Appendix A

Sample	Depth Feet	Description
A2	2	Dark brown/black cinder-like loosely packed particles no odour.
	4	Dark brown/black moist slightly clay-like no real odour.
A3	2	Contaminated sand - strong tarry smell.
	6	Clay type soil, no obvious signs of contamination.
B2	0	Dark black, loosely packed, containing rocks no real smell.
B3	2	Dark grey, clay type. Heavy tar odour, fine particle size.
	6	Pale brown/Ochre colour - fine particles - like clay/sand.
B4	2	Sandy soil with some dark grey particles.
	3-4	Particulate soil, dark brown, little smell.
	4	Moist, dark brown, thick in consistancy with fibrous pieces sharp smell of gas.
C2	2	Quite tightly packed particles although gritty in texture, fairly stoney, brown strong hydrocarbon smell.
	4	Sludge like fairly runny dark brown strong tar smell.
C3	2	Thick dark brown soil. Slight smell of tar.
	4	Very sludge like dark brown, black in places pungent smell of tar
	6	Thick dark brown slightly clay like in consistancy. Strong odour of tar.
C4	2	Dark grey, chalk smell. Probably coke or ash deposits.
	6	Sandy coloured small particles moist slightly packed slight odour
D2	2	Sandy coloured, loosely packed very strong hydrocarbon smell.
	6	Dark tan, sandy loosely packed particles slight odour.
D3	2	Dark brown/black fairly loosely packed, quite gritty very strong smell of tar and a gas type odour.
	6	Brown/tan sandy particles moist tightly packed slight smell.
D4	2	Loosely packed brown soil, slightly sandy containing a few cinders, smell of tar.
	4	Loosely packed reddish-brown sandy/clay contains small lumps of cinders or coal, strong smell of tar
	6-0	Very loosely packed mostly sand, orange/ginger in colour, smell of tar
E2	2-0	Black/brown containing wood and tarry material smell of tar.
	4	Orange/brown tightly packed sand containing cinders sharp tar smell.
	6-0	Loosely packed sand containing small pieces of coal or cinder slight smell of tar.

Sample	Depth Feet	Description
E4	2	Tan/brown colour fairly loosely packed small particles no odour.
	6	Light brown loosely packed small particles contains a few cinders slight odour.
F2	2-0	Loosely packed, sandy patches in dark brown soil. Smell of tar.
	4	Yellow sand some contamination in localised spots.
	6	Dark sandy soil loosely packed particles, no smell.
F3	0	Very black/brown soil, fairly loose, moist. Tar odour.
	2	Fairly loose, dark with orange coloured patches. smell of tar.
	4	Sandy coloured loosely packed sand/clay contains cinders slight hydrocarbon colour.
	6	Thick, clay type soil dark brown/orangy in colour, strong tar smell.
F4	2	Loosely packed brown soil containing long grass and scrub strong tar smell.
	4-6"	Dark brown with some sandy patches. Fairly loosely packed but contains large lumps, slight tar smell.
	6-7	Dark brown with sandy patches, slight tar smell.
G2	2	Black/dark grey very loosely packed, contains cinders slight odour.
	6	Dark sandy soil loosely packed, contains tar like material strong hydrocarbon smell.
G3	2	Loosely packed small particles, dark brown no odour gritty.
	4	Reddish brown, loosely packed particles with large lumps no odour.
	6	Loosely packed particles of various sizes, includes a few cinders, dark brown slight odour.
G4	0	Dark brown loosely packed particles, tree roots, grass no odour.
	4-5	Orange - broken brick constituency, crumbly no organic odour.
	6	Very red contains pieces of brick, loosely packed gritty contains a mixture of particles. Pungent tar odour.
H2	2	Black loosely packed particles contains cinders and small rocks.
	6	Dark tan sandy loosely packed particles strong odour.
I2	2	Tan coloured, moist fairly loosely packed contains alot of sand.
	6	Dark tan, sandy small particles lumped together strong odour.
SP1	0	Black/brown loosely packed particles, gritty, slight odour.
	2	Clay bound with slate like material. Slight odour, sulphur brick as well.
	4	Mixed particles, brick cinder fairly strong smell brown in colour.

Sample	Depth Feet	Description
SP2	2	Loosely packed fairly large lumps, clay like although contains some sand. Strong, sharp clay smell
	4	Fairly tightly packed, clay like dark-brown slight tar smell.
	6	Fairly tightly packed, khaki colour, very clay like in texture although slightly sandy, tar smell.
SP3	2	Very loosely packed, small particles containing pieces of brick reddish brown, strong smell of tar.
SP4	2	Fairly large lumps of sand/soil, yellow/brown in colour, very little odour.
	6	Light tan, sandy, small particles lumped together slight smell.
SP5	2	Dark brown, moist thick in consistance smell of tar or gas.
SP6	2	Black/dark grey, gritty and containing cinders, smell of hydrocarbons.
	4	Very large particles, sandy brown slight odour.
SP7	2	Large beige white particles clay like slight smell of hydrocarbons.
	4	White-grey clayish particles, fairly large, no odour.
STD1		Brownish/black topsoil, loosely packed small particles contains no grass and rocks. No hydrocarbon smell.
STD2		Sandy colour soil, loosely packed small particles no hydrocarbon smell.

Appendix B

Methods of Investigation

1) Moisture

5) g of soil as recieved, dried overnight in an oven at 110°C. The percentage moisture was obtained by reweighing the sample and calculating the moisture lost.

2) pH

30 g of the soil as received was weighed out plus 75 ml of distilled water. This was stirred and left to stand overnight. The pH was determined using a pH meter.

3) Chloride

1 g dried and ground soil plus 100 ml of distilled water was allowed to stand for 1 hour after being stirred. This was filtered and a colorimetric finish done.

Colorimetric Determination

10 ml aliquot of filtrate
plus 4 ml mercuric thiocyanate
plus 8 ml ferric alum (Ferric ammonium sulphate) solution made up to 50 ml with distilled water. This is left for 15 minutes and then measured at 470 wavelength using a 2 cm cell.

4) Phenols

20 g of soil as received plus 200 ml of NaOH, stirred and left for 1 hour. This was then filtered and a colorimetric determination was done.

Colorimetric Determination

10 ml aliquot of filtrate.
plus 30 ml distilled water
plus 1 ml Folin and Ciacaltau reagent
plus 5 ml sodium carbonate

made up to 50 ml with distilled water and left for 20 minutes. The mesurement was done using a wavelength of 675 µm

5) Ammoniacal Nitrogen

5 g dried soil plus 100 ml distilled water, stirred and left for 1 hour. This was filtered and a 50 ml aliquot taken for the release of ammonia. This was placed in a flask along with 200 ml distilled water and 0.25 magnesium oxide, and was distilled for 1 hour. The distillate was collected in 20 ml N/50 HCl.

The distillate was titrated against freshly prepared N/50 NaOH using methyl red as an indicator.

6) Total Cyanide

20 g of soil as received plus 200 ml NaOH stirred and left for 1 hour and then filtered.

Then 50 ml of extract was placed in a flask plus 150 ml distilled water, neutralized to pH7 and the following reagents added.

5 ml lead acetate
plus cuprous chloride.

The distillate was collected in 20 ms of 0.5 N NaOH plus 50 ml distilled water. The solution was allowed to distill for 1 hour, when cool the distillate was made up to 200 ml and determined colorimetrically.

Colorimetric Determination

NB. The following method was also used for simple and ferro-ferric cyanides.

20 ml aliquot of distillate
plus 1.1/2 ml HCl concentration
plus 1.1/2 ml bromine water
plus enough arsenious acid to make the solution clear
plus 20 ml pyridine/phenylene.

This was made up to 50 ml with distilled water and left for 40 minutes.

The measurement was made using a wavelength of 515. µm

7) Simple and Ferro-Ferric Cyanides

50 ml of extract (extraction the same as in Total Cyanide), plus 150 ml of distilled water.

A few drops HCl (0.5N) to make solution acidic
plus 5 ml lead acetate
plus 5 ml zinc acetate.

The distillate was collected in 20 ml of 0.5 NaOH plus 50 ml distilled water. The solution was allowed to distill for 1 hour and when cool was made up to 200 ml and determined colorimetrically.

For Ferro-Ferric Cyanide. When the residue of the above had cooled 5 ml of cuprous chloride solution was added and allowed to distill for 1 hour. The distillate was collected in 0.5N NaOH, made up to 200 ml and determined colorimetrically.

8) Thiocyanate (SCN)

5 g original soil plus 200 ml distilled water.
Boiled for 5 minutes
coded and filtered
Cooled.

Colorimetric finish

20 ml aliquot of extracted soil solution
plus 60 ml distilled water
plus 2 ml HNO_3 (40% v/v)
plus 10 ml ferric nitrate solution
made up to 100ml with distilled water.

Colorimetric determination was made after 10 minutes using a 1 cm cell and a wavelength of 515 μm

q) Sulphates (SO^{2-}_4)

2.5 g dried soil
plus 100 ml HCl 10% (v/v).
Boiled for 5 minutes
cooled and filtered using 540 filter paper.
SO^{2-}_4 determined nephelometrically.

Nephelometric determination of SO^{2-}_4

5 ml aliquot of extract
plus 30 ml distilled water
plus 1 ml conditioning agent (already prepared)
made up to 50 ml with distilled water.
plus 0.15 g Barium chloride, shaken up side down for 1 minute.
Galvanometer reading of nephelometer taken after 3 minutes.
A blank was made up using water.

r Sulphates Sulphides

3 g of original soil placed in a round bottom flask.
Nitrogen is passed through the flask and into a bottle containing zinc acetate solution (2 ml zinc acetate in 25 ml water).
25 ml H_2SO_4 (10%) is added to the soil in the reaction flask dropwise through a funnel.

The reaction flask is heated for 1/2 an hour and then cooled for 10 minutes while still passing nitrogen.

Titration

The ~~precipitate in~~ solution was placed in an iodine flask
plus 10 ml H_2SO_4 solution (1+3)
plus 10 ml N/80 I_2 solution.

~~The I_2 was added in 2 solution.~~

The I_2 was added in such a way as to prevent the escape of any liberated H_2S.

The excess I_2 solution was titrated against N/80 $Na_2S_2O_3$ solution using starch as an indicator.

Metals

All the metal determinations were done using dried (110°C) and crushed soils. 0.25 g dried, ground material was mixed with 2 g litnium tetraborate in a platinum crucible.

The mixture was heated in a muffle furnace at 1000°C (max. temp. attainable) for 1 hour.

The fused product was then extracted in stages, using a total volume of 100 ml acid solution (already prepared).

Magnetic stirrer was used to dissolve the melt in the acid solution.

The solution was made up to 250 ml with distilled water.

THE SOLUTION WAS THEN READY FOR THE AAS

3 calibration solutions were required for each metal determination. Each calibration solution was prepared acording to the sensitivity of the element and each needs to be prepared into 100 ml volumetric flasks and contained 50 ml of "matrix" solution which was already prepared.

CL R/49/81

Sponsor Ref. No. A143W

SECURITY CLASSIFCN.

Distribution as agreed with Estates Department

SEVENOAKS GAS WORKS SOIL SURVEY

P.F. PUTTOCK

SE94
box 95

Summary

This report details the results of the physical and chemical analysis of samples of soil from Sevenoaks Gas Works Site.

This report has been prepared for the Sevenoaks Council on behalf of South Eastern Gas Estates office.

Approved by: D.L. Bamford

SEGAS Management Services

CENTRAL LABORATORIES

709 Old Kent Road

LONDON SE15 1JJ

01-639 2000 ex.470

Work carried out by

F.W. Bacon, M.B. Pearson, A. Godfrey, T.L. Allen
P.F. Puttock and N.H. Farrow

Written by

P.F. Puttock

Approved by

D.J. Bramwell

Date

December 1981

Report Distributed to

External: K.B. Hicks, Estates
Estates Office(3)

Internal: A.C. Collins
A.C. Munnery
D.J. Bramwell
N.H. Farrow

I. Haque
M.B. Pearson
P.F. Puttock

Suitable for Reg. Sci & Technical Reports List.

1. Introduction

This note describes the results of the analyses of samples of soil taken from Sevenoaks Holder Station.

The report outlines the nature of the site, the samples taken, the analyses carried out, and the results of the analyses.

The work was completed following guidelines set out by the Department of Environment, Greater London Council and British Gas.

2. The Site

2.1 Geographical Location

The Sevenoaks Holder Station is located about a mile north of Sevenoaks. The site is on the north face of the Ragstone Ridge. Fig. 1 shows the location of the site with reference to Southern England.

2.2 Geological Description

The Ragstone Ridge is made up of sedimentary rock and much of the area surrounding the Holder Station is sandstone and exposed chalk scarps.

The site itself is on a slight platform of clay and fairly loose soil.

2.3 Site Description

The site plan is shown in Fig.2 and the photographs show various aspects of the site.

The site is fairly flat, having an estimated slope, from end to end, of about 6 feet.

Two major physical features exist on the site and these are shown in the photographs. The main part of the site is a concrete cover. This cover is where old plant and buildings used to exist.

Around the edge of the concrete is scrub grass and trees. The whole of the site that was soil had a covering of plant growth.

There was no apparent tendency for the site to hold water or become water logged, nor was there any apparent flow of water across the site.

2.4 Site History

The acquisition of the site began in 1880 by the Sevenoaks Gas Company. By 1903 the major part of the site had been acquired and gas manufacture would have been underway by this point.

The records indicate that the site was only used for manufacture of gas.

In 1933 the site was sold to the South Suburban Gas Company (later to become part of the Gas Corporation).

Cessation of gas production is known to have been in 1960.

The site was demolished in between 1960 and 1964.

3. Sampling

3.1 Sample Locations

It is customary to sample a site at a number of locations. This ensures that a realistic picture of the distribution of contaminants is obtained.

Fig. 3 shows the sampling locations chosen for the site. The locations are based on a 25 metre grid. Chosing such a system as a grid ensures that there is no bias as to where the samples are taken.

Also, it can be seen in Fig. 3 that a number of extra sample points were chosen. These represent areas where higher levels of contamination may be expected due to the existence of particular items of plant.

Two samples from the surrounding area were taken to act as references for the analysis of heavy metals.

3.2 Sample Depths

Land and soil exhibit stratification which is dependent upon the soil structure, density, permeability etc. As a result, stratification of contaminants is very likely and consequently samples of soil were taken at different depths. This would also show up contaminants that were being gradually leached through the soil, or levels of contaminants in the water table.

Samples were taken at 0, 2, 4 and 6 foot depths.

3.3 Sampling Methods

The samples were taken using a three inch rotating drill mounted on the back of a Land Rover. The equipment was loaned by London Research Station.

The samples were taken by drilling to just above the required depth and sampling the undisturbed soil with a sampling auger.

Care was taken to ensure that the sample was not contaminated with soil from other depths.

4. Analyses

The assessment of the site may be separated into three major areas:-

4.1 The visual inspection of the site.

4.2 Visual inspection of the soil samples.

4.3 Physical and Chemical analysis of samples.

4.1 Visual Inspection of the Site

As stated previously, the general condition of the site was quite good. Concrete cover and vegetation accounted for over 90% of the site.

There were a few isolated areas of what appeared to be oxide waste although these constituted a very low proportion of the site.

The other contaminant visible was a two inch thick covering of tar in an area of some 200 square yards. This tar had obviously been allowed to run onto the site so it would solidify. This contamination would present no problem in terms of disposal.

4.2 Visual Inspection of the Samples

Each sample was visually examined at the laboratory. The texture, make-up and odour of the samples was described in the examination.

The results of this examination are included in Appendix A.

4.3 Chemical Analysis

Table 1 shows an outline of the experimental procedure adopted for the purpose of the tests. This section includes a brief description of each method of the analysis.

Full descriptions of the analyses are detailed in Appendix B.

Table 1 - Outline of Test Method

Test	Method		Reference
pH	Air dried soil agitated with water		
Moisture	Oven dry at 110°C overnight		
Chloride Determination	Mohr's method		BGAM 5.1.5
Ammoniacal Nitrogen	Release of Ammonia and Titration		
Phenol Determination	Water extract and Folin & Ciocalteu's reagent method		IGE/AM/16
Organic Solvent Extraction	Cyclohexane Weigh extractables Toluene " "		
Total Soluble Cyanide	Lead Acetate/Cuprous chloride. Absorb in NaOH		DOE Method p.216
Simple Cyanide	Lead & Zinc Acetate Absorb in NaOH		DOE Method p.226
Soluble Ferro-Ferricyanide	Trap remnants of Simple Cyanide using Cuprous Chloride		
Soluble Thiocyanate	Repeated extraction with boiling water		IGE/AM/12
Total Sulphur	Eschka's mixture & extract with water		BS.1016
Acid Soluble Sulphate	Acid extraction & nephelometric finish		BS.1377.9
Sulphide	Acid liberation of H_2S. Iodometric finish		IGE/AM/13
Elemental/Free Sulphur	Extract with CS_2		NTG Standard Method 17
Total Metals Determination	X-ray dispersive/Atomic Absorption	Zn Cu Ni Pb Hg As Cd	

5. Results

The results have been grouped together with reference to the bore hole. The codes correspond to the grid markings on the plan of the site (Fig.3).

5.1 Physical Observations.

The physical descriptions of the samples are included in Appendix A

5.2 Chemical Analysis.

Sample Point	Depth (ft)	Moisture Content (%)	pH	Chloride ppm (dry soil)	Phenols ppm (as rec'd)	Ammoniacal Nitrogen ppm (dry soil)
A2	2	17.8	7.0	475	8.7	235
	4	18.4	7.2	187	45	213
A3	2	8.6	7.3	3750	12.5	22
	6	15.8	5.9	4310	12.5	112
B2	0	23.6	7.4	687	117.5	258
B3	2	20.6	9.3	425	18	44
	6	13.2	6.7	5000	12.5	12
B4	2	12	7.1	1450	115	12
	4	24.2	7.1	212	375	146
	3-4	23.6	7.1	800	30	68
C2	2	19.8	6.3	50	145	56
	4	25.6	6.8	475	56.5	90
C3	2	18.6	7.6	50	87.5	616
	4	23.6	7.7	1500	145	56
	6	18.0	8.1	850	150	672
C4	2	13.8	7.1	5050	42.5	22
	6	16	6.9	425	5.0	862
D2	2	7.8	8.2	262	5	463
	6	11.4	8.7	375	5	582
D3	2	17.6	8.0	50	45	56
	6	10.6	7.2	50	100	907
D4	2	12.6	7.8	1875	25	280
	4	9.0	7.7	425	5	168
	6	7.8	7.7	2675	5	336
E2	2	15.8	9.9	100	162.5	12
	4	12.0	8.1	2250	5	12
	6	12.2	7.9	850	5	12

(cont'd)

Sample Point	Depth (ft)	Moisture Content (%)	pH	Chloride ppm (dry soil)	Phenols ppm (as rec'd)	Ammoniacal Nitrogen ppm (dry soil)
E4	2	13.2	7.6	262	5	134
	6	12	9.4	1612	65	739
F2	2	8.2	6.6	3100	30	336
	4	6.8	5.6	3425	7.5	22
	6	6.8	5.1	100	5	739
F3	0	15.2	7.7	50	35	560
	2	11.0	8.0	100	30	728
	4	13.2	7.8	3700	17.5	280
	6	19.2	7.3	50	42.5	672
F4	2	24.2	7.3	212	30	336
	4	16.4	7.3	50	17.5	280
	6	14.2	7.2	100	35	560
G2	2	14.0	6.4	162	5	146
	6	5.2	4.1	100	17.5	616
G3	2	10.8	7.5	475	30	123
	4	10	7.5	262	17.5	246
	6	10.2	8.3	962	12.5	56
G4	0	40.0	7.3	425	340	101
	4	13.6	7.5	962	12.5	12
	6	10.0	7.9	1662	30	56
H2	2	15.4	7.8	162	12.5	493
	6	6.8	4.1	50	12.5	739
I2	2	13.4	7.1	100	62.5	123
	6	8.6	7.0	1875	5	862
WELL WATER			6.1	9.6	1	7.3
SP1	0*	15.0	6.2	425	280	134
	0	18.6	7.6	750	7.5	68
	2	17.8	7.4	1025	7.5	56
	4	16.0	7.2	162	52.5	67
SP2	2	16.0	7.5	187	65	112
	4	19.0	7.1	475	140	44
	6	13.4	7.1	187	52.5	22
SP3	2	14.4	10.2	850	35.0	12
SP4	2	12.4	7.7	50	12.5	90
	6	11.4	7.8	587	5	762
SP5	2	20.8	7.5	537	232.5	134
SP6	2	15.0	7.0	100	42.5	582
	4	10.6	7.1	687	62.5	750
SP7	2	13.0	7.4	537	5.0	627
	4	14.6	8.0	587	17.5	123

Sample Point	Depth	Cyanides (ppm) Total (as rec'd)	Simple (as rec'd)	Ferro/Ferric (as rec'd)	Thiocyanate (as rec'd)
A2	2	187	0.8	57.6	200
	4	115	0.8	140	260
A3	2	0.8	6.8	90	240
	6	0.4	25.9	16	380
B2	0	42.6	0.4	0.4	300
B3	2	43.6	5.1	38.4	1780
	6	6.0	3.6	5.2	1260
B4	2	1.6	19.5	84	500
	3-4	0.4	16	144	140
	4	10	3.2	66	360
C2	2	1.1	25.9	175	25
	4	2.0	20.7	42.2	260
C3	2	1.1	4.7	94	150
	4	3.2	22.7	223	230
	6	1.1	1.1	127.5	150
C4	2	107.5	33.6	132	300
	6	4	0.4	0.4	200
D2	2	2.8	0.4	0.4	460
	6	1.1	0.4	0.4	40
D3	2	0.8	3.6	6.8	100
	6	1.1	0.4	1.1	260
D4	2	1.1	1.1	2.0	100
	4	1.6	1.1	1.6	525
	6	1.6	4.7	1.1	300
E2	2	5.1	2.4	1.1	70
	4	2.4	0.8	1.6	150
	6	1.6	0.4	2.8	310
E4	2	5.5	1.6	4.8	260
	6	2.8	2.8	1.6	260
F2	2	0.4	1.1	1.6	225
	4	0.4	0.8	0.8	80
	6	0.8	0.4	0.8	40
F3	0	0.8	0.4	2.4	100
	2	1.1	0.8	2.8	50
	4	0.4	1.1	1.6	375
	6	1.1	8.4	95.5	25
F4	2	0.4	6.0	10.8	12.5
	4	1.1	2.0	2.4	12.5
	6	0.8	1.6	4.0	100

Sample Point	Depth	Cyanides (ppm) Total (as rec'd)	Simple (as rec'd)	Ferro/Ferric (as rec'd)	Thiocyanate (as rec'd)
G2	2	8.4	23.9	5.1	840
	6	0.8	0.4	0.8	40
G3	2	47	7.2	8.8	40
	4	8.4	5.1	7.2	200
	6	1.1	3.2	1.1	125
G4	0	42.2	6.4	6.8	260
	4	47.8	17.1	29.6	300
	6	0.8	10.3	25.9	250
H2	2	28.4	57.5	0.4	720
	6	1.1	0.4	0.4	40
I2	2	6.7	0.4	0.4	1060
	6	0.4	0.4	0.8	720
WELL WATER		40	0.04	0.04	
SP1	0*	270	5.6	6.4	520
	0	36.4	8.8	11.2	460
	2	117.5	24.3	239	80
	4	155	19.1	4.4	300
SP2	2	2.8	16.3	135	20
	4	1.1	2.0	6.3	100
	6	0.4	6.3	4.3	370
SP3	2	2.4	4.3	44.2	70
SP4	2	4.4	0.4	0.4	2360
	6	4.7	0.4	1.1	1120
SP5	2	270	2.0	0.4	260
SP6	2	291	21.9	0.4	800
	4	19.5	2.8	22.3	740
SP7	2	10	0.8	5.1	260
	4	8	2.4	6.8	140

Sample Point	Depth	Sulphur Species(ppm) Total (as rec'd)	Acid SO_4^{2-} (as rec'd)	Sulphide (as rec'd)	Organic Extractables(%) Cyclohexane (as rec'd)	Toluene (as rec'd)	CS_2 (Dried)
A2	2	6250	9700	107	16	18	0.6
	4	4667	23000	73	22	12	2.1
A3	2	958	2600	27	8	8	0.4
	6	1000	2800	27	12	14	0.2
B2	0	3333	2100	187	20	20	1.0
B3	2	8083	-	-	14	14	1.5
	6	583	1400	13	10	14	0.3
B4	2	1250	2300	67	6	10	3.4
	3-4	6583	-	-	8	20	0.8
	4	20000	9900	120	24	6	3.2
C2	2	2292	6300	87	14	20	2.5
	4	1542	2600	113	14	22	1.5
C3	2	1375	1800	67	20	10	0.3
	4	917	2000	27	16	24	1.6
	6	750	1500	20	20	10	0.4
C4	2	2500	3100	87	14	18	0.5
	6	11250	1400	7	16	16	NIL
D2	2	1208	2000	113	12	12	1.0
	6	26250	1400	13	12	14	NIL
D3	2	1750	1900	87	20	18	1.9
	6	583	1600	87	14	14	4.0
D4	2	667	1500	27	10	6	0.2
	4	667	1300	27	10	6	0.2
	6	29583	-	-	8	4	0.3
E2	2	3167	2600	87	16	14	1.8
	4	875	1300	20	10	14	0.7
	6	542	1300	20	10	14	0.4
E4	2	708	850	113	10	14	0.9
	6	583	1800	273	12	14	2.0
F2	2	625	1300	20	10	6	0.3
	4	583	1400	13	2	2	0.3
	6	583	1900	27	2	4	4.0

Sample Point	Depth	Sulphur Species(ppm) Total (as rec'd)	Acid SO_4^{2-} (as rec'd)	Sulphide (as rec'd)	Organic Extractables(%) Cyclohexane (as rec'd)	Toluene (as rec'd)	CS_2 (Dried)
F3	0	3125	1700	87	24	22	15.6
	2	1042	1700	27	12	4	0.7
	4	625	1300	20	14	12	0.4
	6	1000	2900	27	20	14	0.5
F4	2	14375	-	-	24	24	0.6
	4	15625	-	-	16	12	0.8
	6	2292	3000	87	14	8	0.7
G2	2	4125	18400	127	14	8	1.2
	6	29167	4800	147	6	6	2.0
G3	2	15833	2900	127	14	16	2.0
	4	15208	8500	113	6	8	2.0
	6	4792	9000	33	6	2	0.1
G4	0	7125	1900	153	36	38	4.0
	4	6833	-	-	14	16	0.5
	6	875	2000	20	2	2	0.4
H2	2	7125	2580	140	14	18	0.7
	6	708	7400	100	8	8	4.0
I2	2	22333	2100	133	12	14	0.7
	6	21250	1400	133	10	10	0.4
WELL WATER		30	45	18	-	-	-
SP1	0*	3500	9300	153	10	12	4.0
	0	17000	-	-	10	16	1.0
	2	6500	-	-	12	16	0.3
	4	5000	16400	147	12	0	1.5
SP2	2	10625	-	-	12	8	0.9
	4	19792	-	-	18	16	0.3
	6	1083	1900	27	12	12	0.3
SP3	2	2125	7900	107	6	16	0.6
SP4	2	833	1700	100	12	10	1.1
	6	583	1400	107	12	14	4
SP5	2	4667	2100	213	22	24	4.0
SP6	2	4333	10580	120	16	18	3.2
	4	1000	2600	140	12	10	1.3
SP7	2	6000	2580	347	12	12	1.4
	4	33000	2800	193	18	14	1.1

Sample Point	Depth	Total Metals ppm (on dried soil) Zn	Cu	Cd	Pb	Ni	As	Hg
A2	2	330	200	40	300	650	100	3.0
	4	460	325	40	350	800	300	12.2
A3	2	150	225	400	400	500	100	1.5
	6	270	275	60	300	900	100	4.0
B2	0	670	375	40	450	650	100	2.7
B3	2	510	300	60	3250	860	100	2.0
	6	280	275	50	1650	440	100	2.5
B4	2	260	250	50	850	720	100	3.0
	3-4	880	350	70	1180	1340	350	6.5
	4	770	325	80	2500	700	400	6.0
C2	2	410	250	50	2900	1040	100	1.5
	4	280	175	50	400	600	200	1.0
C3	2	330	275	380	400	1120	100	3.5
	4	230	175	30	2000	260	100	1.0
	6	360	650	50	1000	2400	100	3.5
C4	2	200	150	60	1900	380	350	6.5
	6	450	275	40	250	800	500	4.0
D2	2	550	375	60	850	650	100	9.0
	6	460	450	40	450	650	100	1.5
D3	2	910	525	30	1200	580	100	1.0
	6	390	250	40	75	850	100	2.2
D4	2	520	525	60	3050	680	100	1.5
	4	580	300	60	450	1900	100	3.5
	6	230	200	50	3500	440	100	2.0
E2	2	480	350	60	800	1480	100	2.0
	4	330	525	50	700	1500	450	5.5
	6	450	375	50	2400	900	100	2.0
E4	2	300	100	50	300	650	100	3.2
	6	330	200	40	300	400	100	3.2
F2	2	290	600	50	4850	1340	100	1.5
	4	190	175	60	1500	600	100	1.5
	6	240	150	40	75	500	100	2.2
STD1	1	340	-	40	600	600	300	3.25
STD2	1	340	-	40	450	500	100	4.0

Sample Point	Depth	Total Metals ppm (on dried soil) Zn	Cu	Cd	Pb	Ni	As	Hg
F3	0	5840	350	50	1950	820	100	3.0
	2	820	850	50	300	3840	100	6.5
	4	320	300	50	4300	480	450	2.0
	6	330	175	50	31500	1000	100	2.5
F4	2	2580	750	50	1250	1960	100	3.0
	4	1000	375	90	600	680	100	3.5
	6	2180	750	170	2950	640	100	1.0
G2	2	490	375	40	750	800	800	6.0
	6	300	125	40	250	600	100	3.2
G3	2	590	250	40	950	800	400	4.7
	4	800	175	50	750	700	100	3.2
	6	620	375	70	5000	860	350	3.5
G4	0	930	350	40	1550	600	100	7.5
	4	480	300	60	400	500	100	3.5
	6	440	500	70	1050	1180	100	1.0
H2	2	330	250	40	550	650	100	5.7
	6	340	175	50	75	600	100	4.0
I2	2	390	175	170	250	700	100	5.7
	6	330	250	150	75	800	100	6.0
WELL WATER		0.09	0.02	0.01	0.05	0.05	0.4	0.01
SP1	0*	500	350	30	550	850	300	11.2
	0	500	225	50	800	620	100	16.5
	2	430	275	60	400	900	100	3.0
	4	2260	325	50	400	850	400	7.0
SP2	2	560	175	50	400	600	100	2.0
	4	540	500	440	400	1820	100	11.5
	6	730	425	60	300	2420	100	0.5
SP3	2	820	425	60	700	1480	100	1.5
SP4	2	300	200	50	1150	400	500	7.5
	6	330	375	50	75	950	100	2.5
SP5	2	550	275	50	950	500	500	4.0
SP6	2	330	200	70	1750	600	100	7.0
	4	560	325	50	250	950	100	11.2
SP7	2	460	200	40	300	650	100	14.1
	4	330	125	40	250	650	100	8.2

6. Discussion

6.1 Visual Inspection of the Site

The visual inspection of the site indicated that the site was "clean". There was little debris laying around on the site. This would suggest that the clearing of the site was undertaken by a competent contractor.

Any equipment or plant on the site appeared to have been put on to the site at some time since the demolition of the site.

As stated previously, most of the site consisted of concrete cover and scrub grass, bushes and trees.

The concrete appeared to be mostly roadways and in good condition, showing no major signs of breaking up.

The grass, bushes etc, were prolific, indicating that the soil was at least uncontaminated enough to support vegetation.

The minor areas which did show contamination of the surface were specific, small dumps of waste materials. Consequently these areas would not prove to be any problem in terms of disposal.

Photographs of the site are included in the report.

6.2 Visual Inspection of Soil Samples

Appendix A shows the descriptions of the soil samples when inspected at the laboratory.

The descriptions of the soil give an extremely good indication as to the presence or otherwise of contaminants. For gross contamination it could be argued to be the only test necessary.

The careful application of a visual assessment of the soils can give a very good picture of the state of the soil. Especially so is the detection of organic components such as tars, liquors etc.

The soil descriptions would suggest the following contamination.

It should be remembered that this description is subjective.

A2 No contamination
A3 Surface contamination
B2 No contamination
B3 Surface/mid depth contamination
B4 Surface clear but buried contaminant (?)
C2 Heavily contaminated especially further down
C3 Heavily contaminated further down
C4 No contamination
D2 Contamination towards the surface
D3 Contamination near surface
D4 Contamination in all samples
E2 Some contamination
E4 No contamination
F2 Some localised signs of contamination
F3 Some contamination
F4 Contamination
G2 Heavily contaminated at greater depths
G3 No contamination
G4 Heavy contamination at lower depth
H2 Some contamination
I2 Some contamination
SP1 Some contamination
SP2 Some contamination
SP3 Strong tar smell
SP4 No contamination
SP5 Contaminated
SP6 Some contamination
SP7 No contamination
STD1 No contamination
STD2 No contamination.

6.3 Chemical Analyses

A number of areas need to be clarified

6.3.1 Test Methods

The methods chosen for the analysis of the soils were chosen because of their stringency. As a result the figures will err on the high side when compared to results obtained using other methods. This should be borne in mind when results are being compared.

Especially true of this are the results of the metal analyses in which the atomic absorbtion of fused samples showed the total metal content, not just the available or extractable metal. This is shown by the analytical results for the "Standard" samples which give high metal contents.

Similarly, the extraction of organic materials was completed on the soil as received. As a result, the extraction figures are high. This is for two reasons:

In the first place, the extraction percentage includes any water in the sample which is washed from the sample by the hot solvent. The moisture content figures show that the available water could be as much as 20% by weight.

Secondly, if a sample were dried before extraction, it is very likely that some organic compounds would "burn off" from the soil. As a result, the extraction result would be low. In the tests carried out the samples were not heated and therefore the values would be on the high side

6.3.2 Results Tables

The results are quoted for samples as received or dried. Care should be taken to ensure that the values which are being used for comparison with these results, were obtained in the same way. For instance, results quoted for dried samples will give higher apparent contamination than samples that were analysed in the as received condition.

6.3.3 Reference Soils

The soils that were used as reference soils were from the surrounding area. The levels of metals measured in the reference soils is very similar to the levels found in the samples. This is either indicative of a high metal content overall or the stringency of the fusion method for metal analysis. Either way, the reference materials give a good indication of the metal content that can be expected.

7. Conclusions

The results detailed in this report show the levels of contaminants found at different locations on the Sevenoaks site.

There was considerably less localisation of contamination than was anticipated.

The levels of contamination for the different chemical species were fairly even over the whole site.

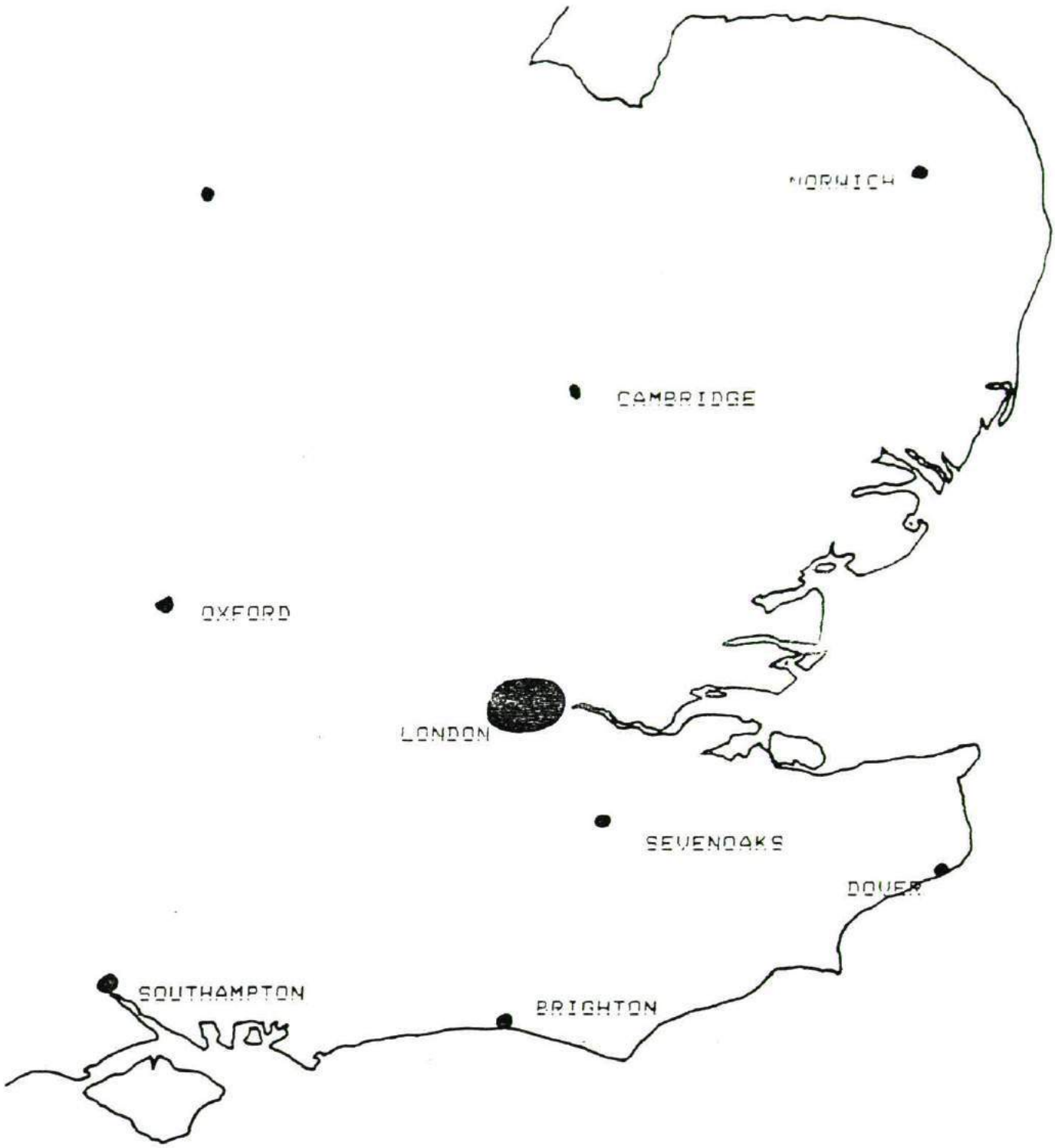
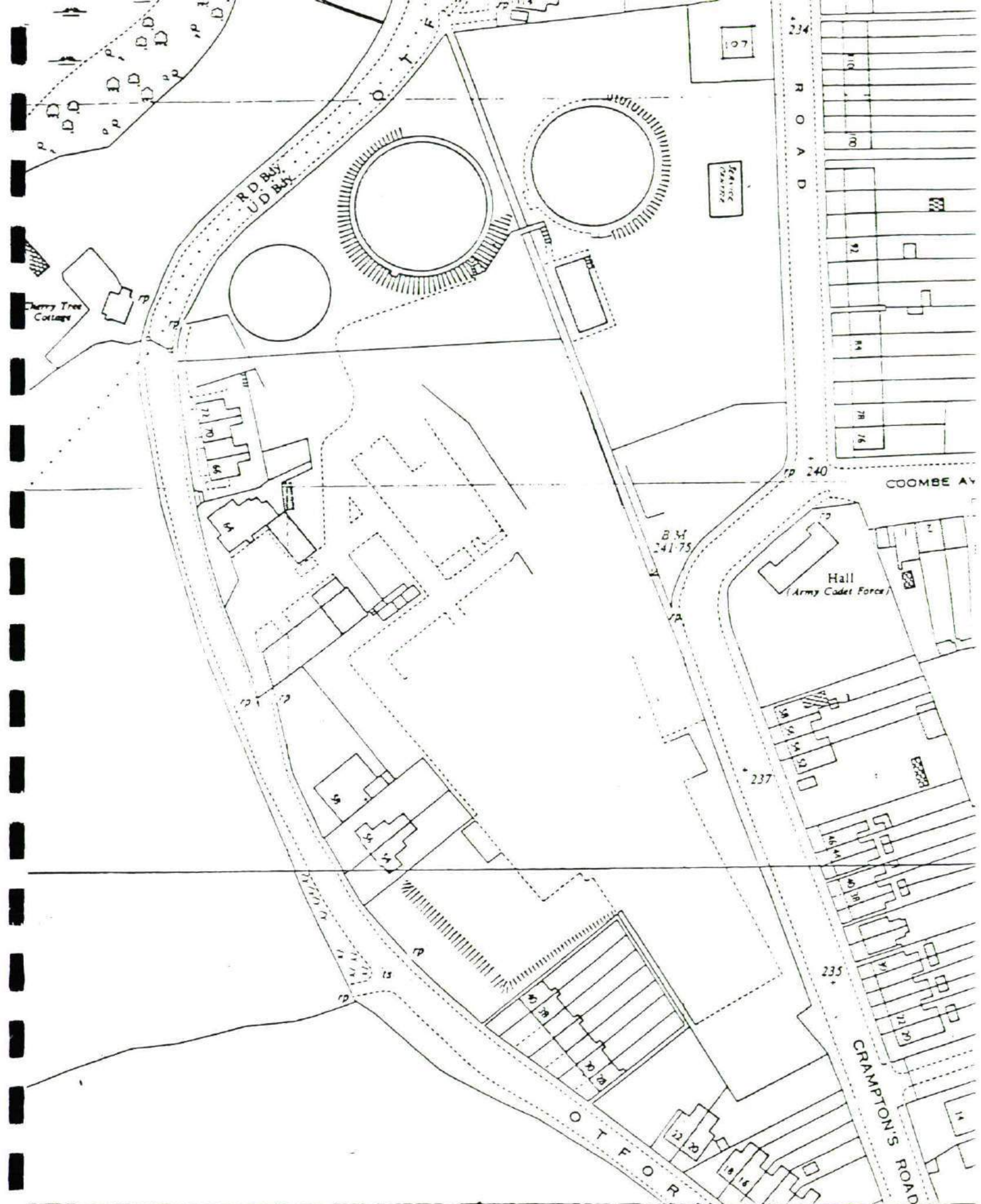
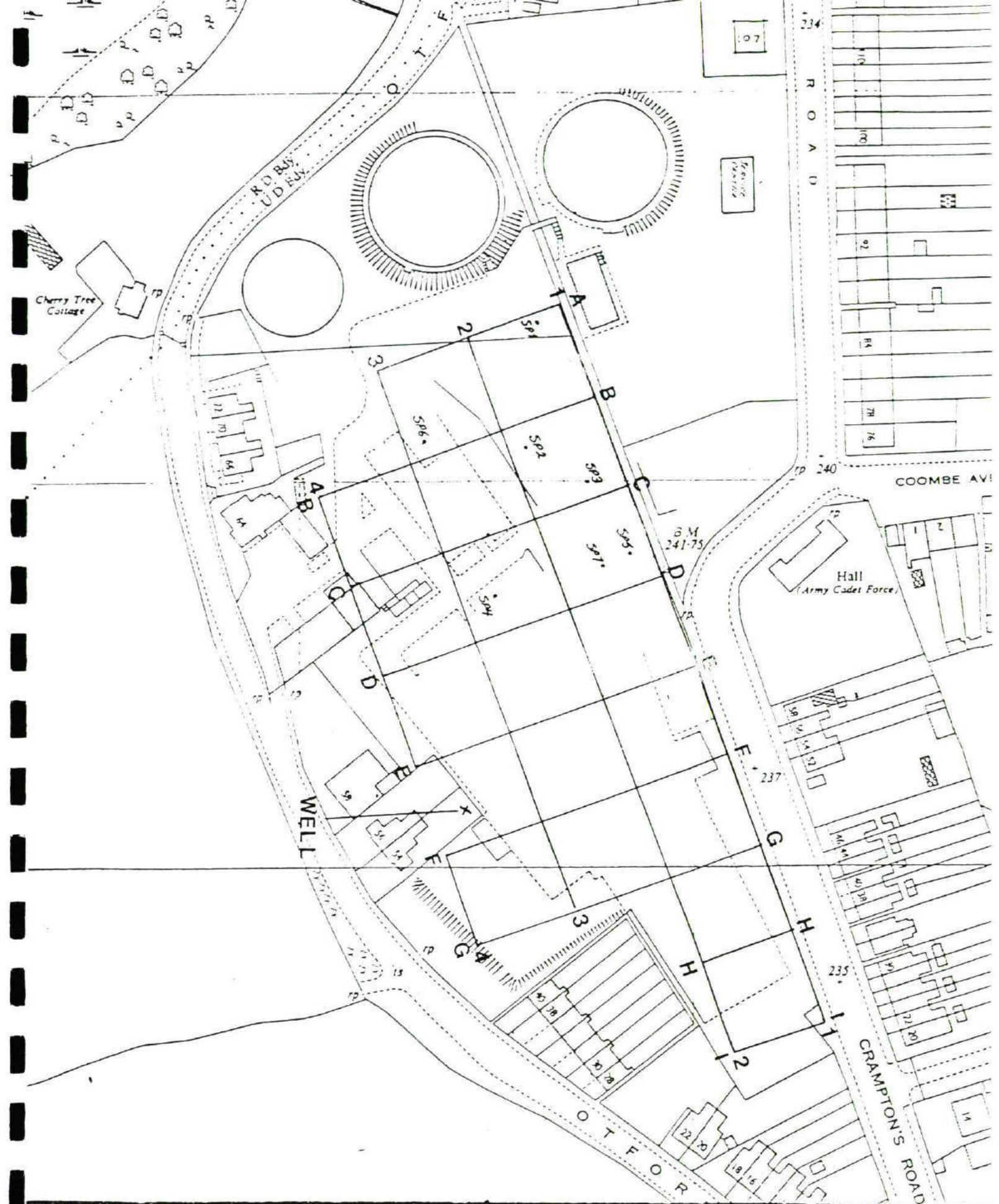


FIG.1. LOCATION OF SEVENOAKS



th Eastern Gas	
Lowman ARICS	
ates Manager	
as House	
	FIG.2. SITE PLAN
	==========

Scale	1/1250
Date	
Copied From	TQ5257SE
File Number	



uth Eastern Gas Lowman ARICS ates Manager gas House ydon CR9 1JU	FIG.3 SITE PLAN SHOWING SAMPLING GRID

Scale	1/1250
Date	
Copied From	TQ5257SE
File Number	
Drawing No.	

Appendix A

Sample	Depth Feet	Description
A2	2	Dark brown/black cinder-like loosely packed particles no odour.
	4	Dark brown/black moist slightly clay-like no real odour.
A3	2	Contaminated sand - strong tarry smell.
	6	Clay type soil, no obvious signs of contamination.
B2	0	Dark black, loosely packed, containing rocks no real smell.
B3	2	Dark grey, clay type. Heavy tar odour, fine particle size.
	6	Pale brown/ochre colour - fine particles - like clay/sand.
B4	2	Sandy soil with some dark grey particles.
	3-4	Particulate soil, dark brown, little smell.
	4	Moist, dark brown, thick in consistency with fibrous pieces, sharp smell of gas.
C2	2	Quite tightly packed particles although gritty in texture, fairly stoney, brown strong hydrocarbon smell.
	4	Sludge like fairly runny dark brown strong tar smell.
C3	2	Thick dark brown soil. Slight smell of tar.
	4	Very sludge like dark brown, black in places pungent smell of tar
	6	Thick dark brown slightly clay like in consistency. Strong odour of tar.
C4	2	Dark grey, chalk smell. Probably coke or ash deposits.
	6	Sandy coloured small particles moist slightly packed slight odour
D2	2	Sandy coloured, loosely packed very strong hydrocarbon smell.
	6	Dark tan, sandy loosely packed particles slight odour.
D3	2	Dark brown/black fairly loosely packed, quite gritty very strong smell of tar and a gas type odour.
	6	Brown/tan sandy particles moist tightly packed slight smell.
D4	2	Loosely packed brown soil, slightly sandy containing a few cinders, smell of tar.
	4	Loosely packed reddish-brown sandy/clay contains small lumps of cinders or coal, strong smell of tar
	6-0	Very loosely packed mostly sand, orange/ginger in colour, smell of tar
E2	2-0	Black/brown containing wood and tarry material smell of tar.
	4	Orange/brown tightly packed sand containing cinders sharp tar smell.
	6-0	Loosely packed sand containing small pieces of coal or cinder slight smell of tar.

Sample	Depth Feet	Description
E4	2	Tan/brown colour fairly loosely packed small particles no odour.
	6	Light brown loosely packed small particles contains a few cinders slight odour.
F2	2-0	Loosely packed, sandy patches in dark brown soil. Smell of tar.
	4	Yellow sand some contamination in localised spots.
	6	Dark sandy soil loosely packed particles, no smell.
F3	0	Very black/brown soil, fairly loose, moist. Tar odour.
	2	Fairly loose, dark with orange coloured patches, smell of tar.
	4	Sandy coloured loosely packed sand/clay contains cinders slight hydrocarbon colour.
	6	Thick, clay type soil dark brown/orangy in colour, strong tar smell.
F4	2	Loosely packed brown soil containing long grass and scrub strong tar smell.
	4-6"	Dark brown with some sandy patches. Fairly loosely packed but contains large lumps, slight tar smell.
	6-7	Dark brown with sandy patches, slight tar smell.
G2	2	Black/dark grey very loosely packed, contains cinders slight odour.
	6	Dark sandy soil loosely packed, contains tar like material strong hydrocarbon smell.
G3	2	Loosely packed small particles, dark brown no odour gritty.
	4	Reddish brown, loosely packed particles with large lumps no odour.
	6	Loosely packed particles of various sizes, includes a few cinders, dark brown slight odour.
G4	0	Dark brown loosely packed particles, tree roots, grass no odour.
	4-5	Orange - broken brick constituency, crumbly no organic odour.
	6	Very red contains pieces of brick, loosely packed gritty contains a mixture of particles. Pungent tar odour.
H2	2	Black loosely packed particles contains cinders and small rocks.
	6	Dark tan sandy loosely packed particles strong odour.
I2	2	Tan coloured, moist fairly loosely packed contains a lot of sand.
	6	Dark tan, sandy small particles lumped together strong odour.
SP1	0	Black/brown loosely packed particles, gritty, slight odour.
	2	Clay bound with slate like material. Slight odour, sulphur brick as well.
	4	Mixed particles, brick cinder fairly strong smell brown in colour.

Sample	Depth Feet	Description
SP2	2	Loosely packed fairly large lumps, clay like although contains some sand. Strong, sharp clay smell
	4	Fairly tightly packed, clay like dark-brown slight tar smell.
	6	Fairly tightly packed, khaki colour, very clay like in texture although slightly sandy, tar smell.
SP3	2	Very loosely packed, small particles containing pieces of brick reddish brown, strong smell of tar.
SP4	2	Fairly large lumps of sand/soil, yellow/brown in colour, very little odour.
	6	Light tan, sandy, small particles lumped together slight smell.
SP5	2	Dark brown, moist thick in consistence smell of tar or gas.
SP6	2	Black/dark grey, gritty and containing cinders, smell of hydrocarbons.
	4	Very large particles, sandy brown slight odour.
SP7	2	Large beige white particles clay like slight smell of hydrocarbons.
	4	White-grey clayish particles, fairly large, no odour.
STD1		Brownish/black topsoil, loosely packed small particles contains no grass and rocks. No hydrocarbon smell.
STD2		Sandy colour soil, loosely packed small particles no hydrocarbon smell.

Appendix B

Methods of Investigation

1) Moisture

50 g of soil as received, dried overnight in an oven at 110°C. The percentage moisture was obtained by reweighing the sample and calculating the moisture lost.

2) pH

30 g of the soil as received was weighed out plus 75 ml of distilled water. This was stirred and left to stand overnight. The pH was determined using a pH meter.

3) Chloride

1 g dried and ground soil plus 100 ml of distilled water was allowed to stand for 1 hour after being stirred. This was filtered and a colorimetric finish done.

Colorimetric Determination

10 ml aliquot of filtrate
plus 4 ml mercuric thiocyanate
plus 8 ml ferric alum (Ferric ammonium sulphate) solution made up to 50 ml with distilled water. This is left for 15 minutes and then measured at 470 /um wavelength using a 2 cm cell.

4) Phenols

20 g of soil as received plus 200 ml of NaOH, stirred and left for 1 hour. This was then filtered and a colorimetric determination was done.

Colorimetric Determination

10 ml aliquot of filtrate.
plus 30 ml distilled water
plus 1 ml Folin and Ciacaltau reagent
plus 5 ml sodium carbonate

made up to 50 ml with distilled water and left for 20 minutes. The measurement was done using a wavelength of 675 /um.

5) Ammoniacal Nitrogen

5 g dried soil plus 100 ml distilled water, stirred and left for 1 hour. This was filtered and a 50 ml aliquot taken for the release of ammonia. This was placed in a flask along with 200 ml distilled water and 0.25 magnesium oxide, and was distilled for 1 hour. The distillate was collected in 20 ml N/50 HCl.

The distillate was titrated against freshly prepared N/50 NaOH using methyl red as an indicator.

6) Total Cyanide

20 g of soil as received plus 200 ml NaOH stirred and left for 1 hour and then filtered.

Then 50 ml of extract was placed in a flask plus 150 ml distilled water, neutralized to pH7 and the following reagents added.

5 ml lead acetate
plus cuprous chloride.

The distillate was collected in 20 ml of 0.5 N NaOH plus 50 ml distilled water. The solution was allowed to distill for 1 hour. When cool the distillate was made up to 200 ml and determined colorimetrically.

Colorimetric Determination

NB. The following method was also used for simple and ferro-ferric cyanides.

20 ml aliquot of distillate
plus 1.1/2 ml HCl concentration
plus 1.1/2 ml bromine water
plus enough arsenious acid to make the solution clear
plus 20 ml pyridine/phenylene.

This was made up to 50 ml with distilled water and left for 40 minutes.

The measurement was made using a wavelength of 515 /um.

7) Simple and Ferro-Ferric Cyanides

50 ml of extract (extraction the same as in Total Cyanide), plus 150 ml of distilled water.

A few drops HCl (0.5N) to make solution acidic
plus 5 ml lead acetate
plus 5 ml zinc acetate.

The distillate was collected in 20 ml of 0.5 NaOH plus 50 ml distilled water. The solution was allowed to distill for 1 hour and when cool was made up to 200 ml and determined colorimetrically.

For Ferro-Ferric Cyanide. When the residue of the above had cooled 5 ml of cuprous chloride solution was added and allowed to distill for 1 hour. The distillate was collected in 0.5N NaOH, made up to 200 ml and determined colorimetrically.

8) Thiocyanate (SCN)

5 g original soil plus 200 ml distilled water.
Boiled for 5 minutes
cooled and filtered

Colorimetric finish

20 ml aliquot of extracted soil solution
plus 60 ml distilled water
plus 2 ml HNO_3 (40% v/v)
plus 10 ml ferric nitrate solution
made up to 100ml with distilled water.

Colorimetric determination was made after 10 minutes using a 1 cm cell and a wavelength of 515.

9) Sulphates (SO_4^{2-})

2.5 g dried soil
plus 100 ml HCl 10% (v/v).
Boiled for 5 minutes
cooled and filtered using 540 filter paper.
SO_4^{2-} determined nephelometrically.

Nephelometric determination of SO_4^{2-}

5 ml aliquot of extract
plus 30 ml distilled water
plus 1 ml conditioning agent (already prepared)
made up to 50 ml with distilled water.
plus 0.15 g Barium chloride, shaken up side down for 1 minute.
Galvanometer reading of nephelometer taken after 3 minutes.
A blank was made up using water.

10) Sulphides

3 g of original soil placed in a round bottom flask.
Nitrogen is passed through the flask and into a bottle containing zinc acetate solution (2 ml zinc acetate in 25 ml water).
25 ml H_2SO_4 (10%) is added to the soil in the reaction flask dropwise through a funnel.

The reaction flask is heated for 1/2 an hour and then cooled for 10 minutes while still passing nitrogen.

Titration

The solution was placed in an iodine flask
plus 10 ml H_2SO_4 solution (1+3)
plus 10 ml N/80 I_2 solution.

The I_2 was added in such a way as to prevent the escape of any liberated H_2S.

The excess I_2 solution was titrated against N/80 $Na_2S_2O_3$ solution using starch as an indicator.

11) Metals

All the metal determinations were done using dried (110°C) and crushed soils. 0.25 g dried, ground material was mixed with 2 g lithium tetraborate in a platinum crucible.

The mixture was heated in a muffle furnace at 1000°C (max. temp. attainable) for 1 hour.

The fused product was then extracted in stages, using a total volume of 100 ml acid solution (already prepared).

Magnetic stirrer was used to dissolve the melt in the acid solution.

The solution was made up to 250 ml with distilled water.

THE SOLUTION WAS THEN READY FOR THE AAS

3 calibration solutions were required for each metal determination. Each calibration solution was prepared according to the sensitivity of the element. Each solution was made up to 100 ml in a volumetric flask containing 50 ml of previously prepared "matrix" solution.

ALFRED MCALPINE HOMES SOUTH LIMITED

RESIDENTIAL DEVELOPMENT
CRAMPTONS ROAD, SEVENOAKS

REPORT ON GROUND CONTAMINATION
WITH PROPOSED REMEDIAL MEASURES

JULY 1985

R Travers Morgan & Partners
Mead House
Cantelupe Road
East Grinstead
West Sussex

i) Desk Study into the historical use of the site.

ii) Site Works and Laboratory analysis of samples.

iii) Assessment of results obtained and proposed remedial measures.

2. THE SITE

Location

2.01 The site was situated between Cramptons Road and Otford Road, Sevenoaks, Kent at O.S. Grid Reference TQ529.570

General Description

2.02 The site comprises part of the area formerly occupied by the Sevenoaks Gas Works. The majority of the site was at the level of Cramptons Road gently sloping to the South West from a high point in the North East corner. The site was generally covered in concrete and asphalt hardstanding with the Southern end used for coach parking. In areas of soil coverage there was significant plant growth, with grass, scrub and trees.

2.03 Alongside the Otford Road in the north west part of the site there were 3 brick built houses (Nos 54, 56, 58 Otford Road). Numbers 54 and 56 were at a level of approximately 1.0 m above the Otford Road and 1.5 m below the general level of the site. Number 58 was at a level approximately 1.5 m above the Otford Road and 1.0 m below the general site level. There were brick retaining walls fronting the Otford Road which were in a state of disrepair. Further retaining walls formed the boundaries between the gardens and the remainder of the site. The south west boundary of the site consisted of a steep embankment, approximately 2 m in height sloping down to the Otford road and adjacent gardens. A brick retaining wall approximately 1 m in height formed the southern site boundary with the rear gardens of numbers 28 to 40 Otford Road.

2.04 A number of physical features were identified which included the following:-

i) A precast concrete underground tank in the southern corner of the site filled with rubble and building debris.

ii) 1 number manhole which was partially filled with ash in the centre of the site.

iii) An electricity sub-station in the southern corner of the site.

iv) A brick built shaft in the rear garden of Number 54 Otford Road which may have been a soakaway.

Details of i), ii) and iv) are included in the Trial Pit

logs in Appendix 3.

2.05 North of the area zoned for industrial use the existing gasworks site remains in active operation.

Geology

2.06 Information on the geology of the site was obtained from the 1:63,360 Geological Survey of Great Britain (England and Wales) Sheet no 287 and from the log of the borehole located just to the north of the site. The borehole log is included in Appendix 2. These sources indicate that the site is located on the Folkestone Beds. The Folkestone beds extend to a depth of about 40.5 m below ground level below which lies a 3 m band of low permeability Sandgate clays over the Hythe Beds.

2.07 Water is abstracted from the Hythe beds by the West Kent Water Company who have wells to the east of Cramptons Road. The logs from these wells are also included in Appendix 2 which show that the wells are subjected to artesian water pressure.

2.08 No information on ground water levels in the Folkestone Beds have been obtained although gravel extraction to the west of the Otford Road has resulted in the formation of large lakes. The goelogical mapping indicates that the strata dips slowly to the north.

Historical Use

2.09 Investigations were made to determine the historical use of the site, these investigations included:

i) Discussion with the Environmental Health Department of Sevenoaks District Council. They had no knowledge of the historical use of the site but had not encountered any problems caused by possible contamination of the site.

ii) Discussions with SEGAS. The majority of their records had been destroyed, however, they advised that the gasworks had been demolished between 1960 and 1964 and were able to supply a drawing dated 1960 showing the layout of the gasworks. A copy of this drawing is included in Appendix 1.

iii) Visit to the British Museum to study historical O.S. Mapping at 1:2500 scale. The gasworks was shown on the 1909, 1935 and 1959 editions of the survey and the information obtained is shown in drawings 7388/3, 4 and 5 in Appendix 1.

2.10 The above sources indicate that the majority of gas production occurred north of the site. The only significant area with an indication of some gas production on the site was along the northern site boundary. This area had been the location of the Retort and Boiler Houses. No tarwells were indicated and the only tank

shown was for water purification. It appeared that the majority of the site had been used for coal/coke storage, railway sidings and some tipping: especially in the area between Nos 40 and 54 Otford Road.

Public Utilities

2.11 We understand from information provided by McAlpine Homes South Ltd that no public utility services cross the site. Neither the West Kent Water Company nor the Thames Water Authority had experienced any contamination of water supplies caused by the gas works site.

3. SITE INVESTIGATION

Sampling Proposals

3.01 Sampling proposals were based on the recommendation of the UKAEA Harwell report "Problems arising from the redevelopment of Gasworks and similar sites" and agreed with the DOE and the Environmental Health Department of the Local Authority.

It was proposed to take soil samples from trial pits excavated at points located on a grid. The grid was offset from that used for the 1981 SEGAS investigation. The trial pits were to be excavated to a depth of approximately 3 m or deeper if necessary to penetrate through the made ground into natural ground. Generally 3 samples were to be taken from each pit at 0.5 m, 1 to 1.5m, and 3 m in depth. Additional trial pits were selected in the area of fill to the south west (X4 and X5) and in the area of gas production (X7. Further samples were to be taken from the tank (X1) Manhole (X3) and shaft to the rear of No 54 Otford Road. A water sample was to be taken wherever water was encountered.

3.02 Before commencing with the site investigation discussions were also held with the Health and Safety Executive, West Kent Water Company and Thames Water Authority. The Health and Safety Executive suggested that eye protection should be worn by site personnel in addition to the basic protection of overalls, boots and gloves. Thames Water Authority and the West Kent Water Company both considered that the site investigation, as proposed would not create any water pollution problems.

Site Works

3.03 The site investigation was carried out on 17, 18 and 19 June, 1985. The trial pits were dug using a rubber tyred hydraulic JCB type excavator. For trial pits Q2, Q3, Q5 and T2 a hydraulic breaker was used to break through concrete bases at the surface. Soil samples were recovered from the bucket, bagged and delivered to the Caleb Brett Laboratories.

3.04 During excavation groundwater was only encountered in trial pit X7. Groundwater was not encountered in any

other pit although they were dug to depths below the water level at X7, this suggests that the water encountered was very localized, possibly due to a leaking water main in Cramptons Road or due to a leak in the lining of the borehole located approximately 30 m to the north.

3.05 A layer of made ground just below the surface was encountered across most of the site. Generally this varied in depth up to about 0.5 m except in the south west where depths were up to about 2.5 m and consisted mainly of coal, coke or ash with bricks, concrete etc. Various structures were encountered, including concrete foundation bases, basements and a brickarch. Detailed information of the ground conditions encountered is given in the trial pits logs (Appendix 3) which contain the visual observations made on site.

Chemical Analysis

3.06 The chemical analysis of the 66 soil samples and 2 water samples was carried out by Caleb Brett Laboratories Ltd. They were required to select methods of analysis compatible with the recommendations and comparable test results given in the following documents:

i) ICRCL 59/85 - Problems arising from the redevelopment of contaminated land.

ii) UKAEA-Harwell - Problems arising from the redevelopment of gas works and similar site.

The results of the chemical analysis are included (Appendix 4).

4. ASSESSMENT OF RESULTS

4.01 The results of the chemical analysis and the visual description of the soils encountered confirm that contamination of the site has occurred but to a lesser extent than that indicated by the 1981 SEGAS Report. In particular the recent results for heavy metals, chlorides, phenols, sulphates, sulphides, and the toluene extract tests show appreciably lower levels of contamination. We are unable to provide any specific reasons for these differences although we understand from discussions with the DOE and Sevenoaks District Council that the methods of analysis adopted by SEGAS did not give results that could be compared with those included in the standard references (ie I.C.R.C.L. 59/83 or the 198: report from U.K.A.E.A. Harwell).

4.02 Detailed comments on the severity of the contamination is provided by Caleb Brett Laboratories Ltd attached to the analytical results in Appendix 4. The results obtained give a reasonable view of the general levels of contamination present but the samples represent a very small proportion of the material on site. The remedial and protective measures proposed below have been prepared on the basis of the information available. If during the

course of the development other information or abnormal material is encountered then further investigations should be undertaken to confirm that the measures adopted were adequate.

4.03 For the purposes of this report we have made a comparison between the analytical results obtained and the 'Trigger Concentrations' provided in I.C.R.C.L. 59/83 and the guidelines proposed in the U.K.A.E.A. Harwell Report. The development under consideration is of a sensitive nature as it includes small domestic gardens and landscaped areas. The trigger concentrations recommended for this type of development are naturally stringent. This is in order to protect children who may ingest the soil and residents who may eat plants grown in the soil.

4.04 A large proportion of the results obtained showed levels of contamination below the specified trigger concentrations for small gardens. However, when giving consideration to the nature and extent of remedial measures we have also taken into account the maximum values recorded. The presence of local 'hot spots' of contamination frequently occur and the protective measures adopted need to take account of these situations.

4.05 Significant deposits of coal, coke, and ash etc were encountered in a few trial pits. These materials are potentially combustible and could also be methane producing. Deposits were found across the site below the concrete slabs and surfacings to a shallow depth but increased in the vicinity of trial pits numbers X4, X5, S4 and also appeared to have been used to fill disused pits/basements at trial pits Q4 and Y2. We understand that it is difficult to obtain an accurate assessment of combustibility and so tests were not undertaken.

4.06 No asbestos was visually identified as being present during the site works.

5. REMEDIAL AND PROTECTIVE MEASURES

General

5.01 The proposed remedial and protective measures have been prepared on the basis of the recommendations contained in the following documents:

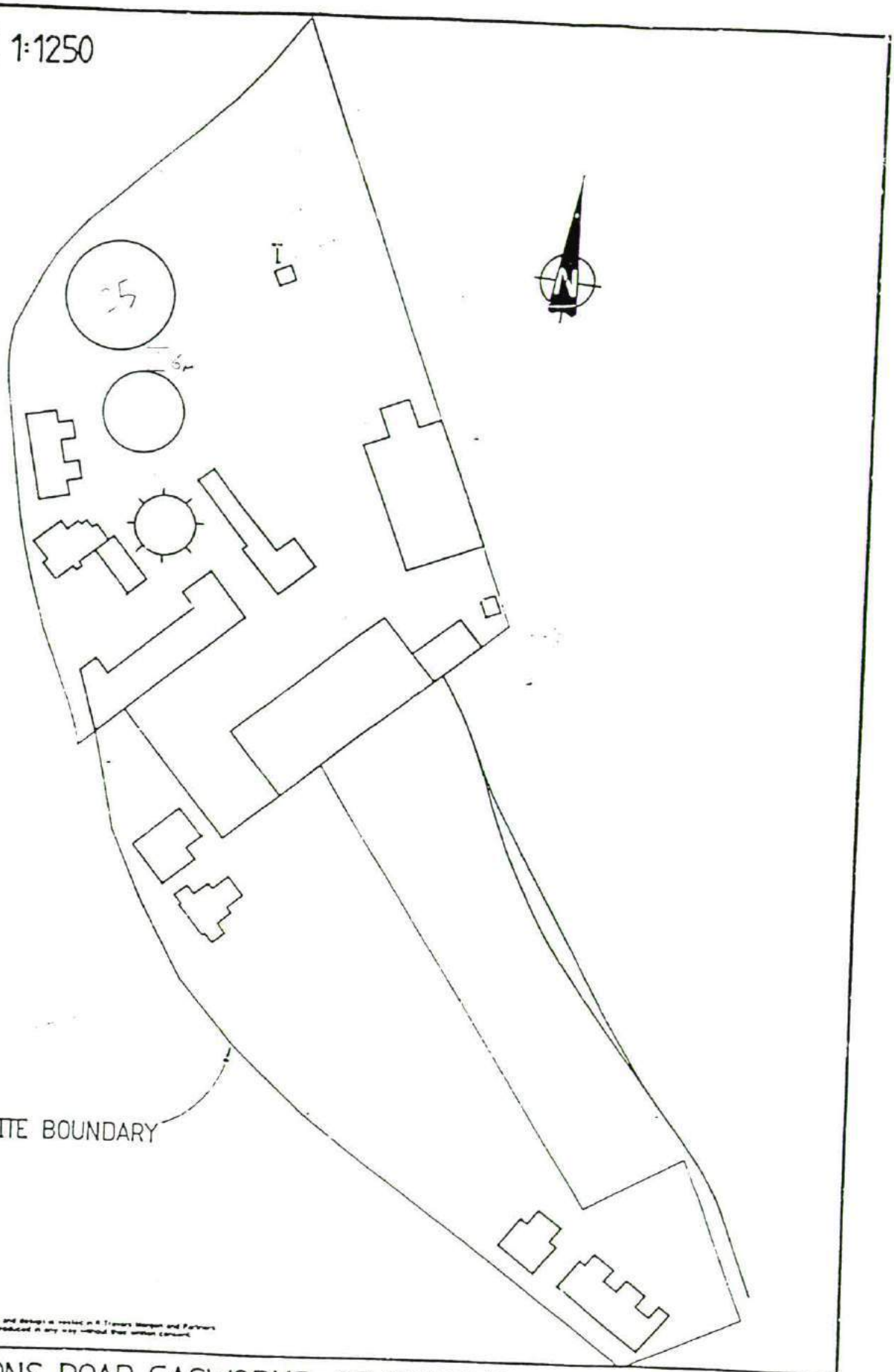
i) Notes on the Redevelopment of Gas Works Sites ICRCL 18/79.

ii) Guidance on the Assessment and Redevelopment of Contaminated Land ICRCL 59/83.

iii) Notes on the Fire Hazards of Contaminated Land ICRCL 61/84.

iv) Problems Arising from the Redevelopment of Gas Works and Similar Sites - UKAEA Harwell 1981.

SCALE 1:1250



KEY

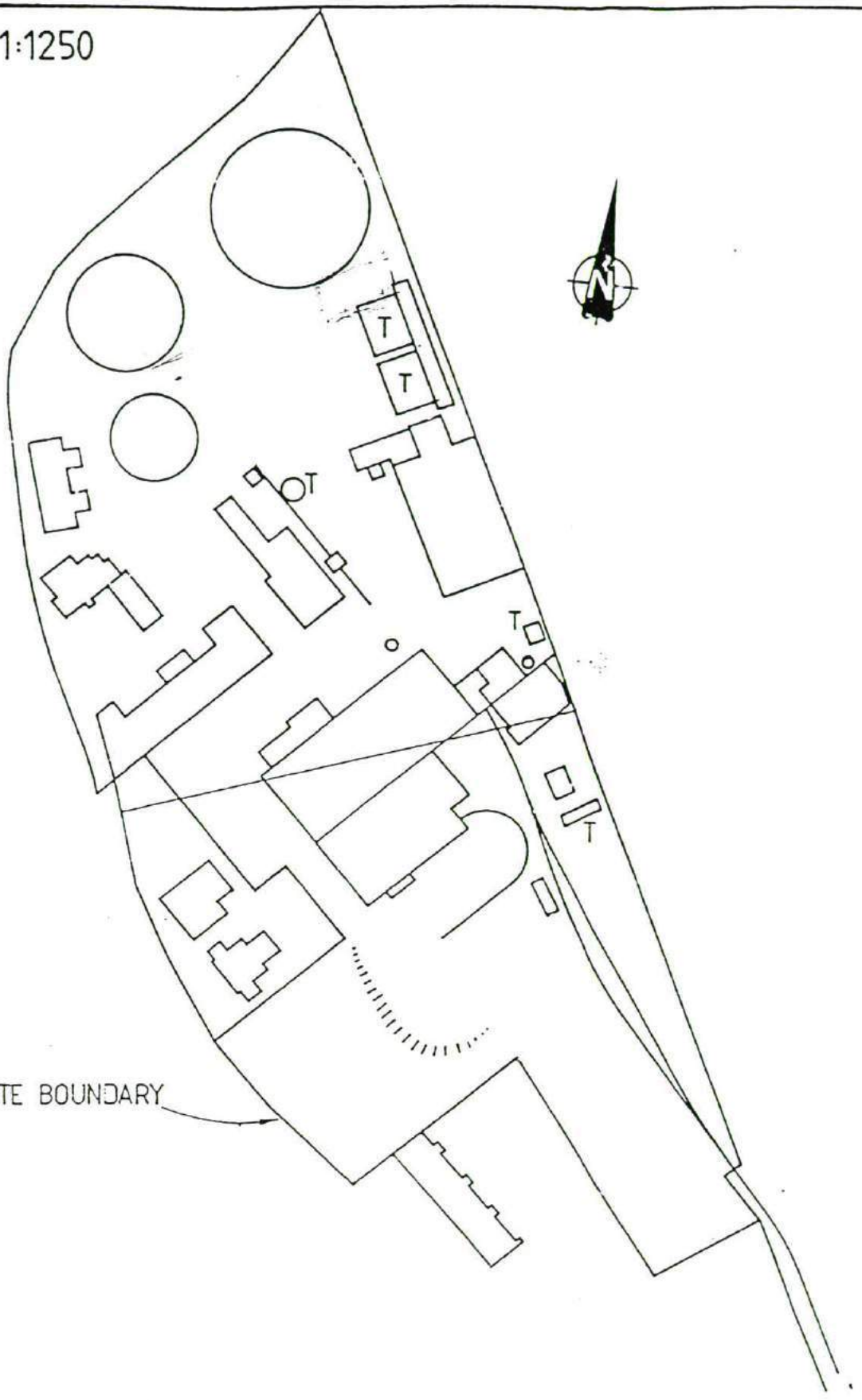
T - TANK

CRAMPTONS ROAD GASWORKS, SEVENOAKS.

SITE LAYOUT BASED ON 1909 1:2500 SURVEY.

R TRAVERS MORGAN & PARTNERS CONSULTING ENGINEERS LONDON EAST GRINSTEAD COLWYN BAY	DRAWN	CHECKED	PASSED	ISSUED	DRAWING NUMBER	REV.
	M.H.				7388/3	

SCALE 1:1250



KEY

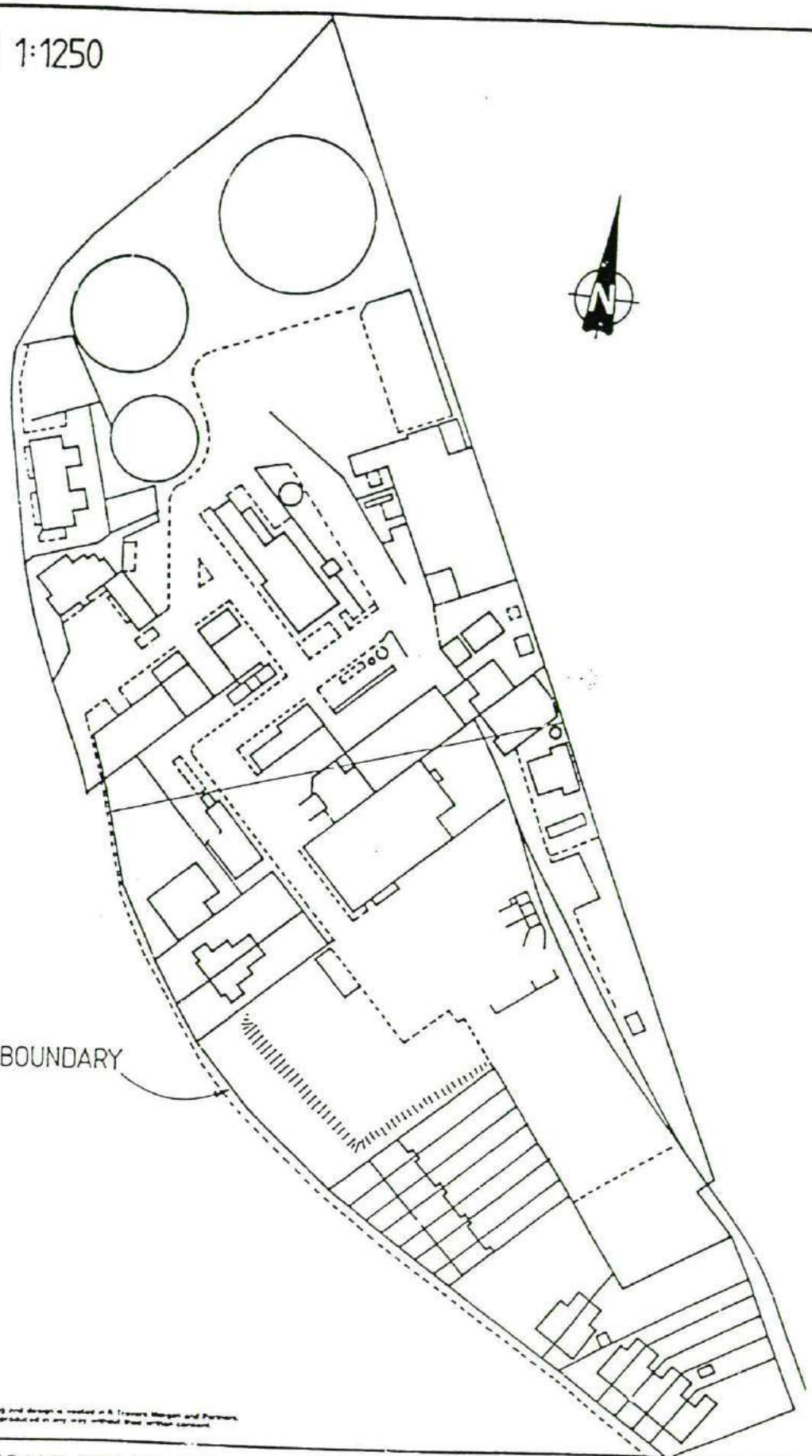
T - TANK

CRAMPTONS ROAD GASWORKS, SEVENOAKS.

SITE LAYOUT BASED ON 1936 1:2500 SURVEY.

R TRAVERS MORGAN & PARTNERS CONSULTING ENGINEERS LONDON EAST GRINSTEAD COLWYN BAY	DRAWN	CHECKED	PASSED	ISSUED	DRAWING NUMBER	REV.
	M.H.				7388 / 4	

SCALE 1:1250



NOTE -

CRAMPTONS ROAD GASWORKS, SEVENOAKS
SITE LAYOUT BASED ON 1959 1:1250 SURVEY.

R TRAVERS MORGAN & PARTNERS CONSULTING ENGINEERS LONDON EAST GRINSTEAD COLWYN BAY	DRAWN	CHECKED	PASSED	ISSUED	DRAWING NUMBER	REV.
	M.H.				7388/5	

BOREHOLE LOGS OBTAINED FROM THE WEST KENT WATER COMPANY

287/25 South Eastern Gas Board, Otford Road, Sevenoaks. (Sealed)

W.S.K. p. 191. Surface +245. Shaft 12; rest bore. Lining tubes: 20 x 7¼ in from 11 down; 115 x 6 in from surface. Overflowed at +259 at 12,000 g.p.h. *Isler, 1901.*
R.W.L. +247. Yield 1,244 g.p.h. *Oct. 1948.* R.W.L. +c.245. *Dec. 1952.* Yield 20,000 g.p.d. *1954.*

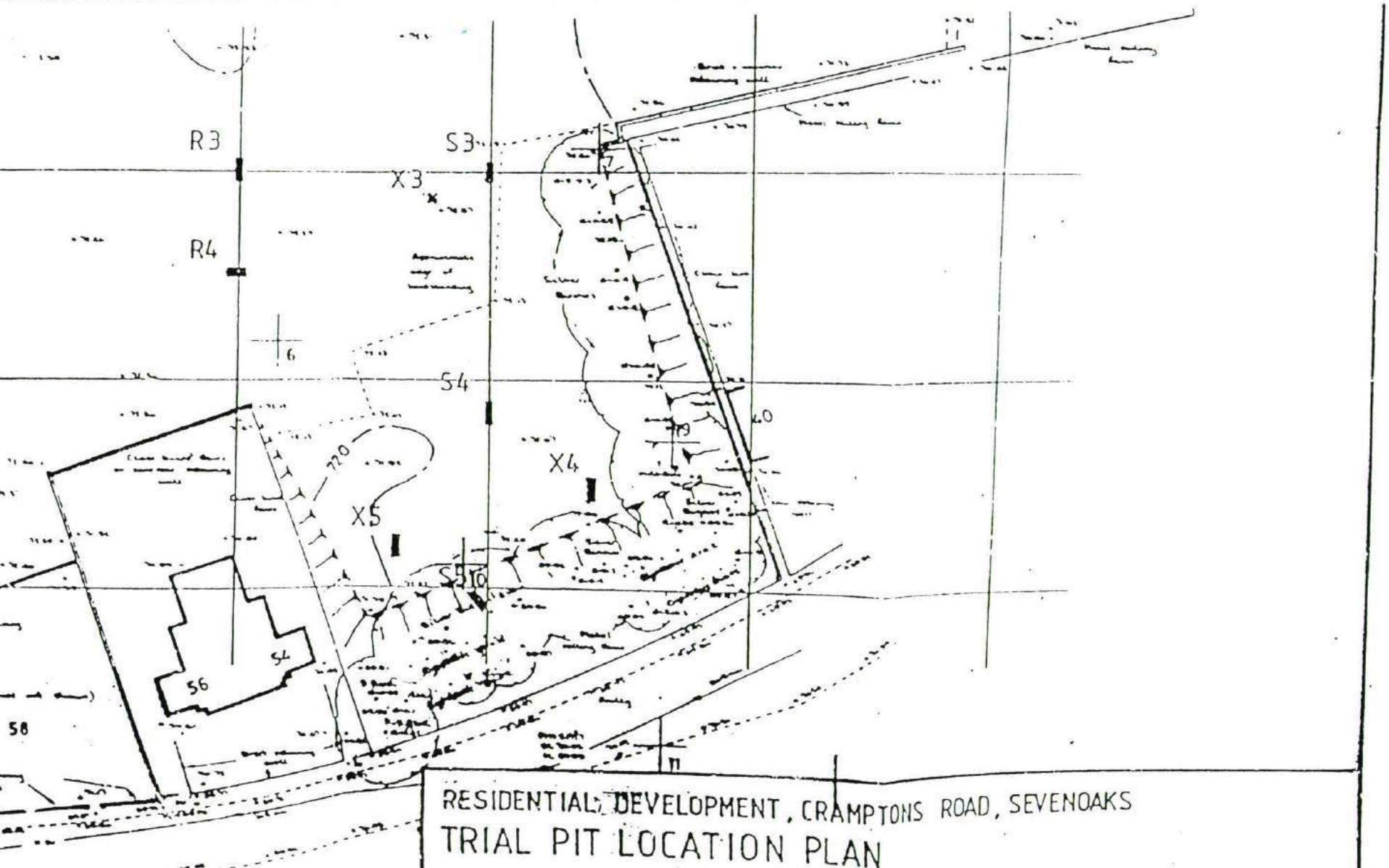
F	124		124
SaB	9		133
H	7		140

287/29 Sevenoaks and Tonbridge Water Co., Cramptons Road Pumping Station, Sevenoaks

(a) Surface +225. Bore 127. Lining tubes: 75 x 27 in from surface; 99 x 24 in from 1 down (perforated 67 to 100). When bore 99½, overflowed at 1,000 g.p.h.; bore 127, overflowed at 24,700 g.p.h. P.W.L. +205. Recovered to +253 in 37 sec. Suction +120. Yield 66,000 g.p.h. (test). Sand entered. *LeGrand, Jan. 1934.*
Additional lining tubes: 102 x 12 in from ½ down. 24 in lining tubes sealed at 96½ down. *1934.* Overflowed at +253 at 30,000 g.p.h. Drawdown 16. Recovered in 12 sec. Yield 79,000 g.p.h. (test). Hardness. P. 79, T. 207, Anal. *Before Sept. 1937.* Overflowed at +253. Yield 90,000 g.p.h. *1944.* Hardness: NC. 50, C. 175. Anal. *Aug. 1948.*
(b) Surface +225. Bore 112. Lining tubes: 75 x 27 in from surface; 99 x 24 in from 1 down; 102 x 12 in from ½ down. When bore 106, overflowed at 7,970 g.p.h; bore 112, overflowed at 50,000 g.p.h. *Isler, Jan. 1935.*
Overflowed at +253 at 60,000 g.p.h. *1937.* Well-top +228. *Before 1964.*
(a) and (b) Yield 114,000 g.p.h. (test). *1935.* P.W.L. +207. Recovered to +225 in 10-12 sec. Yield 140,000 g.p.h. (7 d. test). *Before 1944.* Overflowed at +253 at 2,800,000 g.p.d. *1952.* Overflowed at +253 at 60,000 g.p.h. *Oct. 1957.*
(c) Surface +225. Bore 120. Lining tubes: 60 x 33 in from 5 down; 80 x 24 in from 1 above; 12 x 21 in from 77 down. Water struck at +150. When bore 79, overflowed at 2,000 g.p.h.; bore 120, overflowed at 99,670 g.p.h. Hardness: NC. 40, C. 180. Anal. *Dando, Jan. 1958.*

Overflowed. R.W.L. +238. P.W.L. +219½. Recovered to +238 in 5 sec. Yield 95,633 g.p.h. (11 d. test). *Mar. 1958.* Hardness: NC. 50, C. 185. *July 1962.*
(d) Surface +227. Bore 27 in reduced to 21 in at depth. Lining tubes: 77¾ x 27 in from 3¼ above; 58¼ x 24 in from 51¾ down. When bore 110, overflowed at 3,300 g.p.h.; bore 148, overflowed at 50,000 g.p.h. *Dando, Mar. 1959.*
Well-top +228¾. *Before 1964.*
(a) - (d) Overflowed at +230 at 150,000 g.p.h. R.W.L. +c.245. *Nov. 1961.*

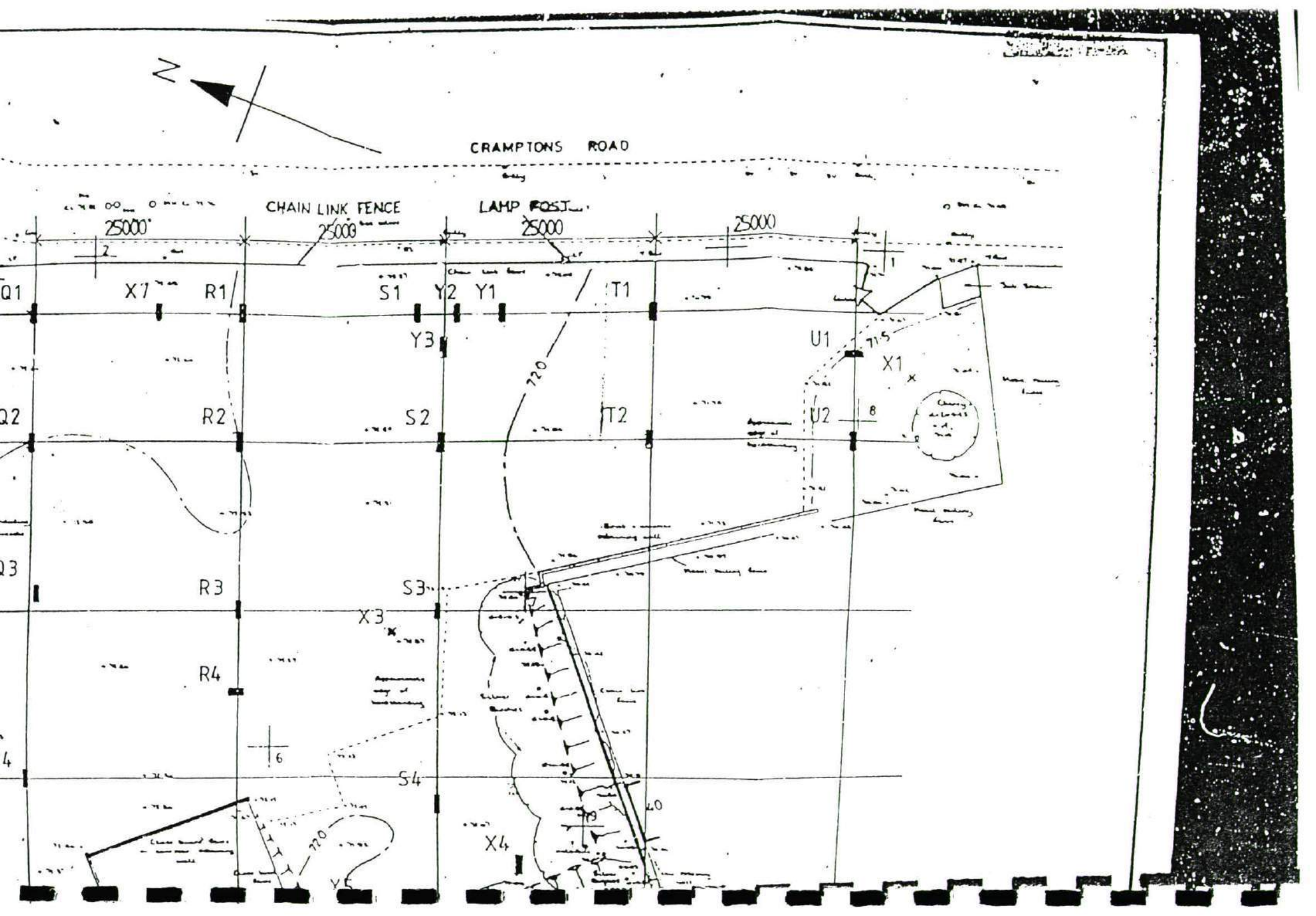
(d) F	85		85
SaB	12		97
H	51		148

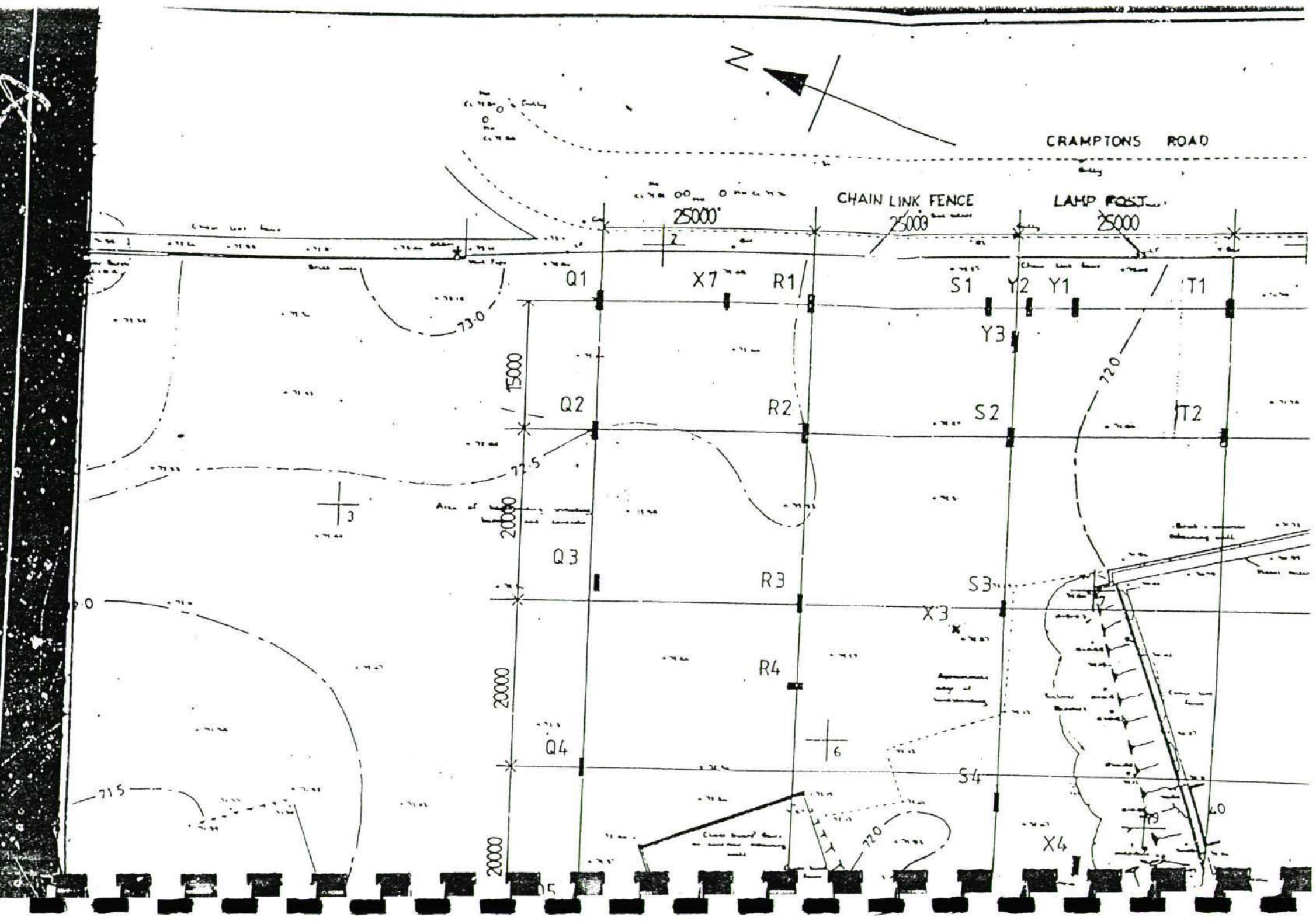


RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT LOCATION PLAN

R TRAVERS MORGAN & PARTNERS CONSULTING ENGINEERS LONDON EAST GRINSTEAD COLWYN BAY	DRAWN	CHECKED	PASSED	ISSUED	DRAWING NUMBER	REV.
	ADC 18.7.85				7388/2	


N
CRAMPTONS ROAD
CHAIN LINK FENCE
LAMP POST
25000
25000
25000
25000
Q1
X7
R1
S1
Y2
Y1
T1
Y3
U1
X1
Q2
R2
S2
T2
U2
R3
S3
X3
R4
S4
X4
720
715
720


N
CRAMPTONS ROAD
CHAIN LINK FENCE
LAMP POST
25000
Q1
X7
R1
S1
Y2
Y1
T1
Y3
15000
Q2
R2
S2
T2
20000
Q3
R3
S3
X3
R4
Q4
S4
X4
73.0
72.0
77.5
71.5
77.0

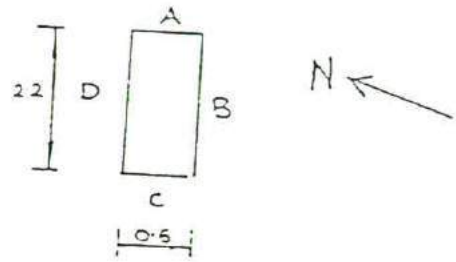

Q3
R3
S3
X3
R4
Q4
S4
X4
Q5
X5
S5
20000
20000
20000
72.5
71.5
71.0
72.0
56
54
58
OTFORD ROAD
RESIDENTIAL DEVELOPMENT, CRAMPTON
TRIAL PIT LOCATION PLAN
R TRAVERS MORGAN & PARTNERS
CONSULTING ENGINEERS
LONDON
EAST GRINSTEAD
COLWYN BAY
DRAWN
ADC
18-7-85
CHECK

TRIAL PIT Q1

Date of excavation: 17/6/85

Dimensions of trial pit: 0.6 x 2.2 x 2.9 m

Plan:



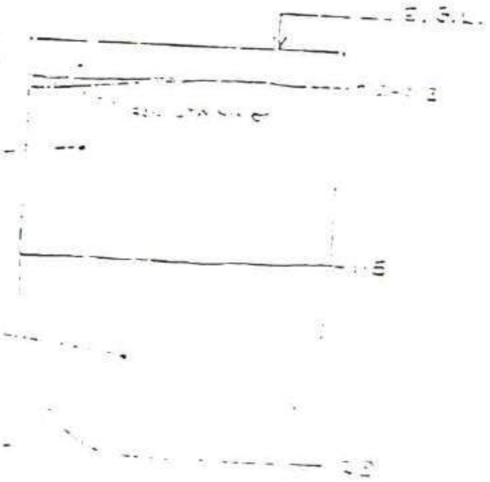
Face D:

Scale 1:50

MADE GROUND: Sand, ash, brick fragments, concrete [illegible]

medium to coarse orange-brown SAND

fine to medium light brown SAND



Faces A, B and C: similar

Remarks: Ground water was not encountered.

Cast iron 100∅ pipe (running parallel to faces B and D) was found at a depth of 300-400 mm. Position of pit was moved 0.5 m [illegible] a 150∅ cast iron pipe (parallel to the 100∅ pipe) at a depth of approximately 400 mm was found.

Position of pit was moved 0.5 m to other side of original location. Trial pit log above relates to this final position.

[illegible] location Final location

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 21/6/85	E.P. 24/6/85		W7388/3

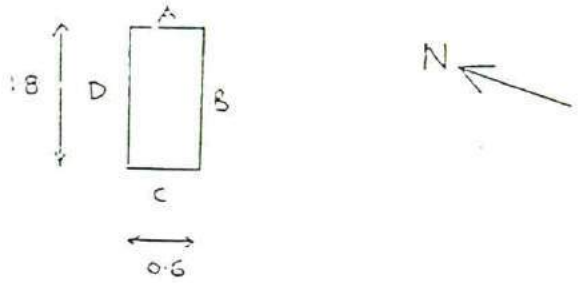
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT Q2

Date of excavation: 19/6/85

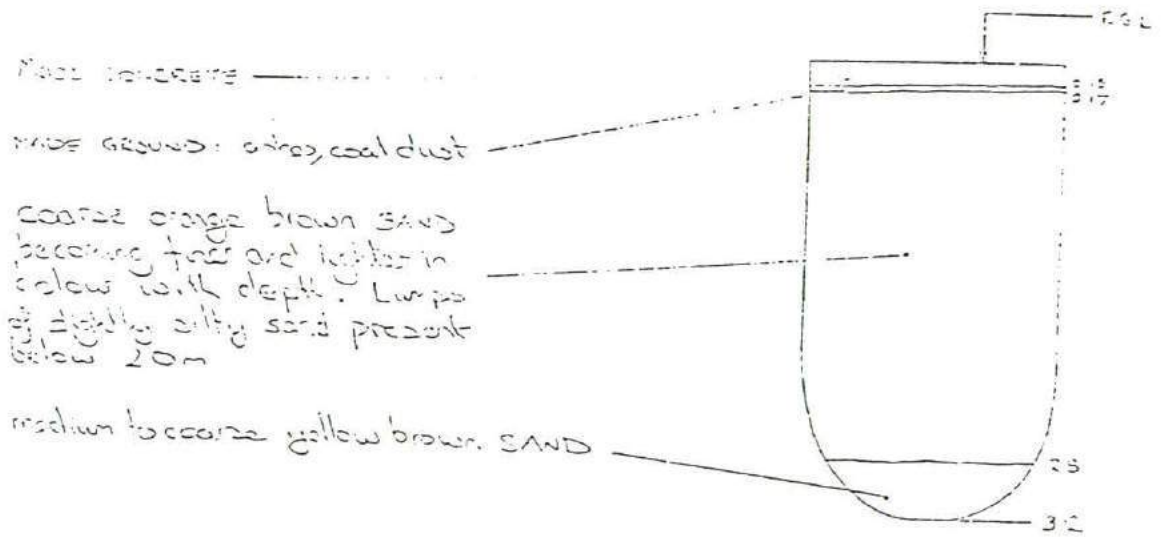
Dimensions of Trial Pit 0.6 x 1.8 x 3.2 m

Plan:



Face D

Scale 1:50



Faces A, B and C: Similar

Remarks Ground water was not encountered

Soil samples Disturbed bulk samples were taken from depths 0.4, 2.1 and 3.2 m

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 21/6/85	E.P. 24/6/85		W7388/4

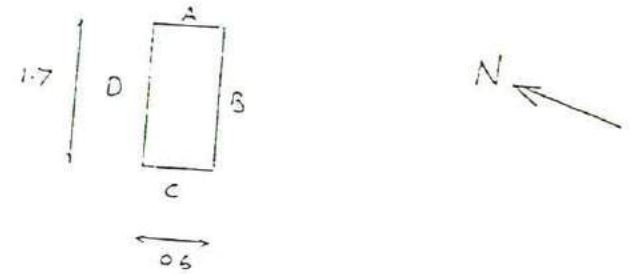
PROJECT RESIDENTIAL DEVELOPMENT, CRAINTONS ROAD, SEVENOAKS

TRIAL PIT Q3

Date of excavation: 19/6/85

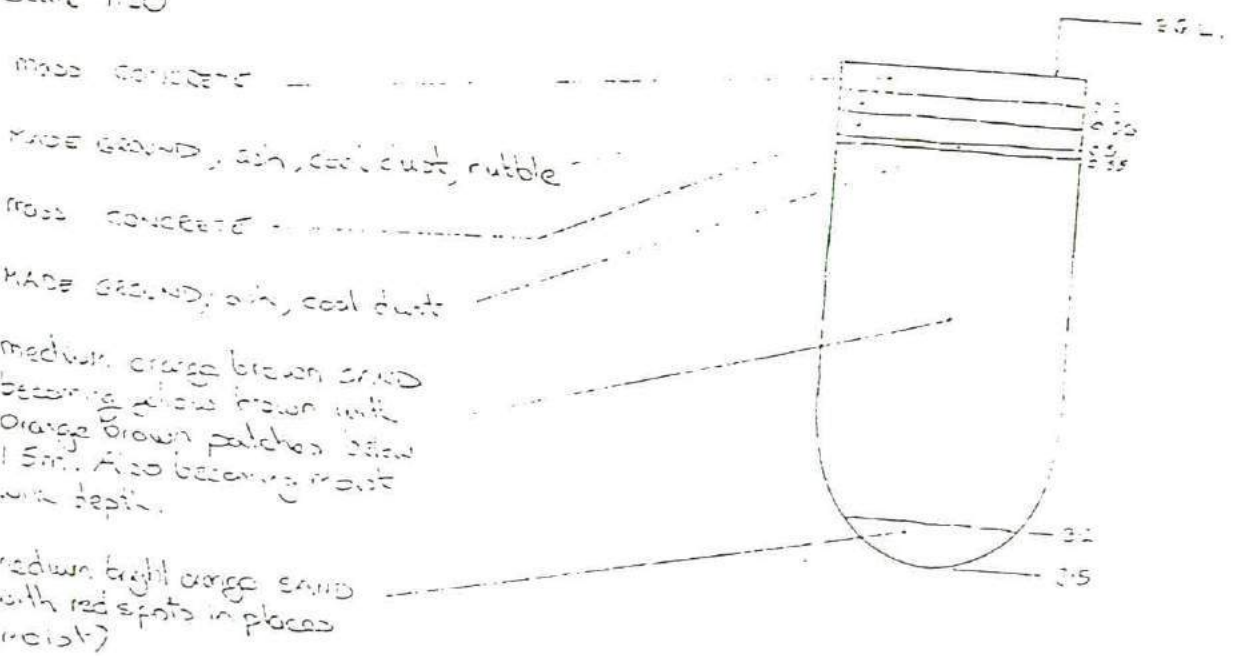
Dimensions of Trial Pit: 0.6 × 1.7 × 3.5 m

Plan



Face B

Scale 1:50



Faces A, C and D: similar, except mass concrete on face C was continuous to depth 0.55m

Remarks: Ground water was not encountered

Soil samples: Disturbed bulk samples were taken from depths 0.6, 1.7 and 3.5 m.

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE ADC 21/6/85	CHECKED E.P. 24/6/85	ISSUED	SHEET NUMBER W7388/5

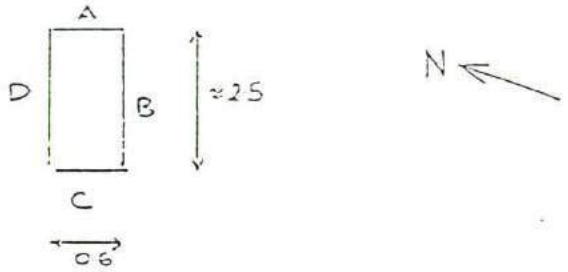
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT Q4

Date of excavation: 18/6/85

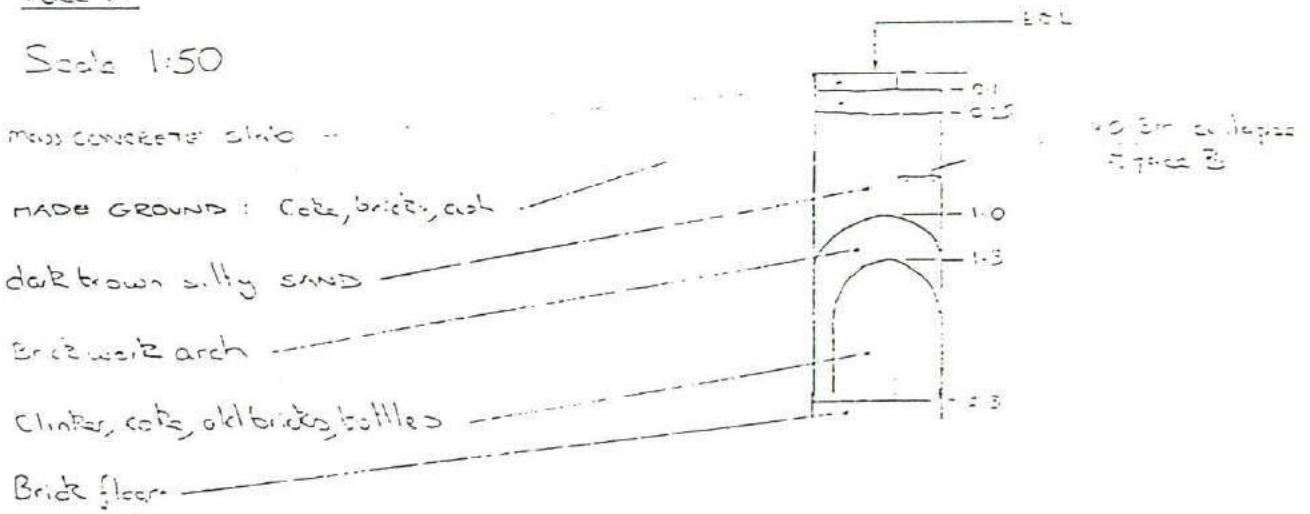
Dimensions of pit: 0.6 × 2.3 m

Plan:



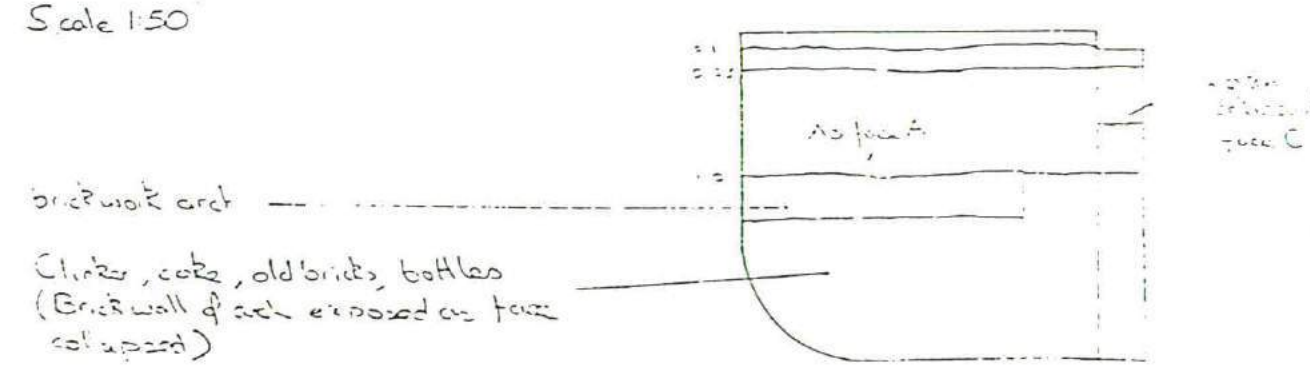
Face A

Scale 1:50



Face B

Scale 1:50



TMS

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE ADC 21/6/85	CHECKED E.P. 24/6/85	ISSUED	SHEET NUMBER W7328/7

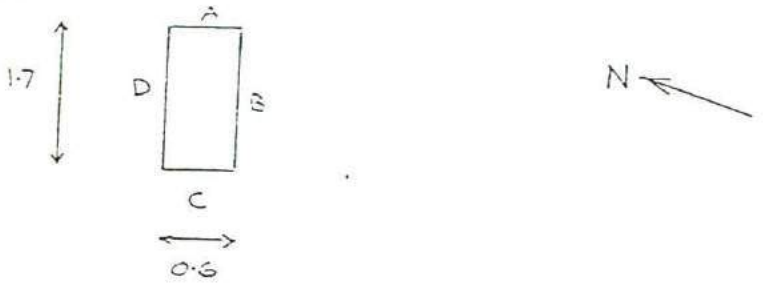
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT Q5

Date of excavation: 19/6/85

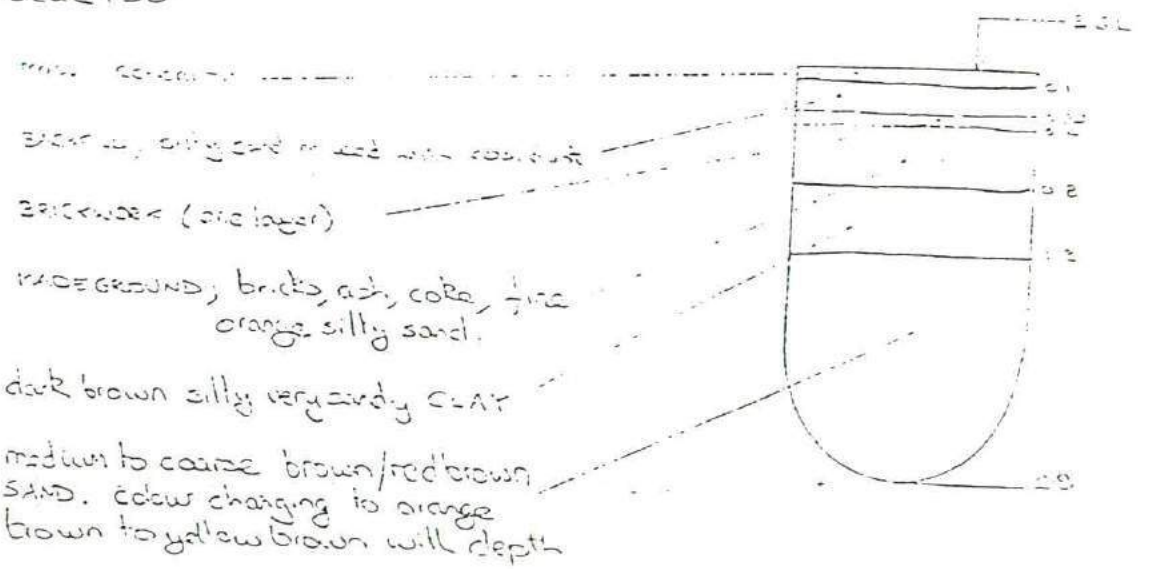
Dimensions of Trial Pit: 0.6 x 1.7 x 2.9m

Plan:



Face D

Scale 1:50



Faces A and C: similar

Remarks: Ground water was not encountered.

Soil samples: Disturbed bulk samples were taken from spoil

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 20/6/85	E.P. 21/6/85		W7388/8

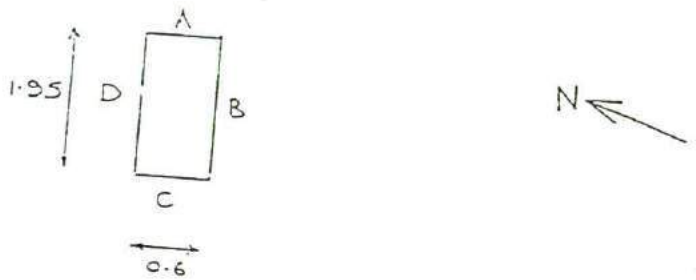
PROJECT RESIDENTIAL DEVELOPMENT, CLAPTONS ROAD, SEVENOAKS

TRIAL PIT R1

Date of excavation: 17/6/85

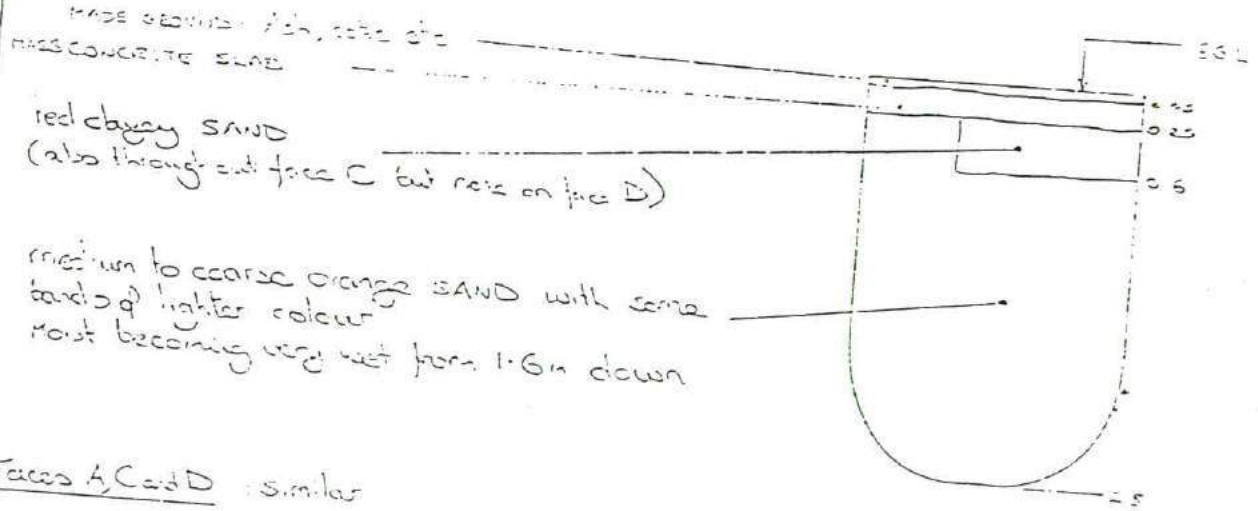
Dimensions of Trial pit: 0.6 × 1.95 × 2.80

Plan



Face B

Scale 1:50



Faces A, C and D : similar

Remarks Water ingress from all sides at depth 2.2m (water from face C coming in from about depth 2.1m). Excavation continued to approximately 2.8m and then water levels were recorded at various time intervals.

Water level (metres below EGL)	Time
2.70	2.36 pm
2.60	2.41
2.55	2.46
Ingress reduced to slow trickle	2.52
2.40	3.20
2.35	4.05
	4.35

Cont...

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 20/6/85	E.P 24/6/85		WTP/E/10

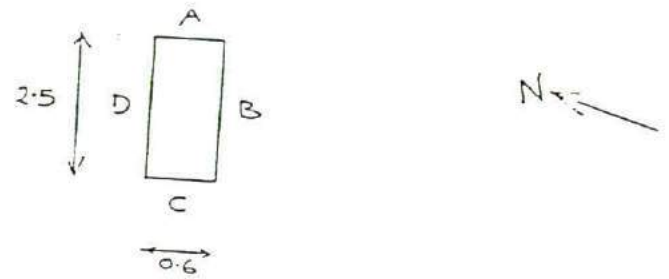
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT R2

Date of excavation: 17/6/85

Dimensions of pit: 0·6 × 2·5 × 2·7 m

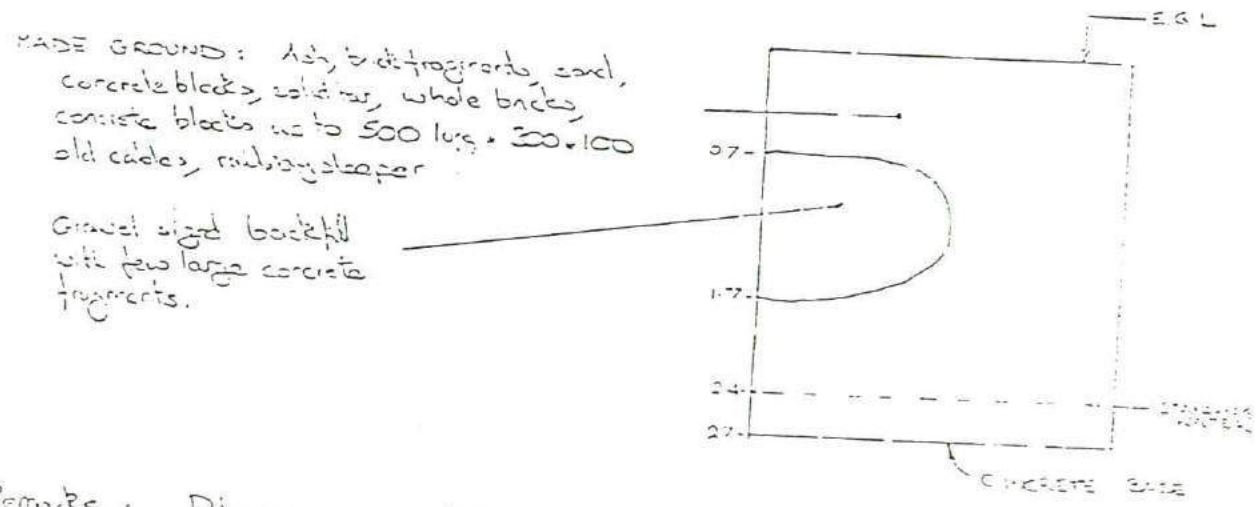
Plan



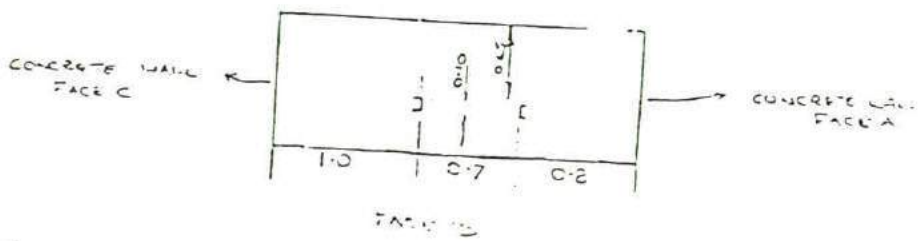
FACES A, C and D: Concrete walls of old basement. Top of base of concrete at 2·7 m.

FACE B:

Scale 1:50



Remarks: Pit was excavated over an old concrete basement. Fill material was gravel rubble. On face D two steel channel sections were protruding from the concrete



FACE D

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE ADC 21/6/85	CHECKED E.P. 24/6/85	ISSUED	SHEET NUMBER W7388/12

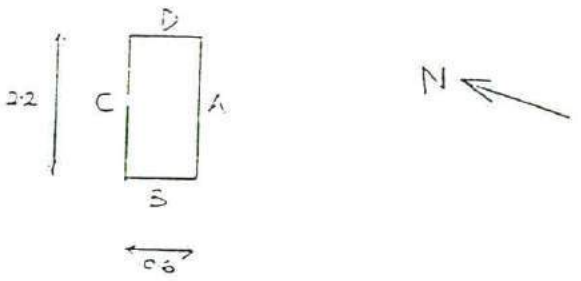
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT R3

Date of excavation: 18/6/85

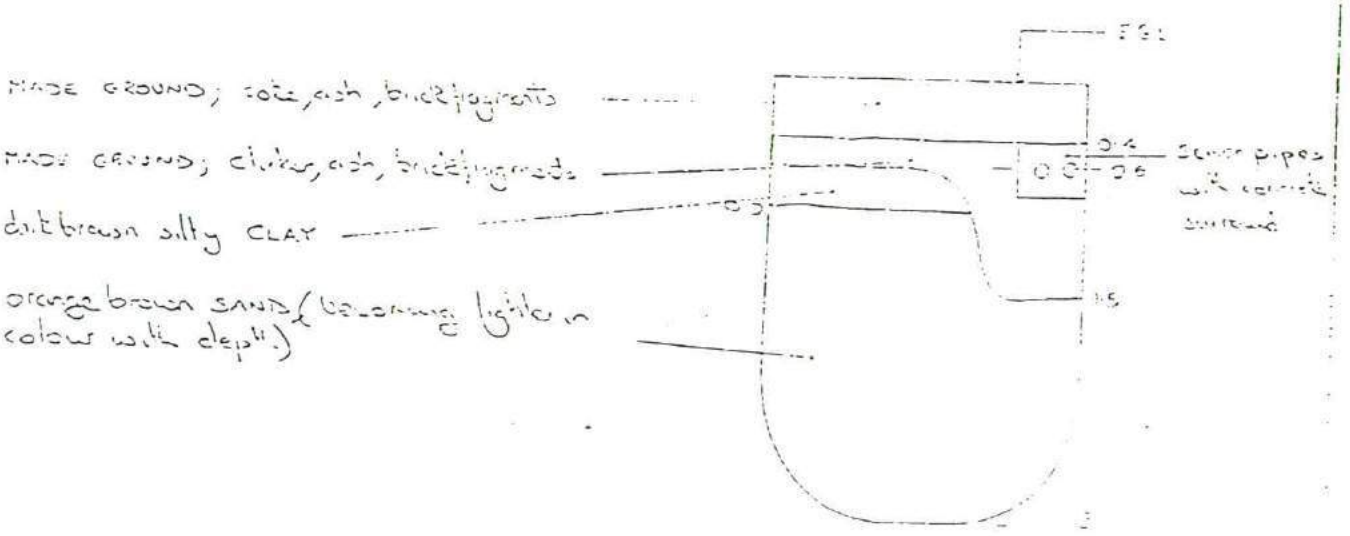
Dimension of T.P.: 0·6 × 2·2 × 3·1

Plan:



Face A

Scale 1:50



Faces B, C and D: Similar except top 0·1 of face C was more concrete

Remarks: Ground water was not encountered.

The sewer pipes (which also appeared on face C) were full of a black material (probably coal dust). The pipe also had a drain rod protruding from it.

Soil samples: 3 bulked bulk samples were taken at depths 1·2 m, 2·1 m

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 21/6/85	E.P. 24/6/85		W7388/13

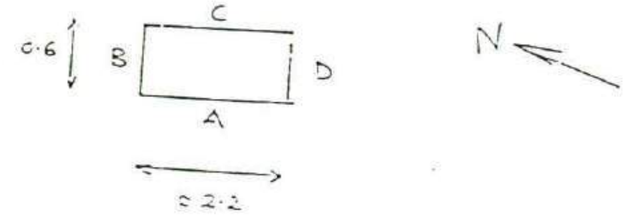
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT R4

Date of excavation: 18/6/85

Dimensions of Trial Pit: 0.6 × × 2.8 m

Plan:



Face A:

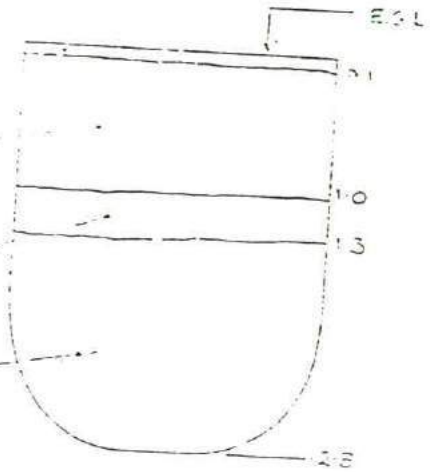
Scale 1:50

MADE CONCRETE slab

MADE GROUND: clinker, ash, coke, brick fragments, old pipes, whole bricks

brown, dark brown silty sandy CLAY

dark brown (becoming orange brown with depth) medium to coarse SAND



Face B, C and D: similar

Remarks: Ground water was not encountered.

Faces A and C collapsed below clay layer (at least 300mm inwards). Thin clay on face A collapsed to underside of made ground. (Face A was [illegible] the spoil heap)

Bulk Samples: Disturbed bulk samples were taken at depths 0.5, 1.5 and 2.8 m.

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 20/6/85	C.P. 20/6/85		W7388/14

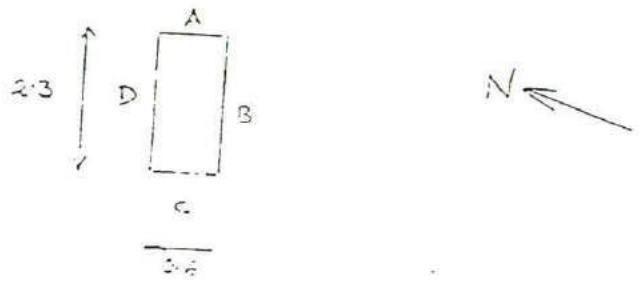
PROJECT RESIDENTIAL DEVELOPMENT, CRIPPING ROAD, SEVENOAKS

TRIAL PIT S1

Date of excavation: 17/6/85

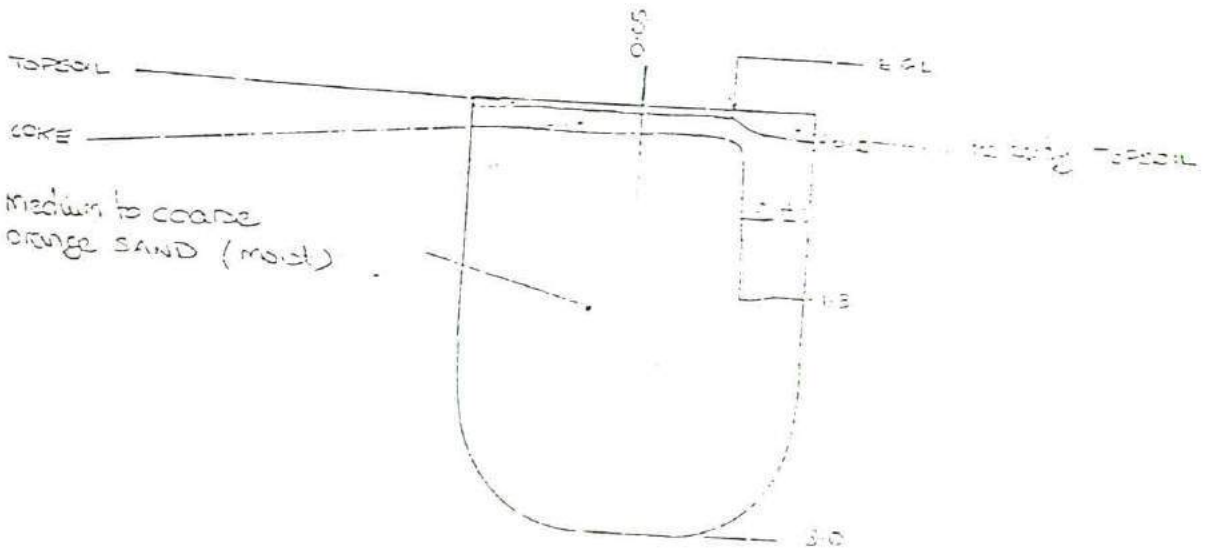
Dimensions of Trial Pit: 0·6 x 2·3 x 3·0 m

Plan



Face D

Scale 1:50



Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 21/6/85	EP 24/6/85		W7388/17

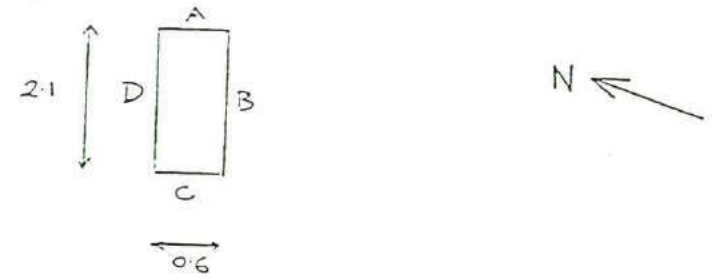
PROJECT RESIDENTIAL DEVELOPMENT CRAMPTONS ROAD SEVENOAKS

TRIAL PIT S2

Date of excavation: 18/6/85

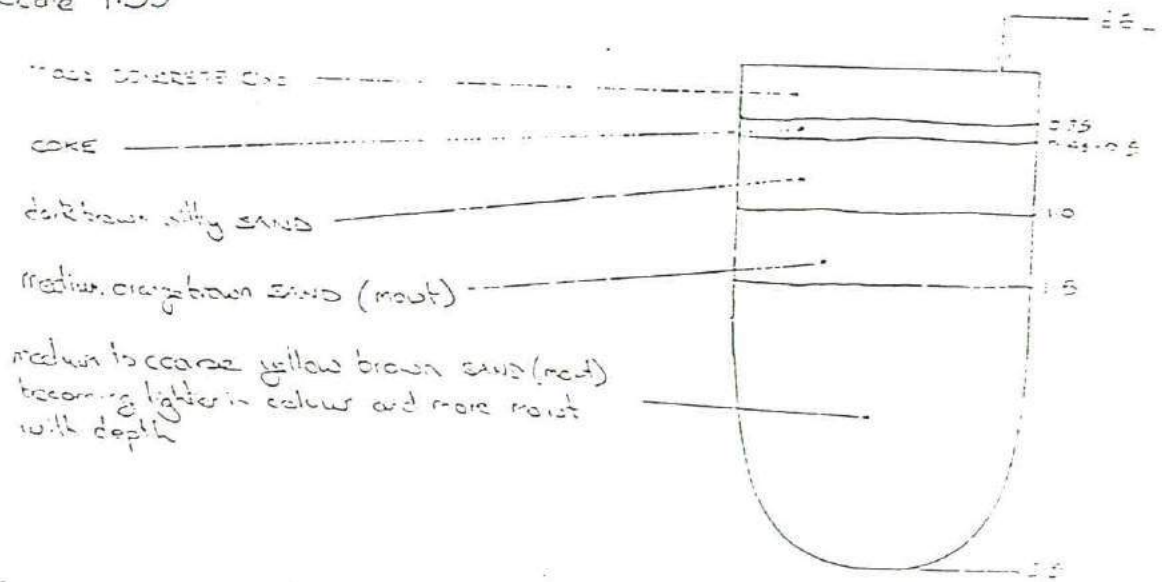
Dimensions of pit: 0·6 × 2·1 × 3·5 m

Plan:



Face B

Scale 1:50



Faces A, C and D: similar

Remarks: Ground water was not encountered

Soil samples: samples were taken at depths 0·5, 1·0 and 3·5 m

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE ADC 21/6/85	CHECKED EP 28/6/85	ISSUED	SHEET NUMBER W7388/18

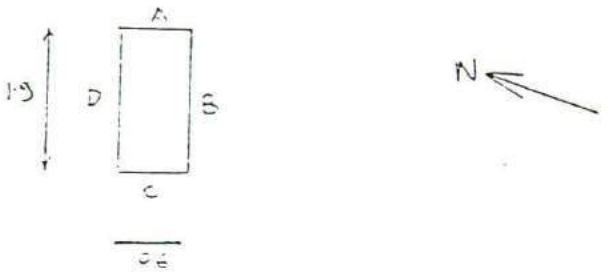
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT 33

Date of excavation: 18/6/85

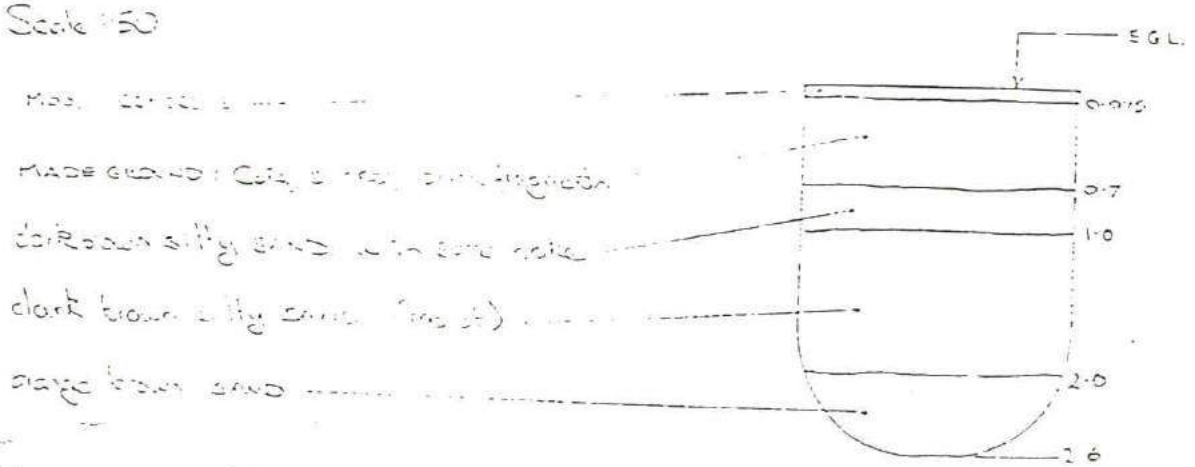
Dimensions of Trial Pit: 0·6 × 1·9 × 2·6 m

Plan:



Face B

Scale 1:50



Face C: Similar to Face B

Face D:

Scale 1:50

Travers Morgan Consulting Engineers and Planners London East Grinstead Croydon	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 21/6/85	E.P. 24/6/85		LT388/20

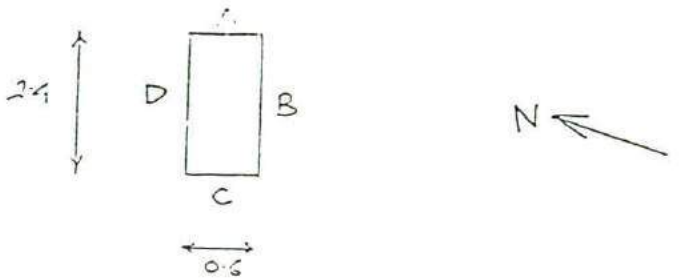
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT S4

Date of excavation: 18/6/85

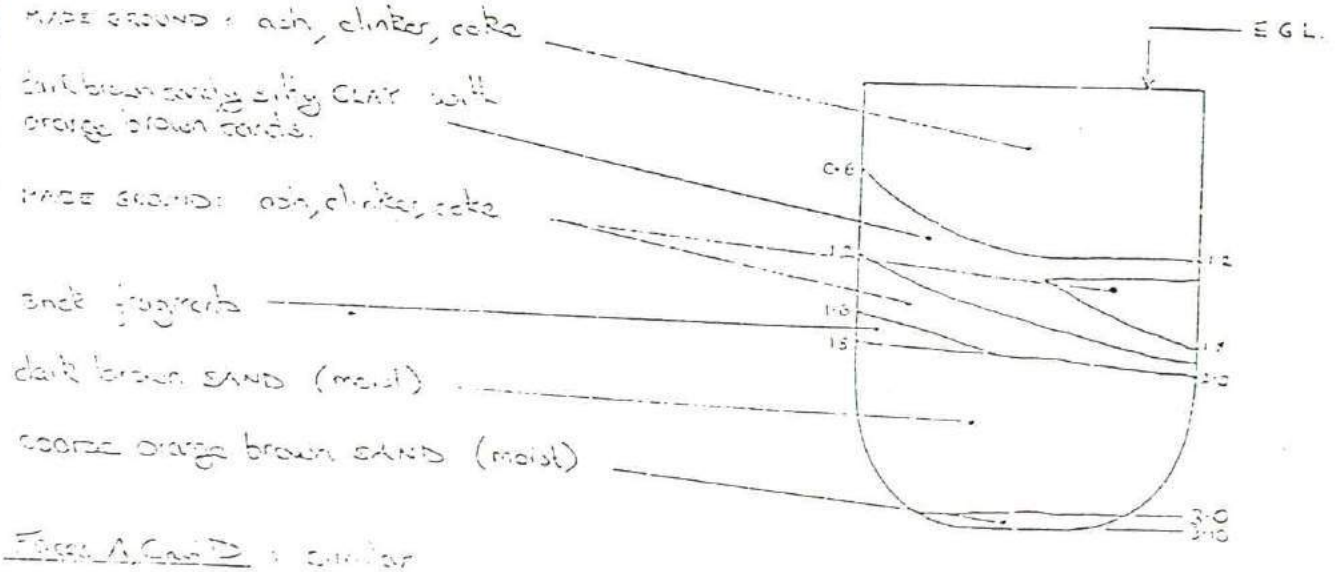
Dimensions of Trial Pit: 0·6 × 2·4 × 3·1 m

Plan



Face B

Scale 1:50



Faces A, C and D: similar

Remarks: Ground water was not encountered

Made ground was collapsing all the time during excavation.

Bulk samples: Disturbed bulk samples were taken at depths 1·2, 2·0 and 3·0 m.

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 21/6/85	E.P. 21/6/85		LJ7388/21

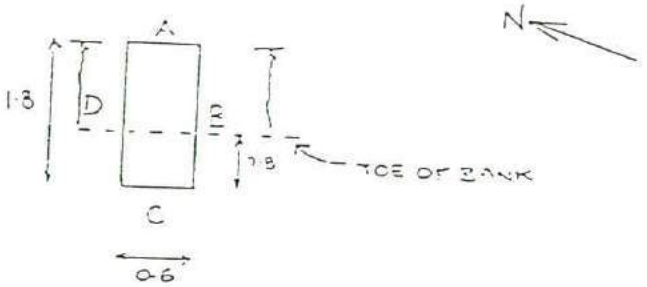
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTON'S ROAD, SEVENOAKS.

TRIAL PIT S5

Date of excavation: 18/6/85

Dimensions of pit: 0.6 × 1.8 × 1.7 m

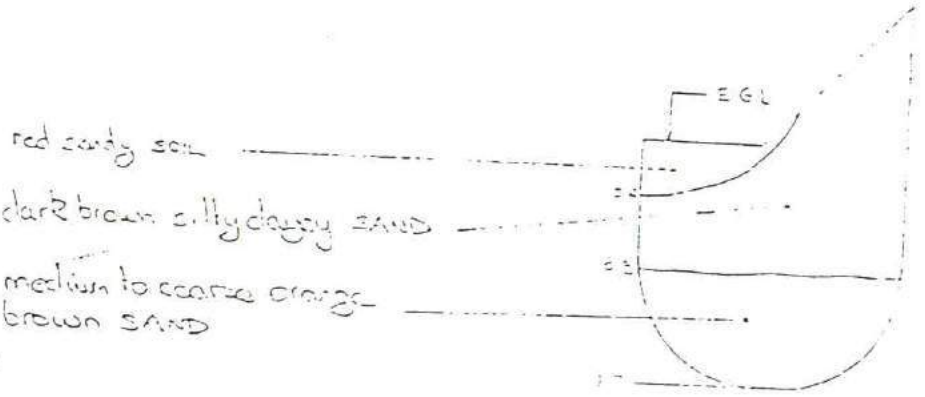
Plan



N.B. depths measured from level ground at foot of bank.

Face D

Scale 1:50



Faces A, B and C: similar

Remarks: Ground water was not encountered.

Tree roots were encountered up to ~0.9 m deep

Soil samples: Disturbed bulk samples were taken at depths 0.5 and 1.7 m

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 20/6/25	E.P. 20/6/25		W7388/22

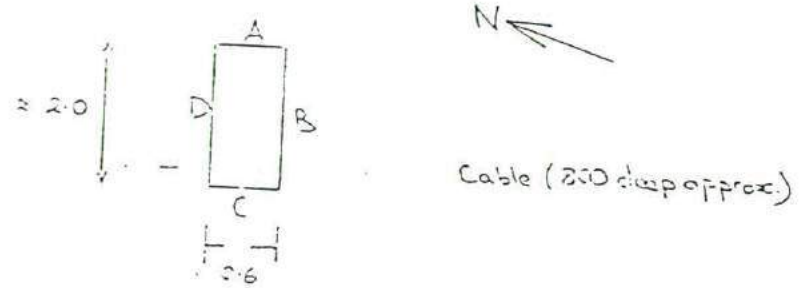
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT T1

Date of excavation: 17/6/25

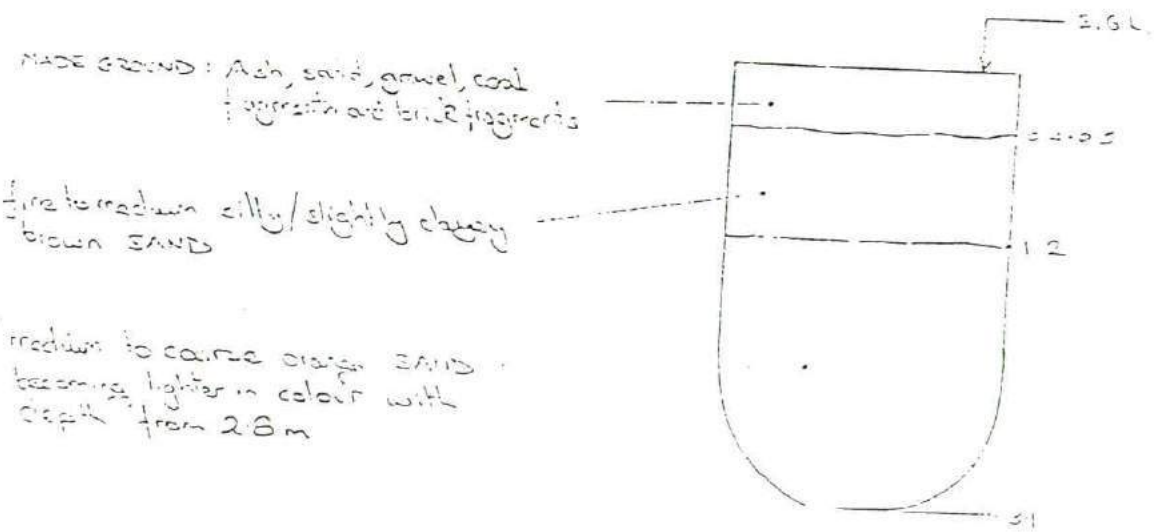
Dimensions of trial pit: 0.6 × 2.0 × 3.1 m

Plan



Face B

Scale 1:50



Faces A, C and D Similar

Remarks Ground Water was not encountered

Soil samples Disturbed bulk samples were taken from depths 0.45, 1.6 and 2.8m.

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE ADC 21/6/85	CHECKED E.P. 24/6/85	ISSUED	SHEET NUMBER U7363/22

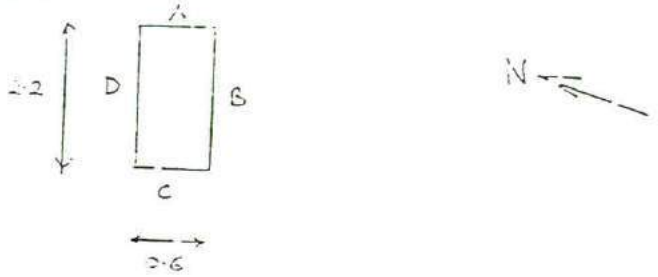
PROJECT RESIDLATION DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT T2

Date of excavation: 19/6/85

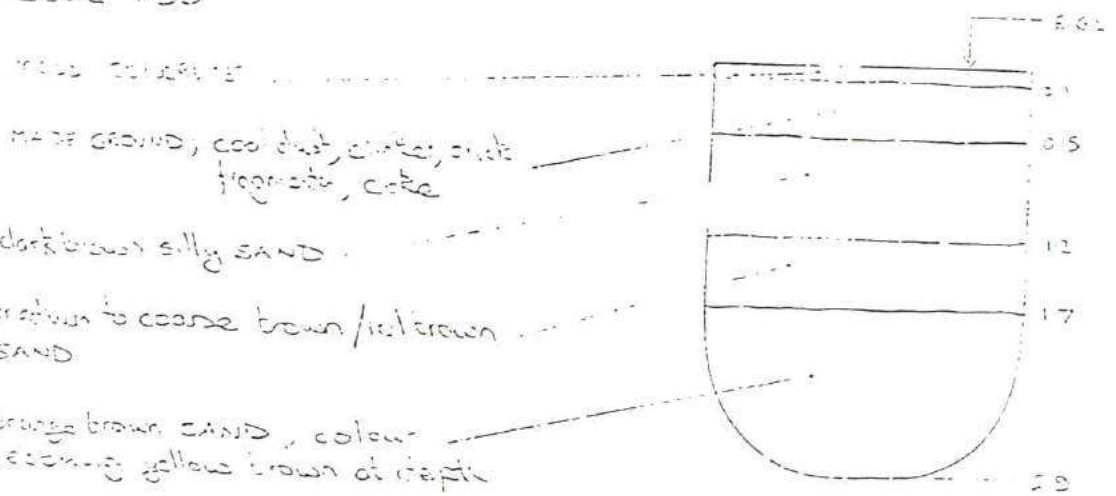
Dimensions of Trial Pit: 0.6 x 2.2 x 2.9

Plan



Face D

Scale 1:50



Faces A and C: similar except concrete on face B only 0.05 thick

Remarks: Ground water was not encountered.

Soil samples: Disturbed bulk samples were taken from depths 0.5, 1.5 and 2.0 m

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 20/6/85	E.P. 20/6/85		W73EE/24

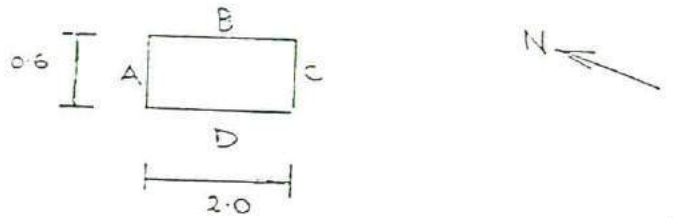
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TIRIAL PIT U1

Date of excavation: 17/6/85

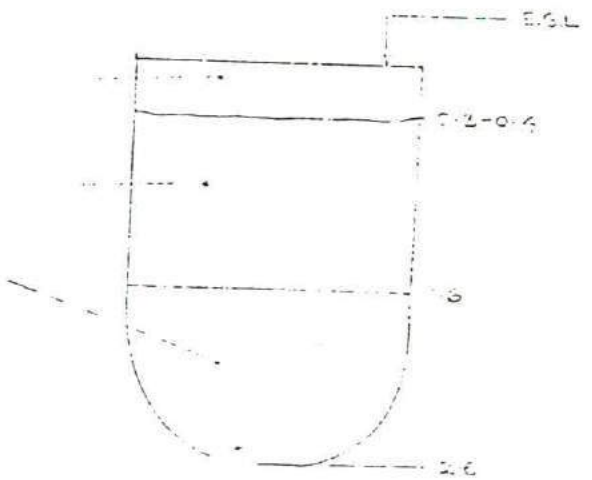
Dimension of Trial Pit: 0.6 × 2.0 × 2.8 m

Plan:



Face B

Scale 1:50



Faces A, C and D: Similar

Remarks: Ground Water was not encountered.

Soil Samples: Disturbed bulk samples were taken at depths, 0.5, 1.5 and 2.8m.

Travers Morgan
Consulting Engineers and Planners
London   East Grinstead   Colwyn Bay

MADE	CHECKED	ISSUED	SHEET NUMBER
ADC 20/6/85	E.P. 24/6/85		W7388/25

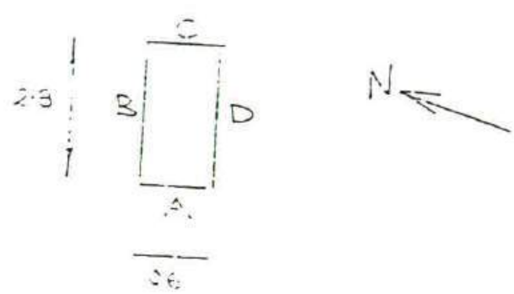
PROJECT: RESIDENTIAL DEVELOPMENT CRAMPTONS ROAD SEVENOAKS

TRIAL PIT U2

Date of excavation: 17/6/85

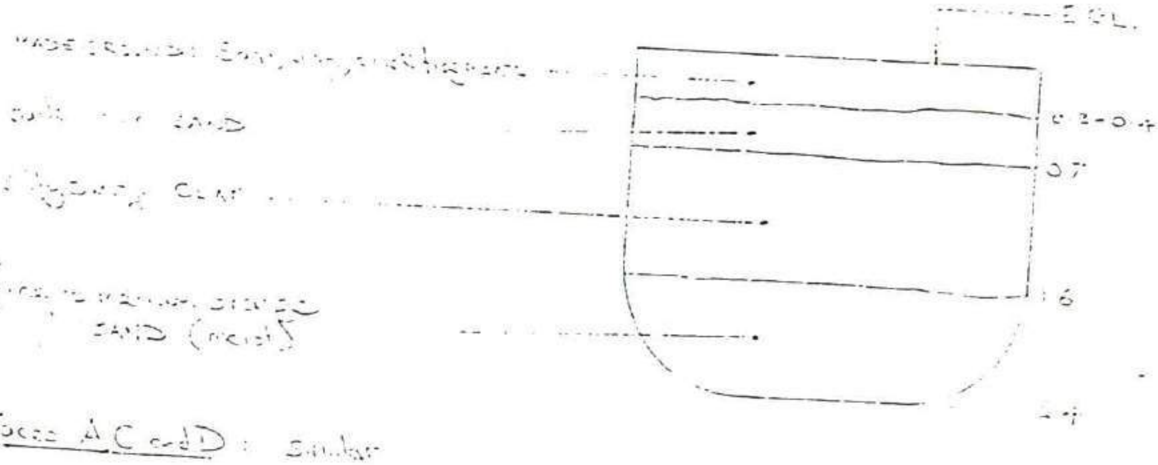
Dimensions of trial pit: 0.6 × 2.8 × 2.4 m

Plan:



Face B:

Scale 1:50

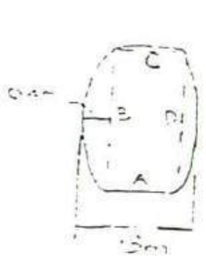


Faces A C and D: similar

Remarks: Ground water was not encountered

Faces B, C and D collapsed during excavation

Face D collapsed at ~1.8 m
Face B collapsed at ~2.0 m
Face C collapsed at ~2.1 m



Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE ADC 21/6/85	CHECKED E.P. 24/6/85	ISSUED	SHEET NUMBER WJ7388/26

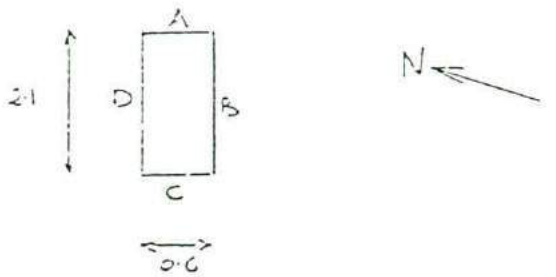
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT X4

Date of excavation: 12/6/85

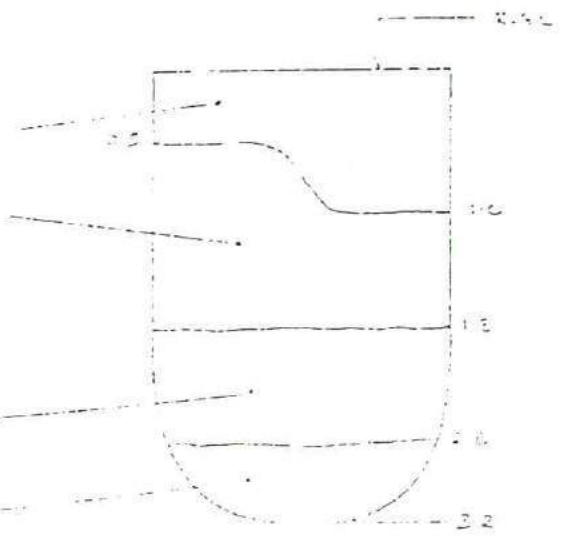
Dimensions of Trial Pit: 0.6 x 2.1 - 3.2 m

Plan:



Face B:

Scale 1:50



MADE GROUND: Clinker, ash, coke, brick fragments, clay pipe fragments, old pipes etc

MADE GROUND: Sandy silty clinker with ground sized coke (larger pieces of coke below 1.0m)

dark brown silty SAND becoming more clayey with depth. Pockets of lighter coloured clayey silty SAND.

coarse orange brown SAND (moist)

Faces A and D: similar

Remarks: Ground water was not encountered

Clinker collapsing in face A during excavation

Soil samples: Disturbed bulk samples were taken at depths [illegible] (made ground and sand) and 3.2 m

FMS

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 21/6/35	E.P. 24/6/35		W7322/27

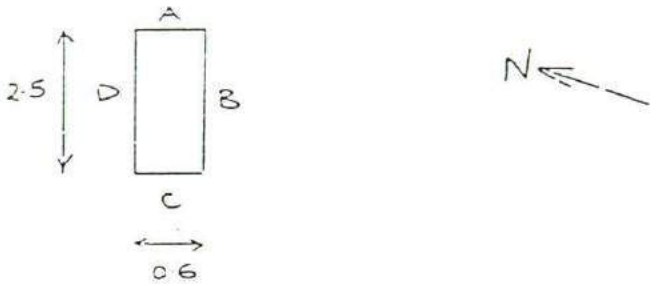
PROJECT RESIDENTIAL DEVELOPMENT CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT X5

Date of excavation : 18/6/35

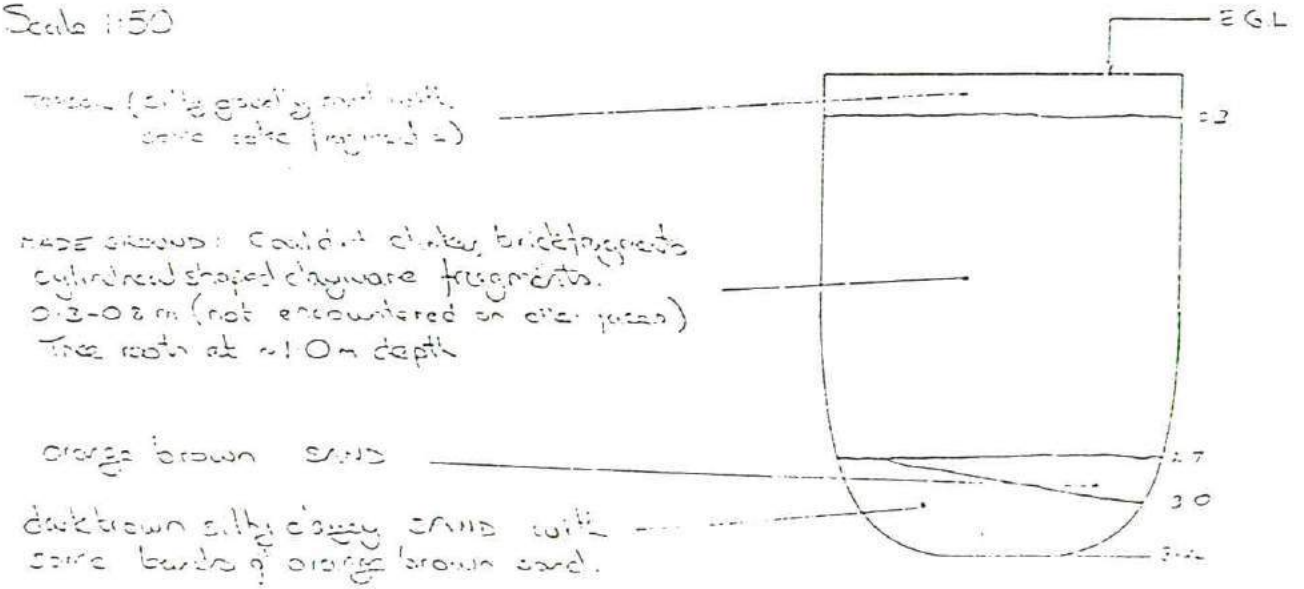
Dimensions of Trial Pit : 0·6 × 2·5 × 3·4 m

Plan



Face B

Scale 1:50



Faces A, C and D : Similar

Remarks : Ground water was not encountered

Minor collapsing within faces D during excavation

Soil samples : Disturbed bulk samples were taken at depths 0·25, 1·5 and 3·4 m

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE ADC 20/6/85	CHECKED E.P 24/6/85	ISSUED	SHEET NUMBER W7386/28

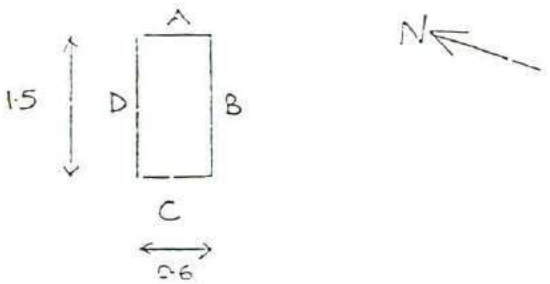
PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT X7

Date of Excavation : 17/6/85

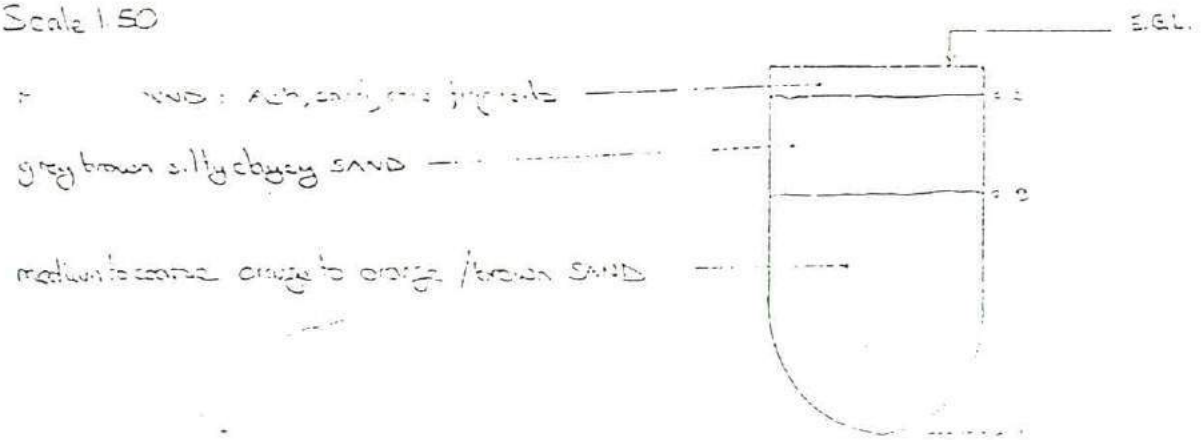
Dimensions of Tr.Pit : 0·6 x 1·5 x 2·6 m

PLAN



FACE B.

Scale 1:50



FACE D: Similar

FACE A: Concrete slab 0·6 m deep then medium to coarse orange to orange/brown SAND to depth of pit

FACE C: Concrete slab 0·6m deep then as face B.

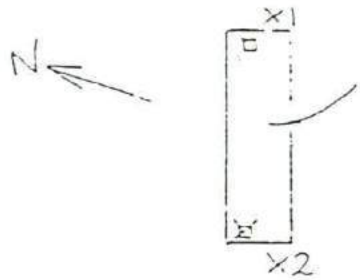
Remarks: Ground Water was not encountered.

The pit was not excavated through the concrete bed between two separate concrete slabs.

SAMPLE LOCATION X1 AND X2

Date of excavation: 17/6/85

Plan
1:200



SIZE OF TANK

Width 1.7m, Depth (soffit of slab to bottom of tank) 1.7m
Cover slab 1.0m below ground level.

SOIL SAMPLES

Soil samples were taken from the rubble at depths 1.5m and 2.7m.

SAMPLE LOCATION X3

This was a manhole on a disused sewer.

Manhole was 0.45 x 0.6m in plan and the depth to invert was 0.8m.

The bottom of the manhole from depth 0.6m to the benching was covered in a [illegible] granular material (probably coal dust). A sample of this material was taken.

SAMPLE LOCATION X6

This was a well / soakaway. Depth 3.75m and [illegible]

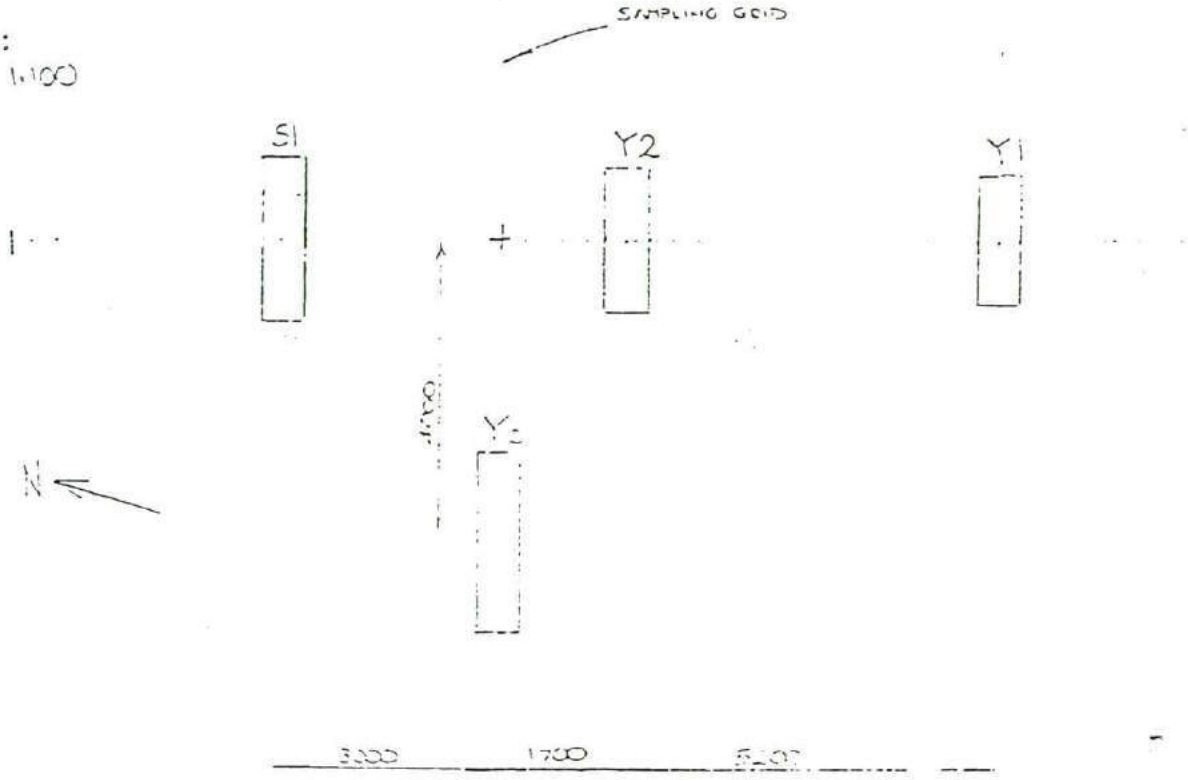
[illegible]

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE ADC 21/6/85	CHECKED A.P. 24/6/85	ISSUED	SHEET NUMBER W7388/31

PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PITS DUG TO ESTIMATE EXTENT OF COKE DEPOSITS LOCATED IN TRIAL PIT S1. (Y1, Y2 and Y3)

PLAN:
Scale 1:100



TRIAL PIT Y1

No coke deposits found (dug to ~0.8m)

TRIAL PIT Y2

Coke deposits were found, to a depth of 2.0m

Fig B (scale 1:50)

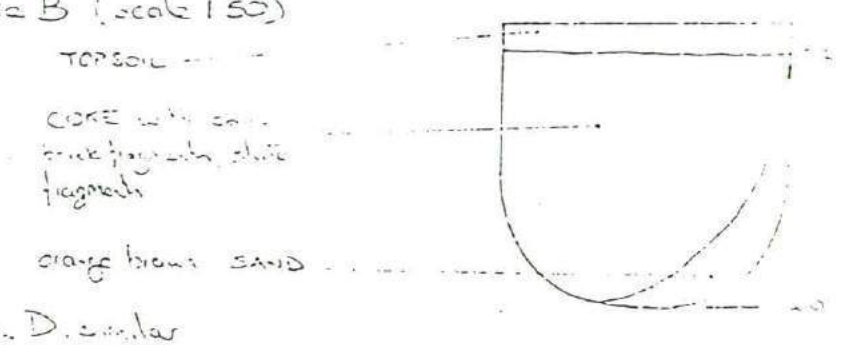


Fig D similar

TMS

Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE ADC 21/6/85	CHECKED E.P. 24/6/85	ISSUED	SHEET NUMBER W7388/33

PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

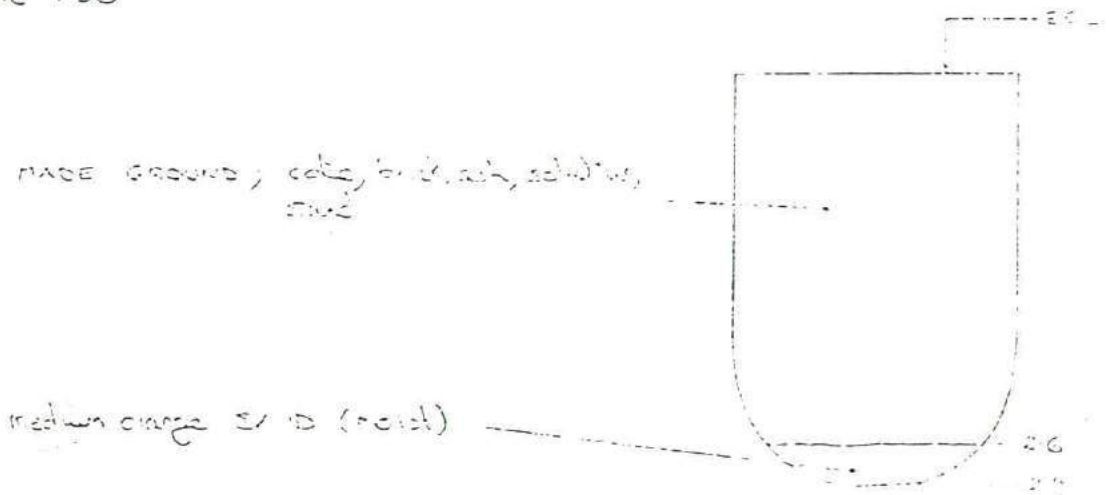
TRIAL PIT TP4

Date of excavation: 17/6/85

Plan:

Face C

Scale 1:50



Faces A, B, D; Similar

Remarks: Ground water was not encountered.

Made ground was continuously collapsing during excavation.

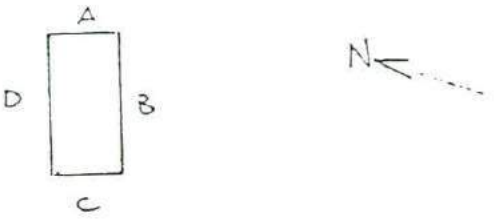
Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 21/6/85	E.P. 24/6/85		WJ388/34

PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT TP5

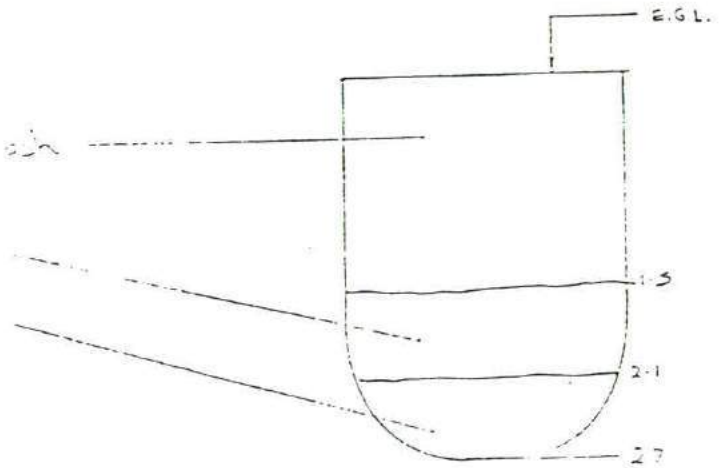
Date of excavation: 17/6/85

Plan



Face B

Scale 1:50



Faces A and D: Similar

Remarks: Ground water was not encountered.

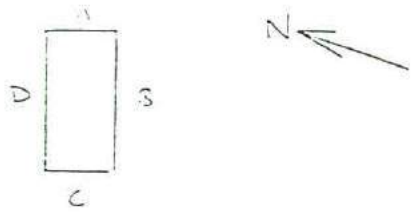
Travers Morgan Consulting Engineers and Planners London East Grinstead Colwyn Bay	MADE	CHECKED	ISSUED	SHEET NUMBER
	ADC 21/6/85	E.F. 24/6/85		W7388/35

PROJECT RESIDENTIAL DEVELOPMENT, CRAMPTONS ROAD, SEVENOAKS

TRIAL PIT YE

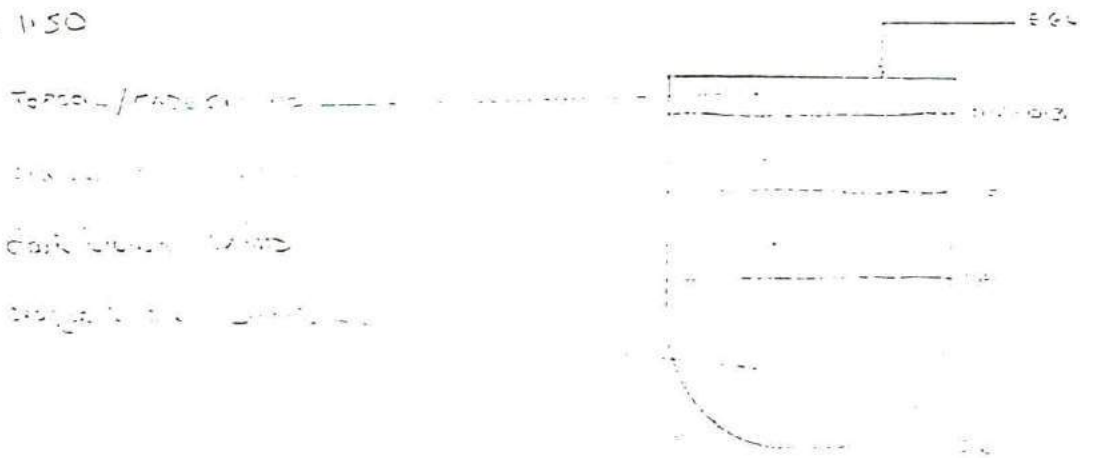
Date of excavation: 17/6/85

Plan:



Face B:

Scale 1:50



Faces A C and D

Remarks

TMS

Ref: C8510A

Soils

Sample No.	Depth (m)	Sample Description	pH	SO_3	S^{2-}	Total Cn	Free Cn	Phenol	Oil	Elem S	Oil X	Avail Zn	Zn	Total Cd	Pb	%	Moisture Content (% wt)	Coal Tar	Water Soluble SO_4 g/litre
Q1/1	0.15	Dark brown oily gravel	8.56	700	<1	<1	<1	<1	<10	<50	23,900	55	300	1.9	310	8	10.4	4900	-
/2	1.0	Yellow/brown sand & clay	8.17	175	<1	<1	<1	<1	<10	<50	1,500	21	90	5.5	100	11	11.8	-	-
/3	2.9	Dark yellow sand & some clay.	7.46	130	<1	<1	<1	<1	<10	<50	1,100	24	70	<0.5	30	3	10.9	-	-
Q2/1	0.4	Yellow/Brown Sand & clay.	7.08	45	<1	<1	<1	<1	<10	<50	900	-	-	-	-	-	10.0	-	-
/2	2.1	Yellow/brown sand.	6.07	60	<1	<1	<1	<1	<10	<50	1,200	-	-	-	-	-	10.5	-	-
/3	3.2	Yellow sand.	6.28	90	<1	<1	<1	<1	<10	<50	1,200	-	-	-	-	-	5.7	-	-
Q3/1	0.6	Dark yellow/ brown sand.	7.36	110	<1	<1	<1	<1	<10	<50	900	6	209	1.4	25	11	9.8	-	-
/2	1.7	Yellow/brown sand.	8.14		<1	<1	<1	<1	<10	<50	1,300	1	20	<0.5	20	7	7.8	-	-
/3	3.5	Dark orange sand.	7.42	70	<1	<1	<1	<1	<10	<50	1,100	2	20	<0.5	20	4	9.8	-	-
Q4/1	0.5	Green clay/ sand & slight gravel.	5.37	190	<1	<1	<1	<1	<10	<50	1,500	-	-	-	-	-	15.5	-	-
/2	1.9	Brown/orange gravel & sand.	7.41	4200	<1	<1	<1	<1	<10	<50	2,000	-	-	-	-	-	14.3	-	-
Q5/1	0.3	Brown Gravel & soil.	9.04	700	<1	<1	<1	<1	<10	<50	2,000	21	155	2.3	100	41	3.3	-	-
/2	1.0	Brown clay & soil.	7.91	300	<1	<1	<1	<1	<10	<50	900	2	88	1.4	25	9	11.1	-	-
/3	2.9	Orange sand.	7.69	135	<1	<1	<1	<1	<10	<50	1,100	<1	7	<0.5	4	2	13.4	-	-
R1/1	0.4	Purple/black clay & coarse sand with gravel.	8.28	2100	<1	<1	<1	<1	<10	<50	1,400	-	-	-	-	-	25.2	-	-
/2	1.1	Yellow/brown clayey sand	7.59	240	<1	<1	<1	<1	<10	<50	800	-	-	-	-	-	15.7	-	-
/3	2.8	Orange/brown heavy clay & sand	7.60	175	<1	<1	<1	<1	<10	<50	1,200	-	-	-	-	-	19.9	-	-

/continued .

Ref: CW1PA

WATER

Sample No:	pH	SO_3	S^{2-}	Total Cn	Free Cn	Phenol	Cl^-	Elem S	Tol X	Avail Zn	Zn	Total Cd	Pb	As
R1/W1	7.4	600	<0.1	<0.1	<0.1	<0.1	<1.0	NA	NA	-	-	-	-	-
R2/W1	7.8	600	<0.1	<0.1	<0.1	<0.1	<1.0	NA	NA	<0.05	<0.05	<0.05	<0.05	<0.05

Ref: CH510A

Sample No:	Depth	Sample Description	pH	SO_3	S^{2-}	Total Cn	Free Cn	Phenol	Cl⁻	Elec S	Tol X	Ni	Zn	Total Cd	Pb	As	Moisture Content (% wt)	Coal Tar	H_2O Sol SO_3 g/litre
R2/1	1.2	Greenish Grey gravel & clayey sand	9.24	630	<1	<1	<1	<1	<10	<50	2,400	71	109	2.7	125	34	16.3	-	-
/2	2.7	" "	9.49	1000	<1	<1	<1	<1	<10	<50	4,900	63	226	2.9	210	14	9.4	-	-
R3/1	1.1	Dark yellow/ brown heavy clay & sand.	7.93	440	<1	4	1	<1	<10	<50	1,200	-	-	-	-	-	17.1	-	-
/2	2.2	Dark yellow sand & slight clay.	8.37	220	<1	<1	<1	<1	<10	<50	800	-	-	-	-	-	12.7	-	-
/3	3.1	Dark yellow sand & slight clay.	8.42	90	<1	<1	<1	<1	<10	<50	900	-	-	-	-	-	10.1	-	-
/4	-	Black (coke) gravel & soil.	7.31	1,500	<1	<1	<1	<1	<10	<50	5,000	-	-	-	-	-	38.9	500	-
R4/1	0.5	Dark brown (coke) gravel & soil.	7.08	1,300	<1	<1	<1	<1	<10	<50	500	20	184	1.3	160	43	21.1	-	-
/2	1.5	Dark yellow/ brown heavy clay & sand.	8.79	310	<1	<1	<1	<1	<10	<50	200	1	71	<0.5	20	3	16.3	-	-
/3	2.8	Orange /brown sand.	8.89	175	<1	<1	<1	<1	<10	<50	1,200	<1	16	<0.5	15	3	12.4	-	-
S1/1	0.5	Purple/black (coke) Gravel & slight clay soil.	7.92	7,700	<1	<1	<1	<1	<10	<50	200	16	370	2.8	405	400	18.4	-	0.03
/2	1.3	Orange sand.	8.37	450	<1	<1	<1	<1	<10	<50	100	5	15	1.7	30	5	11.3	-	-
/3	3.0	Yellow sand.	7.56	130	<1	<1	<1	<1	<10	<50	200	2	2	<0.5	10	4	5.5	-	-
S2/1	0.5	Brown clay & sandy soil.	7.47	150	<1	<1	<1	<1	<10	<50	400	-	-	-	-	-	11.4	-	-
/2	1.6	Orange brown sand.	6.91	100	<1	<1	<1	<1	<10	<50	200	-	-	-	-	-	6.3	-	-
/3	3.5	Yellow sand.	6.93	25	<1	<1	<1	<1	<10	<50	300	-	-	-	-	-	4.6	-	-

/continued.....

SOILS

Ref: C8510A

Sample No:	Depth	Sample Description	pH	SO_3	S^{2-}	Total Cn	Free Cn	Phenol	Cl^-	Elem S	Tot X	Avail Zn	Zn	Total Cd	Pb	As	Moisture Content (% wt)	Coal Tar	H_2O Sol SO_3 g/litre
S3/1	0.7	Brown /dark orange gravel Clay & sand.	8.26	25	<1	<1	<1	<1	<10	<50	500	4	62	2.0	40	12	9.9	-	-
S3/2	2.2	Orange/yellow sand.	8.01	80	<1	<1	<1	<1	<10	<50	300	1	10	2.3	25	3	7.1	-	-
/3	2.6	Yellow sand	7.87	40	<1	<1	<1	<1	<10	<50	400	12	20	1.4	20	9	7.6	-	-
S4/1	1.2	Black/brown clay/gravel.	6.94	100	<1	<1	<1	<1	<10	<50	2,900	-	-	-	-	-	11.0	-	-
/2	2.0	Black/brown heavy clay/ gravel.	6.99	375	<1	52	22	<1	<10	<50	1,600	-	-	-	-	-	18.9	-	-
/3	3.1	Dark yellow/ brown clay & soil.	4.87	830	<1	26	10	<1	<10	<50	900	-	-	-	-	-	6.9	-	-
S5/1	0.5	Brown , some red gravely heavy clay soil.	6.81	150	<1	<1	<1	<1	<10	<50	1,200	13	55	1.9	50	9	7.2	-	-
/2	1.7	Yellow sand	7.00	25	<1	<1	<1	<1	<10	<50	400	2	37	40.5	20	2	4.4	-	-
T1/1	0.45	Dark brown/ grey stoney soil.	8.19	415	<1	<1	<1	<1	<10	<50	2,100	-	-	-	-	-	13.00	-	-
/2	1.6	Orange sand.	7.34	100	<1	<1	<1	<1	<10	<50	1,000	-	-	-	-	-	4.6	-	-
/3	3.1	Orange sand.	7.47	60	<1	<1	<1	<1	<10	<50	600	-	-	-	-	-	4.8	-	-
T2/1	0.5	Black/grey gravely soil some clay	5.00	6,900	<1	7	3	<1	<10	<50	2,100	14	102	1.6	70	21	11.9	-	0.66
/2	1.5	Dark orange brown slightly clayey sand.	3.56	2,020	<1	<1	<1	<1	<10	<50	1,600	1	22	2.3	25	6	5.9	-	-
/3	2.9	Orange sand.	3.60	650	<1	<1	<1	<1	<10	<50	500	<1	23	1.0	20	2	4.2	-	-

/continued.....