

CONTAMINATION REPORT DESK STUDY

Job No. 19855

**Proposed Residential Development
Land West of Lutton Gowts
Long Sutton
Lincolnshire
PE12 9LQ**

Client: Pure Leisure Group

**March 2016
Revision A**

civil • structural • environmental • surveying



cost effective engineering solutions

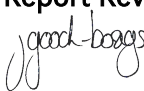
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REPORT CONTROL SHEET

Client: Pure Leisure Group

Job No.: 19855

Project Name: Proposed Residential Development
Land West of Lutton Gowts
Long Sutton
Lincolnshire
PE12 9LQ

Issue		
First Issue	February 2016	
Revision A	March 2016	Report Prepared by:  Tyler Barker Environmental Technician
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CONDITIONS OF INVESTIGATION AND REPORTING

This report and its findings should be considered in relation to the terms of brief and objectives agreed between Plandescil Ltd and the Client.

Plandescil Ltd has made every effort to provide an accurate assessment of the ground condition of the site, within the constraints of this desk study. However it is possible that different ground conditions or contamination may exist in parts of the site which has not been identified in the desk study or the visual survey.

The conclusions within this report are professional opinions based on the interpretation of environmental and historical data which have been compiled using a standard methodology designed to provide reasonable consistency and robustness. Plandescil Ltd cannot be held responsible for any contamination subsequently identified during development of the land.

The details contained in this report are based upon information provided by others and upon the assumption that all relevant information has been provided by those parties from whom it has been requested and that such information is accurate. Information obtained by Plandescil Ltd has not been independently verified by Plandescil Ltd, unless otherwise stated in the report.

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1.0 INTRODUCTION

This Phase 1 Contamination Report Desk Study, including a review of environmental and historical factual data and site walkover, was prepared by Plandescil Ltd on behalf of Pure Leisure Group in March 2016, to accompany a planning application for a proposed residential development of the land west of Lutton Gowt, Long Sutton, Lincolnshire, PE12 9LQ.

This report has been prepared to accompany a planning application for five residential dwellings. In addition to an assessment of the potential contamination arising from the land to be occupied by the five residential dwellings, consideration has been given towards the future development opportunities of the land owned by the client to ensure that contamination is not present on site at levels likely to affect future site users. Drawing No. 19855/802 in the **Drawings Appendix** details the application site boundary and ownership boundary. The land within the ownership boundary as shown on Drawing No. 19855/802 will herein be referred to as the site.

2.0 OBJECTIVES

This Phase 1 Desk Study seeks to identify as far as reasonably practicable, the likelihood of potential environmental contamination which may affect the suitability of the site for future use as a residential development, or adversely affect the health and safety of sensitive receptors.

This will be achieved by;

- construction of a preliminary conceptual site model (CSM), to facilitate an understanding of the potential sources, pathways and receptors which may exist on site;
- production of a qualitative preliminary risk assessment accounting for potential pollutant linkages;
- establishing the need and scope for further investigation.

3.0 SOURCES OF INFORMATION

A variety of public, published and site-specific information sources have been consulted in the compilation of this report. These sources are listed below;

- [1] NHBC, Environment Agency & CIEH. Guidance for the Safe Development of Housing on Land Affected by Contamination. R&D Publication 66: 2008 Volume 1.
- [2] Environment Agency. Model Procedures for the Management of Land Contamination. Contaminated Land Report 11. 2014.
- [3] British Geological Survey. Digital Geological map of Great Britain. Scale 1:50,000. Borehole Records

- [4] British Geological Survey. Digital Geological map of Great Britain. Scale 1:50,000.
- [5] Anglian Water. Information for Developers about Contaminated Land and Ground Condition Assessments.
- [6] Environment Agency: What's In Your Back Yard Maps (WIYBY).
- [7] Environment Agency: Wild Plants: dangerous, invasive and protected species. www.gov.uk.
- [8] Groundsure GeoInsight Report July 2015.
- [9] Groundsure EnviroInsight Report July 2015.
- [10] Groundsure MapInsight (All Scales) July 2015.
- [11] Google (2015) Google Maps.
- [12] UK Grid Reference Finder (2015) Maps.
- [13] Bing (2015) Bing Maps.
- [14] Natural England. Injurious weeds and invasive plants. www.naturalengland.org.uk
- [15] Plandescil Ltd. Topographical Survey Drawing No. 19855/001
- [16] Plandescil Ltd. Flood Risk Assessment February 2016
- [17] Society for Lincolnshire History and Archaeology. 1980. Sutton Bridge and Long Sutton Lincolnshire an Industrial History.
- [18] Water Management Alliance webpage
- [19] South Holland District Council Planning Portal

4.0 SITE HISTORY

4.1 Site Description

The site is to the south of the settlement of Lutton Gowts, which lies approximately 13 miles east of the town of Spalding, refer to Site Location Plan, Drawing No. 19855/701 (**Drawings Appendix**). The site is located at National Grid reference 543585E, 324561N [8], and lies at a maximum elevation of approximately 4.08m above ordnance datum (AOD) in the east and a minimum elevation of 2.45m AOD in the west, refer to Topographical Survey, Drawing No. 19855/001 (**Drawings Appendix**).

The site currently comprises of Silverhill Caravan Park and greenfield land to the north east.

4.2 Historical Setting

Historical maps [10] obtained from Groundsure as part of their MapInsight report [10] and aerial photographs obtained from various archival sources [11] are included at **Appendix C**. A summary of the information obtained from the historical maps and aerial photograph's is provided in **Table 4.1**.

Please note: The site boundary detailed within the Groundsure report identifies the approximate location of the site boundary, please refer to Drawing No. 19855/003 (**Drawings Appendix**) for the accurate location of the proposed development.

Table 4.1 Summary of Historical Land Use

Date of Map	Scale	On Site	Off-Site (<250m)
1887	1:10,560	3 rivers identified on site Roman Bank identified to east of site (likely to represent the old sea bank (OSB) historic sea defences [18])	<ul style="list-style-type: none"> - Roman Bank approx. 0m E - River approx. 0m S - River approx. 5m N - Structure approx. 27m N - Structure approx. 38m N - Structure approx. 59m S - 2 structures approx. 59m E - Structure approx. 75m NE - Windmill (corn) approx. 75m S (feature A on Envirolnsight) - 2 structures approx. 91m E - Structure approx. 97m NE
1888	1:2,500	No significant change	<ul style="list-style-type: none"> - Structure approx. 15m NE identified as Sluice - Structure approx. 38m N identified as Windmill (corn) (feature 1 & B on Envirolnsight) - Smithy approx. 120m N
1903	1:10,560	No significant change	<ul style="list-style-type: none"> - Structure approx. 16m N
1904	1:2,500	No significant change	<ul style="list-style-type: none"> - Smithy approx. 120m N no longer identified
1929	1:10,560	2 rivers identified on site	<ul style="list-style-type: none"> - Structure approx. 81m E
1938	1:10,560	No significant change	<ul style="list-style-type: none"> - Structure approx. 70m SE - Structure approx. 70m E - Structure approx. 86m SE
1950	1:10,560	Roman Bank identified as Sea Bank	<ul style="list-style-type: none"> - Roman Bank approx. 0m E identified as Sea Bank - 2 structures approx. 75m SE - 2 structures approx. 86m E - Windmill (corn) approx. 43m N no longer identified - Windmill (corn) approx. 75m S identified as Old Windmill
1955-1958	1:10,560	No significant change	No significant change within 250m of site
1971	1:2,500	1 river identified to west of site and sea bank no longer identified	<ul style="list-style-type: none"> - Sea bank approx. 0m E no longer identified, bank identified approx. 18m NE - Structure approx. 18m E - 4 structures approx. 27 – 63m SE - 6 structures approx. 42 – 75m E

Date of Map	Scale	On Site	Off-Site (<250m)
			<ul style="list-style-type: none"> - 4 additional structures approx. 81 – 105m E identified as Nursery - Structure approx. 93m S - Structure approx. 95m SE
1974-1976	1:10,000	No significant change	No significant change within 250m of site
1982	1:2,500	No significant change	<ul style="list-style-type: none"> - 3 structures approx. 27 – 63m SE no longer identified - Additional structure approx. 29m E - Structure approx. 33m E - Structures approx. 70m SE, 86m SE & 95m SE no longer identified - Structure approx. 100m SE - Movable greenhouses approx. 107m E
1990	1:2,500	River on western boundary realigned off-site	<ul style="list-style-type: none"> - Structure approx. 33m E no longer identified - Structure approx. 5m NE - Structure approx. 5m N - Structure approx. 45m NE - Structure approx. 51m E - Structure approx. 53m E
1991	1:10,000	No significant change	No significant change within 250m of site
1994	1:2,500	No significant change	No significant change within 250m of site
12/1999	Aerial Photograph	Embankment identified in south of site	No significant change within 250m of site
2002	1:10,000	No significant change	- Structure approx. 51m E
04/2005	Aerial Photograph	Caravan park identified in centre of site 3 structures identified	- Approx. 6 structure approx. 5 – 51m SE
03/2006	Aerial Photograph	No significant change	No significant change within 250m of site
12/2006	Aerial Photograph	No significant change	No significant change within 250m of site
2010	1:10,000	No significant change	No significant change within 250m of site
2014	1:10,000	No significant change	No significant change within 250m of site

5.0 ENVIRONMENTAL SETTING

5.1 Site Walkover

A Site Walkover was conducted on 30th July 2015, by Jemma Gooch-Boags of Plandescil Ltd. and was accompanied by Mr A. Hurst (Pure Leisure Group). The objective of the walkover was to assess existing site activities and identify any potential causes of contamination arising from these, including but not limited to, a review of the physical condition of the surface and any hardstandings present on site to attempt to identify any existing areas of contamination. A brief visual assessment was conducted on-site however access to the communal areas was restricted due to private occupation of the caravan site.

A series of photographs were taken to record the site in its current condition, and are included within the photo portfolio held at **Appendix D**.

The proposed site is situated on land currently occupied by Silver Hill Caravan Park, and comprises three main areas referred to herein as Area's A, B and C. Refer to Drawing No. 19855/802 showing the proposed site layout.

Area A – The site is accessed from Luton Gowts highway, a concrete access road then becomes a gravel access track. Upon entering the site a dedicated reception / welcome area is situated within a landscaped area immediately south of the gravel access road (refer to Existing Site Layout, Drawing No. 19855/702 (**Drawing Appendix**)). The access road extends west into site, two brick buildings are situated along the access road, one to the south and one to the north. The building to the north is understood to comprise a communal / club area for the caravan site and is complete with pool table and amenities, whilst the southern building is understood to provide accommodation for the site manager.

The gravel access road continues to extend west into the site, becoming asphalt. The asphalt road then extends to the south into Area B, and also continues in Area A forming a large triangular loop which connects into the gravel access road close to the site entrance. Static caravans are strategically positioned on individual concrete hardstandings which are accessed from the asphalt road via either brick weave or gravel driveways. Approximately 40 - 50 caravans were situated in Area A. A brick building understood to house a toilet block and possible treatment plant/pumping station was located adjacent to the western boundary of Area A.

Area B – The caravan park has been extended onto land situated to the south of Area A. An asphalt road adjoins the gravel entrance road at Area A and extends south providing access into Area B. Immediately east of the asphalt road lies a gas canister storage area and a screened waste management area comprising Biffa industrial leak proof waste storage bins. No evidence of any leaks or spillages were identified in this area. The asphalt road extends south, before looping back to the north east and connecting back into the asphalt immediately west of the waste and gas canister storage areas. An area of bonfire residue which appeared to be a minimum of 2m in diameter, was identified to the south of Area B. The materials had been cleared leaving a black scarred area, indicating that this area is regularly used for burning, charred conifer branches and twigs were noted around the area indicating that the pyre either partially or wholly comprised untreated wood.

Approximately 20 caravans were situated in Area B, however there were several hardstandings unoccupied. The area appeared to have capacity for at least 10-15 additional caravans the majority of which could be positioned along the eastern boundary, which at the time of the walkover was largely laid to grass, and appeared untidy and overgrown.

Area C – Was inaccessible at the time of the walkover, but the land was viewed at a distance from the highway. The land appeared to comprise overgrown vegetation which looked quite patchy in some areas, inconsistencies within the density and colour of the vegetation were evident from several hundred meters away. It could not be ascertained whether contamination or saturated ground was a factor in limiting vegetation growth in this area. A small wooden

structure was noted to the east of Area C, (possibly a shed) however the structure could not be inspected.

5.2 Existing/Historic Land Use

A summary of current land uses noted during the Site Walkover and on interrogation of the Groundsure EnviroInsight Report [9] are provided at **Table 5.1**.

Table 5.1 Existing & Historic Land Use

Direction	Existing & Historic Land Use
On-Site	Silverhill Caravan Park is located in the south of the site. Greenfield land is located in the north. The site was historically utilised as a coal storage and vehicle haulage facility by Mountains Road Haulage Ltd.
North	The site is bound by greenfield land and residential properties to the north. Ground Sure indicates the following historic industrial uses in this area; <ul style="list-style-type: none"> - Windmill (feature 1) approx. 16m N (dated 1903) - Unspecified Windmill (feature B) approx. 49–50m N (dated 1929–1938) - Tank approx. 245m NW (dated 1982) Ground Sure indicates the following existing industrial uses in this area: <ul style="list-style-type: none"> - Ace Travel Long Sutton Ltd (Vehicle Hire & Rental) approx. 117m NE
East	The site is bound by Lutton Gowts highway to the east. Beyond this lies greenfield land and residential properties. Ground Sure indicates the following historic industrial uses in this area: <ul style="list-style-type: none"> - Nursery approx. 70m E (dated 1974) No existing industrial uses are identified within the Groundsure report within 250m of the site.
South	The site is bound by greenfield land and residential properties to the south. Watercourse Lutton Eau is also identified to the south of the site. Ground Sure indicates the following industrial uses in this area: <ul style="list-style-type: none"> - Disused Windmill/Corn Windmill (feature A) approx. 43–52m S (dated 1887–1991) This is identified to be approx. 45m on historic maps (Table 4.1). - Unspecified Tanks approx. 66m S (dated 1991) - Unspecified Tank approx. 73m S (dated 1938) - Corn Windmill approx. 175m S (dated 1887) Ground Sure indicates the following existing industrial uses in this area; <ul style="list-style-type: none"> - The Lutton Body Shop (Vehicle Repair, Testing & Servicing) approx. 98m S
West	The site is bound by greenfield to the west. Beyond this lies the River Fleet. No historic or existing industrial uses are identified within the Groundsure report within 250m of the site.

5.3 Geology

The British Geological Survey's, Digital geological map of Great Britain 1:50,000 scale [4], identifies the Bedrock Geology to comprise Ampthill Clay Formation (Mudstone). This is overlain

by Superficial Deposits comprising Tidal Flat Deposits (Clay & Silt). This is consistent with the findings of the Groundsure GeoInsight report [8] held at **Appendix B**.

Geotechnical data relating to the project sites ground conditions has been obtained from Groundsure GeoInsight (referred to in **Table 5.2** as Geo) and EnviroInsight (referred to in **Table 5.2** as Enviro) are summarised below.

Table 5.2 Geotechnical Data Summary

Ground Subsidence/ Geotechnical Information	On-site
Ground Workings (Geo Section 2) and Potentially Infilled Land (Enviro Section 1)	Groundsure does not indicate any current or historic ground workings or any potentially infilled land within 250m of the site.
Natural Hazards and Mining	The site is not situated within an area, which has been mined for clay, tin, coal or other valuable materials. The site local geology does not appear to contain natural cavities, and has not been subjected to brine or gypsum extraction.
Shrink-Swell Clay	Low Ground conditions are predominantly medium plasticity.
Landslides	Very Low
Ground Dissolution Soluble Rocks	Negligible
Compressible Deposits	Moderate Significant potential for compressibility problems.
Collapsible Deposits	Negligible
Running Sands	Moderate Significant potential for running sand problems with relatively small changes in ground conditions.
Estimated Background Soil Chemistry	Rural Soil. 4 records of background soil chemistry are located within 250m of the site. All records returned Rural Soil values and are located on-site.
Railways and Tunnels	The site is not situated on, or within 250m of any current or historic railway, tunnel or railway/tunnel feature.

5.4 Hydrology and Hydrogeology

The Groundsure EnviroInsight (**Appendix A**) Report [9] identifies the project site to be situated on Superficial Deposits comprising Tidal Flat Deposits (Clay & Silt), which is designated as Unproductive Strata.

The Bedrock geology comprises Ampthill Clay Formation (Mudstone), which is designated as Unproductive Strata.

The project site is not situated within a designated Source Protection Zone.

No regional BGS Hydrogeological Map is available for the site, as such BGS Borehole Records [3] were consulted to establish an approximate depth of the groundwater beneath the site.

BGS Borehole Records [3] did not identify any boreholes immediately surrounding the site, however a number were identified in the settlements of Long Sutton to the south and Chapelgate to the west, refer to **Appendix E** for further details on the Borehole Locations. Three boreholes have been reviewed to obtain details on the groundwater within the area, the findings of these are detailed in **Table 5.3** below.

Table 5.3 Depth of Groundwater Observed within the Boreholes

Borehole	Approx. distance from site	Approx. ground level m AOD	Date	Depth of Groundwater (m)	
				BGL	AOD
TF42SW16	1.3km south-west	1.83m	Jan 1985	1.95m	-0.12m
TF42SW36	2.2km west	3.00m	July 1981	2.75m	0.25m
TF42SW11	2.3km west	2.96m	Sept 1983	2.80m	0.16m

BGS borehole data [3] indicates the groundwater level to be approximately -0.12 to 0.25m AOD, suggesting the groundwater table to be a minimum of approximately 2.2m below the existing ground level of the site.

The site is located in South Holland Internal Drainage Board (IDB) catchment. The site is located in the catchment of Lutton Leam drain, refer to **Appendix F**. An IDB ordinary watercourse Lutton Eau (IDB reference K16) is located to the south and west, where at its closest is 8m from site, Lutton Eau outfalls into another IDB ordinary watercourse, the Fleet (IDB reference K08) to the west and north, where at its closest is 3.5m from site.

Groundsure identifies six surface water features to be within 250m of the site. Two surface water features are identified within 100m of the site and are likely to be the watercourses detailed above.

5.5 Flooding

Environment Agency Flood Map for Planning (Rivers and Sea) [6] identifies the site to be situated within Flood Zone 3, and is at risk of being affected by flooding of rivers or sea. There is a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year. Refer to the Flood Risk Assessment & Surface Water Drainage Strategy Report prepared by Plandescil Ltd. in February 2016 [16] for additional information regarding flooding risk on site.

5.6 Industrial Pollution

Industrial pollution data for those installations regulated by the Environment Agency, and the Local Authority have been consulted to identify the location of any potentially polluting activities such as landfill sites (current and historic), permitted facilities, and discharge consents etc. The results are summarised within **Table 5.4**.

Table 5.4 Summary of Pollution Data

Data	Source	Results
Industrial Pollution	EA WIYBY [6]	No industrial pollution incidents recorded within 250m of the site.
Air Pollution	EA WIYBY [6]	The site is situated in an area which does not have any individual sources emitting reportable levels of Carbon Dioxide (CO ₂), Sulphur Dioxide (SO ₂), and Particulates (PM ₁₀).
Historic Site Use	South Holland District Council Planning Portal [18]	The site was historically utilised as a coal storage and vehicle haulage facility by Mountains Road Haulage Ltd. It is unknown when operations ceased on site, however the last planning application identified under the haulage company was identified in 1997 and the first planning application for the caravan site was submitted in 2001.
Historical Tanks	Groundsure EnviroInsight [9]	An unspecified tank is identified 245m NW dated 1982. Other unspecified tanks, connected to the windmill (feature A), are located approx. 66–73m S, dated 1938–1991.
Records of Part A(1) and IPPC Authorised Activities	Groundsure EnviroInsight [9]	No records of activities listed as Part A(1) or IPPC authorised activities were identified within 250m of the site.
Records of Part A(2) and Part B Listed Activities and Enforcements	Groundsure EnviroInsight [9]	No records of activities listed as Part A(2) and Part B were identified within 250m of the site.
Records of Licensed Discharge Consents	Groundsure EnviroInsight [9]	Thirteen Licensed Discharge Consents are located within 250m of the site, including one located on site. Seven of the licenses are still effective and are for sewage discharges – final/treated effluent for plots 1 – 5 at Silverhill.
Landfill (Current and Historic)	EA WIYBY/Groundsure EnviroInsight [6,9]	No historic or current landfill sites are located within 500m of the site.
Waste Sites	Groundsure EnviroInsight [9]	Two records of waste transfer stations are identified on site. One is under planning reference H12/217/96 and detailed planning was submitted on 11/03/96. The second is under planning reference H12/612/96 and outline planning was submitted on 02/07/96. Both applications were refused planning.
Services	Groundsure EnviroInsight [9]	There are no records of high pressure underground pipelines within 500m of the site.
Water Abstraction Licenses	Groundsure EnviroInsight [9]	There are no Groundwater, Surface Water or Potable Water Abstraction Licenses within 500m of site.

5.7 Invasive Plant Species

No noticeable evidence of Japanese Knotweed, or Giant Hogweed, was identified during the site walkover. *“It is an offence under section 14(2) Wildlife and Countryside Act 1981 to plant*

or otherwise cause the plant to grow in the wild" Natural England [14]. Should either of these species be identified during the works specialist advice should be sought to control them.

No noticeable evidence of Himalayan Balsam was identified during the site walkover.

5.8 Environmentally Sensitive Areas

Groundsure did not identify any records of Designated Environmentally Sensitive Sites within 250m of the site boundary.

5.9 Radon Data

The site is not situated in a Radon affected area, as defined by the Health Protection Agency, as less than 1% of properties are above the Action Level. Groundsure (**Appendix B**) [8] indicates no radon protective measures are necessary.

6.0 PRELIMINARY CONCEPTUAL SITE MODEL

6.1 Conceptual Site Model

CLR11 [2] states that "*land contamination in its broadest sense describes a general spectrum of site and soil conditions.*" To understand the level of potential contamination present on site, it is essential to understand the natural history of the site and its current and historic uses. Robust research has been conducted to attempt to identify any area of land which may exhibit elevated levels of naturally occurring substances, but also any specific site uses which may have resulted in a legacy of contamination remaining on site from activities including those arising from waste storage and disposal.

The conceptual site model attempts to understand the existing and historic uses in combination with the existing and historic land uses associated with neighbouring sites. A robust understanding of local land use is required to attempt to identify land, which has been affected by aerial deposition, accidents, incidents (including leaks / spillages) and/or migration of contamination, which could affect the condition of the project site.

The preliminary conceptual site model accounts for both on-site and off-site potential sources of contamination and their potential pathways to impact sensitive receptors. Potential sources, pathways and receptors are identified in detail at Sections 6.2 - 6.5.

6.2 Potential Sources of Contamination

Nine potential on-site sources of contamination have been identified relating to the sites current and historic use these include;

- S1. Hydrocarbons and metals from bonfire residue
- S2. Coal tar within the existing asphalt access road
- S3. Hydrocarbons and oils from vehicle parking

- S4. Fuels (diesel, petrol), mineral oils, metals, hydrocarbons, antifreeze (ethylene glycol, methanol), coal (combustion residues) historic vehicle haulage site
- S5. Fertilisers, pesticides, herbicides from agricultural use
- S6. Metals and hydrocarbons from potential waste transfer station
- S7. Pathogens, chemicals and hydrocarbons from treatment plant/pumping station
- S8. Metals and hydrocarbons from screened waste management area
- S9. Metals & hydrocarbons from roman bank

Six potential off-site contamination sources have been identified and include;

- OS1. Hydrocarbons from historic corn windmill and associated tanks
- OS2. Ground Gases (including Carbon Dioxide and Methane, from decomposing Organic Matter) from drain
- OS3. Fertilisers, pesticides, herbicides from nursery
- OS4. Fuels (diesel, petrol), mineral oils, metals, hydrocarbons, antifreeze (ethylene glycol, methanol), solvents, paints from vehicle repair testing and servicing
- OS5. Hydrocarbons from vehicle hire and rental
- OS6. Metals & hydrocarbons from former Blacksmiths

6.3 Potential Pathways

A pathway can be defined as a route or means by which a receptor can be affected by a contaminant. The conceptual site model identifies potential pathways by which potential contaminants may migrate from source to the receptor, these include;

- P1. Permeable Ground – the permeability of the superficial and bedrock ground is considered Low – Very Low.
- P2. Subsurface Structures – electricity, mains water, foul & surface water drainage, and phone and internet connections may be present on site, and are likely to be installed as part of the proposed development. These structures can cause migration of contaminants via leakages, but can also provide a route for mobile contaminants to follow in or around the structure potentially increasing the distance permissible for lateral migration of mobile contaminants.
- P3. Direct Contact – dermal contact or ingestion of substances that are present at or near the surface of the land.

- P4. Inhalation – of airborne particles, vapours or ground gases that may be present on the site.
- P5. Flooding – The site is located within Zone 3, and is at risk from river, or tidal flooding. If flooding were to occur this may facilitate migration of contaminants off-site.
- P6. Groundwater – the bedrock geology is considered Unproductive. The groundwater is approximately 2.2m BGL and the geology has a low permeability, but can possibly enable vertical migration of contaminants into the groundwater.
- P7. Plant Uptake – Ingestion of plants (vegetables / fruit) that contain substances that are present within the land.

6.4 Potential Receptors

CLR11 [2] defines a receptor as something, which can be adversely affected by a contaminant. The potential receptors, which may be affected by the potential presence of contaminants at or around the project site, have been identified as;

- R1. Human Health (construction workers) - Exposure of construction workers to contaminants may occur during the construction process, and must be managed in accordance with applicable Health and Safety and Environmental Legislation.
- R2. Human Health (future land users) – future users may be directly exposed to contaminants via dermal contact, ingestion or inhalation of dusts from potentially contaminated land, where they interact it.
- R3. Groundwater – the bedrock geology is considered Unproductive. The groundwater is approximately 2.2m BGL and the geology has a low permeability, but can possibly enable vertical migration of contaminants into the groundwater.
- R4. Buildings and Structures – services could be vulnerable to chemical attack if ground conditions contain contaminants.
- R5. Ecological Receptors – No environmentally sensitive areas are identified within 1km of the site. The main ecological receptors are considered to be organisms, animals and aquatic life present within the drains and rivers.
- R6. Neighbouring Sites – the neighbouring sites consist of Greenfield land and residential use.
- R7. Surface Water – surface water drainage systems and features may be vulnerable if contaminants migrate into the drainage system. Two watercourses, Eau and Fleet, are identified within 10m of the site.

6.5 Pollution Linkages

The concept of a pollutant linkage, involves a potential contaminant being able to reach a receptor via a specific pathway. It is possible for each element to exist independently but where they are linked, a pollution linkage is realised.

The pollution linkages identified for the project site, are visually summarised within the conceptual site model in Figure 6.6.

6.6 Illustrative Preliminary Conceptual Site Model

A preliminary conceptual site model has been prepared based upon the site survey and desk study and is included at Figure 6.6.

Figure 6.6: Preliminary Conceptual Site Model



7.0 RISK ASSESSMENT

7.1 Risk Categorisation and Terminology

The preliminary conceptual site model at Figure 6.6, establishes the potential source, pathway and receptor linkages, which may exist at the project site. These linkages form the baseline from which the following qualitative risk assessment has been made.

The risk for each pollutant linkage identified at **Table 6.6** has been reviewed based on both the likelihood and consequence of potential contamination impacting on each receptor identified within the Conceptual Site Model.

Risk categorization terminology and description has been adopted from Environment Agency and NHBC guidance [1], and is summarised in **Tables 7.1 – 7.2**.

Table 7.1 Categorisation of Risk

Probability (Likelihood)	Consequence				
		Severe	Medium	Mild	Minor
	High Likelihood	Very High Risk	High Risk	Moderate Risk	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

Source: R&D66:2008 Volume 1 [1]

Table 7.2 Description of Risk Levels

Term	Description
Very High Risk	There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without appropriate remediation action.
High Risk	Harm is likely to arise to a designated receptor from an identified hazard at the site without appropriate remediation action.
Moderate Risk	It is possible that without appropriate remediation action harm could arise to a designated receptor. It is relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely that such harm would be relatively mild.
Low Risk	It is possible that harm could arise to a designated receptor from an identified hazard. It is likely that, at worst if any harm was realised any effects would be mild.
Very Low Risk	The presence of an identified hazard does not give rise to the potential to cause harm to a designated receptor.

Source: R&D66:2008 Volume 1 [1]

7.2 Preliminary Risk Assessment

Utilising the terminology set out in **Tables 7.1 – 7.2**, in combination with the review of current and historical environmental information, and the preliminary conceptual site model, the following risks have been established for the project site in **Table 7.3**.

Table 7.3 Contamination Risk Assessment

Receptor	Contaminant(s)	Probability / Consequence	Risk	Comments / Justification / Linkage
R1 Human Health - Construction Workers	<p>Hydrocarbons, Metals (S1, OS6)</p> <p>Coal Tar (S2)</p> <p>Hydrocarbons, Oils (S3)</p> <p>Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze (ethylene, glycol, methanol), Coal (S4)</p> <p>Fertilisers, Pesticides, Herbicides (S5, OS3)</p> <p>Metals, Hydrocarbons (S6, S8, S9)</p> <p>Pathogens, Chemicals, Hydrocarbons (S7)</p>	Low Likelihood/ Mild	Low	<p>Risk: The risk to human health (construction workers) from potential contamination is considered Low.</p> <p>Justification:</p> <p>S1 – An area of charred vegetation was identified on land in the south of the site, the area affected extended approximately 2m in diameter, and appeared to have been used repeatedly for the burning of materials. Although unlikely to impact the identified receptor, to mitigate any risk Recommendation 1 should be adhered to. Refer to S1 at R2 for additional recommendation, Recommendation 2.</p> <p>Recommendation 1 <i>Construction workers may be exposed to potentially contaminative materials. This risk should be mitigated by the correct use of personal protective equipment, and compliance with relevant health and safety legislation. If unusual materials/ground conditions are encountered these should be treated in accordance with applicable health and safety and environmental legislation and reported to a competent person for further investigation.</i></p> <p>S2 – Asphalt road surfacing provides access to a significant proportion of the caravan park. To enable the materials to be re-used, the asphalt should be tested to identify whether the surfacing comprises coal tar. Coal tar may exist within the asphalt surface comprising the access road. Refer to S2 at R2 for additional recommendation, Recommendation 2.</p> <p>S3 – Vehicle parking outside the caravans was identified during the walkover, an area of hardstanding was allocated for each caravan for vehicle parking. Any contamination from vehicle parking is unlikely to be located within the soils, however Recommendation 1 should be adhered to.</p> <p>S4 – The site was historically utilised as a coal storage and vehicle haulage facility by Mountains Road Haulage Ltd. It is unknown when operations ceased on site,</p>

Receptor	Contaminant(s)	Probability / Consequence	Risk	Comments / Justification / Linkage
	<p>Hydrocarbons (OS1, OS5)</p> <p>Ground Gases (Carbon Dioxide, Methane) (OS2)</p> <p>Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze (ethylene, glycol, methanol), Solvents, Paints (OS4)</p>			<p>however the last planning application identified under the haulage company was identified in 1997 and the first planning application for the caravan site was submitted in 2001. To safeguard the identified receptor, Recommendation 1 should be adhered to.</p> <p>S5 – An area of agricultural land was identified to the north of the site. Although identified as overgrown at the time of the site walkover it is understood to be utilised for agricultural use. Fertilisers, pesticides and herbicides may have been used on the land therefore Recommendation 1 should be adhered to in order to safeguard the identified receptor.</p> <p>S6 – A historic planning application for a waste transfer site is identified on site under reference H12/0217/96 which was withdrawn. A later application for a waste transfer site and commercial recycle centre for cardboard and paper was submitted under reference H12/0612/96 which was refused, despite appeal. As the waste transfer site was never approved, it is very unlikely to cause a risk to the identified receptor.</p> <p>S7 – A small building was identified to the west of the site as a treatment plant/pumping station. Various contaminants including pathogens, chemicals and hydrocarbons may be present if utilised as a pumping station and therefore Recommendation 1 should be adhered to to safeguard the identified receptor.</p> <p>S8 – A managed waste area was identified on site containing enclosed waste, leak-proof storage bins supplied by waste management company, Biffa. The area comprised concrete hardstanding and was in an enclosed, managed area. No evidence of leaks or spillages were identified during the walkover. Contamination arising from this source are unlikely to be generated on a scale which would represent a risk to the identified receptor.</p> <p>S9 – A roman bank was historically located in the east of the site and an embankment remains present in the south of the site. The bank runs adjacent to residential properties and was constructed in the 1800's. It is likely to have been</p>

Receptor	Contaminant(s)	Probability / Consequence	Risk	Comments / Justification / Linkage
				<p>constructed of inert materials and potential risk from the bank materials is minimal.</p> <p>OS1 – Historic corn windmills are located approx. 16m NE, 43–52m S, 49m N and 175m S. The windmills are no longer identified as working on the 1950 historic map. The windmill approx. 175m south appears, from the road, to be in a dilapidated state located to the west of Lutton Body Shop. Any contaminants produced from the windmills during its operational period is unlikely to still be present or without remediation.</p> <p>OS2 – Drains are located 8m south and 3.5m west of the site. These drains are part of Lutton Leam Catchment within South Holland IDB (Catchment K). Lutton Eau and the Fleet are drains located near the site and are typically managed and maintained by the IDB. A number of routine maintenance procedures occur periodically including weed cutting, de-silting and the mowing & control of bankside vegetation [19], minimising the risk to the identified receptor.</p> <p>OS3 – A nursery is identified 81m east from the site. Various fertilisers, pesticides and herbicides are likely to have been utilised within the nursery, however greenhouses are identified on the maps indicating plants are stored inside and not on unprotected soil reducing the risk of contamination to the shallow soils. Any contamination arising from the nursery is unlikely to migrate this distance to site.</p> <p>OS4 – Lutton Body Shop is located approx. 98m south of the site and facilitates vehicle repair, testing and servicing. Various contaminants are likely to be produced from the activities, however are unlikely to migrate this distance to site and impact the identified receptor.</p> <p>OS5 – Ace Travel Long Sutton Ltd operating vehicle hire and rental is located 117m north east, however any contaminants caused from the activities are unlikely to migrate this distance to site and impact the identified receptor.</p> <p>OS7 – A former Blacksmiths is identified on the historic maps in 1888 approx. 120m north of the site and is no longer identified in the 1904 map. A residential</p>

Receptor	Contaminant(s)	Probability / Consequence	Risk	Comments / Justification / Linkage
				property is located north of the former Blacksmith location and any contamination arising from the activities within the Smithy should have been remediated to safeguard the surrounding residents.
R2 Human Health - future land users	<p>Hydrocarbons, Metals (S1, OS6)</p> <p>Coal Tar (S2)</p> <p>Hydrocarbons, Oils (S3)</p> <p>Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze (ethylene, glycol, methanol), Coal (S4)</p> <p>Fertilisers, Pesticides, Herbicides (S5, OS3)</p> <p>Metals, Hydrocarbons (S6, S8, S9)</p> <p>Pathogens, Chemicals, Hydrocarbons</p>	Likely/Mild	Moderate/Low Risk	<p>Risk: The risk to human health (future land users) from potential contamination is considered Moderate/Low.</p> <p>Justification:</p> <p>Refer to R1 for justification of OS1, OS2, OS3, OS4, OS5, OS6 and Recommendation 1.</p> <p>S1, S2, S3, S4, S5, S6, S7, S8 & S9 – Various contaminants may have entered the soil from activities previously and currently undertaken on site. An intrusive investigation should be undertaken on site to determine the presence of various contaminants, Recommendation 2.</p> <p>Recommendation 2</p> <p><i>An intrusive investigation should be undertaken to establish the presence of the following determinands: Asbestos, organic matter, metals, PAH's, TPH's & BTEX. Samples should be obtained of near surface soils at a minimum of two depths approx. 0.2 – 0.4m and 0.5 – 0.8m. A minimum of five trial pits should be positioned across the site. The number and location of the trial pits should be agreed in advance with the local planning authority. If groundwater is encountered at shallow depth, a water sample should be obtained. A surface scrape should be undertaken in the south of the site in the location of the bonfire residue to remove organic contaminants (PAH's, TPH) from the land. The underlying soils should be sampled for PAH's. A sample of the asphalt access road should be tested for 17 PAH's to identify whether coal tar is present. The underlying soils should also be analysed to determine whether any contaminants from the asphalt have migrated laterally or vertically.</i></p>

Receptor	Contaminant(s)	Probability / Consequence	Risk	Comments / Justification / Linkage
	<p>(S7)</p> <p>Hydrocarbons (OS1, OS5)</p> <p>Ground Gases (Carbon Dioxide, Methane) (OS2)</p> <p>Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze (ethylene, glycol, methanol), Solvents, Paints (OS4)</p>			
R3 Groundwater	<p>Hydrocarbons, Metals (S1)</p> <p>Coal Tar (S2)</p> <p>Hydrocarbons, Oils (S3)</p> <p>Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze</p>	Low Likelihood/ Mild	Low Risk	<p>Risk: The risk to groundwater from potential contamination is considered Low.</p> <p>Groundwater Designation:</p> <p>The Aquifer within the Superficial Deposits of Tidal Flat Deposits (Clay & Silt) is designated as Unproductive Strata. The Aquifer within the Bedrock Geology comprising Ampthill Clay Formation (Mudstone) is also designated as Unproductive Strata. The site is not situated in a Source Protection Zone.</p> <p>Ground permeability is identified as low – very low and is unlikely to transmit pollutants.</p> <p>Justification:</p> <p>Borehole TF42SW16 was installed approx. 1.3km south west of site and identified rest water levels of 1.95m bgl. Two other boreholes located 2.2 – 2.3km south west</p>

Receptor	Contaminant(s)	Probability / Consequence	Risk	Comments / Justification / Linkage
	(ethylene, glycol, methanol), Coal (S4) Fertilisers, Pesticides, Herbicides (S5) Metals, Hydrocarbons (S6, S8, S9) Pathogens, Chemicals, Hydrocarbons (S7)			<p>of the site identified groundwater depth 2.75 – 2.80m bgl. The sites groundwater level will be approximately 2.2m bgl, however this is only an approximation. To understand if any contaminants are present in the groundwater, water samples should be taken if groundwater is encountered at shallow depth, Recommendation 2.</p> <p>Refer to R1 and R2 for justification of S1, S2, S3, S4, S5, S6, S7, S8, S9 and Recommendation 2.</p>
R4 Buildings and Structures	Hydrocarbons, Metals (S1, OS6) Coal Tar (S2) Hydrocarbons, Oils (S3) Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze (ethylene, glycol, methanol), Coal (S4)	Low Likelihood/ Minor	Very Low Risk	<p>Risk: The risk to buildings and structures from potential contamination is considered Very Low.</p> <p>Justification:</p> <p>The risk to buildings and structures should be assessed during the intrusive investigation, refer to Recommendation 2.</p> <p>Refer to R1 and R2 for justification of S1, S2, S3, S4, S5, S6, S7, S8, S9, OS1, OS2, OS4, OS5 and OS6.</p> <p>A low hazard rating of shrink-swell clays, a moderate hazard rating of compressible deposits, and a moderate hazard rating of running sands are all located on site. Recommendation 3, 4 & 5, should be adhered to, to mitigate any risk to buildings.</p>

Receptor	Contaminant(s)	Probability / Consequence	Risk	Comments / Justification / Linkage
	<p>Fertilisers, Pesticides, Herbicides (S5, OS3)</p> <p>Metals, Hydrocarbons (S6, S8, S9)</p> <p>Pathogens, Chemicals, Hydrocarbons (S7)</p> <p>Hydrocarbons (OS1, OS5)</p> <p>Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze (ethylene, glycol, methanol), Solvents, Paints (OS4)</p>			<p>Recommendation 3 Trees with high soil moisture demands should not be planted near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE).</p> <p>Recommendation 4 Technical advice should be obtained before draining, loading or de-watering ground near the property. For new build, consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes.</p> <p>Recommendation 5 Avoid large amounts of water entering the ground (for example through pipe leakage or soakaways). Do not dig (deep) holes into saturated ground near the property without technical advice. For new build, consider the consequences of soil and groundwater conditions during and after construction.</p>
R5 Ecological Receptors	<p>Hydrocarbons, Metals (S1, OS6)</p> <p>Coal Tar (S2)</p> <p>Hydrocarbons, Oils (S3)</p>	Unlikely/Mild	Very Low Risk	<p>Risk: The risk to ecological receptors from potential contamination is Very Low.</p> <p>Justification:</p> <p>Refer to R1 and R2 for justification of S1, S2, S3, S4, S5, S6, S7, S8, S9, OS1, OS2, OS4, OS5 and OS6.</p>

Receptor	Contaminant(s)	Probability / Consequence	Risk	Comments / Justification / Linkage
	<p>Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze (ethylene, glycol, methanol), Coal (S4)</p> <p>Fertilisers, Pesticides, Herbicides (S5, OS3)</p> <p>Metals, Hydrocarbons (S6, S8, S9)</p> <p>Pathogens, Chemicals, Hydrocarbons (S7)</p> <p>Hydrocarbons (OS1, OS5)</p> <p>Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze (ethylene, glycol, methanol), Solvents, Paints (OS4)</p>			

Receptor	Contaminant(s)	Probability / Consequence	Risk	Comments / Justification / Linkage
R6 Neighbouring Sites	<p>Hydrocarbons, Metals (S1)</p> <p>Coal Tar (S2)</p> <p>Hydrocarbons, Oils (S3)</p> <p>Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze (ethylene, glycol, methanol), Coal (S4)</p> <p>Fertilisers, Pesticides, Herbicides (S5)</p> <p>Metals, Hydrocarbons (S6, S8, S9)</p> <p>Pathogens, Chemicals, Hydrocarbons (S7)</p>	Low Likelihood/ Minor	Very Low Risk	<p>Risk: The risk to neighbouring sites from potential contamination is Very Low.</p> <p>Justification:</p> <p>Refer to R1 and R2 for justification of S1, S2, S3, S4, S5, S6, S7, S8 and S9.</p>
R7 Surface Water	Hydrocarbons, Metals (S1)	Low Likelihood/ Mild	Low Risk	Risk: The risk to surface water from potential contamination is Low .

Receptor	Contaminant(s)	Probability / Consequence	Risk	Comments / Justification / Linkage
	<p>Hydrocarbons, Oils (S3)</p> <p>Fuels (diesel, petrol), Mineral Oils, Metals, Hydrocarbons, Antifreeze (ethylene, glycol, methanol), Coal (S4)</p> <p>Fertilisers, Pesticides, Herbicides (S5)</p> <p>Metals, Hydrocarbons (S8)</p>			<p>Justification:</p> <p>The site is situated in Flood Zone 3, and shown to be at risk of fluvial and tidal flooding.</p> <p>Six surface water features are identified within 250m of the site, two within 100m identified as drains.</p> <p>S8 – The waste management area is well managed. Waste materials are stored within enclosed industrial bins provided by Biffa. The bins appeared to be in good visual condition with no evidence of any leaks or spillages. Contaminants are unlikely to arise from this source and affect the surface water.</p> <p>Refer to R1 and R2 for justification of S1, S3, S4 and S5.</p>

8.0 CONCLUSION & RECOMMENDATIONS

8.1 Risk Summary

The site conceptual model indicates that there are several potential pollutant linkages on site, and the perceived risk to receptors is summarised at **Table 8.1**.

To safeguard receptors the recommendations and notes detailed in **Table 8.1** should be addressed.

Table 8.1 Receptor Risk Summary

Receptor	Notes	Risk
R1 Construction Workers	<p>Receptor R1 is classified as Low Risk.</p> <p>To reduce the risk to Construction Workers the following recommendations should be addressed;</p> <p>Recommendation 1 <i>Construction workers may be exposed to potentially contaminative materials. This risk should be mitigated by the correct use of personal protective equipment, and compliance with relevant health and safety legislation. If unusual materials/ground conditions are encountered these should be treated in accordance with applicable health and safety and environmental legislation and reported to a competent person for further investigation.</i></p>	Low Risk
R2 Future Land Users	<p>Receptor R2 is classified as Moderate/Low Risk.</p> <p>To reduce the risk to Future Land Users the following recommendations should be addressed;</p> <p>Recommendation 2 <i>An intrusive investigation should be undertaken to establish the presence of the following determinands: Asbestos, organic matter, metals, PAH's, TPH's & BTEX. Samples should be obtained of near surface soils at a minimum of two depths approx. 0.2 – 0.4m and 0.5 – 0.8m. A minimum of five trial pits should be positioned across the site. The number and location of the trial pits should be agreed in advance with the local planning authority. If groundwater is encountered at shallow depth, a water sample should be obtained. A surface scrape should be undertaken in the south of the site in the location of the bonfire residue to remove organic contaminants (PAH's, TPH) from the land. The underlying soils should be sampled for PAH's. A sample of the asphalt access road should be tested for 17 PAH's to identify whether coal tar is present. The underlying soils should also be analysed to determine whether any contaminants from the asphalt have migrated laterally or vertically.</i></p>	Moderate/Low Risk

Receptor	Notes	Risk
R3 Groundwater	Receptor R3 is classified as Low Risk To reduce the risk to Groundwater, Recommendation 2 should be adhered to.	Low Risk
R4 Buildings and Structures	Receptor R4 is classified as Very Low Risk . Recommendation 3 <i>Trees with high soil moisture demands should not be planted near to buildings. For new build, consideration should be given to advice published by the National House Building Council (NHBC) and the Building Research Establishment (BRE).</i> Recommendation 4 <i>Technical advice should be obtained before draining, loading or de-watering ground near the property. For new build, consider possibility of compressible ground in ground investigation, construction and building design. Consider effects of groundwater changes.</i> Recommendation 5 <i>Avoid large amounts of water entering the ground (for example through pipe leakage or soakaways). Do not dig (deep) holes into saturated ground near the property without technical advice. For new build, consider the consequences of soil and groundwater conditions during and after construction.</i>	Very Low Risk
R5 Ecological Receptors	Receptor R5 is classified as Very Low Risk	Very Low Risk
R6 Neighbouring Sites	Receptor R6 is classified as Very Low Risk	Very Low Risk
R7 Surface Water	Receptor R7 is classified as Low Risk	Low Risk

8.2 Conclusion

The basic requirements for land development in the UK is that the land should be suitable for use. The information reviewed in the preparation of this Phase 1 Contamination Report Desk Study did not identify any significant existing or historical on-site sources of contamination which may affect the identified receptors, however Recommendations 1 – 5 in **Table 8.1** should be adhered to.

When developing the site, it is possible that differing ground conditions and higher concentrations of contaminants exist than have been identified by this report, in the event that differing ground conditions are encountered, further assessment/investigation should be undertaken by a competent person(s).