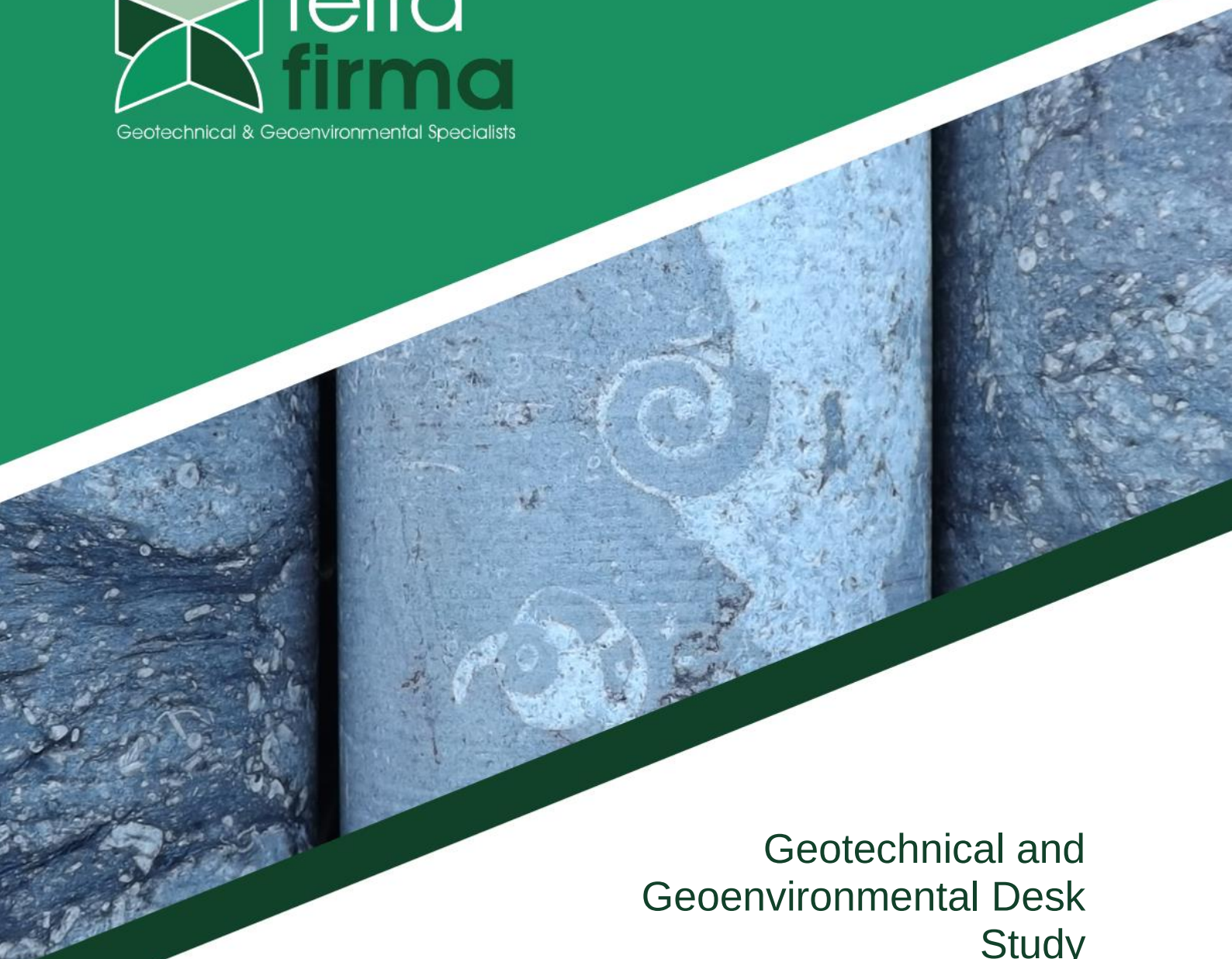




Geotechnical and Geoenvironmental Desk Study

Site: Monsall Mill, Manchester

Prepared For: Revegate Ltd

Issue Date: November 2022

Job No: 17551

REPORT TITLE : **Geotechnical and Geoenvironmental Desk Study: Proposed Commercial Development, Monsall Mill, Manchester**

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Executive Summary

Site Location and Proposed Development	Revegate Ltd (the Client) is proposing an extension to the current commercial unit off Monsall Road, Manchester. This extension comprises a three-storey structure with a storage area/garage on the ground floor and office/ further storage area on the first and second floors. The development site is square in shape and locates off Monsall Road, Manchester. The site centres on an approximate National Grid Reference of 386220, 400940, occupying a plan area of approximately 0.02 Hectares. The site is currently occupied by car park hardstanding next to several factory type buildings. The site elevation is approximately 73m AOD and is generally level.
Site History	Since the earliest map edition available, the site has been situated within the Monsall Dye Works. Structures situated on the site were no longer mapped c.1948, with further development of the Monsall Dye Works factory type buildings, now resembling present day surrounding the site. A reservoir sluice is situated 10m northeast from the site, which was then later infilled around 1948-50. A 'Clay Pit' and 'Brick Works' were situated 100m southwest from the site and was later infilled c.1930-40.
Geology	The 1:50,000 scale British Geological Map of the area (Sheet 085) was consulted for geology underlying the site. The site is shown to be underlain by the Chester Formation. Made ground is expected to a depth of 0.5-1.0mbgl across the site. Strata in the local area have a dip of 15° southwest. Using the 1:10,000 geological map and cross section, it can be seen that no coal seams are situated within close proximity to the site. The closest coal seam to the site is situated 1280m south from the site. Additionally, these coal seams dip south, and therefore do not underlie the site.
Coal Mining Risk Assessment	The Coal Authority Report states that the property is not within a surface area that could be affected by any past underground mining. In the probable unrecorded shallow workings section of the report, it is also confirmed that there are none. No spine roadways are recorded at shallow depth. The report does not record any mine entry within 100m from the site. The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining at the site. The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994. There is no current Stop Notice delaying the start of remedial works or repairs to the property. The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991. The Coal Authority has no record of a mine gas emission requiring action. Given the local geology surrounding the site, it is unlikely that any worked coal seams are situated below the site. Coal seams nearby dip away from the site (20° north), with no coal seams dipping below the site. The Coal Authority Report does not record any mine entry within 100m from the site. The overall risk to the surface stability of the site from possible unrecorded workings is considered negligible.
Radon	The Envirocheck Report (Annex A) details that no radon protective measures are required for new developments on the investigation site.

**Recommended
Site
Investigation**

It is recommended that mini percussive boreholes are sunk over the site to ascertain the strength of the underlying strata and identify a suitable founding stratum.

Contamination for a wide suite of determinants as previously reported should be undertaken.

In-situ gas monitoring stations should be installed in the bores and a programme of gas monitoring undertaken.

Should groundwater be encountered in the boreholes then groundwater testing may also be required.

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Annex A	Envirocheck Report
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Annex C	Coal Authority Report and Map

Drawings

Drawing 01	Proposed Site Layout
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SECTION 1 Introduction and Proposed Development

1.1 Introduction

Revegate Ltd (the Client) is proposing an extension to the current commercial unit off Monsall Road, Manchester. This extension comprises a three-storey structure with a storage area/garage on the ground floor and office/ further storage area on the first and second floors.

Terra Firma (Wales) Limited have been commissioned by A & S Inman (Designs) Ltd on behalf of the Client to undertake a phase 1 desk study for the site.

The main objectives of the assessment programme are to:

- Provide information on past and current uses of the site and surrounding area
- Provide information on the nature of any hazards and physical constraints, for example buried structures/obstructions
- Provide information on the likely ground conditions beneath the site, including soil types, groundwater and if made ground is likely to be present
- Identify the likely potential environmental liabilities at the site associated with any soil and groundwater contamination from past site uses
- Identify if gas emissions either from the site or surrounding areas is likely to be present
- Produce an initial site conceptual model of the site, to detail the nature and extent of potential contamination, its source, potential pathways and likely receptors (pollutant linkage)
- Prepare a human health and environmental risk assessment for the site
- Provide data to assist in the design of an intrusive site investigation and give early indications of possible remediation requirements
- Provide tentative engineering foundation and floor slab recommendations for the proposed development

In order to achieve the above objectives, Terra Firma (Wales) Limited carried out an assessment programme including a review of existing data.

1.2 Limitations and Exceptions of Investigation

The Client has requested that a Phase 1 Desk Study (DS) be undertaken to enable the outlined main objectives.

The DS was conducted, and this report has been prepared for the sole internal reliance of the Client and their design and construction team. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Terra Firma (Wales) Limited. If an unauthorised third party comes into possession of this report, they rely on it at their peril and the authors owe them no duty of care and skill. The report represents the findings and opinions of experience geoenvironmental and geotechnical consultants. Terra Firma (Wales) Limited does not provide legal advice and the advice of lawyers may be required.

1.3 Quality Assurance

The quality and environmental aspects of the assessment comply with Terra Firma Wales Ltd business management system which is UKAS Accredited to ISO 9001:2015 and ISO 14001:2015 standards.

SECTION 2 Review of Existing Data

2.1 Physical Setting and Current Site Use

The development site is square in shape and locates off Monsall Road, Manchester. The site centres on an approximate National Grid Reference of 386220, 400940, occupying a plan area of approximately 0.02 Hectares.

The site is currently occupied by car park hardstanding next to several factory type buildings.

The site elevation is approximately 73m AOD and is generally level.

The site location can be seen on **Figure 2.1** along with the proposed site layout on **Drawing 01**.



Figure 2.1 Site Location (Envirocheck, 2022)

2.2 Site History

Historical maps of the site have been obtained in an Envirocheck Report, provided by Landmark Information Group. The history plans are supplied in **Annex A** of this report, and the most relevant editions are summarised in **Table 2.1**. Distances, where quoted are approximate, and any changes in-between map editions may not be recorded.

Table 2.1 Historical Development from Map Information

Map Edition & Scale	Key Features on Site	Key Features off Site
1848 1:10,560	The site is currently occupied in part by the Monsall Dye Works. Several buildings border on the edge of the northern end of the site.	Much of the surrounding area is comprised of open agricultural land. The Monsall dye works is situated adjacent to the northeast of the site. A reservoir is situated 10m northeast from the site including several reservoir sluices. A clay pit and associated brick works is situated 100m southwest from the site.
1893 1:2,500	No significant changes have been made to the site since 1848.	No significant changes have been made within the immediate surrounding area since 1848.
1882 1:10,560	No mapping available	
1894 1:10,560	No significant changes have been made to the site since 1848.	No significant changes have been made within the immediate surrounding area since 1848.
1908 1:2,500		Several areas of excavated land are now situated 0m south from the site. The brick and tile works are no longer mapped.
1909-10 1:10,560		No significant changes have been made within the immediate surrounding area since 1908.
1923 1:10,560		
1931 1:2,500		
1932-33 1:10,560	No significant changes have been made to the site since 1931.	Several refuse heaps are situated towards the west of the site, roughly 20-40m. Excavation has taken place associated with the Moston Brook, which is culverted for 100-130m to the southwest. A terrace of houses have now been built along Monsall Rd, 15-20m south of the site. No significant changes have been made within the immediate surrounding area since 1933.
1938 1:10,560		
1948-50 1:2,500		
1951 1:2,500		
1951-88 1:2,500		
1951 1:2,500	No mapping available	
1955-69 1:2,500	No mapping available	
1956 1:10,000	No significant changes have been made to the site since 1931.	No significant changes have been made within the immediate surrounding area since 1933.
1966-68 1:10,000		
1968-87 1:2,500	No mapping available	
1972-79 1:10,000	No significant changes have been made to the site since 1931.	A school has been built 100m west from the site.
1975 1:25,000		No significant changes have been made within the immediate surrounding area since 1979.
1975 1:2,500	No mapping available	
1977-80 1:2,500	No mapping available	

1977-79 1:2,500	No significant changes have been made to the site since 1931.	No significant changes have been made within the immediate surrounding area since 1979.
1979-89 1:2,500	No mapping available	
1980-86 1:10,000	No significant changes have been made to the site since 1931.	The Moston Brook is no longer mapped and is potentially now culverted further up north of this watercourse.
1985-87 1:10,000	No mapping available	
1987 1:2,500	No mapping available	
1989 1:10,000	No mapping available	
1990-94 1:10,000	No significant changes have been made to the site since 1931.	No significant changes have been made within the immediate surrounding area since 1986.
1992 1:2,500		
1992-95 1:2,500		
1992-95 1:2,500	No mapping available	
1994-95 1:2,500	No mapping available	
1996 1:2,500	No mapping available	
1999 1:10,000	No significant changes have been made to the site since 1931.	No significant changes have been made within the immediate surrounding area since 1986.
2000 1:2,500		
2006 1:10,000		
2021 1:10,000		

2.3 Geological Setting

2.3.1 Geology

The 1:50,000 scale British Geological Map of the area (Sheet 085) was consulted for geology underlying the site. The site is shown to be underlain by the Chester Formation. Detailed stratigraphical information is provided in **Table 2.2**.

Table 2.2 Detailed Stratigraphical Information

Period	Group	Formation
Modern	/	MADE GROUND associated with the Monsall Dye Works and associate hardstanding buildings.
Holocene	/	Superficial Diamicton till comprising various layers of sandy gravelly CLAY and/or clayey sandy GRAVEL .
Triassic	Sherwood Sandstone Supergroup	Chester Formation: Sandstone, red, yellow and brown, part pebbly; conglomeratic in lower part; pebbles generally extra formational quartz and quartzite, with some intraformational clasts; subordinate red mudstone and siltstone.

Made ground is expected to a depth of 0.5-1.0mbgl across the site.

Strata in the local area have a dip of 15° southwest.

Using the 1:10,000 geological map and cross section, it can be seen that no coal seams are situated within close proximity to the site. The closest coal seam to the site is situated 1280m south from the site. These coal seams dip south, and therefore do not underlie the site.

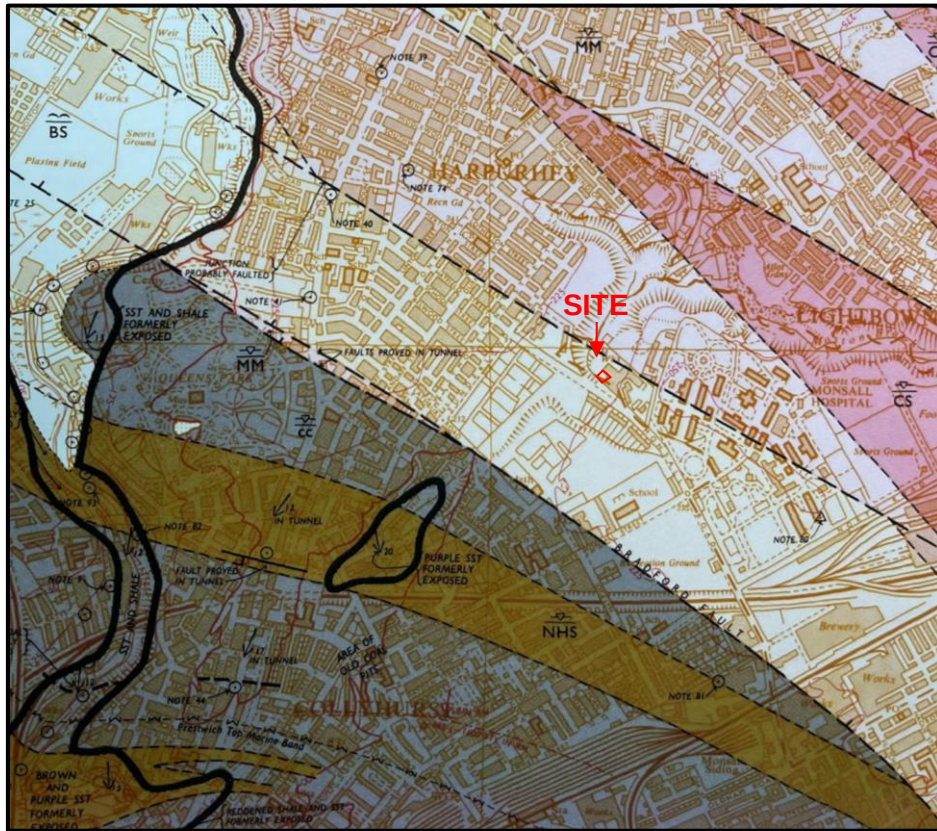


Figure 2.2 1:10,000 geological map SD80SE (Contains British Geological Survey materials © UKRI 2022)

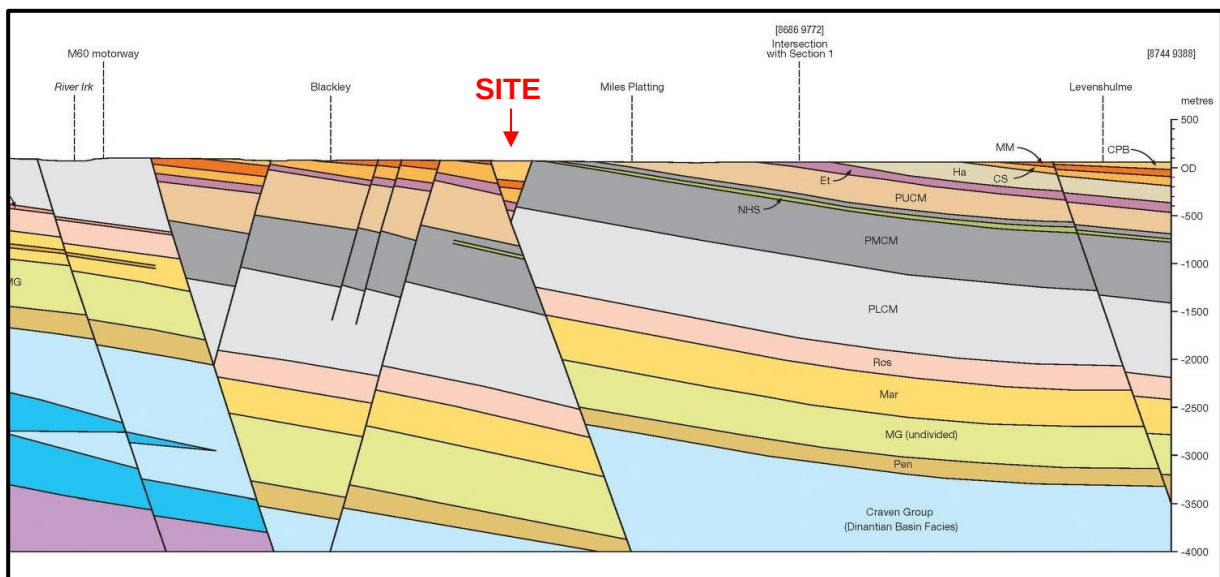


Figure 2.3 Geological cross section Sheet 85 (Contains British Geological Survey materials © UKRI 2022)

2.3.2 BGS Borehole Information

BGS borehole records SD80SE947 and SD80SE80 are situated 50m northwest and 500m southeast of the site, respectively.

Table 2.3 summarises the ground conditions from BGS borehole records SD80SE947 and SD80SE80.

Table 2.3 Summary of BGS Borehole record SD80SE947 and SD80SE80

Depth (m)			Stratum
G.L.	-	1.82	Cinder brick fill
1.82	-	3.35	Firm to stiff black silty sandy CLAY
3.35	-	4.26	Firm to stiff silty sandy CLAY
4.26	-	5.18	Stiff red very sandy stony CLAY
5.18	-	5.9	Stiff red boulder CLAY with traces of red marl
5.9	-	>9.1	Red very sandy boulder CLAY
BGS BOREHOLE SD80SE80			
9.0	-	52.7	Various stratum of sandy gravelly CLAY and SAND
52.7	-	55.7	Fine red SANDSTONE

2.3.3 Radon

The Envirocheck Report (**Annex A**) details that no radon protective measures are required for new developments on the investigation site.

2.3.4 Mining

The site situates within the North West England Coal Fields. A Consultants Coal Ming report was therefore obtained for the site.

The Coal Authority Report states that the property is not within a surface area that could be affected by any past underground mining. In the probable unrecorded shallow workings section of the report, it is also confirmed that there are none. No spine roadways are recorded at shallow depth.

The report does not record any mine entry within 100m from the site.

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining at the site.

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994. There is no current Stop Notice delaying the start of remedial works or repairs to the property. The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

The Coal Authority has no record of a mine gas emission requiring action.

Given the local geology surrounding the site, it is unlikely that any worked coal seams are situated below the site. Coal seams nearby dip away from the site (20° north), with no coal seams dipping below the site.

The Coal Authority Consultants Coal Mining Report is appended in (**Annex C**).

One BGS mineral sites are recorded in the Envirocheck Report within 250m of the site. This site is situated 180m, southwest, referring to an opencast clay and shale pit, as seen on historical map records.

2.3.5 Natural Hazards

The underlying geology is not prone to dissolution due to the significant mudstone component of the geological units and the risk of natural cavities in the bedrock is considered negligible.

The Envirocheck details the following hazard potentials for the site.

Ground Dissolution:	No Hazard
Collapsible Ground:	Very Low
Compressible Ground:	No Hazard
Landslide:	Very Low
Running Sand:	Very Low
Shrinking and Swelling Clays:	Very Low

2.4 Environmental Setting

The following sections have been compiled using the Landmark Information Group Envirocheck datasheet and maps which can be found in **Annex A**.

2.4.1 Hydrogeology

Superficial deposits beneath the site have an aquifer designation of secondary aquifer – Undifferentiated.

The bedrock deposits beneath the site have an aquifer designation of principal aquifer.

Deeper groundwater flow within the underlying bedrock will be controlled by the strata dip and any fractures or bedding planes within the rock units.

The hydraulic gradient will be at its steepest during periods of heavy rainfall and aquifer recharge.

The site does not locate within a groundwater source protection zone.

The nearest groundwater abstraction point is located 687m east, operated by Watney Mann (North) Ltd.

2.4.2 Hydrology

The nearest surface water feature locates off site 64m to the northwest and comprises an inland river within the Mersey catchment.

2.4.3 Flooding

The site is not at risk from extreme flooding from rivers or sea.

The site is not at risk from flooding from surface water.

The Envirocheck report records the site to have potential for groundwater flooding.

2.4.4 Waste

Recorded landfill sites within 250m of the site are summaries in **Table 2.3**.

Table 2.3 Landfill Sites Summary

Landfill Name	Distance/ Direction from site	Operation Dates	Deposited Wastes
Moston Brook	16m, northwest	1974-1977	Inert, Industrial, Commercial, Household, Special Waste and Liquid Sludge

There are no recorded Waste Management Facilities within a 250m radius of the site.

A discharge consent is situated 73m west, operated by United Utilities Water Limited.

2.4.5 Pollution

There are no recorded pollution incidents within a 250m radius of the site.

2.4.6 Sensitive Land Use

The site is located within a Nitrate Vulnerable Zone.

2.4.7 Estimated Urban Soil Chemistry

The BGS have published estimated urban soil chemistry concentrations locally to the site for a number of common contaminants, i.e., arsenic, cadmium, chromium, lead and nickel. All of the given determinands have anticipated concentrations that are below the recognised trigger levels for a commercial scenario.

2.4.8 Industrial Land Use

Relevant contemporary trade directory entries recorded within proximity of the site are summarised in **Table 2.6**.

Table 2.6 Relevant Contemporary Trade Summary

Company	Distance/Direction from site	Classification	Status
T & A Tyres Ltd	22m, east	Tyre Disposal	Inactive
Shafi Cars	22m, east	Car Body Repairs	Active
Monsall Motor Services	22m, east	Garage Services	Active
Junction Fence Supplies	22m, east	Fencing Manufacturers	Inactive
A & H Knitwear	23m, east	Knitwear Manufacturers and Wholesalers	Inactive
Northern Art Promotions	32m, south	Printers	Inactive
New Leaf Press Ltd	66m, southeast	Printers	Inactive
A & H Knitwear	104m, southeast	Knitwear Wholesalers and Manufacturers	Inactive

2.4.9 Infilled Land

Potentially infilled land features within 250m of the site are summarised in **Table 2.4**.

Table 2.4 Potentially Infilled Land

Feature	Distance/Direction from site
Excavated land associated with the Brick and Tile Works infilled c.1938	12m, southwest
Infilled reservoir sluices associated with Dye Works 1948	32m, northeast
Inland stream within Moston Brook	61m, northwest
Large pond potentially infilled c.1908	153m, south
Inland stream within Moston Brook	160m, north
Inland stream within Moston Brook	167m, northwest
Inland stream within Moston Brook	178m, west
Inland stream within Moston Brook	231m, northeast

SECTION 3 Coal Mining Risk Assessment

3.1 Geotechnical Risk

3.1.1 Underground Mining

Based upon geological map data, the stratigraphical sequence within 30m of the ground surface of the site is illustrated in **Figure 3.1**.

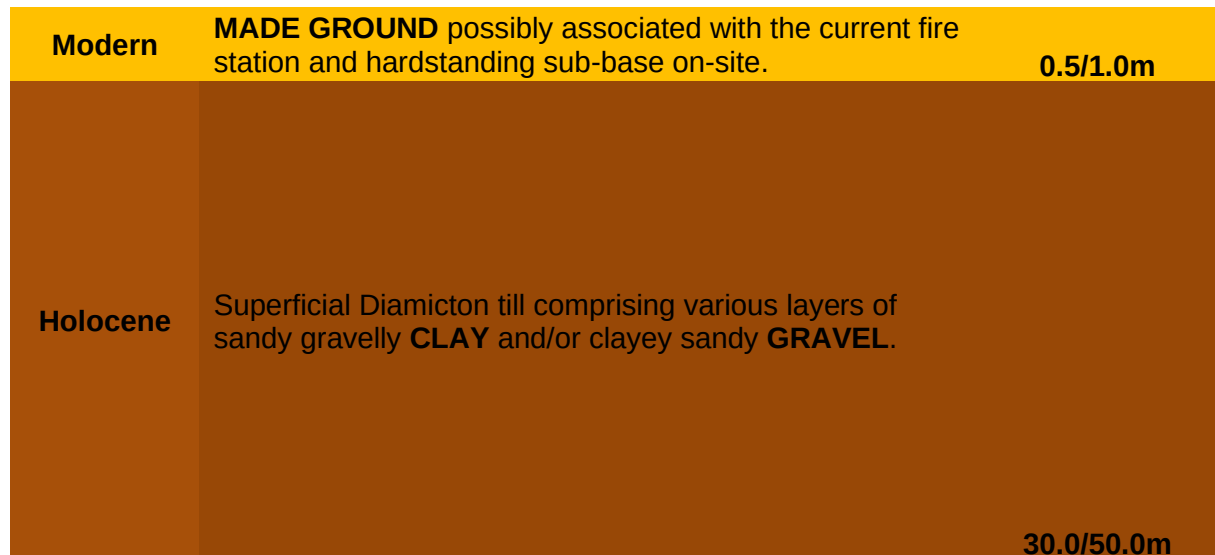


Figure 3.1 Geology and Strata Base below Ground Level

The Coal Authority Report states that the property is not within a surface area that could be affected by any past underground mining. In the probable unrecorded shallow workings section of the report, it is also confirmed that there are none. No spine roadways are recorded at shallow depth.

The report does not record any mine entry within 100m from the site.

The Coal Authority is not aware of any damage due to geological faults or other lines of weakness that have been affected by coal mining at the site.

The Coal Authority has not received a damage notice or claim for the subject property, or any property within 50 metres of the enquiry boundary, since 31 October 1994. There is no current Stop Notice delaying the start of remedial works or repairs to the property. The Coal Authority is not aware of any request having been made to carry out preventive works before coal is worked under section 33 of the Coal Mining Subsidence Act 1991.

The Coal Authority has no record of a mine gas emission requiring action.

Given the local geology surrounding the site, it is unlikely that any worked coal seams are situated below the site. Coal seams nearby dip away from the site (20° north), with no coal seams dipping below the site.

3.1.2 Shafts & Adits

The Coal Authority Report does not record any mine entry within 100m from the site.

3.1.3 Conclusion

The overall risk to the surface stability of the site from possible unrecorded workings is considered negligible.

SECTION 4 Preliminary Human Health and Environmental Risk Assessment

4.1 General

The preliminary human health and environmental risk assessment is a qualitative evaluation of unacceptable risks to human health or the environment from potential 'contaminated land', based on reviewed information in preceding sections of this report.

For 'contaminated land' to exist as defined in Part 2A of the Environmental Protection Act (EPA) 1990, a Pollutant Linkage needs to be identified. Pollutant linkages are defined by having a valid 'source – pathway – receptor' as established in the preliminary conceptual site model.

For our definitions of pollution linkage and how we define risk please refer to **Annex B** which includes our classifications of consequence and probability, and risk assessment matrix.

4.2 Potential Sources of Contamination

Potential or known sources of contamination associated with the sites current and historical land use are summarised in **Table 3.1**.

Table 3.1 Contamination Sources

ID	Source	Contaminant
S1.1	Made ground soils associated with past site uses	Metals, PAH, TPH CWG, Asbestos, ground gas
S1.2	Dye Works	Metals, metalloids Chlorinated organic solvents • Trichloroethene • Tetrachloroethene (TCE) • Perchloroethene (PCE) • 1,1,1-trichloroethane Other organic compounds • Borates • Chlorides • Bromides • Fluorides • Phosphates Asbestos PCBs Ground Gas
S2	Infilled land nearby including historic landfill, infilled stream, infilled excavated land and infilled reservoir sluices	Ground gas

No other significant potential on-site or off-site sources of contamination have been identified during the desk study.

4.3 Potential Pollution Pathways

Potential contaminant pathways associated with a residential with home grown produce land use are as follows.

- P1 – Direct soil and dust ingestion
- P2 – ~~Consumption of home grown produce~~
- P3 – Dermal contact
- P4 – Inhalation of dust and vapours
- P5 – Vertical migration of leachates (unsaturated zone)

- P6 – Horizontal and vertical migration of contaminants (saturated zone)
- P7 – Artificial contaminant pathway (borehole, pile, excavation etc)
- P8 – Surface run-off
- ~~P9 – Plant uptake~~
- P10 – Horizontal and vertical migration of ground gasses and vapours
- P11 – Direct contact with construction materials
- P12 – Inhalation of asbestos fibres

4.4 Potential Receptors

There are human and hydrological receptors to any contamination that may be present on site. Potential receptors include.

- R1 – Construction and maintenance workers
- R2 – Future site users (residents)
- R3 – Passers-by or neighbouring site users
- R4 – Groundwater (aquifer)
- R5 – Surface waters (river/lake)
- R6 – Area of public open space
- R7 – Construction materials (concrete/potable water pipes)

4.5 Preliminary Conceptual Site Model

The preliminary conceptual site model establishes potential pollutant linkages between contaminants (source), pathways and receptors, realised during the preparation of the desk study report. Where a potential pollutant linkage is identified an assessment of risk is subsequently undertaken. The preliminary conceptual site model is tabulated in **Table 3.2**.

Outcomes of the preliminary conceptual site model are used as a basis for the design and implementation of the site investigation, whereby areas of potential contamination can be targeted as well as investigating the wider site.

Findings of the site investigation can in turn be used to develop and refine the conceptual site model.

Table 3.2 Preliminary Conceptual Site Model

Source	Pathway	Receptor	Preliminary Risk Assessment		
			Consequence	Probability	Risk
Human Health					
Contaminated Soils S1, S2	Direct soil and dust ingestion P1 Dermal contact P3 Inhalation of dust and vapours P4	Construction and maintenance workers R1	Medium	Likely	Medium Risk - COSHH assessment and good level of PPE/ hygiene by site workers/ staff; dust suppression measures if required. Suitably designed site investigation recommended
		Passers-by or neighbouring site users R3	Medium	Unlikely	Low Risk - Significant contamination could be expected however dust suppression measures would likely prove effective against certain levels of contamination. Additional precautions may be required if ACMs are present within the currently disused buildings.
		Future site users (employees) R2	Medium	Likely	Medium Risk - Significant contamination could be expected within the made ground deposits which are likely to underlie the site. However, as there are no proposed garden/ landscape areas within the development, there are no pathways for potential contamination to reach receptor. Additionally, the proposed development itself will act as a capping layer to potential contaminated soils.
Radon Gas S3	Horizontal and vertical migration of ground gasses and vapours P10	Future site users (employees) R2	Medium	Unlikely	Negligible Risk - No radon protection measures required
Ground Gas S1		Future site users (residents) R2 Construction and maintenance workers R1	Severe	Unlikely	High Risk – Made ground situated on site and within surrounding area could be a source of ground gas. Infilled land features within the immediate surrounding area (i.e., within influencing distance) could be a source of ground gas. Several features including infilled steams, infilled reservoir sluices and the historic landfill are among these sources.
Impacted Groundwaters S1, S2	Horizontal and vertical migration of contaminants (saturated zone) P6 Dermal contact P3	Construction and maintenance workers R1	Medium	Unlikely	Low Risk
Contaminated Soils S1, S2	Direct Contact P11	Construction materials (water pipes) R7	Mild	Low Likelihood	Low Risk - Chemical analysis of the soils should be undertaken and the

		Construction materials (concrete) R7			appropriate classification of concrete should be specified as per BRE Special Digest 1: Concrete in Aggressive Ground.
Aquatic Environment					
Contaminated Soils S1, S2	Vertical migration of leachates (unsaturated zone) P5	Groundwater (aquifer) R4 Surface waters (river/lake) R5	Mild	Low Likelihood	Low Risk – Due to the potential for CLAY rich strata below the site, it is unlikely that any proposed contamination would be mobile to the aquatic environment. However, if piled foundations are required for the proposed development, this could transmit any potential contamination into perched groundwater/ groundwater.
	Surface run-off P8				
	Horizontal and vertical migration of contaminants (saturated zone) P6	Surface waters (river/lake) R5			

SECTION 5 Anticipated Ground Conditions

5.1 Geology

Based on the available desk study information and previous site investigation, anticipated ground conditions at the site are summarised in **Table 4.1**.

Table 4.1 Anticipated Ground Conditions

Stratum	Depth to base (m)
MADE GROUND consisting of loose to medium dense sandy clayey fine to coarse angular GRAVEL of brick, concrete, sandstone	0.5/1.0m
Firm to stiff sandy gravely CLAY	52.0
RED SANDSTONE	>52.0

5.2 Groundwater

Groundwater is anticipated within any significant SAND and GRAVEL layers within superficial deposits.

SECTION 6 Preliminary Engineering Recommendations

Recommendations given in this section are based upon the available desk study information and need to be confirmed by a relevant intrusive investigation.

6.1 Preparation of Site

Areas of hardstanding should be stripped and removed from below the proposed development area.

Areas of vegetation including all roots should be stripped and removed from beneath the proposed development site.

Contingencies should be made for the protection/diversion of any underground/overhead services present beneath/above the site brought about as a result of the proposed works.

Any reduced levels should be brought up to the required levels with suitable inert mainly granular materials. Department of Transport (DTP) type 2 sub-base or similar should be used and compacted in layers to the requirements of the Specification for Highway Works.

Allowances should also be made for the excavation of any soft spots/areas and their replacement with well compacted imported granular materials.

In accordance with EC Regulation 1272/2008 and Environment Agency Guidance WM3 soils and other materials destined for off-site disposal should be classified on the basis of their hazard phrases prior to disposal. Soils are classified as a mirror entry waste and should be classified on the basis of their specific chemical properties. Terra Firma (Wales) Ltd offer this service if required.

6.2 Tentative Foundation and Floor Slab Solution

Given the likelihood of firm to stiff **CLAY** beneath the site it is likely that a mass concrete trip/trench foundation solution may prove suitable for the proposed development.

Floor slabs may be designed as grounded.

All foundation and floor slab recommendations should be confirmed by a suitably designed site investigation.

6.3 Excavations and Formations

Shallow excavations will likely be possible with normal soil excavating machinery, though allowances should be made for breaking out existing hardstanding.

Excavations are unlikely to encounter shallow groundwater flows. However, any inflows together with rainwater infiltration should be dealt with by conventional pumping techniques.

The sides of any excavations deeper than 1.2m should be supported by planking and strutting or other proprietary means.

The sub-formations/formations will be highly susceptible to loosening, softening and deterioration by exposure to weather (rain, frost and drying conditions), the action of water (flood water or removal of groundwater) and site traffic. Formations should never be left unprotected and continuously exposed to rain causing degradation, or left exposed/uncovered overnight, unless permitted by a qualified engineer.

Construction plant and other vehicular traffic should not be operated on unprotected formations.

6.4 Protection of Buried Concrete

Within BRE Special Digest 1 the chemical agents that aggressively attack concrete are sulphate, sulphides, magnesium ions, ammonium ions, carbon dioxide, chloride ions and phenols.

Aggressive ground conditions may be encountered at the site.

It is recommended that soils are tested to facilitate a classification.

6.5 Access Roads and Car Parking Areas

For car parking and road area formations the CBR value for shallow soils should be determined by in-situ CBR testing.

Allowances should be made for the removal of any 'soft spots/areas' and their replacement with well-compacted granular materials as previously described.

Please note that the Local Council / Highways Authority may require in-situ CBR testing to be undertaken before a road is adopted. In-situ CBR Testing should be performed following earthworks to verify the performance of the engineered fill.

6.6 Storm Water Drainage

Soakaway drainage may be feasible for the proposed development, though this will be dependent on the clay/silt content of the superficial deposits.

The suitability of stormwater drainage should be confirmed by in-situ soakaway testing.

Proposed soakaways should be positioned at least 5.0m away from any structure.

SECTION 7 Recommended Site Investigation

7.1 General

An intrusive site investigation designed and justified in accordance with guidance provided in BS10175:2011+A2:2017 should be undertaken to achieve the following objectives:

- Identify the potential environmental liabilities at the site associated with any soil, gas, vapour and groundwater contamination from past site uses, to substantiate and enhance the conceptual site model, for a commercial scenario with enclosed spaces.
- Provide a suitable foundation and floor slab solution
- Provide recommendations regarding any relevant geotechnical aspects pertaining to the development.

7.2 Intrusive Investigation

It is recommended that mini percussive boreholes are sunk over the site to ascertain the strength of the underlying strata and identify a suitable founding stratum.

Contamination for a wide suite of determinants as previously reported should be undertaken.

In-situ gas monitoring stations should be installed in the bores and a programme of gas monitoring undertaken.

Should groundwater be encountered in the boreholes then groundwater testing may also be required.

**Annex A
Envirocheck Report**

Annex B
Risk Assessment Definitions

The contaminated land regime is set out in Part 2A of the Environmental Protection Act (EPA) 1990 and was introduced on the 1st April 2000 in England and 1st July 2001 in Wales. A similar regime was introduced in Scotland on 14th July 2000.

Part 2A was introduced to achieve three overarching objectives:

- (a) To identify and remove unacceptable risks to human health and the environment.
- (b) To seek to ensure that contaminated land is made suitable for its current use.
- (c) To ensure that the burdens faced by individuals, companies and society as a whole are proportionate, manageable and compatible with the principles of sustainable development.

Under Part 2A the statutory definition of 'contaminated land' is:

"any land which appears to the local authority in whose area it is situated, to be in such a condition, by reason of substances in, on, or under the land, that:

- (a) Significant harm is being caused or there is a significant possibility of such harm being caused; or
- (b) Pollution of controlled waters is being, or is likely to be, caused."

Under Part 2A, for land to be classified as 'Contaminated Land' there must be one or more contaminant, pathway, receptor linkages, known as the '**Pollutant Linkage**'. A pollutant linkage requires three essential elements:

- (a) A **CONTAMINANT** (SOURCE) – a substance that is in, on or under the land and has the potential to cause harm or to cause pollution of controlled waters.
- (b) A **RECEPTOR** – something which could be adversely affected by a contaminant.
- (c) A **PATHWAY** – a route by which a receptor is or might be exposed to or affected by a contaminant.

The term 'Risk' is widely used in different contexts and situations, but a prescriptive definition is given by the Guidelines for Environmental Risk Assessment and Management (DEFRA *et al*, 2000):

'Risk is a combination of the probability, or frequency, of occurrence of a defined hazard and the magnitude of the consequences of the occurrence'.

Model Procedures for the Management of Land Contamination – Contamination Land Report 11 (2004) defines a 'Hazard' as

'a property or situation that in particular circumstances could lead to harm'.

A framework for qualitative risk assessment is provided in CIRIA publication C552 Contaminated Land Risk Assessment – A Guide to Good Practice (2001). The method requires an assessment of the magnitude of the probability of the risk occurring and the magnitude of the potential consequence. Classifications of consequences and probability, levels and descriptions of risk have been devised from the above publication and are defined in the following sections.

Classification of Consequence

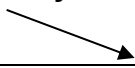
Table A Classification of Consequence	
Classification	Definition
Severe	• Short term (acute) risk to human health likely to result in significant harm • Short term risk to controlled waters • Catastrophic damage to buildings/structures • Short term risk to an ecosystem or organism within the particular ecosystem
Medium	• Chronic damage to human health (long term risk) • Pollution of a sensitive water resource • A significant change in an ecosystem or organism within the ecosystem
Mild	• Pollution of non-sensitive water resources • Significant damage to buildings/structures • Damage to sensitive buildings/structure/services or the environment
Negligible	• Harm (not necessarily significant) which may result in financial loss • Non-permanent health effects to humans (easily prevented by PPE for example) • Easily repairable effects of structural (building) damage

Classification of Probability

Table B Classification of Probability	
Classification	Definition
High Likelihood	• There is a complete pollution linkage and an event appears very likely to occur in the short term and is inevitable in the long term. • Evidence of harm to the receptor
Likely	• There is a complete pollution linkage which means that it is probable that an event will occur • The event is not inevitable but possible in short term and likely in the long term
Low Likelihood	• There is a complete pollution linkage and circumstances are possible under which an event could occur • It is not certain that an event will occur in the long term, and it is less likely to occur in the short term
Unlikely	• There is a complete pollution linkage but circumstances are such that it is improbable that an event would occur even in the long term

Risk Assessment Matrix

By comparing the consequences of a risk and the probability of the risk of a pollution linkage, the likely risk category can be determined as shown in **Table C** below.

Table C Risk Assessment Matrix					
Increasing acceptability 		Consequence			
		Severe	Medium	Mild	Negligible
Probability	High Likelihood	High risk	High risk	Medium risk	Low risk
	Likely	High risk	Medium risk	Low risk	Near zero risk
	Low Likelihood	Medium risk	Low risk	Low risk	Near zero risk
	Unlikely	Low risk	Near zero risk	Near zero risk	Near zero risk

Description of Risks and Likely Actions

High Risk

There is a high probability that severe harm could arise to a receptor, or there is evidence that a receptor is currently being severely harmed. The risk if realised is likely to result in liability, and urgent investigation or remediation will be required.

Medium Risk

It is probable that harm will arise to a receptor. However, it is relatively unlikely that such harm would be severe, or if harm does occur the harm is likely to be relatively mild. Investigation will be required to determine the liability, and some remedial works may be required in the long term.

Low Risk

It is possible that harm may arise to a receptor, but it is likely that the harm would be mild.

Near Zero Risk

There is a very low risk of harm to the receptor. In the event of harm being realised the harm is not likely to be severe.

**Annex C
Coal Authority Report and Map**

DRAWINGS



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