Chartered Consulting Engineers

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BY EMAIL

Newlay Concrete Ltd
Thornhill Works
Calder Road
Dewsbury
WF12 9HY

Our Ref: NCL/03/WWjcl5

18th September 2024

Thornhill Works, Calder Road, Dewsbury
Ground Gas Risk Assessment

In accordance with our commission, and following issue of the ARP Geotechnical Ltd (ARP) Stage 2 Geo-environmental Report (ref: NRL/01r1, dated August 2024), we have now completed all four of the gas monitoring visits at the above site. A full set of gas monitoring results is appended, and summarised below.

Background

During the site investigation undertaken in June, three gas monitoring wells were installed in boreholes WS1, WS4 and WS6 (see location plan enclosed). Subsequent ground gas and water monitoring was undertaken by ARP Geotechnical Ltd. The well was installed to 0.8m depth in WS1 (shallow rock present), and to 2.0m depth in WS4 and WS6. The top 0.4m (WS1) and 1.0m (WS4 and WS6) fitted with plain pipe and bentonite seal, and the bottom section supplied with slotted pipe and gravel surround. All three wells were fitted with a lockable flush cover, bung and gas tap.

Monitoring Results

The ground gas investigation was undertaken in accordance with BS 8576: 2013 "Guidance on investigations for ground gas - Permanent gases and Volatile Organic Compounds (VOCs)". Ground gas risk assessment was carried out in accordance with BS 8485: 2015 + A1: 2019 "Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings".

The monitoring visits were carried out to record the levels of methane (CH_4), carbon dioxide (CO_2), oxygen (O_2), groundwater level, and borehole gas flow rate in litres/hour (l/hr) within the wells. Four visits were made over a 6 week period. The visits were made between the 25/07/2024 and 06/09/2024 during a variety of atmospheric pressures, including one visit below 1,000mb. The atmospheric pressures, on the days of the visits, ranged between 988mb and 1,014mb.

The monitoring showed maximum concentrations, of CH4 and CO2, of 0.0%, and 7.0%, respectively, along with oxygen levels of a minimum of 13.2% (all results measured in percentage by volume). There was no detectable borehole flow rate (the detection limit of 0.1l/hr is assumed where no flow was detected).

Risk Assessment

The British Standard, BS 8485: 2015 + A1: 2019, utilises the concept of borehole hazardous gas flow rates (Q_{hg}), in litres/hour (l/hr), which are obtained by multiplying flow rate by concentrations in the air stream of the particular gas being considered for each borehole. The Q_{hg} is used to derive a gas screening value (GSV), which is defined as the "flow rate of a specific hazardous gas representative of a site or zone, derived from assessment of borehole concentration and flow rate measurements and taking account of all other influencing factors, in accordance with a conceptual site model".

The table below allows the selection of the 'Characteristic Gas Situation' (CS) based on GSVs, using a numbering system of 1 to 6, where 1 equates to a very low hazard potential and 6 equates to a very high hazard potential.

A table showing the Characteristic Gas Situations is provided below: -

Characteristic Gas Situation (CS)	**Hazard Potential**	**Gas Screening Value - l/hr - (GSV)**	**Additional Factors**
1	Very Low	<0.07	Typically, <1% CH_4 and <5% CO_2, otherwise consider an increased Characteristic Gas Regime
2	Low	>0.07 to <0.7	Typical Measured Flow Rate <70 l/hr, otherwise consider an increase to CS 3
3	Moderate	>0.7 to <3.5	
4	Moderate to high	>3.5 to <15	
5	High	>15 to <70	
6	Very High	>70	

Based on Table 2 of BS 8485: 2015 + A1: 2019

A summary of the results obtained from the ground gas monitoring investigation, together with the Q_{hg} for carbon dioxide and methane, is presented in the table on the following page: -

Borehole Ref.	Max Recorded Steady Flow (l/hr)	Max. CO_2 (% v/v)	Max CH_4 (% v/v)	Max BH Qhg (CO_2)	Max BH Qhg (CH_4)
WS1	0.1	1.0	0.0	0.001	0.000
WS4	0.1	7.0	0.0	0.007	0.000
WS6	0.1	2.2	0.0	0.002	0.000
		Worst-credible Qhg (l/hr) *		0.007	0.000
		Worst-possible Qhg (l/hr) +		0.007	0.000

* Based on maximum recorded concentration and maximum flow rate applicable to any individual borehole.

+ Based on maximum recorded concentration and maximum flow rate across the whole site (any borehole).

No methane was detected and therefore, methane can be disregarded for the assessment. The maximum recorded concentration of CO_2 is 7.0% v/v. The worst credible gas regime identified on the site (based on the maximum recorded flow rate and concentration detected together within an individual borehole) is a Q_{hg} of 0.007 l/hr. This equates to a Characteristic Situation of CS1. No gas protection measures are applicable to CS1 conditions.

It is also a requirement of the British Standard to check the very worst-case combination of the highest flow and highest detected concentrations, of any borehole, with values not necessarily from the same borehole. If the worst-case conditions indicate a higher hazard could reasonably exist, then this should be adopted as the GSV, unless further monitoring or other justification is provided for it not to be used. In this case, the worst-possible Q_{hg} is 0.007 l/hr for carbon dioxide, and this still indicates that a CS of 1 is applicable for the site.

The table on the previous page also indicates that, where CO_2 concentrations above 5% are present, an increased Characteristic Gas Regime should be considered. Using the result of 7.0% v/v, the borehole flow would need to increase by an order of magnitude of over 10 times, to 1.1l/hr to reach CS2 conditions. Given that the flow rates have not varied from being undetectable at all locations on all visits (the detection limit assumed) the potential for this magnitude of increase is not considered to be significant and it is not considered necessary to increase the Characteristic Situation on this basis. Conversely, the CO_2 concentration would need to increase to 71% in order to reach CS2, a condition which is not considered realistic.

Furthermore, the elevated concentration of Carbon Dioxide (7.0% in WS4 on the final monitoring visit) is highly likely to be as a result of the drilling and grouting of mine workings that were in progress immediately south of WS4, beyond the site boundary.

Conclusions

Based on the gas monitoring undertaken, gas protection measures are not required for the proposed development.

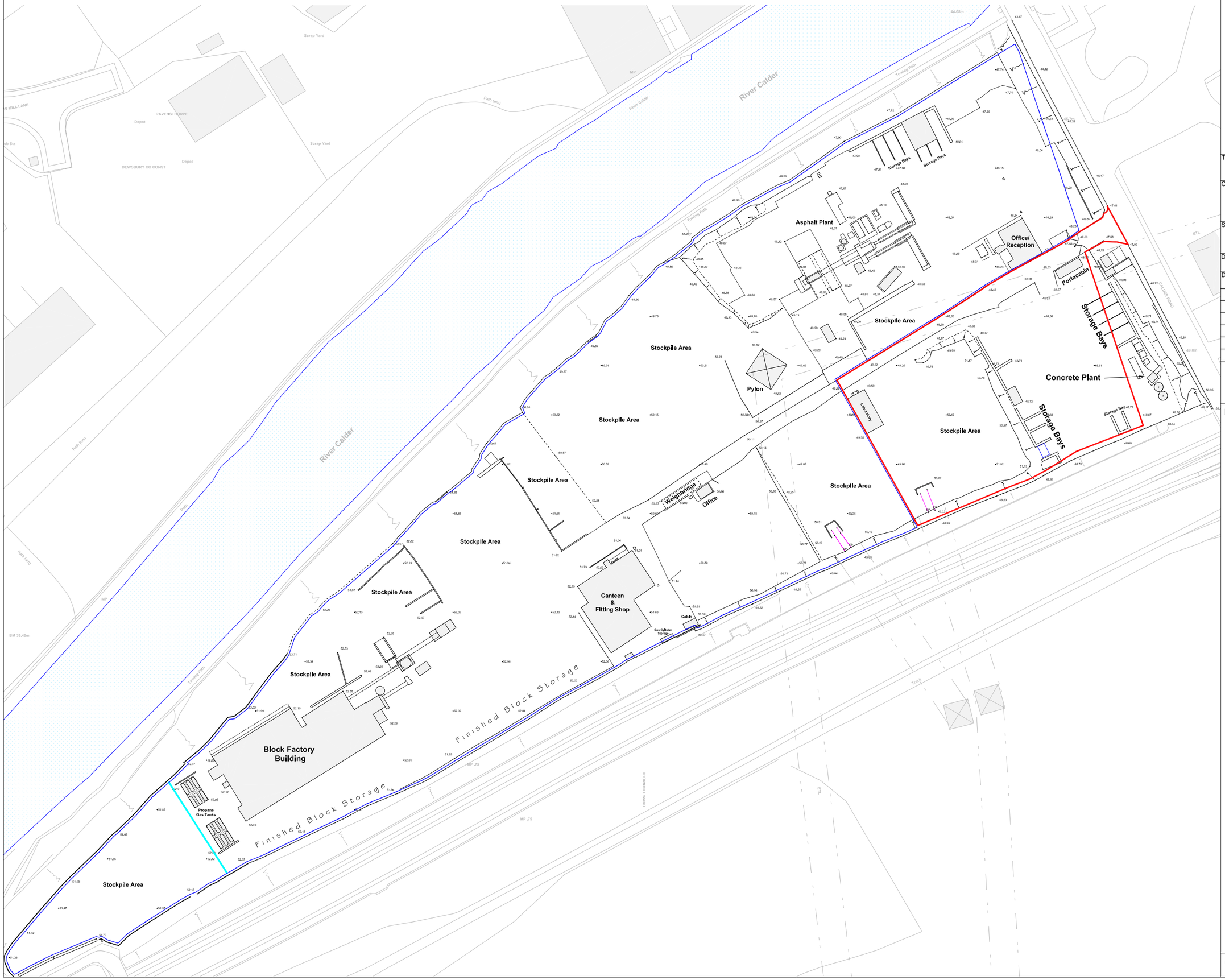
We trust the above is sufficient for your requirements. However, should you have any queries, or wish to discuss the matter further, please do not hesitate to contact us at your convenience.

Yours sincerely
for ARP GEOTECHNICAL LTD

W Watkins

Encs

APPENDIX A



MWP PLANNING

Minerals and Waste Planning
Environmental Permitting
Quarry Consultant

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TITLE

LOCATION PLAN

CLIENT

NEWLAY CONCRETE LTD
THORNHILL WORKS, CALDER ROAD
DEWSBURY

SITE

THORNHILL WORKS, CALDER ROAD
DEWSBURY WF12 9HY

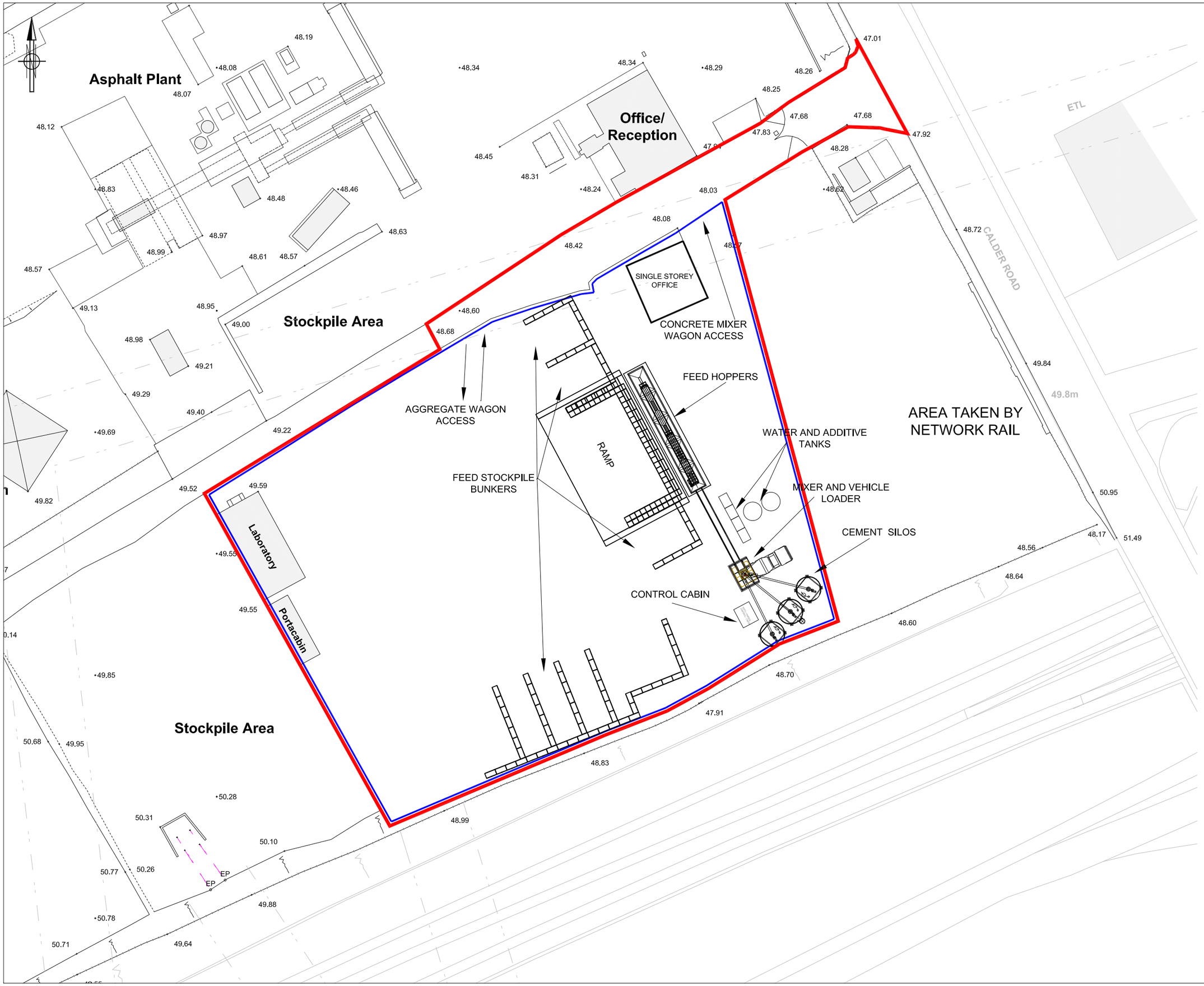
DATE	DRAWN BY	CHECKED BY
09/02/2024	CJB	CJB

DRAWING NO	SCALE
20241/01	1:1250 @ A3

REV	AMENDMENT	DATE

LEGEND

- Planning Application Boundary
- Land Under the Control of the Applicant



MWP
PLANNING

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TITLE
LAYOUT PLAN

CLIENT
NEWLAY READYMIX LTD
THORNHILL WORKS, CALDER ROAD
DEWSBURY

SITE
THORNHILL WORKS, CALDER ROAD
DEWSBURY WF12 9HY

DATE	DRAWN BY	CHECKED BY
09/02/2024	CJB	CJB

DRAWING NO	SCALE
20241/02	1:500 @ A3

REV	AMENDMENT	DATE

LEGEND

Planning Application Boundary

Concrete Pad

APPENDIX B

N

0m 20m

Approximate Scale

(I) - Monitoring Install

ARP Window Sample Locations June 2024

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS
Northwest House 5-6 Northwest Business Park Servia Hill · Leeds LS6 2QH
Telephone : 0113 245 8498 Fax : 0113 244 3864 E-Mail : leeds@arpassociates.co.uk

Project	THORNHILL WORKS CALDER ROAD DEWSBURY
Client	NEWLAY READYMIX LTD
Title	WINDOWLESS SAMPLE BOREHOLE LOCATION PLAN
Date	AUGUST 2024
Drawn	WW
Scale	AS SHOWN
Job No.	**NRL/01**

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Site	Number
Thornhill Works, Dewsbury	WS1

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Dando Terrier Window Sample Rig.			Newlay Readymix Ltd	NCL/03
	Location	**Dates** 28/06/2024	**Engineer** W.W	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
0.40-0.40	D				(0.60)	MADEGROUND: Dark brown clayey very sandy fine to coarse subangular GRAVEL of brick sandstone and limestone with low cobble content. Sand is fine to coarse. Cobbles of brick.			
0.75-0.75	D				0.60 (0.20)	Extremely weak thinly laminated light grey silty MUDSTONE.			
0.80-1.17	SPT 57*/120 18/250		25,32/18		0.80 (0.15)	Cone SPT test no recovery.			
					0.95	Complete at 0.95m			

Remarks
Borehole finished due to SPT refusal at 0.95m on mudstone.
Ground checked for services with CAT prior to drilling. No groundwater encountered.
Monitoring well installed to 0.8m - slotted from base to 0.4m, with gravel surround, plain above, with bentonite seal. Bung, tap and locking cover provided.

Scale (approx)	Logged By
1:25	W.W

Figure No.

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Site	Number
Thornhill Works, Dewsbury	WS2

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Dando Terrier Window Sample Rig.			Newlay Readymix Ltd	NCL/03
	Location	**Dates** 28/06/2024	**Engineer** W.W	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.30-0.30	D				(0.60)	MADEGROUND: Dark brown clayey very sandy fine to coarse subangular GRAVEL of brick sandstone and limestone with low cobble content. Sand is fine to coarse. Cobbles of brick.		
0.70-0.70	D				0.60 (0.15) 0.75 0.80	Firm reddish brown slightly sandy slightly gravelly CLAY. Sand is fine. Gravel is fine to coarse subangular to subrounded of sandstone and mudstone.		
						COAL.		
1.00-1.45	SPT N=43		6,9/7,6,10,20		(0.60)	Extremely weak thinly laminated light grey silty MUDSTONE.		
1.40-1.73	SPT 25*/80 50/245		22,3/50		1.40 (0.10)	Cone SPT test no recovery.		
1.50-1.50	D				1.50	Complete at 1.50m		

Remarks
Borehole finished due to SPT refusal at 1.5m on mudstone.
Ground checked for services with CAT prior to drilling.
Backfilled with arisings upon completion.
No groundwater encountered.

Scale (approx)	Logged By
1:25	W.W

Figure No.

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Site	Number
Thornhill Works, Dewsbury	WS3

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Dando Terrier Window Sample Rig.			Newlay Readymix Ltd	NCL/03
	Location	**Dates** 28/06/2024	**Engineer** W.W	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
						MADEGROUND: Dark brown clayey very sandy fine to coarse subangular GRAVEL of brick clinker sandstone and limestone with low cobble content. Sand is fine to coarse. Cobbles of brick. Ocasional ash.		
1.00-1.45	SPT N=8		3,3/2,2,2,2					
2.00-2.45	SPT N=4		2,2/1,1,1,1		(3.90)			
3.00-3.45	SPT N=17		1,1/2,3,6,6					
					3.90 (0.10)	Extremely weak thinly laminated light grey silty MUDSTONE.		
4.00-4.35	SPT 75*/50 N=0		25,50/		4.00 4.05	Cone SPT test no recovery.		
						Complete at 4.05m		

Remarks
Borehole finished due to SPT refusal at 4.05m on mudstone.
Ground checked for services with CAT prior to drilling.
Backfilled with arisings upon completion.
No groundwater encountered.

Scale (approx)	Logged By
1:25	W.W

Figure No.

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Site Thornhill Works, Dewsbury			**Number** WS4
Excavation Method Dando Terrier Window Sample Rig.	**Dimensions**	**Ground Level (mOD)**	**Client** Newlay Readymix Ltd	**Job Number** NCL/03
	Location	**Dates** 28/06/2024	**Engineer** W.W	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.20) 0.20	CONCRETE			
0.70-0.70	D				(0.90)	MADEGROUND: Dark brown clayey very sandy fine to coarse subangular GRAVEL of brick clinker sandstone and limestone with low cobble content. Sand is fine to coarse. Cobbles of brick. Ocasional ash.			
1.00-1.45	SPT N=9		3,3/3,2,2,2		1.10				
1.40-1.40	D				(0.50)	REWORKED: Firm, medium strength, brown slightly sandy slightly gravelly clay. Sand is fine. Gravel is fine to coarse subangular to subrounded of sandstone and mudstone.			
					1.60				
					(0.40)	Extremely weak thinly laminated light grey silty MUDSTONE.			
2.00-2.41	SPT 50/255		10,10/25,25		2.00 (0.18) 2.18	Cone SPT test no recovery.			
						Complete at 2.18m			

Remarks
Borehole finished due to SPT refusal at 2.18m on mudstone.
Ground checked for services with CAT prior to drilling.
Monitoring well installed to 2.0m - slotted from base to 1.0m, with gravel surround, plain above, with bentonite seal. Bung, tap and locking cover provided.
No groundwater encountered.

Scale (approx)	Logged By
1:25	W.W

Figure No.

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Site Thornhill Works, Dewsbury			**Number** WS5
Excavation Method Dando Terrier Window Sample Rig.	**Dimensions**	**Ground Level (mOD)**	**Client** Newlay Readymix Ltd	**Job Number** NCL/03
	Location	**Dates** 28/06/2024	**Engineer** W.W	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
					(0.15) 0.15	CONCRETE		
					(0.20) 0.35	MADEGROUND: Dark brown clayey very sandy fine to coarse subangular GRAVEL of brick sandstone and limestone with low cobble content. Sand is fine to coarse. Cobbles of brick.		
0.30-0.30	D				(0.25) 0.60	REWORKED: Firm, medium strength, brown slightly sandy slightly gravelly clay. Sand is fine. Gravel is fine to coarse subangular to subrounded of sandstone and mudstone.		
					(0.30) 0.90	Extremely weak thinly laminated dark grey shaley MUDSTONE with interbedded coal. Coal bands are 2-3mm thick.		
					(0.10) 1.00	Extremely weak thinly laminated light grey silty MUDSTONE.		
1.00-1.41	SPT 50/255		8,10/12,13,25		(0.33) 1.33	Cone SPT test no recovery.		
						Complete at 1.33m		

Remarks
Borehole finished due to SPT refusal at 1.33m on mudstone.
Ground checked for services with CAT prior to drilling.
Backfilled with arisings upon completion.
No groundwater encountered.

Scale (approx)	**Logged By**
1:25	W.W

Figure No.

ARP GEOTECHNICAL LTD
CHARTERED CONSULTING ENGINEERS

Site	Number
Thornhill Works, Dewsbury	WS6

Excavation Method	Dimensions	Ground Level (mOD)	Client	Job Number
Dando Terrier Window Sample Rig.			Newlay Readymix Ltd	NCL/03
	Location X=22 Y=	**Dates** 28/06/2024	**Engineer** W.W	**Sheet** 1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	Instr
					(0.20) 0.20	CONCRETE			
0.40-0.40	D				(0.80)	REWORKED: stiff brown slightly sandy slightly gravelly clay. Sand is fine. Gravel is fine to coarse subangular to subrounded of sandstone and mudstone.			
1.00-1.45	SPT N=22		3,3/4,6,6,6		1.00 (0.80)	Stiff, high strength, reddish brown slightly sandy gravelly CLAY. Sand is fine. Gravel is fine to coarse subangular to subrounded of mudstone.			
					1.80 (0.20)	Extremely weak thinly laminated light grey silty MUDSTONE.			
2.00-2.35	SPT 25*/80 50/265		20,5/50		2.00 (0.12) 2.12	Cone SPT test no recovery.			
						Complete at 2.12m			

Remarks
Borehole finished due to SPT refusal at 2.12m on mudstone.
Ground checked for services with CAT prior to drilling.
Monitoring well installed to 2.0m - slotted from base to 1.0m, with gravel surround, plain above, with bentonite seal. Bung, tap and locking cover provided.
No groundwater encountered.

Scale (approx)	Logged By
1:25	W.W

Figure No.

APPENDIX C

ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO: NCL/03 **CLIENT:** Newlay Readymix Ltd

SITE: Thornhill Works, Calder Road, Dewsbury

BH: WS1

Date	BH Flow Rate (l/hr)*	Peak CH_4 %	Qhg CH_4 (l/hr)	Peak CO_2 %	Qhg CO_2 (l/hr)	Min. O_2 %	Depth to G Water (m)	Comment
25/07/2024	0.1	0.0	0.000	1.0	0.001	13.9	Dry	Base at 0.8m
09/08/2024	N.A	N.A	N.A	N.A	N.A	N.A	N.A	Well Destroyed
21/08/2024	N.A	N.A	N.A	N.A	N.A	N.A	N.A	Well Destroyed
06/09/2024	N.A	N.A	N.A	N.A	N.A	N.A	N.A	Well Destroyed

* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO: NCL/03 **CLIENT:** Newlay Readymix Ltd

SITE: Thornhill Works, Calder Road, Dewsbury

BH: WS4

Date	BH Flow Rate (l/hr)*	Peak CH_4 %	Qhg CH_4 (l/hr)	Peak CO_2 %	Qhg CO_2 (l/hr)	Min. O_2 %	Depth to G Water (m)	Comment
25/07/2024	0.1	0.0	0.000	0.7	0.001	20.8	Dry	Base at 1.95m
09/08/2024	0.1	0.0	0.000	1.2	0.001	20.4	Dry	Base at 1.95m
21/08/2024	0.1	0.0	0.000	0.8	0.001	20.6	Dry	Base at 1.95m
06/09/2024	0.1	0.0	0.000	7.0	0.007	13.2	Dry	Nearby RBH's recently grouted.

* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007 GW>RZ: Groundwater is above response zone

ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO: NCL/03 **CLIENT:** Newlay Readymix Ltd

SITE: Thornhill Works, Calder Road, Dewsbury

BH: WS6

Date	BH Steady Flow Rate (l/hr)*	Peak CH_4 %	Qhg CH_4 (l/hr)	Peak CO_2 %	Qhg CO_2 (l/hr)	Min. O_2 %	Depth to G Water (m)	Comment
25/07/2024	0.1	0.0	0.000	0.4	0.000	19.1	Dry	Base at 1.98m
09/08/2024	0.1	0.0	0.000	1.5	0.002	19.2	Dry	Base at 1.98m
21/08/2024	0.1	0.0	0.000	0.6	0.001	19.4	Dry	Base at 1.98m

* Where no flow is detected, detection limit of 0.1l/hr should be inserted

Qhg = Hazardous gas flow rate, in accordance with BS8485:2007

ARP GEOTECHNICAL BOREHOLE MONITORING RESULTS

JOB NO. NCL/03 **CLIENT:** Newlay Readymix Ltd

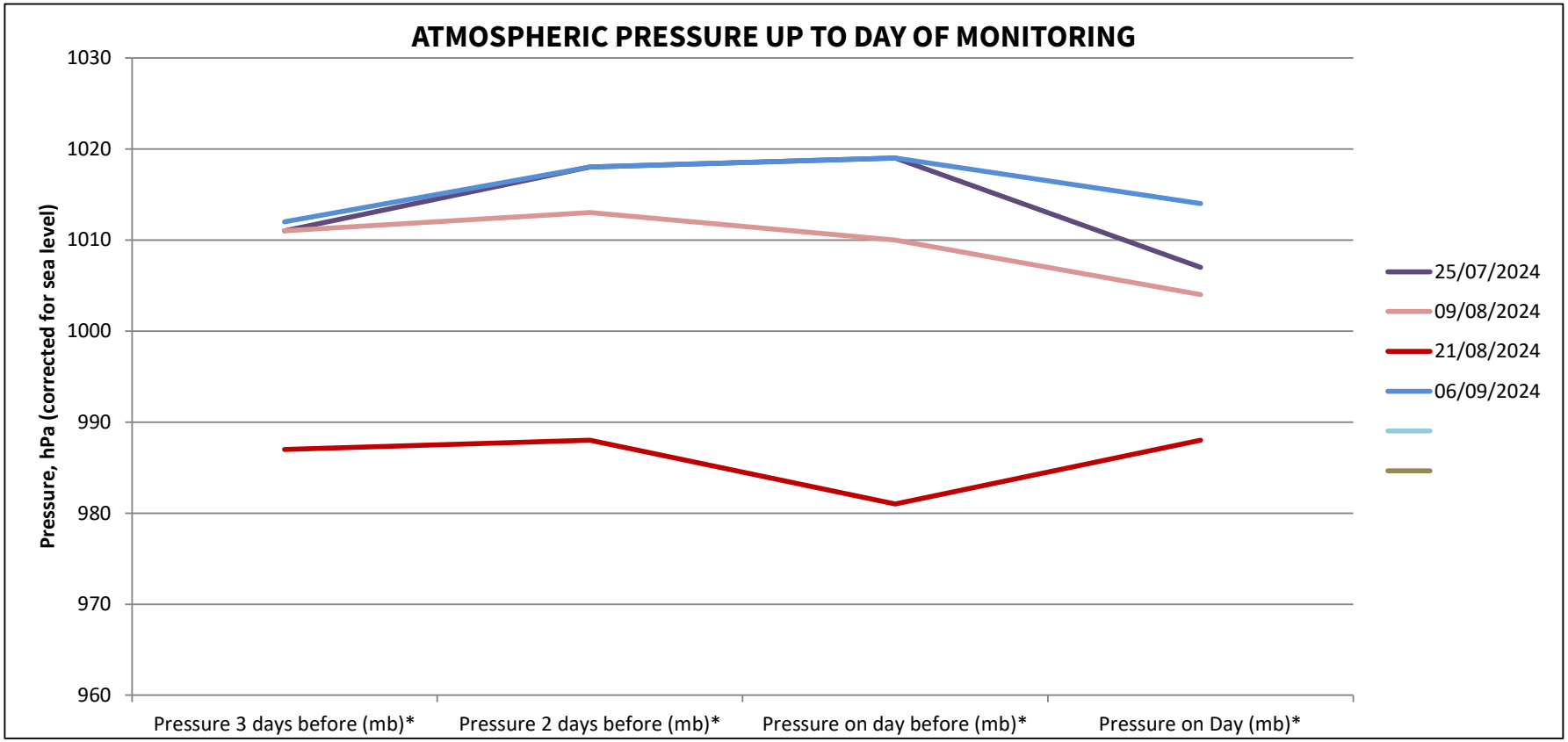
SITE: Thornhill Works, Calder Road, Dewsbury

BAROMETRIC PRESSURES

Monitor Date	Weather on Day	Pressure on Day (mb)*	Pressure on day before (mb)*	Pressure 2 days before (mb)*	Pressure 3 days before (mb)*	3 Day Trend*
25/07/2024	Overcast, 19*C	1007	1019	1018	1011	Falling
09/08/2024	Overcast 19*C	1004	1010	1013	1011	Falling
21/08/2024	Overcast 16*C	988	981	988	987	Stable
06/09/2024	Scattered clouds 19*C	1014	1019	1018	1012	Falling

*Pressures at midday (EGNM) corrected to sea level.

https://www.timeanddate.com/weather/uk/leeds/historic


ATMOSPHERIC PRESSURE UP TO DAY OF MONITORING
Pressure, hPa (corrected for sea level)
1030
1020
1010
1000
990
980
970
960
Pressure 3 days before (mb)*
Pressure 2 days before (mb)*
Pressure on day before (mb)*
Pressure on Day (mb)*
25/07/2024
09/08/2024
21/08/2024
06/09/2024

GROUND GAS SUMMARY SHEET

Borehole ref.	Max Recorded Steady Flow (l/hr)	Max. CO_2 (% v/v)	Max CH_4 (% v/v)	Max BH Qhg (CO_2)	Max BH Qhg (CH_4)
WS1	0.1	1.0	0.0	0.001	0.000
WS4	0.1	7.0	0.0	0.007	0.000
WS6	0.1	1.5	0.0	0.002	0.000

Worst-credible Qhg (l/hr) *	0.007	0.000
Worst-possible Qhg (l/hr) +	0.007	0.000

* Based on maximum recorded concentration and maximum flow rate applicable to any individual borehole.

+ Based on maximum recorded concentration and maximum flow rate across the whole site (any borehole)