Phase 1 Geoenvironmental Risk Assessment/ Coal Mining Risk Assessment and Flood Risk Assessment

HEADLANDS WORKS
HEADLANDS ROAD
LIVERSEDGE

for

Messrs. B. and R. Seale

Report Number 4360

February 2024

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Phase 1 Geoenvironmental Risk Assessment, Coal Mining Risk Assessment and Flood Risk Assessment

HEADLANDS WORKS, HEADLANDS ROAD, LIVERSEDGE

Contents

Figures

Appendices

1 INTRODUCTION

1.1 At the request of Martin Walsh Architects, acting on behalf of Messrs. B. and R. Seale, a Phase I Geoenvironmental and Geotechnical Assessment (Desk Study), Coal Mining Risk Assessment and Flood Risk Assessment have been carried out at Headlands Works in Liversedge. It is proposed to redevelop the site with residential properties.

1.2 The purpose of the combined report is to review and assess information on the site including geological, hydrogeological data, to review the past history of the site and its environmental setting, and to determine if there are any geotechnical or geoenvironmental hazards that may impair its safe and economic development. This has also included a Coal Mining Risk Assessment and preliminary Flood Risk Assessment.

1.3 The combined study has not included checks on services on or adjacent to the site, and no structural or asbestos surveys have been carried out.

2 THE SITE

2.1 The site covers an area of approximately 1.16 hectares. It is located on Headlands Road in Liversedge, approximately 1km west of the centre of Heckmondwike. The Ordnance National Survey Grid Reference is 420150, 423380 and it lies at approximately 89 mAOD on Headlands Road. Figure 1 shows the general site location, whilst figure 2 shows the site in more detail.

2.2 The site was inspected on 12th February 2024. Access is off Headlands Road, which forms the eastern boundary of the site.

Site entrance

Site entrance from Headlands Road

2.3 There are two brick buildings either side of the entrance, which leads to an area of hardstanding to the front of the works buildings. The hardstanding comprises tarmac, although it appears to be underlain by concrete, where the tarmac has been broken out.

2.4 Across the area of hardstanding, there are numerous piles and bagged waste materials. These mainly appear to comprise wood waste, metal and uPVC. There are also numerous old IBC and plastic drums, some of which contain probable waste materials. There is also a lorry trailer, containing wood materials.

View of hardstanding, looking north

View of hardstanding, looking northwest towards works building

Waste material to front of works building

2.5 The main works buildings appear to comprise two separate brick buildings with profile metal sheet cladding and roller doors. Access to these buildings was not possible. To the north of this is a smaller building, which appears to be clad in corrugated asbestos cement sheeting. This has a 'compound' to the front, which was also inaccessible.

Main works building, looking southwest

Smaller building, looking west

2.6 A part concrete and part unmade pathway runs along the southern elevation of the main building, and which leads to its rear. Immediately to the rear are full bags of waste material and a large mound of sawdust.

Waste material and sawdust to rear

View of rear of buildings, looking northeast

2.7 The area to the south and west of the works buildings is unused land, with a number of semi-mature trees across it. The area is also heavily overgrown, such that most of the southern half of the site is inaccessible, as is much of the area along the western boundary. As such, it was not possible to inspect these areas.

2.8 Overall, the ground slopes down in a northeast to southwest direction. To the south, there is residential housing and Headlands Hall, whilst to the north, there is a bed factory. The northern boundary is marked by a footpath. Further housing lies to the east of Headlands Road, whilst to the west, there are playing fields belonging to Spen Valley High School.

View to the northwest and the bed factory beyond

Northern boundary and footpath

2.9 Due to the sloping nature of the site, there appears to have been some cut and fill to accommodate the works buildings.

View towards the western boundary

3 SITE HISTORY

3.1 The following archival Ordnance Survey maps have been examined to trace the past development of the site. These are reproduced in Appendix 2 with the current site boundary superimposed on them. The apparent displacement on the older maps is due to a change in Ordnance Survey co-ordinates.

Scale and Year of Publication			
6" to 1 mile	1855	1:500	1890
	1882	1:2500	1894
	1905		1907
	1931		1922
	1938		1933
	1948		1938
	1955		1957
	1967		
1:10,000	1975	1:1250	1957
	1985		1972
	1988		1977
	2001		1984
	2010		1990
	2024		1992
			1993
			1994
			2003

3.2 The earliest map dates from 1855 and shows the site to be undeveloped land. A coal pit is shown close to the southern corner of the site, but just beyond the site

boundary. Further coal pits lie to the north, northeast and southwest of the site. Approximately 100m to the north is Strawberry Bank Quarry. The maps of 1890 and 1894, record Strawberry Bank Colliery immediately to the northeast of the site.

3.3 The first map to show the site in detail dates from 1907, and continues to record the site as being undeveloped. By this time, Headlands Road had been constructed. The map also shows Tanhouse Beck, approximately 100m to the north of the site, with a "refuse destructor", further to the north.

3.4 The map of 1922 identifies a number of features of Strawberry Bank Colliery, including two shafts, a reservoir and two coke ovens; one of which being close to Headlands Road. A large Leather Works is also shown to the northwest of the site, together with two old mine shafts.

3.5 By 1933, the colliery had been demolished, and by 1938 the Leather Works had become Valley Works specialising in textile machinery. It had also expanded considerably in size.

3.6 The first development on the site itself is recorded on the map of 1956/57, and shows the current main buildings, together with two smaller brick buildings adjoining Headlands Road. A third small building is shown to the south of the main buildings.

3.7 The map of 1970 records the main buildings as an Engineering Works, with another building having been constructed, just to the north the main building. Thereafter, the site remained largely unchanged, with the smaller building immediately to the north of the main buildings being constructed by 1990.

3.8 Due to time and cost constraints, it has not been possible to consult with local history journals and newspapers. This can be carried out if requested at additional cost, but is unlikely to provide any significant additional information.

3.9 The site is unlikely to be of archaeological interest. However, it would be prudent to make enquiries with West Yorkshire Archaeology Service.

4 GEOLOGY AND MINING

4.1 Geology

4.1.1 Maps of the British Geological Survey (BGS), in particular 1:50,000 scale sheet 77 and 1:10560 scale sheet 232SW, show the site to be underlain by undifferentiated mudstones, siltstones, shales and sandstones of the Carboniferous Middle Coal Measures.

4.1.2 A geological fault is recorded through the site. This trends from the northernmost corner of the site, beneath the main buildings and close to the southernmost corner of the site. The fault downthrows to its northwestern side.

4.2 Mining

4.2.1 A mining report has been obtained from the Coal Authority, and is reproduced in full in Appendix 3. It states that there has been recorded mining beneath the site in two seams of coal between 151m and 198m depth, with the last date of working being 1912. Under normal circumstances, ground movement should have ceased by now from these workings.

4.2.2 The latest British Geological Survey maps differ from that provided by the Coal Authority. The British Geological Survey does not record any coal seams outcropping on the site itself. However, the Coal Authority records a seam outcropping through the site to the northwest side of the fault discussed above.

4.2.3 The older 6" to 1 mile geological map (232 SW) records this seam as the Wheatley Lime Coal. This is shown to dip in a southeasterly direction. This seam is also shown outcropping to the south of the site, but dipping under the higher ground to the south of the site. The outcrop of the seam is repeated due to the faulting.

4.2.4 The report also states that "*there are probable unrecorded shallow workings*". The Coal Authority is referring to any seams within 30m of the surface, and it is assumed it is referring to the Wheatley Lime Coal seam. This seam is recorded as being approximately 0.8m thick in the general area, and the geological memoir states that it has been worked to some extent in the district. The next shallowest seam is the Blocking Bed Coal, recorded as being approximately 34m below the Wheatley Lime Coal.

4.2.5 As part of the study, borehole logs from the British Geological Survey have been inspected. There are no records which provide further details of the possible workings. The former Strawberry Bank Colliery lay just to the north of the site, to the other side of Headlands Road. The shaft record for the colliery shows the shallowest seam to be the Blocking Bed Coal, being 0.9m thick and at 20m depth. The geology is such that this seam may underlie the site at a similar depth on the southeastern side of the fault.

4.2.6 The Coal Authority record a former mine shaft on the site (Ref: 420423-021). This is shown adjacent to the northern corner of the main building (National Grid Ref: 420181, 423427). A second shaft is recorded approximately 5m beyond the southwestern boundary of the site (Ref: 420423-026) at National Grid Ref: 420096, 423317.

4.2.7 No further details are given about either of these shafts. It is therefore not known if the shafts have been infilled or capped. At present, it is reasonable to assume that neither have been treated or capped to make them stable.

4.2.8 In addition, the mining report states that none of the following are recorded;

- Spine roadways
- Coal Authority managed tips
- Site investigations
- Remediated sites
- Coal mining subsidence damage notices or claims
- Mine gas
- Mine Water Treatment Schemes
- Future underground mining
- Coal mining licencing
- Court Orders
- Section 46 Notice
- Withdrawal of Support Notices
- Payment to owner of former copyhold land

4.3 GroundSure Geo-Insight

4.3.1 A GroundSure Geo-Insight Report has been obtained for the site and is reproduced in Appendix 1. The report is based on the British Geological Survey (BGS) geological maps, GroundSure data and miscellaneous other geological sources.

4.3.2 None of the following are recorded beneath the site.

Geology
Artificial and Made Ground (50k) Artificial ground permeability (50k) Superficial geology (50k) Superficial permeability (50k) Landslip (50k) Landslip permeability (50k)

Mining, Ground Workings and Natural Cavities
Natural Cavities BritPits Surface ground workings Underground workings Historical Mineral Planning Areas Non-coal mining Mining cavities JPB mining areas Brine areas Gypsum areas Tin mining Clay mining

In respect of natural ground subsidence, the BGS reports the following risk ratings.

Natural Ground Subsidence	Risk
Shrink-Swell Clay	Negligible to Very Low
Running Sand	Negligible
Compressible Deposits	Negligible
Collapsible Deposits	Very Low
Landslide	Very Low
Ground Dissolution of Soluble Rocks	Negligible

5 HYDROGEOLOGY AND FLOOD RISK ASSESSMENT

Hydrogeology

5.1 The Coal Measures occur throughout the heavily industrialised areas of West and South Yorkshire. They comprise a thick sequence of faulted rocks characterised by the repeated sequence of mudstone, siltstone, sandstone, seatearth and coal.

5.2 The Coal Measures, though classed as a minor aquifer, may provide good borehole yields from sandstones and many industrial supplies rely on them. However, groundwater flow is extensively affected by the faulting and fissuring of the rocks, and also by the results of coal mining and associated dewatering activities. Due to the complex, and often poorly understood hydrogeology, it is impossible to subdivide the Coal Measures into aquifers and non-aquifers except on a very detailed level and the whole sequence must therefore be considered in general terms as an aquifer.

5.3 Since April 2010, the Environment Agency's Groundwater Protection Policy has been using aquifer designations consistent with the Water Framework Directive.

5.4 The aquifer within the bedrock deposits is designated as Secondary A. This is described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

5.5 Details provided by the Environment Agency in the GroundSure Enviro-Insight Report, indicate there to be no licensed surface water or groundwater abstraction points within at least 1.8km of the site.

Flood Risk Assessment

5.6 According to data supplied by the Environment Agency in the GroundSure Enviro-Insight report, the site is not at risk from fluvial flooding. There have been no historical flood events recorded.

5.7 A GroundSure Floodview report has also been obtained and is presented in Appendix 4. It records the following risks, with the overall risk given as "negligible". The following were not identified;

Flooding

- Risk of flooding from rivers and the sea
- Flood storage areas: part of floodplain
- Historical flood areas
- Areas benefiting from flood defences
- Flood defences
- Proposed flood defences
- Surface water flood risk
- Groundwater flooding

5.8 According to the Environment Agency the vast majority of the site is shown to be unaffected by surface water flooding. A small area to the front of the main building is shown to be at low risk. This means that the chance of flooding in this area is between 0.1% and 1% each year, with the flooding to be less than 300mm. It should be noted that the Environment Agency states that *"flooding from surface water is difficult to predict as rainfall location and volumes are difficult to predict. In addition, local features can greatly affect the chance and severity of flooding".*

5.9 According to the GroundSure Geo-Insight Report, the risk of groundwater flooding is negligible.

5.10 The Floodview report states that, given the size of the site, *"a full flood risk assessment will be required at the site in the event that it will be developed/re-developed. The National Planning Policy Framework (NPPF) states that the flood risk assessment should identify and assess the risk of all forms of flooding to and from the development and demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account. Those proposing developments should take advice from the emergency services when producing an evacuation plan for the development as part of the flood risk assessment".*

6 GROUNDSURE ENVIRO-INSIGHT REPORT

6.1 A GroundSure Enviro-Insight Report has also been commissioned for this site. The following features are recorded within 250m of the site and full details are given in Appendix 1.

6.2 Historical Waste Sites

Based upon the historical mapping, the former refuse destructor and associated refuse heap are recorded between 28m and 163m north of the site. The refuse heap is also identified by Local Authority mapping and Environment Agency records as being formerly operated by Spenborough Borough Council, but no further details are given.

6.3 Licensed Waste Sites

Kirklees Metropolitan District Council operated a Waste Transfer site at its Headlands Road Depot, approximately 168m to the north. It is licensed for household, commercial and industrial waste, not exceeding 25,000 tonnes per annum.

6.4 Contemporary Trade Entries

The GroundSure Enviro-Insight Report lists various trade entries in the vicinity of the site. It should be noted that these lists are rarely complete.

An internet search identified the following most recent occupiers;

- Unit 1 NID Services (Storage Facilities)
  (Production of high specification components from various metals).

- Unit 2 DS Precision Engineering Limited
  (Turning, milling and drilling of metallic components).

- Unit 3 Payne's Machinery Transport (Transportation Services)
  (Movement of large industrial machinery).

In addition, the client states that Unit 2 was used most recently for recycling wood.

6.5 Others

None of the following are recorded within 250m of the centre of the study site.

Waste and Landfill
Active or recent landfill Historical landfill (BGS records) Historical landfill (LA/mapping records) Historical landfill (EA/NRW records) Licensed waste sites

Current Industrial Land Use
Current or recent petrol stations
Electricity cables
Gas pipelines
Sites determined as Contaminated Land
Control of Major Accident Hazards (COMAH)
Regulated explosive sites
Hazardous substance storage/usage
Historical licensed industrial activities (IPC)
Licensed industrial activities (Part A(1))
Current Licensed pollutant release (Part A(2)/B)
Radioactive Substance Authorisations
Licensed Discharges to controlled waters
Pollutant release to surface waters (Red List)
Pollutant release to public sewer
List 1 Dangerous Substances
List 2 Dangerous Substances
Pollution Incidents (EA/NRW)
Pollution inventory substances
Pollution inventory waste transfers
Pollution inventory radioactive waste

Environmental Designations
Site of Special Scientific Interest (SSSI)
Conserved wetland sites (Ramsar sites)
Special Areas of Conservation (SAC)
Special Protection Areas (SPA)
National Nature Reserves (NNR)
Local Nature Reserves (LNR)
Designated Ancient Woodland
Biosphere Reserves
Forest Parks
Marine Conservation Zones
Proposed Ramsar sites
Possible Special Areas of Conservation (pSAC)
Potential Special Protection Areas (pSPA)
Nitrate Sensitive Areas
Nitrate Vulnerable Zones
SSSI Impact Risk Zones
SSSI Units

Visual and Cultural Designations
World Heritage Sites Areas of Outstanding Natural Beauty National Parks Conservation Areas Scheduled Ancient Monuments Registered Parks and Gardens

Agricultural Designations
Open Access Land Tree Felling Licences Environmental Stewardship Schemes Countryside Stewardship Schemes

Habitat Designations
Priority Habitat Inventory Habitat Networks Open Mosaic Habitat Limestone Pavement Orders

Railway Infrastructure and Projects
Underground railways (London) Underground railways (Non-London) Railway tunnels Royal Mail tunnels Historical railways Railways Crossrail 1 Crossrail 2 HS2

6.6 The GroundSure Enviro-Insight Report is based upon known, published information and may not comprise a complete record of all features of relevance. An explanation of the datasets is provided in the report in Appendix 1.

7 CONTAMINATED LAND AND INVASIVE PLANTS

7.1 There is no visibly contaminated material on the surface of the site, nor is there any distressed vegetation suggestive of significant or serious contamination.

7.2 The inspection of the site did not indicate any obvious invasive plants. However, the identification of such is outside the expertise of this consultancy, and much of the site was inaccessible. Appropriate advice should therefore be sought, if necessary.

8 RADON

8.1 According to the GroundSure Geo-Insight Report the site lies in an area where between 1% and 3% of homes are above the action level recommended by UK Health Security Agency (UKHSA). Radon protective measures are therefore not necessary according to the BGS data provided in the GroundSure Report and UKHSA.

9 GEOENVIRONMENTAL RISK ASSESSMENT

Conceptual Site Model

9.1 A quantitative health and environmental risk assessment has been carried out as part of this assessment. The process of risk assessment is set out in Part IIA of the Environment Protection Act 1990 and amended in part by The Water Act 2003. This defines contaminated land as "*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 there is a significant possibility of significant harm being caused, or that significant pollution of controlled waters is being caused or there is a significant possibility of such pollution being caused".*

9.2 The Act introduces the concept of a pollution linkage. This linkage consists of a pollution (contaminative) source or hazard and a receptor, together with an established pathway between the two. For land to be contaminated, a pollution linkage (hazard-pathway-receptor) must exist. This forms a so-called 'conceptual model' of the site.

9.3 Examples of pathways and effects from land contamination (after PPS 23) are given below, and these are illustrated on figure 3.

9.3.1 Human Health (Pathways 1-5, Receptors A – C)

Uptake of contaminants by food plants grown in contaminated soil - Uptake will depend on concentration in soil, its chemical form, soil pH, plant species and prominence in diet.

Ingestion and inhalation - Substances may be ingested directly by young children playing on contaminated soil, by eating plants which have absorbed metals or are contaminated with soil or dust. Ingestion may also occur via contaminated water supplies. Metals, some organic materials and radioactive substances may be inhaled from dusts and soils.

Skin contact - Soil containing tars, oils and corrosive substances may cause irritation to the skin through direct contact. Some substances (e.g. phenols) may be absorbed into the body through the skin or through cuts and abrasions.

Irradiation - As well as being inhaled and absorbed through the skin, radioactive materials emitting gamma rays can cause a radiation response.

Fire and explosion - Materials such as coal, coke particles, oil, tar, pitch, rubber, plastic and domestic waste are all combustible. Both underground fires and biodegradation of organic materials may produce toxic or flammable gases. Methane and other gases may explode if allowed to accumulate in confined spaces.

9.3.2 Buildings (Pathways 7 and 8)

Fire and explosion - Underground fires may cause ground subsidence and cause structural damage. Accumulations of flammable gases in confined space leads to a risk of explosion. Underground fires may damage services.

Chemical attack on building materials and services - Sulphates may attack concrete structures. Acids, oils and tarry substances may accelerate corrosion of metals or attack plastics, rubber and other polymeric materials used in pipework and service conduits or as jointing seals and protective coatings to concrete and metals.

Physical - Blast-furnace and steel-making slag (and some natural materials) may expand. Degradation of fills may cause settlement and voids in buried tanks and drums may collapse as corrosion occurs or under loading.

9.3.3 Natural Environment (Pathway 6, Receptors D - E)

Phytotoxicity (prevention/inhibition of plant growth) - Some metals essential for plant growth at low levels are phytotoxic at higher concentrations. Methane and other gases may give rise to phytotoxic effects.

Contamination of water resources - Soil has a limited capacity to absorb, degrade or attenuate the effects of pollutants. When this is exceeded, polluting substances may enter into surface and groundwaters.

Ecotoxological effects - Contaminants in soil may affect microbial, animal and plant populations. Ecosystems or individual species on the site, in surface waters or areas affected by migration from the site may be affected.

9.4 For any contaminant source identified, judgement is used regarding the probability of a pollution linkage occurring and the potential consequences of that linkage. Based on the probability and likely consequences, the overall risk (significance) can be established. The definitions that have been used for this purpose are given in Standard Appendix B. The probability of a hazard, combined with its consequences, can be used to assess risk. This forms the so-called Conceptual Site Model.

Sources

9.5 The potential contaminants on a site will largely depend on the history of the site and on the range of activities undertaken there. For much, if not all of its life, the site seems to have been primarily a light engineering works involved in machining various metals into specialist components.

9.6 However at present, little is known about the exact past usage and processes carried out at the site. Oils and solvents are likely to have been used as part of the cleaning and cutting process of turning metals into specialist components. The movement of spillages and leakage of such contaminants will have been limited by the hardstanding of the works floor.

9.7 The western half of the site appears to have remained undeveloped, although it is possible that some waste materials were disposed of to the rear of the building.

9.8 In respect of the haulage business, the initial inspection did not indicate that fuels were stored on the site. However, it should be emphasised that an internal inspection of the buildings has not been carried out at present.

9.9 Given the age of the previous buildings, asbestos containing materials may have been used in their construction. The northern building appears to be extensively clad in asbestos cement sheeting. Should this be the case, any asbestos containing material will have to be safely removed prior to demolition. Nevertheless, waste material may have found their way into the near surface during the original construction.

9.10 Reference has been made to DEFRA publication CLR8 'Potential Contaminants for the Assessment of Land' and the relevant DOE Industry Profiles to identify the typical contaminants associated with the past industrial use.

Risk Assessment based on Conceptual Site Model

Summary of Hazards, Pathways and Receptors

Source	Potential Pollutant	Pathways	Receptor	Risk
Potential contaminated Made Ground. **Possible past minor spillages and metals.**	Oils, fuels, grease, hydraulic fluid, metals, asbestos.	1 - 5	A. Present Occupants.	Site Unoccupied.
			B. Groundworkers.	**Low to Moderate Risk** involved with excavation work, providing personnel adopt suitable precautions, together with washing facilities.
			C. Future Occupants.	**Moderate Risk** at present for residential use.
		6	D. Controlled Waters.	**Moderate Risk.**
			E. Ecosystems.	**Low to Moderate Risk.**
		7	F. Building Materials and Services.	**Low to Moderate Risk.**
Organic Material.	Landfill Gases, Radon, VOCs, SVOCs.	8	A - F	**Low to Moderate Risk.**
Waste materials.				All waste materials to be removed from site.

Pathways and Receptors

9.11 The principal receptors are groundworkers, future residents and controlled water (Receptors B, C and D). Based on the past history of the site, the probability of contamination being present sufficient to affect the identified receptors is considered to be a moderate risk. There is also a moderate risk of ground gases from potential shallow workings and the shafts.

9.12 With any site, the possibility of contaminants being present, sufficient to cause significant harm cannot be entirely precluded without intrusive investigation, sampling and testing since it is not always possible to determine if contaminants have been tipped on the site, or have seeped into the ground, or have migrated below the ground onto the site from adjacent pieces of land.

9.13 At present, the overall risk is assessed to be moderate. At this stage, it is considered that there is unlikely to be any immediate significant risk, but a detailed intrusive investigation in respect of contamination will be required. This should also include a programme of gas monitoring. The investigation should be carried out in accordance with BS10175 “Investigation of Potentially Contaminated Sites”.

9.14 Prior to detailed design it is also recommended that consideration be given to a ground investigation to determine the engineering and foundation characteristics of the sub-soils in respect of the proposed development. This investigation can be carried out at the same time as the investigation into potential contamination.

9.15 The geological maps show the Wheatley Lime Coal to outcrop through the site, and a geological fault to pass through it. There is also a former shaft on the site, for which

there are no records. The overall risk associated with shallow mineworkings affecting surface stability is considered to be moderate.

9.16 It is therefore recommended that a series of rotary openhole boreholes are sunk across the site to determine whether any shallow mineworkings exist in either the Wheatley Lime Coal or the Blocking Bed Coal, which could affect surface stability. It is a requirement to obtain a licence from the Coal Authority before such work is carried out.

9.17 In addition, trenching and trial pitting should be carried out to try and locate the former shaft on the site, and also to determine that the second shaft does not encroach on to the site. The reason for this is that shaft positions were generally poorly recorded and are often inaccurate. The trenching should identify whether the shaft(s) was capped. Once located the shaft(s) may need to be drilled to ascertain how or whether they were backfilled. From this, a safe distance to new housing can be calculated. The Coal Authority Licence should also cover this work.

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February 2024

Procedure Notes

The desk study and/or ground investigation have been carried out using reasonable skill and care, primarily in accordance with the principles of BS5930: 2015 + A1: 2020: Code of Practice for Site Investigations and BS10175: 2011 + A1: 2017: Code of Practice for the Investigation of Potentially Contaminated Sites, and the terms of the client's brief. The report has been prepared for the specific purposes notified at the time of the initial enquiry.

By its very nature any ground investigation only encounters and samples a small percentage of the ground. Consequently changes in ground conditions, soil properties and contamination can occur between any two exploratory points, for example local features such as soft ground, pockets of contamination and faults. This is also true of the exploration of mineworkings and such features can extend beneath parts of the site not investigated. Unrecorded bell pits and shafts can also exist between exploratory points. The ground investigation is designed to minimize such risks with budgetary constraints.

Conclusions and recommendations are based on the information presented in this report, but unforeseen features may exist. No liability can be accepted for ground conditions not revealed by the exploratory holes or for contamination not sampled or tested for. Therefore, actual ground conditions should be noted during construction and further advice sought if they differ from those predicted. Michael D. Joyce Associates LLP reserves the right to amend the conclusions and recommendations in the light of further information. Actual methods of construction or alternative designs should be notified to Michael D. Joyce Associates LLP, such that the recommendations made can be reconsidered in the light of any changes.

Further investigation can be carried out to reduce uncertainty further and risk but ultimately these risks cannot be eliminated. Similarly a desk study normally only considers readily available information and further information could be held by other sources. In commissioning further research or investigation the cost/benefit of doing so must be considered.

It is assumed that groundlevels will not change significantly from those at present. The groundwater conditions are based on observations made at the time of the investigation, unless stated otherwise. It should be noted that the observations are subject to the method of the boring or excavation, and that groundwater levels will vary due to seasonal or other effects.

Where buildings are present on a site, structural and asbestos surveys of the buildings have not been carried out, unless specifically stated. An Unexploded Ordnance (UXO) Survey has not been carried out unless specifically stated. Furthermore, the positive identification of intrusive plants is beyond the expertise of this practice. In relevant situations it would be prudent to commission surveys in respect of UXO and invasive plants.

Where information has been obtained from Third Parties, no liability can be accepted for the accuracy or completeness of this information. Where anecdotal evidence or speculations are presented, they must be treated as such and cannot be relied upon.

Headlands Works, Headlands Road, Liversedge

Site Location

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Scale: NTS

Figure: 1

Headlands Works, Headlands Road, Liversedge

Site Plan

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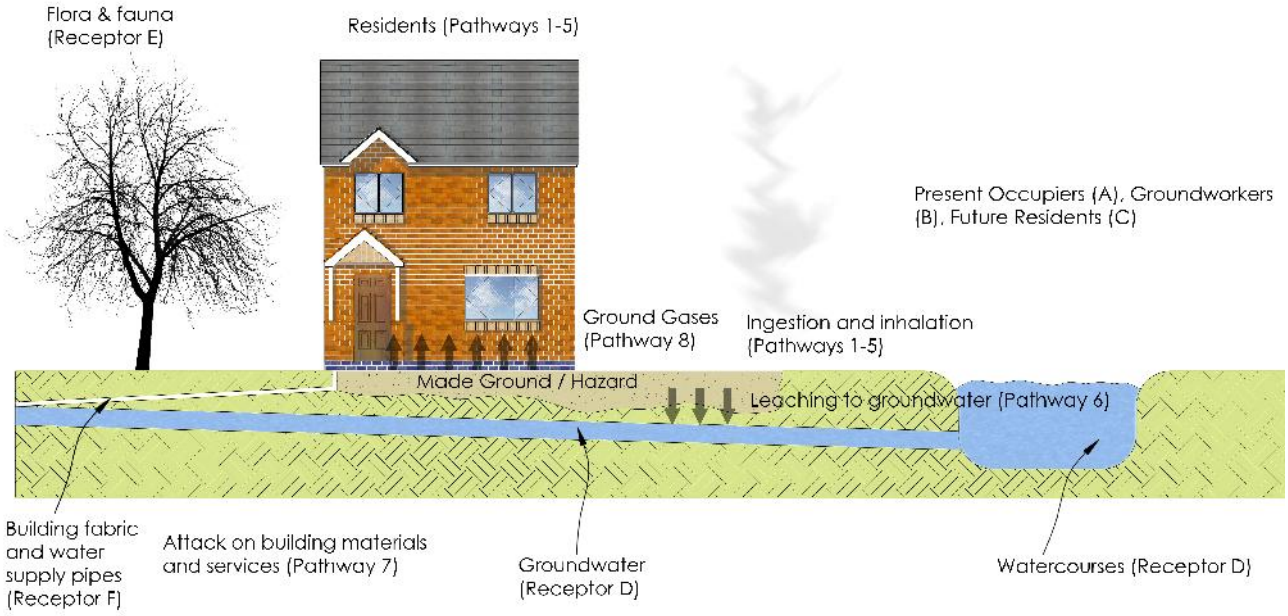
Scale: NTS

Figure: 2



Pathways

1. Ingestion of contaminated soil/dust
2. Ingestion of contaminated food
3. Ingestion of contaminated water
4. Inhalation of contaminated vapours
5. Dermal contact with contaminated soil/dust or water
6. Pollution of controlled water and off site migration
7. Attack on building materials and services
8. Migration of landfill gases and radon

Receptors

A. Present site occupiers
B. Site development personnel
C. Future residents
D. Controlled waters
E. Flora and fauna
F. Building and services

Schematic Representation of Conceptual Site Model

Schematic Representation of Conceptual Site Model

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Figure: 3

Appendix 1

GroundSure Enviro-Insight and Geo-Insight Reports