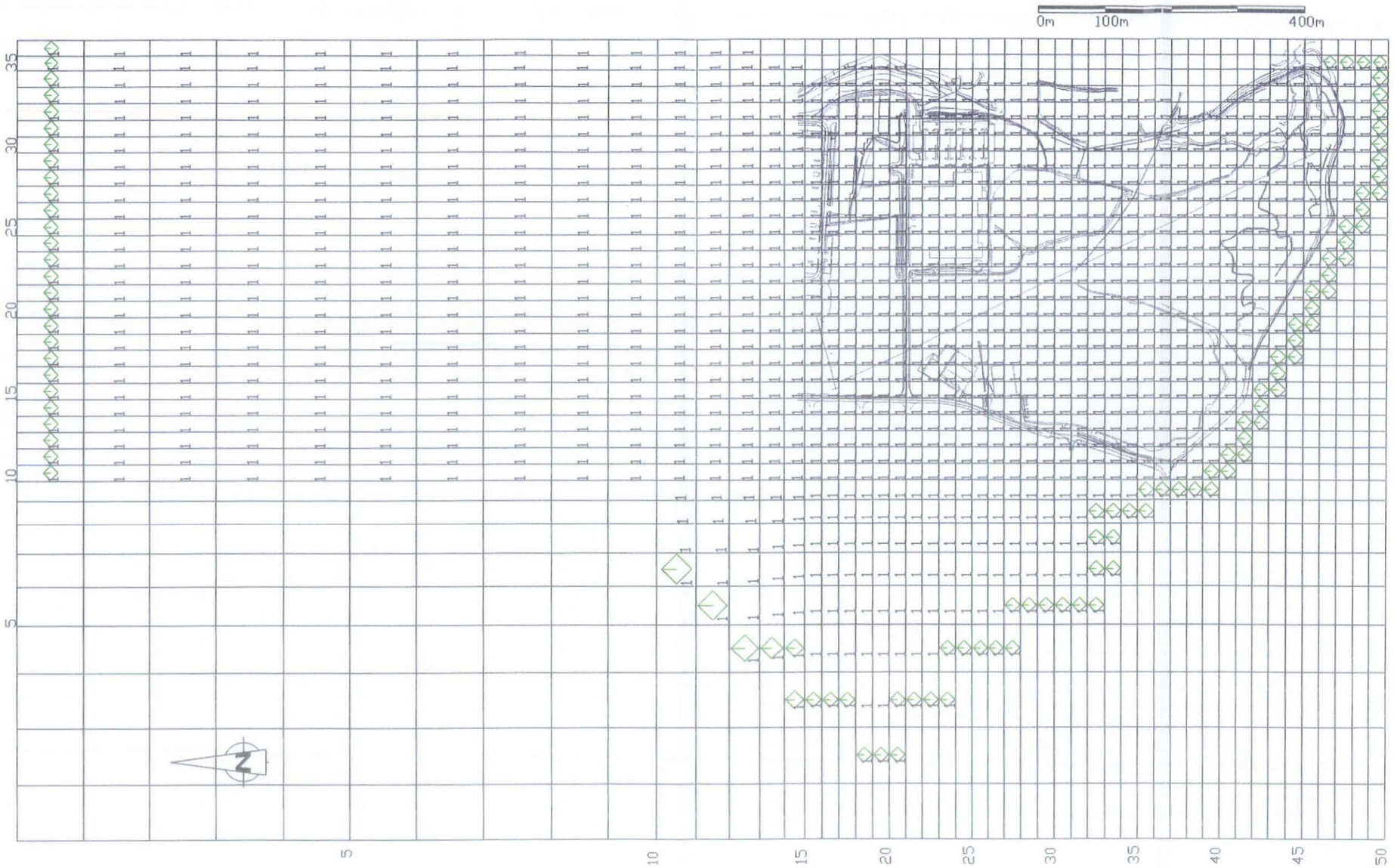
IBM LAND AT SOUTHMOOR, HAVANT

MODELLING PARAMETERS:
EVAPOTRANSPIRATION (LAYER 1)

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
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zone	storage	porosity
1	0.15	0.2
2	0.01	0.02

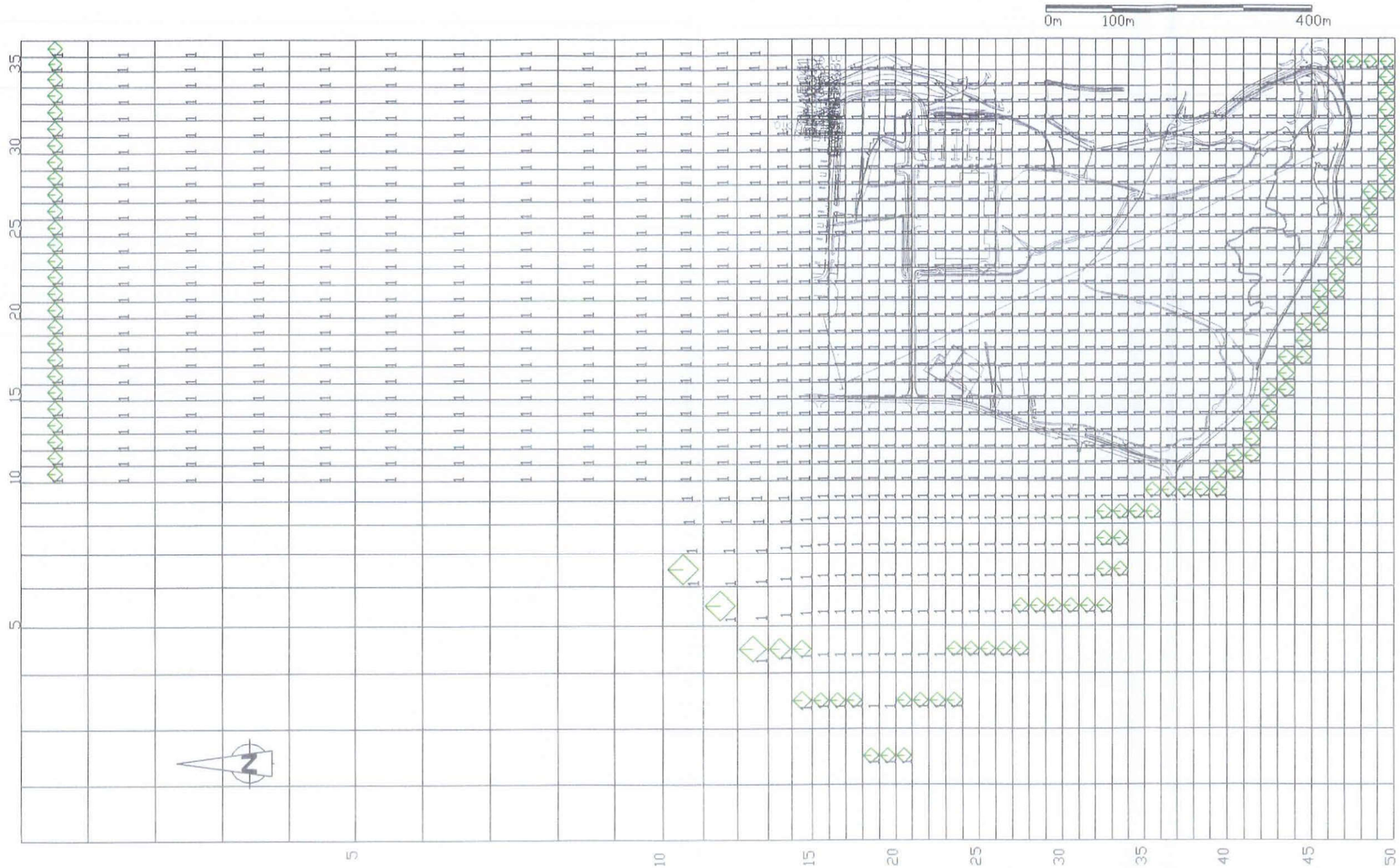
IBM LAND AT SOUTHMOOR, HAVANT

MODELLING PARAMETERS:
STORAGE/POROSITY (LAYER 1)

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
GC			APR'97	N.T.S	E.Grinstead	IX	

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zone	storage	porosity
1	0.15	0.2
2	0.01	0.02

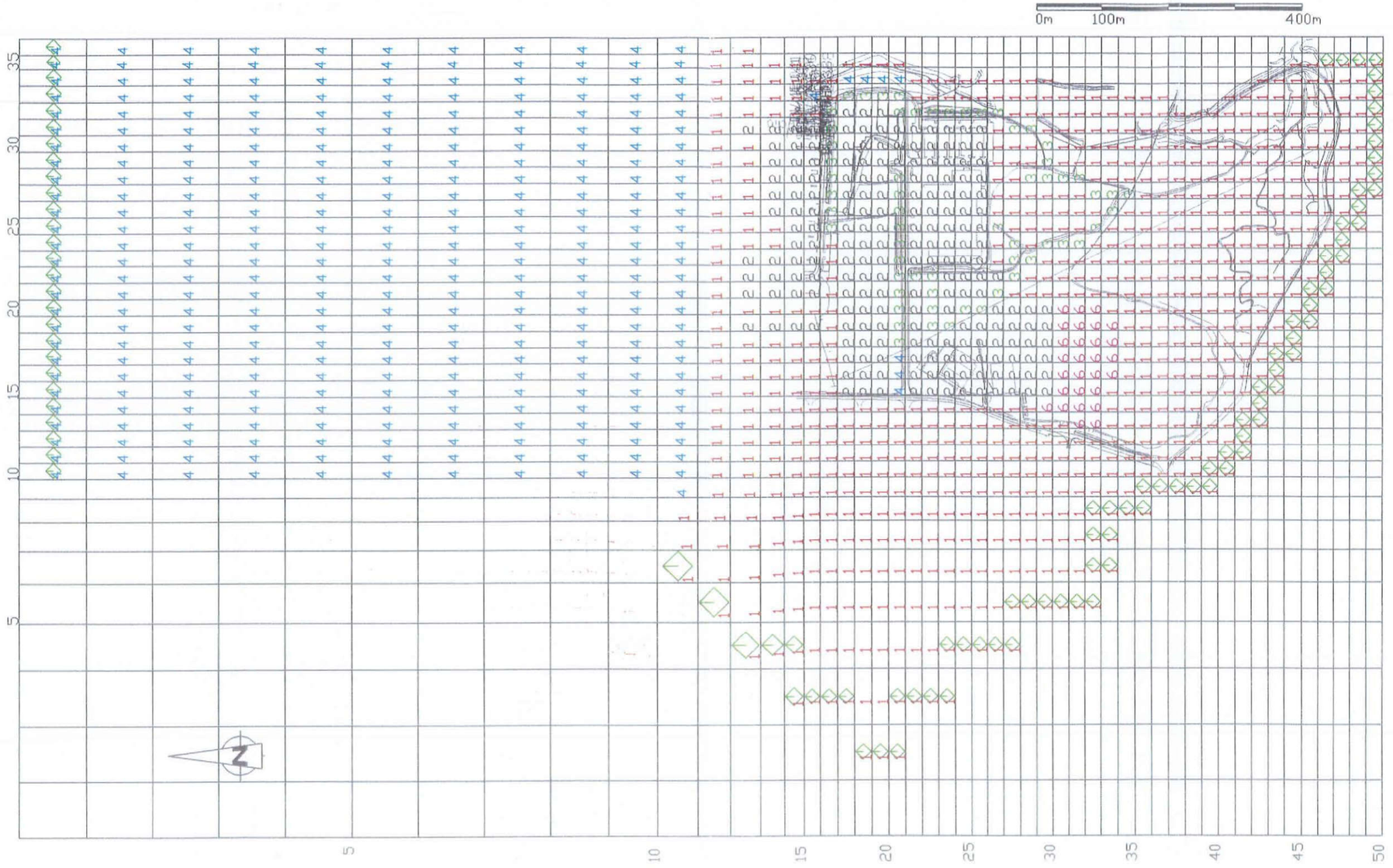
IBM LAND AT SOUTHMOOR, HAVANT

MODELLING PARAMETERS:
STORAGE/POROSITY (LAYER 2)

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
GC			APR'97	N.T.S	E.Grinstead	X	

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zone	Recharge (m/day)
1	0.0019
2	0.000095
3	0.008
4	0.00095
5	0
6	0.000095
7	0.00095

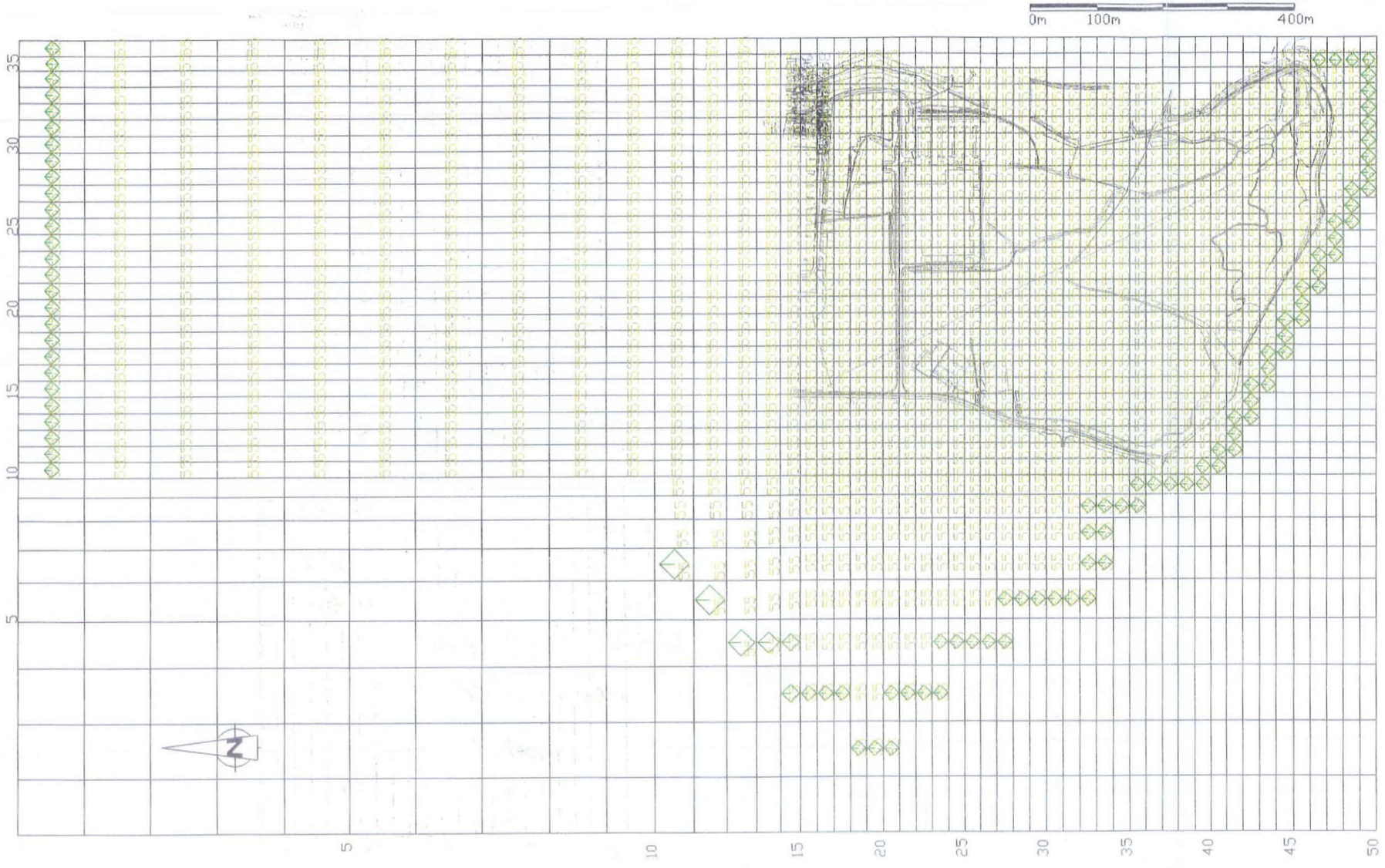
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IBM LAND AT SOUTHMOOR, HAVANT

MODELLING PARAMETERS:
FUTURE DEVELOPMENT – RECHARGE

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
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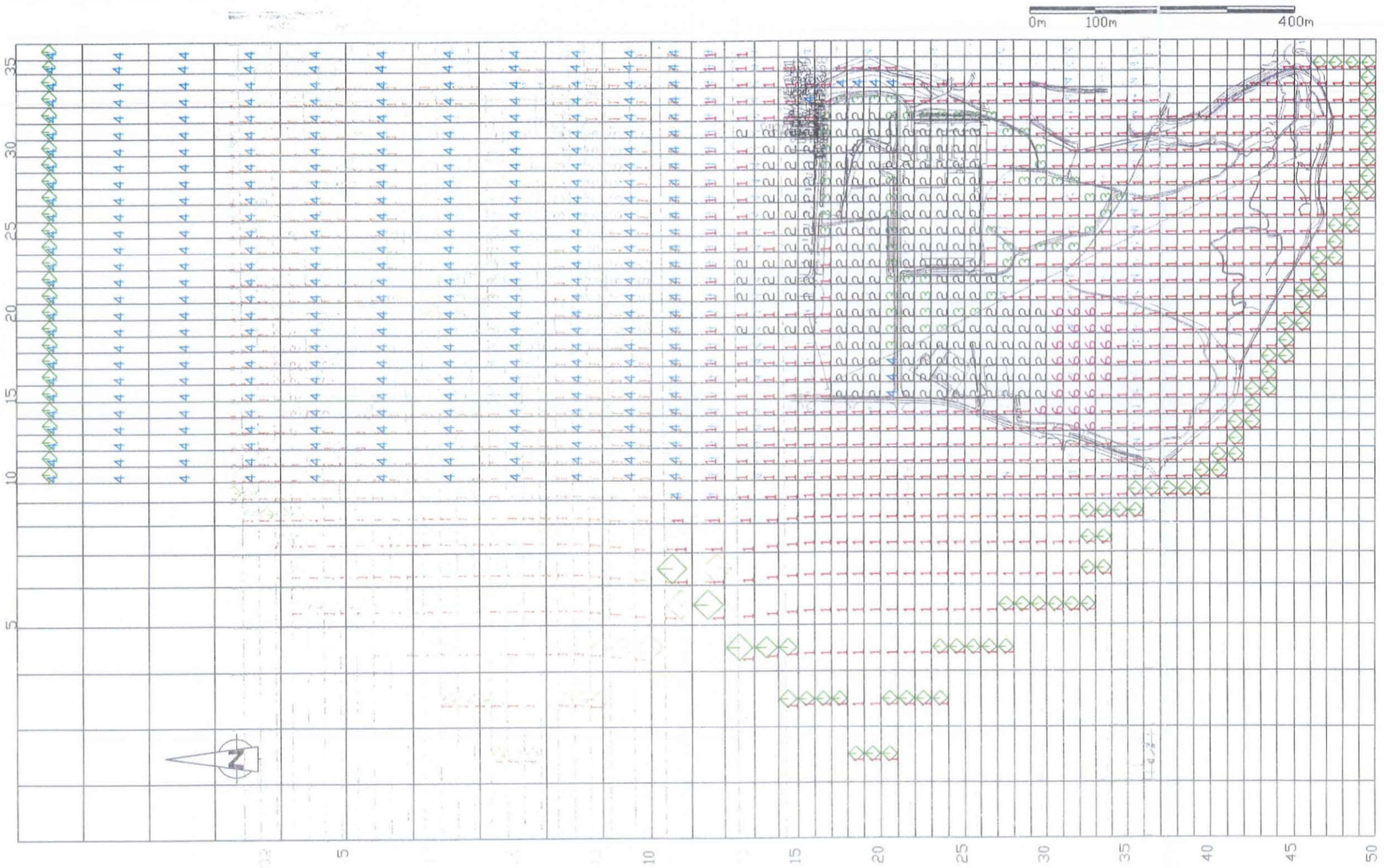
IBM LAND AT SOUTHMOOR – HAVANT

MODELLING PARAMETERS:
BOTTOM ELEVATION OF
LAYER 2

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
GC			APR'97	N.T.S.	E.Grinstead	APPENDIX VI	

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zone	Evapotranspiration (m/day)
1	0.00147
2	0.0021
3	0
4	0.000735

IBM LAND AT SOUTHMOOR, HAVANT

MODELLING PARAMETERS:
FUTURE DEVELOPMENT – EVAPOTRANSPIRATION

SYMONDS TRAVERS MORGAN

DRAWN BY	CHECKED BY	PASSED BY	DATE	SCALES @ A3	ISSUING OFFICE	DRAWING NUMBER	REV
GC			APR'97	N.T.S.	E.Grinstead	XII	

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CONSULTING ENGINEERS

CAMPBELL REITH HILL

Confidential

Southmoor Park, Havant

Contamination Assessment Report

on behalf of

SEEDA

Project N°: 7816

May 2001

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3.0 METHOD OF ANALYSIS

4.0 SUMMARY OF RESULTS

6.0 CONCLUSION

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Figure 2 - Sample Point Locations

Appendix 1- Chemical analysis for ICRCL suite and bacteriological analyses

Document History

Date	Status	WP Ref.	Prepared by	Initials	Reviewed by	Initials
May 2001	D1	THth7816-150501	T.Hillier		D.Innes	

1.0 INTRODUCTION

1.1 Campbell Reith Hill have been commissioned by SEEDA to undertake environmental and engineering appraisals of a site known as Southmoor Park in Havant, Hampshire. The first phase of this work was concluded in the production of a desk study Environmental and Site Appraisal report (ref:THth7816-120401).

1.2 The Environmental and Site Appraisal report (which is summarised in section 2.0) identified the potential for mercury contamination to exist at the site, and therefore recommended the investigation of the site accordingly. The report also highlighted the potential risk due to unexploded munitions, and recommended a more detailed appraisal of the issue. This report presents the findings of the mercury contamination investigation and appraisal, along with an assessment of the results and their implications with respect to SEEDA's potential acquisition and redevelopment of the site.

1.3 This report should be read in conjunction with the environmental and site appraisal report.

1.4 This report has been produced solely for the benefit of SEEDA, and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing.

2.0 SITE STATUS AND BACKGROUND

2.1 *Description and Setting*

2.1.1 The site comprises of two parcels of land forming an 'L' shape, totalling an area of 18.6 acres. The site is covered largely by rough vegetation with some areas of hard standing. There is a network of drainage ditches across the site, however there is no evidence of contamination or contaminative uses on the site.

2.1.2 The site is intermittently underlain by Aeolian deposits over alluvium, these drift deposits are underlain by Seaford Chalk. The underlying chalk is classified as a major aquifer with a soil classification of high leachability, therefore the site has been classified as lying within a hydrogeolological setting of high sensitivity.

2.1.3 The site also lies in close vicinity to a number of surface water features, with the Lavant stream running north to south directly east of the site and Langstone Channel approximately 500m south of the site. Due to the proximity of these water courses the sites surface water sensitivity was assessed as being high.

2.1.4 The overall sensitivity of the site and the area surrounding it was also increased due to the presence of a Site of Special Scientific Interest (SSSI) located south of the site.

2.2 *Desk Study Findings*

2.2.1 Three key issues were identified from the Environmental and Site Appraisal which would required further investigation in order to understand and quantify the potential environmental risks associated with the site and their implications for the acquisition and proposed development of the site. These issues were suspected mercury contamination in the drainage ditches and waters adjoining the site, the potential for the presence of unexploded munitions on the site from the Second World War and the effect of site development on the local ecology.

Mercury Contamination

2.2.2 There is no evidence to suggest that any significant sources of on site contamination exist, although previous site investigations have identified that historically sewage sludge spreading may have taken place on the site. One of these investigations, undertaken by Soils Limited, reported elevated levels of mercury concentrations in the drainage ditches and waters adjoining the site. The spreading of sewage sludge and a historical nearby plating works were identified as possible sources. However a level of uncertainty surrounded this information, as subsequent reports failed to identify further evidence of mercury contamination.

2.2.3 Due to the risk associated with mercury in terms of its toxicity, persistence and bioaccumulation effects CRH identified the need to undertake a validatory exercise of surface sampling of soil, sediment and surface waters at the site in order to eliminate the uncertainty with respect to the presence of mercury, both in terms of the potential liability issues and associated remedial costs.

2.2.4 The methodology and results from this validatory exercise are presented in sections 3.0 and 4.0 respectively

Unexploded Munitions

2.2.5 A second issue arose from research into the historical uses of the land surrounding the site. This research identified that areas surrounding Southmoor Park, namely Hayling Island and Langstone Harbour, were used in the Second World War as decoy sites to draw German bombing raids away from areas such as Portsmouth.

2.2.6 No obvious evidence for the presence of munitions was identified at the site, however it was agreed to commission a specialist desk study investigation to establish that there is no risk from munitions remaining on the site. The results of this work will be reported separately.

Ecology

2.2.7 The third issue related to the potential ecological sensitivity of the site due to the nearby SSSI's. As a result, a more detailed appraisal by a specialist ecological consultancy has been commissioned. The results of this work will be reported separately.

3.0 METHOD OF ANALYSIS

3.1 Surface soil, sediment from the drainage ditches and where possible water samples were collected across the site and from the drainage ditches. Soil samples were collected on an approximate 50m by 50m grid across the site. Samples were not collected where there were areas of hard standing. The samples were collected using a trowel, removing a sufficient quantity of material for sample analysis from beneath any vegetation that was present. The sampling was undertaken from the surface 300mm of soil and/or sediment. The location of each sample was logged on a site plan as shown in Figure 2.

3.2 Sediment samples were collected at approximately 25m intervals where possible from the drainage ditches across the site, following the same methodology. These sample points were again logged on a site plan (Figure.2).

3.3 Water samples were collected in clear plastic bottles at locations where surface water was present in the drainage ditches. Surface water was only found at two locations and these sample locations are also logged on the site plan (Figure.2).

3.4 The samples were immediately dispatched to the laboratory of Geochem Alcontrol (a NAMAS accredited testing house). All samples were analysed for the full suite of ICRCL determinands and at a number of locations across the site a second sample was collected and analysed for bacteriological contamination.

4.0 SUMMARY OF RESULTS

4.1 *Soil Samples*

4.1.1 Mercury was found to be below the limit of detection (LoD) of 1mg/kg for every soil sample collected on the site. Any mercury in the soil is therefore below the ICRCL concentration threshold value of 20 mg/kg for parks, playing fields and open spaces.

4.1.2 Some elevated levels of Polyaromatic Hydrocarbons (PAH's) were found in some of the soil samples at various locations across the site. However these were all found to be below the ICRCL concentration threshold value for landscaped areas, buildings and areas of hard cover of 1000 mg/kg.

4.1.3 Some elevated levels of arsenic were found in some of the soil samples at various locations across the site. However these were all found to be below the ICRCL concentration threshold for parks, playing fields and open spaces of 40 mg/kg.

4.2 *Sediment samples*

4.2.1 Mercury was found to be below the limit of detection (LoD) of 1 mg/kg for every drainage ditch sediment sample collected on the site. Any mercury in the drainage ditch sediment samples is therefore below the ICRCL concentration threshold value of 20 mg/kg for parks, playing fields and open spaces.

4.2.2 Some elevated levels of Polyaromatic Hydrocarbons (PAH's) were found in some of the drainage ditch sediment samples at various locations across the site. However these were all found to be below the ICRCL concentration threshold value for landscaped areas, buildings and areas of hard cover of 1000 mg/kg.

4.2.3 Some elevated levels of arsenic were found in some of the drainage ditch sediment samples at various locations across the site. However these were all found to be below the ICRCL concentration threshold for parks, playing fields and open spaces of 40 mg/kg.

4.3 *Water Samples*

4.3.1 Mercury was found to be below the limit of detection (LoD) of 0.05 mg/kg for both water samples collected on the site.

4.4 Table summarising the presence of contaminants with respect to their associated guidelines.

Contaminant	Sample type	Min.conc (mg/kg)	Max.conc (mg/kg)	Concentration Threshold (mg/kg)	Action value (mg/kg)	% of samples above threshold value
Mercury	Soil	<1	<1	40	*	0
PAH's	Soil	<20	472	1,000	10,000	0
Arsenic	Soil	5	14	40	*	0
Mercury	Sediment	<1	<1	40	*	0
PAH's	Sediment	<20	951	1,000	10,000	0
Arsenic	Sediment	2	15	50	*	0
Mercury	Water	<0.05	<0.05	0.01#	*	0

* No value given in ICRCL guidelines
Dutch guideline intervention value given

4.5 According to ICRCL guidelines all other contaminants tested for in the ICRCL suite were shown to be at levels below the limit of detection for the method of analysis used, or significantly below the Concentration Threshold value. Therefore the site can be regarded as uncontaminated as far as the hazards from these contaminants are concerned.

4.5 No evidence of bacteriological contamination caused by the inferred sewage sludge spreading in the form of coliform was identified by the sample analysis.

4.6 Results of analysis are contained in Appendix 1 for ICRCL suite and bacteriological analyses.

5.0 CONCLUSION

5.1 *Soil, Sediment and Water Analyses*

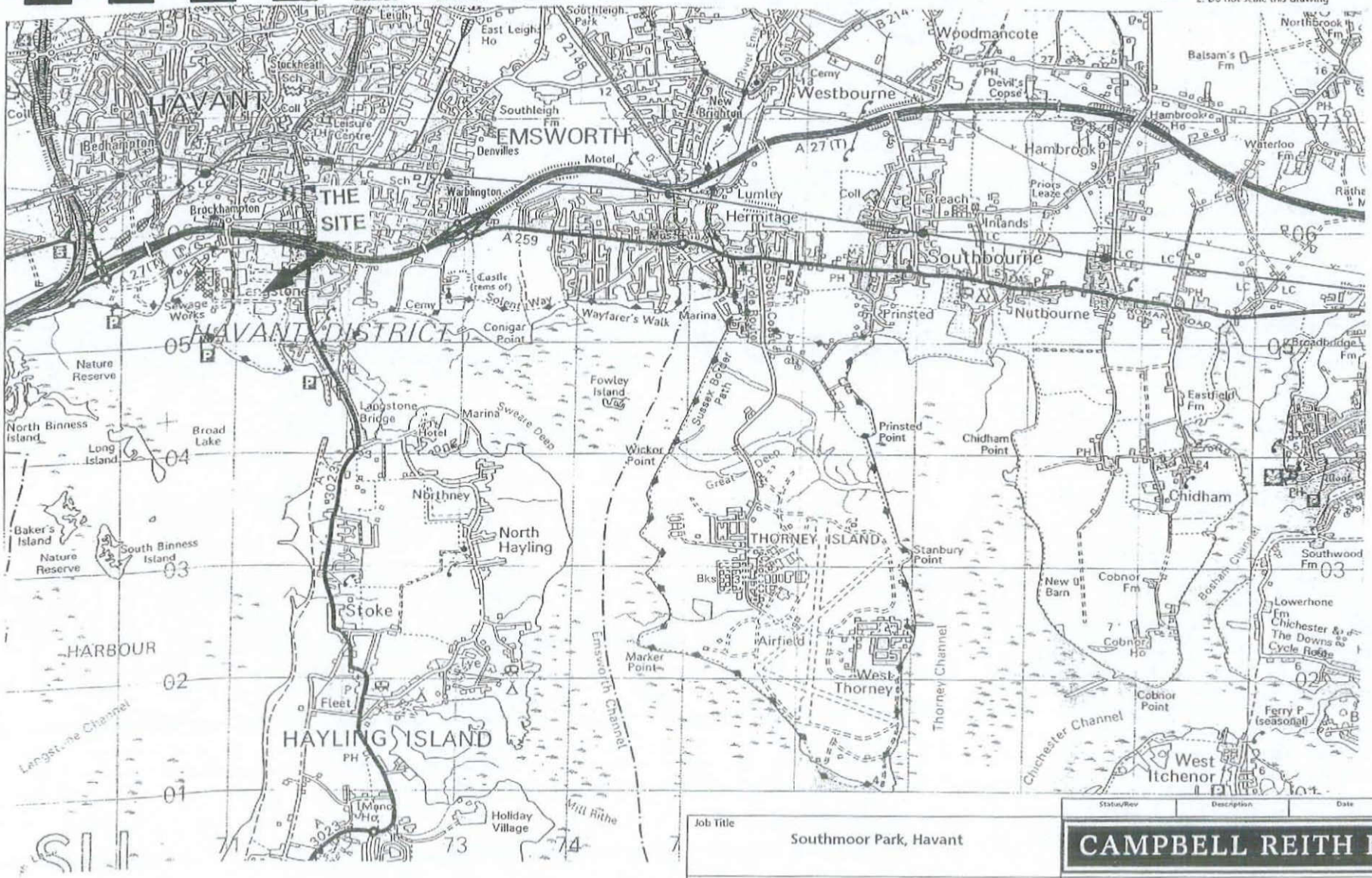
5.1.1 The data obtained from the validatory sampling exercise undertaken at Southmoor Park has provided a comprehensive data set with respect to the sites contaminative status. The data shows that no elevated levels of mercury were found in the samples. All mercury levels were found to be below the limit of detection for mercury. Interpretation of this data indicates that the potential risk from on site mercury contamination is low in terms of possible liability and remedial costs. No subsequent recommendations are therefore required with regards to further intrusive investigation works or remediation requirements.

5.1.2 Analyses have confirmed no other determinands to be elevated with respect to the published guideline thresholds relevant to an industrial end use.

5.1.3 In conclusion, the validatory investigation works have not identified the presence of significant contamination. The site is therefore considered to be low risk with respect to its contaminative status, and no further works or action are considered necessary.

Figure 1: Site Location

No. Only Status 'C' drawings to be used for construction
2. Do not scale this drawing



Status/Rev	Description	Date	By

Job Title: Southmoor Park, Havant					CAMPBELL REITH HILL		
Site Location Plan					Consulting Engineers 21 Dartmouth Street St James Park • London • SW1H 9BP Telephone 020 7565 1600 • Facsimilie 020 7565 1666		
drawn: TH	Date: 12/04/01	Scale: NTS	CI checked:	Filename:	Job No.: 7816	Drg No.: Figure 1	Status/Rev: D1

Figure 2: Surface sample points

Appendix 1:

Chemical analysis for ICRCL suite and bacteriological analyses

GEOCHEM REMEDIATION TESTING

Client Name: Campbell Reith Hill **Location:** Not Specified

GRT Job No.: 01/04063/06/01 **Reference:** 7816

Client Sample No.	S1	S2	S3	S4	S5	S6	S7	S8	S9		
Depth	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN		
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		
Sample Date	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	Units	LoD
GRT Sample No.	1	2	3	4	5	6	7	8	9		
Acid Soluble Sulphide	2	<1	<1	2	2	<1	2	2	4	ppm	1
PAH Screen	78	25	<20	126	63	<20	<20	30	472	ppm	20
Arsenic	-	7	7	6	5	6	7	7	9	ppm	1
Hexavalent Chrome	<1	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Boron (Water Soluble)	<1	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Cadmium	-	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Chromium	-	21	32	29	27	22	17	44	33	ppm	1
Copper	-	19	17	21	17	22	21	19	50	ppm	1
Free Cyanide Soil	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	ppm	2.5
Mercury	-	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Nickel	-	13	16	13	9	10	10	11	10	ppm	1
Lead	-	32	11	32	42	45	41	28	275	ppm	1
pH Value in Soil	7.33	7.77	7.88	7.56	6.28	7.04	7.31	7.34	7.55	NONE	1.00
Total Phenols HPLC	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	ppm	0.01
Selenium	-	2	<1	2	2	2	2	<1	2	ppm	1
Thiocyanate	<5	<5	<5	<5	<5	<5	<5	<5	<5	ppm	5
Total Cyanide	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	ppm	2.5
Total Sulphur	0.04	0.02	0.01	0.04	0.04	0.04	0.02	0.03	0.06	%	0.01
Acid Sol. Sulphate as SO4	<0.01	<0.01	<0.01	0.03	<0.01	0.02	<0.01	<0.01	0.03	%	0.01
Zinc	-	47	42	37	43	45	50	40	183	ppm	1

UKAS Accredited

Validated by Y. Edge Yvonne Edge Date 11/05/2001

GEOCHEM REMEDIATION TESTING

Client Name: Campbell Reith Hill **Location:** Not Specified

GRT Job No.: 01/04063/06/01 **Reference:** 7816

Client Sample No.	S9C	S10	S11	S12	S13	S14	S14C	S15	S16	Units	LoD
Depth	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN		
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		
Sample Date	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01		
GRT Sample No.	10	11	12	13	14	15	16	17	18		
Acid Soluble Sulphide	-	2	2	<1	<1	2	-	2	2	ppm	1
PAH Screen	-	26	25	36	39	57	-	35	83	ppm	20
Arsenic	-	11	14	8	12	7	-	6	10	ppm	1
Hexavalent Chrome	-	<1	<1	<1	<1	<1	-	<1	<1	ppm	1
Boron(Water Soluble)	-	<1	<1	<1	<1	<1	-	<1	<1	ppm	1
Cadmium	-	<1	<1	<1	<1	<1	-	<1	1	ppm	1
Chromium	-	17	22	19	16	20	-	20	27	ppm	1
Copper	-	22	30	22	22	21	-	19	36	ppm	1
Free Cyanide Soil	-	<2.5	<2.5	<2.5	<2.5	<2.5	-	<2.5	<2.5	ppm	2.5
Mercury	-	<1	<1	<1	<1	<1	-	<1	<1	ppm	1
Nickel	-	10	17	11	11	12	-	19	13	ppm	1
Lead	-	50	61	37	42	44	-	17	104	ppm	1
pH Value Soil	-	6.66	5.86	5.82	6.01	6.22	-	7.63	6.94	NONE	1.00
Total Phenols(FTRC)	-	0.05	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	ppm	0.01
Selenium	-	1	2	2	<1	<1	-	<1	2	ppm	1
Thiocyanate	-	<5	<5	<5	<5	<5	-	<5	<5	ppm	5
Total Cyanide	-	<2.5	<2.5	<2.5	<2.5	<2.5	-	<2.5	<2.5	ppm	2.5
Total Sulphur	-	0.04	0.07	0.04	0.03	0.04	-	0.02	0.09	%	0.01
Acid Sol. Sulphate as SO4	-	<0.01	<0.01	<0.01	<0.01	<0.01	-	<0.01	<0.01	%	0.01
Zinc	-	65	122	50	44	45	-	45	52	ppm	1

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GEOCHEM REMEDIATION TESTING

Client Name: Campbell Reith Hill **Location:** Not Specified

GRT Job No.: 01/04063/06/01 **Reference:** 7816

Client Sample No.	S17	S19	S19C	S20	S21	S22	S23	S24	ST1		
Depth	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN		
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		
Sample Date	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	Units	LoD
GRT Sample No.	19	20	21	22	23	24	25	26	27		
Acid Soluble Sulphide	<1	2	~	2	<1	2	<1	2	62	ppm	1
PAH Screen	37	56	~	33	<20	36	36	49	36	ppm	20
Arsenic	6	6	~	6	6	5	7	7	6	ppm	1
Hexavalent Chrome	<1	<1	~	<1	<1	<1	<1	<1	<1	ppm	1
Boron (Water Soluble)	<1	<1	~	<1	<1	<1	<1	<1	<1	ppm	1
Cadmium	<1	1	~	<1	<1	<1	<1	<1	<1	ppm	1
Chromium	34	28	~	22	23	21	19	37	32	ppm	1
Copper	18	27	~	23	18	18	20	27	20	ppm	1
Free Cyanide Soil	<2.5	3.6	~	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	ppm	2.5
Mercury	<1	<1	~	<1	<1	<1	<1	<1	<1	ppm	1
Nickel	9	11	~	9	12	9	10	13	13	ppm	1
Lead	35	107	~	52	27	29	44	52	40	ppm	1
pH Value in Soil	5.68	7.48	~	6.06	6.01	6.18	6.01	6.85	7.07	NONE	1.00
Total Phenols HPLC	<0.01	<0.01	~	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ppm	0.01
Selenium	<1	1	~	<1	<1	1	1	2	<1	ppm	1
Thiocyanate	<5	<5	~	<5	<5	<5	<5	<5	<5	ppm	5
Total Cyanide	<2.5	3.6	~	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	ppm	2.5
Total Sulphur	0.03	0.05	~	0.04	0.02	0.03	0.03	0.04	0.07	%	0.01
Acid Sol. Sulphate as SO4	0.01	<0.01	~	<0.01	<0.01	<0.01	<0.01	<0.01	0.06	%	0.01
Zinc	38	74	~	59	38	40	43	63	40	ppm	1

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GEOCHEM REMEDIATION TESTING

Client Name: Campbell Reith Hill **Location:** Not Specified

GRT Job No.: 01/04083/06/01 **Reference:** 7816

Client Sample No.	ST2	ST3	ST4	ST5	ST6	ST7	ST8	ST9	ST10		
Depth	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN		
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		
Sample Date	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	03.05.01	Units	LoD
GRT Sample No.	28	29	30	31	32	33	34	35	36		
Acid Soluble Sulphide	58	48	4	<1	2	2	4	2	6	ppm	1
PAH Screen	951	440	55	<20	122	238	28	58	<20	ppm	20
Arsenic	8	4	6	5	15	9	5	5	2	ppm	1
Hexavalent Chrome	<1	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Boron Water Soluble	<1	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Cadmium	1	2	<1	<1	2	<1	<1	<1	<1	ppm	1
Chromium	38	109	19	18	54	15	28	46	21	ppm	1
Copper	37	47	25	13	37	29	22	21	13	ppm	1
Free Cyanide Soil	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	ppm	2.5
Mercury	<1	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Nickel	15	21	14	12	16	11	12	11	18	ppm	1
Lead	69	62	35	9	80	66	27	44	6	ppm	1
pH Value in Soil	6.93	7.37	7.32	7.95	6.97	7.35	7.48	7.04	7.43	NONE	1.00
Total Phenols HPLC	<0.01	0.20	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.06	ppm	0.01
Selenium	2	<1	2	2	<1	<1	2	1	1	ppm	1
Thiocyanate	<5	<5	<5	<5	<5	<5	<5	<5	<5	ppm	5
Total Cyanide	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	ppm	2.5
Total Sulphur	0.12	0.14	0.03	<0.01	0.17	0.07	0.02	0.05	<0.01	%	0.01
Acid Sol. Sulphate as SO4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	0.01	%	0.01
Zinc	109	88	47	27	79	60	78	41	38	ppm	1

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$t = 1.699$
$s = 160.8654$

$Js_{95} = \bar{x} + \frac{t.s}{\sqrt{n}}$

$= 68.96$

GEOCHEM REMEDIATION TESTING

$\bar{x} = 100.69$

Client Name: Campbell Reith Hill **Location:** Not Specified

GRT Job No.: 01/04063/06/01 **Reference:** 7816

Client Sample No.	ST11	ST12	Units	LoD
Depth	UNKNOWN	UNKNOWN		
Sample Type	SOIL	SOIL		
Sample Date	03.05.01	03.05.01		
GRT Sample No.	37	38		
Acid Soluble Sulphide	2	6	ppm	1
PAH Screen	41	93	ppm	20
Arsenic	7	8	ppm	1
Hexavalent Chrome	<1	<1	ppm	1
Boron (Water Soluble)	<1	<1	ppm	1
Cadmium	<1	<1	ppm	1
Chromium	35	29	ppm	1
Copper	17	44	ppm	1
Free Cyanide Soil	<2.5	<2.5	ppm	2.5
Mercury	<1	<1	ppm	1
Nickel	17	14	ppm	1
Lead	12	135	ppm	1
pH Value In Soil	7.53	7.48	NONE	1.00
Total Phenols HPLC	0.16	0.01	ppm	0.01
Selenium	1	<1	ppm	1
Thiocyanate	<5	<5	ppm	5
Total Cyanide	<2.5	<2.5	ppm	2.5
Total Sulphur	0.02	0.10	%	0.01
Acid Sol. Sulphate as SO_4	0.02	<0.01	%	0.01
Zinc	38	66	ppm	1

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GEOCHEM REMEDIATION TESTING

Client Name: Campbell Reith Hill **Location:** Not Specified

GRT Job No.: 01/04063/06/01 **Reference:** 7816

Client Sample No.	ST1	ST12	Units	LoD
Depth	UNKNOWN	UNKNOWN		
Sample Type	WATER	WATER		
Sample Date	03.05.01	03.05.01		
GRT Sample No.	39	40		
PAH Screen	<1	<1	ppm	1
Arsenic	<0.05	<0.05	ppm	0.05
Boron	<0.05	<0.05	ppm	0.05
Cadmium	<0.05	<0.05	ppm	0.05
Chromium	<0.05	<0.05	ppm	0.05
Hexavalent Chromium	<0.03	<0.03	ppm	0.03
Copper	<0.05	<0.05	ppm	0.05
Free sulphur Water	<0.1	<0.1	ppm	0.1
Free Cyanide Water	<0.05	<0.05	ppm	0.05
Mercury	<0.05	<0.05	ppm	0.05
Nickel	<0.05	<0.05	ppm	0.05
Lead	0.05	<0.05	ppm	0.05
pH Value in Water	7.14	7.29	NONE	1.00
Total Phenols HPLC	<0.01	<0.01	ppm	0.01
Sulphide in Water	0.04	0.03	ppm	0.01
Selenium	<0.05	<0.05	ppm	0.05
Sulphate(solubles)	46	14	ppm	3
Thiocyanate	0.2	<0.2	ppm	0.2
Total Cyanide on Water	<0.05	<0.05	ppm	0.05
Zinc	<0.05	<0.05	ppm	0.05

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GEOCHEM REMEDIATION TESTING

Client Name: Campbell Reith Hill **Location:** Not Specified

GRT Job No.: 01/04063/06/01 **Reference:** 7816

Client Sample No.	S25	S26	S27	S28	S29	S30	S31	S32	S33		
Depth	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN	UNKNOWN		
Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL		
Sample Date	04.05.01	04.05.01	04.05.01	04.05.01	04.05.01	04.05.01	04.05.01	04.05.01	04.05.01	Units	LoD
GRT Sample No.	41	42	43	44	45	46	47	48	49		
Acid Soluble Sulphide	<1	2	<1	<1	<1	<1	2	2	<1	ppm	1
PAH Screen	64	121	37	37	33	81	138	73	159	ppm	20
Arsenic	8	5	7	5	6	7	5	8	8	ppm	1
Hexavalent Chrome	<1	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Boron (Water Soluble)	<1	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Cadmium	<1	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Chromium	17	17	24	14	21	15	16	18	20	ppm	1
Copper	21	19	20	20	19	25	23	33	29	ppm	1
Free Cyanide Soil	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	ppm	2.5
Mercury	<1	<1	<1	<1	<1	<1	<1	<1	<1	ppm	1
Nickel	10	8	9	8	10	11	9	12	11	ppm	1
Lead	49	65	36	45	35	33	44	136	58	ppm	1
pH Value In Soil	7.13	6.91	7.08	7.49	7.48	7.27	9.37	7.19	7.26	NONE	1.00
Total Phenols HPLC	0.06	0.01	<0.01	0.04	0.01	<0.01	0.36	0.01	<0.01	ppm	0.01
Selenium	<1	2	<1	1	<1	<1	1	2	<1	ppm	1
Thiocyanate	<5	<5	<5	<5	<5	<5	5	<5	<5	ppm	5
Total Cyanide	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	ppm	2.5
Total Sulphur	0.04	0.06	0.04	0.03	0.03	0.05	0.08	0.05	0.04	%	0.01
Acid Sol. Sulphate as SO4	0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.05	0.02	<0.01	%	0.01
Zinc	49	42	42	39	39	54	51	52	53	ppm	1

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Validated by Y-Edge Yvonne Edge Date 14/05/2001

GEOCHEM REMEDIATION TESTING

Client Name: Campbell Reith Hill **Location:** Not Specified

GRT Job No.: 01/04063/06/01 **Reference:** 7816

Client Sample No.	S34	Units	LoD
Depth	UNKNOWN		
Sample Type	SOIL		
Sample Date	04.05.01		
GRT Sample No.	50		
Acid Soluble Sulphide	<1	ppm	1
PAH Screen	215	ppm	20
Arsenic	9	ppm	1
Hexavalent Chrome	<1	ppm	1
Boron (Water Soluble)	<1	ppm	1
Cadmium	<1	ppm	1
Chromium	17	ppm	1
Copper	35	ppm	1
Free Cyanide Soil	<2.5	ppm	2.5
Mercury	<1	ppm	1
Nickel	12	ppm	1
Lead	97	ppm	1
pH (Value) in Soil	7.22	NONE	1.00
Total Phenols HPLC	0.01	ppm	0.01
Selenium	2	ppm	1
Thiocyanate	<5	ppm	5
Total Cyanide	<2.5	ppm	2.5
Total Sulphur	0.08	%	0.01
Acid Sol. Sulphate as SO4	0.06	%	0.01
Zinc	57	ppm	1

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APPENDIX E

SPECIFICATION FOR EARTHWORKS

SPECIFICATION

SECTION 1 - GENERAL

1.1 Location and Extent of Site

The site is located adjacent to Southmoor Lane and Penner Road in Havant, Hampshire as shown on Campbell Reith Hill's drawing no. 7816 Fig01 rev D1. The extent of the site is shown on Campbell Reith Hill's drawing no. 7816 P01 Rev. D1.

1.2 General Description of the Works

The objective of these Works is to raise levels for flood protection purposes and to create a construction platform to enable the future development of the site.

1.3 Extent of the Works

The Works comprise:

1. Removing the vegetation from the site including existing trees.
2. Stripping the topsoil from site and stockpiling it in a location to be agreed with the Engineer.
3. Levelling the site.
4. Undertaking a topographical survey of the site and recording these levels on a 5m grid.
5. Importing Class 1 Fill and spreading and compacting this across the site to achieve the required finished levels.
6. Carrying out a topographical survey of the reprofiled site.

1.4 Drawings

The following drawings are issued with this specification.

Drawing no.	Title
7816 Fig01 rev D1	Location Plan
7816 P01 rev D2	Site Layout and general requirements
7816 S01 rev S2	Existing Services Plan
7816 P02 rev D1	Temporary Construction Plan

1.5 Contractor's Accommodation and Welfare Provisions

1. The Contractor's Accommodation shall be located on the Site as agreed with the Engineer prior to the commencement of the Works.
2. The Contractor shall vacate and remove from the Site all accommodation, facilities and plant etc., within seven days of the Issue of the Certificate of Completion of the Works under Clause 4.5 of the Conditions of Contract.

3. The Contractor shall provide to all his workforce safety jackets, boots and hard hats.

1.6 Privately and Publicly Owned Services

A plan showing the location of existing publicly and privately owned services and supplies is included with the Contract documentation. This is based on information supplied by the service companies and is not exhaustive. A list of contacts is supplied in Appendix B and original drawings are available from Campbell Reith Hill's office. The Contractor is responsible for checking the location of any services that may cross the site in so far as they may affect the Works. The Contractor is responsible for ensuring that all publicly and privately owned services and supplies are protected from damage during the course of the works.

1.7 Working Areas

The Contractor shall have access to Area A and Area B as shown on Campbell Reith Hill's drawings.

1.8 Working Hours

Monday - Friday	0800 - 1800
Saturday	0800 - 1300

The Contractor shall give the Engineer seven days notice in writing if he wishes to work outside these hours. No working will be permitted on Sundays or Public Holidays. No HGV movements to or from the site will be permitted between 09.30 and 16.00 hours.

1.9 Contractor's Reports

The Contractor shall submit a progress report every two weeks during the Works. These reports shall include details of all work carried out to date with records of the plant and labour involved on a daily basis with the activities referred to in the progress report.

1.10 Progress Meetings

Following the commissioning meeting at the start of the works, the Contractor shall be expected to attend two progress meetings on site during the course of the Works. The Contractor is expected to provide facilities for this meeting.

1.11 Returns and Drawings

All reports, diagrams or drawings etc., which the Contractor is required to submit to the Engineer during the progress of the works shall be, unless otherwise directed, furnished in duplicate.

1.12 Ground Investigations

Ground investigation information is appended. The Contractor is deemed to have visited the site prior to the return of tender.

1.13 Datum

The datum to which all levels have been reduced for the purposes of the drawings and the Contract is the Ordnance Survey Bench Mark on the east face, south-east angle of 1 Harts Farm Cottage, Brockhampton Road, Havant, the value of which is 4.228m AOD and west face of wall junction of Cottage Boundary, east side of Langstone Road, Havant, the value of which is 4.029m AOD.

1.14 Setting Out

The Contractor shall provide such bench marks and setting out points as are necessary for the correct setting out and level control for the works in accordance with Clause 3.5 of the Conditions of Contract.

1.15 Site Access

Access to the Works must be arranged with the Engineer and Havant Borough Council generally in accordance with Drawing 78216/P02. Vehicular access to the site can be achieved from Southmoor Lane (Area B) and Penner Road (Area A). The Contractor will be required to enter into a Routing Agreement with the Council.

1.16 Site Security

The Contractor shall secure the site by means of perimeter fencing, ensuring that access to the site by unauthorised persons is prevented.

1.17 Use of Site

The Contractor may use the site only for the purposes connected with the Contract.

1.18 Notices of Operations

The Contractor shall keep the Engineer advised of progress of important activities and give the Engineer 48 hours notice in writing of the completion of important activities so that the Engineer might make arrangements to inspect the works.

1.19 Stability of Unfinished Work

The Contractor shall ensure the stability of the Works at all time, with particular regard to the stability of the slopes of the existing ditches. These ditches shall also be kept operational and free from debris during the works.

1.20 Method Statements

The Contractor shall submit to the Engineer method statements for each work activity at least five full working days before the activity is due to commence.

1.21 Programme

1.27 Site Safety Officer

1. The Contractor shall appoint a site safety officer who shall be suitably qualified and be responsible for ensuring that the site operation are carried out in accordance with all current Health and Safety Legislation.
2. The Contractor shall inform the Engineer in writing prior to the commencement of the works of the identity of the site safety officer.

1.28 Contractor's Monthly Statement

The Contractor shall submit on a monthly basis as stated in Clause 7.2 of the Conditions of Contract a statement showing the estimated value of the works executed up to the end of that period.

SPECIFICATION

SECTION 2 - SITE REPROFILING WORKS

2.1 General

2.1.1 The site as shown on Drawing 7816/ P01 rev D1 comprises two areas, Area A and Area B. The reprofiling works are to take place in Area A. Area B is provided purely for the purposes of stockpiling topsoil material arising from the works in Area A.

2.1.2 The Specification for Highway Works as referred to in this Specification shall be the current version as published by the Highways Agency (1998), with Amendments..

2.2 Site Preparation

2.2.1 The site is covered in vegetation and this is to be stripped and disposed of by the Contractor off-site. Trees are also to be removed as part of the vegetation works. However, the rows of mature conifer trees on the western and north-western boundaries of the site are to be protected and retained. No earthworks operations shall take place within 3 metres of these trees.

2.2.2 Following the vegetation strip, the topsoil shall be stripped to a depth of up to 0.35m. This topsoil is to be stockpiled in Area B at a location to be agreed with the Engineer. The stockpiles shall not exceed 2m in height. Material/general fill deemed unsuitable for topsoil shall be removed from the Site.

2.2.3 Should the Contractor need to temporarily bridge any of the existing ditches to gain access to parts of the site, the Contractor is responsible for these Works and ensuring that the bridges are removed afterwards and the ditches are returned to their original condition.

2.2.4 All concrete hard standings and foundations are to be broken up and removed from site. All existing car parking areas and other non-concrete paved areas are to be broken up such that they are fully permeable. The Contractor is to ensure that no impermeable surfaces in excess of 0.5m2 remain in the area.

2.3 Earthworks

2.3.1 Following a vegetation and topsoil strip, the Contractor shall regrade the Area A to a maximum finished level of 3.8m AOD to within a tolerance of +/- 50mm. All material placed shall be recompacted in accordance with the 600 Series Clauses and Table 6.4 of the Specification for Highway Works. The Contractor's attention is drawn to the existing ditches across the site which must remain operational and free from debris.

2.3.2 Following regrading, the formation is to be proof rolled in accordance with Clause 612 of the Specification for Highway Works. Any soft spots thus identified are to be removed and replaced with Class 1 Fill in agreement with the Engineer. The undrained shear strength of the cohesive material present at the formation is to be

determined at regular intervals. The contractor is to include in his Tender a price for carrying out a minimum of 100 undrained shear strength determinations using Hand shear Vane apparatus. The location of these tests is to be agreed with the Engineer and to be carried out in the presence of the Engineer. The Contractor shall also provide a price for additional tests. If the undrained shear strength of the formation is determined as being less than 50kN/m^2, or, with the agreement of the Engineer, the formation is otherwise determined as being unsuitable as a platform above which compaction of Class 1 Fill can be undertaken, the Contractor is to provide proposals as to how the formation is to be rendered suitable. The placement of Class 1 Fill will not occur until these proposals have been approved by the Engineer and undertaken as appropriate.

2.3.3 When the regraded surface has been approved by the Engineer, the Contractor shall then import Class 1 material as defined in the Specification for Highway Works and spread, level and compact this across the site to achieve a minimum finished level of 4.2m AOD to within a tolerance of +10mm/-25mm. This Class 1 Fill shall be profiled to a notional gradient of 1:500 towards the nearest ditch. The Class 1 Fill shall be laid and compacted in accordance with Table 6.4 of the Specification for Highways Works.

2.3.4 The Contractor should note that any material laid in the vicinity of the existing ditches or open drains should slope at a maximum gradient of 1:2 and that no material should be allowed to block the ditches. The Contractor shall remove any material that enters the ditches to the satisfaction of the Engineer and keep the ditches in an operational condition at all times.

2.3.5 The Contractor is to construct new boundary ditches at the locations shown on Drawing No 7816 P01 Rev D2. The precise location of this ditch is to be agreed on site with the Engineer. The ditch shall have side slopes of 1 in 2 throughout and a constant base width of 0.5m. A minimum gradient to the base of the ditch of 1 in 500 shall be maintained from its start point on the northern boundary of the site to the point at which it connects to the existing ditch. Revetments to the existing ditch must be adjusted, if necessary to accommodate entry of the new ditch.

2.3.6 The Local Authority has identified that an archaeological watching brief shall be carried out on the site in order to ensure that any archaeological remains are protected and preserved for prosperity either by Preservation In-situ or Preservation by Record. The Contractor will provide all facilities as the Archaeologist may require and follow all instructions, with regard to archaeology, as may be required. Confirmation should be sought from the County Archaeologist at the first opportunity.

2.4 Materials

2.4.1 The Contractor is to provide recent test results for the Class 1 Fill, namely wet sieve analysis in accordance with BS1377:1990 Part 2, and chemical testing in accordance with Tables 3 and 4 of the Interdepartmental Committee of Redevelopment of Contaminated Land (ICRCL), Guidance Note 59/83. All tests to be undertaken by UKAS accredited laboratories.

2.5 Monitoring

2.5.1 Following completion of the placement and compaction of the Class 1 Fill, the Contractor shall carry out a survey of the relevelled site and provide a schedule of 3-dimensional coordinates on a grid at 5m centres covering the site. A tolerance of +/-10mm is required for this part of the survey work.

2.5.1 The Contractor is to ensure that the Class 1 Fill has a minimum thickness of 400mm at all locations.

2.6 Mapping Updates

2.6.1 The Contractor is to be provided with base topographical mapping in digital AutoCAD Release 14 format. On completion of the site works the Contractor shall check, update, and amend Area A of this digital mapping to address any changes to topographical features, including site levels that may have changed as a result of the works. The Contractor shall also record on the mapping any drainage features (including ditches, outfalls, and culverts) not already shown on the mapping.

STATS

Specialist Engineering, Materials and Environmental Consultants

Report for

Havant International Limited

commissioned by

Glanville Consultants Limited

Site Investigation Report

HAVANT BOROUGH COUNCIL
REGENERATION GROUP
03 FEB 2004
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Langstone Technology Park, Havant, Hampshire

October 2003

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Specialist Engineering, Materials and Environmental Consultants

DOCUMENT CONTROL

Document Title: Site Investigation Report for Langstone Technology Park, Havant, Hampshire

The Client: Havant International Limited

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SITE INVESTIGATION REPORT
FOR
SITE AT LANGSTONE TECHNOLOGY PARK

1. INTRODUCTION

1.1 Purpose of Investigation

On the instructions of Glanville Consultants Consulting Engineers on behalf of Havant International Limited, STATS Geotechnical has carried out a site investigation of an area within Langstone Technology Park. The project was commissioned in order to obtain information on the ground conditions in relation to the proposed new paved car park and roundabout on the site.

1.2 Project Brief

The project was carried out to an agreed brief, as set out in STATS proposal letter of 7th August 2003, and has included the following tasks:

Desk Study

- A study of local geology and hydrogeology
- A study of the land-use and development history of the site and its surroundings from archival Ordnance Survey mapping
- The identification of aquifer vulnerability rating beneath the site and local water abstraction points from Environment Agency records
- The identification of potential geotechnical hazards
- The identification of potential targets at risk from possible contamination

Site Investigation

- Machine excavation of 13No. trial pits.
- 8No. Dynamic Cone Penetration Tests to assess CBR values.
- Associated sampling and on-site testing.
- Laboratory chemical testing of 10No soil samples for common contaminants.
- Laboratory geotechnical testing of soil samples for classification purposes.
- Interpretative reporting

1.3 Limitations

The opinions and recommendations expressed in this report are based on the ground conditions encountered during the site work, the results of field and laboratory testing and interpretation between exploratory holes. The material encountered and samples obtained represent only a small proportion of the materials present on-site, therefore other conditions may prevail at the site which have not been revealed by this investigation.

The investigation itself was designed generally to meet the objectives of an exploratory investigation, as defined by BS 10175:2001 Code of Practice for the Investigation of Potentially Contaminated Site. As an exploratory investigation. the results may not provide sufficient data to make detailed estimates of the quantities involved in any remediation work, if required.

The results of laboratory tests are covered by UKAS (formerly NAMAS) accreditation, but opinions and interpretations expressed in the report and on the fieldwork records are outside the scope of this accreditation.

2. SITE DETAILS

2.1 Site Location

The site, which may be located by National Grid reference SU 712059, is situated just south of the A27, on Langstone Technology Park, Havant, Hampshire.

An extract of the 1:50 000 Ordnance Survey map showing the location of the site is included in Figure 1.

2.2 Site Description

The site, which covers approximately 0.65 hectares, encompasses a roughly rectangular grassed area running along the north side length of Building 1000 (occupied by Xyratex).

The site contains a number of mature and semi-mature trees predominantly of the Maple, Sycamore and Laburnum variety. The trees are scattered in a linear fashion running the length of the site. In addition to this there are a number of mature herbaceous shrubs as well as a 13m high closely planted row of conifers forming the western most boundary to the site.

The immediate boundaries to the site comprise:

- North A 1.5m chain-link fence and a footpath running parallel with the A27 slip-road.
- East Open grassed area with adjoining car park serving Building 1000.
- South Grass-crete roadway and a 1.5m high grassed bank backing onto Building 1000.
- West 13m high row of conifers, semi-detached residential housing an industrial units.

Ground levels at the site range from 5.28mAOD to 6.03mAOD approximately and with the general fall towards the west.

Some investigative work (excavation of 2No. trial pits) was carried out in the rear garden of the house on the corner of Brookside Road.

A site plan showing the main features of the site is given in Figure 2.

2.3 Local Geology and Hydrogeology

The published 1:63,360 scale geological map of the area (Sheet No 316 "Fareham") indicates the site to be underlain by Quaternary Brickearth and Alluvium deposits, overlying White Chalk (formerly the Upper Chalk) of the Cretaceous System.

The existing topography and history of development of the site suggests that, in addition to these natural strata, made ground may be present on the site.

The hydrogeology of the site is likely to be characterised by the presence of an unconfined shallow aquifer comprising Alluvial Deposits, overlying the Cretaceous Chalk, which is a major aquifer. Variability in the nature of the alluvial deposits may result in perched groundwater being present.

According to the Environment Agency Groundwater Vulnerability Classification (Sheet No.45 "West Sussex & Surrey"), the Alluvial Deposits are a Minor Aquifer and the underlying White Chalk is a major aquifer, both of High Vulnerability.

An abstraction well is located approximately 400m north of the site.

3. DEVELOPMENT HISTORY

The history of the site's land-use and development from Victorian times onwards has been researched from early Ordnance Survey (OS) maps.

Extracts of the OS maps and plans are presented in Figures 3 to 12.

Reference to historical maps provides invaluable information regarding the land use history of the site, but historical evidence will be incomplete for the period pre-dating the first edition and between successive maps.

OS Map, Sheet Hants. 76.11 Dated 1866 at Scale 1:2,534 (Figure 3)

The Ordnance Survey edition of 1866 shows the site to be undeveloped fields. Havant Mill is located approximately 1.6km to the east-north-east.

OS Map, Sheet Hants. 76.11 Dated 1896 at Scale 1:2,534 (Figure 4)

The site and surroundings remain unchanged.

OS Map, Sheet Hants. 76.11 Dated 1907 at Scale 1:2,534 (Figures 5 & 6)

A sewage works has been constructed immediately to the east of the site and an engine house on the western boundary of the sewage works appears to exist on the eastern margin of the site. Filter beds associated with the sewage works are shown immediately to the southeast.

OS Map, Sheet Hants. 76.11 Dated 1931 at Scale 1:2,534 (Figures 7& 8)

The sewage works has extended so that associated buildings would have occupied the eastern part of the site, approximately 170m in from the east site boundary.

OS Map, Sheet SU 7105 Dated 1972 at Scale 1:2,500 (Figure 9)

The site is occupied by a landscaped area that contains some trees. The A27 Havant by-pass is located along the northern site boundary and a large 'works' has been constructed immediately to the south of the site. The sewage works and associated buildings mentioned above have been removed.

OS Map, Sheet SU 7105 Dated 1984 (Figure 10 – not to scale)

The site is unchanged and the immediate surroundings remain essentially unchanged.

OS Map, Sheet SU 7105 Dated 1996-7 at Scale 1:2,000 (Figures 11 &12)

The site is little changed, although an east-north-east, west-south-west running drain is shown near the centre of the site.

4. GROUND INVESTIGATION

4.1 Fieldwork

The fieldwork was carried out on 18th and 19th September 2003 and involved the following:-

Table 4.1 Summary of ground investigation fieldwork items

Investigation Type	Number	Location/ Designation	Appendix
Trial Pits - excavated by mechanical excavator	13	TP1 to TP13	A1 to A13
In situ Dynamic Cone Penetrometer	8	DCP1 to DCP8	A14 to A21
Trial Pit Soakaways	2	TP9 & TP10	A22 & A23

The location of all investigation points is shown on the site layout plan in Figure 2. The depths of boreholes, descriptions of strata encountered and comments on the groundwater conditions are given in the trial pit records in Appendix A.

The exploratory points were located approximately by reference to physical features present on the site at the time of investigation using the site plan provided by Glanville Consultants Ltd (drawing ref: ML 230287/101). The ground levels at the borehole locations have not been determined.

4.2 Laboratory Testing

A programme of geotechnical and chemical laboratory testing, scheduled by STATS, was carried out on selected samples taken from various strata. The results are presented in Appendices B and C, respectively.

The chemical analyses were carried out by ALcontrol Geochem (Geochem) under sub-contract to STATS. Geochem are an approved subcontractor in accordance with the requirements of STATS' quality system and are themselves UKAS accredited for a range of chemical analyses (UKAS Laboratory Testing No 1291).

5. GROUND CONDITIONS

5.1 Ground

5.1.1 General Succession of Strata

The exploratory holes revealed that the site is underlain by a variable thickness of made ground over alluvial deposits comprising sandy Clay over sandy Gravel. This appears to confirm the published geological records, although the White Chalk was not proven due to the shallow depth of investigation. For the purpose of discussion, the ground conditions are summarised in Table 5.1 below.

Table 5.1 General succession of strata

Brief Description	Depth to top of stratum m.bgl (mAOD)	Thickness (m)
Made Ground	Ground Level	0.35 to 2.9 (generally 0.65 to 0.8)
Sandy Clay (locally absent in TP11 and TP12)	0.35 to 1.1	Absent to 1.75
Sandy Gravel	1.1 to 2.3	0.9 Proven in TP10

5.1.2 Topsoil / Made Ground

The exploratory holes encountered a variable thickness of topsoil / made ground across the site. The maximum thickness of made ground was encountered in TP13 where a sub-surface concrete tank was uncovered, presumably related to the sewage works that were present on the site. The tank was found to be in-filled with a clayey sand Fill containing many whole bricks and occasional metalwork.

In general the made ground comprises a 0.1m thick superficial layer of topsoil over sandy gravelly clay with frequent sand sized brick and sand to gravel sized flint fragments with occasional chalk pieces.

5.1.3 Sandy CLAY

The sandy CLAY typically comprised stiff to very stiff light brown sandy clay with occasional to frequent sub-angular to sub-rounded gravel to cobble sized flints and flint fragments. A layer of soft silty CLAY with lenses of organic material was found to separate the sandy CLAY and sandy GRAVEL in TP9 between depths of 1.75m and 2.25m.

The measured and inferred soil parameters for the stratum are listed in Table 5.2 below.

Table 5.2 Summary of soil parameters for sandy Clay

Soil Parameters	Range	Results
Liquid Limit (%)	46% (71%)	Appendix B
Plastic Limit (%)	23% – 26% (34%)	Appendix B
Plastic Index (%)	20% – 23% (37%)	Appendix B
Plasticity Term	Intermediate plasticity (very high)	Figure 13
Shrinkage Potential (NHBC)	Medium	-
Moisture Content (%)	13% – 21%	-
Strength Term	Stiff to very stiff (soft)	-
Shear Strength Inferred by Pocket Penetrometer (kN/m^2)	158 – 225 (25)	-

Note: value in brackets refers to soft silty clay encountered in TP9 from 1.75m to 2.25m.

5.1.4 Sandy Gravel

The sandy GRAVEL typically comprised dark brown to light grey clay-bound sandy gravel. The gravel is sub-angular to sub-rounded flints and flint fragments with occasional sand sized chalk pieces. Within some of the trial pits (i.e. TP1, TP2, TP3 & TP8) white communited chalk is noted on the surface of the flints some 0.3m from the top of the unit. Further down the gravel sequence the clay is absent and the unit appears light orange brown in colour.

5.2 Groundwater

Groundwater was encountered in TP1, TP9 & TP10 at depths of between 2.25m and 2.7m depth. Groundwater was only seen to flow within trial pits TP9 & TP10 and the inflow was noted as slow.

It should be noted that groundwater levels might fluctuate for a number of reasons including seasonal variations. On-going monitoring would be required to establish both the full range of conditions and any trends in groundwater levels.

5.3 Chemical Analysis of Soil Samples

5.3.1 Introduction

Chemical analyses have been performed on a total of 10no. soil samples, including both fill materials and natural soils, down to a maximum depth of 0.75m below existing ground level. The test results are reported in Sheet C1.

5.3.2 Data Summary

With respect to the current CLEA Soil Guideline Values (SGV) and, where applicable, the former Dutch Guidelines the following summary can be made.

Table 5.3 Summary of Soil Results versus All Land Use Criteria

Substances present above CLEA Soil Guideline Values or ICRCL Threshold Trigger Concentrations[1] (maximum concentrations in mg/kg)				
Category of Substance	Residential - with plant uptake	Residential - without plant uptake	Commercial - Industrial	Dutch Target Value[2]
"Heavy" Metals:	N/A	N/A	None	None
Phytotoxins:	N/A	N/A	None	Copper (63), Zinc (267)
Non-metals:	N/A	N/A	None	None

1. Substances assessed against CLEA SGV's include: Arsenic, Cadmium, Chromium, Lead, Mercury, Selenium, Nickel. The remaining determinands have been assessed versus the Dutch target value.
2. Substances above the Dutch intervention value are highlighted in bold.

5.3.3 Discussion of Results

The chemical analyses have indicated that the samples tested are uncontaminated, with the exception of isolated elevated concentrations of copper and zinc.

A single copper concentration and two zinc concentrations exceeded the Dutch target values of 36mg/kg and 140mg/kg respectively, but were well below their respective Dutch intervention values of 190mg/kg and 720mg/kg. It should be noted that the Dutch guideline values do not take into account the type of proposed land use. It is considered that the concentrations of copper and zinc present on the site are below acceptable levels for the commercial land use proposed.

In conclusion, this reconnaissance-level exploratory investigation has found no evidence of significant ground contamination on the site.

5.4 Chemical Analysis of Water

An investigation of groundwater quality beneath the site was outside the scope of this investigation.

6. ENGINEERING CONSIDERATIONS

6.1 Details of Proposed Development

It is understood that the proposed development will comprise a new paved car park and roundabout (easing access to/from the west) to the side and rear of Building 1000.

6.2 Alleviation Measures in Respect of Ground Contamination

The results of the chemical analyses on the samples tested indicate that the materials on-site do not exceed the CLEA SGV's (and are acceptable within the Dutch guidelines) for commercial land use. Therefore, there is no evidence of significant ground contamination on the site in relation to the proposed end-use.

In view of the above findings, no special measures are required in terms of remediation, subject to ensuring that suitable topsoil is present in landscaped areas.

Suitable health and safety precautions should be adopted during the site works and care should be taken to minimise the amount of dust generated on-site. Site workers engaged in earthworks and working in trenches/excavations should, as a precautionary measure, minimise physical contact with the soil, and be rigorous in matters of personal hygiene.

With respect to off site disposal, the results of the chemical analyses indicate that the majority of soils will be classified as "uncontaminated". This is in accordance with the Environment Agency Interim Guidance on the Disposal of "Contaminated Soils".

6.3 Geotechnical Hazards

A summary of commonly occurring geotechnical hazards is given in Table 6.1 together with an assessment of whether the site may be affected by each of the stated hazards.

Table 6.1 Summary of main potential geotechnical hazards that may affect site

Hazard category (excluding contamination issues)	Hazard status based on investigation findings and proposed development			Engineering considerations if hazard affects site
	Found to be present on site	Could be present but not found	Unlikely to be present and/or affect site	
Sudden lateral changes in ground conditions		✓		Likely to affect ground engineering and foundation design and construction
Shrinkable clay soils	✓	Silty Clay and sandy Clay – medium potential		Design to NHBC Standards Chapter 4 or similar
Highly compressible and low bearing capacity soils, (including peat and soft clay)	✓	Soft Silty Clay with organic-rich lenses in TP9 only		Likely to affect ground engineering and foundation design and construction
Silt-rich soils susceptible to rapid loss of strength in wet conditions	✓	Silty / Sandy Clay		Likely to affect ground engineering and foundation design and construction
Karstic dissolution features (including 'swallow holes' in Chalk terrain)		✓		May affect ground engineering and foundation design and construction
Evaporite dissolution features and/or subsidence			✓	May affect ground engineering and foundation design and construction
Ground subject to or at risk from landslides			✓	Likely to require special stabilisation measures

Ground subject to peri-glacial valley cambering with gulls possibly present			✓	Likely to affect ground engineering and foundation design and construction
Ground subject to or at risk from coastal or river erosion			✓	Likely to require special protection/stabilisation measures
High groundwater table (including waterlogged ground)		✓		May affect temporary and permanent works
Rising groundwater table due to diminishing abstraction in urban area			✓	May affect deep foundations, basements and tunnels
Underground mining			✓	Likely to require special stabilisation measures
Existing sub-structures (e.g. tunnels, foundations, basements, and adjacent sub-structures)	✓	Buried sub-structure found in TP13		Likely to affect ground engineering and foundation design and construction
Filled and made ground (including embankments, infilled ponds and quarries)	✓	Maximum of 2.9m of made ground present in TP13.		Likely to affect ground engineering and foundation design and construction
Adverse ground chemistry (including expansive slags and weathering of sulphides to sulphates)			✓	May affect ground engineering and foundation design and construction

Seismicity is not included in Table 5.1 as this is not normally a design consideration in the UK.

The likely presence of chalk at shallow depth indicates that subsidence related to chalk dissolution features might be a possibility. Based on the Edmond's risk assessment model for natural dissolution features referred to in CIRIA Project Report II (1994), the site falls into the "moderately low subsidence risk" category. With reference to Edmund's data-base of known natural/man-made chalk solution features there are no such features in the immediate vicinity of the site.

6.4 Sub-grade Conditions for Road Pavements

Sub-grade materials present and groundwater levels

It is understood that the finished ground level of the proposed development will be at approximately the existing ground level.

In the 1m to 1.1m below the proposed finished ground level the exploratory holes have revealed a soil profile comprising made ground composed of clayey sand overlying sandy clay. The potentially poorest sub-grade material within this profile is the made ground due to its variable nature and unknown history of compaction.

The groundwater conditions are anticipated to comprise a low water-table, i.e. at least 1m below the pavement formation level. The ground investigation revealed the shallowest water strike to be 2.25m b.g.l. however, groundwater levels should be expected to be higher in the winter months

Estimated minimum CBR under long-term conditions

The estimated minimum, equilibrium soil-suction, CBR value for the soils (sandy clay) and groundwater conditions described above under a completed pavement is 4%, after Table C1 in TRRL Report LR1132 (1984).

CBR values determined under current conditions

The in situ sub-grade soils CBR values have been assessed under present conditions using the DCP test apparatus and the results are summarised in Table 6.2.

Table 6.2 Summary of CBR values derived from in situ DCP tests

Test Location	Material Type	Minimum CBR value determined at or just below anticipated formation level
TP1	Made Ground	5% (typically above 10%)
TP2	Made Ground	6%
	Sandy Clay	10%
TP3	Made Ground	6% (typically above 10%)
	Sandy Clay	9%
TP4	Made Ground	12%
TP5	Made Ground	12% (typically above 20%)
TP6	Made Ground	12% (typically above 30%)
TP7	Made Ground	5%
TP8	Made Ground	7%
	Sandy Clay	4%

The made ground materials in the vicinity of test locations may be susceptible to improvement by rolling with conventional compaction plant.

Recommended CBR value for road pavement design
The recommended sub-grade soil CBR value for road pavement design is therefore 6%. This value assumes that during construction the formation level will be carefully compacted and any soft spots dug out and replaced by compacted suitable fill material.

Frost-susceptibility of sub-grade soils
The sandy clay sub-grade soils can be regarded as non-frost-susceptible (PI>15%), after the criteria given in Appendix 1 of TRRL Report Road Note 29 (Ref). The made ground may be frost susceptible due to the presence of chalk gravel. When the sub-grade is frost-susceptible the thickness of sub-base must be sufficient to give a total thickness of non-frost-susceptible pavement construction over the soil of not less than 450mm.

6.5 Chemical Attack on Buried Concrete

The results of chemical tests carried out on soil samples indicate 2:1 water soil extract sulphate contents of up to 0.06g/l with generally near neutral pH values.

These results indicate that, in accordance with BRE Special Digest 1: 2001 *Concrete in aggressive ground*, the Aggressive Chemical Environment for Concrete (ACEC) Classification is **AC-1s** with a Design Sulfate Class for the site of **DS-**1. This assumes nominally static groundwater conditions and that no significantly disturbed clay comes into contact with concrete foundations or structures.

If significantly disturbed clay is likely to come into contact with concrete foundations or structures it will be necessary to carry out additional tests on the soil to investigate its total potential sulphate content. This will facilitate a revaluation of the ACEC Classification and Design Sulfate Class for the material, to take into consideration potential oxidation of available sulphides (e.g. pyrite), as defined in Table 2 BRE Special Digest 1: 2001.

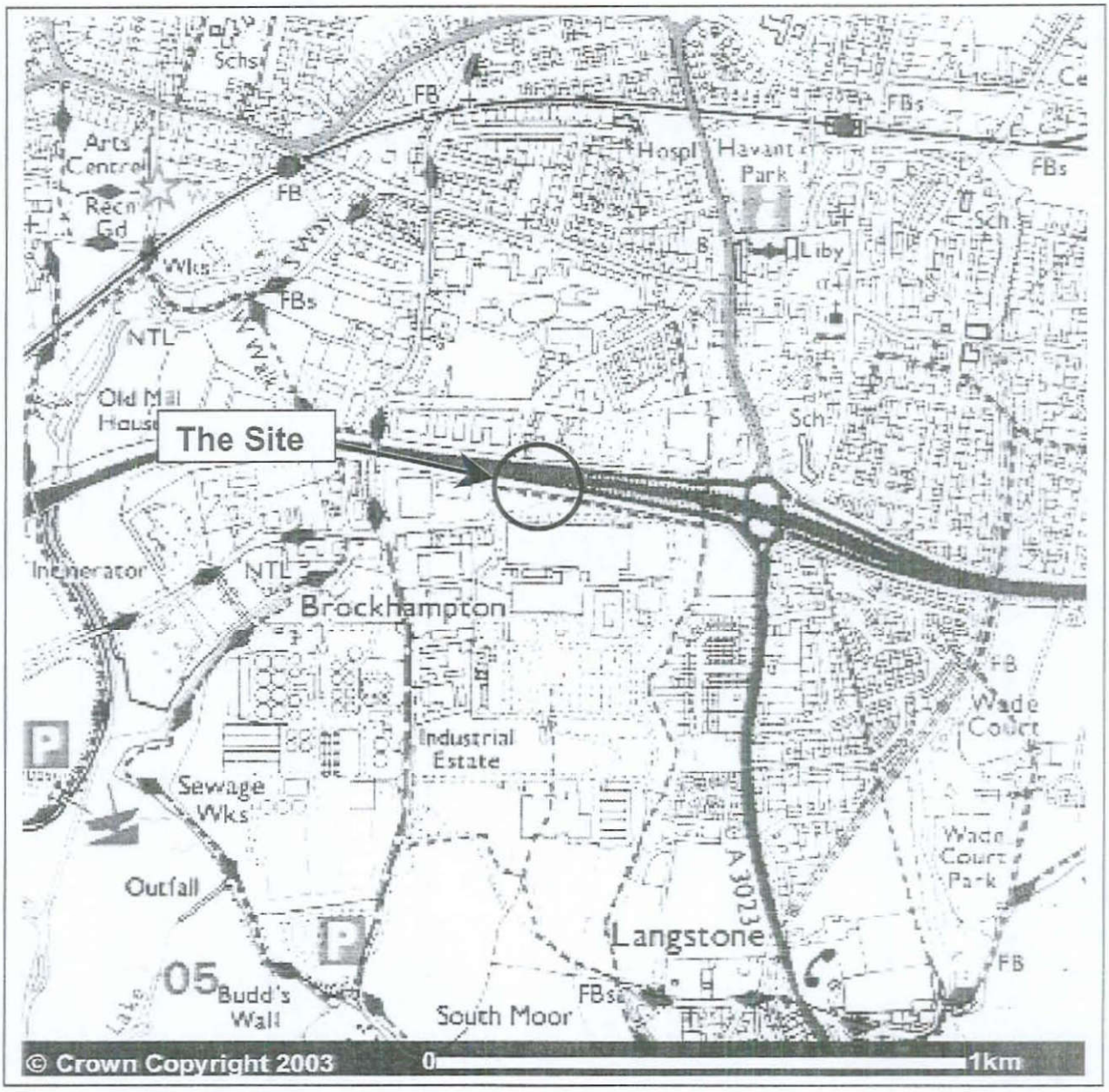
6.6 **Soakaways**

Soakage tests were carried out in trial pits TP9 and TP10 in general accordance with BRE 365 and the results are given in Appendix A, Sheets A22 and A23.

The test results both show some infiltration. By adjusting the soakage calculations to consider infiltration through the permeable gravel horizontally, infiltration rates of 2.66x10-5 and 1.99x10-5 have been calculated for TP9 and TP10, respectively.

FIGURES

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Extract of 1:50,000 Ordnance Survey Landranger Map

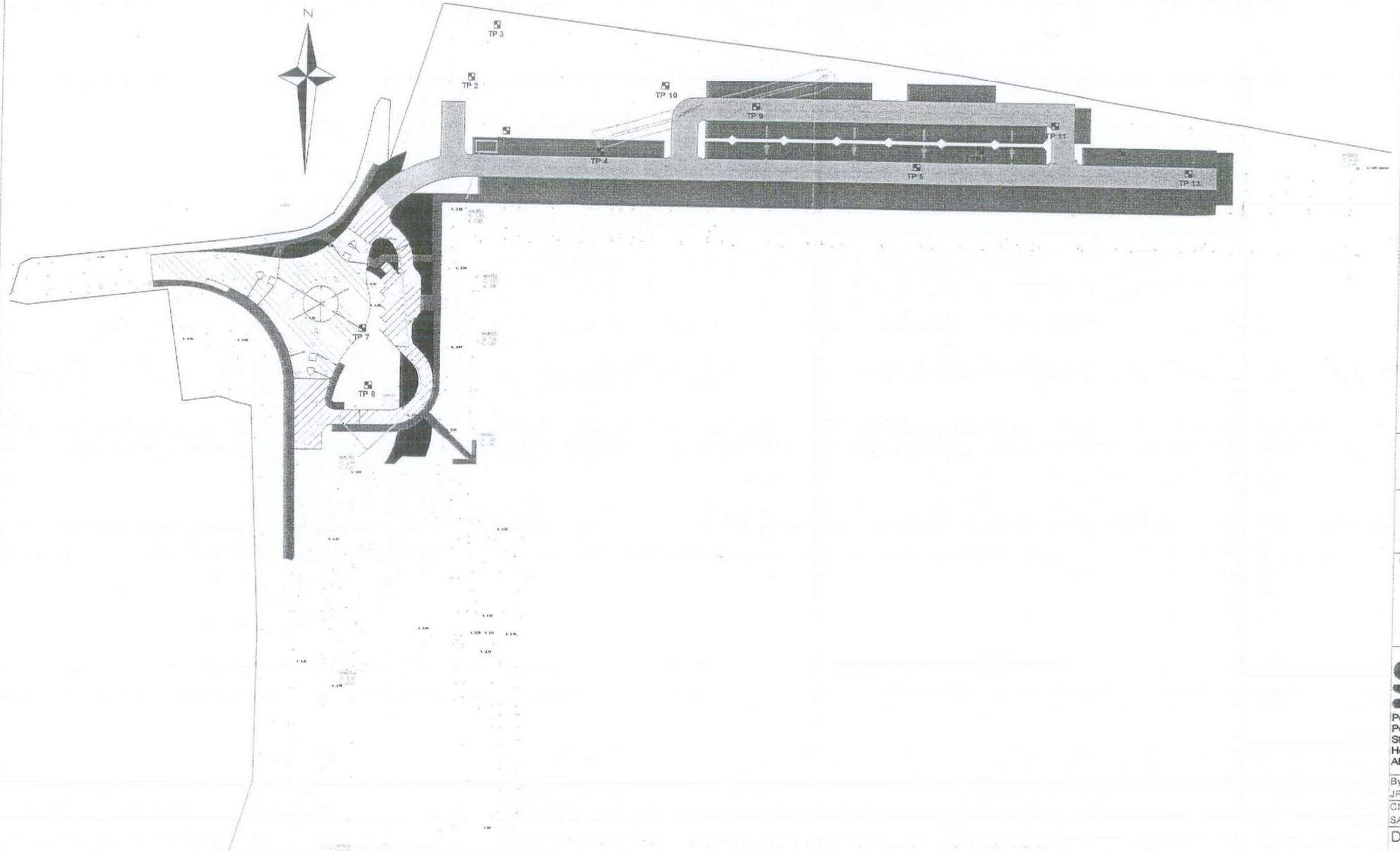
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Site: Langstone Technology Park	Client: Havant International
National Grid Reference: SU 7105 NW	Scale: See attached scale

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SITE LOCATION PLAN

Job No:	33893/01
Fig No:	1



NOTES:

LANGSTONE TECHNICAL PARK

Exploratory Hole Location Plan

Client:

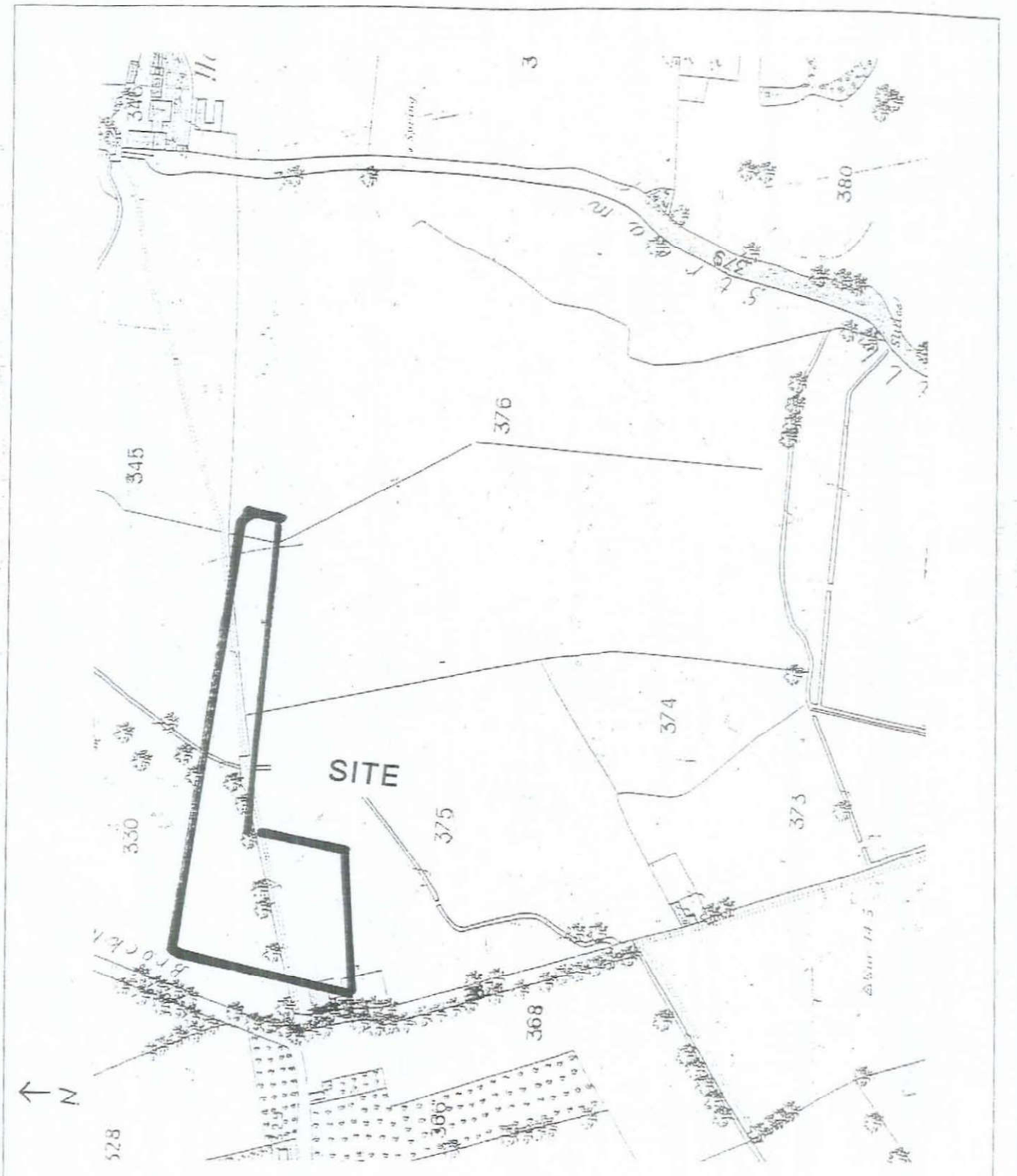
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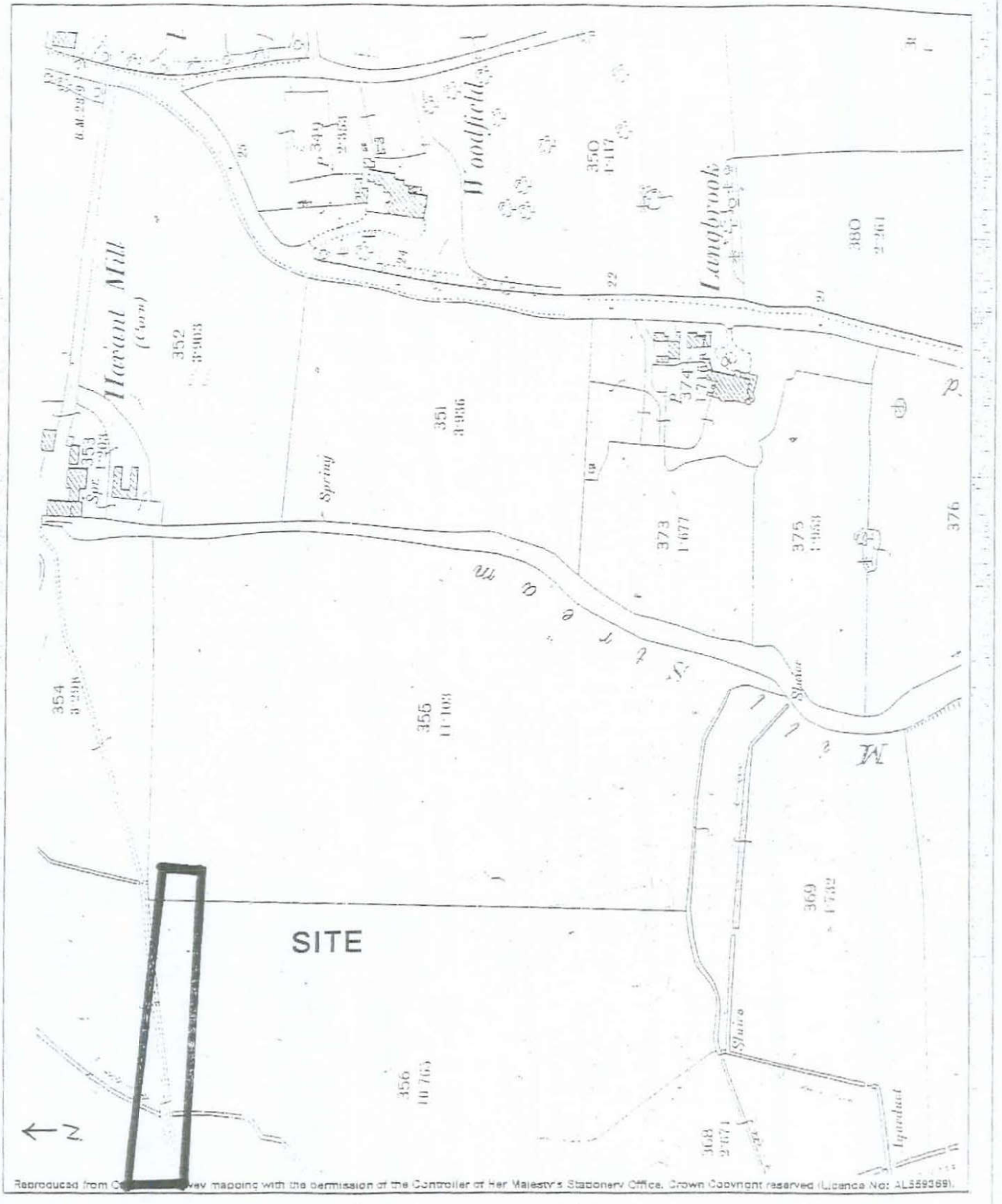
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Source:	OS Map Hampshire Sheet 76.11	Scale:	1:2534

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EXTRACT FROM HISTORICAL MAP DATED 1866

Job No: 33893

Fig No: 3



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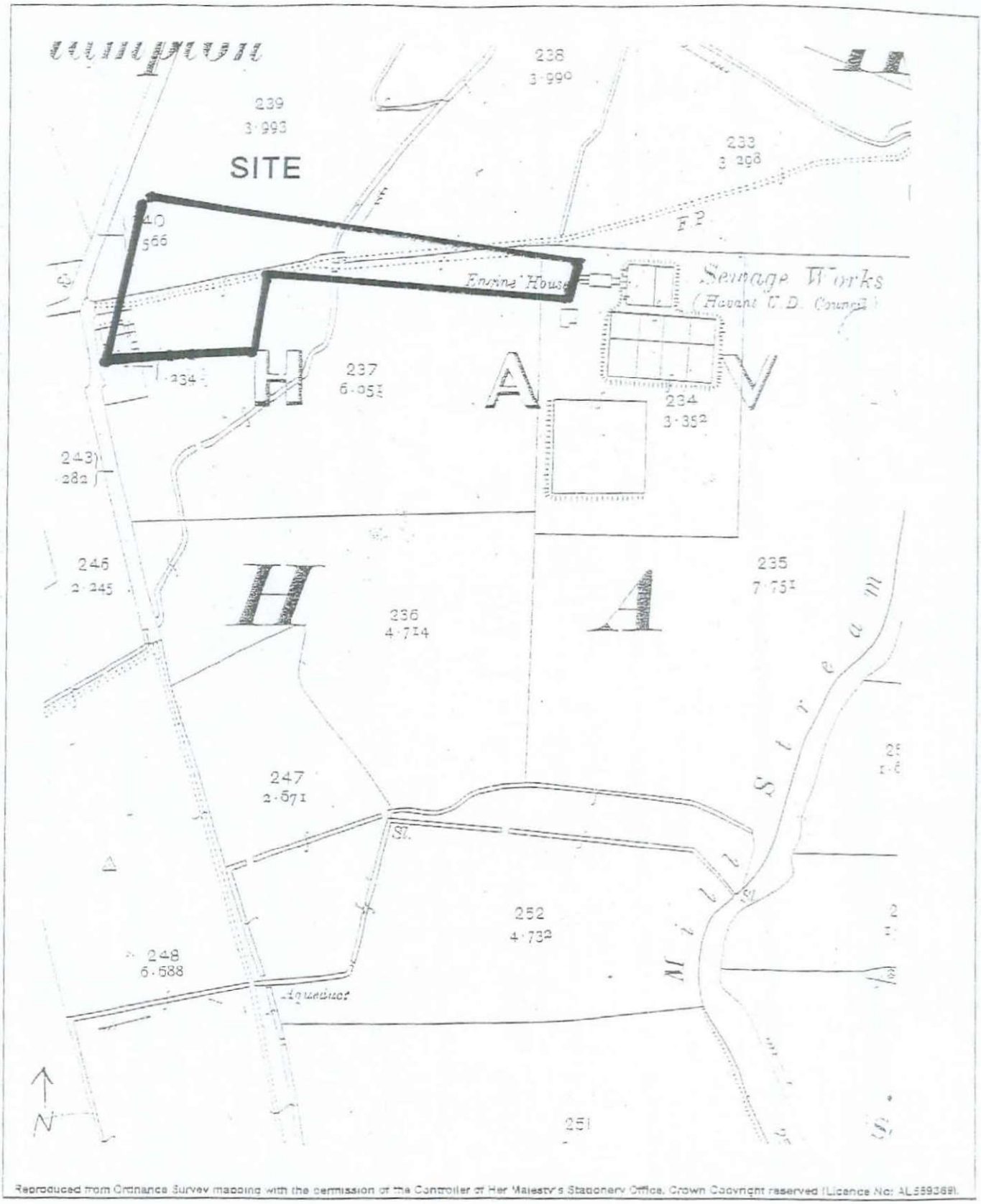
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EXTRACT FROM HISTORICAL MAP DATED 1897

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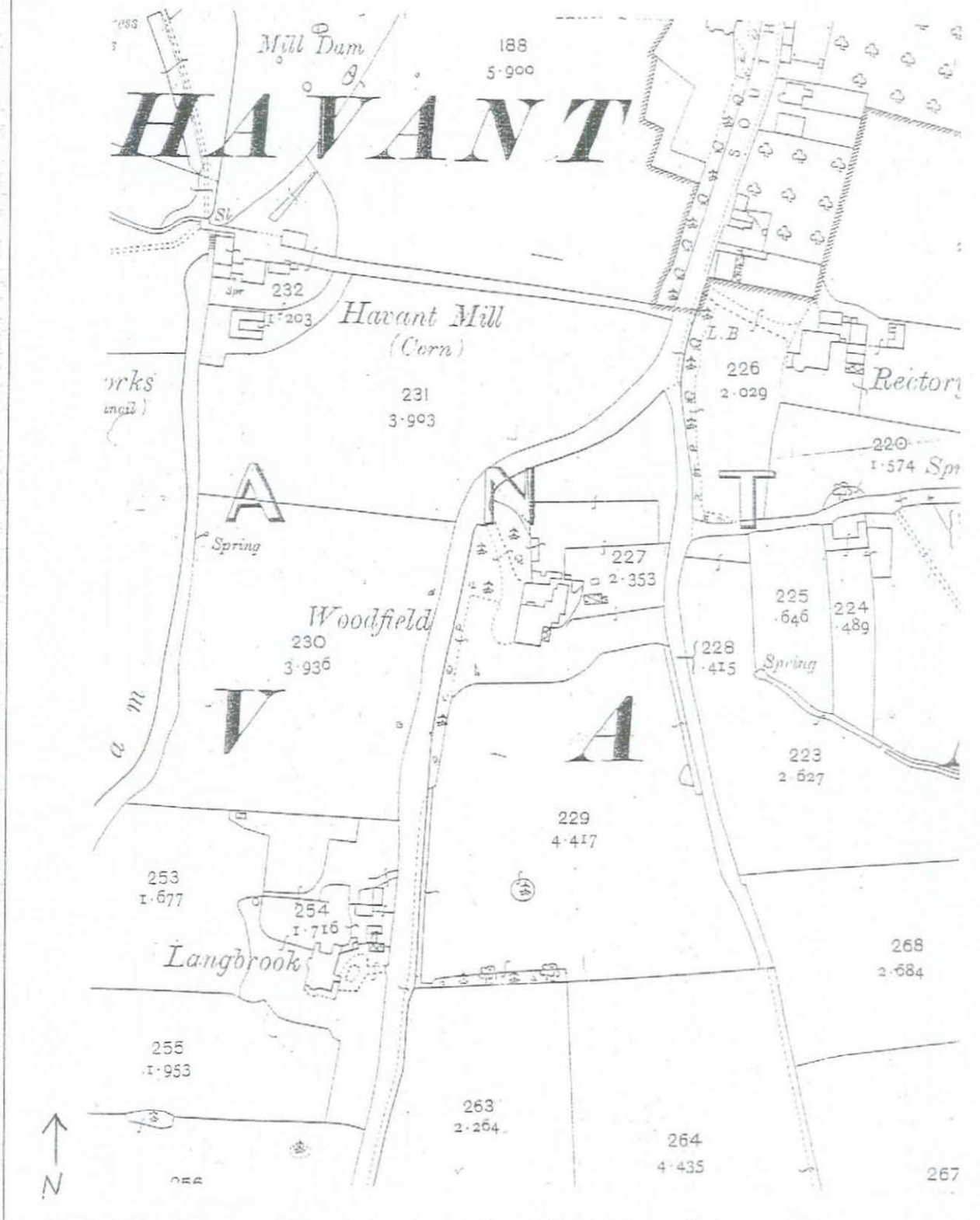
Site:	Langstone Park, Havant	Client:	Glanville Consultants Ltd.
Source:	OS Map Hampshire Sheet 76.11 (1 of 2)	Scale:	1:2534

STATS

EXTRACT FROM HISTORICAL MAP DATED 1907

Job No: 33893

Fig No: 5



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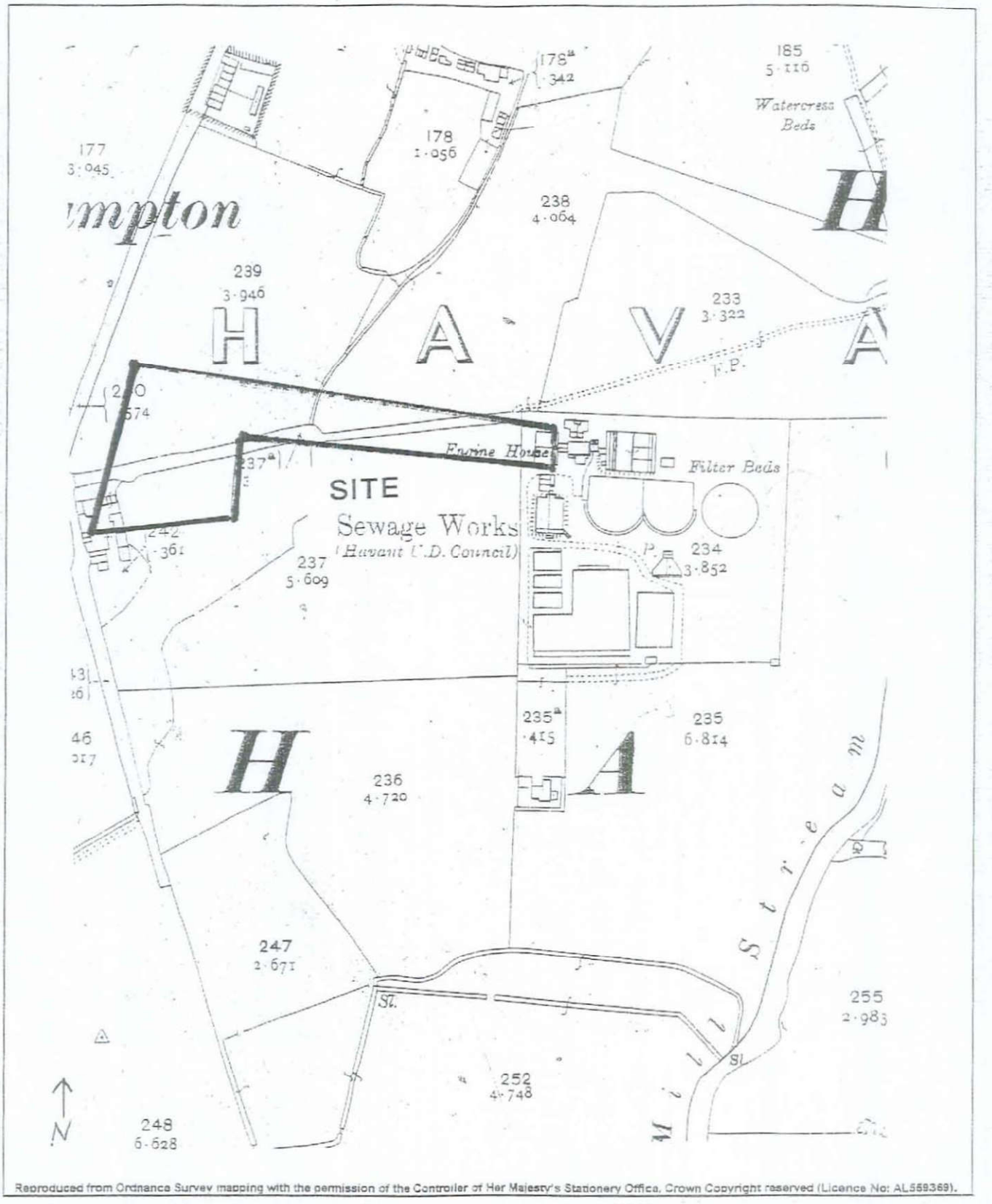
Site:	Langstone Park, Havant	Client:	Glanville Consultants Ltd.
Source:	OS Map Hampshire Sheet 76.11 (2 of 2)	Scale:	1:2534

STATS

EXTRACT FROM HISTORICAL MAP DATED 1907

Job No: 33893

Fig No: 6



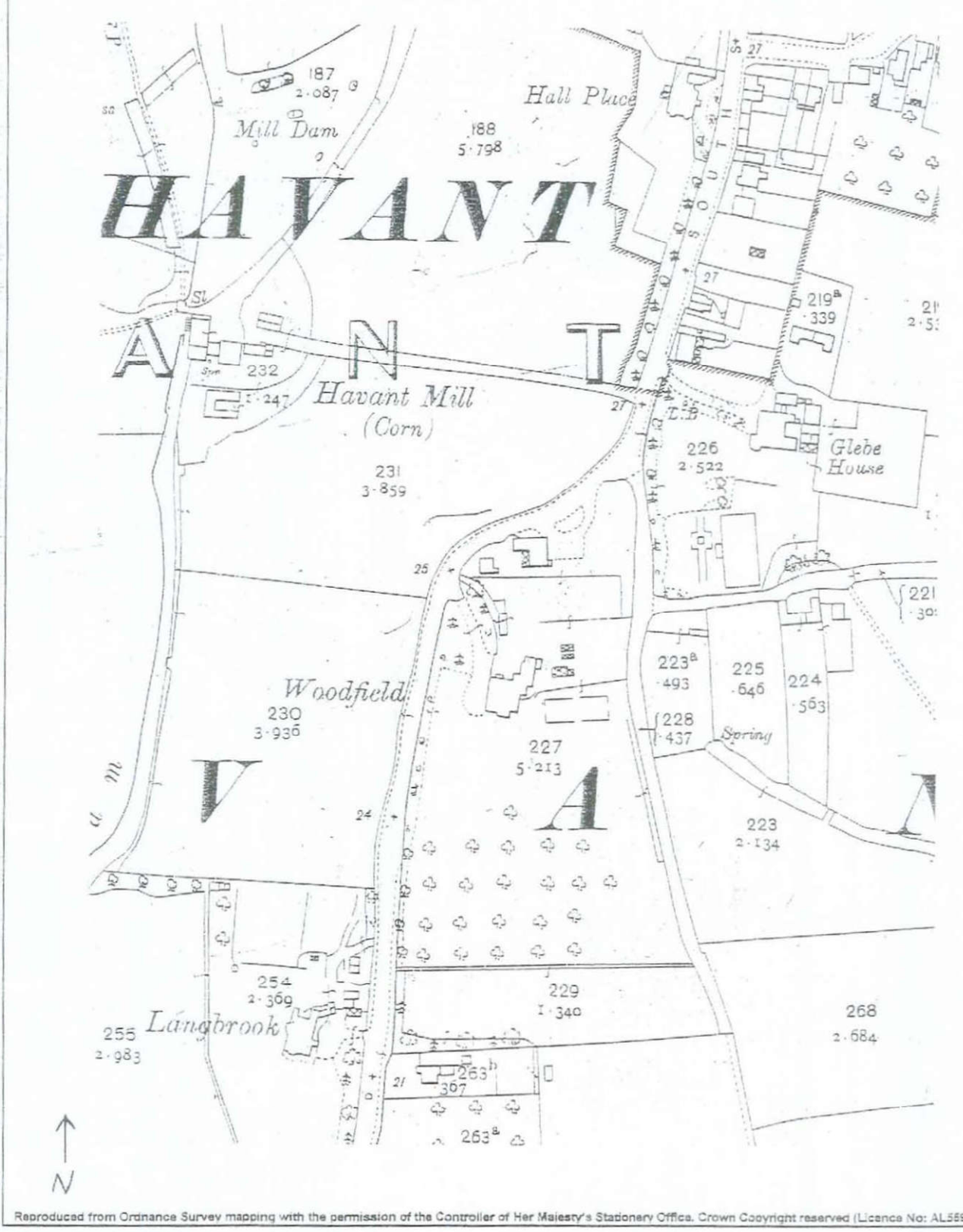
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Site: Langstone Park, Havant	Client: Glanville Consultants Ltd.
Source: OS Map Hampshire Sheet 76.11 (1 of 2)	Scale: 1:2534

STATS

EXTRACT FROM HISTORICAL MAP DATED 1932

Job No:	33893
Fig No:	7



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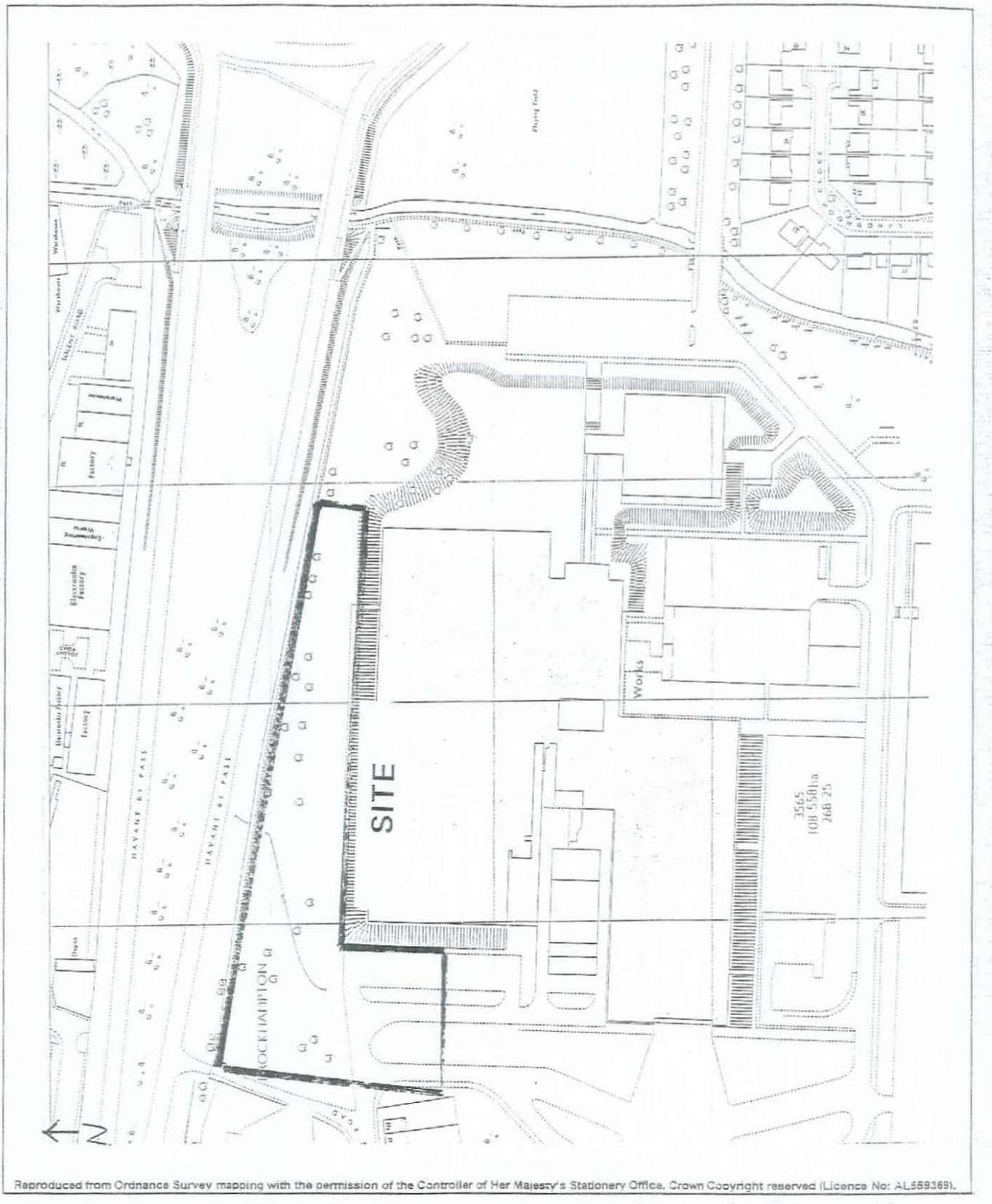
Site: Langstone Park, Havant	Client: Glanville Consultants Ltd.
Source: OS Map Hampshire Sheet 76.11 (2 of 2)	Scale: 1:2534

STATS

EXTRACT FROM HISTORICAL MAP DATED 1932

Job No: 33893

Fig No: 8



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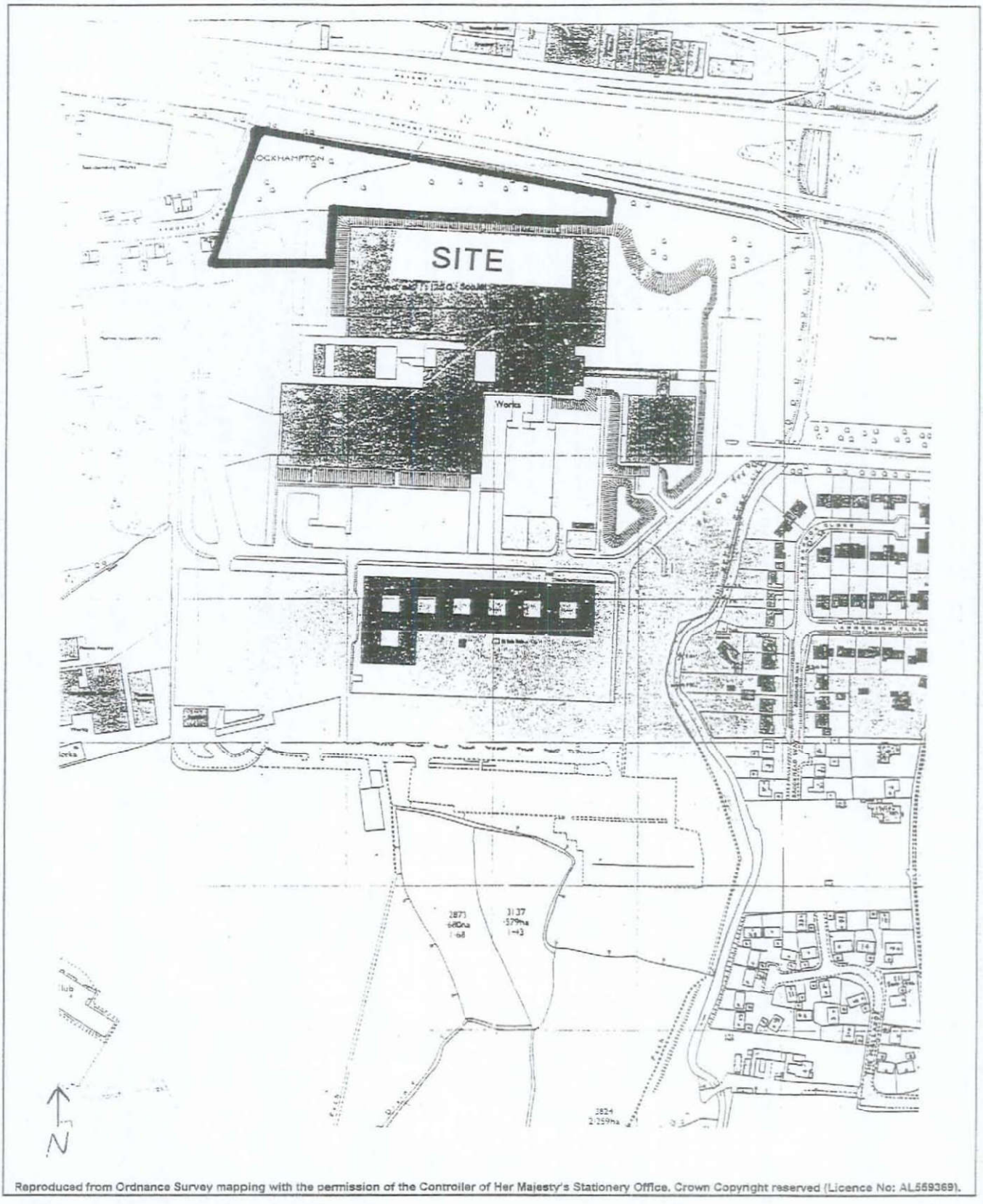
Site: Langstone Park, Havant	Client: Glanville Consultants Ltd.
Source: OS Map Sheet SU 7105	Scale: 1:2500

STATS

EXTRACT FROM HISTORICAL MAP DATED 1972

Job No: 33893

Fig No: 9



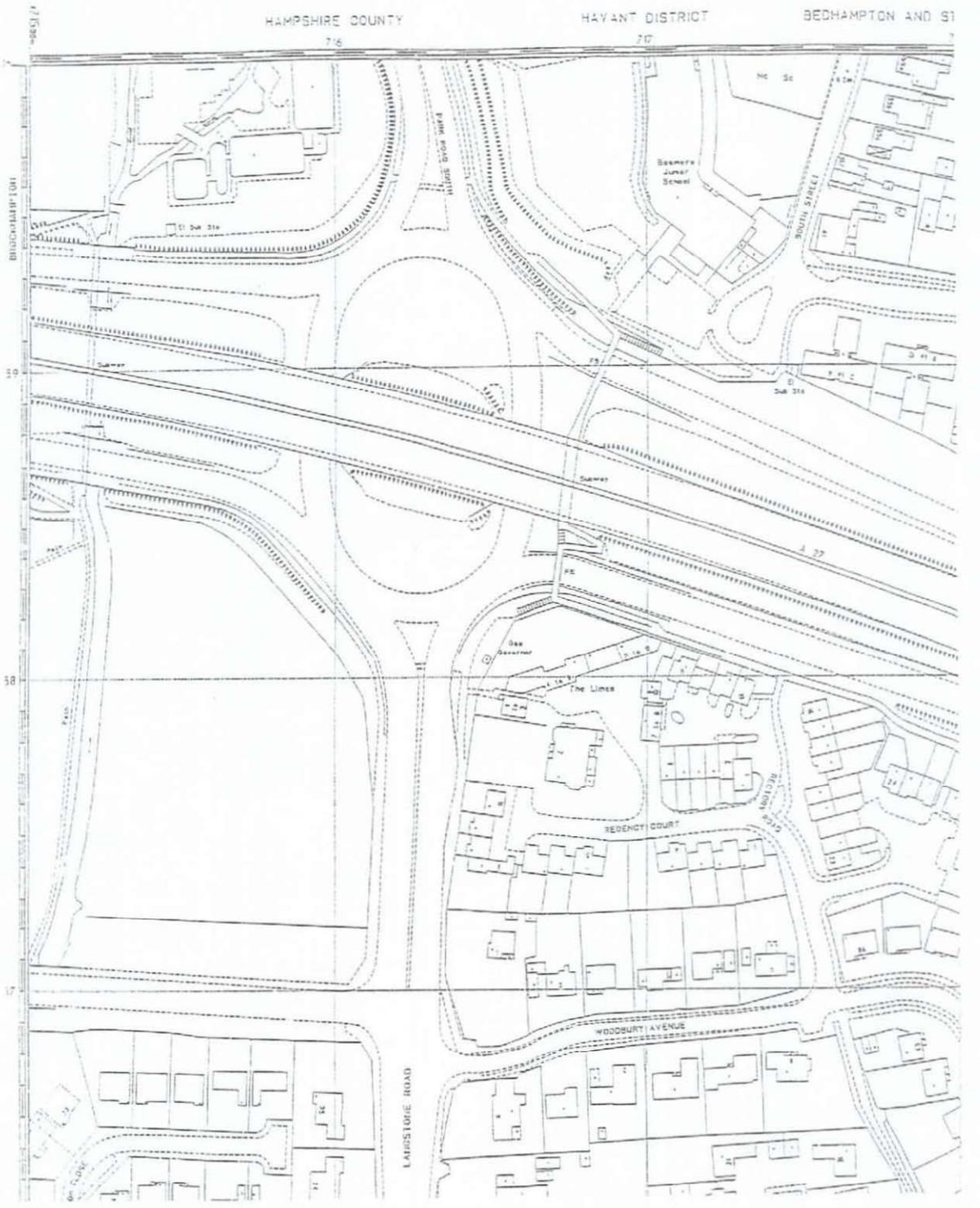
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Site: Langstone Park, Havant	Client: Glanville Consultants Ltd.
Source: OS Map Sheet SU 7105	Scale: NTS

STATS

EXTRACT FROM HISTORICAL MAP DATED 1984

Job No:	33893
Fig No:	10



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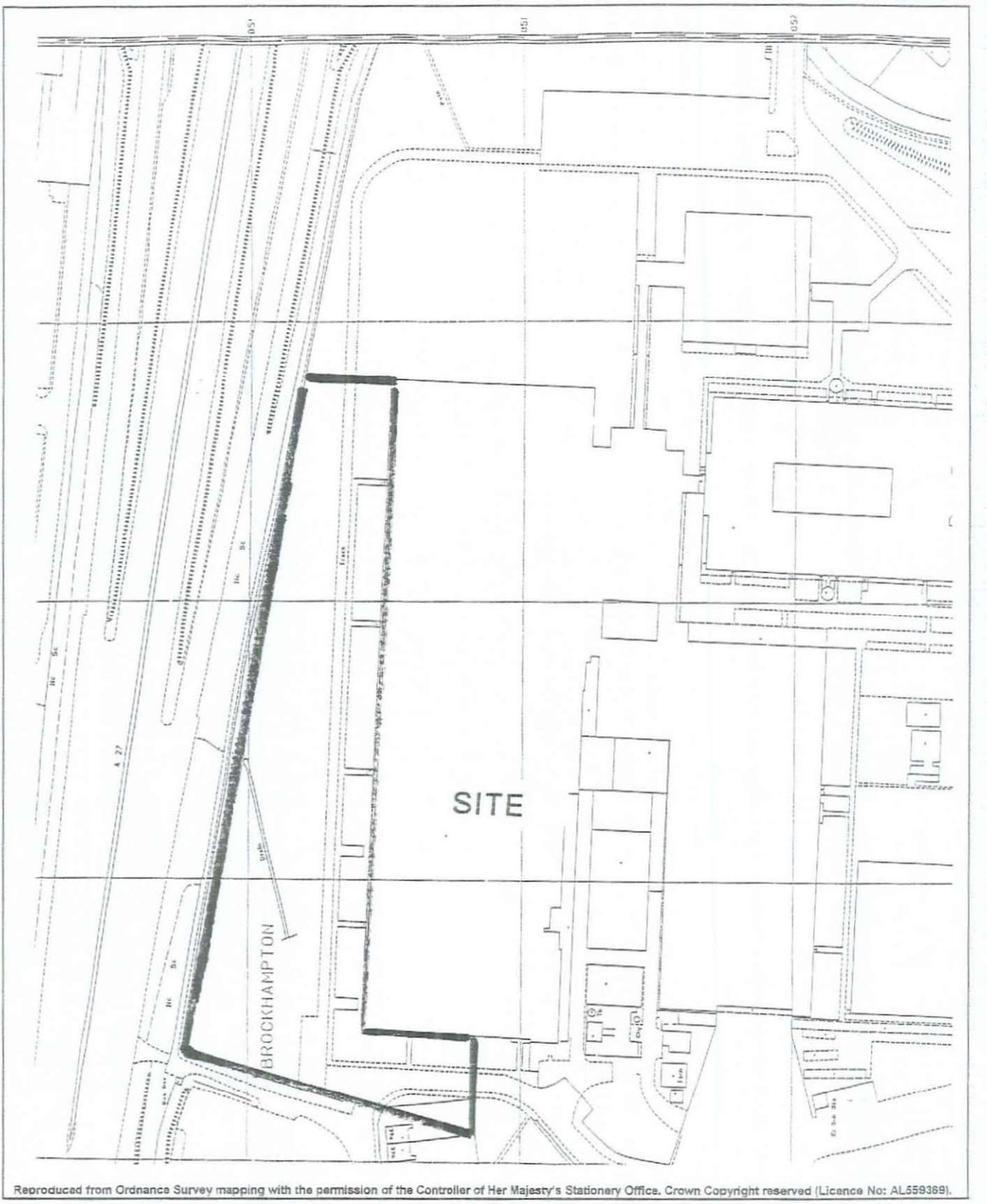
Site: Langstone Park, Havant	Client: Glanville Consultants Ltd.
Source: OS Map Sheet SU 7105 NE	Scale: 1:2000

STATS

EXTRACT FROM HISTORICAL MAP DATED 1996

Job No: 33893

Fig No: 11



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Site: Langstone Park, Havant	Client: Glanville Consultants Ltd.
Source: OS Map Sheet SU 7105 NW	Scale: 1:2000

STATS

EXTRACT FROM HISTORICAL MAP DATED 1997

Job No:	33893
Fig No:	12

STATS

Specialist Engineering, Materials and Environmental Consultants

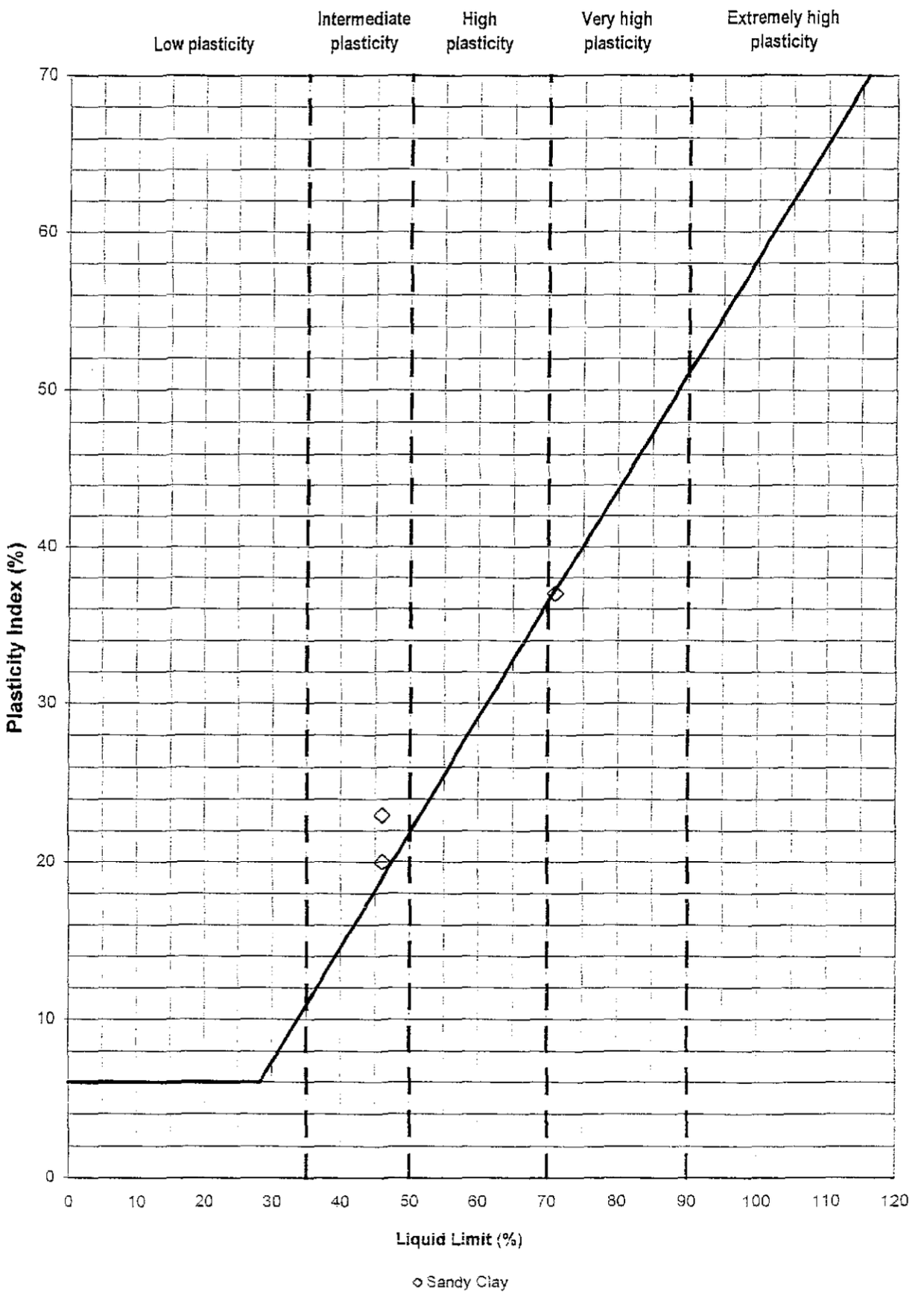
PLASTICITY CLASSIFICATION CHART

Site: Langstone Technology Park

Client: Glanville Consultants Limited

Job Number: 33893

Figure: 13



APPENDIX A

FIELDWORK RECORDS

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP1

Site: Langstone Technology Park

Location: Langstone Road, Havant

Client: Glanville Consultants Ltd

Ground Level: GL not measured

Dates: 18 Sep 03

Job No.: 33893

GROUND WATER | SAMPLES/TESTS | STRATA RECORD | Sheet 1 of 1

Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key	Description
			D1 0.00-0.10	0.00	0.10	0.10		MADE GROUND: Grass cover over topsoil. Frequent rootlets (mm scale).
								MADE GROUND: Dark brown clayey sand with frequent sub-angular to sub-rounded gravel sized flint fragments and occasional brick fragments to cobble size. Occasional to frequent rootlets. Rare to occasional sub-angular chalk pieces to gravel size.
			D2 0.85	PP 0.85 158	0.80	0.70		Stiff light brown sandy CLAY with frequent sub-angular gravel sized flints to pebble size.
		1	D3 1.40					
			D4 1.90					
		2	D5 2.05		2.05	1.25		Light to dark brown clay-bound sandy GRAVEL. Gravel is angular to sub-rounded flint fragments.
▼			D6 2.25					... @2.25m white communited chalk mixed with sandy Gravel.
			D7 2.70		2.70	0.65		*End of Trial Pit at 2.70 m*
		3						
		4						

Remarks and Water Observations

Pit terminated at 2.7m depth. sandy Gravel is noticeably damp.

Key for Insitu tests

HV-Hand Vane (kN/m2)

PP-Pocket Penotometer (kN/m2)

MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NAW

Figure: A1

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP2

Site: Langstone Technology Park

Location: Langstone Road, Havant

Client: Glanville Consultants Ltd

Ground Level: GL not measured

Dates: 18 Sep 03

Job No.: 33893

GROUND WATER | SAMPLES/TESTS | STRATA RECORD | Sheet 1 of 1

Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key	Description
			D1 0.00-0.10	0.00	0.10	0.10		MADE GROUND: Grass cover over topsoil. Frequent rootlets (mm scale).
					0.35	0.25		MADE GROUND: Dark brown clayey sand with frequent sub-angular to sub-rounded gravel sized flint fragments and occasional brick fragments to cobble size. Occasional to frequent rootlets. Rare to occasional sub-angular chalk pieces to gravel size.
				PP 0.65 200				Stiff to very stiff light brown sandy CLAY with frequent sub-angular gravel sized flints to pebble size.
		1	D2 1.10					
			D3 1.75					...@1.4m very frequent sub-rounded to sub-angular flint nodules to cobble size.
		2	D4 2.15		2.10	1.75		...@2.0m communited chalk noted on flint surfaces
			D5 2.25		2.30	0.20		Light to dark brown clay-bound sandy GRAVEL. Gravel is angular to sub-rounded flint fragments.
		3						*End of Trial Pit at 2.30 m*
		4						

Remarks and Water Observations

Pit terminated at 2.3m depth. No groundwater encountered.

Key for Insitu tests

HV-Hand Vane (kN/m2)
PP-Pocket Penetrometer (kN/m2)
MP-Mackintosh Probe (N150)

Scale: 1:25
Logged by: NAW
Figure: A2

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP3

Site: Langstone Technology Park

Location: Langstone Road, Havant

Client: Glanville Consultants Ltd

Ground Level: GL not measured

Dates: 18 Sep 03

Job No.: 33893

Sheet 1 of 1

GROUND WATER		SAMPLES/TESTS			STRATA RECORD			
Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key	Description
			D1 0.00-0.10	0.00	0.10	0.10		MADE GROUND: Grass cover over topsoil. Frequent rootlets (mm scale).
			D2 0.60	PP 0.65 225	0.65	0.55		MADE GROUND: Dark brown clayey sand with frequent sub-angular to sub-rounded gravel sized flint fragments and occasional brick fragments to cobble size. Occasional to frequent rootlets. Rare to occasional sub-angular chalk pieces to gravel size.
		1	D3 0.75					Very stiff light brown sandy CLAY with frequent sub-angular gravel sized flints to pebble size.
			D4 1.20					...@1.2m very frequent flints
			D5 1.60		1.60	0.95		Light to dark brown clay-bound sandy GRAVEL. Gravel is angular to sub-rounded flint fragments.
		2						...@1.9m communited chalk appearing on flint surfaces
					2.10	0.50		*End of Trial Pit at 2.10 m*
		3						
		4						

Remarks and Water Observations

Pit terminated at 2.1m depth. No groundwater encountered.

Key for Insitu tests

HV-Hand Vane (kN/m2)
PP-Pocket Penetrometer (kN/m2)
MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NAW

Figure: A3

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP4

Site:	Location:		
Langstone Technology Park	Langstone Road, Havant		
Client:	**Ground Level:**	**Dates:**	**Job No.:**
Glanville Consultants Ltd	GL not measured	18 Sep 03	33893

GROUND WATER | SAMPLES/TESTS | STRATA RECORD | Sheet 1 of 1

Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key	Description
			D1 0.00-0.10	0.00	0.10	0.10		MADE GROUND: Grass cover over topsoil. Frequent rootlets (mm scale).
			D2 0.40		0.30	0.20		MADE GROUND: Light brown sandy gravel. Gravel is sub-angular to sub-rounded flint fragments. Rare to occasional sand sized brick fragments and sub-angular chalk pieces to gravel size.
		1	D3 1.20	PP 1.20 213	0.65	0.35		MADE GROUND: Dark brown clayey sand with frequent sub-angular to sub-rounded gravel sized flint fragments and occasional brick fragments to cobble size. Occasional to frequent rootlets. Rare to occasional sub-angular chalk pieces to gravel size.
			D4 1.80		1.70	1.05		Stiff to very stiff light brown sandy CLAY with frequent sub-angular gravel sized flints to pebble size.
		2			2.00	0.30		Light to dark brown clay-bound sandy GRAVEL. Gravel is angular to sub-rounded flint fragments.
								End of Trial Pit at 2.00 m
		3						
		4						

Remarks and Water Observations

Pit terminated at 2m. No groundwater encountered.

Key for Insitu tests

HV-Hand Vane (kN/m2)
PP-Pocket Penetrometer (kN/m2)
MP-Mackintosh Probe (N150)

Scale: 1:25
Logged by: NAW
Figure: A4

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP6

Site: Langstone Technology Park

Location: Langstone Road, Havant

Client: Glanville Consultants Ltd

Ground Level: GL not measured

Dates: 18 Sep 03

Job No.: 33893

Sheet 1 of 1

GROUND WATER		SAMPLES/TESTS			STRATA RECORD		
Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key / Description
			D1 0.00-0.10	0.00	0.10	0.10	MADE GROUND: Grass cover over topsoil. Frequent rootlets (mm scale).
			D2 0.40		0.65	0.55	MADE GROUND: Light brown sandy gravel. Gravel is sub-angular to sub-rounded flint fragments. Rare to occasional sand sized brick fragments and sub-angular chalk pieces to gravel size.
		1	D3 1.00		1.10	0.45	MADE GROUND: Dark brown clayey sand with frequent sub-angular to sub-rounded gravel sized flint fragments and occasional brick fragments to cobble size. Occasional to frequent rootlets. Rare to occasional sub-angular chalk pieces to gravel size.
			D4 1.30	PP 1.30 225	1.80	0.70	Very stiff light brown sandy CLAY with frequent sub-angular gravel sized flints to pebble size.
		2			2.10	0.30	Light to dark brown clay-bound GRAVEL. Gravel is sub-angular to sub-rounded flint fragments. Occasional to frequent sand to fine gravel sized chalk fragments.
							End of Trial Pit at 2.10 m
		3					
		4					

Remarks and Water Observations

Pit terminated at 2.1m depth. No groundwater encountered.

Key for Insitu tests

HV-Hand Vane (kN/m2)

PP-Pocket Penetrometer (kN/m2)

MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NAW

Figure: A6

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP7

Site: Langstone Technology Park

Location: Langstone Road, Havant

Client: Glanville Consultants Ltd

Ground Level: GL not measured

Dates: 18 Sep 03

Job No.: 33893

GROUND WATER | SAMPLES/TESTS | STRATA RECORD

Sheet 1 of 1

Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key	Description
			D1 0.00-0.25					MADE GROUND: Dense overgrowth over light to dark brown clayey sand with occasional brick and concrete pieces. Occasional whole bricks.
			D2 0.80-0.90					...@0.8m to 0.9m brick FILL
			D3 0.90-1.05		0.90	0.90		Stiff to very stiff light brown sandy CLAY with frequent sub-angular gravel sized flints to pebble size.
		1			1.10	0.20		Light to dark brown clay-bound GRAVEL. Gravel is sub-angular to sub-rounded flint fragments. Occasional sand to fine gravel sized chalk fragments.
			D4 1.50					
					1.70	0.60		*End of Trial Pit at 1.70 m*
		2						
		3						
		4						

Remarks and Water Observations

Pit terminated at 1.7m. No groundwater encountered.

Key for Insitu tests

HV-Hand Vane (kN/m2)

PP-Pocket Penetrometer (kN/m2)

MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NAW

Figure: A7

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP8

Site: Langstone Technology Park

Location: Langstone Road, Havant

Client: Glanville Consultants Ltd

Ground Level: GL not measured

Dates: 18 Sep 03

Job No.: 33893

GROUND WATER | SAMPLES/TESTS | STRATA RECORD

Sheet 1 of 1

Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key	Description
			D1 0.10					MADE GROUND: Dense overgrowth over light to dark brown clayey sand with occasional brick and concrete pieces. Occasional whole bricks.
			D2 0.50		0.50	0.50		Very stiff light brown sandy CLAY with frequent sub-angular gravel sized flints to pebble size.
		1						
			D3 1.40		1.40	0.90		Light to dark brown clay-bound GRAVEL. Gravel is sub-angular to sub-rounded flint fragments. Occasional sand to fine gravel sized chalk fragments.
			D4 1.60		1.80	0.40		... @1.6m communited chalk noted on flint surfaces
		2						*End of Trial Pit at 1.80 m*
		3						
		4						

Remarks and Water Observations

Pit terminated at 1.8m depth. No groundwater encountered.

Key for Insitu tests

HV-Hand Vane (kN/m2)

PP-Pocket Penetrometer (kN/m2)

MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NAW

Figure: A8

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP9

Site: Langstone Technology Park

Location: Langstone Road, Havant

Client: Glanville Consultants Ltd

Ground Level: GL not measured

Dates: 19 Sep 03

Job No.: 33893

Sheet 1 of 1

GROUND WATER		SAMPLES/TESTS			STRATA RECORD		
Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key / Description
			D1 0.00-0.10	0.00			
			D2 0.10-0.30		0.10	0.10	MADE GROUND: Grass cover over topsoil. Frequent rootlets (mm scale).
							MADE GROUND: Dark brown clayey sand with frequent sub-angular to sub-rounded gravel sized flint fragments and occasional brick fragments to cobble size. Occasional to frequent rootlets. Rare to occasional sub-angular chalk pieces to gravel size.
			D3 0.80-0.90		0.80	0.70	Stiff light brown sandy CLAY with frequent sub-angular gravel sized flints to pebble size.
		1					
			D4 1.80	PP 1.80 25	1.75	0.95	Soft light brown grey silty CLAY with occasional to frequent lenses of brown black organic material 150mm diameter.
		2					
▼					2.25	0.50	Light grey clay-bound sandy GRAVEL. Gravel is sub-angular to sub-rounded flint fragments.
			D5 2.50				...@2.75m no longer clay-bound, light orange brown in colour
		3			3.10	0.85	*End of Trial Pit at 3.10 m*
		4					

Remarks and Water Observations

Pit terminated at 3.1m depth. Groundwater struck at 2.25m depth. Inflow slow to fair at base of pit. Some collapse of pit side walls from 2.2m. Trial pit 2.6m long, 0.7m wide. 1No soakaway test conducted in pit.

Key for Insitu tests

HV-Hand Vane (kN/m2)

PP-Pocket Penetrometer (kN/m2)

MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NAW

Figure: A9

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP10

Site: Langstone Technology Park

Location: Langstone Road, Havant

Client: Glanville Consultants Ltd

Ground Level: GL not measured

Dates: 19 Sep 03

Job No.: 33893

Sheet 1 of 1

GROUND WATER		SAMPLES/TESTS			STRATA RECORD		
Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key / Description
			D1 0.00-0.10		0.10	0.10	MADE GROUND: Grass cover over topsoil. Frequent rootlets (mm scale).
			D2 0.30-0.50		0.50	0.40	MADE GROUND: Dark brown clayey sand with frequent sub-angular to sub-rounded gravel sized flint fragments and occasional brick fragments to cobble size. Occasional to frequent rootlets. Rare to occasional sub-angular chalk pieces to gravel size.
			D3 0.70				Stiff light brown sandy CLAY with frequent sub-angular gravel sized flints to pebble size.
		1			1.80	1.30	Light grey clay-bound sandy GRAVEL. Gravel is sub-angular to sub-rounded flint fragments.
▼		2	D4 1.90		2.40	0.60	Light orange brown sandy GRAVEL. Gravel is sub angular to rounded flint fragments, damp. ... @2.40m no longer clay-bound, light orange brown in colour
			D5 2.50		2.70	0.30	*End of Trial Pit at 2.70 m*
		3					
		4					

Remarks and Water Observations

Pit terminated at 2.7m depth . Groundwater struck at 2.4m depth. Inflow slow at base of pit. Some collapse of pit side walls from 2.4m. Trial pit 2.9m long, 0.7m wide. *No soakaway test conducted in pit.

Key for insitu tests

HV-Hand Vane (kN/m2)

PP-Pocket Penotometer (kN/m2)

MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NAW

Figure: A10

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP11

Site: Langstone Technology Park

Location: Langstone Road, Havant

Client: Glanville Consultants Ltd

Ground Level: GL not measured

Dates: 19 Sep 03

Job No.: 33893

Sheet 1 of 1

GROUND WATER			SAMPLES/TESTS			STRATA RECORD		
Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key	Description
			D1 0.00-0.10		0.10	0.10		MADE GROUND: Grass cover over topsoil. Frequent rootlets (mm scale).
			D2 0.30-0.35					MADE GROUND: Dark brown clayey sand with frequent sub-angular to sub-rounded gravel sized flint fragments and occasional brick fragments to cobble size. Occasional to frequent rootlets. Rare to occasional sub-angular chalk pieces to gravel size.
			D3 0.90-1.00		0.90	0.80		Medium dense (estimated) clayey SAND with occasional to frequent flints to cobble size.
		1			1.60	0.70		Dark brown clay-bound sandy GRAVEL. Gravel is sub-angular to sub-rounded flints, occasionally to cobble size.
			D4 1.80					...@1.8m becoming light brown due to presence of sand to fine gravel sized chalk pieces.
		2	D5 2.20					
					2.35	0.75		*End of Trial Pit at 2.35 m*
		3						
		4						

Remarks and Water Observations

Pit terminated at 2.35m depth. No groundwater encountered.

Key for Insitu tests

HV-Hand Vane (kN/m2)

PP-Pocket Penetrometer (kN/m2)

MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NAW

Figure: A11

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP12

Site: Langstone Technology Park

Location: Langstone Road, Havant

Client: Glanville Consultants Ltd

Ground Level: GL not measured

Dates: 19 Sep 03

Job No.: 33893

Sheet 1 of 1

GROUND WATER		SAMPLES/TESTS			STRATA RECORD		
Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key / Description
			D1 0.00-0.10		0.10	0.10	MADE GROUND: Grass cover over topsoil. Frequent rootlets (mm scale).
			D2 0.30-0.35				MADE GROUND: Dark brown clayey sand with frequent sub-angular to sub-rounded gravel sized flint fragments and occasional brick fragments to cobble size. Occasional to frequent rootlets. Rare to occasional sub-angular chalk pieces to gravel size.
		1					
		2			2.30	2.20	Light to dark brown clay-bound GRAVEL. Gravel is sub-angular to sub-rounded flint fragments. Occasional sand to fine gravel sized chalk fragments.
			D3 2.40				
			D4 2.90				...@2.8m becoming light brown white in colour due to increased presence of chalk pieces
		3			3.00	0.70	*End of Trial Pit at 3.00 m*
		4					

Remarks and Water Observations

Pit terminated at 3m depth. No groundwater encountered.

Key for Insitu tests

HV-Hand Vane (kN/m2)

PP-Pocket Penetrometer (kN/m2)

MP-Mackintosh Probe (N150)

Scale: 1:25

Logged by: NAW

Figure: A12

STATS *Specialist Engineering, Materials and Environmental Consultants*

TRIAL PIT RECORD

Trial Pit Number: TP13

Site:	Location:	
Langstone Technology Park	Langstone Road, Havant	
Client:	**Ground Level:**	**Dates:** / **Job No.:**
Glanville Consultants Ltd	GL not measured	19 Sep 03 / 33893

GROUND WATER | SAMPLES/TESTS | STRATA RECORD | Sheet 1 of 1

Strike	Well	Depth (m)	Type/Depth (m)	In-situ Tests	Depth (m)	Level (mAOD)	Key	Description
			D1 0.00-0.10		0.10	0.10		MADE GROUND: Grass cover over topsoil. Frequent rootlets (mm scale).
			D2 0.50-0.75					MADE GROUND: Brick fill mixed with dark brown clayey sand with frequent gravel sized concrete pieces. Frequent whole bricks and occasional metal work.
		1						
		2						
					2.90	2.90		*End of Trial Pit at 2.90 m*
		3						
		4						

Remarks and Water Observations

Pit terminated at 2.9m depth. No groundwater encountered. Sub-surface wall encounterd down to 2.9m, base of wall not determined.

Key for Insitu tests

HV-Hand Vane (kN/m2)
PP-Pocket Penotometer (kN/m2)
MP-Mackintosh Probe (N150)

Scale: 1:25
Logged by: NAW
Figure: A13

STATS *Specialist Engineering, Materials and Environmental Consultants*

IN-SITU DCP TEST

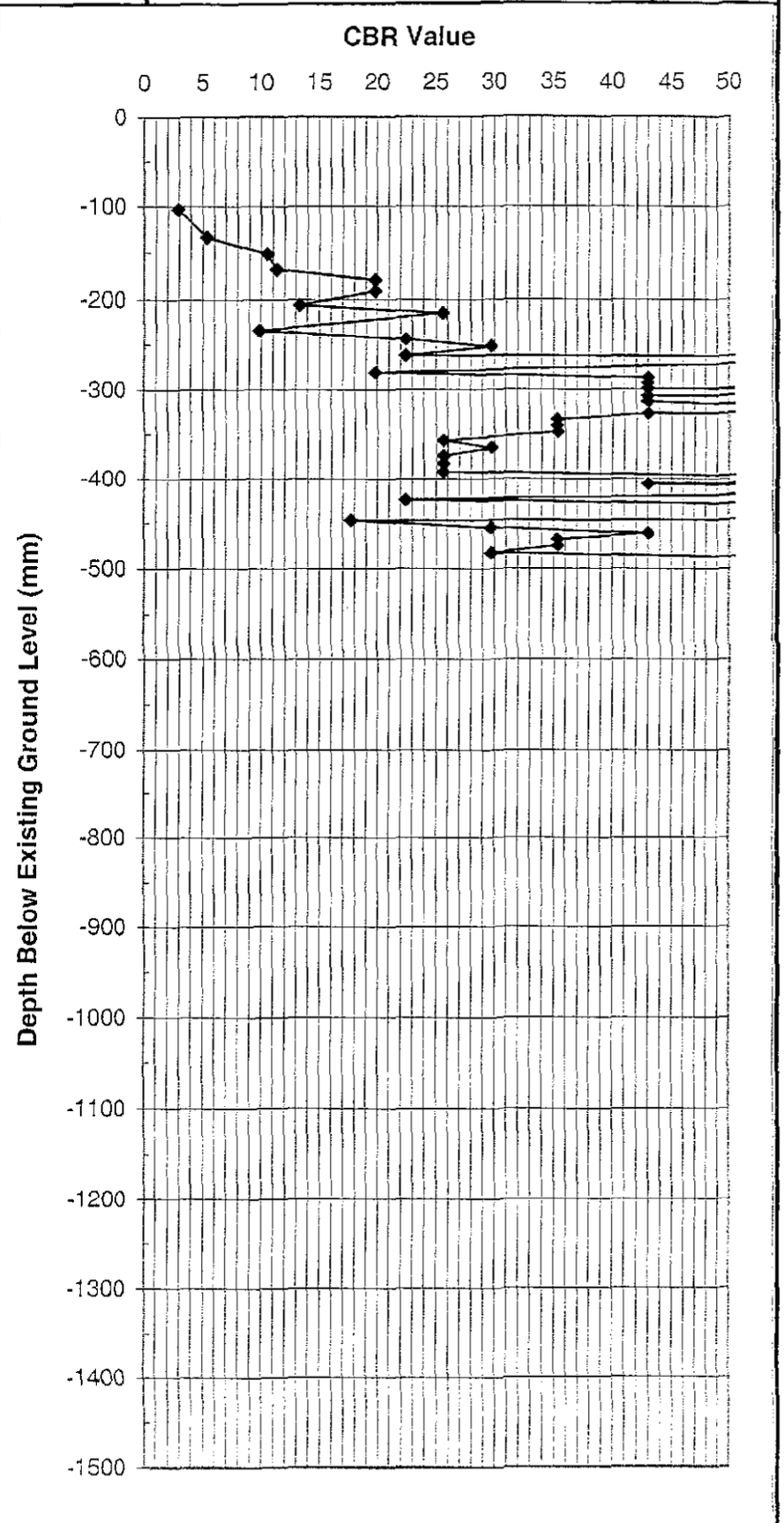
1

Site: Langstone Techology Park, Langstone Road, Havant

Client: Glanville Consultants

Depth (mm): -54

Reading (mm)	Depth (mm)	Number of Blows (mm)	Penetration (mm)	CBR Value
54	-54	0		
103	-103	1	49	3
134	-134	2	31	5
152	-152	3	18	11
169	-169	4	17	11
180	-180	5	11	20
191	-191	6	11	20
206	-206	7	15	13
215	-215	8	9	26
234	-234	9	19	10
244	-244	10	10	22
252	-252	11	8	30
262	-262	12	10	22
265	-265	13	3	104
270	-270	14	5	54
281	-281	15	11	20
287	-287	16	6	43
293	-293	17	6	43
299	-299	18	6	43
302	-302	19	3	104
308	-308	20	6	43
314	-314	21	6	43
319	-319	22	5	54
321	-321	23	2	175
327	-327	24	6	43
334	-334	25	7	35
341	-341	26	7	35
348	-348	27	7	35
357	-357	28	9	26
365	-365	29	8	30
374	-374	30	9	26
383	-383	31	9	26
392	-392	32	9	26
397	-397	33	5	54
400	-400	34	3	104
406	-406	35	6	43
410	-410	36	4	72
410	-410	37	0	426
414	-414	38	4	72
424	-424	39	10	22
429	-429	40	5	54
434	-434	41	5	54
435	-435	42	1	426
447	-447	43	12	18
455	-455	44	8	30
461	-461	45	6	43
468	-468	46	7	35
475	-475	47	7	35
483	-483	48	8	30
488	-488	49	5	54
492	-492	50	4	72
495	-495	51	3	104
499	-499	52	4	72



Comments: Test complete to 500mm depth.

Job Number: 33893

Figure: A14

STATS *Specialist Engineering, Materials and Environmental Consultants*

IN-SITU DCP TEST

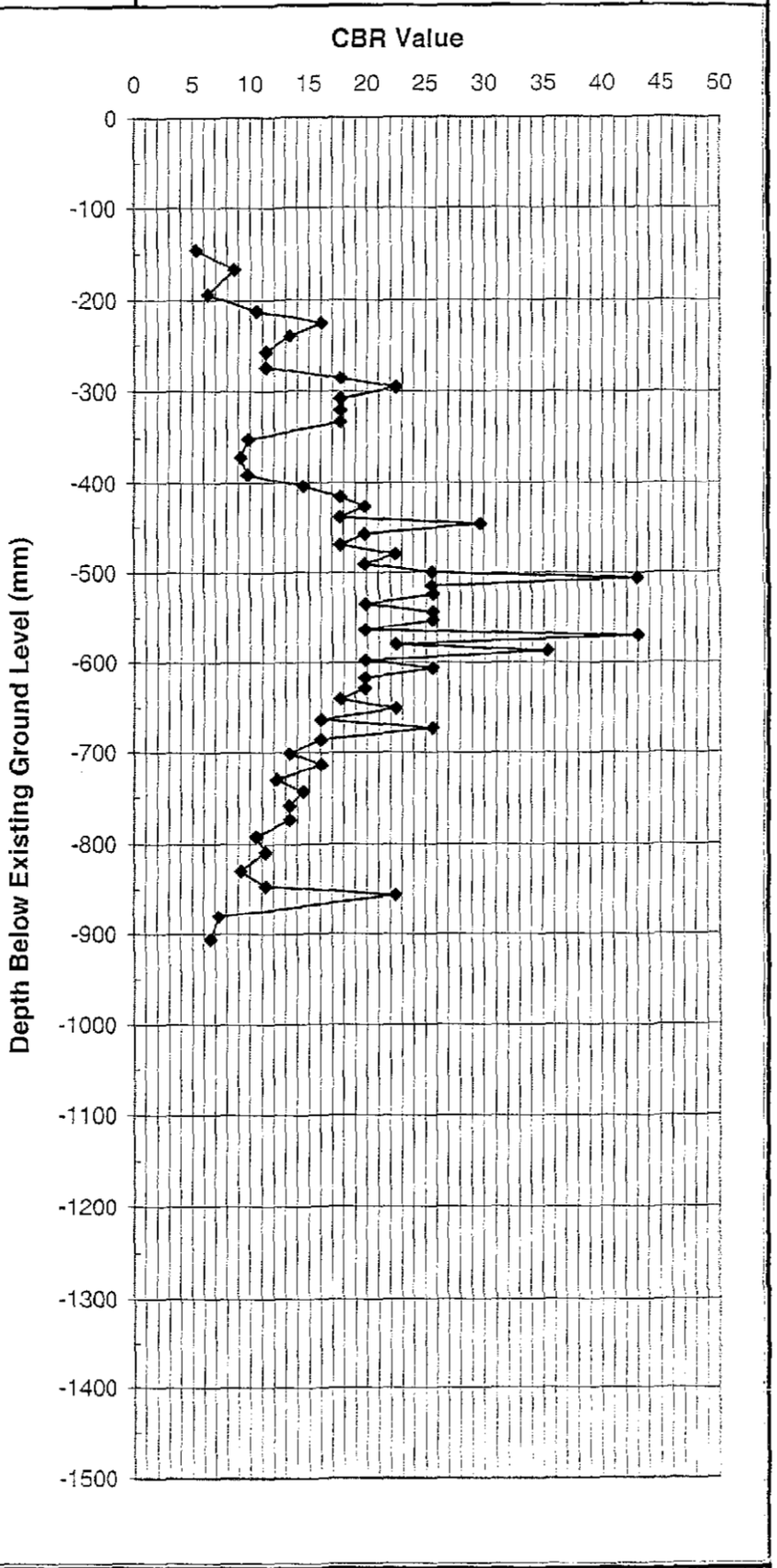
3

Site: Langstone Techology Park, Langstone Road, Havant

Client: Glanville Consultants

Depth (mm): -115

Reading (mm)	Depth (mm)	Number of Blows (mm)	Penetration (mm)	CBR Value
115	-115	0		
146	-146	1	31	5
167	-167	2	21	9
194	-194	3	27	6
212	-212	4	18	11
225	-225	5	13	16
240	-240	6	15	13
257	-257	7	17	11
274	-274	8	17	11
286	-286	9	12	18
296	-296	10	10	22
308	-308	11	12	18
320	-320	12	12	18
332	-332	13	12	18
351	-351	14	19	10
371	-371	15	20	9
390	-390	16	19	10
404	-404	17	14	15
416	-416	18	12	18
427	-427	19	11	20
439	-439	20	12	18
447	-447	21	8	30
458	-458	22	11	20
470	-470	23	12	18
480	-480	24	10	22
491	-491	25	11	20
500	-500	26	9	26
506	-506	27	6	43
515	-515	28	9	26
524	-524	29	9	26
535	-535	30	11	20
544	-544	31	9	26
553	-553	32	9	26
564	-564	33	11	20
570	-570	34	6	43
580	-580	35	10	22
587	-587	36	7	35
598	-598	37	11	20
607	-607	38	9	26
618	-618	39	11	20
629	-629	40	11	20
641	-641	41	12	18
651	-651	42	10	22
664	-664	43	13	16
673	-673	44	9	26
686	-686	45	13	16
701	-701	46	15	13
714	-714	47	13	16
730	-730	48	16	12
744	-744	49	14	15
759	-759	50	15	13
774	-774	51	15	13
792	-792	52	18	11
809	-809	53	17	11
829	-829	54	20	9
846	-846	55	17	11
856	-856	56	10	22
880	-880	57	24	7
906	-906	58	26	7



Comments: Test complete to 906mm depth.

Job Number: 33893

Figure: A16

STATS *Specialist Engineering, Materials and Environmental Consultants*

IN-SITU DCP TEST

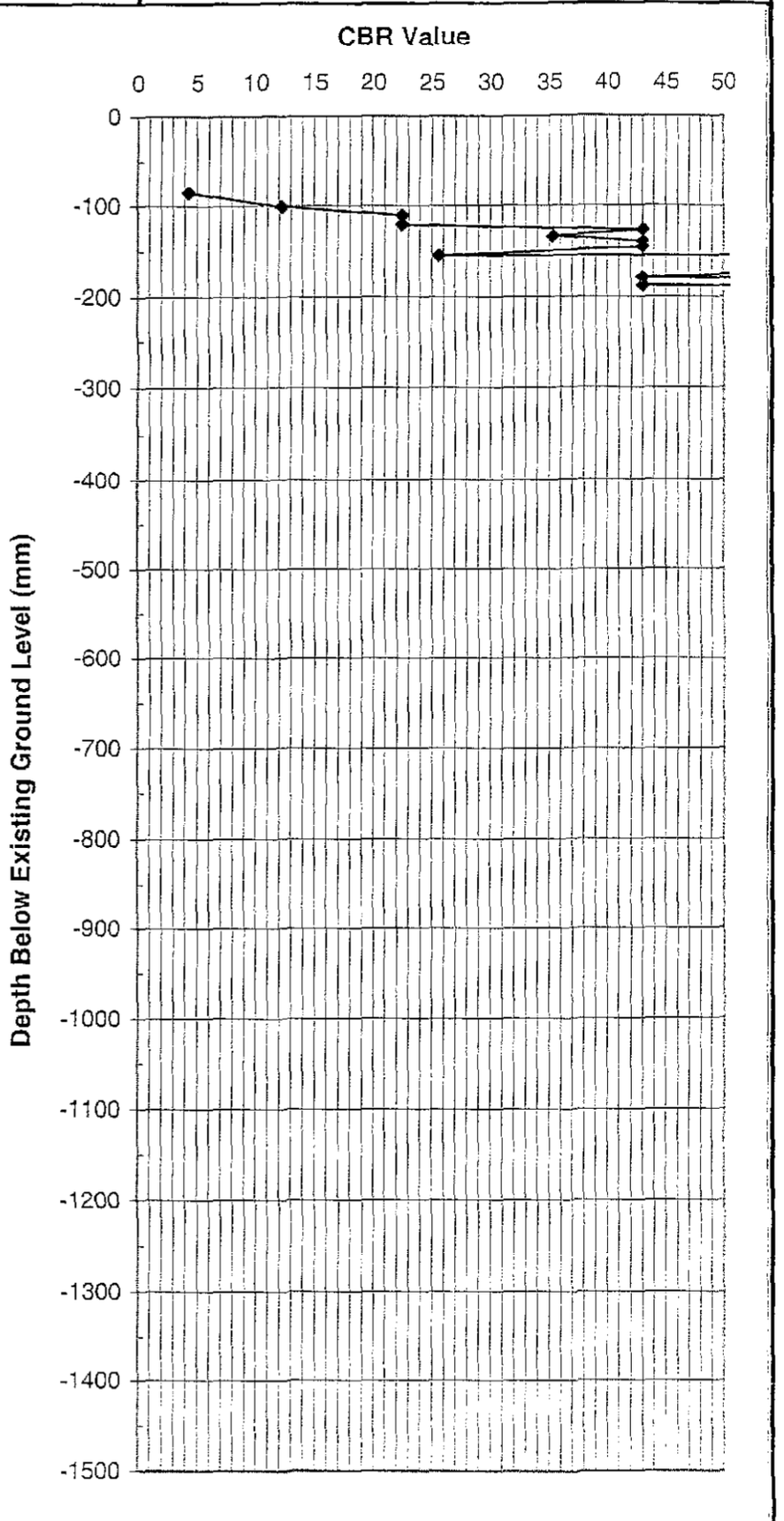
4

Site: Langstone Techology Park, Langstone Road, Havant

Client: Glanville Consultants

Depth (mm): -49

Reading (mm)	Depth (mm)	Number of Blows (mm)	Penetration (mm)	CBR Value
49	-49	0		
85	-85	1	36	4
101	-101	2	16	12
111	-111	3	10	22
121	-121	4	10	22
127	-127	5	6	43
134	-134	6	7	35
140	-140	7	6	43
146	-146	8	6	43
155	-155	9	9	26
157	-157	10	2	175
161	-161	11	4	72
165	-165	12	4	72
169	-169	13	4	72
174	-174	14	5	54
180	-180	15	6	43
181	-181	16	1	426
182	-182	17	1	426
188	-188	18	6	43
191	-191	19	3	104
195	-195	20	4	72
196	-196	21	1	426
200	-200	22	4	72
201	-201	23	1	426
204	-204	24	3	104
206	-206	25	2	175
209	-209	26	3	104
210	-210	27	1	426
211	-211	28	1	426
212	-212	29	1	426
213	-213	30	1	426



Comments: Test refusal at 213mm depth due to flint fragments.

Job Number: 33893

Figure: A17

STATS *Specialist Engineering, Materials and Environmental Consultants*

IN-SITU DCP TEST

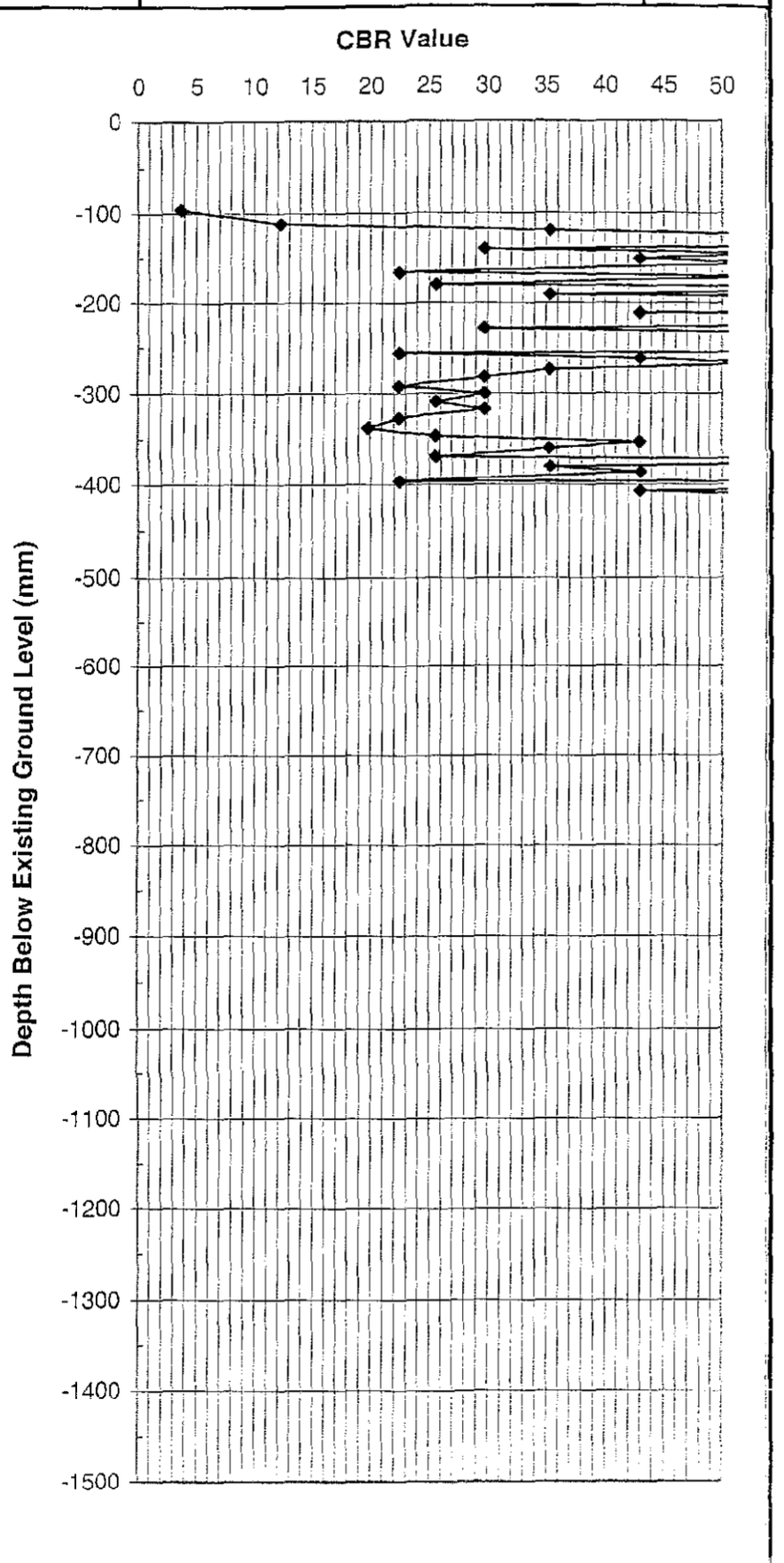
5

Site: Langstone Techology Park, Langstone Road, Havant

Client: Glanville Consultants

Depth (mm): -55

Reading (mm)	Depth (mm)	Number of Blows (mm)	Penetration (mm)	CBR Value
55	-55	0		
96	-96	1	41	4
112	-112	2	16	12
119	-119	3	7	35
124	-124	4	5	54
129	-129	5	5	54
132	-132	6	3	104
140	-140	7	8	30
145	-145	8	5	54
151	-151	9	6	43
156	-156	10	5	54
166	-166	11	10	22
171	-171	12	5	54
180	-180	13	9	26
184	-184	14	4	72
191	-191	15	7	35
195	-195	16	4	72
198	-198	17	3	104
201	-201	18	3	104
202	-202	19	1	426
205	-205	20	3	104
211	-211	21	6	43
214	-214	22	3	104
217	-217	23	3	104
220	-220	24	3	104
228	-228	25	8	30
233	-233	26	5	54
237	-237	27	4	72
242	-242	29	5	54
245	-245	29	3	104
246	-246	30	1	426
256	-256	31	10	22
262	-262	32	6	43
267	-267	33	5	54
274	-274	34	7	35
282	-282	35	8	30
292	-292	36	10	22
300	-300	37	8	30
309	-309	38	9	26
317	-317	39	8	30
327	-327	40	10	22
338	-338	41	11	20
347	-347	42	9	26
353	-353	43	6	43
360	-360	44	7	35
369	-369	45	9	26
373	-373	46	4	72
380	-380	47	7	35
386	-386	48	6	43
396	-396	49	10	22
398	-398	50	2	175
401	-401	51	3	104
407	-407	52	6	43
412	-412	53	5	54
417	-417	54	5	54
422	-422	55	5	54
425	-425	56	3	104
430	-430	57	5	54
435	-435	58	5	54
439	-439	59	4	72



Comments: Test complete to 532mm depth.

Job Number: 33893

Figure: A18

STATS *Specialist Engineering, Materials and Environmental Consultants*

IN-SITU DCP TEST

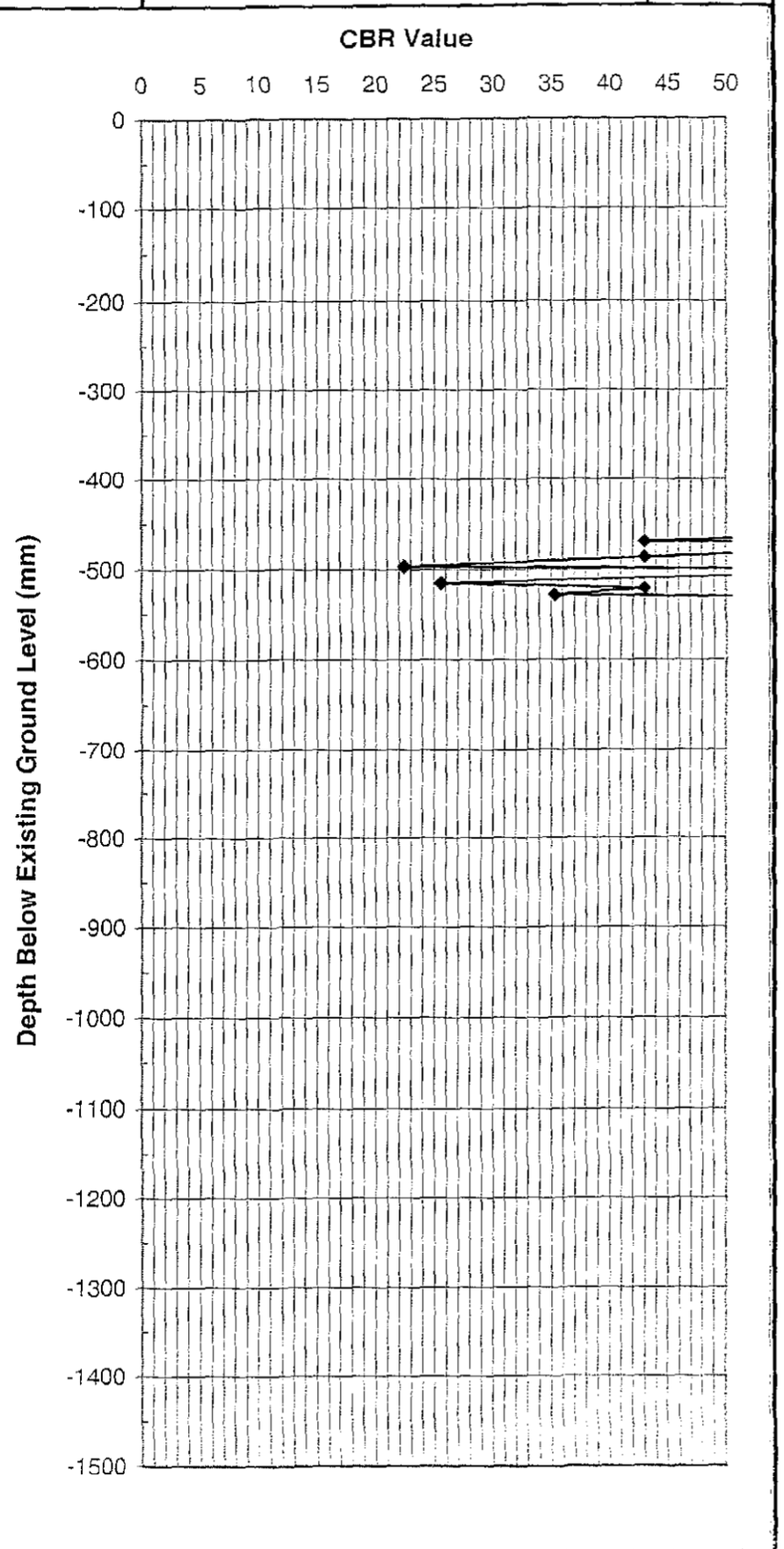
5 Ctnd

Site: Langstone Techology Park, Langstone Road, Havant

Client: Glanville Consultants

Depth (mm): -442

Reading (mm)	Depth (mm)	Number of Blows (mm)	Penetration (mm)	CBR Value
442	-442	60	3	104.4
444	-444	61	2	175
449	-449	62	5	54
454	-454	63	5	54
459	-459	64	5	54
464	-464	65	5	54
470	-470	66	6	43
472	-472	67	2	175
476	-476	68	4	72
481	-481	69	5	54
487	-487	70	6	43
497	-497	71	10	22
501	-501	72	4	72
506	-506	73	5	54
515	-515	74	9	26
521	-521	75	6	43
528	-528	76	7	35
532	-532	77	4	72



Comments:

Job Number: 33893

Figure: A18

STATS *Specialist Engineering, Materials and Environmental Consultants*

IN-SITU DCP TEST

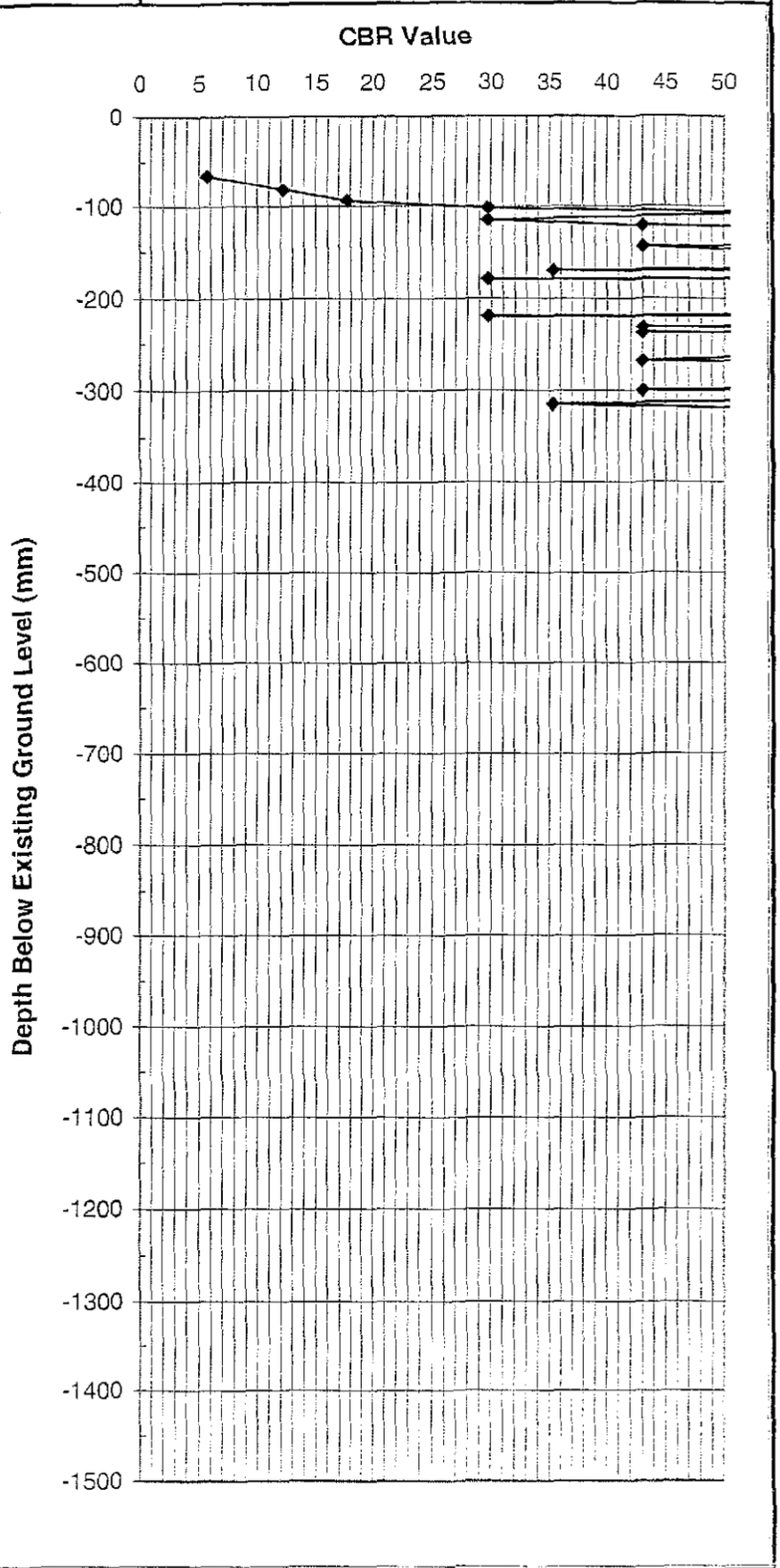
6

Site: Langstone Techology Park, Langstone Road, Havant

Client: Glanville Consultants

Depth (mm): -37

Reading (mm)	Depth (mm)	Number of Blows (mm)	Penetration (mm)	CBR Value
37	-37	0		
66	-66	1	29	6
82	-82	2	16	12
94	-94	3	12	18
102	-102	4	8	30
107	-107	5	5	54
115	-115	6	8	30
121	-121	7	6	43
125	-125	8	4	72
130	-130	9	5	54
135	-135	10	5	54
138	-138	11	3	104
144	-144	12	6	43
149	-149	13	5	54
151	-151	14	2	175
156	-156	15	5	54
160	-160	16	4	72
163	-163	17	3	104
170	-170	18	7	35
171	-171	19	1	426
171	-171	20	0	426
179	-179	21	8	30
181	-181	22	2	175
186	-186	23	5	54
188	-188	24	2	175
192	-192	25	4	72
195	-195	26	3	104
198	-198	27	3	104
202	-202	28	4	72
205	-205	29	3	104
209	-209	30	4	72
211	-211	31	2	175
219	-219	32	8	30
220	-220	33	1	426
222	-222	34	2	175
225	-225	35	3	104
231	-231	36	6	43
231	-231	37	0	426
232	-232	38	1	426
238	-238	39	6	43
240	-240	40	2	175
244	-244	41	4	72
247	-247	42	3	104
252	-252	43	5	54
257	-257	44	5	54
262	-262	45	5	54
268	-268	46	6	43
271	-271	47	3	104
275	-275	48	4	72
280	-280	49	5	54
285	-285	50	5	54
290	-290	51	5	54
294	-294	52	4	72
300	-300	53	6	43
303	-303	54	3	104
307	-307	55	4	72
314	-314	56	7	35
319	-319	57	5	54
323	-323	58	4	72
327	-327	59	4	72



Comments: Test refusal at 331mm depth due to flint fragments.

Job Number: 33893

Figure: A19

STATS *Specialist Engineering, Materials and Environmental Consultants*

IN-SITU DCP TEST

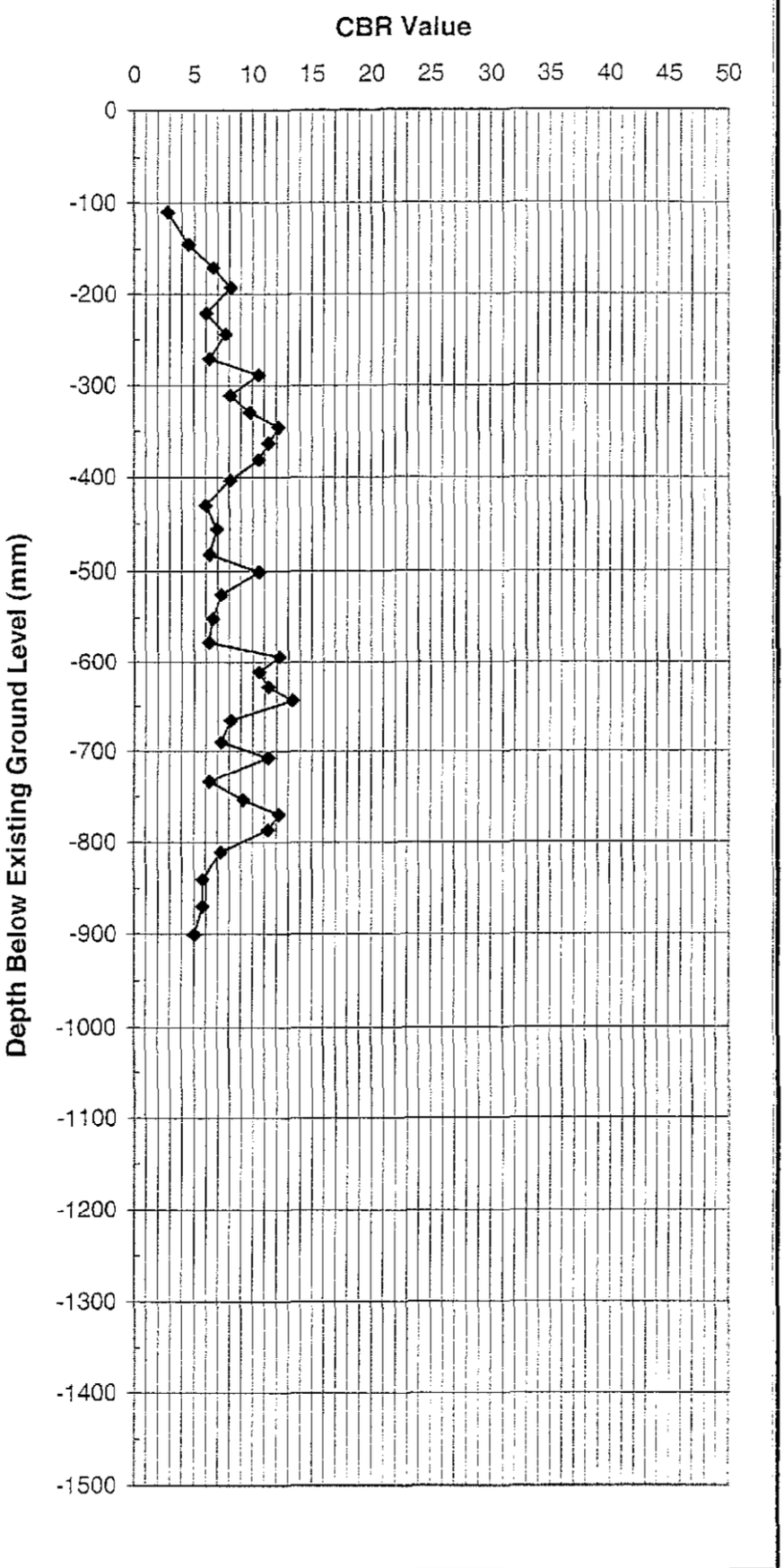
7

Site: Langstone Techology Park, Langstone Road, Havant

Client: Glanville Consultants

Depth (mm): -59

Reading (mm)	Depth (mm)	Number of Blows (mm)	Penetration (mm)	CBR Value
59	-59	0		
110	-110	1	51	3
145	-145	2	35	5
171	-171	3	26	7
193	-193	4	22	8
221	-221	5	28	6
244	-244	6	23	8
271	-271	7	27	6
289	-289	8	18	11
311	-311	9	22	8
330	-330	10	19	10
346	-346	11	16	12
363	-363	12	17	11
381	-381	13	18	11
403	-403	14	22	8
431	-431	15	28	6
456	-456	16	25	7
483	-483	17	27	6
501	-501	18	18	11
525	-525	19	24	7
551	-551	20	26	7
578	-578	21	27	6
594	-594	22	16	12
612	-612	23	18	11
629	-629	24	17	11
644	-644	25	15	13
666	-666	26	22	8
690	-690	27	24	7
707	-707	28	17	11
734	-734	29	27	6
754	-754	30	20	9
770	-770	31	16	12
787	-787	32	17	11
811	-811	33	24	7
840	-840	34	29	6
869	-869	35	29	6
901	-901	36	32	5



Comments: Test complete to 901mm depth.

Job Number: 33893

Figure: A20

STATS *Specialist Engineering, Materials and Environmental Consultants*

IN-SITU DCP TEST

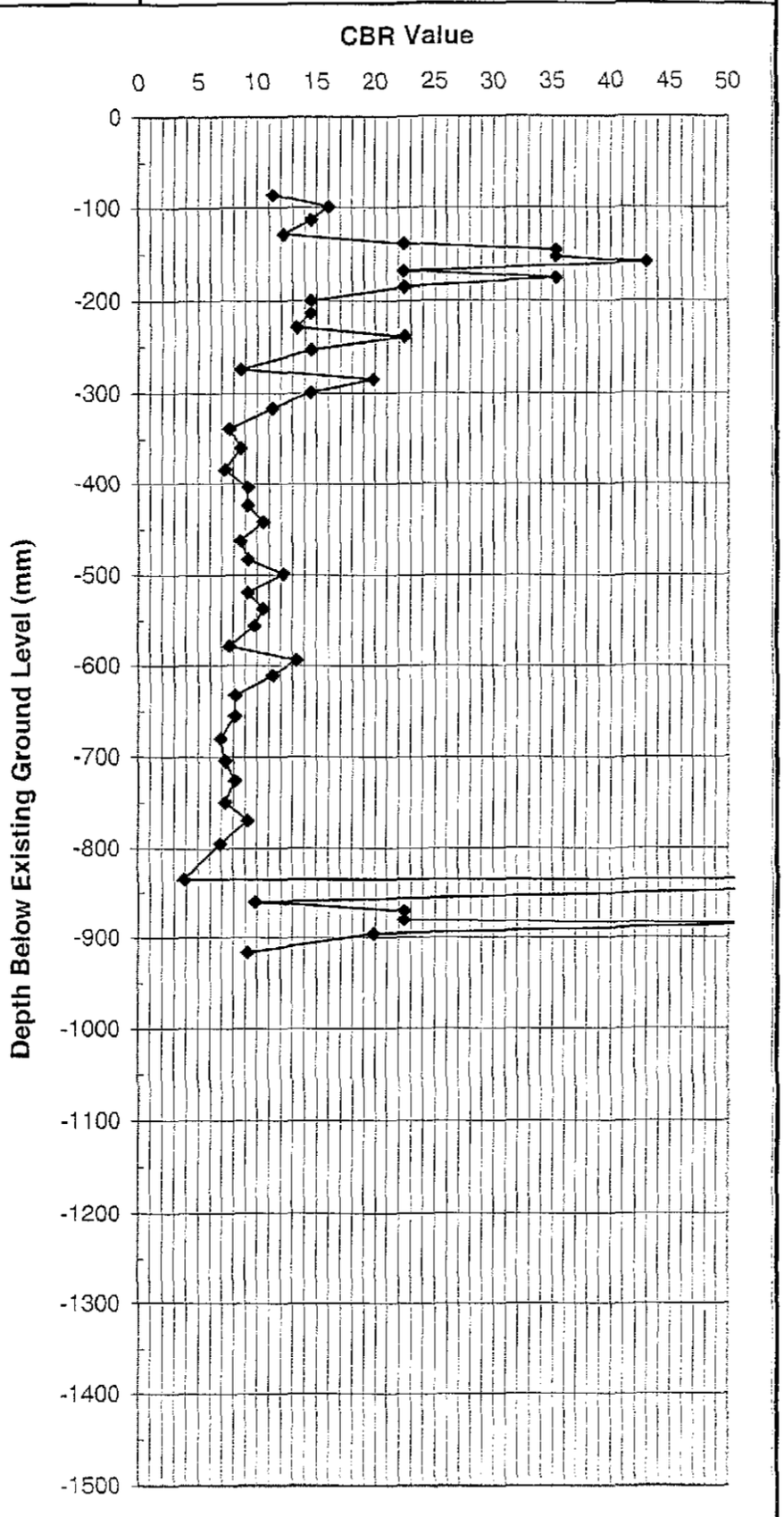
8

Site: Langstone Techology Park, Langstone Road, Havant

Client: Glanville Consultants

Depth (mm): -69

Reading (mm)	Depth (mm)	Number of Blows (mm)	Penetration (mm)	CBR Value
89	-69	0		
106	-86	1	17	11
119	-99	2	13	16
133	-113	3	14	15
149	-129	4	16	12
159	-139	5	10	22
166	-146	6	7	35
173	-153	7	7	35
179	-159	8	6	43
189	-169	9	10	22
196	-176	10	7	35
206	-186	11	10	22
220	-200	12	14	15
234	-214	13	14	15
249	-229	14	15	13
259	-239	15	10	22
273	-253	16	14	15
294	-274	17	21	9
305	-285	18	11	20
319	-299	19	14	15
336	-316	20	17	11
359	-339	21	23	8
380	-360	22	21	9
404	-384	23	24	7
424	-404	24	20	9
444	-424	25	20	9
462	-442	26	18	11
483	-463	27	21	9
503	-483	28	20	9
519	-499	29	16	12
539	-519	30	20	9
557	-537	31	18	11
576	-556	32	19	10
599	-579	33	23	8
614	-594	34	15	13
631	-611	35	17	11
653	-633	36	22	8
675	-655	37	22	8
700	-680	38	25	7
724	-704	39	24	7
746	-726	40	22	8
770	-750	41	24	7
790	-770	42	20	9
815	-795	43	25	7
855	-835	44	40	4
857	-837	45	2	175
861	-841	46	4	72
880	-860	47	19	10
890	-870	48	10	22
900	-880	49	10	22
905	-885	50	5	54
916	-896	51	11	20
936	-916	52	20	9



Comments: Test complete to 936mm depth .

Job Number: 33893

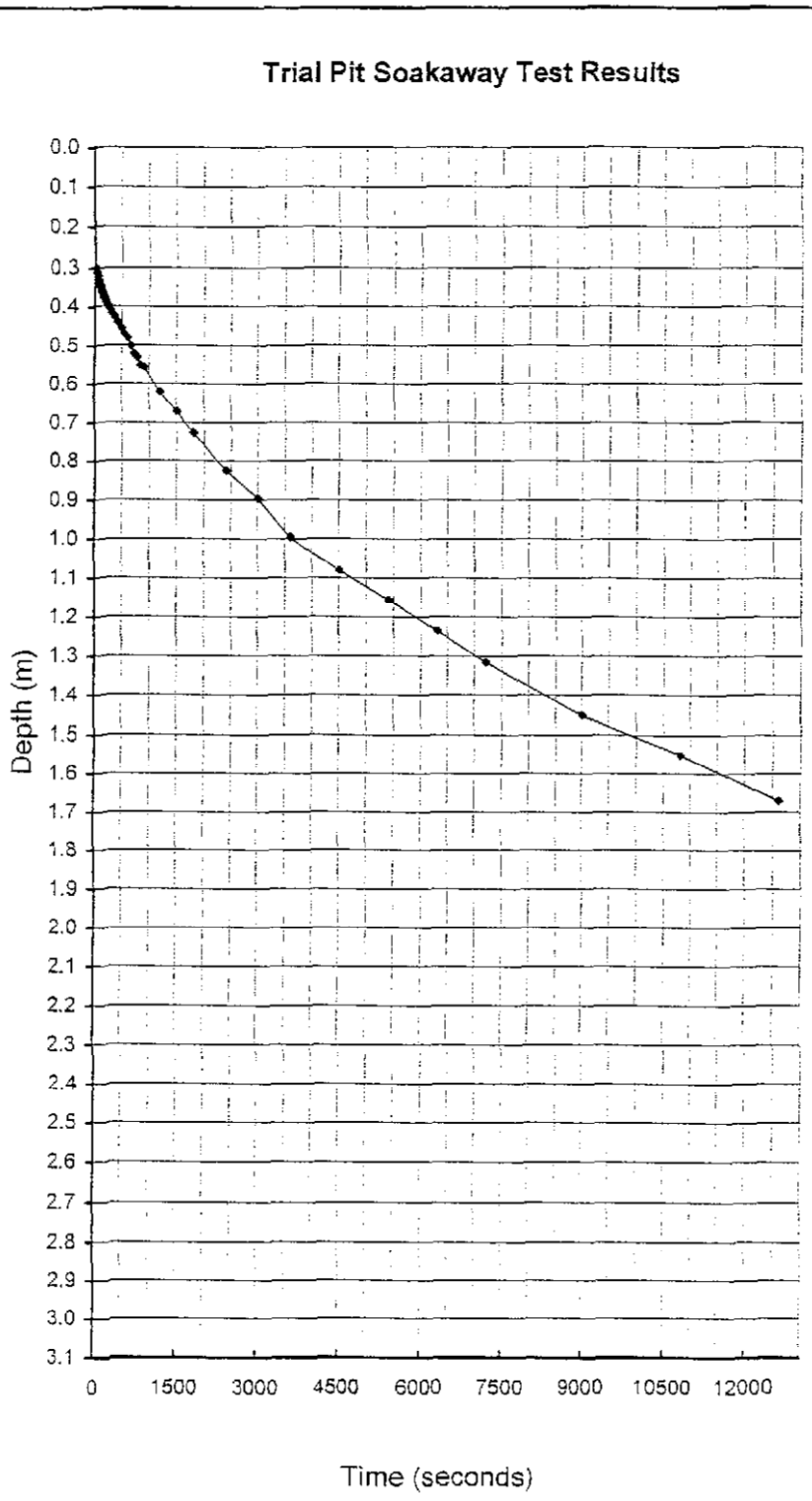
Figure: A21

STATS

Trial Pit Soakaway Test

Location	Langstone Technology Park, Havant	Test No	TP9. Test 1
Client	Havant International Limited	Length of Trial Pit (m)	2.6
Job Number	33893/01	Width of Trial Pit (m)	0.7
Date	19-Sep-03	Water level at start (mbgl)	0.3
Operator	Neil Whittlev	Depth to Base of Trial Pit (m)	3.1

Time (Secs)	Water level (mbgl)
15	0.300
30	0.310
45	0.320
60	0.330
75	0.335
90	0.345
105	0.350
120	0.360
135	0.365
150	0.370
165	0.375
180	0.380
195	0.385
210	0.390
225	0.395
240	0.400
255	0.400
270	0.405
285	0.410
300	0.415
360	0.425
420	0.440
480	0.455
540	0.470
600	0.480
660	0.500
720	0.520
780	0.530
840	0.550
900	0.555
1200	0.620
1500	0.670
1800	0.725
2400	0.825
3000	0.895
3600	0.995
4500	1.080
5400	1.155
6300	1.235
7200	1.315
9000	1.450
10800	1.550
12600	1.670



Results

Vp (m3)	2.49
ap Gravel (m2)	7.43
tp (s)	12600.00
Infiltration Rate (m/s)	2.66E-05

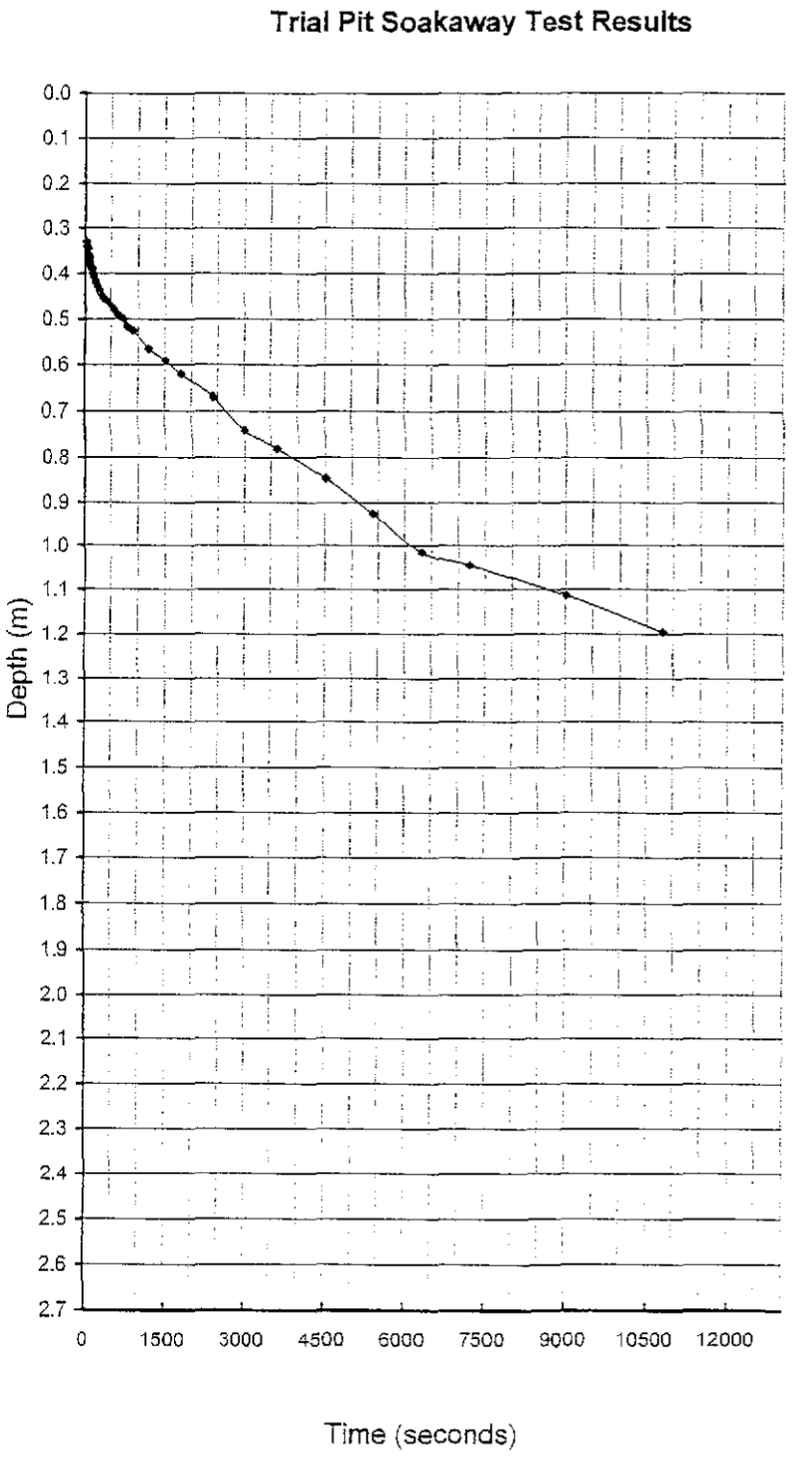
Value to be determined from graph

STATS

Trial Pit Soakaway Test

Location	Langstone Technology Park, Havant	**Test No**	TP10, Test1
Client	Havant International Limited	**Length of Trial Pit (m)**	2.9
Job Number	33893/01	**Width of Trial Pit (m)**	0.75
Date	19-Sep-03	**Water level at start (mbgl)**	0.33
Operator	Neil Whittlev	**Depth to Base of Trial Pit (m)**	2.7

Time (Secs)	Water level (mbgl)
15	0.330
30	0.340
45	0.345
60	0.360
75	0.365
90	0.375
105	0.385
120	0.390
135	0.390
150	0.400
165	0.405
180	0.410
195	0.415
210	0.420
225	0.425
240	0.430
255	0.435
270	0.435
285	0.440
300	0.445
360	0.455
420	0.460
480	0.470
540	0.480
600	0.490
660	0.495
720	0.500
780	0.515
840	0.520
900	0.525
1200	0.565
1500	0.590
1800	0.620
2400	0.670
3000	0.740
3600	0.780
4500	0.845
5400	0.925
6300	1.015
7200	1.045
9000	1.113
10800	1.195



Results

Vp (m3)	1.88
ap Gravel (m2)	8.75
tp (s)	10800.00
Infiltration Rate (m/s)	1.99E-05

Value to be determined from graph

APPENDIX B

GEOTECHNICAL LABORATORY TEST RECORDS

STATS

UKAS TESTING 0278

STATS Laboratories
Tel: +44 (0) 1727 833261
Fax: +44 (0) 1727 835682
Email: info@stats.co.uk
Website: www.stats.co.uk

Porterswood House
Porters Wood
St Albans
Herts AL3 6PQ
United Kingdom

CERTIFICATE OF TEST

MOISTURE CONTENT AND PLASTICITY INDEX OF SOIL

Your Ref: NAW/33893
Certificate: 82995/13398
Sheet 1 of 1
Site : **Langstone Technology Park**
Client : Glanville Consultants Limited
Corinthian Court
80 Milton Park
Abingdon
Oxon
OX14 4RY

Sampled by STATS Ltd
Date of:-
Receipt : 24/9/03
Test: 25-26/9/03
Tested by: DBG/MGC

METHOD

Moisture content was determined in accordance with BS 1377: Part 2:1990 Clause 3.2.
Plasticity Index was determined in accordance with BS 1377:Part 2:1990 Clause 4.2,4.4,5.2,5.3 & 5.4.

RESULTS

Batch No.	BH/TP No.	Depth (m)	Moisture Content %	Plasticity Index			% Retained 425Micron
				LL (%)	PL(%)	PI	
2059	TP4	1.20	12				
	TP6	1.30	13				
	TP9	0.80	13	46	26	20	0 N
	TP9	1.80	48	71	34	37	0 N
	TP10	0.70	21	46	23	23	0 N

REMARKS

N-Natural State
No soil description required

WS – Wet Sieve Preparation

For STATS

Jonathan Bailey
Senior Geotechnical Engineer

Date of issue: 16 October, 2003

STATS

UKAS TESTING 0278

STATS Laboratories
Tel: +44 (0) 1727 833261
Fax: +44 (0) 1727 835682
Email: info@stats.co.uk
Website: www.stats.co.uk

Porterswood House
Porters Wood
St Albans
Herts AL3 6PQ
United Kingdom

CERTIFICATE OF TEST
PARTICLE SIZE DISTRIBUTION OF SOIL

Your Ref :- NAW/33893
Certificate No :- 82995/13399
Sheet 1 of 4
Site :- **Langstone Technology Park**
Client :- Glanville Consultants Limited
Corinthian Court
80 Milton Park
Abingdon
Oxon
OX14 4RY

Sampled by STATS Ltd
Date of Receipt :- 24/9/03
Test :- 1/10/03
Tested by :- MGC/MWC
Batch No :- 2059

METHOD

The particle size distribution test was carried out in accordance with BS1377: Part 2: 1990: Clause 9.2.

RESULTS

The particle size distribution curves are presented on sheets 2-4.

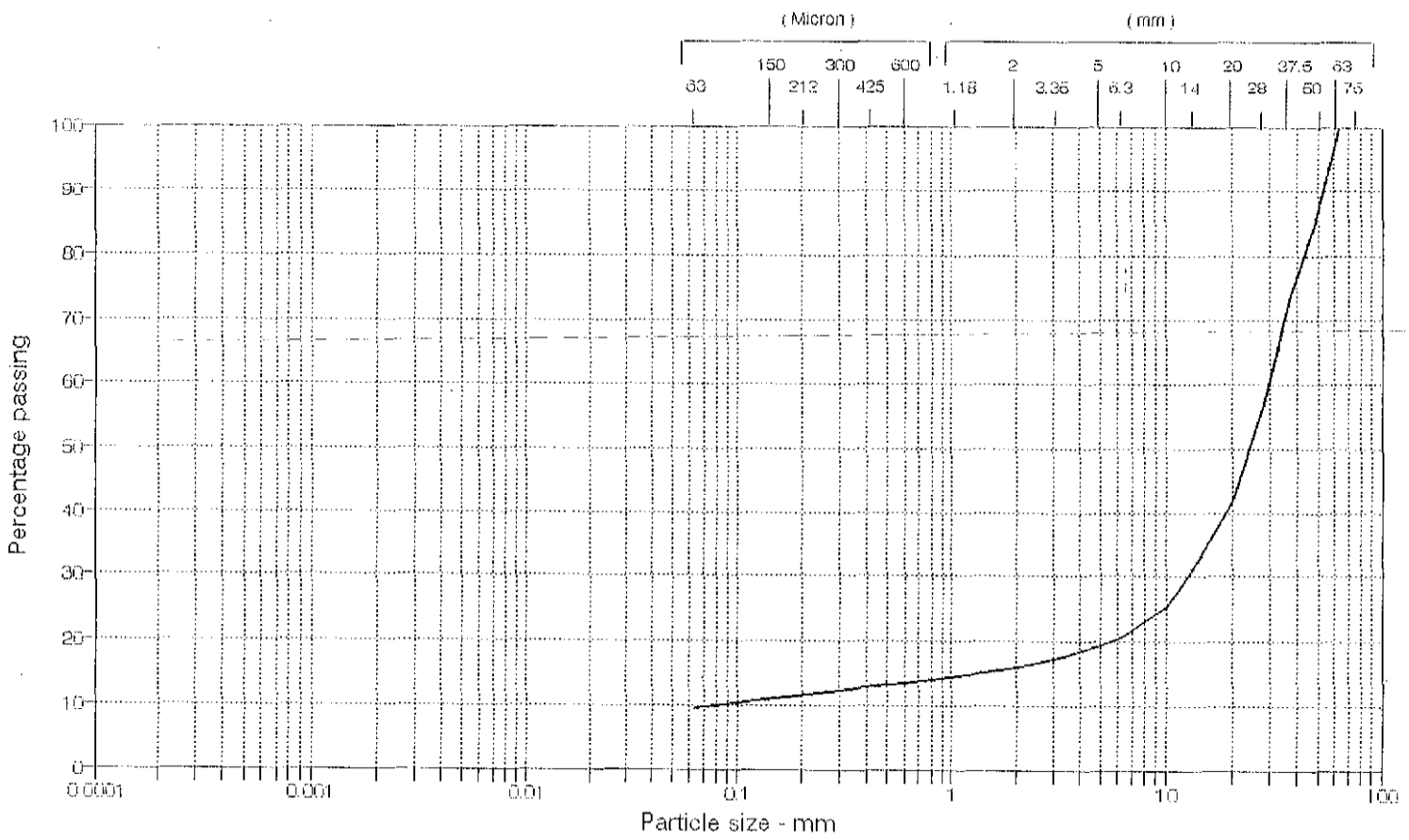
The mass of the test samples submitted for testing was less than the minimum mass specified in the test method.

No soil description required.

For STATS

Jonathan Bailey
Senior Geotechnical Engineer

Date of issue: 16 October, 2003

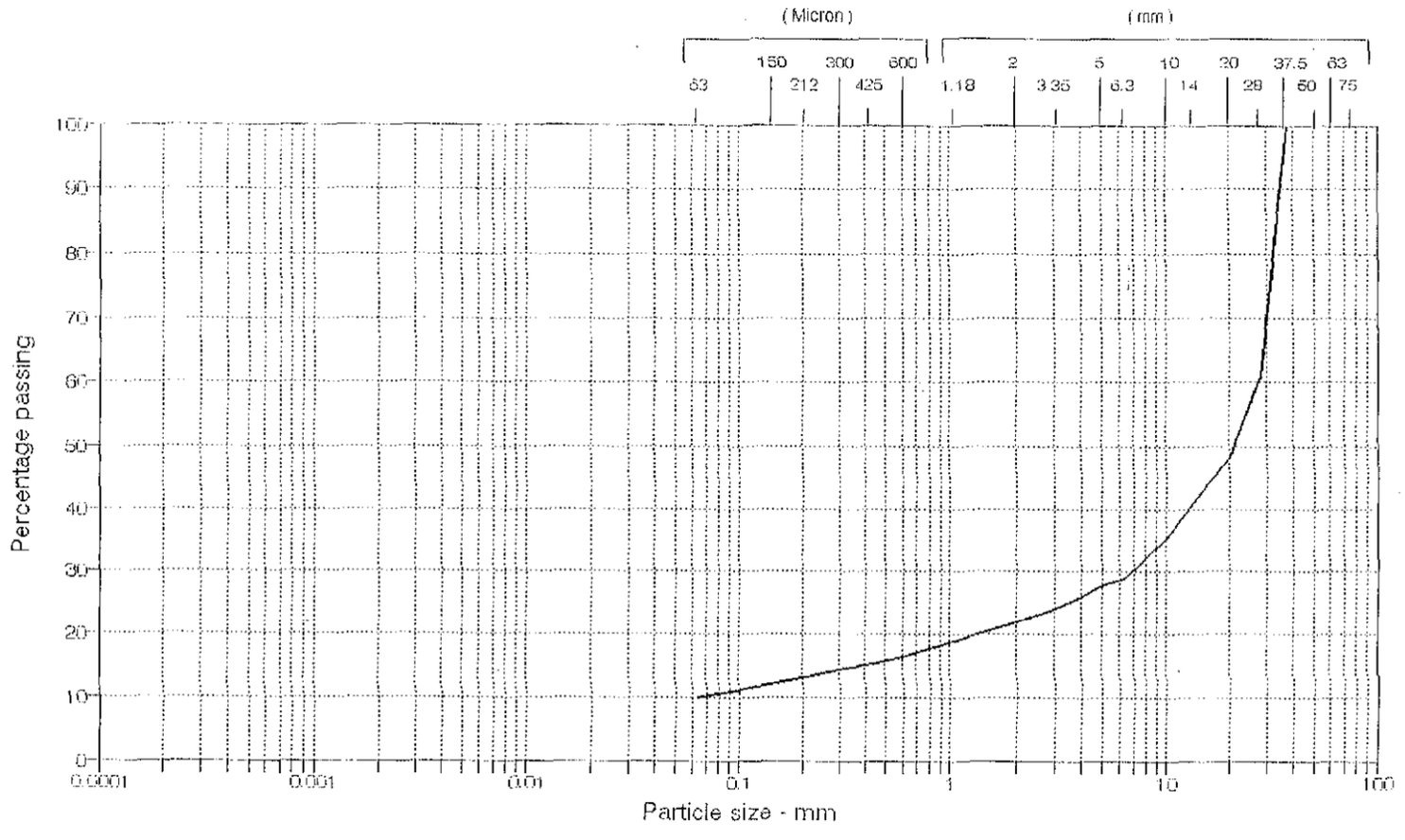


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE
	SILT			SAND			GRAVEL		

PARTICLE SIZE DISTRIBUTION

Your Ref: NAW/33893
Client: Glanville Consultants Ltd
Site: Langstone Park
Certificate no: 82995/13399

TP no: 1
Batch no: 2059
Depth - m: 2.7
Sheet 2 of 4

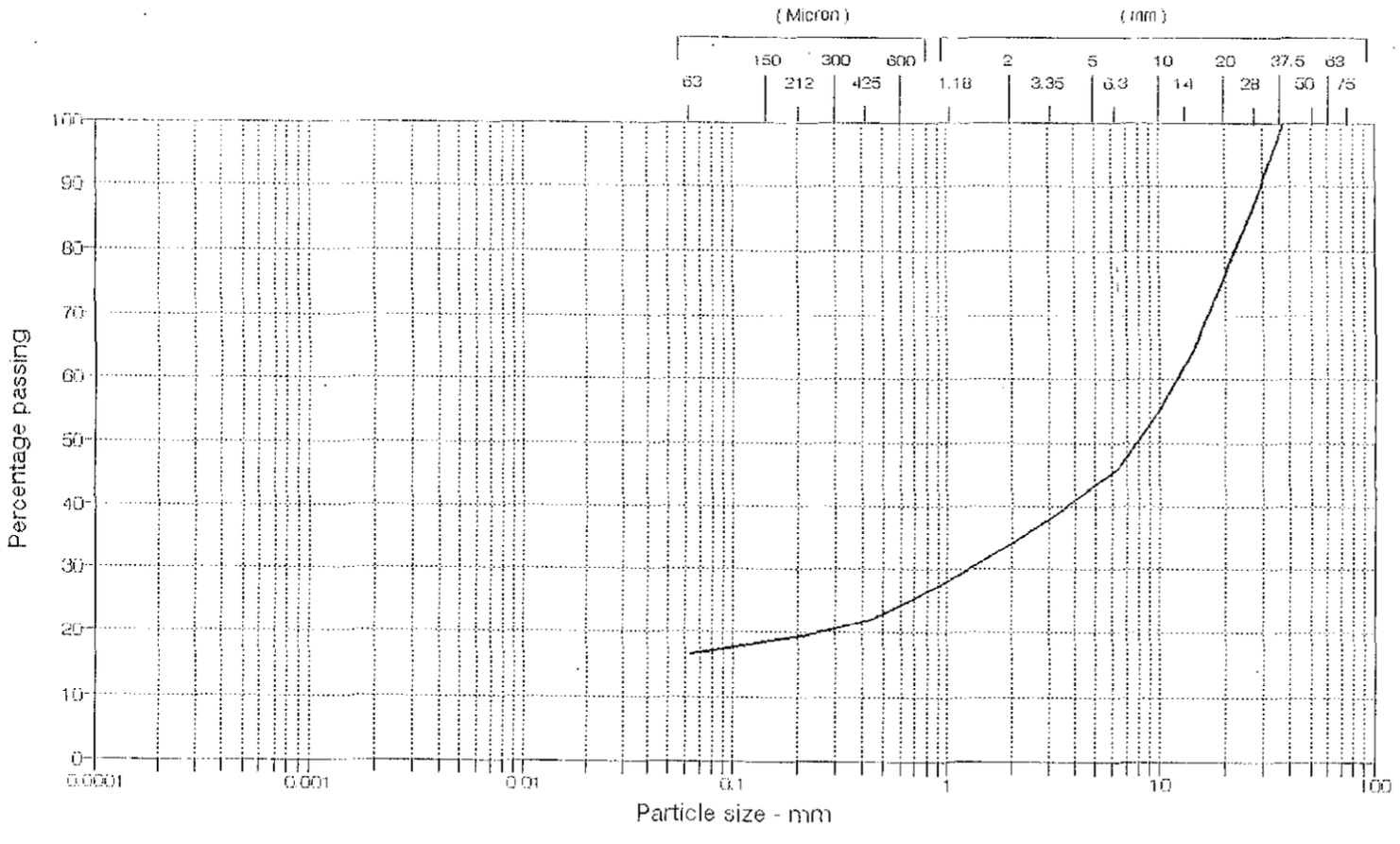


CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE
	SILT			SAND			GRAVEL		

PARTICLE SIZE DISTRIBUTION

Your Ref: NAW/33893
Client: Glanville Consultants Ltd
Site: Langstone Park
Certificate no: 82995/13399

TP no: 10
Batch no: 2059
Depth - m: 2.5
Sheet 3 of 4



CLAY	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE
	SILT			SAND			GRAVEL		

PARTICLE SIZE DISTRIBUTION

Your Ref: NAW/33893
Client: Glanville Consultants Ltd
Site: Langstone Park
Certificate no: 82995/13399

TP no: 11
Batch no: 2059
Depth - m: 2.2
Sheet 4 of 4

STATS

UKAS TESTING 0278

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United Kingdom

Water-Soluble Sulfate Content and pH of Soil

BS 1377: Part 3: 1990

33893 Langstone Technical Park

Client Details			
Glanville Consultants Limited Corinthian Court 80 Milton Park Abingdon Oxon OX14 4RY			
Contact Name	Jay Chandarana		
Order Reference	NAW/33893	Order Date	24/9/03

Sample Details			
Sample Type	Soils		
Sampled By	STATS Ltd.	Sampling Date	19/9/03
STATS Batch No	2059	No of Samples	3
Receipt Date	24/9/03	Test Date/Period	30/9-3/10/03

Methods	
Test	1. pH was determined in accordance with BS 1377:Part 3:1990:Clause 9. 2. Water soluble sulfate content of soil was determined in accordance with BS 1377:Part 3:1990:Clause 5.5. The test results are reported to the nearest 0.1g/l with the calculated value shown in parentheses.
Deviations	Test 2: The samples were initially dried at 45°C followed by 75-80°C. Clause 5.3.3.6 – a 25 ml aliquot of filtered extract was used for sample 2059/TP4 and a 50 ml aliquot of filtered extract was used for samples 2059/TP6 and 2059/TP10.

Results

Sample Reference	Depth [m]	% mass passing 2 mm	Sulfate as SO_3 [g/l]	pH
2059/TP4	1.2	28	0.1 (0.06)	7.2
2059/TP6	1.3	97	<0.1 (0.01)	7.6
2059/TP10	0.7	100	<0.1 (0.01)	7.6

Certification

Certificate prepared by		Certificate reviewed by	
Philippe Mueller Construction Materials Scientist		Fergus A Collie Director	
Testing by	BJS/DGG/PM	Certificate Issue Date	7/10/03

The results given in this certificate relate only to those samples submitted and specimens tested and to any materials properly represented by those samples and specimens. Any opinions and interpretations expressed herein are outside the scope of our UKAS accreditation.

End of Certificate

APPENDIX C

CHEMICAL LABORATORY TEST RECORDS

☐ Preliminary

☑ Validated

ALcontrol Geochem Analytical Services

Table Of Results

Job Number: 03/12470/02/01 **Sample Type:** SOIL

Client: Stats Limited Location: Langstone Technology Park

Date of Receipt: (of first sample) 26/09/03 Client Contact: James Dennis

Client Ref. No.: 33893

	UKAS Accredited		✓	✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
	Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	pH Units	g/l
	Detection Method		ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	Soxtec	Spectro	HPLC	IRIS	Meter	Spectro1
	Method Detection Limit		<1	<1	<1	<1	<1	<1	<1	<1	<50	<1	<10	<5	<0.01	<0.3	<1.00	<0.003
Sample Number	**Sample Identity**	**Depth (m)**	**Arsenic**	**Boron (Water Soluble)**	**Cadmium**	**Chromium**	**Copper**	**Nickel**	**Lead**	**Selenium**	**Total Sulphate by ICP**	**Zinc**	**Solvent Extractable Matter**	**Acid Soluble Sulphide**	**Total Phenols HPLC**	**Mercury by IRIS**	**pH Value in Soil**	**Soluble Sulphate as SO4 in 2:1 Extract**
1	TP 2	0.00-0.10	6	1	<1	30	30	17	89	<1	851	133	357	<5	<0.01	<0.3	7.55	-
2	TP 5	0.00-0.10	<1	2	1	25	16	14	55	<1	1046	102	305	42	<0.01	<0.3	7.83	-
3	TP 6	0.40	10	<1	3	48	22	38	33	<1	746	104	180	<5	<0.01	<0.3	8.11	-
4	TP 7	0.25	13	2	1	35	63	21	281	<1	1128	267	614	<5	<0.01	<0.3	7.40	-
5	TP 8	0.00-0.10	5	2	<1	25	22	16	57	<1	1251	92	398	<5	<0.01	<0.3	7.62	-
6	TP 9	0.10-0.30	<1	<1	<1	22	14	12	33	<1	714	57	340	<5	<0.01	<0.3	7.92	-
7	TP 11	0.30-0.35	8	<1	2	42	15	23	14	<1	542	60	106	<5	0.01	<0.3	8.10	-
8	TP 12	0.30-0.35	2	<1	<1	20	11	11	17	2	700	48	153	<5	<0.01	<0.3	7.89	-
9	TP 13	0.50-0.75	2	<1	<1	16	34	9	387	<1	2822	155	289	<5	<0.01	0.3	8.08	0.101

Note: METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

NFP = NO FIBRES PRESENT

Checked By _____ William Williams

[ ] Preliminary

[✓] Validated

ALcontrol Geochem Analytical Services

Table Of Results

Job Number: 03/12470/02/01 **Sample Type:** SOIL

Client: Stats Limited Location: Langstone Technology Park

Date of Receipt: (of first sample) 26/09/03 Client Contact: James Dennis

Client Ref. No.: 33893

	UKAS Accredited		✓															
	Units		mg/kg															
	Detection Method		Spectro2															
	Method Detection Limit		<1															
Sample Number	**Sample Identity**	**Depth (m)**	**Total Cyanide Soil**															
1	TP 2	0.00-0.10	<1															
2	TP 5	0.00-0.10	<1															
3	TP 6	0.40	<1															
4	TP 7	0.25	<1															
5	TP 8	0.00-0.10	<1															
6	TP 9	0.10-0.30	<1															
7	TP 11	0.30-0.35	<1															
8	TP 12	0.30-0.35	<1															
9	TP 13	0.50-0.75	<1															

Note: METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

NFP = NO FIBRES PRESENT

Checked By _____ William Williams

APPENDIX D

STANDARD GROUND INVESTIGATION INFORMATION

General

The techniques STATS uses to investigate the geotechnical properties of the ground are generally in accordance with the Site Investigation Steering Group's Specification for Ground Investigations Part 3 and the British Standard Code of Practice for Site Investigations, BS5930: 1999. The descriptions of soils and rocks used in the report are generally in accordance with Section Eight of BS5930: 1999.

The techniques STATS uses to investigate the contamination of ground are generally in accordance with the British Standard Code of Practice for the Identification and Investigation of Potentially Contaminated Land, BS10175: 2001.

Exploratory Hole Records

The depths of the exploratory holes, descriptions of strata encountered, record of samples taken and comments on the groundwater conditions are given in the exploratory hole records in Appendix B.

The borehole records show at what depths disturbed and undisturbed samples (U100's) samples were taken. Taking undisturbed samples involves driving an open-tube sampler (with a nominal diameter of 100mm) into the ground by a drop weight or sliding hammer. The number of blows taken to drive the tube into the ground is recorded on the borehole logs. The quality of undisturbed samples can be reduced when the U100 blow counts are high; in this situation, U100 sampling is replaced by Standard Penetration Testing which is described below.

The borehole records show the 'N' values of any penetration resistance tests undertaken. These are the results of Standard Penetration Tests (SPT's) which are carried out in accordance with BS1377: Part 9: 1990, Clause 3.3, and similar penetration tests using a solid 60° cone point, SPT(C). These tests are carried out in strata to assess the density/consistency of the materials.

The exploratory hole records show the results of any hard shear vane tests and pocket penetrometer tests carried out with the results stated as equivalent undrained shear strength in kPa. The results of the hand vane tests carried out on soft, normally consolidated, clays have been corrected in relation to plasticity, after the recommendation of Bjerrum.

Details of groundwater strikes, seepage and any water level readings made during exploration are given in the exploratory hole records. Groundwater encountered in boreholes during the course of boring was allowed to approach an equilibrium level for a period of time. These observations may not give an accurate indication of the actual groundwater conditions obtaining within the ground. The reasons for this include that boreholes are rarely left standing at the relevant depth for a sufficient time for the water level to reach true equilibrium; that a permeable stratum may have been sealed off by the borehole casing; and that water may have been added to the borehole to facilitate progress. It should also be noted that groundwater levels fluctuate due to seasonal variations in rainfall.

Standpipe/Piezometer/Monitoring Well Installation and Monitoring

Details including the depth of installation of any piezometers or dual purpose soil-gas/water monitoring wells comprising 50mm ID casing and screen are given in the borehole records. Recorded water level readings obtained using an electronic dipmeter are included in the records where applicable.

Other Field Tests

In situ Dynamic Probing tests are carried out with equipment conforming to the SRS 15 apparatus given in the German Standard DIN4094 and in all major aspects with the DPH apparatus given in BS1377 Part 9 1990. The results of the tests are presented as the blow count for every 100mm of penetration (N_{100}) against depth.

In situ Dynamic Cone Penetrometer tests are carried out to assess the in situ California Bearing Ratio (CBR) strength of the soils pertaining at the time of investigation. The tests were carried out in accordance with the method described by Kleyn et al, 1982, Proc. 2nd Euro Symp. Penetration Testing, pp 277-282, using a 60° test cone. The results of these tests are presented with the correlation between DCP and CBR.

Tests on Soils and Groundwaters for Civil Engineering Purposes

The test procedures used by STATS are generally in accordance with the methods described in BS1377: 1990. Details of the specific test methods are generally given on the test certificates.

Reports issued by STATS do not necessarily report the full comprehensive laboratory results required by BS1377: 1990 and the NAMAS Accreditation Standard, M10. However, they do report all the results necessary for design purposes, to the generally accepted industry format. The full laboratory results complying with BS1377: 1990 and the NAMAS Accreditation Standard, M10, are kept, and can be supplied upon request.

HAWTHORNE KAMM
PLANNING CONSULTANCY

HAVANT BOROUGH COUNCIL
REGENERATION GROUP
12 JAN 2004
RECEIVED

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www.hawthornekamm.com

Mrs J A Batchelor
Head of Development Control
Havant Borough Council
Civic Offices
Havant
Hampshire
PO9 2AX

AH/sf/99.P86
9 January 2003

Dear Mrs Batchelor

DH TI
03/50238

LANGSTONE TECHNOLOGY PARK

I refer to the above site and recent outline planning application for the erection of 4 no three storey buildings for employment class B1 and associated works as approved under your reference 02/50238/076. I refer also to the revised application for the variation of Conditions 3 and 5 of the approved scheme and to allow for a phased approach for the development as approved 8th September 2003, your reference 02/50238 and write to request the formal discharge of a number of the outstanding conditions attached to this consent as detailed within the following text.

Condition 11
No development shall take place until the developer has carried out adequate investigation to assess the degree of contamination of the site and to determine its water pollution potential. The methods and extent of the investigation shall be agreed with the Planning Authority before any work commences. Details of the appropriate measures to prevent pollution of ground water and surface water, including provisions for monitoring, shall be then be submitted to and approved in writing by the Planning Authority. Please find attached a copy of the contamination survey completed in line with the scope agreed with Hampshire County Council.

Condition 5
No development hereby permitted, other than shown as Phase 1 on drawing no 02/726/170 shall commence until a specification of materials to be used for the surfacing of all open parts of the site proposed to be hard surfaced have been submitted to and approved in writing by the Local planning Authority. The development shall not be brought into use until the implementation of all such hard surfacing has been completed in full accordance with the specification. I enclose copies of drawing reference 02726200B, 02726201C, 02726202B and 02726203B providing the require detail in accordance with Condition 5.

Condition 9
The development hereby permitted shall not commence until plans and particulars specifying the provision to be made for external lighting of the same have been submitted to and approved in writing by the Local Planning Authority. I enclose copies of plan reference 02726204B, 02726205B, 02726206B, 02726207B illustrating lighting and landscape detail in accordance with the requirements of Condition 9.

Extra copies requested.
20/1/04 DMH

Directors: Jonathan Kamm BA DipTP MRTPI, Martin Hawthorne BSc(Hons) MRTPI, Mark Carrington BSc(Hons) DipTP(Dist) MRTPI, Nigel Schoolcraft FCCA
Associates: Jeremy Gardiner BA (Hons) BPI DipCons (AA) MRTPI, Sylvia Jezeph, Sharon Brentnall BA (Hons) DipTP DipIS CertUD MRTPI
BSI Quality Assurance: ISO 9001/BS5750 Registered Firm No: FS26663 VAT Registration No: 582960311
Reg. Office: Hawthorne Kamm Ltd, St. Clair's Farm. Registered in England Reg. No: 2066641

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I trust that the above detail is acceptable and will allow progress on the formal discharge of a number of the outstanding Conditions.

Should you require any additional information please do not hesitate to contact me at the above number.

Yours sincerely

ALISTAIR HARRIS

Enc

Cc Dianne Heath, Havant International
Phil Parkinson, PLC Architects
John Birch, Glanville
Steve Connor, Langstone Technology Park

Directors: Jonathan Kamm BA DipTP MRTPI, Martin Hawthorne BSc(Hons) MRTPI, Mark Carrington BSc(Hons) DipTP(Dist) MRTPI, Nigel Schoolcraft FCCA
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STATS

Specialist Engineering, Materials and Environmental Consultants

Report for

Havant International Limited

commissioned by

Glanville Consultants Limited

Site Investigation Report

HAVANT BOROUGH COUNCIL
REGENERATION GROUP
03 FEB 2004
RECEIVED

Langstone Technology Park, Havant, Hampshire

October 2003

Report No. 33893/01

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