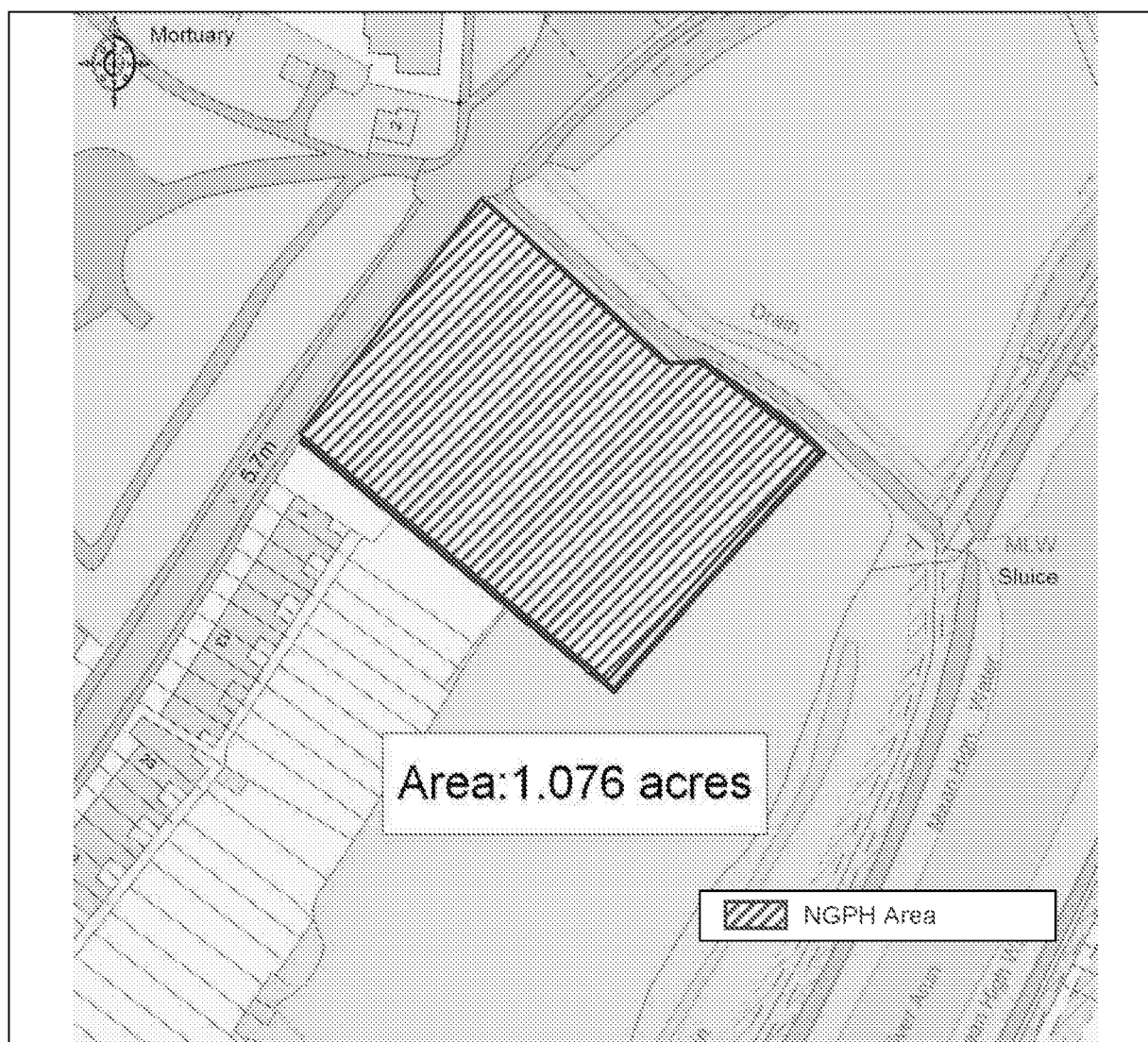


Ford Road, Arundel

Site Information

National Grid Property Holdings

July 2019



Site Address	Ford Road, Arundel, West Sussex, BN18 9DX	NGP Document Tracking code	
Report Title	Ford Road, Arundel – Site Information		
Report Type	Site Information	Retention Period	Indefinitely
Site Code	2551	Author (Company)	Atkins
Report Date	July 2019	Factual/Interpretative	Factual
Draft/Final	Final	H&S File?	No
Work Stage*	Remediation		
Brief description of contents	Site Information for site wide Design & Build remediation		
Access Permitted	NGPH Land Regeneration Team	NGPH Contact	Gareth Taylor eAOC Nicola Carver

Notice

This document and its contents have been prepared and are intended solely as information for National Grid Property Holdings and use in relation to Site Information

Atkins Limited assumes no responsibility to any third party, other than those identified in the Offer of services dated 29 November 2018, in connection with this document and/or its contents unless approved by collateral warranty at the request of National Grid Property Holdings in accordance with Atkins' 2017-19 Framework agreement. Copying of this report without the permission of National Grid Property Holdings Limited and/or Atkins is not permitted.

This document has 16 pages including the cover.

Document history

Revision	Purpose description	Origin- ated	Checked	Reviewed	Authorised	Date
Rev 1.0	Draft	AW	MAB	RC	JS	13/06/2017
Rev 2.0	Final	AW	MAB	SW	JS	14/07/2017
Rev 3.0	Final Revised	AW	MAB	SW	JS	16/08/2017
Rev 4.0	Final Updated	AW / NM	MAB / SW	SW / LB	JS / SW	24/07/2019

Client signoff

Client	National Grid Property Holdings
Project	Ford Road, Arundel
Job number	5156428
Client signature / date	

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3. Site Information	7
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Appendix B.	Previous Factual Reports
Appendix C.	Topography Survey Information
Appendix D.	Utility Service Plans
Appendix E.	Tree Protection Orders

1. Introduction

Atkins Limited (Atkins) has been appointed by National Grid Property Holdings Limited (NGPH) to produce remediation Site Information (SI) for their site located on Ford Road, Arundel, West Sussex, BN18 9DX (herein referred to as 'the site'). This is required to support the tendering of Remediation Works ('the works'), as detailed within the Project Works Information (PWI) [1].

The works will be undertaken as a Site Wide Design and Build project under the Framework Agreement for the Provision of Land Remediation Contracting Services, and in accordance with the requirements of the NGPH Core Specification [2].

This document should be read in conjunction with the PWI [1] which specifies the requirements for the works.

For the avoidance of doubt, the site boundary is as delimited by the blue line title boundary on the NGPH provided Promap drawing included in Appendix A.

2. Site Details

A summary of relevant site details is provided within Table 2-1 below.

Table 2-1 Summary of Site Details

Site Address	Ford Road, Arundel, West Sussex, BN18 9DX. A site location plan is provided as Figure 1.
NGPH Site Code	2551
Ordnance Survey Grid Reference	The Ordnance Survey grid reference for the centre of the site is 501308E, 106749N.
Site Access	The site can be accessed from Ford Road adjacent to the north-west of the site. The site can also be accessed from the east through single-width metal access gates off an access track which runs along the northern-eastern site boundary between the access gates and Ford Road.
Site Use and Description	The site is an approximately rectangular shaped area of land covering 0.44 hectares (ha) and owned by NGPH. The site currently comprises secure vacant land. An electricity sub-station is located on the north-eastern site boundary adjacent to the site entrance 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. There is currently no fence between the electricity substation and the adjacent access track. The site is generally level at an approximate elevation of 3 m above ordnance datum (aOD). The site is generally level with surrounding land, with the exception of residential properties to the south / south-west of the site which are raised above site level by approximately 1 m. A site layout plan is provided as Figure 2.
Site Surroundings	The surrounding land use comprises: South-west: residential houses with gardens; South-east: private grazing land with the River Arun beyond; North-west: Ford Road, beyond which is a cemetery; and North-east: 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.

Further details relating to the site are presented within Appendix A.

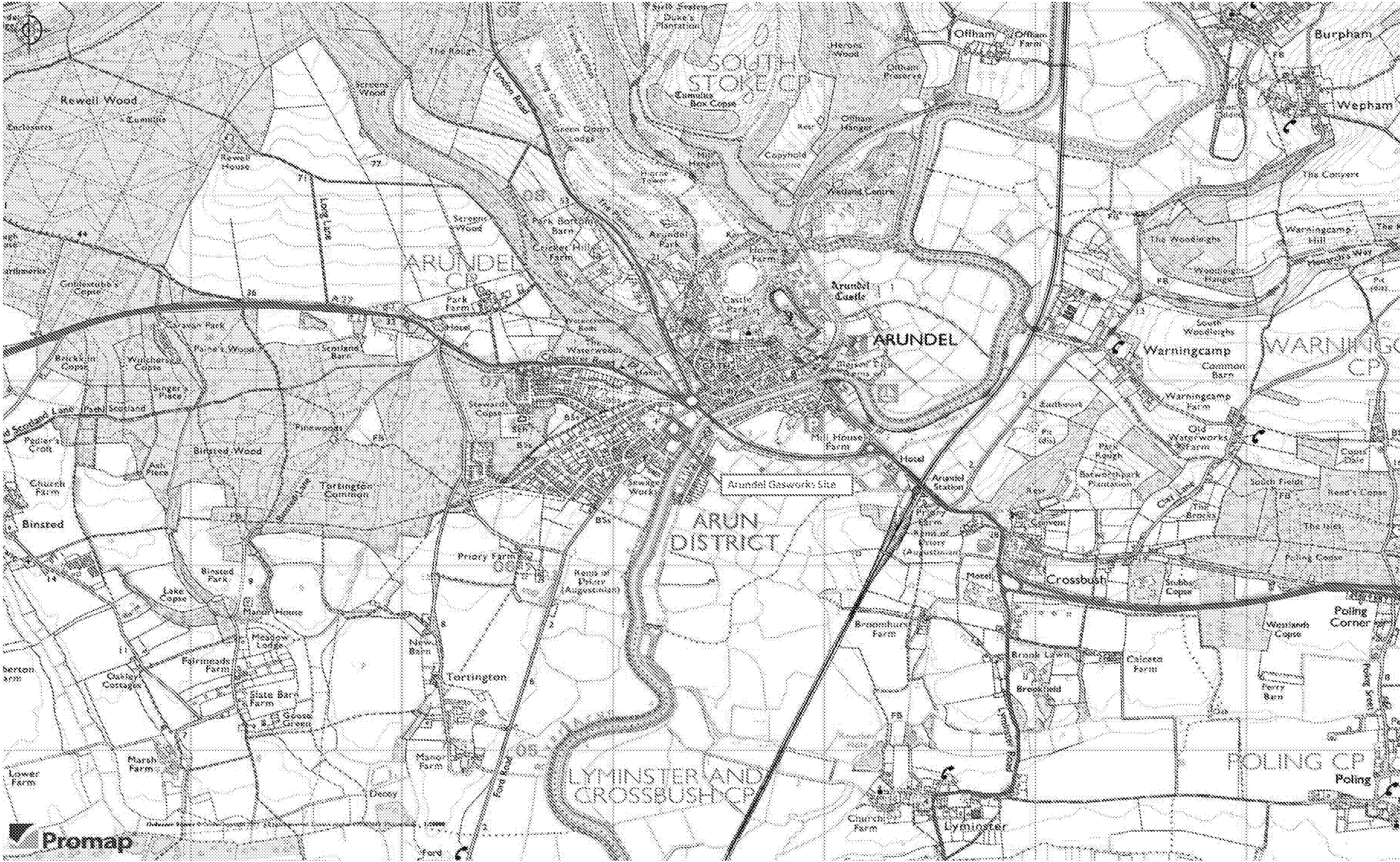
3. Site Information

Refer to Appendices A - E for Site Information.

4. References

- [1] Atkins, "Ford Road, Arundel. Project Works Information.," July 2019.
- [2] NGPH, "Assessment, Project Management and Remediation Core Specification," 2019.

Figures



REVISIONS	Drawn by	Checked by	Date

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

Atkins Limited
Consulting Engineers
The Axis, 10 Holliday Street
Birmingham, West Midlands B1 1TF
Tel 0121 483 5000
Fax 0121 483 5252

©
THIS DRAWING IS NOT TO BE SCALED

CLIENT
National Grid Property Holdings Limited

PROJECT
Ford Road, Arundel

DRAWING TITLE
Site Location Plan

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

DRAWING NO
Figure 1

REV
1



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

- 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

National Grid Property Holdings Limited

Ford Road, Arundel
Project Works Information

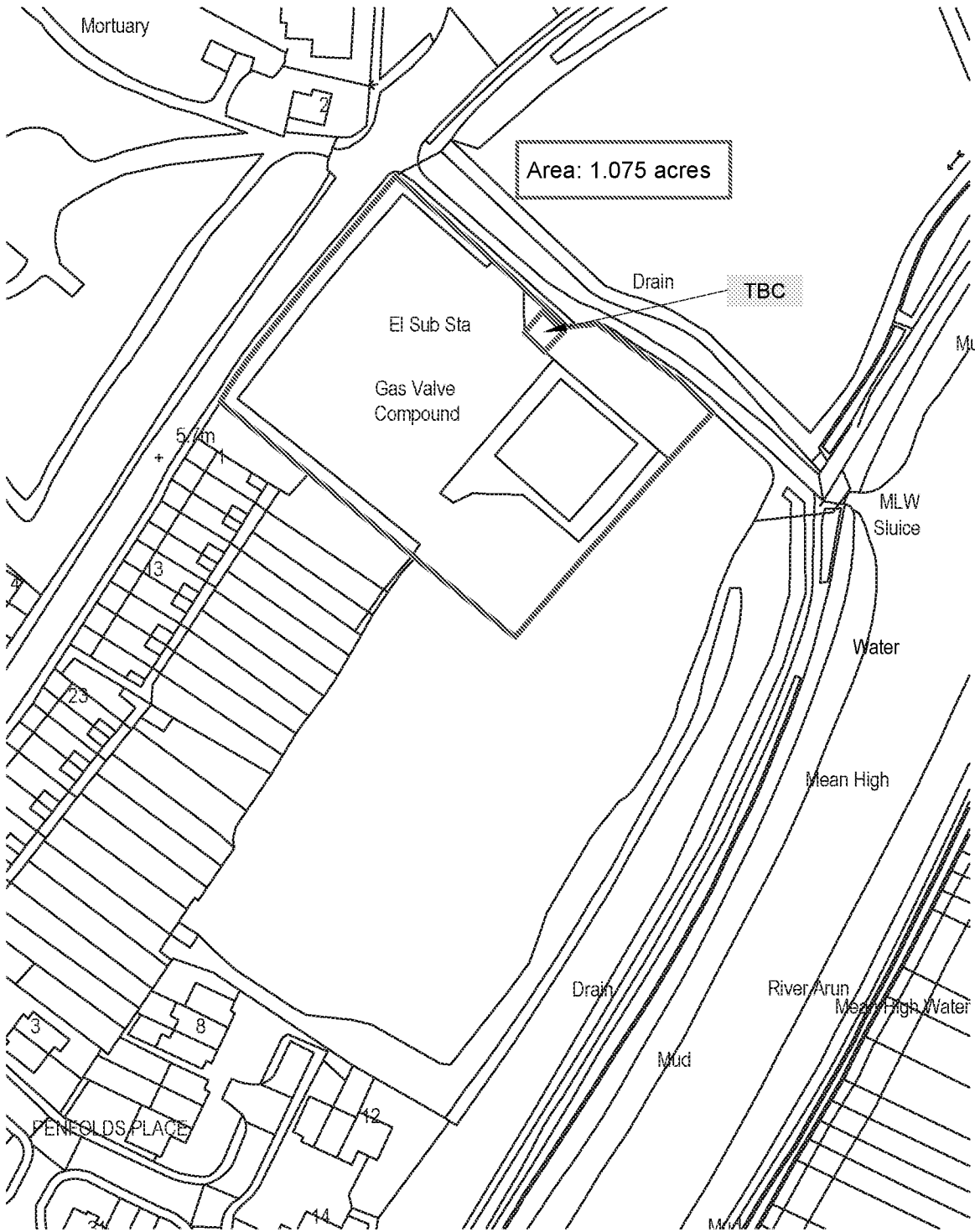
Site Layout Plan

FIGURE 2

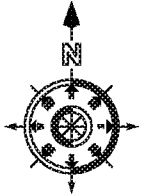
Appendices

Appendix A. Site Boundary

Drawing Title	Drawing No.	Author	Revision	Issued Date
Ford Road, Arundel. Boundary Property Access	B9990	CAPITA	V1	Not stated. Obtained from NGPH via Gatekeeper system on 23/07/2019



0 25 50 100 200
SCALE BAR 1:1250



- DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
- ALL DIMENSIONS ARE IN MILLIMETERS UNLESS STATED OTHERWISE.
- THE CONTRACTOR IS TO CHECK DRAWINGS AND TO VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK OR MAKING ANY SHOP DRAWINGS. ANY DISCREPANCIES ARE TO BE NOTIFIED TO BNP PARIBAS REAL ESTATE IMMEDIATELY.
- THIS DRAWING IS THE PROPERTY OF BNP PARIBAS REAL ESTATE. COPYRIGHT IS RESERVED BY THEM AND THE DRAWING IS ISSUED ON THE CONDITION THAT IT IS NOT COPIED, REPRODUCED, RETAINED OR DISCLOSED TO ANY UNAUTHORISED PERSON, EITHER WHOLLY OR IN PART, WITHOUT THE CONSENT IN WRITING OF BNP PARIBAS REAL ESTATE.
- ALL WORK IS TO BE CARRIED OUT IN ACCORDANCE WITH THE CURRENT BUILDING REGULATIONS AND ALL ASSOCIATED BRITISH STANDARDS.
- THIS DOCUMENT IS UNCONTROLLED WHEN PRINTED.
- BOUNDARIES, WAY LEAVES AND EASEMENTS SHOULD NOT BE RELIED UPON.

Rev	Date	Drw	Chk	Notes
A	19.01.18	HB	AK	Key Added

KEY

- Property Boundary
- Lease Plan

nationalgrid

Client Name



North
Drawing Status
Issued

Project Name:
(2551)
Arundle
Ford Road, BN18 9EX
Drawing Name:
Site Plan

Scale:	Date:	Drawn:	Checked:
1:1250	19.01.18	NG	AA
Drawing Number:			Rev:
001			A



**BNP PARIBAS
REAL ESTATE**

9 Colmore Row
Birmingham
B3 2BJ

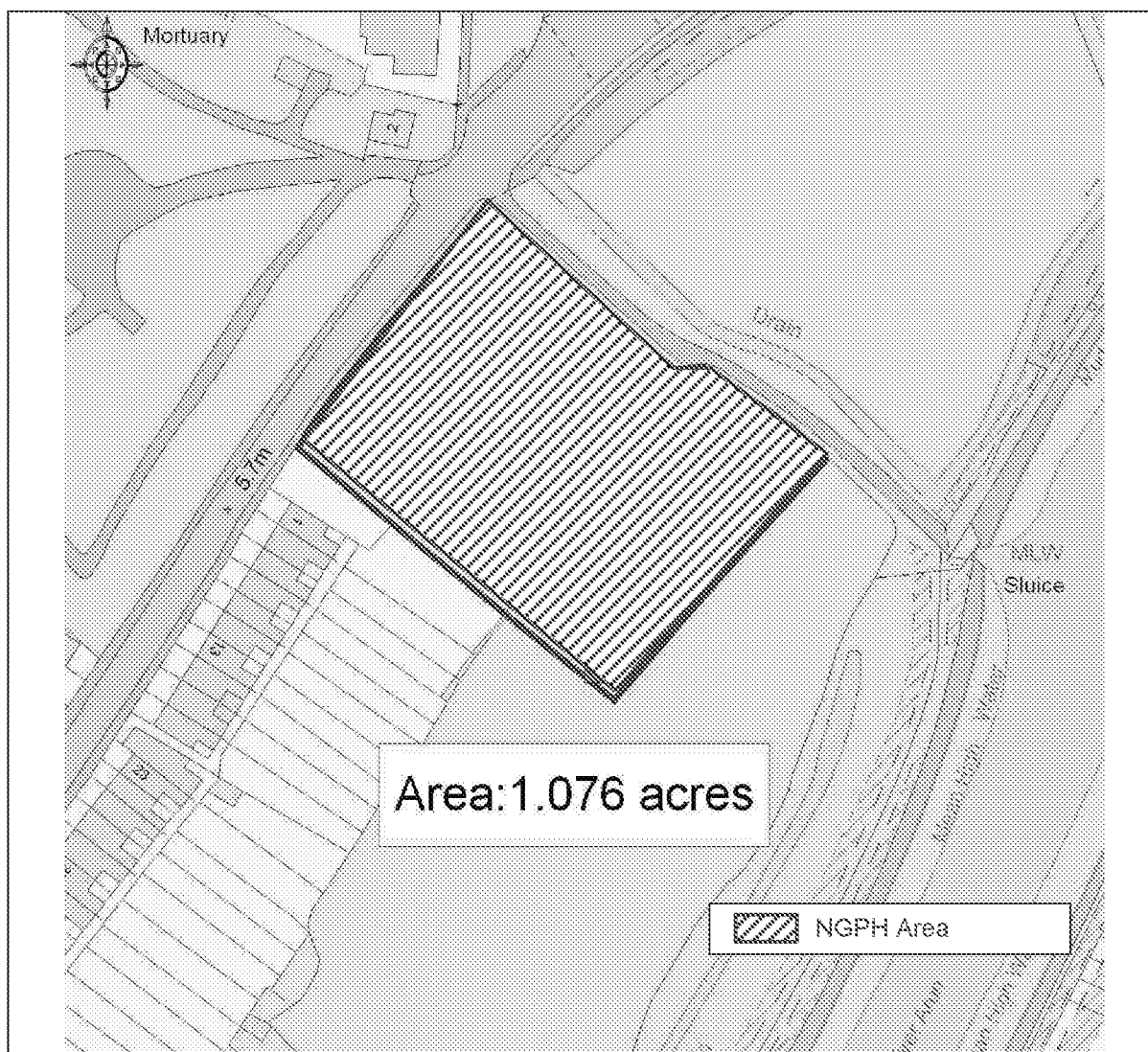
0121 237 1200

www.realestate.bnpparibas.co.uk

Appendix B. Previous Factual Reports

Document Title	Work Stage	Document Reference Number	Author	Report Date	Issued Date
British Gas Environmental Liability Assessment Report Report redacted to remove interpretative information.	Desk Study	E5347/LR860.NL/gp	Atkins	April 1994	April 1994
Environmental Assessment Site Investigation, Final Factual Report	Site Investigation (Factual)	A71430/GTG.2000078 /R002rev1/December2000	Atkins	December 2000	December 2000
Environmental Groundwater Monitoring Letter Report, Ford Road, Arundel, Mentor No. 015162 Report redacted to remove interpretative information.	Site Investigation (Factual)	A71430/GTG.2000078 /Arundel/R004rev0/mg	Atkins	July 2001	July 2001
Ford Road, Arundel (Site No. 2551) Site Investigation Report Report redacted to remove interpretative information.	Site Investigation (Factual)	5104362/GTG.20100923/Arundel 2011/R001v0	Atkins	October 2011	October 2011
Detailed Quantitative Risk Assessment Report, Ford Road, Arundel (Site No. 2551) Report redacted to remove interpretative information.	Detailed Quantitative Risk Assessment	5104362/GTG.20100923/Arundel DQRA 2012/R002v1	Atkins	October 2012	October 2012

A factual desk study report undertaken by Harrison and Company (1993), entitled "*Desk Study on a Disused Gas Work at Ford Road, Arundel, West Sussex for British Gas (South Eastern) Plc*" was requested from NGPH but is understood to be unavailable. Factual excerpts are included in the appendices of the Atkins (2000) factual site investigation report.



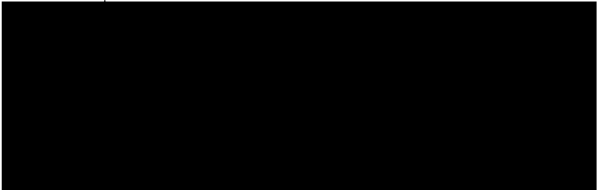
Site Address	Ford Road, Arundel, West Sussex, BN18 9DX	NGP Document Tracking code	
Report Title	Ford Road, Arundel – Environmental Liability Assessment Report		
Report Type	Desk Study	Retention Period	Indefinitely
Site Code	2551	Author (Company)	Atkins
Report Date	April 1994	Factual/Interpretative	Factual
Draft/Final	Final	H&S File?	No
Work Stage*	Desk Study		
Brief description of contents	Desk Study		
Access Permitted	NGPH Land Regeneration Team	NGPH Contact	Sarah Helby

BRITISH GAS PROPERTIES

E5347/1994/APRIL

**ARUNDEL, FORD ROAD
(Ref SE12)
ENVIRONMENTAL LIABILITY
ASSESSMENT REPORT**

WS Atkins Environment
Woodcote Grove
Ashley Road
Epsom
Surrey



Client: British Gas Properties
Project: British Gas Environmental Liability
 Assessment Report
Title: Arundel, Ford Road (Ref SE12)

Job No: E5347 *Copy No:*
Document Reference: E5347/LR860.NL/gp

0	Client Issue	N Legg	JE Steeds	DJ Nancarrow	JE Steeds		
							Client
Revision	Purpose Description	Originated	Checked	Reviewed	Authorised (PM)	Date	
		WS Atkins					

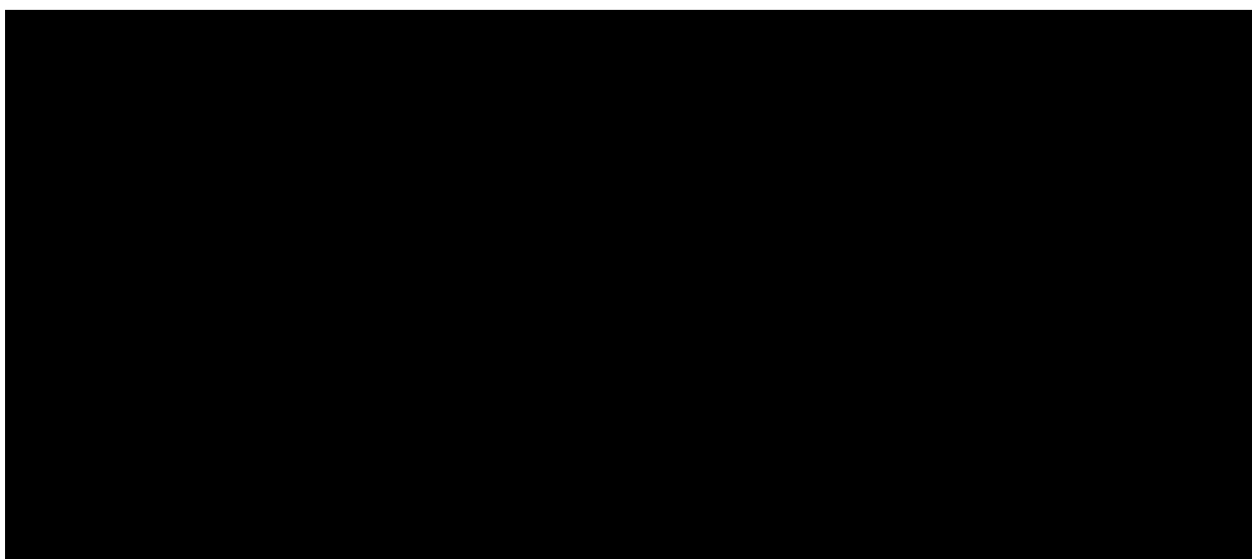
CONTENTS

1	INTRODUCTION.....	2
2	SITE LOCATION AND DESCRIPTION	4
3	GEOLOGY AND GROUND CONDITIONS	7
4	SITE HISTORY AND POTENTIAL CONTAMINANTS.....	9
5	SITE INVESTIGATION DATA	17
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7	RECOMMENDATIONS : SITE INVESTIGATION AND REMEDIAL MEASURES.....	23

1 INTRODUCTION

Terms of Reference

- 1.1 WS Atkins was commissioned by British Gas Properties to undertake a desk study of possible ground contamination at Arundel, Ford Road (Ref SE12) resulting from the previous use of the site as a town gas manufacturing works. The boundary of the study site is WS Atkins interpretation of information supplied by British Gas. A definitive study site boundary was not available.



Methods and Information Sources

- 1.3 The study has been undertaken in general accordance with the guidance given in the British Standards Institution document DD175 (Reference 1), Appendix E of British Standards 5930 (Reference 2), Problems Arising from the Redevelopment of Gasworks (DoE 1988) (Reference 3) and the Technical Specification for Environmental Liability Assessments (PDU 1993) (Reference 4).
- 1.4 The sources of information used to carry out this assessment are given in Tables A.1 to A.3 (Appendix A). No historical site plans were available from British Gas for this site. The report of a former Desk Study (1983) was provided. This report included a brief summary of a report of a 1986 site investigation by the same company. British Gas could not identify any current or former employees with a knowledge of the operational history of the site.

1.5 Information on potential contaminants associated with gas manufacturing and associated processes has been obtained from the following reference sources:

- (i) Encyclopedia of Occupational Health and Safety, International Labour Organisation 1983;
- (ii) Problems Arising from the Redevelopment of Gasworks and Similar Sites (2nd Edition), Department of the Environment, 1987.

Report Structure

1.6 The following sections of the report contain:

- (i) a description of the site status at present, ie. current use and surface ground conditions;
- (ii) a description of the site geology and hydrogeology;
- (iii) a description of the site history ie. process activities, waste disposal and potential contaminants;
- (iv) a summary of the findings of a previous site investigation;

■ [REDACTED]

■ [REDACTED]
[REDACTED]

■ [REDACTED]

2 SITE LOCATION AND DESCRIPTION

2.1 The Ordnance Survey National Grid Reference No. is TQ014067 and the site covers an area of approximately one hectare (see Figure 1). Full details of the site are provided in Table 2.1 (site visit record sheet 1) and on Figure 2.

2.2 The site is located adjacent to the north west bank of the River Arun, Ford Road and Old Forge Mews.

Table 2.1 : Site Visit Record Sheet I

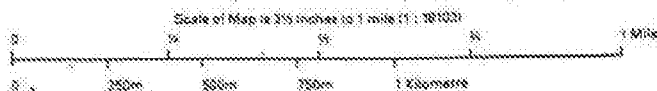
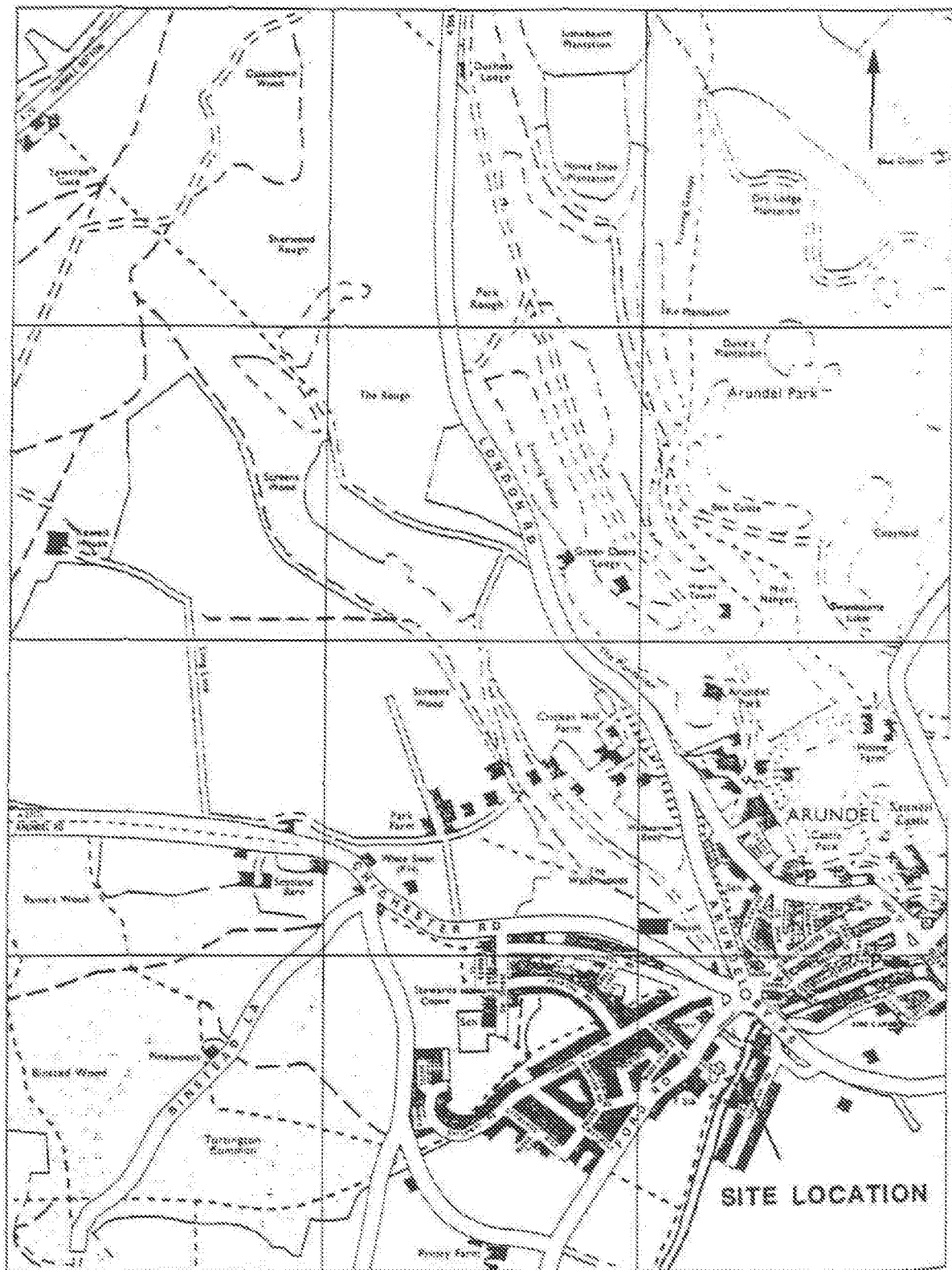
Site Name: Arundel, Ford Road (Ref SE12)

Date of Visit: 24 March 1994

Visited by: Nicola Legg

SUBJECT	INFORMATION
Current site size and uses	The site occupies an area of approximately one hectare. Approximately 60% is a grass field which is let for grazing (by horses). The remainder is classed as operational as the pressure monitor is checked once a week.
Description of ground cover, % of hard standing, (gravel/concentration/tarmac), condition of ground, % infiltration of precipitation	Approximately 60% is grassed, 5% has a tarmac surface and the remainder has a gravel surface. [REDACTED] Much of the site was waterlogged on the day of the site visit.
Location and type of surface drainage,(culverts, streams, rivers, ponds), approximate water level relative to ground surface	Drainage ditches along NE and SE boundaries. Any direct drainage connections from the site to these ditches was not visible. Any manholes observed during the walk-over survey are shown on the Figure 2.
Location and type of bunds, pits, walls. State of repair.	The bund along the river appeared in good condition but anecdotal evidence suggests the land on either side of the river (including the study site) floods frequently. Retaining walls along Ford Road and between the site and houses to the west both appeared to be in good condition.

SUBJECT	INFORMATION
Adjacent land uses	West: houses with gardens. Northwest: cemetery beyond Ford Road. North east: field (appeared not to be grazed). East and south-east: River Arun separated from site by narrow stretch of waterlogged land, ditch and bund. South west: new houses.
Name of adjacent roads/rivers/canals	Ford Road, Old Forge Mews, River Arun.
Level of ground in relation to adjacent areas and other parts of site	The site itself is generally flat. It is set into the side of a gently sloping hill and the surrounding land slopes down from north west to south east. The houses to the west are at a higher level than the site although the lower parts of their gardens are at a similar level. The houses to the south west are at a similar level to the site.
Access to site boundaries	Access to the site boundary around the north arm of the site is slightly restricted by chain link security fencing which is positioned approximately 1m in from a wooden boundary fence. Access to all boundaries in the southern grassed half is unrestricted.
Visibly contaminated areas	Rubble (including concrete and old tarmac) was present on the operational area of site. Some iridescence on standing water and mud outside the site entrance was evident [REDACTED] [REDACTED]
Visible evidence of foundations	Broken out old governor tank in north east corner. Concrete slab (tank base) in south east corner.
Present day potentially contaminative activities	Small electricity substation near north-east boundary.



Site
Arundel, Ford Road (Ref SE12)
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
18/03/94	KM	NJS	JCS	N/A	Figure 1	E5347

3 GEOLOGY AND GROUND CONDITIONS

Geology

- 3.1 The general geology in the vicinity of the site is shown on the British Geological Survey (BGS) 1:625,000 scale geological map No. 2. Other information was obtained from BGS Well Records Nos 21 and 88.
- 3.2 The solid geology of the study site is chalk overlain by sandy silty clay alluvium associated with the River Arun. The BGS borehole records indicate depths of alluvial material of 19m and 24m some 200m to the north east of the site. However, a site investigation by Harrison and Company of Thornton Heath in 1988 (see Chapter 5) indicated that less than 5m of alluvial material overlay the chalk (assuming the trial pits did not extend beyond 5m). Both BGS borehole records indicate the presence of groundwater in the Alluvium at approximately 2m depth. [REDACTED]

Hydrogeology

- 3.3 An NRA groundwater vulnerability map is not yet available for this area and similarly NRA Source Protection Zones are not yet completed for the region. The Southern Region's Appendix to the NRA's Policy and Practice for the Protection of Groundwater (Ref 6) indicates that under the former Southern Region Aquifer Protection Policy, the chalk is classified as Zone 1 in this area. [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED] The NRA have no records of any significant pollution incidents associated with the site.

- 3.4 [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED] A total of four groundwater abstractions are located within 2km of the study site. These are shown in Table 3.1. [REDACTED]
- [REDACTED]

Hydrology

- 3.5 The NRA indicated that the tidal stretch of the River Arun adjacent to the site is classed as Estuary Class A (Good Quality) based on an assessment of biological, aesthetic and water quality.
- 3.6 The NRA have no records of any licensed abstractions from the River Arun itself within 2km of the study site. However, their records indicate that there are four abstractions within that distance from other smaller watercourses that are part of its catchment. These abstractions are also shown in Table 3.1.

Table 3.1 : Water Abstraction Data

Grid No.	Details	Source	Annual Quantity Abstracted (m ³)
TQ 00250526	Private water undertaking	Chalk	4550.0
TQ 01870794	Wild Fowl and Wetlands Trust	Chalk	1991148.0
TQ 00890742	Fish Farm	Chalk	318220.0
TQ 01800778	Public water supply	Chalk	1647000.0
TQ 0126 0533	Spray irrigation	Surface	13636.2
TQ 99460563	Spray irrigation	Surface	2500.0
TQ 02250503	Fish Farm	Surface	332000.0
TQ 01510567	Spray irrigation	Surface	24999.7

4 SITE HISTORY AND POTENTIAL CONTAMINANTS

Site History

Introduction

- 4.1 The site history has been assessed using all available plans, records and anecdotal information (see Appendix A). Relevant Ordnance Survey maps are given in Appendix B and anecdotal information is given in Appendix C. The information has been summarized in Table 4.1 and Figure 3. All processes and activities which are likely to have, or are known to have, resulted in contamination have been included in Table 4.1. Each feature described in Table 4.1 is given a reference number which can be used to identify it on Figure 3. The history of adjacent land uses is presented in a similar manner in Table 4.2.

Information from Statutory Authorities

- 4.2 The Environment, Tourism and Leisure Department of Arun District Council have limited records of a landfilling operation in the area immediately to the south west of the study site. This was essentially infilling of the former baths in the 1950s and 1960s. Materials used included bottles, timber, ash and pottery. The Council's records do not state the exact depth or volumes of wastes involved but it is believed that the maximum depth of waste is approximately 3.0m. This area and the land further south west (the site of Tortington Ironworks between 1899 and the early 1960s) has since been developed for 40 houses with gardens. The Council stated that a site investigation was carried out prior to development. A total of 500m³ of topsoil was removed owing to the presence of copper, nickel, lead and zinc. The site investigation report concluded that there was "no major contamination threat".
- 4.3 West Sussex County Council Trading Standards Department have stated that a closed landfill site ("Canada Road Tip") is located within 250m of the site, to the north west. The landfill predates licensing regulations and the Council have no records of the depth or volume of waste involved. They believe, however, that the landfill received household waste and that tipping ceased in 1973 at the latest.
- [REDACTED]
- [REDACTED]
- [REDACTED]
- [REDACTED]

4.5

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

4.6

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

4.7

[REDACTED]

[REDACTED]

Table 4.1 : Historical Data Summary Sheet : Site Uses

Ref	Use/Feature	1875 OS	1899 OS	1912 OS	1914 OS	1933 OS	1937 OS	1946 OS	1961 OS	1971 OS	1994 SVI
1	Gasholder	North east of operational area	x	x	x	x	x	x	x	x	x
2	Drainage ditch	Through north of site and along western boundary	—	—	—	—	x	x	x	x	x
3	Buildings	South-western corner of site	—	—	—	—	—	—	—	—	x
4	Small circular structure (tank?)	North corner of operational area	x	x	x	x	x	x	x	x	x
5	Buildings	Operational area	—	—	—	—	—	Only two in north corner remained	—	x	x
6	Gasholder	*	North west corner of operational area	—	—	—	—	—	—	x	x
7	Gasholder	*	North of operational area	—	—	—	—	—	x	x	x
8	Small circular structure (tank?)	*	*	North east of operational area	?	?	—	?	?	x	x
9	Gasholder	*	*	*	*	*	Centre of site	—	—	—	x
10	Electricity sub station	*	*	*	*	*	*	*	*	North-east boundary	
11	Above ground tank	*	*	*	*	*	*	*	*	North-east boundary	Concrete base remaining
12	Valve pits	*	*	*	*	*	*	*	*	Centre of site	
13	Toilet	*	*	*	*	*	*	*	*	North-east boundary	

KEY	
?	Plan does not show this area or does not provide information
	Feature still present
x	Feature demolished/no longer present
OS	Ordnance Survey Map
BGP	British Gas Plan
AI	Anecdotal information from ex-employee
SVI	Site visit information
*	Feature not present

Notes:

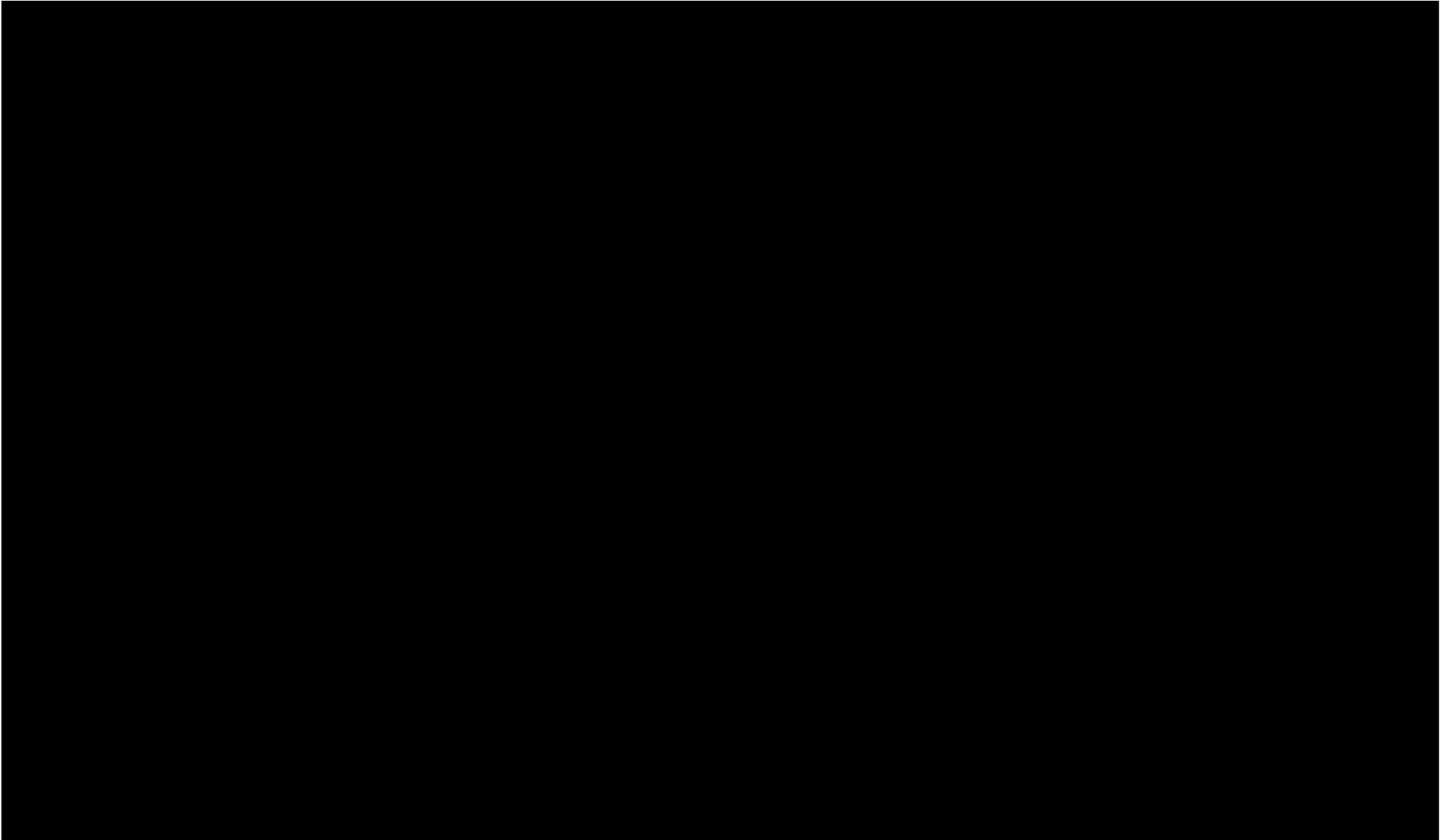
1. Shaded features indicate areas of higher contaminative potential.
2. Waste disposal activities may have occurred throughout the site especially during its early history.

Table 4.2 : Historical Data Summary Sheet : Adjacent Site Uses

Boundary	1875 OS	1899 OS	1912 OS	1914 OS	1933 OS	1937 OS	1946 OS	1961 OS	1971 OS	1994 SVI
North west	Greenfield	Cemetery beyond road	–	–	–	–	–	–	–	–
North east	Drainage ditch with greenfield beyond	–	–	–	–	–	–	–	–	–
South east	Drainage ditch with River Arm beyond	–	–	–	–	–	–	–	–	–
South west	Baths and "Works"	Baths, iron works and sewage works	–	–	–	–	Ironworks buildings labelled as "works"	–	Agricultural engineering works, boat builders, sewage works and fire station	New housing estate
West	Greenfield	Terraced houses with gardens	–	–	–	–	–	–	–	–

KEY	
?	Plan does not show this area or does not provide information
	Feature still present
x	Feature demolished/no longer present
OS	Ordnance Survey Map
BGP	British Gas Plan
AI	Anecdotal information from ex-employee
SVI	Site visit information
*	Feature not present

1. [REDACTED]
2. The baths on the perimeter of the south-western boundary were infilled in the 1950s and 1960s (see paragraph 4.3).
3. A closed landfill is situated within 250m of the north-west boundary of the site (see paragraph 4.3).

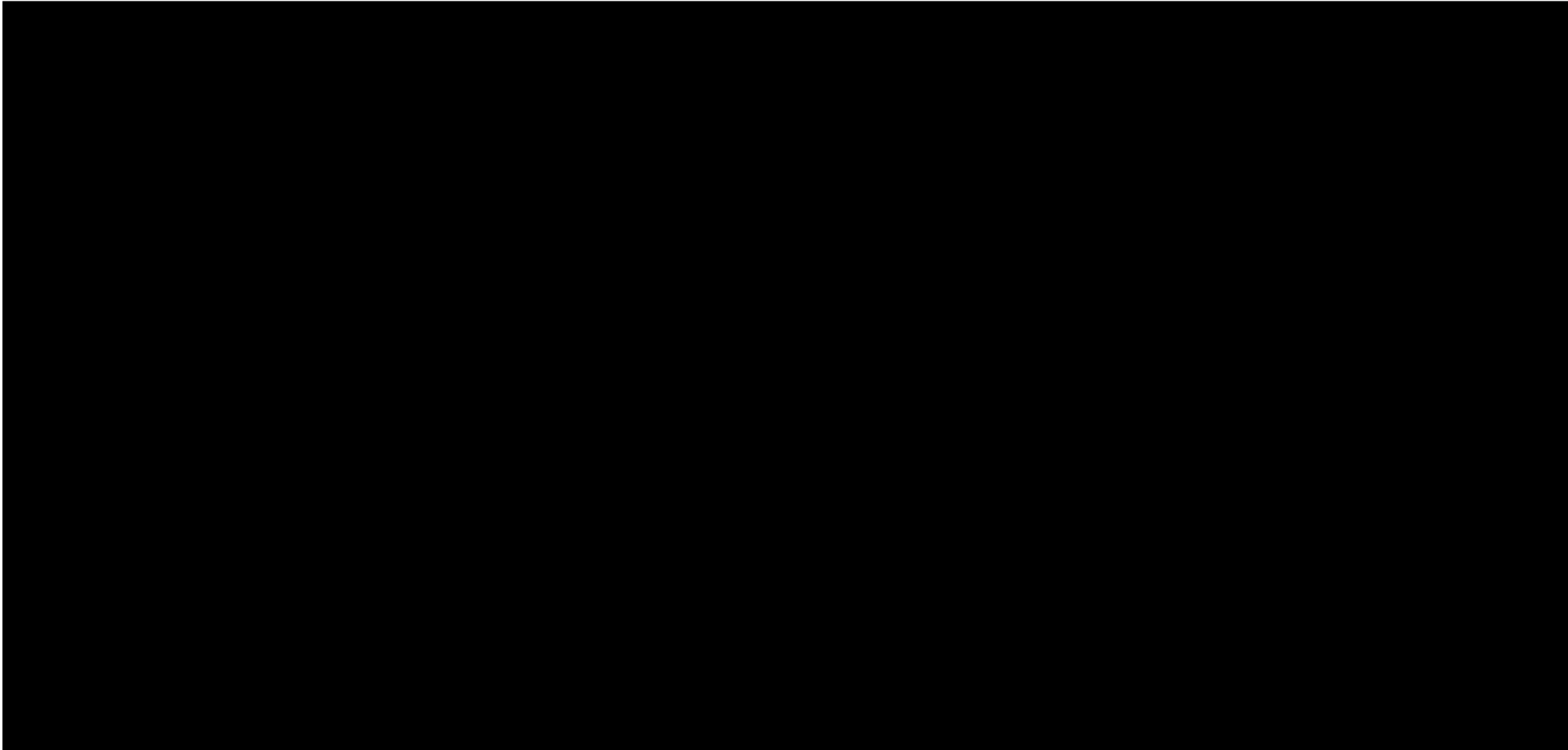


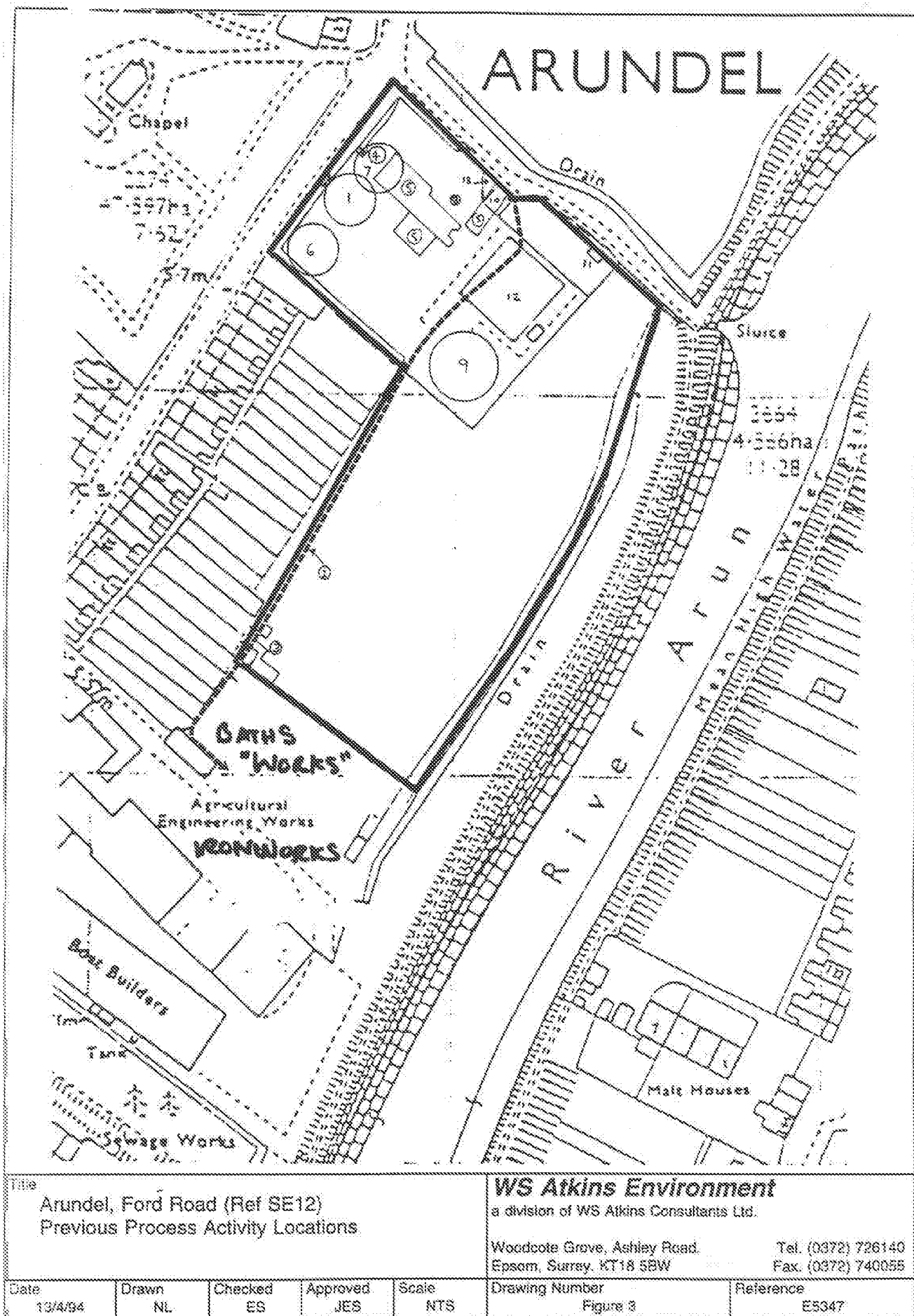
[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]





5 SITE INVESTIGATION DATA

Introduction

- 5.1 An investigation of the study site was carried out by Harrison and Company of Thornton Heath in 1988. The investigation comprised excavation of 22 trial pits to assess the contamination on the site. The original site investigation report was not available. The information given below is from a summary of the original report given in a desk study report produced by the same company in 1993.

Ground Conditions

- 5.2 In the north half of the site up to 3.0m (average 1.3m) of made ground was encountered. The nature of fill materials is not given in the summary. Buried structures including concrete, pipes and metal were found in this area.

[REDACTED]

- 5.4 Groundwater was not mentioned in the summary. Similarly there was no mention of visual or olfactory evidence of contamination.

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

6.1 [REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

6.2 [REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]

[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]
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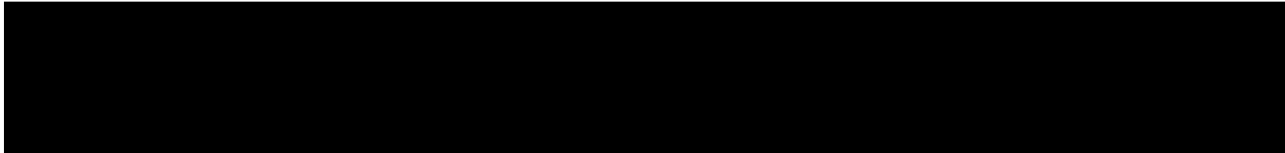
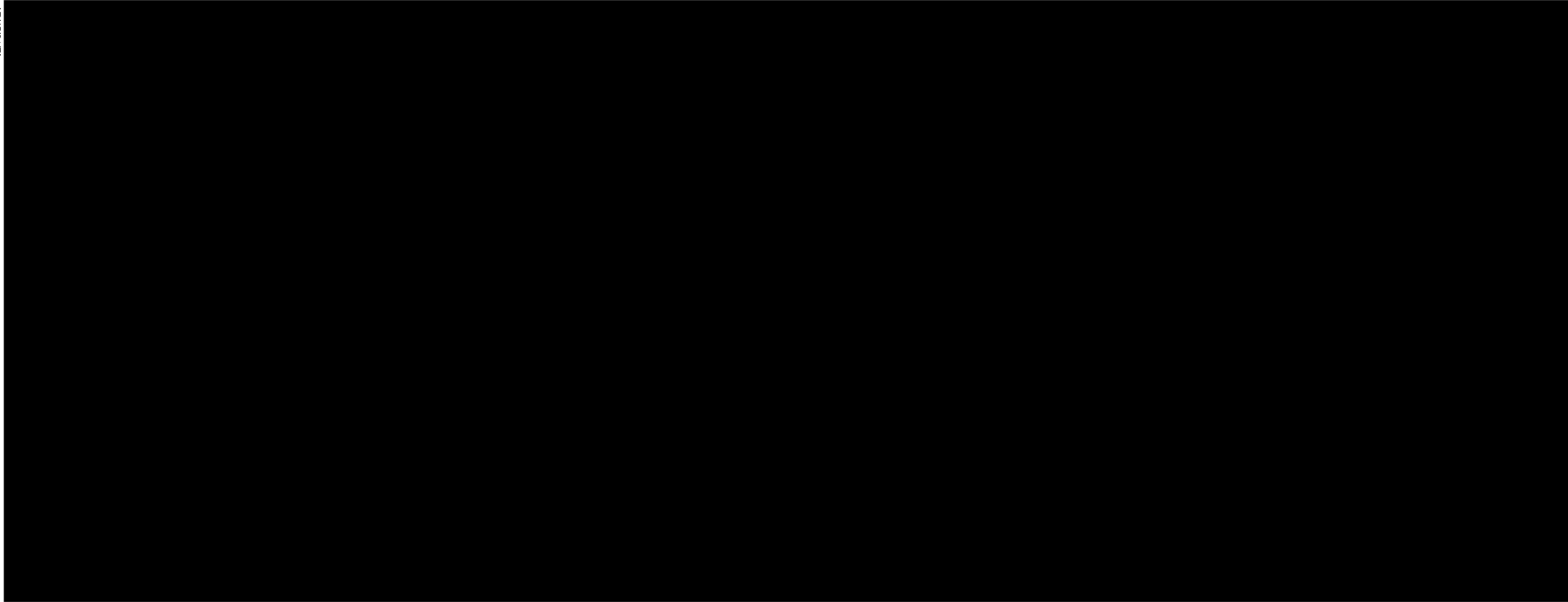
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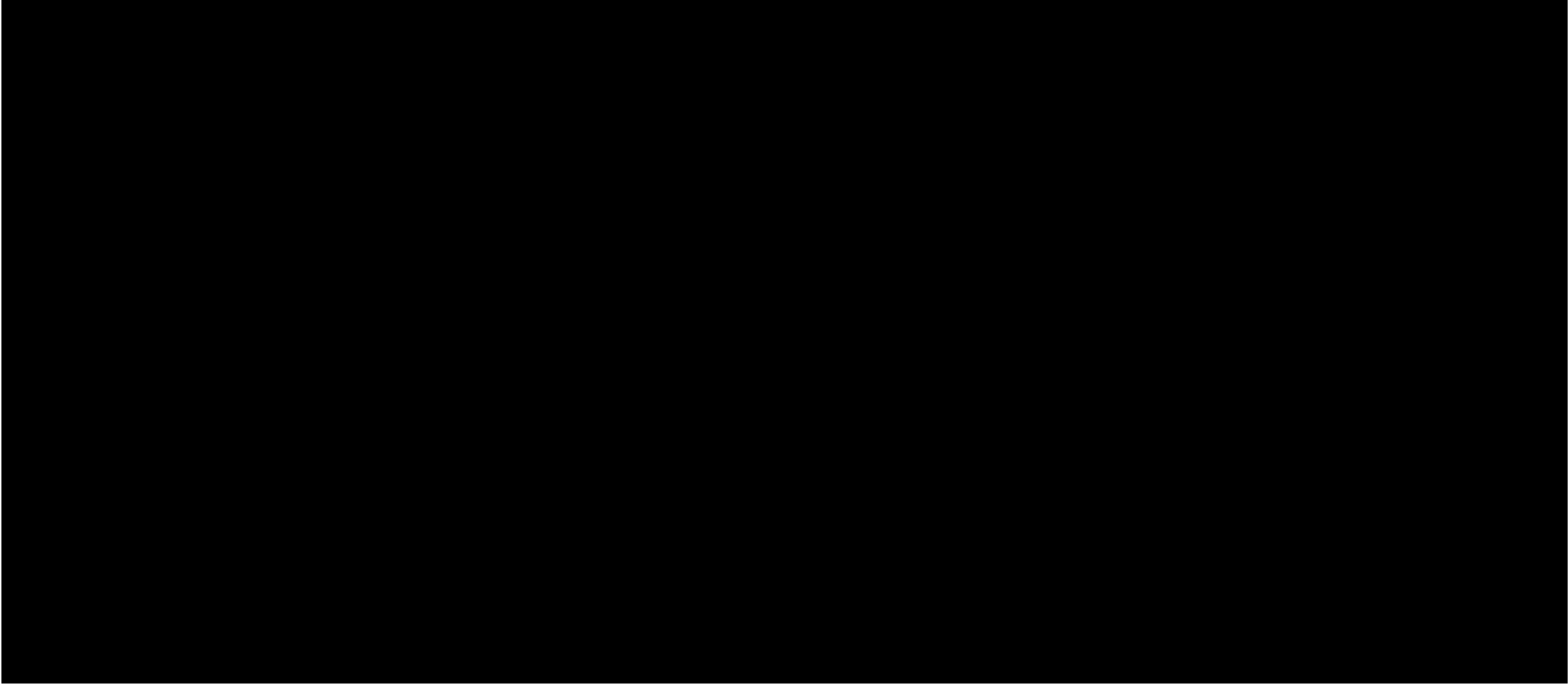
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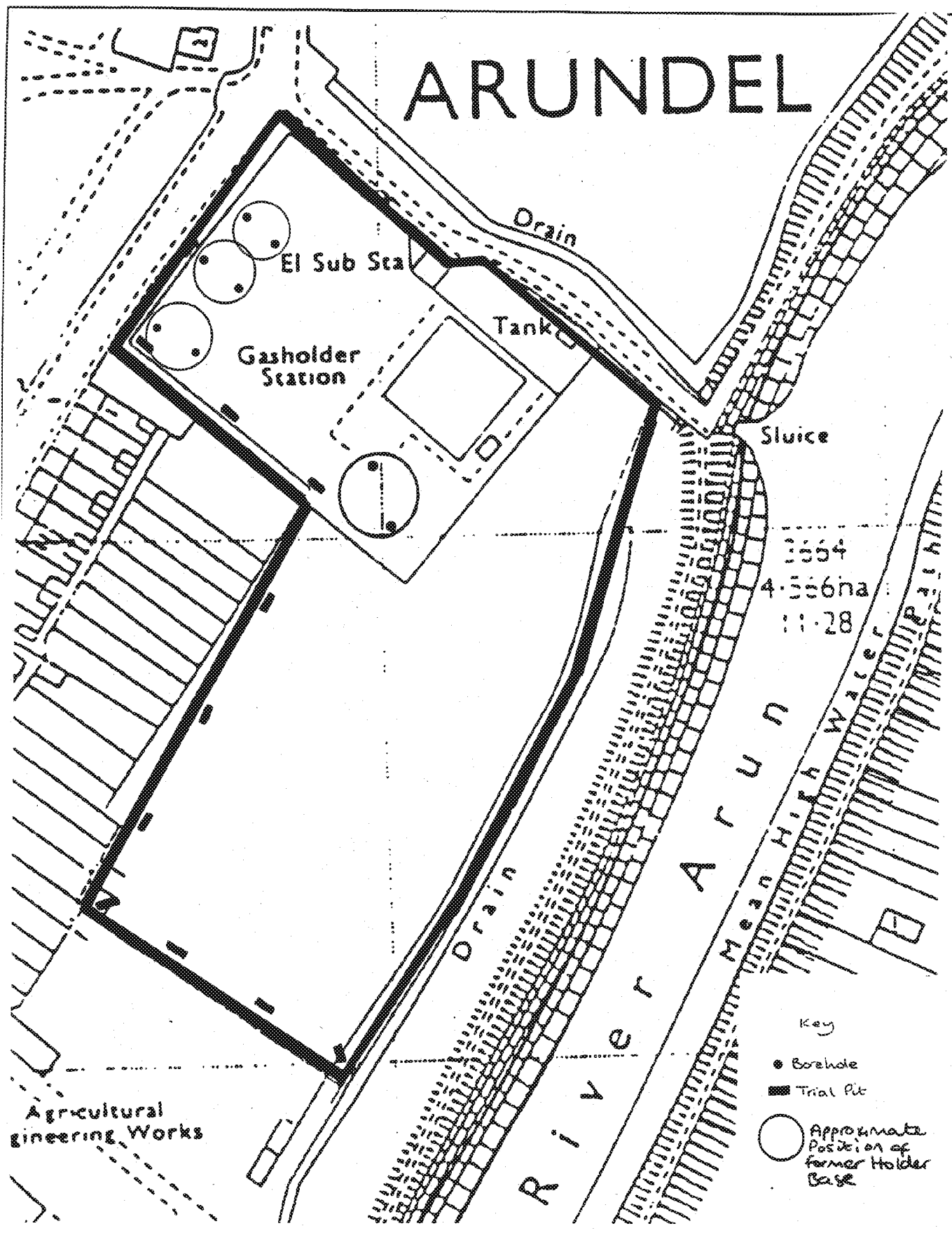
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[REDACTED]







Title Arundel, Ford Road (Ref SE12) Proposed Site Investigation Locations for Statutory Purposes					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	
13/4/94	NL	ES	JES	NTS	Figure 4	E5347	
							page 29

REFERENCES

1. BSI Draft for Development. Code of Practice for the Identification of Potentially Contaminated Land and its Investigation. DD175 (1988), British Standards Institution.
2. British Standard 5930. Code of Practice for Site Investigation (Appendix E) 1981.
3. Problems Arising from the Redevelopment of Gasworks and Similar Sites. Department of the Environment, 1987.
4. Technical Specification for Environmental Liability Assessments of Development Sites. British Gas plc (PDU) 1993.
5. Policy and Practice for the Protection of Groundwater. National Rivers Authority 1992.
6. Policy and Practice for the Protection of Groundwater. Regional Appendix Southern Region. National Rivers Authority 1993.

APPENDIX A

INFORMATION SOURCES

**Table A.1 : British Gas Interpretative Reports
Information Sources Summary Sheet**

Study Site Name: Arundel, Ford Road (Ref SE12)

Type	Source	Data Sought (Date)	Data Obtained/ Copied (Date)
Ordnance Survey Maps	West Sussex Records Office Chichester	7/3/94	11/3/94
British Gas Archive Plans	British Gas North Thames 2nd Floor Elizabeth House c/o North Thames House London Road Staines Middlesex TW18 4AE The London Gas Museum British Gas Plc (North Thames) Twelve Trees Crescent Bromley-by-Bow London E3 3JH	25/2/94	None available
		6/4/94	None available
Service Plans	Regional Wayleave Officer British Gas South-Eastern Regional Headquarters Croydon Surrey The Drawing Office Southern Electric Lower Drayton Lane Cosham Portsmouth Hampshire PO6 2HF Development Services	14/3/94	16/3/94
Gas			
Electricity		14/3/94	7/3/94
Water Supply		21/3/94	25/3/94

Type	Source	Data Sought (Date)	Data Obtained/ Copied (Date)
	Southern Water Ltd Southern House Lewes Road Falmer Brighton BM9 9PI		
Sewer	Development Services Southern Water Ltd Southern House Lewes Road Falmer Brighton BM9 9PI	21/3/94	25/3/94
BT	BT Tunbridge Wells Kent	14/3/94	28/3/94
Mercury Communications	Utilities Manager Mercury Communications Mercury House Waterside Park Langshotts Lane Bracknell, Berkshire	14/3/94	21/3/94
NRA Information			
	Pollution Control Officer NRA Sussex Region Rivers House 3 Liverpool Gardens Worthing West Sussex	21/3/94	20/4/94
Pre-1974 waste disposal information, contamination and pollution information	Mr J Green Environmental Health Department Arun District Council Civic Centre Maltravers Road Littlehampton West Sussex	21/3/94	30/3/94
	Matthew Thompson Waste Regulation Department Trading Department West Sussex County Council The Tannery Westgate, Chichester	21/3/94	31/3/94

Type	Source	Data Sought (Date)	Data Obtained/ Copied (Date)
Geological information	British Geological Survey	24/3/94	27/3/94
Hydrogeological information	British Geological Survey - Hydrology Group	24/3/94	27/3/94
Site investigation data	British Gas North Thames 2nd Floor Elizabeth House c/o North Thames House London Road Staines Middlesex TW18 4AE	25/2/94	16/3/94
Anecdotal information from present or ex- employees (see Site Visit Record Sheet II)	Name: None available Position: Dates of employment:		

Table A.2 : Library Visit Record Sheet

Study Site Name:

Arundel, Ford Road (Ref SE12)

Date:

11/3/94

Library Name:

West Sussex Records Office

Signature:

Kika Mitchell

Chichester

Date	Edition	Scale	Ref No.	Copied
1875	-		LX III/1	—
1899	-		LX III/NW	—
1912	-		LX III/1	—
1914	-		LX III NW	—
1933	-		LX III/NW	—
1937	-		LX III/1	—
1938	Rev of 1909-10		LX III/NW	—
1946	Rev of 1909-10		LX III/NW	—
1961	-		TQ 100/NW	—

1971	-		TQ 0006/0106	--

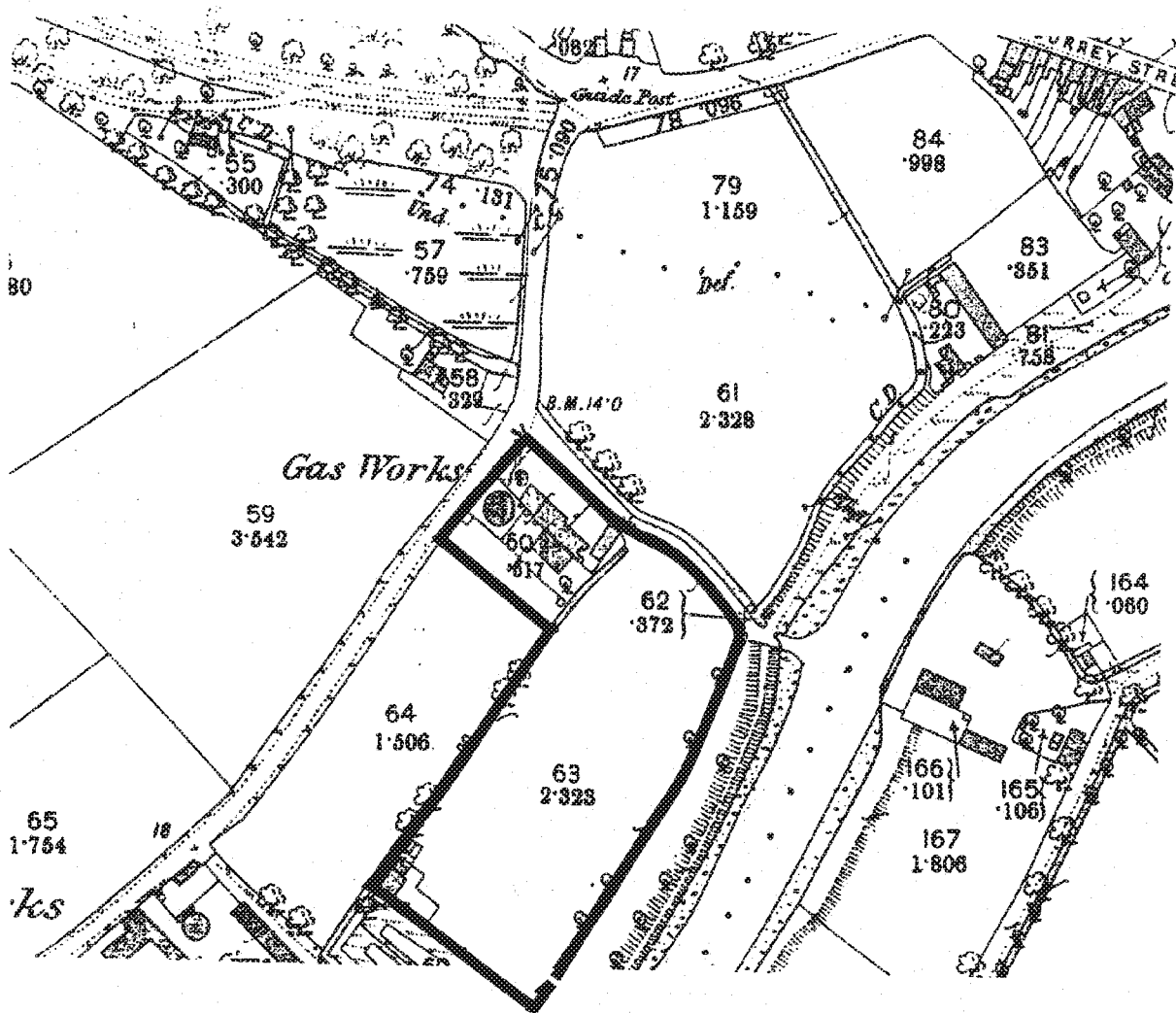
Table A.3 : Archive Visit Record Sheet

Study Site Name: Arundel, Ford Road (Ref SE12) Date: March 1994
 Archive Name:
 Contact Name: John Beer

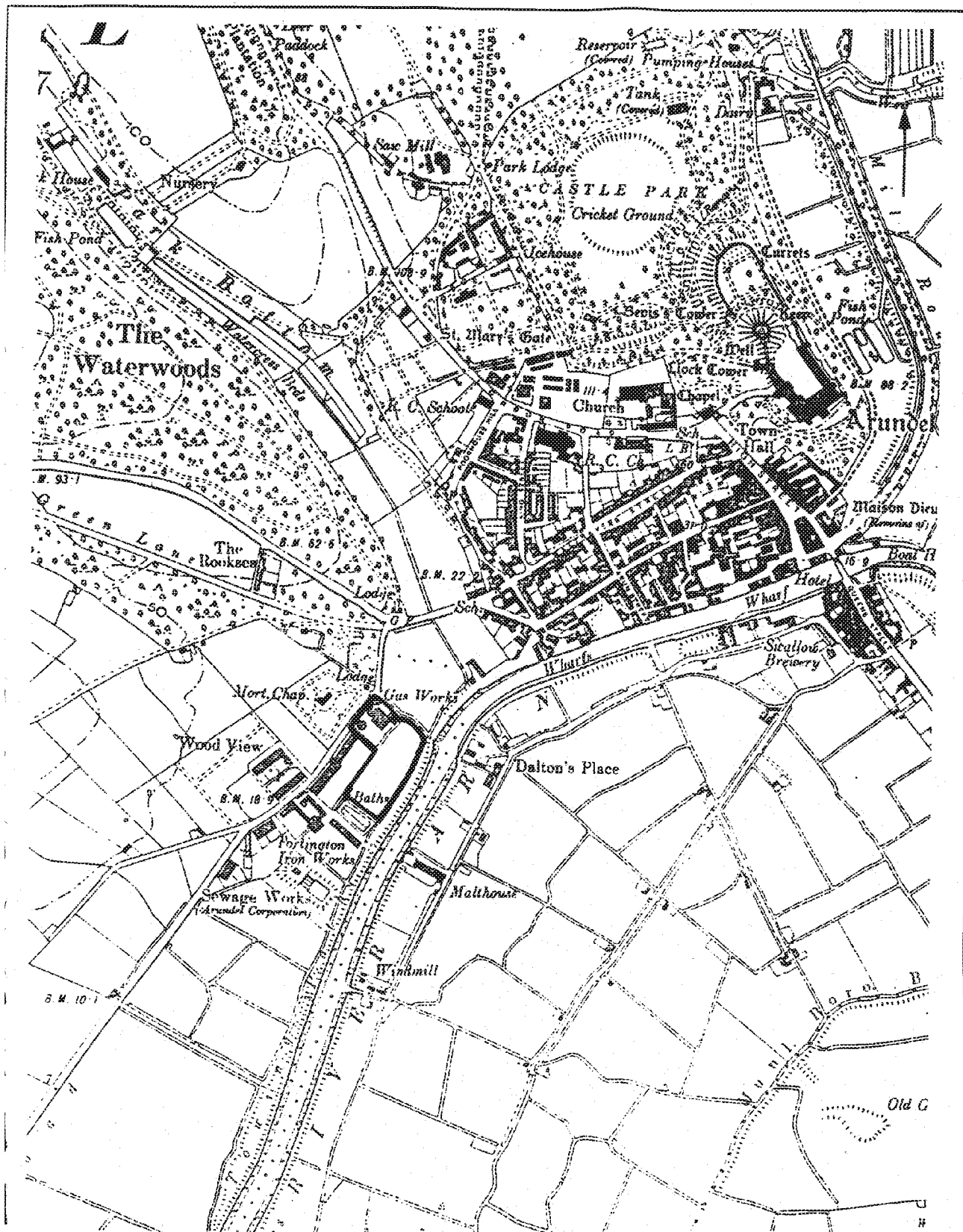
Plan/Record	Title	Date	Ref No.	Copied
Plan	Arundel Holder Station - mains layout	July 1976	DE/SX/4/200	--
Report	Desk study on a disused gasworks at Ford Road, Arundel	July 1993	C604A	--

APPENDIX B

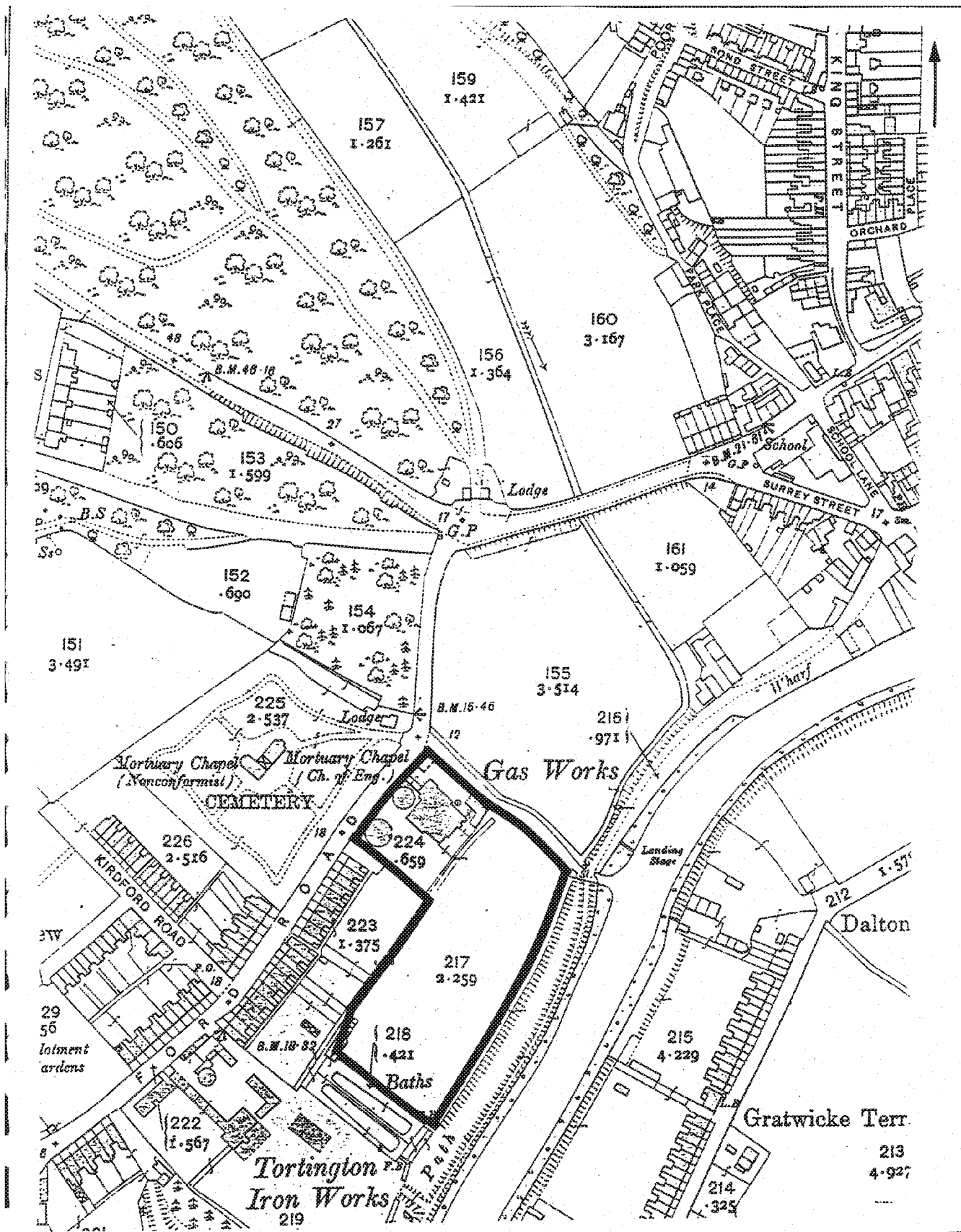
Ordnance Survey Maps



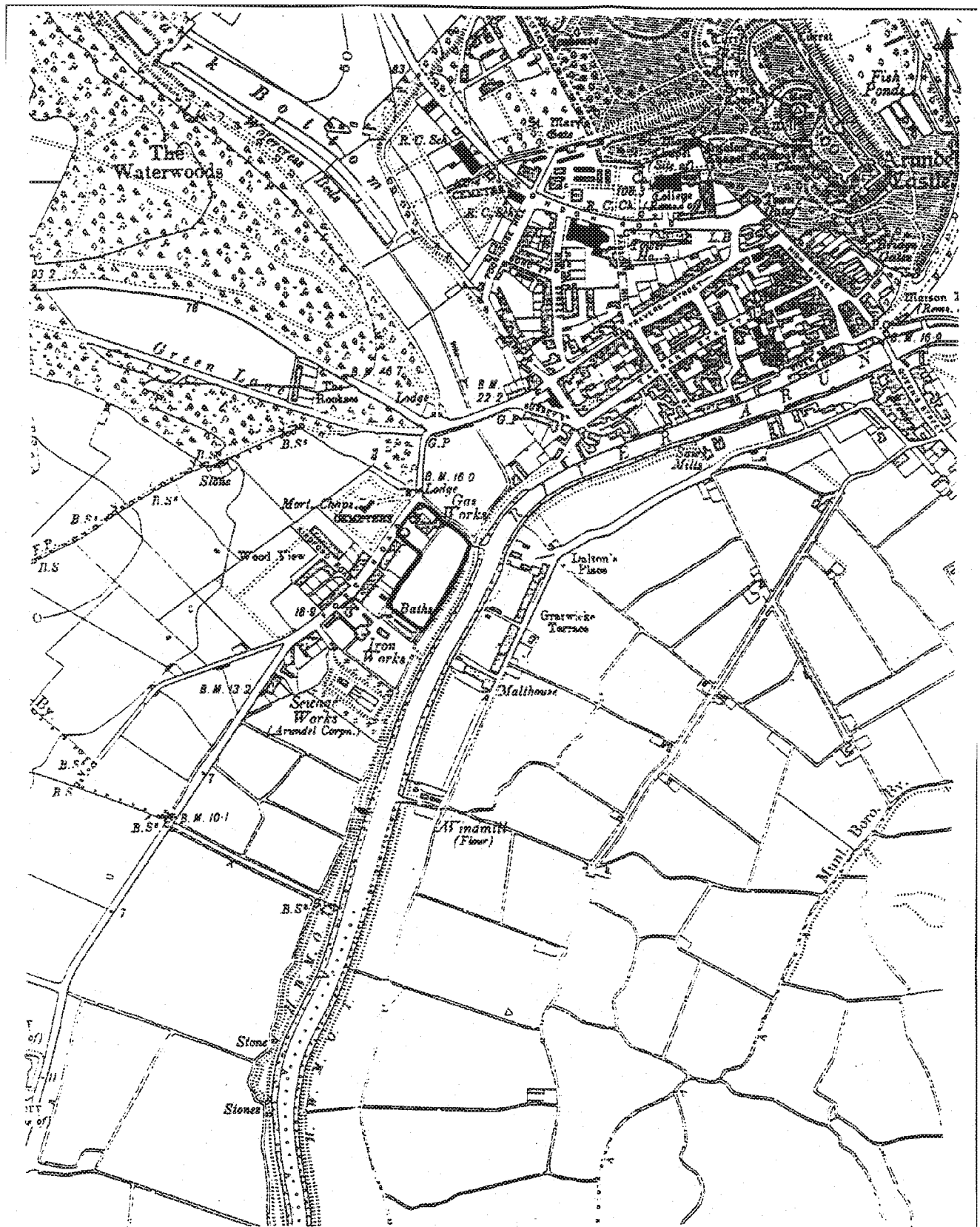
Title Arundel, Ford Road (Ref SE12) 1875 Ordnance Survey Map					WS Atkins Environment a division of WS Atkins Consultants Ltd. Woodcote Grove, Ashley Road. Epsom, Surrey. KT18 5BW Tel. (0372) 726140 Fax. (0372) 740055	
Date 22/3/04	Drawn KM	Checked N.H.	Approved IES	Scale 1:2500	Drawing Number R.1	Reference F5347



Title Arundel, Ford Road (Ref SE12) 1899 Ordnance Survey Map					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 23/3/94	Drawn KM	Checked NJL	Approved JES	Scale N.T.S.	Drawing Number B.2	Reference E5347	



Title Arundel, Ford Road (Ref SE12) 1912 Ordnance Survey Map					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 23/3/94	Drawn KM	Checked NJL	Approved JES	Scale 1:2500	Drawing Number B.3	Reference E5347



Title

Arundel, Ford Road (Ref SE12)
1914 Ordnance Survey Map

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

23/3/94

Drawn

KM

Checked

NJL

Approved

JES

Scale

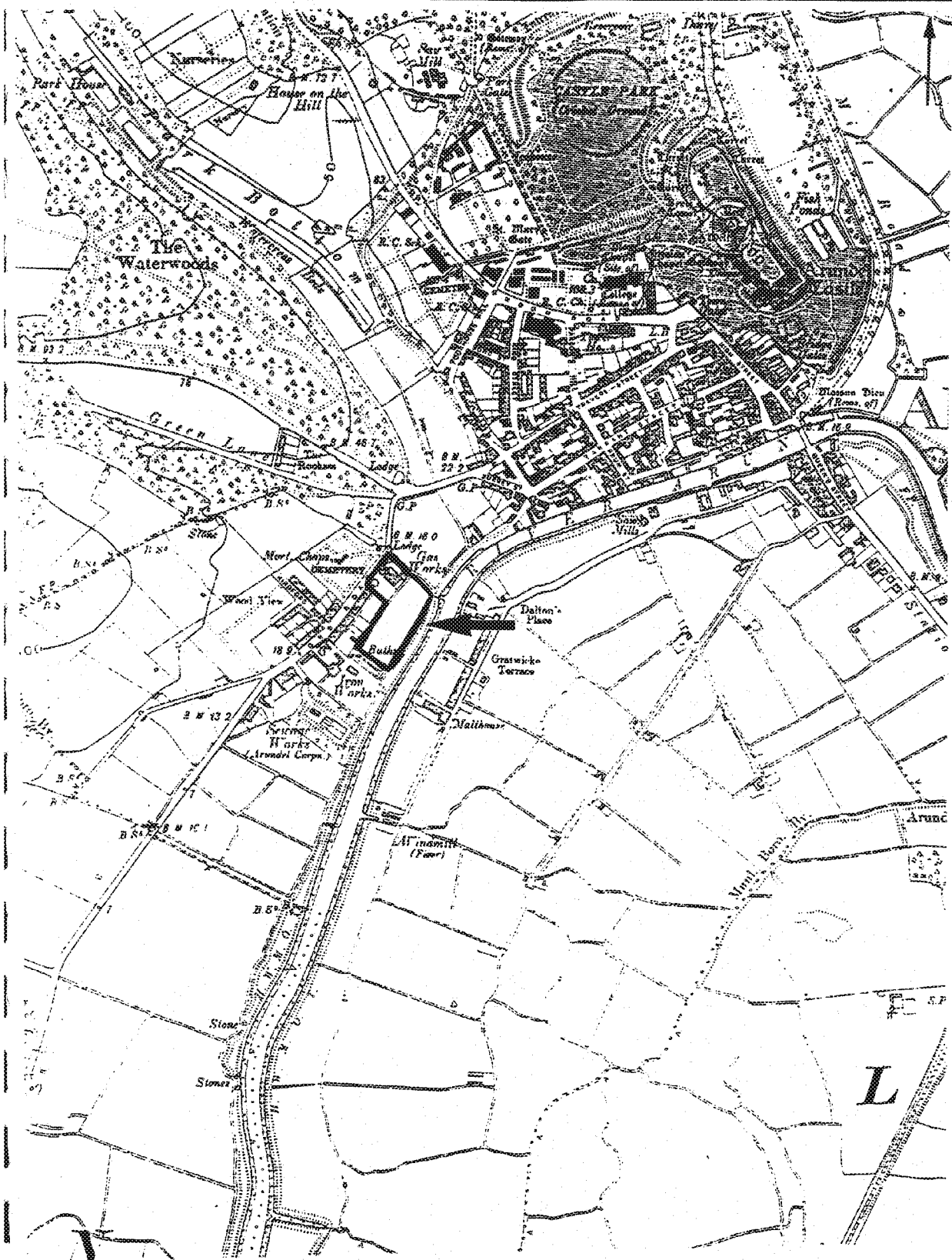
NTS

Drawing Number

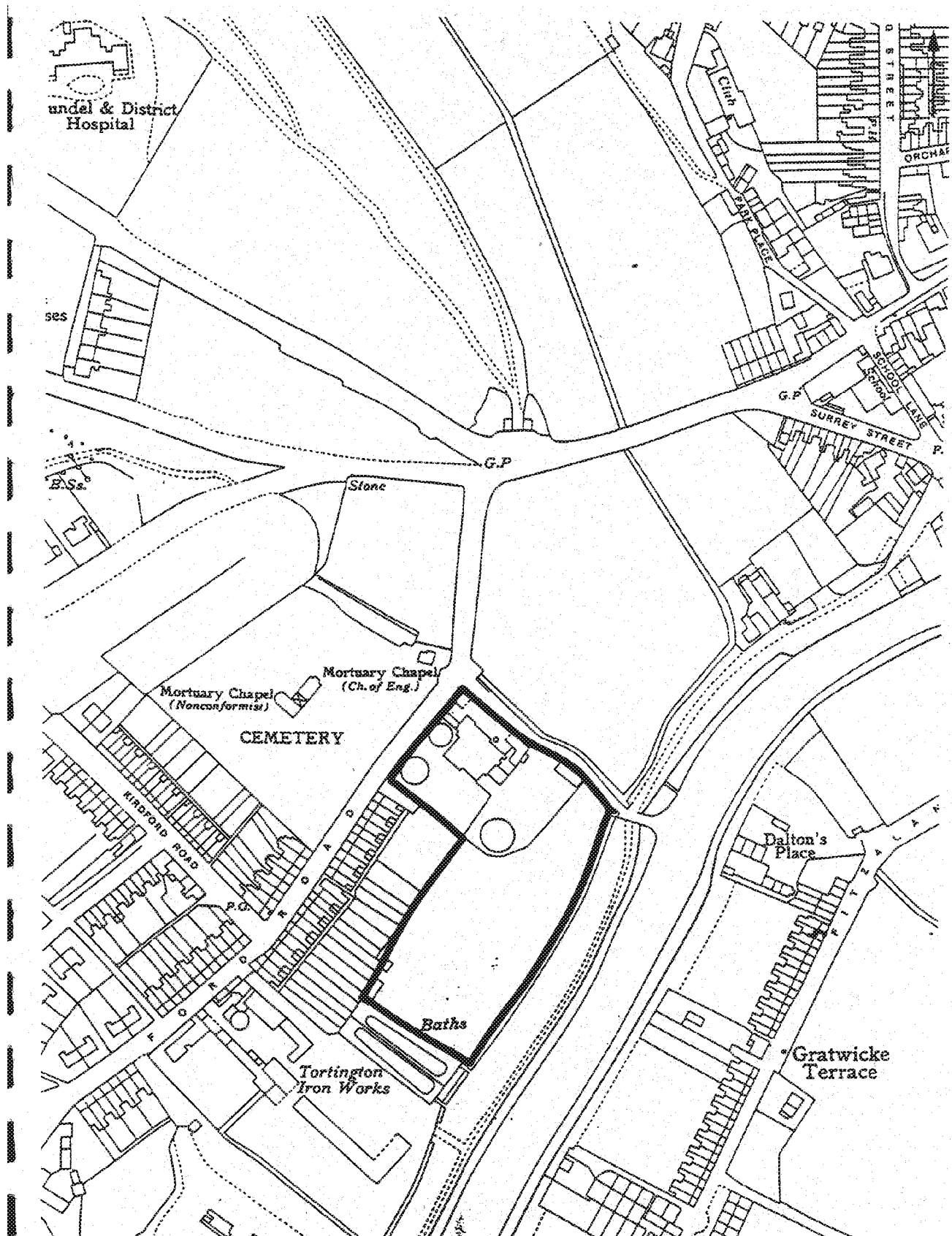
B. 4

Reference

E5347



Title Arundel, Ford Road (Ref SE12) 1933 Ordnance Survey Map					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
23/3/94	KM	NJL	JES	NTS	B.5	E5347



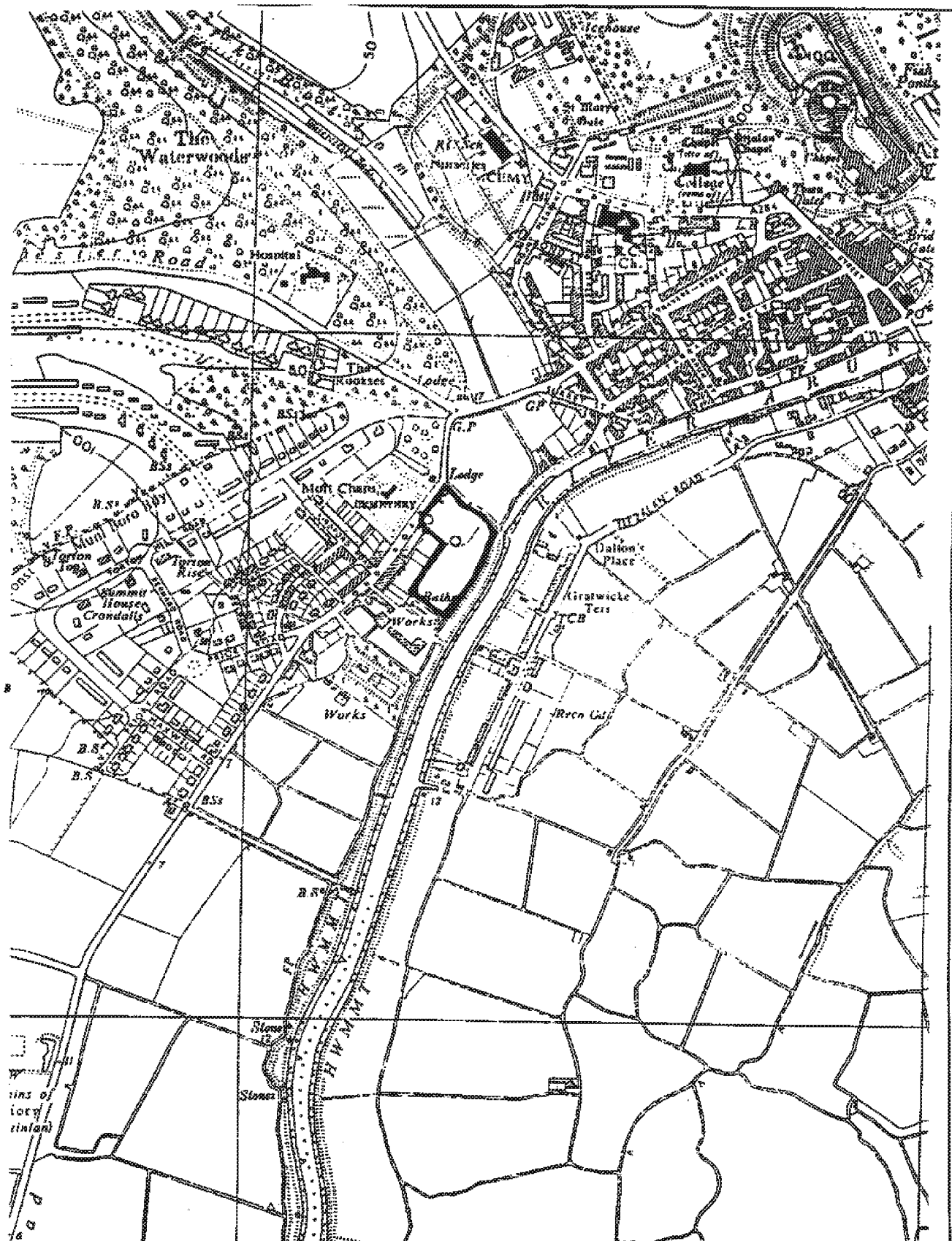
File
Arundel, Ford Road (Ref SE12)
1937 Ordnance Survey Map

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
23/3/94	KM	N.H	JFS	1:2500	B.6	E5347



Arundel, Ford Road (Ref SE12):
1961 Ordnance Survey Map

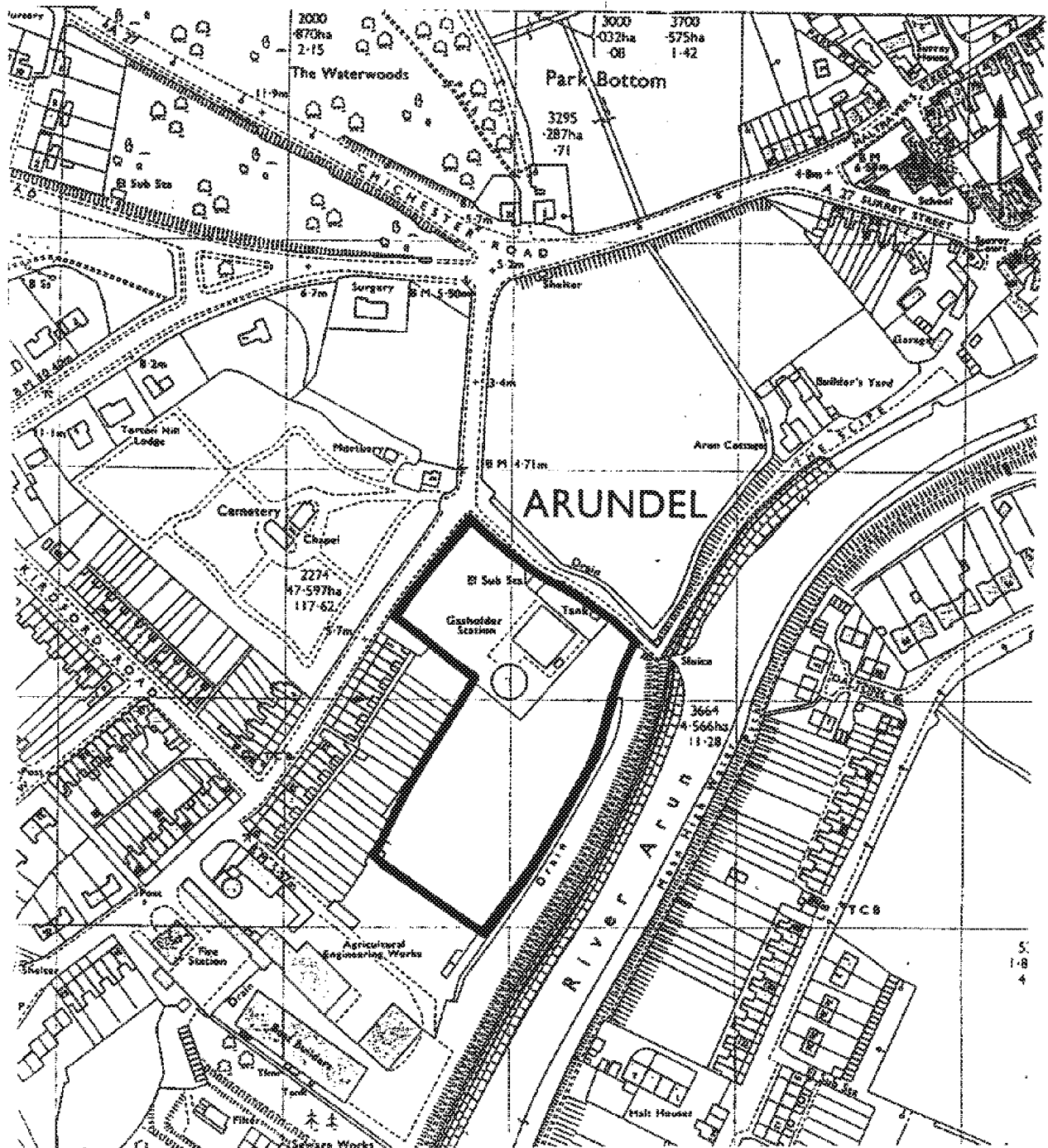
WS Atkins Environment

a division of WS Atkins Consultants Ltd.

Woodcote Groves, Ashley Road.
Epsom, Surrey. KT18 5BW

Tel. (0372) 726140
Fax. (0372) 740055

3/94	Drawn KM	Checked NJL	Approved JES	Scale NTS	Drawing Number B.5	Reference E5347
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File Arundel, Ford Road (Ref SE12): 1971 Ordnance Survey Map					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 3/3/94	Drawn KM	Checked NJL	Approved JES	Scale 1:2500	Drawing Number B.9	Reference E5347

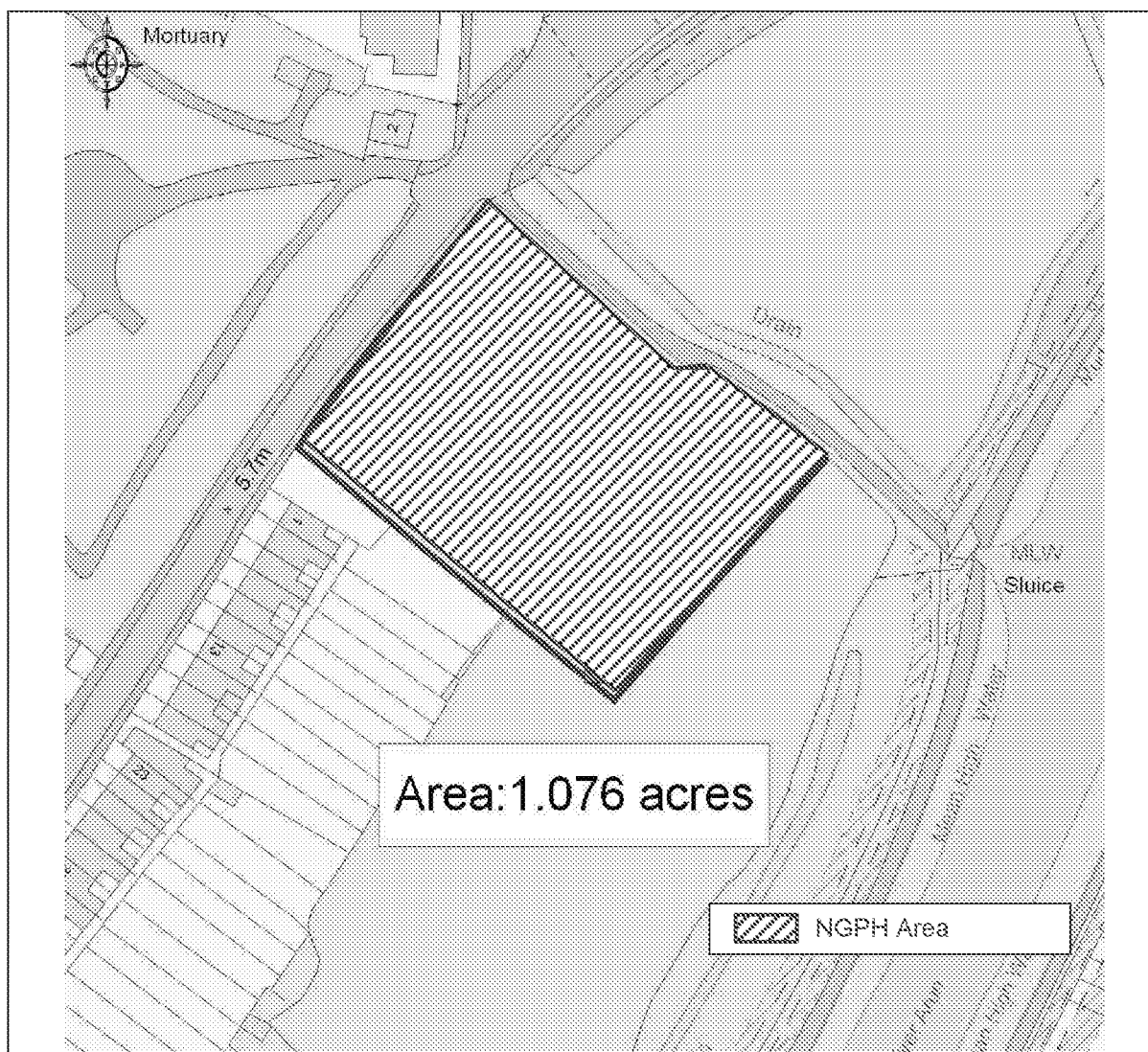
APPENDIX C

Site Visit Anecdotal Information Record

This Appendix could not be completed as British Gas could not identify any current or former employees with a knowledge of the operational history of the site.

APPENDIX D

Ground Investigation Specification



Site Address	Ford Road, Arundel, West Sussex, BN18 9DX	NGP Document Tracking code	
Report Title	Ford Road, Arundel – Environmental Assessment Site Investigation Report		
Report Type	Site Investigation	Retention Period	Indefinitely
Site Code	2551	Author (Company)	Atkins
Report Date	December 2000	Factual/Interpretative	Factual
Draft/Final	Final	H&S File?	No
Work Stage*	Site Investigation		
Brief description of contents	Factual Site Investigation		
Access Permitted	NGPH Land Regeneration Team	NGPH Contact	Sarah Helby

**FORD ROAD, ARUNDEL
MENTOR NO. 015162**

**ENVIRONMENTAL ASSESSMENT SITE
INVESTIGATION**

**FINAL
FACTUAL
REPORT**

DECEMBER 2000

Client: **Lattice Property Holdings**
Project: **FORD ROAD, ARUNDEL**
Mentor No. 015162
Title: **Environmental Assessment Site**
Investigation
Factual Report Final
Job No: **A71430/GTG.2000078** *Copy No:*
DocumentReference: **A71430/GTG.2000078/R003rev1/December2000**

0	Final	M Griffin	PK Meares	JE Steeds	MW Reed		
1	Final - revised	M Griffin	PK Meares	JE Steeds	MW Reed		
							Client
Revision/ Status	Purpose Description	Originated	Checked	Reviewed	Authorised	Date	
		WS Atkins					

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Appendix B Trial Pit and Borehole Logs, Site Photographs and Site Works Log

Appendix C Results of Chemical Analysis

Appendix D Groundwater Levels

Appendix E Analytical Quality Control Standard Charts

0. EXECUTIVE SUMMARY

Current Site Status	The site covers an area of approximately 1.1 hectares, (11,045m²) of which 60% is a grass field let for grazing. The ownership of this area is currently under review. The 40% of the site investigated (total of 0.40 hectares, 3996m²) was, until recently, occupied by Transco who used the site to control the local gas pressure and for the addition of additives. It is bounded by houses and gardens on the south west and to the north west by Ford Road, beyond which is a cemetery. To the south and east are grazing fields. A drain runs parallel to the north eastern site boundary and into the River Arun via a sluice gate. The Arun flows adjacent to the south (beyond the grazing land) and is separated from the site by a narrow stretch of low lying waterlogged land. The majority of the site is flat with the surrounding land sloping from north west to south east. The houses and road to the west and south west of the site are at a higher level than the site although the gardens slope down to a similar level.
Site History	The first map published of this area in 1841 showed a small gasworks consisting of a single circular holder, a medium sized works building and a small cottage. Within the next century three more gas holders were built, although the first one was demolished at the end of the 19th century and the buildings were expanded. However, by 1994 only the electricity substation, valve pits, toilet and a concrete base of a tank were remaining with the gas holder in the south having been only recently decommissioned. Adjacent landuse, particularly to the south west, has changed dramatically over the years with an ironworks being present between 1899 and 1937, which was then built on by an agricultural engineering works, neither of which showed direct evidence of contamination, based on the initial site investigation carried out by Harrison and Co (1988) (Appendix A).
Hydrogeology	The site is underlain by alluvial silty sandy clay overlying the Upper Chalk aquifer.

Hydrology	The River Arun flows in a southerly direction approximately 40m south east from the gasworks site, and adjacent to the grazing land. A drainage ditch flows along the north eastern boundary of the site and into the River Arun via a sluice gate.
Site Investigation	A previous desk study by WS Atkins (1994) and site investigation Harrison and Co. (1988) have documented the geology and site history, with further recommendations for site investigation work. Chemical analysis from the current investigation has identified the highest contaminant concentrations to be in the made ground, within the three holder bases in the northern part of the site and below the demolished gas processing area. In particular the 'hotspot' to the north east of the former buildings (TP5) contained visible tarry residues, where a wide range of contaminants were detected. Perched water also had concentrations of a number of dissolved contaminants, some which were also detected within samples of groundwater from the chalk aquifer and the surface water in the adjacent drainage ditch.

1. INTRODUCTION

General

1.1 WS Atkins was commissioned by Lattice Property Holdings in June 2000 to undertake an assessment of possible ground contamination at their premises at Ford Road, Arundel resulting from historical use of the site for gas production, storage and transmission.

1.2 This document provides a combined factual desk study and site investigation report.

Report Format

1.3 The following sections of the report contain:

- (i) a description of the site status, i.e. site use and surface ground conditions;
- (ii) a description of the site geology, hydrology and hydrogeology;
- (iii) a description of the site history i.e. process activities, waste disposal and potential contaminants; and
- (iv) details of the current site investigation undertaken.

2. SITE LOCATION AND DESCRIPTION

- 2.1 The Ordnance Survey National Grid Reference No. is TQ014067 (501293E, 106737N) and the site covers an area of approximately 1.1 hectares (see Figure 1 within the WS Atkins Environmental Liability Assessment Report, Appendix A). Full details of the site are provided in Table 2.1 (Site visit record sheet 1). As directed by Lattice Property Holdings the current site investigation refers to the former gas production and storage area only, occupying 3,996m² (0.40ha) in the north east of the site (hereafter referred to as the study site). The centre point of the study site has ordnance co-ordinates 501293E, 106737N.
- 2.2 The site is located adjacent to the north west bank of the River Arun, Ford Road and Old Forge Mews. The site is currently unoccupied, has no telephone contact, and has a postal address of Former Holder Station, Ford Road, Arundel, BN18 9DX.

Table 2.1 : Site Visit Record Sheet

Site Name: Arundel, Ford Road (Ref. SE12)

Date of Visit: 06/06/2000

Visited by: Gary Attenborough

SUBJECT	INFORMATION
Current site size and uses	The study site occupies an area of approximately 0.40 hectares. The land use of the adjacent site area identified by Environmental Liability Assessment Report still remains grazing (by horses). This was not investigated by the current investigation due to the land ownership being under review.
Description of ground cover, % of hard standing, (gravel/concentration/tarmac), condition of ground, % infiltration of precipitation	Approximately 25% of the study site ground cover is tarmac and the remainder has a gravel or wood chip surface with sporadic patches of vegetation. [REDACTED] [REDACTED] [REDACTED].
Location and type of surface drainage,(culverts, streams, rivers, ponds), approximate water level relative to ground surface	Drainage ditches along NE and SE boundaries. Any direct drainage connections from the site to these ditches was not visible.

Cont'd

SUBJECT	INFORMATION
Adjacent land uses	<i>West:</i> houses with gardens. <i>North west:</i> cemetery beyond Ford Road. <i>North east:</i> field (appeared not to be grazed). <i>East and south east:</i> River Arun separated from site by narrow stretch of waterlogged land, ditch and bund. <i>South west:</i> modern residential houses.
Name of adjacent roads/rivers/canals	Ford Road, Old Forge Mews, River Arun.
Level of ground in relation to adjacent areas and other parts of site	The study site itself is generally flat. It is set into the side of a gently sloping hill and the surrounding land gently slopes down from north west to south east. The houses to the west are at a higher level than the site although the southern parts of their gardens are at a similar level.
Site boundary length, type and condition	The study site boundary is 266 metres and consists of a chain link fence in reasonable condition. In the south of the site the fence is partially covered with climbing vegetation.
Access to site boundaries	Access to the study site boundary around the north arm of the site is slightly restricted by chain link security fencing which is positioned approximately 1m in from a wooden boundary fence.
Site services	A high voltage electricity cable supplies the sub-station on the north eastern site boundary. A surface water drain was located running east west across the centre of the site. No other live services were located. Numerous redundant process pipes were identified within fill material in the made ground.
Visibly contaminated areas	Ash and some spent oxide were present on the surface of the gas processing area in the centre of the study site.
Visible evidence of foundations	Broken out old governor tank in north east corner. Concrete slab (tank base) in south east corner.
Present day potentially contaminative activities	None.

3. GEOLOGY, HYDROGEOLOGY, HYDROLOGY

- 3.1 The geology, hydrogeology and hydrology are summarised below. More detail, including interpretation, is provided within the WS Atkins Environmental Liability Assessment Report, 1994. Selected factual extracts from this report are provided in Appendix A.

Geology

- 3.2 The general geology in the vicinity of the site is shown on the British Geological Survey (BGS) 1:625,000 scale geological map No. 2. Other information was obtained from BGS Well Records No's 21 and 88.
- 3.3 The solid geology of the study site is Cretaceous Upper Chalk overlain by 2 to 5m of sandy silty clay alluvium associated with the River Arun.

Hydrogeology

- 3.4 At the time of the Environmental Liability Assessment Report (1994) the study site was not covered by EA groundwater vulnerability or source protection zone maps. Based on current data the site is classified as high vulnerability (soil class H1 - Major Aquifer) and is not currently within a published source protection zone. The Upper Chalk is the principal aquifer in the region and has been used for potable water abstraction in the region (Appendix A – Table 3.1).
- 3.5 Despite carrying out two rounds of groundwater monitoring on the site, it was not possible to determine the direction of groundwater flow. This is anticipated to be a result of tidal influence from the River Arun extending onto site via the chalk aquifer and due to local variation in groundwater recharge i.e. sandy areas in the clay. ■

- 3.6

Hydrology

- 3.4 A total of four licensed surface water abstractions were located within 2km of the study site (1994) and these are detailed in the WS Atkins Environmental Liability Assessment Report (Appendix A – Table 3.1).
- 3.5 A drainage ditch is located approximately five metres off-site from the north eastern site boundary. In addition a former surface water drain was located running east west across the central site area. The River Arun flows in a southerly direction approximately 40 metres to the south east of the site.

4. SITE HISTORY

- 4.1 The site history (including the wider site area currently used as grazing land) has been assessed using all available plans, records and anecdotal information (see Appendix A). The information has been summarised in Table 4.1 and Figure 3. [REDACTED]

[REDACTED] Each feature described in Table 4.1 is given a reference number, which can be used to identify it on Figure 3. The history of adjacent land uses is presented in a similar manner in Table 4.2.

- 4.2 The following sections outline the principal forms of ground contamination that may be present on the site based on the previous industrial use and surrounding industries.

4.3

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

- 4.4 The various activities that are thought likely to have resulted in ground or water resource contamination on this site are listed below in Table 4.3. The potential contaminants from each process or activity are described along with the hazards they pose. The areas can again be identified using the reference numbers that correspond to those given in Figure 3.

Table 4.1 : Historical Data Summary Sheet : Site Uses

Ref	Use/Feature	1875 OS	1899 OS	1912 OS	1914 OS	1933 OS	1937 OS	1946 OS	1961 OS	1971 OS	1994 SVI	June 2000 SVI
1	Gasholder	North east of operational area	x	x	x	x	x	x	x	x	x	x
2	Drainage ditch	Through north of site and along western boundary	—	—	—	—	x	x	x	x	x	x
3	Buildings	South-western corner of site	—	—	—	—	—	—	—	—	x	x
4	Small circular structure (tank?)	North corner of operational area	x	x	x	x	x	x	x	x	x	x
5	Buildings	Operational area	—	—	—	—	—	Only two in north corner remained	—	x	x	x
6	Gasholder	*	North west corner of operational area	—	—	—	—	—	—	x	x	x
7	Gasholder		North of operational area	—	—	—	—	—	x	x	x	x
8	Small circular structure (tank?)	*	*	North east of operational area	?	?	—	?	?	x	x	x
9	Gasholder	*	*	*	*	*	Centre of site	*	*		x	x
10	Electricity sub station	*	*	*	*	*	*	*	*	North-east boundary	—	—
11	Above ground tank	*	*	*	*	*	*	*	*	North-east boundary	Concrete base remaining	Concrete base remaining
12	Valve pits	*	*	*	*	*	*	*	*	Centre of site		
13	Toilet	*	*	*	*	*	*	*	*	North-east boundary		x

KEY	
?	Plan does not show this area or does not provide information
	Feature still present
x	Feature demolished/no longer present
OS	Ordnance Survey Map
BGP	British Gas Plan
AI	Anecdotal information from ex-employee
SVI	Site visit information
*	Feature not present

Notes:

1. [REDACTED]
2. Feature references correlate to Figure 3: Historical Site Composite Plan.

Table 4.2 : Historical Data Summary Sheet : Adjacent Site Uses

Boundary	1875 OS	1899 OS	1912 OS	1914 OS	1933 OS	1937 OS	1946 OS	1961 OS	1971 OS	1994 SVI	June 2000 SVI
North west	Greenfield	Cemetery beyond road	--	--	--	--	--	--	--	--	--
North east	Drainage ditch with greenfield beyond	--	--	--	--	--	--	--	--	--	--
South east	Drainage ditch with River Arun beyond	--	--	--	--	--	--	--	--	--	--
South west	Baths and "Works"	Baths, iron works and sewage works	--	--	--	--	Ironworks buildings labelled as "works"	--	Agricultural engineering works, boat builders, sewage works and fire station	New housing estate	New housing estate
West	Greenfield	Terraced houses with gardens	--	--	--	--	--	--	--	--	--

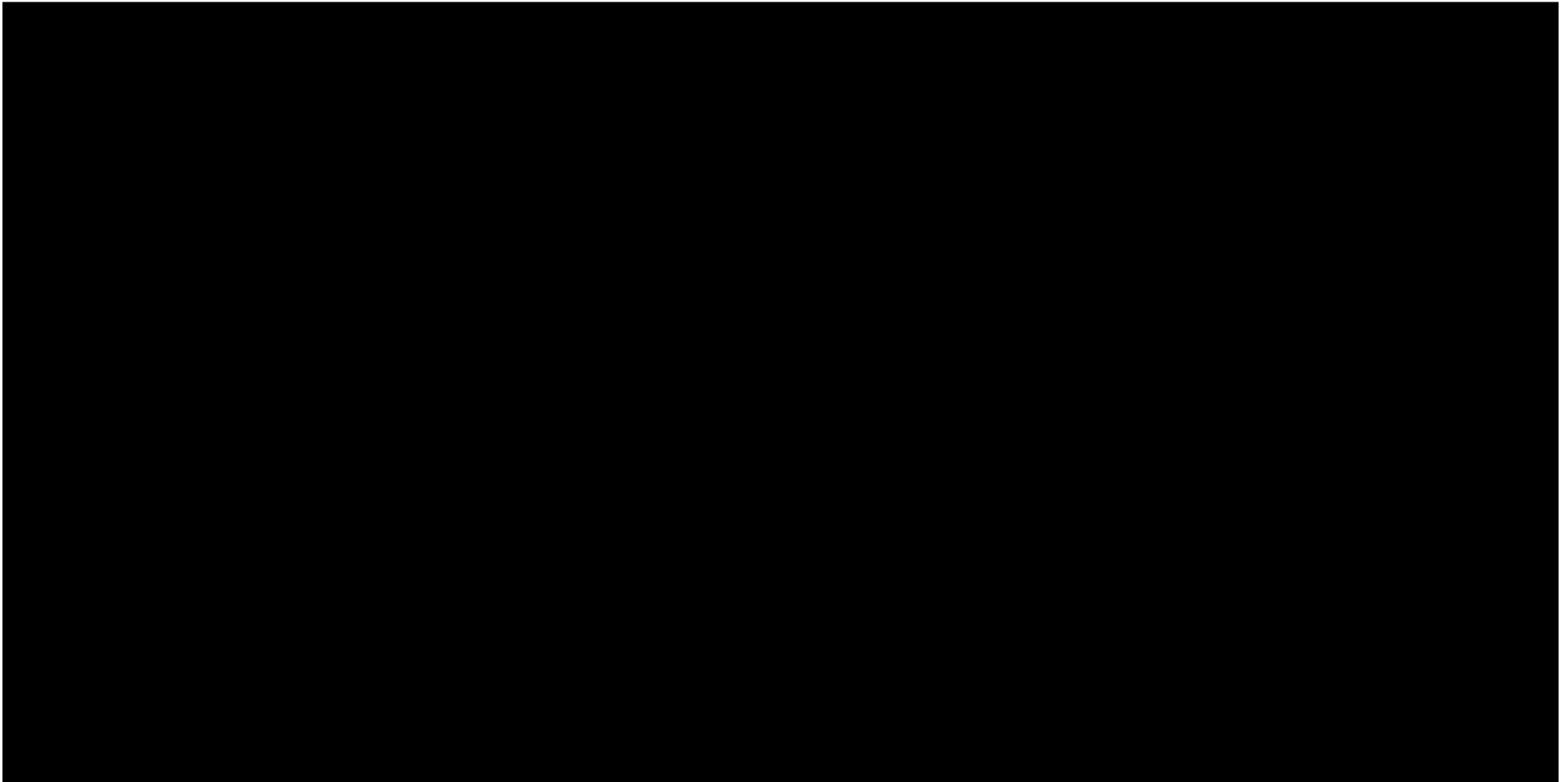
KEY	
?	Plan does not show this area or does not provide information
--	Feature still present
x	Feature demolished/no longer present
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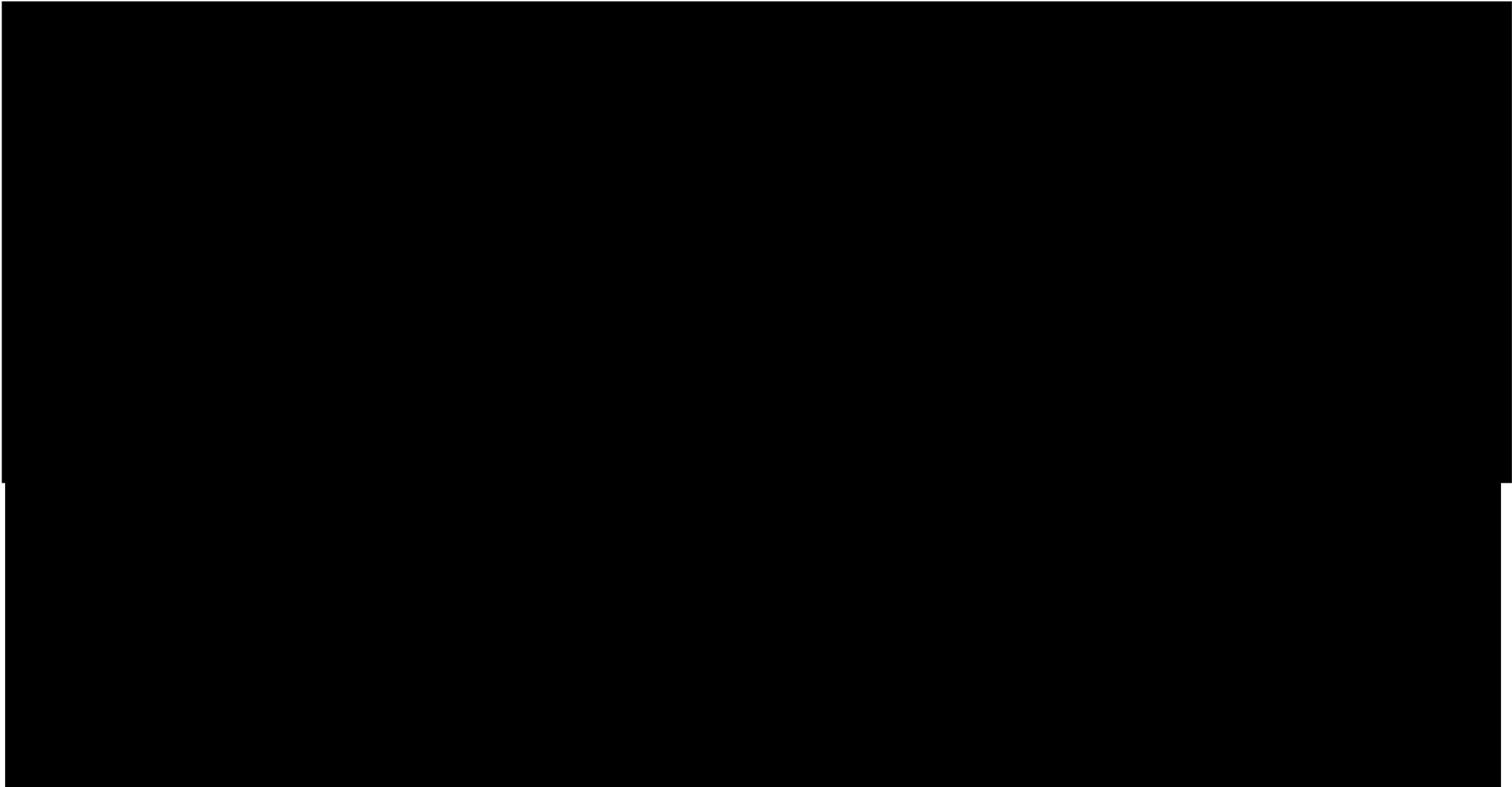
Notes:

1. The baths on the perimeter of the south-western boundary were infilled in the 1950s and 1960s. This area is part of that which has recently been developed for housing.
2. A closed landfill is situated within 250m of the north-west boundary of the site.

Ford Road, Arundel

Lattice Property Holdings





5. PREVIOUS SITE INVESTIGATION

Introduction

- 5.1 A desk study was carried out for the site (including the area to the south of the study site) by Harrison and Company of Thornton Heath in July 1993 (Report Ref. C604A). The Harrison and Company desk study is provided in full in Appendix A of this report. The report refers to a limited site investigation carried out by them in 1988. The investigation comprised the excavation of 22 trial pits to assess the contamination on the site, including the grazing field to the south. The site investigation report, logs and chemical analysis (Report Ref. C604) are not available but a brief summary of the results is provided in their desk study report and outlined below.

Ground Conditions

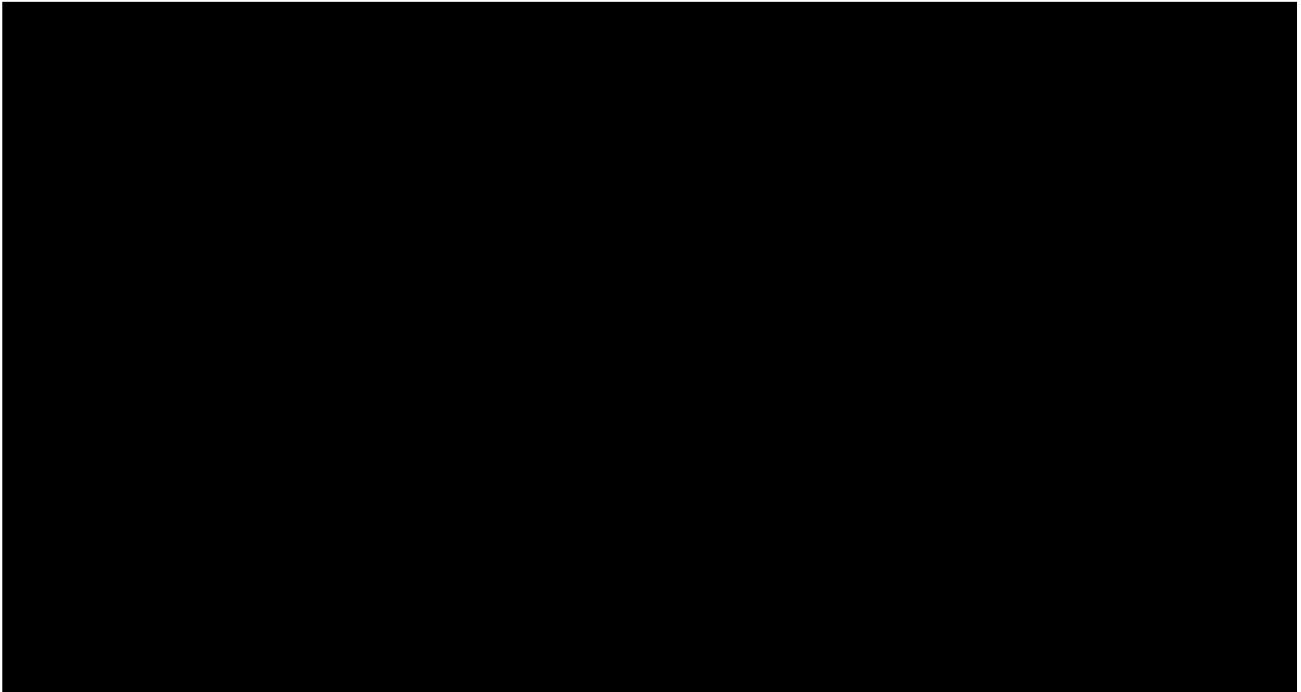
- 5.2 In the north half of the site up to 3.0m (average 1.3m) of made ground was encountered. The nature of fill materials within this area of the site is not given in the summary. Buried structures including concrete, pipes and metal were found in this area.

Chemical Analysis

- 5.3 [REDACTED]
[REDACTED]
[REDACTED]

6. CURRENT SITE INVESTIGATION

Introduction



Site Investigation Methodology

- 6.2 The investigation work was undertaken during the period of 5th to 9th June 2000, comprising the installation of five groundwater monitoring boreholes, two trial trenches, and 14 trial pits. The boreholes were installed by Environmental Sampling Ltd using rotary solid stem augers whilst working under the supervision of WS Atkins. 50mm UPVC monitoring standpipes were installed in each borehole, the construction details of which are provided in Appendix B. The trial pits and boreholes were sampled, photographed (see Appendix B) and logged by WS Atkins personnel in accordance with British Standard 5930 (1999). The ground investigation was carried out in accordance with BG Property Holdings guidance document “Guidance for Assessing and Managing Potential Contamination on Former Gasworks and Associated Sites. Version 2.4, May 1999” (Ref 1).

Exploratory Hole Locations

- 6.3 Exploratory holes were targeted to investigate features such as the former main gas manufacturing areas and gas holder bases, as well as to obtain information relating to

boundary conditions and the nature and extent of made ground across the site. [REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED] The groundwater quality within the Chalk aquifer below the site was also investigated. The rationale for the chosen locations of the exploratory holes is detailed in Table 6.1.

- 6.4 The location and levels of the boreholes and trial pits were surveyed as part of the topographical survey given in Figures 2a and 2b.
- 6.5 Live and redundant services were identified by a third party tracing contractor prior to the commencement of the works. On the eastern margin of the site an electrical cable entered the sub station, however the majority of the line was off site. A surface water sewer was located west to east across the site (see Figure 3).
- 6.6 The boreholes were installed by rotary open hole using a solid stem auger.
- 6.7 Water sampling and monitoring standpipes were installed in each borehole. The construction details are provided in Appendix B. In addition perched water was encountered in TP1, 2, 5, 8 and 12.
- 6.8 All trial pits and boreholes were logged, sampled and photographed by an experienced Environmental Scientist/Geologist in accordance with British Standard 5930 (1999). All excavation logs and selected photographs (including the general site area) are displayed in Appendix B.
- 6.9 All groundwater monitoring wells are proposed to be retained to facilitate long term monitoring of the quality and groundwater flow within the Chalk aquifer.

Table 6.1 : Site Investigation Locations

Location	Rationale for location	Actual Depth	Restrictions
BH 1, BH 2		10m bgl	None encountered
BH3		10m bgl	None encountered
BH4 & BH5		10m bgl	None encountered
TP 1,2,3,4		1.2m to 2.4m bgl	At TP4 the intact holder base was encountered and not breached.
TP 5,6		2.5m & 1.5m bgl	At TP5 redundant cast iron pipes were encountered running parallel to the edge of the site.
TP 7,8,9		1.2m to 1.7m bgl	None encountered
TP 10, 11		1.1m to 2.3m bgl	The holder base was encountered, however trial pits were extended to sample adjacent and below this.
TP 12,13,14		1.15m to 1.6m bgl	At TP14 a concrete slab was encountered at 1.2m bgl which could not be breached and the edge could not be located due to access restrictions.
TT1, TT2		1.6m to 2m bgl	Numerous concrete foundations and cast iron pipes were encountered, the edges which were investigated to identify tanks. However the foundations were not breached.

Sample Selection for Chemical Analysis

- 6.10 Soil samples were taken at one metre intervals with additional samples taken when a different stratum or specific evidence of contamination was encountered. Each borehole was developed by purging three well volumes after the monitoring well was installed, and then a further three well volumes, prior to groundwater sampling on 9th June 2000.
- 6.11 All of the water samples collected and 73 out of 74 soil samples recovered from the exploratory holes and excavations were selected for analysis on the following basis:
- all visually or olfactory contaminated soil samples were analysed for the current Lattice Property Holdings (LPH) soils analytical suite (Table 6.2).
 - generally, when visually contaminated soil was encountered, a sample from the underlying, relatively less contaminated soil was analysed to confirm the vertical extent of the contamination;
 - a selection of visually and olfactory less contaminated soil samples, both from the made ground and from the natural ground, were analysed;
 - ten soil samples from a selection of geological strata were tested for total organic matter;
 - eight soil samples were scheduled for leachate testing; the resulting leachate was tested for the current LPH analytical suite for leachates (Table 6.2);
 - asbestos analysis was only scheduled if visually evident. In the event, no asbestos was visible;
 - eleven groundwater samples were scheduled for the current LPH analytical suite for waters (Table 6.2).

Sampling and Analysis

- 6.12 Analysis of samples was carried out by TES Bretby, a UKAS accredited and Lattice Property Holdings approved laboratory. The results are given in Appendix C. Samples of soil and water were tested for the analytical suites specified in Table 6.2. Laboratory analytical quality control standard charts are attached in Appendix E.

Table 6.2. : Analytical Suites

Package 1 - Soils (42 Samples)	
pH	Phenols - total
Moisture Content	Polycyclic Aromatic Hydrocarbons
Loss on ignition	(PAH) - total of 16 priority PAHs
Easily Liberatable Cyanide	Elemental Sulphur
Total Cyanide	Water Soluble Sulphate
Complex Cyanide	Water Soluble Chloride
Mercury	Exchangeable Ammonia
Arsenic	Selenium
Cadmium	Chromium
Lead	Total Organic Carbon
Package 2 - Soils and Waters (as required)	
BTEX	
TPH (Total Petroleum Hydrocarbons)	
Poly-Chlorinated Biphenyls	
Package 3 - Waters (11 samples)	
pH	PAH - individual data for 16 priority pollutants
Electrical Conductivity	Sulphate
Total Ammonium	Sulphide
Total Cyanide	Metals
Easily Liberatable Cyanide	Total Organic Carbon
Total Phenols	Phenols
Thiocyanate	Nitrate
Chloride	Total Suspended Solids
Package 4 - Leach Tests (8 samples)	
(as per Waters minus Total Suspended Solids)	
Assumed Sampling Rate	
Trial Pits/Trench locations – analyse - 4 x soil and 1 x water (if encountered) per location	
Boreholes - analyse - 6 x soil and 1 x water per location	

Water Level Monitoring

6.13 Water level monitoring was undertaken at the time of collection of groundwater samples on 9th June 2000. The results are presented in Appendix D.

Quality Assessment**Management, Design, Specification and Site Supervision**

- 6.14 The site investigation was designed, specified and supervised 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 site supervision have been in place prior to and during the investigation.

Quality Assessment and Assurance

- 6.15 Continuous quality assessment was provided by site inspection and testing data throughout the duration of the site investigation. The Environmental Assessment Site Investigation Report in itself provides the final Quality Assessment and evidence of Quality Assurance of the site investigation.

Competent Contractors

- 6.16 The intrusive works were awarded to Quality Assured contractors, Environmental Sampling Ltd. (ESL), and Method Statements relating to all aspects of the works were prepared by the Contractor, and approved by WSA. The implementation of the Method Statements was controlled by ESL and continuously monitored by WSA.

Testing Regime

- 6.17 Samples were regularly collected during the site investigation and were appropriately stored, transported and tested after the site investigation.

Site Quality Control, Monitoring and Audit

- 6.18 The site investigation was supervised by sufficient and competent staff working for the Engineer (WSA), and similarly for the Contractor (ESL).

7. SITE INVESTIGATION RESULTS

Physical Ground Conditions

Made ground

- 7.1 The majority of the study site surface is covered by a loose light brown gravel fill, (placed as a cover layer), tarmac and concrete, with the exception of the southern boundary which is covered by vegetation or wood chippings.
- 7.2 Made ground varied in thickness across the site ranging from 0 to 2.0m below ground level (bgl), with the greatest depths in the areas that formerly contained holders and pipes. Made ground is therefore principally located to the centre and north of the study site with natural ground at the surface 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 very small quantities of spent oxide.

Underground structures

Pipes

- 7.3 300mm (OD) cast iron pipes were encountered in TP5 and TP8 at depths of between 0.7 and 1.2m below ground level (bgl). In TP8 the pipes reduce in depth as they extend away from the adjacent governors.
- 7.4 A dry 200mm clay land drainage pipe (breached by the excavation), a 400mm concrete pipe (integrity intact) and a 0.5m² brick manhole were encountered at TP10, at approximately 1.2m bgl. The latter drain is considered to be the old drain running across the site from the former iron works, the location of which is shown in Figures 1a and 1b.

Foundations

- 7.5 Brick and concrete foundations were encountered in TT1, TT2 and TP5 at depths of between 0.2 and 0.4m bgl, these occur in the area which formerly contained the gas works buildings. The trial trenches were constructed to the depth of the underlying

foundations, with deeper excavations in the areas between these (TT1A, B and TT2A, B), to investigate the possible presence of tanks. These excavations did not reveal the presence of any tanks. However, tarry contamination was encountered in TP5. However, the complete absence of tanks can not be confirmed due to the limited nature of the excavations and because the depth of most of these was limited due to obstructions. Full investigation of this area would have involved removing the top 0.5m of made ground, exposing the foundations and breaking out selected areas. This was considered to be beyond the scope of the current investigation.

Gas holders

- 7.6 The base slabs of the gas holders in the western and southern corners of the site were encountered between 0.6 and 1.5m bgl in TP3, TP4, TP10 and TP11. The bases of the other two holders located along the north eastern boundary were not encountered in either TP1 or TP2. However, pieces of broken concrete were observed in TP2.
- 7.7 The holder base in the western corner of the site consisted of a integral 200mm thick mass concrete slab at 1.2m bgl, which visually appeared to contain a small quantity of black stained material just above it. This holder and the two holders north east of this have been backfilled with chalk at their eastern ends. However at their western ends the fill comprised loose light brown or orange sandy silt with gravel, mixed with a variety of waste materials (wood, timber, brick, scrap metal, plastic, steel pipes, steel drums, car parts, glass bottles, coal, railway lines and cast iron) and pockets of reworked natural ground. Pockets of this material exhibited a slight 'gasworks odour'.
- 7.8 The holder base in the southern corner consisted of a broken pink–light red 200mm thick mass concrete slab, underlain by 300mm of loose grey sand and tarmac. This was underlain by a grey integral 300mm thick mass concrete slab at a depth of 0.9m bgl. The holder has been backfilled with a soft dark brown-black silty clay with ash, gravel, coal, brick and timber, overlain by loose light brown clayey top soil.
- 7.9 All holder bases encountered were founded directed on the soft orange-brown clay alluvium (natural ground), which did not appear to have any visual or olfactory contamination.

Former tanks

- 7.10 TP 14 was excavated in the eastern corner of the site to the east of a potential former tank base slab. The base slab was a 150mm thick integral mass concrete slab present at the ground surface, underlain by two rows of red bricks. The tank base was underlain by made ground as described above and a concrete foundation at 1.15m bgl. Unfortunately it was impossible to break through the slab at this depth or find the edge due to the tight working space.

Natural Strata

- 7.11 The top of the natural strata occurred between ground level (TP6, TP12 and TP13) and approximately 2.0m 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. This was underlain by a soft white to light grey weathered chalk with occasional grey staining, stones and flinty gravel.

Groundwater

- 7.12 Groundwater extracted from the Chalk aquifer was chalky and odourless with no visual signs of contamination. The site was revisited on 19th July 2000 and the normalised groundwater levels were recorded in Table 8.1 below. See Appendix D for further details.

Table 7.1 Groundwater Levels (19/07/2000)

Borehole	Water Depth (mbgl)	Standing Groundwater Level (mAOD)
BH1	3.900	0.070
BH2	3.465	0.245
BH3	3.115	0.475
BH4	2.435	0.435
BH5	2.855	0.045

- 7.13 Surface water levels in the drainage ditch to the north east of the site (controlled by a sluice gate) and the River Arun (tidal) were not surveyed during the site works.

Perched Water

- 7.14 Perched water ingress was encountered in TPs 1, 2, 5, 8 and 12 and is described in Table 8.2 below.

Table 7.2 Perched Groundwater Observations

Trial Pit and Depth	Trial Pit Elevation (mAOD)	Perched Water Elevation (mAOD)	Visual and Olfactory Observations
TP1 @ 1.4m	3.60	2.20	Clean appearance, with a slight organic odour.
TP2 @ 1.8m	3.71	1.91	Dark brown with a brown foam and a tarry odour.
TP5 @ 1.2m	3.35	2.15	Dark brown with a tarry odour and an oily/ tarry sheen.
TP8 @ 1.2m	2.94	1.94	Dark brown/ green with a phenol/ oily odour and a sheen on the water surface.
TP12 @ 1.3m	2.43	1.13	Clean appearance, with no odour.

Gas Emissions

- 7.15 Gas monitoring was not undertaken during this investigation.

Laboratory Analysis Results

- 7.16 Laboratory data for soil chemistry, including leachate testing, are provided in Appendix C.
- 7.17 Samples of perched water and groundwater from the underlying chalk aquifer were analysed and the data are provided in Appendix C. This also includes the results for a surface water sample taken from the drainage ditch running parallel to the site and into the River Arun.

8. REFERENCES

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3. British Standard 5930. Code of Practice for Site Investigation (Annex F) 1999.
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