

Morris Homes

Desk Study Report

For

Greenhill Nursery, Allerton,

Liverpool

June 2014

REPORT NO: 14MOR001/DS

- *Desk Studies and Site Walkovers*
- *Intrusive Contaminated Land Investigations*
- *Geotechnical Appraisals and Ground Investigations*
- *Landfill Gas Assessments and Remedial Design*
- *Remediation Design and Implementation*
- *Remediation Project Management and Supervision*
- *Site Abnormal Assessments (Foundations and Contaminated Land)*
- *Ecological Surveys (Bats, Badgers, Newts, Japanese Knotweed etc)*

DOCUMENT ISSUE RECORD

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1 EXECUTIVE SUMMARY

Action

Site Location:

The site is located off Nursery Lane, Allerton, Liverpool, L19 6PR (coordinates for centre of site 340290, 385510). The site area is approximately 2.68 hectares.

Proposed Development:

The proposed construction of residential dwellings with associated infrastructure, gardens and public open space.

Site Description:

On Site:

Site was visited by a Geo-Environmental Engineer on the 4th June 2014 and pictures of site are located in Appendix A.

There are two entrances to the former Greenhill Nursery, one to the north east on Greenhill Road and southeast on Nursery Lane, both entrances are metal palisade gates.

The site is a former nursery depot for growing of plants; the greenhouses are still present to the south of the site in a state of disrepair. There are no longer any greenhouses to the north around the boiler house (centrally located). There is a staff room and chemical stores to the east and gatehouse on the eastern entrance.

To the north of the boiler house (most recently gas fired) is a container with what appears to be a backup generator. The boiler house has asbestos warning signs and was flooded at the time of the site visit. Gas shut off valve and electric have been cut off in a building to the southeast, asbestos warning signs were present.

The rest of the site consists of several roads of hard standing, trees, overgrown vegetation, some fly tipped material to the north beyond the drain to the north east and former growing beds. It was noted that along the east and south boundaries there was evidence of fly tipping. The drain/stream to north was shallow and had no evidence of water.

The site slopes gently from the southeast (~30m AOD) to the northwest (~33m AOD).

The site boundaries are as follows;

- **North** – Adjacent is residential house called the Bungalow with mature trees and hedgerows defining the boundary.
- **East** – Access gate with metal palisade gate and trees and hedgerows.
- **South** – Mature trees and hedgerows.
- **West** – Trees, hedgerows and corrugated metal fencing. Metal palisade gate entrance.

Surrounding Area

Surrounding land uses for the site are as follows:

- **North** – Immediately adjacent residential dwelling and the main railway line, residential dwellings of Allerton beyond railway line.
- **West** – Adjacent is several residential dwellings and Greenhill Lane, beyond are further residential dwellings.
- **South** – immediately adjacent are residential dwellings and 30m beyond is Long Lane with Garston Recreational Park 45m beyond.
- **East** – Adjacent are residential dwellings with Nursery Lane 32m beyond and further residential dwellings beyond.

Site History:

On Site:

The earliest map is the c1849-1850 and shows the site as fields with the railway line to the north/northeast/east. This remained the same until circa 1893 when the site became part of Liverpool Botanical Gardens. The site was used as the main propagating location for the botanical gardens and remained the same until circa 2012 when it was made redundant.

Ground Investigation to Confirm

The 1893 map shows several ponds located centrally (no longer shown by 1907), stream flowing northwest to southeast. Allerton Rope Works in north of site (no longer shown by 1927-1928). 1937 map shows extensive buildings/greenhouses across the site, by 1954 a number of these are shown as ruins. 1993 map show two tanks (unknown use) in southeast corner.

The current boiler house appears circa 1960's on the 1:2,500 maps, the maps show a similar sized building to the north of the current boiler house. This is the possible location of the older (probably) coal fired boiler house. It would be advisable to contact Liverpool Botanical Gardens to see if they have detailed historical site plans, this would help in locating former chemical stores, fuel storage areas and the former boiler house. Two tanks shown on the 1993 map to the southeast, near gas shut off valve.

Surrounding Area:

c1849-50	Surrounded by fields. 0m N – Railway Line (still present). 30m S – Long Lane (still present).
1893-1894	c130m W – Ponds (no longer shown 1907, converted to Brodie Avenue pre 1937).
1907-1909	46m S – Garston Recreational Ground (still present).
1927-1928	0m SW – Several residential dwellings (still present). 45m S/50m N – Residential dwellings (still present).
1937-1938	0m S/SW – Further residential dwellings (still present). 40m W – Beyond Greenhill Lane residential dwellings (still present).
1965-68	0m W – Two semi-detached residential dwellings (still present).
1974-1978	0m SE – Residential dwellings (still present).
1978-2014	No Significant Changes.

World War Two UXO

The site lies south of Liverpool and approximately 1km north of Garston Docks and 1.2km north of major railway infrastructure and gas works. This area was frequently bombed during world war two. Initial online research regarding Allerton, shows several bombs fell, but was confined towards Garston Docks.

The risk of Unexploded Ordnance (UXO) is deemed Low, but the risk cannot be discounted altogether. It may be prudent to undertake a UXO Desk Study to risk assess in more detail.

Published Geology:

The BGS map shows the geology (1:10,000 Maps SJ55NE, 1962) beneath the following:

- **Drift – Glacial Till** – Clay, sandy, gravelly, cobbly, diamicton
- **Bedrock – Chester Pebble Beds** – Sandstone.

Hydrogeology and Hydrology:

- The Glacial Till Deposits are classed as a Unproductive Strata (Negligible Permeability).
- The bedrock deposits of the Chester Pebble Beds are classed as a Principle Aquifer (High Permeability).
- The site does not lie within a Groundwater Source Protection Zone as defined by the Environment Agency.
- The nearest water feature is a drain which runs through the centre of site, this was shown to be blocked and no evidence of water during the site walkover.
- There are no water abstractions within 1000m of site.

Radon Protection:

The property is not in a radon affected area with less than 1% of properties above the action level. Therefore no Radon protection measures are necessary.

Summary of Environmental Data:

Possible Contamination Sources;

- **Current/Historical Land Use On Site** - The site has been used as a propagating nursery for Liverpool Botanical Gardens for more than 150 years. Localised made ground from previous greenhouses, stores, sheds etc. Asbestos risk and TPH's and PAH's from fuel storage. Possibility of historical heavy metal use. Unlikely to be affected by short term life of pesticides and fertilizers. PCB's around boilers and electrics. **Possible**
- **Boiler House On Site** - The current boiler house seems to have been constructed circa 1960's. There is a warning of asbestos on front door. The current boiler is gas fired. It is suspected that

**Ground
Investigation
to Confirm**

- there was another boiler house on site coal or oil fired. **Possible.**
- **Rope Works On Site N** - Generally metals, PAH's and if dyes are suspected then VOC/SVOC, phenols, pesticides, cyanides screen will be required. Though Garston Rope Works is no longer shown by 1928. The area has had several buildings up till mid 1990's. **Possible.**
 - **Historical Ponds On Site** - Historical ponds centre of site, built over several times. Currently greenhouses over the top. Possible Made Ground with PAH's and Metal contamination, given that the material used to infill pond is unknown. In excess of 120 years since backfilled, ground gas migration is negligible. **Yes**
 - **Railway 0m N** - Historical residue of PAH's from coal fired trains along the northern part of site and asbestos from brake linings. **Yes**
 - **Tanks On Site SE** - 1993 map shows two tanks (no longer present), these tanks are of unknown use (fuel, chemicals, water). Target during ground investigation. **Yes**

Qualitative Risk Assessment: In this qualitative risk assessment, a **Low/Moderate** risk implies that limited remedial action is likely to be necessary at the site, the likes of which cannot be confirmed until the geotechnical and contamination ground investigation has been completed.

2 SITE DESCRIPTION

2.1 Introduction

This investigation was carried out on the instruction of Morris Homes. The purpose of the work was to carry out a Desk Study to provide geotechnical and contamination risk information for the construction of residential dwellings with associated infrastructure, gardens and public open space.



Detailed site layout - Morris Homes (PL 01 Site Layout)

2.2 Site Location

The site is located off Nursery Lane, Allerton, Liverpool, L19 6PR (coordinates for centre of site 340290, 385510). The site area is approximately 2.68 hectares. See Site Location Plan in Appendix A.

2.3 Site Description

2.3.1 On Site

Site was visited by a Geo-Environmental Engineer on the 4th June 2014 and pictures of site are located in Appendix A.

There are two entrances to the former Greenhill Nursery, one to the north east on Greenhill Road and southeast on Nursery Lane, both entrances are metal palisade gates.

The site is a former nursery depot for growing of plants; the greenhouses are still present to the south of the site in a state of disrepair. There are no longer any greenhouses to the north around the boiler house (centrally located). There is a staff room and chemical stores to the east and gatehouse on the eastern entrance.

To the north of the boiler house (most recently gas fired) is a container with what appears to be a backup generator. The boiler house has asbestos warning signs and was flooded at the time of the site visit. Gas shut off valve and electric have been cut off in a building to the southeast, asbestos warning signs were present.

The rest of the site consists of several roads of hard standing, trees, overgrown vegetation, some fly tipped material to the north beyond the drain to the north east and former growing beds. It was noted that along the east and south boundaries there was evidence of fly tipping. The drain/stream to north was shallow and had no evidence of water.

The site slopes gently from the southeast (~30m AOD) to the northwest (~33m AOD).

The site boundaries are as follows;

- **North** – Adjacent is residential house called the Bungalow with mature trees and hedgerows defining the boundary.
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- **West** – Trees, hedgerows and corrugated metal fencing. Metal palisade gate entrance.

2.3.2 Surrounding Area

Surrounding land uses for the site are as follows:

- **North** – Immediately adjacent residential dwelling and the main railway line, residential dwellings of Allerton beyond railway line.
- **West** – Adjacent is several residential dwellings and Greenhill Lane, beyond are further residential dwellings.
- **South** – immediately adjacent are residential dwellings and 30m beyond is Long Lane with Garston Recreational Park 45m beyond.
- **East** – Adjacent are residential dwellings with Nursery Lane 32m beyond and further residential dwellings beyond.

3 SITE HISTORY

3.1 Site History from Ordnance Survey Maps

A search of available historic maps was undertaken to establish the land use history of the site. Extracts of the maps discussed below can be found in Appendix B of this report. All maps are Ordnance Survey unless otherwise stated. All distances quoted on OS maps are taken from the site boundary, which is marked on the map.

3.2 Summary of Site History

3.2.1 On Site

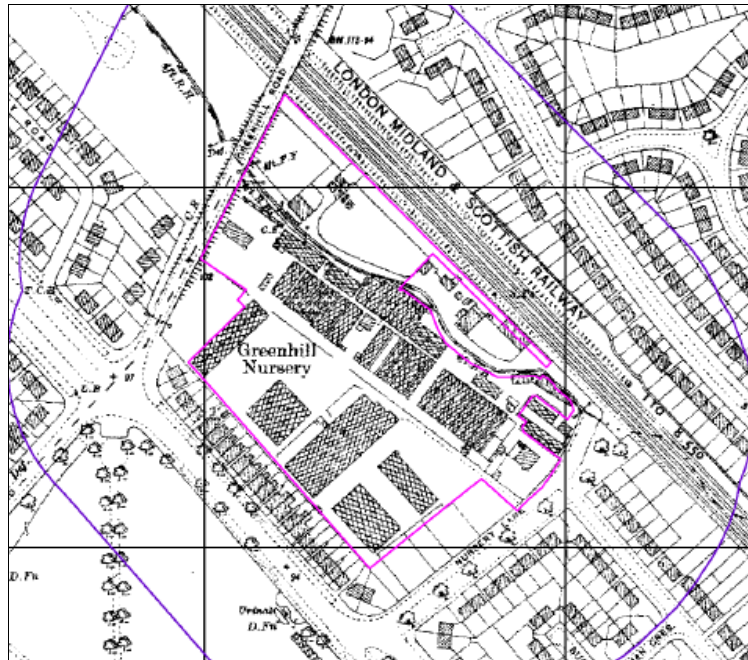
The earliest map is the c1849-1850 and shows the site as fields with the railway line to the north/northeast/east. This remained the same until circa 1893 when the site became part of Liverpool Botanical Gardens. The site was used as the main propagating location for the botanical gardens and remained the same until circa 2012 when it was made redundant.

The extract below shows the site in 1893, there are several ponds centrally located (no longer shown by 1907) and stream flowing northwest to southeast. Allerton Rope Works on site (no longer shown by 1927-28);



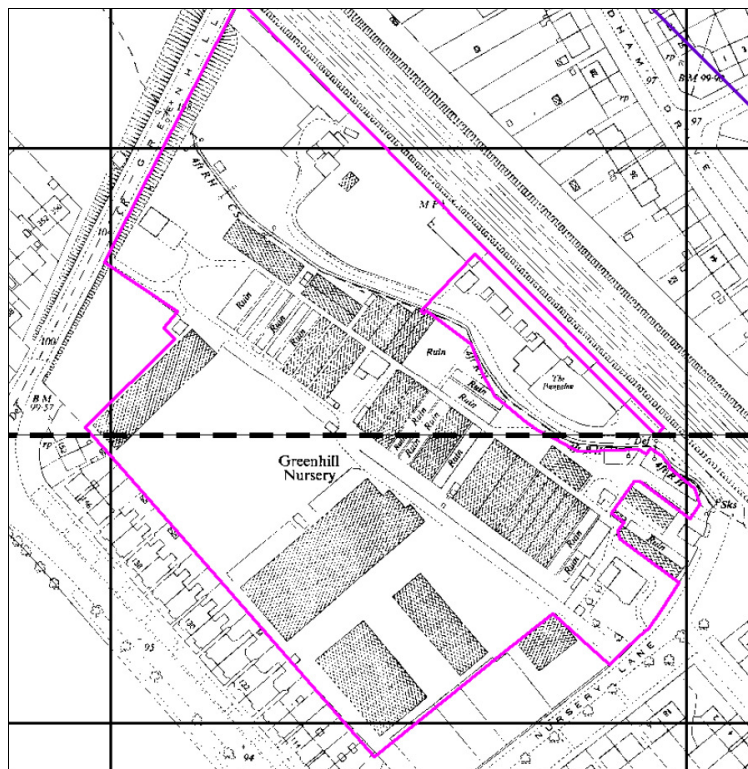
Map extract from 1893 map showing the site

The 1937 map shows extensive buildings/greenhouses and an extract is below;

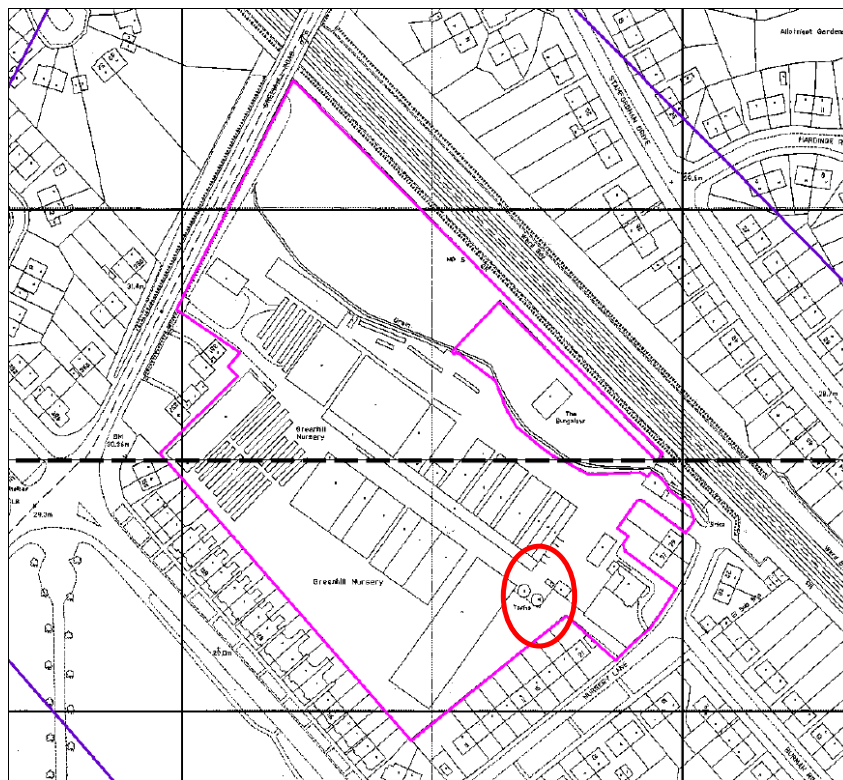


Map extract from 1937 map showing the site

The 1954 map shows several of the greenhouses/buildings as ruins, extract of map is below;



Map extract from 1954 map showing ruins on the site



1993 1:2500 map, red circle indicates two tanks (unknown use).

The 2012 Google Earth image shows the site as current and extract below;



Google Earth Map extract from 2009 map showing the site

The current boiler house appears circa 1960's on the 1:2,500 maps, the maps show a similar sized building to the north of the current boiler house. This is the possible location of the older (probably) coal fired boiler house. It would be advisable to contact Liverpool Botanical Gardens to see if they have detailed historical site plans, this would help in locating former chemical stores, fuel storage areas and the former boiler house. Two tanks shown on the 1993 map to the southeast, near gas shut off valve.

3.2.2 Surrounding Area

The following table below summarises the significant changes in historical use surrounding the site:

Date First Shown	Land Uses
c1849-50	Surrounded by fields. 0m N – Railway Line (still present). 30m S – Long Lane (still present).
1893-1894	c130m W – Ponds (no longer shown 1907, converted to Brodie Avenue pre 1937).
1907-1909	46m S – Garston Recreational Ground (still present).
1927-1928	0m SW – Several residential dwellings (still present). 45m S/50m N – Residential dwellings (still present).
1937-1938	0m S/SW – Further residential dwellings (still present). 40m W – Beyond Greenhill Lane residential dwellings (still present).
1965-68	0m W – Two semi-detached residential dwellings (still present).
1974-1978	0m SE – Residential dwellings (still present).
1978-2014	No Significant Changes.

3.2.3 World War Two UXO

The site lies south of Liverpool and approximately 1km north of Garston Docks and 1.2km north of major railway infrastructure and gas works. This area was frequently bombed during world war two. Initial online research regarding Allerton, shows several bombs fell, but was confined towards Garston Docks.

The risk of Unexploded Ordnance (UXO) is deemed Low, but the risk cannot be discounted altogether. It may be prudent to undertake a UXO Desk Study to risk assess in more detail.

4 ENVIRONMENTAL DATA






The following section details both geological and environmental data available for the site and the surrounding area. Full details can be found in the Envirocheck Report by Landmark located in Appendix C.

4.1 Geology



The documented geology of the site is summarised on British Geological Survey map principally, with further site specific detailed below in maps:

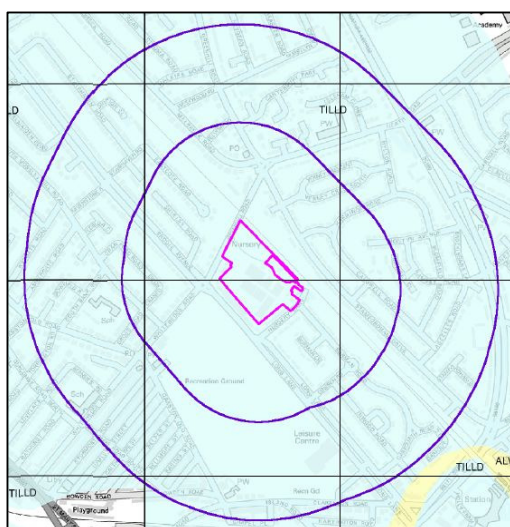
Geology	Drift	Solid
1:10,000 Maps SJ48NW, 1946	Glacial Till – Clay, Sandy Gravelly, Cobbly, Diamicton	Chester Pebble Beds Formation – Sandstone

Superficial Geology

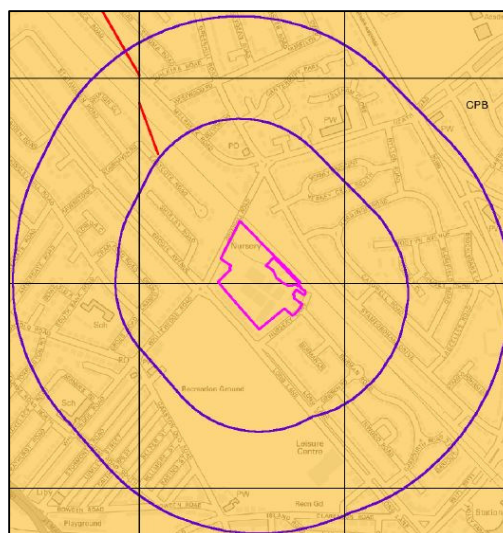
Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Flandrian - Pleistocene
	ITDU	Intertidal Deposits (Undifferentiated)	Clay, Silty, Sandy [Unlithified Deposits Coding Scheme]	Holocene - Saalian
	TILLD	Till, Devensian	Diamicton	Devensian - Ipswichian
	TILLD	Till, Devensian	Clay, Sandy, Gravelly, Cobbly [Unlithified Deposits Coding Scheme]	Devensian - Ipswichian
	SSA	Shirdley Hill Sand Formation	Sand	Flandrian - Ipswichian

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	CPB	Chester Pebble Beds Formation	Sandstone	Early Triassic - Early Triassic
	Fault			



Superficial Geology



Bedrock Geology

4.1.1 Fault Lines

The geological map shows a fault line 300m to the North West of site, this is of low significance to site.

4.2 Mining, Extraction and Natural Cavities

4.2.1 Coal Mining

The site does not lie within an area affected by historical, current or future coal mining.

4.2.2 Natural Cavities and Mineral Extraction

There are no recorded mineral sites or natural cavities within 500m of site.

4.3 Environmental Permits, Incidents and Registers

4.3.1 Discharge Consents

There are no discharge consents within 500m of site.

4.3.2 Local Authority Pollution Prevention and Controls

There no Local Authority Pollution Prevention and Controls within 500m of site.

4.3.3 Pollution Incidents to Controlled Waters

There are three (3 No.) Minor Incident Pollution Incidents to Controlled Waters within 500m of site, these are detailed below;

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
8	Pollution Incidents to Controlled Waters Property Type: Water Company Sewage: Foul Sewer Location: Stream At Rear Of , 174 Stamfordham Drive Authority: Environment Agency, North West Region Pollutant: Other Sewage Note: Smells; Unknown Tributary; Sewage Incident Date: 25th November 1997 Incident Reference: 97741854 Catchment Area: Mersey - Tidal Receiving Water: Freshwater Stream/River Cause of Incident: Blocked Sewer Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A14SW (SE)	474	2	340800 385200
8	Pollution Incidents to Controlled Waters Property Type: Other Location: Stamfordham Drive , LIVERPOOL Authority: Environment Agency, North West Region Pollutant: Miscellaneous - Inert Suspended Solids Note: Unknown Tributary Mersey; Silt/Worms Incident Date: 29th July 1997 Incident Reference: 97741386 Catchment Area: Mersey - Tidal Receiving Water: Freshwater Stream/River Cause of Incident: High Flow Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A14SW (SE)	477	2	340800 385195
8	Pollution Incidents to Controlled Waters Property Type: Miscellaneous Premises: Other Location: Stream At Rear Of , 174 Stamfordham Drive Authority: Environment Agency, North West Region Pollutant: Miscellaneous - Unknown Note: Unknown Stream; Not Known Incident Date: 11th November 1997 Incident Reference: 97741897 Catchment Area: Mersey - Tidal Receiving Water: Freshwater Stream/River Cause of Incident: Unknown Incident Severity: Category 3 - Minor Incident Positional Accuracy: Located by supplier to within 100m	A14SW (SE)	481	2	340805 385195

4.4 Landfills and Other Waste Sites

4.4.1 Licenced Waste Management Facilities

There is one (1 No.) Licenced Waste Management Facility (license been rescinded) within 500m of site, this is detailed below;

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
14	Licensed Waste Management Facilities (Locations) Licence Number: 53883 Location: Garston Old Road, Liverpool, Merseyside, L19 Operator Name: Liverpool City Council Street Cleansing D S O Operator Location: Not Supplied Authority: Environment Agency - North West Region, South Area Site Category: Household, Commercial And Industrial Transfer Stations Licence Status: Surrendered Issued: 10th October 1991 Last Modified: Not Supplied Expires: Not Supplied Suspended: Not Supplied Revoked: Not Supplied Surrendered: 19th February 2001 IPPC Reference: Not Supplied Positional Accuracy: Located by supplier to within 100m	A13SE (S)	189	2	340300 385200

There are no other landfills, waste management or other waste sites within 500m of site.

4.5 Contemporary Trade Directory Entries

There is one (1 No) Contemporary Trade Directory Entry within 250m of site, this is inactive and detailed below;

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
19	Contemporary Trade Directory Entries Name: Errew Ltd Location: 24, Heath Road, Liverpool, L19 4UF Classification: Safes & Vaults - Suppliers & Installers Status: Inactive Positional Accuracy: Automatically positioned to the address	A13NE (NE)	242	-	340432 385807

4.6 Flood Risk

The site lies within Flood Risk Zone 1 as defined by the Environment Agency. As the site is greater than one hectare a Flood Risk Assessment would be required for any planning application

4.7 Radon

The property is in a lower probability area, as less than 1% of homes are above the action level. Therefore no Radon protective measures are necessary in the construction of new dwellings or extensions.

4.8 Hydrogeology and Hydrology

- The Glacial Till Deposits are classed as a Unproductive Strata (Negligible Permeability).
- The bedrock deposits of the Chester Pebble Beds are classed as a Principle Aquifer (High Permeability).
- The site does not lie within a Groundwater Source Protection Zone as defined by the Environment Agency.
- The nearest water feature is a drain which runs through the centre of site, this was shown to be blocked and no evidence of water during the site walkover.
- There are no water abstractions within 1000m of site.

5 SUMMARY OF ENVIRONMENTAL SENSITIVITY

The following section is a review of the environmental sensitivity of the site as discussed in Sections 2-4. Significant potential risks are discussed in the following subsections and will then be evaluated as part of the Site Conceptual Model in Section 5.

Sources are defined as where pollution comes from, pathways are a route in which the pollution travels and receptors are anything affected by a pollutant. Further details on Source-Pathway-Receptor methodology can be found in Appendix D.

The table below focuses on significant site specific sources, pathways and receptors. More 'generic' pathways and receptors (such as site end uses) will be covered as part of the full Site Conceptual Model in Section 5.

5.1 Sources

Source	Distance/ Direction	Details	Significant Risk
Current/Historical Land Use	On Site	The site has been used as a propagating nursery for Liverpool Botanical Gardens for more than 150 years. Localised made ground from previous greenhouses, stores, sheds etc. Asbestos risk and TPH's and PAH's from fuel storage. Possibility of historical heavy metal use. Unlikely to be affected by short term life of pesticides and fertilizers. PCB's around boilers and electrics.	Possible
Boiler House	On Site	The current boiler house seems to have been constructed circa 1960's. There is a warning of asbestos on front door. The current boiler is gas fired. It is suspected that there was another boiler house on site coal or oil fired.	Possible
Rope Works	On Site N	Generally metals, PAH's and if dyes are suspected then VOC/SVOC, phenols, pesticides, cyanides screen will be required. Though Garston Rope Works is no longer shown by 1928. The area has had several buildings up till mid 1990's.	Possible
Historical Ponds	On Site	Historical ponds centre of site, built over several times. Currently greenhouses over the top. Possible Made Ground with PAH's and Metal contamination, given that the material used to infill pond is unknown. In excess of 120 years since backfilled, ground gas migration is negligible.	Yes
Railway	0m N	Historical residue of PAH's from coal fired trains along the northern part of site and asbestos from brake linings.	Yes
Tanks	On Site SE	1993 map shows two tanks (no longer present), these tanks are of unknown use (fuel, chemicals, water). Target during ground investigation.	Yes

5.2 Pathways

Source	Distance/ Direction	Details	Significant Risk
Drain/Stream	On Site	Drain/stream is dry/blocked at time of site walkover. No significant risk of runoff.	No

5.3 Receptors

Source	Distance/ Direction	Details	Significant Risk
Aquifer	Below Site 125m	Aquifer is classed as Principal Aquifer, given anticipated cohesive strata, the pathway risk is reduced. Given the site is derelict the likelihood of continuing risk to this receptor is low. However historical contamination may have occurred. Should significant contamination be encountered on site.	Possible
Drain/Stream	On Site	No water evident within ditch during site walkover, vegetated, lessening risk.	Possible

6 INITIAL CONTAMINATION CONCEPTUAL MODEL

For details on how the conceptual model is evaluated please refer to Appendix D

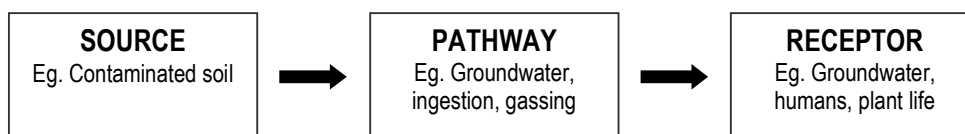
This section of the report aims to identify land which could potentially be affected by contamination, such that it could affect the value or re-use of the land, or such that mitigation would be required for certain proposed end uses of the land.

Potential contamination sources and environmentally sensitive receptors have been discussed in Section 4.10. Potentially significant risks are evaluated as part of the subsequent sub-sections.

6.1 Source-Pathway-Receptor-Linkages

The risk assessment uses a 'Source-Pathway-Receptor' methodology for assessing whether a source of contamination could potentially lead to harmful consequences. This means that there needs to be a pollutant linkage from source to receptor for harm to be caused, this linkage consisting of: a source of pollution; a pathway for the pollutant to move along; a receptor that is affected by the pollutant.

The current potential risks to site arising from various Source-Pathway-Receptor linkages are assessed below. A risk may be considered significant if all three of the stages are present and therefore providing a pollution linkage. The various sources, pathways and receptors are considered separately. The assessment is based on the future use, which is understood to be residential dwellings with gardens and associated infrastructure.



Type of Contamination	Potential Sources	Potential Pathway	Potential Receptors	Pollution Linkage	Comment	Estimated Level of Risk
Ground Gas	Historical Ponds On Site	Inhalation of Vapours	Construction/ Maintenance Workers	Potentially Active	Pond 125m W is under round and cohesive geology anticipated, negligible risk. Pond onsite backfilled in excess of 100 years, cohesive strata anticipated. Localised made ground. Ground gas monitoring and ground investigation to confirm.	Low/ Moderate
	Ponds 125m W Made Ground On Site	Vapours Penetrating Unprotected Buildings	Future Site Users	Potentially Active	Pond 125m W is under round and cohesive geology anticipated, negligible risk. Pond onsite backfilled in excess of 100 years, cohesive strata anticipated. Localised made ground. Ground gas monitoring and ground investigation to confirm.	Low/ Moderate
Surface and Near Surface Contaminants Within Soils	Current/Historical Land Use as Nursery Rope Works 0m N Railway 0m N	Ingestion, Inhalation, Dermal Contact	Current Site Users	Potentially Active	Localised potential for determinants within Made Ground across site, from rearrangement of greenhouse, buildings, ponds and former rope works. Hard standing minimises risk, but is patchy in nature.	Low/ Moderate
			Construction Workers	Potentially Active	Localised potential for Made Ground across site. PPE to minimise risk	Low/ Moderate
			Future Site Users	Potentially Active	Possible localised Made Ground, ground investigation and ground gas monitoring to confirm.	Low
			Adjacent Land Users	Potentially Active	Cohesive strata anticipated, low migration and significant runoff is not anticipated. Ground investigation to confirm.	Low/ Moderate
		Direct Contact	Structures	Potentially Active	Potential risk to structures from sulphates and biochemical. Ground investigation to confirm.	Low/ Moderate
		Absorption in Root Zone	Plants	Potentially Active	Potential risk of contamination largely due to anticipated Made Ground. Ground investigation to confirm.	Low
Mobile Contaminants, Leachables e.g. from Pollution Sources Adjacent to Site/On Site	Current/ Historical Land Use as Nursery	Leaching into Groundwater	Groundwater	Potentially Active	Potential risk if contamination is encountered. Extensive cohesive strata anticipated. If contamination encountered groundwater samples should be taken and if water present, up/mid/downstream of drain/stream.	Low/ Moderate
	Railway 0m N Rope Works 0m N	Off-site Migration in Groundwater	Abstractions	Potentially Active	No water abstractions within 1000m. Not in a Groundwater Source Protection Zone. Below site is Principal Aquifer, no pathways identified and significant cohesive strata anticipated.	Low
			Controlled Waters	Potentially Active	Potential risk if contamination is encountered. Extensive cohesive strata anticipated. The drain is dry and seemed blocked. Low risk of runoff.	Low/ Moderate
Organic and Inorganic Contaminants Within Soils / Groundwater	Current Land Use Rope Works 0m N	Potable Water Supply Pipes	Utilities Workers	Potentially Active	Potential risk of contamination, liaise with local water authority supplier following the SI.	Low/ Moderate

6.2 Summary

In this qualitative risk assessment, a **Low/Moderate** risk implies that limited remedial action is likely to be necessary at the site, the likes of which cannot be confirmed until the geotechnical and contamination ground investigation has been completed.

6.3 Geotechnical Constraints

- Potential Tree Heave where cohesive stratum are encountered.
- Deep foundations in area of former pond and beneath existing buildings. Unknown made ground depth.

7 SCOPE OF GROUND INVESTIGATION

7.1 Objectives of the Ground Investigation

The objectives of the intrusive ground investigation will be to:

- Clarify the 'Initial Contamination Conceptual Model'.
- Clarify the initial risk assessment.
- Benchmark the contamination status of the site.
- Provide data for the design of any remedial works that may be required.
- Provide a geotechnical appraisal for the site

7.2 Proposed Ground Investigation Scope

On assessing the previous potential risks on site, we have compiled the following recommendations for initial investigation.

- Two (2 No) day machine excavated trial holes 3.00 – 5.00mbgl.
- Ten (10 No) small diameter boreholes to 3.00 – 5.00 mbgl. to assess risk of ground gas migration at anticipated foundation depth.
- Install ten (10 No) gas monitoring wells - followed by 6 ground gas monitoring visits over a period of at least 3 months with varying barometric pressures.
- Forty (40 No) soil samples (made ground and natural) taken for chemical analysis to benchmark contamination levels across the site targeted to garden areas which will be the key pathway. Proposed testing will include but not be limited to the following; heavy metals suite (comprising; As, Cd (low level), Cr Vi, Pb, Hg, Se, Ni, Cu, Zn), Organic Matter, Sulphate, pH, speciated polycyclic aromatic hydrocarbons and TPH CWG. Asbestos testing in made ground.
- Six (6 No) groundwater testing post installation, comprising As, Cd, Cr, Pb, Hg, Se, Ni, Cu, Zn, speciated PAH, EPH, sulphate, pH and should soil levels indicate significant risk to waters.
- Further analysis, investigation and remediation of hotspots may be required following the results of this initial investigation, subject to ground investigation findings.
- Should elevated determinant levels be encountered, additional leachate testing within soil and/or groundwater testing may be required.

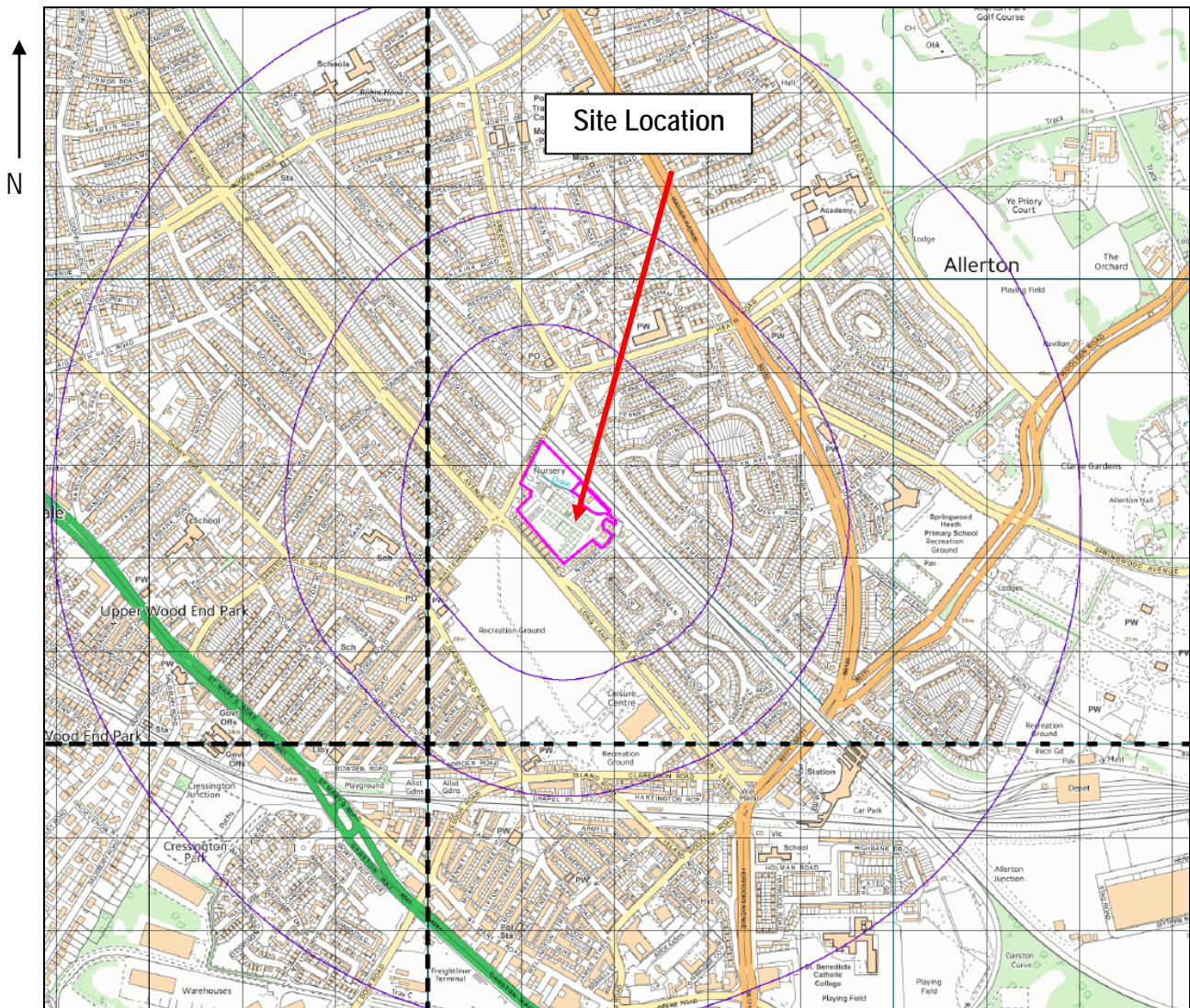
The scope of works should be agreed with the Local Authority prior to the intrusive ground investigation and as such may change.

8 REFERENCES

- 8.1 BS 5930:1999 +A2 Code of Practice for Site Investigation.
- 8.2 Investigation of Potentially contaminated sites BS10175:2011 +A1:2013.
- 8.3 BS8576:2013 Guidance on investigations for ground gas.
- 8.4 R & D Publication CLR 8 (March 2002) Assessment of Risks to Human Health from Land Contamination: An Overview of the Development of Soil Guideline Values and Related Research. Environment Agency.
- 8.5 R & D Publication CLR 10 (March 2002) The Contaminated Land Exposure Assessment Model (CLEA): Technical basis and algorithms. Environment Agency.
- 8.6 Contaminated Land Risk Assessment; a Guide to Good Practice; CIRIA C552: 2001.
- 8.7 BRE 211 Radon: guidance on protective measures for new buildings (including supplementary advice for extensions, conversions and refurbishment) (2007 edition)
- 8.8 British Geological Survey Maps Sheet 75
- 8.9 Assessment of risks to human health from land contamination: an overview of the development of guideline values and related research. EA, 2002
- 8.10 *Contaminated Land Risk Assessment; A Guide to Good Practice; CIRIA C552: 2001.*
- 8.11 *Health and Safety in Construction, HSG150, HSE, 1996.*
- 8.12 *Baker W (1987), Investigation Strategy - lecture at City of Birmingham Development Department Symposium on Methane Generating Sites, 9 December 1987, Industrial Research Laboratories, Birmingham*
- 8.13 *NHBC Standards, Chapter 4.2, 2003 Building Near Trees*
- 8.14 *'Guidance on Evaluation of Development Proposals on Sites Where Methane and Carbon Dioxide are Present', Report Edition No.04 March 2007 NHBC – designed for use with low rise residential properties*
- 8.15 *CIRIA C665 'Assessing risks posed by hazardous ground gases for buildings' 2007 - for high rise residential / flats*
- 8.16 *BS8485:2007 'Code of practice for the characterization and remediation from ground gas in affected developments'*
- 8.17 *BRE 414 'Protective measures for housing on gas-contaminated land' Roger Johnson, Parkman Environment 2001*
- 8.18 *BS 8500- 1:2006 'Concrete – Complementary British Standard to BS EN 206-1 – Part 1: Method of specifying and guidance for the specifier' November 2006*
- 8.19 *CLR11 'Model Procedures for the Management of Land Contamination' DEFRA 2004*
- 8.20 <http://liverpoolremembrance.weebly.com/> (Liverpool online research regarding bombing during world war two)

APPENDIX A

(i) Site Location Plan



Site Location Plan

Nursery Lane, Allerton, Liverpool, L19 6PR
(coordinates for centre of site 340290, 385510)

(ii) Site Photographs



Site entrance (eastern side)



Evidence of fly tipping along eastern boundary



A view from main gate area looking towards boiler house (SW looking)



A view along eastern boundary, showing staff room/chemical store, gas/electric isolating building and greenhouses



Further evidence of fly tipping along boundary



Staff room



Chemical store adjacent to staff room (no direct access via staff room)



Warning sign in the chemical store



Gas and Electric isolation building with asbestos warning sign



Extensive vegetation growing around site