

North Bierley WWTW –Phase 1 & 2 Development Area

Coal Mining Risk Assessment

Curtins Ref: B065646-CUR-00-XX-RP-GE-001

Revision: V03

Issue Date: 4 February 2020

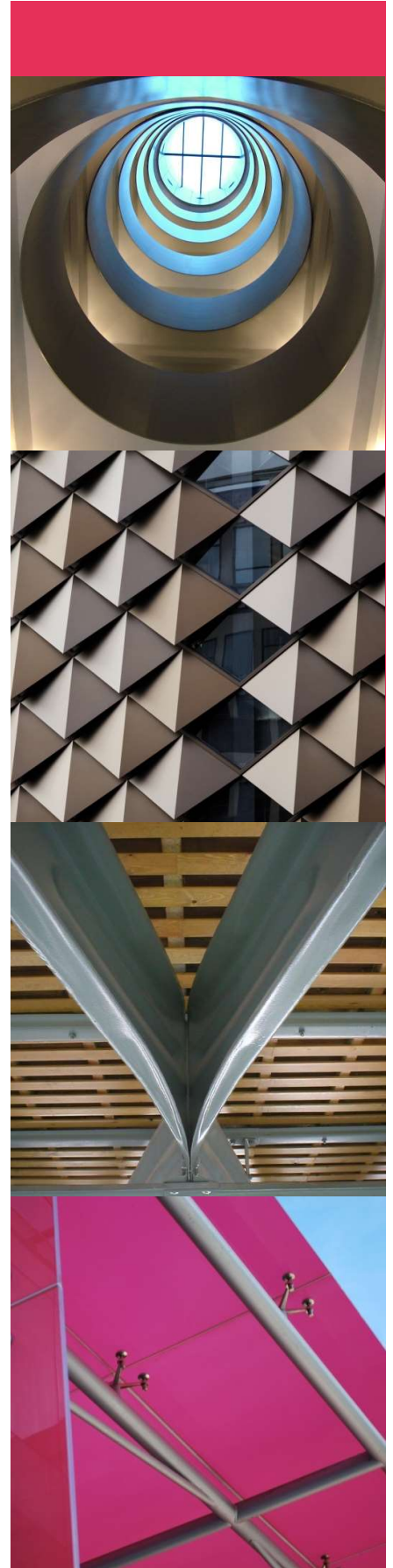
Client Name: Opus North

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	4 November 2019
V02	Amended following comment	MB	ML	14 January 2020
V03	Amended following comment	MB	ML	4 February 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
L. Doel BSc (Hons) FGS Geo-Environmental Engineer		4 February 2020

Reviewed	Signature	Date
M. Biggins BSc (Hons) CSi CEnv MCIWEM C.WEM Senior Geo-environmental Engineer		4 February 2020

Authorised	Signature	Date
M. Lomas BSc (Hons) CSci CEnv MCIWEM C.WEM Associate		4 February 2020

Table of Contents

1.0	Introduction	3
1.1	Purpose of this Report	3
1.2	References	3
2.0	Desk Study Information	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
2.5	Coal Authority Information	9
3.0	Intrusive Investigation Works	13
3.1	Wardell Armstrong 2015 Ground Investigation	13
3.2	Curtins 2019 Ground Investigation.....	13
3.3	Curtins 2019 Mine Shaft Investigation	14
4.0	Ground Model.....	17
5.0	Coal Mining Risk Assessment.....	18
5.1	Shallow & Surface Coal mining.....	18
5.2	Deep Coal Mining.....	19
5.3	Mine entries	19
5.4	Mine Gas	22
6.0	Conclusion & Recommendations	23

Appendices

Appendix A – Drawings

Appendix B – BGS Borehole Record

1.0 Introduction

In August 2019 Curtins were instructed by Fox LLoyd Jones, on behalf of Opus North to undertake a Coal Mining Risk Assessment (CMRA) in support of the redevelopment of the former North Bierley Waste Water Treatment Works (WWTW). The proposed development plans (current at the point of issue) are presented within Appendix A.

It is noted that this document has been previously issued and is revised in the context of the proposed reserved matters planning applications, covering Phase 1 and Phase 2 of the wider Interchange 26 development.

This report refers specifically to the Phase 1 & Phase 2 development areas of the site. These areas are presented in detail within drawings in Appendix A. For the purpose of this report it is assumed that all permanent and temporary development (e.g. construction access compound etc.) are limited to the be within the boundary of the Phase 1 & Phase 2 development area. Further assessment will be required for any development outside the Phase 1 and Phase 2 development area shown on Drawing 1856 PL 103B Appendix A

The findings and conclusions of this report are specifically tailored to the separate reserved matters applications for Phase 1 & Phase 2.

In line with current planning guidance, all development sites that fall within Development High Risk Areas require a CMRA to establish the risk presented by the specific hazards relating to coal mining legacy. Development High Risk Areas are determined by various factors, however, in this instance, the high-risk development area has been ascribed due to the potential presence of two recorded mine entries within the site boundary.

1.1 Purpose of this Report

The CMRA has been undertaken principally to provide an overview of the geological setting of the site of interest, specifically in relation to past, present and future mining activities (including non-coal mining). The report provides an assessment of the risks that could be presented to site users and the built environment.

More specifically, the CMRA provides a review and assessment of the site with respect to the potential impact of mining or mineral extraction activities on the proposed development.

1.2 References

The information presented within the Coal Mining Risk Assessment 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 CMRA makes reference to information presented within existing reporting prepared for this site by Wardell Armstrong, namely;

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

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.

1.3 Planning Context

This report is prepared in order to support discharge of planning conditions.

It is understood that planning conditions relate to the outline planning application conditions. Outline planning permission has been gained for the site ref: 18/92298.

Specifically related to coal mining the conditions within the permission are;

Condition 16:

Prior to the submission of reserved matters, the developer shall submit a report detailing intrusive site investigations for the mine entries and shallow coal workings on site for the written approval of the Local Planning Authority

This report is prepared specifically for the Phase 1 & Phase 2 development area of the North Bierley site, as presented on drawing 1856 PL 103B (Phasing Plan) & 1856 PL 104A (Phasing Plan with Constraints) in Appendix A. As such, this report is intended to provide support to discharge of condition 16 for the Phase 1 & Phase 2 development area only. However, where mining features are identified within the wider outline planning boundary area, these are also discussed as relevant, but may require further consideration during future development/ reserved matters applications.

It is noted that at the time of writing no development is proposed to the area north of the Phase 1 development boundary.

It is also noted that areas outside of the Phase 1 & 2 development boundary will require further investigation and assessment as appropriate prior to development.

2.0 Desk Study Information

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.

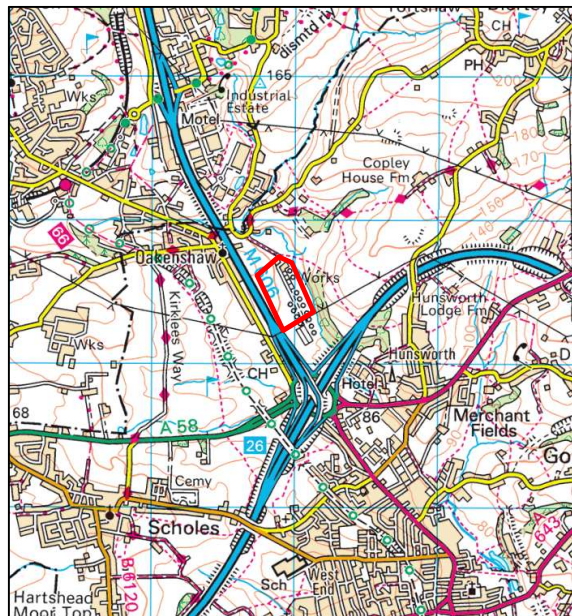


Figure 2.1: Site location plan - Proposed development layout in red.

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

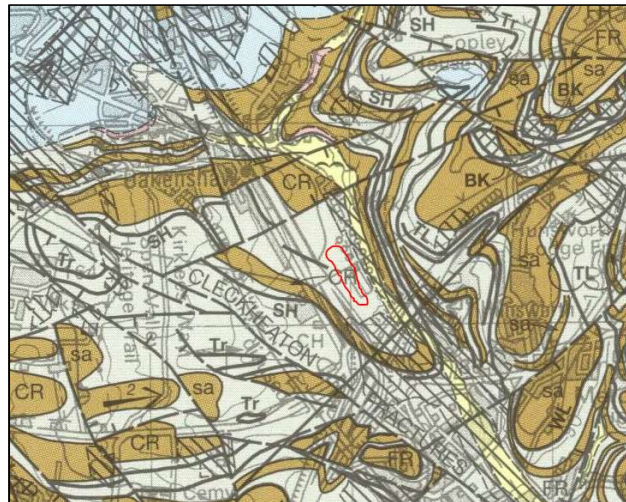


Figure 2.4.1: Extract from BGS 1:50,000 mapping sheet 77 (Huddersfield). The approximate site boundary is edged in red

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.

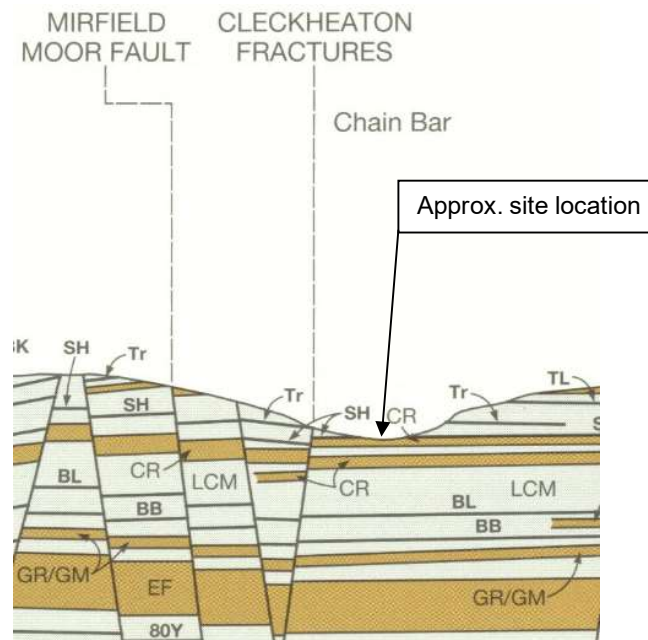


Figure 2.4.2: Extract from BGS 1:50,000 mapping sheet 77 (Huddersfield) section.

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.

2.5 Coal Authority Information

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).

2.5.1 Surface, Shallow & Deep Coal Mining

The Coal Authority records the site to lie outside of a High-Risk Development Area, with the exception of identified mine entries.

The Coal Authority report within the Wardell Armstrong Phase 1 study (different site boundary), records the potential for mining in three seams of coal. However, as discussed in section 2.4, mining within the shallow Sherfcliffe seam is expected to relate specifically to the south of the site, outside of the Phase 1 & Phase 2 development area, but within the outline planning boundary. Workings within the other two recorded seams at up to 120 m bgl are considered to relate to the Black Bed and Better Bed coal seams as per figure 2.4.2.

The Coal Authority interactive map viewer does not record the presence of probable shallow workings on the site.

In terms of surface (open cast) coal mining, the Coal Authority report states that the 'property does not lie within 200 m of the boundary of an open cast site from which coal is being removed'. Additionally, the Coal Authority interactive map viewer and the historic plans do not record evidence of surface coal mining.

2.5.2 Mine Entries

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.

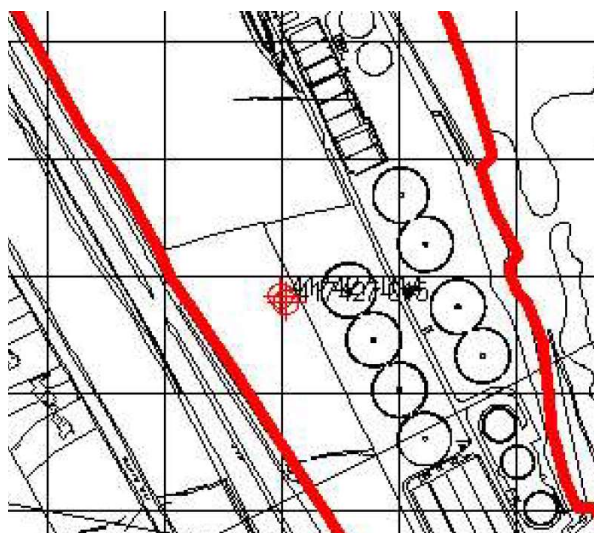


Figure 2.5.1; Extract of Coal Authority report 00052445 showing two mine entries present.

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 1 & Phase 2 development area.

2.5.3 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.

2.5.4 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 Intrusive Investigation Works

The site has been subject to a series of intrusive investigations, undertaken both previously and as a part of this work. This section presents a summary of intrusive investigation undertaken to date which is relevant to the mining history of the site as identified in section 2.0.

3.1 Wardell Armstrong 2015 Ground Investigation

Wardell Armstrong undertook ground investigation works across the site during 2015. The works undertaken were designed to investigate the site as a whole for future development. In particular the report investigated the presence of shallow coal mining to the south of the site, which is beyond the boundary of the current development site.

This report summarises the pertinent information specific to Coal Mining for the current development layout as presented in Appendix A.

- A total of three rotary boreholes (BH4, BH5 and BH6) were drilled to the south of the current development area for the site to investigate the potential for shallow workings in the Shercliffe coal seam. The closest of these borehole (BH4) to the current site boundary did not identify coal or workings. However, BH5 & BH6 did identify the presence of shallow mine workings in the Shertcliffe seam.
- The depth of rockhead, within areas close to recorded mine shafts, is recorded at 6.10 m bgl BH01. It is noted however that there is a topographic level change between the recorded mine shaft locations and the nearest Wardell Armstrong borehole (BH1)

The borehole log for BH01 is presented in Appendix C.

3.2 Curtins 2019 Ground Investigation

During 2019 Curtins were commissioned to complete a supplementary ground investigation across the proposed development site to support civil and structural design.

As part of this works Curtins were commissioned to undertake intrusive investigation of the recorded mine shafts within the Phase 2 area presented in section 2.5, this is detailed in section 3.3.

The results of the wider investigation are to be reported separately. However, a summary of pertinent information from this investigation, along with the results of the mine shaft investigation are presented.

3.2.1 Ground Investigation summary

The wider Curtins ground investigation summary identified similar ground conditions to that of the Wardell Armstrong study. The results of specific relevance to this report are the depth to rockhead within the vicinity of the recorded mine shafts.

WS105 was completed within proximity of the recorded mine shafts, although outside of the zone of influence. WS105 recorded the geological sequence presented in table 3.2.1.

Table 3.2.1; WS105 Geological Sequence

Stratum	Depth of strata (m bgl)
Topsoil	0 – 0.15
Soft brown slightly sandy gravelly Clay. Rare ceramic. Frequent rootlets (Possible made ground).	0.15 – 0.60
Black clayey Gravel. Rare ceramics and rootlets. (Possible Made Ground)	0.60 – 1.30
Firm orange brown mottled grey gravelly Clay.	1.30 – 2.70
Soft brown mottled black slightly sandy gravelly Clay.	2.70 – 5.45

WS105 was advanced to 5.45 m bgl and did not encounter rockhead.

3.3 Curtins 2019 Mine Shaft Investigation

As part of the wider 2019 Curtins investigation, Curtins specifically investigated the two recorded mine entries at the site within the Phase 2 development area.

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.

3.3.1 Field Works

Field works comprised a surface search for the mine shafts utilising a long reach excavator. Works were undertaken under Coal authority permit reference; 18769.

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 3.3.1 is a plate of the shaft.



Figure 3.3.1; 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.

Investigation of mine entry 417427-014 did not positively identify the feature. Excavations were undertaken over the recorded departure zone of the entry with evidence of made ground and ground disturbance, but no clear evidence of a mine shaft.

The excavation for 417427-014 identified the presence of a triangular area of made ground. The material was recorded as a deposit of loose sandy gravelly ash with numerous whole glass bottles. The Made Ground is interpreted as a former, informal, landfill area. The soils overlying the 'landfill' material were white and interpreted as a form of lime. The area around Valley Pit is recorded on historical plans as a surface excavation, triangular in shape. It is possible therefore that the identified area of made ground corresponds to the surface excavation of the Valley Pit.

The made ground is located within the recorded position of the Valley Pit shaft. Given the positional accuracy of Shaft 417427-015 (Bateman shaft) which utilises the same record information as the Valley Pit shaft it is possible that the Valley Pit shaft is located beneath this area of fill and as such is difficult to positively identify.

Figure 3.3.2 & 3.3.3 present plates of the excavation area.



Figure 3.3.2; Mine Entry 417427-014, excavation area



Figure 3.3.3; Lime material within excavation area

No elevated mine gases were recorded during the investigation works.

4.0 Ground Model

On review of the information, both desk based and intrusive, an extract of the mining specific ground model is presented in Figure 4.1, and is appended in drawing 064646_CUR_00_XX_DR_GE_005_V01.

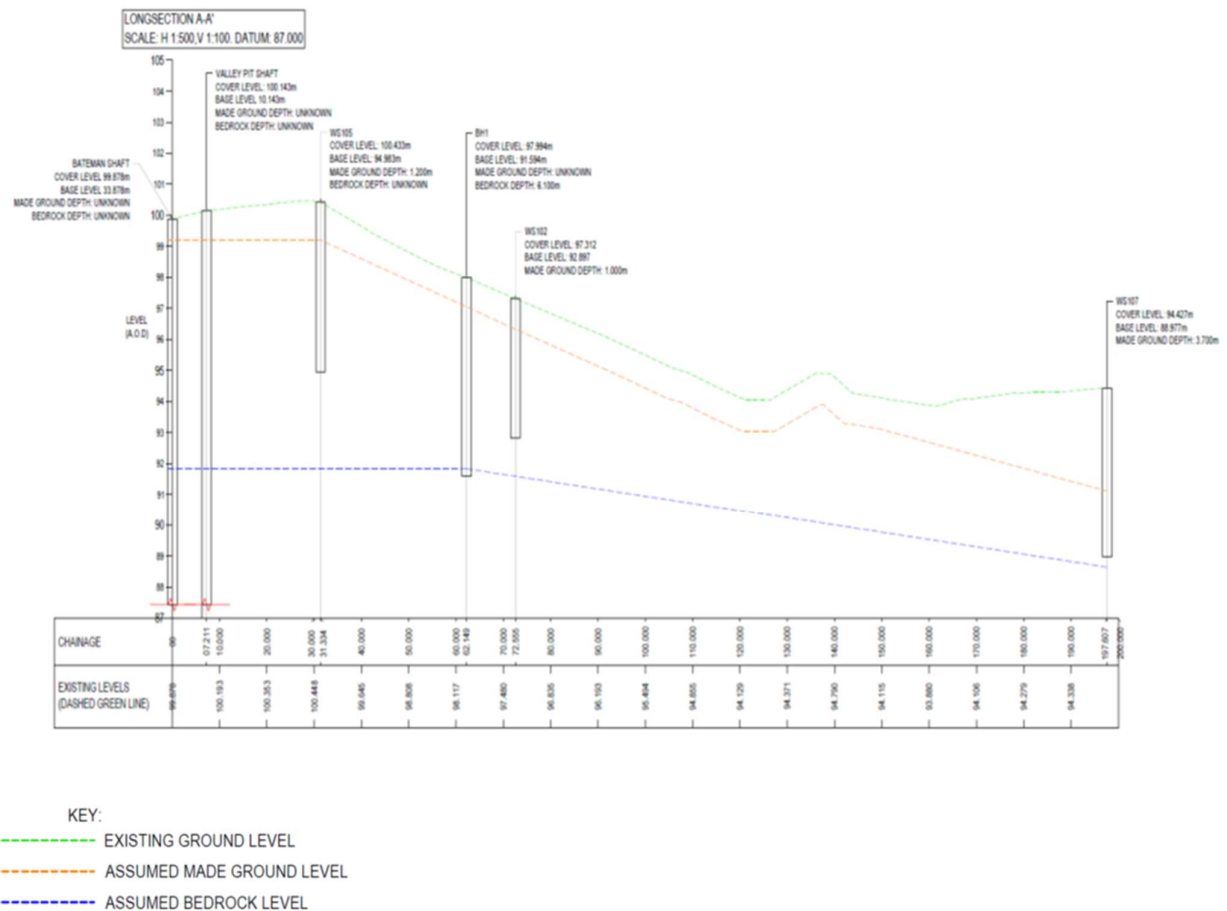


Figure 4.1; Ground Model

5.0 Coal Mining Risk Assessment

This section collates the information gained from the desk based and intrusive investigations undertaken to present the anticipated risk to the proposed development from the mining legacy of the site. The risk assessment is based specifically on the current development layout and makes an assessment for this development only. Where the development layout changes this risk assessment should be updated.

As noted, the aim of the Coal Mining Risk Assessment is to inform the requirement for further works and or risk mitigation measures, e.g. stabilisation of shallow mine-workings.

Risks associated with coal mining can be broadly characterised by the following scenarios: deep coal mining, shallow coal mining, mine entries, opencast coal mining, coal mining geology & mine gases.

Deep coal mining risk relates to mine workings present at depths greater than 30m below rockhead level. In general, the risk presented by these workings is very low as a result of either the depth at which historic workings (pillar and stall) lie. Additionally, the cessation of modern mining in the UK (longwall) that tends to induce surface subsidence within a short timescale reduces the risk from deep mining.

Shallow coal mining risk relates to mine workings present at depths shallower than 30m below rockhead level where collapses within relic workings are likely to result in the propagation of voids to the surface of the site, e.g. crown holes. Collapses within relic mine workings can occur immediately following abandonment but tend to be delayed and controlled by numerous factors, e.g. strength of roof material, groundwater regime, structural geology.

5.1 Shallow & Surface Coal mining

Surface Coal Mining

The Coal authority does not identify any surface coal mining activities at the site. In addition, no records of surface mining are present on the historic plans. As such the risk from surface mining is considered to be negligible.

Shallow Coal Mining

Shallow coal mining is considered to be coal mining within 30 m of the ground surface.

The interaction between topography of the site and the stratigraphy of the Pennine Lower Coal Measures in this area of the site are presented in section 2.4. The interaction between topography and stratigraphy identifies that, although present to the south, the site is not underlain at shallow depth by the Shertcliffe coal seam.

The coal seam underlying the Shertcliffe are the Black Bed and Better Bed seams. These two seams are anticipated to be the target seams of the two on-site mine shafts as presented in section 2.5.3. The Black Bed and Better Bed seams are therefore anticipated to be present at c. 66m and 90m respectively.

The depth of these seam is outside of the definition of shallow coal mine working and hence are considered in section 5.2.

In summary, the absence of coal at shallow depth on the site (Phase 1 & Phase 2 development area) identifies a negligible risk from shallow coal mining.

Shallow coal mining will require further consideration for development to the south of the Phase 1 & Phase 2 development area, or where the Phasing of the site changes from that presented in appendix A. The anticipated area of shallow coal mining is presented within the Wardell Armstrong reporting, specifically drawing SH10534-008 (Appendix A).

5.2 Deep Coal Mining

Deep coal mining, considered to be that in excess of 30 m below ground level is identified at the site. Workings within the Black Bed and Better Bed seams are recorded. The presence of two mine shafts, Bateman shaft and Valley Pit shaft, which are expected to have mined the Black Bed and Better Bed seams respectively, further corroborates the presence of workings. The coal authority data also identifies workings present within these two seams.

In consideration of risk to the development. Bedrock is noted to vary due to topographic gradient at the site. However, from Wardell Armstrong BH01, bedrock is recorded to lie at c. 6.10 m bgl. The identified depth of the shallower Better Bed seam at c. 66 m bgl identifies a substantial thickness of rock (c. 60 m) overlying this seam. Although the exact thickness of the Black Bed seam is unknown, BGS geological records indicate the Black Bed to be a maximum of 1.8 m thick. Considering the 10x seam thickness rule presented in table 5.1 of Ciria C758D guidance (10), the required rock cover is 18 m. It is noted that the Black Bed seam was extracted for both coal and ironstone which may thicken the working thickness slightly. Given that there is c. 60m of rock overlying the Black Bed seam, being 3 x the 10x working height, the risk of collapse in the Black Bed or underlying seams influencing the site is considered to be negligible.

5.3 Mine entries

Two mine entries are recorded to be present within the Phase 2 development area boundary (appendix A). These mine entries are recorded by the Coal Authority to be mine shafts of substantial depth (66 m – 90 m bgl). A further 8 mine shafts are recorded to be present within the wider outline planning boundary, as shown on drawing SH10534-008 (appendix A).

Desk based and intrusive investigation of these mine shafts has been conducted. One mine shaft was located via excavation, the location and size of this shaft indicates it to be the Bateman shaft. The Valley Pit shaft was not encountered during intrusive works.

Although the Valley Pit shaft was not encountered during intrusive works, 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. Additionally, following the mining disaster in Huskar Pit, Silkstone Common in 1838, there was a legal requirement for mines to provide two mine entries for access. Considering the above, the presence of two mine entries at the site is still considered high.

The influence of the mine entries on the development is considered in reference to the adjacent proposed structures to the east (buildings 5a and 5b). The influence radius of mine entries is typically taken from rockhead at a 45° angle to surface. 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. Although the Valley Pit shaft collapse zone is conservatively positioned, it is noted that the accuracy of the Coal Authority data, which was used to indicate the position of both Valley Pit and Bateman shafts, indicates the shaft may be present beneath identified made ground within the departure zone. This is presented schematically in figure 5.3.1. Additionally drawing 064646_CUR_00_XX_DR_GE_004_V01 (appendix A) identifies the zone of collapse in plan.

It is noted that as the Bateman shaft was identified as brick lined. The estimate of collapse zone of 7.4 m radius is intended to be conservative. However, the presence of a brick lining of the shaft would likely give further stability to any collapse, potentially raising the depth of collapse and therefore decreasing the collapse zone.

Based on the location of the identified mine shaft, the collapse zone of that shaft does not reach the proposed buildings and as such should not influence the development layout. However, the mine entries are present beneath proposed car parking areas.

The Coal Authority interpretive mine entry report for the site identifies that 'The statistical risk...is very small' in reference to damage of a theoretical building of the site boundary dimensions. However, externally to the site boundary mine shaft collapse is recorded.

In summary, the identified mine shafts, located via intrusive and desk-based study present a risk to the proposed development and as such will require treatment.

The evidence of the Bateman shaft indicates that the Coal Authority mine shaft data is broadly accurate and as such could be used for preliminary treatment design purposes for the Valley Pit shaft, however, positive location of this shaft will be required by further investigation.

The presence of unrecorded mine entries cannot be discounted.

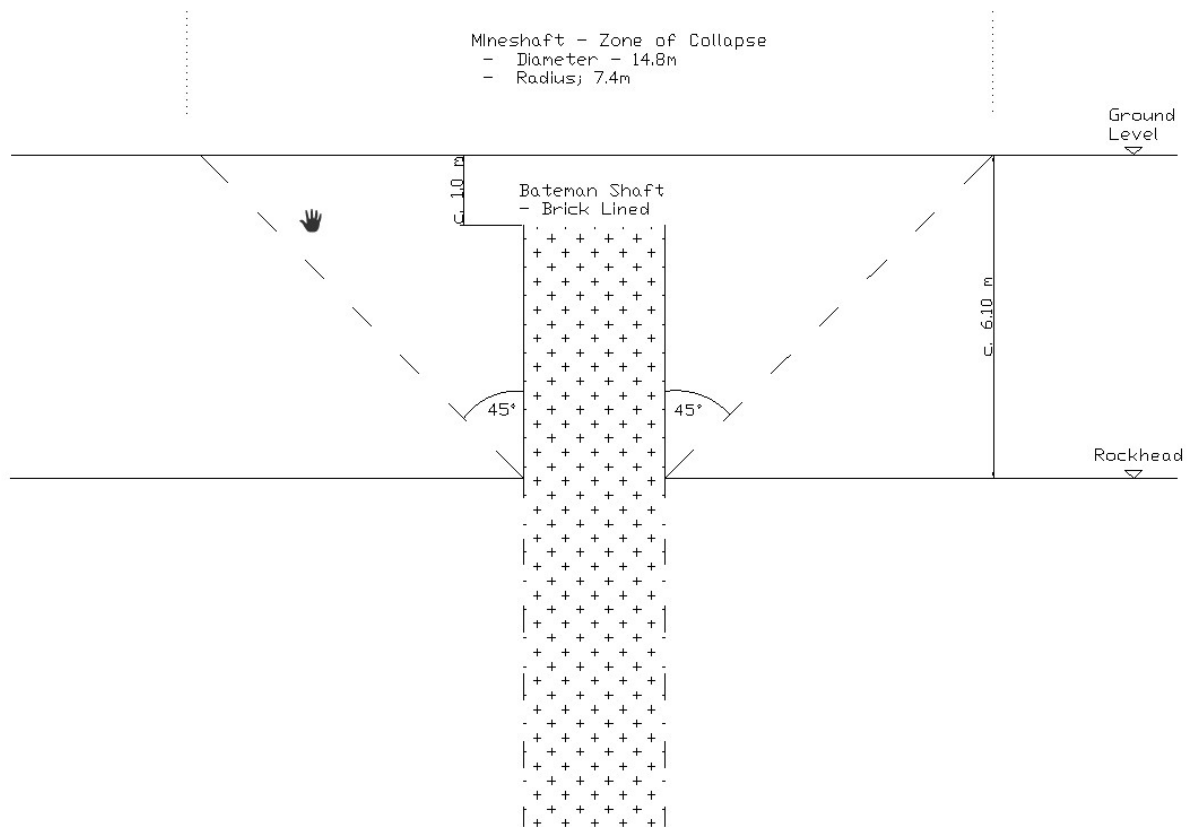


Figure 5.3.1; Schematic drawing of mine shaft influence zone.

5.4 Mine shafts - Wider Site

As demonstrated from drawing 1856 PL 104A in appendix A, the mine entries within the wider site boundary (outline planning boundary) are located some distance (minimum c. 50m) from the Phase 1 & 2 development areas.

Considering both the information presented within the Wardell Armstrong reporting and the calculated mine shaft influence zones of the shafts within the Phase 1 & Phase 2 development the mine shafts outside of the Phase 1 & Phase 2 development are not considered to be within influencing zone of the Phase 1 & Phase 2 development area. The development of Phase 1 & Phase 2 is therefore not

anticipated to change the existing situation with regards to mine shafts outside of Phase 1 & Phase 2 development area.

On the basis of the above, the mine shafts across the wider site area (outside of the Phase 1 & Phase 2 development areas) are not considered to require further treatment to facilitate development of Phase 1 & Phase 2 of the site. It is noted however, that any risk relating to the untreated mine shafts remains the same as prior to development.

Where the Phase 1 & Phase 2 development boundary varies, and where further phases of development proceed on the site (including temporary development, e.g. site access or compounds), the mine shafts within the wider site area will require further consideration and or mitigation as appropriate.

5.5 Mine Gas

The area is not recorded to be within a known mine gas area. The Black Bed seam and the Better Bed seam are not recorded by the Coal Authority as spontaneously combustible seams.

Elevated levels of mine gas were not recorded during the mine entry investigation works.

It is therefore considered that the risk posed to the site from mine gas is low.

Mine gas monitoring should be undertaken during any future treatment works with assessment updated as appropriate, including, if required, post treatment ground gas monitoring.

6.0 Conclusion & Recommendations

This Coal Mining Risk Assessment has been prepared with reference to the proposed development layout (Phase 1 & 2 development area) as presented within Appendix A

Considering the context of the proposed reserved matters planning applications, as highlighted within section 1.0, the conclusions of this CMRA have been considered independently within the separate reserved matter planning boundaries of Phase 1 and Phase 2.

Where further development is proposed at the site, or the Phase 1 & Phase 2 development area boundaries change further consideration of the mine entries and shallow coal mining across the wider site will be required. However, for Phase 1 & Phase 2 development area in its current form, this stage of development is not anticipated to change the existing situation for the wider site.

It is noted that a residual risk may be present from the existing untreated mine shafts, although the development of Phase 1 & Phase 2 development area is not assessed to change this risk.

Phase 1

The site is located in a region with a rich mining history with evidence of mining features recorded adjacent to the site.

No records of surface coal mining, or coal resources at shallow depths are identified within the Phase 1 development area.

The geology and topography of the site identify that coal seams are not present beneath the site at shallow depth (less than 30 m bgl). However, coal extraction within the Black Bed and Better Bed Coal seams at depths of 66 m and 90 m respectively has been undertaken, the legacy of which presents in the two mine shafts located within the adjacent Phase 2 development area.

In summary the risks presented from coal mining to the Phase 1 development area are considered to be;

- Negligible risk from shallow coal mining;
- Negligible risk from deep coal mining;
- Negligible risk from surface mining;
- Negligible risk from on-site mine entries.
- Negligible risk from mine gases, due to the absence of mine entries;

No further investigative works are proposed for the Phase 1 development area, with regard to Coal Mining risk.

The presence of unrecorded mine entries cannot be ruled out, and it is recommended that inspection of cut surfaces is undertaken by a suitably qualified engineer during any ground works undertaken within Phase 1.

Where mine entries are suspected or identified, work should be stopped, and the advice of a qualified engineer should be sought.

Phase 2

The site is located in a region with a rich mining history with evidence of mining features recorded both adjacent to and on the site (mine entries, mining tramway and associated structures).

No records of surface coal mining, or coal resources at shallow depths are identified within the Phase 2 development area.

The geology and topography of the site identify that coal seams are not present beneath the site at shallow depth (less than 30 m bgl). However, coal extraction within the Black Bed and Better Bed Coal seams at depths of 66 m and 90 m respectively has been undertaken, the legacy of which presents in the two mine shafts located within the Phase 2 development area.

Intrusive investigation has identified one of the two recorded mine shafts recorded in the Phase 2 development area. Although only one of the shafts, the Bateman shaft, was identified, it is considered highly likely that the Valley Pit shaft is also present.

In summary the risks presented from coal mining to the Phase 1 & Phase 2 development area are considered to be;

- Negligible risk from shallow coal mining;
- Negligible risk from deep coal mining;
- Negligible risk from surface mining;
- Low risk from mine gases;
- High risk from on-site mine entries.

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.

For the Phase 2 development area, It is therefore recommended that;

- A mine entry treatment plan / design is completed for both the Valley Pit (preliminary) and Bateman shafts;
- Further investigation is undertaken for the positive identification of the Valley Pit shaft to confirm the suitability for (and requirement of in the event that the shaft is not located) the preliminary design;
- It is noted that the design of remedial works for mine entries must account for the impacts of cut and or fill to achieve development levels.

At this stage, given the identified depth of rockhead, treatment design should consider the use of a soil founded shaft cap, with full grout treatment of the mine shaft. However, where possible, preference should be given to a rockhead founded shaft cap.

In addition, mine shaft treatment should allow for monitoring of the presence of gases during treatment works with consideration / re-assessment of the ground gas conceptual site model as part of the treatment design. Treatment via grouting of the shaft column and cap is expected to reduce any mine gas risk.

References

1. **British Geological Survey.** *BGS 1:50,000 Mapping Records (Solid and Drift) Huddersfield (Sheet 77).* 2003.
2. **Survey, British Geological.** *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. **Authority, The Coal.** *Non-Residential Coal Mining Consultants Report.* November 2017. 51001693567001.
5. **Moody, Darren.** *Non-Residential Coal and Brine Report - Site At, North Bierley Works, Bradford Road, Oakenshaw, Bradford, West Yorkshire.* s.l. : The Coal Authority, 2010.
6. **Kelly, M.** *North Bierley WWTW - Phase I Environmental Assessment.* Sheffield : Wardell Armstrong, 2017. RPT-004.
7. **Kelly, M and Lymer, J.** *Phase II Geo-Environmental Assessment.* Sheffield : Wardell Armstrong, 2017. RPT-002C.
8. **WSP Environmental Ltd;** *Report on a Site Investigation, Land at Bradley Road/Old Lane, Huddersfield, Mine Shaft Probing (No. 1 and No. 3).* July 2003. 12110512.
9. **WSP Environmental Ltd;** *Report on a Site Investigation, Land at Bradley Road/Old Lane, Huddersfield, Mine Shaft Probing (No. 2).* November 2002. 12110420.
10. **Brooks, John and Powell, Michael.** *Planning Statement - Employment and Residential Development, Former North Bierley Waste Water Treatment Works, Oakenshaw.* s.l. : Turley, 2016.
11. **old-maps.co.uk.** *Britain's most comprehensive historical map archive.* *old-maps.co.uk.* [Online] 2019. <https://www.old-maps.co.uk/#/Map/418038/427395/10/101161>.
12. **Google.** *Google Maps.* [Online] *The GeoInformation Group, Map data,* 2019. <https://www.google.com/maps/place/Oakenshaw,+Bradford+BD12+7ES>.
13. **British Geological Survey.** *BGS 1:10,000 Mapping Records Sheet SE12SE-1.* 1998.
14. **The Coal Authority.** *Mine Entry Interpretive Report.* s.l. : 2019, 2019. 51002171843001.

Appendix A – Drawings

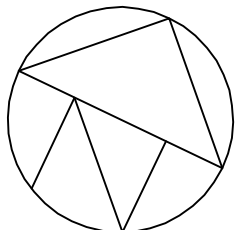
- Proposed development layout.
- Proposed site phasing plan 1856 PL 103B
- Proposed site phasing plan with constraints; 1856 PL 104A
- Exploratory Hole Location Plan; 064646_CUR_00_XX_DR_GE_001_V04Mining Ground Model; 064646_CUR_00_XX_DR_GE_005_V01
- Mine entry zone of collapse plan; 064646_CUR_00_XX_DR_GE_004_V01
- 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 orient orientation

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



ellis healey
architecture

PRE-APP

PROJECT: PROPOSED DEVELOPMENT
FORMER BIERLEY TREATMENT WORKS
CLEANWATER

TITLE: PROPOSED SITE LAYOUT
WIDER CONTEXT

DRAWING NO: 1856 PA.101

DESIGNED BY: DFE DATE: OCT 2019

SCALE @A1: 1:2500

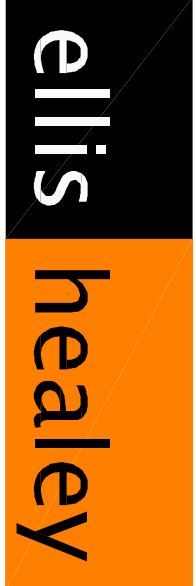
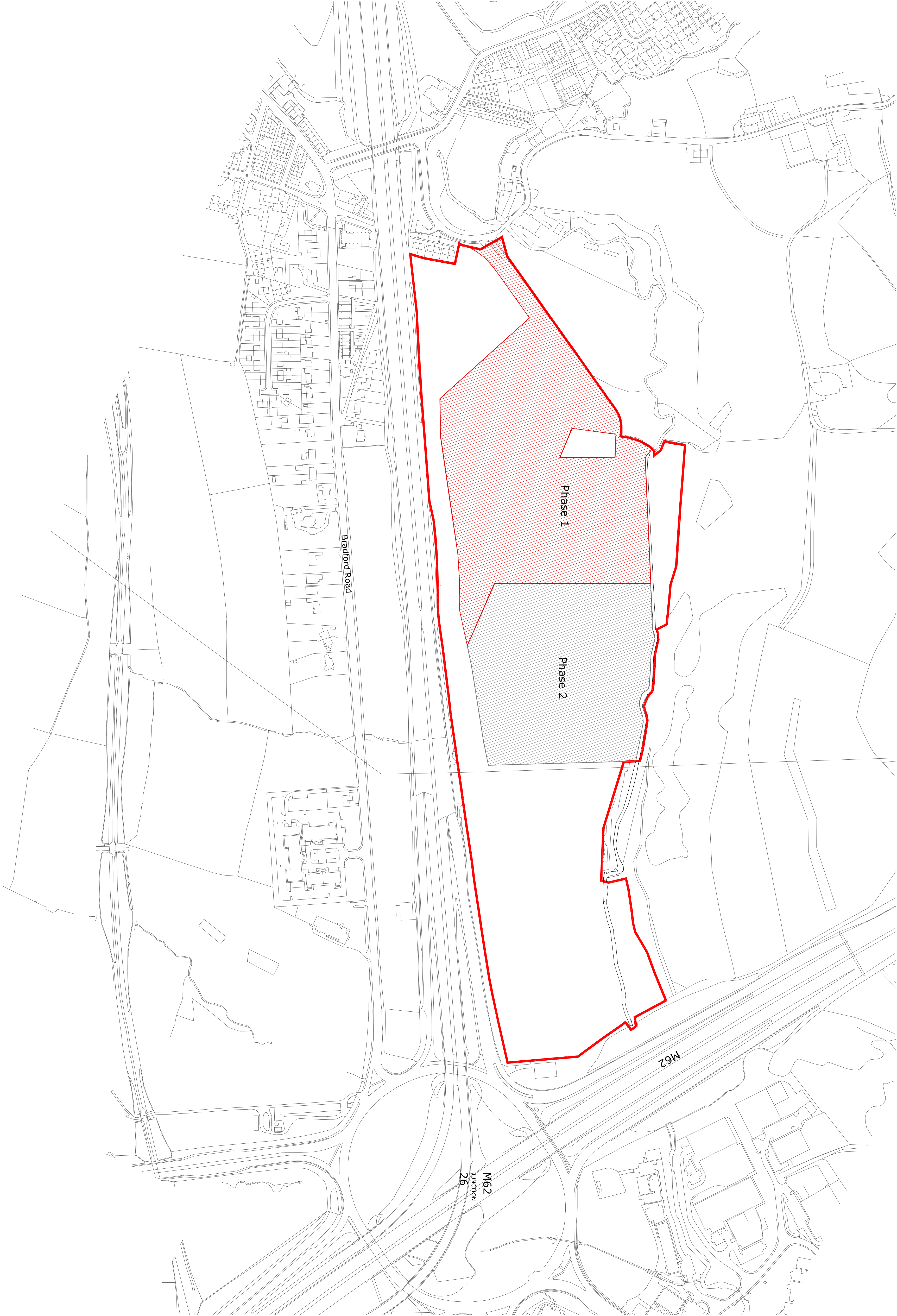
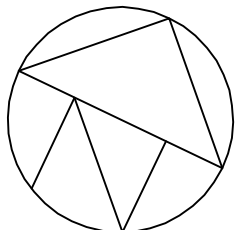
Town Works, Oak Road, Leeds, LS11 5SD
Tel: 0113 3450300 Email: info@ellishealey.com

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

Do not scale from this drawing.
Only refer to written 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



PLANNING

PROJECT: PROPOSED DEVELOPMENT INTERCHANGE 28 CLEOKHEATON

TITLE: SITE PHASING PLAN

DRAWING NO: 1856 PL 103B

DESIGNED BY: DFE DATE: NOV 2019

SCALE @A1: 1:2500

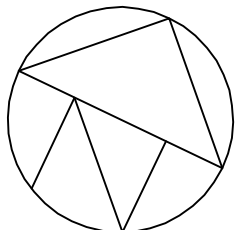
Town Works, Oakley Road, Loughborough, Leicestershire, LE11 5DD
Tel: 0113 3450300 Email: info@ellishealey.com

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

Do not scale from this drawing
Only refer to written dimensions

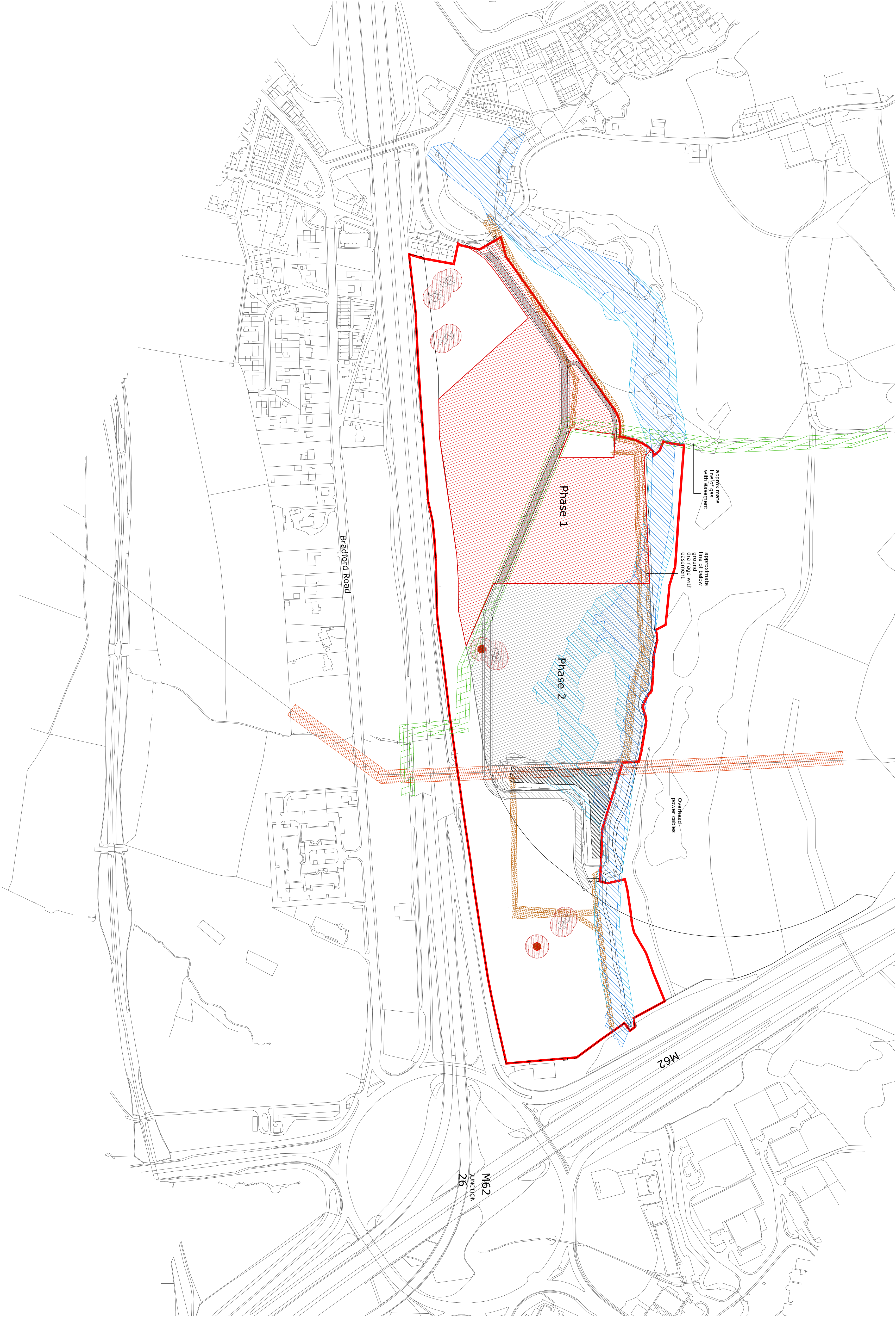
This drawing is the property of Ellis Healey Architecture and copyright is reserved by them. The drawing is not to be copied or reproduced in any form without the prior written consent of Ellis Healey Architecture.

NOTES



key

- Overhead power cables
- Approximate line of gas with easement
- Approximate line of below ground drainage with easement
- Flood zone 2
- Flood zone 3
- Safe (after GCS) with 15m radius zone of uncertainty
- Safe (after CA) with 15m radius zone of uncertainty



ellis healey
architecture

PLANNING

PROJECT: PROPOSED DEVELOPMENT INTERCHANGE 28 CLEVERHEATON

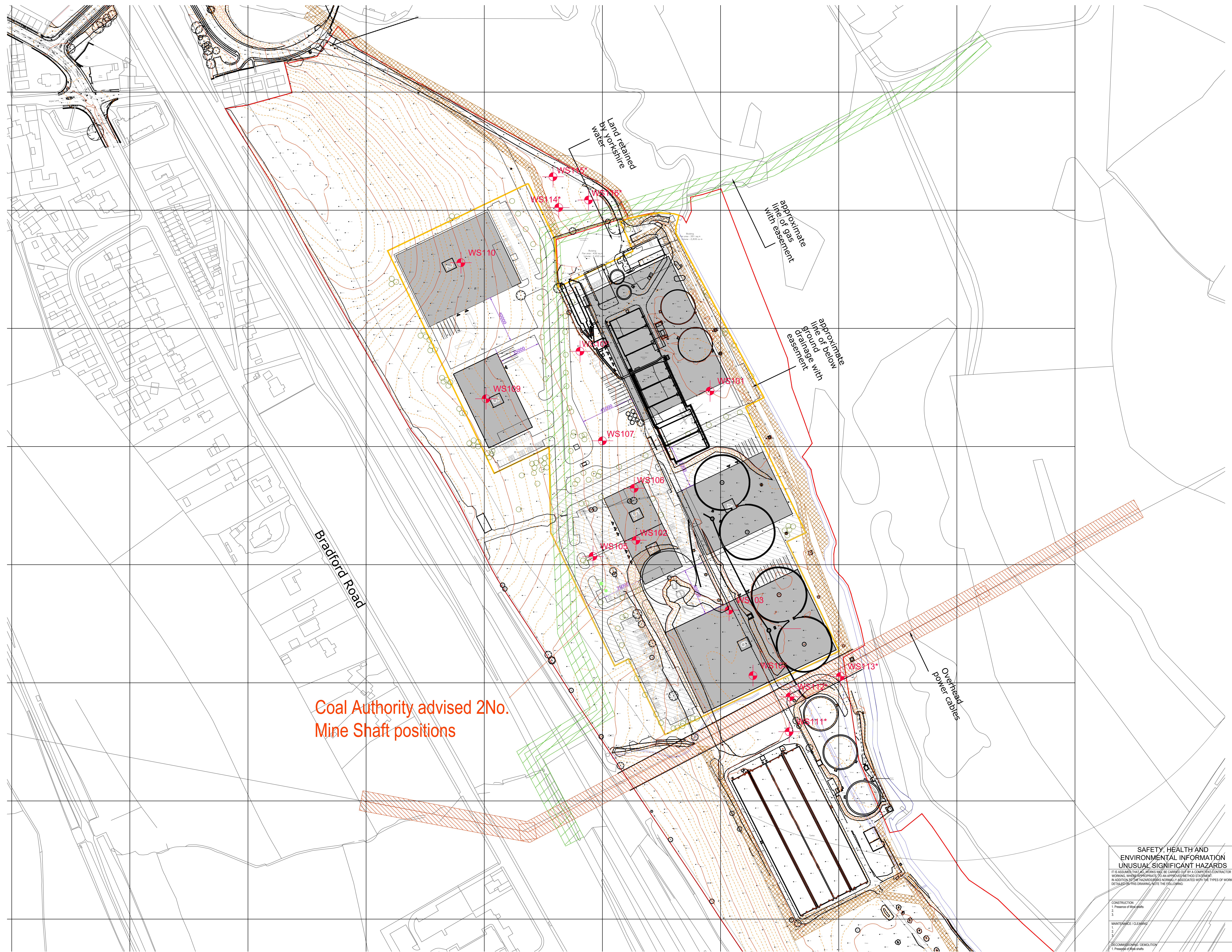
TITLE: SITE PHASING PLAN WITH CONSTRAINTS

DRAWING NO: 1856 PL 104A

DESIGNED: DFE DATE: NOV 2019

SCALE @A1: 1:2500

Town Works, Oakley Road, Lough, L81 5GQ
Tel: 0113 3450300 E: info@ellishealey.com



Coal Authority advised 2No.
Mine Shaft positions

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
UNUSUAL SIGNIFICANT HAZARDS

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.
IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, NOTE THE FOLLOWING:

CONSTRUCTION
1. Presence of Mine shaft

2
3

MAINTENANCE / CLEAN	
---------------------	--

1. ☐ ☐ ☐

DECOMMISSIONING / D

1. Prescribe of Nipis short

3

GENERAL NOTES:

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.
2. 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.
3. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
4. FOR GENERAL NOTES REFER TO DRAWING.

GROUND INVESTIGATIONS KEY

Curtins Ground Investigation

 Window sample borehole
* (asterisk) denotes monitoring well

Mine Shaft
Dashed line indicates

P04	Updated locations following GI	01/11/19	MB
P03	Added Further WS locations	02/10/19	MB
P02	Amended	01/10/19	KE
P01	ISSUE	30/09/19	MB
Rev:	Description:	Date:	By:



Office
Telephone
Email
Web

Structures • Transport Planning • Environmental • Infrastructure • Geotechnical • Conservation & Heritage • Professional Services
 Bristol • Cambridge • Cardiff • Douglas • Dublin • Edinburgh • Glasgow • Kentral • Leeds • Liverpool • London • Manchester

■■■■■

FINAL

NORTH BIERLEY

LABORATORY HOLE LOCATION

PLEURATORY HOLE LOCATION

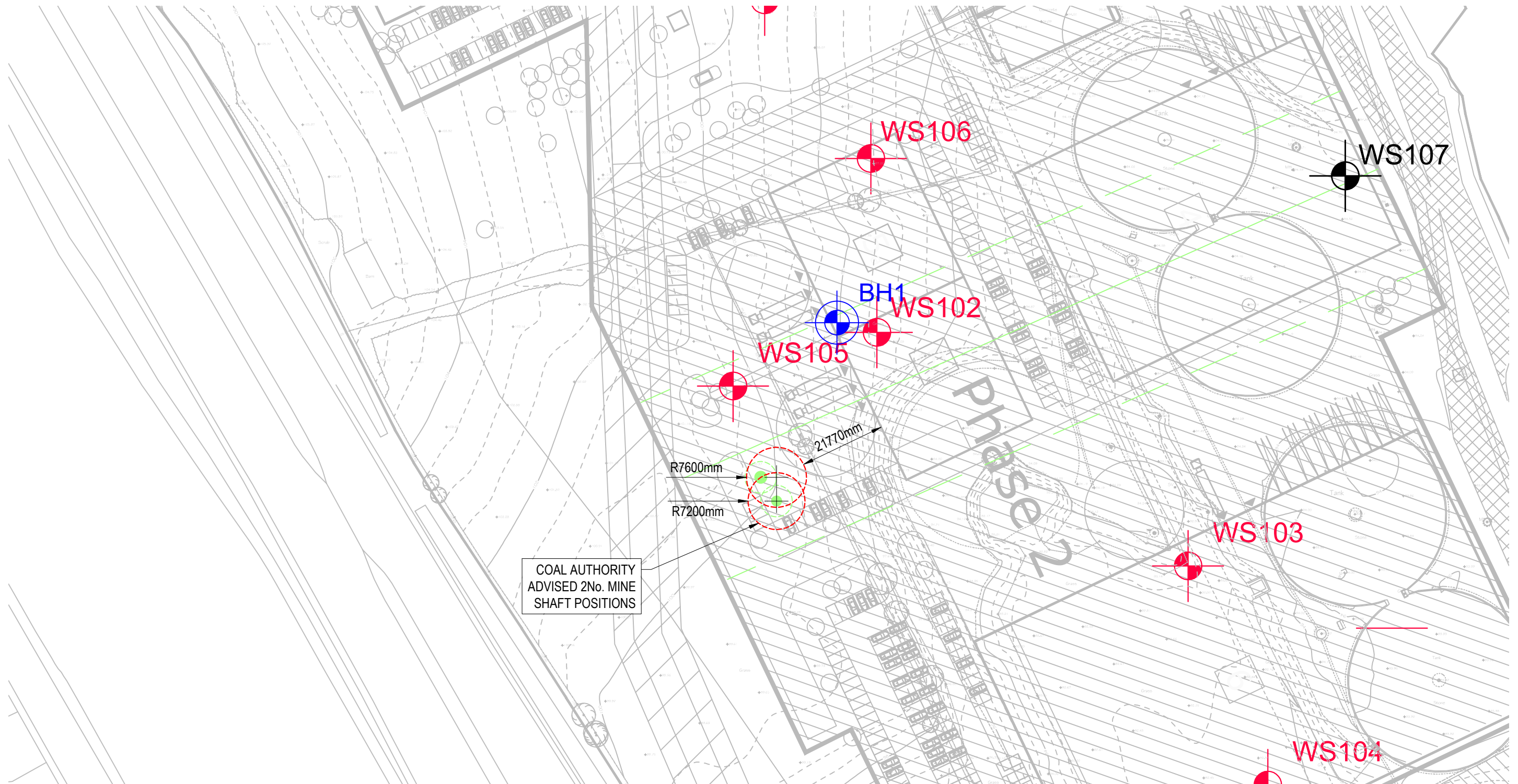
Date:	Drawn By:	Designed By:	C
-------	-----------	--------------	---

	01/11/2019		
70		MB	MB

Originator:	Volume:	Level:	Type:	Role:	Category / Number
-------------	---------	--------	-------	-------	-------------------

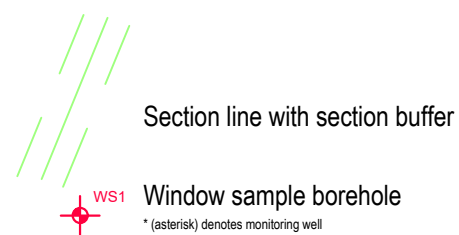
6 - CUR - 00 - XX - DR -GE- 001

m22\Projects\055645_FRA_Addendum N\Blairey_WWTP\QMS 4 Production\48_Models & Drawings_Environmental_ZCAD



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:

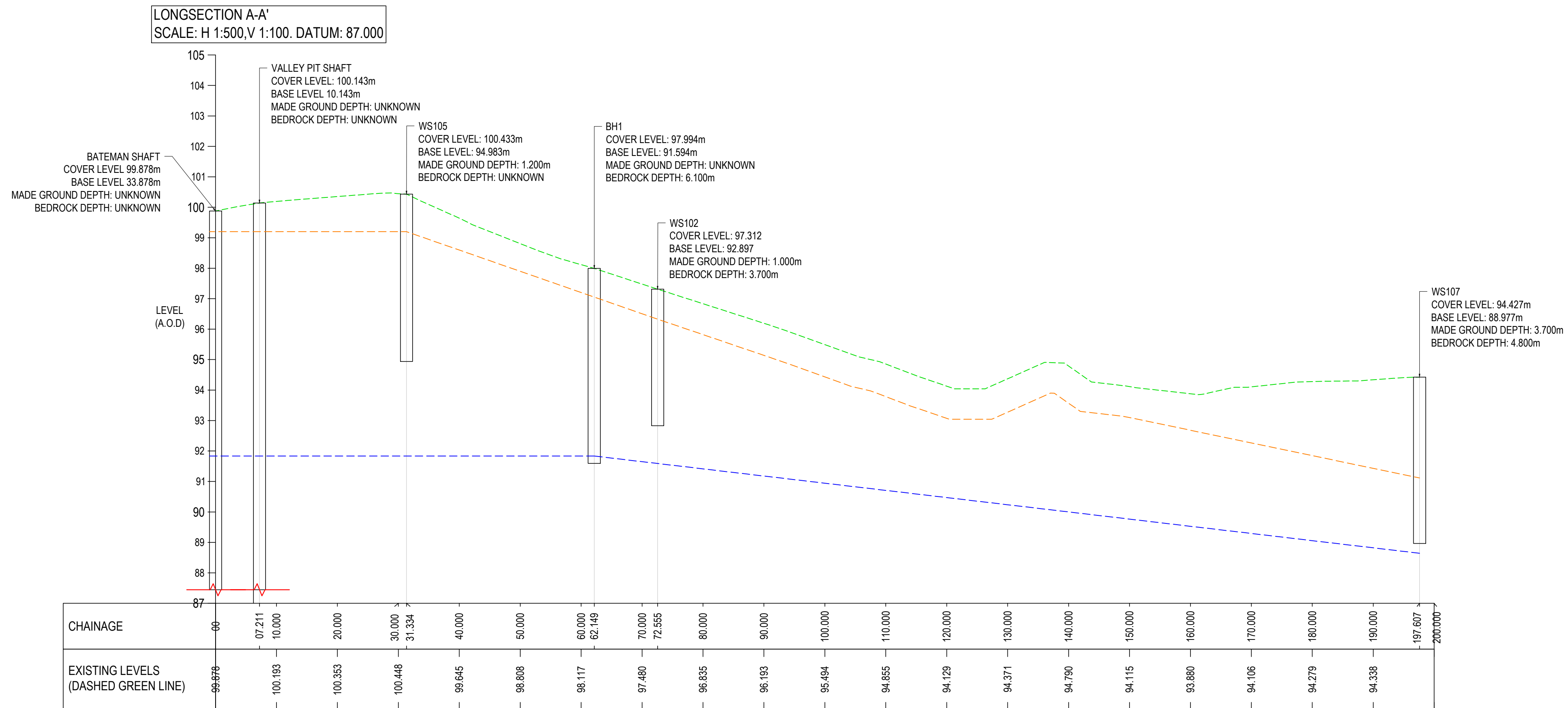
V01	FIRST ISSUE	05/11/19	GL	MB
Rev:	Description:	Date:	By:	Chkd:

GENERAL NOTES:

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

KEY:

- - - - - EXISTING GROUND LEVEL
 - - - - - ASSUMED MADE GROUND LEVEL
 - - - - - ASSUMED BEDROCK LEVEL



V01	FIRST ISSUE	04/11/19	AJR	MB
Rev:	Description:	Date:	By:	Chkd:



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

Status: **SUITABLE FOR INFORMATION** **S2**

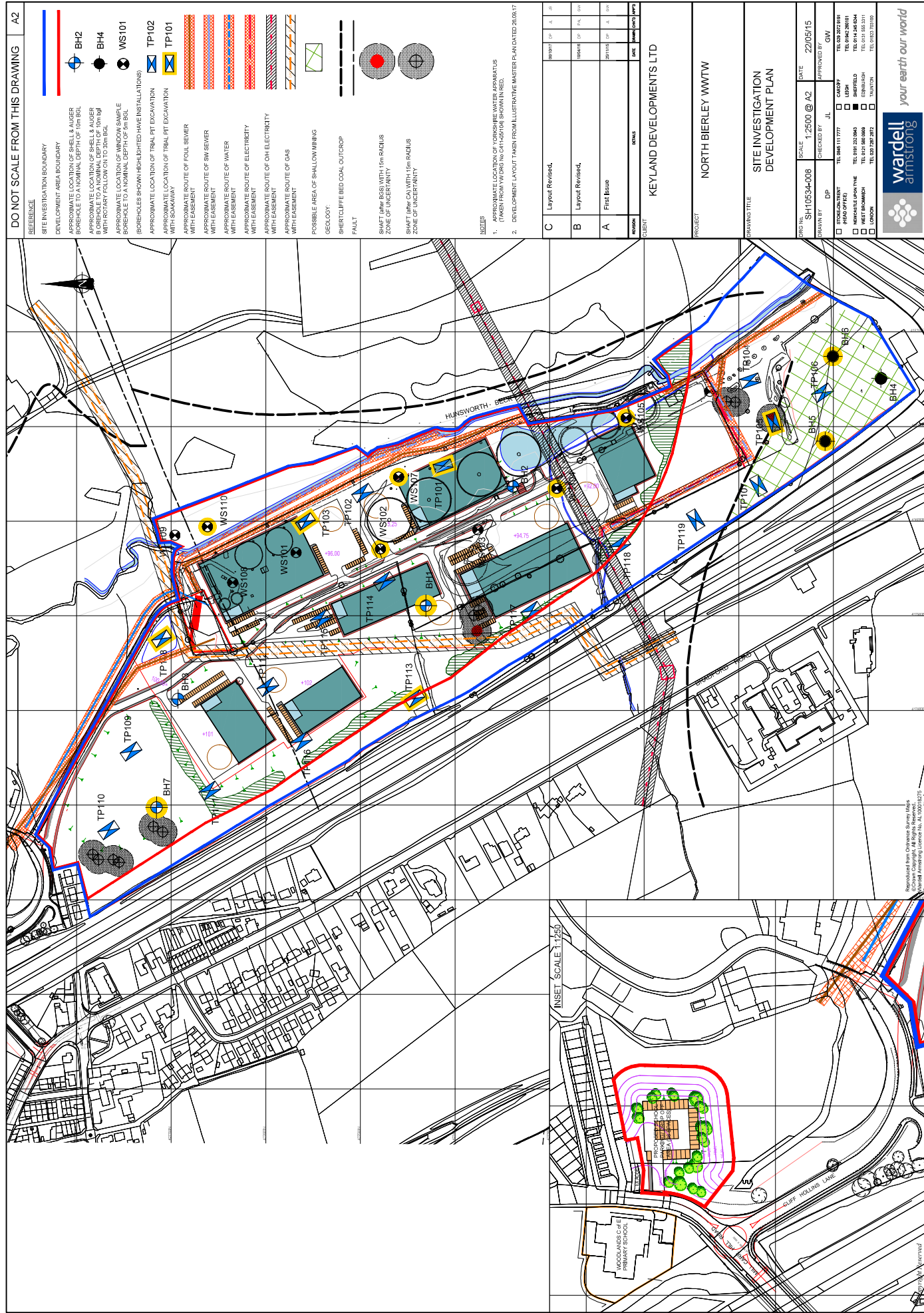
Project: NORTH BIERLEY

Drig Title:

MINING GROUND
PROFILE VIEW

Size:	Date:	Drawn By:	Designed By:	Checked By:			
A1	04/11/19	AJR	MB	MB			
Scale: 1:500							
Project No:	Originator:	Volume:	Level:	Type:	Role:	Category / Number:	Rev:

065646 - CUR - 00 - XX - DR -GE- 005 - V01



Appendix B

- BGS Borehole Record
- Wardell Armstrong BH01
- Curtins WS105

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	Field Records	
					Depth	Sample Type No. Test	
Soft to firm silty CLAY with some rootlets. (TOPSOIL)		98.95 98.60		(0.35) 0.35	0.35 0.50	D 1 D 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	U 3 D 4 D 5	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).					2.00 - 2.45 2.50 2.75	U 6 D 7 D 8	89 blows 0.40m recovery
Below 3.10m, with much gravel.		96.05		2.90 (0.80)	3.00 - 3.10 3.10 - 3.55 3.10 - 3.60	D 9 D 10 B 10	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)	3.70	D 11	
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)	4.10 4.20 - 4.65 4.70 4.95	D 12 U 13 D 14 D 15	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)	6.00	D 18	
		92.45		6.50	6.20 - 6.50 6.50	U 19 D 20	Poor penetration after 150 blows 0.25m recovery
					7.00 7.20 - 7.65 7.20 - 7.70	D 21 D 22 B 23	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)	8.00 8.20 - 8.65 8.20 - 8.70	D 24 D 25 B 26	S M-31 5,6/7,7,8,9
					9.00 9.20 - 9.65 9.20 - 9.70	D 27 D 28 B 29	S M-32 7,5/6,8,9,9
					10.00	B 30	

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.

 Soil Mechanics		BOREHOLE No. 44	
British Geological Survey		British Geological Survey	
British Geological Survey		Sheet 2 of 4	
Equipment & Methods		Location No. 7808	
As sheet 1		Location	
		M62 (EAST)/M606 LINK ROADS	
Carried out for		Ground Level	
Department of Transport		Coordinates	
		As sheet 1	
		Date	
Description		Samples/Tests	
Reduced Level		Depth (Thick)	
		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.		150 blows	
88.25			
87.85			
87.15			
86.55			
84.45			
83.15			
80.60			
SANDSTONE (As sheet 3)			
Vertical fracture			
Intersecting subvertical and vertical fractures.			
Remarks		Logged by	
2. Backfilled with grout on completion.		AJQ	
Notes:		Scale	
Materials are described in accordance with Appendixes. For explanation of symbols and abbreviations see Fig. 1. (a) Soil Mechanics		1:50	
		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

British Geological Survey
DescriptionReduced
LevelBritish Geological Survey
LegendDepth
(Thick)

Drilling Records

Mechanical core log

Field Records
and
Test Results

Depth

W

TCR

SCR

RQD

If

British Geological Survey

Clay lined horizontal
fracture
Vertical fracture.
Clay lined horizontal
fracture.

British Geological Survey

Grey and light grey fine
to medium grained thinly
bedded slightly weathered
SANDSTONE, strong to very
strong, closely to medium
fractured.
Extremely closely to
closely spaced thin
laminae of dark grey
siltstone.

Very weak micaceous
sandstone.
Very weak micaceous
sandstone

British Geological Survey

(13.15)

British Geological Survey

NI
180
400
(6)

Discontinuities:

1. Subhorizontal, planar
and rough, occasional clay
lining with non
penetrative orange brown
iron staining.
2. Subvertical planar to
irregular and rough.

British Geological Survey

British Geological Survey

British Geological Survey

NI, recovered as clay
with some gravel.

British Geological Survey

Clay lined horizontal
fracture

British Geological Survey

British Geological Survey

Clay lined fracture

Clay infill on
subvertical and
horizontal fracture.

Clay lined horizontal
fractures.

Remarks

British Geological Survey

British Geological Survey

British Geological Survey

Logged by

AJQ

Scale

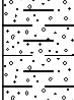
1:50

Notes:

Materials are described in accordance with Appendices. For explanation of symbols and abbreviations see Fig. 1. (c) Soil Mechanics

Fig.

Notes:

						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		



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)	5.45				5
								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.



Our Locations

Birmingham

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

Kendal

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

Bristol

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

Leeds

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

Cardiff

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

Liverpool

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

Douglas

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

London

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

Dublin

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

Manchester

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

Edinburgh

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

Nottingham

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

Glasgow

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

