

Technical Note

Project	Newhall & Mercia Academy	Project No	14228
Subject	Mine Workings Collapse Assessment – Newhall Junior School Temporary Accommodation	Date	18 November 2024
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NEWHALL COMMUNITY JUNIOR SCHOOL TEMPORARY ACCOMMODATION – MINE WORKINGS COLLAPSE ASSESSMENT

1.0 PROJECT OVERVIEW

- 1.1 CampbellReith has been instructed by Reds 10 Modular Limited to undertake an assessment to determine the risk of subsidence due to the potential collapse of unrecorded historical coal mining workings that may affect the proposed two-storey modular structure providing temporary accommodation for Newhall Community Junior School or the safety of users of the site.
- 1.2 The assessment follows a previous assessment for the two-storey modular structure providing temporary accommodation provision for Mercia Academy as reported in technical note, 14228-CRH-XX-XX-TN-GE-0001.
- 1.3 Proposals involve construction of a two-storey modular temporary accommodation structure that will be sited part on an existing hard play area and part on a grassed sports pitch area of the Newhall & Mercia Academy site. The proposed foundation solution is a series of shallow pad foundations spaced on a grid with centre-to-centre distances varying from 3m to 4m.
- 1.4 The following information has been provided to CampbellReith and has been reviewed to inform the assessment:
- GRM Development Solutions Ltd - Ground Investigation Letter Report - September 2019 (ref. P9014/LET-1)
 - Coal Authority – Consultants Coal Mining Report – November 2022 (ref. 51003326132001)
 - Geotechnics Ltd – Desk Study Report Rev 2 - June 2023 (ref. PC238588)
 - Mott MacDonald - Coal Mining Risk Assessment Rev P02 – February 2024 (ref. SRP1104-MMD-XX-XX-T-G-0001-058CoalRiskAssessment-S1-P02)
 - Structural Soils – Draft Ground Investigation Report – June 2024 (ref. 765693-1 (01))

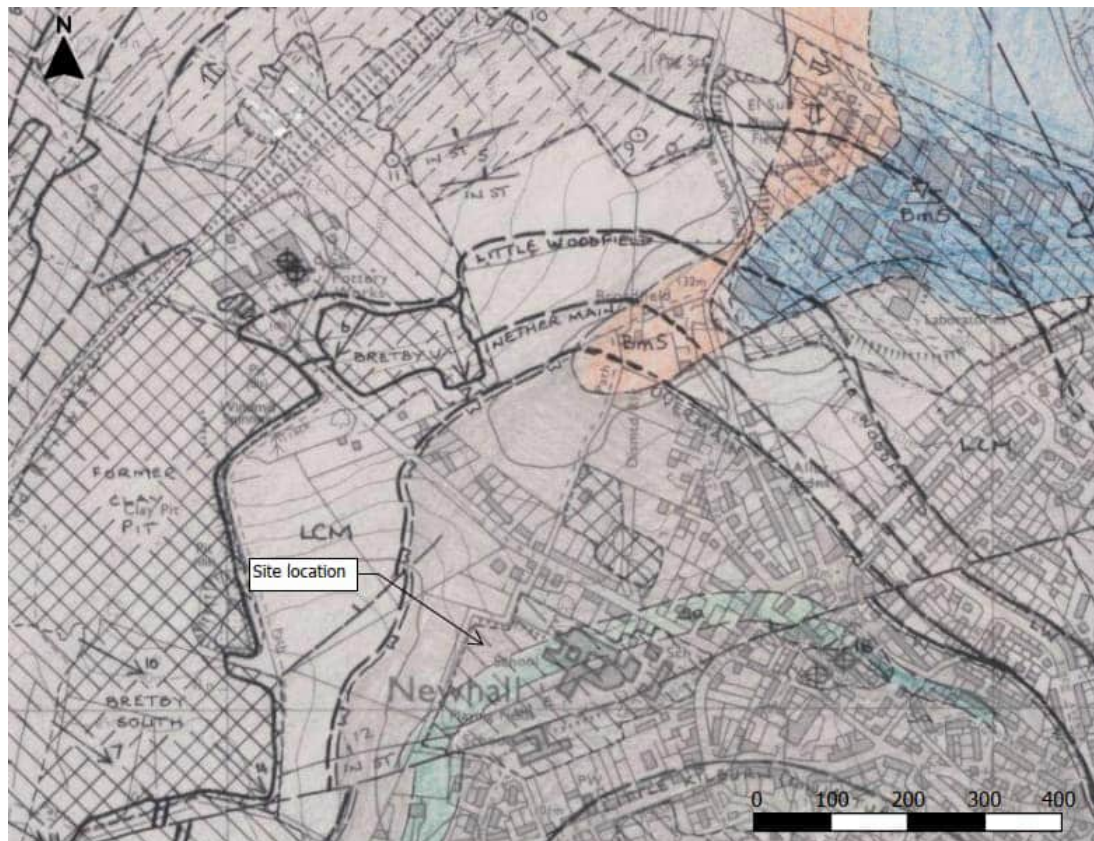
- Design ID – Foundation GA Rev P02 – September 2024
(ref. SRP1140-DID-XX-00-D-S-1001-FOUNDATION GA)
- Sense of Space – Proposed Site Plan Rev P013 – September 2024
(ref. 332 035-SOS-01-00-D-A-1001 - PROPOSED SITE PLAN)

2.0 GROUND CONDITIONS

Geology

- 2.1 The British Geological Survey (BGS) data¹ indicates that the mapped bedrock geology is the Pennine Middle Coal Measures Formation of the Carboniferous Period. Superficial deposits are not recorded within the site boundary.
- 2.2 Large deposits of Made Ground are recorded in the surrounding area associated with opencast mining. The nearest historical opencast pit is located approximately 250m to the west of the proposed temporary accommodation structure.
- 2.3 The BGS 1:10,000 mapping² shows that landscaped ground is present across the school site as shown in map extract in Figure 1.

Figure 1 BGS 1:10,000 Map Series Extract



Contains British Geological Survey materials @ NERC 2023 (Open Government Licence).

¹ BGS. (2024). GeoIndex onshore. Retrieved from <https://www.bgs.ac.uk/map-viewers/geoindex-onshore/>

² BGS (2024). Geological map sheet SK22SE. Retrieved from <https://largeimages.bgs.ac.uk/iip/mapsportal.html?id=13591833>

- 2.4 A single northeast southwest trending fault is mapped approximately 26m to the southeast of the proposed temporary accommodation structure, roughly following the alignment of the northern elevation of the existing Newhall Community Junior School building as shown on Figure A.1, Appendix A.
- 2.5 The downthrow of the fault is shown to be to the northwest. The BGS geological map indicates that the site is situated on the hinge of a syncline.
- 2.6 Based on the recorded structural geology, the bedrock dip direction and inclination may vary across the site and surrounding area. It is possible that numerous smaller faults and fractures are present within the bedrock thereby forming a potentially complex system of juxtaposed strata.

Coal Authority Records

- 2.7 The Coal Authority interactive map viewer³ shows that the site, and the wider area around Swadlincote, are located within a Development High Risk Area associated with probable shallow coal mine workings.
- 2.8 The Coal Authority Consultants Coal Mining Report for the site indicates that a number of recorded coal workings associated with the Stanhope, Bretby and Stanton collieries are present below the site. The workings targeted the Eureka, Stanhope, Stockings and Woodfield seams at depths ranging between 93m and 240m with recorded extraction thicknesses ranging from 110cm to 210cm. The recorded seams dip towards to the southeast, south and southwest with dips ranging from 3.1° to 17° (although generally the dip ranges from 5° to 12°). The recorded workings are considered to be of sufficient depth to have negligible impact on ground surface stability and therefore have not been considered further in this assessment.

Mott MacDonald Coal Mining Risk Assessment

- 2.9 The Mott MacDonald Coal Mining Risk Assessment (CMRA) considers that based on the geological dip of the strata in the surrounding area, the Main and Little Woodfield seams are likely to underlie the site. The overlying Main seam comprises three principal seams named the Nether Main, Over Main and Main Rider. All seams of the Main Group have been extensively mined throughout the coalfield. Figure 2 provides a summary of the postulated stratigraphy of the coal seams beneath the site as presented in the Mott MacDonald CMRA, based on their review of a historical borehole record from the Nadins opencast mine located approximately 250m to the southwest of the proposed temporary accommodation structure. The depth of the coal seams will of course vary throughout the site due to the dip of the strata.

³ Coal Authority. (2024). Coal Authority's interactive map viewer. Retrieved from <https://www.gov.uk/government/organisations/the-coal-authority>

Figure 2 Extract from Mott MacDonald CMRA show stratigraphy of coal seams beneath the site

Coal Seam	Depth Beneath Site (m)	Seam Thickness (m)	Within Influencing Distance	Additional Comments
Main Rider	17	0.80	YES	The seam is not mapped at outcrop and is not recorded in memoirs to have been economically exploitable in the surrounding area, however, it is known to have been present and likely worked open-cast at Nadins pit 250m southwest of site. Although it is generally of a lower quality than the underlying Over Main, should the Over Main be worked beneath site, the Rider may have been mined in conjunction due to the minimal thickness of interburden separating these seams (as little as 0.1m in places).
Over Main	18	0.8 to 2.0	YES	Seam is of economic thickness and likely within influencing distance of surface, particularly in the west of site where identified as present (BH2) and worked (BH1) by the GRM 2019 GI.
Nether Main	33*	2.70	YES	Seam is of economic thickness and likely within influencing distance of the Over Main Coal seam. GRM 2019 GI did not extend deep enough to investigate this seam.
Little Woodfield	43	0.60-1.20	NO	

Note: *: Worst case seam interburden thickness of 15m has been assumed. Workings are likely to be present within separate leaves of coal. Depths are approximate and have been estimated based on all available information. Depths provided are for use in developing a ground model of the site and should be confirmed through intrusive investigation if required.

2.10 The Mott MacDonald Coal Mining Risk Assessment concludes there is high risk from unrecorded shallow workings following industry guidance C758D⁴. As a result, an intrusive ground investigation was commissioned to quantify the risk to the development.

⁴ Parry, D. and Chiverrell, C. (2019). Abandoned mine workings manual, C758D. CIRIA: London.

3.0 INTRUSIVE GROUND INVESTIGATIONS

- 3.1 Two phases of ground investigation have been undertaken on the site between 2019 and 2024. A plan showing the location of the exploratory holes from both investigations in relation to the approximate footprints of the modular structures providing temporary accommodation provision for Mercia Academy and Newhall Community Junior School is shown in Figure A.1, Appendix 1.
- 3.2 A ground investigation was undertaken within the school site by GRM Development Solutions Ltd in August 2019 (prior to issue of the Mott MacDonald CMRA) to investigate the potential risk of shallow unrecorded workings within the Over Main seam. The investigation comprised:
- 7no. rotary boreholes to 20m bgl (BH1 – BH7)
 - 4no. windowless sample boreholes to a maximum depth of 3m bgl (BH8 – BH11)
- 3.3 The rotary boreholes were located at the northern area of the site around Mercia Academy and the grassed sports pitch. They were advanced to effective refusal using dynamic sampling techniques and followed on to their scheduled depth by rotary open-hole techniques.
- 3.4 The windowless sample boreholes were undertaken within an area of hardstanding to the east of Newhall Community Junior School and were advanced to effective refusal using dynamic sampling techniques.
- 3.5 Only boreholes BH1, BH2 and BH7 from the 2019 GRM investigation have been considered in the assessment as the other boreholes were either located outside of the assessment area or were too shallow to gather information on the coal seams underlying the site.
- 3.6 A more recent intrusive investigation, commissioned by Mott MacDonald following issue of the CMRA, was undertaken by Structural Soils between March and April 2024 to investigate the potential risk of shallow unrecorded coal workings. The investigation comprised:
- 17no. rotary boreholes to a maximum depth of 40.05m bgl (BH01-BH17)
 - 5no. hand dug inspection pits advanced to a maximum depth of 1.20m bgl
 - 3no. dynamic cone penetrometer tests in selected inspection pits.
- 3.7 Thirteen of the rotary boreholes (BH02-BH05, BH07 and BH09-16) were set out on a grid layout in the grassed sports pitch area covering the footprint of the modular structure providing temporary accommodation provision for Mercia Academy. The centre to centre spacing of the grid varies from c.25m to c.40m.
- 3.8 Boreholes BH01 and BH17 were located to the south and north of Newhall Community Junior School respectively. Boreholes BH06 and BH08 were located to the south and north of Mercia Academy respectively.
- 3.9 The hand dug inspection pits and dynamic cone penetrometer tests have not been considered in the assessment as they are too shallow to gather information on the coal seams underlying the site.

- 3.10 It is noted that the Coal Authority permit for the 2024 Structural Soils Investigation limited the depth of exploration to 40m bgl. This was anticipated by Mott MacDonald to be the depth extent to which seams/workings would be encountered according to the findings of their CRMA.
- 3.11 The ground conditions encountered in both investigations typically comprise a mantle of topsoil or Made Ground to depths of between 0.25m and 1.40m, over residual soils derived from the highly weathered bedrock below. Rockhead was generally encountered at depths ranging from 0.40m to 3.93m within the grassed sports pitch area (where the modular structures are to be located) with the bedrock typically comprising extremely weak thinly bedded to thickly laminated mudstone with subordinate siltstone and sandstone.
- 3.12 Water flush was used as the drilling medium for the 2024 Structural Soils Investigation and as such any groundwater strikes were masked. A summary of the groundwater monitoring results for the boreholes undertaken within the grassed sports pitch area is presented in Table 1.

Table 1 Summary of groundwater monitoring results

Hole ID	Base of hole (m bgl)	Monitored depth – min (m bgl)	Monitored depth – max (m bgl)
BH02	29.95	4.78	6.07
BH04	30.00	1.91	2.93
BH07	30.00	3.07	3.57
BH10	40.05	6.07	5.35
BH16	34.00	3.64	4.04

- 3.13 The results show that groundwater levels varied during the monitoring period (March to June 2024) from 1.91m to 6.07m bgl with the groundwater level lying below the rockhead level in all boreholes.
- 3.14 Coal seams were encountered between 1.60m and 39.34m bgl, ranging in thickness between 0.26m and 2.97m as summarised in Table 2. Minor coal seams/laminations have not been included in the summary table.

Table 2 Summary of coal seams positively identified in the ground investigations

Investigation	Hole ID	Methodology	Base of borehole (m bgl)	Depth of coal seam (m bgl)	Thickness of coal seam (m)
GRM 2019	BH1	Rotary open hole	20.00	13.80 – 15.00*	1.20*
	BH2	Rotary open hole	20.00	18.50 – 19.30	0.80
	BH7	Rotary open hole	20.00	-	-
Structural Soils 2024	BH01	Rotary core	39.85	23.35 – 25.60 38.95 – 39.34	2.25 0.39
	BH02	Rotary core	29.95	20.80 – 23.17	2.37
	BH03	Rotary open hole	30.00	26.50 – 28.50*	2.00*
	BH04	Rotary core	30.00	2.93 – 3.20**	0.27**

				3.70 – 4.50**	0.80**
	BH05	Rotary open hole	40.00	16.00 – 17.40*	1.40*
	BH06	Rotary core	30.00	2.70 – 3.50 3.70 – 4.20 4.50 – 4.76	0.80** 0.50** 0.26**
	BH07	Rotary core	29.90	13.20 – 16.00	2.80
	BH08	Rotary core	40.00	25.48 – 27.86	2.38
	BH09	Rotary open hole	30.00	-	-
	BH10	Rotary core	40.05	27.53 – 30.05	2.52
	BH11	Rotary core	30.00	15.60 – 18.22	2.62
	BH12	Rotary open hole	30.00	23.50 – 25.00*	1.50*
	BH13	Rotary open hole	40.00	9.40 – 10.40*	1.00*
	BH14	Rotary open hole	30.50	19.50 – 19.80	0.30
	BH15	Rotary core	40.00	24.97 – 27.40	2.43
	BH16	Rotary core	34.00	1.60 – 2.20** 29.28 – 32.25	0.60** 2.97
	BH17	Rotary open hole	30.00	21.10 – 24.00	2.90

*Intact coal not encountered – but postulated based on reported voids/loss of flush/black flush returns.

**Shallow intact coal seams are considered unlikely to have been mined by pillar and stall techniques and have not been considered in the collapse assessment.

3.15 Table 3 provides a summary of possible voiding associated with coal mine workings encountered during the intrusive investigations evidenced by recorded voids, assumed zones of core loss (AZCL) or losses of flush. A degree of interpretation has been made to discount losses of flush or core loss attributed to material weakness.

Table 3 Summary of evidence of possible mine workings

Investigation	Hole ID	Depth of void (m bgl)	Thickness of void (m)	Commentary
GRM 2019	BH1	13.80 – 15.00	1.20	Weak drilling/temporary flush loss
	BH2	-	-	-
	BH7	-	-	-
Structural Soils 2024	BH01	-	-	Black wood (possible mine roof prop) identified between 24.80-24.85m
	BH02	22.40 – 22.90	0.50	Wood debris in liner and AZCL
	BH03	26.50 – 28.50	2.00	Loss of flush
	BH04	-	-	-
	BH05	16.00 – 17.00 17.40 – 26.50*	1.00 9.10*	Possible coal band/void Loss of flush*
	BH06	-	-	-
	BH07	-	-	-

	BH08	26.50 – 27.60	1.10	AZCL / driller notes void
	BH09	-	-	-
	BH10	28.05 – 30.05	2.00	Void/possible workings
	BH11	15.77 – 17.45	1.68	AZCL / loss of flush
	BH12	23.50 – 25.00	1.50	Loss of flush
	BH13	9.40 – 10.40 30.80 – 32.30	1.00 1.50	Loss of flush** Loss of flush
	BH14	-	-	-
	BH15	25.40 – 26.20	0.80	AZCL
	BH16	-	-	-
	BH17	-	-	-

*Loss of flush over a large depth considered to be likely associated with drilling disturbance or natural fracturing. Low flush returns recorded to the base of the hole.

**Localised loss of flush considered to be likely be associated with drilling disturbance or natural fracturing.

3.16 A geological cross section as shown in Figure A.1, Appendix 1 displaying information from both phases of ground investigation is presented in Appendix 1.

3.17 A number of the 2024 exploratory holes were sunk in close proximity to those from 2019 and some exploratory holes have therefore been omitted from the cross section to aid clarity. Boreholes have also been omitted where they plot close to other exploratory holes on the line of section. The findings of the excluded boreholes, which are listed below, show good agreement with those displayed in the cross section:

- BH1 2019
- BH2 2019
- BH7 2019
- BH05 2024
- BH08 2024
- BH09 2024
- BH10 2024
- BH12 2024
- BH13 2024

3.18 Ground levels are not presented on the logs for the GRM 2019 boreholes, as such the ground level has been estimated based on the ground level recorded in nearby borehole logs from the Structural Soils 2024 investigation.

3.19 The findings show clear evidence of a continuous coal seam, postulated to be the Over Main seam, with the top of the seam (determined by observation of intact coal or a suspected void)

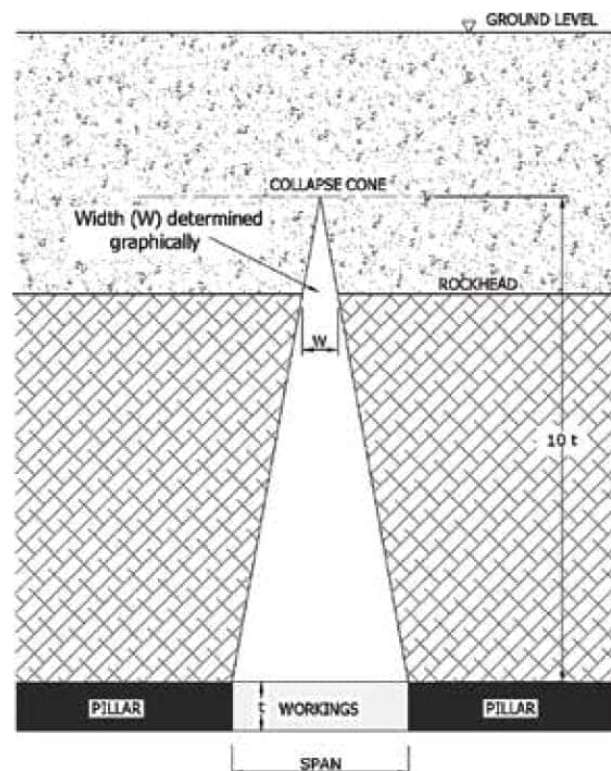
recorded to vary from 13.20m to 30.80m bgl. The direction of dip is shown to be towards the southeast of the site and the dip angle generally varying from c.9° to c.10°.

- 3.20 No evidence of the presence of the Over Main seam was encountered in BH7 2019, BH04 2024 or in BH06 2024. It is considered that these boreholes were not advanced to a sufficient depth to encounter the Over Main seam.
- 3.21 The findings of the ground investigation indicate that the fault passes between BH06 2024 and BH17 2024 (as evidenced by an observed vertical displacement in the Over Main seam) which agrees well with the mapped location of the fault.
- 3.22 The mapped location of the geological fault has been overlaid onto Section 1 in Appendix A. It should be noted that the mapped location of the fault shown in Section 1 does not fall between BH06 2024 and BH17 2024 due to the projection of the cross section.
- 3.23 It is noted that neither investigation showed clear evidence of voids being present above the Over Main seam.
- 3.24 No evidence of the Nether Main seam was encountered in either investigation. The deepest borehole, BH05 2024 was advanced to a depth of 40m (67.40mAOD). Whilst the elevation of the base of the Over Main seam is difficult to discern from the borehole log for BH05 2024 due to limited information recorded (the borehole was advanced using rotary open hole techniques), the adjacent borehole BH11 2024 proved the base of the Over Main seam at this location at 89.10mAOD. It is therefore postulated that at least 21.7m of vertical separation exists between the Over Main and Nether Main coal seams at the site location.

4.0 COLLAPSE ASSESSMENT

- 4.1 It is postulated that the unrecorded mine workings encountered in both phases of ground investigation are older coal workings undertaken prior to 1872 (after this date, there was a legal obligation for mine owners to deposit plans and record their activities with the Secretary of State). Based on the anticipated age of the mine workings, it is assumed the coal was extracted via the 'room and pillar' technique, where short headings were driven and radiated out from the base of a shaft, or transversely from an adit, with pillars of the coal left to support the roof rock above.
- 4.2 In old abandoned mine workings, most collapses result from a general deterioration within the mine. The process of deterioration within mine workings can be very slow and mine workings can remain open and intact long after their abandonment. As such, the potential for a failure to occur in older mines may increase with time. CIRIA C758D notes that "precisely when collapse might take place in the absence of stabilisation is not predictable", and therefore recommends that mine workings should be considered potentially susceptible to collapse unless measures are taken place to secure them or there is sufficient information to demonstrate they are inherently stable.
- 4.3 An assessment of the potential migration of voids caused by the collapse of the roof of mine workings has been undertaken following guidance presented in CIRIA C758D and based on an assumed conical failure mechanism. The geometry of the cone of collapse is determined by the height of the mine working, the span of the mine working and the theoretical maximum height of void migration as illustrated by Figure 3.

Figure 3 Extract from C758D showing geometry of conical collapse mechanism



- 4.4 No modifications to the methodology from CIRIA 758D have been made to account for the dip of the coal seam.
- 4.5 Based on guidance from CIRIA C758D, it is assumed that the maximum theoretical height of void migration is 10 x the height of the mine working (t). Whilst CIRIA C758D provides examples of scenarios where a lower theoretical height of void migration could be considered, based on the following factors it is considered that the industry standard relationship '10t' is suitably conservative:
- The rock cover is generally of low strength, predominantly comprising extremely weak thinly bedded to laminated MUDSTONE.
 - Reference to Bell & Mortimer (1988)⁵ found void collapse height is greater in interbedded strata than more uniform strata, potentially due to the difference of interbedded rock properties (strength, thickness, etc) facilitating delamination, bed separation and fracture.
 - Shallow groundwater conditions can redistribute fallen/collapsed materials leading to further void migration.
 - Loss of flush during drilling suggests high fracture permeability and/or potential roof rock collapse.
 - Uncertainty of information i.e. no abandonment plans or records.
- 4.6 Evidence of voiding was encountered in 11no. of the 20no. boreholes considered in the assessment. The thickness of the voids varies from 0.50m to 2.00m. The 2m voids were recorded at depths of 26.50m and 28.05m bgl in boreholes BH03 2024 and BH10 2024 respectively. Whilst coal seams up to 2.97m thick have been encountered, there is no evidence that the full seam thickness has been worked. The thickness of the mine working used in the assessment has been taken as 2.00m based on the maximum recorded thickness of voids encountered in the investigations.
- 4.7 It is considered that the presence of an intact coal seam does not preclude the possible working of that seam in the nearby vicinity, as the borehole may have been undertaken through an intact 'pillar'. Where intact coal seams have been encountered, the assessment has been undertaken based on a potential 2.00m thick mine working (with the top of the working taken as the top of the coal seam).
- 4.8 No records are available for the coal mining workings encountered in the investigations, and as such there is uncertainty on the span of the mine workings. CIRIA 758D provides guidance that the ratio of span width to worked thickness was generally around two, as such for the purposes of this assessment the span width has been taken as twice the height of the working.
- 4.9 An individual assessment has been undertaken at each borehole location within the assessment area to identify any trends across the site in the probability and size of voids

⁵ Bell, F.G., & Mortimer, B. (1992) Subsidence Due to Abandoned Mines: Risk, Evaluation and Mitigation. International Journal of Rock Mechanics and Mining Sciences & Geomechanics Abstracts, V29, P535-593.

occurring at rockhead level. The findings of the assessment are summarised in Table 4 and in Figure A.2, Appendix 1.

Table 4 Summary of findings of collapse assessment

GI	Hole ID	Depth to working (m)	Thickness of working (m)	Void width at rockhead (m)	Commentary
GRM 2019	BH1	13.80	2.0	2.0	Conservative 2m height of working considered in assessment.
	BH2	18.50	2.0	0.7	Conservative 2m height of working considered in assessment.
	BH7	No workings/seams encountered in borehole.			
Structural Soils 2024	BH01	23.35	2.0	Adequate rock cover	Thick intact coal seam present (2.25m). Conservative 2m height of working considered in assessment.
	BH02	20.80	2.0	0.3	Thick intact coal seam present (2.37m). Conservative 2m height of working considered in assessment.
	BH03	26.50	2.0	Adequate rock cover	Loss of flush recorded over 2m depth.
	BH04	No workings/seams encountered in borehole.			
	BH05	16.00	2.0	1.4	Conservative 2m height of working considered in assessment.
	BH06	No workings/seams encountered in borehole.			
	BH07	13.20	2.0	1.5	Thick intact coal seam present (2.80m). Conservative 2m height of working considered in assessment.
	BH08	26.50	2.0	Adequate rock cover	Conservative 2m height of working considered in assessment.
	BH09	No workings/seams encountered in borehole.			
	BH10	28.05	2.0	Adequate rock cover	Thick intact coal seam present (2.52m). Conservative 2m height of working considered in assessment.
	BH11	15.77	2.0	1.3	Conservative 2m height of working considered in assessment.
	BH12	23.50	2.0	Adequate rock cover	Loss of flush present over 1.50m depth range. Conservative 2m height of working considered in assessment.
	BH13	30.80	2.0	Adequate rock cover	Loss of flush present over 1.50m depth range. Conservative 2m height of working considered in assessment.
	BH14	19.50	2.0	0.6	Thin coal seam present (0.30m). Conservative 2m height of working considered in assessment.
	BH15	25.40	2.0	Adequate rock cover	Thick intact coal seam present (2.43m). Conservative 2m height of working considered in assessment.

	BH16	29.28	2.0	Adequate rock cover	Thick intact coal seam present (2.97m). Conservative 2m height of working considered in assessment.
	BH17	21.10	2.0	Adequate rock cover	Thick intact coal seam present (2.90m). Conservative 2m height of working considered in assessment.

- 4.10 The findings as displayed in Figure A.2, Appendix 1 show that that the size of voids migrating to rockhead level due to roof collapse of shallow mine workings reduces towards the southeast of the site, consistent with the direction of the dip of the Over Main Seam.
- 4.11 Two boreholes were undertaken in close proximity to the proposed location of the temporary accommodation structure for Newhall Community Junior School.
- 4.12 The footprint of the temporary accommodation structure is located approximately 26m to the northwest of the mapped location of a geological fault. Whilst there may exist a degree of uncertainty on the exact location of the geological fault, the findings of the ground investigation provide strong evidence that the proposed footprint of the temporary accommodation structure for Newhall Community Junior School is located on the downthrow side of the fault.
- 4.13 At the location of BH03 2024, undertaken approximately 2m to the north of the building footprint, the assessment indicates that adequate rock cover is present to arrest void migration.
- 4.14 At the location of BH02 2024, undertaken approximately 5m to the northwest of the building footprint, it is estimated that a 0.3m diameter void could propagate to rockhead level. As the dip direction of the Over Main Seam is towards the southeast of the site, it is conservatively assumed that the maximum diameter of void that may impact the temporary accommodation structure for Newhall Community Junior School will be 0.3m based on the findings of BH02 2024.
- 4.15 For simplicity, the void diameter has been estimated at rockhead level. Based on the Design ID Foundation General Arrangement Drawing, it is assumed that foundations have been constructed within natural ground at a depth of at least 1.50m bgl and where localised pockets of soft material were encountered these would have been excavated and replaced with C28/35 concrete (therefore the foundations may locally be deeper). The ground conditions overlying rockhead in boreholes located near the footprint of the temporary accommodation structure for Newhall Community Junior School (BH02 2024 and BH03 2024) generally comprise firm to very stiff clay. It is assumed that these soils will not contribute to arresting migration of voids, and that the diameter of the void occurring at foundation level would the same as that occurring at rockhead level.
- 4.16 The findings of this collapse assessment have been presented to the scheme structural engineer, Design ID, to allow them to assess the impact of void migration on the superstructure design, and to determine appropriate mitigation measures.

- 4.17 The Design ID Foundation General Arrangement shows that the pad foundations supporting the structure vary in size from 0.70m x 0.70m to 1.60m x 1.60m.
- 4.18 The structural design conservatively considers the total loss of a pad foundation based on the worst-case scenario of a void migrating to foundation level directly below a pad foundation, whereas this assessment indicates the maximum void diameter is much smaller at 0.3m.
- 4.19 The findings of the Design ID assessment will be presented in their own technical note (ref. SRP1140_TN01 Newhall Community Junior School - Natural Collapse).
- 4.20 Quantification and assessment of the risk of the collapse of mine workings will be included in the Design ID Designer's Risk Assessment (ref. SRP1140-DID-XX-XX-T-S-0002).
- 4.21 No clear evidence of voiding was encountered above the Over Main seam in either ground investigation undertaken at the site, although it is acknowledged that there is a possibility that void migration may have occurred between borehole locations and therefore may not have been identified.
- 4.22 Should the findings and recommended mitigation measures of the structural assessment be deemed to be unacceptable, then a potential option would be to stabilise the mine workings (e.g. by drilling and grouting). The design and execution of the stabilisation works would need to be undertaken by a reputable specialist contractor.
- 4.23 No evidence of the Nether Main seam was encountered in either investigation, as such there is insufficient information available to undertake a detailed assessment of the potential for a compound collapse of both the Nether Main and Over Main seams.
- 4.24 It has however been established that there is likely over 21.7m of vertical separation between the seams at the site location. Based on an assumed thickness of the Nether Main seam of 2.70m and assuming that the full thickness of the seam has been worked, the rock cover above the Nether Main seam is judged to be at least 8 x the thickness (t). This is sufficient rock cover to arrest voids from a rectangular or wedge collapse mechanism (based on guidance from Figure 5.4 of C758D). As such, any collapse of workings within the Nether Main would likely be associated with a conical collapse and manifest as localised voids at the base of the Over Main seam rather than a larger scale void which might be expected from a rectangular or wedge collapse mechanism. It is therefore considered that the likelihood of a compound collapse is very low.
- 4.25 In order to undertake a detailed assessment of the potential for compound collapse of both seams, further investigation would be required comprising boreholes advanced to a sufficient depth to either prove the thickness of the Nether Main seam or to establish that sufficient vertical separation exists between both seams. The most efficient location to undertake the boreholes would be to the northwest of the site where the depth to the coal seams will be the shallowest. Scoping of such an investigation is outside the scope of this report.
- 4.26 It should be noted that the assessment has been undertaken based on the findings of borehole records undertaken at discrete locations that represent only a small proportion of the ground conditions present on the site. There may be other conditions prevailing at the site which have

not been revealed and therefore have not been taken into account by the assessment. It should also be noted that the borehole records from the Structural Soils 2024 ground investigation have been presented to CampbellReith in draft format and therefore may not been through their full quality assurance process.

5.0 CONCLUSIONS

- 5.1 Unrecorded coal mining workings postulated to be associated with the Over Main seam have been identified within the general area where it is proposed to construct the temporary accommodation structure for Newhall Community Junior School. Based on the anticipated height of the mine workings and the recorded rock cover, there exists a possibility that voids caused by the collapse of the mine workings may migrate to rockhead level and may manifest as subsidence at foundation level.
- 5.2 The findings of the assessment presented in Figure A.2, Appendix A show that the risk of subsidence manifesting at foundation level reduces towards the southeast of the site based on the recorded dip of the Over Main seam. The maximum estimated void diameter within the footprint of the proposed temporary accommodation structure is 0.3m.
- 5.3 The findings of this collapse assessment have been presented to the scheme structural engineer, Design ID to allow them to assess the impact of void migration on the superstructure design, and to determine appropriate mitigation measures.
- 5.4 The structural design conservatively considers the total loss of a pad foundation based on the worst-case scenario of a void migrating to foundation level directly below a pad foundation.
- 5.5 The findings of the Design ID assessment are presented in their own technical note. Quantification and assessment of the risk of the collapse of mine workings is included in the Design ID Designer's Risk Assessment.
- 5.6 Should the findings and recommended mitigation measures of the structural assessment be deemed to be unacceptable, then a potential option would be to stabilise the mine workings (e.g. by drilling and grouting). The design and execution of the stabilisation works would need to be undertaken by a reputable specialist contractor.
- 5.7 No evidence of the Nether Main seam was encountered in either investigation, as such there is insufficient information available to undertake a detailed assessment of the potential for a compound collapse of both the Nether Main and Over Main seams. However, based on the findings of the ground investigation, the likelihood of a compound collapse is considered to be very low.
- 5.8 In order to undertake a detailed assessment of the potential for compound collapse of both seams, further investigation would be required comprising boreholes advanced to a sufficient depth to either prove the thickness of the Nether Main seam or to establish that sufficient vertical separation exists between both seams. Scoping of such an investigation is outside the scope of this report.

LIMITATIONS

Environmental & Geotechnical Interpretative Reports

1. This report provides available factual data for the site obtained only from the sources described in the text and related to the site on the basis of the location information provided by the client.
2. Where any data or information supplied by the client or other external source, including that from previous studies, has been used, it has been assumed that the information is correct. No responsibility can be accepted by CampbellReith for inaccuracies within this data or information. In relation to historical maps the accuracy of maps cannot be guaranteed and it should be recognized that different conditions on site may have existed between and subsequent to the various map surveys
3. This report is limited to those aspects of historical land use and enquiries related to environmental matters reported on and no liability is accepted for any other aspects. The opinions expressed cannot be absolute due to the limit of time and resources implicit within the agreed brief and the possibility of unrecorded previous uses of the site and adjacent land.
4. The material encountered and samples obtained during on-site investigations represent only a small proportion of the materials present on the site. There may be other conditions prevailing at the site which have not been revealed and which have therefore not been taken into account in this report. These risks can be minimised and reduced by additional investigations. If significant variations become evident, additional specialist advice should be sought to assess the implications of these few findings.
5. The generalised soil conditions described in the text are intended to convey trends in subsurface conditions. The boundaries between strata are approximate and have been developed on interpretations of the exploration locations and samples collected.
6. Water level and gas readings have been taken at times and under conditions stated on the exploration logs. It must be noted that fluctuations in the level of groundwater or gas may occur due to a variety of factors, which may differ from those prevailing at the time the measurements were taken.
7. Please note that CampbellReith cannot accept any liability for observations or opinions expressed regarding the absence or presence of asbestos or on any product or waste that may contain asbestos. We recommend that an asbestos specialist, with appropriate professional indemnity insurance, is employed directly by the client in every case where asbestos may be present on the site or within the buildings or installations. Any comments made in this report with respect to asbestos, or asbestos containing materials, are only included to assist the client with the initial appraisal of the project and should not be relied upon in any way.
8. The findings and opinions expressed are relevant to those dates of the reported site work and should not be relied upon to represent conditions at substantially later dates.
9. This report is produced solely for the benefit of the client, and no liability is accepted for any reliance placed upon it by any other party unless specifically agreed in writing.



Appendix 1

Figure A.1 – Exploratory hole location plan

Figure A.2 – Graphical summary of findings of collapse assessment

Geological Section – Section 1



Newhall & Mercia Academy
Client: Reds 10 Modular Limited

Figure A.1:
Exploratory hole location plan



Legend

GRM 2019 Ground Investigation

- Borehole

Structural Soils 2024 Ground Investigation

- Borehole

Notes:

X.Xm: Diameter of void manifesting at rockhead level displayed.

0.0m*: Adequate rock cover is present to arrest voids.

N/A: No evidence of coal seams or mine workings recorded in borehole.

Newhall & Mercia Academy

Client: Reds 10 Modular Limited

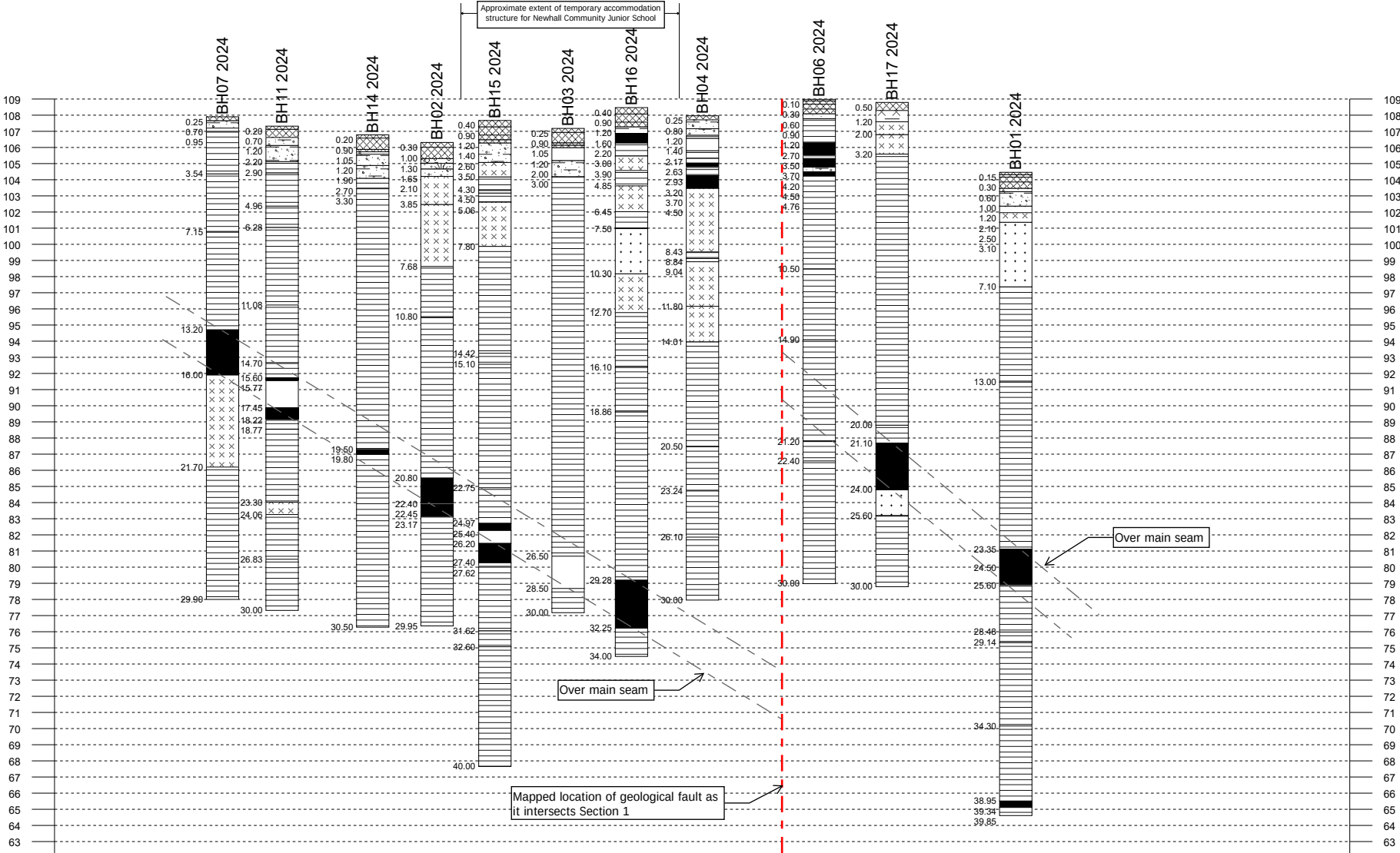
Figure A.2:
Graphical summary of findings of collapse assessment

Project Id: 14228
Project Title: Newhall & Mercia Academy
Location: South Derbyshire
Client: Reds 10 Modular Limited

Title: Section 1
Vertical Scale: 1:360
Horizontal Scale: 1:1440
Engineer: CampbellReith

Legend Key

- MADE GROUND
- Clay/Silt
- Sandy CLAY
- MUDSTONE
- Sandy gravelly CLAY
- SILTSTONE
- CLAY
- COAL
- Void
- Sandy gravelly cobbly CLAY
- Sandy gravelly organic CLAY
- SANDSTONE



Chainage (m)	0.00	4.41	80.88	36.49	41.24	52.62	58.66	71.61	88.14	91.11	98.12	106.81	124.39	153.32	171.35	201.99	204.11
Offset (m)	107.00	59.56	40.95	81.99	82.53	61.76	12.41	106.30	86.92	10.36	91.05	62.02	36.99	121.41	76.86	11.63	
Elevation (mAOD)	107.00		107.40	108.00	108.75	108.00	106.31	109.87	108.78	107.18	108.00	108.47	107.96	108.98	108.79	104.46	