CHAPEL ROAD,
PRESTON

UPDATED PHASE 1:
PRELIMINARY RISK ASSESSMENT

Job Number: LKC 21 1750
Date: November 2021
Client: Whitegate Property Developers Ltd

INCREASING LAND VALUE

LK GROUP

LK Consult Document Verification			
Site Address	66 Chapel Road, Hesketh Bank, Preston, Lancashire, PR4 6RT		
Report Title	Phase 1: Updated Preliminary Risk Assessment		
Job Number	LKC 21 1750	**Document Ref.**	CL-602-LKC 21 1750-01
Date Issued	November 2021	**Report Version**	R0
Prepared By	Emma Khadun	**Reviewed By**	Colin Crompton

Revision Record			
Revision No.	**Date**	**Nature of Revision**	**Approved By**

DISCLAIMER

This report has been prepared by LK Consult (LKC) who have exercised such professional skill, care and diligence as may reasonably be expected of a properly qualified and competent consultant, experienced in preparing reports of a similar scope.

However, to the extent that the report is based or relies upon information contained in records, reports or other materials provided to LKC, which have not been independently produced or verified, LKC gives no warranty, representation or assurance as to the accuracy or completeness of such information.

This report is prepared solely for the benefit of Whitegate Property Developers Ltd. It may not be relied upon by, or submitted to a third party for their reliance for the purposes of valuation, mortgage, insurance and regulatory approval, until all invoices have been settled in full.

Those using this information in subsequent assessments or evaluations do so at their own risk.

Contents

Figures

Appendices

1 Introduction

LK Consult Ltd (LKC) has been commissioned to carry out a Phase 1 Preliminary Risk Assessment (PRA) for Chapel Road, Hesketh Bank.

A Phase 1 PRA has previously been compiled by LKC for the site (ref. CL-602-LKC 20 1065-01 dated November 2019). This is the first phase of development. This report is an update of the previous report, which reflects a change to the site boundary to include of a portion of land to the northwest i.e. the second phase of development. Please note, the correct site boundary is shown on Figure 1, while the historical mapping and Envirocheck report reflects the previous site boundary.

In accordance with current guidance (including LCRM[1] and the National Planning Policy Framework (NPPF)[2]), the PRA will include a site reconnaissance, site history, geology, hydrogeology, hydrology, mineral search and a landfill search. Information gathered from the desk study and site reconnaissance will be used to develop a contamination conceptual model for the site.

In addition, the information gathered will be used to identify potential geotechnical constraints associated with the redevelopment of the site.

Based on the findings of this report, an appropriate site investigation can be derived, if required.

Site details are provided in Table 1-1. Figure 1 shows the site location and boundary. Figure 2 shows the proposed development plan.

Site Location	North of Chapel Road, to the west of Station Road, Hesketh Bank. Preston, PR4 6RT. Centred at approximate National Grid Reference 344390E, 423370N.
Approximate Area	3,800m^2.
Topography	14 metres Above Ordnance Datum (AOD). Site is approximately level.
Current Site Use	Site Access road to the south east of the site surfaced in asphalt hardstanding. First development phase area in progress as of November 2021 – formerly occupied by glass greenhouses and timber sheds, with areas of grass to the north east and south west. Second development phase currently occupied by a greenhouse. Surrounding Area North: Nursery and greenhouses and residential properties. East: Residential properties. South: Chapel Road and residential properties. West: Residential properties and nursery.
Purpose of Report	Pre-planning for second phase of development.
Proposed Development	Residential housing with gardens / soft landscaping. 12no. residential houses with rear gardens, driveways, parking areas, soft landscaping, access road and turning area (9no. in first phase and 3no. in second phase of development).

Table 1-1: Summary of site details.

[1] Land Contamination Risk Management (LCRM) https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm
[2] "National Planning Policy Framework." The Ministry of Housing, Communities and Local Government. Published March 2012, Updated July 2021.

2 Historical Review

In compiling the site history, LKC consulted Envirocheck historical mapping (Appendix A) and other public domain maps / aerial photography.

Please note: the site boundary on the Envirocheck historical mapping is incorrect and does not include the area to the northwest of the site.

Table 2-1 summarises features on site. Table 2-2 summarises potentially contaminative land uses within approximately 50m and potentially infilled features within approximate 250m.

Site Features	Location on Site	Dates Present		Comments
		From	To	
Ponds and drain/ditch	N	1891	1964	- Ditch/drain no longer present by 1931 mapping. - Ponds becomes reeds/marshes by 1931 mapping. - No longer present from 1964 mapping.
Greenhouses	N	1964	present	- Site labelled as a nursery from 1964 mapping, with an access road / path present along the south eastern boundary. One greenhouse in the north east no longer present.
Small buildings/sheds	N	1964	present	- Sales pack shows small timber sheds located in the northern sector of the site.

Table 2-1: Summary of site features. Dates based on available historical map editions.

Surrounding Area Features	Distance (m)	Direction	Dates Present		Comments
			From	To	
Issues	10	NE	1931	present	- Presumably flowing north.
Nurseries with glass greenhouses and tanks	10-235	all directions	1964	present	
Numerous ponds and drains	150-249	all directions	1848	present	- Several ponds are no longer present from 1912-1955 mapping. Presumably been infilled.

Table 2-2: Summary of potentially contaminative features within 50m and potentially infilled features with 250m. Dates are based on available historical map editions.

The 1893 mapping showing the former ponds and drainage ditch is shown on Plate 2-1. This also includes an overlay of the current updated study area.

Plate 2-1: Extract from 1893 mapping.

The 1963 mapping showing the greenhouses and small buildings is shown on Plate 2-2.

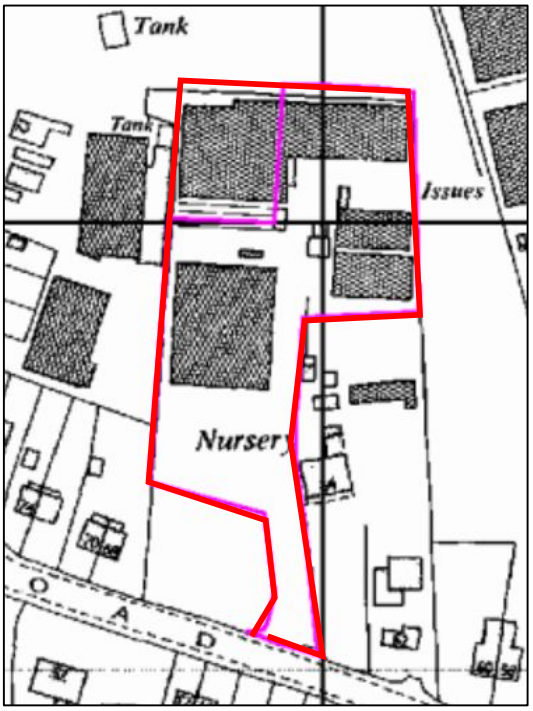


Plate 2-2: Extract from 1963 mapping.

3 Environmental Setting

A summary of environmental settings is presented in Table 3-1, based on a review of available environmental data.

Categories(data sources)			Details
Geology[1,2,3]	Artificial		- None recorded on the database.
	Superficial		- Glacial Till.
	Bedrock		- Tarporley Siltstone Formation (mudstone, siltstone and sandstone). - Singleton Mudstone Member (mudstone) located immediately to the south of the site.
	BGS Logs (<50m)		- None in close vicinity to the site.
Hydro-geology[1]	Aquifer Designation	- Secondary Undifferentiated.	- Secondary Undifferentiated Aquifer.
		- Secondary B.	- Secondary B Aquifer.
	Source Protection Zone (SPZ)		- Site is not within an SPZ.
	Groundwater Abstractions (100m)		- None within 250m.
Hydrology[1]	Surface Water Courses (100m)		- Issues 10m NE, assumed flowing north. - Drain 60m S.
	Flooding risk		- Flood Zone 1. - Potential for groundwater flooding at the surface.
	Surface Water Abstractions (100m)		- None.
	Discharge Consents		- None.
	Pollution Incidents		- None.
Minerals & Mining[1,4]	Coal Mining		- Not within a Coal Reporting Area. - Not within a Development High Risk Area.
	Surface Mineral Extractions (250m)		- None.
	Cheshire Brine Compensation District		- Not within Compensation District. - Not within Consultation Area.
	Non-Coal Mining Area		- Not within an area of conclusive metalliferous mining.
Ground Stability[1]	Collapsible Ground		- Very low hazard.
	Compressible Ground		- No hazard.
	Ground Dissolution		- No hazard.
	Landslide		- Very low hazard.
	Running Sand		- Very low hazard.
	Shrinking / Swelling Clay		- Very low hazard.
Landfill Sites (250m)[1]	Known / Registered		- None.
	Potentially infilled sites, based on LKC historical review		- Onsite: 2no. former ponds, former drain / ditch. - 7no. within 250m.
Radon Potential[1]			- <1% of homes above Action Level. No protective measures are necessary in the construction of new dwellings or extensions.
Designated Sites (50m)[1]			- None.
Contemporary Trade Directory (50m)[1]			- None.
Fuel Station Entries (50m)[1]			- None.
Unexploded Ordnance Risk (UXO)			- Low

Table 3-1: Summary of the environmental setting.

Notes: Distance in brackets is the distance from site that features are included. Where no distance given, features relate to on site only.

Data Sources: **1** – Envirocheck Report (Appendix A & B); **2** – BGS Sheet 75 1:50,000; **3** – BGS GeoIndex http://mapapps2.bgs.ac.uk/geoindex/home.html (Appendix C); **4** –The Coal Authority Web Mapping Services (WMS) and Interactive Map Viewer http://coal.decc.gov.uk/en/coal/cms/publications/data/map/map.aspx; **5** – Zetica UXO Unexploded Bomb Risk Map (Appendix C).

4 Site Reconnaissance

A site reconnaissance was carried out on 8th November 2019 (first phase of development) and 30th November 2021 (second phase of development comprising 3no. additional plots in north west corner). Hand dug trial holes were undertaken in accessible areas to confirm the shallow ground conditions. An outline of pertinent features and photographs (Plate 4-1) are provided below.

Relevant features identified on site are summarised below:

- Rough ground across the majority of the site with occasional shrubs and trees.
- Tarmac access road in the southern area of the site off Chapel Road.
- Derelict building in the east of the site with possible asbestos containing material (ACM).
- Small building with a brick chimney containing potential boiler located in the north of the site.
- Fly tipping (wood, asbestos cement, car batteries) observed in the east of the site.
- Above ground storage tank (AST) observed in the west of the site. No spillages of leakages observed.
- Greenhouse contained air conditioning / heating ducts and AST located in the west of the site (see P3 and P4, Plate 4-1).
- Trial holes TH1 to TH3 encountered made ground, which contained brick, glass, ash, clinker to 0.3-0.5mgl over natural clay.
- No access restrictions.
- No evidence of significant contamination identified within the hand dug trial holes.
- Second phase development area occupied by a greenhouse and storage of construction materials (see P10 to P12. Plate 4-1).

The surrounding area comprises a residential house adjacent to the east, Chapel Road with residential houses beyond adjacent to the south, a nursery and greenhouses to the north, and residential houses and a nursery to the west.

/

Relevant photographs are provided in Plate 4-1.

	
Photograph 1 (P1): Access road from Chapel Road and gated entrance, southern sector of site, looking north.	**Photograph 2 (P2):** Sheets of possible ACM stacked against the southeast border, central sector of the site.

Plate 4-1: Site photographs.

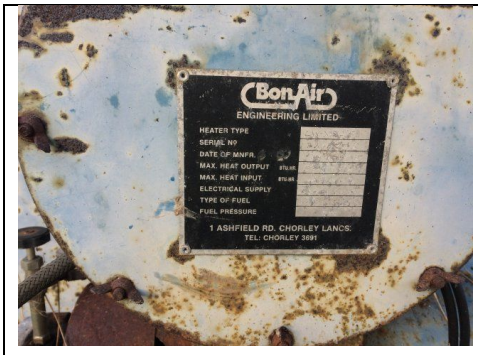
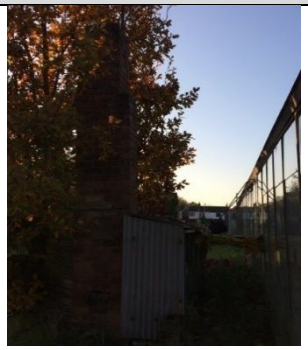
	
Photograph 3 (P3): Above ground fuel tank located within greenhouse, west of the site.	**Photograph 4 (P4):** Air conditioning machinery inside greenhouse, central sector of the site.
	
Photograph 5 (P5): "Danger Deep Water" sign, looking east wards in the central sector of the site	**Photograph 6 (P6):** Stockpiled material in vicinity of former pond/drain, north of the site, looking eastwards.
	
Photograph 7 (P7): Brick and sheeted ACM building, central sector of the site, looking south west.	**Photograph 7 (P8):** Boiler, small brick and ACM sheeted building with chimney, north sector of the site.

Plate 4-1 (continued): Site photographs.

	
Photograph 9 (P9): Above ground storage tank rear of greenhouses, central sector, looking north westwards.	**Photograph 10 (P10):** View north of greenhouse and storage of construction materials. Second development phase.
	
Photograph 11 (P1): View internally of greenhouse. Second development phase.	**Photograph 12 (P12):** View west of southern greenhouse elevation and storage of construction materials. Second development phase.

Plate 4-1 (continued): Site photographs.

5 Preliminary Conceptual Model

5.1 Introduction

The aim of the conceptual model is to provide a preliminary assessment of the likelihood of a pollutant linkage for each potential combination of contaminant, pathway and receptor. A conceptual model can be used to make an informed decision on the contamination risks associated with the site and whether further site investigation work is required.

The Sections below are therefore divided into potential contaminant, potential pathway and potential receptor as described in LCRM[3], on the premise that, if there is no pollutant linkage, then there will be no risk to the receptor. The final Section provides an assessment of the potential pollutant linkages that may still be present on the site if redevelopment were to occur.

5.2 Potential Contaminants

Potential viable contamination sources are detailed in Table 5-1. These are split into onsite sources, offsite sources and underlying geology.

Source	Contaminants
Onsite	
Onsite nursery and agricultural land (boiler house, machinery, ASTs, existing and demolished buildings)	- Use and maintenance of air conditioning machinery: hydrocarbons, oils. - Boiler house with potential boiler still in situ: hydrocarbons, oils. - Above ground storage tank (AST): hydrocarbons. - Storage / use of pesticides and herbicides: organophosphates, organochlorides, chlorophenols, aldrin, dieldrin, atrazine and DDT. - Existing and demolished buildings: Asbestos Containing Material (ACM).
Onsite former pond and ditch	- If significant depth of organic / putrescible material: Hazardous gas (principally carbon dioxide and methane).
Onsite made ground	- Ash and clinker (e.g. from hearths and boilers, often historically used for site raising / levelling, noted in the site walkover): Heavy metals, sulphates and PAHs[4].
Onsite access road	- Spillages / leakages: petroleum hydrocarbons, oils (source expected to be minimal and localised).
Surrounding Area	
Offsite potentially infilled ground (ponds, ditches)	- Hazardous gas (principally carbon dioxide and methane). - Given age, size and location of potentially infilled features, not considered to be a significant source.
Surrounding area	- No significant contamination sources within influencing distance of the site, other than tanks containing unknown substances.

Table 5-1: Potential contamination sources.

[3] Land Contamination Risk Management (LCRM) https://www.gov.uk/government/publications/land-contamination-risk-management-lcrm
[4] Defra (2002). "Potential Contaminants for the Assessment of Land". R&D Publication CLR 8.

5.3 Potential Receptors

Potential receptors are detailed in Table 5-2.

Receptors	
Human Health	- Future site users (including residents, visitors and site workers). - Offsite land users.
Controlled Waters	- Issues 10m NE, drain 60m S. - Secondary Undifferentiated and Secondary B Aquifers.
Buildings and structures.	
Potable water pipes.	
Flora within future gardens and landscaping.	

Table 5-2: Potential receptors.

5.4 Potential Pathways

Potential pathways are detailed in Table 5-3.

Pathways		
Soil	Human Health[5] (residential land use: houses with private gardens)	- Ingestion of soil. - Ingestion of soil-derived indoor dust. - Ingestion of contaminated vegetables. - Ingestion of soil attached to vegetables . - Dermal contact with soil. - Dermal contact with soil-derived indoor dust. - Inhalation of soil-derived outdoor dust. - Inhalation of soil-derived indoor dust. - Inhalation of vapours outside. - Inhalation of vapours inside.
	- Windblown dust and fibres to adjacent receptors.	
	- Direct contact with receptors (building foundations, services).	
	- Root uptake.	
Water	- Surface run-off over impermeable surfaces e.g. access road. - Site is relatively flat and grassed; therefore, surface run-off will be limited.	
	- Infiltration into the ground, through potentially contaminated material (contamination possibly going into solution).	
	- Migration through potentially permeable strata and preferential pathways. - Superficial (Till) likely to be low permeability. - Bedrock (mudstone, siltstone, sandstone) likely to be variably permeable. - Preferential pathways: existing service trenches on site.	
Gas	- Migration through potentially permeable strata and preferential pathways. - Superficial (Till) likely to be low permeability. - Bedrock (mudstone, siltstone, sandstone) likely to variably permeable. - No preferential pathways are anticipated.	
	- Migration into buildings (e.g. via services) and accumulation of gases in confined spaces (potentially causing explosion if methane is present).	

Table 5-3: Potential pathways.

[5] EA (2008). "Updated Technical Background to the CLEA Model". Science Report – SC050021/SR3.

5.5 Preliminary Contamination Conceptual Model

The Preliminary Contamination Conceptual Model is illustrated in Table 5-4 and has identified seven generic potential pollutant linkages.

Each linkage is described along with an assessment of the risk based upon guidance on probabilities and consequences outlined in CIRIA C552[6].

In order to assess the potential risk for each pollutant linkage, an assessment of the magnitude of the potential consequence (severity) of the risk occurring and the magnitude of the probability (likelihood) of the risk occurring has been considered and classified. This is based on the guidance provided in CIRIA C552 and further details including a risk matrix is provided in Appendix D.

Where LKC identified a low to very low risk, targeted or low-density intrusive investigation work, a watching brief (during construction work) or no investigation work will be recommended. This will be dependent on the nature of the site and the proposed development.

Where the risk falls into the moderate/low risk, LKC will undertake an assessment to establish what category the pollutant linkage will fall into (i.e. moderate or low risk will be chosen).

Where LKC identifies a moderate or higher risk, intrusive investigation work or precautionary remedial measures will be recommended.

It should be noted that there may be risk from short term exposure from contaminated soil to site workers. The Preliminary Contamination Conceptual Model deals with long term exposure to key receptors. Acute risks can be easily mitigated by good environmental management of the site during site works. Standard health and safety precautions (as per HSE guidance[7]) should be adopted by all workers involved with site enabling and construction works. Therefore, this receptor is not considered in the contamination conceptual model.

[6] CIRIA (2001). "Contaminated Land Risk Assessment: A Guide to Good Practice". C552.
[7] HSE (1991). "Protection of Workers and the General Public During Development of Contaminated Land". London HMSO.

PL	Pathway	Receptor	Contaminants of Concern (CoC)	Probability	Consequence	Risk	Recommendations
1	- Dermal contact. - Inhalation of soil, fibres and dust. - Ingestion of soils, dust, vegetables, soil attached to vegetables. - Windblown dust.	- Future site users. - Offsite receptors.	- ACM (current and former buildings, potentially in made ground). - Heavy metals, PAHs (made ground, boiler)	Likely (given history of site, presence of ACM sheeting and on current buildings, ash and clinker in made ground.)	Medium	**Moderate**	Intrusive investigation required. Soil analysis of CoC.
			- Heavy end hydrocarbons (ASTs, boiler house, air conditioning machinery).	Likely (ASTs, boiler house and plant identified on site)	Medium	**Moderate**	No evidence of recent spills / leakages identified; historic leaks/spills likely to be confined to localised areas of the site. Intrusive targeted investigation required. TPHCWG testing required if evidence of hydrocarbons identified in the ground.
			- Pesticides, herbicides.	Low Likelihood (previous use unlikely to be widespread)	Medium	**Moderate** / Low (moderate assumed due to sensitive nature of development)	Intrusive investigation required. Soil analysis of CoC.
2	- Inhalation of vapours. - Migration via permeable strata and preferential pathways.	- Future site users. - Offsite receptors.	- Volatile contaminants (TPHCWG, SVOC, VOCs associated with made ground, access road, ASTs).	Low likelihood (previous use unlikely to be widespread)	Medium	Moderate / **Low** (Historic spills/ leaks are likely to be confined to localised areas)	Targeted intrusive investigation required, to include PID testing. Soil analysis of CoC, subject to ground conditions encountered and PID testing.
3	- Inhalation of gas. - Migration via permeable strata and preferential pathways. - Explosion in confined spaces. - Exposure to radon.	- Future site users. - Buildings. - Offsite land users.	- Ground / hazardous gas (carbon dioxide, methane).	Low Likelihood (given limited gas source, pond infilled 40-70 years ago)	Severe	**Moderate**	Intrusive investigation to confirm ground conditions. If significant gas source and pathway identified, gas monitoring or gas protection measures required.
			- Radon	Unlikely (as <1% of homes above action level)	Medium	**Low**	(<1%) No protective measures are necessary in the construction of new dwellings or extensions.
4	- Surface run-off. - Migration via permeable strata and preferential pathways. - Perched waters migration.	- Groundwater (Secondary Undifferentiated and Secondary B Aquifer). - Surface water (issues).	- Mobile contaminants such as metals, PAHs, hydrocarbons, volatile compounds.	Low Likelihood (only minimal mobile contamination anticipated with limited pathway)	Medium	Moderate / **Low** (low risk assumed given anticipated clay below site limited vertical migration)	Targeted intrusive investigation required. Groundwater sampling required if contamination identified in soil. Analysis of CoC.

PL	Pathway	Receptor	Contaminants of Concern (CoC)	Probability	Consequence	Risk	Recommendations
5	- Sulphate attack on concrete.0	- Building structure.	- Sulphate.	Likely (given site history, ash and clinker noted in made ground)	Mild	**Moderate** / Low (moderate assumed until depth of made ground confirmed)	Intrusive investigation required. - Soil analysis of CoC.
6	- Ingestion of tainted water supply.	- Future site users. - Water pipes.	- Organic contaminants such as petroleum hydrocarbons, naphthalene, volatile compounds (made ground, machinery, ASTs).	Low Likelihood (although some contamination may be present, significant contamination not expected at pipeline depth)	Medium	**Moderate** / Low (moderate risk assumed until ground conditions confirmed)	Intrusive investigation required. - Soil analysis of CoC if made ground encountered at anticipated new pipeline depth (0.75-1.35m).
7	- Direct contact (plant uptake).	- Flora.	- Phytotoxic contaminants such as heavy metals.	Likely (made ground likely present across the site. Ash present in made ground)	Minor	**Low**	Low density intrusive investigation required. Soil analysis of CoC.

Table 5-4: Preliminary Contamination Conceptual Model.
Notes: PL = Pollutant Linkage. Contaminant of Concern (CoC) - See Table 5-1 for contamination sources. Site conditions based on observations during site reconnaissance.

6 Preliminary Geotechnical Risk Assessment

Table 6-1 summarises the possible geotechnical constraints of the site, based on the site history, environmental settings and site reconnaissance. Investigation work will be required to confirm the risks and provide a detailed geotechnical assessment and foundation design.

Coal Mining	Site is not within a Development High Risk Area. No further assessment required.
Slope Stability	Site is relatively flat. No significant slope stability risk anticipated. No further assessment required.
Envirocheck Ground Stability Hazards	No to low hazard identified. No further action required.
Made Ground	Unknown depth and constituent of made ground across the site. Possible in-ground structures from previous developments. Deep made ground possible on site associated with former ponds. Unlikely to be a suitable founding stratum unless engineering work is undertaken.
Field boundaries	Possible former hedges / trees / ditch resulting in increased likelihood of roots, organic material, shallow made ground.
Superficial	Unknown strength of soils for foundation design. Glacial till likely to comprise clay with sand / gravel bands anticipated below the site. Strata may be variable giving differential settlement.
Bedrock	Unknown depth to bedrock.
Groundwater	Unknown depth and variability of groundwater. Shallow / fluctuating groundwater can affect the strength of the soil, particularly in granular ground. Shallow groundwater can also affect construction works.
Plasticity	Plasticity of clay deposits should be confirmed, particularly where trees are present or proposed, to identify the shrink / swell risk. Clay recorded on site.
Sulphate	Unknown sulphate content of the made ground and natural. Ash noted in the made ground which may give rise to elevated sulphate. Anticipated strata below the site is a sulphate bearing strata.
Road / Pavement Design	Unknown CBR values for footpath and road design.

Table 6-1: Summary of geotechnical constraints.

7 Summary Conclusions and Recommendations

7.1 Summary Conclusions

Table 7-1 summarises the site details, historical review, environmental settings and site reconnaissance.

Current Site Use	Access road to the south east of the site surfaced in asphalt hardstanding. Remainder of the site occupied by glass greenhouses and timber sheds, with areas of grass to the north east and south west.
Proposed Development	Residential houses with garden / soft landscaped areas. 12no. residential houses with rear gardens, driveways, parking areas, soft landscaping, access road and turning area.
Main Historical Features	Onsite: Ponds / marsh, drainage ditch / drain, small buildings / sheds, greenhouses. Surrounding Area: Issues, ponds, drains, nurseries (glass houses, ASTs).
Geology / Hydrogeology	Artificial: No BGS recorded artificial. Superficial: Glacial Till. Secondary Undifferentiated Aquifer. Bedrock: Tarporley Siltstone Formation (mudstone, siltstone, sandstone) / Singleton Mudstone Member Rock (mudstone). Secondary B Aquifer.
Landfills / Infilled ground	No recorded landfills. Potentially infilled ground identified.
Site walkover	ACM, fly tipped material, AST, plant, boiler house, ash in made ground.

Table 7-1: Summary of site details, historical review, environmental settings and site reconnaissance.

A preliminary contamination conceptual model has been produced by LKC, which is summarised in Table 7-2.

Pollutant Linkage		Risk	Recommendations
PL1: Contaminants posing a risk to future site users via dermal contact, ingestion and inhalation (of soil, dust, fibres and vegetables).	ACM, heavy metals, PAHs	**Moderate**	Intrusive investigation required. Soil analysis of CoC.
	Petroleum hydrocarbons	**Moderate**	Targeted intrusive investigation required. Soil analysis of CoC, subject to ground conditions encountered.
	Pesticides	**Moderate** / Low	Intrusive investigation required. Soil analysis of CoC.
PL2: Volatile contaminants posing a risk to future site users via the inhalation of vapours.		Moderate / **Low**	Targeted intrusive investigation required, to include PID testing. Soil analysis of CoC, subject to ground conditions encountered and PID testing.
PL3: Gas posing a risk to buildings and future site users via the migration of gas into building causing explosion and asphyxiation.	Carbon dioxide & methane	**Moderate**	Intrusive investigation to confirm ground conditions. If significant gas source and pathway identified, gas monitoring or gas protection measures required.
	Radon	**Low**	(<1%) No protective measures are necessary in the construction of new dwellings or extensions.
PL4: Mobile contamination posing a risk to controlled waters via the migration through permeable strata.		Moderate / **Low**	Targeted intrusive investigation required. Groundwater sampling, subject to ground conditions encountered. Analysis of CoC.

Table 7-2: Summary risk table.
Where moderate / low risk had been identified, the assumed risk is shown in bold.

Pollutant Linkage	Risk	Recommendations
PL5: Sulphate posing a risk to building via direct contact (sulphate attack).	**Moderate /** Low	Intrusive investigation required. Soil analysis of CoC, subject to ground conditions encountered.
PL6: Organic contaminants posing a risk to water pipes.	**Moderate** / Low	Intrusive investigation required. Soil analysis of CoC, subject to depth of made ground encountered.
PL7: Phytotoxic metals posing a risk to flora via root uptake.	**Low**	Low density intrusive investigation required. Soil analysis of CoC, subject to ground conditions encountered.

Table 7-2 (continued): Summary risk table.
Where moderate / low risk had been identified, the assumed risk is shown in bold.

A preliminary geotechnical assessment has been carried out by LKC. Table 7-3 summarises the geotechnical constraints.

Coal Mining	No further assessment required.
Slope Stability	No further assessment required.
Made Ground	Unknown depth and constituent of made ground across the site. Possible deep made ground associated with former ponds.
Superficial	Unknown strength of soils for foundation design.
Bedrock	Unknown depth to bedrock.
Groundwater	Unknown depth and variability of groundwater.
Plasticity	Plasticity of clay deposits should be confirmed.
Sulphate	Unknown sulphate content of the made ground and natural.
Road / Pavement Design	Unknown CBR values for footpath and road design should be calculated.

Table 7-3: Summary of geotechnical constraints.

7.2 Recommendations

Recommendations are provided in Table 7-4.

Contamination status	There is sufficient information on the potential contaminative status of the site to allow conditional approval of a planning application, based on the proposed end use detailed in the PRA.
Further assessment recommendations	Phase 2 intrusive investigation required, once planning has been approved. Phase 2 investigation to be carried out in line with current guidance, including BS10175[8], BS5930[9] CIRIA C665[10], RB17[11] and BS8485[12]. Either 'exploratory investigation': 1 sample per 25-50m square centres. Or 'detailed investigation': 1 sample per 10-25m square centres. Plus targeted investigation locations in areas of concern (contamination and geotechnical). To be agreed with the local authority.
Type of investigation work	Boreholes, with supplementary hand dug pits.

Table 7-4: Recommendations.

[8] British Standard (2017). "Investigation of Potentially Contaminated Sites – Code of Practice". BS10175:2017.
[9] British Standard (2015). "Code of Practice for Ground Investigations". BS5930:2015.
[10] CIRIA (2007). "Assessing Risks Posed by Hazardous Ground Gases to Buildings". CIRIA C665.
[11] CL:AIRE Research Bulletin RB17 (November 2012) "A Pragmatic Approach to Ground Gas Risk Assessment".
[12] BSI (2015). "Code of Practice for the Design of Protective Measures for Methane and Carbon Dioxide Ground Gases for New Buildings"." BS8485:2015.

PL 1, 2, 5, 6, 7	Intrusive investigation work recommended to confirm ground conditions across the site. Targeted investigation of ASTs, boiler house, former building slabs, ponds and ditch. Testing of contaminants of concern based on preliminary conceptual model and field observations (PID tests and visual / olfactory evidence).
PL 3	Intrusive investigation to confirm ground conditions. If significant gas source and pathway identified, gas monitoring or gas protection measures required.
PL 4	Groundwater sampling, subject to ground conditions encountered.
Reporting	Information from the above can be used to carry out a contamination and geotechnical assessment and provide a remediation strategy for the site.
Importation of soils	Any topsoil or subsoil brought on to the site for use in gardens / soft landscaping should be suitably chemically validated prior to its use on site, according to Local Authority guidance.

Table 7-4 (continued): Recommendations.

Further Considerations are summarised in Table 7-5.

Asbestos	Even though no asbestos was identified externally on the existing buildings, given the age, there may be areas inside that have Asbestos Containing Materials (ACMs). Therefore, we would advise that a Pre-Demolition and Major Refurbishment Asbestos Survey is undertaken prior to demolition by a professional contractor. The LK Group have a designated Asbestos Department would be happy to advise you on the appropriate steps to take in order to have the building suitably surveyed.

Table 7-5: Further considerations.

Figures

Client: Whitegate Property Developers Ltd				Title: Site Location & Boundary Plan	LK CONSULT
Site: Chapel Road, Preston				Scale (see scale bar): 1:25,000 & 1:2,000 @ A4	Figure: 1
Job No.: LKC 21 1750	Drawn By: JW	Checked By: EK	Drawn: Nov 2021		Revision:

Extract from: Plan Supplied by Client
Drawing Ref: 3 no Detached.pdf

0 20
SCALE (Metres)

KEY

Site Boundary

indicates new planting bed

indicates new tree

Refer to Drawing No Z312.001 Planting Plan Details by ***Oakbay Design,*** and landscape specification.

Footpaths and patios to perimeter of dwellings formed from 50mm thick hydraulically pressed precast concrete paving flags.
Driveways formed from permeable tarmacadam.
Rear gardens to be turfed.
Serivce strips and common areas of soft landscaping to be seeded.

Sampling Locations and features annotated by LK Consult Ltd are approximate and are based upon observed measurements unless otherwise stated. Do not scale from this drawing and work from marked dimensions only. All dimensions and features should be confirmed on site by the Contractor. Where this drawing includes information provided to LK Consult Ltd by others, LK Consult Ltd gives no warranty, representation or assurance as to the accuracy of such information.

LK CONSULT LIMITED

Client: Whitegate Property Developers Ltd

Site: Chapel Road, Preston

Title: Proposed Development Plan

Job No.:	Scale (See Scale Bar):	Figure:	Revision:
LKC 21 1750	1:500 @ A3	2	

Drawn By:	Checked By:	Drawn:
AC	EK	Nov 2021

Appendix A

Historical Maps

Appendix B

Envirocheck Report

Appendix C

Zetica UXO Unexploded Bomb Risk Map

Appendix D

Risk Evaluation

Risk Evaluation

The method for risk evaluation is a qualitative method of interpreting the output from the risk estimation stage of the assessment, based on CIRIA 552[13]. It involves the classification of the:

- Magnitude of the potential consequence (severity) of the risk occurring (Table A).
- Magnitude if the probability (likelihood) of the risk occurring (Table B).

Consequence (Severity)		
Classification	**Definition**	**Example**
Severe	- Short term (acute) risk to human health likely to results in 'significant harm' as defined by the Environment Protection Act 1990, Part IIA. - Short term risk of pollution (note: Water Resources Act contains no scope for considering significance of pollution) of sensitive water resource. - Catastrophic damage to buildings/properties. - A short term risk to a particular ecosystem, or organism forming part of such ecosystem (note: the definition of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000).	- High concentrations of cyanide on the surface of an informal recreation area. - Major spillage of contaminants from site into controlled waters. - Explosion, causing building collapse (can also equate to short term human health risk if buildings are occupied).
Medium	- Chronic damage to Human Health ('significant harm' as defined in DETR, 2000). - Pollution of sensitive water resources (note Water Resources Act contains no scope for considering significance of pollution). - A significant change in a particular ecosystem, or organism forming part of such ecosystem.	- Concentrations of a contaminant from site exceed generic, or site specific assessment criteria. - Leaching of contaminants from a site to a major or minor aquifer (Principal and Secondary). - Death of a species within a designated nature reserve.
Mild	- Pollution of non-sensitive water resources. - Significant damage to crops, buildings, structures and services ('significant harm' as defined in DETR, 2000). - Damage to sensitive buildings / structures / services or the environment.	- Pollution of non-classified groundwater. - Damage to building rendering it unsafe to occupy (e.g. foundation damage resulting in instability).
Minor	- Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. - Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.). - Easily repairable damage to buildings, structures and services.	- The presence of contaminants at such concentrations that protective equipment is required during site works. - The loss of plants in a landscaping scheme. - Discoloration of concrete.

Table A: Classification of consequence.

Probability (Likelihood)	
Classification	**Definition**
High likelihood	- There is a pollutant linkage and an event that either appears very likely in the short term and almost inevitable over the long term, or there is evidence at the receptor of harm or pollution.
Likely	- There is a pollutant linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. - Circumstances are such that an event is not inevitable, but possible in the short term and likely over the long term.
Low likelihood	- There is a pollutant linkage and circumstances are possible under which an event could occur. - However it is by no means certain that even over a longer period such event would take place, and is less likely in the shorter term.
Unlikely	- There is a pollutant linkage but circumstances are such that it is improbable that an event would occur in the very long term.

Table B: Classification of probability.

[13] CIRIA (2001). "Contaminated Land Risk Assessment: A Guide to Good Practice". C552.

These classifications are then compared to indicate the risk presented by each pollutant linkage (Table C). It is important that this classification is only applied where there is a possibility (which can range from high likelihood to unlikely) of a pollutant linkage existing.

		Consequence			
		Severe	**Medium**	**Mild**	**Minor**
Probability	**High likelihood**	Very High Risk	High Risk	Moderate Risk	Moderate / Low Risk
	Likely	High Risk	Moderate Risk	Moderate / Low Risk	Low Risk
	Low likelihood	Moderate Risk	Moderate / Low Risk	Low Risk	Very Low Risk
	Unlikely	Moderate / Low Risk	Low Risk	Very Low Risk	Very Low Risk

Table C: Comparison of consequence against probability.

Once the risk has been determined the corresponding action can be assessed (Table D).

Risk	Action Required
Very High Risk	- There is a high probability that severe harm could arise to a designated receptor from an identified hazard, OR, there is evidence that sever harm to a designated receptor is currently happening. - This risk, if realised, is likely to results in a substantial liability. - Urgent investigation (if not already undertaken) and remediation are likely to be required.
High Risk	- Harm is likely to arise to a designated receptor from an identified hazard. - Realisation of the risk is likely to present a substantial liability. - Urgent investigation (if not undertaken already) is required and remedial works may be necessary in the short term and are likely over the longer term.
Moderate Risk	- It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. - Investigation (if not already undertaken) is normally required to clarify the risk and to determine the potential liability. Some remedial works may be required in the longer term.
Low Risk	- It is possible that harm could arise to a designated receptor from an identified hazard, but it is likely that this harm, if realised, would at worst normally be mild.
Very Low Risk	- There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe.

Table D: Description of the classification and likely action required.

Where LKC identified a low to very low risk either limited intrusive investigation work, a watching brief (during construction work) or no investigation work will be recommended. This will be dependent on the nature of the site and the proposed development.

Where the risk falls into the moderate/low risk, LKC will undertake an assessment to establish what category the pollutant linkage will fall into (i.e. moderate or low risk will be chosen).

Where LKC identifies a moderate or higher risk intrusive work or precautionary remedial measures will be recommended.