

Interchange 26

Mine Entry Investigation and Preliminary Treatment Strategy

Curtins Ref: 065646-CUR-00-XX-RP-GE-005

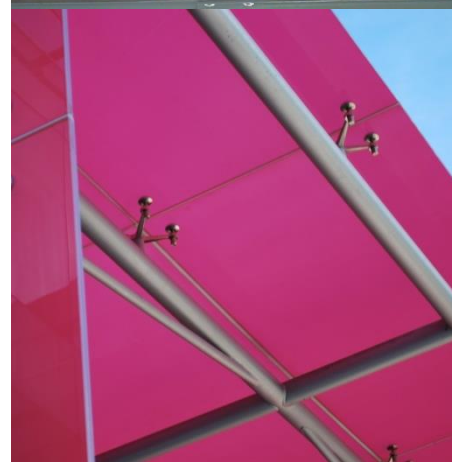
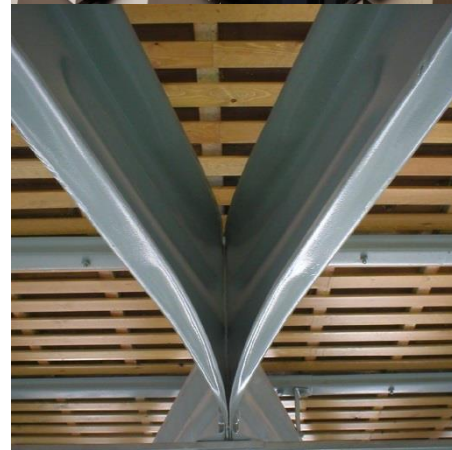
Revision: V02

Issue Date: 9 March 2020

Client Name: Opus North

Client Address: 35 Brook Street, Ilkley, West Yorkshire, LS29 8AG

Site Address: Former North Bierley WWTW, Cliff Hollins Lane, Bradford, BD4 6RQ



Curtins
Rose Wharf
78-80 East Street
Leeds LS9 8EE
Tel: 0113 274 8509
www.curtins.com

STRUCTURES • TRANSPORT PLANNING • ENVIRONMENTAL • CIVILS & INFRASTRUCTURE • EXPERT ADVICE • SUSTAINABILITY • STAKEHOLDER ENGAGEMENT
Birmingham • Bristol • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • Manchester • Nottingham



Rev	Description	Issued by	Checked	Date
V01	Issue	MB	ML	9 March 2020
V02	Amendments following Comments	RA	ML	7 May 2020

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Limited with respect to the information contained in the report will not extend to any third party.

Author	Signature	Date
M. Biggins BSc (Hons) CSi CEnv MCIWEM C.WEM Senior Geo-environmental Engineer		9 March 2020

Authorised	Signature	Date
M. Lomas BSc (Hons) CSci CEnv MCIWEM C.WEM Associate		9 March 2020

Table of Contents

1.0	Introduction	3
1.1	Purpose of this Report	3
1.2	References	3
2.0	Background	5
2.1	Site Location and Existing Use	5
2.2	Historical Records	5
2.3	Coal Mining Specific History	6
2.4	Geological Setting	6
2.4.1	BGS Borehole Records	8
2.5	Coal Authority Information – Mine Entries	10
2.5.1	Targeted Coal Seam	11
2.5.2	Summary of Desk-based Information.....	12
3.0	Previous Mine Entry Investigation Works.....	13
3.1	Field Works	13
4.0	Further Coal Mining Investigation.....	15
4.1	Field Works	15
4.1.1	Health & Safety Requirements.....	15
4.1.2	Excavation.....	17
4.1.3	Reporting.....	17
5.0	Treatment Recommendations	18
5.1	Drill and Grout	18
5.2	Shaft Cap	18
	References	20
	Appendix A – Drawings	1
	Appendix B	2

Appendices

Appendix A – Drawings

Appendix B –Borehole Records

1.0 Introduction

Curtins have been instructed by Fox LLOYD Jones, on behalf of Opus North to undertake a Mine entry investigation strategy as part of ongoing works at the proposed interchange 26 development.

This report has been produced in support of discharge of reserved matters planning application for the site (Condition 16) relating to the Phase 2 development boundary highlighted on Drawing Ref: 1856 PL 103B, (Appendix A). Condition 16 has previously been discharged in relation to the Phase 1 boundary, with discharge supported by Curtins document reference B065646-CUR-00-XX-RP-GE-001 V03, Feb 2020. This report is to be read in conjunction with Curtins document reference B065646-CUR-00-XX-RP-GE-001 V03, Feb 2020.

The proposed development plans (current at the point of issue) are presented within Appendix A.

1.1 Purpose of this Report

This report is prepared specifically to detail the investigation requirements for mine entries recorded within Phase 2 of the Interchange 26 site.

It is noted however, that contractors undertaking the works are responsible for reviewing this documentation and employing appropriate measures to ensure the works are conducted in a safe manner in accordance with industry guidance.

1.2 References

The information presented within this report has been prepared with reference to the following information sources:

- British Geological Society (BGS) 1:50,000 mapping (Sheet 77, Huddersfield) (1).
- BGS Borehole Records (2).
- Coal Authority Interactive Mapping (3).
- Mine Entry Interpretive Report (Ref MR-51002171843001-1569402545448 September 2019) (4).
- The Coal Authority 'Non-Residential Coal and Brine Report – Site At, North Bierley Works, Bradford Road, Oakenshaw, Bradford, West Yorkshire' – 000524450-10 (5).

In addition to the above, the report makes reference to information presented within existing reporting prepared for this site, namely;

- Wardell Armstrong, Phase I Environmental Assessment - November 2017 (6)
- Wardell Armstrong, Phase II Geo-Environmental Assessment - November 2017 (7)

- Curtins, Coal Mining Risk Assessment, November 2019 (8)
- Curtins, Phase II Ground Investigation., November 2019 (9)

It is noted that these reports relate to a wider site area than the one considered within this report. It is assumed the reader has access to these reports.

2.0 Background

2.1 Site Location and Existing Use

The site is located at immediately east of the M606, near Oakenshaw, West Yorkshire. The centre of the site is located at national grid reference SE 17893 27459. The development site boundary considered in this report is highlighted approximately in red on Figure 2.1, it is noted that this area is smaller than the outline planning permission boundary.

The site is bounded in all directions by open fields with the exception of the M606 to the west.

The site slopes to the south from an altitude of approximately 102 m AOD on the western boundary of the site to an altitude of around 97 m AOD on the eastern boundary of the site. The site is currently occupied to the east by the former waste water treatment works (9), and undeveloped open fields to the west.

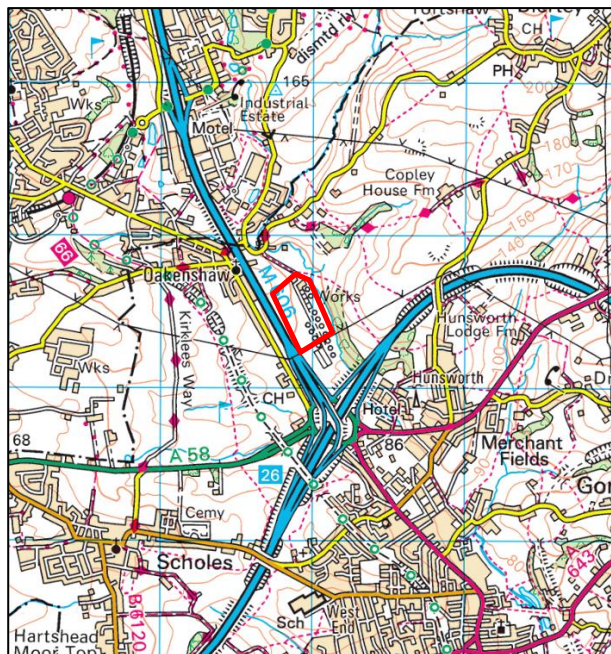


Figure 2.1: Site location plan - Proposed development layout in red.

2.2 Historical Records

On Site

Historical mapping records suggest that the site was undeveloped fields until initiation of mining activities on the site circa. 1893. The western site area is noted to broadly remain as open fields throughout its history.

A pond / pit is shown in the location of the former Valley Pit located within the central site area, which remains until the latest available plans in the 1990's.

Development of a sewage works encroaches onto the site from the 1933 plan. The sewage works continues to expand to its current configuration.

Off Site

A sewage works is recorded to the east of the development site from 1893. The sewage works shows general expansion to present day configuration on-site.

Development of the M606 motorway to the west of the site during the early 1970's.

2.3 Coal Mining Specific History

Initiation of mining activities on the site circa. 1893. Mining activities are recorded to be extensive, with a number of recorded coal pits / old coal pits, the presence of Valley Pit and a tramway, presumably for export of coal. Valley Pit is recorded to have extracted Coal and Ironstone. The historical plans identify surface excavations as part of the Valley Pit works.

Valley Pit is no longer shown from early 1900 plans, although removal of all mining activity is not observed until the 1920's.

To the south of the site (off-site for Phase 1 & Phase 2 development area), further mining activity is recorded which corresponds in timeframe to mining activities identified on-site. The tramway identified both on and off-site links the off and on-site mining areas, which extend out from Valley Pit.

2.4 Geological Setting

A study of British Geological Survey (BGS) 1:50,000 mapping records (Bedrock and Superficial), Sheet No. 77 for Huddersfield (1) indicates that the site is underlain by the Pennine Lower Coal Measures Formation – mudstone, siltstone and sandstone.

BGS mapping does not indicate superficial deposits to be present over the majority of the site, however, alluvium (clay, silt, sand and gravel) is indicated in the far eastern extent of the site, along the line of the Hunsworth Beck.

The geological setting of the site is presented in Figure 2.4.1

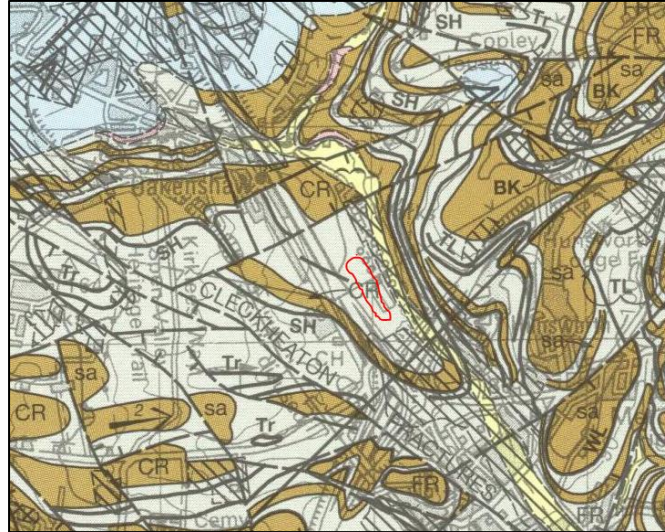


Figure 2.4.1: Extract from BGS 1:50,000 mapping sheet **77 (Huddersfield)**. The approximate site boundary is edged in red

There are several coal outcrops in relative proximity to the site to the east and west. The topographic change surrounding the site is that of a valley, with the site at the base of the valley. As such, the coal outcrops to the east and west are considered a reflection of topography. This is most clearly observed in the Shertcliffe seam which outcrops both to the east and west of the site. Considering this in relation to coal mining, the outcrops identified to the east and west of the site, including the Shertcliffe coal indicate that the Shertcliffe coal would have been eroded during production of the valley. The site is therefore likely to be underlain by coal seams stratigraphically older than the Shertcliffe seam. Further, the dip of the strata is identified to be to the north east. As such, coal seams outcropping to the east of the site and or stratigraphically younger than the Shertcliffe are not considered to underlie the site and hence are not considered further.

It is noted however, that the Shertcliffe seam will be present to the south of the Phase 1 & Phase 2 development area, and hence within the outline planning boundary but outside of the current development boundary.

Considering the above, the coal seams which may underlie the site at shallow depth are considered to be the Black Bed and Better Bed coal seams. Figure 2.4.2, an extract from BGS 1:50,000 mapping sheet 77 (Huddersfield) identifies the stratigraphic sequence within the area of the site, referred to on the BGS section as Chain Bar. The change in topographic gradient can be seen to remove the Shertcliffe seam in the vicinity of the site.

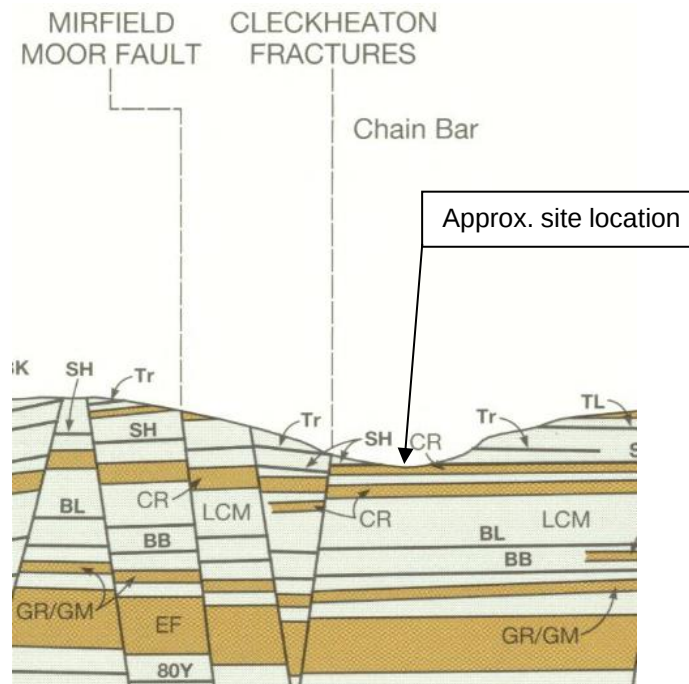


Figure 2.4.2: Extract from BGS 1:50,000 mapping sheet 77 (Huddersfield) section.

It is noted that the Wardell Armstrong report identified workings on-site to the south within the Shertcliffe seam. These workings relate to an area which is outside of the current site development boundary of this report (Phase 1 & Phase 2 development area) and are likely present due to a combination of strata dip and erosional history.

2.4.1 BGS Borehole Records

A review of the available BGS borehole records has identified borehole SE12NE927 which is present to the south east of the site (adjacent to the M606) and was advanced to 35 m bgl. The record is presented in Appendix B

The record is present almost on the eastern outcrop of the Shertcliffe coal seam. The geological record is summarised in table 2.4.3.

Table 2.4.3; Summary of BGS borehole SE12NE927

Depth (m bgl)	Geology
0 – 3.7	Made ground
3.7 – 6.0	Stiff clay
6.0 – 11.1	Mudstone
11.1 – 12.0	Siltstone / Seatearth
12.0 – 35.0	Mudstone / Sandstone / Siltstone

The BGS borehole identifies the potential presence of the Sherfcliffe seam as an intact siltstone and seatearth at 11.1 – 12.0 m bgl.

A review of instructive investigations within the general area of the mine shafts identify the expected geological sequence presented in table 2.4.4;

Table 2.4.4; Summary of BGS borehole SE12NE927

Depth (m bgl)	Geology
0 - 1.30	Made ground
1.30 – 6.00	Firm to tuff clay
6.00	Bedrock

A schematic section of anticipated ground conditions around the area of the mine entries is presented in Figure 2.4.5

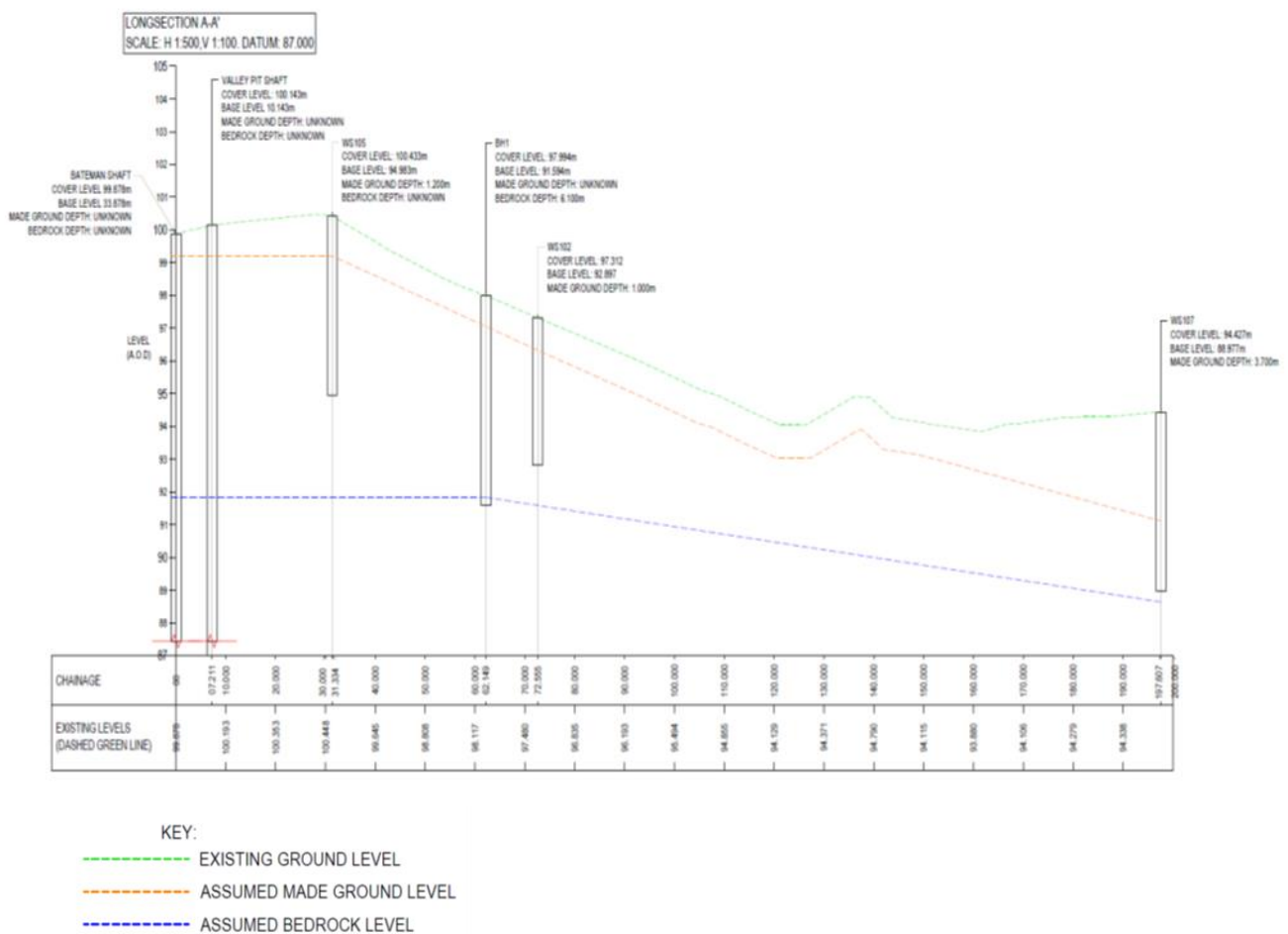


Table 2.4.5; Schematic of anticipated ground conditions

It is noted that an area of potentially deeper made ground was identified during the previous investigations, this area comprised an ashy material with glass fragments and whole glass

bottles. There is a potential that the Valley Pit shaft may be present beneath this area of made ground and this should be further investigated.

2.5 Coal Authority Information – Mine Entries

The Coal Authority information has been reviewed utilising;

- i) A review of opensource data available on the Coal Authority interactive mapping (3);
- ii) A Coal Authority Mining Report (Ref 00052445 November 2010) (5);
- iii) A Coal Authority Mine Entry Interpretive Report (Ref 51002171843001 September 2019) (4).

Two mine entries are recorded within the Phase 2 development area within the Coal Authority data, as referenced within the Coal Authority mine entry interpretive report (4) and Non-Residential coal and brine Report (4). An extract of the non-residential coal and brine report is presented in figure 2.5.1.

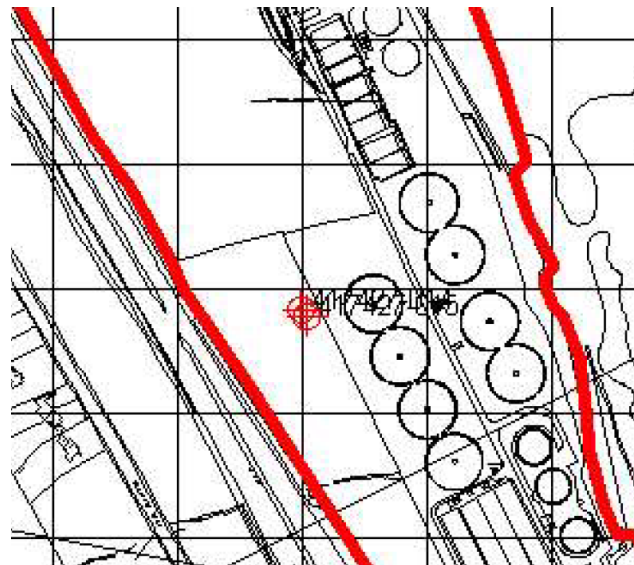


Figure 2.5.1; Extract of Coal Authority report 00052445 showing two mine entries present.

The recorded mine entries are numbered 417427-014 and 417427-015 with the former being located c. 10 m to the north of the latter. The location of the mine entries in relation to the site phasing is presented on drawing 1856 PL 104A (Appendix A).

The Coal Authority mining report and interpretative Mine entry report (4 & 5) identify that no treatment details are held for either of the mine entries present at the site.

Details of the mine entry interpretive report are summarised in tables 2.5.2 and 2.5.3.

Table 2.5.2; Summary of Mine Entry 417427-014

Element	Coal Authority Comment
Shaft or adit	Shaft
Mineral worked	Mineral worked Coal
Source	Source Ab plans 4056 LM9 LM5 LM21 GCR179 GCR180. 1st and 2nd Ed. Geological
Colliery name	Colliery name Unknown
Entry name	Entry name Valley Pit Shaft
Depth of superficial deposits (m)	1.0
Depth of shaft (m)	91.4
Diameter / Maximum width (m)	3.0
Treatment Details	Unknown

Table 2.5.3; Summary of Mine Entry 417427-015

Element	Coal Authority Comment
Shaft or adit	Shaft
Mineral worked	Coal
Source Ab plans	4056 LM9 LM5 LM21 GCR180
Colliery name	Unknown
Entry name	Bateman
Depth of superficial deposits (m)	1.0
Depth of shaft (m)	66.0
Diameter / Maximum width (m)	2.5
Treatment Details	Unknown

A further 8 mine entries are recorded within the vicinity of the site. These Mine Entries are further discussed within the Wardell Armstrong Phase 1 report. These further mine entries are outside of the Phase 2 development area but should be reviewed to ensure works do not encroach into these areas.

2.5.1 Targeted Coal Seam

The two mine entries identified on-site are recorded to target coal, but the exact seam is not reported by the Coal Authority. The geological sequence presented within section 2.4 combined with the Coal Authority record of two coal seams underlying the site (excluding the Shertcliffe see section 2.4), gives an expectation that the two coal seams are the stratigraphically shallower Black Bed and stratigraphically deeper Better Bed seams. The Black Bed seam is therefore considered to be present at c. 66 m bgl and targeted by the Bateman shaft, with the Better bed present at c. 90 m bgl, targeted by the Valley Pit shaft

The Black Bed and Better Bed seams are known locally to be of good quality which likely resulted in the Valley Pit extracting this resource. The Better Bed seam is known for its quality as a low-sulphur coal for coking.

Historic plans also identify that Valley Pit, to which the mine entries were a part, also extracted ironstone. An online review of local history indicates the Black Bed coal seam was often encountered with ironstone deposits.

2.5.2 Summary of Desk-based Information

- The geology and topography of the site reduce the site level to a level stratigraphically lower than the Shertcliffe Coal;
- The site is underlain by the Black Bed and Better Bed coal seams. Cross referencing between records indicates the Black Bed to be present at c. 66 m depth, and the Better Bed present at c. 90 m depth.
- Two mine entries (Bateman Shaft & Valley Pit Shaft) are present on the site (Phase 2 development area), interpreted to target the Black Bed & Better Bed seams respectively from Valley Pit.

3.0 Previous Mine Entry Investigation Works

The site has been subject to a previous mine entry investigation, undertaken by Curtins during October 2019 as part of the wider 2019 Curtins investigation.

The intention of the works was to establish the presence or absence of the mine shafts, along with location and dimensions of the mine shafts.

3.1 Field Works

Field works comprised a shallow surface search for the mine shafts utilising a long reach excavator.

Fieldworks comprised the marking out of the two mine shafts at the Coal Authority coordinates and gradual excavation of soils working toward the expected location of the mine shafts from the edge of the calculated zone of influence.

Ground conditions typically mirrored those of WS105, with made ground present from surface, to the depth of the excavation at c. 0.6 m bgl.

The southern mine entry recorded as 417427-015 the Bateman shaft was investigated initially.



Figure 3.1.1; Mine Entry 417427-015, Bateman Shaft

The mine entry was recorded to be 2.2 m in diameter, with a double skinned brick lining. The mine entry was backfilled visually at surface with a black cohesive soil containing mudstone, sandstone and coal.

The mine entry was recorded at coordinates SE17906, 27378. The Coal Authority report that the mine shaft is present at SE17903, 27378 which is within the tolerance of the GPS used on site.

The Valley Pit shaft was not located during the investigation, this absence does not necessarily mean the shaft is not present. Considering the records of the two mine entries, the distinction in depth, diameter and location between the two shafts identifies that these are unlikely to be the same mine shaft. The date of the workings in the late 1800's onwards also indicates that two mine shafts would be present. The mining methods of the time would typically necessitate the use of two shafts to instigate air circulation around the mine. Considering the above, the presence of two mine entries at the site is still considered high, though it is plausible that only one mine entry exists.

4.0 Further Coal Mining Investigation

This section identifies the further coal mining investigation works which are to take place at the site in order to further consider the coal mining legacy of the site.

It remains the responsibility of the contractor to ensure that all appropriate health and safety measures are put in place in accordance with CDM Regulations to ensure safe working practices.

4.1 Field Works

4.1.1 Health & Safety Requirements

General

The Principal Contractor should adhere to recommendations for intrusive site investigations as detailed within CIRIA C758D, in particular sections 12.2.2 and 14.3.1.

The Principal Contractor is to gain appropriate Coal Authority permits for the investigation prior to works commencing and ensure all works are undertaken in accordance with the relevant permit.

Anticipated Zone of Influence

Considering the identified ground conditions and taking a conservative approach that the collapse zone will extend from bedrock. A preliminary assessment of the potential collapse zone has been undertaken.

Figure 4.1 identifies the potential collapse zone of the mine entries in plan and section. The size and location of the Valley Pit shaft has been taken as per the Coal Authority information provided.

The Curtins ground investigation, specifically WS105, did not encounter bedrock within the upper 5.45 m. However, Wardell Armstrong BH01, located slightly further to the north east of WS105, located rockhead at 6.10 m bgl. As such rockhead is taken to be at 6.10 m bgl. On this basis, the influencing radius of the Bateman mine shaft and the Valley Pit shaft are calculated to be 7.2 m and 7.6 m respectively. Given the identification of the Bateman shaft this collapse zone is taken from the centre of the shaft. As the Valley Pit shaft was not identified, the collapse zone is conservatively positioned on the edge of the departure zone on Figure 4.1.

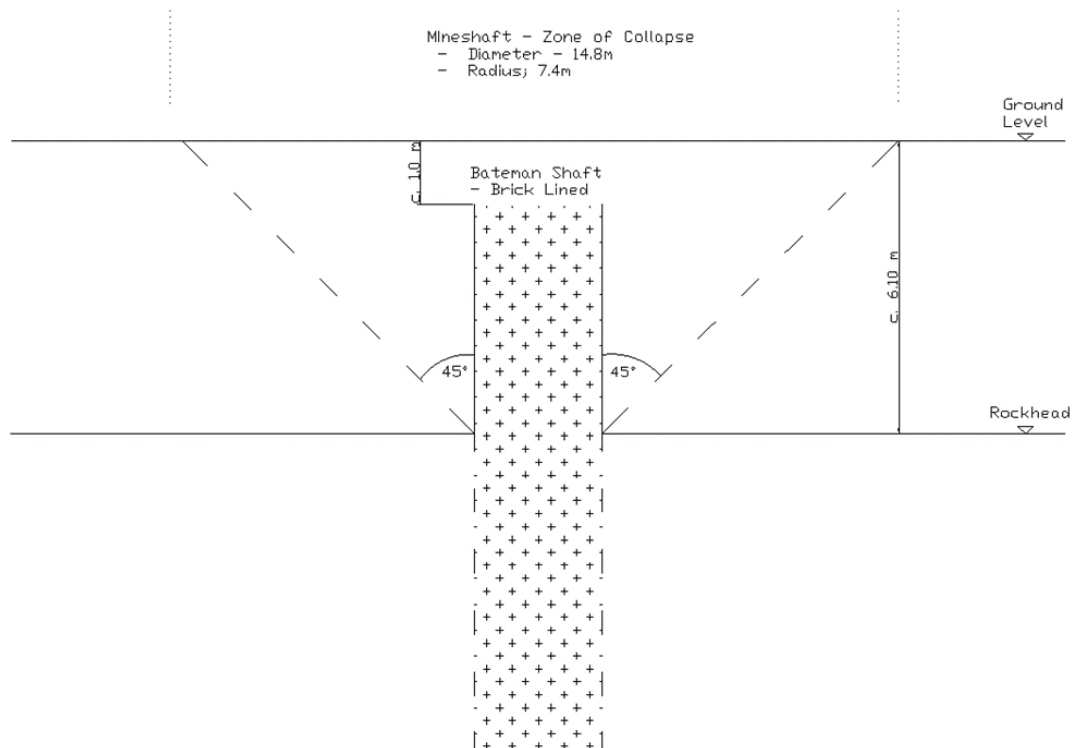


Figure 4.1 Calculated collapse zone for the Bateman Shaft – Section view

It is expected that the weathered bedrock, and for the Bateman Shaft, brick lining would afford further stability and thus reduce the collapse zone. However, for the purposes of investigation the assessment from bedrock is considered appropriate.

The presence of unrecorded mine entries cannot be discounted.

Excavation Procedure

Excavation is to proceed in a staged manner.

Excavations shall proceed from the edge of the zone of influence, working toward the suspected location of the mine entry.

Where the mine entry location is unknown, the mine entry shall be presumed to be at the edge of the departure zone (See Coal Authority reporting).

The excavator shall have sufficient reach to ensure the plant body remains outside of the zone of influence during excavation.

Excavation shall be completed to natural ground. Where necessary the excavation shall be suitably and safely widened and benched to ensure the excavator remains within 1.0 m of the excavation surface.

Arisings should be placed outside of the zone of influence so as not to increase any loading of the mine entry.

4.1.2 Excavation

The following works are to be completed as a staged process;

- All excavation works are to be completed under the supervision of a suitably qualified engineer;
- The suspected location of the mine entries shall be marked out, along with the zone of influence / departure zone;
- Excavation is to proceed in a staged manner as outlined in section 4.1.1
- The Bateman Shaft is to be located first and used as a reference point;
- Excavation is then to proceed to identify the location of the Valley Pit shaft;
- Soils are to be excavated to natural ground;
- Excavation is to proceed to follow the natural ground horizon, progressing from the extent of the zone of influence toward the suspected area of the Valley Pit shaft;
- Where at any point areas of suspected collapse, or mine entry are identified works shall be reassessed by the engineer to ensure plant remains outside of the zone of influence.

4.1.3 Reporting

The following information will be recorded by the engineer;

- Mine Entry location;
- Mine Entry diameter;
- Photographs of mine entries;
- Gas Monitoring – or absence of any mine gases.

All information is to be incorporated into a revision and update of the Curtins Coal Mining Risk Assessment (ref. 8) to detail the findings of the investigation works.

5.0 Treatment Recommendations

Due to the high risk of the two mine entries present on the site and the use of this area as external car parking, treatment of the mine shafts will be required. Given the identification of the Bateman shaft from Coal Authority data, the Coal Authority data for the Valley Pit shaft may be broadly accurate, albeit that the location may differ. As such preliminary treatment design could be undertaken utilising the Coal Authority information. However, further investigation of the Valley Pit shaft will be required.

In accordance with C758 Chapter 14 the proposed site setting is considered to be high risk, albeit the proposed building is outwith the calculated collapse zone the mine entries are likely to be either overlying or in close proximity to external areas.

No evidence of slumping has been identified in and around the recorded shaft areas and investigation into the located entry shows that it is filled, at least at surface. As such the following treatment options are considered to be appropriate:

1. Investigation to assess condition (discussed in detail in previous Sections of this document)
2. Drill and grout and consider installation of reinforced cap
3. Install reinforced cap

5.1 Drill and Grout

Drilling and Grouting should be undertaken by a suitably qualified contractor under Coal Authority Issued Permit and with necessary risk mitigation measures in place. These are likely to include designed safety platforms to facilitate the drilling.

Grout comprising PFA, cement and sand mix should be utilized. It is considered likely that the shafts have been filled given the lack of evidence of ground movement and evidence noted to date however this will require confirmation prior to selection of grout mix. Assuming that the shaft is filled then consideration could be given to a Cement : PFA : Sand = 1:10:2 mix. However if it is determined that large voids are present bulk filling with pea gravel may be considered prior to grouting with a Cement : PFA : Sand = 1:6:1

Given the shaft diameter of the identified shaft and the high risk setting it is recommended that three grout holes are progressed to treat the shaft.

5.2 Shaft Cap

Where possible, preference should be given to a rockhead founded shaft cap, however given the depth to rockhead it is likely that the shaft will be constructed on the stiff glacial till identified.

The final depth and design of the shaft shall be confirmed based on the recorded diameter of the shafts, the final development loadings and building levels. The shaft shall be designed by a suitably qualified structural engineer however is anticipated to be:

Be square and measuring a minimum of 2 times the diameter of the shaft (i.e. for the Bateman shaft minimum of 4.4mx4.4m

Be founded on strata of sufficient bearing capacity to accommodate the cap

Be a minimum of 450mm thick and reinforced in accordance with BS EN 1992-1-1:2004+A1:2014

Given it is likely that the cap will not be able to be placed at rockhead further consideration of the inclusion a 500mm square, secured against man entry that may allow for future monitoring and or topping of the shaft fill, however the requirement for such measures should be determined on completion of the drilling and grouting. manhole

Based on the current assessment and the proposed development layout it is not considered necessary to provide additional measure for ground gas mitigation (e.g. vents).

References

1. **British Geological Survey.** *BGS 1:50,000 Mapping Records (Solid and Drift) Huddersfield (Sheet 77).* 2003.
2. **British Geological Survey.** Geology of Britain Viewer - British Geological Survey. [Online] <http://mapapps.bgs.ac.uk/geologyofbritain/home.html>.
3. **The Coal Authority.** Interactive Coal Mining Risk Map. [Online] <http://mapapps2.bgs.ac.uk/coalauthority/home.html>.
4. **The Coal Authority.** *Mine Entry Report* - September 2019 - MR-51002171843001-1569402545448.
5. **The Coal Authority.** Non-Residential Coal and Brine Report – Site At, North Bierley Works, Bradford Road, Oakenshaw, Bradford, West Yorkshire’ – 000524450-10
6. **Wardell Armstrong.** *North Bierley WWTW - Phase I Environmental Assessment.* Sheffield : 2017 - RPT-004.
7. **Wardell Armstrong.** *Phase II Geo-Environmental Assessment.* Sheffield : 2017- RPT-002C.
8. **Curtins** *Coal Mining Risk Assessment* February 2020 - B065646-CUR-00-XX-RP-GE-001.
9. **Curtins.** *Phase 2 Ground Investigation Report.* December 2019 - 065646-CUR-00-XX-RP-GE-001

Appendix A – Drawings

- Proposed development layout.
- Exploratory Hole Location Plan; 064646_CUR_00_XX_DR_GE_001_V04Mining Ground Model; 064646_CUR_00_XX_DR_GE_005_V01
- Mine entry zone of collapse plan; 064646_CUR_00_XX_DR_GE_004_V01
- SH10534-008 – Wardell Armstrong EHLP.

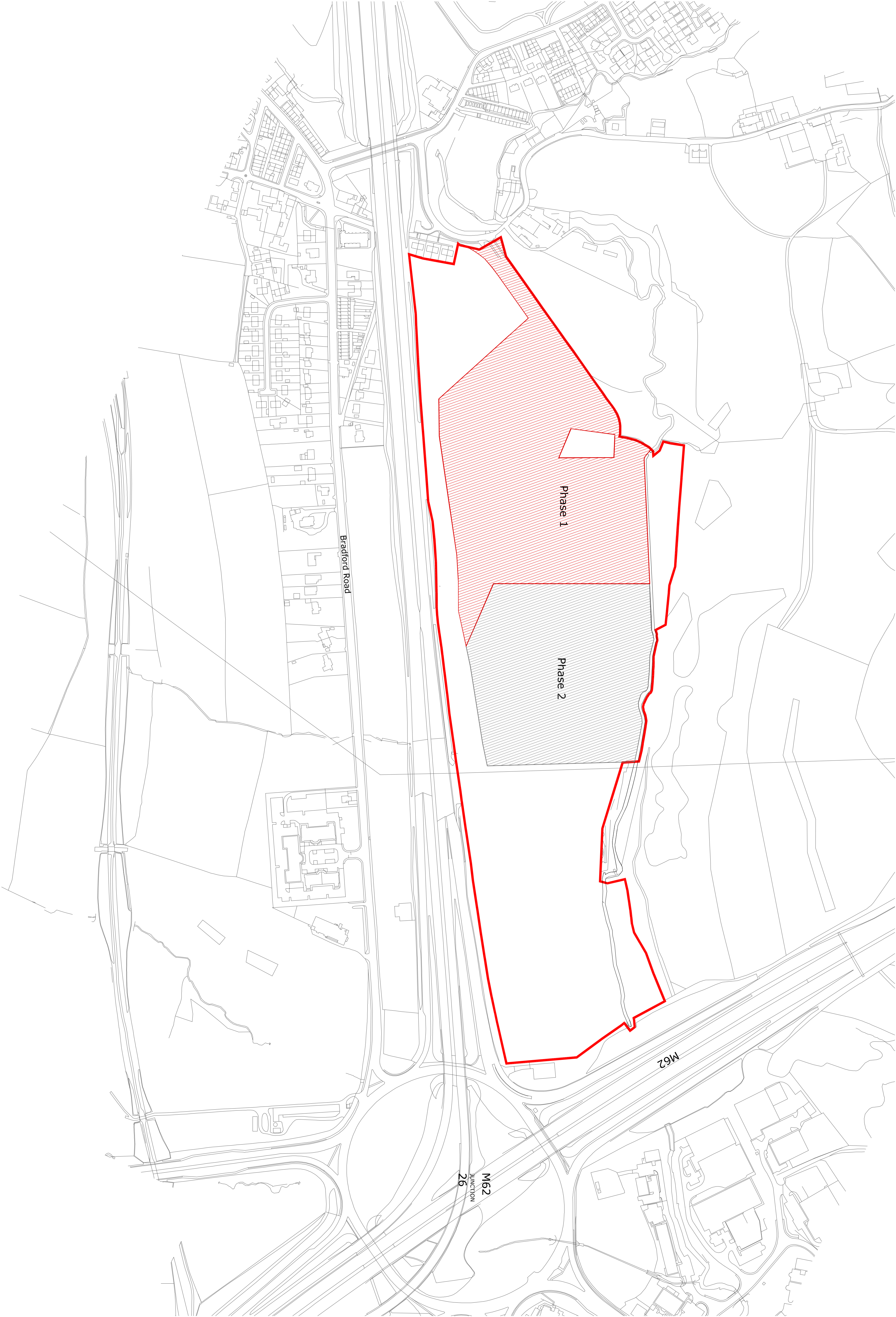
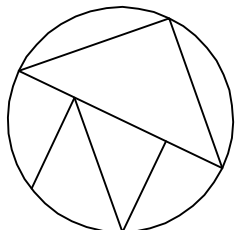
All site dimensions shall be verified by the contractor on site prior to work commencing.

Do not scale from this drawing.

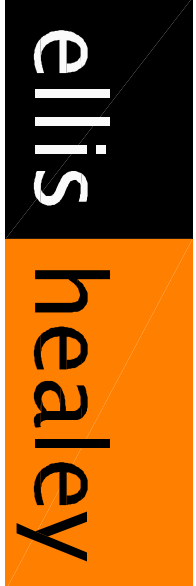
Only notes to explain dimensions.

This drawing is the property of Ellis Healey Architecture and copyright is reserved by them. The drawing is not to be copied or reproduced in any form without the prior written consent of Ellis Healey Architecture.

NOTES



Rev B	Updated	17.12.19	DPH
Rev A	Updated	06.12.19	DPH
Designation	Drawn / Revised	CHW	HEA/CHW



PLANNING

PROJECT: PROPOSED DEVELOPMENT INTERCHANGE 28 CLEVERHEATON

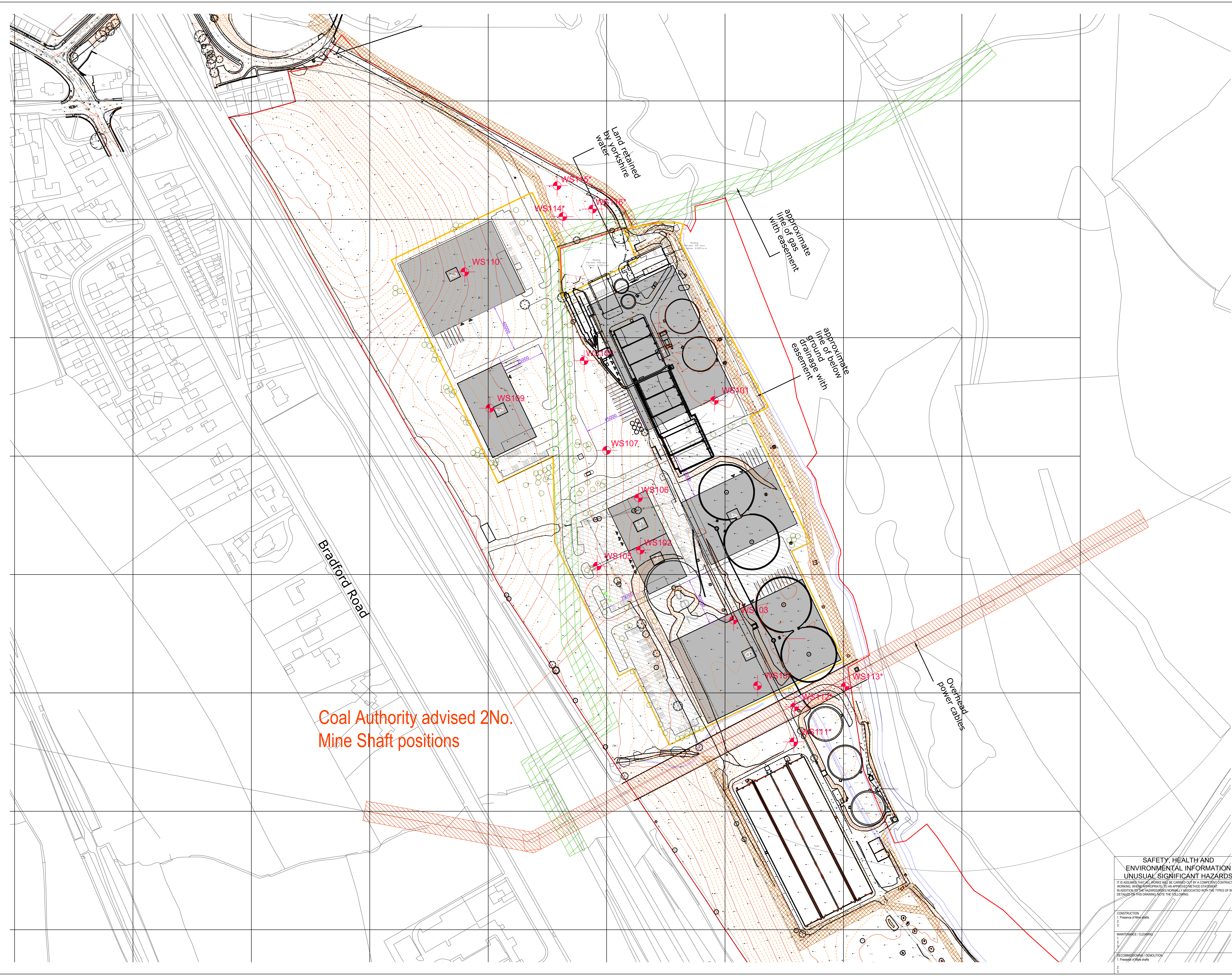
TITLE: SITE PHASING PLAN

DRAWING NO: 1856 PL 103B

DESIGNED: DPH DATE: NOV 2019

SCALE @A1: 1:2500

Town Works, Oakley Road, Loughborough, Leics, LE11 5DD
Tel: 0113 3450300 E: info@ellishealey.com



GENERAL NOTES:

- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
- DO NOT SCALE THIS DRAWING. ANY AMBIGUITIES, OMISSIONS AND ERRORS ON DRAWINGS SHALL BE BROUGHT TO THE ENGINEERS ATTENTION IMMEDIATELY. ALL DIMENSIONS MUST BE CHECKED / VERIFIED ON SITE.
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- FOR GENERAL NOTES REFER TO DRAWING.

GROUND INVESTIGATIONS KEY

Curtins Ground Investigation

Window sample borehole
Checked line indicates for location close to shaft

Mine Shafts
Checked line indicates for location close to shaft

V04	Updated locations following GI	01/11/19	MB	MB
P03	Added Further WS locations	02/10/19	MB	MB
P02	Amended	01/10/19	KE	MB
P01	ISSUE	30/09/19	MB	MB
Rev	Description	Date	By	Check

curtins

Office
Telephone
Email
Web

Civil & Structural • Transport Planning • Environmental • Interaction • Development • Construction & Heritage • Project Designer
Birmingham • Bristol • Canterbury • Cardiff • Glasgow • London • Manchester • Newcastle • Nottingham • Oxford • Plymouth • Southampton • Swansea • Wolverhampton

Status:

FINAL

Project:

NORTH BIERLEY

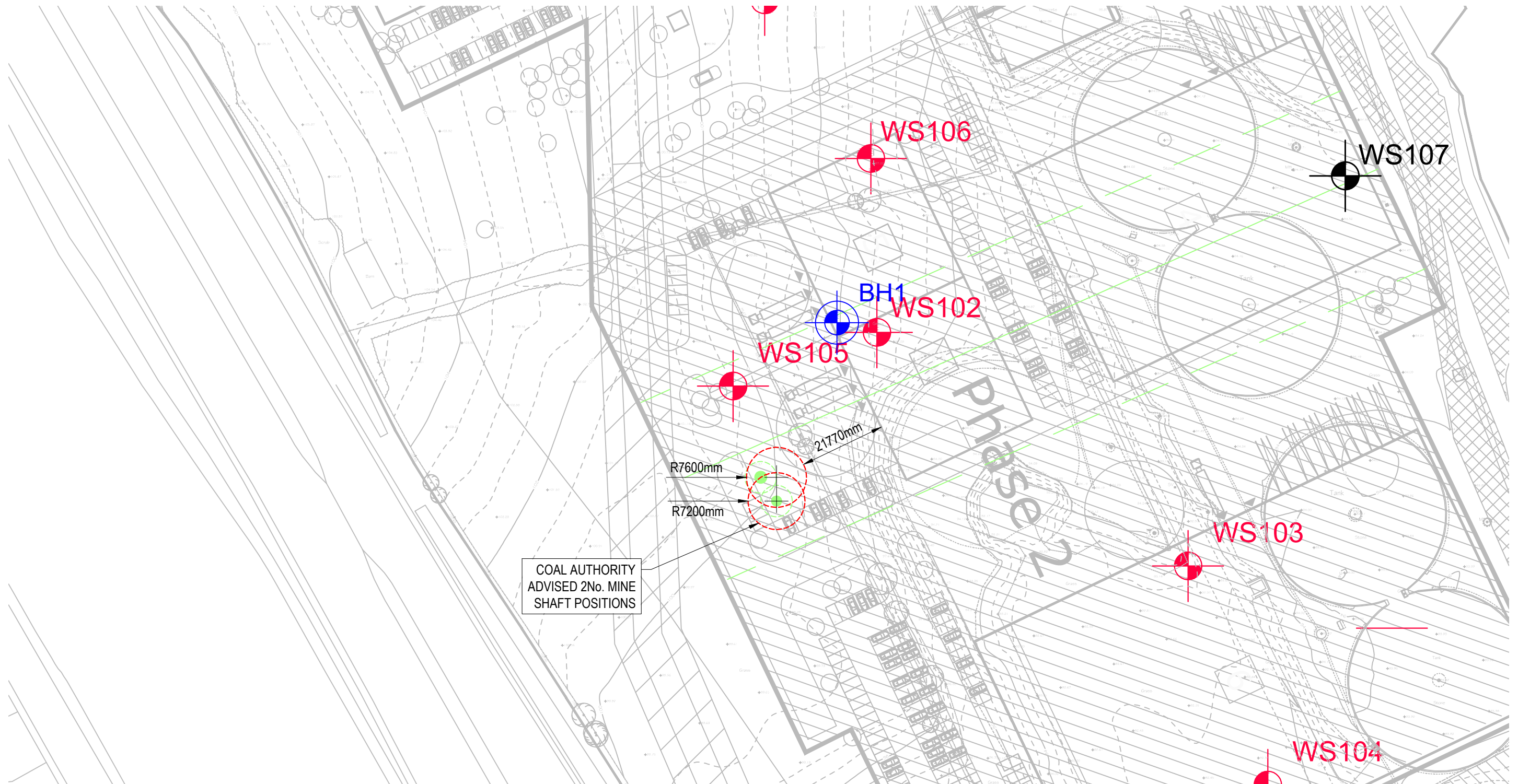
Dwg Title:

EXPLORATORY HOLE LOCATION PLAN

Size	Date	Drawn By	Designed By	Checked By
A0	01/11/2019	MB	MB	MB

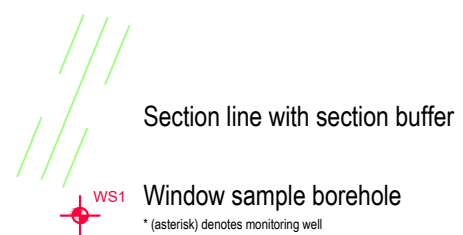
Scale: 1:1000

Project No	Originator	Volume	Level	Type	Role	Category / Number	Rev
065646	CUR	00	XX	DR	GE	001	V04



GROUND INVESTIGATIONS KEY

Curtins Ground Investigation



Mine Shafts

Dashed green line indicates 8m departure zone from shafts, dashed red line indicated 14.8m collapse zone from shafts

Wardell Armstrong 2015 Ground Investigation



Cable Percussive borehole

Window sample borehole



Rose Wharf Ground Floor, 78-80 East Street, Leeds, LS9 8EE
0113 274 8509
leeds@curtins.com
www.curtins.com

Civils & Structures • Transport Planning • Environmental • Infrastructure • Geotechnical • Conservation & Heritage • Principal Designer
Birmingham • Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kendal • Leeds • Liverpool • London • Manchester • Nottingham

Project: NORTH BIERLEY WWTW					Status: FINAL						
Drg Title: MINE ENTRY ZONE OF COLLAPSE PLAN					Drawn By: GL		Checked By: MB				
					Designed By: MB		Date: 05/11/2019				
					Scale: 1:1000 @ A3						
Project No:		Originator:	Volume:	Level:	Type:	Role:	Category / Number:		Rev:		
064646 - CUR - 00 - XX - DR - GE -										004 - V01	

GENERAL NOTES:

V01	FIRST ISSUE	05/11/19	GL	MB
Rev:	Description:	Date:	By:	Chkd:



DO NOT SCALE FROM THIS DRAWING
A2

REFERENCE

SITE INVESTIGATION BOUNDARY

DEVELOPMENT AREA BOUNDARY

APPROXIMATE LOCATION OF SHELL & AUGER BOREHOLE TO A NOMINAL DEPTH OF 10m BGL

APPROXIMATE LOCATION OF SHELL & AUGER BOREHOLE TO A NOMINAL DEPTH OF 10m bgl WITH ROTARY FOLLOW ON TO 30m BGL

APPROXIMATE LOCATION OF WINDOW SAMPLE BOREHOLE TO A NOMINAL DEPTH OF 5m BGL

(BOREHOLES SHOWN HIGHLIGHTED HAVE INSTALLATIONS)

APPROXIMATE LOCATION OF TRIAL PIT EXCAVATION

APPROXIMATE LOCATION OF TRIAL PIT EXCAVATION WITH SOAKAWAY

APPROXIMATE ROUTE OF FOUL SEWER WITH EASEMENT

APPROXIMATE ROUTE OF SW SEWER WITH EASEMENT

APPROXIMATE ROUTE OF WATER WITH EASEMENT

APPROXIMATE ROUTE OF ELECTRICITY WITH EASEMENT

APPROXIMATE ROUTE OF O/H ELECTRICITY WITH EASEMENT

APPROXIMATE ROUTE OF GAS WITH EASEMENT

POSSIBLE AREA OF SHALLOW MINING

GEOLOGY:

SHERTCLIFFE BED COAL OUTCROP

FAULT

SHAFT (after BGS) WITH 15m RADIUS ZONE OF UNCERTAINTY

SHAFT (after CA) WITH 15m RADIUS ZONE OF UNCERTAINTY

NOTES

1. APPROXIMATE LOCATION OF YORKSHIRE WATER APPARATUS (TAKEN FROM YW DRG No C411-05/104) SHOWN IN RED.

2. DEVELOPMENT LAYOUT TAKEN FROM ILLUSTRATIVE MASTER PLAN DATED 26.09.17

C	Layout Revised.	08/10/17	DP	JL	JS
B	Layout Revised.	18/04/16	DP	PAL	GW
A	First Issue	25/11/15	DP	JL	GW

REVISION	DETAILS	DATE	DRAWN	CHK'D	APP'D

CLIENT

KEYLAND DEVELOPMENTS LTD

PROJECT

NORTH BIERLEY WWTW

DRAWING TITLE

SITE INVESTIGATION DEVELOPMENT PLAN

DRG No.	SH10534-008	SCALE	1:2500 @ A2	DATE	22/05/15
DRAWN BY	DP	CHECKED BY	JL	APPROVED BY	GW

☐ STOKE-ON-TRENT (HEAD OFFICE)	TEL 0845 111 7777	☐ CARDIFF	TEL 029 2072 9191
☐ NEWCASTLE UPON TYNE	TEL 0191 232 0943	☐ LEIGH	TEL 01942 260101
☐ WEST BROMWICH	TEL 0121 580 0909	☐ SHEFFIELD	TEL 0114 245 6244
☐ LONDON	TEL 020 7287 2872	☐ EDINBURGH	TEL 0131 555 3311
		☐ TAUNTON	TEL 01823 703100

wardell armstrong
your earth our world

Appendix B

- BGS Borehole Record
- Wardell Armstrong BH01
- Curtins WS105

British Geological Survey  Soil Mechanics		British Geological Survey SEIZNE 927		British Geological Survey BOREHOLE No. 44 Sheet 2 of 4	
Equipment & Methods		Location No. 7808			
As sheet 1		Location			
		M62 (EAST)/M606 LINK ROADS			
Carried out for		Ground Level		Coordinates	
Department of Transport		As sheet 1		Date	
Description		Reduced Level	Legend	Depth (Thick)	Samples/Tests
					Depth
					Sample
					Type
					No.
					Test
					Field Records
MUDSTONE (As sheet 1)					
Dark grey thinly laminated carbonaceous highly weathered MUDSTONE, recovered as very weak to weak gravel.		88.25		(4.20)	10.30 W 36
					10.30 - 10.70 U 31
					10.70 D 32
				(0.40)	
		87.85		11.10	D 33
					D 34
				11.20 - 11.53	S 50
				(0.70)	
Grey brown highly weathered, locally sandy SILTSTONE, very weak to weak extremely closely fractured with much dark grey fossil plant remains. Discontinuities, curved, smooth, polished. (SEATEARTH) 11.80-12.00m, Core loss. 12.40-13.00m. Grey stained brown siltstone. Recovered as gravel with a little clay.		87.15	x x x	11.80	
			x x x	(0.60)	
		86.55	x x x	12.40	
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		
			x x x		

British Geological Survey

Fig.

Equipment & Methods

As sheet 1

Location No. 7808

Location

M62 (EAST)/M606 LINK ROADS

Carried out for

Department of Transport

Ground Level

Coordinates

Date

As sheet 1

Description

Reduced
Level

Legend

Depth
(Thick)

Drilling Records

Mechanical core log

Field Records
and
Test ResultsSANDSTONE
(As sheet 3)Clay lined horizontal
fracture.

Vertical fracture

Grey thinly laminated
siltstone.

Grey thinly laminated
slightly weathered
SILTSTONE, moderately
strong to strong, very
closely to closely
fractured.

Discontinuities:

1. Subhorizontal, planar
and smooth.

2. Subvertical, planar,
rough to smooth with
occasional clay lining.

Below 32.50m, occasional
thin laminae of sandstone.

Clay lined fractures.

NI, recovered as gravel
with a little clay.

NI, recovered as gravel

Dark grey thinly laminated
slightly weathered
SILTSTONE, very weak to
moderately strong,
extremely closely to
closely fractured.

Discontinuities:

1. Subvertical, planar
and smooth with occasional
clay infill.

2. Subhorizontal,
irregular and smooth.
3. Non intact, randomly
orientated, planar to
irregular, smooth with a
little clay infill.

NI, recovered as gravel
with a little clay.

BOREHOLE ENDS AT 35.20 m.

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1993					
08.01	0800	0.00	0.00	-	Start of shift Water entry End of borehole
08.01	-	10.30	-	10.30	
08.01	1800	11.80	9.00	10.80	
10.02	0800	11.80	11.80	9.37	
10.02	1000	28.00	12.00	10.99	
11.02	0800	28.00	12.00	11.60	
11.02	1800	35.20	12.00	11.22	

Remarks

Logged by

AJQ

Scale

1:50

Notes:

Equipment & Methods Cable tool boring, 150mm diameter, to 11.80m. Rotary coring, 92mm diameter, using an Edeco T30, with air/mist as flush.		Location No. 7808 Location M62 (EAST)/M606 LINK ROADS		18020 27081		
Carried out for Department of Transport		Ground Level 98.95 m A.O.D.		Coordinates 8022.68m E 7081.11m N		
				Date 08.04.93		
Description		Reduced Level	Legend	Depth (Thick)	Samples/Tests Depth Sample Type No. Test	Field Records
Soft to firm silty CLAY with some rootlets. (TOPSOIL)		98.95 98.60		(0.35) 0.35	0.35 0.50 D 1 2	
MADE GROUND (Firm to stiff brown mottled orange brown and grey very silty clay with a little to some subangular to subrounded fine to coarse gravel of mudstone).				1.00 - 1.45 1.50 1.75 (2.55)	3 4 5 D D D	75 blows 0.35m recovery
MADE GROUND (Stiff brown mottled light grey and dark grey very silty clay with a little to some fine to coarse gravel of mudstone, sandstone and coal). Slightly sandy with occasional gravel of coal.				2.00 - 2.45 2.50 2.75	6 7 8 U D D	89 blows 0.40m recovery
Below 3.10m, with much gravel.		96.05		2.90 (0.80)	9 10 D B	C M-31 U100 attempted, poor penetration after 40 blows 15,16/6,8,10,7
Firm orange brown mottled grey sandy CLAY. Foreman reports occasional sandstone cobbles.		95.25		3.70 (0.40)	11 D	
Very stiff brown mottled grey slightly sandy CLAY with some subangular fine to coarse gravel of mudstone and siltstone and occasional dark grey carbonaceous pockets (<10mm size). Below about 4.80m, with occasional orange brown mottling.		94.85		4.10 (1.90)	12 13 14 15 D U D D	150 blows 0.30m recovery
Grey and brown mottled completely weathered MUDSTONE, recovered as very stiff clay with some lithorelicts of very weak mudstone (<6mm size).		92.95		6.00 (0.50)	18 D	
		92.45		6.50	19 20 U D	Poor penetration after 150 blows 0.25m recovery
					21 22 23 D D B	S M-42 4,5/9,10,11,12
Grey with some orange brown staining highly weathered MUDSTONE, recovered as angular fine to coarse gravel of very weak to weak mudstone.				(4.20)	24 25 26 D D B	S M-31 5,6/7,7,8,9
				27 28 29 D D B	S M-32 7,5/6,8,9,9	
				30 B		

Remarks

1. Chiselling from 3.10 to 3.70m for 0.5 hours, 11.40 to 11.80m for 0.5 hours.

Notes:

Materials are described to accordance with Appendix 1 for explanation of symbols and abbreviations see Fig. 1 (a) Soil Mechanics

Logged by

A20

Scale

1:50

Fig.



Borehole Log

Borehole No.

WS105

Sheet 1 of 2

Project Name: North Bierley

Project No.
B065646.300

Co-ords: -

Hole Type
WS

Location: Bradford

Level:

Scale
1:20

Client: Opus North

Dates: 03/10/2019 - 03/10/2019

Logged By
ES

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15						Soft brown gravelly CLAY. Gravel is fine to coarse sub rounded to angular concrete, mudstone and sandstone. Frequent rootlets.	
		0.40	ES					Soft brown slightly sandy gravelly CLAY. Gravel is fine to coarse sub angular to angular brick, coal, concrete, mudstone and sandstone. Rare ceramic. Frequent rootlets.	
		0.60							
		1.20		N=12 (2,2/2,2,3,5)				Black clayey fine to coarse sub angular to angular coal and mudstone GRAVEL. Rare ceramics and rootlets.	1
		1.30							
		2.00		N=23 (9,13/9,5,4,5)				Firm orange brown mottled grey gravelly CLAY. Gravel is fine to coarse sub angular to angular coal, mudstone and sandstone. Low sandstone cobble content.	2
		2.70							
		3.00		N=4 (1,1/1,0,1,2)				Soft brown mottled black slightly sandy gravelly CLAY. Gravel is fine to coarse sub rounded to angular mudstone and sandstone.	3
		4.00		N=11 (1,2/1,3,3,4)					4
								Continued on next sheet	

Remarks

1. Hole location scanned with CAT4+ prior to breaking ground. 2. Hand excavated pit 1.2m prior to drilling. 3. Terminated due to target depth being achieved.





Borehole Log

Borehole No.

WS105

Sheet 2 of 2

Project Name: North Bierley

Project No.
B065646.300

Co-ords: -

Hole Type
WS

Location: Bradford

Level:

Scale
1:20

Client: Opus North

Dates: 03/10/2019 - 03/10/2019

Logged By
ES

Well	Water Strikes	Samples and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		5.00		N=21 (2,5/6,5,5,5)					5
					5.45			End of borehole at 5.45 m	6
									7
									8

Remarks

1. Hole location scanned with CAT4+ prior to breaking ground. 2. Hand excavated pit 1.2m prior to drilling. 3. Terminated due to target depth being achieved.



						Site North Bierley WWTW			Borehole Number BH1	
Boring Method Cable Percussion		Casing Diameter		Ground Level (mOD)		Client KeyLand Developments			Job Number SH10534	
		Location See Drawing SH10534-002		Dates 16/05/2011		Engineer M Kelly			Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.20 0.30-0.80	D1 B2					(0.15) 0.15	Loose dark brown slightly clayey SAND (TOPSOIL).			
0.80 0.85-1.20	D3 B4					(0.65) 0.80	Firm dark brown sandy gravelly CLAY. Gravel of angular-subrounded sandstone and coal fragments.			
1.20-1.65	U5			68 blows		(1.10)	Firm orange brown sandy CLAY.			
1.70 1.90 2.00-2.45	D6 D7 U8			83 blows		1.90	Firm-Stiff brown sandy gravelly CLAY. Gravel of angular-subrounded sandstone and shale.			
2.50 2.50-3.00	D9 B10									
3.00-3.20 3.00-3.20	B11 U			100 blows						
3.50-3.95	U12			100 blows		(3.20)				
4.00	D13									
4.50-4.95 4.50-4.95 4.50-5.00	SPT N=53 S14 B15			5,8/9,11,14,19						
5.10 5.20-5.65 5.20-5.65 5.20-6.10	D16 SPT N=52 S18 B17			4,9/10,12,14,16		5.10	Dense grey sandy GRAVEL of weatehred sandstone, mudstone and shale.			
						(1.00)				
6.10 6.20-6.65 6.20-6.40	D19 SPT N=50 S20			16,9/31,19		6.10 (0.30) 6.40	Strong orange brown grey SANDSTONE.			
							Complete at 6.40m			
Remarks								Scale (approx)	Logged By	
								1:50	M Kelly	
								Figure No. SH10534.BH1		

Our Locations

Birmingham

2 The Wharf
Bridge Street
Birmingham
B1 2JS
T. 0121 643 4694
birmingham@curtins.com

Bristol

Quayside
40-58 Hotwell Road
Bristol
BS8 4UQ
T. 0117 302 7560
bristol@curtins.com

Cardiff

3 Cwrt-y-Parc
Earlswood Road
Cardiff
CF14 5GH
T. 029 2068 0900
cardiff@curtins.com

Douglas

Varley House
29-31 Duke Street
Douglas
Isle of Man
IM1 2AZ
T. 01624 624 585
douglas@curtins.com

Dublin

39 Fitzwilliam Square
Dublin 2
Ireland
T. 00353 1 507 9447
dublin@curtins.com

Edinburgh

1a Belford Road
Edinburgh
EH4 3BL
T. 0131 225 2175
edinburgh@curtins.com

Glasgow

Queens House
29 St Vincent Place
Glasgow
G1 2DT
T. 0141 319 8777
glasgow@curtins.com

Kendal

28 Lowther Street
Kendal
Cumbria
LA9 4DH
T. 01539 724 823
kendal@curtins.com

Leeds

Rose Wharf
Ground Floor
Leeds
L29 8EE
T. 0113 274 8509
leeds@curtins.com

Liverpool

Curtin House
Columbus Quay
Riverside Drive
Liverpool
L3 4DB
T. 0151 726 2000
liverpool@curtins.com

London

40 Compton Street
London
EC1V 0BD
T. 020 7324 2240
london@curtins.com

Manchester

Merchant Exchange
17-19 Whitworth Street West
Manchester
M1 5WG
T. 0161 236 2394
manchester@curtins.com

Nottingham

56 The Ropewalk
Nottingham
NG1 5DW
T. 0115 941 5551
nottingham@curtins.com