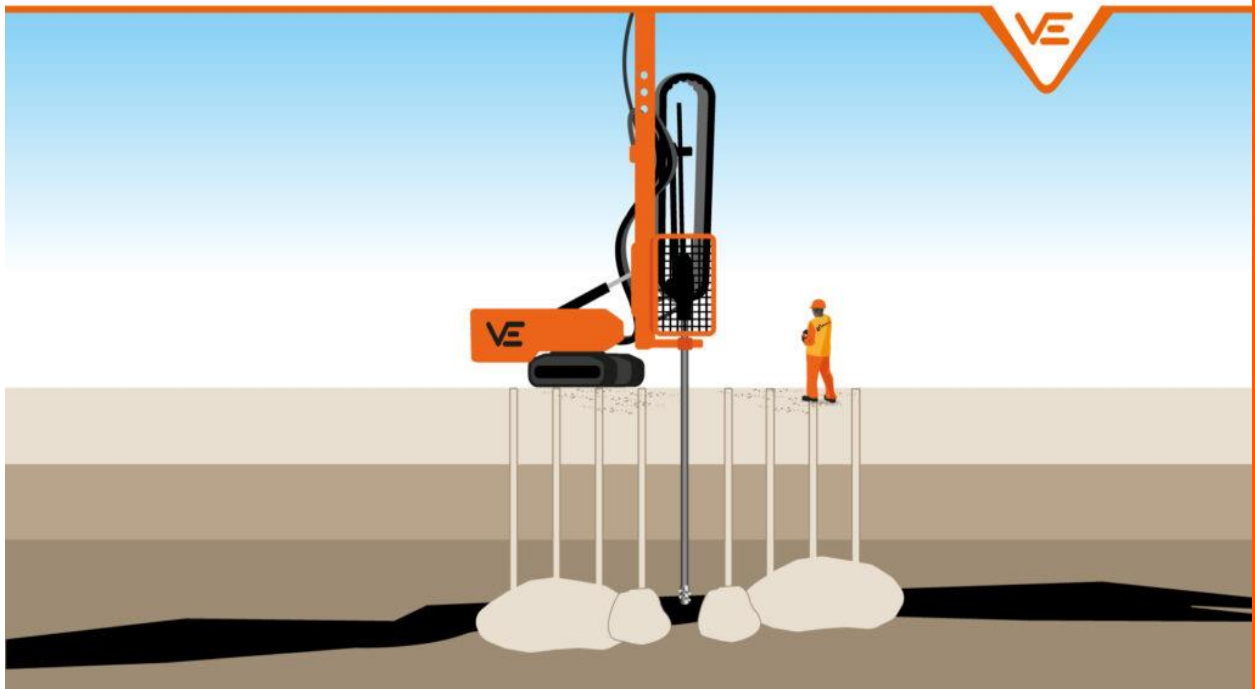


Land to North of Etihad Stadium

Specification for Consolidation of Mine Workings by Drilling and Grouting

Bulk infill drilling and grouting



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Control Sheet

This report has been prepared for the sole benefit, use and information of John Sisk & Sons Limited for the purposes set out in the instructions commissioning it. The liability of Van Elle Ltd in respect of the information contained in the report will not extend to any third party.

Prepared by	Paul Grocott BSc MIMMM FGS	Signed	Date 11/07/2023
Approved by	David Bourne	Signed	Date 11/07/2023

1.0 Introduction

John Sisk & Sons Limited (JSSL), in their capacity as Principal Contractor, has instructed Van Elle (VE) to prepare a design and specification to allow the stabilisation and consolidation of underlying Coal seams and any workings found within them only. Any geological / manmade features above the coal seams will not form part of these works.

The stabilisation of the workings / coal seams will be carried out by Drilling and Grouting, an industry wide term, used to describe the processes identified and described below.

The Drilling Grid (shown in Figure 1) shows the areas to be treated from suspected workings within the Charlotte Upper and Lower Seams.



Figure 1: 6m Borehole Grid

The Drilling and Grouting works have been designed to treat the coal seams only and not any features manmade or natural below, above or in between each seam.

1.1 Site Location and Description

The site is located off the A6020, Alan Turing Road to the east northeast of Manchester City centre the treatment area is some 10,500m² and is located to the north of the stadium where the existing club shop sits, shown in Figure 2.



Figure 2: Site plan

1.2 Ground Conditions & Geology

A check of the BGS GeoIndex online resource GeoIndex shows the site to be underlain by the “Pennine Upper Coal Measures” comprising of mudstone, siltstone, and sandstone with some bands of coal’.

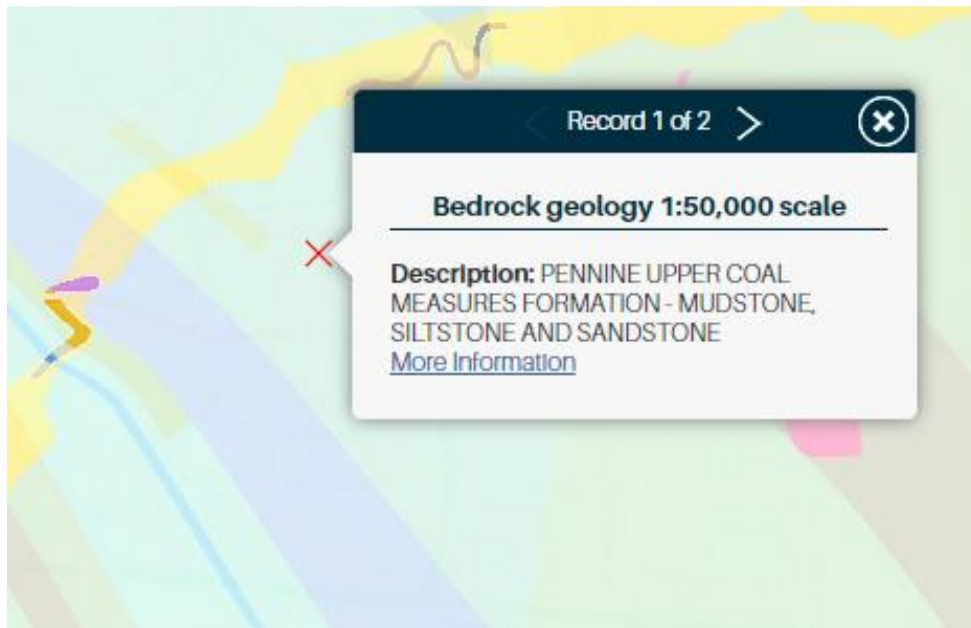


Plate 3. Showing Geological Environment

A further check of the Coal Authority Interactive viewer also revealed that the site is within a former coal mining area. It was therefore recommended that these “seams” be investigated and if found to be showing evidence of workings to be consolidating by drilling and grouting.



Plate 4 – showing former coal mining area.

1.3 Purpose of the Works

Treatment of coal seams / workings is required where less than ten times seam thickness of rock cover exists between the top of the worked seam and the base of the proposed piles/rock head.

This 10T rule is an industry adopted common practice based on information and guidance given within Section 5.3 of CIRIA Publication C758D published in 2019.

1.4 Permissions

1.4.1 Coal Authority

A permit to treat workings will be obtained from the Coal Authority. A copy of the permit shall be kept on site by the foreman.

1.4.2 Environment Agency

Any permits required by the EA must be obtained by the Client / Principal Contractor unless otherwise agreed.

1.5 Services

All services must be identified on site and shown to the Foreman and drill crew. All protection, diversion, and reinstatement of any service under CDM fall under the responsibility of the Principal Contractor and permits to work must be issued.

2.0 Specification

2.1 Design

A 6m grid has been superimposed on the whole footprint of the future development. There is a potential to reduce the grid spacing, should grout takes be high in any particular area. Boreholes are to be drilled to an average depth of 30m below existing ground level to intercept the target seam(s).

Treatment will be afforded to the **Coal Seams Only**.

There are several tension piles on site which will clash with the treatment area. Information gleaned from the tender documents does not give an accurate record of the location, depth, or orientation of said tension piles and therefore a 3m standoff in all directions will be adopted.

2.2 Supervision

A full time non-working foreman will be on site during the project, who will be responsible for ensuring the works comply with the specification. He will liaise with VE contract management staff daily.

The Foreman will be supported by a visiting Contracts Supervisor and Contracts Manager, further IT and Engineering support will be provided from back in the office and if required on site.

2.3 Drilling

Drilling will be carried out using hydraulic driven rotary percussive drill rig, advancing 101mm steel casing to rockhead. Once this casing has been socketed in at this horizon, drilling will continue down to target seam. A nominal 76mm diameter borehole into the target seam to allow grouting and consolidation. Rotary percussive drilling techniques will be used with water as the flushing medium. The rigs will be fitted with a fully interlocked guard, which will be in operation at all times that drilling is being carried out.

2.3.1 Primary Grid

A primary grid of 6m will be drilled with boreholes extending to average depth 30m bgl. If grout takes exceed 5T in any one borehole a reduced grid spacing will be drilled around this position to assist with consolidating the workings in this area.

2.3.2 Perimeter

This does not appear necessary since there is no great dip in the workings or significant voids.

2.3.3 Records

Full records shall be maintained during the works, showing job name and location, hole reference number, date, plant in use and crew members, inclination of borehole, daily and cumulative length drilled depth to each major change in stratum, description noting where

stratum is broken, details of any voids or suspected workings and depth of completed borehole.

2.3.4 Unknown Mineshafts

Should unknown mineshafts be encountered it will be necessary to probe drill the shaft to work out its diameter. The PC should then record the position via GPS and VE will inform the Coal Authority as the permit holder. The CA will amend the permit to allow treatment.

A shaft safety platform would then need to be mobilised to allow treatment. Methodology and risks will be covered in an amended set of RAMS and Specification.

2.4 Grouting

2.4.1 Materials & Mix

Grout materials shall consist of Pulverised Fuel Ash and Ordinary Portland Cement, mixed at a ratio of 10:1 with a water solids ratio of no more than 40%. No thixotropic or thickening agents will be added during agitation. OPC shall comply with BS12 and PFA shall be in accordance with BS 3892: part 2.

If open voids are encountered the introduction of pea gravel shall be used within the grout mix.

2.4.2 Equipment

Grout will be batched on site using an agitator mixer powered using an electric motor powered by a diesel generator. Constituent materials shall be introduced by a loading shovel and pumped to each treatment borehole using an electric MAPP pump and pressure head atop the steel casing. All plant shall be certified safe and maintained properly throughout the operation.

2.4.3 Water

A source of water will be provided to Van Elle from a hydrant with a standpipe.

2.4.5 Testing

4 Grout cubes shall be taken daily, whichever is the greater, and tested at 3, 7 and 28 day intervals to achieve a minimum strength of 1N/mm² after 28 days.

The foreman shall ensure that mixes are tested regularly for flow and bleed using a Colcrete type flowmeter and graduated beaker respectively. Flows should be with the range of 300-600mm and bleed should be no more than 2% by volume.

2.5 Testing

2.5.1 Test holes

Test holes will be drilled at the site to validate the works. The position of the test holes will be chosen to correspond with the areas of the site where the highest grout takes are recorded. The position of the test holes will be indicated on the Grout borehole layout plan. All test holes will be pressurised to correspond with the amount of overburden (i.e., 10kN/m of overburden) for 2 minutes. The test shall be considered a pass where not more

than 1t can be injected, and the pressure drops by no more than 10% for 2 minutes. Drill and Grout records of test holes will be kept.

2.5.2 Gas testing

A gas monitor shall be used throughout the consolidation program to monitor for the presence of three harmful gases, carbon monoxide (CO), hydrogen sulphide (H₂S) and Methane (CH₄). Levels of airborne Oxygen (O₂) will also be monitored. The gas alarms have visible and aural alarms should concentrations of any of these gases touch pre-determined trigger levels. Records of the gas monitoring shall be kept.

3.0 Reporting

A completion report will be compiled within 28 days of the works being completed. The report will include drilling records, grouting records, testing records and an as-built location plan showing the location of the boreholes and any test holes carried out. It will also summarise total length drilled, and quantities of grout materials.

4.0 References

CIRIA Special Publication C758D –Abandoned Mineworkings

ETIHAD GROUND INVESTIGATION - FACTUAL GROUND INVESTIGATION REPORT,
Geotechnical Engineering Limited (17/03/2023)

Appendix 1

Sample Drilling & Grouting Records

CON 10 R2 31/03/15



Kirkby Lane, Pinxton, Nottinghamshire NG16 6JA
Telephone: (01773) 580580 Fax: (01773) 862100
Website: www.van-elle.co.uk E-mail: info@van-elle.co.uk

Open Hole Drillers Log

[illegible]



DAILY & ACCUMULATIVE GROUTING RETURN

Job No. Client Site Address

HOLE REF.	DEPT H (M)	ANGLE/ PRESSURE	BRIEF LOG OF HOLE	QUANT OF GROUT (T)	OPC	PFA	SAND	PEA GRAVEL		CEMENT	PFA	SAND	PEA GRAVEL
									Today's Deliveries				
									Previous Deliveries				
									Total Deliveries				
									Total Used				
									Stock on Site				
										OPERATIVES ON SITE			
										REMARKS			
										I CONFIRM THIS IS A TRUE RECORD			
										VAN ELLE OPERATIVE SIGNATURE			
													
										CLIENTS SIGNATURE			
													
										DATE			
		TOTAL HOLES GROUTED TODAY	TODAY'S TOTAL GROUT										
		PREVIOUS TOTAL	PREVIOUS TOTAL										
		TOTAL TODATE	TOTAL GROUTING										