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Brompton

CONSULTING

WELLINGTON WAY, WATERLOOVILLE

PHASE 1 DESK STUDY





NON-TECHNICAL SUMMARY

This Phase 1 Desk Study has been prepared for the clearance and redevelopment of an existing retail site located off Wellington Way, in Waterlooville, Hampshire, PO7 7ED by Lustre Consulting Limited (Lustre) for CPI Wellington Way 2 Ltd. CPI Wellington Way 2 Ltd requires this Phase 1 Desk Study to support a new planning application, which is understood will involve the demolition and clearance of the existing Shopping Centre and construction of a residential apartment block, with amenities and communal residential garden.

The site historically comprised a small residential dwelling, with gardens until the 1930s, after which it formed part of a motor works, which extended off-site to the north and north east. The entire motor works was cleared in the late 1960s and by 1972 the site had been redeveloped as part of the wider Wellington Way Shopping Centre. There is therefore the potential for a layer of Made Ground to be present beneath the site associated with the historical industrial use of the motor works and clearance of the site prior to its redevelopment, with potential contaminants including asbestos, metals, inorganics, polyaromatic hydrocarbons (PAHs) total petroleum hydrocarbons (TPH) and Volatile Organic Compounds (VOCs). The site is situated within an area with an industrial legacy, particularly to the north and north east of the site including former depots, warehouse, factories, engineering works, electrical engineering works and boat works, which now comprise a mixed commercial and industrial estate, as well as active garages located to the south of the site, all of which present potentially off-site sources of contamination. An historical landfill is also present approximately 470m to the east of the site.

The site is directly underlain bedrock geology of the London Clay Formation, comprising poorly laminated, blue-grey or grey-brown, silty to very silty clay. No superficial deposits are recorded beneath the site. Superficial Head Deposits, comprising clay, silt, sand and gravel are present approximately 150m north west of the site and extend to the north west in a band approximately 1.5km thick. The London Clay Formation is classified as Unproductive Stratum. The site is located within a groundwater Source Protection Zone (SPZ) - Zone 1c (Inner Zone) for subsurface activity only. No significant controlled surface water features are recorded within 500m of the site.

This Phase 1 Desk Study has determined that there is an overall **moderate / low** potential for contamination to be present in a circumstance which could lead to unacceptable risks to identified receptors. The proposed end uses of the site (comprising residential redevelopment with limited communal gardens), where potential exposure pathways between the identified potential sources of contamination and future site users are likely have also been taken into consideration.

Based on the findings of this Phase 1 Desk Study, there is now a good understanding of the potential sources of contamination at the site and the risks posed to identified receptors. The anticipated contaminative status of the site is not considered, in our opinion, to be prohibitive to the proposed redevelopment scheme. A Phase 2 Site Investigation, principally driven by a geotechnical assessment, is recommended to investigate the shallow soils, and the potential for hazardous gases/vapours.



PROJECT RECORD		
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CLIENT	CPI WELLINGTON WAY 2 LTD	
REPORT DETAILS		
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REGISTRATION OF AMENDMENTS

Revision and Date	Amendment Details	Revision Author	Revision Reviewer





1.0 INTRODUCTION

- 1.1 This Phase 1 Desk Study has been prepared for the clearance and redevelopment of an existing retail site located off Wellington Way, in Waterlooville, Hampshire, PO7 7ED by Lustre Consulting Limited (Lustre) for CPI Wellington Way 2 Ltd. The assessment has been undertaken in accordance with our fee proposal dated 14/11/2017, which was formally approved by CPI Wellington Way 2 Ltd on 20/11/2017.
- 1.2 The site, irregular in plan, is centered at National Grid Reference 468170 109390, and occupies an approximate area of 0.25ha as shown in Figure 1. The site currently comprises part of Wellington Way Shopping Centre and is located within a mixed commercial and residential land use area. CPI Wellington Way 2 Ltd requires this Phase 1 Desk Study to support a new planning application, which is understood will involve the demolition and clearance of the existing Shopping Centre within the redline boundary shown in Figure 1 and construction of a residential apartment block, with amenities and communal residential garden. Figure 2 illustrates the proposed development layout at ground level.

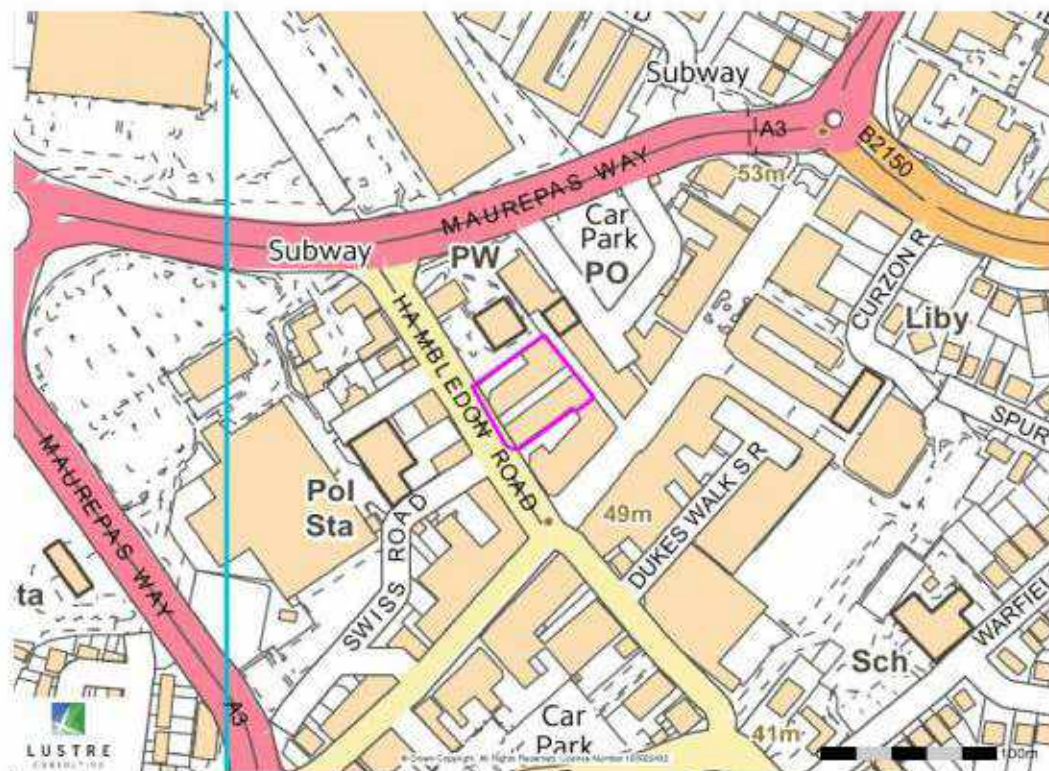


Figure 1: Site Location Plan



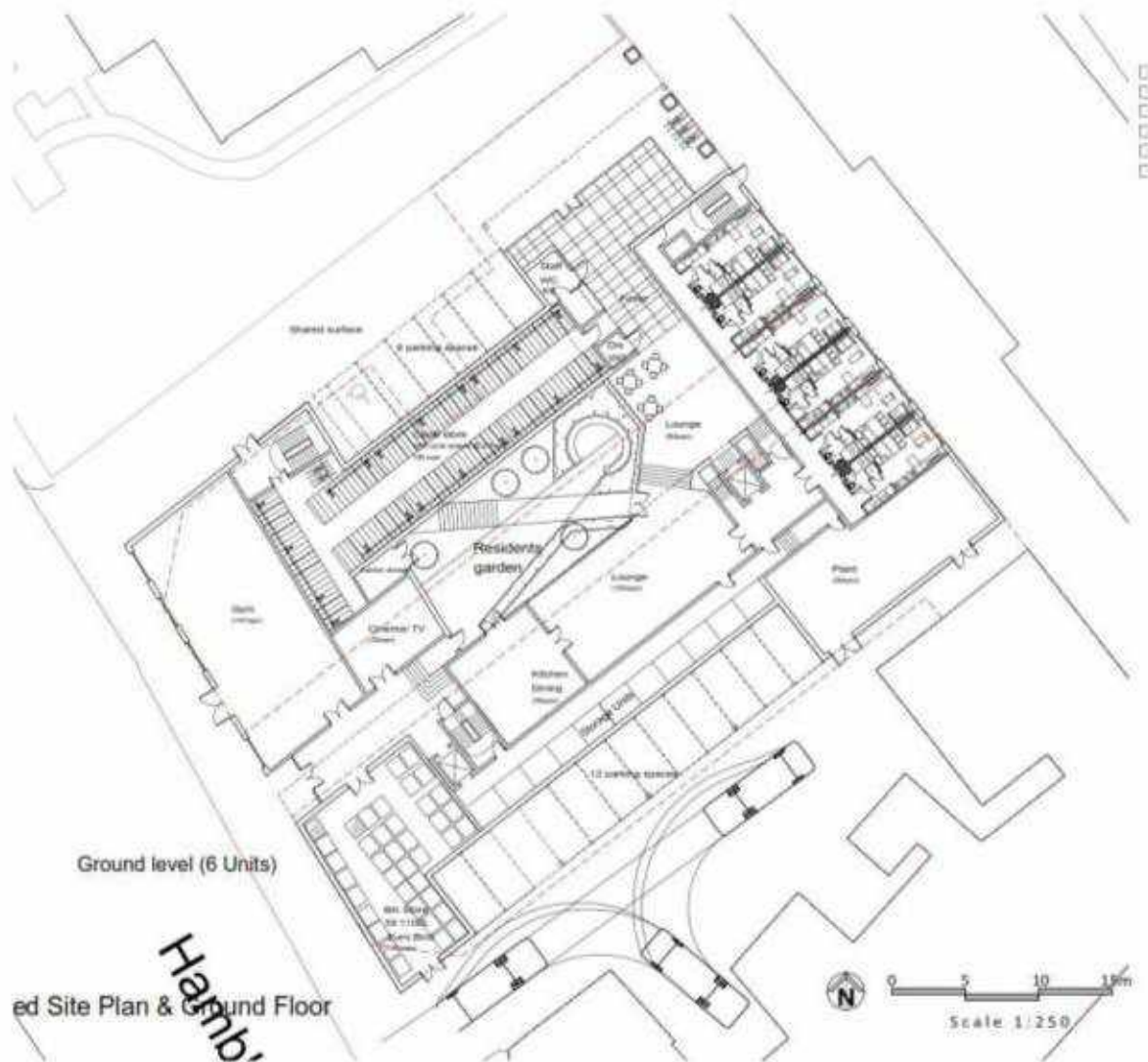


Figure 2: Proposed Site Layout Ground Floor (NTS)

Objective

- 1.3 The objective of this Phase 1 Desk Study (also known as a Contaminated Land Assessment) is to determine the contaminative status of the site and to provide a general indication of the likely geoenvironmental issues which may be present on site or affect the site, as well as to provide guidance on any resultant liabilities. Information on likely geotechnical conditions and hazards is also to be assessed.





Scope of Works

1.4 The scope of works for the desk study is summarised below:

- Review of available historical Ordnance Survey maps (dating back to the mid-1800s) of the site and surrounding areas to identify current or former potential sources of contamination both on-site and within the immediate surrounds;
- Review of published geological, hydrogeological and hydrological records to assess the environmental setting of the site and surrounding areas;
- Review of available public information and up-to-date regulatory information from relevant authorities to identify any potentially significant environmental issues at the site and surrounding areas;
- Review of any existing information and reports relating to the site and surrounding area, including any available plans, development layouts etc; and
- Development of a conceptual site model and risk assessment following the source-pathway-receptor pollution linkage.

1.5 The Phase 1 Desk Study has been prepared in keeping with best practice and current planning guidance. *The National Planning Policy Framework (NPPF)*¹ advises regulatory consultees to ensure that adequate site investigation information is provided at the initial planning stage, whilst the Environment Agency's *Model Procedures for the Management of Land Contamination (CLR11)*² requires a phased, risk based approach when dealing with land affected by contamination in the UK.

1.6 This Phase 1 Desk Study forms the first stage of an iterative contaminated land assessment, to identify any potential sources of contamination before undertaking any further intrusive Phase 2 investigation works or remedial action, if required. The methodology adopted in this Phase 1 Desk Study is based on the source-pathway-receptor model as set out in *CLR11*². More information on Lustre's approach to such assessments can be found at the following link: www.lustreconsulting.com/Services/ContaminatedLandAssessment.aspx and in Appendix A.

¹ Department for Communities and Local Government, National Planning Policy Framework, March 2012.

² DEFRA/Environment Agency, Model Procedures for the Management of Land Contamination, CLR11, September 2004.





Asbestos Containing Materials (ACM)

- 1.7 Under Regulation 4 of the Control of Asbestos Regulations 2012³, those parties ("duty holders") who have control over the maintenance or repair of non-domestic premises are required to identify and manage any asbestos or presumed asbestos found in their premises. Where asbestos is or is liable to be present, the duty holder(s) shall ensure that they have an adequate management plan, undertake and review risk assessments and maintain an Asbestos Register detailing the probable exposure to all employees and site users. The duty holder may be the business owner, landlord, tenant, or others by virtue of a contract.
- 1.8 Regulation 5 requires duty holder(s) to identify asbestos prior to maintenance or any other work which exposes or is liable to expose employees to asbestos unless there has been a sufficient assessment. There is always a risk that asbestos will be present in soils, under hardstanding and below ground structures, and that it may spread particularly during clearance and demolition works. It is therefore essential that any asbestos or presumed asbestos is identified, managed, removed and disposed by a licensed remover (if licensable work) in accordance with relevant HSE guidance. It is the responsibility of the duty holder under Regulation 16 to ensure measures are put in place to prevent the 'spread' of asbestos.
- 1.9 Where ACM in existing structures (i.e. within the building fabric) is observed during the site walkover, a brief description will be included in this report in order to inform our assessment of Asbestos Containing Soils (ACS) (presented in Chapter 2.0). It must be noted however, that this Phase 1 Desk Study does not include detailed identification and assessment of ACM within existing structures both above and below ground (i.e. basements, services). This should be carried out by an appropriately experienced and qualified asbestos surveyor and is outside of our agreed scope of works.
- 1.10 Where ACM is present on proposed development sites, there is always a risk of impacting the underlying soils, particularly during clearance and demolition works. It is therefore essential that any ACM identified by the asbestos surveyor is appropriately managed, removed and disposed offsite by specialist contractors in accordance with good practise and current guidance. It is the responsibility of the duty holder and / or client to ensure measures are put in place to prevent contamination of the soils during such works.

³ Control of Asbestos Regulations (CAR) 2012





Report Structure

- 1.11 The report structure generally follows the pollution linkage approach described above. Chapter 2 of the report provides information relating to the **"source(s)"** of potential contamination through a study of current and historical land uses, whilst the sensitivity and anthropology information in Chapter 3 relates to the **"receptor"** and **"pathway"** components. Report conclusions, including a summary of the conceptual site model and risk assessment Appendix, are set out in Chapter 4. Recommendations for further actions, where considered necessary, are presented in Chapter 5.





2.0 LAND USE

Introduction

- 2.1 This Chapter identifies and provides information on any potential on-site and off-site **"sources"** of contamination within the source-pathway-receptor model. The chapter includes a review of information obtained from photographic records, publicly recorded information on environmental issues and controls within relevant distances of the site (which may indicate the presence of potential source(s) of contamination, such as licensed landfills), available planning records obtained from regulatory websites and OS historical mapping. A summary of the identified sources and potential contaminants are given at the end of the chapter.

Site Description

- 2.2 A site walkover was undertaken by a qualified consultant from Lustre on 29th November 2017. Matt Dean of Lustre Consulting was present throughout the site walkover and access was granted to M&Co. (the only occupied building that required access) and all external areas.

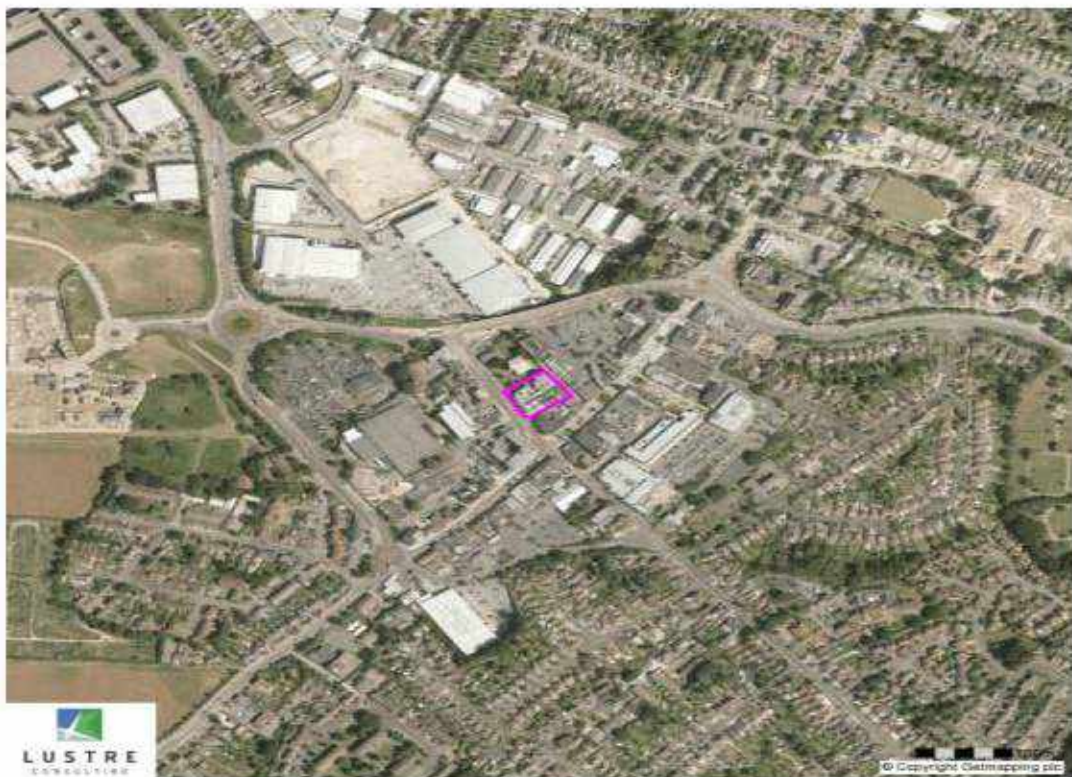


Figure 3: Aerial Photograph





- 2.3 The subject site is part of Wellington Way Shopping Centre, a two storey concrete framed retail development constructed circa 1960s, with brick and block façade. The retail units are arranged in two distinct blocks, one to the north west and one to the south east bisected with a paved pedestrian precinct that runs centrally. The main entrance to the retail units are from the precinct, with tradesman entrances to the rear of the units available via shared access to the north west and south east of the site. It appeared that much of the ground floor within the retail units was taken up with retail space, with the first floor used for storage of goods and materials. The site was noted as sloping gently from the north east to the south west down to Hambledon Road, following the general topography of the area. The fall from the top of the site to the bottom was approximately 1m.
- 2.4 At the time of the walkover, half of the units were recorded as vacant. The vacant units appeared to have once been occupied by a charity shop, an angling and bait shop, a baby goods outlet, a café and a toy shop. The remaining occupied units included charity shops, a health food shop, an estate agent, a greengrocer and a clothing shop. There was no notable sign of ground contamination associated with the current use of the site.



View of retail units and precinct towards Hambledon Road



Tradesman entrance behind north western block

Observations on Ground Stability and Structural Damage

- 2.5 No evidence of ground stability hazards or significant structural damage was observed on site. However, this report does not constitute a structural survey or similar survey. It was noted that some of the exposed concrete frame had appeared broken away from the main structure, most likely due to some localised corrosion.





Retail units and view of concrete frame



Shared tradesman entrance to the rear of south eastern block

Bulk Storage of Fuels and Hazardous Material

- 2.6 Lustre has not been made aware of, or observed, any current or former bulk above ground fuel storage areas/ hazardous material storage on site. No evidence of any current underground fuel tanks (e.g. unexplained manhole covers, vents, fill points etc) was noted during the site walkover.

Asbestos Containing Soils (ACS)

- 2.7 ACM was commonly used in construction and refurbishment projects until their use was prohibited in 1999. Given the age of the buildings present on site (including any refurbishment works), the potential for ACM to be present within the building fabric and curtilage is highly likely. The presence of a boiler room in M&Co. at roof level lead to the internal investigation of that room to check for the potential of ACMs. On arrival, it was clear that this unit had undergone its own asbestos management survey which was confirmed by the manager. However, it was not made available at the time of the survey. Asbestos warning signs were noted on the floor tiles (likely present in the vinyl tiles and bitumen) and on the door of the boiler room. A quick inspection of the boiler room noted the presence of asbestos containing materials in the pipe lagging, water cisterns, electronic switch gear and redundant boilers. The lagging was in good condition and had been painted.
- 2.8 Soil contamination from asbestos can be caused through inappropriate use and poor care of ACM in the building fabric and curtilage causing cross contamination during historic demolition or renovation works. ACS can also be encountered within infilled land and/or imported sub base / fill materials associated with previous construction or renovation works (such as the construction of a new hardstanding). Taking into account the date of construction /





renovation/refurbishment works and historical demolition works the potential for ACS to be present underlying the hardstanding should be considered.



View of vinyl floor tiles in M&Co.



View of ACM lagging and pipework in M&Co. Boiler room

Waste

- 2.9 Waste generated at the site appears to include general commercial waste and recyclables. Wastes are generally stored in Eurobins located service yards at the rear of the retail units. The retail tenants are responsible for the appropriate collection and disposal of waste materials.
- 2.10 Based on the site use, potentially contaminative waste streams are not considered likely. General domestic type waste is likely stored in small volumes for regular collection by an appointed and licensed waste contractor.

Drainage

- 2.11 Only sanitary wastewater, surface water run-off (from roof areas and hardstanding) is generated on site. No evidence of activities that would require a Discharge Consent was observed. Lustre *has not* been made aware of any oil / water interceptors within the site drainage system by the Client.
- 2.12 Existing drainage plans were not made available for viewing, however the property is expected to drain to the municipal sewerage system. A number of manhole covers for foul and/or surface water were observed around the site.





Persistent Organic Pollutants (POPs, inc. Polychlorinated Biphenyls (PCBs))

- 2.13 No sub-stations, high voltage cables (in excess of 100kV) or other potential sources of PCB were identified at the site.
- 2.14 No other specific POP point sources were identified during the site inspection that could have adversely impacted soils on site.

Invasive Species

- 2.15 No invasive species (e.g. Japanese knotweed, Giant Hogweed, Himalayan Balsam) were identified during the site walkover, however the site visit conducted does not constitute a full 'injurious weeds and invasive plants' survey.

Potential Off-site Sources / Points of Interest

- 2.16 The site is surrounded by commercial and retail activities with a relatively modern place of worship (built circa 1950s) noted adjacent to the north west boundary of the site. It is understood that Timpson's undertake dry cleaning off-site. There were no notable potential sources of contamination adjacent to the boundary of the site.

Further Surveys

- 2.17 Whilst the site walkover discussion references observations made regarding the presence of features/issues such as invasive species, ACM, site drainage and evidence of structural abnormalities, this report does not constitute specialist surveys on these matters. Should further specialist surveys be carried out in this regard, the findings of these should be reported to Lustre so that we may determine if this has any discernible impact on the findings of this report.

Public Record Information

- 2.18 Information on potentially significant environmental issues and controls at the site and surrounding area may be held on public records by various regulatory authorities. Information referenced in this Chapter has been sourced directly from the regulatory authorities and from the Landmark database (data summarised within relevant distances of the site centre). A copy of the Envirocheck report is attached at Appendix B. A summary of the significant environmental issues and controls in the Envirocheck report is summarised in the following table.





Public Record	On site / Off site	Features
Environmental Permits for Part B Processes	Off site	Four records are noted within 500m of the site, with the closest located circa.90m NE held by Solent Dry Cleaners Ltd and pertains to PG6/46 dry cleaning. Approximately 230m W and 290m SW two PG1/14 permits are listed for active PFS's and 380m NW a surrendered authorisation is listed for Part B processes at Hopkins Recycling Ltd.
Pollution Incidents to Controlled Waters	Off site	There are no pollution incidents recorded within 250m of the site.
Hazardous Substances	Off site	There are no hazardous substances (e.g. Control of Major Accident Hazards (COMAH), Notification of Installations Handling Hazardous Substances (NIHHS) or Planning Hazardous Substance Consents) recorded within 250m
Landfill Sites	Off site	One Landfill Site is recorded within 1km of the site. This is recorded circa. 470m E of the site at the Old Council Depot on Hulburt Road and was licensed to accept Household Waste. No information is available regarding dates of operation. The site is recorded as both an Historical Landfill and a Local Authority Recorded Landfill.
Waste Management Facilities	Off site	There are no Licensed Waste Management Facilities (LWMF) or registered waste treatment / disposal sites recorded within 250m of the site.
Contemporary Trade Directories	Off site	A total of 37 entries are recorded within 250m of the site. The closest entry is recorded approximately 20m SE of the site and relates to an inactive Dry Cleaners (Brooks).The next closest two entries are located circa. 30m S and 70m NE and relate to a pet food and animal feed retail unit and a Dry Cleaners respectively, both of which are recorded as inactive. Other entries include car dealerships, tyre suppliers, garage services, printers, photographic processors and furniture manufacturers. Approximately 75% of the entries are listed as inactive.
Petrol Filling Stations (PFS)	Off site	One recorded within 250m of the site, located approximately 240m W of the site at an Asda Supermarket, on Maurepass Way.

The approximate bearing of identified features is abbreviated with the first letter(s) (e.g. south-west = SW).

Review of Regulatory Information

- 2.19 A review of the Environment Agency's website⁴ has not identified any additional pollution incidents to those summarised in the table above or provided any further information relating to landfill sites within the surrounding area.

⁴ Information from Environment Agency Website: www.environment-agency.gov.uk consulted in month of report issue





2.20 A review of the available online planning records held by Havant Borough Council has not provided any pertinent information relating to the subject site.

2.21 The EHO at Havant Borough Council has been contacted and a response is awaited.

Previous Environmental Reviews / Intrusive Investigations

2.22 The following previous Environmental Reports have been produced for the site:

- Environmental Audit, Wellington Way Precinct, Waterlooville, Hampshire, Watts and Partners, June 2005 (Ref: ARGJMcC/AT/51811).

2.23 A pre-acquisition environmental audit was carried out at the site by Watts & Partners in 2005. The report included: a site inspection; a review of the history of the development of the site; regulatory enquiries to Building Control, the Environmental Health Department, the Planning Department and the Environment Agency; and a review of the environmental sensitivity of the site.

2.24 No issues of environmental concern were reported from the site inspection. The report did identify both on and off-site historical potential sources of contamination (including the former on-site motor works). However, the Local Authority indicated that it was not aware of any significant contamination issues in connection with the site and that the site was unlikely to be classified as 'contaminated land' under the provisions of Part IIA of the Environmental Protection Act, 1990.

2.25 Given the low sensitivity of the site in terms of groundwater and surface water resources, Watts and Partners concluded that the site was low risk with regards to environmental liabilities and that no further investigations were deemed necessary prior to purchase of the property.

- Phase I Environmental Review: Wellington Way Shopping Centre, Waterlooville, Hampshire PO7 7ED, UK, Ambiente International LLP, April 2014.

2.26 Ambiente International LLP was commissioned by Westbrook Partners on behalf of F9 CPI Holdings Limited to carry out a Phase I Environmental Review of: Wellington Way Shopping Centre, Waterlooville, Hampshire, PO7 7ED, UK in conjunction with the proposed acquisition of the property. The report included: a site inspection of the wider Shopping Centre; a review of the history of the development of the site; regulatory enquiries to the Environmental Health Department and a review of the environmental sensitivity of the site.

2.27 The report generally confirmed the findings of the previous Environmental Audit, with no issues for concern reported from the site inspection and the main potential sources of contamination confirmed as motor works, which were historically present onsite from 1930 until 1960 and the





potential for asbestos containing materials to be present within the onsite structures. The site was also assessed as having low sensitivity in terms of groundwater and surface water resources given the presence of low permeability London Clay Formation directly underlying the site.

- 2.28 The potential environmental risks associated with the historical industrial use of the property were assessed to be very low for site users/maintenance workers. The potential environmental risk associated with the presence of asbestos containing materials on site was assessed to be moderate to site users /maintenance workers. This assessed level of risk reflected the severity of the consequence of exposure to asbestos fibres and the lack of available asbestos documentation. The potential environmental risk associated with migration of contaminant from nearby industrial land uses from the 1870s to present was also assessed to be very low for site users/maintenance workers.
- 2.29 The level of environmental risk associated with the continued use of the subject property was assessed to be acceptably low and no further environmental investigation or assessment was considered necessary prior to purchase of the site.

Site History

- 2.30 The site history has been assessed by reviewing historical Ordnance Survey maps provided by Landmark and aerial photographic imagery from Google Earth. Relevant maps are reproduced in Appendix C. The historical development of the site and the surrounding area are summarised in the following tables. Where features are identified as having a potential impact on the proposed development, an indication of potential contaminants has been provided at the end of the Chapter.
- 2.31 It is noted that the mapping process adopted in generating the historical Ordnance Survey records (mapping intervals/frequency, scale, inclusion/exclusion of features etc), may result in an incomplete account of a site's history. Changes in land use between mapping dates, or small yet potentially contaminative land uses, may not be identified from the records. The following account is therefore based solely on the information provided in the mapping records and the dates listed should be considered as approximate.

On Site Land Use	Date Feature Present	Date Feature Removed
The site comprises undeveloped land, likely residential gardens with a small dwelling present within the eastern corner of the site.	1879	1897





Two rectangular buildings have been constructed adjacent to the western site boundary, likely residential or commercial. The remainder of the site comprises undeveloped land	1897	1932
A motor works has been constructed across the site, extending offsite to the north and north east. Buildings associated with the works remain within the western section of the site, whilst the remainder of the site comprises a works yard.	1932	1953
The site remains as a motor works with the addition of several smaller units within the eastern section of the site and the demolition of buildings along the western site boundary.	1953	1966
The motor works have been demolished and the whole site comprises vacant land	1966	1972
The site has been redeveloped as commercial shopping centre, subdivided into smaller connected units.	1972	Present

The approximate bearing of identified features is abbreviated with the first letter (e.g. south-west = SW). Approximate distances are interpreted from historical mapping and in metres.

- 2.32 Environmentally pertinent historical information from the immediate surrounding area (within 250m) has been summarised in the following table.

Surrounding Land Use	Distance / Bearing	Date Feature Present	Date Feature Absent
Motor Works	Adjacent / N / NE	1932	1966
Vacant Land		1966	1972
Wellington Way Shopping Centre		1972	Present
Electricity Substation	60m / N	1972	Present
Builders Yard	60m / NE	1953	1966
Warehouse		1966	1973
Works		1973	1977
Car Park		1977	Present
Depot	100m / NE	1973	1993
Mixed Commercial and Industrial Estate		1993	Present
Electricity Substation	100m / NW	1973	Present
Engineering Works	105m / NE	1973	1993
Mixed Commercial and Industrial Estate		1993	Present
Electricity Substation	105m / SW	1953	Present
Printing Works	120m / NE	1973	1993
Mixed Commercial and Industrial Estate		1993	Present
Electricity Substation	120m / NE	1972	Present
Electricity Substation	120m / E	1973	Present





Surrounding Land Use	Distance / Bearing	Date Feature Present	Date Feature Absent
Works	120m / SE	1972	1993
Car Park		1993	Present
Builders Yard	130m / W	1966	2006
Residential		2006	Present
Builders Yard	130m / SW	1961	1972
Car Park		1972	1980
Supermarket		1980	Present
Garage	130m / S	1973	Present
Leather Goods Factory	130m / SE	1966	1993
Car Park		1993	Present
Allotment Gardens	135m / W	1897	1993
Supermarket		1993	Present
Garage	140m / NW	1966	2006
Supermarket		2006	Present
Factory	140m / N	1966	1993
Mixed Commercial and Industrial Estate		1993	Present
Factory	170m / NE	1966	1993
Mixed Commercial and Industrial Estate		1993	Present
Electricity Substation	180m / N	1966	Present
Warehouse	180m / NE	1966	1993
Mixed Commercial and Industrial Estate		1993	Present
Electricity Substations (x2)	180m / SW	1973	Present
Factory	190m / NE	1966	1993
Mixed Commercial and Industrial Estate		1993	Present
Electronic Engineering Works	210m / N	1966	1993
Mixed Commercial and Industrial Estate		1993	Present
Engineering Works	230m / N	1966	1993
Mixed Commercial and Industrial Estate		1993	Present
Coach building works	230m / NW	1966	1993
Commercial Estate		1993	Present
Smithy	230m / SW	1897	1932
Residential / Commercial		1932	Present
Boat building works	240m / N	1966	1993
Industrial Estate		1993	Present

The approximate bearing of identified features is abbreviated with the first letter (e.g. south-west = SW). Approximate distances are interpreted from historical mapping and in metres.





Summary of Identified Potential Sources of Contamination

- 2.33 This section has assessed both the current and historical uses of the site and surrounding areas, as well as publicly available regulatory information. In accordance with *CLR11*, this assessment has allowed potential sources of contamination to be identified.
- 2.34 Based on our understanding, it is considered that some potential sources can be discounted at this stage of the assessment. Potential sources of contamination have only been discounted where sufficient evidence has been gathered to indicate that the particular source, for reasons relating to the viability of its presence/significance, need not be considered further.
- The current use of the site as part of the Wellington Way Shopping Centre will not be considered further reflecting the nature of the on-site activities and the fact that no visual evidence of contamination was noted during the site walkover. It is assumed that a pre-construction asbestos survey will be undertaken, and all ACMs removed before the existing structure is removed.
 - The former builders yard located 130m west of the site has not been considered further as this site has recently been redeveloped to comprise a residential development. Considering this more sensitive end use, it is likely that this site was suitably investigated and remediated under the planning system to be fit for purpose, with the removal of any gross contamination, thereby removing any significant on-going sources of contamination which may impact the site. Similar the garage located 140m north west of the site and the builders yard located 130m south west of the site have also not been considered further due to their redevelopment as part large commercial supermarkets, which would have removed any significant on-going sources of contamination.
 - The smithy located 230m south west of the site has not been considered further as the smithy was converted to residential dwellings in the 1930's. Given the time lapsed since this potentially contaminative land use was active, it is considered unlikely to present a significant on-going source of contamination.
 - The off-site electrical substations located approximately 60m north, 100m north west, 105m south west, 120m north east, 120m north, 180m north and 180m south west of the site have also been discounted from the risk assessment. Although the substations may have been constructed before the use of polychlorinated biphenyls (PCBs) was prohibited (and as such there is a potential for the leaching of transformer oils containing PCBs into the subsurface), the substations are likely to have been regularly inspected and maintained in accordance with The Environmental Protection (Disposal





of Polychlorinated Biphenyls and Other Dangerous Substances) (England and Wales) Regulations 2000, which require all equipment containing PCBs to be disposed of and decontaminated.

- The active Petrol Filling Station located approximately 240m west of the site has also been discounted from the risk assessment due to its recent construction (circa. 2016). This site will have therefore been constructed to be compliant with all guidance issued by the Environment Agency and been compliant with the Environmental Permit issued by the Local Authority, all of which are design to prevent pollution and to protect the environment.

2.35 Viable potential sources of contamination noted in this chapter, which will be carried forward into the conceptual model and risk assessment, include:

- On-site: The site historically comprised a small residential dwelling, with gardens until the 1930s, after which it formed part of a motor works, which extended off-site to the north and north east. The entire motor works was cleared in the late 1960s and by 1972 the site had been redeveloped as part of the Wellington Way Shopping Centre. There is therefore the potential for a layer of Made Ground to be present beneath the site associated with the historical industrial use and clearance of the site prior to its redevelopment, with potential contaminants including asbestos, metals, inorganics, polyaromatic hydrocarbons (PAHs) total petroleum hydrocarbons (TPH) and Volatile Organic Compounds (VOCs). Depending on the amount of putrescible material present in these soils, the Made Ground may also represent a source of ground gas;
- On-site: The potential presence of ACS including infilled land / imported sub-base materials beneath the shopping centre introduced to level the site;
- Off-site: The site is situated within an area with an industrial legacy, particularly to the north and north east of the site including former depots, warehouse, factories, engineering works, electrical engineering works and boat works, which now comprise a mixed commercial and industrial estate, as well as active garages located to the south of the site. Given the proximity of the majority of these uses, the potential for contaminants to migrate onto site should be considered, including metals, organic and inorganic compounds, PAH, TPH and VOCs and SVOCs.
- Off-site: The former Old Council Depot Landfill site on Hulburt Road is present approximately 470m east of the site, which is recorded as both an historical landfill and a Local Authority Recorded Landfill, licensed to accept household waste. The historically mapping records show that prior to 1980 this site comprised a sewage





works with filter beds, which were likely infilled prior to the construction of a council depot in the early 1980s. By 1991 the depot had been removed and replaced by a cemetery. Given the proximity to the site, this historic landfill may represent a source of landfill gas (methane and carbon dioxide) and landfill leachate. However, it is noted that over 30 years has passed since infilling, over which time any significant gas generation phase is likely to have passed. The church next door is showing a grave yard on some of the old historic maps, however due to the time that has lapsed since it was used as an active grave yard, this is unlikely to pose a gas risk.





3.0 SENSITIVITY & ANTHROPOLOGY

Introduction

- 3.1 This chapter provides information relating to on-site and off-site **'pathways'** and **'receptors'** and includes a review of the geology, hydrogeology, hydrology and ecological setting of the site. A general assessment and review of the site anthropology, such as identified human / built environment receptors, including current and future site occupiers, below ground structures, flora etc is also provided. A summary of identified receptors and site specific pollutant linkages is given at the end of the chapter. Any pathways (contaminant migration, exposure pathways), which can be discounted in conceptual terms (i.e. considering the unviable nature of the pathway given the proposed development setting or local geology/hydrogeology etc), are discussed at the end of the chapter.

Geology

- 3.2 The 1:50,000 British Geological Survey (BGS) map (Sheet 316)⁵ and the BGS website (National Geoscience Information Service)⁶ show the site to be directly underlain bedrock geology of the London Clay Formation, comprising poorly laminated, blue-grey or grey-brown, silty to very silty clay.. No superficial deposits are recorded beneath the site.
- 3.3 Superficial Head Deposits, comprising clay, silt, sand and gravel are present approximately 150m north west of the site and extend to the north west in a band approximately 1.5km thick. Given their proximity to the site these superficial deposits may underlie the site, particularly across the north western section.
- 3.4 Given the recorded development of the site to date, a layer of Made Ground of unknown thickness is anticipated on site.
- 3.5 Historic borehole records have been identified relating to boreholes drilled within the general vicinity of the site and surrounding area. The closest historic borehole was recorded approximately 60m north-east of the site (SU60NE232). A summary of ground conditions encountered is provided below and a copy of the borehole log is included in Appendix D.

⁵ BGS Solid and Drift Map Sheet MAP

⁶ Information from BGS website: www.bgs.ac.uk consulted in month of report issue





- Made Ground recorded to a depth of 0.25m bgl.
- Brown and Blue Sandy Clay (likely Head Deposits) to a depth of 3.0m bgl.
- Blue Sandy Clay (London Clay) to a depth of 10.60m bgl.
- Groundwater was encountered at a depth of approximately 0.60m bgl, likely perched within the superficial Head deposits.

3.6 The BGS also holds data on non-coal mining areas and potential ground stability hazards for the UK that may affect the site. The Coal Authority holds data on coal mining affected areas for the UK. The non-mining and potential ground stability hazards provided by Landmark are summarised in the following table.

Details	On-site	Hazard Potential
Mining Instability	No	No Hazard
Man-Made Mining Cavities	No	No Hazard
Natural Cavities	No	None Recorded
Coal Mining Affected Area	No	No Hazard
Non-Coal Mining Affected Area	No	No Hazard
Potential for Collapsible Ground Stability Hazards	Yes	Very Low
Potential for Compressible Ground Stability Hazards	No	No Hazard
Potential for Ground Dissolution Stability Hazards	No	No Hazard
Potential for Landslide Ground Stability Hazards	Yes	Very Low
Potential for Running Sand Ground Stability Hazards	No	No Hazard
Potential for Shrinking or Swelling Clay Ground Stability Hazards	Yes	Low

- 3.7 No BGS Recorded Mineral entries are listed within 1km of the site.
- 3.8 No man-made cavities or natural cavities are recorded within 1km of the site.
- 3.9 The site is located within a low probability radon area, as less than 1% of homes are above the action level; no radon protective measures are considered necessary in the construction of new dwellings or extensions.





Hydrogeology

- 3.10 The Groundwater Vulnerability Map of England and the Environment Agency website⁷ have been reviewed to determine the aquifer designations. The London Clay Formation is listed as being an unproductive stratum. These are low permeability strata which are not considered to retain significant quantities of groundwater. If groundwater is present within unproductive strata, for example within more permeable lenses or small fissures, it is typically discontinuous, of low value and very low sensitivity.
- 3.11 The site is located within a groundwater Source Protection Zone (SPZ) - Zone 1c (Inner Zone) for subsurface activity only.
- 3.12 No groundwater abstractions are recorded within 1km of the site.
- 3.13 No groundwater discharge consents are recorded within 250m of the site.
- 3.14 A detailed description of the various aquifer types, soil classifications and Source Protection Zones is provided in Appendix A.

Hydrology

- 3.15 The closest surface water feature is a drain located approximately 185m south. A network of drainage channels is also present approximately 250m west of the site which eventually discharge into Southwick Park Lake, located approximately 4.5km to the south west of the site. These surface water features are not monitored by the Environment Agency under their River Basin Management Plans.
- 3.16 No surface water abstractions are recorded within 1km of the site.
- 3.17 One surface water discharge consent is recorded within 250m of the site. This relates to a lapsed consent registered to the Asda supermarket site located approximately 180m west of the site. The discharge consent was for other matter surface water into an unknown freshwater / stream.

⁷ Information from Environment Agency Website: www.environment-agency.gov.uk consulted in month of report issue





Ecology

- 3.18 A review of the MAGIC (Multi-Agency Geographic Information for the Countryside) website⁸ indicates that the site is not located within an ecologically sensitive area. There are no recorded Nature Reserves, Conservation Areas, National Parks, Areas of Outstanding Natural Beauty (AONB) or Sites of Special Scientific Interest (SSSIs) within 1km of the site.
- 3.19 The site is located within a Nitrate Vulnerable Zone (NVZ).

Environmental Sensitivity

- 3.20 The sensitivity of each of the identified receptors is rated depending upon the environmental setting of the site, the likelihood for pollutant linkages to be present and potential consequence of those potential pollutant linkages. The assessment approach adopted is based on guidance set out in the *NHBC R&D 66*⁹ document.
- 3.21 Groundwater within the London Clay Formation is considered to have a Very Low groundwater sensitivity (L2), which is described in the guidance as being a "Not a recognised aquifer, but strata beneath site may retain a small amount of contaminated liquid but there is likely to be limited vertical penetration." This reflects the classification of the London Clay Formation as unproductive stratum. However, it is noted that the site is located within Zone 1c of a Groundwater SPZ, for subsurface activity only. This likely relates to groundwater within any superficial deposits in the area rather than the low permeability London Clay. Based on the BGS mapping records Superficial deposits are not anticipated to be present across the site, with the closest superficial deposits, comprising Head deposits, present approximately 150m to the north west of the site.
- 3.22 Due to the sites location within Zone 1c of an SPZ groundwater within any Superficial deposits in considered to have Very High groundwater sensitivity (H1) which is described in the guidance as being " Highly vulnerable aquifer, actively used in vicinity of site with short travel times to sources of supply or sensitive watercourses. Likely to be within an inner or outer groundwater protection zone (Zones I or II under EA protection policy). All contaminant releases to the ground environment of concern".

⁸Information from Environment Agency Website: <http://magic.defra.gov.uk/> consulted in month of report issue

⁹ Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66, NHBC, 2008





- 3.23 The site is considered to have a Low surface water sensitivity (L1), which is listed in the guidance as a "Within catchment of and over 250m from generally poor quality watercourse (GQA E or F) that is unlikely to improve by current or foreseeable surface water quality objectives or at distance (over 1000m) from a good quality watercourse with no interconnecting drains or baseflow from fissured strata." This reflects the absence of controlled surface waters within 1km of the site. The closest surface water feature is a drain, located approximately 185m to the south of the site. This is unlikely to be in hydraulic continuity with the site due to the presence of low permeability London Clay directly underlying the site and the land to the south.
- 3.24 The site is considered to have a low ecological sensitivity given the absence of any formal ecological receptors either on-site or within proximity to the site.
- 3.25 The sensitivity classifications noted above have been taken into consideration in the development of the conceptual model presented at the rear of this report.

Anthropology

- 3.26 Proposed anthropological receptors at the site are considered to include future residents, site workers and visitors. In the short term, groundworkers and construction personnel will also be considered.

Summary of Identified Receptors and Site Specific Pollutant Linkages

- 3.27 A review of the environmental sensitivity and proposed anthropological use of the site has identified the following **receptors**, as detailed below.

Identified receptors:

- Future site workers and visitors,
- Future site residents and visitors,
- Ground / construction workers,
- Future maintenance / landscape workers,
- Shallow / perched groundwater within Made Ground,
- Groundwater within the Head Deposits (if present beneath the site),
- Surface water,
- Adjacent land (including neighboring residential dwellings, wild animals, livestock),
- Flora,
- Below ground structures and foundations, and
- Potable water pipes.





Viable pathways and pollution linkages:

3.28 A number of **viable migration and exposure pathways** and potential pollutant linkages have been identified, whereby a receptor may be exposed to a source. The viable pollutant linkages have then been used to develop a conceptual model. The following is a summary of **viable**, site specific pathways and pollutant linkages to be considered further:

- In areas of open ground the following exposure pathways to humans are considered to be active:
 - Inhalation of contaminated dust, and
 - Dermal contact and direct ingestion of contaminated soils,

It is noted that these exposure pathways are only active in communal soft landscaped areas; permeant hardstanding breaks the potential pathways.
- Inhalation of toxic vapours, potentially migrating into above ground structures from organic contaminants within the Made Ground, contaminated groundwater or localised spills / leaks. Potential for vapours to migrate through hardstanding and open ground.
- Hazardous ground gases, potentially generated by the Made Ground or organic-rich natural soils, may migrate into above ground structures and accumulate within building voids and enclosed spaces (resultant risk of asphyxiation and / or explosion).
- Shallow soil contamination has the potential to vertically migrate downwards into the underlying natural soils and perched or shallow groundwater by leaching and infiltration. These processes are enhanced in areas of soft landscaping due to an increased infiltration potential. Conversely, areas of hardstanding reduce infiltration potential and leaching rates, which results in a lower mobility of any shallow contamination.
- Flora grown within areas of soft landscaping may be exposed to contaminants through root uptake mechanisms.
- Below ground concrete structures and foundations are susceptible to chemical attack from aggressive ground conditions (pH and water soluble sulphate).
- Potable water pipes are susceptible to chemical attack from shallow soil contamination.
- Lateral migration of site-borne contaminants to off-site areas (down hydraulic gradient), including adjacent land and surface water (via surface water runoff and baseflow).
- Ground gases generated off-site may also migrate through the Made Ground and more permeable lenses of the underlying natural soils onto site.
- Lateral migration of potentially contaminated shallow groundwater from off-site areas (up hydraulic gradient), impacting on-site groundwater.



*Non-viable pathways and pollution linkages*

3.29 The following site specific pathways and pollutant linkages are not considered to be viable, and therefore discounted from the conceptual model and risk assessment:

- The London Clay Formation, directly underlying the site is noted to be a low permeability clay geology, with a very low porosity and permeability. As such this stratum is not anticipated to be a viable groundwater aquifer or capable of storing or transmitting significant quantities of groundwater. Any groundwater present will likely be held within discontinuous more granular lenses and be of limited value and low significance. The potential for significant mobilisation of contamination within this stratum is therefore very low. As such, the vertical mixing of shallow groundwater can be discounted. This will also limit the potential for the lateral migration of site-borne contaminants to off-site areas (down hydraulic gradient), including the off-site surface water located to the south and west of the site. Surface water has therefore been discounted as a viable receptor given the absence of a pollutant linkage.
- Migration of potential sources of off-site contamination located to the south, east and west of the site: Acknowledging the presence of low permeability London Clay directly underlying areas to the east, south and west of the site and the absence of more permeable superficial deposits the lateral migration of off-site contaminants from potential sources located to the east, south and west of the site is not considered viable. This includes the historical landfill recorded at the Old Council Depot approximately 470m east of the site.





4.0 CONCLUSIONS

Geoenvironmental Considerations

- 4.1 A conceptual model and qualitative risk assessment have been included at the end of this report. The risk ratings assigned in the risk table, and summarised in this Chapter, are based on information obtained through desk-based research, a site walkover and on our experience in assessing risks from similar sites.
- 4.2 This Phase 1 Desk Study has determined that there is a moderate to low potential for contamination to be present on site in a circumstance which could lead to unacceptable risks to identified receptors. This is driven by the potentially contaminative historical land use (motor works) as well as the demolition of the former onsite structures prior to the construction of The Wellington Way Shopping Centre. The proposed end use of the site (comprising a residential development with limited communal gardens at ground level), where potential exposure pathways between the identified potential sources of contamination and future site users are likely has also been taken into consideration.
- 4.3 As illustrated in the risk assessment table, a number of the risks attributable to viable pollutant linkages were considered to be low and very low. However, the risks which require further consideration are detailed below:
- **Moderate /low** risks have been assessed to construction and ground workers from Made Ground beneath and around the shopping centre as a result of historical industrial use and redevelopment work. The pathway considered relates to the inhalation of contaminated dusts, gases and vapours, dermal contact and direct ingestion of contaminated soils.
 - **Moderate / low risks** have also been identified to buried services (potable water pipes) from the Made Ground across the site, reflecting the introduction of residential users.
 - An initial **moderate/ low** risk has been identified from ground gases within the shallow soils underlying the site and from the identified potential off-site sources of contamination to the north and north west of the site. Based on the CIRIA C665 risk matrices, the severity of this risk is the principal driver for the moderate / low risk rating. Acknowledging the unlikely occurrence due to the anticipated absence of significant putrescible materials within the Made Ground underlying the site and naturally low organic content of the underlying natural soils (*London Clay*), the risk from ground gas is considered to be **acceptably low**.





- 4.4 Based on the above findings and with due regard to the proposed redevelopment of the site for residential housing development with gardens, it is the opinion of Lustre that the site represents an overall **moderate / low** risk with respect to environmental issues.
- 4.5 The qualitative nature of the risk assessment is not absolute. Furthermore, although very low and low risks may have been assigned to various pollutant linkages, the risk cannot be eliminated (i.e. "no risk") at this stage of the assessment and residual risks will remain which should not be discounted on the basis that the risk is low.

Comments on Waste Classification

- 4.6 Separate to the human health and wider environmental risks from potential contamination, the presence of some contaminants can also impact the waste spoil disposal costs. Depending on the chemical composition of the Made Ground and any contaminants present and their distribution, soils may require different levels classification for waste disposal purposes. For example, the presence of asbestos within the Made Ground or any historic demolition waste can significantly change the classification of waste soils which could incur greater disposal costs. The Client should consider the impacts that this may have the overall waste disposal strategy for the site. This is likely to pose more of a factor when removing potentially contaminated soils due to the scale of the development works rather than managing environmental protection issues, much of which will be managed as a consequence through the nature of the development.

Initial Geotechnical Considerations

- 4.7 The BGS information shows that the site is directly underlain bedrock geology of the London Clay Formation, comprising poorly laminated, blue-grey or grey-brown, silty to very silty clay. No superficial deposits are recorded beneath the site.
- 4.8 A significant body of shallow groundwater is not anticipated to be present beneath the site due to the likely absence of permeable superficial deposits. However, within an historical borehole located approximately 60m north east of the site perched groundwater was encountered at 0.60m bgl within the more permeable lenses of the Head deposits.
- 4.9 A Phase 2 Site Investigation should be undertaken to assess the ground conditions beneath the site and to determine the most suitable foundations option based on the proposed development plans. It is likely that based on the size and scale of the development that piles will be required to support the proposed superstructure taken down at depth into the London





Clay Formation. The geotechnical assessment will need to ensure suitable coverage and depth of boreholes and shear strength testing of the soils.

Statutory Designation

- 4.10 The *National Planning Policy Framework (NPPF)* states that "land should be suitable for its new use and as a minimum, after carrying out remediation (if required), the land should **not** be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990". It is our opinion that, based on the findings of this Phase 1 Desk Study, it is unlikely the site would be designated as statutory contaminated land by the Local Authority under the provision of the published Statutory Guidance. It is advisable however, that any recommendations made in Chapter 5 are implemented in line with current guidance and good practice, especially where verification of the risk assessment is necessary.





5.0 RECOMMENDATIONS

- 5.1 Based on the findings of this Phase 1 Desk Study, there is now a clear understanding of the potential sources of contamination at the site and the risks posed to identified receptors. The anticipated contaminative status of the site is not considered, in our opinion, to be prohibitive to the proposed redevelopment scheme. The risk ratings identified should be verified and possibly reduced by the implementation of the following recommendations.
- 5.2 It is recommended that a Phase 2 Site Investigation is undertaken due to the potentially contaminative historical land use identified. The investigation should focus principally on assessing the engineering capacity of the London Clay Formation for foundation design and to establish the presence or absence of more permeable superficial Head Deposits across the site. Sampling and testing of the shallow soils (and groundwater if encountered) should be undertaken to verify its condition and confirm the risk levels identified within this Phase 1. Such an investigation would also determine the suitability of onsite soils if they are to be retained in the communal garden areas and validate the ground gas regime beneath the site. It is recommended that this investigation be undertaken following the clearance of the site and could be conditioned as part of planning application post – clearance.
- 5.3 A suitable asbestos survey should also be undertaken at each site prior to the start of any site demolition works, if not already completed. If encountered, asbestos and asbestos containing materials, should be dealt with in accordance with CAR 2012.
- 5.4 Should there be a need for the disposal of soils as part of the development, it is recommended that the Client consider the need for undertaking a waste spoil assessment as part of any intrusive works. This may include an assessment of the hazardous nature of the soil by virtue of any contamination (in accordance with the Waste Framework Directive and the Environment Agency's *Technical Guidance WM3 Hazardous Waste*¹⁰), and Waste Acceptance Criteria (WAC) testing.
- 5.5 Whilst this report references observations made regarding the presence of features/ issues such as invasive species, ACM, site drainage and evidence of structural abnormalities, this report does not constitute specialist surveys on these matters. Should further specialist surveys be carried out in this regard, the findings of these should be reported to Lustre so that we may determine if this has any discernible impact on the findings of this report.

¹⁰ Technical guidance WM3: Guidance on the Classification and Assessment of Waste (1st Edition 2015). Environment Agency.





- 5.6 Finally, this assessment has been carried out to determine the potential risks posed to future end users, along with other key receptors, based on the current development proposals, as set out in Chapter 1. Should revisions in the development proposals result in a change any assessment parameters detailed in this report, a re-assessment of the risk should be carried out.



**CONCEPTUAL
MODEL & RISK
ASSESSMENT**

ENVIRONMENTAL RISK ASSESSMENT

This section assesses the significance of the environmental issues that have been identified on the site or in the surrounding area. This is achieved by developing an initial conceptual model for the site and undertaking a qualitative risk assessment.

The objective of the conceptual model is to identify potential contaminant "source(s)", "pathways" and target "receptors" relating to the site and surrounding area. The information obtained is described in detail in the Land Use Chapter and the Sensitivity & Anthropology Chapter. This information is then collated and a qualitative risk assessment^{11, 12} undertaken to assess the source-pathway-receptor linkages. The potential for a pollution event to occur is evaluated using a risk classification tool¹³. The level of risk is assigned by considering the likelihood that a pollution event might occur with the consequence of its occurrence. The consequence is essentially a measurement of the severity of a hazard (or source) and sensitivity of the receptor (e.g. aquifer type or end user).

The Table presented overleaf details the various components of the site conceptual model and evaluates the risks associated with each viable potential pollution linkage. Where additional explanation is required, Justification Notes have been given at the end of the Table. The risk assessment methodology explaining the risk categories together with a risk matrix is given in Appendix A. The risks associated with each potential pollution linkage are also discussed within the report conclusions.

¹¹ Guidance for the Safe Development of Housing on Land Affected by Contamination R&D66, NHBC, 2008.

¹² Construction Industry Research and Information Association (CIRIA). Contaminated Land Risk Assessment. A Guide to Good Practice. CIRIA C552 2001.

¹³ Department of the Environment, Transport and the Regions, Environment Agency and Institute of Environmental Health. Guidelines for Environmental Risk Assessment and Management. HMSO July 2000.

CONCEPTUAL SITE MODEL & QUALITATIVE RISK ASSESSMENT

1777

Wellington Way, Waterloooville

Report Ref: 1777\AR\12-2017\737


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CONCEPTUAL SITE MODEL					QUALITATIVE RISK ASSESSMENT			
Source		Pollutant	Pathway	Receptor	Likelihood of Occurrence	Consequence (severity)	Potential Risk	Justification of Risk
On-site	Made Ground associated with the historical use of the site as Motor Works and subsequent clearance prior to development as the Wellington Way Shopping Centre	Asbestos, metals, inorganics, PAH, TPH, VOCs	Inhalation of contaminated dusts, gases and vapours, dermal contact and direct ingestion of contaminated soils.	Future residents and site visitors	Unlikely	Medium	Low	See Notes: 1, 2, 3, 4
			Inhalation of contaminated dusts, gases and vapours, dermal contact and direct ingestion of contaminated soils.	Ground / construction workers	Low Likelihood	Medium	Moderate/low	See Notes: 1, 2, 3, 5
			Vertical migration downwards via leaching	Shallow / perched groundwater within Made Ground and any Head Deposits potentially extending onto the site	Unlikely	Mild	Very Low	See Notes: 1, 2, 6, 7, 8, 9
			Lateral migration of contaminants to down hydraulic gradient areas in groundwater and surface water runoff	Adjacent land	Unlikely	Mild	Very Low	See Notes: 10, 2, 6, 11
			Root uptake mechanisms	Flora	Low Likelihood	Mild	Low	See Notes: 10, 2, 6, 12
			Chemical attack from aggressive ground conditions (pH and water soluble sulphate) and shallow contamination	Buried services and below ground structures and foundations	Low Likelihood	Medium	Moderate/low	See Notes: 10, 2, 6, 13
		Methane, Carbon Dioxide	Migration and accumulation within building voids and enclosed spaces	Building and site occupants	Unlikely	Severe	Moderate/low	See Notes: 14, 15, 16
	Current and historical industry uses located to the north and	Vapours	Inhalation of vapours from soils and groundwater	Future residents and site visitors	Unlikely	Medium	Low	See Notes: 17, 18, 19

CONCEPTUAL SITE MODEL & QUALITATIVE RISK ASSESSMENT

1777

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CONCEPTUAL SITE MODEL					QUALITATIVE RISK ASSESSMENT			
Source		Pollutant	Pathway	Receptor	Likelihood of Occurrence	Consequence (severity)	Potential Risk	Justification of Risk
Off-site	north west of the site, including factories, depots and an industrial estate	Methane, Carbon Dioxide	Migration and accumulation within building voids and enclosed spaces	Building and site occupants	Unlikely	Severe	Moderate/ low	See Notes: 20, 21, 16

JUSTIFICATION NOTES:

- 1 Contamination likely minor, with possible sporadic localised areas of higher contamination. Any gross contamination expected to have been removed when the shopping centre was constructed
- 2 Potential for leaks and spills of fuels, oils at surface associated with historical motor works and potential for USTs to have been present
- 3 Presence of good quality hardstanding likely to have limited shallow soil contamination associated with current site use and significantly limits leaching potential
- 4 Communal gardens proposed, exposure of end users to shallow soils limited as no home grown vegetation expected
- 5 Construction workers - use of appropriate PPE and awareness of potential hazards through 'toolbox' talks
- 6 Widespread hardstanding significantly limits leaching potential
- 7 Perched groundwater is likely discontinuous and of limited value
- 8 More permeable and sensitive Head Deposits are not anticipated to be present across the site
- 9 Located in SPZ for subsurface soils only, with the site anticipated to be directly underlain by low permeability London Clay, rather than more permeable Head deposits
- 10 Contamination likely minor, with possible sporadic localised areas of higher contamination
- 11 Low permeability soils - limited potential for lateral migration of contaminated groundwater / ground gas
- 12 Residential garden areas, exposure of flora to shallow soils likely
- 13 Potable water pipes likely laid in Made Ground
- 14 Potential for putrescible materials possibly associated with historical demolition works across the site
- 15 Organic material content of soils generally low
- 16 Potential for accumulation of any ground gases in poorly ventilated areas
- 17 Distance to potential vapour source significant. Any volatiles in groundwater will have likely volatilised
- 18 Identified source(s) likely localised and not significant
- 19 Low permeability soils - limited potential for lateral migration of vapours
- 20 Significant thickness / potential for putrescible materials low
- 21 Low permeability soils - limited potential for lateral migration of ground gas



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