

Manchester Airport Building 401

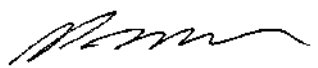
Phase 1 Tier 1 Geo-environmental and geotechnical
Assessment

Manchester Airport Group Ltd

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Quality information

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The methodology adopted and the sources of information used by AECOM in providing its services are outlined in this Report. The work described in this Report was undertaken between **24th August 2021** and **15th September 2021** and is based on the conditions encountered and the information available during the said period of time. The scope of this Report and the services are accordingly factually limited by these circumstances. AECOM disclaim any undertaking or obligation to advise any person of any change in any matter affecting the Report, which may come or be brought to AECOM's attention after the date of the Report.

The site reconnaissance consisted of a general external inspection of the site aimed at identifying any obvious signs of geotechnical hazards and potential sources of ground contamination affecting the site. An environmental compliance audit and/or detailed structural inspection of existing buildings were outside the project brief. Similarly, the site visit excluded detailed consideration of the ecological or archaeological aspects of the site, and if such are believed to be of potential significance then it is recommended that specialist advice is sought.

Any risks identified in this Report are perceived risks, based on the information reviewed during the desk study and therefore partially based on conjecture from available information. The study is limited by the non-intrusive nature of the work and actual risks can only be assessed following a physical investigation of the site.

The opinions expressed in this report and the comments and recommendations given are based on a desk assessment of readily available information and an initial site reconnaissance by an AECOM Engineer. At this stage intrusive investigations have yet to be undertaken at site to establish actual ground and groundwater conditions and to provide data for an assessment of the geo-environmental status of the site.

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Table of Contents

1.	Introduction.....	7
1.1	Terms of Appointment	7
1.2	Report Objectives	8
1.3	Sources of Information.....	8
2.	Site Setting	9
2.1	Location	9
2.2	Description and Setting.....	9
3.	Geological and Environmental Setting.....	10
3.1	Introduction	10
3.2	Geology and Soils.....	10
3.3	Hydrogeology.....	13
3.4	Hydrology.....	15
4.	Historical & Planned Development	16
4.1	Historical Ordnance Survey Mapping & Aerial Photographs.....	16
4.2	Planning Authority Records.....	17
4.3	Records from MAG	18
4.4	Unexploded Ordnance Risk	18
5.	Review of Historical Reports.....	19
5.1	ESG Factual Report on Ground Investigation (Feb 2017)	19
5.2	Project Quantum Site Assessment (Feb 2019)	20
5.3	Historical Reports for Adjacent DNATA Warehouse Site	20
6.	Regulated Activities and Statutory Consultation	24
6.1	Introduction	24
6.2	Regulated Processes.....	24
6.3	Licensed Waste Management Facilities.....	25
6.4	Industrial Land Use.....	26
6.5	Sensitive Land Uses	28
7.	Site Reconnaissance	29
8.	Preliminary Ground Model.....	30
8.1	Groundwater	30
8.2	Preliminary Gas Risk Assessment (based on RB17)	31
9.	Initial Conceptual Model	32
9.1	Introduction	32
9.2	Assessment Framework	32
9.3	Sources of Potential Contamination.....	32
9.4	Summary of potential sources	34
9.5	Potential Receptors	35
9.6	Potential Pathways	36
10.	Environmental Risk Assessment	38
10.1	Risk Assessment Principles	38
10.2	Risk Assessment Framework.....	38
10.3	LCRM Assessment of Risk	39
10.4	Preliminary Risk Assessment.....	39
10.5	Discussion of Acute Risk to Future Construction Workers & Off-Site Receptors.	47
11.	Waste Management & Potential Reuse of Site-Won Material.....	48
11.1	Initial Assessment of Probable Waste Generation	48

11.2	Initial Assessment of Probable Material Available for Reuse	48
11.3	Outline Recommendations.....	48
12.	Review of Geotechnical Risk and Preliminary Engineering Assessment.....	49
12.1	Geotechnical Risk.....	49
12.2	Preliminary Engineering Assessment.....	50
13.	Conclusions	51
13.1	Geo-environmental Risks Review.....	51
13.2	Geotechnical Risks and issues	52
14.	Recommendations.....	53
15.	References	54

Figures

Figure 1 Screenshot of relevant exploratory hole locations from BGS GeoIndex Viewer.....	11
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Tables

Table 2-1. Features Surrounding the Site.....	9
Table 3-1. Geological Succession from Published Mapping.....	10
Table 3-2. Geological Succession from BGS borehole Logs.....	11
Table 3-3. Estimated Soil Chemistry	12
Table 3-4. Surface Water Quality	15
Table 4-1 MAG Records.....	18
Table 6-1 Summary of Regulatory Information.....	24
Table 6-2 Potentially Contaminative Industrial Land Use on and Within 250 m of the Site	26
Table 8-1. Preliminary Ground Model.....	30
Table 9-1 Potential Sources of Contamination	34
Table 9-2 Potential Receptors.....	36
Table 9-3 Potential Pathways.....	37
Table 10-1 Description of Severity of Risk.....	38
Table 10-2 Likelihood of Risk Occurrence.....	38
Table 10-3 Risk based on Comparison of Likelihood and Severity.....	39
Table 10-4 Conversion to LCRM Risk Categories.....	39
Table 10-5 Potential Sources, Pathways and Receptors.....	40
Table 15-1: Classification of Probability and Impact.....	60
Table 15-2: Risk Matrix.....	60
Table 15-3: Classification of Risk Rating	60

Appendices

Appendix A Figures	55
Appendix B GroundSure Report and Historic Mapping (including Google Earth Pro aerial photography)	56
Appendix C BGS Recorded Borehole Logs	57
Appendix D Zetica Online UXO planning	58
Appendix E Site Reconnaissance Photo Log.....	59
Appendix F Geotechnical Risk Register.....	60

1. Introduction

1.1 Terms of Appointment

On the instructions of Manchester Airport Group (MAG) (the Client), AECOM Infrastructure and Environment UK Limited (AECOM) has carried out a Phase 1 Geotechnical and Geo-environmental Desk Study of the site known as Building 401.

The work has been carried out in accordance with the AECOM fee proposal dated 07 April 2021, reference MAG_B401_Ph1.

1.1.1 Background and Proposed Development

The report has been produced on the assumption that the site will be redeveloped to incorporate a single warehouse structure divided into three units with incorporated offices. The current proposed warehouse shall cover c.7,056m² occupying approximately one third of the site area. The remainder of the site shall comprise of associated infrastructure, including lorry and car parking, two new access routes into site from Avro Way, and soft landscaping. Figure 3 shows the current proposed development.

The development of the site is anticipated to require the following stages:

- Demolition of the existing building 401 on the site;
- Demobilisation of the temporary structures of the airport bus depot;
- Site earthworks, including excavation levelling and landscaping for external areas;
- Installation of services and site drainage; and
- Construction of the new building and associated infrastructure.

AECOM are privy to a number of existing reports on the site including reports undertaken by AECOM on or in the vicinity of the site previously. These include:

- Project Quantum (AECOM) Report No: MAN-19 60592411, February 2019 – High level desk study and walkover; and
- Manchester Airport Bus Depot Relocation, Wilmslow: Factual Report on Ground Investigation (ESG) Report No: F6042-16, February 2017.

1.2 Report Objectives

The primary objectives of this report are to:

- determine whether potentially contaminative uses have taken place within, or in close proximity to, the site which could have led to the contamination of underlying soils or groundwater; and
- to understand the effects of the geological conditions and site activities on the geotechnical properties for site redevelopment.

This Phase 1 Tier 1 report is prepared to advise on site conditions under the requirements of Town and Country Planning Act 1990 (as amended), the National Planning Policy Framework (2012) and considers the potential implications of Part 2A of the Environmental Protection Act 1990 (Part 2A) and the associated Contaminated Land (England) Regulations 2006 and Contaminated Land Statutory Guidance (2012).

This report has been prepared in general accordance with the technical guidance and procedures described in the UK Government guidance Land Contamination: Risk Management (LC:RM) (2019, revised 2021), British Standard (BS) 5930:2015 (as amended) Code of Practice for Site Investigations (BSI), BS:EN 1997 Eurocode 7 – Geotechnical Design (BSI) and BS 10175:2011 (as amended) Investigation of Potentially Contaminated Sites – Code of Practice (BSI), to:

- Describe the geology, hydrogeology, and shallow mining potential;
- Describe the environmental setting/ sensitivity and current/ historical land use of the site and surrounding area;
- Describe the findings of a site reconnaissance visit;
- Summarise the history of the site;
- Summarise the underlying geology and hydrogeology;
- Summarise the findings of any historical ground investigation work;
- Provide an initial Conceptual Site Model (CSM) for the prevailing ground conditions;
- Using the source-pathway-receptor model present a preliminary qualitative risk assessment of potential land contamination risks to human (chronic), environmental, or controlled water receptors from contamination sources on or in the vicinity of the site, via transport pathways;
- Present a preliminary qualitative evaluation of potential geotechnical issues; and
- Identify the potential need for further intrusive ground investigation and potential need for remediation works. The purpose of such to substantiate the findings of the preliminary risk assessment and thereby refine the CSM.

1.3 Sources of Information

This report has been prepared using a combination of published records from publicly available sources (e.g. British Geological Survey (BGS), Environment Agency, Defra). As part of this assessment a site-specific Groundsure Report has been acquired, including published environmental, geological and hydrogeological data and mapping, and historical mapping for the area.

In addition, information provided by the Client, and from other sources such as the previous reports at or in the vicinity of the site as noted in Section 1.1.1, the Local Authority Environmental Health / Contaminated Land Officer, and observations made during the site reconnaissance have also been reviewed where available.

Specific information sources are referenced throughout the document and a bibliography is included in Section 14 of the report

2. Site Setting

2.1 Location

The site is located on the north east side of the junction of Avro Way and Pinfold Lane (M90 5XR) and is centred on National Grid Reference 380906 384825. The site is within Manchester Airport's landside western commercial and industrial development c.14km south of Manchester city centre. A site location plan is provided as Figure 1.

2.2 Description and Setting

The site covers an area of approximately 2.11 hectares and is defined by the red line boundary shown in Figure 2.

The site is broadly rectangular in shape oriented North East to South West, and is predominantly level with ground elevations ranging from c.68m Above Ordnance Datum (AOD) to c.70mAOD.

The site is currently occupied by commercial development and at the time of this report the site is broadly split into two.

The majority of the north eastern half of the site is occupied by the current MAG Building 401 which covers c.6,785m². To the immediate north west of the building is tarmac and concrete hard standing. To the immediate east is a grass landscaped area with small trees and shrubs which rises gently to Avro Way. To the south of the building the area is slightly larger and comprises a tarmac and concrete area in front of eight lorry bays for the building, with an entrance from Pinfold Lane and associated landscaping.

The south western side of the site is broadly divided into two. The far south western portion lies outside of the fenced boundary for the current development on the site and comprises a broadly level wooded area. The north eastern portion between the wooded area and the main building is an area of tarmac hard standing which was previously the car parking area for building 401. This tarmac area is currently occupied by a 'temporary' bus depot service area for airport vehicles. All of the structures in this area are temporary and stand atop the hard standing, including mobile offices, multiple fuel terminals, associated storage tanks and a vehicle wash. This area also includes a second entrance from Pinfold Lane to the South.

Building 401 is currently derelict and has been empty for some time. The last usage of the site was by an airline food company 'LSG SkyChefs' which is understood to have moved to renovated facilities in building 402 to the immediate north of the site, with additional buildings within the commercial/ industrial estate.

A brief study of the site as Building 401 was undertaken as part of AECOMs Project Quantum. This involved a brief focused desk review and walkover. The review was largely focused upon potential contaminative uses of the site from current operations and onsite storage of materials. A summary of the findings of the Project Quantum site assessment is presented in Section 5.2.

Relevant features immediately surrounding the site are summarised in Table 2-1.

Table 2-1. Features Surrounding the Site

Direction	Summary
North East	Immediately adjacent to site is Avro Way. Beyond the road is car parking for a series of offices to the north of the site. Further from site is a large goods building, which operates as the transfer from land to airside of goods.
South East	Immediately adjacent to site is Pinfold Lane. The other side of the road is a large recently constructed warehouse building used by the Dubai National Air Travel Agency (DNATA). The building is a logistics site dealing with airline goods. C.100m east from site is a large fuel storage facility servicing the airport. The closest above ground tanks are approximately 160m from site.
South West	Immediately adjacent to the site is Wilmslow Old Road, a narrow dead-end road allowing access to The Romper public house. To the immediate south across the junction of the road with Pinfold Lane is a church and associated graveyard.
North West	Immediately adjacent to the site is a shared access road to the rear of building 401 and the building 402 site which borders the site, broadly mirroring the Building 401 site with a structure in the north east portion and car parking within the south west section.

3. Geological and Environmental Setting

3.1 Introduction

The environmental setting including the topography, geology, hydrogeology and hydrology are the key factors that influence the way in which contaminants in the soil or groundwater can be transported on or off site, and also the way in which contamination can affect applicable receptors including controlled waters and users of the site.

The environmental setting of the Site has been assessed by making reference to the information sources detailed in Section 1.3.

3.2 Geology and Soils

3.2.1 Published Geology & Exploratory Hole Records

AECOM has reviewed publicly available information. The published 1:50,000 and 1:63,000 geological maps of the area produced by the BGS (Sheet 98, Stockport, Drift, 1971 and Sheet 98, Stockport, Solid, 1977) indicates the site is underlain by the geological succession summarised in Table 3.1. Extracts of the superficial deposit and bedrock maps are included as part of the Groundsure Geo-Insight Report (Appendix B).

Table 3-1. Geological Succession from Published Mapping

Age	Group	Geological Stratum	Stratum	Description
Quaternary - Devensian	N/A	Diamicton Till	Superficial Deposits*	A wide range of deposits and geomorphologies associated with glacial and inter-glacial periods during the Quaternary
Triassic	Sidmouth Mudstone Formation	Bollin Mudstone Member	Bedrock	Upper: laminated reddish-brown and greenish-grey mudstone with siltstones. Lower: structureless and laminated, dominantly reddish-brown mudstone. (Within the lower part of the member, a unit termed the 'Lower Keuper Sandstone' has been recognised in the Stockport area. This unit closely resembles the Tarporley Siltstone Formation of adjacent areas.)

**While anticipated due to the developed nature of the site, no artificial deposits are recorded on the geological mapping*

Source: bgs.ac.uk (BGS Lexicon of Named Rock Unites)

The BGS maintains an archive of historical exploratory hole records throughout the UK. AECOM has searched the database and those which are publicly available and considered to provide useful information on the ground profile at the site, have been referenced in producing this report. The extract below shows those boreholes recorded by the BGS in the site area. The black boreholes are not publicly available, leaving 8no. boreholes located within the site which may be publicly available. Of these only 3no. have online records. These are the three to the west of building 401 (SJ88SW235, SJ88SW236 and SJ88SW237).

Presented in

Table 3-2 is a summary of the three boreholes, with full copies of the exploratory hole records included as Appendix C. Relevant information from the records is considered as part of the Preliminary Ground Model in Section 8.

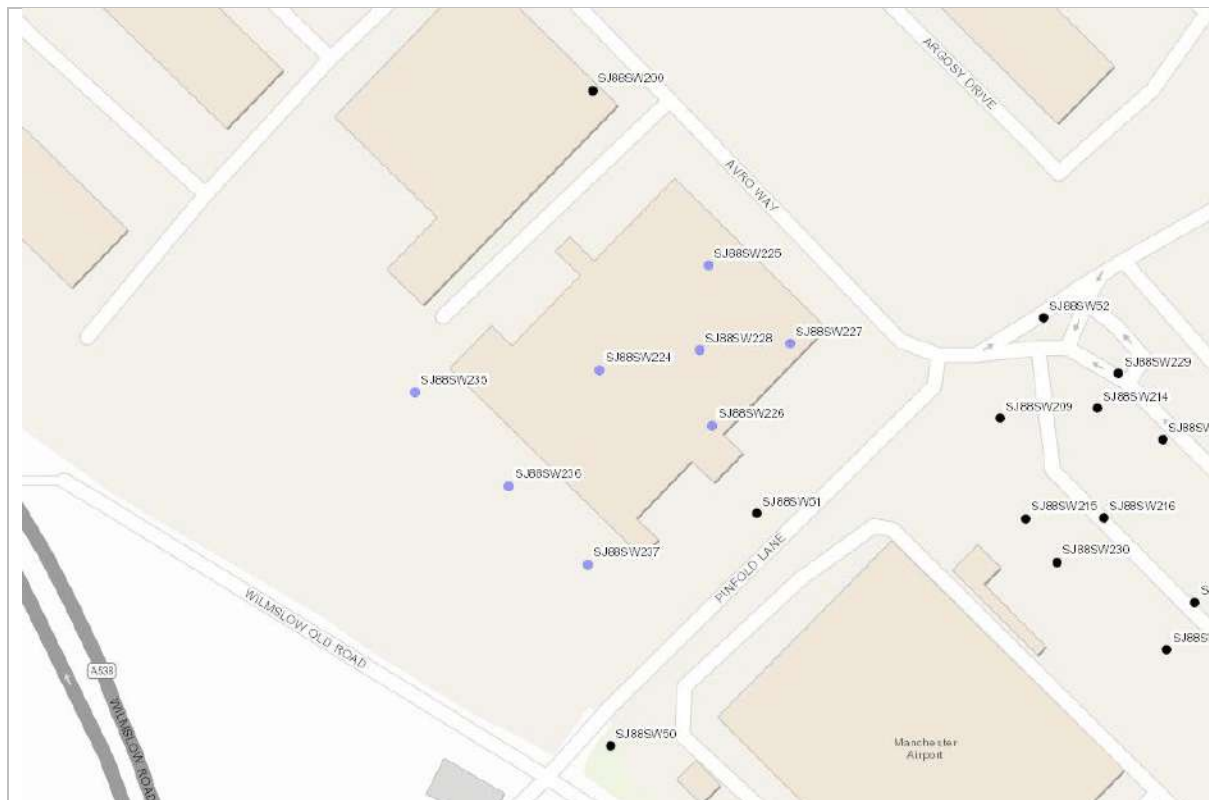


Figure 3-1 Screenshot of relevant exploratory hole locations from BGS GeoIndex Viewer

Table 3-2. Geological Succession from BGS borehole Logs

Borehole	Made Ground mbgl (Thickness m)	Description summary	Superficial Deposits mbgl (Thickness m)	Description summary
SJ88SW235 (BH6)	0.60 (0.60)	Soft Medium brown Clay with stones and broken tarmac	4.00 (3.40)	Very soft becoming stiff with depth, Mottled brown and grey CLAY
SJ88SW236 (BH7)	1.20 (1.20)	Loose concrete, brick, stone, tarmac and Clay over reinforced concrete between 0.6mbgl and 0.9mbgl below which is hardcore fill.	4.00 (2.80)	Firm to stiff, to stiff, Dark reddish brown slightly marly CLAY
SJ88SW237 (BH8)	0.70 (0.70)	Soft to form dark brown and black silty Clay (disturbed - fill)	4.00 (3.30)	Firm to stiff mottled brown and grey CLAY becoming stiff and marly at 1.3mbgl.

Note: mbgl = metres below ground level.

3.2.2 Soils and Soil Chemistry

Information obtained from Soilscales online mapping (<http://www.landis.org.uk/soilscales/> Accessed 06/09/2021) describes the soils within the vicinity of the site as slowly permeable, seasonally wet, slightly acid but base-rich, loamy and clayey soils. (Soilscales Classification 18). These soils have impeded drainage, draining typically to stream networks, and have moderate fertility.

Natural England reports the Agricultural Land Use Classification for land in England. Information obtained from Natural England website (<http://publications.naturalengland.org.uk/> - ALC Map North West) reports the Agricultural Land Use Classification to be Good to Moderate agricultural land.

However, it is noted that the location of the site lies within the footprint of Manchester Airport and its infrastructure. The site and surrounding area are predominantly given over to industrial use. As such, it is considered that the ground conditions at the site are unlikely to relate to the soils and agricultural land classifications of the wider area as noted above.

The BGS Soil Chemistry datasets provide indicative information on regional concentrations of five potentially harmful elements (PHEs): arsenic (As), cadmium (Cd), chromium (Cr), nickel (Ni) and lead (Pb) in soil, as presented within the Groundsure Report. Elevated concentrations of these PHEs can exist because of natural geological conditions or possible anthropogenic contamination. The following BGS estimated soil chemistry levels are attributed to the vicinity of the site based on the geometric mean concentrations of available data (presented in Table 3-3).

Table 3-3. Estimated Soil Chemistry

Potentially Harmful Element	Maximum onsite estimated geometric mean concentration (mg/kg)
Arsenic	15
Cadmium	1.8
Chromium	60-90
Lead	100
Lead (Bioaccessible)	60
Nickel	15

3.2.3 Ground Stability Records

Table 3.3 shows the variable risk of ground stability hazards across the site, taken from the Groundsure report:

Table 3.3. Ground Stability Records

Hazard Type	Hazard Potential	Description
Collapsible Ground Stability	Very low	Deposits with potential to collapse when loaded and saturated are unlikely to be present.
Compressible Ground Stability	Negligible	Compressible strata are not thought to occur.
Ground Dissolution Stability	Negligible	Soluble rocks are either not thought to be present within the ground, or not prone to dissolution. Dissolution features are unlikely to be present.
Landslide Ground Stability	Very low	Slope instability problems are not likely to occur but consideration to potential problems of adjacent areas impacting on the site should always be considered
Running Sand Ground Stability	Very low	Running sand conditions are unlikely. No identified constraints on land use due to running conditions unless water table rises rapidly.
Shrinking or Swelling Clay Ground Stability	Very low	Ground conditions predominantly low plasticity.

3.2.4 Mining and Mineral Extraction

Aggregate/Mineral Quarrying and Mining

The Groundsure report presents publicly available information on mining and quarrying operations, past and present that have taken place within 250m of the site.

The Groundsure report checks databases held by The British Geological Survey, The Coal Authority, Mining Searches UK, Kaolin and Ball Clay Association (UK), Stantec UK Ltd, Johnson Poole and Bloomer, Cheshire Brine Subsidence Compensation Board and British Gypsum; as well as records of surface and ground workings identified from Ordnance Survey and Groundsure mapping.

Of those databases and mapping only one entry is noted within 250m of the site. A surface ground working named as a 'pond' was noted 133m North East of the site located within the area of landscaping at the southern side of Pinfold Lane within the area of the large airport fuel depot.

The GroundSure data identifies no other features within 250m of the site. Within 250m to 500m from the site the only features recorded relate to other small surface ground workings, the largest relating to a reservoir and pump house for Manchester Airport's fire management system.

The Project area also lies within an area defined as the Cheshire Brine Compensation District and as such, it is recommended that a Cheshire Salt Search is obtained.

Coal Mining

Reference to the Coal Authority Interactive Map indicates the following in relation to the site:

- The site is within a surface coal resource area;
- Areas of known probable past shallow coal mine workings are not indicated at the site;
- The site is not within a High-Risk Development Area; and
- There are no mine entries on or within 1km of the site the site.

Surface Coal Resource Areas are defined as coal resources capable of being extracted by surface mining methods, often referred to as 'opencast'. This information is used by Local Planning Authorities as part of the duty to safeguard minerals from unnecessary sterilisation and is derived from Coal Authority and British Geological Survey data.

It should be noted that Surface Coal Resource Area is very broad, covering the Liverpool and Greater Manchester Area, and extending as far south as Birmingham. With no surface features recorded in the site vicinity relating to open cast coal mining and as the site is not within a 'High Risk Development Area' for coal mining, a site-specific Coal Mining Risk Assessment is not recommended at this stage. However, this would be subject to review dependent upon any future ground investigation data.

3.2.5 Radon

The Groundsure report indicates that the site is not within a radon affected area. The site is identified as having less than 1% of properties are above the UK 'Action Level'. This classification identifies no specific radon protective measures are likely to be considered necessary for the proposed development.

3.3 Hydrogeology

3.3.1 Aquifer Classification

The Environment Agency's Groundwater Protection Policy adopts aquifer designations that are consistent with the Water Framework Directive. Definitions of the various aquifer types can be found on the Environment Agency section of the gov.uk website. The following classifications are taken from this system:

Superficial Aquifers

Devensian Glacial Till: Classified as a Secondary Undifferentiated Aquifer. These designations are described by the EA as being 'assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.

Bedrock Aquifers

Bollin Mudstone Member: Classified as a Secondary B Aquifer. These are described by the EA as 'predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers'.

3.3.2 Groundwater Vulnerability

The Environment Agency's Groundwater Vulnerability Mapping available from the online Defra Magic Mapping (magic.defra.gov.uk) identifies the groundwater vulnerability to pollution of an area. All associated terminology/definitions can be found on the Environment Agency section of the gov.uk website.

The Magic Mapping shows the site and surrounding area to have a 'medium to low' classification for groundwater vulnerability. However, the Groundsure Report (Source: British Geological Survey and the Environment Agency) breaks this down by aquifer; and identifies both the superficial and bedrock aquifers to be of low vulnerability.

3.3.3 Source Protection Zones

In terms of identifying the risk of contamination from potential polluting activities in a given area to groundwater sources (e.g. wells, boreholes, and springs) used for supplying public drinking water, the EA identifies Source Protection Zones (SPZ).

These show the extent of a groundwater source catchment and are divided into three zones, definitions of which can be found on the Environment Agency section of the gov.uk website.

The mapping produced by the EA and supplied both within the Groundsure report and EA mapping from Magic Maps, indicates that the site is not within a SPZ.

The nearest SPZ is c.6.5km south east of site. The EA mapping from Magic Maps also identifies that the site is not within a Drinking Water Safeguard Zone for either surface water or groundwater.

3.3.4 Licensed Groundwater Abstractions

No Licensed Groundwater Abstractions have been identified within 2km of the site.

AECOM has contacted the local authority (Greater Manchester City Council Council) for details of private water supplies and ground water abstractions. As of the time of this report no response has been received for records held by the local council.

3.3.5 Risk of Flooding from Groundwater

The GroundSure report identifies that the risk of flooding from Groundwater both onsite and within 50m are considered to be 'Low' based upon a 1 in 100-year return period and a 5m Digital Terrain Model (DTM).

The Low risk identified is considered to present a limited potential for groundwater flooding to occur at the site.

3.4 Hydrology

3.4.1 Surface Water Courses and Drainage

There are no ponds, streams, or drainage ditches on or adjacent to the site. The site is however is understood to be included within Manchester Airports drainage and fire management systems.

The site lies on the boundary of two Water Framework Directive (WFD) surface water body catchments. The boundary runs along the southern boundary of the site. to the north of this line, including the site area, is within the catchment of Timperley Brook. To the south of the boundary the area is within the River Bollin (River Dean to Ashley Mill) catchment.

The nearest Water Framework Directive-relevant surface watercourse/feature to the site is the River Bollin located approximately 259m South of the site at its closest point, flowing in a south-westerly direction.

Table 3-4 summarises the surface water quality information available for the watercourses of the two catchments associated with the site.

Table 3-4. Surface Water Quality

Surface Water Feature	Distance (m)	GQA (Overall)	GQA (Chemical)	GQA (Ecological)	Upstream / Downstream of Site
Bollin (River Dean to Ashley Mill)	259m (S)	Moderate	Good	Moderate	Downstream
Timperley Brook	2314m (NW)	Moderate	Good	Moderate	Downstream

It should be noted, as above, that the site is understood to be included within Manchester Airports drainage system and fire management areas. As such, it is unlikely that in its current state that the surface waters of the site would be in connection to the nearby water courses. In this area it is understood that the drainage waters from the airport pass through a monitoring and filtrations system before being outlet ultimately to the River Bollin.

3.4.2 Licensed Surface Water Abstractions

No surface water abstractions have been identified within 1km of the site.

3.4.3 Risk of Flooding from Surface Water

The indicative floodplain map for the area, published by the Environment Agency, shows that the site does not lie within a Flood Zone. Therefore, the site is not considered to be susceptible to fluvial/marine flooding.

The Groundsure Report presents surface water flood mapping which highlights the highest risk onsite is a 1 in 30 year risk of 0.1m-0.3m flooding. The area with this designation is focused on a small area in centre of the current building 401 onsite. This is likely associated with the current part basement of the building.

Based on the Groundsure Report and EA mapping, the site is not at risk of significant and extensive surface water flooding as a result of extreme rainfall events.

4. Historical & Planned Development

4.1 Historical Ordnance Survey Mapping & Aerial Photographs

Historical Ordnance Survey (OS) maps of the Site and the wider environs were provided in the Groundsure Report (scales 1:2,500, 1:10,560 and 1:10,000) and from Google Earth Pro and these are reviewed in this section. Copies of these maps are presented as Appendix B.

The historical Ordnance Survey (OS) maps obtained with the Groundsure report date between 1877 and 2021.

Table 4.1 presents a summary of the main features present on and within approximately 250m radius of the Site boundary. AECOM notes that only indicative map scales are provided. Where dates are stated, these refer to the dates of maps on which the features are present, have changed use or are no longer annotated, and do not necessarily refer to the exact dates of existence of a particular feature. Development that may have occurred between map editions is recorded as occurring on the latter published map, hence there are some limitations to the accuracy to the date of development unless supplementary evidence is available:

Table 4.1 Summary of Historical Mapping

Date	Key Features on-site	Key Features off site (250m)
1877 (1:2500)	Partial map does not cover site	- Land use is predominantly agricultural with field boundaries and paths/tracks - Yewtree Lane is noted c.150m NE running NW to SE. - A pond is noted c.200m NE close to a number of buildings (Manor Farm). - Lilac Cottage is noted c.110m S of site to the East of the church.
1881 (1:2500)	The site is presumed agricultural land with two field boundaries crossing the site NW to SE dividing the site into broadly three equal sections.	- Land use is predominantly agricultural with field boundaries and paths/tracks - Pinfold Lane runs along the SE boundary meeting the crossroad with Wilmslow Road. - A pond is noted c.20m S of site. - The Red Lion Inn (Romper) and All Saints Church are in their current location on the crossroads. - A smithy is noted attached to the Inn. - Oak Farm is noted c.200m W. - The Grange, a collection of buildings with ponds is noted c.175 E.
1898 (1:2500)	The southernmost field boundary is no longer present.	A square pond/ reservoir is attached to Oak Farm.
1899 (10:10560)	No notable change	No notable change
1909 (1:2500)	No notable change	No notable change
1910 (10:10560)	No notable change	No notable change
1935 (1:2500)	Partial map does not cover site	No notable change
1938 (10:10560)	No notable change	The area of Manchester Airport to the east of site now contains no mapping other than three large buildings noted c.250 E of site.
1954 (10:10560)	The site is occupied by a series of looped hardstanding areas associated with the Ringway Airport (Manchester Airport). These are understood to be taxiing and aircraft storage.	Hangar 3 and Hangar 5 of Manchester Airport are present c.25m S and SE including a bund between the two. Hangar 4 lies further south c.150m for site.
1967 (10:10560)	Partial map does not cover site	Partial map - No notable change
1968 (1:2500)	No notable change	- Peters Croft is present next to the church c.75m S - VHF Receiver Station present c.200m NW. - Oak Field farm has expanded. - A tank is noted c.75m SE associated with Hangar 3.

Date	Key Features on-site	Key Features off site (250m)
1969 (1:2500)	No notable change	No notable change
1974 (1:2500)	No notable change	Partial map - No notable change
1981 (10:10000)	No notable change	- Wilmslow Road is now Wilmslow Old Road - A new larger Wilmslow Road curves part the site c.50m W. running N to S. - Wilmslow Road joins a roundabout junction to the north of Oak Farm over 250m from site which adjoins the M56.
1987 (1:2500)	- A smaller building is present in the location of Building 401 including lorry entrances to the building and the entrances from Pinfold lane and Avro Way. - An electrical substation is noted on the West side of the building. - Western half of the site remains with partial hard standing.	- Avro Way is present on the NE site boundary - Cargo Centre is now present c.20m NE. - An elongate building is added to Hangar 4. - A large tank is noted c.100m north of site (associated with fire water (Project Quantum))
1990 (10:10000)	No notable change	No notable change
1992 (1:2500)	The building has expanded NW and the access has moved north with it.	No notable change
1995 (1:2500) 1995 (1:10000)	- The building has expanded SW. - The substation is no longer noted. - A light tower is noted in the SW half of the site which is now as hard standing. - The site is broadly as it is at present	- Building 402 is now present to the immediate NW with associated infrastructure including an electrical substation on the site boundary. - An embankment is present along Wilmslow road to the W. - An office building is noted c.100m N.
2001 (10:10000)	No notable change	- Hangar 5 to the E of site is no longer present. - A small expansion to Building 402 N of site.
2003 (1:2500)	No notable change	No notable change
2010 (10:10000)	No notable change	No notable change
2021 (10:10000)	No notable change	- Hangar 3 is no longer present (It is known that in 2021 DNATA warehouse was built across the former Hangar 3 and 5 sites. - Oak Farm is no longer Present. Two very large warehouses replace it with associated access roads as part of a large commercial industrial development (World Logistics Hub) including warehouses for Amazon, Thomas Cook, DHL and others.
Aerial Photography 2000 to 2021	No notable difference from mapping	Between 2013 and 2016 a large area c. 70m S of site adjacent to the church and extending to c.600m from site is a large hard standing parking area.

4.2 Planning Authority Records

Online planning application records on the Manchester City Council Website are available to the public. Those planning applications within 250m of the site are solely for the development of the World Logistics Hub, including specific applications for a number of the large warehouse buildings and general applications for the wider development.

It should be noted that a portion of Manchester Airports developments are considered permitted development and as such do not necessarily require planning applications with the council and therefore would not be recorded in this register.

4.3 Records from MAG

AECOM reviewed Manchester Airport Groups history on 06 September 202a via their 'Our History' page on their website (<https://www.manchesterairport.co.uk/about-us/manchester-airport-and-mag/history/>). A summary of findings that may relate to the Building 401 site are summarised in Table 4-1 below.

Table 4-1 MAG Records

Date	Details of Development
1935	Building of Manchester Airport, formerly known as Ringway Airport
1938	Ringway Airport opens
1939-45	Last aeroplane flies on the 1 st September 1939 due to the Second World War. Ringway Airport becomes an aircraft manufacturing centre for war planes.
1969	The runway is extended to 2745m.
1986	Opening of the World Freight Terminal.

4.4 Unexploded Ordnance Risk

4.4.1 Wartime Land-Use

Based on a review of historical maps (state ages of maps and reference them), the site was located within part of what was later Manchester Airport during Wartime Britain and based on CIRIA C681 could have been close to areas targeted by aerial bombing. While the main airport buildings were not immediately close to site at this time, the site was occupied by aircraft storage and hard standing attached to the runway and taxiing layout at the time. Historic photography shows the site containing fighter planes.

The site was located near to wartime sites of interest, which include military bases, ports, or industrial centres, notably the airport and as such a risk of potential unexploded ordnance (UXO) is considered to be present.

4.4.2 Post War Development

An analysis of the post war historical mapping from the Groundsure Report shows little change to the site until the 1980s when the site was developed as Building 401, a commercial/ industrial warehouse for the airport. No immediate redevelopment within the area is noted in the post-war years, which could potentially indicate redevelopment as a consequence of bomb damage.

The potential for encountering UXO during the course of the development are considered low within Building 401 primarily due to the presence of a half basement. The parking area within the western half of the site has seen little development and historic mapping indicates that hard standing associated with the former airfield may still be present beneath the current hardstanding cover. Due to the lack of previous disturbance in this area, there may be a higher risk of encountering UXO.

4.4.3 Unexploded Ordnance Mapping

The regional UXO mapping published by Zetica (Appendix D) shows that the site lies within a zone classified as having a low risk of UXO. In areas with a low risk of UXO, it is estimated that 15 bombs failed to explode within an area of 1,000 acres.

However, the site is within the vicinity of Manchester Airport with a Luftwaffe Target noted c.175m SE of the site which appears to be associated with historical airport buildings which are understood to have manufactured planes. In addition, it is understood from the historic mapping and historic photography that the site was used as a taxiing and storage area for fighter aircraft.

Based on the findings of this initial assessment, AECOM recommends that a detailed UXO Assessment is undertaken prior to the commencement of any intrusive investigation.

5. Review of Historical Reports

5.1 ESG Factual Report on Ground Investigation (Feb 2017)

The 2017 ESG factual report produced for BAM construction summarises a ground investigation undertaken by Jacobs in June 2016.

The ground investigation comprised three concrete cores (CC1-CC3), four window sample boreholes (WS1-WS4) and three dynamic cone probes (DCP1-DCP3) (Figure 5-1).

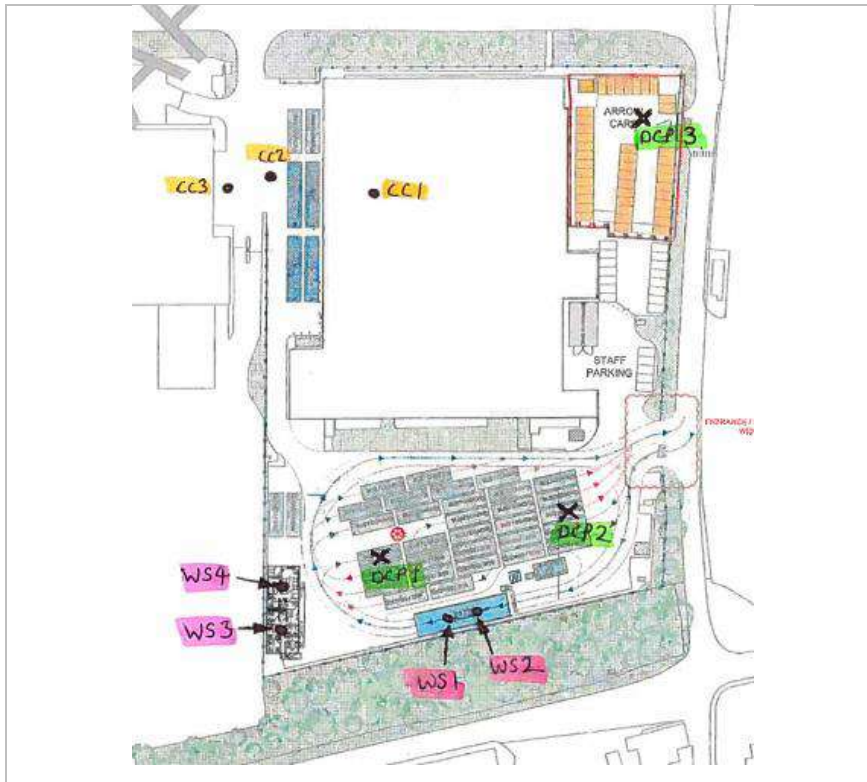


Figure 5-1 Extract of Borehole Location Plan – ESG Factual Report 2017

The borehole logs for the window samples indicated a made ground thickness of 0.8-1.0mbgl typically comprising 0.1m of macadam over orange/ brown Sand to 0.7mbgl in WS1 and WS2, over reworked Clay to 1.0m. WS3 and WS4 identified a thinner sand layer underlain by a black ashy gravel over the reworked clays extending to 0.8mbgl. WS4 also noted a type 1 sub-base style gravel below the macadam.

All four locations encountered Glacial Till below the Made Ground extending to the base of the boreholes at a maximum of 4.45mbgl. The Glacial Till comprised orangish brown CLAY described as firm to stiff, increasing in stiffness with depth. WS3 noted no recovery and a light brown sand between 3.8mbgl and 4.2mbgl. Thin sand bands of less than 5cm were also noted in the CLAY above.

Three boreholes drilled to 4mbgl encountered groundwater which rose to depths between 3.9mbgl and 3.4mbgl. Some limited waters and seepage were noted at around 1mbgl within the Made Ground.

DCP and Concrete cores identified concrete up to a thickness of 0.35m. It should be noted that based on BGS borehole and anecdotal evidence, it is considered likely that the original aircraft taxi and storage hard standing is present below the current hard standing in some areas of the site. The potential for two layers of concrete should be factored into any further ground investigation or development.

5.2 Project Quantum Site Assessment (Feb 2019)

The overall objective of Project Quantum was to produce holistic executive summary reports for assets of the airport site. For each asset an asset fact file based upon a site walkover and workshop with MAG staff as well as publicly available data.

Building 401 was classified as asset MAN-19, for which the walkover assessment was undertaken on 03/12/2018. It should be noted that this assessment was for Building 401 only and not the current redline boundary of the site provided as part of this brief, however off-site descriptions were included which covered the current site area.

The report identified that VLF testing had identified a failure of the HV cable between the Hangar 4 substation and 'Z' substation. The failure of the cable was believed to be below Building 401. At the time it was proposed that MAG would divert the cable and relocate the 'Z' substation prior to demolishing the existing building in April 2019. Hangar 3 was demolished and the HV cable was relocated in advance of the construction of the DNATA warehouse on the Hangar 3 site.

The report identifies Building 401 as an office and warehouse described as the former Skychefs catering building noted as disused. It is understood that air-conditioning and refrigeration units are anticipated to still be present within the site.

The south western portion of the current site is described in the report as the temporary MAG bus depot, including refuelling points, port-a-cabin offices, and a bus washing facility. Within this area are a number of storage facilities including: two diesel storage tanks, an AdBlue storage tank, and storage of drums of cleaning chemicals associated with the bus washing facility.

Offsite, the report identifies a mobile diesel refuelling tank within the carparking area of Building 402 to the north. It is noted that the tank had been leaking, however the leak had been contained largely within the tank's incorporated bund.

To the south of the site within the former Hangar 3 site there was a foul water pumping station prior to development, this remains in place in the north west corner of the DNATA site. The report also identified a former refuelling depot within the Hangar 3 site to the south which was remediated due to hydrocarbon contamination, and a former sweeper tip at the Hangar 5 site to the south east, the contents of which were unknown but believed to include material from the former hangar. Both of these sites have been redeveloped with the DNATA warehouse and as such Made Ground is inferred to have been removed or remediated as part of the development.

The report includes a preliminary risk assessment chiefly comprising a tabulated preliminary conceptual model (CM) and risk assessment. The findings of this risk assessment identified the site to be of Low Risk.

While samples were obtained during the assessment, no geotechnical or environmental chemical data is included within the report. As such, no further comment can be made upon the chemical or geotechnical characteristics of the strata.

5.3 Historical Reports for Adjacent DNATA Warehouse Site

The plot to the south of the site is currently occupied by the DNATA warehouse completed in 2019. Prior to this the site was occupied by Hangar 3 and a storage yard which was itself previously Hangar 5. A number of reports have been undertaken on the DNATA site and surrounding area. These are briefly summarised below.

5.3.1 Arcadis Geraghty & Miller International Inc. Hangar 3 Fuelling Farm, Tier 1 Environmental Assessment Report. (June 2003)

Arcadis Geraghty & Miller International Inc., Hangar 3 Fuelling Farm, Tier 1 Environmental Assessment Report. June 2003. Report Number: 919120003.

An environmental assessment of the Hangar 3 fuelling farm located approximately 200m south west of the site, consisting of an intrusive investigation and groundwater monitoring. Olfactory evidence of contamination was identified in the area surrounding the tank farm, which had no visible drainage around the fuelling area. It was reported that gas oil Tank 1 had split earlier in 2003.

Light Non-aqueous Phase Liquid (LNAPL) was encountered in BH2 between 1.0mbgl and 1.3mbgl, and was indicative of a diesel fuel source within the made ground. Results of the site investigation indicated that the soil had been impacted by hydrocarbons with BH2 exceeding the action level set in the report. Groundwater at BH2 was impacted by naphthalene. Contamination was reported to be localised within the Made Ground surrounding the underground storage tank (UST).

5.3.2 Scott Wilson, Hangar 5 Site Interpretive Geo-Environmental Assessment on Ground Investigation (March 2005)

Scott Wilson, Hangar 5 Site, Manchester Airport, Interpretive Geo-Environmental Assessment on Ground Investigation. March 2005. Report Number: D107899/07.1/INT/H5/01.

An intrusive investigation of the ground conditions in the vacant land directly northeast of historical Hangar 3 located approximately 150m southwest of the site, comprised of various trials pit locations and window samples.

The area was considered to present a moderate risk to controlled waters based on elevated concentrations of copper, sulphide, sulphate, ammoniacal nitrogen, polycyclic aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH) within groundwater sampled from the superficial glacial till.

Ground conditions agreed with the published geology comprising of made ground to a maximum depth of 0.95mbgl. Superficial geology of glacial till was encountered to a proven depth of 3.40mbgl. Bedrock of weathered mudstone was observed from 1.90mbgl to 3.90mbgl. Perched groundwaters were encountered within the superficial glacial till, however consistent groundwaters were not encountered laterally across the site during the investigation.

5.3.3 OPUS International Consultants (UK) Ltd., Hangar 3 Fuelling Farm, Supplementary Environmental Investigation (Feb 2013)

OPUS International Consultants (UK) Ltd., Hangar 3 Fuelling Farm, Manchester Airport, Supplementary Environmental Investigation. February 2013. Report Number: J-W0364_R1.

An intrusive environmental investigation of the ground conditions at historical Hangar 3, to assess potential contamination within the vicinity of the UST.

The report concluded that there was significant hydrocarbon contamination within the made ground. Soil contamination was present within all of the exploratory wells undertaken. However, it was not present in all of the deeper groundwater samples and was therefore considered to be limited in extent to the soil contamination 'hotspot' surrounding the USTs.

5.3.4 URS Proposed Motor Transport Building, Geotechnical & Geo-Environmental Desk Study (Nov 2013)

URS, Manchester Airport Proposed Motor Transport Building, Geotechnical & Geo-Environmental Desk Study Report. November 2013, Report Number: 47066850/MTB/MARP007.

An investigation into the geotechnical and geo-environmental conditions for a proposed motor transport building located in the current vacant land adjacent to Hangar 3, located approximately 150m southwest.

The report highlighted the current at the time of the report (2013) and historical environmental conditions surrounding the site and used the information to populate a conceptual site model for the proposed development. The risk for contamination of deeper groundwaters was considered likely due to the nature of the superficial geology comprising permeable layers of sand and silt. The remaining risks to construction workers, current and future land users, and development infrastructure were considered low to moderate / low.

5.3.5 URS Proposed Motor Transport Building, Geo-Environmental & Geotechnical Interpretative Report (March 2014).

URS, Manchester Airport Proposed Motor Transport Building, Geo-Environmental & Geotechnical Interpretative Report. March 2014. Report Number: 47066850/MTB/MARP002.

An interpretive report of the intrusive ground investigation for the proposed motor transport building located in the current vacant land adjacent to Hangar 3, located approximately 150m southwest of the site. The investigation comprised of 3 No. boreholes, 14 No. window samples and 12 No. dynamic cone penetrometer holes.

The report identified that where made ground was encountered, it was not considered a suitable bearing stratum for future structural foundations due to the heterogeneity of the material under a ground bearing capacity of 100kN/m². Varying CBR values were determined for pavement design, dependant on the underlying geology and subgrade thickness. A UST and refuelling island had been identified on site, however AECOM (formally URS) de-commissioned and removed the UST and associated contaminated soils in August 2014.

Results obtained from soil analysis indicated no significant exceedances of contaminants at the site, with the exception of asbestos containing materials (ACMs), it was therefore considered that contaminants posed a low risk in terms of chronic exposure to receptors. Trace amounts of amosite and crocidolite asbestos were obtained from 2 of 15 soils samples taken within the Made Ground.

Groundwater was observed at depths ranging from 0.80mbgl and 3.70mbgl across three separate monitoring rounds. Elevated levels of copper, selenium, phenol, and sulphate were interpreted from the groundwater samples obtained and deemed a potential risk to controlled waters. The potential for groundwater migration was considered to be minimal due to the perched nature of the groundwater bodies encountered and the presence of significant thicknesses of discontinuous clays.

The geology encountered throughout the geotechnical investigation comprised of Made Ground to a depth of 1.20mbgl, superficial deposits ranging from 0.20mbgl to 7.70mbgl, and bedrock of weather mudstone ranging from 3.70mbgl to 8.00mbgl.

5.3.6 URS Former Re-Fuelling Depot, Verification Report (Nov 2014)

URS, Manchester Airport Former Re-Fuelling Depot, Verification Report. November 2014. Report Number: 47066850.

A verification report for the remediation of the historical Hangar 3 refuelling area, located approximately 200m southwest.

A total of 5 USTs were removed, with associated pipework and saturated soils which were removed from the areas surrounding the tanks to a depth of 5mbgl. 20 No. soil samples were obtained from the excavation to verify that impacted soils had been delineated and successfully removed. The analysed verification samples reported concentrations of contaminants below the remediation target levels set for the project. The excavation was backfilled with engineered fill to a highway specification.

Impacted soils were noted to extend beneath the roadway to the southwest along the line of pipework, although determining the extent of the contamination was beyond the proposed scope, and it was therefore not removed as part of the remediation process. No significant thickness of LNAPL was identified during the investigation and as such the potential for migration of contamination within these soils post remediation was considered limited.

5.3.7 Brownfield Solutions Ltd HV Cable, Factual Environmental Report (May 2017)

Brownfield Solutions Ltd., Manchester Airport HV Cable, Factual Environmental Report. May 2017. Report Number: LC/C3450/6933.

A factual Environmental Investigation carried out by Brownfield Solutions Ltd. to determine the ground conditions for the installation of a high voltage electricity cable directly underneath the DNATA site, located approximately 150m southwest of the site. The investigation comprised of several window sample boreholes positioned on the periphery of the historic maintenance hangar, however samples taken were not screened against any specific criteria. The report indicated the potential presence of PAHs in borehole WS102A, located on the north west boundary of the site and Pinfold Lane. No other olfactory or gross contamination evidence was present.

Made Ground was encountered in all exploratory wells to a depth of 1.75m, comprised of macadam surfacing over limestone and brick subbase. Superficial geology was only encountered in WS101 and WS103, with bedrock encountered in WS103 at a depth of 1.05m. Perched groundwater was encountered within the Made Ground at a depth of 0.20m.

6. Regulated Activities and Statutory Consultation

6.1 Introduction

The key relevant features that characterise the site and surrounding area are summarised in this section, along with an indication of the risk to the land quality of the site.

Information on groundwater and surface water abstractions is detailed in Section 3.3.4 and 3.4.2 and is not repeated here.

Generally, any regulated activities within 250 m of the site could, depending upon their nature, represent potential off-site sources of contamination. Whilst a 1 km search area was generally adopted, this section places emphasis on those activities present within 250 m.

6.2 Regulated Processes

Table 6-1 summarises information on regulated processes contained in the Groundsure report (Appendix B). The report collates data from a variety of sources including the Environment Agency (EA) and the British Geological Survey (BGS). All data suppliers are referenced in the report.

Table 6-1 Summary of Regulatory Information

Subject	Number present				Distance	Details
	On site	0-250 m	250-500 m	500-1000 m		
<u>Agency & Hydrological</u>						
Contaminated Land Register Entries and Notices	0	0	0	0		None listed
Licenced discharge to controlled waters	0	0	0	11	314m SE x2 and 328m NE 342m NE	4 of the 11 licences are potentially active. Of those potentially active: 3 Relate to the Manchester airport site drainage and containment system – Trade Discharge – site drainage to River Bollin. The Romper PS Public House, Sewage and trade combined - unspecified to River Bollin. Those revoked are mostly Manchester airport drainage and aircraft stand drainage.
Historical Licensed industrial activities (IPC)	0	0	0	0		None listed
Licensed industrial activities (Part A(1))	0	0	0	0		None listed
Licensed pollutant release (Part A(2)/B)	0	0	2	2	98m SE 229m SE 270m SW 496m SE	Fls Aerospace Ltd - Respraying of Road Vehicles (Historic) Airline Services Limited, Hanger 4 Western Maintenance Area – Dry Cleaning (Historic) BP Airport City, BP Airport City SF Connect - Unloading of Storage Petrol into Storage at Service Stations (Current) Air Livery Plc – Respraying of Road Vehicles (Current)
Pollutant release to Surface Waters (Red List)	0	0	0	0		

Subject	Number present				Distance	Details
	On site	0-250 m	250-500 m	500-1000 m		
Pollutant release to public sewers	0	0	0	0		None listed
Pollution Incidents (EA/NRW)	0	0	0	0		None listed
Pollution Inventory substances	0	0	0	0		None listed
Pollution Inventory waste transfers	0	0	0	0		None listed
Control of Major Accident Hazards Sites (COMAH)	0	0	1	0	115m E -	Air BP Limited current COMAH site – COMAH Lower Tier Operator
Regulated Explosive Sites	0	0	0	0		None listed
Hazardous substance storage/usage	0	0	2	1	187m E - 273m NE -	2 entries: Air BP Ltd - Storage of Jet fuel A1 Shell UK Ltd – Hazardous Substances Consent for Storage of Aviation AVGAS
Radioactive Substance Authorisations	0	0	0	0		None listed
Pollution inventory radioactive waste	0	0	0	0		None listed
List 1 Dangerous Substances	0	0	0	0		None listed
List 2 Dangerous Substances	0	0	0	0		None listed

Source: Envirocheck Report

6.3 Licensed Waste Management Facilities

The Groundsure report provides details of waste facilities within 1km of the site based upon data from the Environment Agency, British Geological Survey, Ordnance Survey/ Groundsure records and mapping, and Local Authority records.

With reference to the above data the Groundsure report identified no recorded licensed waste management facilities or landfilling operations, past and present, within 500m of the site.

The report does identify 9No. waste exemptions 'Activities involving the storage, treatment, use or disposal of waste that are exempt from needing a permit'.

The closest 6No. of waste exemptions related to the use of waste material on construction or wood cutting and pulverising in relation to construction works; including at Building 402 to the north and Hangar 3 to the south largely as part of the remediation works on the former fuel tank area, or the DHL warehouse to the south west

The remaining 3no. related to Hale Depot / Hale motorway maintenance compound for storage of waste in secure containers and treatment of waste aerosol cans.

It should be noted that as part of the Project Quantum review of buildings associated with the airport, most of the of the buildings reviewed by their nature as commercial / industrial premises have some storage of potentially contaminative materials. The security of these storage facilities is monitored by the airport.

With reference to the historical data there have clearly been demolition and construction activities both in the vicinity of the site and onsite and therefore the presence of made ground should not be overlooked.

6.4 Industrial Land Use

The Groundsure Report collates data on potentially contaminative active and inactive industrial land uses, tanks, fuel station entries, Points of Interest, Gas Pipelines and Underground Electrical Cables within 500m of the site, that may have the potential to have caused contamination.

Various active and inactive entries for these land uses have been identified on or within the vicinity of the site. Table 6-2 summarises those entries that may have the potential to have caused contamination within a search radius of 250 m of the Site.

Table 6-2 Potentially Contaminative Industrial Land Use on and Within 250 m of the Site

Subject	Location	Details
Historical Industrial Land Uses	On Site	Airport - 3no entries 1953, 1989, 1953
	Off-Site	11m SW Smithy 1938
		17m SW Smithy 1910
		20m SW Smithy 1899
		48m N Airport 1989
		164m E Unspecified Tanks 1989
		175m NE Airport 1967
		175m NE Airport 1975
		177m NW Wireless Station 1989
		205m W Unspecified Tank 1989
		231m SE Unspecified Works 1974
Historical Tanks	On Site	No Entries
	Off-Site	59m SE Unspecified Tank 1987
		60m SE Unspecified Tank 1968
		60m SE Unspecified Tank 1973
		101m N Unspecified Tank 1995
		101m N Unspecified Tank 1987
		101m N Unspecified Tank 1990
		101m N Unspecified Tank 1991
		146m SE Tanks 1995
		146m SE Tanks 1996
		158m SE Tanks 1995
		158m SE Tanks 1996
		159m E Tanks 1987
		159m E Tanks 1990
		161m E Tanks 1995
		161m E Tanks 1996
		187m E Unspecified Tank 1995
		187m E Unspecified Tank 1996
		206m SE Unspecified Tank 1987
		206m SE Unspecified Tank 1990
		207m W Unspecified Tank 1987
		209m E Unspecified Tank 1987
		209m E Unspecified Tank 1990
		209m SE Unspecified Tank 1995
		209m SE Unspecified Tank 1996
		209m E Unspecified Tank 1995
		209m E Unspecified Tank 1996
		214m E Unspecified Tank 1995
		214m E Unspecified Tank 1996
		222m E Unspecified Tank 1987
		222m E Unspecified Tank 1990
		226m E Unspecified Tank 1995
		226m E Unspecified Tank 1996
		238m E Unspecified Tank 1987
		238m E Unspecified Tank 1990
		239m E Unspecified Tank 1995
		239m E Unspecified Tank 1996

Subject	Location	Details
		246m E Unspecified Tank 1987 246m E Unspecified Tank 1990 247m E Unspecified Tank 1995 247m E Unspecified Tank 1996
	On Site	Electricity Sub Station - Electrical Features
Recent industrial land uses	Off-Site	58m NW Alpha LSG – Aeroplanes 65m SE Tank - Tanks (Generic) 103m N Air Canada - Distribution and Haulage 108m N Tank - Tanks (Generic) 108m N Supply 2 Order - Container and Storage 111m N N N R Global Logistics - Distribution and Haulage 111m N Warme Heating Ltd - Industrial Repairs and Servicing 111m N Davies Turner Plc - Distribution and Haulage 111m N T Q Express - Airlines and Airline Services 112m N Select Euro Transport - Distribution and Haulage 114m N R & M Developments Ltd - Civil Engineers 114m N A Z Freight Services Ltd - Airlines and Airline Services 114m N Noatum Logistics Ltd - Distribution and Haulage 114m N E M S Cargo Ltd - Distribution and Haulage 114m N Atlantic Pacific Global Logistics - Distribution and Haulage 114m N Evolution Logistics - Distribution and Haulage 114m N Air Sea Worldwide - Airlines and Airline Services 118m N Future Forwarding - Distribution and Haulage 118m N Puma Cargo Ltd - Distribution and Haulage 118m N C B I Global Freight Management - Distribution and Haulage 118m N A I T Worldwide Logistics Ltd - Airlines and Airline Services 118m N Maurice Ward Group - Distribution and Haulage 119m N Electricity Sub Station - Electrical Features 125m NW Mapcargo - Distribution and Haulage 125m NW Air Menzies International - Distribution and Haulage 133m NW D B Schenker - Distribution and Haulage 133m NW Tranzfast Logistica UK Ltd - Airlines and Airline Services 133m NW Red Head International - Distribution and Haulage 136m N Vantec World Transport Manchester - Distribution and Haulage 164m NW Tank - Tanks (Generic) 164m E Electricity Sub Station - Electrical Features 166m SE Tank - Tanks (Generic) 168m E Tank - Tanks (Generic) 169m W Electricity Sub Station - Electrical Features 176m NW Electricity Sub Station - Electrical Features 180m SE Airline Services Ltd - Aeroplanes 186m E Tank - Tanks (Generic) 187m N AFI - Airlines and Airline Services 190m W Electricity Sub Station - Electrical Features 194m NE Airline Cargo Management Ltd - Airlines and Airline Services 194m NE Dunwoody Airline - Distribution and Haulage 194m NE Air Liaison - Airlines and Airline Services 194m NE Singapore Airlines Cargo - Distribution and Haulage 194m NE Omni Airline Services - Distribution and Haulage 194m NE Globe Air Cargo - Airlines and Airline Services 200m E Tank - Tanks (Generic) 202m N Trilogy Freight - Distribution and Haulage 202m N S O S Air Cargo Ltd - Distribution and Haulage 202m N Blacksmith Freight Services - Distribution and Haulage 202m N Fedex Trade Networks - Airlines and Airline Services 207m E Tank - Tanks (Generic) 209m E Tank - Tanks (Generic) 214m W Tank - Tanks (Generic) 215m SE Tank - Tanks (Generic) 219m E Tank - Tanks (Generic) 223m E Tank - Tanks (Generic) 225m W Electricity Sub Station - Electrical Features 231m NE Electricity Sub Station - Electrical Features 233m SE Aeroco Group - Aviation Engineers 238m E Tank - Tanks (Generic) 238m E Tank - Tanks (Generic)
	On Site	Electricity Substation 1987

Subject	Location	Details
Historic Energy Features	Off-Site	106m N Electricity Substation 1995
		106m N Electricity Substation 1987
		106m N Electricity Substation 1990
		106m N Electricity Substation 1991
		156m E Electricity Substation 1987
		156m E Electricity Substation 1990
		156m E Electricity Substation 1987
		156m E Electricity Substation 1990
		156m E Electricity Substation 1995
		156m E Electricity Substation 1996
		228m NE Electricity Substation 1992
		229m NE Electricity Substation 1987
Fuel Station & Garages Entries	On Site	N/A
	Off-Site	284m SW BP Wilmslow Road - Open
Gas Pipelines*1	On Site	N/A
	Off-Site	N/A
Underground Electrical Cables	On Site	N/A
	Off-Site	N/A

*1 While not identified in the Groundsure potentially due to sensitivity, it is known that the main pressurised fuel line to the airport runs within the vicinity of the site. It is broadly understood to pass to the north of the site.

6.5 Sensitive Land Uses

The Groundsure Report and Defra Magic Mapping identify adjacent sensitive land uses based upon factors such as Sites of Special Scientific Interest (SSSI), Environmentally Sensitive Areas, Areas of Outstanding Natural Beauty, World Heritage sites, Nature Reserves, National Parks, Nitrate Sensitivity Areas/Vulnerability Zones, and Special Protection Areas.

The Groundsure Sensitive Land Use Map and Magic Maps indicate that the site is not within an area of sensitive land use. However, the site is located within the area of three SSSI impact risk zones.

The nearest SSSI for which the site is in the impact risk zone is Cotteril Clough 345m South of the site.

The impact risk zone is described in the GroundSure report as being 'Developed to allow rapid initial assessment of the potential risks to SSSIs posed by development proposals. They define zones around each SSSI which reflect the particular sensitivities of the features for which it is notified and indicate the types of development proposal which could potentially have adverse impacts'. No specific impacts are ascribed to Cotteril Clough.

The impact risk zone is large and encompasses the wider airport area and beyond. Due to the developed nature of this area and as the site is located within the airport and captured within its drainage system it is unlikely that there is notable potential for the development to impact upon the SSSI of Cotteril Clough.

No nitrate sensitive areas or nitrate vulnerable zones are located within 2km of the study site.

7. Site Reconnaissance

An external inspection of the site was completed by a suitably qualified and experienced AECOM Engineer on 08/09/2021. The aim of the visit was to identify the range of activities carried out on the site and any obvious potential sources of ground contamination or geotechnical issues.

The principal observations made during the visit are summarised below. A photographic record of the visit is included as Appendix E.

The site is broadly level and generally in line with the elevations of the surrounding area, there is a slight raise in the form of a c.1m grass shallow embankment up to Building 401 from the western carparking area and again on the eastern side of the building to Avro Way.

The majority of the north eastern half of the site is occupied by the current MAG Building 401 which covers c.6785m². To the immediate North West of the building is tarmac and concrete hard standing. To the immediate east is a grass landscaped area with small trees and shrubs which rises gently to Avro Way. To the south of the building the area is slightly larger and comprises a tarmac and concrete area in front of eight lorry bays for the building with an entrance from Pinfold Lane and associated landscaping.

Within the area north west of the building is the 'Z' sub-station which is understood to be disused. The substation comprises electrical units close to the building and a small metal service building adjacent.

The area to the south of the building is currently occupied by a number of airport busses in various states of repair. At the western end of this area close to the main entrance to the site is a brick gas utility house. In the eastern corner of these area is a former customer entrance and hydraulic lift to a service door. This corner contains a number of air-conditioning and refrigeration units on pallets as well as what appears to be a small oil tank. These appear to have been removed from the building as part of some decommissioning works.

The South Western side of the site is broadly divided into two. The far South Western portion lies outside of the fenced boundary for the current development on the site and comprises a broadly level wooded area. The north eastern portion between the wooded area and the main building, is an area of tarmac hard standing which was previously the car parking area for building 401. This tarmac area is currently occupied by a 'temporary' bus depot service area for airport vehicles. All of the structures in this area are temporary and stand atop the hard standing including mobile offices, multiple fuel terminals (two diesel and one AdBlue) and associated storage tanks and a vehicle wash. The fuel tank and pump in the southern end of site appears to have had a number of leaks or spills however these are predominantly caught in the tanks own internal bund. Some spilling outside of this is present but within the areas of the interceptor which crosses the front of this area. Additional interceptors are noted along the other tank area and vehicle wash. The vehicle wash and the site offices are raised on additional concrete foundations. The MAG bus depot area adjoins the main entrance from Pinfold Lane to the South.

Building 401 is currently derelict and is understood to have been empty for some time. The last usage of the site was by an airline food company 'LSG SkyChefs' for which liveries are still present on the building. Access was not obtained to the interior of the building however it is noted through the entrance that wall some panelling has been removed to access ducting and it is assumed some level of decommissioning of the building has taken place.

The building is comprised of a half-height brick base with corrugated steel construction above to c.2 stories. The other of the building appears to be predominantly in good repair with the exceptions of some fascia panels.

Services are noted across the site broadly following routes around the outside of building 401, noted onsite were at least drainage and telecoms. The current temporary bus depot buildings have new services for drainage noted.

8. Preliminary Ground Model

Based on the review of published geological and hydro-geological information, the three historical borehole records available onsite, and the previous ground investigation data included in the ESG Factual Report; the ground conditions within the site are considered to comprise the following sequence presented in Table 8-1.

Table 8-1. Preliminary Ground Model

Geology		Groundwater	
Stratum	Typical Description	Anticipated Thickness (m)	
Made Ground (Hard Standing)	Thin macadam or	Macadam c.0.1mbgl	N/A
	Concrete hard standing	Concrete c.0.35m with potential for second deeper layer below.	
Made Ground	Shallow made ground predominantly hardcore fill or ashy gravels over orange brown Clay fill and reworked natural Clay.	c.1mbgl	Potential for perched groundwater within granular Made Ground.
Superficial Strata	Orangish brown and grey CLAY with some Sand bands c. 4m	c.4.5mbgl	Groundwater encountered at 4mbgl in onsite boreholes.
Bedrock	Mudstones	Previous reports at the Hangar 3 and Hangar 5 sites to the south suggest	It is not anticipated that groundwater shall be encountered

From previous ground investigations in the area which extend deeper than those onsite c.4.45mbgl bedrock is anticipated to be relatively shallow c.4-5mbgl.

8.1 Groundwater

The onsite borehole logs identify perched groundwaters at c.1mbgl with the Made Ground at two of the four window samples from the ESG report. all four window samples identify ground water at c.4mbgl within the superficial deposits which ties in with the thin sand bands identified within one of the boreholes at this depth.

Wider ground investigations from the Hangar 3 and 5 sites identified laterally discontinuous sand bands within the superficial deposits some of which contained perched waters including where these overlay the bedrock. This may potentially tie with the encountered groundwater onsite at c.4mbgl potentially suggesting bedrock of a similar depth.

From the reports addressing the hydrocarbon impact of the refuelling station at Hangar 3 to the south of the site, a south westerly groundwater gradient is noted down ground level gradient and towards Cotteril Clough. It is likely that if present the site shall share a similar groundwater gradient however it is noted that the site lies just to the north of the boundary of the Timperley Brook catchment rather than River Bollin Catchment.

Preliminary Gas Risk Assessment (based on RB17)

CL: AIRE Research Bulletin RB17 (2012)¹ presents a pragmatic approach to Ground gas risk assessment. This assessment can be undertaken with no gas monitoring data, based instead upon other characteristics of the site including ground conditions, chemistry, and site history.

Limited previous ground investigation data is available for the site including no chemical analysis to determine the Total Organic Content of the onsite strata to allow for a full assessment under RB17. However, review of the available information on the site allows for a speculative initial assessment of potential ground gas risks at the site to be made.

Taking into consideration the ESG and BGS boreholes onsite, it is anticipated that the Made Ground on site is at least c.1m thick outside of Building 401. The depth of the Made Ground beneath the Building itself is unknown. It is also anticipated that there may be areas of deeper made ground around other structures including drainage, gas, and electrical services onsite. It is taken that the Made Ground beneath the building will have been in place for >20 years, while outside the building the timing of any resurfacing of the parking and hard standing areas is unknown.

Previous investigations on the Hangar 3 and 5 sites to the south and south east identify broadly a TOC of less than 1%.

On review of the available information against RB17 Table 1, the Site could have an initial speculative classification as a Characteristic Situation 1 (CS1) (in line with BS 8485 and CIRIA C665). However, data for the site is limited and with the commercial/ industrial nature and known historic contamination of the surrounding area, and the unknown details of the building and any potential contamination of Site, it is recommended that a suitable programme of ground gas monitoring is undertaken as part of any future investigation.

¹ CL:AIRE (2012) Research Bulletin 17, A pragmatic Approach to Ground Gas Risk Assessment

9. Initial Conceptual Model

9.1 Introduction

This section is aimed at identifying possible risks, if any, arising from substances used or deposited on-site, or from other sources of land contamination. Both past and current potentially contaminative land uses have been considered. It is based on the proposed site redevelopment which will comprise a single large warehouse building split into three units each with internal office units, and associated access roads parking and landscaping as identified in Section 1.1.1.

9.2 Assessment Framework

The Site, in terms of potential land contamination, will be regulated by the Local Authority Manchester City Council under the Town and Country Planning Act 1990 (as amended), taking account of the National Planning Policy Framework 2019, with the Environment Agency, Natural England and English Heritage acting as potential statutory consultees.

Environmental liabilities can arise through provisions contained within statutory legislation including Part 2A of the EPA 1990, the Environmental Damage (Prevention and Remediation) Regulations 2009, the Water Resources Act 1991, the Groundwater Regulations 2009 and the Water Act 2003.

Current best practice recommends that the determination of health hazards due to contaminated land is based on the principle of risk assessment, as outlined in the Statutory Guidance to Part 2A (2012) and Land Contamination: Risk Management (LCRM).

The "suitable for use" approach is adopted for the assessment of contaminated land where remedial measures are undertaken where unacceptable risks to human health or the environment are realised taking into account the use (or proposed use) of the land in question and the environmental setting. The proposed end-use for the Site is a commercial development including a single large warehouse with associated internal office units.

The risk assessment process for environmental contaminants is based on a source-pathway-receptor analysis. These terms can be defined as follows:

- **Source:** hazardous substance that has the potential to cause adverse impacts; and
- **Pathway:** route whereby a hazardous substance may come into contact with the receptor: examples include ingestion of contaminated soil and leaching of contaminants from soil into watercourses; and
- **Receptor:** target that may be affected by contamination: examples include human occupants/ users of site, water resources (surface waters or groundwater), or structures.

For a risk to be present, there must be a relevant/ viable contaminant linkage; i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway.

The following sections details the iCM which has been developed for the Site with a view to assessing the potential risks/ liabilities and constraints associated with the Site in its current condition prior to any proposed redevelopment. Risks associated with the proposed redevelopment have also been assessed based on a commercial/industrial future land use scenario, including any potential sources of contamination, potential receptors and potential contaminant pathways identified during this desk-based assessment.

9.3 Sources of Potential Contamination

9.3.1 ONSITE

The Historic mapping and aerial photography show onsite that the site was initially open presumed farmland. By 1954 (between 1938 and 1954) the site was occupied by a series of looped hardstanding areas associated with the Ringway Airport (Later Manchester Airport). These are understood to be for taxiing and aircraft storage and were operational during WW2. The current Building 401 was first developed by 1987 (potentially from 1959) and expanded over the years to the present layout c.1995. Building 401 was used last by LSG Skycheffs for the storage and manufacture of airline foods. It is known that the building is currently derelict, and it is understood to still contain refrigeration units and air conditioning units. Other buildings in the area are known to use generators onsite.

Based on the above the following potential sources of contamination may be found at the proposed development site:

- *Made Ground associated with the development of Building 401 and its infrastructure*
- *Made Ground associated within the former aircraft standing areas.*
- *Current 'Z' electrical substation onsite (potentially disused) and other electrical housings across the site.*
- *Building 401 refrigeration and air-conditioning equipment*
- *Building 401 potential electrical and heating generators onsite*
- *Mag Bus Depot 2 Diesel fuel above ground storage tanks onsite*
- *Mag Bus Depot AdBlue above ground storage tanks onsite*
- *Mag Bus Depot vehicle wash chemicals above ground storage in various containers and an IBC onsite*
- *Mag Bus Depot potential spillages and leaks of fuels and oils.*

9.3.2 OFF SITE

The maps show that significant off-site historic development which might affect the proposed development including: Former Hangar 3 and Hangar 5 to the south of the site, Hangar 3 is known to have included a refuelling depot which historically had leaked and since been remediated; Building 402 and associated sub-station immediately to the north of the site including parking and above ground fuel storage; Parking for the cargo centre to the north east and Avro Way runoff. Further from site there is also the large airport fuel depot. It should be noted however that Hangar 3, 5 and the airport fuel depot are down hydraulic gradient from the site.

Based on the above the following potential sources of contamination may be found at the proposed development site:

- *Electrical sub-station on northern boundary associated with Building 402.*
- *Above ground diesel fuel tank associated with Building 402.*
- *Made Ground potential contamination associated with Building 402.*
- *Made Ground historic contamination including potential hydrocarbon impact within area surrounding Hangar 3 and 5 (outwith DNATA development).*
- *Foul pumping station to south west of site.*
- *Runoff of potential spills of fuels and oils from Avro Way.*

9.4 Summary of potential sources

With reference to the DoE Industry Profile including for Airports; Road vehicle fuelling, service and repair; Table 9-1 indicates the potential contaminants that may be associated with the current land use.

Table 9-1 Potential Sources of Contamination

Source Reference	Location	Potential Sources	Associated Contaminants of Potential Concern (CoPC)
S1	On Site	Made Ground – Building 401 including refrigeration and air-con units, and electrical generators	Heavy metals, Total Petroleum Hydrocarbons (TPH), Semi-volatile Organic Compounds (VOCs), Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAHs), phenols, sulphate, ammoniacal nitrogen, asbestos, asbestos containing materials (ACMs), Ground gases including carbon dioxide and methane. Electricals: polychlorinated biphenyl (PCB), Refrigeration and air-con: Organics, solvents, hydrocarbons (eg. Tetrafluoroethane, Chloro-Fluorocarbons, Chloro-Fluorocarbon, Polystyrene and Acrylonitrile). Ground gases including carbon dioxide and methane.
S2	On Site	Made Ground – former aircraft standings	Heavy metals, PAH, TPH (including aviation kerosene and gasoline, gas oil and diesel) SVOCs, VOCs, acids, alkalis, glycols (e.g. Antifreeze and de-icing agents), organic solvents, fire-fighting agents, washing agents, cleaners and lubricants, solvents (e.g. paints and thinners). Phosphoric acid, corrosion inhibitors, PCBs and ACMs Ground gases including carbon dioxide and methane.
S3	On Site	Electrical Substation 'Z' and electrical housings	Heavy metals, PCBs
S4	On Site	MAG Bus depot including vehicle wash, and fuel and AdBlue storage tanks.	Heavy metals, organics, inorganics, PAH, TPH, SVOCs, VOCs, solvents, glycols (e.g. Anti-freeze), fuel additives (AdBlue) and detergents. Ground gases including carbon dioxide and methane.
S5	Off Site	Made Ground – Building 402 site including associated electrical substation, chemical storage, and diesel tank.	Heavy metals, Total Petroleum Hydrocarbons (TPH), Semi-volatile Organic Compounds (VOCs), Volatile Organic Compounds (VOCs), Polycyclic Aromatic Hydrocarbons (PAHs), phenols, sulphate, ammoniacal nitrogen, asbestos, asbestos containing materials (ACMs), Ground gases including carbon dioxide and methane. Electricals: polychlorinated biphenyl (PCB).
S6	Off Site	Made ground associated with current and past land uses of the surrounding airport infrastructure including Hangar 5 and Hangar 3 inc refuelling depot and foul water pump.	Heavy metals, PAH, TPH (including aviation kerosene and gasoline, gas oil and diesel) SVOCs, VOCs, acids, alkalis, glycols (e.g. Antifreeze and de-icing agents), organic solvents, fire-fighting agents, washing agents, cleaners and lubricants, solvents (e.g. paints and thinners). Phosphoric acid, corrosion inhibitors, PCBs, and ACMs. Ground gases including carbon dioxide and methane.

9.5 Potential Receptors

9.5.1 On-Site Receptors

Potential on-site receptors have been identified as follows:

Human Health

- Future construction and maintenance workers²
- Future site visitors
- Future site users (commercial)

Water Environment

- Shallow aquifer within the superficial Glacial Till deposits is classified as a Secondary Undifferentiated aquifer.
- The deep aquifer within the Bollin Mudstone Member is classified as a Secondary B aquifer.

Buildings & Infrastructure

- Concrete foundations
- Building structures
- Underground services
- Gas/ damp membranes

9.5.2 Off-Site Receptors

Human Health

- Adjacent site users (commercial)

Water Environment

- The shallow aquifer within the superficial Glacial Till deposits is classified as a Secondary Undifferentiated aquifer.
- The deep aquifer within the Bollin Mudstone Member is classified as a Secondary B aquifer.
- The nearest surface Water Cotteril Clough 345m SW of the site.

² This report and the preliminary risk assessment included does not consider acute linkages for construction and maintenance workers. AECOM anticipates that these acute linkages will be managed by appropriate health and safety measures.

9.5.3 Summary of Potential Receptors

Potential receptors associated with the potential development are shown on Table 9-2:

Table 9-2 Potential Receptors

Receptor Reference	Receptor	Description
R1	Human Health: Acute	Future site users – Site visitors.
R2	Human Health: Chronic	Future site users – workers at the site.
R3	Human Health: Acute	Adjacent site users – workers and road users (During construction phase)
R4	Water Environment: Superficial Aquifer	Secondary Undifferentiated Aquifer in the Superficial Glacial Till
R5	Water Environment: Bedrock Aquifer	Secondary B Aquifer in the Bollin Mudstone Member
R6	Water Environment: Surface waters	Cotteril Clough 345m SW of the site
R7	Flora	Plants, trees, and landscaping
R8	Buildings & Infrastructure: Concrete	Future proposed foundations and services at the site may be impacted by contamination in the ground. Concrete foundations can be corroded if perched groundwaters or leachates have high sulphate levels.
R9	Buildings & Infrastructure: Structures	Proposed structures may be impacted by accumulation of ground gases.
R10	Buildings & Infrastructure: Services	Potable water supply pipes and other service may be impacted by contamination in the ground. Toxic and corrosive contaminants can migrate through water supply pipes
R11	Buildings & Infrastructure: Gas/ damp membranes	Potential for hydrocarbons in soils and ground waters may deteriorate membranes.

9.6 Potential Pathways

9.6.1 On-Site Pathways

On-site pathways include direct contact, ingestion and dermal absorption of soil and inhalation of soil particles and soil vapour derived from soils, spillage / loss and run off from surface of site, leaching of chemicals and vertical migration via permeable unsaturated strata to shallow groundwater, lateral migration of impacted shallow groundwater to surface water features off-site, vertical migration of shallow impacted groundwater to deeper groundwater, direct contact of buried concrete, services and pipes with contaminated soils and the migration of hazardous gases and chemicals via permeable strata.

9.6.2 Off-Site Pathways

Off-site pathways include migration and leaching of hazardous gases and chemicals via permeable unsaturated strata, contact with shallow impacted groundwater travelling horizontally offsite, migration of CoPC via underground drainage/ sewers (including granular backfilling materials) and spillage/loss/runoff via on land rivers.

9.6.3 Summary of Potential Pathways

Potential pathways associated with the proposed development are shown in Table 9-3.

Table 9-3 Potential Pathways

Pathway Reference	Receptor	Description
P1	Human Health	Direct Pathway: Direct contact, dermal absorption, or ingestion of soil.
P2	Human Health	Indirect Pathway: Inhalation of soil particulates derived from soils.
P3	Human Health	Indirect Pathway: Inhalation of soil vapour derived from soils or groundwater
P4	Human Health	Indirect Pathway: Migration of hazardous gases/vapours via permeable strata into confined spaces (asphyxiation/ explosion)
P5	Water Environment: Groundwater	Indirect Pathway: Leaching of chemicals and vertical / lateral migration via permeable unsaturated strata to shallow and/ or deep groundwater
P6	Water Environment: Groundwater	Indirect Pathway: Vertical migration of impacted shallow groundwater to the deeper Secondary B aquifer.
P7	Water Environment: Groundwater/ surface water	Indirect Pathway: Lateral migration of impacted groundwater to off-site surface water.
P8	Water environment: Surface water	Indirect pathway: Migration via underground drainage / sewers (including granular backfilling materials), spillage / loss / run-off from the surface direct to receiving water.
P9	Buildings & Infrastructure: Concrete	Direct Pathway: Direct contact of buried concrete with contaminated soils (i.e. hydrocarbons) and aggressive ground conditions (pH and sulphate).
P10	Buildings & Infrastructure: Supply pipes	Direct Pathway: Direct contact of services and supply pipes with contaminated soils.
P11	Buildings & Infrastructure: Structures	Indirect Pathway: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches
P12	Buildings & Infrastructure: Gas/ damp membranes	Indirect Pathway: Potential for hydrocarbons in soils and ground waters may deteriorate membranes.
P13	Ecosystems: Flora.	Direct pathway: Direct contact with contaminated soils.

10. Environmental Risk Assessment

10.1 Risk Assessment Principles

Current best practice recommends that the determination of hazards due to contaminated land is based on the principle of risk assessment, as outlined in the Environment Agency guidance on LCRM.

For a risk to be present, there must be a viable contaminant linkage; i.e. a mechanism whereby a source impacts on a sensitive receptor via a pathway.

Assessments of risks associated with each of these contaminant linkages are discussed in the following sections.

Using criteria broadly based on those presented in the National House Building Council/Environment Agency/Chartered Institute of Environmental Health publication R&D 66 (NHBC/EA/CIEH, 2008), the magnitude of the risk associated with potential contamination at the Site has been assessed. To do this an estimate is made of:

- The magnitude of the potential consequence (i.e. severity);
- The magnitude of probability (i.e. likelihood).

The severity of the risk is classified according to the criteria in Table 10-1.

10.2 Risk Assessment Framework

Table 10-1 Description of Severity of Risk

Term	Description
Severe	– Highly elevated concentrations likely to result in significant harm to human health. – Catastrophic damage to crops, buildings or property (e.g. by explosion). – Equivalent to EA Category 1 pollution incident including persistent and/or extensive effects of water quality. – Major damage to aquatic or other ecosystems.
Medium	– Elevated concentrations which could result in significant harm to human health. – Significant damage to crops, buildings or property (e.g. damage to building rendering it unsafe). – Equivalent to EA Category 2 pollution incident including significant effect on water quality. – Significant damage to aquatic or other ecosystems.
Mild	– Exposure to human health unlikely to lead to significant harm. – Minor damage to crops, buildings or property (e.g. surface spalling to concrete). – Equivalent to EA Category 3 pollution incident including minimal or short-lived effect on water quality. – Minor or short-lived damage to aquatic or other ecosystems.
Minor	– No measurable effect on humans. – Repairable effects of damage to buildings, structures, and services. – Equivalent to insubstantial pollution incident with no observed effect on water quality of ecosystems.

The probability of the risk occurring is classified according to the criteria in Table 10-2.

Table 10-2 Likelihood of Risk Occurrence

Likelihood	Explanation
High	Contaminant linkage may be present that appears very likely in the short-term and risk is almost certain to occur in the long term, or there is evidence of harm to the receptor.
Likely	Contaminant linkage may be present, and it is probable that the risk will occur over the long term.
Low	Contaminant linkage may be present and there is a possibility of the risk occurring, although there is no certainty that it will do so.
Unlikely	Contaminant linkage may be present but the circumstances under which harm would occur even in the long-term are improbable.

An overall evaluation of the level of risk is gained from a comparison of the severity and probability, as shown in Table 10-3.

Table 10-3 Risk based on Comparison of Likelihood and Severity

		Severity			
Likelihood		SEVERE	MEDIUM	MILD	MINOR
	HIGH	Very High	High	Moderate	Low
	LIKELY	High	Moderate	Moderate/Low	Low
	LOW	Moderate	Moderate/Low	Low	Very Low
	UNLIKELY	Moderate/Low	Low	Very Low	Very Low

10.3 LCRM Assessment of Risk

In 2019, the UK government issued new guidance on the evaluation and management of contaminated land, LCRM. Current contaminated land guidance in LCRM (Environment Agency, 2020) categorises risk at Stage 1 Tier 1 (i.e. PRA) as follows:

- Acceptable;
- Unacceptable.

However, no framework for assessing the risk has been published to accompany the guidance, so the CIEH & NHBC R&D 66 assessment framework constitutes best practice in this regard. To align the risk rankings in Section 10.2 with the LCRM rankings and with the Part 2A definitions, the following matrix has been utilised. This conversion is demonstrated in Table 10-4 below:

Table 10-4 Conversion to LCRM Risk Categories

	Acceptable	Unacceptable
Very Low		
Low		
Moderate/Low		
Moderate*		
High		
Very High		

* This risk category spans both acceptable and unacceptable. This is intentional as it is this risk band that tends to have the greatest level of uncertainty associated with it. Acceptability will dependent on site-specific circumstances and level of confidence in the available evidence

For a risk to be unacceptable, the contaminant linkage should be associated with at least a “medium” severity as defined in Table A4.3 in Annex 4 of R&D66 and the probability should (in the majority of cases) be at least “likely” as defined in Table A4.4 of R&D66

These risk categories represent the level of risk as it is currently understood from the information available at this time.

10.4 Preliminary Risk Assessment

An iCM illustrating plausible contaminant linkages has been formulated for this site. The qualitative preliminary risk assessment of the possible linkages of the above sources (S1 to S6), transport pathways (P1 to P11) and receptors (R1 to R12) is provided in the Table 10-5.

The level of risk is determined based on the current condition of the Site (i.e. the effects of mitigation measures are not included).

The preliminary risk assessment undertaken with in this section does not consider acute linkages for construction and maintenance workers. AECOM anticipates that these acute linkages will be managed by appropriate health and safety measures.

Table 10-5 Potential Sources, Pathways and Receptors

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk (LCRM)	Linkage Reference	Justification
On-Site sources of CoPCs Made Ground and potential contaminants associated with Building 401, former aircraft standings, electrical substation 'Z' and MAG bus depot. (S1, S2, S3, S4)	Direct contact, dermal absorption, or ingestion of soil (P1)	Human Health: Acute: Future site visitors (R1)	Medium	Unlikely	Acceptable	L1	The site is currently occupied by the derelict building 401 and MAG bus depot. With the exception of a fenced off area of woodland in the western end of the site the majority of the site is covered by hard standing. The proposed development is anticipated to include a single large warehouse type building, access, and parking with limited landscaping. The previous and current land use at the site and limited ground investigation indicates the presence of c.1m of made ground which could be more extensive within the building and services footprints. Due to the age of the building and services onsite and identification of asbestos lagged piping within the Hangar 3 site during the DNATA development, there is the potential for Asbestos to be present on site. Based on the current site use and the proposed development it is unlikely in its current or future state to allow dermal contact with, or ingestion of, CoPCs within the soils. The risk of dermal contact and ingestion shall be greatest during the construction phase. As with all construction works the Principal Contractor will need to comply with the CDM 2015 regulations and, therefore, the workforce should be appropriately protected from exposure to potential contaminants during construction.
		Human Health: Chronic: Future site users (R2)					
	Indirect Pathway: Inhalation of soil particulates derived from soils (P2)						
		Adjacent site users – workers and road users (During construction phase) (R3)	Medium	Low	Acceptable	L2	See L1 – For adjacent site users the risk of dermal contact and ingestion of wind-blown soils shall be greatest during the construction phase. As with all construction works the Principal Contractor will need to comply with the CDM 2015 regulations and, therefore, the workforce should be appropriately protected from exposure to potential contaminants during construction.
	Inhalation of Soil Vapour (P3)	Human Health: Acute: Future site visitors (R1) Human Health: Chronic: Future site users (R2)	Medium	Unlikely	Acceptable	L2	See L1

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk (LCRM)	Linkage Reference	Justification
		Adjacent site users – workers and road users (During construction phase) (R3)	Medium	Low	Acceptable	L3	See L1
	Migration of hazardous gases/vapours into confined spaces (Human Health) (P4)	Human Health: Acute: Future site visitors (R1) Human Health: Chronic: Future site users (R2)	Medium	Likely	Unacceptable	L4	The speculative RB17 assessment indicates a potential CS2 status based on the current limited borehole logs and potential TOC based upon previous reports from the wider area. However as noted this is only speculative in review of RB17 which is only a reliable pragmatic approach with robust site data available. As the site is proposed to be a single very large warehouse split into three large units with regular ventilation from regular use of access doors, the potential for gas build up in the main warehouse floor areas would be relatively limited however the building will include confined spaces and service ducts, offices and other areas where the accumulation of hazardous gases and vapours would be more likely. <i>It is recommended, further investigation should be carried out prior to development to include a suitable ground gas monitoring programme, ground gas risk assessment; and gas mitigation measures, if necessary, should be implemented based upon the assessment.</i>
		Buildings & Infrastructure: Structures, Services & Membranes (R9, R10, R11)	Medium	Low	Acceptable	L5	See L4: The potential for the accumulation of hazardous gases within confined spaces within the buildings and infrastructure have the potential to develop a risk of explosion
	Leaching of chemicals and vertical / lateral migration via permeable unsaturated strata to shallow groundwater (P5)	Shallow groundwater – Secondary un-differentiated Aquifer (R3)	Medium	Likely	Unacceptable	L6	It is anticipated that potential CoPCs may be present on-site associated with the potential sources identified within the iCM. These CoPCs are considered to have the potential to leach to sub strata. The limited ground investigation available for the site identified a variably granular / cohesive made ground to c.1mbgl over a predominantly cohesive glacial till. The till is identified as orangish brown and grey firm to stiff Clays, however shallow sand bands are noted c.3.5-4.0mbgl The wider ground investigations from previous reports are known to identify more extensive sand bands both shallower and deeper than those identified onsite. These are understood to be laterally discontinuous over larger areas.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk (LCRM)	Linkage Reference	Justification
							Seepage and limited groundwater strikes were identified c.1mbgl at the base of the made ground. Further groundwater strikes were identified at all four ESG window samples at c.4.0mbgl coinciding with the deeper sand bands. While the superficial deposits are predominantly cohesive the presence of sand bands known to be more extensive in the wider area, and shallow perched groundwaters, it is considered possible that vertical migration of contaminants could occur between the Made Ground and the shallow potentially perched groundwater. <i>A ground investigation is recommended to understand the hydraulic conductivity beneath the site.</i>
	Vertical migration of impacted shallow groundwater to the deeper secondary B aquifer (P6)	Deep Groundwater Secondary B aquifer of the Bollin Mudstone Member (R4)	Medium	Low	Acceptable	L7	See L6: While the ground investigation onsite has not identified bedrock, it is understood to comprise weathered mudstones over more competent mudstone bedrock. The underlying bedrock is noted to be of 'low permeability with migration of water only taking place along 'fractures or granular lenses'. While it is possible that granular lenses are present in the bedrock which may be in contact with granular lenses within the superficial deposits; the predominantly cohesive nature of the two strata are likely to inhibit vertical migration to the underlying aquifer.
	Lateral migration of impacted groundwater off-site to surface water (P7)	Surface Waters, Cotteril Clough (R5)	Medium	Low	Acceptable	L8	It is possible that there could be lateral migration of contaminated ground water with potential impacts to off-site surface waters including Cotteril Clough 345m SW. Study of the former refuelling depot at Hangar 3 to the south of the site indicated a south west groundwater gradient and identified with regards to hydrocarbon leakage a plume extending to the south west in accordance with this. While the building 401 site lies on the boarder of a different water catchment it is considered likely that migration of contaminants would be to Cotteril Clough which lies down gradient of the site. However, it is acknowledged that the superficial deposits are predominantly cohesive clays with negligible permeability and as such the potential for migration over this distance would be limited. It is possible however, should more extensive sand bands be present on site, that there could be an increased risk for migration.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk (LCRM)	Linkage Reference	Justification
							A ground investigation is recommended to understand the hydraulic conductivity beneath the site.
	Lateral migration of surface waters / shallow ground waters via underground drainage / sewers (including granular backfilling materials), spillage / loss / run-off from the surface direct to surface water (P8)	Surface Waters, Cotteril Clough (R5)	Medium	Unlikely	Acceptable	L8	It is considered unlikely that there should be lateral migration of contaminated surface and shallow groundwater via existing services and runoff with potential impacts to off-site surface waters including Cotteril Clough 345m SW. The site is located within the Manchester Airport drainage system. Waters going to drains are monitored as part of the airports environmental procedures and treated if required before being released to surface water. The site itself currently has interceptors down gradient from their above ground fuel storage tanks which themselves are internally banded.
	Direct contact of buried concrete with contaminated soils (P9)						A ground investigation would be required to understand the hydraulic conductivity beneath the site.
	Direct contact of services and supply pipes with contaminated soils (P10)	Buildings & Infrastructure: Concrete and Services (R8, R10)	Medium	Likely	Unacceptable	L9	Since Made Ground is expected to be present across most of the site to variable extent, it is possible for buried concrete and services and supply pipes associated with the development to come into contact with contaminants such as sulphate and hydrocarbons. Aggressive ground conditions can pose a risk to underground structures, services, and concrete foundations. As such the risk is considered medium and the likelihood likely therefore the risk is moderate. A ground investigation would be required to understand the chemical status of the shallow strata beneath the site with respect to underground structures.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk (LCRM)	Linkage Reference	Justification
	Indirect Pathway: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches (P11)	Buildings & Infrastructures (Structures and services (R9, R10)	Medium	Likely	Unacceptable	L10	See L5 and L9
	Indirect Pathway: Potential for hydrocarbons in soils and ground waters may deteriorate membranes (P12)	Buildings & Infrastructures (Gas/damp membranes R11)	Medium	Likely	Unacceptable	L11	See L9
	P13 – Direct contact with contaminated soils	R7 – Flora & fauna	Mild	Low	Acceptable	L12	Contaminants may be present onsite which may present a risk to ecological receptors such as flora or fauna. However, the proposed development is understood to include only limited soft landscaping and as such the risk is considered Low. It is recommended that for landscaped areas a suitable growing medium is utilised either imported or site won. Environmental chemical analysis of site soils as part of an intrusive ground investigation could support the use of site won materials should this be required.

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk (LCRM)	Linkage Reference	Justification
Off-Site sources of CoPCs Made Ground and contamination associated with current and historic surrounding land uses, including Building 402 and associated diesel tank and substation, and the wider airport infrastructure including Hangar 3 and 5. (S5, S6)	Direct contact, dermal absorption, or ingestion of soil (P1)	Human Health: Acute: Future site visitors (R1)	Medium	Unlikely	Acceptable	L13	There is the potential for CoPCs to be present within near surface Made Ground and contaminated shallow soils, derived from the off-site sources notably the storage and use of fuels within building 402 to the immediate north of the site and the electrical substation on the site boundary. As with L1: Due to the site and wider area being predominantly commercial/ industrial in use with limited landscaping or bare soils, the likelihood of direct contact is considered unlikely and the risk is considered low.
	Indirect Pathway: Inhalation of soil particulates derived from soils (P2)	Human Health: Chronic: Future site users (R2)					This would potentially differ should future development works be undertaken on the surrounding sites. However, as with all construction works the Principal Contractor will need to comply with the CDM 2015 regulations and, therefore, the workforce should be appropriately protected from exposure to potential contaminant during construction and mitigation measures be in place for off site migrations of wind-blown materials.
	Inhalation of soil vapour (P3)	Human Health: Acute: Future site visitors (R1)	Medium	Unlikely	Acceptable	L14	See L13
		Human Health: Chronic: Future site users (R2)				L15	See L13
	Migration of hazardous gases/vapours into confined spaces (P4)	Human Health: Chronic: Future site users (R2)	Medium	Low	Acceptable	L16	See L4: There is the potential for CoPCs to be present within near surface Made Ground and contaminated shallow soils, derived from the off-site sources notably the storage and use of fuels within building 402 to the immediate north of the site. However due to the distance from site the likelihood is considered lower than those potential sources onsite
		Buildings & Infrastructure: Structures, Services & Membranes (R9, R10, R11)	Medium	Low	Acceptable	L17	See L16 and L5. However, due to the distance from site the likelihood is considered lower than those potential sources onsite

Source	Pathway	Receptor	Potential Severity	Likelihood of Occurrence	Potential Risk (LCRM)	Linkage Reference	Justification
	Leaching of chemicals and vertical / lateral migration via permeable unsaturated strata to shallow and/ or deep groundwater (P5)	Secondary Undifferentiated Aquifer in superficial Glacial Till (R3) Deep Groundwater Secondary B aquifer of the Bollin Mudstone Member (R4)	Medium	Low	Acceptable	L19	There is the potential for CoPCs derived from off-site sources S5 & S6 to be present and for vertical migration to occur between the contaminated surface soils and shallow groundwater/ deep groundwater (see L6 and L7). This would be most prevalent for migration within shallow granular made ground of leaked hydrocarbons from locations such as the storage tank at BH402 which was noted in Project Quantum to have leaked. PCBs associated with the electrical substation while not particularly mobile may be present onsite due to the proximity to the boundary. While present the likelihood is considered low due to the mobility of the potential contaminants and distance
	Vertical migration of impacted shallow groundwater to the deeper secondary B aquifer (P6)	Deep Groundwater Secondary B aquifer of the Bollin Mudstone Member (R4)	Medium	Low	Acceptable	L20	See L7
	Indirect Pathway: Migration of hazardous gases/vapours via permeable strata into enclosed spaces and service/utility trenches (P11)	Buildings & Infrastructures (Structures and services (R9, R10)	Medium	Low	Acceptable	L21	See L10: However, due to distance the likelihood of gas / vapour migration from off site is considered low.

10.5 Discussion of Acute Risk to Future Construction Workers & Off-Site Receptors.

AECOM understands that the proposed development works will be undertaken in compliance with Construction Design and Management (CDM) 2015 regulations.

Prior to work commencing, a health and safety risk assessment should be carried out by the appointed Principal Contractor / developed in accordance with current health and safety regulations. This assessment should cover potential risks to construction staff, permanent site staff and the local population. Based on the findings of this risk assessment, appropriate mitigation measures should be implemented during the construction period.

The greatest potential for generation of dust will be during the Site works and therefore dust generation should be kept to a minimum in accordance with general best practice, as outlined in, for example, 'Environmental Good Practice on Site', CIRIA Publication C692 to reduce this risk.

The risk to construction workers during the excavation and construction phases in terms of potential exposure to high concentrations of contaminants is considered to be low given the historic and current land uses identified at the Site. Should gross contamination be identified during the construction phase, then this may pose a potential acute risk to construction works. In addition, due to the age of the building present onsite it is possible that asbestos or ACM may be present onsite which poses its own acute risks.

It is likely to be able to be effectively managed through good health and safety practices and protocols. Adoption of appropriate dust suppression techniques would also mitigate the degree of potential particulate migration off-site

11. Waste Management & Potential Reuse of Site-Won Material

11.1 Initial Assessment of Probable Waste Generation

The current proposed development plans indicate a large single warehouse building to cover the majority of the site area, however, no specific design plans are currently available. Based upon the proposed redevelopment, it is probable that general construction and soil waste will be generated for the site as part of the development.

11.2 Initial Assessment of Probable Material Available for Reuse

Based on the proposed redevelopment, the earthworks design would likely include cut and fill works, cut / fill balance, and an investigation of the potential to include for the re-use of site won materials during the earthworks.

11.3 Outline Recommendations

It would be prudent to undertake a hazardous waste assessment on samples collected during any future ground investigations, to determine the classification of soils for any off-site disposal and to determine the chemical suitability of soils for consideration for re-use as site won materials. This initial assessment could support the determination of costings for disposal of site generated soils if they are unsuitable for use.

12. Review of Geotechnical Risk and Preliminary Engineering Assessment

12.1 Geotechnical Risk

A preliminary geotechnical risk register is given in Appendix F which describes the main ground related hazards on the site (excluding ground contamination) and mitigation measures which may be implemented to eliminate or reduce the risk by means for further investigation or during the design.

The most significant risks are:

1. Former foundations and voids associated with former developments including basements and service ducts ground have implications for surface/foundation stability and settlement, especially under increased loading from structures or earthworks.
2. Any existing Made Ground is unlikely to provide a suitable founding stratum for structural foundations and potentially unsuitable for pavement. Although ground investigation will be required to confirm this. The extent and characteristics of the Made Ground should be investigated most notably beneath the current structures
3. While the current limited ground investigation data and GroundSure report identified firm to stiff shallow natural strata and negligible compressibility of underlying strata; should the presence of weak and compressible soils be identified onsite these may pose a risk of excessive total or differential settlement of foundations.
4. Where ground may be required to be re-graded, the material will require classification for re-use. Glacial Till is a highly variable material and will need classification for re-use.
5. While the site is broadly level and it is anticipated that the proposed development would not require notable slopes or embankments, should these be required slope stability of embankments and cuttings should be assessed. The long-term settlement of raised areas should be assessed, if excessive total and differential settlement are a concern for the proposed area of the scheme.
6. High, perched or variable ground water levels which may impact earthworks, causing instability in excavations, cuttings, and temporary works. The current limited ground investigation onsite has identified perched groundwater within Made Ground and the superficial deposits.
7. Unknown/unrecorded buried structures: The nature of the foundations of building 401 are current unknown, it is understood that building 402 has a partial sub-basement. There are also a number of underground services onsite including a large manhole area in the south west of the site the nature of which is unknown.
8. Potential obstructions to piling or drilling from boulders in the Glacial Till, previous underground structures or foundations or variable rock head level and into variable properties of rock.
9. Striking underground services during ground investigation or construction.
10. Chemically aggressive ground conditions.

To mitigate these risks, it is recommended that:

1. A thorough ground investigation is carried out including a more extensive UXO survey for the scheme and in areas where proposed buildings. Dependent upon the nature of the foundations and potential for basements. It may be prudent to undertake the investigations post demolition of the above ground structures at the site.
2. The extent of and potentially highly variable thickness of Made Ground, weak and compressible materials or soils, should be assessed during a ground investigation and foundations should be placed on a suitable bearing stratum below any Made Ground or weak and compressible soil. It may require excavation and replacement, or treatment for new hardstanding areas.
3. The ground conditions should be characterised below structures by a ground investigation. A variety of foundations may be required to support the design loads including shallow spread and deep piles.
4. For pavement design, the proposed sub-grade level for access roads/car parks should be confirmed prior to construction. Any soft ground or unsuitable materials should be excavated out and replaced with engineering fill, before starting any pavement construction works.

5. Where ground is to be regraded, testing should be carried to assess its suitability for reuse.
6. An investigation into the groundwater levels including seasonal variation is recommended prior to commencement of any detailed earthworks or foundation design. If required, the use of special measures to control groundwater.
7. Slope stability should be undertaken for detailed earthworks design. The long-term settlement of raised areas should be assessed, if excessive total and differential settlement are a concern for the proposed area of the scheme.
8. Establish site procedures to be undertaken in the event underground services are encountered, including risk assessment and method statement. Ensure any existing services are identified and fully traced prior to commencement of GI and construction works. Utilities diversion.
9. Ground investigation for the proposed site extents and any likely structure locations to reduce risk of potential obstructions.
10. Carrying out PAS128 surveys or using cable avoidance tools prior to breaking ground.
11. Chemical testing of soil to BRE requirements to support selection of underground materials.

12.2 Preliminary Engineering Assessment

12.2.1 Foundations

Subject to the findings of a ground investigation and detailed design, generally for lightly loaded structures with no concern for excessive total and differential settlement, the underlying stiff/dense Glacial Deposits may be suitable for the use of traditional spread foundations founded within the formation. However, bearing resistance of foundation stratum and settlement tolerance of the proposed structures will need to be considered for suitability of any spread foundations. In general, foundations should be located within natural ground beneath any fill, Made Ground, highly compressible soil, and below the depth of effect of variations due to vegetation, seasonal and climatic change. Depending on the depth of the suitable foundation formation, piled foundations may be considered based on economical and construction reasons.

Piled foundations may be considered for more heavily loaded structures and for economical and construction reasons as mentioned above. Based upon the nature of the proposed development it is likely that some form of piled foundations will be required.

Piles may encounter boulders within the Glacial Till, obstructions from existing and or historical underground structures or foundations and or variable rock head level and into variable properties of rock, these should be taken into consideration.

Where structures are located within influencing distance of any existing or future trees, reference should be made to Chapter 4.2 of NHBC's Standards.

12.2.2 Ground Floor Slabs

The potential use of ground bearing floor slabs would be determined following the ground investigation.

12.2.3 Excavations

Where excavations for foundations, earthworks, and drainage and are required, stability of excavated areas should be considered. Close or continuous support will be required for any manned entry to excavations.

Shallow groundwater may be encountered and may require groundwater control during excavation. Detailed information regarding the groundwater regime will be available following the ground investigation and subsequent monitoring.

12.2.4 Soakaways

The ground conditions are unlikely to be suitable for the use of soakaways, where cohesive Glacial Till or cohesive materials are present, due to their low permeability. Therefore, surface water run-off should be directed to main drainage subject to appropriate consent to discharge.

13. Conclusions

The following is a summary of the review of the information sources listed in Section 1.3:

The site is located on the north east side of the junction of Avro Way and Pinfold Lane (M90 5XR) and is centred on National Grid Reference 380906 384825 and covers an area of approximately 2.11 hectares. The environmental setting identified in the ICM is considered to be of Low to Moderate risk based on the below information:

- The superficial strata are predominantly cohesive Glacial Till comprising clays and sand bands. The bedrock is of the Bollin Mudstone Member and is anticipated to comprise weathered mudstones over more competent mudstone with depth. The superficial strata anticipated to be relatively thin with bedrock anticipated at c.4.5m – 5.5mbgl based upon wider historic ground investigations.
- There is anticipated to be Made Ground on site based on current and historical land use at the site including: hardstanding areas for taxiing and aircraft storage during WW2, Building 401 first developed onsite by 1987 (potentially from 1959) expanding over the years and the temporary bus depot for MAG including refuelling facilities and a vehicle wash.
- The superficial deposits are noted as a secondary undifferentiated aquifer and the bedrock a secondary B aquifer. Groundwater was identified in the limited ground investigations onsite, to be present perched within the Made Ground and Superficial Glacial Till associated with granular sand lenses.
- No ground gas monitoring has been available for the site for this assessment and while a speculative RB17 assessment identifies a CS1 classification, a suitable gas monitoring programme and risk assessment should be undertaken as part of any future investigation.

13.1 Geo-environmental Risks Review

Onsite potential sources of contamination have been identified through this desk study review including:

- Made Ground associated with past land use/development;
- Ground gases: methane and carbon dioxide generated from Made Ground and naturally occurring strata;
- Soil vapours: volatile organic compounds may be present emanating from soil/groundwater sources of organic contaminants;
- Asbestos associated with Made Ground and the current structures;
- Potential presence of UXO.

Offsite sources of contamination have also been identified and include:

- Made Ground and shallow natural soils associated with past land use/development.

Potential receptors identified as being at risk from contamination in association with usage of the site and proposed redevelopment include human health (current and future site users and adjacent site users), controlled waters (Secondary Undifferentiated, and Secondary B Aquifers underlying the site) and current and future developments and landscaping.

A risk assessment has been carried out in accordance with LC:RM. The potential geo-environmental risks that have been identified have been assessed by the preliminary risk assessment as being Low to Moderate risk, with the majority being low or Moderate/Low risk based on the existing information.

Those linages considered as potentially “Unacceptable” risks at this stage under LC:RM include:

- Human Health: Gases and vapours (Moderate)
- Controlled Waters: leaching of chemicals to shallow groundwaters (Moderate)
- Buildings & Infrastructure: direct contact of CoPCs in soils with concrete and services and gas/ groundwater membranes (Moderate)
- Buildings & Infrastructure: migration of Gases and vapours services (Moderate)

13.2 Geotechnical Risks and issues

Potential geotechnical hazards identified include:

- Any existing Made Ground in its current state is unlikely to provide a suitable founding stratum for structural foundations and potentially unsuitable for pavement. Made Ground is anticipated in most areas of the site. The extent and characteristics of the Made Ground will need to be investigated further, notably within the footprint of the current Building 401 and across the footprint of the proposed building.
- Potential unsuitable ground for pavement construction.
- High, perched or variable ground water levels which may impact earthworks, causing instability in excavations, cuttings and temporary works.
- Potential obstructions to piling or drilling from boulders in the Glacial Till deposits, previous underground structures or foundations.
- Striking underground services during ground investigation or construction.
- Chemically aggressive ground conditions.
- Soil shrink and heave and potential effect on foundations and pavement construction from any trees retained or removed as part of landscaping within the proposed development.

14. Recommendations

Once the layout and nature of the development /buildings are finalised a ground investigation will be required in order to inform the detailed design of the site.

The geo-environmental investigation should be designed with due consideration of the requirements of BS 10175:2017.

The geotechnical elements of the investigation should be designed with consideration of BS EN 1997-1:2004, BS EN 1997-2:2007 (Eurocode 7: Geotechnical Design – Parts 1 and 2) and BS 5930:1999.

In summary, key objectives to be addressed by the investigation include:

- Confirmation of the ground (and groundwater) conditions and validation of the CSM;
- Chemical status of Made Ground and natural soils for the purpose of risk assessment to human health, groundwater and for preliminary waste classification;
- Chemical status of groundwater in order to determine risks to controlled waters;
- Ground gas monitoring to determine the potential risks to the proposed development and surrounding properties;
- Identification of geotechnical design parameters for earthworks and preliminary foundation design; and
- Confirmation of infiltration characteristics.

By undertaking an intrusive ground investigation, an assessment of the ground and groundwater profiles may be carried out and the geotechnical and geo-environmental risks associated with the site made. This will allow a refined risk assessment and CM to be developed in accordance with LCRM methodology. The investigation will allow a quantitative assessment as to whether any of the potential risks identified in this study are present and are of material concern to the development.

Due to the location of the site within the wider operating areas of the airport during WWII and its use as aeroplane standing, it is recommended that the Client commissions a specialist UXO report in advance of any future intrusive site works or development. The report should be prepared with cognisance of CIRIA publication C681 (Stone et al., 2009).

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