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CONSULTING ENGINEERS

E P

PHASE 1 AND 2 GEOTECHNICAL AND GEO-ENVIRONMENTAL SITE INVESTIGATION

SHORTWOOD BUSINESS PARK, HOYLAND, BARNSLEY PHASE 2

FOR

E. V. WADDINGTON LIMITED



35189-03

4 February 2014

Eastwood & Partners, St Andrew's House, 23 Kingfield Road, Sheffield, S11 9AS
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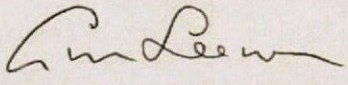
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FOR

E. V. WADDINGTON LIMITED

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Eastwood & Partners (Consulting Engineers) Limited Registered No 1835021

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1.0 EXECUTIVE SUMMARY

1. Eastwood & Partners were instructed by E V Waddington Ltd to carry out an intrusive investigation of approximately 1.5 hectares of land located around Ordnance Survey National Grid Reference 435866 401454. The site is an empty plot within the Shortwood Business Park off the Dearne Valley Parkway to the south of Barnsley.

2. Historically, the site has undergone two phases of opencast workings, initially as a clay pit and then extended to a quarry. The site was backfilled in the 1990s to the levels as are now present.

3. Older deep coal mining has also been undertaken below the site. All ground movements associated with the deep mining should have ceased by now, and no precautions against mining subsidence are considered necessary.

4. The ground conditions on the site comprise well consolidated backfill of reworked clay, sand and mudstone and sandstone gravel to depths of beyond 3 m below current ground level. Below the fill, stiff clay or mudstone or sandstone bedrock is anticipated.

5. Reinforced concrete ground beams founded on the fill are considered appropriate for the lightweight structures proposed. In areas of shallow fill pad foundations founded on the natural ground may be appropriate. Ground bearing floor slabs may be used.

6. A design sulphate class of DS-2 AC-2 should be adopted for all sub-surface concrete on site.

7. No radon or ground gas precautions are required.

8. No elevated concentrations of any common contaminant have been recorded. No significant risk to human health, plants or controlled waters are anticipated. No remedial works are required. A nominal 150 mm layer of topsoil may be required in any landscaping strips as a growing medium for plants.

9. There is unlikely to be a significant risk to construction workers from contamination on the site but normal good hygiene precautions such as washing hands before eating should be implemented.

10. The conclusions made in this report in relation to contamination are subject to agreement by the approving bodies such as the Local Authority.

2.0 INTRODUCTION

2.1 Terms of Reference

This report presents the findings of a geotechnical and geo-environmental site investigation carried out by Eastwood and Partners (Consulting Engineers) Ltd for, and on the behalf of, E. V. Waddington Limited. Any other parties using the information in this report do so at their own risk and any duty of care is excluded.

2.2 Previous Investigations

Eastwood and Partners has undertaken an investigation for another part of the business park. The reference for this report is 34072, dated March 2012.

2.3 Aims and Objectives

The aims and objectives of this investigation were as follows.

- Assimilate Phase 1 data to derive an outline conceptual model identifying potential contaminants, pathways and receptors, as well as possible linkages between these;
- Detail the ground conditions and their geotechnical properties relative to the proposed development of commercial units, thus enabling outline foundation proposals to be made;
- Carry out tiered risk assessment to establish the likely risks to future receptors, involving the use of generic assessment criteria and where unacceptable risks are identified, site specific assessment criteria within a detailed quantitative risk assessment;
- Identify feasible remediation options if unacceptable risks are highlighted and develop an appropriate remediation strategy where remediation is required.

2.4 Scope of Investigation

This document is split into two sections. These constitute the findings of the Phase 1 and Phase 2 investigations, consecutively.

2.4.1 Phase 1

The Phase 1 investigation involved a review of published documentation regarding the current and former land uses both on and surrounding the site, as well as the environmental sensitivity of the site location as determined by factors including geology, hydrogeology and hydrology. These have been from the following sources:

- Historical maps as shown on the website www.old-maps.co.uk.

- Geological Maps and associated Geological Memoirs.
- Environment Agency Website.

2.4.2 Phase 2

This part of the investigation comprised intrusive works and laboratory analysis. The findings were used to test the conceptual model and produce a final risk assessment.

The intrusive works comprised trial pits which were excavated to enable:

- Examination of the upper few metres of ground;
- In situ description of soils, enabling any localised lateral and vertical changes in soil conditions to be logged;
- Assessment of any contamination identified using visual and olfactory methods and contamination testing.

2.5 Limitations of Investigation

This report is based on the assumption that the site will be developed with commercial units of conventional construction and that existing ground levels will not alter significantly. If this is not the case, further advice may be needed.

Where assessments of site areas affected in particular ways are given, these are approximate. All information, comments and opinions given in this report are based on the ground conditions encountered during the site work, on the results of laboratory testing carried out as part of the investigation and information gained from a geological and historical desk study. However, there may be conditions at the site that have not been taken into account, such as unpredictable soil strata and water conditions between or below investigation points.

This report considers the ground and groundwater and does not cover any buildings or their fabric. Generally, testing has only been carried out for contaminants identified as potentially present with no assessment made of biological contamination. Risks to ecological receptors, such as bats, have not been considered.

3.0 THE SITE

3.1 Description

The site is located to the north west of Shortwood Roundabout, on the A6195 Dearne Valley Parkway. The site is within the Shortwood Business Park, which has been prepared for commercial development. The site has an area of approximately 1.5 hectares and is located around Ordnance Survey National Grid Reference 435675 410450 to the south of Barnsley.

The plot is currently undeveloped and is surfaced with scrub grass. The site level rises by about 2.0 m from north to south, with an embankment around the edge of the site on the eastern, southern and western edges of the site rising by approximately 2 m.

The site is bounded by industrial / commercial units to the east and west and by Shortwood Way to the south. The northern boundary of the site is not marked and beyond is additional grass scrubland with a balancing pond. There is a single row of houses approximately 100 m north of the site.

3.2 History

Historical maps have been viewed from the website www.old-maps.co.uk.

The Shortwood Business Park is situated in an area formerly occupied by part of the High Royd Colliery within the Rockingham opencast site. The earliest map of 1855 shows the site to be fields. By 1893 the site is shown to be within a clay pit for an adjacent brick works to the north east. There are no changes until 1956 when the site is shown to be over a pond at the base of clay pit. By 1972 the clay pit has been relabelled into a quarry (disused) and the number of associated buildings to the north east also has increased. The last map of 1989 shows no significantly changes, however the site has since been backfilled to the levels now present.

The surrounding area was originally predominantly agricultural or undeveloped land. A railway was constructed by 1855, approximately 100 m north west of the site and is shown as dismantled by 1980. The clay pit and opencast coal extraction extended to the north east and south beyond the site boundaries and has been backfilled. The land immediately east, south and west of the site has recently developed with light industry or commercial properties.

3.3 Geology and Groundwater Vulnerability

3.3.1 Geology

The geological map SE 30 SE (1:10,560) shows the site to be part of an opencast coal seam area which has been backfilled. The underlying bedrock is sandstone of the Middle Coal Measures.

The coal extracted was the Kents Thick Coal Seam which is indicated to be between 0.86 m and 2.26 m thick. This seam outcrops to the north of the site on the line of dismantled railway line.

No faults or drift deposits are expected on site.

3.3.2 Groundwater Vulnerability

The 1:100,000 map of Groundwater Vulnerability shows the geology beneath the site contains a Secondary A aquifer, comprising permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

The overlying soils are recorded as being of high leaching potential. This is due to the site's location within an 'urbanised' area where fewer observations are available and therefore a worst case scenario is assumed. The surrounding land is generally classified as being of low leaching potential, and therefore this is more likely to be the actual classification of the soils.

The site is not located within a Groundwater Source Protection Zone, as identified by the Environment Agency.

3.3.3 Hydrology

The nearest major surface water feature is the Shortwood Dyke located around 400 m north west of the site. There is also a balancing pond located approximately 20 m west of the site which appears to be the nearest surface water feature to the site.

3.4 Mining

3.4.1 Opencast

The shallowest seam of coal beneath the site is the Kent's Thick Coal. This outcrops to the north west of the site, trending approximately south west to north east and dips towards the south. However, the seam has been extracted via opencast mining and is now absent from much of the site. The shallowest remaining coal seam below the site is therefore the Barnsley Rider Coal.

The opencast workings are calculated to increase in depth from the north west towards the south east across the site. The depth of the opencast mining is anticipated to be between 6 m and 16 m

below the site. No boundaries of the opencast workings are shown to be present below the site and therefore no high walls are anticipated.

3.4.2 Underground Mining

As part of an early investigation for the adjacent site, the South Yorkshire Mining Advisory Service was contacted and it was indicated that several seams of coal have been worked at depth beneath the site. Records indicate that the worked seams are between 65 m and 420 m below ground level, and that any ground movement associated with these workings should have ceased by now.

3.5 Ground Gas

Information supplied by the BRE states that the site lies within an area where no radon precautions are required.

There is one recorded landfill site within 250 m of the site on the Environment agency website. This is located 100 m north of the site and was active between 1962 and 1990, accepting inert and industrial wastes. In addition, much of the land to the north of the site has been worked as opencast coal mines or clay pits over the past 100 years. The site also contains backfilled opencast workings generally up to around 6 m bgl.

3.6 Flooding

According to the Environment Agency website, the site does not lie within an area at risk from flooding by rivers.

4.0 OUTLINE CONCEPTUAL MODEL

The current development proposals for the site include the construction of two industrial units with limited landscaping. This is not therefore a particularly sensitive end use with respect to human health.

The desk study information indicates that there is made ground across the site to depths of at least 6 m. It is likely that the made ground comprises predominantly reworked natural overburden, placed on completion of opencast coal and clay pit workings. Prior to the opencast operations, the land was predominantly agricultural.

It is unlikely that there is significant contamination on the site. The main potential risk to the proposed development will therefore be contamination within the backfill material. The receptors will be the end users of the proposed units on the site.

5.0 GROUND INVESTIGATION

5.1 Site Works

A ground investigation was required to confirm the ground conditions at the site.

We visited site on 10 December 2013 and excavated fourteen trial pits, TP1 to TP14, to obtain samples for chemical testing and confirm the ground conditions on the site.

The trial pits were excavated using a JCB 3CX excavator and reached depths of between 1.9 m and 3.7 m below ground level (bgl).

Logs of the trial pits are presented in Appendix 3, and their locations are plotted on the '*Exploratory Hole Location Plan*', Drawing number 35189/002 revision A in Appendix 1.

5.2 Laboratory Testing

Two samples of made ground were despatched for chemical testing. Soil samples were taken in 500 g plastic tubs. All samples were analysed at Chemtest Laboratories, Newmarket using MCERTs accredited methodologies where available.

Laboratory testing results are presented in Appendix 4 and discussed further in Section 8.0.

6.0 GROUND CONDITIONS

6.1 Made Ground

Opencast backfill materials were encountered from surface in all of the trial pits excavated by Eastwood & Partners.

The made ground encountered was generally grey very gravelly clay. The gravel comprising mainly mudstone but occasional sandstone fragments. The base of the trial pits often encountered occasional brick or concrete fragments, with refusal in several trial pits on either concrete or sandstone.

6.2 Natural Ground

No natural ground was encountered on the site.

6.3 Obstructions

In four of the trial pits excavation refusal occurred at a depth of between 1.9 m to 3.7 m.

The general backfill materials were found to contain numerous cobbles of mudstone and sandstone, although these did not cause any significant issues when excavating the trial pits.

6.4 Groundwater

No groundwater was encountered in any of the trial pits.

6.5 Evidence of Contamination

Visual or olfactory evidence of possible significant contamination was not identified in any of the exploratory holes.

7.0 GEOTECHNICAL APPRAISAL

7.1 General

The intrusive investigations indicate that backfill materials are present all across the site. The depth of fill is generally deeper than the trial pits, extending to greater than 2.5 m across the site. The base of the fill was encountered in three trial pits at between 1.9 m and 3.7 m. However the material observed looks to have been placed in a controlled manner and been compacted when placed.

The fill has been in place for around 20 years, and the majority of self weight settlement is expected to have occurred. Significant further self weight settlement is not expected.

The proposed units will be a lightweight construction, and the amount of settlement due to loading is expected to be low. Inundation settlement is unlikely to be a significant issue as the natural water table is not expected to rise into the backfill and will remain in the underlying bedrock.

7.2 Foundations

For the proposed development, which comprises a number of lightweight commercial/industrial steel framed units, the most appropriate foundation solution will be to use reinforced concrete ground beams founded in the fill, after proof rolling and removing any soft spots.

Where the natural ground is at shallow depth it may be feasible to use pad foundations taken through to the base of the fill and constructed on the stiff natural clay or weathered bedrock. It would be preferable for the foundations for each building to be on similar ground to limit the potential for any differential settlement.

7.3 Ground Floors

Ground bearing concrete floors may be used within the proposed development. The backfill should be proof rolled prior to casting the slab, and any soft spots removed and backfilled with suitable granular material.

7.4 Superstructure Precautions

No additional superstructure precautions will be required due to the ground conditions encountered.

7.5 Excavation Problems

We do not anticipate any problems excavating trenches within the ground on site, although the made ground is expected to be unstable in excavations left open for any period of time.

Support will be required in accordance with current Health & Safety Regulations wherever access is required to trenches deeper than 1.2 m or less where there is risk of collapse.

7.6 Obstructions

Significant obstructions are not expected to be encountered on site. Localised boulders may be contained within the backfill, which will need to be removed.

7.7 Surface Water Drainage

The backfill material is expected to be relatively permeable and soakaways may therefore work. However, it is not recommended that soakaways are used on this site. The concentration of water flows into filled ground in the vicinity of buildings can lead to localised inundation of the fill and in turn can lead to excessive localised settlement. This should be avoided.

Surface water from the proposed development should therefore be directed into a piped drainage system. It appears that provision has been made in the overall business park development for a connection from the currently proposed site.

7.8 Concrete

As discussed in section 8.7.3, a sulphate resistance class of DS-2 AC-2 should be used on this site.

8.0 REFINEMENT OF OUTLINE CONCEPTUAL MODEL

8.1 Source Characterisation

An outline conceptual model, detailing the possible sources and associated contaminants of concern, potential pathways and receptors is set out in section 4.0 above.

8.2 Ground Conditions

Generally, the backfill materials comprise reworked natural overburden of sand, clay and mudstone or sandstone gravel. Limited amounts of ash or brick were encountered. General contamination levels are not expected to be high within the predominantly naturally derived materials.

8.3 Gas Precautions

No radon precautions are required.

Greater than 2.5 m of made ground is present across the site. No significant amounts of organic or biodegradable material were noted in the trial pits. Therefore significant generation of ground gas is not expected.

Gas monitoring was undertaken on the adjoining site by others. It did not reveal any significant concentration or flow of any gas. Ground gas precautions are not considered to be necessary based on the results of this testing. The material is not expected to be gassing significantly after 20 years and the proposed development in any case comprises well ventilated units.

8.4 Unexpected Contamination

No visual or olfactory observations of unexpected contamination were noted.

8.5 Chemical Testing

Two samples of made ground were sent for chemical testing. Each of the samples was analysed for the suite of contaminants listed below:

Contaminant Type	Actual Contaminants
Metals/Metalloids	Arsenic, cadmium, chromium (hexavalent and trivalent), lead, mercury, nickel, selenium, copper and zinc
pH	pH
PAHs	Speciated PAH
Sulphates	Water soluble sulphate, acid soluble sulphate and sulphur

8.6 Assessment Criteria

The proposed development of the site is for industrial units, therefore the assessment criteria relating to a commercial / industrial end use has been used.

Tables detailing the relevant assessment concentrations used are included in Appendix 4.

8.7 Chemical Test Results

8.7.1 Metals/Metalloids

None of the metals or metalloids were found to exceed their assessment values in the made ground.

8.7.2 Polycyclic Aromatic Hydrocarbons (PAHs)

None of the polycyclic aromatic hydrocarbons were found to exceed their assessment values.

8.7.3 Sulphates

The site has been taken as a Brownfield location in relation to the Aggressive Chemical Environment as made ground was encountered.

Tests indicate that the total sulphate (HCl extract) for the made ground is 0.05%, compared with the upper limit of Design Sulphate Class 1 of 0.24%. The made ground concentrations of water soluble sulphate are less than 10 mg/l compared with the upper limit of Design Sulphate Class 1 of 500 mg/l. The pH values are above 7 for both samples.

The chemical testing indicates that no sulphate precautions are required on the site, however due to the variability of made ground it would be prudent to provide DS-2, AC-2 concrete on this site.

8.8 Significant Pollutant Linkages

Therefore no significant pollutant linkages are present at the site. The made ground shows no elevated contaminants.

9.0 RISK ASSESSMENT

9.1 Human Health – Future Site Users, Staff and Visitors

The site is to have a commercial/industrial end use, and will be predominantly hard covered. There will be little opportunity for general site users to have any contact with the soils which underlie the site. Limited areas of soft landscaping are proposed, although these will generally consist of landscaping borders around the perimeter of the site of slopes created around the buildings during the earth works phase of the development. These areas will be tended by maintenance groundworkers and staff or visitors should not have any significant contact with the soil.

No remedial works are considered necessary at this stage, and no significant risk to human health is anticipated to be presented by the soils which are present.

9.2 Human Health – Construction Workers and Maintenance Staff

Ground workers employed during the construction phase of the development and maintenance staff employed post construction are most at risk of harm due to them having direct contact with the soils. However, the contact is generally of short duration, and all competent ground workers will be aware of the potential risks associated with soils of this nature. Therefore the overall risk to the health of construction workers and grounds staff is considered to be low.

Normal site procedures such as the wearing of gloves when handling soils, and the washing of hands prior to eating should still be implemented despite no significant concentrations of contaminants being encountered.

Any unusual, brightly coloured, ashy or odorous material encountered during construction should be brought to the attention of the site staff and investigated.

9.3 Plants

No significant risk to plants has been identified.

The site is currently covered by scrub grass and therefore the soils appear capable of supporting plant growth. However, if more sensitive species of grass or plants are to be grown in the landscaping areas, a nominal 150 mm layer of topsoil may need to be provided as a growing medium.

9.4 Controlled Waters

No significant risk to controlled waters has been identified. Once developed, the site will be predominantly hard covered and positive drainage will be provided, meaning that the potential for surface water to permeate through the soils will be greatly reduced from present, thus reducing the potential risk even further.

9.5 Construction Materials

As discussed in section 8.7.3, a sulphate resistance class of DS-2 AC-2 should be used for sub-surface concrete structures.

9.6 Unexpected Contamination Encountered During Groundworks

It is considered unlikely that further significant contamination will be encountered during the construction works on the site.

Should any unusual, brightly coloured, ashy or odorous material be encountered during construction this should be brought to the attention of the site staff and investigated. Where necessary, Eastwood & Partners should be consulted and additional works may be specified depending on the level and nature of the suspected contamination. These works may include site visits, additional testing or removal of the material from site.

10.0 CONTAMINATION - RECOMMENDATIONS AND APPROVALS

1. No elevated concentrations of any common contaminant were recorded in the soils on the site in relation to the proposed development of commercial/industrial units. Therefore no significant risk to human health, plants or controlled waters are anticipated and no remedial works should be required.

2. A nominal 150 mm covering of topsoil may be required as a growing medium in landscaping areas, depending on the nature of the proposed planting in these areas.

3. DS-1 AC-1 concrete can be used on this site for buried concrete structures.

4. No radon or ground gas precautions are required at the site.

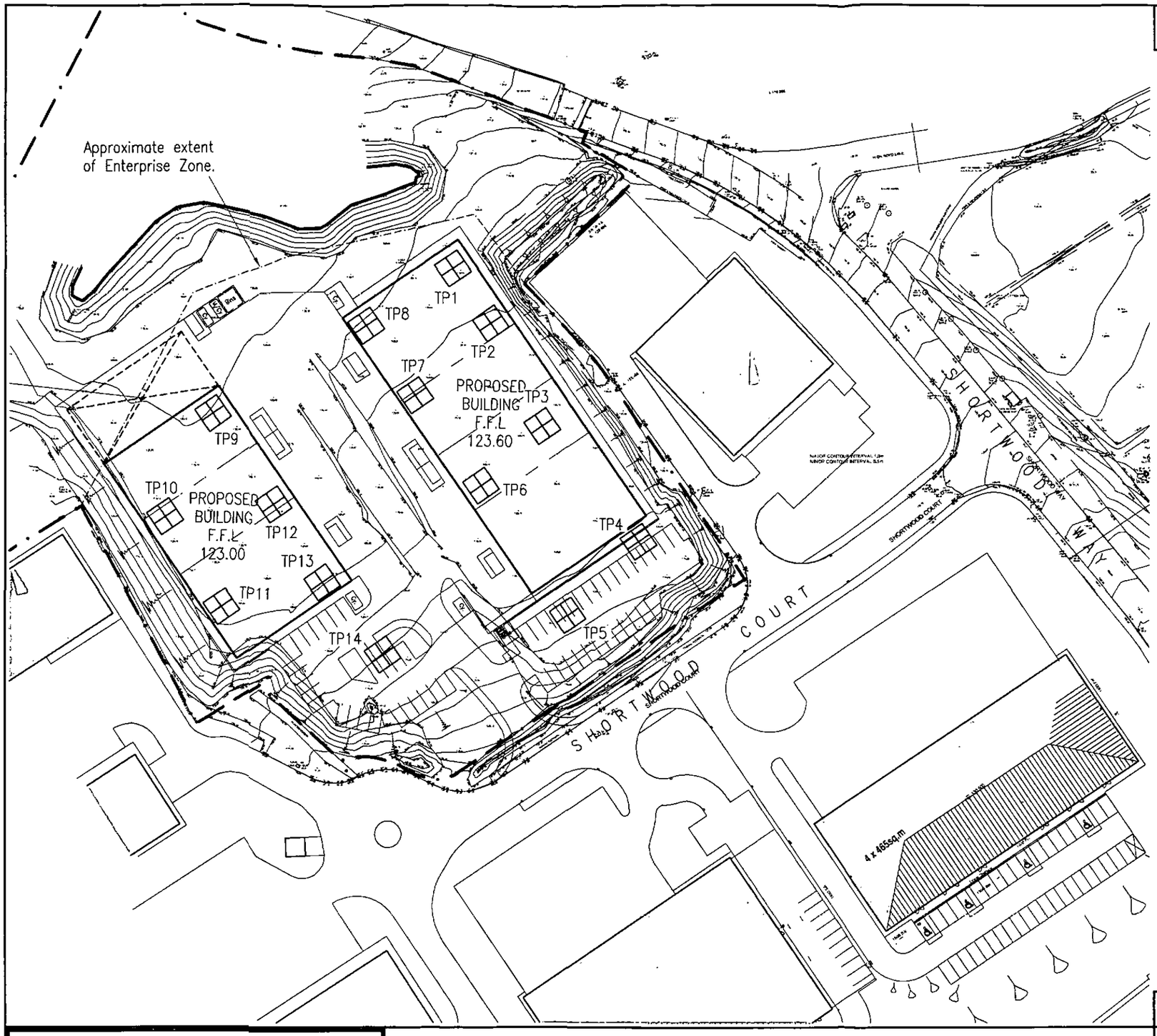
5. There should be no significant contamination risks to construction workers from the ground on the site but normal good hygiene precautions such as washing hands before eating should be implemented.

6. The conclusions made in this report in relation to contamination are subject to agreement by the approving bodies such as the Local Authority.

Appendix 1

'Exploratory Hole Location Plan', drawing reference 35189/002 Revision A

Information within this drawing is not necessarily produced to scale.
Always use figured dimensions and co-ordinates – if in doubt, ask.



Key:

Approximate location of trial pits excavated on 10 December 2013 by Eastwood & Partners. ⊞

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E.V WADDINGTON LTD.

SHORTWOOD PHASE 2

EXPLORATORY HOLE LOCATION PLAN

REV	DESCRIPTION	SIG	CHK	DATE
A	First Issue.			

SCALE WHEN PLOTTED AT A3	DRAWING STATUS
1:1000	PRELIMINARY

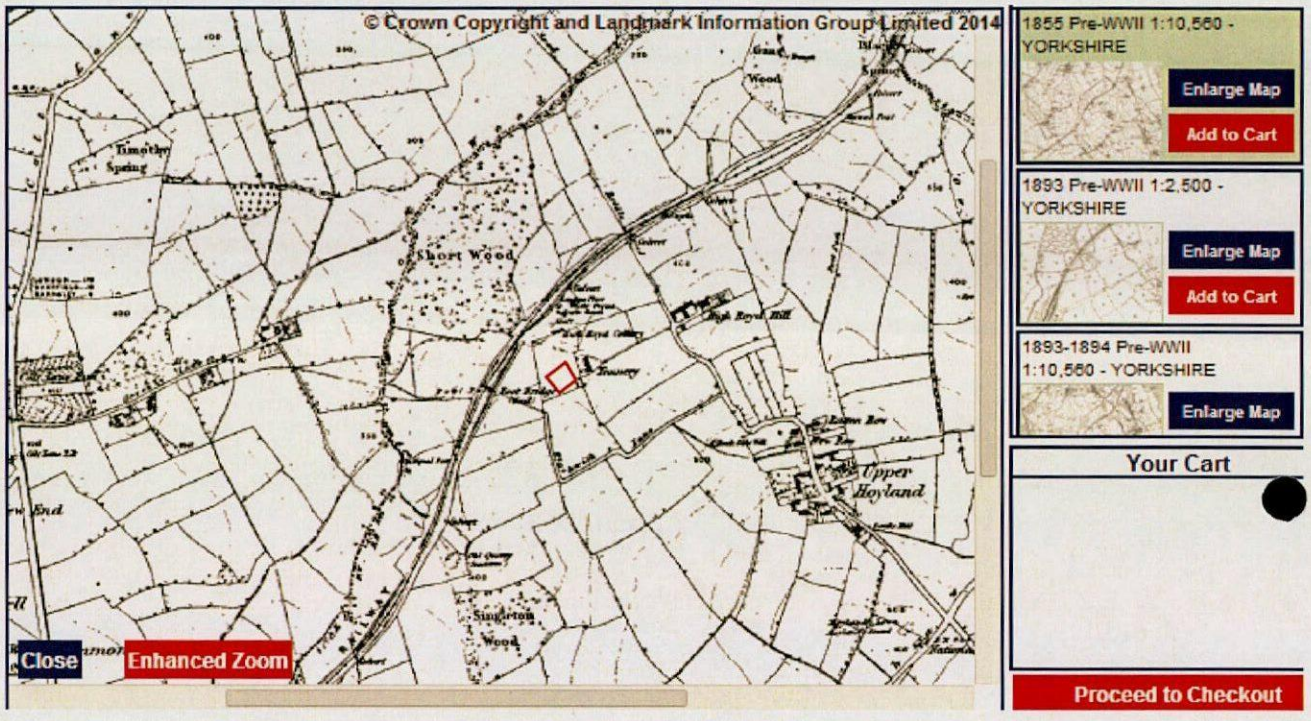
DRAWN	CHECKED	DATE	DRAWING NUMBER	REV
JL	KLG	10-12-13	35189/002	A

Appendix 2

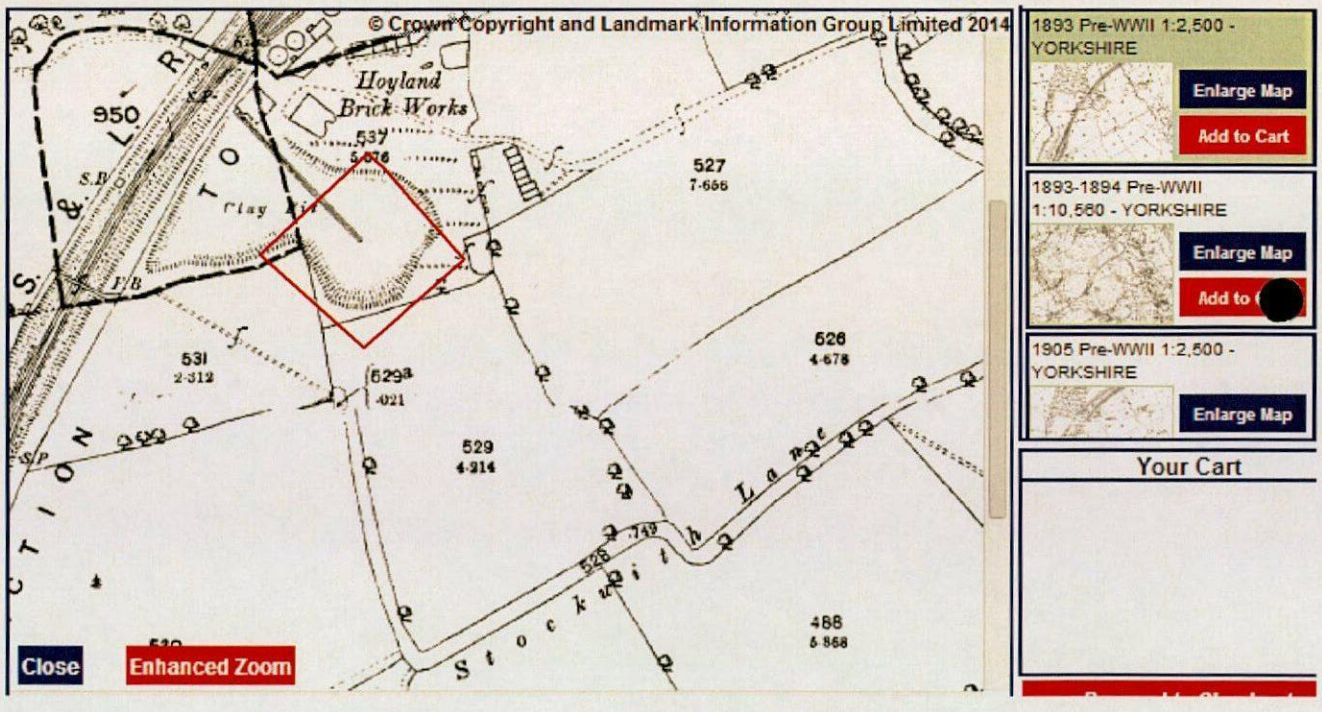
Historical Maps

Extract of Historical Plans from old-maps.co.uk

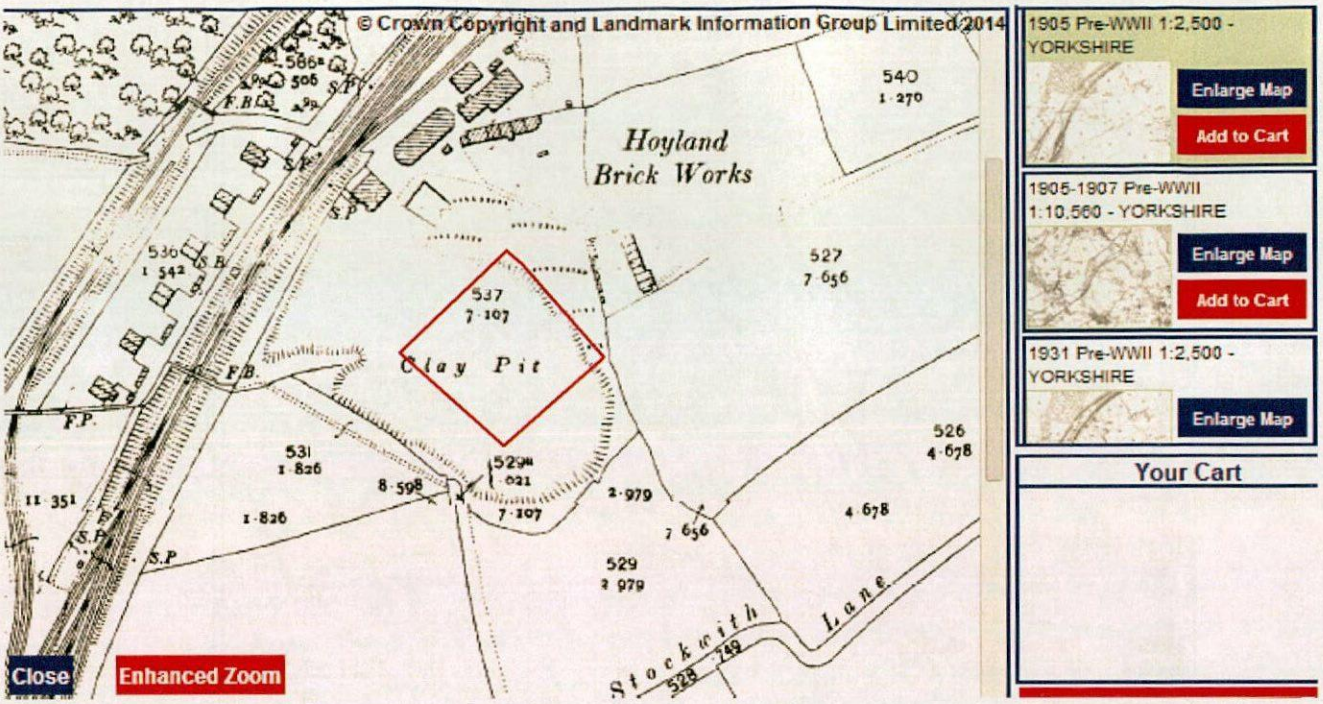
Approximate location of site indicated



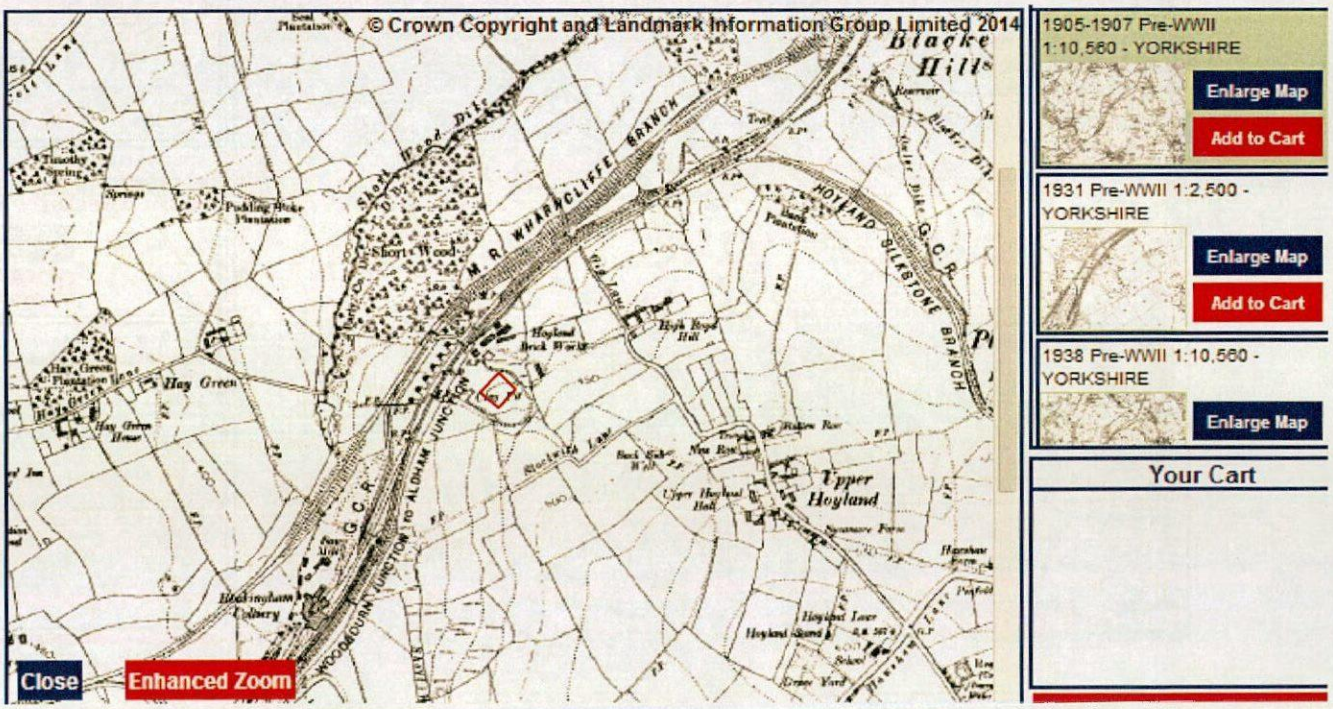
1855



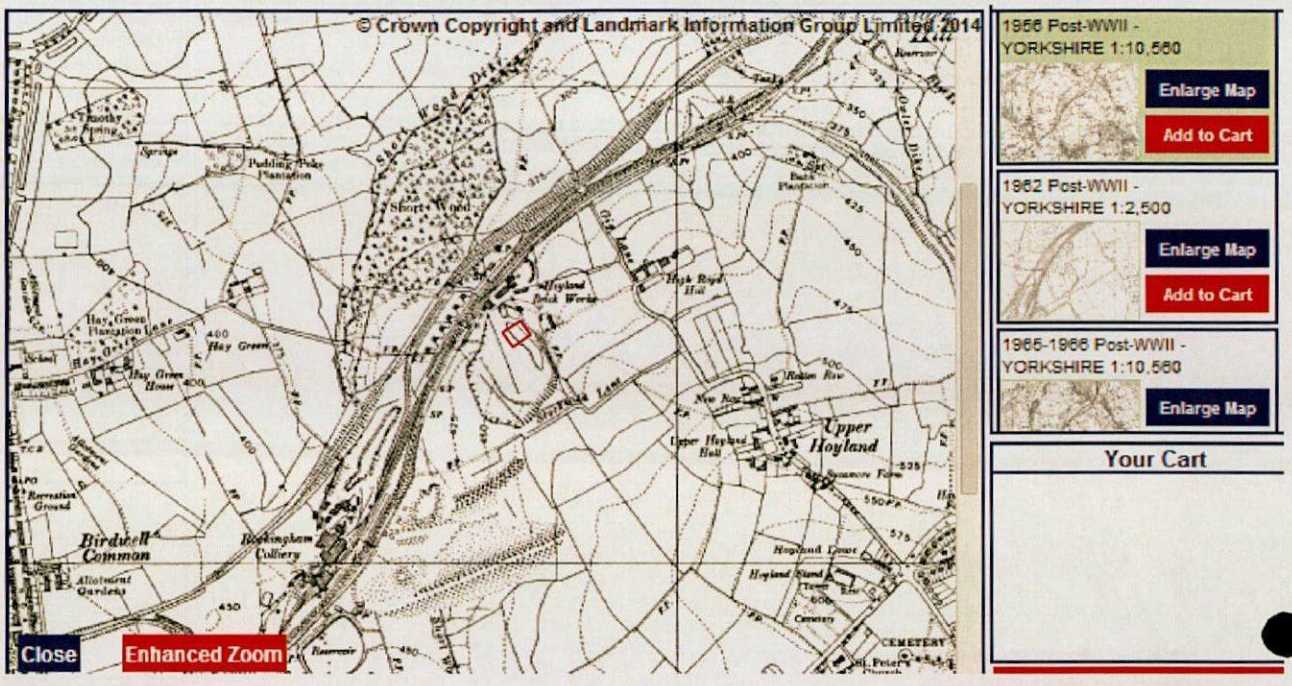
1893


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Clay Pit
Stockwith Lane
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1·270
527
7·656
537
7·107
530
1·542
531
1·826
529
2·979
526
4·678
11·351
8·598
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Enhanced Zoom
1905 Pre-WWII 1:2,500 - YORKSHIRE
Enlarge Map
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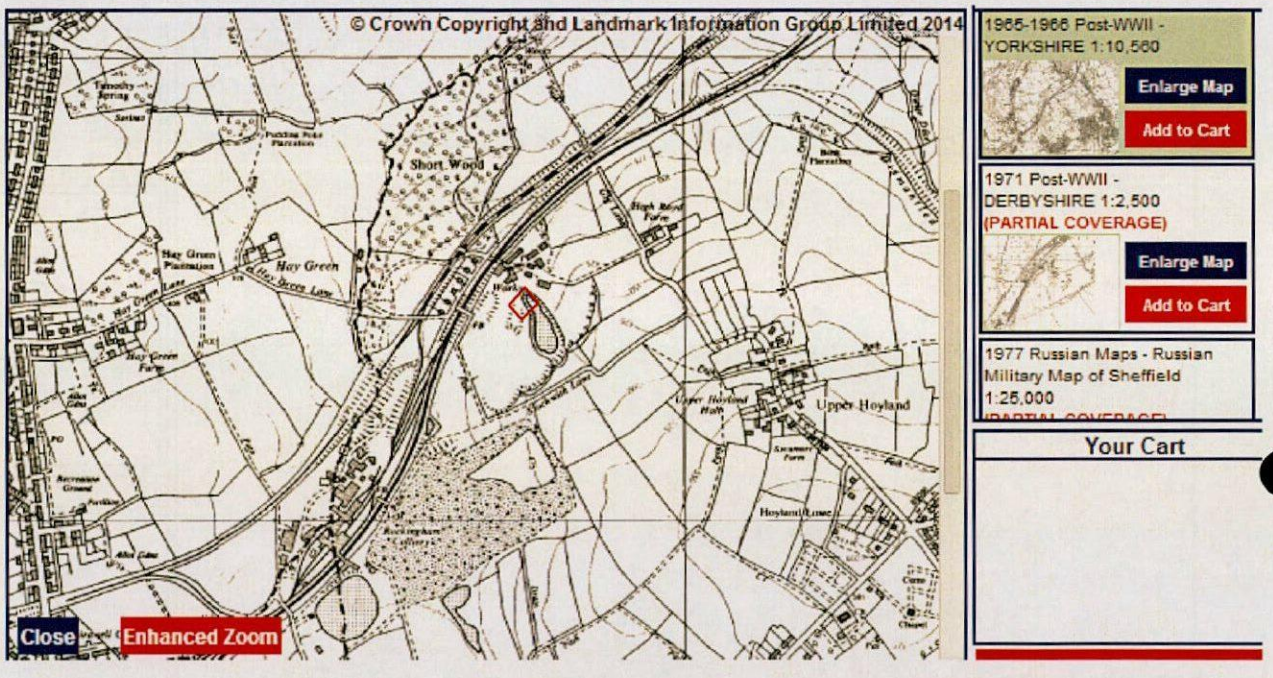
1905


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Short Wood
Hay Green
Upper Hoyland
Close
Enhanced Zoom
1905-1907 Pre-WWII 1:10,560 - YORKSHIRE
Enlarge Map
Add to Cart
1931 Pre-WWII 1:2,500 - YORKSHIRE
Enlarge Map
Add to Cart
1938 Pre-WWII 1:10,560 - YORKSHIRE
Enlarge Map
Your Cart

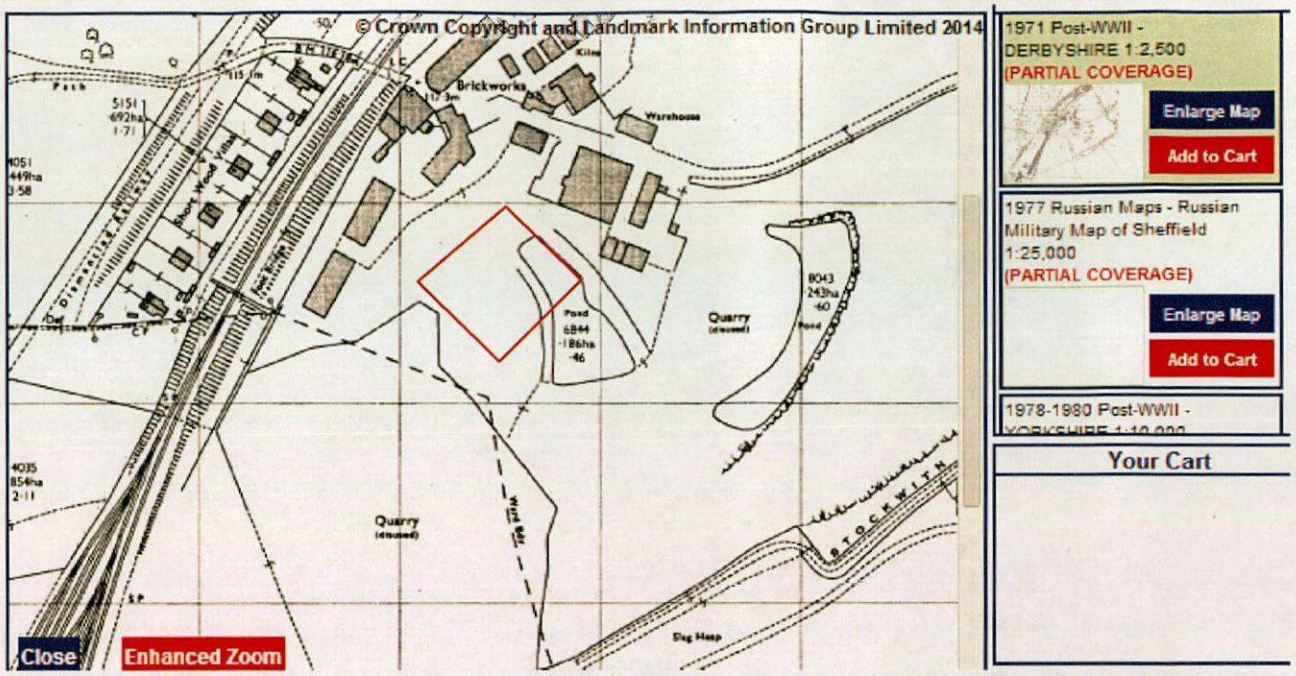
1905


© Crown Copyright and Landmark Information Group Limited 2014
Close
Enhanced Zoom
1956 Post-WWII - YORKSHIRE 1:10,560
Enlarge Map
Add to Cart
1962 Post-WWII - YORKSHIRE 1:2,500
Enlarge Map
Add to Cart
1965-1966 Post-WWII - YORKSHIRE 1:10,560
Enlarge Map
Your Cart

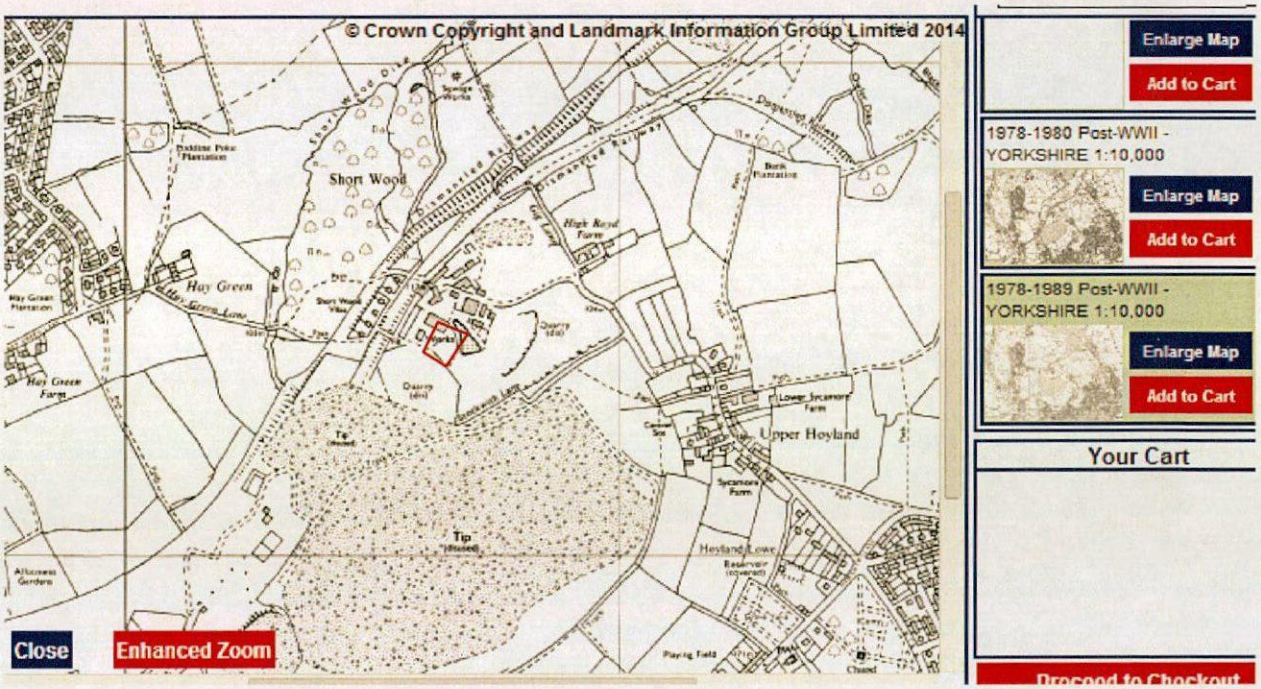
1956


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Close
Enhanced Zoom
1965-1966 Post-WWII - YORKSHIRE 1:10,560
Enlarge Map
Add to Cart
1971 Post-WWII - DERBYSHIRE 1:2,500
(PARTIAL COVERAGE)
Enlarge Map
Add to Cart
1977 Russian Maps - Russian Military Map of Sheffield 1:25,000
Your Cart

1965


© Crown Copyright and Landmark Information Group Limited 2014
Brickworks
Warehouse
Quarry (disused)
Quarry (disused)
Pond
Slag Heap
STOCKWITH
Close
Enhanced Zoom
1971 Post-WWII - DERBYSHIRE 1:2,500 (PARTIAL COVERAGE)
Enlarge Map
Add to Cart
1977 Russian Maps - Russian Military Map of Sheffield 1:25,000 (PARTIAL COVERAGE)
Enlarge Map
Add to Cart
1978-1980 Post-WWII -
Your Cart

1971


© Crown Copyright and Landmark Information Group Limited 2014
Short Wood
Hay Green
Upper Heyland
Tip (disused)
Close
Enhanced Zoom
Enlarge Map
Add to Cart
1978-1980 Post-WWII - YORKSHIRE 1:10,000
Enlarge Map
Add to Cart
1978-1989 Post-WWII - YORKSHIRE 1:10,000
Enlarge Map
Add to Cart
Your Cart

1978

Appendix 3

Trial Pit Logs

E P Eastwood & Partners
CONSULTING ENGINEERS

Eastwood & Partners
St. Andrew's House
23 Kingfield Road
Sheffield
S11 9AS

Trialpit No
TP 1
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
Client: E V Waddington		Depth 3.70m	Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Light and dark grey gravelly clay. Gravel is fine to coarse mudstone fragments.
0.60	D		0.70			
0.80	D					MADE GROUND: Grey and brown very sandy very gravelly clay. Gravel is fine to coarse and cobble sized sandstone fragments.
			1.30			MADE GROUND: Grey very gravelly clay. Gravel is fine to coarse mudstone and rare concrete or brick fragments.
			2.60			MADE GROUND: Grey very clayey cobbly sand and gravel. Gravel and cobbles of whole and fragments of bricks and concrete.
			3.70			Trialpit Complete at 3.70 m

Remarks: Pit sides stable. Refusal at 3.70 m

Groundwater: No groundwater observed.

AGS

HoleBASE 3.1 (Bd 420,48) Standard Trialpit Log v2 dated 27th Nov 03

E P
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23 Kingfield Road
Sheffield
S11 9AS

Trialpit No
TP 2
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
Client: E V Waddington		Depth 3.30m	Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.40	D					MADE GROUND: Grey brown slightly sandy clay and gravel. Gravel is fine to coarse mudstone fragments.
1.00	D					
			2.95			MADE GROUND: Grey gravelly clay. Gravel is fine to coarse mudstone, sandstone or brick fragments.
			3.30			Trialpit Complete at 3.30 m

Remarks: Pit sides stable. Refusal at 3.30 m.

Groundwater: No groundwater observed.

AGS

HoleBASE 3.1 (Bd 428.48) Standard Trialpit Log v2 dated 27th Nov 03

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Sheffield
S11 9AS

Trialpit No
TP 3
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
Client: E V Waddington		Depth 1.90m	Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Grey slightly silty gravelly CLAY. Gravel is of mudstone with very rare surface debris of plastic.
0.60	D					
1.10	D					Large boulder of mudstone at 1.0m bgl.
			1.90			Trialpit Complete at 1.90 m

Remarks: Pit side stable. Refused at 1.90m.

Groundwater: No groundwater observed.

AGS

HoleBASE 3.1 (Bid 428.48) Standard Trialpit Log v2 dated 27th Nov 03

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S11 9AS

Trialpit No
TP 4
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
		Depth 3.50m	
Client: E V Waddington			Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Grey slightly silty gravelly cobbly CLAY. Gravel and cobbles are of mudstone and sandstone fragments. Rare brick fragments near the base of the trial pit.
			3.50			Trialpit Complete at 3.50 m

1
2
3
4

Remarks: Pit sides stable.

Groundwater: None encountered.

AGS

HoleBASE 2.1 (Bd 426.48) Standard Trialpit Log v2 dated 27th Nov 03

E P Eastwood & Partners CONSULTING ENGINEERS

Eastwood & Partners
St. Andrew's House
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Sheffield
S11 9AS

Trialpit No
TP 5
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
Client: E V Waddington		Depth 3.50m	Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.20	D					MADE GROUND: Grey slightly silty gravelly CLAY. Gravel is angular of mudstone fragments and rare sandstone or brick fragments.
0.80	D		0.80			MADE GROUND: Grey slightly silty clayey gravel of mudstone.
						Wire crossing pit at 2.10m bgl.
			3.30			MADE GROUND: Grey slightly silty gravel and cobbles of sandstone, mudstone and brick fragments.
			3.50			Trialpit Complete at 3.50 m

Remarks: Pit sides stable.

Groundwater: None encountered.

AGS

HoleBASE 3.1 (Bd 428.48) Standard Trialpit Log v2 dated 27th Nov 03

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23 Kingfield Road
Sheffield
S11 9AS

Trialpit No
TP 6
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
Client: E V Waddington		Depth 2.90m	Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.50	D					MADE GROUND: Grey slightly silty gravelly clay. Gravel is fine to coarse of mudstone with rare cobbles of sandstone and large boulders of mudstone.
						Sandstone boulder at 1.80m bgl.
			2.90			Trialpit Complete at 2.90 m

Remarks: Pit sides stable.

Groundwater: None encountered.

AGS

HoleBASE 2.1 (Bd 426.48) Standard Trialpit Log v2 dated 27th Nov 03

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Sheffield
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Trialpit No
TP 7
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
		Depth 2.80m	
Client: E V Waddington			Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Grey slightly silty gravelly clay. Gravel is fine to coarse of mudstone with rare cobbles of sandstone and large boulders of mudstone.
1.00	D					
			2.80			Trialpit Complete at 2.80 m

Remarks: Pit sides stable.

Groundwater: None encountered.

AGS

HoleBASE 3.1 (Bd 428.48) Standard Trialpit Log v2 dated 27th Nov 03

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CONSULTING ENGINEERS

Eastwood & Partners
St. Andrew's House
23 Kingfield Road
Sheffield
S11 9AS

Trialpit No
TP 8
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
		Depth 2.30m	
Client: E V Waddington			Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.30	D					MADE GROUND:Grey/brown slightly silty gravelly clay. Gravel is of mudstone and sandstone with cobbles of sandstone.
						Large piece of black plastic at 0.8m bgl.
			2.30			Trialpit Complete at 2.30 m

Remarks: Pit sides stable.

Groundwater: None encountered.

AGS

HoleBASE 3.1 (Bd 428.48) Standard Trialpit Log v2 dated 27th Nov 03

Eastwood & Partners
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St. Andrew's House
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Sheffield
S11 9AS

Trialpit No
TP 9
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
Client: E V Waddington		Depth 2.40m	Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
0.10	D					MADE GROUND:Grey clayey gravel. Rare brick fragments and old metal.
			0.65			MADE GROUND: Brown slightly silty gravel. Gravel is of sandstone and rare brick.
			0.80			MADE GROUND: Grey clayey gravel. Gravel is of mudstone.
						Large boulder of mudstone at 1.10 m bgl.
			2.05			MADE GROUND: gravel to cobble sized fragments and whole bricks.
			2.40			Trialpit Complete at 2.40 m

Remarks: Pit sides stable. Refusal at 2.40 m.

Groundwater: None encountered.

AGS

HoleBASE 3.1 (Rel 426.48) Standard Trialpit Log v2 dated 27th Nov 03

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Sheffield
S11 9AS

Trialpit No
TP 10
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
Client: E V Waddington		Depth 2.60m	Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Slightly silty gravelly clay. Gravel is of mudstone and sandstone with rare metal fragments.
						Fragments of sandstone between 1.0m-1.30m bgl.
1.20	D					
			2.25			MADE GROUND: Dark grey ashy gravel and cobbles. Gravel to cobble sized fragments of brick, mudstone and sandstone.
			2.60			Trialpit Complete at 2.60 m

Remarks: Pit sides stable.

Groundwater: None encountered.

AGS

HoleBASE 3.1 (Bd 426.48) Standard Trialpit Log v2 dated 27th Nov 03

E+P Eastwood & Partners CONSULTING ENGINEERS

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St. Andrew's House
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Sheffield
S11 9AS

Trialpit No
TP 11
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
Client: E V Waddington		Depth 2.90m	Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Grey sandy gravelly clay. Gravel is of mudstone and sandstone fragments.
			1.75			MADE GROUND: Cobbles and boulders of sandstone fragments.
			2.10			MADE GROUND: red brown clayey gravel. Gravel is mudstone and rare coal fragments and organic matter.
			2.90			Trialpit Complete at 2.90 m

Remarks: Pit sides stable.

Groundwater: Slight groundwater ingress encountered at 1.75 m.

AGS

HoleBASE 3.1 (Bld 420.48) Standard Trialpit Log v2 dated 27th Nov 03

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Sheffield
S11 9AS

Trialpit No
TP 12
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
		Depth 2.30m	
Client: E V Waddington			Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Brown/grey slightly silty clayey sandy gravel. Gravel is of mudstone with rare ash and brick fragments.
1.00	D					
			2.30			Trialpit Complete at 2.30 m

Remarks: Pit sides stable.

Groundwater: None encountered.

AGS

HoleBASE 3.1 (Bd 425.48) Standard Trialpit Log v2 dated 27th Nov 03

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23 Kingfield Road
Sheffield
S11 9AS

Trialpit No
TP 13
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
Client: E V Waddington		Depth 3.20m	Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Grey clayey slightly sandy GRAVEL. Gravel is of sandstone and mudstone with cobbles of sandstone.
			2.40			MADE GROUND: Black shiny coal in clay matrix with occasional brick fragments and sandstone cobbles.
			2.60			MADE GROUND: Firm grey clay with brick fragments.
			3.20			Trialpit Complete at 3.20 m

Remarks:

Groundwater: None encountered.

AGS

HoleBASE 3.1 (Bd 420.48) Standard Trialpit Log v2 dated 27th Nov 03

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Sheffield
S11 9AS

Trialpit No
TP 14
Sheet 1 of 1

Project Name	Project No.	Co-ords: -	Date
Shortwood Phase 2	35189	Level: -	10/12/2013
Location: Shortwood Business Park		Dimensions: -	Scale 1:25
Client: E V Waddington		Depth 2.40m	Logged By KLG

Samples & In Situ Testing			Depth (m)	Level (m AOD)	Legend	Stratum Description
Depth (m)	Type	Results				
						MADE GROUND: Slightly clayey sandy GRAVEL. Gravel is of sandstone.
			0.40			MADE GROUND: Grey clayey GRAVEL. Gravel is of mudstone with rare wooden fragments and sandstone boulders.
			2.40			Trialpit Complete at 2.40 m

Remarks:

Groundwater: None encountered.

AGS

HoleBASE 3.1 (Rel 425.48) Standard Trialpit Log v2 dated 27th Nov 03

Appendix 4

Chemical Test Results – Chemtest Report Ref 247449

Table of Assessment Values

Chemtest
The right chemistry to deliver results

Depot Road
Newmarket
CB8 0AL
Tel: 01638 606070

Eastwood & Partners
St. Andrews House
23 Kingfield Road
Sheffield
S11 9AS

FAO Karen Green
20 December 2013

Dear Karen Green

Test Report Number **247449**

Your Project Reference **35189 - Shortwood Phase 2 - Shortwood Business Park**

Please find enclosed the results of analysis for the samples received 18 December 2013.

All soil samples will be retained for a period of one month and all water samples will be retained for 7 days following the date of the test report. Should you require an extended retention period then please detail your requirements in an email to customerservices@chemtest.co.uk. Please be aware that charges may be applicable for extended sample storage.

If you require any further assistance, please do not hesitate to contact the Customer Services team.

Yours sincerely

Keith Jones, Technical Manager

UKAS TESTING
2183

MCERTS

Notes to accompany report:

- *The sign < means 'less than'*
- *Tests marked 'U' hold UKAS accreditation*
- *Tests marked 'M' hold MCertS (and UKAS) accreditation*
- *Tests marked 'N' do not currently hold UKAS accreditation*
- *Tests marked 'S' were subcontracted to an approved laboratory*
- *n/e means 'not evaluated'*
- *i/s means 'insufficient sample'*
- *u/s means 'unsuitable sample'*
- *Comments or interpretations are outside of the scope of UKAS accreditation*
- *The results relate only to the items tested*
- *Stones represent the quantity of material removed prior to analysis*
- *All results are expressed on a dry weight basis*
- *The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, phenols*
- *For all other tests the samples were dried at < 37°C prior to analysis*
- *Uncertainties of measurement for the determinands tested are available upon request*
- *Soil descriptions, including colour and texture, are beyond the scope of MCertS accreditation*
- *None of the test results included in this report have been recovery corrected*

Registered in England & Wales - Registration Number 6511736 - Registered Office: 11 Depot Road Newmarket Suffolk CB8 0AL

Eastwood & Partners
St. Andrews House
23 Kingfield Road
Sheffield
S11 9AS

FAO Karen Green

LABORATORY TEST REPORT

Results of analysis of 2 samples received 18 December 2013

35189 - Shortwood Phase 2 - Shortwood Business Park

Chemtest
The right chemistry to deliver results

Report Date
20 December 2013

Login Batch No					247449	
Chemtest LIMS ID					AJ60020	AJ60021
Sample ID					TP1	TP5
Sample No						
Sampling Date					17/12/2013	17/12/2013
Depth					0.60m	0.20m
Matrix					*SOIL*	*SOIL*
SOP↓	Determinand↓	CAS No↓	Units↓	*		
2030	Moisture		%	M	5.66	7.67
	Stones content (>50mm)		%	M	<0.02	<0.02
2040	Soil colour			M	brown	brown
	Soil texture			M	clay	clay
	Other material			M	none	none
2010	pH			M	8.3	7.9
2175	Sulfur (total TRL report 447)		%	M	0.068	0.062
2120	Sulfate (2:1 water soluble) as SO4	14808798	g l-1	M	0.29	0.25
2490	Chromium (hexavalent)	18540299	mg kg-1	N	<0.5	<0.5
2430	Sulfate (total BS1377 HCl extract)	14808798	%	M	0.04	0.05
2450	Arsenic	7440382	mg kg-1	M	8.7	8.9
	Cadmium	7440439	mg kg-1	M	0.13	0.12
	Chromium	7440473	mg kg-1	M	17	18
	Copper	7440508	mg kg-1	M	22	28
	Mercury	7439976	mg kg-1	M	<0.10	<0.10
	Nickel	7440020	mg kg-1	M	29	36
	Lead	7439921	mg kg-1	M	11	7.2
	Selenium	7782492	mg kg-1	M	<0.20	<0.20
	Zinc	7440666	mg kg-1	M	74	79
2800	Naphthalene	91203	mg kg-1	M	0.24	<0.10
	Acenaphthylene	208968	mg kg-1	N	<0.10	<0.10
	Acenaphthene	83329	mg kg-1	M	<0.10	<0.10
	Fluorene	86737	mg kg-1	M	<0.10	<0.10
	Phenanthrene	85018	mg kg-1	M	0.43	<0.10

All tests undertaken between 18/12/2013 and 20/12/2013

* Accreditation status

This report should be interpreted in conjunction with the notes on the accompanying cover page.

Eastwood & Partners
St. Andrews House
23 Kingfield Road
Sheffield
S11 9AS

FAO Karen Green

LABORATORY TEST REPORT

Results of analysis of 2 samples received 18 December 2013

35189 - Shortwood Phase 2 - Shortwood Business Park

Chemtest
The right chemistry to deliver results

Report Date
20 December 2013

					247449	
					AJ60020	AJ60021
					TP1	TP5
					17/12/2013	17/12/2013
					0.60m	0.20m
					SOIL	*SOIL*
2800	Anthracene	120127	mg kg-1	M	<0.10	<0.10
	Fluoranthene	206440	mg kg-1	M	0.37	<0.10
	Pyrene	129000	mg kg-1	M	0.36	<0.10
	Benzo[a]anthracene	56553	mg kg-1	M	0.13	<0.10
	Chrysene	218019	mg kg-1	M	0.13	<0.10
	Benzo[b]fluoranthene	205992	mg kg-1	N	0.14	<0.10
	Benzo[k]fluoranthene	207089	mg kg-1	N	<0.10	<0.10
	Benzo[a]pyrene	50328	mg kg-1	M	<0.10	<0.10
	Dibenzo[a,h]anthracene	53703	mg kg-1	N	<0.10	<0.10
	Indeno[1,2,3-cd]pyrene	193395	mg kg-1	M	<0.10	<0.10
	Benzo[g,h,i]perylene	191242	mg kg-1	M	<0.10	<0.10
	Total (of 16) PAHs		mg kg-1	N	<2.0	<2.0

All tests undertaken between 18/12/2013 and 20/12/2013

* Accreditation status

This report should be interpreted in conjunction with the notes on the accompanying cover page.

Contaminant	Intended Land Use: Commercial/Industrial End Use (mg/kg)				
	Human Health	Phytoxicity			
		pH 5.0-5.5	pH 5.5-6.0	pH 6.0-6.5	pH >7.0
Arsenic	640	50			
Cadmium	230	3			
Chromium	5,000	400			
Chromium (VI)	35	-			
Lead	750	300			
Mercury	26	1			
Nickel	1,800	50	60	75	110
Selenium	13,000				
Copper		80	100	135	200
Zinc		200	200	200	300

Notes:

The assessment values are the Soil Guideline Values derived by DEFRA and Environment Agency using the '*Contaminated Land Exposure Assessment*' model. The assessment concentrations for arsenic, cadmium, nickel, mercury and selenium are outlined in the Environment Agency's Science Report series SC050021. These are based on a sandy loam soil and 6% soil organic matter.

The assessment concentrations for the remaining metals/metalloids are described in the Contaminated Land Report Series (CLR), which have now been withdrawn. The SGV threshold value is not intended to be applied to individual sample results where materials are similar, as the levels of contaminants will have a natural variability across the site. The modified mean value should instead be compared with the SGV.

The assessment values for phytotoxicity are levels at which plant growth is thought to be affected. These are taken from the maximum permissible and advisable concentrations in soil after application of soil sludge given in the '*The Code of Good Agricultural Practice for the Protection of Soil*', MAFF, 1998.

The assessment criterion for chromium (VI) have been taken from Nathanail, C. P., McCaffrey, C., Ashmore, M. H., Cheng, Y. Y., Gillett, A., Ogden, R. & Scott, D., 2009 '*The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment 2nd Edition*', Land Quality Press, Nottingham. These are also all based on a sandy loam soil and 6% soil organic matter.

Prepared	AJK	Typist	KLG	Checked	CAS	Date	8.1.14	Job No	35189

E⊕P
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St Andrew's House
23 Kingfield Road
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Tel: (0114) 2554554 Fax: (0114) 2554330

SHORTWOOD BUSINESS PARK – PHASE 2

GENERIC ASSESSMENT CRITERIA – COMMERCIAL/INDUSTRIAL

Organic Compounds	Intended Land Use Commercial (mg/kg)		
	1% SOM	2.5% SOM	6% SOM
Naphthalene	200	480	1100
Acenaphthene	85,000	98,000	100,000
Acenaphthylene	84,000	97,000	100,000
Fluorene	64,000	69,000	71,000
Phenanthrene	22,000	22,000	23,000
Anthracene	530,000	540,000	540,000
Fluoranthene	23,000	23,000	23,000
Pyrene	54,000	54,000	54,000
Benzo(a)anthracene	90	95	97
Chrysene	140	140	140
Benzo(b)fluoranthene	100	100	100
Benzo(k)fluoranthene	140	140	140
Benzo(a)pyrene	14	14	14
Dibenz(a,h)anthracene	13	13	13
Indeno(1,2,3-cd)pyrene	60	61	62
Benzo(g,h,i)perylene	650	660	660
Phenol	1,100,000	1,100,000	3,200
Benzene	~	~	95
Toluene	~	~	4,400
Ethylbenzene	~	~	2,800
o-Xylene	~	~	2,600
m-Xylene	~	~	3,500
p-Xylene	~	~	3,200

The assessment criteria for the sixteen polycyclic aromatic hydrocarbon (PAH) species covered under the USEPA test have been taken from Nathanail, C. P., McCaffrey, C., Ashmore, M. H., Cheng, Y. Y., Gillett, A., Ogden, R. & Scott, D., 2009 *'The LQM/CIEH Generic Assessment Criteria for Human Health Risk Assessment 2nd Edition'*, Land Quality Press, Nottingham. This is also the case for phenol at 1% and 2.5% SOM. These are also all based on a sandy loam soil.

The assessment values for phenol (6% SOM) and the BTEX compounds are the Soil Guideline Values derived by DEFRA and Environment Agency using the '*Contaminated Land Exposure Assessment'* model. These are outlined in the Environment Agency's Science Report series SC050021. The threshold value is not intended to be applied to individual sample results where materials are similar, as the levels of contaminants will have a natural variability across the site. The modified mean value should instead be compared with the threshold value.

Prepared	AJK	Typist	KLG	Checked	CAS	Date	8.1.14	Job No	35189

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SHORTWOOD BUSINESS PARK – PHASE 2

GENERIC ASSESSMENT CRITERIA – COMMERCIAL/INDUSTRIAL