ARUN DISTRICT COUNCIL AB/88/19/PL

PAH duplicate data

6890 GC 5 28/06/00 12:36:00

05 Dec 00 09:52

	Date:	06/24PAH	06/24PAH	
	Time/Inj:	08/11/00 13	08/11/00 13	
Compound	Lab ID:	CL152898	CL15289	RPD
NITROBENZENE-D5	*	88.6	88.1	5%
NAPHTHALENE		3.4	1.3	86%
2-FLUOROBIPHENYL	*	9.7	9.2	5%
ACENAPHTHYLENE		1.5	1.6	6%
ACENAPHTHENE		0.4	-	
FLUORENE		0.4	0.3	6%
PHENANTHRENE		4.4	4.6	4%
ANTHRACENE		1.6	1.8	9%
FLUORANTHENE		7.5	8.1	7%
PYRENE		6.3	6.7	7%
TERPHENYL D14	*	17.4	10.2	115%
BENZO(A)ANTHRACENE		3.4	3.4	3%
CHRYSENE		4.8	5.0	4%
BENZO(B)FLUORANTHENE		5.6	12.3	75%
BENZO(K)FLUORANTHENE		4.4	-	
BENZO(A)PYRENE		5.0	5.1	2%
INDENO(1,2,3)PYRENE		4.6	4.7	2%
DIBENZO(A,H)ANTHRACENE		0.9	0.9	2%
BENZO(G,H,I)PERYLENE		8.2	7.9	4%

* surrogate

06/24PAH	06/24PAH	
08/11/00 13	08/11/00 13	
CL152868	CL15286	RPD
10.7	10.5	1%
932.1	884.9	5%
10.3	9.5	8%
332.5	316.5	5%
113.0	107.9	5%
252.8	241.1	5%
1518.0	1449.5	5%
507.9	482.3	5%
1245.8	1191.6	4%
1154.8	1112.6	4%
108.6	68.9	45%
429.5	413.3	4%
476.4	457.2	4%
698.7	682.5	2%
2.5	2.4	5%
407.8	346.9	4%
286.6	270.0	3%
62.8	55.1	13%
287.3	264.6	8%

06/24PAH	06/24PAH	
08/11/00 13	08/11/00 13	
CL15279R	CL15279	RPD
10.5	10.3	2%
12.0	11.8	2%
9.8	9.4	4%
1.5	1.4	7%
0.9	1.1	21%
2.5	2.3	6%
11.3	11.1	1%
3.0	2.8	4%
0.1	0.0	1%
7.0	6.8	2%
11.9	11.8	2%
4.1	4.0	4%
3.4	2.8	17%
7.4	5.1	36%
-	2.3	0%
3.6	3.4	4%
2.4	2.4	2%
0.4	0.5	23%
0.3	1.5	176%

06/24PAH	06/24PAH	
08/11/00 13	08/11/00 13	
CL15942R	CL15942	RPD
10.4	9.6	7%
0.6	0.5	26%
9.5	9.5	1%
-	-	
0.3	0.2	21%
0.3	0.2	18%
1.7	1.8	22%
0.4	0.3	14%
1.7	1.5	11%
1.3	1.1	13%
10.3	9.6	7%
0.5	0.4	21%
0.7	0.6	15%
1.2	2.3	58%
-	-	
0.3	0.3	12%
0.3	0.3	26%
0.3	0.2	15%
0.2	0.1	21%

ARUN DISTRICT COUNCIL AB/88/19/PL

PAH duplicate data

6890 GC 5 30/06/00 10:39:41

06-Jun-00 09:52

	Date:	06/27PAH	06/27PAH	
	Filename:	012F1301.D	09R01601.D	
Compound	Lab ID:	CL152818	CL15281	RPD
NITROBENZENE D5	*	11.5	11.5	0%
NAPHTHALENE		70.1	70.3	0%
2-FLUOROBIPHENYL	*	9.8	10.0	1%
ACENAPHTHYLENE		9.0	8.3	8%
ACENAPHTHENE		37.8	38.0	0%
FLUORENE		33.0	33.2	1%
PHENANTHRENE		143.4	145.9	2%
ANTHRACENE		39.0	38.2	2%
FLUORANTHENE		93.9	97.1	3%
PYRENE		68.1	64.1	6%
TERPHENYL D14	*	15.3	15.5	0%
BENZO(A)ANTHRACENE		30.7	30.9	1%
CHRYSENE		36.4	36.7	1%
BENZO(B)FLUORANTHENE		23.5	21.3	10%
BENZO(K)FLUORANTHENE		21.7	23.8	9%
BENZO(A)PYRENE		27.5	27.8	1%
INDENO(1,2,3)PYRENE		14.5	14.0	3%
DIBENZO(AH)ANTHRACENE		2.9	3.0	5%
BENZO(G,H,I)PERYLENE		9.6	8.6	11%

* surrogate

06/28PAH	06/28PAH	
06481301.D	06581601.D	
CL160538	CL16053	RPD
7.3	8.5	13%
-	0.1	0%
6.8	7.8	13%
-	-	
-	-	
-	-	
-	0.1	0%
-	-	
-	-	
-	-	
8.7	9.7	10%
-	-	
-	-	
1.5	1.4	7%
-	-	
-	-	
-	-	
-	-	
-	-	

06/29PAH	06/29PAH	
01F1501.D	06R01601.D	
CL16219R	CL16219	RPD
11.5	10.5	9%
-	-	
9.7	8.7	10%
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
0.4	0.4	9%
10.4	9.5	9%
-	-	
-	-	
10.4	6.7	43%
-	-	
-	-	
-	-	
-	-	
-	-	
2.4	1.9	23%

06/29PAH	06/29PAH	
06701501.D	06581601.D	
CL16213R	CL16212	RPD
8.6	8.8	2%
0.1	0.2	18%
8.3	8.3	0%
-	-	
-	-	
-	-	
0.5	0.5	2%
-	-	
0.5	0.5	4%
0.4	0.4	0%
10.0	10.2	2%
0.1	0.1	3%
0.2	0.2	0%
2.0	2.2	9%
-	-	
0.2	0.1	14%
-	-	
-	-	
-	-	

ARUN DISTRICT COUNCIL AB/88/19/PL

PAH duplicate data

8890 GC 5 10/07/08 14:26:43

05-Dec-08 09:32

	Date:	0620PAH	0620PAH		0704PAH	0704PAH		0760PAH	0760PAH		0760PAH	0760PAH	
	Filename:	08080101.D	08080601.D		08120101.D	08120201.D		08080501.D	08080201.D		08130101.D	08140401.D	
Compound	Lab ID	CL158088	CL15808	RPD	CL18160	CL18160	RPD	CL17365R	CL17365	RPD	CL18139R	CL18139	RPD
NITROBENZENE-D5	*	10.8	11.1	2%	12.0	12.3	3%	11.3	9.9	13%	8.3	10.0	19%
NAPHTHALENE		204.3	206.8	1%	84.2	85.2	1%	56.3	49.5	13%	9.7	9.6	4%
2-FLUOROBIPHENYL	*	10.3	10.4	1%	8.8	8.9	1%	10.1	9.0	12%	7.7	9.2	17%
ACENAPHTHYLENE		253.9	259.4	2%	37.8	37.7	0%	134.4	116.7	14%	-	-	
ACENAPHTHENE		92.9	95.6	3%	35.9	36.2	2%	33.1	29.0	13%	-	-	
FLUORENE		337.4	301.3	11%	39.4	40.1	2%	130.6	117.5	11%	-	-	
PHENANTHRENE		2017.1	2069.2	3%	199.8	203.6	2%	396.2	365.1	8%	0.5	0.5	13%
ANTHRACENE		541.6	557.0	3%	84.0	85.4	2%	164.9	145.4	13%	-	-	
FLUORANTHENE		1639.9	1670.3	2%	204.5	206.4	1%	230.1	210.8	9%	0.7	0.9	21%
PYRENE		1310.8	1444.4	10%	153.1	154.2	1%	166.7	151.1	10%	0.6	0.7	21%
TERPHENYL D14	*	113.3	30.8	114%	26.3	26.3	0%	35.2	28.6	21%	8.6	10.2	17%
BENZO(A)ANTHRACENE		520.8	533.2	2%	81.1	83.9	3%	88.9	80.3	10%	0.3	0.4	18%
CHRYSENE		864.5	575.6	2%	97.1	98.3	1%	90.8	90.7	10%	0.4	0.5	23%
BENZO(B)FLUORANTHENE		571.1	607.0	6%	80.8	84.2	1%	63.6	53.9	10%	1.5	1.7	11%
BENZO(K)FLUORANTHENE		243.4	258.5	5%	59.0	58.0	2%	58.6	50.4	8%	-	-	
BENZO(A)PYRENE		516.3	521.9	1%	90.7	91.8	1%	76.0	70.2	8%	0.4	0.5	22%
INDENO(1,2,3)PYRENE		312.1	318.4	2%	50.1	50.1	0%	33.3	28.0	17%	0.2	0.3	23%
DIBENZO(AH)ANTHRACENE		61.8	65.3	5%	16.8	14.9	12%	12.4	10.4	18%	-	-	
BENZO(G,H,I)PERYLENE		299.3	291.4	3%	43.7	43.6	0%	25.9	23.2	11%	0.4	0.5	25%

* surrogate

ARUN DISTRICT COUNCIL AB/88/19/PL

PAH duplicate data

05-Dec-08 09:53

	Date:	07308PAH	07308PAH		07308PAH	07308PAH		07312APAH	07312APAH		07318BKO	07318BKO	
	Filename:	08SEP001.D	08SEP002.D		01SEP001.D	01SEP002.D		08SEP001.D	08SEP002.D		02SEP001.D		
Compound	Lab ID:	CL183337R	CL183337	RPD	CL186428R	CL186428	RPD	CL188527R	CL188527	RPD	CL186438R	CL186438	RPD
NITROBENZENE D5	*	8.6	10.6	21%	10.1	9.9	3%	9.9	9.8	5%	9.8	10.5	7%
NAPHTHALENE		0.7	0.8	13%	2.2	2.2	0%	-	-		1.4	1.4	0%
2-FLUOROBIPHENYL	*	7.8	9.6	20%	9.2	9.0	2%	9.1	8.9	9%	9.1	9.2	1%
ACENAPHTHYLENE		-	-		12.5	12.4	1%	-	-		-	-	
ACENAPHTHENE		-	-		1.1	1.1	0%	-	-		1.5	1.8	18%
FLUORENE		0.2	0.2	0%	1.2	1.3	7%	-	-		-	0.3	0%
PHENANTHRENE		0.7	0.7	0%	17.7	18.8	8%	-	-		1.9	2.3	16%
ANTHRACENE		-	-		10.6	11.0	4%	-	-		-	-	
FLUORANTHENE		-	-		31.5	31.9	1%	-	-		1.6	1.8	14%
PYRENE		0.3	0.2	40%	31.2	31.3	0%	-	-		1.1	1.2	6%
TERPHENYL D14	*	7.8	10.5	29%	10.1	12.5	21%	9.9	9.9	0%	11.0	11.3	3%
BENZO(A)ANTHRACENE		-	-		14.5	14.5	0%	-	-		1.1	1.3	16%
CHRYSENE		-	-		20.8	20.8	0%	-	-		1.9	2.1	12%
BENZO(B)FLUORANTHENE		1.0	1.7	46%	24.1	25.5	6%	-	-		3.3	3.9	18%
BENZO(K)FLUORANTHENE		-	-		15.1	17.2	14%	-	-		-	-	
BENZO(A)PYRENE		-	-		25.6	26.6	3%	-	-		1.0	1.1	10%
INDENO(1,2,3)PYRENE		-	-		16.6	15.8	5%	-	-		1.2	1.3	10%
DIBENZO(A,H)ANTHRACENE		-	-		3.8	3.7	3%	-	-		-	0.7	0%
BENZO(G,H,I)PERYLENE		0.3	-		15.6	15.1	3%	-	-		1.0	1.1	6%

* surrogate

ARUN DISTRICT COUNCIL AB/88/19/PL

PAH duplicate data

6890 GC 5 21/07/00 05:52:04

05-Dec-00 09:53

	Date:	07/12/2000	07/12/2000	
	Filename:	0338F001.D	0338F001.D	
Compound	Lab ID	CL18447R	CL18447	RPD
NITROBENZENE D5	*	11.0	10.8	2%
NAPHTHALENE		3.9	3.9	1%
2-FLUOROBIPHENYL	*	9.2	9.0	2%
ACENAPHTHYLENE		11.2	11.1	1%
ACENAPHTHENE		0.9	0.9	1%
FLUORENE		0.6	0.6	22%
PHENANTHRENE		8.6	8.7	1%
ANTHRACENE		9.4	9.3	0%
FLUORANTHENE		1.8	1.9	8%
PYRENE		49.4	49.8	1%
TERPHENYL D14	*	10.9	9.8	10%
BENZO[A]ANTHRACENE		30.6	32.8	19%
CHRYSENE		41.1	37.9	8%
BENZO[B]FLUORANTHENE		36.8	35.7	3%
BENZO[K]FLUORANTHENE		25.3	26.2	3%
BENZO[A]PYRENE		42.9	42.8	0%
INDENO[1,2,3]PYRENE		17.8	17.5	2%
DIBENZO[AH]ANTHRACENE		5.3	5.0	5%
BENZO[GHI]PERYLENE		17.0	16.1	5%

07/12/PAH	07/12/PAH		
0338F001.D	0338F001.D		
CL19647R	CL19647	RPD	
9.9	9.9	0%	
0.4	0.3	12%	
9.0	8.9	1%	
0.9	0.9	2%	
0.4	0.4	7%	
0.6	0.6	5%	
6.2	6.2	0%	
2.1	2.3	6%	
12.5	12.8	4%	
9.6	10.0	3%	
11.8	11.7	1%	
4.8	5.0	4%	
6.2	6.5	4%	
5.5	7.8	30%	
4.7	3.8	22%	
5.9	6.2	4%	
3.5	3.6	3%	
0.7	0.7	4%	
3.8	3.7	2%	

07/19/PAH	07/19/PAH		
0339F001.D			
CL18873R	CL18877	RPD	
10.6	10.3	1%	
0.5	0.4	29%	
9.2	9.2	0%	
0.1	0.1	23%	
0.1	0.1	2%	
-	-		
0.9	0.9	4%	
0.3	0.2	23%	
0.3	0.2	17%	
1.2	1.3	3%	
10.8	10.9	1%	
0.5	0.5	8%	
0.9	0.9	3%	
3.7	3.3	6%	
-	-		
0.9	1.0	9%	
0.7	0.7	1%	
0.2	0.2	3%	
0.2	0.3	17%	

07/20/PAH	07/20/PAH	
0035F001.D	0040F001.D	
CL18633R	CL18633	RPD
9.4	9.2	2%
6.9	6.4	8%
5.1	8.9	55%
-	-	
-	-	
0.5	0.8	8%
0.6	0.4	38%
-	-	
-	-	
-	-	
8.2	10.7	54%
0.4	0.4	16%
-	-	
2.0	2.0	0%
-	-	
1.5	1.5	0%
-	-	
-	-	
5.3	5.2	2%

* surrogate

TES Bretby

CL18447R.xls

ARUN DISTRICT COUNCIL AB/88/19/PL

PAH duplicate data

05-Dec-00 09:53

	Tube:	0721PAH	0721PAH	
	Filename:	0005070I.D	0005080I.D	
Compound	Lab ID:	CL198698	CL198670	RPD
NITROBENZENE D5	*	9.5	9.9	4%
NAPHTHALENE		-	-	
2-FLUOROBIPHENYL	*	9.2	9.8	2%
ACENAPHTHYLENE		-	-	
ACENAPHTHENE		-	-	
FLUORENE		-	-	
PHENANTHRENE		0.6	0.4	40%
ANTHRACENE		0.3	-	
FLUORANTHENE		-	-	
PYRENE		1.0	0.8	22%
TERPHENYL D14	*	10.7	11.0	3%
BENZO(A)ANTHRACENE		0.4	0.3	29%
CHRYSENE		0.6	0.5	18%
BENZO(B)FLUORANTHENE		1.8	1.5	18%
BENZO(K)FLUORANTHENE		-	-	
BENZO(A)PYRENE		0.7	0.6	15%
INDENO(1,2,3)PYRENE		0.5	0.6	22%
DIBENZO(AH)ANTHRACENE		-	-	
BENZO(G,H,I)PERYLENE		0.8	0.8	0%

0723PAH	0723PAH	
0288296I.D	0297008I.D	
CL196734	CL196737	RPD
7.2	7.0	3%
-	-	
7.1	7.6	9%
-	-	
-	-	
-	-	
-	-	
-	-	
-	-	
10.6	10.6	0%
-	-	
-	-	
2.1	2.0	6%
-	-	
-	-	
-	-	
-	-	
-	-	

0723PAH	0723PAH	
0298160I.D	0308088I.D	
CL192270	CL19227	RPD
9.6	9.8	2%
1.2	2.3	64%
9.2	9.1	1%
-	-	
-	-	
-	-	
1.1	1.1	0%
0.3	0.3	0%
-	-	
1.7	1.7	2%
10.7	10.5	1%
0.9	0.8	7%
1.2	1.2	1%
2.8	3.6	25%
-	-	
1.5	1.5	0%
0.9	0.9	2%
0.4	-	
1.2	1.2	4%

0723PAH	0723PAH	
0270296I.D	0281006I.D	
CL181150	CL183115	RPD
10.3	12.6	20%
1.2	1.1	12%
9.6	11.7	20%
0.5	0.5	0%
-	-	
0.7	-	
4.6	5.7	18%
1.5	0.0	35%
5.1	4.4	14%
3.7	3.3	12%
10.8	13.1	20%
2.1	1.8	15%
2.0	1.8	13%
3.9	4.3	11%
-	-	
2.0	1.2	50%
1.1	1.0	12%
-	-	
0.8	0.7	10%

* surrogate

ARUN DISTRICT COUNCIL AB/88/19/PL

PAH duplicate data

05-Dec-01 09:54

	Title:	0720PAH	0720PAH		0726PAH	0726PAH		0727PHA	0727PHA		0727PHA	0727PHA	
	Filename:	0401R001.D	0401R001.D		0501S01.D	0501S01.D		0501S001.D	0501S001.D		0501S001.D	0501S001.D	
Compound	Lab ID:	CL20098R	CL20098	RPD	CL20353R	CL20353	RPD	CL20591R	CL20591	RPD	CL19889D	CL19889	RPD
NITROBENZENE D5	*	9.7	9.8	3%	9.5	9.7	3%	8.8	9.6	8%	9.8	9.8	1%
NAPHTHALENE		1.7	1.9	9%	0.3	0.3	14%	0.6	0.6	2%	-	-	
2-FLUOROBIPHENYL	*	8.9	9.2	3%	8.8	8.9	1%	7.8	8.4	7%	9.1	9.1	0%
ACENAPHTHYLENE		2.6	2.6	1%	1.0	1.0	5%	1.9	2.0	6%	-	-	
ACENAPHTHENE		0.7	0.7	3%	0.3	0.3	6%	0.6	0.7	8%	-	-	
FLUORENE		2.0	2.2	11%	1.1	1.0	6%	1.3	1.4	8%	-	-	
PHENANTHRENE		13.3	14.5	8%	7.7	7.1	8%	19.5	20.7	6%	-	-	
ANTHRACENE		2.5	2.5	0%	2.3	2.2	6%	4.7	5.0	7%	-	-	
FLUORANTHENE		27.3	28.2	3%	11.9	10.6	6%	19.8	20.9	6%	-	-	
PYRENE		21.9	22.4	2%	8.3	7.9	5%	15.8	16.7	5%	-	-	
TERPHENYL D14	*	15.0	15.1	1%	11.2	11.4	1%	10.9	11.7	7%	10.1	10.3	2%
BENZO(A)ANTHRACENE		17.7	18.2	3%	5.9	4.4	28%	6.9	7.2	4%	-	-	
CHRYSENE		20.6	21.2	3%	5.4	5.3	2%	8.8	9.3	6%	-	-	
BENZO(B)FLUORANTHENE		17.9	19.4	8%	4.7	5.6	18%	13.6	12.2	5%	0.2	0.4	81%
BENZO(K)FLUORANTHENE		15.4	15.7	2%	4.5	4.2	8%	8.3	0.8	2%	-	-	
BENZO(A)PYRENE		18.9	18.9	0%	5.0	4.9	2%	8.9	9.3	4%	-	-	
INDENO(1,2,3)PYRENE		9.2	9.4	2%	2.8	2.8	1%	5.9	6.1	3%	-	-	
DIBENZO(AH)ANTHRACENE		3.1	3.1	1%	0.8	0.7	7%	1.1	1.2	6%	-	-	
BENZO(G,H,I)PERYLENE		7.8	7.9	1%	2.5	2.4	3%	5.8	6.0	3%	-	-	

* surrogate

WS Atkins Consultants Limited

Woodcote Grove
Ashley Road
Epsom
Surrey KT18 5BW England

[redacted]

A71430/GTG.2000078/Arundel/R004rev0/mg

23 July 2001

4418

Mr Win Bowen
Construction Manager
Lattice Property Holdings Ltd
Aviary Court
Wade Road
Basingstoke
Hants RG24 8GZ

Lattice Property
26 JUL 2001
Initials [redacted]

take one copy and put both into folders and send to Win.

Dear Win

FORD ROAD, ARUNDEL, MENTOR No. 015162
ENVIRONMENTAL GROUNDWATER MONITORING LETTER REPORT

Introduction

WS Atkins was commissioned by Lattice Property Holdings Limited (LPH) in February 2001 to undertake further monitoring of groundwater contamination at their premises at Ford Road, Arundel, BN18 9DX resulting from use of the site for works associated with historical gas production, gas storage and transmission. Residential housing lies to the south and west of the site. Grazing land and open ground lies to the east and south, and Ford Road forms the north and north east boundary. The River Arun lies approximately 40 metres to the south east of the site. This letter report provides an [redacted] summary of the additional groundwater monitoring undertaken on this solely Lattice owned land, hereafter referred to as the study site.

Having been the subject of an extensive intrusive investigation, undertaken in June 2000, information on current site status, site history and proposed remedial requirements is reported in WS Atkins Environmental Assessment Site Investigation Report (WSA Ref. A71430/GTG.2000078/R002rev1/December2000). This current report should be read in conjunction with the December 2000 Site Investigation Report.

Letter Report Format

The following sections of this report contain:

- a description of the study site geology, hydrology and hydrogeology as determined by the June 2000 site investigation;
- details of the further groundwater monitoring undertaken within the study site area in February and March 2001 to confirm groundwater quality and movement;
- details of sampling and analysis undertaken and analytical results;
- [redacted]
- [redacted]

Geology

Made ground was encountered to a maximum depth of 2.0m bgl. The solid geology consists of Cretaceous Upper Chalk (which was encountered during the investigation). Overlying this are sandy silty clay alluvium associated with the River Arun. Historical features and areas of potential foundations are shown in Figure 3. The boreholes were logged in accordance with BS 5930, 1999 (Ref. 1) at the time of the initial investigation. No perched water was encountered in the boreholes and appropriate bentonite seals were placed at the base of the alluvial layers to prevent downward migration of contamination. The logs are provided in Appendix A.

Hydrology

A drainage ditch is located approximately 5m off-site from the north eastern boundary. The River Arun flows in a southerly direction approximately 40m to the south east of the site. 75% of the study site has a gravel surface finish and it is estimated that almost all precipitation will directly enter the ground.

Hydrogeology

The Upper Chalk is classified as a major aquifer. The water table was encountered during the initial site investigation, and was found to lie between 2.4 and 3.9m bgl. The direction of the deep groundwater flow could not be confirmed after two monitoring rounds, this was anticipated to be due to the tidal influence of the River Arun. The recent groundwater level monitoring has confirmed this tidal influence.

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Site Investigation

Site investigation of the study site took place between 27th February and 13th March 2001. The works involved the purging and sampling of the 5 No. borehole locations on the site, followed by the installation of a Unidata 6508D STARLOG datalogger with 10m depth probe into three borehole locations (BH1, BH3 and BH5, Figure 2). The probe was placed approximately 5m bgl in each location and remained in place for two weeks after installation in order to record both spring and neap tide events. During this two week interval the datalogger recorded the depth of water above the probe at 20 minute intervals. Graphical data of the approximately 1000 pressure measurements recorded by the probes are presented in Graph 1.

Due to concern over the variation in chemical results obtained from this sampling round (analysed by ALcontrol Geochem) relative to the initial June 2000 data (analysed by TES Bretby) a further round of samples were collected for TPH analysis in May 2001. At the request of Lattice Property these additional samples were analysed solely by ALcontrol Geochem.

Sampling and Analysis

Analysis of March and May 2001 samples was carried out by ALcontrol Geochem, a UKAS accredited and LPH approved laboratory. The results are given in Appendix B. The March 2001 water samples were tested for the analytical suite specified in Table 1. The May 2001 samples were solely tested for Total Petroleum Hydrocarbons by GC-FID. Of the five samples collected in May 2001, one sample (BH2) was broken in transit to the laboratory.

Table 1: Analytical Suite

Waters (5 samples)	
pH	Total Phenols
Moisture Content	Polycyclic Aromatic Hydrocarbons
Loss on ignition	(PAH) – total of 16 priority PAHs
Easily Liberateable Cyanide	Elemental Sulphur
Complex Cyanide	Water Soluble Sulphate
Total Cyanide	Exchangeable Ammonia
Arsenic	Water Soluble Chloride
Selenium	BTEX (Benzene, Toluene, Ethylbenzene
Cadmium	and Xylene)
Chromium	TPH (Total Petroleum Hydrocarbons,
Lead	with carbon banding)
Mercury	

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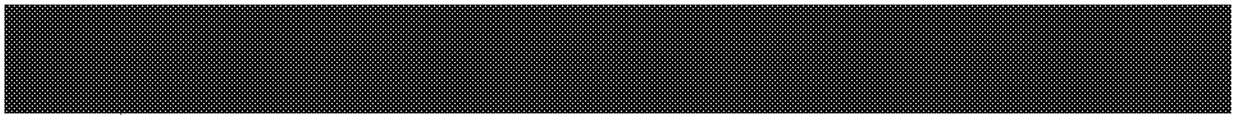
Chemical Results

March 2001



The chemical results of the March 2001 monitoring round are presented in Appendix B.

May 2001



The chemical results of the May 2001 monitoring round are presented in Appendix B.

Water level monitoring

Graphs and plots of the levels are shown in Graph 1, and Figures 4 to 7 respectively. The tidal influence is demonstrated by up to 2400 mm in BH5. Interpretation of the data suggests that the groundwater flow direction is generally to the east, i.e. towards the tidal River Arun with a maximum gradient of approximately 0.010. A gentler gradient (approximately 0.006) from the east to west is demonstrated for shorter periods of high tide. These reversals are associated with the larger magnitude spring high tides, and it is reasonably assumed that this occurs over a bi-monthly cycle.

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[redacted]

Quality Assurance

The further groundwater monitoring was designed, specified and undertaken by competent staff of WS Atkins Consultants Ltd (WSA), maintaining BSI EN ISO 9001: 1994 registered status. Quality assured procedures for ensuring quality both in specification, procurement and in implementation have been in place prior to and during the monitoring works.

Risk Assessment

[redacted]

Risk Management Approach

[redacted]

Yours sincerely,
For and behalf of WS Atkins Consultants Ltd

[redacted]

MW Reed
Project Manager

WS Atkins

ARUN DISTRICT COUNCIL AB/88/19/PL

References

1. British Standard 5930. Code of Practice for Site Investigation (Annex F) 1999.
2. Guidance for Assessing and Managing Potential Contamination on Former Gasworks and Associated Sites. BG plc Property Division, May 1999, Version 2.4.

List of Figures

Figure 1 Study Site Location Plan

Figure 2 Topographical Survey (A3) (including investigation locations)

Figure 3 Study site layout plan with historical information (including adjacent land)

Figure 4 Piezometric Surfaces of 6th March 2001 Through Neap Tide Cycle

Figure 5 Piezometric Surfaces of 6th March 2001 Through Neap Tide Cycle

Figure 6 Piezometric Surfaces of 11th/12th March 2001 Through Spring Tide Cycle

Figure 7 Piezometric Surfaces of 11th/12th March 2001 Through Spring Tide Cycle

List of Graphs

Graph 1 Lattice Property Arundel Hydrograph 27/02/01 – 13/03/01.

Appendices

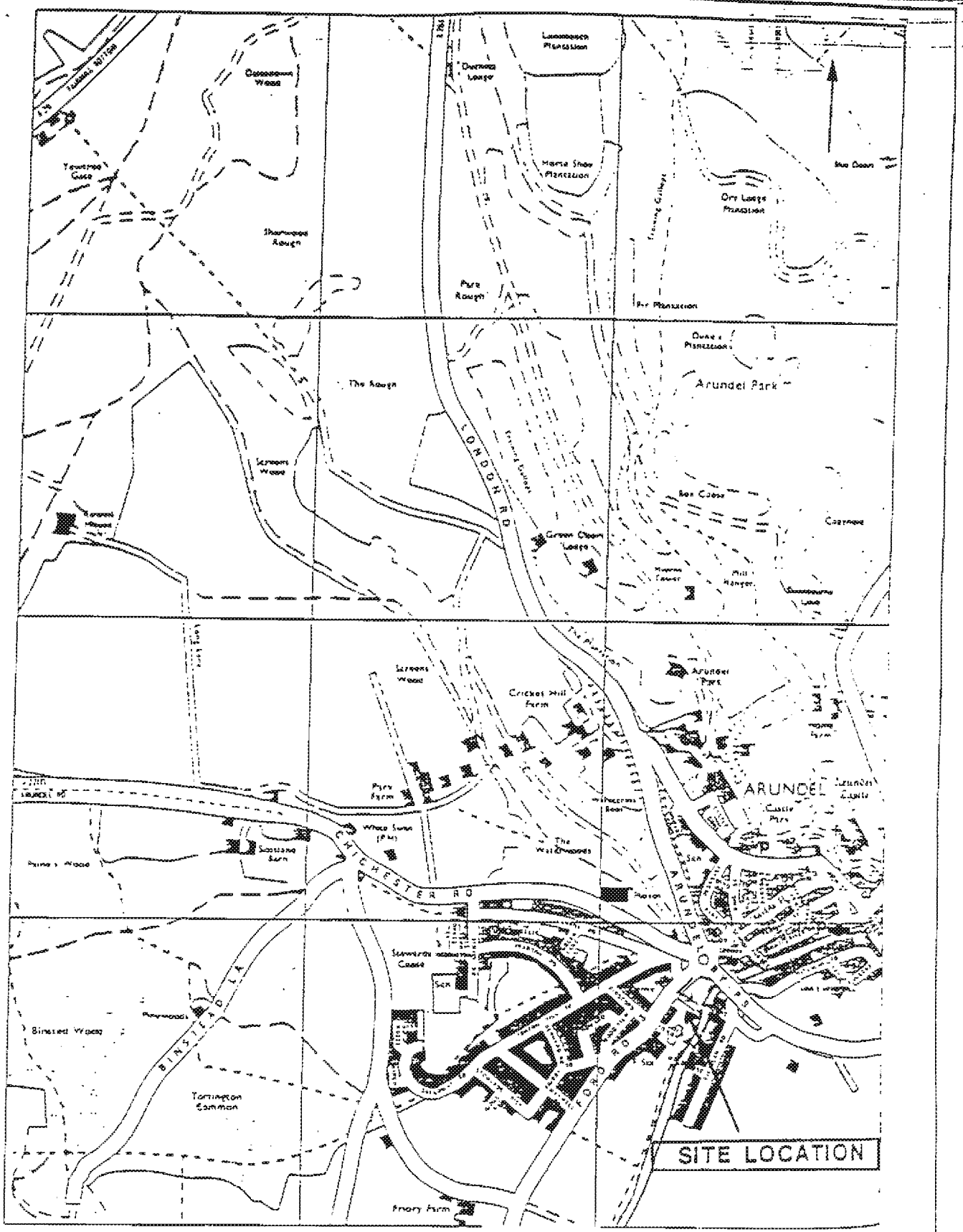
Appendix A: Borehole Logs

Appendix B: Results of Chemical Analysis, March 2001

Appendix C : Results of Chemical Analysis, May 2001.

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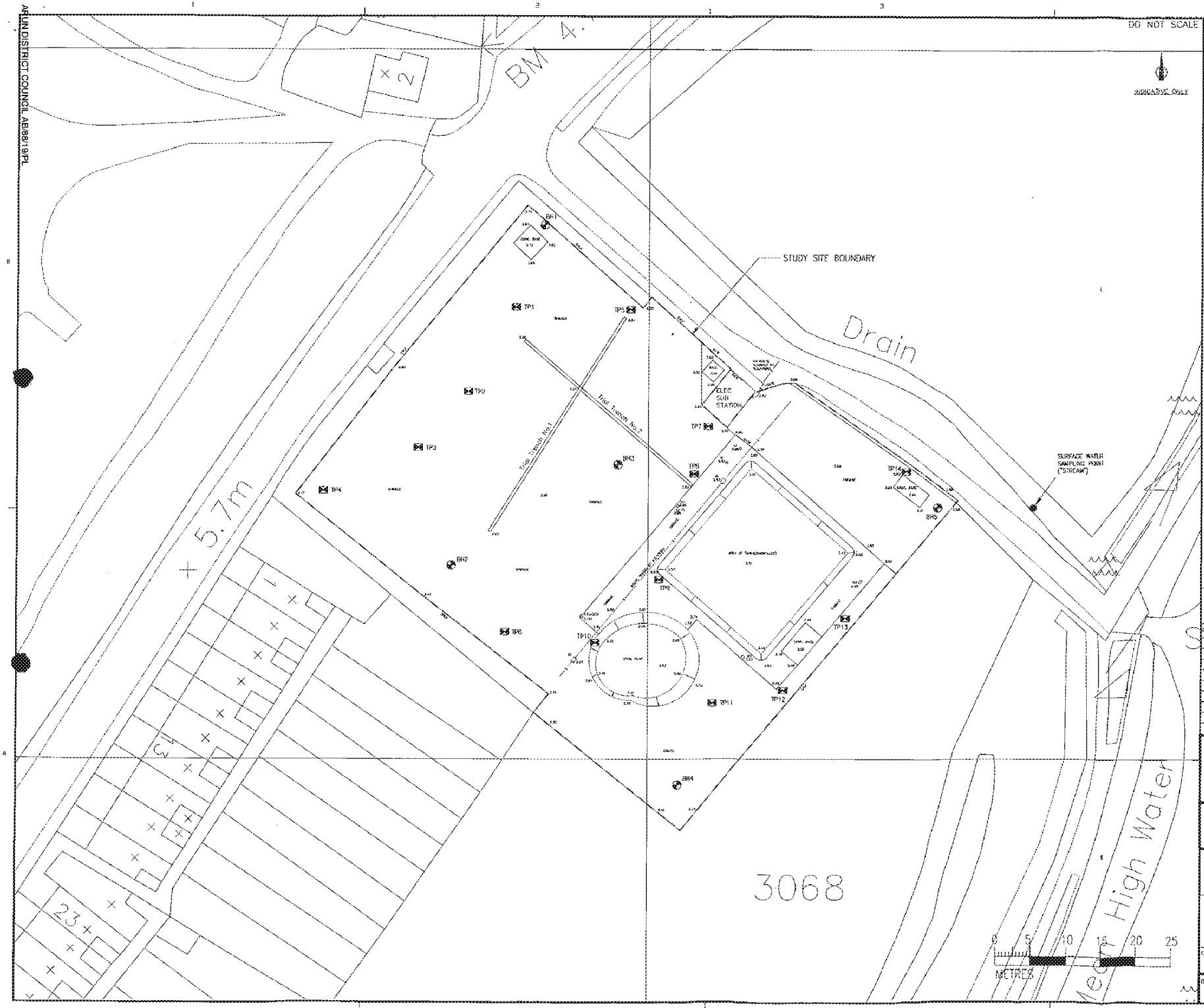
Arundel, Ford Road
Site Location

WS Atkins Environment
a division of WS Atkins Consultants Ltd.

Woodcote Grove, Ashley Road.
Epsom, Surrey. KT18 5BW
Tel. (0372) 726140
Fax. (0372) 740055

Date	Drawn	Checked	Approved	Scale	Drawing Number	Reference
11/12/2000	KM	NJL	JES	N/A	Figure 1	A71430

ARUN DISTRICT COUNCIL AB/88/19/PL



WS Atkins

Topographical Abbreviations

A/R	Asphalted Road	ELEC	Electric
BH	Borehole	ET	Electricity Transformer Chamber
BRK	Brick	EW	Overhead Cable
BT	Bell Telephone Chamber	FB	Footbridge
BM	Bench Mark Flush	FCH	Fireman's Connection Hydrant Mark
CAB	Cable	FH	Fire Hydrant
CATV	Cable TV Cover	FM	Flow Meter
CB	Catch Basin/Gully	FP	Footpath Crossing Location
CC	Cable Chamber Cover	G	Gate & Post Pedestrian
CH	Cable Chamber	GA	Gate & Post Vehicle
CHK	Chainage	GAS	Gas Valve & Box Marker
CL	Centre Line	GB	Grit Bin
CLF	Chain Link Fence	GC	Gas Governor Cover
CLR	Clear	GP	Guard Post
CONC	Concrete	GR	Guard Rail
CP	Concrete Pipe	GV	Gas Valve
CR	Crash Barrier	HR	Hedge
CS	Concrete Surface	HYD	Hydrant
CSW	Concrete Surface Box	IC	Inspection Cover
D	Drain	IL	Invert Level
DC	Drain Chamber	K	Kerb
DCC	Drain Chamber Cover	LA	Lamp Column
DE	Drain End	LB	Letter Box
DI	Drain Inlet	LP	Lamp Post
DP	Drain Pipe	LT	Light
DPC	Damp Proof Course	M	Manhole
DS	Drain Outlet	MB	Marker Post
E	Electricity Box	MH	Manhole
EB	Electricity Box	MP	Mile Post
EC	Electricity Cable	NP	Notice Post
EL	Electricity Pole	O	Oil Tank
EM	Electricity Meter	OHL	Overhead Line
EP	Electricity Post	P	Post
ES	Electricity Sub Station	PC	Pedestrian Crossing
ET	Electricity Transformer	PH	Pothole
EW	Overhead Cable	PM	Parking Meter
FB	Footbridge	PO	Pole
FCH	Fireman's Connection Hydrant Mark	PP	Power Pole
FH	Fire Hydrant	PS	Pumping Station
FM	Flow Meter	R	Rodding Eye
FP	Footpath Crossing Location	RB	Road Bollard
G	Gate & Post Pedestrian	RE	Road Edge
GA	Gate & Post Vehicle	RG	Road Gully
GAS	Gas Valve & Box Marker	RM	Road Marker
GB	Grit Bin	RP	Retaining Wall
GC	Gas Governor Cover	RWP	Rain Water Pipe
GP	Guard Post	S	Sign
GR	Guard Rail	SA	Sign Arm
GV	Gas Valve	SB	Sign Bollard
HR	Hedge	SC	Sign Cantilever
HYD	Hydrant	SG	Sign Gantry
IC	Inspection Cover	SP	Sign Post
IL	Invert Level	SW	Soil Vent Pipe
K	Kerb	T	Tree
LA	Lamp Column	TB	Telephone Box
LB	Letter Box	TC	Traffic Light
LP	Lamp Post	TCB	Telephone Chamber Box
LT	Light	TL	Traffic Light
M	Manhole	TP	Telephone Pole
MB	Marker Post	TR	Traffic Light Controller
MH	Manhole	TS	Telephone Switch Box
MP	Mile Post	UP	Unidentified Pipe
NP	Notice Post	V	Valve
O	Oil Tank	VP	Vent Pipe
OHL	Overhead Line	W	Water Tap
P	Post	WB	Water Boiler
PC	Pedestrian Crossing	WC	Water Cock
PH	Pothole	WM	Water Meter
PM	Parking Meter	WP	Water Pipe
PO	Pole	WV	Water Valve
PP	Power Pole		
PS	Pumping Station		
R	Rodding Eye		
RB	Road Bollard		
RE	Road Edge		
RG	Road Gully		
RM	Road Marker		
RP	Retaining Wall		
RWP	Rain Water Pipe		
S	Sign		
SA	Sign Arm		
SB	Sign Bollard		
SC	Sign Cantilever		
SG	Sign Gantry		
SP	Sign Post		
SW	Soil Vent Pipe		
T	Tree		
TB	Telephone Box		
TC	Traffic Light		
TCB	Telephone Chamber Box		
TL	Traffic Light		
TP	Telephone Pole		
TR	Traffic Light Controller		
TS	Telephone Switch Box		
UP	Unidentified Pipe		
V	Valve		
VP	Vent Pipe		
W	Water Tap		
WB	Water Boiler		
WC	Water Cock		
WM	Water Meter		
WP	Water Pipe		
WV	Water Valve		

Legend

Borehole/Trial pit Information

Ch.No.	Eastings	Northings	Ground Level	Dia. of Hole
BH1	501086.287	107775.200	3.87	2.87
BH2	500977.031	107973.908	4.10	2.77
BH3	501060.154	107911.525	3.83	3.54
BH4	501030.351	107886.280	3.81	2.87
BH5	501163.865	107726.862	3.65	2.86

Ch.No.	Eastings	Northings	Ground Level
TP1	500992.298	107767.754	3.68
TP2	500974.944	107781.951	3.71
TP3	501041.314	107741.946	3.74
TP4	500954.156	107717.459	3.55
TP5	501081.383	107811.182	3.82
TP6	501096.042	107717.832	3.61
TP7	501068.468	107741.302	3.76
TP8	501106.445	107741.564	3.64
TP9	501101.634	107736.220	3.83
TP10	501125.636	107718.384	3.73
TP11	501101.198	107677.822	3.89
TP12	501139.214	107678.728	3.61
TP13	501121.682	107716.626	3.68
TP14	501158.313	107760.644	3.80

SITE AREA: 2hHa eq. (5.5ac NETTABLE, 3.8ETTACE ACRES)

LOCATION OF SITE: SU 9921/0/0/0, 1007/0/0/0

Notes:
No grid is related to Ordnance Survey.
All levels are related to 2Offer water 5.90m, become on perimeter wall of Arundel Brewery Chemists, Tarmacadam Road.

Rev	Description	By	Date	Chk'd	Auth

Purpose of Issue	Rev	Date	Authorised

WS Atkins Consultants Limited ©
Consulting Engineers,
Woodcote Grove,
Ashley Road,
Epsom, Surrey, England, KT18 5BW
Fax (01372) 740055
Tel (01372) 726140

Client: LATTICE PROPERTY HOLDINGS

Project: ARUNDEL GAS WORKS SITE, FORD ROAD, ARUNDEL

Title: TOPOGRAPHIC SURVEY

Original Scale	Drawn	Checked	Authorised	
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	Date 14.11.00	Date 27.11.00	Date 22/12/00	

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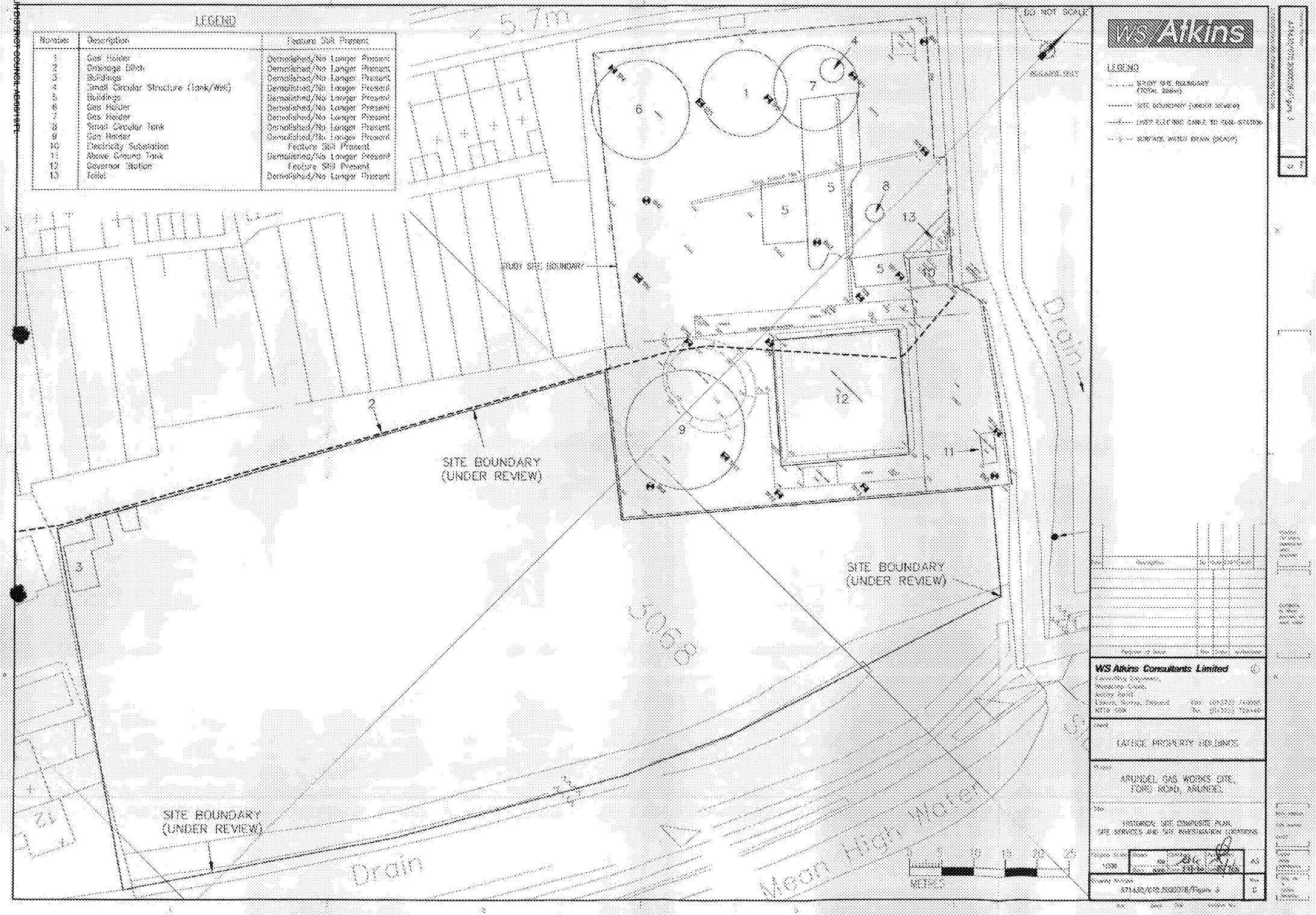
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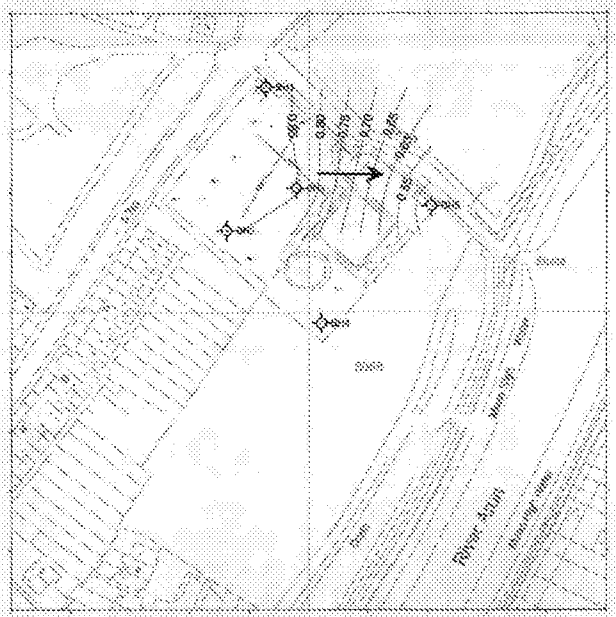
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Complete to show purpose of each issue

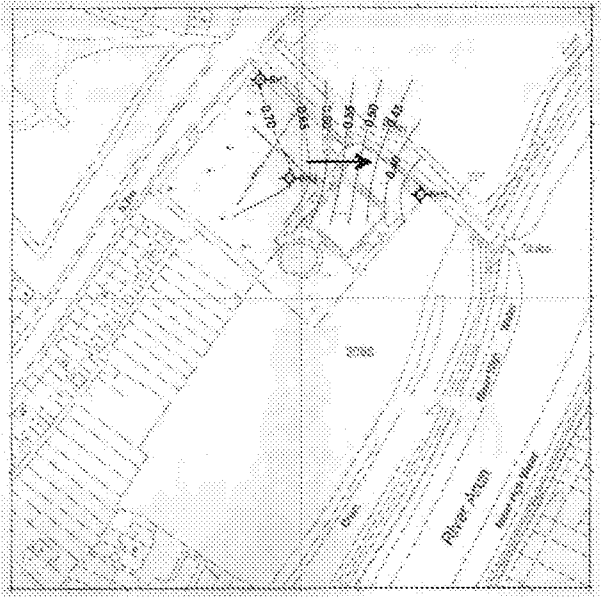
Main section
Sub section
Detail
Initial Issue Signature
Dwg. No. & Latest Revision


LEGEND
Number | Description | Feature Still Present
1 Gas Holder Demolished/No Longer Present
2 Drainage Ditch Demolished/No Longer Present
3 Buildings Demolished/No Longer Present
4 Small Circular Structure (Tank/Well) Demolished/No Longer Present
5 Buildings Demolished/No Longer Present
6 Gas Holder Demolished/No Longer Present
7 Gas Holder Demolished/No Longer Present
8 Small Circular Tank Demolished/No Longer Present
9 Gas Holder Demolished/No Longer Present
10 Electricity Substation Feature Still Present
11 Above Ground Tank Demolished/No Longer Present
12 Governor Station Feature Still Present
13 Toilet Demolished/No Longer Present
STUDY SITE BOUNDARY
SITE BOUNDARY (UNDER REVIEW)
SITE BOUNDARY (UNDER REVIEW)
SITE BOUNDARY (UNDER REVIEW)
Drain
Drain
Mean High Water
DO NOT SCALE
METRES
WS Atkins
LEGEND
STUDY SITE BOUNDARY (TOTAL 25ha+)
SITE BOUNDARY (UNDER REVIEW)
OVER ELECTRIC CABLE TO SUB-STATION
SURFACE WATER DRAIN (DEAD)
WS Atkins Consultants Limited
LATIGE PROPERTY HOLDINGS
ARUNDEL GAS WORKS SITE, FORD ROAD, ARUNDEL
HISTORICAL SITE COMPOSITE PLAN SHOWING SITE SERVICES AND SITE INVESTIGATION LOCATIONS
5114430/GIS/SK07/B/Figure 3

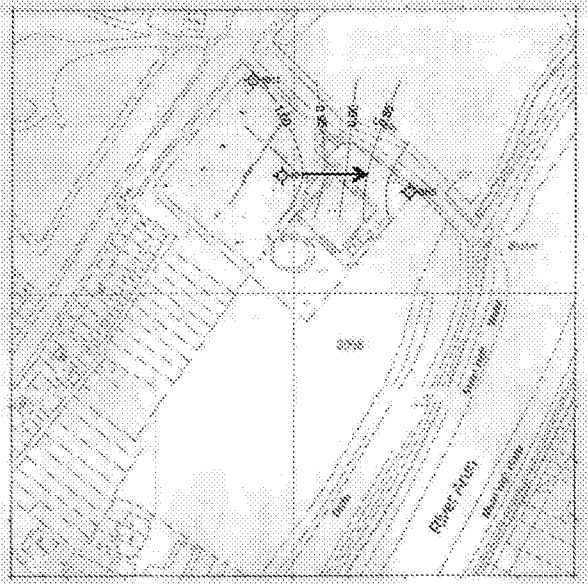
ARUN DISTRICT COUNCIL AB/88/19/PL



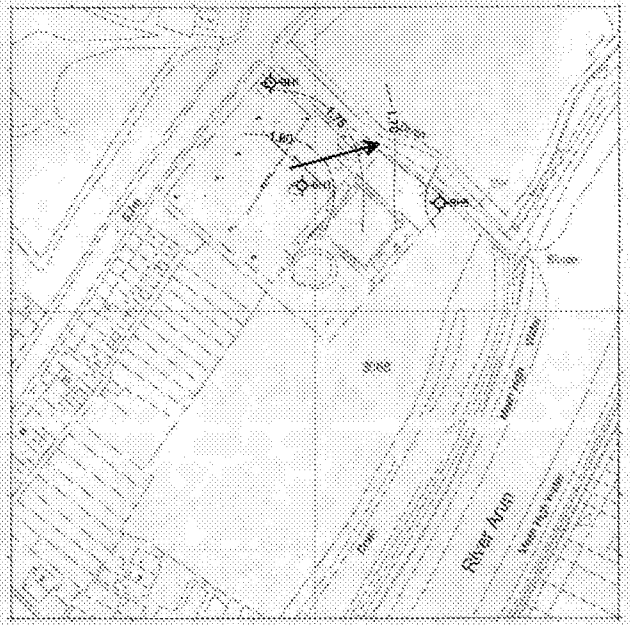
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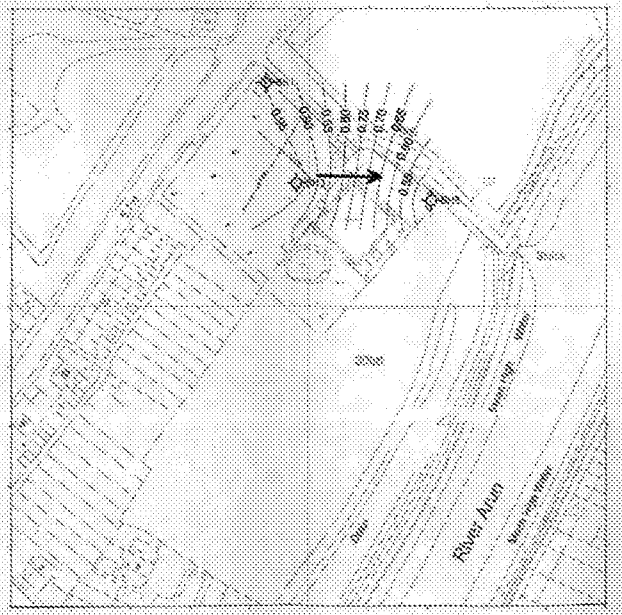
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TIME 0940



TIME 1340

WS Atkins

Project
Lattice Property - Arundel

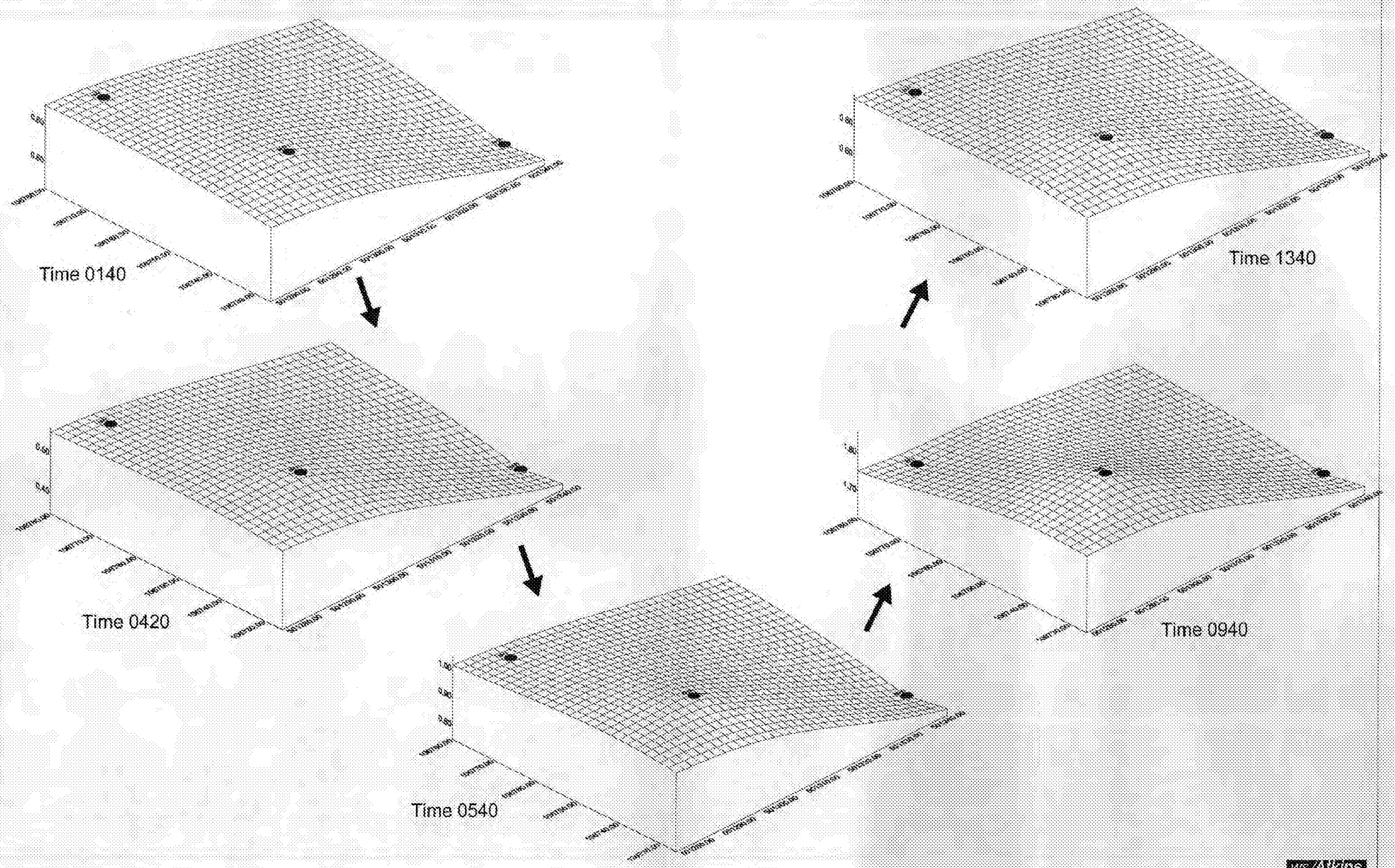
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NTS	LN	MW	
	Date 19/7/01	Date 19/7/01	Date 25/7/01

Title
Piezometric surfaces on 6th March 2001 through neap tide cycle

Job No.
A71430/GTG2000078/Arundel

Figure 4

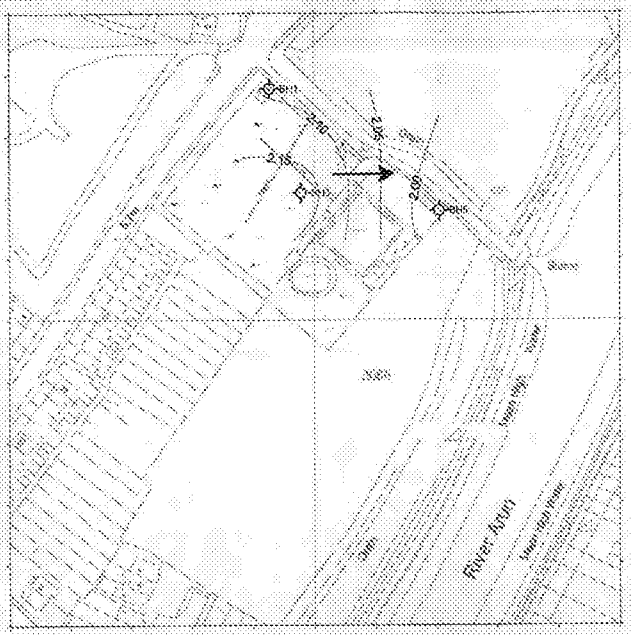
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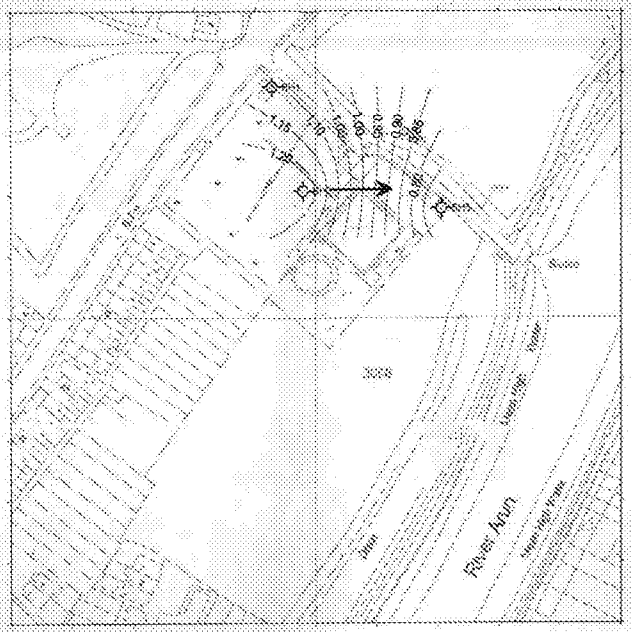
WS Atkins

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			Date 19/07/01	Date 19/07/01	Date 25/7/01	
Title	Piezometric surfaces of 6th March 2001 through neap tide cycle	Job No. AF4842/GTG2000078/Arundel	Figure 5			

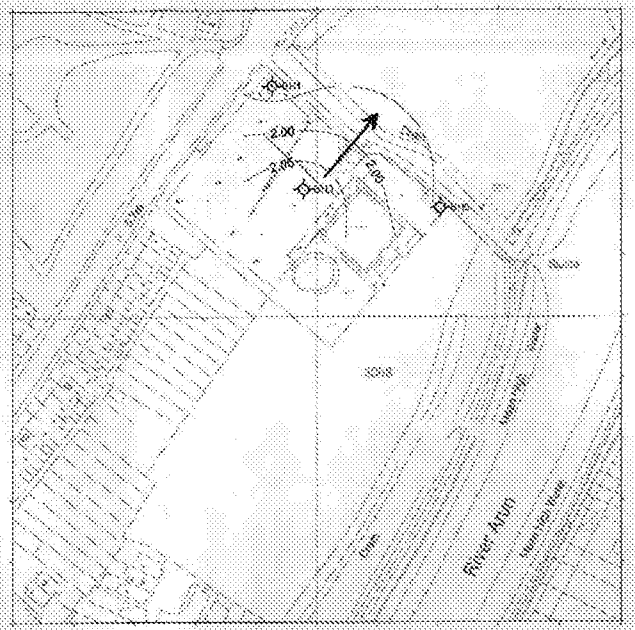
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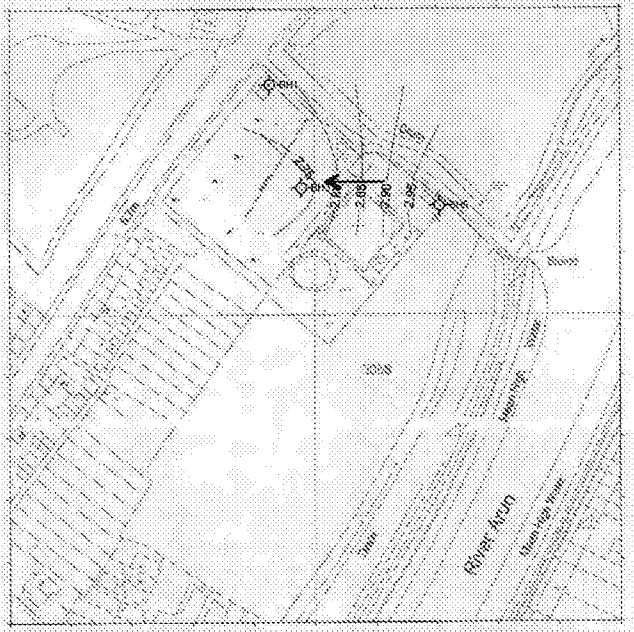
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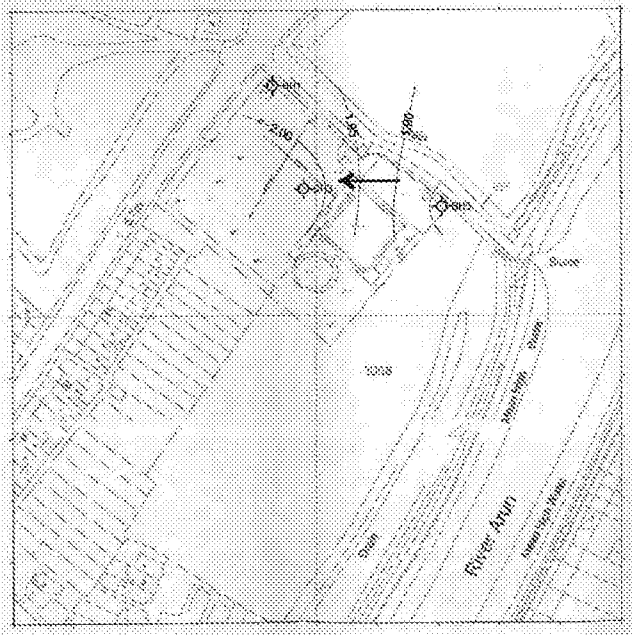
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TIME 2340 (11/3)



TIME 0240 (12/3)

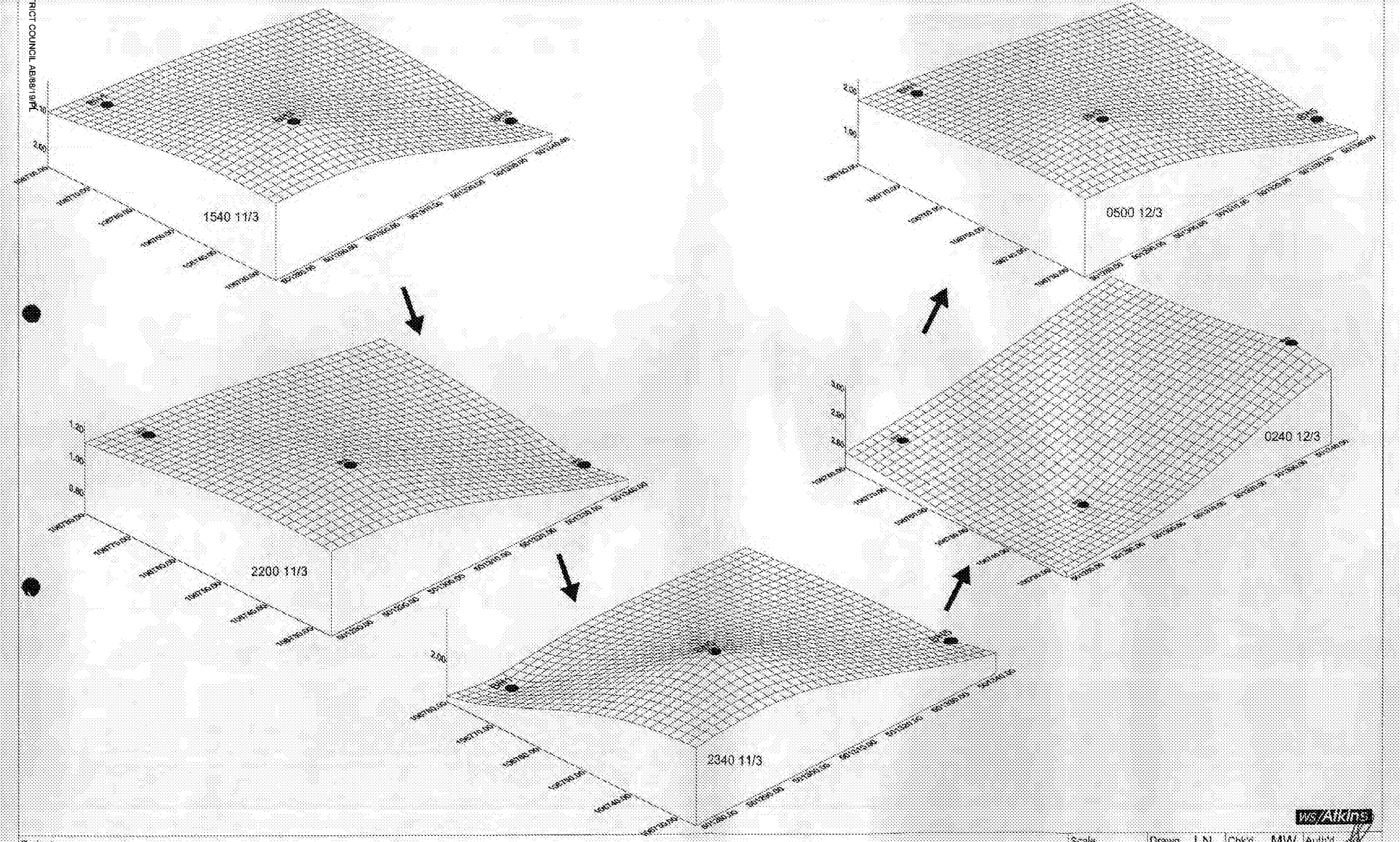


TIME 0500 (12/3)

WS Atkins

Project: Lattice Property - Arundel	Scale	Drawn LN	Chk'd MW	Auth'd JK
		Date 19/7/01	Date 19/7/01	Date 25/7/01
Title: Piezometric surfaces on 11/12th March 2001 through spring tide cycle	Job No. A71430/GTG2000078/Arundel			Figure 6

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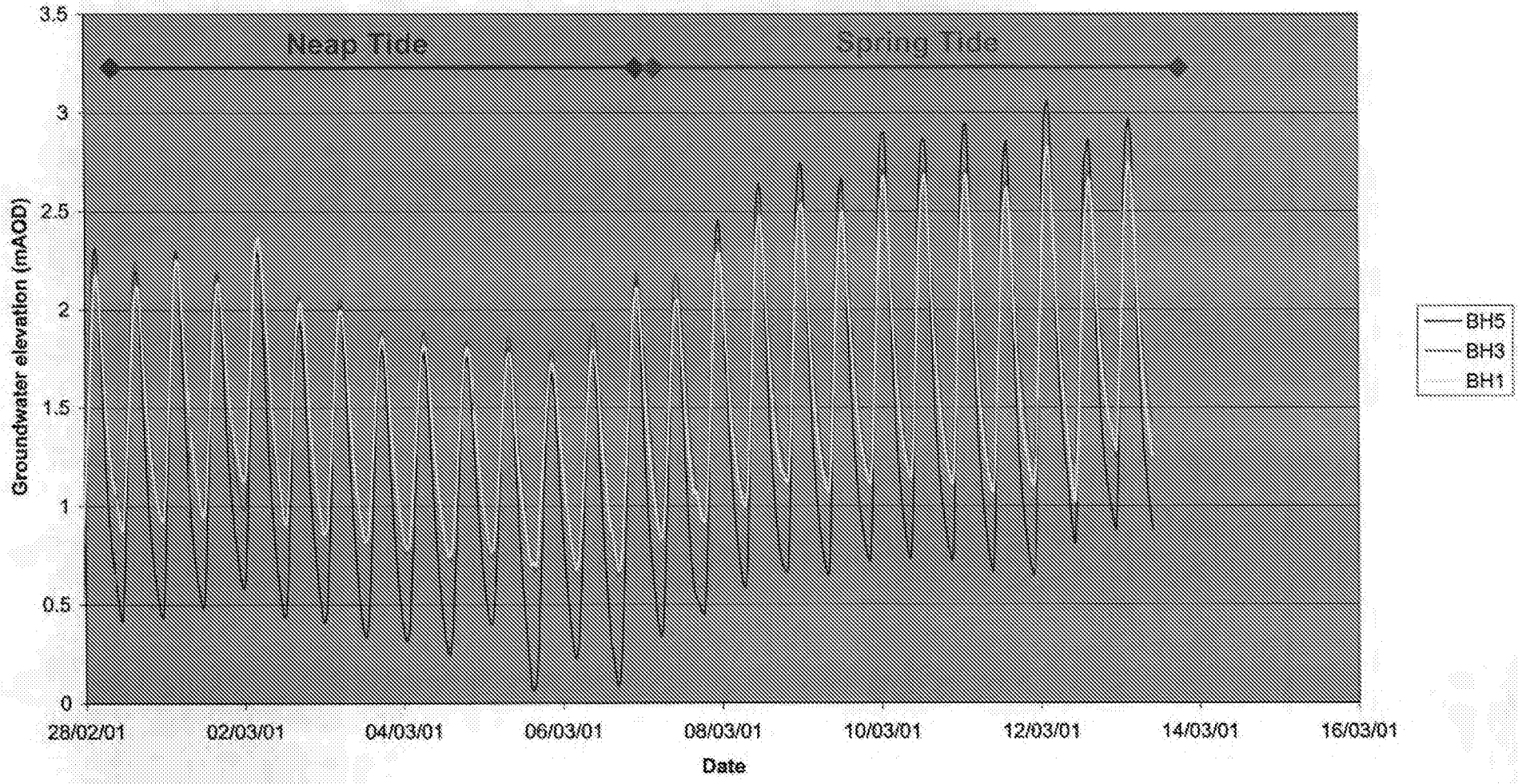


WS Atkins

Project	Lattice Property - Arundel	Scale	NTS	Drawn LN	Chk'd MW	Auth'd
				Date 19/07/01	Date 19/07/01	Date 25/7/01
Title	Piezometric surfaces on 11/12th March 2001 through spring tide cycle.	Job No.	AF4842/GTG2000078/Arundel	Figure 7		

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Graph 1: Lattice Property Arundel Hydrograph



Appendix A:
Borehole Logs

ARUN DISTRICT COUNCIL AB/88/19/PL

WS Atkins Environment
Woodcote Grove, Ashley Road
Epsom, Surrey, KT18 5BW
[redacted]

BOREHOLE LOG

Boring Contractor : ESL		Job No :A71430/ 015162	Borehole No : BH1
Boring method : CFA		Client : Lattice Property	Sheet 1 of 2
Boring diameter : 100	Casing diameter : 50	Site : Arundel	Ground level : 3.67 (Relative to Ordnance datum)
Boring equipment :		Project : Arundel Site Investigation	Date commenced : 07/06/2000 / Date completed : 07/06/2000
Easting : 501285.29	Northing : 106775.30		

Sample Details			Groundwater Details		Depth (mBGL)	Level (mAOD)	Key	Description of Strata
Reference	Type (Soil/Water)	Depth (mBGL)	Strike	Well		3.67		
					0.80	2.87		Soft to firm brown sandy clay with much gravel and cobble of builders rubble fill. MADE GROUND
01	S	1.00						Firm light brown very gravelly CLAY. Gravel of flint. NATURAL GROUND.
02	S	2.00						Red brown silty sandy with only occasional gravel at 1.8m.
								Brown without sand/ silt, very gravelly at 2.5m.
03	S	3.00	▽					
								Soft to firm wet light brown with occasional fine chalk gravel (not flint) at 2.5m.
04	S	5.00						
					6.50	-2.83		Soft light grey decomposed CHALK with occasional dark grey staining, slight odour. NATURAL GROUND.
05	S	7.00						With occasional hard core stones at 7.4m.
								Continued Next Sheet

Groundwater ▽ Depth to water strike

Remarks :

Logged By : ESL

Struck (m): Flow Remarks :
3.30

WS Atkins Environment
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Epsom, Surrey, KT18 5BW
[redacted]

Atkins

BOREHOLE LOG

Boring Contractor : ESL		Job No :A71430/ 015162	Borehole No : BH1
Boring method : CFA		Client : Lattice Property	Sheet 2 of 2
Boring diameter : 100	Casing diameter : 50	Site : Arundel	Ground level : 3.67 (Relative to Ordnance datum)
Boring equipment :		Project : Arundel Site Investigation	Date commenced : 07/06/2000 / Date completed : 07/06/2000
Easting : 501285.29	Northing : 106775.30		

Sample Details			Groundwater Details		Depth (mBGL)	Level (mAOD)	Key	Description of Strata
Reference	Type (Soil/Water)	Depth (mBGL)	Strike	Well		3.67		
06	S	9.00						Soft light grey decomposed CHALK with occasional dark grey staining, slight odour. NATURAL GROUND.
					10.00	-6.33		End of Borehole at 10.00 m

Groundwater		Remarks :	Logged By :
Struck (m)	Flow Remarks :		ESL
3.30			

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WS Atkins

BOREHOLE LOG

Boring Contractor : ESL		Job No :A71430/ 015162	Borehole No : BH2
Boring method : CFA		Client : Lattice Property	Sheet 1 of 2
Boring diameter : 100	Casing diameter : 50	Site : Arundel	Ground level : 3.40 (Relative to Ordnance datum)
Boring equipment :		Project : Arundel Site Investigation	Date commenced : 08/06/2000 / Date completed : 08/06/2000
Easting : 501272.21	Northing : 106727.31		

Sample Details			Groundwater Details		Depth (mBGL)	Level (mAOD) 3.40	Key	Description of Strata
Reference	Type (Soil/Water)	Depth (mBGL)	Strike	Well				
					0.20	3.20		Loose light brown coarse gravel fill. MADE GROUND
01	S	1.00						Soft to firm red/brown very silty CLAY. NATURAL GROUND. Much flint gravel at 0.7m.
02	S	2.00						Soft sandy with only very occasional gravel at 1.8m.
03	S	3.00	▽					
								Light brown without sand at 4.0m.
04	S	5.00						
					6.50	-3.10		Soft wet white to light brown completely decomposed CHALK with very occasional flint gravel. NATURAL GROUND. With occasional hard core stones at 7.2m.
05	S	7.00						
								Continued Next Sheet

Groundwater ▽ Depth to water strike

Struck (m): 2.68 Flow Remarks :

Remarks :

Logged By : ESL

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Epsom, Surrey, KT18 5BW

[redacted]

BOREHOLE LOG

Boring Contractor : ESL		Job No :A71430/ 015162	Borehole No : BH2
Boring method : CFA		Client : Lattice Property	Sheet 2 of 2
Boring diameter : 100	Casing diameter : 50	Site : Arundel	Ground level : 3.40 (Relative to Ordnance datum)
Boring equipment :		Project : Arundel Site Investigation	Date commenced : 08/06/2000 / Date completed : 08/06/2000
Easting : 501272.21	Northing : 106727.31		

Sample Details			Groundwater Details		Depth (mBGL)	Level (mAOD)	Key	Description of Strata
Reference	Type (Soil/Water)	Depth (mBGL)	Strike	Well		3.40		
06	S	9.00						Soft wet white to light brown completely decomposed CHALK with very occasional flint gravel. NATURAL GROUND.
					10.00	-6.60		End of Borehole at 10.00 m

Groundwater	Remarks :	Logged By :
Struck (m): Flow Remarks : 2.68		ESL

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Epsom, Surrey, KT18 5BW
[redacted]

BOREHOLE LOG

Boring Contractor : ESL		Job No :A71430/ 015162	Borehole No : BH3
Boring method : CFA		Client : Lattice Property	Sheet 1 of 2
Boring diameter : 100	Casing diameter : 50	Site : Arundel	Ground level : 3.22 (Relative to Ordnance datum)
Boring equipment :		Project : Arundel Site Investigation	Date commenced : 07/06/2000 / Date completed : 07/06/2000
Easting : 501295.70	Northing : 106741.54		

Sample Details			Groundwater Details		Depth (mBGL)	Level (mAOD)	Key	Description of Strata
Reference	Type (Soil/Water)	Depth (mBGL)	Strike	Well		3.22		
					0.60	2.62		Soft to firm black /brown sandy CLAY fill, with much gravel and builders rubble. With odour. MADE GROUND
01	S	1.00						Soft to firm light brown CLAY. No odour. NATURAL GROUND Red /brown with flint gravel at 0.8m.
								Very gravelly at 1.3m.
02	S	2.00						
03	S	3.00	▽					With gravel at 2.8m. Soft light brown light grey with fine chalk gravel (no flint) at 3.0m. Light grey with odour at 3.2m.
								Light brown with flint gravel (no chalk) and slight odour at 4.3m.
04	S	5.00						
					5.80	-2.58		White very light brown completely decomposed CHALK with occasional hard core stones. NATURAL GROUND.
05	S	7.00						
								Continued Next Sheet

Groundwater ▽ Depth to water strike

Struck (m): Flow Remarks :
3.20

Remarks :

Logged By : ESL

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Epsom, Surrey, KT18 5BW
[redacted]

Atkins

BOREHOLE LOG

Boring Contractor : ESL		Job No :A71430/ 015162	Borehole No : BH3
Boring method : CFA		Client : Lattice Property	Sheet 2 of 2
Boring diameter : 100	Casing diameter : 50	Site : Arundel	Ground level : 3.22 (Relative to Ordnance datum)
Boring equipment :		Project : Arundel Site Investigation	Date commenced : 07/06/2000 / Date completed : 07/06/2000
Easting : 501295.70	Northing : 106741.54		

Sample Details			Groundwater Details		Depth (mBGL)	Level (mAOD)	Key	Description of Strata
Reference	Type (Soil/Water)	Depth (mBGL)	Strike	Well		3.22		
06	S	9.00						White very light brown completely decomposed CHALK with occasional hard core stones. NATURAL GROUND.
					10.00	-6.78		End of Borehole at 10.00 m

Groundwater		Remarks :	Logged By :
Struck (m)	Flow Remarks :		ESL
3.20			

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Epsom, Surrey, KT18 5BW
[redacted]

Atkins

BOREHOLE LOG

Boring Contractor : ESL		Job No :A71430/ 015162	Borehole No : BH4
Boring method : CFA		Client : Lattice Property	Sheet 1 of 2
Boring diameter : 100	Casing diameter : 50	Site : Arundel	Ground level : 2.51 (Relative to Ordnance datum)
Boring equipment :		Project : Arundel Site Investigation	Date commenced : 06/06/2000 / Date completed : 06/06/2000
Easting : 501304.21	Northing : 106696.39		

Sample Details			Groundwater Details		Depth (mBGL)	Level (mAOD)	Key	Description of Strata
Reference	Type (Soil/Water)	Depth (mBGL)	Strike	Well		2.51		
					0.50	2.01		Firm brown silty gravelly clay fill. MADE GROUND
01	S	1.00						Soft to firm light brown CLAY. NATURAL GROUND. With gravel at 1.0m
02	S	2.00	▽					
03	S	3.00						Very gravelly at 2.5m. Red / brown stiff silty with very occasional gravel at 3.5m.
04	S	5.00						Firm light brown and gravelly at 4.2m.
					5.90	-3.39		Soft wet white decomposed CHALK with occasional hard core stones and occasional flinty gravel. No odour. NATURAL GROUND.
05	S	7.00						
								Continued Next Sheet

Groundwater ▽ Depth to water strike

Struck (m)	Flow Remarks :
2.28	

Remarks :

Logged By : ESL

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Epsom, Surrey, KT18 5BW
[redacted]

WS Atkins

BOREHOLE LOG

Boring Contractor : ESL		Job No :A71430/ 015162	Borehole No : BH4
Boring method : CFA		Client : Lattice Property	Sheet 2 of 2
Boring diameter : 100	Casing diameter : 50	Site : Arundel	Ground level : 2.51 (Relative to Ordnance datum)
Boring equipment :		Project : Arundel Site Investigation	Date commenced : 06/06/2000 / Date completed : 06/06/2000
Easting : 501304.21	Northing : 106696.39		

Sample Details			Groundwater Details		Depth (mBGL)	Level (mAOD)	Key	Description of Strata
Reference	Type (Soil/Water)	Depth (mBGL)	Strike	Well		2.51		
06	S	9.00						Soft wet white decomposed CHALK with occasional hard core stones and occasional flinty gravel. No odour. NATURAL GROUND.
					10.00	-7.49		End of Borehole at 10.00 m

Groundwater		Remarks :	Logged By :
Struck (m)	Flow Remarks :		ESL
2.28			

ARUN DISTRICT COUNCIL AB/88/19/PL

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Epsom, Surrey, KT18 5BW
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Atkins

BOREHOLE LOG

Boring Contractor : ESL		Job No :A71430/ 015162	Borehole No : BH5
Boring method : CFA		Client : Lattice Property	Sheet 1 of 2
Boring diameter : 100	Casing diameter : 50	Site : Arundel	Ground level : 2.55 (Relative to Ordnance datum)
Boring equipment :		Project : Arundel Site Investigation	Date commenced : 06/06/2000 / Date completed : 06/06/2000
Easting : 501341.00	Northing : 106735.55		

Sample Details			Groundwater Details		Depth (mBGL)	Level (mAOD) 2.55	Key	Description of Strata
Reference	Type (Soil/Water)	Depth (mBGL)	Strike	Well				
					0.10	2.45		Asphalt. MADE GROUND
					0.30	2.25		Loose red, grey, brown builders rubble. MADE GROUND
01	S	1.00						Soft to firm light brown CLAY. NATURAL GROUND.
								Band of gravel at 1.1m.
02	S	2.00						
								With much gravel at 2.5m.
03	S	3.00						
								Band of gravel at 3.7m.
								Band of gravel at 4.5m.
04	S	5.00						Damp at 5.0m.
					6.00	-3.45		Soft white light grey decomposed CHALK with occasional hard core stones and occasional flint gravel. Wet with hydrocarbon odour. NATURAL GROUND.
05	S	7.00						
								Continued Next Sheet

Groundwater

Struck (m): Flow Remarks :

Remarks :

Logged By : ESL

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Epsom, Surrey, KT18 5BW

[redacted]

BOREHOLE LOG

Boring Contractor : ESL		Job No :A71430/ 015162	Borehole No : BH5
Boring method : CFA		Client : Lattice Property	Sheet 2 of 2
Boring diameter : 100	Casing diameter : 50	Site : Arundel	Ground level : 2.55 (Relative to Ordnance datum)
Boring equipment :		Project : Arundel Site Investigation	Date commenced : 06/06/2000 / Date completed : 06/06/2000
Easting : 501341.00.	Northing : 106735.55		

Sample Details			Groundwater Details		Depth (mBGL)	Level (mAOD)	Key	Description of Strata
Reference	Type (Soil/Water)	Depth (mBGL)	Strike	Well		2.55		
06	S	9.00						Soft white light grey decomposed CHALK with occasional hard core stones and occasional flint gravel. Wet with hydrocarbon odour. NATURAL GROUND.
					10.00	-7.45		End of Borehole at 10.00 m

Groundwater

Struck (m)| Flow Remarks :

Remarks :

Logged By : ESL

Appendix B:
Results of Chemical Analysis
March 2001

ARUN DISTRICT COUNCIL AB/88/19/PL

ARUN DISTRICT COUNCIL AB/88/19/PL

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Table Of Results

☐ **UKAS Accredited**

Job Number: 01/01971/04/01 **Sample Type:** WATER

Client: W.S. Atkins Location: BG Arundel

Date of Receipt: (of first sample) 01/03/01 Client Contact: Matt Watts

Client Ref. No.:

	Units		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
	Detection Method		ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	ICP	Spectro	Spectro	Spectro	Colour	GC-FID	Grav
	Method Detection Limit		<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5	<0.01	<0.5	<0.2	<0.01	<10
Sample Number	Sample Identity	Depth (m)	Arsenic	Cadmium	Chromium	Copper	Iron	Mercury	Nickel	Lead	Selenium	Zinc	Easily Liberatable Cyanide	Sulphide In Water	Total Cyanide BG Method	Ammoniacal Nitrogen as NH4-N	Diesel Range Organics by GC	Total Suspended Solids
2	BH1	UNKNOWN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	-	<0.01	6406
3	BH1	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	46.3	-	-
4	BH1	UNKNOWN	-	-	-	-	-	-	-	-	-	-	<0.5	-	<0.5	-	-	-
5	BH1	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-
9	BH2	UNKNOWN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.08	<0.05	0.05	-	-	-	-	<0.01	2314
10	BH2	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	1.3	-	-
11	BH2	UNKNOWN	-	-	-	-	-	-	-	-	-	-	<0.5	-	<0.5	-	-	-
12	BH2	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-
15	BH3	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	-
16	BH3	UNKNOWN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	-	-	-	-	8360
17	BH3	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	4.5	-	-
18	BH3	UNKNOWN	-	-	-	-	-	-	-	-	-	-	<0.5	-	<0.5	-	-	-
19	BH3	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-
22	BH4	UNKNOWN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.5	0.13	<0.5	1.3	-	3905
23	BH4	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	-
24	BH5	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.01	-
25	BH5	UNKNOWN	<0.05	<0.05	<0.05	<0.05	0.11	<0.05	<0.05	0.05	<0.05	<0.05	-	-	-	-	-	1225
26	BH5	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	-	70.0	-	-
27	BH5	UNKNOWN	-	-	-	-	-	-	-	-	-	-	<0.5	-	0.5	-	-	-
28	BH5	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-

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 Anneli Fryer

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ARUN DISTRICT COUNCIL AB/68/19/PL

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Table Of Results

☐ UKAS Accredited

Job Number: 01/01971/04/01
Client: W.S. Atkins
Date of Receipt: 01/03/01
(of first sample)

Sample Type: WATER
Location: BG Arundel
Client Contact: Matt Watts
Client Ref. No.:

	Units		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	mS/cm		ppb	ppb	ppb	ppb
	Detection Method		HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	IR	Meter	Meter	MSD	MSD	MSD	MSD
	Method Detection Limit		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1	<0.025	<1.00	<1	<1	<1	<1
Sample Number	Sample Identity	Depth (m)	2-Isopropyl Phenol by HPLC	Catechol by HPLC	Cresols By HPLC	Naphthol by HPLC	Total Phenols HPLC	Phenol HPLC	Resorcinol by HPLC	Trimethyl Phenol By HPLC	Xylenols by HPLC	Tot. Org. Carbon in Water	Electrical Conductivity	pH Value in Water	Benzene by MSD	Ethylbenzene by MSD	Toluene by MSD	Xylene by MSD
2	BH1	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	7	1.380	7.45	-	-	-	-
6	BH1	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1
9	BH2	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5	0.861	7.37	-	-	-	-
13	BH2	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1
15	BH3	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	4	-	-	-	-	-	-
16	BH3	UNKNOWN	-	-	-	-	-	-	-	-	-	-	0.750	7.40	-	-	-	-
20	BH3	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<1
22	BH4	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5	0.682	7.42	<1	<1	<1	<1
24	BH5	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	15	-	-	-	-	-	-
25	BH5	UNKNOWN	-	-	-	-	-	-	-	-	-	-	1.704	7.49	-	-	-	-
29	BH5	UNKNOWN	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<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 _____ Anneli Fryer

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☑ Validated

Table Of Results

UKAS Accredited

Job Number: 01/01971/04/01 **Sample Type:** WATER

Client: W.S. Atkins Location: BG Arundel

Date of Receipt: 01/03/01 Client Contact: Matt Watts
(of first sample)

Client Ref. No.:

	Units		ppm	ppm	ppm
	Detection Method		Ion Chr	Ion Chr	Ion Chr
	Method Detection Limit		<0.01	<0.01	<0.01
Sample Number	Sample Identity	Depth (m)	Chloride by Dionex	Nitrate by Dionex	Sulphate by Dionex
2	BH1	UNKNOWN	117	1.6	272
9	BH2	UNKNOWN	67	24.2	49
16	BH3	UNKNOWN	62	<0.3	59
22	BH4	UNKNOWN	51	21.3	41
25	BH5	UNKNOWN	108	<0.3	650

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

NDP = NO DETERMINATION POSSIBLE

NFP = NO FIBRES PRESENT

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ALcontrol Geochem

Job Number : 01/04798/02/01
Client : W.S. Atkins
Ref :
Sample Type : WATER
Units : µg/l

Sample No	Sample Identity	Depth	Total Volatiles C_4 to C_{13}	MTBE	Benzene	Toluene	Ethyl Benzene	Total Xylene
1	BH 1		< 10		< 10	< 10	< 10	< 10
3	BH 3		< 10		< 10	< 10	< 10	< 10
4	BH 4		< 10		< 10	< 10	< 10	< 10
5	BH 5		< 10		< 10	< 10	< 10	< 10

ARUN DISTRICT COUNCIL AB/88/19/PL

ARUN DISTRICT COUNCIL AB/88/19/PL

ALcontrol Geochem

C_{10} to C_{40} Hydrocarbons

Job Number : 01/01971/04/01
Client : W.S. Atkins
Ref :
Sample Type : WATER
Units : µg/l

Sample No	Sample Identity	Depth	Total Soluble Extract	Diesel Range Hydrocarbons	Mineral Oil	Carbon Range Distribution			Interpretation
						C_{10}-C_{20}	C_{21}-C_{30}	C_{31}-C_{40}	
2	BH1			< 10		< 10	< 10	< 10	No Identification Possible
9	BH2			< 10		< 10	< 10	< 10	No Identification Possible
15	BH3			< 10		< 10	< 10	< 10	No Identification Possible
23	BH4			< 10		< 10	< 10	< 10	No Identification Possible
24	BH5			< 10		< 10	< 10	< 10	No Identification Possible

ARUN DISTRICT COUNCIL AB/88/19/PL

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Table of PAH Results

Job Number: 01/01971/04/01

Client: W.S. Atkins

Date of Receipt: 01/03/01
(of first sample)

Location: BG Arundel

Client Contact: Matt Watts

Client Ref. No.:

Sub-Method

PAH 16 BG

WATER

	Units		µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l	µg/l
	Method Detection Limit		<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Sample Number	Sample Identity	Depth (m)	Naphthalene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(e)pyrene	Benzo(a)pyrene	Indeno(123cd)pyrene	Dibenzo(ah)anthracene	Benzo(ghi)perylene	Total 16 PAH British Gas
2	BH1	UNKNOWN	0.415	0.430	0.107	0.256	0.058	0.281	0.200	0.216	0.100	0.081	0.064	0.076	0.107	0.092	0.033	0.086	2.602
9	BH2	UNKNOWN	0.247	<0.010	<0.010	<0.010	<0.010	0.161	0.115	<0.010	<0.010	0.036	0.026	0.031	0.055	0.063	0.026	0.054	0.812
15	BH3	UNKNOWN	<0.010	<0.010	<0.010	<0.010	<0.010	0.027	0.020	<0.010	<0.010	<0.010	<0.010	<0.010	0.021	0.020	0.016	0.018	0.121
23	BH4	UNKNOWN	<0.010	<0.010	0.018	<0.010	<0.010	0.164	0.128	0.096	0.090	0.044	0.027	0.039	0.040	0.038	0.010	0.031	0.725
24	BH5	UNKNOWN	<0.010	2.731	2.521	<0.010	<0.010	0.266	0.128	<0.010	<0.010	<0.010	0.011	0.011	0.013	0.015	0.013	0.014	5.722

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

NDP = NO DETERMINATION POSSIBLE

NFP = NO FIBRES PRESENT

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Appendix C:
Results of Chemical Analysis
May 2001

ARUN DISTRICT COUNCIL AB/88/19/PL

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ALcontrol Geochem

C_{10} to C_{40} Hydrocarbons

Job Number : 01/04798/02/01
Client : W.S. Atkins
Ref :
Sample Type : WATER
Units : µg/l

Sample No	Sample Identity	Depth	Total Soluble Extract	Diesel Range Hydrocarbons	Mineral Oil	Carbon Range Distribution			Interpretation
						C_{10}-C_{20}	C_{21}-C_{30}	C_{31}-C_{40}	
1	BH 1			< 10					No identification possible
3	BH 3			< 10					No identfication possible
4	BH 4			< 10					No identfication possible
5	BH 5			223					1 Discrete Unknown Peak at C15/unknown cluster of peaks at C17 to C18

ATKINS

National Grid Property Holdings Limited
Ford Road, Arundel (Site No. 2551)

Site Investigation Report

October 2011

Plan Design Enable

ARUN DISTRICT COUNCIL AB/88/19/PL

National Grid Property Holdings Limited
Ford Road, Arundel (Site No. 2551)

Site Investigation Report

October 2011

Notice

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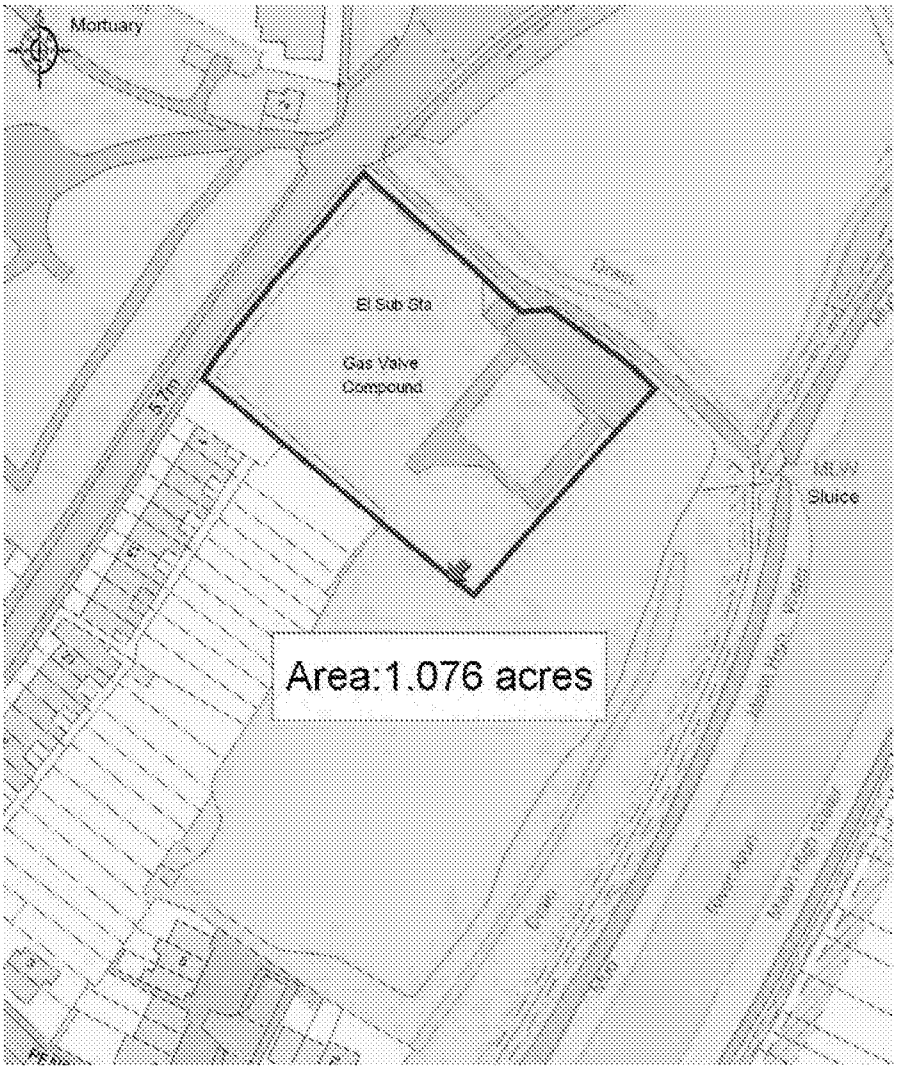
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Document History

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Reporting Area



Site Address	**Ford Road, Arundel, West Sussex, BN18 9DX**	NGP Document Tracking code	
Report Title	**Land Contamination Site Investigation and Generic Quantitative Risk Assessment**		
Report Type	**Contamination**	Retention Period	**Indefinitely**
Site Code	**2551**	Author (Company)	**Atkins**
Report Date	**September 2011**	Factual/Interpretative	**Interpretative**
Draft/Final	**Draft**	H&S File?	**No**
Work Stage	**Site investigation and generic quantitative risk assessment**		
Brief description of contents	**Supplementary site investigation and updated generic quantitative risk assessment report including previously obtained site data**		
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[redacted]

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List of Abbreviations

Abbreviation	Definition
ALV	Alluvium
aOD	above Ordnance Datum
Atkins	Atkins Limited
ATD	Atomic Thermal Desorption
bgl	below ground level
BGS	British Geological Survey
BTEX	benzene, toluene, ethylbenzene and xylene
CHK	Chalk
CoC	contaminant of concern
CLEA	Contaminated Land Exposure Assessment
CSM	conceptual site model
DQRA	detailed quantitative risk assessment
GAC	generic assessment criteria
GQRA	generic quantitative risk assessment
ha	hectare
i2	i2 Analytical Limited
MDL	method detection limit
MG	Made Ground
NAPL	non-aqueous phase liquid
NGPH	National Grid Property Holdings Limited
NM	not measured
OS	Ordnance Survey
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photo ionisation detector
PORT	prioritisation of risk tool
PPL	potential pollutant linkage
PW	perched water
RBCA	Risk Based Corrective Action
SGV	Soil Guideline Value
SOM	soil organic matter
SPZ	Source Protection Zone
SR	Science Report
SSV	soil screening values
TIC	tentatively identified compound
TOC	total organic carbon
TPH CWG	total petroleum hydrocarbon criteria working group
VOC	volatile organic compound
WSV	water screening value

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Executive Summary

Introduction

National Grid Property Holdings Limited (NGPH) retained Atkins Limited (Atkins) to conduct a supplementary phase intrusive investigation [redacted] on the former Arundel Gasworks, located on Ford Road, Arundel (herein referred to as the „site").

The site is recorded to have been operated as a gasworks from at least 1840 until the late 20th century. Investigation and assessment works conducted at the site by Harrison and Co. in 1993 (Ref. 2) and Atkins in 1994 and 2000, [redacted]. In [redacted] June 2010, NGPH commissioned Atkins to undertake a supplementary phase intrusive site investigation [redacted].

[redacted]

Physical Investigation Findings

The results of the intrusive site investigation identified Made Ground across the site, generally comprising firm, sandy, gravelly clay and fine to medium, gravelly, clayey sand with frequent brick, chalk and flint gravels and fragments of clinker, up to a maximum identified thickness of 2.7 m (in the northern corner of the site). Stiff, very gravelly clay and fine to coarse sub-rounded to angular flint gravels in a stiff clay matrix (Alluvium) ranging between 0.7 m to 5.1 m thickness was encountered beneath the Made Ground. Chalk (comprising structureless fine chalk gravels and chalk cobbles in a soft off-white/grey clay matrix) was identified beneath the Alluvium between 3.4 and 6.8 m below ground level (bgl).

A number of visual and olfactory indicators of potential contamination were identified in the Made Ground, Alluvium and Chalk during drilling. [redacted]. Due to constraints encountered during the recent site investigation works associated with vegetation, nesting birds and underground pipe work (identified in TP108 and TP111), it was not possible to extend the trial pit locations in order to fully delineate this potential source area.

Tidal monitoring indicated significant tidal variation in the groundwater level at the site (up to approximately 2 m variance), [redacted]

[redacted]

[redacted]

[redacted]

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1. Introduction

1.1 General

National Grid Property Holdings Limited (NGPH) has retained Atkins Limited (Atkins) to conduct a supplementary phase intrusive investigation [redacted] on the former Arundel Gasworks, located on Ford Road, Arundel (herein referred to as the „site").

This document presents the findings of the supplementary intrusive investigation [redacted] produced in accordance with Atkins offer of services, dated March 2011 (Ref. 1).

1.2 Background

The site is recorded to have been operated as a gasworks from at least 1840 until the late 20th century. Investigation and assessment works conducted at the site comprising a desk based assessment by Harrison and Co. in 1993 (Ref. 2) and an environmental liability assessment (Ref. 3) and interpretive site investigation report (Ref. 4) undertaken by Atkins in 1994 and 2000, [redacted]

[redacted] in June 2010, NGPH commissioned Atkins to undertake a supplementary phase intrusive site investigation [redacted].

[redacted]

- [redacted]
- [redacted]

[redacted]

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1.4 Project Team

The project team is presented in Table 1.1, below.

Table 1.1 - Project Team

Role	Contact
Client	NGPH Paul Mantell, Regeneration Manager
Principal Contractor Project Director Project Manager Lead Engineer	Atkins Mathew Worboys, Associate Director Samuel Tonkin, Associate Lucy Hay, Senior Environmental Consultant
CDM Co-ordinator	Confluence PMC Ken Buchanan, Associate
Service clearance	Amethyst Surveys Ltd
Borehole drilling	Geotechnical Engineering Ltd
Hand pits/hand augers	Smith Drilling Services Ltd
Trial pits	Chertsey Plant Hire Ltd
Chemical analysis (soils and water)	i2 Analytical Ltd (i2)
Chemical analysis (soil vapour)	Chemex Ltd
Waste collection	Williams Environmental Ltd

1.5 Information Sources

The following historical reports pertaining to the site have been reviewed as part of this assessment:

- Harrison and Company, 1993. Desk Study on a Disused Gas Work at Ford Road, Arundel, West Sussex for British Gas (South Eastern) plc. Ref C604A (Ref. 2);
- Atkins, April 1994. British Gas Environmental Liability Assessment Report. Ref E5347/LR860.NL/gp (Ref. 3)[redacted]
- [redacted]

A site investigation was also undertaken by Harrison and Co. in 1988, however, Atkins has not reviewed this report. A summary of the investigation is provided within the Harrison and Co. 1993 desk study and only this information has been reviewed.

This report presents the findings of the recent 2011 investigation[redacted]

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2. Site Status and Environmental Setting

2.1 Introduction

The section provides a summary of the current site status and environmental setting. Information regarding the site status has been based on observations made during a site walkover conducted by Atkins on 17 May 2011 and records from previous investigations at the site. Information regarding the environmental setting has been summarised from the Environmental Assessment Site Investigation Final Interpretative Report, produced by Atkins in December 2000 (Ref. 4).

2.2 Site Status

2.2.1 Location

The site is located on Ford Road, Arundel, West Sussex, BN18 9DX at National Grid Reference No. TQ013067 (501308E, 106749N) and covers an area of approximately 0.4 hectares (ha). Figure 1 presents a site location plan, and Figure 2 presents a site layout plan including historical site features. A selection of site photographs from the site walkover conducted by Atkins on 17 May 2011 is presented in Appendix A.1.

2.2.2 Current Site Layout

The site is generally flat and set into the side of a gently sloping hill with the surrounding land sloping from northwest to southeast. Residential houses and a road located to the west and south west of the site are at a higher level than the site, although the gardens of the residential properties slope down to a similar level. An electricity sub-station is located on the eastern site boundary adjacent to the site entrance (Appendix A.1, photograph 8) and concrete slab foundations are located in the northern and eastern corners of the site. No other above ground structures or buildings are present on the site. A raised spoil heap and raised rectangular area (identified on the historical plans to have been the location of a governor compound) are located in the southern and south eastern portions of the site, respectively.

During the site investigation undertaken in 2000 (Ref. 4), the site was recorded as comprising approximately 25 % tarmac, with the remainder comprising of either gravel or wood chip with sporadic patches of vegetation and bare earth. However, during the site walkover undertaken on 17 May 2011, the site was found to be heavily overgrown with buddleia making an appraisal of the majority of the ground cover at the site not possible (see Appendix A.1, photographs 5 and 9). It is understood that no activity has taken place on the site since 2000, and following vegetation clearance works undertaken as part of the site investigation undertaken by Atkins in June 2011, the ground cover was estimated to be consistent with that recorded in 2000.

The site boundary comprises a 2 m high chain link fence in reasonable condition. During the site walkover some minor damage was noted along the south western boundary, however, thick vegetation was located along this boundary making entry via this opening (by potential trespassers) unlikely (Appendix A.1, photograph 7). Access to the site is gained via 2 m high chain-link padlocked double gates located along an access track adjacent to the north eastern boundary of the site (off Ford Road). Two metal security bollards are also located on the inside of the gates (Appendix A.1, photograph 3).

The surrounding land uses are as follows:

- to the south west are residential houses with gardens;
- to the south east is private grazing land. The River Arun is located beyond the private grazing land and flows towards the south east (although is tidally influenced);
- to the north west is Ford Road, beyond which is a cemetery; and

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- to the north east is an access track leading off Ford Road, beyond which is a small surface water drain (which runs towards the River Arun via a sluice gate), and private grazing land.

2.2.3 Historical Site Layout

Historical maps have been obtained for the site and identify the gasworks to have been present from before 1840 and expanding in the west in circa 1899 and in the south and south east in circa 1937.

A summary of the development of the site taken from historical maps is presented in Table 2.1. A plan of the site in 1967, provided by the National Grid archives, is included in Appendix B.

Table 2.1 - Site History

Map	On-Site	Off-Site
1840 Tortington Tithe Map	The site is recorded as being confined to the north east of the current site area with the remainder of the site split into land parcels by a number of boundaries. A single gas holder is identified in the north of the site. A works building is recorded in the central northern portion of the site to the south of the holder. A rectangular building is identified adjacent to what is currently the site entrance.	Ford Road (unnamed on the plan) is identified along the north western boundary of the site with open fields beyond. An access track leading to the River Arun is recorded along the north eastern boundary with open fields, a small building and drainage channels beyond. Open fields, drainage channels and the River Arun are identified to the south east of the site. Open land segregated into smaller parcels is identified to the south west.
1875 Ordnance Survey (OS) Map	The site is recorded as a "Gas Works". The gas holder located in the north of the site is recorded to have reduced in size and a second, larger gas holder is identified within the site along the north western boundary. The works buildings are recorded to have expanded to the south and west.	Minor changes, with a small number of buildings are identified to the north, south and south west of the site.
1877 OS Map	An additional small circular structure (potential gas holder or tar tank) is identified in the central portion of the site adjacent to the works buildings.	No significant changes recorded.
1897 OS Map	The gas works area is recorded to have expanded to the west. The smaller possible gas holders/tar tanks previously identified in the north and central portion of the site are no longer recorded. A circular gas holder is recorded in the west of the site. The works buildings previously identified in the central portion of the site has expanded. Additional works buildings are identified in the northern corner of the site. The building previously recorded adjacent to what is now the site entrance has expanded.	A cemetery with lodge house is recorded to the north west of the site Beyond the open fields to the south of the site "Baths", "Tortington Iron Works" and a "Sewage Works" are identified. Housing located along the south of Ford Road is identified adjacent to the site to the south west.

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Map	On-Site	Off-Site
1899 OS Map	No significant changes identified.	No significant changes identified.
1910 OS Map	A small circular structure (possible chimney or tank) is identified along the north eastern boundary.	Additional residential properties with gardens are recorded to the west and south west of the site.
1912 OS Map	No significant changes identified.	No significant changes identified.
1914 OS Survey Map	No significant changes identified.	No significant changes identified.
1933 OS Map	No significant changes identified.	No significant changes identified.
1937 OS Map	The site is recorded to have expanded to the south and south east with a circular gas holder structure identified in the southern corner and a rectangular building identified in the eastern corner.	No significant changes identified.
1961 OS Map	Only the circular holder structures are identified in the southern and western corners of the site, however, other features may be present but not shown due to the map scale.	No significant changes identified.
1971 OS Map	No features are recorded in the northern, western and central portions of the site. An electricity sub-station is identified adjacent to the site entrance along the north eastern boundary. A rectangular tank is identified in the eastern corner of the site (a rectangular concrete slab is still present on the site at this location indicating that this may have been an above ground tank). A square structure along the south eastern boundary is identified (recorded to be a governor compound on the plan provided from the National Grid archive, presented in Appendix B)	The baths to the south of the site are no longer identified and the iron works are now recorded as an agricultural engineering works and builders yard.
1973-77 OS Map	No significant changes identified.	No significant changes identified.
1979-94 OS Map	The circular tank structure in the southern corner of the site and the rectangular tank structure in the east of the site are no longer identified. The remaining features identified include the electricity sub-station and the square feature along the south eastern boundary which is recorded as a gas valve compound.	No significant changes identified.

2.2.4 Services

Service drawings from known utility suppliers were requested prior to the start of the intrusive investigation works. Appendix C presents the service plans received and the responses obtained from the service providers that have plant with in the vicinity of the site.

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2.3 Environmental Setting

2.3.1 Geology

2.3.1.1 Regional

The geology in the vicinity of the site is identified on the British Geological Survey (BGS) Sheet 317, Chichester (Ref. 5). BGS Well Records Nos. 21 and 88 have also previously been reviewed.

The solid geology of the study site is shown to comprise the Spetisbury Chalk Member overlain by 2 to 5 m of clay, silt, sand and gravel alluvium (Raised Marine Deposits) associated with the River Arun.

2.3.1.2 Site Specific

The following information regarding the site specific geology is based on the findings of the investigation and assessment works undertaken by Atkins in 2000 (Ref. 4). Exploratory borehole logs from the 2000 site investigation are presented in Appendix A.2, and the location of the historical site investigation locations is presented on Figure 2.

Made Ground

Made Ground varied in thickness across the site ranging from absent to 2.0 m below ground level (bgl), with the greatest depths in the areas that were recorded to be formerly occupied by gas holders and pipes. Made Ground was therefore principally located to the centre and north of the site with natural ground at surface level along the southern, eastern and south-western boundaries. The Made Ground generally comprised a loose black silty sand or sandy silt with coal, bricks, clinker, scrap metal, chalk and some reworked natural ground in TP5, TP7, TP8, TP9, TP14, TT1 and TT2. In addition TP8 contained small quantities of spent oxide.

Natural Strata

The top of the natural strata was identified between ground level (TP6, TP12 and TP13) and approximately 2.0 m bgl. The natural strata comprised a soft dark brown silty clay or clayey silt with gravel and rootlets, underlain by a light brown-orange clay with flint gravel and bands of stiff red-brown silty sand, gravel rich bands, brown clay with and without sand, and occasional chalk in light brown-grey layers (Alluvium). This was underlain by a soft white to light grey weathered chalk with occasional grey staining, stones and flinty gravel (Chalk).

2.3.2 Hydrogeology

The Environment Agency designation for the Raised Marine Deposits at the site is as a Secondary (A) Aquifer (Ref. 6). The Chalk is designated as a Principal Aquifer. Information obtained from the Environment Agency website (Ref. 6) indicates that the site does not lie within a Source Protection Zone (SPZ).

Perched water was encountered during the 2000 site investigation in the Made Ground and Alluvium as detailed in Table 2.2. In TP5 and TP8, the water encountered was associated with historical features. Groundwater strikes in the Chalk were noted in four of the five boreholes. During subsequent monitoring rounds, groundwater levels in the Chalk Aquifer were recorded between 0.045 m above Ordnance Datum (aOD) and 0.475 m aOD. [redacted]

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Table 2.2 – Perched Water and Groundwater Strikes during the 2000 Site Investigation

Location ID	Perched Water/ Groundwater Strike			Groundwater Level 03/06/00		Groundwater Level 19/07/00		Notes
	m bgl*	m aOD	Stratum	m bgl*	m aOD	m bgl*	m aOD	
TP1	1.40	2.20	MG	-	-	-	-	
TP2	1.80	1.91	MG	-	-	-	-	Brown foam and tar odour. Associated with tar stained gravels.
TP5	1.20	2.15	MG	-	-	-	-	Potentially associated with two cast iron pipes containing water identified at 0.9 m bgl and broken during excavation. Tar contamination visually identified in the water.
TP8	1.20	1.94	MG	-	-	-	-	Water contained within a cast iron pipe broken during excavation. Phenol/oil odour and sheen.
TP11A	1.40	1.19	ALV	-	-	-	-	Associated with gravels in the clay Alluvium.
TP12	1.30	1.13	ALV	-	-	-	-	Associated with gravels within the clay Alluvium.
BH1	3.20	0.037	CHK	3.30	0.67	3.90	0.07	
BH2	2.68	0.72	CHK	2.68	1.03	3.47	0.25	
BH3	3.20	0.02	CHK	3.20	0.39	3.12	0.48	
BH4	2.28	0.23	CHK	2.28	0.59	2.44	0.44	
BH5	NM	NM	NM	2.02	0.88	2.86	0.05	

Notes: MG Made Ground
ALV Alluvium
CHK Chalk
NM Not measured
- No installation and therefore groundwater level monitoring not possible
* Ground level during drilling represents the original ground level, and ground level during subsequent rounds of monitoring represents the top of the well cover.

2.3.3 Hydrology

The River Arun is located approximately 40 m south east from the site, adjacent to the grazing land. The river is tidally influenced in the local area and generally flows in a southerly direction towards the English Channel, with reversal of flow during high tide. A drainage ditch is located approximately 5 m from the north eastern site boundary and flows in a south easterly direction into the River Arun via a sluice gate (see Appendix A.1, photograph 6).

2.4 Previous Assessment Reports

2.4.1 Harrison and Co., 1988: Site Investigation

The site investigation undertaken by Harrison and Co. in 1988 is summarised within their desk study report (Ref. 2). The site investigation comprised 22 trial pits across the site and the grazing field adjacent to the south of the site.

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Within the current site boundary, buried structures including concrete, pipes and metalwork were encountered within the Made Ground, found to be approximately 1.3 m in thickness but ranging up to 3.0 m. [redacted]

2.4.2 Atkins, 2000: Site Investigation

In 2000, Atkins undertook an intrusive investigation at the site with the findings reported in the Atkins Environmental Assessment Site Investigation Report (Ref. 4). The Atkins site investigation comprised:

- five groundwater monitoring wells installed within the Chalk Aquifer;
- excavation of two trial trenches; and
- excavation of 14 trial pits.

[redacted]

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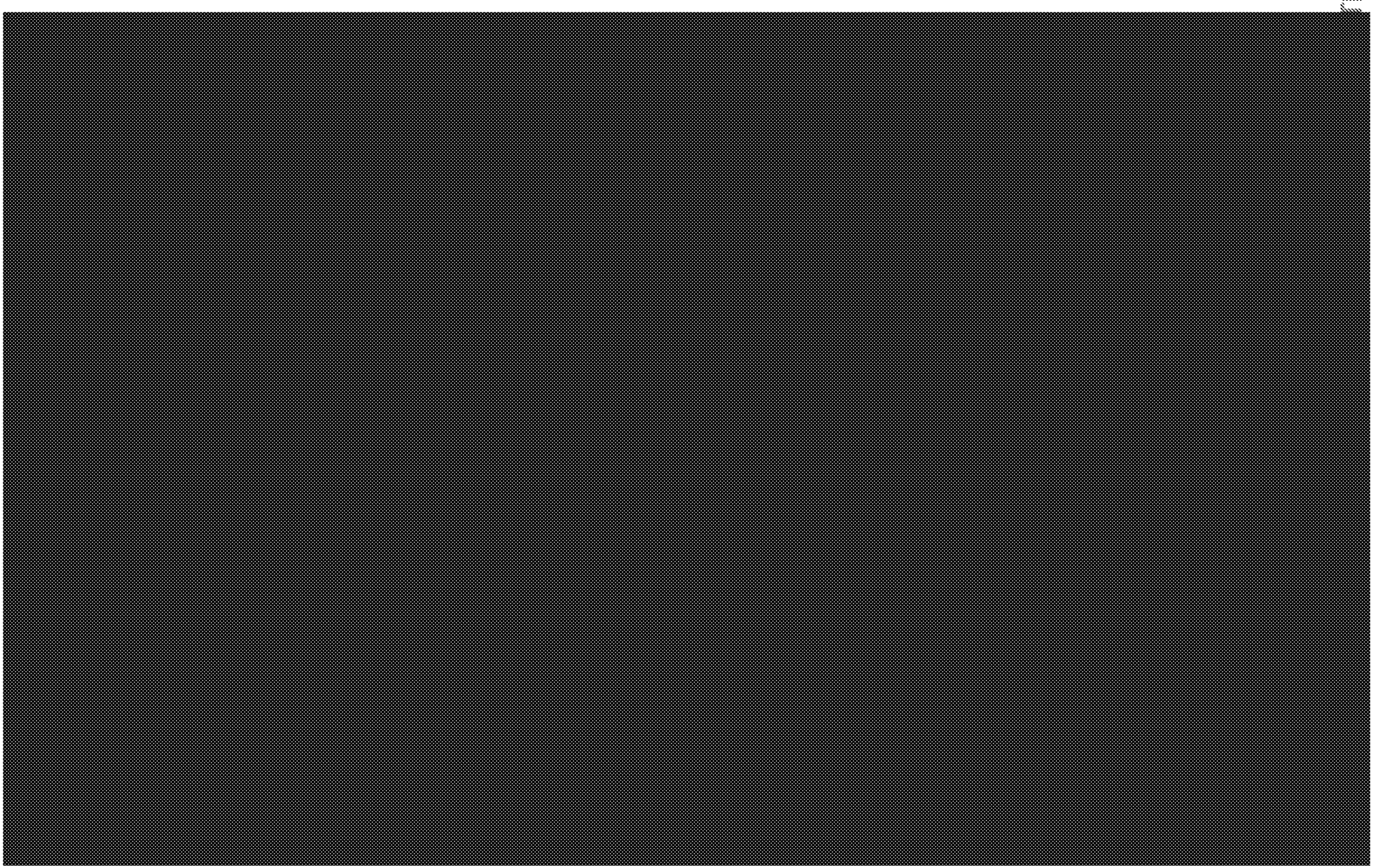
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SMS1



4. Supplementary Site Investigation

4.1 Introduction

The intrusive investigation was designed to supplement existing information available for the site

The supplementary site investigation methodology is presented in Section 4.2 and is summarised below:

- site walkover;
- service clearance;
- 5 No. hand dug/augered pits numbered VP200 to VP204 installed as vapour monitoring wells;
- 15 No. trial pits numbered TP101 to TP115;
- 5 No. boreholes numbered BH101 to BH105 installed as groundwater monitoring wells;
- one round of surface water sampling from the drainage ditch adjacent to the site;
- two rounds of soil vapour sampling and groundwater dipping and sampling; and
- permeability testing and tidal monitoring.

During the site walkover undertaken on 17 May 2011 the site was noted to be covered with dense vegetation (largely buddleia) which would have severely restricted access for the site investigation works. The potential for sensitive ecology to be present was also noted and therefore an ecology site walkover and vegetation clearance works were scheduled in advance of the intrusive investigation.

The initial phase of intrusive ground investigation (hand pitting and trial pitting) was undertaken between 13 and 16 June 2011. During these works the boreholes drilled during Atkins' 2000 site investigation (BH1 though BH5) were found to have been decommissioned (see Appendix A.1, photograph 12) and therefore replacement groundwater monitoring wells were drilled between 28 June and 1 July 2011 as a second phase of intrusive works. All works were undertaken under the full time supervision of a suitably qualified Atkins site engineer.

Investigation locations from the recent and previous site investigations are presented in Figure 2.

4.2 Methodology

4.2.1 Service Clearance

Service clearance was undertaken in advance of the intrusive works by a specialist sub-contractor (Amethyst Surveys Ltd). No live services were identified during the clearance works with the exception of the known high voltage electricity cable within the access track leading to/from the electricity sub-station.

4.2.2 Ecology Survey and Vegetation Clearance

While not accounted for within the proposed scope of works presented in Atkins' offer of services (Ref. 1), in order to gain reasonable access to undertake the intrusive works, and provide suitable protection to potentially sensitive ecology present on the site, an ecology survey, followed by

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vegetation clearance under a watching brief by a specialist ecologist, was required (see Appendix A.1, photographs 10 and 11).

An ecology survey was undertaken on 2 June 2011 with the observations made presented in Section 4.3.1. Subsequently, vegetation clearance was undertaken between 8th and 10th June 2011 by Homegrown Timber Ltd under an ecology watching brief. Areas where proposed site investigation locations were located were cleared of vegetation to ground level to create safe working areas. Where nesting birds were encountered, the investigation locations were moved.

On completion, approximately 50 % of the site was clear of vegetation. Remaining areas of dense vegetation are shown on the hazard plan presented as Figure 3. Further vegetation clearance may be required to remove constraints associated with access should further site investigation, remediation or development of the land be undertaken. [redacted]

4.2.3 Hand Dug/Augered Pits

A total of five hand dug/augered pits were progressed to a maximum depth of 1.3 m bgl, and installed as vapour monitoring wells (VP200 to VP204). The locations were positioned to enable the collection of soil and leachate samples [redacted].

The narrow diameter vapour wells were installed in accordance with current good practice guidance to allow vapour monitoring and sampling. Each well comprised a narrow diameter (< 5 mm) HDPE tube, air filter block and sampling tap. The annulus between the well material and borehole was filled using washed quartz sand around the filter block, and bentonite flakes to provide a seal over the plain pipe sections (installation details presented on the borehole logs included in Appendix A.3).

The permanent vapour wells were installed prior to the trial pitting, during which visual and olfactory evidence of hydrocarbon contamination was identified in the northern and north eastern areas of the site. In order to obtain vapour data from areas considered representative of those more contaminated conditions, one vapour sample per sampling round was taken in the vicinity of TP111 using an AMS Inc. vapour sampling probe system and „retract-a-tip". This vapour sampling methodology comprises the progression of a stainless steel temporary probe to the required sampling depth using a slide hammer. Once at the required depth, the probe is withdrawn approximately 1.5 cm to expose a sampling screen, and is then purged and sampled in-situ.

4.2.4 Trial Pits

A total of 15 trial pits were excavated under the full time supervision of Atkins across the site to a maximum depth of 2.7 m and positioned to enable the collection of soil and leachate samples from across the site, target specific historical structures and delineate the tarry residues identified in the vicinity of TP5 during Atkins" 2000 site investigation.

4.2.5 Borehole

Using a hollow stem auger drilling technique, five boreholes (BH101 through BH105) were progressed by Geotechnical Engineering Limited under the full time supervision of Atkins to a maximum depth of 11.0 m bgl. Each borehole was positioned to replace decommissioned historical boreholes BH1 through BH5, drilled during Atkins" 2000 site investigation.

Each borehole location was installed with a 50 mm HDPE monitoring well standpipe to enable subsequent collection of groundwater samples from the Chalk (installation details are presented on the borehole logs in Appendix A.3). Each well was completed with 5 mm gravel (within the response zone) and sealed with bentonite. Headworks for each monitoring location were completed using a traffic rated flush mounted cover.

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Due to visual evidence of hydrocarbon contamination within the Alluvium at BH101, dual groundwater monitoring well installations were installed within the Alluvium (BH101S) and Chalk (BH101D) at this location to prevent creating a pathway to the underlying Chalk (though it should be noted that visual and olfactory evidence of hydrocarbon contamination was also noted within the Chalk during drilling).

4.2.6 Sampling and Monitoring

4.2.6.1 Soil and Leachate Sampling

Appropriate soil sampling and geological description (in line with current good practice) was undertaken at each investigation location. Sampling was informed by visual and olfactory indicators of contamination, and in-situ headspace screening of soils for volatile organic compounds (VOC) using a photo ionisation detector (PID). Sampling of soils was generally undertaken at the following rate:

- one sample within the top 1 m at each location; and
- one further sample above the saturated zone.

Sample selection was designed to ensure a suitable spread of data, both laterally and vertically which also included samples from the deeper (natural) strata.

A total of 35 soil samples were scheduled for the following analysis in line with the NGPH soils analytical suite:

- asbestos screen and identification, loss on ignition, moisture and stone content;
- inorganic parameters: pH, soil organic matter (SOM), total sulphate, sulphur, phenols, total, free and complex cyanide, thiocyanate, ammonium, chloride, boron;
- metals: arsenic, chromium, copper, lead, selenium, zinc, cadmium, mercury and nickel;
- polycyclic aromatic hydrocarbons (PAHs);
- benzene, toluene, ethylbenzene and xylene (BTEX); and
- total petroleum hydrocarbon (TPH) criteria working group (CWG) banding with aliphatic/aromatic split.

Analysis was undertaken by i2 Analytical (i2), the results of which are presented in Appendix E.1.

In addition, seven samples were scheduled for soil-derived leachate analysis (as per the groundwater analysis suite presented below), with the results presented in Appendix E.2.

4.2.6.2 Groundwater and Surface Water Monitoring and Sampling

Groundwater monitoring and sampling was undertaken on 7 and 15 July 2011. The groundwater samples were scheduled for analysis by i2 of the following:

- inorganic parameters: pH, total organic carbon (TOC), suspended solids, conductivity, total sulphate, sulphide, phenols, total, free and complex cyanide, thiocyanate, ammonium, chloride;
- metals: arsenic, chromium, copper, iron, lead, selenium, zinc, cadmium, mercury and nickel;
- PAHs;
- BTEX; and
- TPH CWG.

Groundwater analytical results are presented in Appendix E.3.

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One surface water sample was obtained on 13 June 2011 from the surface water drainage ditch located to the north east of the site. The sample was taken down-stream of the site and to the north of the sluice gate where two drainage ditches converge and join the River Arun. The sample was analysed for the same suite as the groundwater samples, with the results presented in Appendix E.4.

Aquifer permeability testing was also undertaken at BH101D, BH102 and BH103 (all installed within the Chalk Aquifer) and continuous groundwater elevation monitoring was undertaken at BH101D, BH104 and BH105 to determine the impact of tidal variation in the River Arun on the groundwater elevation beneath the site. [redacted]

4.2.6.3 Soil Vapour Monitoring

Soil vapour samples were collected from four of the five permanent vapour well locations (VP200, VP202, VP203 and VP204) on 7 and 15 July 2011. In addition, samples were taken adjacent to TP111 using the temporary AMS vapour probe (and labelled VP201-temp). Sampling was not possible from the permanent well installation at VP201 due to water saturation of the filter block at the time of sampling.

Prior to sampling, the well volume was purged using a gas syringe. A low flow air sampling pump was used to draw a fixed volume of gas through atomic thermal desorption (ATD) tubes, pre-prepared by Chemex Limited (a UKAS accredited laboratory) with „Tenax" sorbant. The tubes were submitted for thermal desorption-mass spectrometry analysis of the following:

- VOCs including naphthalene, tentatively identified compounds (TICs) and speciated aliphatic and aromatic petroleum hydrocarbons in accordance with the CWG fractionations.

Appendix E.5 presents the analytical results for the vapour samples.

4.2.6.4 Quality Assurance/Quality Control

Trip and Field Blanks

Field and trip blank water samples were taken during the second groundwater sampling round (15 July 2011). Trip blank vapour samples were taken during both sampling rounds and an ambient air sample was taken during the second vapour sampling round (15 July 2011). The field and trip blanks were analysed as control samples to identify any cross-contamination in the field. The ambient air sample was analysed to identify any background concentrations of volatile constituents. Analytical results are included within Appendix E.

Schewart Charts

In order to check the laboratory QA/QC procedures, Schewart charts have been requested from i2 and will be reviewed and discussed within the final version of this report.

4.3 Physical Investigation Findings

Appendix A.1 presents a selection of photographs taken during the 2011 site works.

4.3.1 Ecology

4.3.1.1 Birds

During the walkover survey, evidence of breeding birds was observed across the site. This included singing birds including dunnocks, common whitethroats, a chaffinch and a sighting of a recently fledged song thrush. [redacted]

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4.3.1.2 Reptiles

The River Arun is located to the southeast of the site and has a bank consisting of a 10 m wide strip of dense ruderals. This bank has high/medium potential for reptiles. The bank and river are separated from the site by approximately 20 m of a short-grazed grass field, but the habitats are connected [redacted]. The site itself is of low suitability for reptiles as it consists of buddleia with little or no ground vegetation, or extremely dense scrub. However, there is an area in the west of the site that is more open, contains low ruderals [redacted].

4.3.1.3 Great Crested Newts

Busy roads to the north and east, and a river to the south form barriers to the movement of great crested newts (GCNs) on to the site. There are houses present to the east. No ecological desk study has been carried out and therefore it is not possible to confirm whether there are ponds within 500 m of the site or whether there are GCNs present in the surrounding area. [redacted]

4.3.1.4 Badgers

No evidence of badgers was recorded during the walkover survey. However a raised area of ground, marked as a spoil heap on Figure 2, could not be inspected due to the dense scrub that covers it. A large proportion of the site appeared to be covered by a layer of dense stones and no clear animal signs or tracks were recorded during the walkover. [redacted]

4.3.1.5 Other Legally Protected or Notable Species

There was no evidence of any other legally protected or notable species, however no ecological desk study has been undertaken and parts of the site were inaccessible due to the dense vegetation so findings are limited.

4.3.2 Site Specific Geology

Appendix A.3 provides the intrusive logs from the 2011 site investigation, with a summary of the findings presented below.

4.3.2.1 Made Ground

Made Ground was identified at all locations across the site at thicknesses ranging between 0.5 m (BH102 and TP104) and 2.7 m (BH101). The base of the Made Ground was not proven at TP108B (>2.5 m), TP111 (>2.3 m), VP202 (>1.0 m), VP203C (>1.2 m) or VP204 (>1.3 m).

The composition of the Made Ground was variable across the site, but generally comprised firm, sandy, gravelly clay and fine to medium, gravelly, clayey sand with frequent brick, chalk and flint gravels and fragments of clinker. The concrete bases of two former gas holders were identified in: TP106 at between 0.95 m bgl to 1.1 m bgl (feature 8, Figure 2) (see Appendix A.1, photograph 16); and TP114 at between 0.55 m bgl to 0.85 m bgl (feature 15, Figure 2) (see Appendix A.1, photographs 23 and 24). Other obstructions encountered are as follows (marked on the constraints and hazard plan presented as Figure 3):

- TP101 – a brick wall was identified at 0.3 m bgl in the northern portion of the pit, with a concrete base at 0.8 m bgl;
- TP103 – a brick wall and concrete base were identified at approximately 0.5 m bgl (see Appendix A.1, photograph 15);
- TP104 – a series of electricity cables (previously identified as redundant during Atkins' 2000 investigation) were encountered at approximately 0.4 m bgl;

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- TP107 – a possible brick wall was encountered at the southern extent of the pit;
- TP108 – three cast iron pipes were encountered crossing the pit. Two at 0.8 m bgl and one at 1.2 m bgl (see Appendix A.1, photograph 17);
- TP109 – a brick wall was identified at 0.3 m bgl in the northern portion of the pit, with a concrete base at 0.8 m bgl (see Appendix A.1, photograph 20);
- TP111 – a cast iron pipe was located at the southern extent of the pit at approximately 0.5 m bgl; and
- TP115 – three cast iron pipes located in an initial trial hole dug adjacent to the edge of the former governor compound at approximately 0.4 m bgl. The trial pit was relocated to the centre of the former governor compound.

4.3.2.2 Natural Ground

Where natural ground was encountered, this comprised Alluvium of stiff, very gravelly clay or fine to coarse sub-rounded to angular flint gravels in a stiff clay matrix ranging between 0.7 m (BH101) to 5.1 m (BH103) thickness, overlying Chalk. The Chalk was found to be structureless fine Chalk gravels and chalk cobbles in a soft off-white/grey clay matrix. The top of the Chalk was generally encountered between 5.1 m (BH102) and 6.8 m (BH104) bgl. However, Chalk was encountered at 3.4 m bgl at BH101.

4.3.3 Indications of Potential Contamination (Visual and Olfactory Observations)

A number of visual and olfactory indicators of potential contamination were identified in the Made Ground, Alluvium and Chalk during drilling. In addition, preliminary screening for VOC vapours present within the shallow unsaturated soils was undertaken using a PID (MiniRAE 2000 VOC detector), capable of measuring VOC concentrations in parts per million (ppm). The results of the PID screening provide an initial indication of the presence of volatile compounds within the soil profile; however, this method is non-selective and does not identify specific compounds. PID screening helps to ascertain where volatile compounds may be expected to be identified during soil laboratory analysis. PID readings greater than 10 ppm are presented in Table 4.1.

Table 4.1 details visual and olfactory observations made during the intrusive works and the maximum positive PID readings identified at these depths.

Table 4.1 - Visual and Olfactory Observations and PID Readings

Location	Strata	Depth (m bgl)	Visual/Olfactory Observation	Max VOCs (ppm)
BH101	MG	0.0-1.2	Clinker.	-
	ALV	1.5-2.7	Black mottling and occasional pockets of saturated black tar. Faint hydrocarbon odour from 1.5-1.8 m bgl. Strong hydrocarbon odour from 1.8-2.7 m bgl.	-
	ALV	2.8-3.4	Dark grey/black clay and gravels with strong hydrocarbon odour and saturated with free product (see Appendix A.1, photograph 25).	-
	CHK	3.4-7.5	Pockets of free phase product and black mottling with a moderate to slight hydrocarbon odour (see Appendix A.1, photographs 26 and 27).	-
	CHK	7.5-11.0	Slight hydrocarbon odour.	-
BH103	MG	0.0-0.5	Clinker.	-

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Location	Strata	Depth (m bgl)	Visual/Olfactory Observation	Max VOCs (ppm)
BH105	MG	0.3-2.0	Clinker.	-
BH104	MG	0.0-1.8	Clinker.	-
	MG	3.5-3.65	Faint hydrocarbon odour.	-
TP101	MG	0.0-0.4	Clinker.	0.1
	MG	0.4-0.6	Black ash and clinker.	0.1
	MG	0.6-0.9	Occasional clinker.	-
TP102	MG	0.0-0.3	Clinker.	-
TP103	MG	0.0-0.8	Clinker.	0.2
TP104	MG	0.0-0.5	Occasional clinker.	<0.1
TP105	MG	0.9-1.3	Clinker gravels and black ash.	0.1
TP106	MG	0.0-0.95	Clinker.	0.3
TP108A	MG	0.0-1.2	Clinker.	0.2
TP108B	MG	0.9-2.5	Occasional clinker. Slight hydrocarbon odour from 1.4-1.9 m bgl. Strong hydrocarbon odour from 1.9-2.5 m bgl. Black, hydrocarbon saturated soil from 1.9 m bgl (see Appendix A.1, photographs 18 and 19).	0.6
TP109A	MG	0.0-0.8	Clinker. Black stained flints and faint hydrocarbon odour from 0.4-0.8 m bgl (see Appendix A.1, photograph 20).	1.9
TP109B	MG	0.0-1.6	Clinker.	0.0
TP110	MG	0.2-0.5	Clinker.	0.2
TP111	MG	0.2-1.1	Clinker and solidified tar fragments.	0.7
	MG/ ALV	1.1-2.0	Clinker and saturated tarry soils. Moderate tar odour from 1.3 m bgl. Strong tar odour from 1.4 m bgl. Slight hydrocarbon/tar odour and occasional black staining from 1.6-2.0 m bgl.	12.7
TP112	MG	0.0-0.2	Clinker.	-
	MG	0.7-0.75	Band of black solidified tar and clinker.	-
TP113	MG	0.0-1.0	Clinker.	2.4
	ALV	1.25-2.3	Pockets of hydrocarbon saturated tarry clay. Strong hydrocarbon/tarry odour (see Appendix A.1, photographs 21 and 22).	18.2
TP115	MG	0.9-2.0	Clinker.	0.1
VP200A	MG	0.0-0.3	Solidified tar.	-
VP201	MG	0.0-0.25	Clinker.	-
VP202	MG	0.0-1.0	Clinker.	0.2
VP203C	MG	0.1-0.6	Clinker.	0.2
VP204	MG	0.0-0.3	Clinker.	0.2
	MG	0.85-1.3	Fragments of solidified tar.	0.6

Notes: "-" PID reading not taken; MG – Made Ground; ALV – Alluvium; CHK - Chalk

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[redacted] Due to constraints encountered during the recent site investigation works associated with vegetation, nesting birds and underground pipe work (identified in TP108 and TP111), it was not possible to extend the trial pit locations in order to fully delineate this potential source area.

No evidence of asbestos was visually identified during the recent or previous site investigations and asbestos has not been positively identified within any of the soil samples submitted for analysis.

4.3.4 Perched Water/Groundwater

Water was identified in three trial pit locations (TP102, TP106 and TP112) during the recent works at depths ranging between 1.30 and 2.65 m bgl [redacted]

One set of groundwater levels measured at high tide (at 00:34 on 15 July 2011) and one at low tide (at 19:24 on 17 July 2011) are presented in Table 4.2. [redacted] The tidal monitoring undertaken between 7 and 15 July 2011 also indicates that there is significant tidal variation in the groundwater level at the site (up to approximately 2 m variance).

Table 4.2 - Groundwater Monitoring at High and Low Tide

Location	Groundwater Level at High Tide (Metres Above Ordnance Datum (m aOD))	Groundwater Level at Low Tide (m aOD))
BH101	1.937	0.363
BH104	2.003	-0.034
BH105	2.078	0.030

4.4 Health, Safety and Environmental Incidents

All sub-contractors working on site were given a full site induction by the Atkins Lead Engineer prior to commencing works. In addition a site log of health, safety or environmental incidents was maintained throughout the duration of the works.

There were no reportable health, safety or environmental incidents during the works. Additional hazards and constraints identified during the site investigation works were added to the hazards and constraints plan, presented as Figure 3.

4.5 Laboratory Analysis

Laboratory analytical results are presented in Appendix E and summarised within Sections 5 and 6.

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4.5.1 QA/QC

4.5.1.1 Field and Trip Blanks

Groundwater

Field and trip blank water samples were analysed for the 15 July 2011 sampling round. Table 4.3 presents the concentrations identified above the MDL.

Table 4.3 - Concentrations above the MDL in Field and Trip Blank Samples

Analyte	MDL (mg/l)	15 July 2011 Concentrations (mg/l)	
		Field Blank	Trip Blank
Sulphate	0.045	1.9	1.3
Ammonium	0.015	1.3	0.47
Chromium	0.0004	0.001	0.0007
Copper	0.0007	0.0011	0.0011
Nickel	0.0003	0.0011	0.0011

[redacted]

The field blank was taken by decanting a distilled water sample supplied by the laboratory into clean, unused sample jars whilst in the field. Correct sampling procedure was followed [redacted]

Vapour

Trip blank vapour samples (labelled Trip Blank) were analysed for each sampling round. As shown in Appendix E.5, a concentration above the MDL for toluene was identified in the trip blank sample during the 7 July sampling round (20 ng/tube).

[redacted]

The trip blanks remained sealed and within their packaging for the duration of the sampling [redacted]

[redacted]

4.5.1.2 Schewart Charts

Schewart charts have been requested from i2 [redacted]

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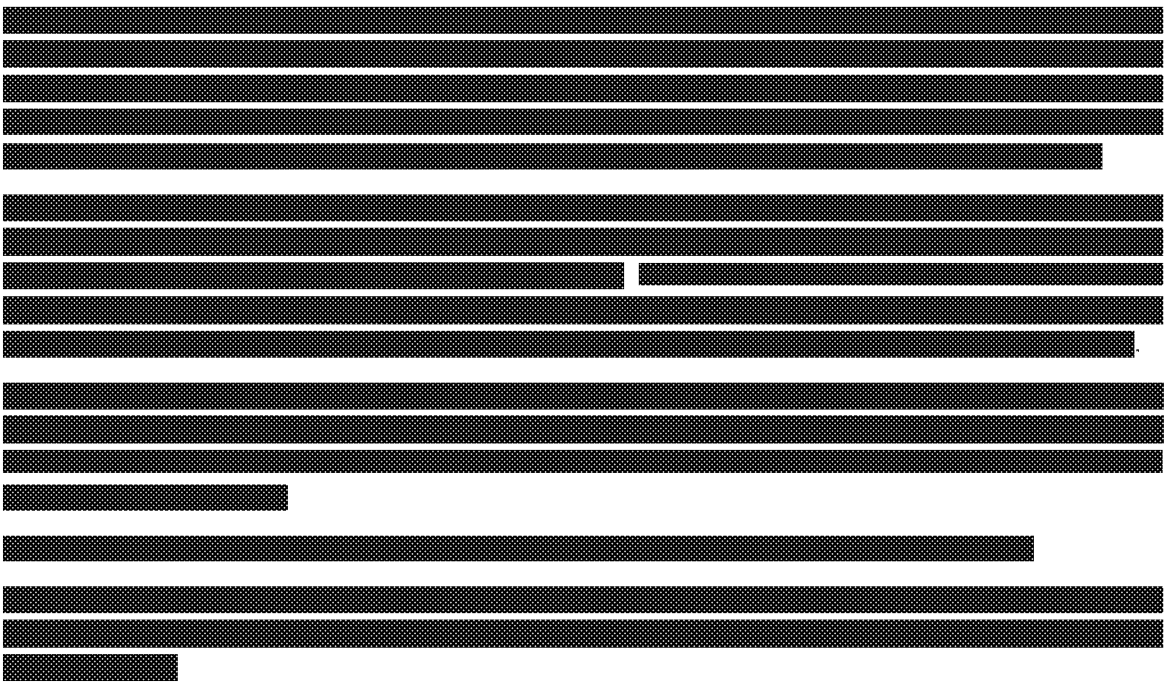
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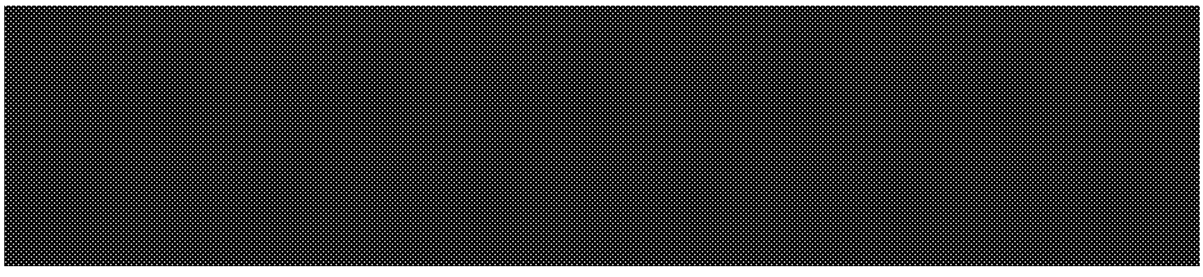
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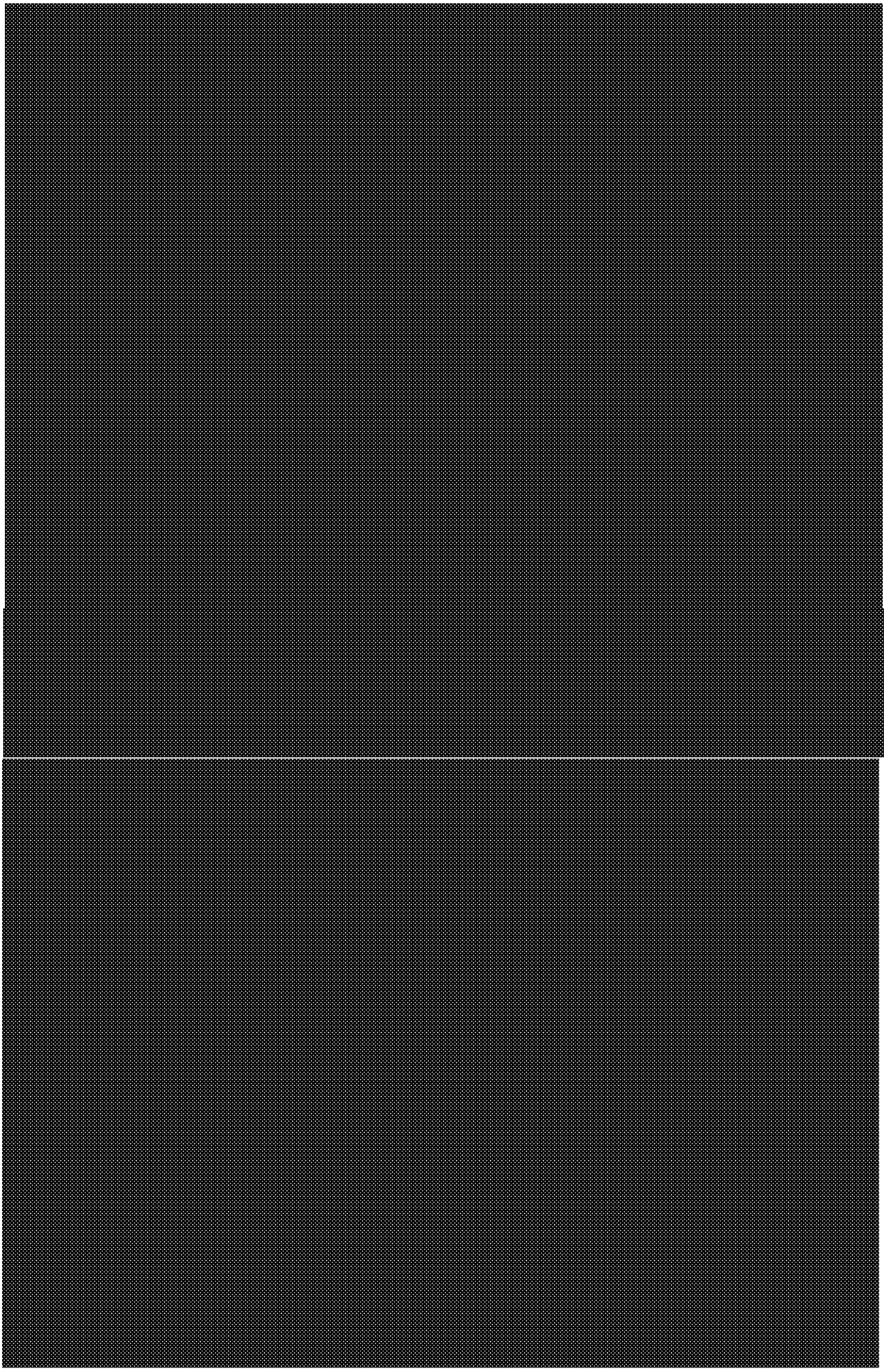
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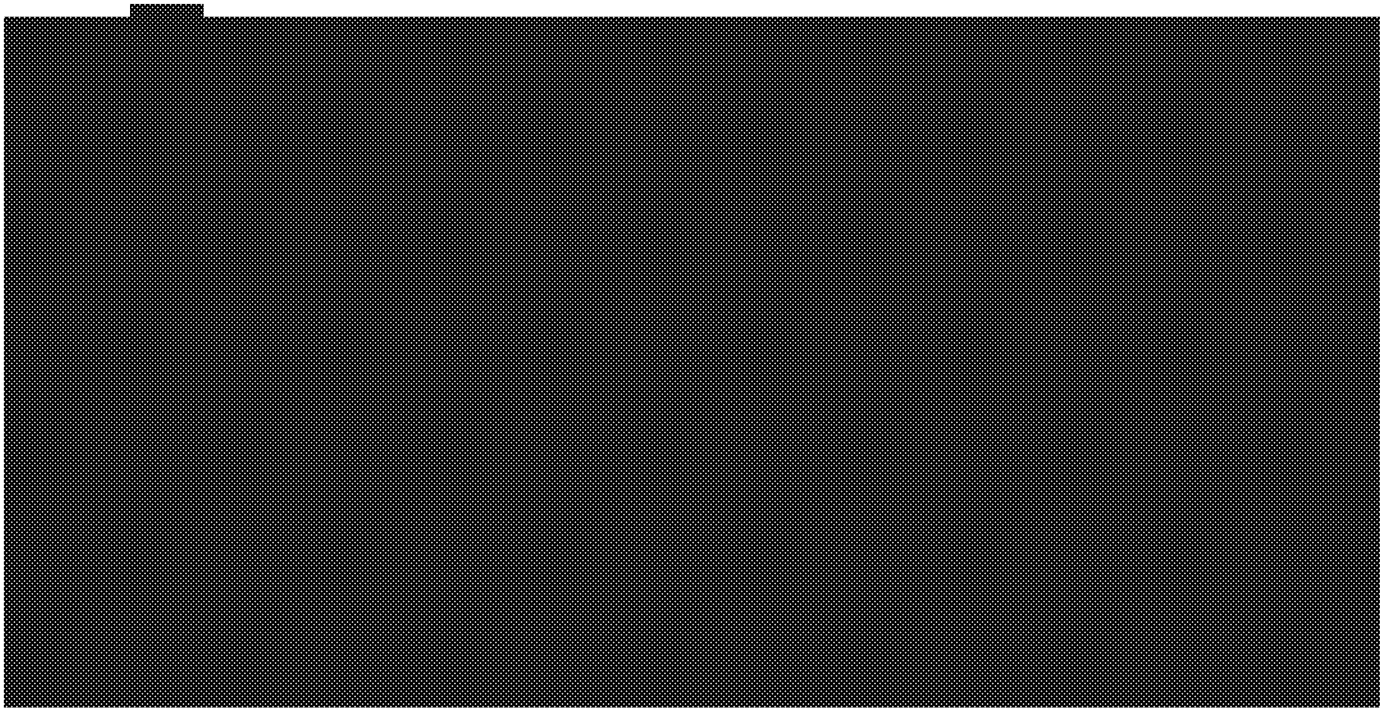


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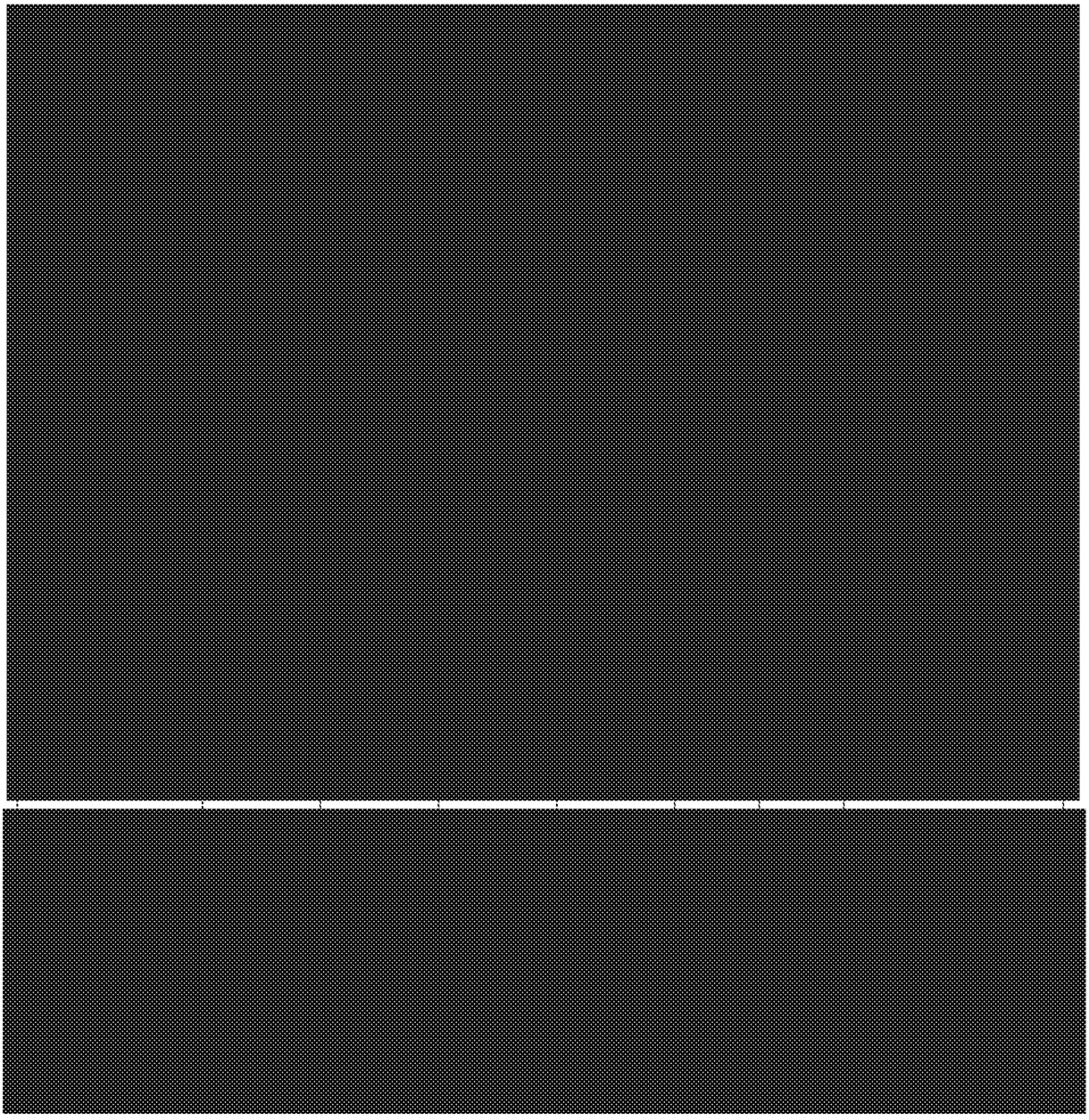
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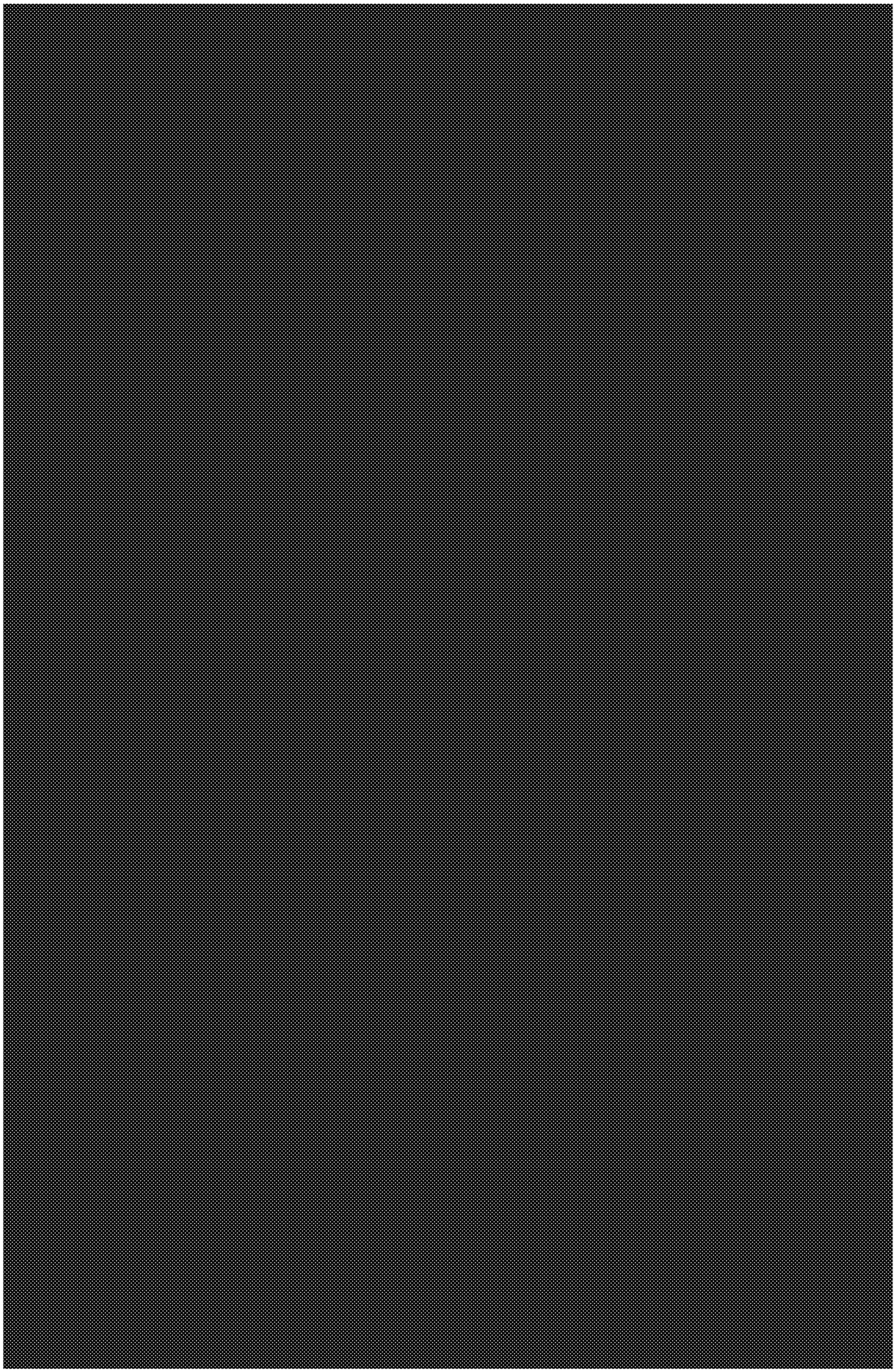
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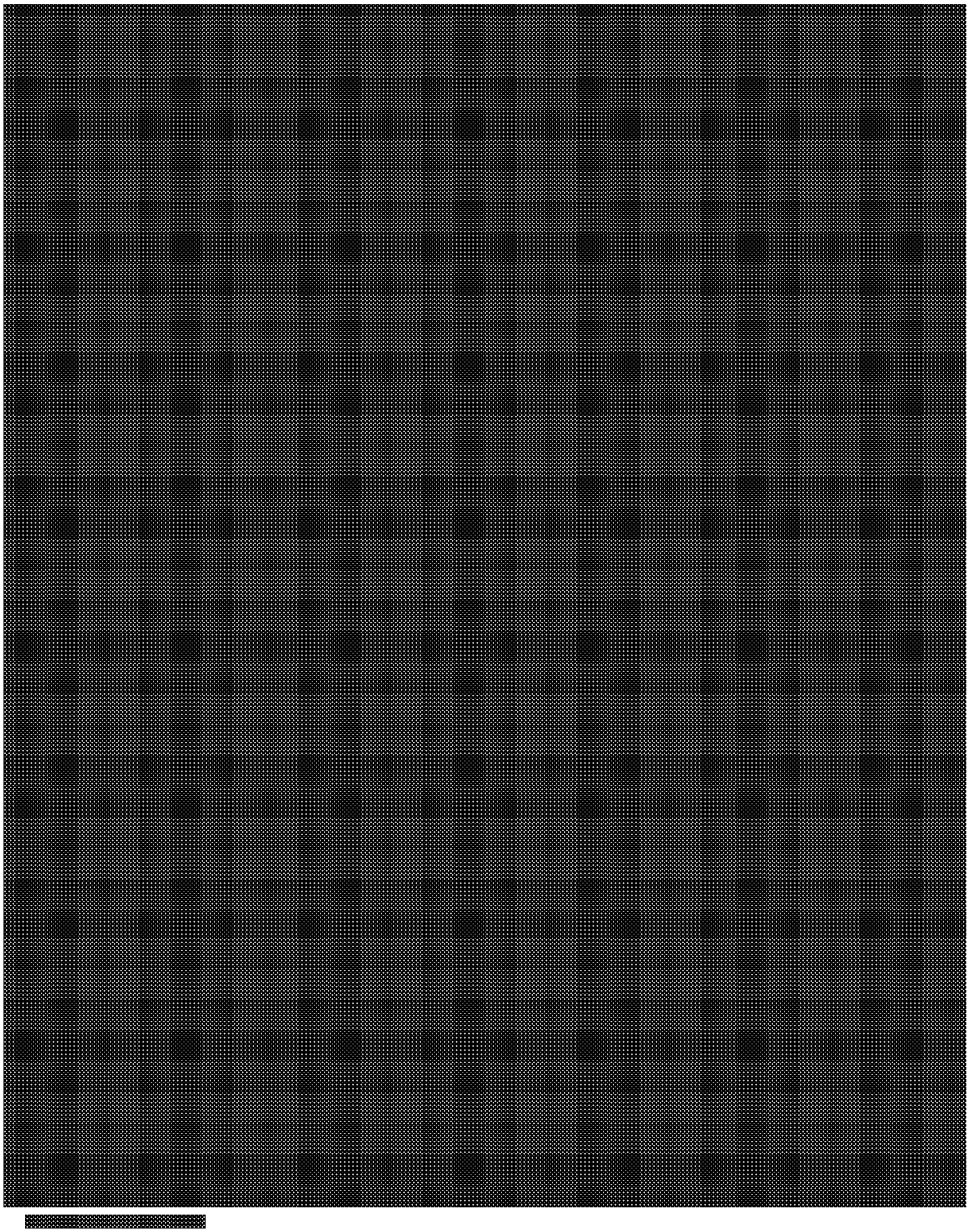
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EXHIBIT





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8.1.2

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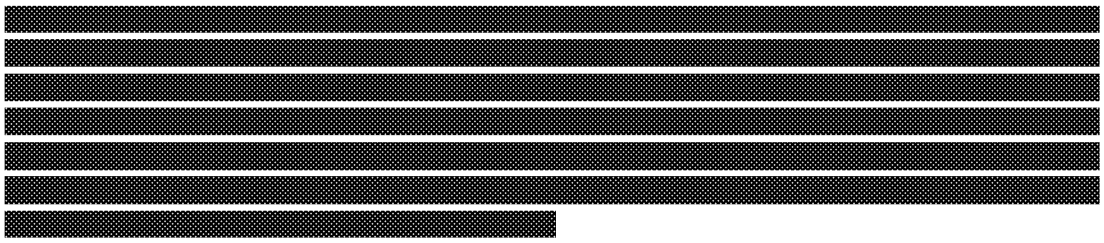
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9. References

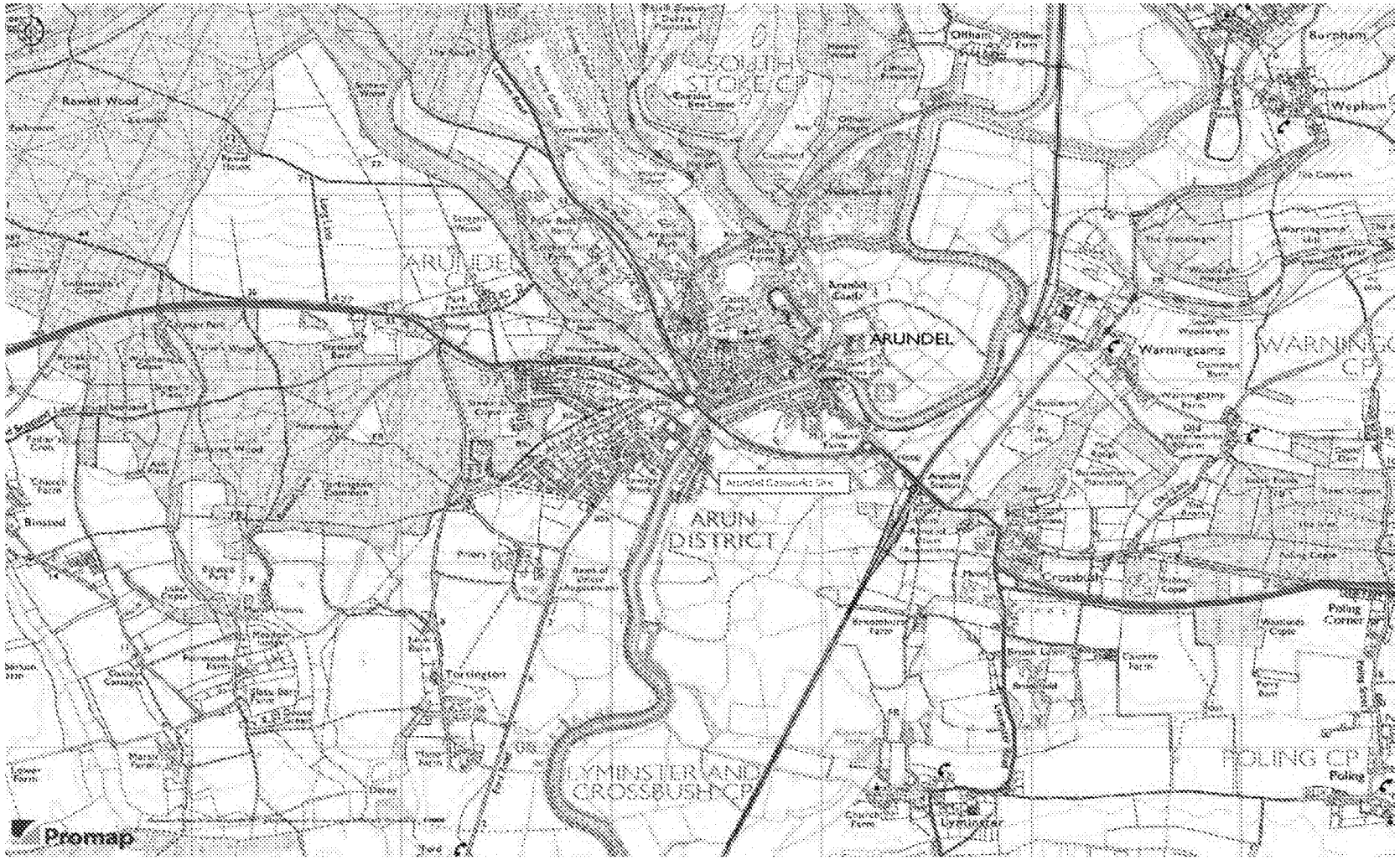
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Figures

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REVISIONS	Drawn by	Checked by	Date

PURPOSE OF ISSUE	Rev.	Authorised for issue	Date
SI & GQRA Report	Rev 0	MW	3/6/11

Atkins Limited
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Birmingham, West Midlands B1 1TF
Tel 0121 483 5000
Fax 0121 483 5252

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CLIENT
National Grid Property Holdings Limited

PROJECT
Ford Road, Arundel
Land Contamination Site Investigation and GQRA

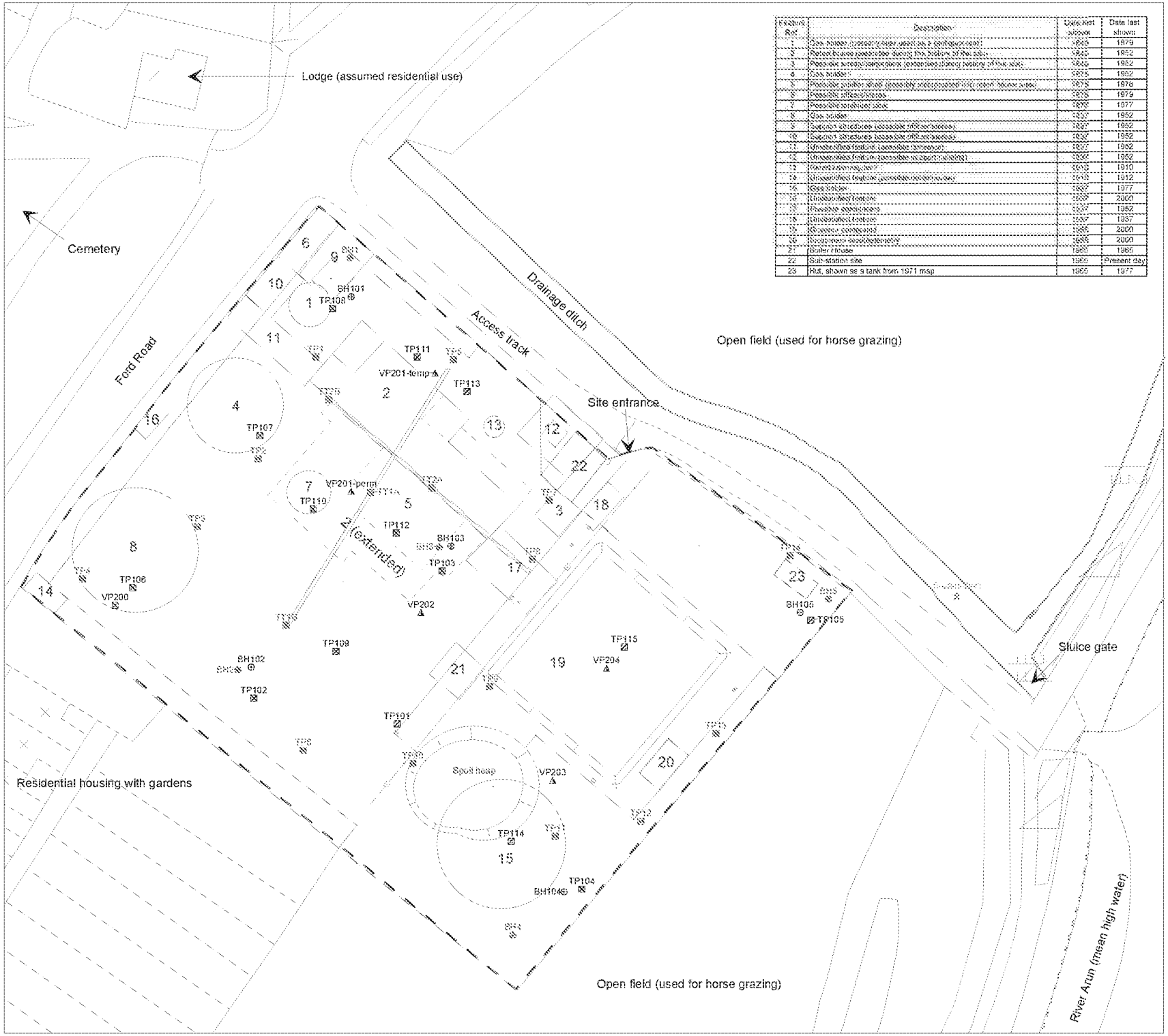
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Site Location Plan

SCALES	DRAWN	CHECKED	CO-ORD CHECK
NTS	LH	ST	-
	DATE 03/06/2011	DATE 03/06/2011	DATE -
0		SHEET A3	PLOT DATE

DRAWING NO
Figure 1

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1

ARUN DISTRICT COUNCIL AB/88/19/PL



Feature Ref	Description	Date first shown	Date last shown
1	Gas holder (possibly later used as a storage shed)	1945	1979
2	Petrol filling station (on during the history of the site)	1945	1952
3	Possible service compound connected (being nearby of the site)	1945	1952
4	Gas holder	1945	1952
5	Possible public shed (possibly incorporated into other nearby site)	1975	1976
6	Possible offices/stores	1975	1979
7	Possible transformer house	1975	1977
8	Gas holder	1937	1952
9	Suspected structures (possible offices/stores)	1937	1952
10	Suspected structures (possible offices/stores)	1937	1952
11	Unidentified feature (possible conveyor)	1937	1952
12	Unidentified feature (possible conveyor/ramp)	1937	1952
13	Gravel pit/quarry	1910	1910
14	Unidentified feature (possible coal/ash dump)	1910	1912
15	Gas holder	1937	1977
16	Unidentified feature	1937	2000
17	Possible conveyors	1937	1952
18	Unidentified feature	1937	1937
19	Service compound	1945	2000
20	Equipment store/workshop	1945	2000
21	Boiler house	1960	1965
22	Sub-station site	1960	Present day
23	Hut, shown as a tank from 1971 map	1965	1977

ATKINS
ATKINS CONSULTANTS Ltd.
WOODCOTE GROVE
ASHLEY ROAD
EPSOM
KT18 5BW
Tel: 01372 726140
Fax: 01372 740055

LEGEND

- 2000 Atkins Borehole Location
- 2000 Atkins Trial Pit Location
- 2000 Trial Trench Location
- 2011 Atkins Borehole Location
- 2011 Atkins Trial Pit Location
- 2011 Vapour Well Location
- Surface Water Sample Location

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PROJECT

Ford Road, Arundel

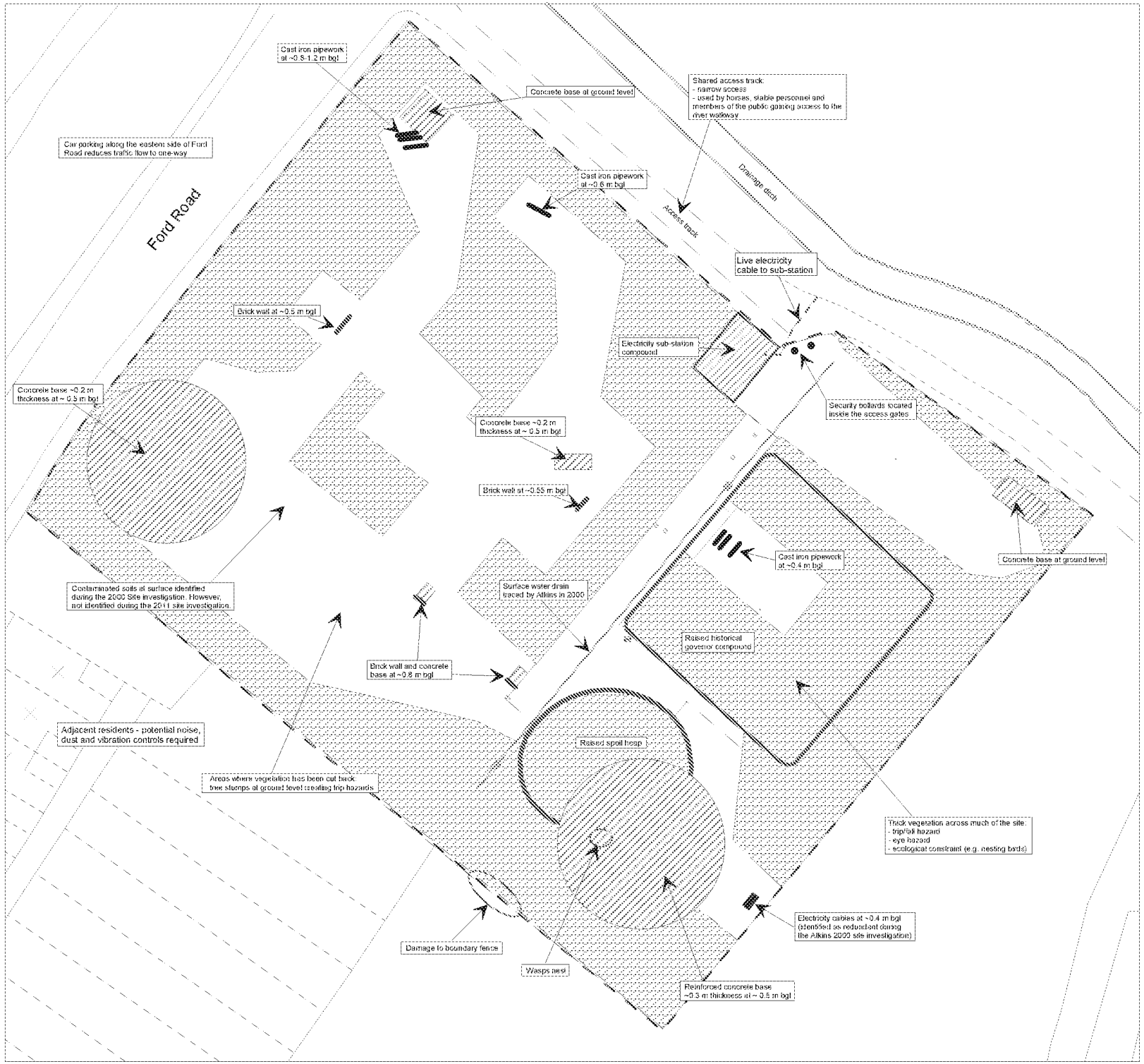
Land Contamination Site Investigation and Generic Quantitative Risk Assessment

TITLE

Site Layout Plan, Including Historical Features and Site Investigation Locations

FIGURE 2

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ATKINS CONSULTANTS Ltd.
WOODCOTE GROVE
ASHLEY ROAD
EPSOM
KT18 5BW
Tel: 01372 726140
Fax: 01372 740055

LEGEND

Approximate areas of dense vegetation

Note: Location of pipework, electricity cables and brick walls is approximate

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Ford Road, Arundel

Land Contamination Site Investigation and Generic Quantitative Risk Assessment

TITLE

Site Constraints and Hazards Plan

FIGURE 3

Photograph 1: Access track located off Ford Road



Photograph 2: North western boundary of the site along Ford Road

