

PHASE I GEO-ENVIRONMENTAL DESK STUDY

LAND OFF HYDE ROAD

Manchester City Council

Report: 10041634-ARC-XX-XX-RP-ZZ-0002-01-P1DS

JUNE 2020

Incorporating

EC HARRIS
BUILT ASSET
CONSULTANCY



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Land off Hyde Road

Phase I Geo-Environmental Desk Study

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This report dated 25 June 2020 has been prepared for Manchester City Council (the “Client”) in accordance with the terms and conditions of appointment dated 17 April 2020 (the “Appointment”) between the Client and **Arcadis Consulting (UK) Limited** (“Arcadis”) for the purposes specified in the Appointment. The contents of this report may only be used by or relied upon by any person other than the Client in accordance with the terms of the Appointment.

CONTENTS

1	INTRODUCTION	1
1.1	Appointment.....	1
1.2	Objectives.....	1
1.3	Scope of Works.....	1
1.4	Reliability of Information / Limitations	2
2	SITE SETTING	3
2.1	Site Location	3
2.2	Site Description	3
2.3	Potential On-site Contamination Sources & Pathways	3
2.4	Surrounding Land-use	3
3	ENVIRONMENTAL SETTING	5
3.1	Geology.....	5
3.1.1	Regional Geology – Published Sources	5
3.1.2	Radon Affected Areas.....	6
3.1.3	Ground Stability Issues.....	6
3.1.4	Coal Mining Affected Areas	6
3.1.5	Other Mining Activity and Mineral Resources.....	6
3.2	Hydrogeology and Groundwater Vulnerability	7
3.2.1	Regional Hydrogeology	7
3.2.2	Aquifer Classification	7
3.2.3	Groundwater Vulnerability	7
3.2.4	Groundwater Abstraction	7
3.2.5	Groundwater Protection Zones.....	7
3.3	Hydrology	7
3.3.1	Surface Water Features.....	7
3.3.2	Flooding Risk	8
3.3.3	Discharge Consents	8
3.3.4	Pollution Incidents.....	8
3.4	Landfills and Waste Management Activities.....	8
3.5	Current Industrial Land-Use	8
3.6	Environmental Designations	8

3.7	Invasive Plants & Species.....	8
3.8	Unexploded Ordnance (UXO) Screening Assessment	9
4	SITE HISTORY	10
4.1	Site History	10
4.2	Potentially Contaminative History of the Surrounding Area.....	10
4.3	History Summary	11
5	PRELIMINARY CONCEPTUAL SITE MODEL.....	12
5.1	Introduction	12
5.2	Contamination Sources	12
5.2.1	On-Site.....	12
5.2.2	Off-Site.....	13
5.3	Contamination Pathways	13
5.3.1	Airborne Migration Pathways.....	13
5.3.2	Direct Contact Exposure Pathways	13
5.3.3	Aqueous Migration Pathways	13
5.4	Contamination Receptors	14
5.4.1	Human Health	14
5.4.2	Ecosystems.....	14
5.4.3	Property (buildings, landscaping etc.)	14
5.4.4	Water Environment	14
5.5	Preliminary Qualitative Risk Assessment.....	14
5.5.1	Overall Environmental Risk	15
6	OTHER DEVELOPMENT CONSTRAINTS	16
6.1	Preliminary Geotechnical Appraisal	16
7	CONCLUSIONS AND RECOMMENDATIONS	17
7.1	Geo-Environmental Risks	17
7.2	Recommendations.....	17
7.2.1	Phase II Ground Investigation	17

APPENDICES

APPENDIX A

Arcadis Study Limitations

APPENDIX B

Figures & Drawings

APPENDIX C

Site Walkover Photo Log

APPENDIX D

Groundsure Insight Report

APPENDIX E

BGS and E3P Borehole Records

APPENDIX F

Environet Japanese Knotweed Report

APPENDIX G

Zetica Pre-Desk Study UXO Assessment

APPENDIX H

Historical Ordnance Survey Maps

1 INTRODUCTION

1.1 Appointment

Arcadis Consulting (UK) Limited (Arcadis) was commissioned by Manchester City Council to complete a "Phase 1" Geo-Environmental Desk Study for redevelopment of the site located off Hyde Road, Manchester, M12 5AL (the "site").

Manchester City Council is in the process of negotiating the purchase of the Showcase cinema site (approximately 16.7 acres) located between Hyde Road and Kirkmanshulme Lane. This acquisition will allow the demolition of the existing cinema and redevelopment of the central part of the site with a 1200 place high school and residential use of the two parcels of land lying to the southeast and northwest of the main site. As part of the City Councils due diligence, site investigation surveys are required to understand the cost and scope of any remediation to enable future development for education and residential uses across the site.

All work contained within this report was conducted in line with UK regulatory guidance, Land contamination: risk management (Environment Agency, 2019); the Investigation of Potentially Contaminated Sites – Code of Practice (BS10175:2011+A2:2017), and the Code of Practice for Ground Investigations (BS5930:2015+A1:2020).

1.2 Objectives

As part of the purchase due diligence, the client needs to obtain and review information on ground conditions to inform potential redevelopment constraints, the potential scope and cost of any remediation required for the proposed end use, and to assist in the determination of the Net value of the site.

The objectives of this Phase 1 desk study are to:

- Establish the environmental setting of the site including the geology, hydrology, and hydrogeology;
- Evaluate the environmental sensitivity of the site with regards to ecology, archaeology, previous mining/quarrying activities, ground subsidence etc;
- Assess the likely environmental condition of the site based on its current and historical use, and that of the surrounding area;
- Develop a Conceptual Site Model (CSM) to produce a preliminary risk assessment identifying and qualitatively assessing risks to Human Health and Controlled Water receptors; and,
- Provide recommendations for the scope of Phase 2 intrusive investigation at the site, focussed on assessing potential chemical contamination and geotechnical concerns.

1.3 Scope of Works

To achieve the objectives the following scope of work was defined:

- Complete a site walkover examining the site for potential items and areas of concern, and review information collected for incorporation into the study;
- Review and evaluate the published and readily available information concerning the site including:
 - Recent Ordnance Survey (OS) maps;
 - Public register and environmental information – provided by Groundsure;
 - Historical Ordnance Survey maps – provided by Groundsure;
 - BRE Radon Atlas for England;
 - British Geological Survey (BGS) published maps and online GeoIndex including relevant archive borehole records;
 - The Coal Authority (CA) website; and,
 - The Environment Agency (EA) website.
- Obtain a preliminary Unexploded Ordnance (UXO) screening assessment, to provide an indication on the likelihood of UXO being present beneath the site;

- Develop a Conceptual Site Model and prepare a Preliminary Risk Assessment; and
- Determine potential development constraints that would affect the design of foundations and construction.

1.4 Reliability of Information / Limitations

Arcadis warrants that the services performed were conducted in a competent and professional manner in accordance with sound consulting practices and procedures.

Arcadis cannot warrant the actual property conditions described in this report beyond matters amenable to confirmation within the limits of this report.

The reader is referred to the Study Limitations, presented in Appendix A.

2 SITE SETTING

2.1 Site Location

The site comprises an area of land approximately 3km southeast of Manchester city centre which is currently occupied by the Showcase Cinema and adjoining car parking. The site is situated north of Belle Vue Greyhound Stadium, bound by Hyde Road to the north and Kirkmanshulme Lane to the south. A residential housing development is present to the west and a leisure outlet is located to the east.

The centre of the site is located roughly at National Grid Reference 387602 396211, and an indicative post code for the site is M12 5AL. A site location plan illustrating the current red-line site boundary and the current site layout is presented in Appendix B.

2.2 Site Description

A site walkover was undertaken on 19th June 2020 and the following paragraphs provide a summary of observations made during the visit. A selection of photographs taken during the site walkover are included in Appendix C.

As per the plans in Appendix B, the site can be divided into three plots; two smaller plots to the northwest and southeast covering 2.3ac and 1.8ac respectively, and the larger central plot covering 12.6ac.

The entrance to the site is located off Hyde Road. The access road continues to the south where an exit is provided to Kirkmanshulme Lane. The site is currently occupied by the Showcase Cinema located to the north of the central parcel with parking facilities to the south of the building. The north-western parcel comprises an area of redundant hardstanding and the south-eastern parcel comprises further car parking.

Hardstanding is present across the majority of the site along with flagged areas and some areas of soft landscaping. The hardstanding across the majority of the site is in very good condition, however the parcel of land to the southeast has numerous cracks and uprooting from mature trees, with Japanese knotweed observed in the cracks. The western boundary of the site is occupied by a mature tree line, and grassed areas, with Japanese Knotweed observed. The southern border is divided by mature trees, hedgerows and bollards along the boundary. Surface water drains are located in the car parks. These were frequently observed to be clogged and some surface water flooding was seen around the site. A member of the cinema staff commented that some fly tipping had occurred in the past.

The site topography is roughly level with ground elevation at around 60-61m AOD. During the walkover, it was observed that the site is generally flat, with the exception of the western boundary which had a gentle slope towards to the east. The south-eastern parcel of land was elevated compared to the main car park.

2.3 Potential On-site Contamination Sources & Pathways

During the site walkover, the following potential on-site contamination sources were noted:

- Designated car parking areas, although ground conditions were generally good, some areas of poor-quality hardstanding were observed.
- Several substations on site, however historic plans suggest these were built around the same time as the cinema (late 1980's), therefore the use and presence of polychlorinated biphenyl (PCB) is unlikely.
- Waste facility onsite.
- Fly tipping onsite, potentially containing hazardous or contaminative materials.
- Surface water drainage, generally reasonable condition, however some blocked, therefore damage to drainage could provide a contamination pathway.

2.4 Surrounding Land-use

The current land uses surrounding the site are described below:

North: The site is bound to the north by Hyde Road with Gorton Park, B&M Home Store and smaller terraced residential and commercial properties beyond.

- East:** Adjacent to the site to the east is a commercial property occupied by Gala Bingo with parking facilities and Diamond Lodge hotel.
- South:** Directly south of the site is Belle Vue Greyhound Stadium, Sports Village and National Speedway Stadium, beyond which lie residential properties.
- West:** The site is bound to the west by a mature tree line with residential properties beyond. British Car Auctions is located directly west of the north-western site area.

3 ENVIRONMENTAL SETTING

3.1 Geology

3.1.1 Regional Geology – Published Sources

The regional geological information pertaining to the site was gained from a review of the BGS 1:50,000 scale map (Manchester, Sheet 85, 2011), BGS online GeoIndex website and a site-specific Groundsure Insight report (Appendix D). This was supplemented where possible by archived borehole records available through the BGS GeoIndex (Appendix E) and a search of the Manchester City Council planning portal for ground investigation reports undertaken to support nearby planning applications (Appendix E).

Unit	Published Information	Borehole Record Information
Superficial Deposits		
Artificial	Infilled Ground (South east corner – relating to historic boating lake) General Made Ground – unknown thickness anticipated across the site, associated with previous development.	No borehole records within extent of infilled ground.
Superficial	Till, Devensian - Diamicton (100% Coverage) Unsorted and unstratified drift, generally over consolidated, deposited directly by and underneath a glacier without subsequent reworking by water from the glacier. It consists of a heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape.	2019 E3P Site Assessment for Belle Vue Manchester: - BH101 (~125m east): 1.8 – 15.1m bgl – Stiff to very stiff brown CLAY with occasional gravel and lenses of red sand toward the base. Very stiff from 7m bgl. - BH102 (~195m south): 1.0 – 16.6m bgl – Stiff to very stiff CLAY with occasional gravel and cobbles. Very stiff from 15m bgl. SJ89NE646 (~95m northwest): 0.3 – 10m bgl - Very stiff brown slightly silty CLAY with occasional medium fine gravel (Boulder Clay). SJ89NE647 (~135m northwest): 1.5 – 10m bgl - Stiff becoming hard from 2.50m brown slightly silty CLAY with occasional medium fine gravel (Boulder Clay). SJ89NE1598 (~170m east): 0.49 – 30.27m bgl - Black clay wet 1.68m, brown sandy clay 4.91m, Stiff brown clay with pebbles 18.72m, light brown clay with small gravels 26.22m, gravel bed 30.27m.
Bedrock		
Bedrock	Chester Pebble Beds Formation- Sandstone (100% Coverage) Triassic sandstone, fine to coarse-grained, commonly pebbly, with conglomerates and sporadic siltstones; cross-stratified.	2019 E3P Site Assessment for Belle Vue Manchester: - BH101 (~125m east): 15.1 – 15.45m bgl (base of borehole) – Dense red brown weathered sandstone. - BH102 (~195m south): 16.6 – 16.95m bgl (base of borehole) – Dense red brown weathered sandstone.

	SJ89NE1598 (~170m east): 30.27 – 70.19m bgl (base of borehole) - Weathered red sandstone 32.19m, saturated red sandstone 70.19m. SJ89NE663 (~325m east): 29.4 – 31m bgl - Red brown weathered fine to medium grained sandstone. SJ89NE1404 (~165m south): 18 – 70m bgl (base of borehole) – Soft red sandstone 23m, soft yellow sandstone 25m, red sandstone and marl 70m.
Faults	17m west - normal fault, inferred; downthrow side indicated to east

3.1.2 Radon Affected Areas

Review of the Indicative Radon Map of the UK shows that some parts of the searched 1km grid square are in bands of elevated radon potential. Maximum radon potential indicated to be 1-3 %.

The Groundsure report, accurate to 50m suggests between 1 and 3% of properties are above the action level within the northwest corner of the site. The remainder of the site is not in a Radon affected area, as less than 1% of properties are above the action level.

On this basis, radon measures would not be required for any new residential dwellings on site and unlikely to be required for new commercial structures.

3.1.3 Ground Stability Issues

The Groundsure report indicates the following with regards to ground stability issues:

- Negligible risk from compressible deposits and ground dissolution of soluble rocks.
- Very low risk from shrink swell Clays, running sands, collapsible deposits and landslides.

3.1.4 Coal Mining Affected Areas

The Groundsure Insight report states that the site is located within the specified search distance of an identified coal mining area. However, review of the information presented on the interactive CA web map viewer indicates the site is not within a development high risk area. The CA map viewer also indicates:

- There are no records of surface mining or past shallow coal mining within the vicinity of the site;
- The nearest “probable” shallow coal mining workings are indicated approximately 1.25km to the north of the site, associated with coal outcrops in the area;
- There are no mine entries within the vicinity of the site; the nearest is located approximately 850m to the northwest;
- There are no records of underground working beneath the site. Underground workings are recorded beneath land approximately 290m west, however workings are indicated at -349m AOD or a depth of roughly 402m bgl.

Given the above, the site is not considered to be at risk from coal mining related issues, and no coal mine workings or shallow coal seams are indicated to be present beneath the site.

3.1.5 Other Mining Activity and Mineral Resources

Review of the Groundsure report indicates there are no records of non-coal mining activities at the site including natural cavities, brine and gypsum extraction or tin and clay mining.

As described in Section 3.1.1, the geology beneath the site is anticipated to comprise Superficial Deposits of Devensian Glacial Till clay (around 15-20m deep). With reference to the BGS report CR/05/182N “Mineral Resource Information in Support of National, Regional and Local Planning: Greater Manchester (comprising Cities of Manchester and Salford and Metropolitan Boroughs of Bolton, Bury, Oldham, Rochdale, Stockport,

Tameside, Trafford and Wigan)”, brick clay is the term used to describe ‘clay and shale’ used in the manufacture of structural clay products. In Greater Manchester, brick clay has been produced for local consumption from small brick pits via the extraction of a variety of clays including boulder clay. Today, one active clay quarry remains in Manchester, at Harwood, working the Pennine Lower Coal Measures (PLCM). The report states that the PLCM are the principal brick clay resource in North West England, therefore it is unlikely that the Glacial Till beneath the site would be used as a source for brick clay in the future.

Sandstone bedrock comprising the Triassic Chester Pebble Beds Formation of the Sherwood Sandstone Group is present beneath the superficial Glacial Till. The BGS report states that the Sherwood Sandstone is rarely worked due to difficulties in removing overburden in the form of Glacial Till and extra treatment required which can make the resource uneconomic compared to more easily worked glacial sands.

In view of the above, it is considered that the Glacial Till clay has no potential value as a mineral resource for construction related use and extraction of the underlying sandstone would not be viable due to the anticipated thickness of clay overburden above and the limited size of the development site.

Additionally, it is considered unlikely that excavations for the development of residential housing or a high school building on the site would extend below the superficial clay strata underlying the site, however onsite ground conditions need to be confirmed through a Phase 2 intrusive ground investigation.

3.2 Hydrogeology and Groundwater Vulnerability

3.2.1 Regional Hydrogeology

The historical borehole logs available for the surrounding area record water strikes at depths of between 24.0 to 28.0m bgl, and resting groundwater levels between 18.5 to 22.0m bgl. The regional water table appears to lie within the upper sandstone strata. Groundwater flow direction is unclear at this stage.

3.2.2 Aquifer Classification

The Groundsure report indicates that the Superficial geology is classified as a Secondary Undifferentiated Aquifer. Generally, these layers have been previously designated as minor and non-aquifers due to variable characteristics of the rock type.

The bedrock geology is classified as a Principal Aquifer. Principal aquifers have high intergranular and/or fracture permeability, providing a high level of water storage and may support water supply/river base flow on a strategic scale.

3.2.3 Groundwater Vulnerability

An assessment of the vulnerability of the groundwater beneath the site to a pollutant discharged at ground level is presented in the Groundsure report.

Groundwater vulnerability at the site has been assessed as Low, which is described as areas providing greatest protection from pollution, likely characterised by the presence of low permeability superficial deposits.

3.2.4 Groundwater Abstraction

The Groundsure report found no current records relating to licensed groundwater abstractions within 1km of the site. There are six records of historical groundwater abstractions, the nearest located 163m east for groundwater from the Permo-Triassic sandstone for dust suppression at Belle Vue.

3.2.5 Groundwater Protection Zones

The site does not lie within 500m of a groundwater Source Protection Zone (SPZ).

3.3 Hydrology

3.3.1 Surface Water Features

The Groundsure report indicates that the nearest surface water body is Platt Brook located 366m south.

3.3.2 Flooding Risk

The Groundsure report indicates that the site is in Flood Zone 1 and is not at risk of flooding from rivers and sea. Localised areas of the site, around the northern perimeter of the cinema building and the access road along the west of the site, are indicated to have a low to high risk of surface water flooding. The site is generally indicated to be at moderate to high risk of groundwater flooding. However, there are no records of historical flood events from rivers, the sea, groundwater or surface water.

3.3.3 Discharge Consents

The Groundsure report includes three records of licensed discharges to controlled waters within 500m of the site. The nearest is a revoked license relating to sewer storm overflow approximately 376m south of the site.

3.3.4 Pollution Incidents

The Groundsure report includes records of four substantiated pollution incidents since 2006 within 500m of the site. None of these had an impact on water, however an incident 323m northeast in 2008 involving vehicles and vehicle parts is stated to have had a significant impact to land.

3.4 Landfills and Waste Management Activities

The Groundsure report did not identify any active or recent landfill sites or BGS/LA recorded historical landfills within 500m of the site.

One EA record of an historical landfill was identified 238m southeast of site. This relates to Mount Road Plant site accepting household waste.

Fourteen historical waste sites are recorded within 500m of the site. The nearest is located 287m southeast relating to a refuse destructor in 1934.

One EA licensed waste site is recorded within 500m of the site. This record relates to King Autos located 412m south, dealing with vehicle depollution.

Fifteen waste exemption records are recorded within 500m of the site. The nearest is located 410m east at Victoria Works, for storage of non-agricultural waste in a secure place.

3.5 Current Industrial Land-Use

The Groundsure report indicates there are 17 potentially contaminative industrial sites within 250m of the study site. Identified on site are two electrical sub stations. Offsite records relate to further electrical features, tanks, containers, storage and warehouses.

The nearest open petrol filling station is 419m east of the site and is operated by Texaco. A closed petrol station is also recorded 229m northwest of the site.

The site is not designated as Contaminated Land under Part 2a of the Environmental Protection Act 1990.

Five records of licensed pollutant release (Part A(2)/B) have been found within 500m of the site. The nearest is 232m northwest of the site relating to Belle Vue Filling Station permitted for unloading petrol into storage at service stations.

3.6 Environmental Designations

The Groundsure report did not identify any of the following statutory protected sites within 2km of the site: Site of Special Scientific Interest (SSSI), Conserved Wetland Site (Ramsar Sites), National Nature Reserve (NNR), Special Area of Conservation (SAC), Special Protection Area (SPA), RAMSAR, Local Nature Reserve (LNR), Designated Ancient Woodland, Biosphere Reserves, Forest Parks, Marine Conservation Zones, Green Belt, Proposed Ramsar Sites, Possible Special Areas of Conservation (pSAC), Potential Special Protection Areas (pSPA) or Nitrate Sensitive Areas/Vulnerable Zones.

3.7 Invasive Plants & Species

A specific ecological walkover has not been completed by Arcadis, and therefore no detail can be given regarding the presence or absence of invasive plants / protected species.

However, Arcadis has been made aware that Japanese Knotweed is present within areas of the site. Environet UK Ltd had been commissioned by Reed Smith LLP on behalf of National Amusements Ltd LLC to assess liabilities associated with Knotweed at the site and Japanese Knotweed has been identified in several areas. The findings and recommendations of their report can be found in Appendix F.

3.8 Unexploded Ordnance (UXO) Screening Assessment

A search of Zetica UXO Risk Map identified the site is located within an area of moderate risk from UXO. The area is indicated as having a bombing density of 15 to 49 bombs per 1000 acres.

A Pre-Desk Study UXO Assessment was requested from Zetica and is presented in Appendix G. Zetica's recommendation is that whilst always prudent, a detailed desk study is not considered essential for this site.

4 SITE HISTORY

4.1 Site History

Based on historical maps provided by Groundsure (presented in Appendix H) the site history is summarised below.

Map Dates	Comments
1849	The majority of the site was originally part of Belle Vue Gardens. Several ponds are shown to the southwest of the site.
1893 - 1961	The site was developed as Belle Vue Zoological Gardens with buildings present across the northern half, a lake in the south-eastern parcel and a pond and landscaping to the south. A railway siding appears to enter and terminate in the north-western corner of the site. The buildings to the north may have been associated with the neighbouring brewery. A tank is labelled within the southern boating lake on the 1933 map edition. Additional small ponds are shown to the south of the site from 1950 and a scenic railway is shown to the northwest from this date. A miniature railway and chimney are depicted on the 1960 map though the centre of the site.
1968 - 1984	Northern part of the site remains unchanged with similar building layout. Boating lake to the east of the site appears to have been infilled. Lake to the south potentially also infilled. The site is called Belle Vue Leisure Park by 1984.
1985 - 1989	Site has been cleared with two roads appearing to enter the site from neighbouring highways to the west of site.
1991 - 2001	Site has undergone major redevelopment into current layout with main cinema building to the north of the central parcel, car parking to the south and east and access road on site.
2003	Majority of the site remains unchanged. Northwest corner has seen small development of two buildings.
2019 (Aerial Photograph)	Large central building (Cinema) remains with car parking to the south. Buildings in northwest corner demolished between 2015 and 2019.

4.2 Potentially Contaminative History of the Surrounding Area

Based on historical maps provided by Groundsure (presented as Appendix H) the pertinent history of the area surrounding the site is summarised below.

Location	Map dates	Land Use
~450m south	1849 - 1923	Print and bleach works. Relabelled dye works and chemical works from 1892.
Adjacent northwest	1892 - 1933	Railway line from Longsight station approximately 700m southwest.
~20m west (potentially extending onsite)	1892 - 1923	Brewery.
~300m east	1892 - Present	Railway line.
~200m northwest	1892 - 1981	Iron works. Labelled engineering works and iron works from 1923 map.

Phase 1 Geo-Environmental Desk Study
Land off Hyde Road

Adjacent north and south	1893 - 1933	Tramlines shown within Hyde Road and Kirkmanshulme Lane.
~300m south	1905 – 1923	Tarpaulin works.
~340m northeast	1905	Brick Works
~350m southeast	1905 – 1968	Sewage works. Later just labelled refuse destructor.
~35m west	1908	Gas works. Tanks shown between 1893 and 1922, however only labelled gas works on 1908 map.
~190m east	1915 - 1938	Corporation Yard
~150m west	1934 - 1985	Speedway stadium and exhibition hall.
~350m northeast	1934 - 1985	Motor works.
~250m west	1991 – Present	Car auction.

4.3 History Summary

The site was originally part of Belle Vue Gardens, later becoming the Belle Vue Zoological Gardens. Several ponds and boating lake features were subsequently infilled and by 1991 the site was redeveloped to the current layout principally comprising a cinema building and associate car parking. The recent buildings located on the northwest parcel have since been demolished.

Surrounding land has comprised a mix of industrial, commercial leisure and residential uses. Nearby breweries, tanks, engineering and other works were present locally from the late 1800's, however heavy industry has since faded from the area.

5 PRELIMINARY CONCEPTUAL SITE MODEL

5.1 Introduction

This section summarises the findings of this desk-based assessment and site reconnaissance in the form of a geo-environmental conceptual site model (CSM).

The CSM provides a qualitative evaluation of potentially active “pollutant linkages” at the site; these being plausible scenarios whereby a contamination source is connected to a possible receptor by one or more pathways:

- Potential sources of contamination: these include any actual or potentially contaminating materials and activities, located either on or near the site;
- Potential pathways for contamination migration: these comprise the routes or mechanisms by which contaminants may migrate from the source to the receptor including environmental migration pathways and human health exposure pathways; and
- Potential receptors of contamination including present and/or future land users, ecological systems, water resources and property.

5.2 Contamination Sources

Based on the information reviewed in this report the following potential contamination sources have been identified.

5.2.1 On-Site

The table below summarises the potential on-site contamination sources (current and historic) and the primary contaminants associated with them.

Potential Sources	Primary Contaminants
Made Ground/ Infilled Ground	Polycyclic Aromatic Hydrocarbons (PAHs), toxic metals, sulphate, asbestos. Ground Gas – potentially elevated concentrations if Made Ground contains a high organic content and/or contamination is present within the infilled water bodies.
Railway Infrastructure	Fuel Oils, PAHs, herbicides, ash, sulphate, solvents, toxic metals.
Parked Vehicles	Total Petroleum Hydrocarbons (TPH) (including MTBE/BTEX).
Pre-1999 Buildings	Buried Asbestos Containing Material (ACM) e.g. cement sheeting, pipework lagging etc.
Brewery (Associated Chemicals and Alcohol)	Any contaminative chemicals that are associated with former brewery processes on site.

5.2.2 Off-Site

Potentially contaminative current and historic land uses have been identified within the surrounding area, the most pertinent of which are presented in the table below with associated potential contaminants.

Potential Sources	Primary Contaminants
Railway Infrastructure	TPH, PAH, solvents, creosote, sulphate, toxic metals.
Petrol Filling Station	Hydrocarbons.
Various Engineering Works	Toxic metals, PAH, TPH, solvents, asbestos.

5.3 Contamination Pathways

Potential migration pathways based on the sites perceived current condition and potential future residential end-use (the most conservative scenario) are discussed below.

5.3.1 Airborne Migration Pathways

Airborne pathways via which particulate and/or vaporised ground contaminants can migrate to sensitive receptors within soil (air pores), and the above ground atmosphere:

- While a large proportion of the site area will be covered in some form of hard standing; gardens and soft landscaped areas will be incorporated as part of the redevelopment plans. As such, particulate inhalation due to dust generation is a potentially active pathway. During development works, sub-surface soils will be exposed at the surface and therefore dust has the potential to be generated and inhaled by site operatives.
- Vapour inhalation pathways in relation to soil are potentially active irrespective of site status. A vapour inhalation pathway in relation to isolated / perched groundwater may be potentially active if a shallow groundwater body is identified during intrusive investigation.
- Vertical migration of permanent ground gases (CO₂, CH₄, O₂), including those generated by potential soil/groundwater contamination, and subsequent accumulation in confined spaces leading to asphyxiation and/or explosion is considered potentially active.

5.3.2 Direct Contact Exposure Pathways

Pathways via which ground contaminants can migrate to human receptors by ingestion and/or absorption:

- While a large proportion of the site area will be covered in some form of hard standing; gardens and soft landscaped areas will be present. As such, direct contact pathways in relation to soil are considered active.
- A direct contact pathway in relation to isolated / perched groundwater may be potentially active if a shallow groundwater body is identified during intrusive investigation.
- Direct contact pathways will be active throughout the construction phase when the sub-surface soils are exposed in excavations / reduced-level digs.

5.3.3 Aqueous Migration Pathways

- Leaching of contaminants in the shallow soils is likely to be negligible in areas of hardstanding where infiltration of rainfall would be minimal. However, in areas of soft landscaping infiltration of rainfall may occur prompting the migration of any dissolved-phase contamination; as such this pathway is considered potentially active.
- Lateral migration of potential on-site, and off-site contamination onto site, is considered active, as groundwater within the Bedrock is considered likely mobile. It is unknown whether a shallow groundwater table exists and what its viability is as a medium for transport of contamination.
- Certain types of contamination have the potential to permeate plastic water supply pipes and impact drinking water quality. The type and extent of contamination on site is currently unknown, therefore this is considered a potentially active pathway.

5.4 Contamination Receptors

With reference to Part 2a of the Environmental Protection Act (1990), the potential receptors to be considered in any contaminated land scenario can be categorised as follows.

5.4.1 Human Health

For the purposes of this assessment a residential/education scenario has been assumed. Therefore, construction workers and residential/school end-users are the primary receptors of concern with regards to contamination risk.

Users of the adjacent buildings (neighbouring residents) could also be at risk. However, for exposure to occur, active cross-boundary migration pathways would be required.

5.4.2 Ecosystems

An ecological site walkover has not been completed by Arcadis to investigate for protected species, however it is understood that the site is not located within 500m of a statutory protected area.

5.4.3 Property (buildings, landscaping etc.)

The proposed development will include new structures and associated infrastructure, the concrete of which could be subject to potential sulphate attack (naturally occurring or originating from contamination).

5.4.4 Water Environment

Groundwater beneath the site requires consideration and protection. The Bedrock deposits beneath the site are classified as a Principal Aquifer, therefore the resource value for water in the bedrock is likely significant with the potential for contaminant mobility both laterally and vertically. Hence, groundwater resources are considered to potentially be at risk from contamination originating on-site or off-site. However, the groundwater vulnerability is considered to be reduced due to the anticipated overlying low permeability superficial strata.

There are no surface water features within proximity of the site, and therefore surface water features are not considered a potential receptor.

5.5 Preliminary Qualitative Risk Assessment

Based on the CSM the following table presents the plausible Source-Pollutant-Receptor (SPR) linkages that apply to this site, including the likelihood of risk to receptor.

Potential Receptor	Potential Source	Potential Pathway	Risk*
Future End-Users Construction workers, staff/pupils, residents, visitors, and neighbouring residents/workers. Construction Workers During redevelopment	Made Ground	Dermal Contact & Ingestion Particulate/Fibre Inhalation Vapour Inhalation	Low
	On-Site Point Sources Infilled ground, historic railway infrastructure, parked vehicles, historic/demolished buildings, historic brewery.	Soil Leaching / Aqueous Migration Dermal Contact & Ingestion Particulate/Fibre Inhalation Vapour Inhalation	Low to Moderate
	Off-Site Point Sources	Soil Leaching / Aqueous Migration	Low

	Railway infrastructure, petrol station, engineering works.	Vapour Inhalation	
	Permanent Ground Gas	Vapour Inhalation (locally)	Moderate
Controlled Waters Groundwater in underlying aquifers	Made Ground and On-Site Point Sources	Soil Leaching / Aqueous Migration	Low to Moderate
Property Future Buildings	Sulphate impacted soil and groundwater	Chemical Attack	Moderate
	Ground Gas	Structural Damage due to explosion of combustible gas	Low - Moderate
Property Future Landscaping	Contaminated Soil – phytotoxic contaminants	Vegetation Root Uptake	Low to Moderate (easily managed by providing clean planting medium)
Property Future water supply pipes	Organic Contamination	Impacts to drinking water quality	Low to Moderate

*Based on a Residential Land-use Scenario without any mitigation/remediation measures

5.5.1 Overall Environmental Risk

In general, the preliminary risk for the site in the context of potential future residential education redevelopment is considered to be **low to moderate**; primarily due to:

- The site's development history and its probable impact on the type and amount of Made Ground materials beneath the surface (particularly within the areas of infilled ground associated with former lakes and ponds);
- Potentially contaminative localised historical processes and associated contamination sources on-site; and
- The likelihood for viable/potentially active pathways for potential contamination to significantly affect the soil, groundwater (including migration within), and thereby impact upon receptors.

Near-surface and surface contaminants in areas of the site could impact upon **construction workers** during redevelopment groundworks activities, however it is envisaged that pre-commencement investigations/surveys, appropriate health and safety risk assessment and personal protective equipment would provide appropriate mitigation for acute exposure.

The preliminary risk to **future end-users** from potentially contaminated ground is considered low to moderate at this stage, however the risk ultimately depends on the extent and nature of the Made Ground and the level of contaminant concentrations present (to be investigated during a Phase II assessment).

Given the potential for areas of infilled ground, a moderate risk exists from **permanent ground gas** until proven otherwise or mitigated through incorporation of appropriate gas protection measures into new buildings.

The preliminary environmental risk posed by the site to **groundwater** is considered low to moderate at this stage. This is based on the presence of potential historical and current on-site ground contamination sources and the Principal Aquifer designation. However, the anticipated significant thickness of overlying low permeability superficial strata is expected to afford some protection to the aquifer.

Risks to **property** including chemical attack, phytotoxic soil conditions and degradation new water supplies is considered low to moderate until proven otherwise and will be mitigated by survey and design if required.

6 OTHER DEVELOPMENT CONSTRAINTS

6.1 Preliminary Geotechnical Appraisal

The following table summarises the potential geotechnical constraints associated with site and the further investigation required to address uncertainties.

Ground / Groundwater Constraint	Consequence	Further Investigations / Actions
Ground / groundwater aggressive to concrete	Risk of deterioration of below ground concrete and mortar, loss of structural integrity, reduction in design life.	As the aggressivity of the site soils is currently unknown this risk is considered moderate. Sampling and testing of soils and groundwater should be undertaken to determine aggressivity to concrete.
Compressible ground	Risk of foundation stability over time due to ground compressing under new load – potential issue for any new structures intended for the site, particularly within the areas of infilled historic ponds and lakes.	Sampling and testing of soils to determine compressibility.
Poor ground conditions	An unknown thickness of Made Ground is anticipated to be present beneath the site. If extensive, shallow foundations may be unsuitable for the proposed development.	Intrusive investigation to determine near surface and deeper ground conditions.
Relict foundations from previous development	Encountering abandoned below ground structures leading to additional groundworks and consequential delays.	Carry out intrusive investigation in vicinity of historic structures.

7 CONCLUSIONS AND RECOMMENDATIONS

This Phase I report presents an assessment of the geo-environmental information pertaining to the site based on readily available desktop / published sources and a site reconnaissance walkover survey.

The objective of this assessment was to collate and review the available geo-environmental information to determine potential ground contamination risks associated with the site in its current condition and with regards to potential residential and education redevelopment.

7.1 Geo-Environmental Risks

From the review of the available site information it is plausible that historical and current land-uses of the site may have generated contamination impacts to soil and/or groundwater. Potential contamination sources have been identified including Made Ground deposits and localised sources associated with localised historical use of site with railway infrastructure, car parking, infilled lakes etc. There are potentially active pollutant linkages between these sources and identified receptors.

The preliminary risk to future Human Health (under potential redevelopment proposals) and controlled waters associated with potentially “active” Source-Pathway-Receptor linkages is generally considered to be low to moderate at this stage. This should be interrogated/tested by appropriate sampling, analysis and risk assessment during Phase II investigations.

Under the redevelopment proposals, certain exposure pathways may remain active (particularly during construction and in landscaped areas) and therefore may require mitigation by management and design.

7.2 Recommendations

Prior to any redevelopment of the site, intrusive investigations will be required to establish the nature of the ground conditions and to identify and confirm any potential contamination or geotechnical risks. Additional future intrusive investigations will be required to obtain development-specific geotechnical design parameters.

Potential pollutant linkages have been identified which merit further investigation to characterise the ground conditions and therefore the investigation strategy should include an “environmental” investigation; designed to interrogate the Phase I CSM, establish the status of the identified Source-Pathway-Receptor linkages and thereby reduced uncertainties in the preliminary risk assessment.

7.2.1 Phase II Ground Investigation

A Phase II Ground Investigation has been commissioned and will be reported separately.

A proposed exploratory hole plan (Appendix B) has been produced for a combined environmental and geotechnical investigation of the site with locations positioned to target areas of potential concern and to provide an even spatial coverage to characterise ground and groundwater conditions across the site.

The investigation strategy involves soil sampling via percussive boreholes, and the preliminary scope of work comprises:

- Utility surveying and spot clearance;
- 7no cable percussion boreholes to 15m or refusal, with in-situ Standard Penetration Tests (SPTs);
- 16no windowless sampling boreholes to a target depth of 5m bgl;
- In-field soil sampling and screening (utilising a Photo Ionisation Detector (PID));
- Installation of combined groundwater / ground gas monitoring wells in select locations;
- Laboratory analysis of soil samples to assess potential contamination and waste classification of soils;
- Geotechnical analysis of soil samples;
- Monitoring of wells for groundwater and ground gas (4no monitoring visit and to include initial groundwater sampling)
- Laboratory analysis of groundwater samples to assess potential contamination; and
- Production of an interpretative report.

Phase 1 Geo-Environmental Desk Study
Land off Hyde Road

All works to be conducted in line with UK Regulations and Legislation, including British Standards 10175:2011 +A2:2017 and 5930:2015+A1:2020.