

Geotechnical Assessments

White Young Green (WYG) was instructed by Langtree Group Plc to undertake a Stage I Preliminary Trial Pit Investigation of the application site in 2006. Subsequent to this a Desk Top Study was undertaken by WS Atkins on behalf of English Partnerships, prior acquiring the site in 2002. The relevant geotechnical assessment of the site undertaken in 2002 has been appended to the WYG report for information.

Spawforths

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Spawforths is a trading name of Spawforth Rolinson Ltd. Incorporated in England, Company Registration Number 2247289

Our Ref: A019530/AJ

Date: 19th January 2006

Langtree Group Plc.
Centrix House
Crow Lane East
Newton Le Willows
WA12 9UY

For the Attention of Mr S Barnes

Consulting

Civil
Electrical
Environmental
Health & Safety
Management Services
Mechanical
Rail
Structural
Town Planning
Transportation

Dear Sirs,

Duke St, Liverpool – Stage 1 Preliminary Trial Pit Investigation

1.0 Introduction

Further to our proposals for supplementary site investigation and your instruction in December, we attended site on 19th December 2005 to carry out stage 1 preliminary ground investigation to obtain an overview of the site conditions. Weather was noted as overcast with occasional rain.

The site falls on a gentle slope from North to South. The site is bordered to the Northeast by 82-90 Duke St, partially by 90 Duke St to the Southeast, Henry St to the Southwest and a partly demolished building to the Northwest.

On arrival the site was being used as a car park for adjacent construction site and a well compacted layer of hardcore was at the surface. Prior to the investigation starting, the vehicles and building materials on the site were removed where possible.

The investigation included a series of trial pits by mechanical excavation and hand dug pits adjacent to existing buildings. The purpose of the mechanical trial pits was to confirm bearing strata, level of contamination in both fill and natural strata and to establish the type and amount of obstructions within the fill. Prior to excavation commencing, service record drawings were considered and it was noted that no service runs crossed the site. In order to confirm this, the proposed pit sites were CAT scanned. The purpose of the hand dug pits was to establish existing foundation details of 82, 84 and 86 Duke Street.

Cont'd



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Offices throughout the UK and overseas



INVESTOR IN PEOPLE

thinking beyond construction

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2.0 Findings

Results of the investigation were as follows:

2.1 Mechanical Excavations

Depth of fill varied across the site. The true level of natural sand/weathered sandstone can be established by reviewing the trial pit logs which indicate the approximate ground level. In addition, White Young Green Consulting Engineers drawing A019530/002/P1 shows interpolated ground profiles based on the trial pit information.

Trial Pit 1 (Refer to trial pit logs and photos P01-P03)

Dark brown sandy fill containing many brick fragments was found to a depth of 2.4m. Light yellow sand was found beneath this depth to the termination of the trial pit at 3.0m. Sand appeared to be initially loose and became denser as the excavation progressed. Although described in a report by WS Atkins (dated April 2002) as weathered sandstone, a rock stratum was not encountered. Depth of fill material varied in each face of the pit. A buried masonry foundation was also encountered in the fill material. Sides of pit were not stable in fill but remained vertical in sand. Trial pit was dry when terminated.

Trial Pit 2 (Refer to trial pit logs and photos P04-P06)

Dark brown sandy fill containing many brick and concrete fragments was found to a depth of 1.8m. Light yellow sand was found beneath this depth to the termination of the trial pit at 3.5m. Sand appeared to be initially loose and became denser and darker as the excavation progressed. A rock stratum was not encountered. Sides of pit were not stable in fill but remained vertical in sand. Trial pit was dry when terminated.

Trial Pit 3 (Refer to trial pit logs and photos P07-P10)

Dark brown sandy fill containing many brick and concrete fragments was found to a depth of between 1.0m and 2.6m. Light yellow sand was found beneath this depth to the termination of the trial pit at 3.4m. Sand appeared to be initially loose and became denser and darker as the excavation progressed. A rock stratum was not encountered. Sides of pit were not stable in fill but remained vertical in sand. Trial pit was dry when terminated. The trial pit appeared to be at a junction between differing depths of fill.

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Trial Pit 4 (Refer to trial pit logs and photos P14-P16)

Dark brown sandy fill containing many brick fragments was found to a depth of between 1.0m and 2.5m. Light yellow sand was found beneath this depth to the termination of the trial pit at 3.4m. Sand appeared to be initially loose and became denser as the excavation progressed. A rock stratum was not encountered. Sides of pit were not stable in fill but remained vertical in sand. Trial pit was dry when terminated. Depth of fill varied around the trail pit. A masonry wall was observed to a depth of 2.6m in one face.

Trial Pit 5 (Refer to trial pit logs and photos P17-P19)

Excavation appeared to be located over a series of intersecting, buried masonry walls. Dark brown sandy fill containing many brick fragments was noted between the walls. At a depth of approximately 900mm the top of a brick arch was identified. There appeared to be a 100mm void beyond the arch ending at a concrete wall. The trial pit was abandoned at a depth of 1m due to the obstructions noted.

Trial Pit 6 (Refer to trial pit logs and photos P20-P22)

Dark brown sandy fill containing many brick and concrete fragments was found to a depth of between 1.45m. Light yellow sand was found beneath this depth to the termination of the trial pit at 2.3m. Sand appeared to be initially loose and became denser as the excavation progressed. A rock stratum was not encountered. Sides of pit were not stable in fill but remained vertical in sand. Trial pit was dry when terminated.

2.2 Hand Dug Excavations

Hand Dug Pit 1 to the rear of 82/84 Duke St (Refer to trial pit logs and photo P23-P25)

Limited access and site debris dictated location of pit. Excavation located a brick step out at 1.675m depth, however, masonry extended beyond a depth of 2.6m. Due to the nature of the fill (loose granular material) the sides of the excavation were unstable; therefore the pit was abandoned at a depth of 2.6m. Excavated material was dark brown sandy fill containing many brick fragments for the full depth of the excavation.

Hand Dug Pit 2 to the rear of 86 Duke St (Refer to trial pit logs and photo P13-P15)

Excavation located the top of an open arch at a depth of 400mm. Due to the uncertainties of interfering with the unexpected basement structure and potential to affect the existing building, the excavation was abandoned. Excavated material was dark brown sandy fill containing many brick fragments for the full depth of the excavation.

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2.3 Chemical testing

Three samples were taken of the fill material and two samples were taken of the compacted sand for initial screening. White Young Green Consulting Engineers liaised with a waste disposal company in order to classify the material for disposal.

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For health and safety reasons, further investigation will require such area to be made safe prior to commissioning these works. This will likely be achieved by demolition of the existing structures that are no longer required and propping the existing buildings to remain where necessary.

Both a temporary and permanent earth retaining solution will be required in order to form the basement without causing disruption to the highway bordering the South East and South West boundaries of the site. If sheet piling is utilised there may be difficulties in ground penetration when the rock head is reached. For this reason a propping system may be required or an alternative method eg. Kingpost.

Based on current data, an allowable safe bearing pressure of 300kN/m^2 in the well compacted sand/weathered sandstone should be assumed. However, if further investigation in the form of rock coring and subsequent testing is carried out, this could substantially improve allowable bearing pressures.

Chemical testing results were forwarded to a local waste disposal company. Based on the samples obtained, it has been determined that the fill would be classified as Non-hazardous waste and the underlying compacted sand/weathered sandstone as inert. No asbestos was detected in the samples submitted for testing.

Ground water was not detected in any excavations and therefore it is very unlikely that dewatering will be required if the proposed structure is limited to a single level of basement.

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3.0 Discussion / Conclusions

Generally the site is overlain with sandy fill containing brick fragments which is likely demolition material. It would be logical to assume that the fill encountered was infill to the basements of structures previously located on the site. Due to the age of the buildings, the presence of contaminated material such as asbestos and horsehair plaster should be considered, albeit not evident in this investigation. This will also factor in the classification of spoil removed from the site. Demolition materials, predominantly granular, include part bricks, whole bricks and concrete fragments.

Buried basement walls and floors were also discovered during the investigation. In addition as noted in trial pit 3, junctions between fill and natural material were encountered. These junctions are likely on the lines of walls of in filled basements. As can be seen from the attached photographs (P01, P02, P15, P18 and P19) the basement sub floor walls encountered were in reasonable condition and adequate allowance should be made for the removal of the walls and the floors during the excavation works.

Immediately below the demolition material, loose light yellow sand was encountered. The sand appeared to become denser with depth; however, a rock head was not obvious. The sand retained verticality throughout the excavation demonstrating considerable compaction or very weak bond. One would assume that this material is the border of the highly weathered sandstone noted in WS Atkins report. In several cases the sand was located at considerably shallower depths. Although the rock head was not directly encountered in the investigation, it would be prudent to allow for some degree of difficult excavation during the formation of basements, foundations and drainage/services.

Ground water was not encountered.

Based on current DLA section drawings, the vast majority of fill would be removed during the construction of the proposed basements. Therefore, foundations for this structure would be formed in the compacted sand/weathered sandstone.

Excavations adjacent to 82/84 Duke St to form new basements will likely require underpinning of the existing foundations to 82/84 Duke St in car park. This can only be confirmed by carrying out further investigation in order to prove the existing foundation depth. Further investigation will also be required in order to determine existing building foundations to 86-90 Duke St and the building on the North West boundary. This investigation will determine further the details of underpinning requirements.

It would also be prudent to carry out ground investigation beneath the existing building to the South East boundary which is to be demolished.

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Limitations

The opinions and comments given in this report are subject to the limitations imposed by employing normal methods of investigation.

The investigation was limited to of a series of isolated trial pits which can only provide factual information about a relatively small volume of subsoil. There may however be specialist conditions pertaining to the site which have not been discovered by the exploratory holes and which have not been taken into account within this.

Any reference to the strength of the ground are estimates from an on site visual appraisal of the excavated material.

It should be noted that no environmental or geotechnical testing has been carried out as this was outside the scope of the investigation.

The report is strictly private and confidential to Langtree Group plc. Whilst it may be shown to their professional advisers or insurers, the contents are not to be disclosed to or made use by any third party without our express written consent. Without such consent we can accept no responsibility to any third party.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'A Jones', with a stylized flourish at the end.

Antony Jones
SENIOR ENGINEER

Cc Jamie Davenport – DLA
John Luddington – ECM





PO1 – TP1



P02 – TP1



PO3 - TP1



PO4 - TP 2



PO5 - TP 2



PO6 - TP 2



P07 - TP 3



P08 - TP 3



P09 – TP 3



P10 – TP 3



P12 - H 002



P13 - H002



P14 – H002



P15 – TP 4



P16 TP 4



P17 - TP 4



P18 - TP 5



P19 - TP 5



P20 – TP 5



P21 – TP 6



P22 – TP 6



P23 – TP 6



P24 - H001



P25 - H001



P26 - H001



P27 - H001

Scientific Analysis Laboratories

Report Number: 70117-1
Date of Report: 16-Jan-2006
Client: White Young Green,
Regatta House;
Clippers Quay,
Salford Quays,
Manchester.
M5 2XP

Client Contact: Mr Antony Jones
Client Job Reference: A019530/AJ/AJ
Client Site Reference: Duke St Liverpool

Date Job Received at SAL: 22-Dec-2005
Date Analysis Started: 23-Dec-2005
Date Analysis Completed: 16-Jan-2006

The results reported relate to samples received at the laboratory
Opinions and Interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs

Key to symbols used in this report:
W: Analysis was performed at another SAL Laboratory
S: Analysis was sub-contracted
N: Analysis is not UKAS accredited
U: Analysis is UKAS accredited

Report checked
and authorised by:

Miss Lucy Walsh
Project Manager



1549
Group

Results

Soil

					SAL Ref:	70117 001	70117 002	70117 003	70117 004	70117 005
					Client Ref:	S1	S2	S3	S4	S5
					Type:	Soil	Soil	Soil	Soil	Soil
Determinand	Method	Units	LOD	Symbol						
Cyanide (Total)	Colorimetry	mg/kg	1	U	<1	<1	<1	<1	<1	<1
Phenols (Total-Mono)	Colorimetry	mg/kg	1	U	<1	<1	<1	<1	<1	<1
Sulphide	Colorimetry	mg/kg	10	N	<10	<10	<10	<10	<10	<10
Polycyclic Aromatic Hydrocarbons (Total)	GC/FID	mg/kg	1	N	<1	<1	7	<1	<1	<1
Arsenic	ICP/OES	mg/kg	1	U	34	5	8	3	11	
Boron	ICP/OES	mg/kg	1	N	<1	<1	<1	<1	<1	<1
Cadmium	ICP/OES	mg/kg	1	U	<1	<1	<1	<1	4	
Chromium	ICP/OES	mg/kg	1	U	53	15	17	13	36	
Copper	ICP/OES	mg/kg	1	U	69	11	26	5	58	
Lead	ICP/OES	mg/kg	1	U	360	61	200	25	300	
Mercury	ICP/OES	mg/kg	1	U	<1	2	<1	<1	<1	<1
Nickel	ICP/OES	mg/kg	1	U	45	12	13	7	18	
Selenium	ICP/OES	mg/kg	2	U	<2	<2	<2	<2	<2	<2
Sulphate (Total)	ICP/OES	%	0.01	N	0.25	0.04	0.06	0.02	0.22	
Sulphate(2:1)	ICP/OES	g/l	0.1	N	0.1	<0.1	<0.1	<0.1	0.3	
Zinc	ICP/OES	mg/kg	1	U	150	36	50	19	210	
pH	Probe			U	7.9	8.7	8.7	8.8	8.5	
Asbestos (Screen Only)	Visual			N	ND	ND	ND	ND	ND	ND

Notes

ND - None Detected

CORY ENVIRONMENTAL (CENTRAL) LTD
 Customer Services
 Tel: 01785 251555
 Fax: 01785 251666
 Waste Disposal Quotation Form GEN-RC-004a

Mithras Ltd		17 JAN 2006	
24	AD19S30	FILE NO	

WASTE DISPOSAL QUOTATION 9059

Antony Jones
White Young Green

T: 0161 872 3223
F: 0161 872 3193
Date: 17/01/2006

Waste Description: **Contaminated soil**
 Waste Producer: **Duke Street, Liverpool**

Landfill for Disposal of Waste: **LYME & WOOD (HAYDOCK)**

Disposal Price: **£11.00 per tonne**
 Minimum Charge:
 Landfill Tax Rate: **Standard (see Note 1)**

Analysis/MSDS? **FULL SITE INVESTIGATION REPORT REQUIRED**
 Containment: **Swtipper** Frequency: **One off**
 Difficult to Handle? **Difficult**
 Hazardous/Non-hazardous: **Non-Hazardous**

The receipt of the above waste is subject to the following conditions:

- Waste is only acceptable if it has been sampled in line with a sampling plan, written in accordance with any applicable guidance/legislation in force at the time of disposal.
- A waste disposal transfer note must be submitted with each load stating the customer name, waste producer name, waste description, charge category/DA number and EWC code
- Daily inputs to be agreed with site management.
- A waste characterisation form must be completed prior to the acceptance of this waste
- SUBJECT TO RECEIPT OF FULL SITE INVESTIGATION REPORT AND CONFIRMATION OF QUANTITY OF WASTE**

IMPORTANT NOTE

Once you have agreed this quotation, you are required to inform Customer Services on 0178 251555 so that the disposal of this waste can be authorised. In the case of hazardous and difficult wastes, a Disposal Authorisation number will need to be sought. This must be obtained at least **48 hours prior to delivery**.

Any opinions on the nature of this waste is our opinion only and based on the information provided at the time. It is the producers responsibility to ensure that their wastes are disposed of at suitably classed landfill sites (i.e. Inert, non-hazardous, stable non-reactive hazardous or hazardous).

UNAUTHORISED WASTES WILL NOT BE ACCEPTED AT ANY OF CORY'S LANDFILL SITES

Note 1: Both the disposal price and the minimum load price are exclusive of Landfill Tax, VAT and all other applicable taxes, statutory levies and duties. Any amounts due in respect of such Landfill Tax, VAT and other taxes levies and duties shall be paid by the customer in addition to these prices. The Landfill Tax rate shown is for indicative purposes only and the customer is liable at all times for the appropriate Landfill Tax rate for the actual waste delivered. These prices are only valid until further notice and will expire automatically one month from today's date. It is important to note that this quotation is not an offer capable of acceptance: any order is only accepted at our entire discretion (expressly in writing, by fax, post or by hand). Any contract between us will be upon Cory Environmental's terms of business that are available on request and any disposal will be subject to availability of suitable void at the Site and the authorisation of all relevant licensing and regulatory authorities.

Cory Environmental (Central) Ltd. Registered in England No: 2773558 Registered Office: 2, Coldbath Square, London EC1R 5HL

CORY ENVIRONMENTAL (CENTRAL) LTD

Customer Services

Tel: 01785 251555

Fax: 01785 251666

Waste Disposal Quotation Form GEN-RC-004a

WASTE DISPOSAL QUOTATION 9060

Antony Jones
White Young Green

T: 0161 872 3223
F: 0161 872 3193
Date: 17/01/2006

Waste Description: **Contaminated soil**
Waste Producer: **Duke Street, Liverpool**

Landfill for Disposal of Waste: **LORD ST HELENS (ST HELENS)**

Disposal Price: **£11.50 per tonne**
Minimum Charge:
Landfill Tax Rate: **Standard (see Note 1)**

Analysis/MSDS? **FULL SITE INVESTIGATION REPORT REQUIRED**
Containment: **8wtipper** Frequency: **One off**
Difficult to Handle? **Difficult**
Hazardous/Non-hazardous: **Non-Hazardous**

The receipt of the above waste is subject to the following conditions:

- Waste is only acceptable if it has been sampled in line with a sampling plan, written in accordance with any applicable guidance/legislation in force at the time of disposal.
- A waste disposal transfer note must be submitted with each load stating the customer name, waste producer name, waste description, charge category/DA number and EWC code.
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Ground Level (m AOD):					Trial Pit No. TP 1		Sheet: 0 1	
Samples and In-situ Tests				Water	Description of Strata	Depth (Thickness)	Legend	
Depth	No	Type	Result					
500			S1		HARDCORE	0.1		
					BROWN SANDY FILL MANY BRICK FRAGMENTS, WHOLE BRICKS / LARGE FRAGMENTS OF CONCRETE	0.6		
					BLACK ASH	0.8		
1000			S2		BROWN SANDY FILL WITH BRICK FRAGMENTS			
1500					SAND LIGHTER WITH DEPTH			
2000								
2500					COMPACTED SAND	2.4		
3000					TRIAL HOLE TERMINATED AT 3.0m	3.0		
3500								
4000								
4500								

Plan		General Remarks	
		PHOTOGRAPHS - P1 P2 P3 SAND SHALLOWER IN SOME FACES OF TRIAL PIT BURIED MASONRY FOUNDATION IN FACE OF TRIAL PIT	

All dimensions in millimetres		Method JCB		Logged By ANTONY JONES	
Regatta House Clippers Quay Salford Quays Manchester M50 3XP Tel: 0161 872 3223 Fax: 0161 872 3193 e-mail: manchester@wyg.com		 Project: 2701 DUKE STREET LIVERPOOL		Drawing Title: TRIAL PIT SHEET SK 001	
Consulting Engineers Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management		Drawn By: SAT Date: JAN 06 Checked By: CS Date: 2701 Approved By: PI Date:		Project No: A019530 Office: 2701 Type: CS Drawing No: SK 001 Revision: PI	
				APPROVAL <input type="checkbox"/> INFORMATION <input type="checkbox"/> TENDER <input type="checkbox"/> CONTRACT <input type="checkbox"/> CONSTRUCTION <input type="checkbox"/>	

Ground Level (m AOD):					Trial Pit No. TP 2		Sheet: 0 1	
Samples and In-situ Tests				Water	Description of Strata	Depth (Thickness)	Legend	
Depth	No	Type	Result					
500			S3		HARDCORE	0.1		
					BROWN SANDY FILL MANY LARGE BRICK FRAGMENTS BURIED CONCRETE FOUNDATIONS SAND LIGHTER WITH DEPTH			
1000								
1500								
2000					VERY LIGHT BROWN SAND INITIALLY LOOSE BUT BECOMING DENSE	1.8		
2500								
3000								
3500			S4		DARKER BROWN SAND TO VERY WEATHERED SANDSTONE	3.5		
4000					TRIAL HOLE TERMINATED AT 3.8m	3.8		
4500								

Plan	General Remarks PHOTOGRAPHS - P4 P5 P6
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All dimensions in millimetres		Method JCB	Logged By ANTONY JONES										
Regatta House Clippers Quay Salford Quays Manchester M50 3XP Tel: 0161 872 3223 Fax: 0161 872 3193 e-mail: manchester@wyg.com 		Project: WYQUAY DUKE STREET LIVERPOOL	Drawing Title TRIAL PIT SHEET SK 002										
		Client/Owner LANGTREE	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td>Drawn By SAI</td> <td>Date JAN 06</td> <td>Checked By</td> <td>Date</td> <td>Approved By</td> <td>Date</td> </tr> <tr> <td>Project No A019530</td> <td>Office 2701</td> <td>Type CS</td> <td>Drawing File SK 002</td> <td>Revision P1</td> <td></td> </tr> </table>	Drawn By SAI	Date JAN 06	Checked By	Date	Approved By	Date	Project No A019530	Office 2701	Type CS	Drawing File SK 002
Drawn By SAI	Date JAN 06	Checked By	Date	Approved By	Date								
Project No A019530	Office 2701	Type CS	Drawing File SK 002	Revision P1									

Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management

APPROVAL ☐ INFORMATION ☐ TENDER ☐ CONTRACT ☐ CONSTRUCTION ☐

Ground Level (m AOD):				Trial Pit No. TP 4		Sheet: 0 1													
Samples and In-situ Tests				Water	Description of Strata	Depth (Thickness)	Legend												
Depth	No	Type	Result																
500					HARDCORE	0.1													
1000					DARK BROWN SANDY FILL WITH MANY BRICK FRAGMENTS	1.0													
1500					LIGHT BROWN SAND APPEARS FAIRLY LOOSE BECOMING DENSER WITH DEPTH														
2000																			
2500																			
3000																			
3500					COMPACTED SAND	3.4													
4000					TRIAL HOLE TERMINATED AT 3.7m	3.7													
4500																			
Plan				General Remarks															
				PHOTOGRAPHS - P14 P15 & P16 WALL TO DEPTH OF 2.6m IN ONE FACE DEPTH OF FILL VARIES AROUND PERIMETER OF HOLE.															
All dimensions in millimetres				Method JCB		Logged By ANTONY JONES													
Regatta House Clippers Quay Salford Quays Manchester M50 3XP Tel: 0161 872 3223 Fax: 0161 872 3193 e-mail: manchester@wyg.com				Project 1110/000 DUKE STREET LIVERPOOL		Drawing Title TRIAL PIT SHEET SK 004													
Consulting Engineers Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management				CLIENT/ARCH LANGTREE		<table border="1"> <tr> <td>Drawn By SAT</td> <td>Date JAN 05</td> <td>Checked By</td> <td>Date</td> <td>Approved By</td> <td>Date</td> </tr> <tr> <td>Project No. A019530</td> <td>Issue 2701</td> <td>Type CS</td> <td>Drawing No. SK 004</td> <td>Revision P1</td> <td></td> </tr> </table>		Drawn By SAT	Date JAN 05	Checked By	Date	Approved By	Date	Project No. A019530	Issue 2701	Type CS	Drawing No. SK 004	Revision P1	
Drawn By SAT	Date JAN 05	Checked By	Date	Approved By	Date														
Project No. A019530	Issue 2701	Type CS	Drawing No. SK 004	Revision P1															
				APPROVAL <input type="checkbox"/> INFORMATION <input type="checkbox"/> TENDER <input type="checkbox"/> CONTRACT <input type="checkbox"/> CONSTRUCTION <input type="checkbox"/>															

Ground Level (m AOD):						Trial Pit No.		TP 5		Sheet:		0 1	
Samples and In-situ Tests				Water	Description of Strata	Depth (Thickness)	Legend						
Depth	No	Type	Result										
					HARDCORE	0.1							
500					DARK BROWN SANDY FILL WITH MANY BRICK FRAGMENTS AND HALF BRICKS								
1000					TRIAL HOLE ABANDONED DUE TO BRICK VAULTS	1.0							
1500													
2000													
2500													
3000													
3500													
4000													
4500													
Plan				General Remarks									
				PHOTOGRAPHS - P17 P18 & P9 SEVERAL INTERSECTING BRICK WALLS WITH ARCHES THROUGH. APPEARS TO BE CONCRETE WALL BEHIND ARCH TRIAL PIT ABANDONED									
All dimensions in millimetres				Method		Logged By							
				JCB		ANTONY JONES							
Regatta House Clippers Quay Salford Quays Manchester M50 3XP Tel: 0161 872 3223 Fax: 0161 872 3193 e-mail: manchester@wyg.com				Project: HYGSIU DUKE STREET LIVERPOOL		Drawing Title: TRIAL PIT SHEET SK 005							
Consulting Engineers Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management				Client/Arch:		Drawn By							
				LANGTREE		SAT							
				Date		Checked By							
				JAN 06		D.S.							
				Office		Type							
				A019530		SK 005							
				Revision		P1							
				Approval		Information							
				Tender		Contract							
				Construction									

Ground Level (m AOD):						Trial Pit No.		TP 6		Sheet:		0 1	
Samples and In-situ Tests				Water	Description of Strata	Depth (Thickness)	Legend						
Depth	No	Type	Result										
			S5		HARDCORE	0.1							
500					DARK BROWN SANDY FILL MANY BRICK FRAGMENTS								
1000					2 OLD BURIED DRAINS NOTED 1 AT BASE OF FILL.								
1500					LIGHT BROWN SAND APPEARS FAIRLY LOOSE	1.45							
2000					DENSER WITH DEPTH								
2500					COMPACTED SAND	2.3							
3000					TRIAL HOLE TERMINATED AT 2.6m	2.6							
3500													
4000													
4500													
Plan				General Remarks									
				PHOTOGRAPHS - P20 P21 & P22									
All dimensions in millimetres				Method		Logged By							
				JCB		ANTONY JONES							
Regatta House Clippers Quay Salford Quays Manchester M50 3XP Tel: 0161 872 3223 Fax: 0161 672 3193 e-mail: manchester@wyg.com				Project WYG/JUN DUKE STREET LIVERPOOL		Drawing title TRIAL PIT SHEET SK 006							
Consulting Engineers Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management				CLIENT/ARCH LANGTREE		Drawn By SAT Date JAN 06 Checked By Data Approved By Data Project No A019530 Office 2701 Type CS Drawing No SK 006 Revision P1							
				APPROVAL <input type="checkbox"/> INFORMATION <input type="checkbox"/> TENDER <input type="checkbox"/> CONTRACT <input type="checkbox"/> CONSTRUCTION <input type="checkbox"/>									

Ground Level (m AOD):	Trial Pit No. HD 01	Sheet: 0 1												
Plan	General Remarks PHOTOGRAPHS - P23 P24 & P25													
All dimensions in millimetres	Method HAND DIG	Logged By ANTONY JONES												
Regatta House Clippers Quay Salford Quays Manchester M50 3XP Tel: 0161 872 3223 Fax: 0161 872 3193 e-mail: manchester@wyg.com	Project WYG-331 DUKE STREET LIVERPOOL CLIENT/ARCH LANGTREE	Drawing Title TRIAL PIT SHEET SK 007 <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td>Drawn By SAI</td> <td>Date JAN 05</td> <td>Checked By</td> <td>Date</td> <td>Approved By</td> <td>Date</td> </tr> <tr> <td>Project No A019530</td> <td>Office 2701</td> <td>Type CS</td> <td>Drawing No SK 007</td> <td>Revision P1</td> <td></td> </tr> </table>	Drawn By SAI	Date JAN 05	Checked By	Date	Approved By	Date	Project No A019530	Office 2701	Type CS	Drawing No SK 007	Revision P1	
Drawn By SAI	Date JAN 05	Checked By	Date	Approved By	Date									
Project No A019530	Office 2701	Type CS	Drawing No SK 007	Revision P1										
Consulting Engineers Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management														

Ground Level (m AOD):	Trial Pit No. HD 02	Sheet: 0 1
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PIER

INFILLED ARCH

GROUND LEVEL

400

2ND OPEN ARCH

Plan	General Remarks PHOTOGRAPHS – P11 P12 & P13 APPEARS TO BE 2ND ARCH RATHER THAN FOOTING PIT ABANDONED.	
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All dimensions in millimetres <div style="display: flex; justify-content: space-between; align-items: flex-start;"> <div style="width: 45%;"> Regatta House Clippers Quay Salford Quays Manchester M50 3XP Tel: 0161 872 3223 Fax: 0161 872 3193 e-mail: manchester@wyg.com </div> <div style="width: 45%; text-align: center;"> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> White Young Green </div> <div style="margin-top: 10px;"> Consulting Engineers <small>Civil Structural Mechanical Electrical Process Rail Traffic Environmental Project Management</small> </div> </div> </div>	Method HAND DIG Project WYGVVV DUKE STREET LIVERPOOL CLIENT/ARCH LANGTREE	Logged By ANTONY JONES Drawing No. TRIAL PIT SHEET SK 008 <table border="1" style="width: 100%; border-collapse: collapse; font-size: 0.8em;"> <tr> <td>Drawn By SAT</td> <td>Date JAN 06</td> <td>Checked By</td> <td>Date</td> <td>Approved By</td> <td>Date</td> </tr> <tr> <td>Project No A019530</td> <td>Office 2701</td> <td>Type CS</td> <td>Drawing No SK 008</td> <td>Revision P1</td> <td></td> </tr> </table> <div style="font-size: 0.7em; margin-top: 5px;"> APPROVAL <input type="checkbox"/> INFORMATION <input type="checkbox"/> TENDER <input type="checkbox"/> CONTRACT <input type="checkbox"/> CONSTRUCTION <input type="checkbox"/> </div>	Drawn By SAT	Date JAN 06	Checked By	Date	Approved By	Date	Project No A019530	Office 2701	Type CS	Drawing No SK 008	Revision P1	
Drawn By SAT	Date JAN 06	Checked By	Date	Approved By	Date									
Project No A019530	Office 2701	Type CS	Drawing No SK 008	Revision P1										

5. GROUND INVESTIGATION METHODOLOGY

HEALTH AND SAFETY

- 5.1 Prior to the commencement of the ground investigation works, a Health and Safety Risk Assessment was undertaken.
- 5.2 Prior to undertaking site investigation works, a review of existing service plans was undertaken. In addition, all locations were first checked for services using a cable avoidance tool (CAT). All cable percussive boreholes were commenced with a hand dug inspection pit. No underground services were encountered during the course of the investigation works.

GROUND INVESTIGATION METHODOLOGY

- 5.3 Site investigation works were conducted on the 25 and 26 February 2002 by Allied Exploration and Geotechnics Limited (AEG). Three number holes were drilled using a cable percussive rig (BH1 to BH3) to depths of between 3.4m and 4.2m below ground level (bgl). Two locations for window sample holes (WS1 and WS3) were abandoned when hand excavated pits met concrete and brick obstructions at 0.7 and 0.8m bgl. Four number holes were drilled using a narrow diameter window sampler rig (WS1A, WS2, WS3A and WS4) to refusal at depths of between 2.4m and 3.9m bgl. Copies of the contractor's borehole and window sample records are presented in Appendix 8. No exploratory holes were undertaken on the open area of land adjacent to Suffolk Street; this was due to access difficulties. The locations of the exploratory holes are shown in Figure 3.

Field Testing

- 5.5 In order to obtain information on soil strength along the boundary of the made/natural ground a number of standard penetration tests (SPTs) were undertaken in the boreholes.

Installation of Monitoring Wells

- 5.6 At each of the three borehole locations 50mm diameter gas/groundwater monitoring wells were installed on completion of boring. Details of the installations are shown on the exploratory hole records.

Sample Selection for Chemical Analysis

- 5.9 Representative samples were taken from each exploratory hole, and samples selected for subsequent “fast-track” chemical analysis. These samples were analysed by Derwentside Environmental Testing Services Ltd. All samples were tested for the following parameters:

Arsenic, cadmium, chromium, lead, mercury, selenium, copper, nickel, zinc, water soluble boron, hexavalent chromium, total cyanide, free cyanide, thiocyanate, total sulphate, sulphide, total sulphur, pH, solvent extraction, total polyaromatic hydrocarbons (PAH), phenols, asbestos, TPH and diesel range organics (DRO).

The analytical results are presented in Appendix 9.

Gas Monitoring

- 5.10 Gas monitoring was carried out on three occasions between 5 and 20 March. Measurements were made of methane, carbon dioxide and oxygen concentrations. Normally we would undertake a minimum of six rounds of gas monitoring per site. However, given the short project time-scale and absence of biodegradable matter in the made ground, we consider that three rounds of gas monitoring should be sufficient to obtain a preliminary understanding of the ground gas regime on the site. The monitoring records are presented in Appendix 10.

Water Sampling

- 5.11 Groundwater was not encountered in the boreholes during the gas monitoring exercise. Hence no samples were collected.

6. GROUND AND GROUNDWATER CONDITIONS

GENERAL

- 6.1 The general sequence encountered across the site was approximately 3m of granular made ground overlying sandstone bedrock, which was proved to 4.2m depth bgl. No groundwater was encountered during the investigation.
- 6.2 A summary of the ground conditions is presented in Table 6.1 below. The borehole and window sample logs are contained in Appendix 8.

Table 6.1 – Summary of Ground Conditions

Strata	Depth to base	Description
<i>Made Ground</i>	Proven to depths of 2.8m to 3.4m bgl in boreholes. Window sample driller recorded 'base' at 0.9m bgl (WS4)	Whole bricks and concrete blocks with angular to subrounded gravel and cobble size fragments of brick, pottery and slate with a little ash and much brown fine to coarse sand
<i>Bedrock</i>	Proven to depth of 4.2m bgl in boreholes.	Yellow/brown sand with gravel to cobble size fragments of sandstone (Weathered Sandstone)

MADE GROUND

- 6.3 Granular made ground was encountered to depths of between 2.8 and 3.4m bgl in the three cable-percussive boreholes beneath approximately 0.1m of surface hardcore. The made ground generally comprised loose and medium dense brown fine to coarse sand and angular to subrounded fine gravel to cobble-size fragments of brick and concrete, with many whole bricks in the top 0.5m. Occasional fragments of wood, pottery and slate were also noted, as well as a little ash in BH2.

- 6.4 In window sample hole WS3A, similar materials as described above were encountered to 2.85m bgl, as well as in holes WS1 and WS3 above their refusal depths. In window sample holes WS1A, WS2 and WS4 however, between 0.9m and 3.9m bgl a yellow brown sand with varying proportions of gravel-size fragments of yellow brown sandstone was recovered. Although the driller believed this material to be weathered bedrock (see descriptions below), such material was absent in the cable-percussion boreholes above 2.8m bgl. Also the fact that the window sample holes were able to continue to depths of 2.4m, 3.45m and 3.9m (in WS1A, WS2 and WS4 respectively) indicates that the material above 2.8m bgl is unlikely to be bedrock. It is possible that the materials may be excavated sandstone used as fill. The possibility that rockhead may be as high as 0.9 to 1m bgl at the location of these window sample holes however should not be totally discounted. If that is the case then it implies that rock has been excavated and replaced with fill at the locations of BH1, BH2, BH3 and WS3A.

BEDROCK

- 6.5 Discounting the three window sample holes mentioned previously, rockhead varies from 2.8m bgl in the north-west corner (BH1) to 3.4m bgl in the south-east corner (BH3).
- 6.6 The material encountered below the granular made ground in the cable-percussion boreholes was recovered as yellow and orange brown sand with occasional angular gravel and cobble-size fragments of sandstone. This material is believed to represent weathered bedrock. The Standard Penetration Tests (SPTs) and the relatively slow rate of advancement of the cable-percussive chiselling tool (0.4m/hour) indicates 'competent' sandstone at a depth of approximately half a metre below rockhead.
- 6.7 The materials recovered from window sample holes WS1A, WS2 and WS4 between 0.9m and 3.9m bgl have been discussed above, and it is difficult to accurately determine the depth to bedrock. WS3A met refusal at 2.85m with a coating of yellow brown sand recovered from the base of the hole.

GROUNDWATER

- 6.8 No groundwater was encountered in any of the exploratory holes. Also, three rounds of monitoring of the standpipe installations in boreholes BH1 to BH3 inclusive between the 5 and 20 March recorded no groundwater.

7. ENGINEERING ASSESSMENT

ENGINEERING PROPERTIES

- 7.1 Geotechnical laboratory testing was not undertaken on the materials encountered on the site due to the limited time available after the completion of the site works.

Made Ground

- 7.2 The results of seven Standard Penetration Tests carried out in the made ground recorded 'N' values ranging between 5 and 37, with a mean of 13. The variation of 'N' values with depth is presented as Figure 4.
- 7.3 Fifteen number total sulphate tests were undertaken as part of the 'fast track' contamination testing on the made ground materials, and the results ranged from 0.01 to 0.55%. The pH values ranged from 8.6 to 11.4.

Bedrock

- 7.4 Five Standard Penetration Tests were carried out in the sandstone bedrock and did not achieve full penetration. 'N' values extrapolated from the amount of penetration for a certain number of blows ranged from 128 to 300. The variation of 'N' values with depth is presented as Figure 4.

GEOTECHNICAL ASSESSMENT

- 7.5 Although part of the site is at present being used for car parking, the made ground is considered unsuitable as a bearing stratum for any proposed building foundations. Indeed it is understood that the development option being considered by English Partnerships requires excavation of materials from the site to accommodate construction of up to four storeys of residential property with basement car parking.

- 7.6 Based on information provided by EP we have assumed that the volume of excavation required is approximately 2350m³. This is based on excavation from existing ground level for the area of the existing car park and the area adjacent to Suffolk Street, with excavation of the made ground to an average depth of 3mbgl. However, as no final site levels have been provided for review this figure is likely to change. The costs of excavating the made ground and it's off-site disposal will be dependent on it's 'contamination' classification. This is discussed further in the Recommendations section of Chapter 12 of this report.
- 7.7 Although final site levels, or proposed foundation loads are not known, the sandstone bedrock should be suitable as a bearing stratum for any proposed building foundations. The SPT 'N' values show a relative increase approximately half a metre below rockhead, indicating a relative increase in strength. However, in the absence of rock core it is difficult to assign a presumed bearing value for the sandstone at this depth, as it will be dependent on factors such as rock mass strength, or degree of cementation.
- 7.8 The sulphate results from the contamination testing undertaken on the made ground materials encountered on site indicate that generally Class 1 conditions are considered appropriate for the design of any buried concrete at the site (Reference 1). Four test results did indicate Class 2 conditions, however removal of the made ground from the site will mean that there should be no special requirements for buried concrete structures within the site..
- 7.8 Shoring should be provided for any temporary excavations though the made ground materials. There should be no requirements for any dewatering operations, other than the provision of sump pumping to combat any surface water entering any temporary excavations.

8. GAS AND CONTAMINATION ASSESSMENT METHODOLOGY

SOIL GAS ASSESSMENT

- 8.1 The hazards associated with the generation and migration of landfill gas relate principally to the explosivity of methane and toxic/asphyxiant properties of carbon dioxide. Normal ambient levels of methane and carbon dioxide in the atmosphere are about 2ppm and 300ppm respectively. In natural soils, carbon dioxide levels can vary considerably depending on the geological conditions and it is not unusual to have concentrations up to 2% in some topsoils.
- 8.2 Methane is a colourless, odourless gas which is explosive in air at concentrations between about 5% and 15%, the former value being commonly called the Lower Exposure Limit (LEL). The Upper Explosive Limit is, in practical terms, largely academic, since no comfort can be taken from high values. This is because any zone of high concentration will have some fraction within the explosive range, by virtue of a concentration gradient on the interface with the air mass. Methane may be oxidised in the ground to carbon dioxide by soil bacteria and is slightly soluble in water.
- 8.3 Carbon dioxide is an asphyxiant and toxic gas, which is very soluble in water. Concentrations higher than that of normal air (about 0.03%) can occur as a result of aerobic and anaerobic decomposition of organic material. A concentration of 1.5% is used by the Health and Safety Executive as the short term (10 minutes) occupational exposure level; 0.5% is the long term (8 hours) occupational exposure level.
- 8.4 The units used to describe methane levels are % GAS (ie the total volume of methane in air), % LEL (ie the percentage of the Lower Explosive Limit of 5% GAS) and ppm (parts per million). An example of the equivalent values of these are given below:

$$1\% \text{ GAS} = 20\% \text{ LEL} = 10,000 \text{ ppm.}$$

8.5 Landfill gas may migrate from areas of generation towards sensitive targets (for example on the surrounding site) via high permeability pathways within the groundmass. This may result in its accumulation within confined spaces such as buildings. Our assessment of the landfill gas hazard is made in the context of the above information and taking account of guidance in the following documents:

- The Building Research Establishment (BRE) report Construction of New Buildings on Gas-Contaminated Land (Reference 2);
- Approved Document C of the Building Regulations (Reference 3);
- Waste Management Paper 27: Landfill Gas (Reference 4); and
- CIRIA Report 149 Protecting Development from Methane (Reference 5).

SOIL CONTAMINATION ASSESSMENT

UK Guidance Criteria

8.6 The UK Government has indicated in the recent Framework for Contaminated Land (Reference 6) that it is committed to the “suitable for use” approach to the control and treatment of existing contamination. The basis of contamination assessment in the UK is not fully formalised and considerable use of value judgement is needed. Some reference values exist for a range of contaminants as relevant to redevelopment scenarios. These were published by the Inter-Departmental Committee on the Redevelopment of Contaminated Land (ICRCL) and relate to soil quality only (Reference 7).

8.7 ICRCL guidance note 59/83 (see Reference 7) establishes “threshold” trigger concentrations (TTC) and, for some contaminants, “action” trigger concentrations (ATCs) for potentially contaminated soil in relation to specific end uses, eg domestic gardens, parks, buildings or hard cover. ATCs have not been set by ICRCL for heavy metal contaminants. The assessment of results has addressed buildings, other hard cover and landscaped open space.

8.8 In all cases, risk assessment considerations are based not only on whether concentrations are below or above the screening criteria but consider the site-specific environmental context in which they occur.

- 8.9 As the site is to be developed for residential and commercial properties without garden areas the results of the soil analysis carried out during the investigative works have been compared initially to the ICRL Threshold values for parks, playing fields, and open spaces or landscaped areas.
- 8.10 The results of the soil sampling have also been compared with guidance contained in the Environment Agency *Guidance on the Disposal of 'Contaminated Soils'* (Reference 8). This guidance, which quotes Lower and Upper Threshold Concentrations (LTCs and UTCs) is used by the Environment Agency to arrive at suitable disposal routes for waste soils. Soils in which concentrations are below the LTCs are effectively considered as 'uncontaminated'. Soils in which the UTCs are not exceeded can be considered as suitable for re-use as fill subject to the granting of an exemption from waste management licensing. An exemption will only be granted if it can be demonstrated that the re-use of the soils will not present a significant environmental risk.

9. SOIL GAS RESULTS

- 9.1 Three rounds of gas monitoring were undertaken between 5 and 20 March 2002. On each occasion recorded concentrations of methane were below detection limits of the monitoring instrument. Recorded concentrations of carbon dioxide gas were below detection levels on two occasions. However, low concentrations of carbon dioxide were detected on 20 March 2002 in BH2 and BH3 at concentrations of 0.2% and 0.1% respectively. These concentrations are below the 0.5% concentration used by the Health and Safety Executive as the long term (8 hours) occupational exposure level.
- 9.2 This preliminary monitoring suggests that ground gas is not a significant issue on the subject site.

10. CONTAMINATION RESULTS

10.1 Fifteen soil samples were submitted for chemical analysis to Derwentside Environmental Testing Services Limited. The maximum concentrations recorded are presented in Table 10.1, with a complete set of results presented in Appendix 9.

Table 10.1 – Summary of chemical analysis for all soil samples

Determinant	Minimum Concentration (mg/kg)	Maximum Concentration (mg/kg)	Threshold Trigger Concentration	No of Samples Exceeding Trigger concentration
Arsenic	<2	18	40 ⁽¹⁾	0 out of 15
Cadmium	<0.2	0.6	15 ⁽¹⁾	0 out of 15
Chromium Total	4	45	1000 ⁽¹⁾	0 out of 15
Lead	3	660	2000 ⁽¹⁾	0 out of 15
Mercury	<0.3	1.4	20 ⁽¹⁾	0 out of 15
Selenium	<0.3	All samples <0.3	6 ⁽¹⁾	0 out of 15
Copper	<2	710	130 ⁽¹⁾	1 out of 15
Nickel	5	31	70 ⁽¹⁾	0 out of 15
Zinc	8	460	300 ⁽¹⁾	2 out of 15
Boron water soluble	0.2	3.9	3 ⁽¹⁾	1 out of 15
Total cyanide	<1	All samples <1	-	-
Free cyanide	<1	All samples <1	-	-
Thiocyanate	<1	3.5	50 ⁽¹⁾	0 out of 15
Sulphur	<50	All samples <50	5000 ⁽¹⁾	0 out of 15
Sulphide	<10	130	250 ⁽¹⁾	0 out of 15
Total Sulphate	100	5500	2000 ⁽¹⁾	4 out of 15
pH	8.6	11.4	-	-
Phenols	0.7	6.9	5 ⁽¹⁾	1 out of 15
Total PAH	<5	All samples <5	1000(1)	0 out of 15
TPH	<20	All samples <20	-	-
Diesel Range Organics	<20	All samples <20	-	-

Notes: ⁽¹⁾ ICRCL 59/53 – Guidance on Assessment and Redevelopment of Contaminated Land 1987. (Reference 7)

- 10.2 The results of the chemical analysis indicate that the concentrations of determinands in the majority of soil samples analysed were below the relevant guideline values.
- 10.3 A few samples exhibited slightly elevated levels of phytotoxic substances (copper and zinc). The results of the leachate analysis for copper and zinc suggested that these determinands are in relatively soluble chemical forms, and could, theoretically, present a risk to the aqueous environment. As both these determinands are phytotoxic and not normally hazardous to human health it is considered that (since the development will not incorporate garden areas) these determinands do not represent a significant risk to development. However, there is a theoretical risk to the aqueous environment.
- 10.4 One sample had an elevated boron concentration of 3.9mg/kg, slightly exceeding the ICRCL threshold value of 3mg/kg. As this determinand is phytotoxic and not normally hazardous to human health it is considered that (since the development will not incorporate garden areas) it does not represent a significant risk, either to the development or the wider environment.
- 10.5 Four samples of made ground had elevated concentrations of sulphate. The highest value recorded was 5500mg/kg, which is above the ICRCL threshold guidance value of 2000mg/kg. The results of the leachate analysis for sulphate recorded concentrations of 180 and 260µg/l, which exceed the 150µg/l guideline value. The main risk associated with sulphate is to buried concrete. The concentrations recorded indicate a requirement for Class 1 or 2 sulphate resistant concrete (Reference 1), although removal of the made ground from the site will mean Class 2 concrete will not be required.
- 10.6 Recorded soil pH values indicate alkaline conditions, with all samples recording pH values of between 8.6 and 11.4.
- 10.7 One sample exhibited an elevated level of phenol at 6.9mg/kg. This is slightly above the guidance value of 5mg/kg. The results of the leaching test did not record any elevated phenol concentrations.
- 10.8 Analysis for organic species, ie polyaromatic hydrocarbons (PAH) or petroleum hydrocarbons (TPH) did not record any concentrations above detection limits.
- 10.9 The results have also been compared with the UTCs and LTCs quoted in the Environment Agency's Guidance on the Disposal of Contaminated soil.

- 10.10 The UTC for phenol (5mg/kg) was exceeded by elevated phenol concentrations, as was the UTC for sulphate (2000 mg/kg) in four samples. No other UTC concentrations were exceeded.
- 10.11 Two soil samples were submitted for leaching tests and subsequent analysis of the derived leachates. The maximum concentrations recorded are presented in Table 10.2, with a complete set of results presented in Appendix 9.

Table 10.2 – Summary of Leachate Analysis exceeding LQT Values

Determinant	Minimum Concentration (µg/l)	Maximum Concentration (µg/l)	LQT Guidance Concentration	No of Samples Exceeding LQT Guidance Concentrations
Arsenic	<1	14	10 ⁽¹⁾	1 out of 2
Lead	<30	550	50 ⁽¹⁾	1 out of 2
Copper	17	223	20 ⁽¹⁾	1 out of 2
Nickel	30	60	50 ⁽¹⁾	1 out of 2
Zinc	104	585	500 ⁽¹⁾	1 out of 2
Total Sulphate mg/l	180	260	150 ⁽¹⁾	2 out of 2

Notes: ⁽¹⁾ Guidance on the Disposal of “Contaminated Soils” – EA Feb 2001 (Reference 8)

11. PRELIMINARY ENVIRONMENTAL LIABILITY ASSESSMENT

ASSESSMENT OF CONTAMINATED LAND

11.1 Part IIA of the Environmental Protection Act 1990 (inserted by Section 57 of the Environment Act 1995) provides a new regime for the control of specific threats to health or the environment from existing land contamination. In accordance with the Act and the statutory guidance document on The Contaminated Land (England) Regulations 2000 (Reference 9), the definition of contaminated land is intended to embody the concept of risk assessment. Within the meaning of the Act, land is only “contaminated land” where it appears to the regulatory authority, by reason of substances within or under the land that

- a) significant harm is being caused or there is significant possibility of such harm being caused; or
- b) pollution of controlled waters is being, or is likely to be, caused.

11.2 For a risk of pollution or environmental harm to occur as a result of ground contamination, all of the following elements must be present:

- a) a source, ie a substance that is capable of causing pollution or harm;
- b) a receptor (or target), ie something which could be adversely affected by the contaminant;
- c) a pathway, ie a route by which the contaminant can reach the receptor.

- 11.3 If one of these elements is missing there can be no significant risk. If all are present then the magnitude of the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.
- 11.4 The overall environmental risk assessment is composed of the probability of the identified event occurring and the effect or consequence if that event were to occur. It also takes into account the environmental sensitivity of the on-site and off-site receptors.

CONTAMINATION SOURCES

On-site contamination sources

- 11.5 No historical on-site sources of potential contamination were identified on the subject site.
- 11.6 Ground investigations undertaken on the site did not identify the presence of significantly contaminated materials. Laboratory testing undertaken on representative samples of made and natural ground identified isolated slightly elevated concentration of phenol and phytotoxic metals, i.e. copper and zinc.
- 11.7 As the site is proposed for hard development, i.e. residential/commercial properties without gardens, the presence of elevated phytotoxic metals which will potentially impede plant growth are not considered to be significant. Although toxic to human health, the presence of localised slightly elevated phenols within the made ground are not considered to pose a significant health risk. Made ground containing these contaminants will be effectively isolated from human receptors by the presence of hardstanding.
- 11.8 The localised elevated concentration of phenol is only slightly above the TTV. As such it is not considered to present a significant health risk. However, there is a potential for the tainting of water supplies carried in plastic pipes through soils containing phenols.
- 11.9 In addition, the absence of perched water on the site and prevention of precipitation from infiltrating by proposed buildings/hardstanding, these identified contaminants are not considered to represent a significant risk to the wider environment.

- 11.10 The asbestos survey undertaken by Rhodar Ltd identified the presence of asbestos insulating board (AIB) on all fire doors and asbestos panelling within the existing buildings on the site. Full details are provided in the Rhodar Report contained in Appendix 7. The report identifies that in a number of cases that these materials are in poor condition and represent a significant risk to human health.
- 11.11 Limited gas monitoring on the site did not identify the presence of flammable or toxic gases and as such does not represent a constraint to development.

Off-site contamination sources

- 11.12 The desk study review has identified the presence of historical and current potentially contaminative activities within the vicinity of the site. However, ground investigation works undertaken on the site have not identified any evidence of contaminants from off site sources. Although we cannot exclude the potential for such contaminants to be present at depth within the underlying groundwater regime, it is deemed unlikely that such contaminants would have a significant impact on the site.

12. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Environmental Assessment

- 12.1 Although slightly elevated concentration of phenol, zinc and copper have been recorded, it is considered that such concentrations do not pose a significant risk to site occupiers and the wider environment. In addition the absence of perched water will reduce the potential for such contaminants to migrate off site or into the underlying aquifer.
- 12.2 The presence of slightly elevated phenol concentrations could result in the fouling of water supplies. This low risk can be mitigated by the use of clean granular backfill in any service trenches. This is normal good practice anyway, and should not result in any significant abnormal development cost.
- 12.3 Limited gas monitoring undertaken on the site has not identified the presence of flammable or toxic gases and as such are considered unlikely to represent a significant risk to future site users.
- 12.4 The asbestos survey undertaken by Rhodar Limited, has identified the presence of asbestos within the fabric of the building. In certain instances this is considered to represent a significant risk to human health. As such this will require removal by a suitably licensed asbestos removal contractor.

PART IIA LIABILITY ASSESSMENT

- 12.5 The Contaminated Land (England) Regulations 2000 implement Part IIA of the Environment Protection Act 1990 (as inserted by Section 57 of the Environment Act 1995). This legislation requires relevant authorities to identify “contaminated land” and as necessary force “appropriate persons” to carry out any necessary remedial measures. The identification of “contaminated land” must include an assessment of risk. In other words, land can only be identified as contaminated if it is actually

causing or likely to cause significant harm. On the basis of the information available for this report, we consider that the relevant authority is highly unlikely to consider the subject site as contaminated for identification as “contaminated land”.

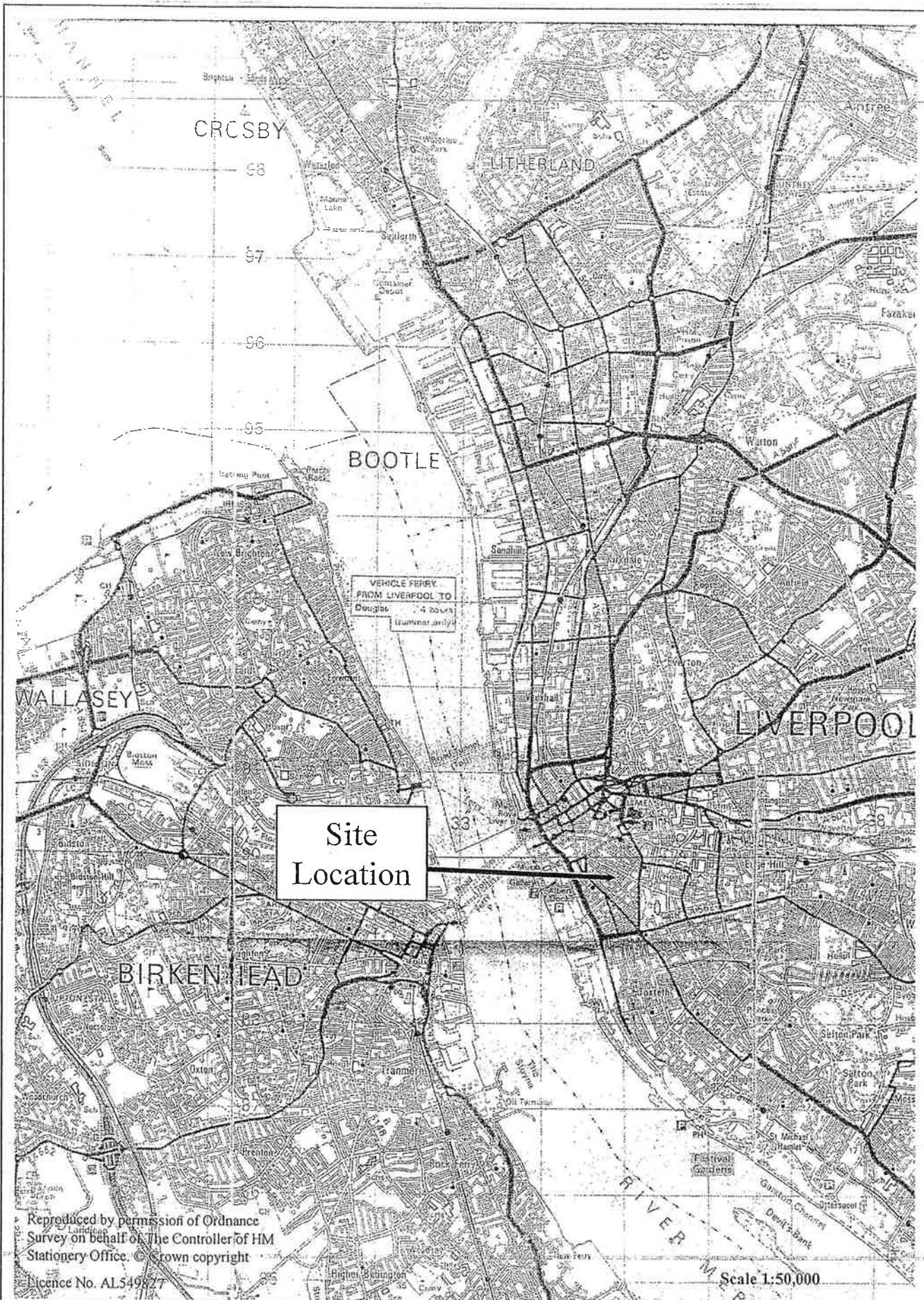
RECOMMENDATIONS

- 12.6 Based on the proposed development of the site as detailed on preliminary sketches prepared by EP, there will be a requirement to excavate materials from the site to accommodate construction of the proposed residential/commercial properties with associated car-parking areas, including basements. Based on the information provided by EP, we have assumed that approximately 2350m³ of material will be required to be excavated. Although no final site levels or dimensions have been provided, it is assumed however that all spoil will be surplus to requirement and will require off-site disposal.
- 12.7 Typical costs for disposal of excavation spoil are in the region of £20/m³. Therefore the cost for disposal of 2350m³ would be approximately £47,000.
- 12.8 However, a strict interpretation of the Environment Agency guidance could result in all spoil being classed as contaminated and incurring an assessed cost of £35/m³ to £50/m³. This would result in additional costs (above the £20/m³ estimate) of £35,000 to £70,000.
- 12.9 It is possible that costs associated with disposal of “contaminated” spoil could be reduced if specific further analysis is undertaken.
- 12.10 EP also requested an assessment of potential costs for refurbishment/demolition of the existing buildings present on the site. Preliminary cost estimates for three development options gave a maximum figure of approximately £2.75million. These figures included the £47,000 quoted above for excavation and disposal of made ground.

13. REFERENCES

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9. Department of the Environment, Transport and the Regions (2000), Statutory Guidance on the Contaminated Land (England). Regulation 2001.

FIGURES



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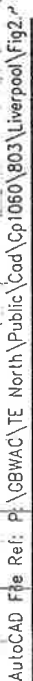
Site Location Plan

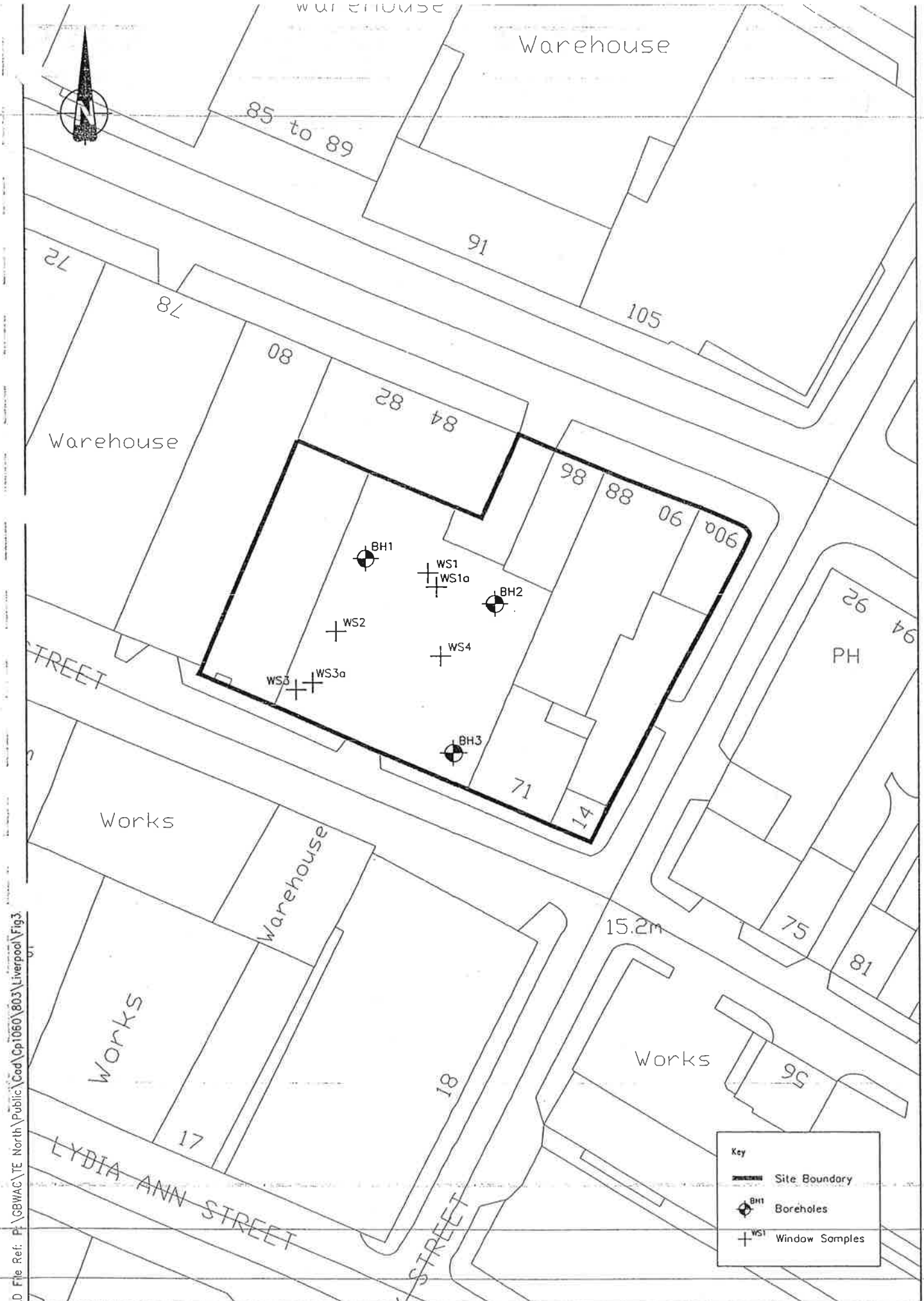
Figure 1

Client: English Partnerships

Project: 90 Duke Street,
Liverpool

Project No:
CP1060.203b/9





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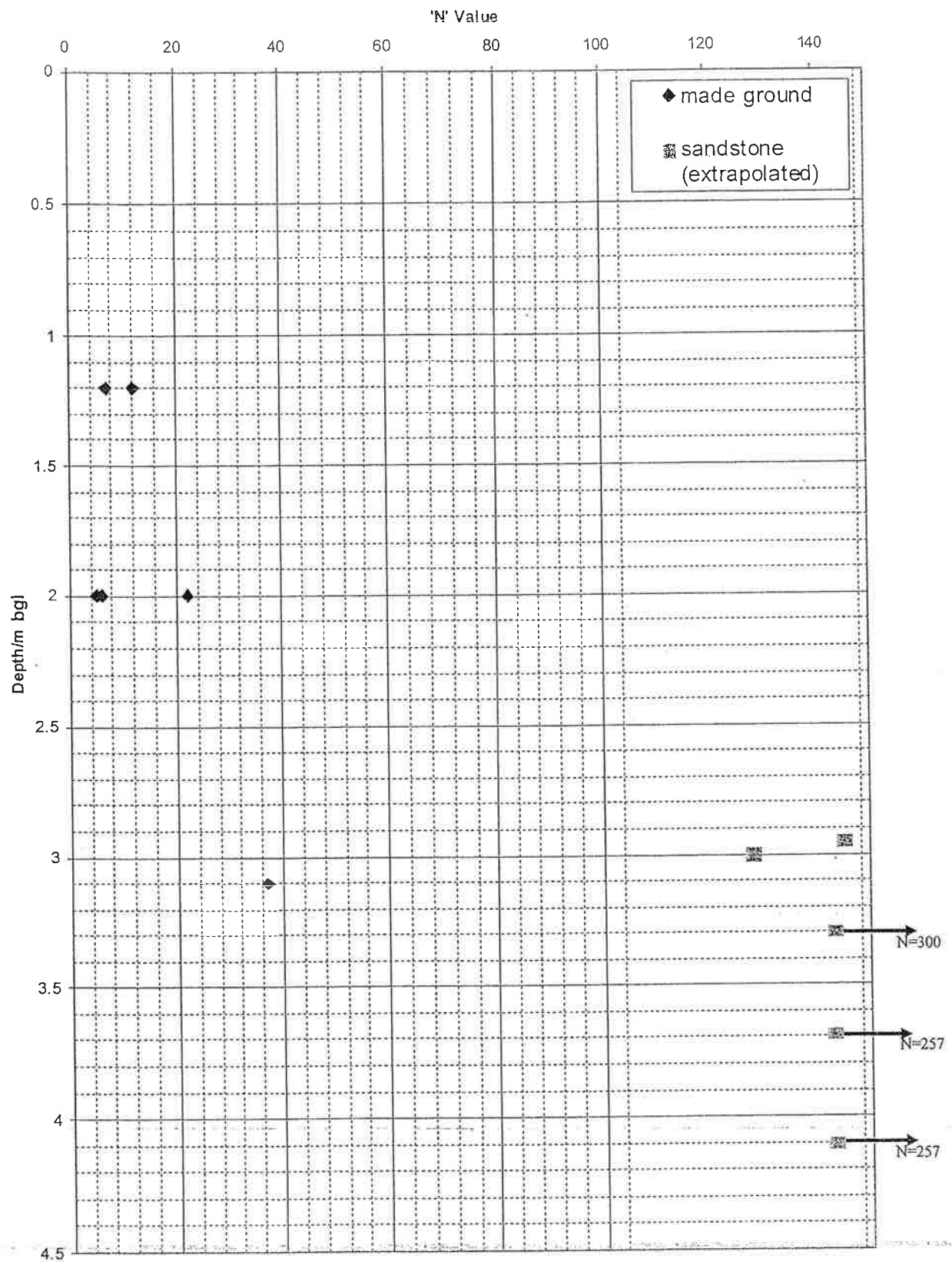
90, Duke Street
Liverpool

Site Investigation Locations

Scale 1:500

Figure 3

Duke Street GI: SPT 'N' Values



SPT 'N' Values versus Depth

Figure 4



Client: English Partnerships

Project: 90 Duke Street,
Liverpool

Project No:
CP1060.203b/9