



**SDL4330
NOVEMBER 2022**

**SPECIFICATION FOR THE DRILLING AND GROUTING OF SHALLOW
MINE WORKINGS**

**of land at
UNITS 3B & 3C – THE PEEL CENTRE, BARNSELY**

**prepared for
HAVERCROFT CONSTRUCTION LIMITED**

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APPENDICES

APPENDIX A FIGURES AND DRAWINGS

Drawing No.	Title	Scale
SDL4330/SP/01	Site Location Plan	1:25,000
SDL4330/SP/02	Proposed Treatment Borehole Layout Plan	1:500

1. INTRODUCTION

Sirius Drilling Ltd (Sirius) have been commissioned by Havercroft Construction Limited (HCL), the Client, to prepare a specification for the stabilisation of shallow mine workings below the extension of an existing retail unit at The Peel Centre, Barnsley, South Yorkshire.

It is understood that HCL intend to construct an extension of the existing 3B & 3C retail units including an external loading bay area with the development utilising ground bearing slabs as the foundation type.

A Ground Investigation Report was prepared for the site by Arc Environmental Limited (Arc) in 2021, which identified the presence of shallow coal and suspected shallow mineworkings below the site. Two shallow seams were identified below the site, considered to be the Two-Foot Coal (Ryston Half-Yard) and the Abdy (Winter) seams however there is the potential that the seams are the Abdy and top Beamshaw as there are local uncertainties regarding correlation.

The investigation comprised of two rotary boreholes drilled within the footprint of the proposed extension. Borehole RBH03 encountered evidence of workings at 13.00m bgl (1.00m thick), considered to represent the Two-Foot seam, and intact coal at 19.00m bgl (1.00m thick), considered to represent the Abdy seam. Borehole RBH04 encountered intact coal at 11.00m bgl (1.70m thick), considered to represent the Two-Foot seam, and intact coal at 20.50m bgl (0.70m thick), considered to represent the Abdy seam. The workings identified in the Two-Foot Coal are considered to be within influencing distance of the surface.

A plan showing the required treatment area and proposed treatment borehole layout, together with the development proposals, is enclosed in Appendix A.

Boreholes will be drilled on a primary staggered 6m x 6m grid across the development area, with the nominal zone of consolidation extending up to 3m beyond the plot line. Should mine workings be encountered, the grid will be reduced locally to form a 3m x 3m grid.

Should the foundation type vary from that proposed within the investigation then the specification and therefore treatment may require revision.

The stabilisation works will be undertaken by injecting a PFA / cement grout into the workings via the boreholes with the aim of substantially filling any mining related voiding.

The Client will supply the contractor with details of all known underground and above ground services, equipment, property etc. prior to commencing operations and will also directly mark on the surface the accurate locations of any and all services present .

All works shall be carried out in accordance with the Construction Design Management (CDM) Regulations and the Construction Phase Health and Safety Plan.

This specification is divided into two sections; the general site details including information on the site, previous investigations and their findings; the second part of this report is a general specification for the works to be undertaken.

On completion of the drill and grout programme, a validation report containing copies of borehole records, a borehole location plan, procedures followed during the works, the results of validation boreholes and pressure tests, and a record of any deviation from this specification will be produced and issued to the client and all other relevant parties.

This specification has been prepared for the sole use of Havercroft Construction Limited and their appointed agents. No other third party may rely upon or reproduce the contents of this report without the written approval of Sirius. If any unauthorised third party comes into possession of this report, they rely on it entirely at their own risk and the authors do not owe them any Duty of Care or Skill.

2. SITE DETAILS AND DESCRIPTION

Table 2.1 Site Location

Location	The site is located to the north of Dryden Road, in the southern central part of the Peel Retail Park, approximately 1km north east of Barnsley town centre.
National Grid Reference	NGR 435216, 406869
Current Site Description	The site comprises an active retail park covering an area of approximately 6.5 hectares. The treatment area is located to the south of an existing unit in what is currently concrete covered service/loading area.
Site Boundaries	West – Existing retail properties East – Existing retail properties and an undeveloped area beyond South – Dryden Road with undeveloped wooded area beyond. North – Existing retail properties

3. GEOLOGICAL SETTING

A summary of available published geological information is provided in Table 3.1 below.

Table 3.1 Geological Summary

Sources of Information	BGS 1:10,000 scale geological maps (Sheet SE30NE).
Made Ground	No made ground is recorded on the BGS plan.
Drift Geology	No superficial soils are recorded on the BGS map.
Solid Geology	Solid strata underlying the site comprise Pennine Lower Coal Measures strata, which typically consists of undifferentiated sandstones, siltstones, mudstones and coals.
Mining and Quarrying	Coal Seams: The Two Foot Coal seam is indicated to outcrop immediately to the north of the treatment area, dipping to the south east. The Abdy Coal seam is indicated to outcrop in the north of the retail park area and underlie the treatment area at 10-20m below the Two Foot Coal. The Top Beamshaw Coal seam also underlies the site approximately 10m below the Abdy Coal seam. Coal Mining: The site is noted to be in a Development High Risk Area due to the presence of probable unrecorded shallow mine working. Mine Entries: A number of recorded mine entries are present within the broader site area but none are present within or adjacent to the treatment area. Opencast Coal & Quarries: No historic quarrying activity is recorded within the site.

4. PREVIOUS INVESTIGATIONS

The site has been the subject of a Ground Investigation Report prepared by Arc Environmental Limited in 2021. The report details the findings of an intrusive investigation and geoenvironmental assessment.

Summary of Relevant Findings

Within their report, Arc state that....

“...the site was considered to be at risk from potential shallow mine workings within the Two-foot (aka Royston Half Yard) coal seam and The Adbby (aka Winter coal) coal seam, which are anticipated to be present at shallow depths below the site. Therefore, 2 no. open hole rotary boreholes have been carried out to determine the potential risks posed to this site from this geo-hazard. From the rotary boreholes carried out, evidence of coal and broken ground with complete loss of flush were recorded, ranging between c.0.70m to c.1.70m thick.

It is felt that the coal and broken ground recorded is representative of the Two-foot and The Adbby coal seams. The depths to which evidence of coal and workings (broken ground) were recorded during the investigation works can be seen in Table 2 below, together with the calculated rock cover ratio.

<u>Position</u>	<u>Depth to Coal / Workings from EGL (m)</u>	<u>Thickness of Coal / Workings (m)</u>	<u>Intact Rock Cover Ratio</u>
RBH03	13.00 (W) 19.00 (C)	1.00 1.00	10.9:1
RBH04	11.00 (C) 20.50 (C)	1.70 0.70	4.4:1

EGL=Existing Ground Level. C = Coal. W = Workings

When considering the thickness of workings (broken ground) recorded, it appears that some void migration has occurred. The overlying rock cover ratio falls below the conventionally accepted minimum rock cover ratio of 10:1, taken as “safe” conditions (CIRIA Special Publication 32 – Building over abandoned mine workings) in all rotary boreholes.

In summary, from these works completed, it can be seen that mitigation measures (i.e. further drilling and / or grouting) will be required, due to the presence of shallow workings and insufficient rock cover being present.”

5. GENERAL SPECIFICATION

5.1. Constituent Materials for Grouting

Water shall be from the mains supply or other source approved by the Resident Engineer (RE) and supplied by the Client.

Cement shall be CEMII (CEM) conforming to BS EN 197-1:2011

Pulverised Fuel Ash (PFA) complying with BS EN 12715: 2000 shall be conditioned hopper ash, or dry powder ash, or a type suitable as a constituent for grout and obtained from an approved supplier.

Sand shall generally comply with BS882 and be of a grading suitable for use in the Contractor's plant and approved by the RE.

Pea gravel shall comply with BS882, and be of grading approved by the RE.

Thixotropic admixtures shall be bentonite or another admixture approved by the RE.

5.2. Storage and Use of Materials

Storage of materials shall be such as to prevent contamination and deterioration. Cement shall be kept in a dry location, and the sequence of deliveries recorded so that cement can be used in rotation.

PFA shall be stored within a pre-defined area and if necessary will be kept dampened to mitigate against fugitive dust.

5.3. Grouting Plant

The Contractor shall submit to the RE, for approval, details of the proposed method of mixing, and pumping of grout to the injection points, together with the means of monitoring grouting pressures and the quantities injected. The materials shall be introduced into the mixer via approved volumetric methods.

The grout mixer shall be capable of producing a homogenous mix, all particles being thoroughly wetted without segregation.

5.4. Grout Mixes

With consideration to the future use of the area, the filling material shall generally consist of a PFA: cement grout which should be generally mixed in the proportions of to 12:1.

The mixes shall produce cubes with crushing strengths of not less than 1.0 MN/m² at 28 days (Note: the 7 day test is performed to indicate that the 28 day strength is achievable i.e. a 7 day value of about 0.4MN/m² would probably be considered on target).

Where excessive lateral flow of grout is anticipated or when voids greater than 500mm are encountered, sand or pea gravel may be introduced into the workings in accordance with CIRIA C758D. The specified grout mix shall have the minimum water content consistent with effective pumping.

The actual proportions to be used initially for the various grouts shall be agreed with the RE paying due regard of the conditions met in drilling and the results of any trial grouting carried out before work commences.

5.5. Grout Properties and Testing

With water / (cement and PFA) ratios generally in the range of 0.4 to 0.45, (including the moisture in the aggregates), the mixes proposed should produce pumpable grout with flowability readings of between 300 to 600mm, when measured in a meter of the “Colcrete” type.

The sample for the flowability test shall be obtained by the grouting Contractor at the point of injection i.e., from the end of the tremie pipe.

A minimum of two flowability tests per week shall be performed by the Contractor as directed by the RE.

High-bleed grouts shall be avoided. Bleed capacity should be limited to 5% maximum unless agreed otherwise with the RE.

A minimum of two bleed capacity tests shall be performed by the Contractor per shift or as directed the RE. The sample of grout for the test shall be taken from the point of injection i.e. the end of the tremie pipe.

Bleed capacity shall be measured in a clear plastic or glass graduated cylinder which has an internal diameter not less than 50mm and with a volume of approximately 1000ml. After placing the grout, a cover shall be placed over the cylinder to avoid evaporation. Bleed capacity shall be read at hourly intervals for neat cement grout, and readings should continue for not less than 3 hours. For PFA: cement grouts, readings should continue for not less than 6 hours.

The Contractor shall prepare two sets of test cubes of grout per week, or as directed by the RE. Each cube shall be of 100mm side, or as agreed with the RE, and shall be taken from the grout at the point of injection i.e. the end of the tremie pipe.

At the instruction of the RE, the Contractor shall arrange for them to be tested by crushing at 7 and 28 days in accordance with BS 12390-3:2009..

The testing shall be carried out by an independent laboratory or as agreed with the RE.

As stated previously mixes shall produce cubes with crushing strengths of not less than 1.0 MN/m² at 28 days

If the RE considers the results of the test indicate that a change of mix proportions is required, the Contractor shall make such modifications as the RE may direct.

5.6. Drilling Procedures for Treatment of Shallow Mine Workings

All boreholes to be used for the injection of grout, including those which strike coal pillars, shall be drilled by rotary or rotary percussive techniques down to a minimum of 0.5m beyond the base of the old workings in the seam or the floor of the seam itself whichever is greater. The drilling system and flushing medium to be used shall be as instructed on the Coal Authority licence, and approved by the RE. The Contractor shall allow for the provision of appropriate dust suppression for those holes that are to be drilled near sensitive receptors (e.g. nearby houses, highways, active commercial properties, car parks and public footpaths).

Treatment of the retail unit extension footprint and below the loading area will be undertaken utilising a primary staggered 6m x 6m grid, with the zone of consolidation extending up to

3m beyond the building footprint. Where workings are identified, secondary boreholes will be drilled locally to reduce the grid spacing to a localised 3m x 3m grid.

The minimum diameter of the holes shall be 75mm unless otherwise specified by the RE. When it is impracticable to drill at the minimum diameter for the full depth, the diameter of the boreholes shall be increased in the upper lengths.

Boreholes shall be temporarily cased through superficial deposits down to the rockhead and if directed by the RE, down through the rock strata. The boreholes shall be kept open until grout injection into the workings and rock is complete.

Where a borehole proves abortive because it becomes obstructed, it shall be re-drilled in a suitable location as directed by the RE, at a large diameter and re-cased.

Boreholes shall be formed in general accordance with the locations shown on the plan in Appendix A. Any deviation from this proposed layout including the drilling of test holes shall be recorded by the contractor and a revised borehole location plan provided to the RE.

During the course of the works, the RE will review the borehole records generated, and will review the potential for the presence of workings at shallow depth below rockhead elsewhere on the site.

5.7. Grouting Procedures for Shallow Mine Workings

The aim of the stabilisation work is to substantially fill any old workings within the identified seam as well as any voids or broken ground found within the overlying strata in order to mitigate the development of crown holes at the surface \ foundation level.

Perimeter grout walls, if required, shall be formed by filling boreholes with a viscous grout composed of appropriate proportions of cement, PFA, sand or pea gravel and water. The mix, proportions and method must be agreed with the RE.

Pressure need not be applied to the grout in affected boreholes unless required by the RE.

Unless specified otherwise, the section of the perimeter wall at the deepest part of the seam shall be constructed first.

Immediately prior to grouting each borehole, the Contractor shall check that it is unobstructed to the required depth to receive the tubing or tremie pipes for grout injection. Obstructions shall be dealt with as described in 'drilling procedures' above.

Grout shall be injected into each hole via an approved flexible tube with grout placed to the base of the hole.

Grouting shall proceed upwards from the base of each borehole to the base of the surface deposits. It is not intended that, as a general rule, significant quantities of grout shall be injected into the surface deposits unless specified otherwise. This requirement will be subject to RE review.

The grout shall be injected at the approved rates until grout appears near the point of injection, when the borehole shall be deemed complete. If the criteria is reached quickly, the grout tubes shall be lifted to check that a local obstruction is not preventing flow of the grout into the strata.

Hydrostatic pressure shall be applied to the grout in every borehole. If grout has not appeared at the point of injection after 5 tonnes of grouting materials have been introduced then sand and/or pea gravel (gravel which passes through a 6.33mm sieve and is retained on a 2.36mm sieve) may be added to the mix or placed down the borehole.

5.8. Stabilisation Procedures for the Treatment of Mine Shafts

Any former mine shafts encountered on site shall be stabilised in accordance with the recommendations given in the NCB handbook 'The Treatment of Disused Mine Shafts and Adits.' and CIRIA C758D.

All work on or about old mine shafts must be carried out from a safety platform of adequate dimensions that will span the potential collapse zone and support the crew and equipment should a catastrophic failure of the shaft occur.

Prior to work commencing the area will be inspected to ensure that the safe movement of heavy equipment can proceed. This will be carried out by a competent, experienced person

who will be securely fastened to the surface by means of a full body harness anchored at an appropriate safe distance away from the potential shaft collapse zone.

If any shaft is found to be open from the surface, then it shall be backfilled with graded material. Any such material will be introduced directly into the shaft from the surface utilising equipment such as a 360 excavator or conveyor.

If the shaft is backfilled then reversed stage pressure grouting of the infill material will be undertaken. Such treatment is achieved by a combination of permeation grouting and low pressure compaction grouting of the infill material which forms an enhanced bond between the infill and the shaft lining \ country rock.

Treatment will therefore be undertaken in the following manner.

A rigid steel and wooden shaft frame will be then mounted over the shaft mouth to ensure that any slumping of the shaft infill will not jeopardise the stability of the drilling rig and the safety of the crew.

Once the safety frame is in place, the drill rig will be positioned over the shaft to allow the sinking of a centrally located borehole through fill material.

Treatment will involve the drilling of a single borehole to the base of the shaft and at least three metres into natural strata, this is to ensure that no “staging” is present within the shaft and that the actual shaft base has been reached. Shaft staging would typically be encountered within the first 50m below ground within shafts although no hard or fast rules can be applied to this. Staging can be a problem if, over time, it deteriorates to such an extent that catastrophic failure of the infill material occurs

On completion of the first borehole temporary steel casing may then be inserted into the borehole. This casing forms the basis of the reversed stage pressure grouting technique.

The grouting operation will commence on completion of the borehole and will involve direct injection down the borehole under pressure through the drill rods or casing in ascending 1.5m stages.

The grout will possess water: solids ratio of no more than 0.4 giving an approximate compressive strength of 1.00 MN/m² @ 28 days.

Grout will be mixed by loading hopper conditioned PFA and bagged CEM directly into the mixer via a front loading shovel and by hand. Water supplied from the approved water source will be then be added to the mix to produce grout of the correct consistency.

The grout mixer will be capable of producing a homogenous mix, with all particles being thoroughly wetted without segregation occurring.

The grout will be mixed and injected using a 50mm diaphragm pump operating at around 100 psi and will be pumped via 50mm reinforced grout hoses into borehole. This will continue until either a maximum pressure is reached, or refusal of grout occurs. A length of casing will then be extracted, and the process repeated until the complete length of the shaft has been treated.

Should any significant thickness of permeable / granular fill be present on site, grouting may need to be terminated at the level of the base of such material.

If any significant voids are encountered during the operation, a grout \ pea gravel mix will be introduced into the borehole to restrict excessive movement of grout. However, should any major mining feature such as roadways running off the shaft are suspected these will require investigation and treating separately from the shaft.

Depending on the location of the shaft, a capping solution may be required such as a reinforced concrete cap.

Any cap will be designed by a competent structural engineer with its orientation founding depth and ultimate design agreed by the Coal Authority prior to construction. As a minimum any reinforced cap will be typically twice the shaft diameter,

5.9. Services and Roads

The Main Contractor shall take all necessary precautions, including making all reasonable liaison with the Developer, to ascertain the positions and depths of underground services

and drains passing through the site, making full allowance for working around live services and drains.

The Main Contractor shall be responsible for maintaining close liaison with the Local Authority and the Public Utility Authorities so as to avoid any disruption of the existing services.

When introducing grout into any borehole the Contractor shall ensure by regular inspections throughout the day that the grout is not entering adjacent drains, services, culverts and ducts. In the event that any such leakage is detected the Contractor shall immediately suspend the grouting operations and commence to remove any accumulated grout.

5.10. *In Situ* Testing

When directed by the RE, the Contractor shall test the consolidated ground for permeability and strength.

Permeability by grout acceptance testing shall be checked by drilling test holes in positions to be selected by the RE and injecting grout at pressures appropriate to the depth, all in accordance with the requirements for infilling grouting. If the RE considers that the quantities of grout accepted are excessive, further holes shall be drilled and grouted at the rates and prices agreed.

After testing, boreholes shall be completed in accordance with the requirements for grouting infill holes.

5.11. Records

The Contractor shall prepare and keep available for inspection on site, plans showing the positions of all boreholes, daily drilling records (see below), together with the total amounts of grout injected. Levels shall be given with reference to a datum to be confirmed by the RE.

The plans shall be updated daily in conformity with the Records noted below. On completion of the works, the Contractor shall give fair copies of the plans and sections to the RE within one week of completion of the programme of grouting.

As works proceed, the Contractor shall maintain separate daily records for drilling, for grouting and for materials and plant received in a form to be approved by the RE. The daily records signed by the Contractor's agent shall be submitted each day to the RE for his agreement. The Contractor shall provide one copy of the agreed record for the RE's retention and keep a further copy available for inspection on site.

Daily drilling records shall be provided for each borehole and contain the following information:

1. Job title and location
2. Borehole reference number
3. Date
4. Contractor's name
5. Plant in use, crew members and hours worked
6. Method of boring or drilling
7. Type, diameter and depth of casing used
8. Diameter and depth of hole at the beginning and end of each working day or shift
9. Loss of any flushing medium during drilling
10. Standing time, with reason, or time lost overcoming obstructions
11. Details of underground services located
12. Details of any settlement or ground heave
13. Daily and cumulative length drilled
14. Depth to each major change of stratum
15. Description , with identification, of the stratum and whether it is intact or broken

16. Each depth at which groundwater is encountered (if apparent), the depth to which it rose and any steps taken to stop the flow
17. Depths at which any samples are taken
18. Details and results of any permeability tests instructed by the RE
19. Details of any voids or suspected workings
20. Details of any emissions of gas, water, etc.
21. Depth of completed borehole

Daily grouting records shall be provided for each borehole and contain the following information:

1. Job title and location
2. Borehole reference number
3. Date
4. Contractor's name
5. Plant in use, crew members and hours worked
6. Details of type of injection grout-line dimensions and length of standpipes inserted
7. Type of grout mix and volumetric quantity injected including total quantity by weight by each type of grouting material introduced
8. Grout pressures recorded, with the corresponding depths
9. The results of all flow and bleed tests
10. Details of casing abandoned
11. Details of grouting materials delivered to the site and a running total of each of the materials delivered

12. The nature, frequency and results of all inspections of services to check for grout penetration

13. Details of all stoppages or delays and any other relevant information

The daily records of materials and plant received shall show in particular that day's quantities by weight of each type of material and cumulative quantities. With the daily records, the Contractor shall submit to the RE copies of receipts or invoices for all materials delivered and he shall keep them on site until the Works are complete.

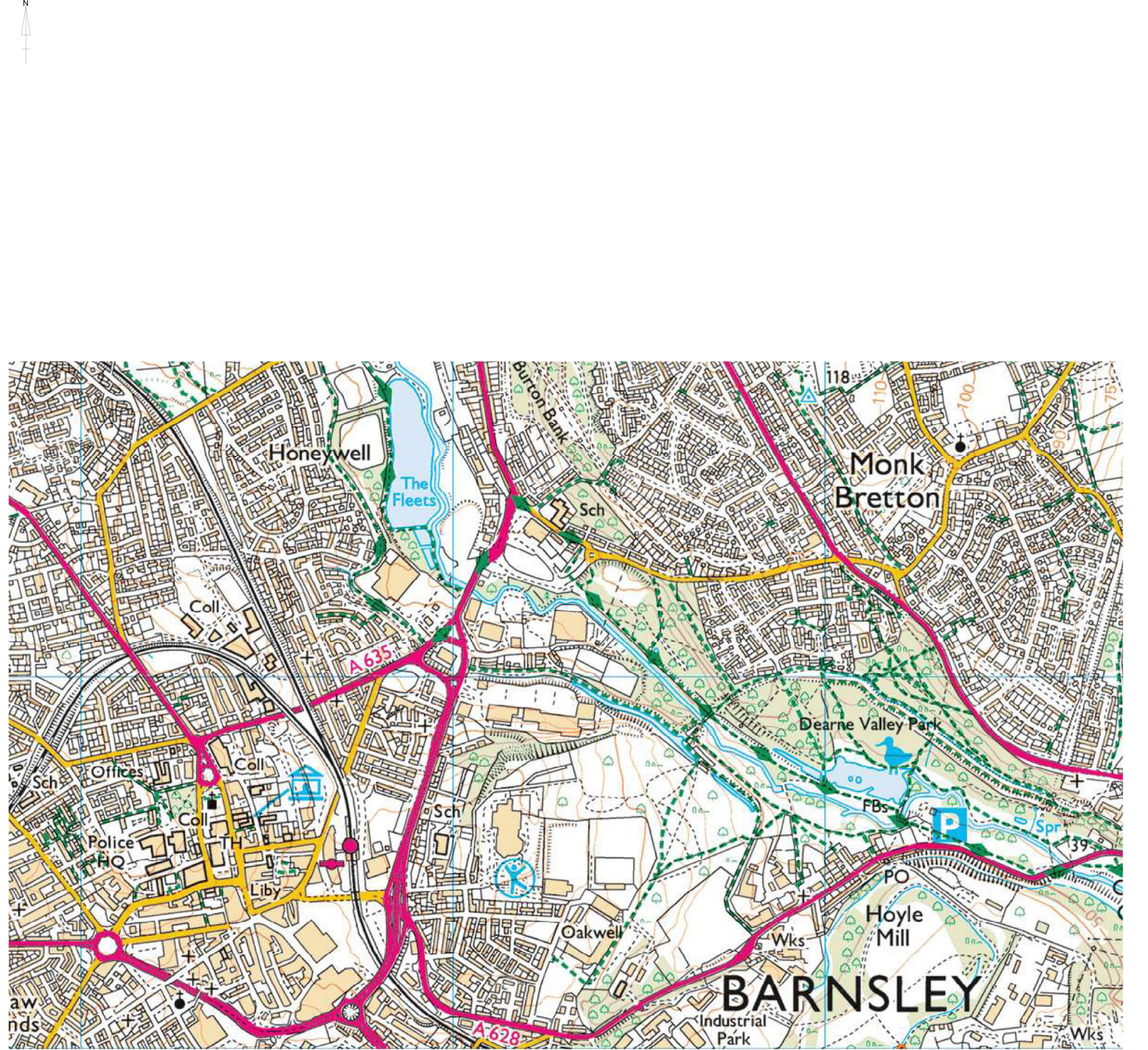
Notwithstanding the information listed above, the Contractor shall provide any other information required by the RE.

On completion of the drill and grout programme, the RE shall prepare a validation report containing copies of borehole records, a borehole location plan, procedures followed during the works, the results of validation boreholes and pressure tests, and a record of any deviation from this specification.



APPENDIX A

FIGURES AND DRAWINGS



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NOTES

 Site Location

REVISION		CLIENT HAVERCROFT CONSTRUCTION LIMITED	DRAWING NO.		REVISION NO.			
0	For information		SDL4330/SP/01		0			
A	>>							
B	>>							
C	>>							
D	>>	SITE UNITS 3B & 3C THE PEEL CENTRE BARNSELEY	DRAWN BY		APPROVED BY			
			NJI		AGT			
SIRIUS DRILLING LTD 4245 Park Approach Thorpe Park Leeds LS15 8GB www.thesiriusgroup.com TEL: 0113 2649960 FAX: 0113 2649962 		DRAWING TITLE		DATE		SCALE		A4
		SITE LOCATION PLAN		NOVEMBER 2022		1:25,000		



PLAY AND
AREA

M&S
-FOOD-

GOODS UNLOADING

Design Transport Vehicle (2016)

UNITS 3B & 3C
THE PEEL CENTRE
BARNSELY

GOODS UNLOADING

NOTES

- PRIMARY TREATMENT BOREHOLE
- SECONDARY TREATMENT BOREHOLE

REVISION	BY	DATE
0	>>	>>
A	>>	>>
B	>>	>>
C	>>	>>
D	>>	>>

SIRIUS
DRILLING LTD
4245 Park Approach,
Thorpe Park,
Leeds
LS15 8GB
www.thesiriusgroup.com
TEL: 0113 264 9960
FAX: 0113 264 9962



CLIENT

HAVERCROFT
CONSTRUCTION
LIMITED

SITE

UNITS 3B & 3C
THE PEEL CENTRE
BARNSELY

DRAWING TITLE

PROPOSED TREATMENT
BOREHOLE LAYOUT PLAN

DRAWING NO. SDL4330/SP/02		REVISION NO. 0	
DRAWN BY NJI		APPROVED BY AGT	
DATE NOVEMBER 2022	SCALE 1:250		PAPER SIZE A3