



Supplementary Phase II Geo-Environmental Assessment

Pfizer

32 New Lane
Havant
PO9 2NG

Prepared for:

Havant Property Investment LLP

38 Seymour Street
London
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PFIZER, 32 NEW LANE, HAVANT

NON-TECHNICAL CLIENT SUMMARY

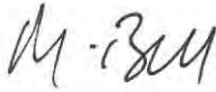
This report presents the findings of a supplementary Phase II Intrusive Investigation undertaken to determine ground conditions, establish if there are any environmental risks associated with the site and its development and to support a geotechnical appraisal. Pertinent findings and conclusions may be summarised as follows:

- A previous Phase I Desk Study identified the site to comprise a pharmaceutical distribution centre formerly used for manufacturing, now intended to undergo redevelopment for commercial purposes. This supplementary investigation was undertaken to fill data gaps and implement recommendations from a previous investigation undertaken at the site by EPS in March 2021, focussed on previously inaccessible buildings, as well as targeting key Potential Areas of Concern.
- This intrusive investigation comprised the drilling of 12 boreholes and 12 trial pits across the site, with ground conditions found to be broadly similar to previous investigations and comprise a variable thickness of made ground overlying successive layers of cohesive and granular River Terrace Deposits. Below this lay London Clay, which comprised of layers of silt and stiff, grey clay. Follow up monitoring identified groundwater to rest at levels ranging between 2.78m (BH7) and 2.96m (BH9), which is also similar to depths in other boreholes across the site.
- Laboratory analysis of shallow and deeper soils has corroborated the findings of the previous investigation. Contamination has not been identified capable of posing a significant risk to future site users or controlled waters in a commercial setting. Additional soil vapour analysis has not identified a risk associated with intrusion of organic vapours into future buildings (or neighbouring properties).
- Although these two phases of investigation have not identified any widespread contamination, an approach to remediation is still recommended based on the likely presence of localised 'hotspots' along with a discovery strategy for any unforeseen contamination. These measures along with general good practise to protect groundworkers and drinking water supplies are presented within an accompanying Remedial Strategy.
- This document should be provided to the Environmental Health Department of Havant Borough Council to support the current planning application. Both this report and the Remedial Strategy will need to be approved by the Council prior to any commencement on site.

ENGINEERING SUMMARY

- As part of this work, EPS drilled two additional deep boreholes for geotechnical purposes within the existing building. The findings of these boreholes indicate very similar ground conditions to those encountered previously. On this basis, the geotechnical recommendations made within section 5 of the previous report are considered appropriate across the site.
- Additional soakaway testing has identified generally medium to good permeability conditions, particularly within the granular layer of the superficial River Terrace Deposits, which may be suitable for infiltration drainage provided a suitable location can be found on site which discharges above the water table.
- A design sulphate class of DS-2 is considered suitable for concrete in direct contact with Made Ground and DS-1 for the superficial River Terrace Deposits at the site, with an aggressive chemical environment for concrete (ACEC) of AC-1. However, the underlying London Clay should be classified as DS3 (AC-3).

The above points represent a simplified summary of the findings of this assessment and must not form the basis for key decisions for the proposed development. A thorough review of the details is contained within the following report, or alternatively get in touch and we'll talk you through it.

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	Appendix I updated discussion on phthalates following regulatory feedback (October 2021)	
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Where ground investigations have been conducted, these have been limited to the level of detail required for the site in order to achieve the objectives of the investigation. The report has been written, reviewed and authorised by the persons listed above. It has also undergone EPS' quality management inspection. Should you require any further assistance regarding the information provided within the report, please do not hesitate to contact us.

The National Planning Policy Framework 2019 requires a competent person to prepare site investigation information, which is defined as a person with a recognised relevant qualification, sufficient experience in dealing with the type(s) of pollution or land instability, and membership of a relevant professional organisation. EPS considers that it fulfils these criteria and would welcome any request for staff CVs or case studies to demonstrate it.

As stated within DEFRA's Contaminated Land Statutory Guidance (2012), with any complex risk assessment it is possible that different suitably qualified people may reach slightly different conclusions when interpreting the same information. EPS recognises this and considers the conclusions presented within this report to be robust and appropriate but input from the Local Authority and their judgement in line with this guidance would still be welcomed.

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1 INTRODUCTION

In June 2021, Environmental Protection Strategies Ltd (EPS) was commissioned by Havant Property LLP to complete a Supplementary Phase II Geo-Environmental Assessment Report at the former Pfizer site, 32 New Lane, Havant PO9 2NG ('the site'); see Figure 1. Selected site photographs are included as Appendix A and a Detailed Site Layout is included in Appendix B.

The work was commissioned in order to fulfil pre-commencement requirements relating to contaminated land for the demolition of the existing buildings and construction of a new commercial warehouse building (Havant Borough Council ref APP/21/00200). A proposed development plan is included as Appendix C.

This current report presents the findings, conclusions, and recommendations of the Supplementary Phase II Intrusive Investigation undertaken as instructed.

1.1 Previous Reports

A number of previous reports have been undertaken for the site by Golder Associates and EPS, which are detailed below and summarised in Section 2 of this report. It is recommended that the previous reports (as below) are reviewed before the reader examines the content of this document.

- *Divestiture Environmental Site Assessment (Golder Associates (UK) Ltd)*, dated 26th September 2019
- *Groundwater Investigation* – Golder Associates (UK) Ltd (ref 20137712.600/A.0, February 2020)
- *Detailed Quantitative Risk Assessment (DQRA) for Controlled Waters* – Golder Associates (UK) Ltd (ref 20137712.602/A.0, March 2020)
- *Phase I Environmental Assessment – 32 New Lane, Havant (Issue 4)* – January 2021 (Reference: UK20.5052)
- *Phase II Geo-Environmental Assessment – Pfizer, 32 New Lane, Havant (Issue 1)* – March 2021 (Reference: UK20.5052c)
- *Supplementary Soil Gas and Vapour Monitoring Letter – Pfizer, Havant (Issue 1)* – June 2021 (Reference: UK20.5052e)

1.2 Objectives

The objectives of this investigation were as follows:

- a) Investigate potential contaminant linkages identified in the Conceptual Site Model (CSM) by means of investigating shallow soils, groundwater and soil gases.
- b) Determine the potential risks posed by the site and make recommendations for further work that may be required, to ensure safe development in accordance with the Environment Agency's *Land Contamination: Risk Management* guidance (LC:RM, 2020) and the *National Planning Policy Framework*.
- c) Collect information on ground conditions and strength in order to make appropriate recommendations for geotechnical design.
- d) Undertake soakaway testing in order to assess the infiltration characteristics of the site and make recommendations for appropriate drainage design.

1.3 Scope of Work

To perform an exploratory assessment of the site in accordance with the principles and requirements of DEFRA's 'Contaminated Land Statutory Guidance' (2012), BS10175 – 'Investigation of Potentially Contaminated Sites', BS5930:2015 'Code of practice for ground investigations' and BS EN 1997 'Geotechnical Design', the following tasks were undertaken:

Intrusive Investigation:

- Site walkover, inspection of any visual evidence of contamination at the site, obtaining photographic records.
- Health and safety briefing / site supervision.
- Drilling of two boreholes to a depth of 12.0m using a cable percussive drilling rig and installation of groundwater monitoring wells.
- Drilling of 10 window sample boreholes to a depth of 2.2m below ground level (bgl) using a track-mounted percussive rig.
- Installation of gas/vapour monitoring wells within eight window sampler boreholes.
- Excavation of 12 trial pits using a mechanical excavator.
- Vacuum Excavation of 2 additional trial holes initially planned to comprise window sampler boreholes.
- Soakaway testing at three locations.
- Continual logging of ground conditions including inspection of samples for visual and olfactory contamination, and laboratory analysis of selected representative soil samples.
- In-situ testing using a photo-ionisation detector (PID).
- Two rounds of gas/vapour monitoring (of different monitoring wells) using summa canisters, a GFM Gas Analyser and a Photoionisation detector.

Reporting:

- Data collection
- Interpretation of data including completion of a Generic and Detailed Quantitative Risk Assessment

The findings and conclusions of these investigations are presented in the following sections.

1.4 Limitations and Constraints

The purpose of this report is to present the findings of a soil sampling investigation conducted at the location(s) specified. When examining the data collected from the investigations made during the assessment, Environmental Protection Strategies Ltd (EPS) makes the following statements:

No investigation method is capable of completely identifying all ground conditions that might be present in the soil or groundwater under a site. Where outlined in our report, we have examined the ground beneath a site by constructing a number of boreholes and / or trial pits to recover soil and / or groundwater samples. The locations of these excavations and sampling points are considered to be representative of the condition of the whole site subsurface however, ground conditions are naturally variable and it may be possible that the conditions encountered may differ to those found during the investigation.

No visible evidence of Japanese Knotweed was identified during the site walkover. However, this plant can be difficult to identify in the early stages of growth and therefore it is not always possible to identify its' presence at certain times of the year. For this reason, EPS cannot confirm that Japanese Knotweed rhizomes do not exist and it is recommended that if it is suspected that this species, or other similarly invasive plants are present at the site, a specialist contractor should be commissioned to make a detailed assessment.

The investigation was carried out to assess the significance of contamination resulting from the use of the site as identified in this report. Unless EPS has otherwise indicated, no assessment of potential impact of any other previous uses has been made.

2 SITE CHARACTERISATION & PREVIOUS REPORTS

The following section provides a summary of the information collected for the previous Phase I Environmental Assessment and Phase II Geo-Environmental Assessment completed by EPS in January 2021 and March 2021 respectively in relation to the site location and geo-environmental context.

2.1 Site Location & Description

Detail	Description
Location	The site is located adjacent to the east of New Lane, in northeast Havant, Hampshire.
National Grid Reference	472540, 107180
Topography	The site area is flat, situated at around 15m Above Ordnance Datum (AOD).
Site Description	The property is a former industrial facility covering around 66,000 square metres (6.6ha), of which around 28,000 square metres has been developed as buildings. A number of separate buildings lie within the site as detailed in the glossary in Section 7. Up until recently, the pharmaceutical operations undertaken on site involved repackaging injectables for onward supply, but manufacturing has taken place in the past. The site is predominantly surfaced with hardstanding, although a large, gravelled area is located towards the northwest. Vegetation is mostly limited to semi-mature to mature trees along the site boundaries.
Surrounding Land Use	The site lies in a predominantly urban area, with industrial facilities, a business centre and commercial outlets to the north and a site occupied by Sumika Polymers Ltd (a plastics extruding operation), and Kenwood UK south of the property, bound by a railway line to the east. Residential areas are located to the immediate west of the site along New Lane and to the east beyond the railway line.

A plan showing the site location is provided as Figure 1. A current site layout plan is included as Figure 2, whilst an aerial photograph is included as Figure 3.

2.2 Summary of Previous Reports

2.2.1 Site History & Context

The site is located in the northern area of Havant and comprised undeveloped agricultural land from the mid to late nineteenth century until the post WW2 period. The main site was purchased in 1956 and was developed for pharmaceutical purposes in phases. In the following decade, the site underwent the first built development and by 1960, a factory building had been established in the north-western part, covering approximately 25% of the total site.

Further expansion of the site was undertaken in the south-western and north-eastern areas of the site during the late 1960s and 1970s. By the early 1980s, the site comprised 5 large factory buildings and 6 smaller buildings throughout the property. Historical, 'tanks' are shown in the southwest, centre-north and the northeast of the site around this time. By the early 1990s, further integration of the factory buildings had been carried out and much of the site was fully utilised. Some demolition/clearance of buildings has occurred in recent times.

In recent years, site activities have involved the repackaging of medical injectable products into dispensable units and no manufacturing of product is undertaken. Operations in the past did include primary and secondary manufacturing and of note in this respect, pharmaceutical operations began on site in around 1956/1957, a small fine chemicals manufacturing unit (FCMU) was established in 1961, and by 1992, a solvent recovery plan was installed at the site.

A detailed summary of the buildings that have been present on site associated with the works was provided in the previous report and is included within the glossary of this document for reference, whilst a plan showing the current layout is included as Appendix B.

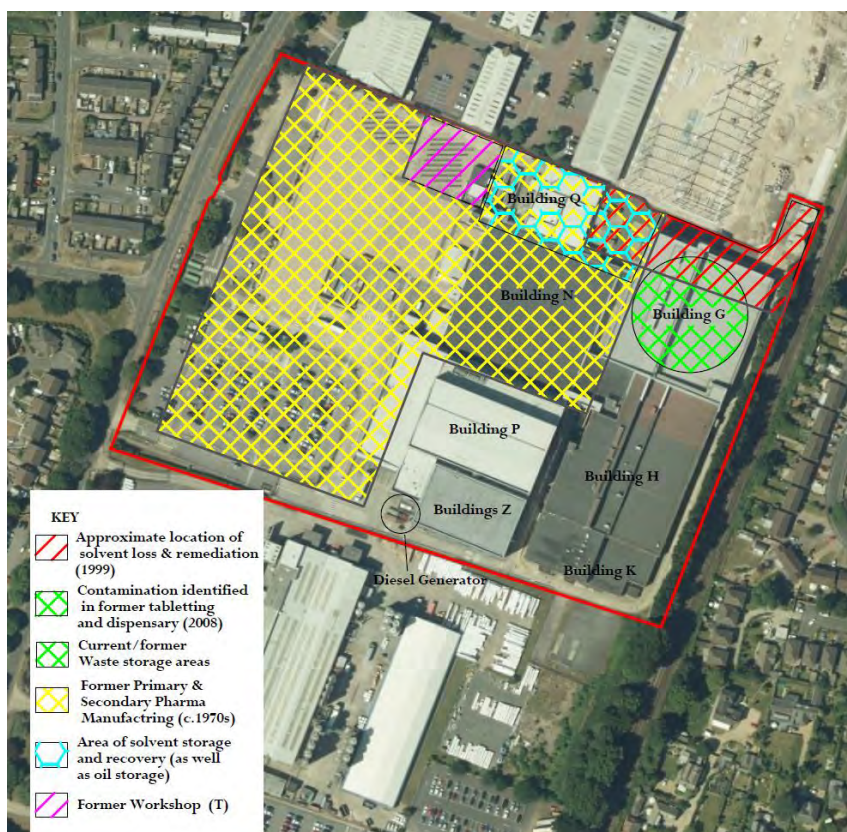
2.2.2 Key Potential Areas of Concern (PAOC)

The Phase I report identified a need for further investigation in several areas, summarised as follows:

- Localised detailed delineation of the already identified and partially remediated areas of potential concern in the north-east of the site including the FCMU, Waste Storage Area, Boiler House and Solvent Storage).
- Assessment of ground gas conditions beneath the areas of the site under future building footprints.
- Shallow groundwater conditions with some additional monitoring wells to bolster the existing monitoring well network and provide a single unified snapshot of groundwater conditions at the site now. This being for both human health and controlled waters protection.

Based on the available site records, additional PAOC were suggested to include:

- Diesel generator/fuel storage in the central southern area, including former oil storage removed in around 2001.
- Former engineering workshop (Building T).
- Historical records in the Golder report showing that in 1995, Cyanamide products (associated with significant VOC, cyanide, PCB and metals contamination in America) were transferred to the site.
- It also has to be acknowledged that the 'contaminating potential' of the site is likely lower now than it was in the past, as primary and secondary processing no longer takes place. Therefore, the site layout when those processes were undertaken is potentially more significant in terms of contamination. During those periods, buildings were present to the centre, west and northwest, many of which do not remain or have changed significantly.
- Drainage infrastructure, particularly drainage runs present when the site was used for manufacturing but prior to full mains connections and solvent recovery.



2.2.3 Previous Investigations

The following table details the findings of the previous investigations undertaken at the site, including the most recent investigation undertaken by EPS in March 2021.

Detail	Description
EPS Investigation (March 2021)	EPS' investigation comprised the drilling of 22 boreholes and 12 trial pits across the site, with ground conditions found to comprise a moderate thickness of made ground overlying successive layers of cohesive and granular River Terrace Deposits. Below this lay London Clay Formation which comprised of a soft initial layer of silt overlying stiff, grey clay. Laboratory analysis of shallow and deeper soils from across the site did not identify concentrations of contaminants to exceed the adopted screening criteria protective of future site users in a commercial setting. An initial assessment of the risks posed did not identify a significant risk to either human health or controlled waters. Some relatively low concentrations of VOCs and SVOCs were identified at selected locations though, with a notable concentration (53.568mg/kg) of Benzylbutyl Phthalate ('BBP') identified within a shallow soil sample in borehole BH3. This borehole is located in the north-eastern part of the site where contamination has been historically identified. However, a groundwater sample from the same borehole did not identify concentrations of this compound above method detection limit, suggestive that vertical migration has been limited. Although unlikely to represent contamination capable of posing a significant risk to future site users,

	further testing in this area was deemed necessary to confirm this low level of risk. In addition to this, laboratory testing of groundwater did not identify concentrations which were considered to pose a risk to the groundwater body, whilst detailed quantitative soil vapour analysis has not identified a risk associated with intrusion of volatile organic compounds into future buildings. An initial programme of ground gas monitoring found the site to fall into Characteristic Situation 1, for which no ground gas protection measures would be required. However, it was acknowledged that this was subject to additional investigation work and laboratory testing and therefore it was recommended that the site-specific conceptual site model be revised following the outstanding works. Once a comprehensive dataset is available, it may also be necessary to develop site-specific assessment criteria for certain compounds (including Benzylbutyl Phthalate) which currently lack readily available published screening criteria.
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2.3 Regulatory Input

Subsequent to submission of the Phase II Geo-Environmental Assessment (and Outline Remedial Strategy) to the local authority, comment was made following review by Mr Jonathan Driver in the Environmental Health team of Havant Borough Council. His comments from a memo dated 21st July 2021 are outlined below along with EPS' proposed way forward included for clarity:

Details included in the memo relating to the Outline Remedial Strategy have been accounted for in that report, within an updated version.

"The additional phase 2 site investigation (UK20.5052b Iss.1) did not find any soil contamination considered to be significant against a human health commercial landuse scenario. The investigation was however unable to target areas of the site known to be 'of potential concern' ("AOPC"), and vapour monitoring identified light-fraction hydrocarbons quite widely across the site, indicating that there is a source of relatively 'fresh' (non-degraded) contaminants within soils at the site that has not been captured by the soil sampling undertaken to date.

EPS – This is partially correct in that certain potential areas of concern were not fully accessible in the previous Phase II investigation and that should be addressed within this Supplementary Investigation.

The vapour monitoring referred to has indeed identified hydrocarbons across the site but it should be appreciated that the methods of analysis used had extremely low detection limits, with results presented in ug/m³ and ppbV (Parts Per Billion by Volume). The analytical vapour results are not directly comparable to the soil results.

The hazard indices calculated in Section 6.3 of the Phase 2 report based on the vapour analysis are all below 0.00, where the trigger value for unacceptable risk being 1.0, so there is a significant margin of safety before any of the results suggest any appreciable risk exists. In addition, to give context to the results identified, the majority of the results for toluene were <100ug/m³ in the vapour sample taken from WS10 (equates to 26.5ppbV). Most vapour risk assessments are undertaken utilising Photo-Ionisation Detectors, which typically have a detection limit of

0.1ppmV (i.e. 100ppbV), hence the limited detections gathered through PID headspace testing during the investigations are expected. To give context to these results, reference should also be made to ambient air. With reference to the WHO's Air Quality Guidelines report (2000), it states that the 24-hour average concentration of toluene in ambient air in major American metropolitan centres ranged from 8 to 62 $\mu\text{g}/\text{m}^3$. (Ref - EDGERTON, S.A. ET AL. *Inter-urban comparison of ambient volatile organic compounds concentrations in U.S. cities. Journal of the Air and Waste Management Association*, 39: 729–732, 1989).

(WHO report available at this link https://www.euro.who.int/_data/assets/pdf_file/0020/123068/AQG2ndEd_5_14Toluene.PDF)

Section 6.3 includes a vapour phase risk assessment which concludes a low-negligible risk to a sensitive commercial receptor (female employee), claiming on the strength of this assessment that the off-site migration risk is also low-negligible. Whilst it is accepted that it is possible that this interpretation may ultimately prove to be reasonable; in the absence of clarity on whether a separate CLEA assessment has been undertaken to determine an appropriate benchmark for a residential receptor, this conclusion is not considered to be well supported by the data at this stage.

EPS – As stated above the recorded VOC concentrations have resulted in a hazard indices generated through the CLEA model below 0.00 for the proposed land use. There is a substantial margin of safety built into the assessment, even if the proposed land use were to change to a more sensitive one (or taking account of neighbouring properties). It should also be appreciated that the development will not introduce any new risks to off-site receptors from organic vapours, and there will be some betterment introduced through the current remedial proposals as well as a significant re-profiling of soils (cut & fill). Therefore risks from organic vapours from site-derived contamination to existing neighbouring residents should never increase beyond what they already have been in the past. A similar situation applies to controlled waters.

Section 6.2 includes a groundwater risk assessment, concluding that screening criteria (GAC) are not exceeded in groundwater samples. However, I note that there is no GAC given for Chromium within Appendix J, and the GAC selected for Nickel is substantially greater than the EA's 'priority hazardous substances' environmental quality standard (EQS). Contrary to the conclusions of the report, exceedances are noted of CrVI EQS-AA (total Chromium results are not speciated) and Ni EQS-AA (max. recorded dissolved phase Ni results approximate to the EQS maximum allowable concentration, EQS-MAC). Similarly, one Ali C5-C6 result is approx. 400% of the Appendix J GAC.

EPS - All soil and groundwater analysis for metals included speciated chromium. The laboratory reports present the Chromium result with the other metals and the Hexavalent Chromium result on the following page, hence it may have been missed by the Council.

All of the results for Chromium VI in groundwater samples (16 in total) were below the method detection limit of <0.006 mg/l, so no further risk assessment of Cr VI is necessary. For Chromium (III) the highest recorded result was 8.6ug/l in 'BH04 1996', which is still within short-term freshwater EQS of 32ug/l and not considered to be significant.

The highest recorded concentration of nickel in groundwater was 33ug/l in BH12. This is below the adopted screening value of 200ug/l, although above the AA-EQS referenced by the Council for nickel (and its compounds) of 20ug/l. All of the other results for dissolved nickel are either below detection or well below either of these screening values. The position of BH12 is in the far south-western corner of the site, away from all of the key Areas of Concern and may not be related to any on-site source. Regardless of the origin, there does not appear to be a widespread

impact of dissolved nickel at the site and a risk to controlled waters associated with this contamination does not appear to exist from site-derived source.

With regards to petroleum hydrocarbons, and specifically the single groundwater result recorded above method detection limits (208ug/l - BH3), that is an exceedance of the adopted screening criteria (50ug/l) which was not discussed but may be representative of the chlorinated aliphatic compounds detected in this well which are discussed in Section 6.2.2 of the Phase II report. It is highly unlikely to be representative of a wider source given that all other monitoring wells, including those hydraulically down-gradient, did not encounter any petroleum hydrocarbons above detection limits. However, localised remediation is proposed in the vicinity of BH3 (see Remedial Strategy for detail).

I am cautious to agree that the site is unlikely to pose a significant risk to groundwater given that results indicate the likely presence of a low-solubility denser-than-water (DNAPL) hydrocarbon, which may be present within the topographic low-points of gravel lenses of the river terrace deposits (noted to be present at the site). This is a similar conceptual model to that which applied at a nearby site where similar materials were identified to have migrated in free-phase over distances of several hundred meters.

EPS: The controlled waters risk assessment is included in Section 6.2.2. Specifically, with regards to the above point it should be acknowledged that several hydraulically down gradient monitoring positions (of BH3) were sampled and widespread impacts of any contaminants were not detected, including chlorinated solvents. Further, vapour analysis has also not identified a widespread issue. All of the chlorinated solvents discussed in Section 6.2.2 are volatile and would be detected in these samples if present, including the dissolved phase of groundwater (chlorinated solvents released years in the past would not stay wholly in the free-phase indefinitely). Remedial action is still proposed though for the area around BH3, so the risk assessment is still currently considered appropriate and conservative.

Section 2.2. refers to previous investigations and quantitative risk assessments undertaken by Golder associates – notably including a quantitative detailed groundwater risk assessment. The Council has not had opportunity to review this document, and its content may be material to the current application. The Golder reports (or the key sections of them) should be made available for context if the Council is to be able to account for their reported content.

EPS – All of the Golder reports should be submitted to the Council, or at least the relevant sections. The key points have been discussed in the EPS Phase II report but we have also requested the reports are submitted to the Council by the client.

The overall conclusion of the report is presented in the summary of findings, and the recommendations given at section 6. (broadly agreed). No refined conceptual site model (CSM) is presented at section 6.5, as “[the] contaminant linkages presented in the Conceptual Site Model all require the dataset for the whole site prior to re-evaluation. As this is not yet available, a refined CSM cannot yet be presented”. The recommendations at 6.7 seek to obtain the data which section 6.5 concludes to be necessary to support a re-evaluation of the CSM.

EPS – The refined CSM is presented in Section 6.5.

3 SUMMARY OF INTRUSIVE INVESTIGATIONS

Intrusive ground investigations were undertaken between 26th and 29th July and 26th and 9th September 2021 in accordance with EPS standard operating procedures, copies of which will be made available on request. A summary of all site activities is presented in the following sections:

3.1 Exploratory Hole Locations

Exploratory hole locations were selected through consideration of the potential contaminant linkages identified through the Phase I Desk Study, the proposed development layout, the client's requirements, current access limitations and the location of below ground utilities, as well as operational and health & safety considerations associated with an active site.

Ten window sample boreholes (WS03-WS06, WS18-WS23) were formed at the site to a maximum depth of 2.2m using a track-mounted percussive drilling rig. Two further boreholes (WS16-WS17) were planned to be drilled following vacuum excavation due to their proximity to services. However, due to problems getting the drilling rig onto position, it was not possible. Nevertheless, the excavations did extend to depths of 1.1m and 0.72m respectively and were logged and sampled. These boreholes were drilled as part of confirmatory sampling works undertaken by EPS between 6th and 9th September 2021, the results of which are outlined in a separate letter report, which is included in this report as Appendix D.

Two cable percussive shell & auger boreholes (BH7 & BH9) were drilled to a depth of 12m.

Twelve trial pits (TP03, TP05-TP08, TP10, TP21, TP23-TP26, TP28) were excavated using a mechanical excavator to a maximum depth of 2.15m. Soakaway testing was also undertaken in three of these trial pits (TP05, TP07, TP24).

The exploratory hole layout of this phase of works was broadly designed on the basis of a formal stratified systematic sampling pattern, however this was combined with some specific client requests and some targeted locations. Due to the absence of a formal sampling pattern, the use of a three-dimensional dataset (i.e. samples at varying depths) and targeted nature of the investigation taking into account the PAOCs, it is unlikely that any statistical analysis can be applied to the soil dataset in accordance with CL:AIRE's 2020 guidance (*Comparing Soil Contamination Data with a Critical Concentration*). It is therefore likely that the most significant sampling result for each source or averaging zone will drive the risk assessment and design of remedial measures.

The overall objective in terms of exploratory hole locations was to provide an appropriate lateral and vertical coverage of the soils/groundwater/soil gases underlying the site in order to offer information relating to their quality and nature as well as provide information for geotechnical design. The exact locations were agreed amongst the project team prior to the beginning of the works. Further rationale for each sampling location is provided within the table below:

Location	Rationale
BH7, BH9	Drilled across the site to provide information on the geology at depth below the proposed building area, in order to aid pile design and install groundwater monitoring wells.

WS03-WS06, WS19-WS23	Boreholes drilled to facilitate installation of gas and vapour monitoring wells below the proposed new building area.
TP03, TP05- TP08, TP10, TP21, TP23- TP26, TP28	Excavated across the site, predominantly inside buildings which were inaccessible during the initial phase of works, to provide information on the nature and quality of the shallow geology underlying the site.
SK03 (TP05), SK04 (TP07), SK06 (TP24)	Undertaken across the site to complete soakaway testing to understand the infiltration characteristics.
BH7a, BH9a, WS03a-WS06a, WS16a-WS18a, TP03a, TP05a- TP08a, TP10a, TP21a, TP23a- TP26a, TP28a	Boreholes drilled adjacent to all original positions in order to obtain confirmatory soil samples (see Appendix D).

Groundwater monitoring standpipes were installed within BH07 and BH09. Groundwater sampling pipes were installed using 50mm diameter uPVC well casing and fitted with a gas tap. Slotted casing (1mm slot) was installed at each location from the base of the borehole to approximately 1.0m below the surface. The installations were completed to ground surface using plain casing. A filter pack of 2-3mm of washed gravel extended from the base of the boreholes to approximately 0.1m above the slotted section with a bentonite seal to surface. All installations were finished with flush-mounted, bolt-down headworks.

Soil vapour monitoring wells were installed in WS03-WS06 and WS19-WS22. It should be noted that a vapour well was planned within WS23 however the appropriate depth could not be reached due to the density of the ground. As such, a vapour well was placed within a borehole located nearby, adjacent to TP26 and is referenced as TP26a for the purpose of this report. The positions were designed to target specific sampling horizons within the subsurface. Each sampling point was fitted with a stainless steel sparge point at the base of the borehole (1.8m). A filter pack of 2-3mm washed gravel extended from the base of the installation to approximately 0.1m above the sparge point, with a bentonite seal to the surface.

A borehole and trial pit location plan is presented as Figure 4.

3.2 In-Situ Testing & Soil Sampling

Each borehole was logged for ground conditions encountered and inspected for any physical evidence of contamination, such as soil staining, odour and the presence of separate phase liquids on a precautionary basis. Borehole and trial pit logs are presented in Appendix E.

Standard or cone penetration tests (SPT / CPT) were carried out in all shell & auger boreholes using an automatic trip hammer. The number of blows required to advance a standard split spoon, (or solid 60° nose cone for the CPT test) over the final 300mm of a 450mm total drive was recorded, and is shown on the borehole records at the penetration resistance ("N" value).

Where potentially volatile organic compounds are suspected, EPS carries a Photoionisation Detector (PID), which can be used to measure the relative concentrations of vapour associated with soil samples collected from different depths and locations at the site. In these circumstances, soil samples will be placed into plastic bags, sealed, shaken and then allowed to rest for a few minutes to allow time for volatile vapour to accumulate in the air trapped within the bag. The PID probe will then be used to pierce the bag and sample the air above the soil to measure the concentration of volatile compounds that have accumulated. PID readings are only used to provide EPS with a basic means to quantify areas of volatile organic compound in the field to help guide the investigation. As potentially volatile organic compounds were identified in the conceptual site model, PID readings were collected during this intrusive investigation. These readings are included within borehole logs presented as Appendix E and the results are discussed further in later sections.

3.3 Laboratory Testing

Samples obtained for analysis of identified contaminants of concern were submitted to Element Materials Technology of Flintshire, who hold appropriate UKAS / MCERT accreditation for the required testing. Samples were transported in laboratory supplied containers and delivered to the laboratory by approved courier. An environmental laboratory testing schedule is included as Table 1.

Geotechnical testing was undertaken by Soil Property Testing, Huntingdon, a UKAS accredited laboratory. A geotechnical laboratory testing schedule is included as Table 2.

Copies of chain of custody documentation are held by EPS and will be made available on request.

3.4 Ground Gas & Vapour Monitoring

One round of soil vapour monitoring was also undertaken across two dates, 10th August 2021 and 15th September (due to the phased nature of the works), to measure the presence and concentration of contaminants and ground gases within the soil vapour. Soil vapour samples were collected using Summa cannisters, which connect to the sampling point via a dedicated sampling train supplied by Element Materials Technology of Flintshire.

Subsequently samples obtained for analysis of identified contaminants of concern were submitted to Element Materials Technology of Flintshire, who hold appropriate UKAS / MCERT accreditation for the required testing. Samples were transported in laboratory supplied containers and delivered to the laboratory by approved courier.

During sampling of soil vapour within each of the monitoring points, leak test of the sampling train was undertaken. Limonene present within shaving foam was used as a potential leakage indicator. The joints within the sampling train were treated with shaving foam containing limonene, and subsequently all soil gas samples were tested for presence of limonene.

Ground gas monitoring was also undertaken to measure the presence and concentration of ground gas (including carbon dioxide, oxygen and methane) and organic vapour using a GFM 435 gas analyser, PID and flow meter respectively.

It should also note that this report takes account of a previous round of monitoring undertaken on 17th and 21st February 2021 on boreholes drilled in the first phase of works at this site (report ref: UK20.5052c). This round of monitoring was done subsequent to issue of the previous report and therefore has been included in this report for assessment. The boreholes monitored were WS1-WS2 and WS7-WS15. A brief letter report covering this data is included in Appendix [edit](#).

Recorded ground gas monitoring data is included as Table 3 with the results and implications of this data discussed in later sections of this report.

4 FINDINGS OF THE INVESTIGATION

This section of the report provides a summary of the findings of the various aspects of the ground investigation.

4.1 Ground Conditions

A total of 2 deep boreholes, 10 shallow boreholes and 12 trial pits were formed at the site, along with review and logging of two vacuum excavated trial holes and the ground conditions encountered, from surface level, have been interpreted to comprise:

- Made Ground
- River Terrace Deposits
- London Clay Formation

Site specific borehole and trial pit logs are included as Appendix E and give descriptions and depths of strata encountered. Broadly speaking, ground conditions were found to be very similar to those encountered within the previous investigation however a summary of the general strata encountered during this phase of investigation is provided in the table below, with more detailed description given in the following sub sections.

Geological Strata	Maximum Depth to Base of Strata (m bgl)	Strata Thickness (m)
Made Ground	>2.1 (not proven)	0.20->2.1(not proven)
River Terrace Deposits	6.3	>0.38 (not proven)-5.4
London Clay Formation	>12.0 (not proven)	>5.7->6.5 (not proven)

4.1.1 Made Ground

Made Ground was encountered within the vast majority of boreholes below variable surfacing of concrete which including rebar reinforcement and gravel. It predominantly comprised a greyish brown sometimes slightly clayey sandy gravel with brick and concrete fragments. Although in some areas the made ground encountered was predominantly a brown / greyish brown gravelly clay with brick, concrete, metal and wood fragments. Some hardcore / granular material (likely representing subbase material) was found in places. Its thickness was variable but fairly regularly in the range of 0.5 – 1.0m and was found to a maximum depth of 2.1m in TP23 but the final depth was not proven.

In selected locations, a geotextile damp proof membrane was encountered below the concrete and in other locations it was also found directly below the made ground.

It should also be noted that the made ground directly below the concrete within Building G was extremely dense and the drilling rig could not penetrate through it in some places.

4.1.2 River Terrace Deposits

Below the made ground in all boreholes lay soils interpreted as River Terrace Deposits. These generally comprised an initial layer of brown, gravelly clay with variable gravel content and some gravel lenses. Gravel was brown, black, and white, angular to sub-rounded flint and chert. Although logged in the field as a clay, some of the geotechnical laboratory testing indicates it could be gravellier in places and in some boreholes the material was described as occasionally sandy, very clayey gravel.

Below this layer in some of the shallow boreholes (WS03 and WS05) and the deeper borehole locations lay dense to very dense, black, brown and white, angular to sub-rounded, sandy gravel. The gravels consisted predominantly of flint. The depth of the base of this layer ranged between 0.9m and 6.3m.

4.1.3 London Clay Formation

Encountered directly below the River Terrace Deposits in both of the deep shell & auger boreholes lay soils interpreted as part of the London Clay Formation.

This generally comprised a layer of stiff, brown to greyish brown, silty sandy clay that extended to the base of BH9. Underlying this layer at BH7 was a grey clayey silt that extended to the base of BH7.

4.2 Groundwater

Groundwater was struck within both shell & auger boreholes during the investigation at 3.8m in BH7 and 2.9m in BH9. The follow up monitoring identified groundwater to rest at levels ranging between 2.78m (BH7) and 2.96m (BH9). These levels are broadly similar to those identified within the previously installed monitoring boreholes across the site.

4.3 Physical Evidence of Contamination

Despite the presence of a limited thickness of made ground, there was no palpable evidence of contamination, waste or putrefiable material encountered across the majority of the site.

This was supported by headspace testing undertaken at regular intervals during the field works which did not identify any concentrations of organic vapours above 1ppmV.

4.4 Chemical Laboratory Analysis

4.4.1 Soil

A laboratory analysis testing schedule is presented as Table 1 and all environmental sample results obtained from the laboratory are included as Appendix F. The key results of laboratory testing on environmental soil samples are summarised below.

Contaminant	No. of Samples	No of Detections	Range of Detections (mg/kg)		Highest Location & Depth (m bgl)
			Min	Max	
Arsenic	29	29	2.7	14.8	TP08 (0.3-0.5)

Cadmium	29	26	0.1	8.1	TP08 (0.3-0.5)
Chromium III	29	29	8.1	125.9	BH7 (0.3-0.4)
Chromium VI	29	0	-	-	-
Copper	29	29	2	24	WS18 (0.3-0.5)
Lead	29	28	6	1,195	WS03 (0.12-0.4)
Mercury	29	0	-	-	-
Nickel	29	29	3.7	41.4	TP10 (0.6-0.8)
Selenium	29	0	-	-	-
Zinc	29	29	14	2,237	TP08 (0.3-0.5)
Naphthalene	29	1	-	0.07	WS18 (0.3-0.5)
Benzo[a]pyrene	29	11	0.06	2.07	TP23 (0.3-0.6)
Dibenz(ah)anthracene	29	3	0.05	0.33	TP23 (0.3-0.6)
PAH (16 Total)	29	11	0.8	29.6	TP23 (0.3-0.6)
Cyanide	29	0	-	-	-
Benzene	29	0	-	-	-
Toluene	29	1	-	0.009	WS21 (0.4-0.6)
Ethylbenzene	29	0	-	-	-
m/p - xylene	29	1	-	0.006	WS21 (0.4-0.6)
o - xylene	29	0	-	-	-
TPH CWG	29	6	90	1,163	TP21 (0.1-0.2)
PCB	24	0	-	-	-
VOC	29	3	0.003	0.085	WS03 (0.12-0.4)
SVOC	29	8	0.012	0.6	WS18 (0.3-0.5)
Ammoniacal Nitrogen	29	0	-	-	-
Asbestos (%)	29	0	-	-	-

Notes:

- Contaminant not found above laboratory detection limits
- PAH Polycyclic Aromatic Hydrocarbons
- BTEX Benzene, Toluene, Ethylbenzene, Xylenes
- TPH CWG Total Petroleum Hydrocarbons (Criteria Working Group)
- VOC Volatile Organic Compounds
- SVOC Semi-Volatile Organic Compounds
- PCB Polychlorinated Biphenyls

- Detectable concentrations of heavy metals were encountered across the site.
- Detectable concentrations of PAHs and TPH were encountered at selected locations above method detection limit.
- Very low and isolated concentrations of VOC and SVOC were found at selected locations.
- Asbestos was not encountered above minimum detection limits (MDL) of 0.001% in any sample.

Deviating results were recorded for the soil samples analysed at this site (for Cyanide, EPH, GRO, PAH, SVOC, VOC). This was due to the holding time between soil sampling and analysis at the laboratory falling slightly outside of the period required for accreditation (4-7 days outside of the 14-day period). Only four of the samples were outside of holding time upon receipt at the laboratory, but the remaining twenty soil samples fell outside of the holding time while at the laboratory pending analysis. All samples were kept refrigerated throughout this period, well below the required minimum of 8 degrees Celsius. The sample holding time does not represent a 'drop off point' in the degradation of the sample, realistically samples undergo a gradual decline from the moment the sample is taken. It is unlikely to have significantly influenced the results or risk assessment, particularly as the most sensitive substances (volatiles) are subject to separate

forms of assessment in this instance (vapour). However, to ensure the dataset is wholly robust and accredited, EPS attended to re-sample these soils on the 6-9th September 2021 and the results have been assessed in a separate letter report, which for ease is appended to this document is Appendix D.

The analytical suite for all soils at the Pfizer site was very broad, partly driven by a request of the client. As part of the laboratory analysis, Tentatively Identified Compound (TIC) interpretation was requested by EPS on both the VOC and SVOC suites. In some instances, such as TP21A (included Appendix F), several additional compounds were 'tentatively identified' beyond the 59 target compounds within the SVOC suite. EPS consulted the laboratory over this aspect and received clarification, who stated that *in order for an 'unknown' or an 'uncalibrated' compound to be reported, its concentration must be above the TIC LOD of 100ppb and its mass spectrum must meet or exceed our quality match criteria of 80% when it is compared to the mass spectra of reference compounds within our GCMS library software in which there are in excess of 300,000 mass spectra of reference compounds.*

The 59 target compounds within the SVOC suite are those, which the risk assessment presented within this report is focussed on. It should be appreciated that the analytical suites undertaken through contaminated land assessment in the UK have been refined through prioritisation of certain substances taking account of toxicological data and risk. For instance the current metals suite is based on the now out-dated ICRL framework, similarly the PAH suite is based on the historical US EPA list. For this dataset, additional consideration has been given to these TIC compounds described above, although the concentrations reported are generally low. The TIC results are generally <1mg/kg, and all are below 30mg/kg. Whilst some of the SVOC target compounds were also detected in these samples, the majority were below detection limits. It should also be remembered that risks associated with volatile compounds are more accurately assessed under vapour analysis from dedicated monitoring wells.

The end use for the site is not sensitive; it is commercial with the majority of the surfacing hard landscaping. Generally, SVOC contaminant concentrations of this order are unlikely to pose significant risks or risks not accounted for in the target suites. Therefore it is considered reasonable to focus the risk assessment on the target SVOC suite and the associated principal contaminants of concern.

4.4.2 Soil Vapour

The below table summarises the findings of the soil gas / vapour analysis undertaken by the laboratory analysis. For ease of use, only those VOCs / SVOCs identified above method detection have been summarised.

Contaminant	No. of Samples	No of Detections	Range of Detections ($\mu\text{g}/\text{m}^3$)		Highest Location & Depth
			Min	Max	
Carbon Dioxide (%)	9	9	0.06	0.37	TP26a
Carbon Monoxide (%)	9	0	-	-	-
Hydrogen (%)	9	0	-	-	-
Methane (%)	9	0	-	-	-
Nitrogen (%)	9	9	79.1	79.9	WS20
Oxygen (%)	9	9	20.0	20.9	WS03

Ethanol	9	9	271.3	508.7	TP26a
Acetone & Propanol	9	9	38	114	WS03
2-Propanol	9	9	27	47	WS03
Carbon Disulphide	9	1	-	17.1	WS05
2-butanone	9	4	27	492	WS03
Hexane	9	2	5.6	5.6	WS06a, WS19
Toluene	9	9	7.5	6588.7	WS19
m/p - xylene	9	7	7.4	15.6	WS23
1,2-Dichlorobenzene	9	3	32	100	WS04
Naphthalene	9	2	1.8	2.1	WS03
Trichloroethene (TCE)	9	1	-	21	WS04
Tetrachloroethene (PCE)	9	4	14.2	581.3	WS03
1,1,1- Trichloroethane	9	2	10.9	15.8	WS04
Sum of VOC TO15 Compounds	9	9	353	7163.5	WS19
Aliphatic C4-C6	9	3	36	103	WS03
Aliphatic C6-C8	9	3	53	204	WS05
Aliphatic C8-C10	9	3	308	463	WS03
Aliphatic C10-C12	9	3	137	196	WS03
Aromatic EC7-EC8 (Toluene)	9	9	7.5	6588.7	WS19
Limonene	9	0	-	-	-

Notes: VOC Volatile Organic Compound

The laboratory testing has identified minor concentrations of a number of volatile organic compounds within various monitoring positions across the site.

4.5 Revised Waste Analysis

Waste classification (i.e. hazardous or non-hazardous) was undertaken on samples of both made ground and granular river terrace deposit soils, which included total concentrations of metals and hydrocarbons, using computer software provided by HazWaste Online™. The results of the WAC analysis are included within Appendix F and the outputs from the software are included in a Waste Classification Report in Appendix G.

Waste Acceptance Criteria was subsequently undertaken on one sample each of the made ground and granular layers of River Terrace Deposits (RTD) respectively during the investigation, to add to the previous analysis undertaken on the cohesive layer of RTD and the underlying London Clay. Although these results are preliminary given the limited sampling density, they are considered likely to represent the major waste streams produced through the development. These results, together with those of the waste classification from the previous phase of works are summarised in the following table:

Strata	Typical Depth (m bgl) and Description	Is it Hazardous?	Waste Acceptance Criteria	Appropriate Landfill
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Made Ground	0.2->2.1 – Brown to Greyish Brown slightly clayey sandy GRAVEL with brick and concrete	Yes	Passed criteria for Hazardous Landfill	HAZARDOUS
Cohesive River Terrace Deposits	0.3->6.3 - Brown sandy CLAY	No	Passed criteria for Inert Landfill	INERT
Granular River Terrace Deposits	1.8-7.8 - Brown, black and white angular to rounded sandy slightly silty GRAVEL.	No	Passed criteria for Inert Landfill	INERT
London Clay Formation	>5.8-20.0 - Brownish grey SILT and dark grey CLAY	No	Passed criteria for Inert Landfill	INERT

Based on the above, all natural soils on site can be classified as **INERT** for the purposes of off-site disposal, under the waste code **17 05 04**.

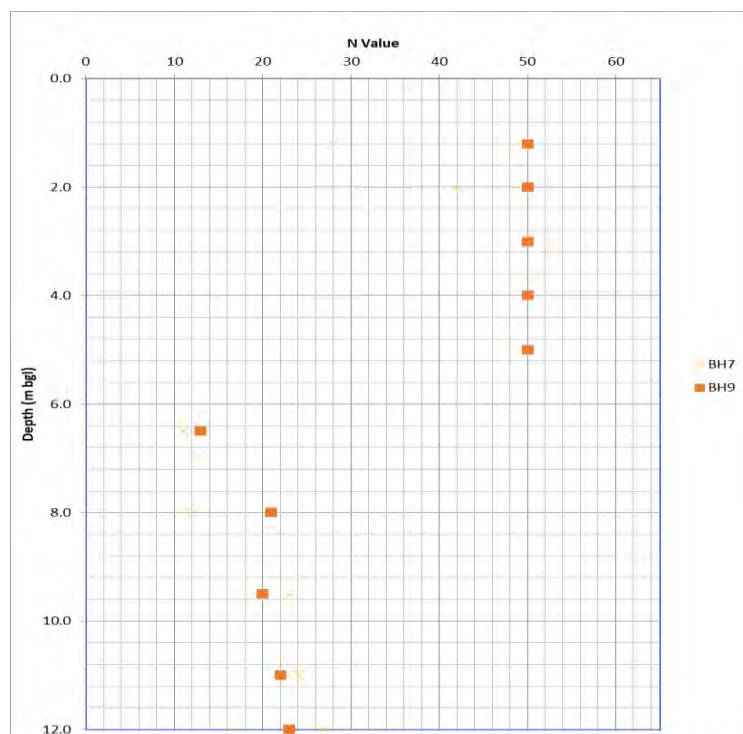
The made ground should be classified as Hazardous at this stage under the waste code **17 05 03*** due to elevated concentrations of lead, zinc, TPH and pH which marginally exceed the hazardous waste threshold in selected samples. However, given the volume of made ground soils across the site, it is recommended that further testing is undertaken on stockpiled surplus soils of this material that are anticipated to be disposed of offsite during the groundworks. Waste producers have a legal responsibility to minimise the generation of hazardous wastes and it is likely that a significant volume of the made ground will not be hazardous once further characterisation has taken place.

For made ground present on a brownfield site such as this, although the soil sampling process did not identify potentially hazardous concentrations of Asbestos Containing Material (ACM) within the soil, it must be acknowledged that the material may exist within areas which were not sampled or accessible during the investigation. Any visually identifiable fragments of ACM can invalidate non-hazardous waste classification.

4.6 Geotechnical Testing

4.6.1 In -Situ Geotechnical Testing

The results of in-situ geotechnical testing are summarised in the graph below.



The above data indicates that the natural granular River Terrace Deposits that were encountered in these two boreholes to depths of around 5.0m are very dense, although the slightly shallower clay in BH7 is lower strength, nevertheless it remains firm. However, below the granular River Terrace Deposits, the upper silty layer of the London Clay deposits is softer in nature, although still fairly competent and typically increases in strength with depth.

4.6.2 Laboratory Geotechnical Testing

The results of geotechnical laboratory testing are summarised in the table below and all geotechnical sample results obtained from the laboratory are included as Appendix H. The key results of laboratory testing on geotechnical soil samples are summarised below.

Strata	Range of Parameters										
	Moisture Content (%)		Plasticity Index (%)		Particle Size Distribution (%)			California Bearing Ratio (%)		Maximum Dry Density (Mg/m ³)	
	Min	Max	Min	Max	Fines	Sand	Gravel	Max	Min	Max	Min
Made Ground	-	-	-	-	-	-	-	62	82	1.85	2.14
River Terrace Deposits	11.2	21.7	20 (10)	28	3-26	7-40	55-86	3.1	36	1.69	2.04
London Clay Formation	17.7	31.3	9	21 (20)	52-53	46-48	0-1	-	-	-	-

() adjusted for granular content

Moisture contents and Atterberg Limit was established for six samples of cohesive soils in accordance with BS EN ISO: 17892-1: 2014 & BS1377: Part 2: 3.2, 4.4, 5.3, 5.4.

Particle Size Distribution was undertaken on eight samples of granular soils in accordance with BS1377: Part 2: 1990: 9.2.

California Bearing Ratio Tests were done on seven samples of made ground and natural soils in accordance with BS 1377: Part 4: 1990: 7.

Dry Density / Moisture Content Tests were undertaken on seven samples of made ground and natural soils in accordance with BS1377: Part 2: 1990: 3.2 & Part 4: 1990: 3.

Sulphate contents and pH values determinations were carried out by the analytical laboratory, the results of which are included in Appendix F and summarised in section 6.4

A laboratory analysis testing schedule is presented as Table 1.

5 GEOTECHNICAL APPRAISAL

The ground conditions have been found to comprise a moderate thickness of made ground underlain by cohesive and granular River Terrace Deposits. Below this lay silt and clay of the London Clay Formation.

5.1 Structural Foundations

The previous phase of works involved the drilling of the majority of the deep boreholes on the site and provided detailed recommendations on foundation design for both shallow spread foundations and piles at depth. This additional investigation comprised the drilling of two additional deep boreholes to a depth of 12m within the existing building and ground conditions, both in nature and strength, were identified to be broadly similar to the previous phase.

As such the recommendations on foundation design made in Section 5 of the initial Phase II report are considered to remain applicable and therefore no additional assessment has been made within this document. Reference should be made to the previous Phase II report to inform any design.

5.2 Drainage

Infiltration testing was undertaken in three additional trial pit locations (SK03, SK04, SK06) in general accordance with *BRE Digest 365*. The results of the testing are detailed in the table below:

Trial Pit Location	Test Depth (m bgl)	Infiltration Rate (m/s)	Comments
SK03 (TP05 - test 1)	2.15	9.201×10^{-5}	Complete Test
SK03 (TP05 - test 2)		3.452×10^{-5}	
SK03 (TP05 - test 3)		2.772×10^{-5}	
SK04 (TP07 - test 1)	2.1	-	Readings could not be taken in this test due to rapid infiltration. The entirety of a 2000L water tanker drained almost instantaneously into the ground, with the rate at no time slow enough to take readings. It took approximately 10 minutes to drain the tanker on each occasion.
SK04 (TP07 - test 2)		-	
SK04 (TP07 - test 3)		-	
SK06 (TP24 - test 1)	1.6	1.161×10^{-4}	
SK06 (TP24 - test 2)		4.630×10^{-5}	
SK06 (TP24 - test 3)		3.965×10^{-5}	

Based on the results, it is possible that an infiltration drainage solution will be suitable at the site, particularly if the water drains directly into the granular layer and provided the water table is not

too high. However, the use of any infiltration drainage must also take account of groundwater protection.

It is recommended that soakaways aren't placed within 5m of existing or proposed structures.

5.3 Concrete Grade

Sulphate contents and pH values determinations were carried out for the natural material by the analytical laboratory, the results of which are also included within Appendix F. These have been combined with the results of the previous phase of works and the concrete grades are summarised in the following table:

Strata	Water Soluble Sulphate (mg/l SO ₄)		Total Potential Sulphate (TPS)		pH	
	Min	Max	Min	Max	Min	Max
Made Ground	6.6	1,581	-	-	7.32	12.07
River Terrace Deposits	<1.5	182.2	-	-	7.74	12.05
London Clay Formation	12.2	275.8	0.84	3.00	7.92	9.02

In accordance with Part 1 of the BRE Special Digest 1 'Concrete in Aggressive Ground' 2005, in a data set where there are 10 or more results available, the mean of the highest 20% of the sulphate test results (rounded to 100 mg/l) should be taken as the characteristic value.

On this basis a Design Sulphate Class (DS) of DS-2 with an aggressive chemical environment for concrete (ACEC) of AC-1 is considered appropriate for the Made Ground.

A Design Sulphate Class (DS) of DS-1 with an aggressive chemical environment for concrete (ACEC) of AC-1 is considered appropriate for the River Terrace Deposits.

However, for the underlying London Clay, a Design Sulphate Class (DS) of DS-3 is considered appropriate, with an aggressive chemical environment for concrete (ACEC) of AC-3 due to concentrations of total potential sulphate.

5.4 Re-Use of Site-Won Soils

Depending on final site levels, there may well be the opportunity to re-use shallow (likely upper 2m to 3m) site-won materials on site as part of either structural or indeed general filling operations. This would require the materials to be proven 'suitable' in in both an environmental and geotechnical sense and any potential wastes would need a suitable framework such as a Materials Management Plan (see Section 6.8) to justify their re-use.

Geotechnical laboratory testing has been undertaken to help assess the potential re-use of site-won soils, which is further summarised below.

Strata	Maximum Dry Density Range (Mg/m³)	Optimum Moisture Content Range (%)
Made Ground	1.85 to 2.14	8.3 to 14.0
River Terrace Deposits (Cohesive)	1.69 to 1.74	18 to 20.0
River Terrace Deposits (Granular)	1.93 to 2.04	11 to 13.0

5.4.1 *Made Ground*

There may well be the possibility that Made Ground at the site can be re-used, although it must be appreciated that these soils are by their nature very variable in composition, and it is particularly important to note that some wood was noted in the Made Ground (such as in TP23) which isn't appropriate for re-use and as such, screening of the Made Ground for such deleterious items would be required. Screened materials should be re-analysed for their particle size distribution to ensure they comply with the required particle size.

Particle size analysis undertaken on bulk samples of the Made Ground is summarised in the table below;

Fines Content (%)	Sand Content (%)	Gravel Content (%)
10 to 19	10 to 22	65 to 71

5.4.2 *River Terrace Deposits*

There may well also be the possibility that River Terrace Deposits at the site can be re-used, although it must be again appreciated that these soils have been noted as being both cohesive and granular in nature and will therefore have very different re-use characteristics.

Particle size analysis undertaken on bulk samples of the River Terrace Deposits are summarised in the table below;

Fines Content (%)	Sand Content (%)	Gravel Content (%)
1 to 26	3 to 40	55 to 96

5.4.3 *General Fill Specification*

In general, all fill should comply with the 'Manual of Contract Documents for Highways Works, Volume 1, Specification for Highways Works'. Compaction of any fill materials should be in accordance with Table 6/4 of the Manual of Contract Documents for Highways Works, Specification for Highways Works, Series 600, Earthworks.

Immediately prior to placing the first layer of any fill, all surfaces upon which fill is to be placed shall be cleaned of all objectionable materials in an approved manner. Such surfaces shall have all

water removed from depressions and shall be properly monitored to obtain a suitable bond with the fill.

No vegetable matter, other perishable material shall be placed in the fill.

The fill shall be prepared by levelling, moistening (if required) and rolling so that the surface materials will be compacted and will provide a satisfactory bonding surface.

Materials to be used for fill, which for whatever reason become, or when placed are too wet for immediate compaction shall be placed in temporary stockpiles or removed until the moisture content is reduced sufficiently to permit adequate compaction. Conversely, excavated material with a moisture content lower than that required, to ensure adequate compaction shall be wetted before placement.

The in-situ competency of the fill shall be checked at regular intervals to ensure that they are placed to the required effort. This should include either, plate load testing, sand replacement density testing or nuclear density meter testing. In addition, the fill may also be checked using a hand shear vane or perth penetrometer, depending on material properties.

The fill should be placed to ensure that at least 95% of the optimum dry density is being achieved. If this is not achieved, then the fill may need to be removed and re-compacted.

6 ENVIRONMENTAL APPRAISAL

The following section outlines the approach applied to assessing the risks posed to human health and controlled waters, then identifies any sample results found by this investigation which warrant further consideration. In accordance with the Environment Agency's Land Contamination: Risk Management, this section represents the second tier of Stage 1, the Generic Quantitative Risk Assessment.

6.1 Human Health

6.1.1 Land Use Setting & Generic Screening

In order to screen laboratory data for concentrations of contaminant in soil with potential to cause harm to human health in a commercial land-use setting, relevant generic screening values for contaminants in soil have been used. The technical framework used to derive the assessment criteria and the documents in which they are published are summarised as follows:

- *EA Science Reports* (SC050021/SR2, SC050021/SR3, and SC050021/SR7)
- *EA Soil Guideline Value Science Reports*
- *Suitable for Use Levels (S4ULs) for Human Health Risk Assessment* – LQM and CIEH (2015)
- *Soil Generic Assessment Criteria for Human Health Risk Assessment* - EIC/AGS/CL: AIRE (2010)
- *Development of Category 4 Screening Levels for assessment of land affected by contamination* - SP1010 – DEFRA (2013)

A summary of the screening criteria and the methodology used to derive them is included in Appendix I.

6.1.2 Assessment of Results- Human Health

The results of the screening process for on-site human receptors showed that generic screening criteria protective of future site users, where available, were not exceeded for any contaminant at any location.

Across the investigation, some generally low concentrations of VOCs and SVOCs have been identified at selected locations. However, the only notable concentration comprised 53.568mg/kg of Benzylbutyl Phthalate identified within a shallow soil sample in BH3 during the initial Phase II investigation. Benzylbutyl Phthalate (BBP) is a plasticiser, used to enhance the physical properties of materials by typically improving their flexibility. BBP has been used in coatings and adhesives, although the specific origin of it on this site is not clear. BH03 is outside of any buildings, it may be associated with a drainage feature. BBP has proven toxic effects and established toxicology. A generic screening value is included in the EIC/AGS/CL:AIRE (2010) for BBP of 940,000mg/kg (commercial/1% SOM), although reference to the saturation limit of 26.3mg/kg may be more appropriate given the uncertainty around the source of the contaminant as well as the additive effect of other similar plasticisers. Following additional feedback from the local environmental health team, a revised assessment/re-use criteria has been discussed for these contaminants. This is based on 25% of the original saturation limits of 26.3mg/kg and 8.68mg/kg respectively for Benzylbutyl Phthalate (BBP) and Bis(2-ethylhexyl) (B(2e)P) to take account for uncertainty over

risks to controlled waters. Revised criteria of 6.6mg/kg for BBP and 2.2mg/kg for B(2e)P have been included in Appendix I.

Borehole BH3 is located in the north-eastern part of the site where contamination has been historically identified. However, a groundwater sample from the same borehole did not identify concentrations of this compound above method detection limit, suggestive that vertical migration has been limited. Moreover, during this second investigation trial pits TP24 and TP25 were excavated in close proximity to this borehole and soil concentrations were not identified close to this level. A sample taken from TP24 did not identify a concentration of this (or any other) phthalate above method detection limit (MDL) of 0.1mg/kg, whilst the sample from TP25 contained a concentration of 0.153mg/kg.

This minor detection, along with the larger concentration from BH3 does suggest a localised source of Benzylbutyl Phthalate in this area of the site which will be subject to targeted remedial action in the Remedial Strategy.

6.2 Controlled Waters

6.2.1 Generic Screening

In addition to screening the recorded concentrations of contaminants in soils capable of posing a risk to human health, EPS has also screened the results of groundwater analysis for potential to cause harm to water resources.

The criteria used for this process were derived by EPS using the following technical guidance:

- *Environment Agency Remedial Targets Methodology: Hydrogeological Risk Assessment for Land Contamination.*

Resource Sensitivity of Area	Basis of Tier 1 Criteria
High Groundwater Resource Potential (HGwRP) - Principal Aquifers	UK Drinking Water Standards (UKDWS)
Low Groundwater Resource Potential (LGwRP) - Secondary Aquifers not being abstracted and Unproductive groundwater strata	UK Environmental Quality Standards (EQS)

Screening criteria for Low Groundwater Resource Potential (LGwRP) have been adopted for this site due to the underlying geology being classified as a Secondary A Aquifer and taking account of the nearby watercourse (where EQS would typically apply).

6.2.2 Assessment of Results- Controlled Waters

The previous phase of investigation included sampling of groundwater from boreholes across the site. Although very minor detections of chlorinated solvents TCE, DCE and Vinyl Chloride were identified within the groundwater sample obtained from BH3, the concentrations of these detections (5ug/l, 4ug/l and 0.2ug/l) were very low, only very slightly above method detection

limit, and all within their respective Water Quality Standards including the most sensitive UK Drinking Water Standards. The presence of certain dissolved metals as well as a concentration of petroleum hydrocarbons was also discussed in correspondence from the regulator included in Section 2.3.

On this basis an unacceptable risk to groundwater was not considered to be present and further groundwater sampling not deemed necessary unless notable contamination was identified in any of the soil sampling in this phase of works for areas of the site not initially investigated.

The soil analysis in this subsequent investigation has not exceeded screening criteria representative of risks to controlled waters from concentrations of contaminants in soil and as such no further groundwater sampling was considered necessary.

On the basis of the data acquired from both investigations, EPS does not consider a significant risk to controlled waters to be present in the context of the sensitivity of the site and no further assessment is warranted. However, some betterment will be afforded to the water environment through the proposed remediation of hot spots as well as the removal of any unforeseen contamination encountered through the discovery strategy, as discussed in detail in the Remedial Strategy.

6.3 Assessment of Risks from Soil Vapour – Inhalation

To further assess the risks to future site users from vapour intrusion, 9 new soil gas monitoring points were fitted with a stainless steel sparge point towards the base of the boreholes (WS03-WS06, WS19-WS21, WS23, TP26a). The screened section was installed between 1.65m and 1.8m within each borehole.

This risk assessment has been undertaken using site-specific information, where available, to derive risk-based assessment criteria.

6.3.1 Methodology

Following collection of soil vapour analytical data, it is possible to further assess the vapour migration and inhalation pathways. The focus of this assessment is on vapour intrusion to indoor air as this is the critical exposure pathway for the vapour inhalation pathways.

Use of soil vapour data removes some of the uncertainty when assessing risks from vapour intrusion, as the partitioning and volatilisation from soil/groundwater to soil gas does not need to be modelled as it is measured directly.

6.3.2 Model Selection

There are a number of human health modelling software packages capable of modelling risks from CoC concentrations measured in soil gas. One of these is CLEA 1.07 and as such it has been adopted as a suitable modelling tool to assess the potential risks to (future) human health receptors from CoC in soil gas.

6.3.3 Chemical and Toxicological Parameters

The toxicological parameters were selected following the guidance presented within SR2 using the pre-loaded data within the CLEA model.

6.3.4 Model Input Parameters

In order to accurately reflect the risk to the offsite receptors, the following basic model input parameters were used.

Land Use	Commercial
Receptor	Female (com) 16-65yrs
Building	Office (post-1970)
Soil Type	Sandy Loam

It should be noted that the model set up is considered to represent a conservative scenario as for the purpose of risk assessment.

6.3.5 Selection of Contaminants of Concern

A number of contaminants were measured at concentrations above laboratory MDL. In the absence of detailed modelling information available for some of these contaminants, the following have been used to represent the potential risks associated with inhalation of volatile contaminants by neighbouring residents.

- Carbon Disulphide
- m/p - Xylene
- Trichloroethene
- Tetrachloroethene
- 1,1,1 – Trichloroethane
- Aliphatic C5-C6
- Aliphatic C6-C8
- Aliphatic C8-C10
- Aliphatic C10-C12
- Aromatic EC7-EC8 (Toluene)
- 2 Propanone (Acetone)
- 1,1,1 – Trichloroethane
- Naphthalene
- 1,2 - Dichlorobenzene

6.3.6 Assessment of Risks from Vapour Inhalation

Maximum concentrations of the selected contaminants measured within the soil vapour sampled were input into the model to assess the risks to current and future on-site receptors. The CLEA Output is presented as Appendix J.

The results of the soil gas assessment indicate that the maximum measured concentrations of all contaminants in soil vapour do not present an unacceptable level of risk to current or future site users, with the calculated hazard indices for all contaminants being 0.00, which falls significantly below the trigger value of 1.0.

As such the risks to future site users from volatile contamination originating at the site is considered to be acceptable. This assessment also demonstrates that off-site risks from site-derived contaminant sources generating organic vapours to neighbouring residential properties are negligible. This latter point had been raised previously by the LPA and therefore formed part of the original Conceptual Site Model.

These findings are in line with those from the initial Phase II assessment.

6.4 Ground Gas Risk Assessment

The results of the soil gas monitoring are presented in Table 4 and have been assessed in accordance with CIRIA guidance '*Assessing Risks Posed by Hazardous Ground Gases to Buildings*' (C665).

Results of the monitoring visits show that no discernible flow was recorded at any of the borehole locations and that no methane was measured above minimum instrument detection limits of 0.1% v/v. Carbon dioxide was only encountered at a maximum of 0.5% within one borehole.

As proposed development plans are understood to include the construction of a commercial warehouse building, the '*Modified Wilson and Card Classification System*' has been used to assess the risks from ground gases, (in accordance with CIRIA C665).

The maximum individual Gas Screening Value (GSV) is calculated by multiplying the maximum borehole flow rate (l/hr) by the maximum gas concentration (%). This gives a gas screening value for methane of <0.0001l/hr and carbon dioxide of <0.0005l/hr, which both fall into the 'very low risk' category and Characteristic Situation 1 (CS1) conditions.

These results are also confirmed by the findings of the laboratory gas analysis from the summa canisters obtained on site, which did not identify any concentrations of methane above method detection limit of 0.05%, whilst carbon dioxide was measured at a maximum concentration of 0.37%.

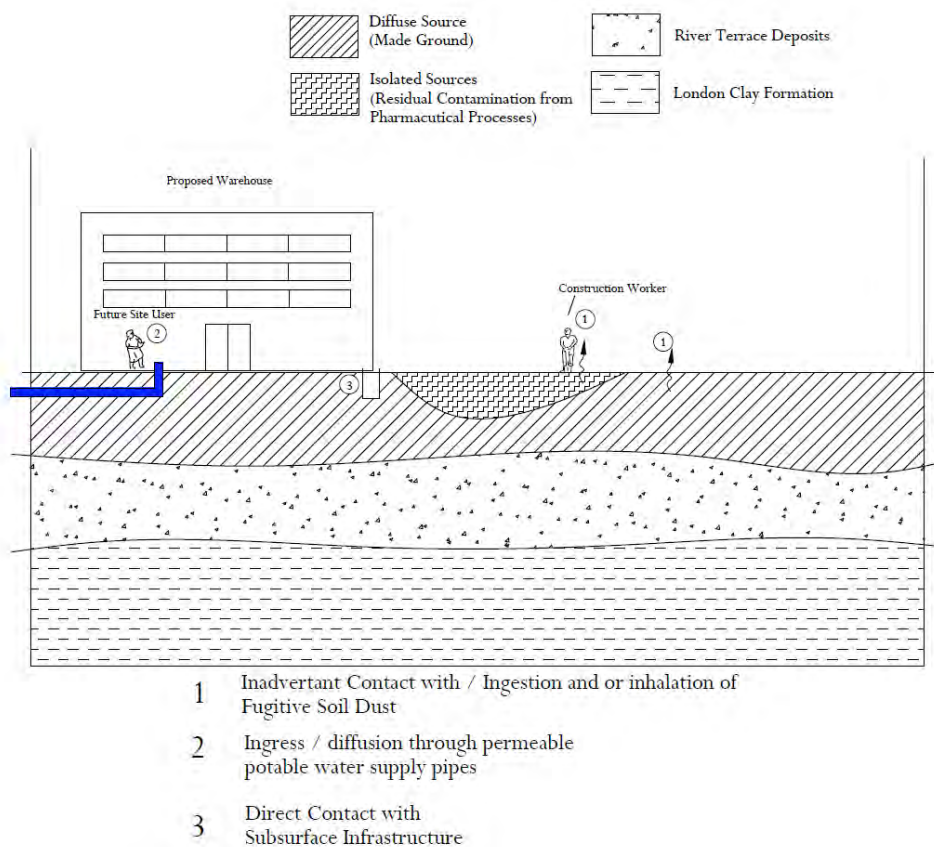
These findings are broadly similar to those identified for the monitoring undertaken on other boreholes across the site during the initial phase of works.

6.5 Refined Conceptual Site Model

Based on the findings of the results of this investigation and the previous one, EPS has revised the initial site specific conceptual model, which is detailed below:

The following diagram provides an illustration of the plausible contaminant linkages that may be active at the site and which may need further investigation or control to ensure safe development:

Illustrative Conceptual Site Model – Pfizer, Havant



6.6 Summary of Findings

This supplementary intrusive investigation was undertaken to fill data gaps from a previous investigation undertaken by EPS in March 2021, most notably to obtain data from within the previously inaccessible buildings at the site, as well as target key Potential Areas of Concern.

The intrusive investigation comprised the drilling of 12 boreholes and 12 trial pits, with ground conditions found to comprise a variable thickness of made ground overlying successive layers of

cohesive and granular River Terrace Deposits. Below this lay London Clay Formation which comprised of layers of silt and stiff, grey clay.

Laboratory testing of soils and soil vapour broadly confirm the findings of the previous investigation which do not indicate significant risks to human health from contamination in soil. Further ground gas monitoring data confirms the findings of the previous work in that the site falls into Characteristic Situation 1, for which no ground gas protection measures would be required.

The most notable concentration of any contaminant remains a concentration of 53.568mg/kg of Benzylbutyl Phthalate identified within a shallow soil sample in BH3 during the initial investigation. However, further testing of locations in this area during this investigation has not identified any further notable contamination and no trace of the contaminant was identified in the groundwater sample during the first phase. Nevertheless, this borehole is located in the north-eastern part of the site where contamination has been historically identified and trace levels of aliphatic petroleum hydrocarbons, PCE, TCE and Vinyl Chloride were also identified in the groundwater sample obtained from BH3 (although not considered to pose a risk to controlled waters). Overall, the quality of soil, groundwater and soil gases appears relatively good, in the general context of a site used in the past for primary and secondary pharmaceutical manufacturing.

On this basis, although the two EPS investigations have not identified any contamination which is considered to pose a significant risk to human health or controlled waters, an approach to remediation is still recommended based on the likely presence of localised 'hotspots' along with a discovery strategy for any unforeseen contamination. These measures along with general good practise to protect groundworkers and drinking water supplies are presented within an accompanying Remedial Strategy.

The findings of this report do not indicate any obvious barrier to redeveloping the site (in terms of contamination). Moreover, the site does not pose a significant possibility of significant harm to existing receptors and would not warrant determination as 'contaminated land' under Part 2A of the Environmental Protection Act 1990 (although that decision would remain the value judgement of the LPA).

6.7 Recommendations

In the context of potentially unacceptable or acceptable risks as outlined within the Environment Agency's *Land Contamination: Risk Management* guidance (LC:RM, 2020), the risks identified by this work will require mitigation in order to make the site safe and suitable for its proposed end use.

This document will be accompanied by a Remedial Strategy and Implementation Plan which EPS has produced concurrently. This document outlines the remedial requirements for the site in order to manage the identified risks and provides a plan for implementing them. EPS recommends that it is reviewed alongside this document.

It is recommended that a copy of this report be provided to the Environmental Health Department of Havant Borough Council so that the information can be used to support the current planning application. Both this report and the Remedial Strategy will need to be approved by the Council via discharge of condition application.

6.8 Waste Management

Due to the re-profiling requirements of the final scheme and any associated earthworks balance, the site will be subject to a materials management exercise to ensure all potential waste soils are handled and re-used in a legally correct sustainable fashion.

In accordance with CL:AIRE's *Definition of Waste: Development Industry Code of Practice*, re-use criteria will be defined for site-won soils which are suitable for use being both protective of relevant receptors and geotechnically appropriate (with input from the structural engineers as necessary). EPS will prepare a Materials Management Plan and have it formally declared by a Qualified Person prior to commencement of groundworks. EPS can also assist with similar mechanisms for re-using waste materials exempt of an environmental permit, such as a U1.

EPS would always encourage the employment of an MMP to sustainably manage the re-use of site won soils and minimise the highly unsustainable practise of landfilling.

7 GLOSSARY

BPF	Biotech Packaging Facility
BTEX	Benzene, Toluene, Ethylbenzene & Xylenes
CoC	Contaminant of Concern
CSM	Conceptual Site Model
DCE	1,1 Dichloroethene
EA	Environment Agency
EDC	European Distributing Centre
FCMU	Fine Chemicals Manufacturing Works
HBC	Havant Borough Council
MTBE	Methyl Tert Butyl Ether
PAOC	Potential Areas of Concern
PCE	Tetrachloroethene
PFC	Perfluorinated Chemicals
PFOA	Perfluorooctanic Acid
PFOS	Perfluorooctane Sulforate
UST	Underground Storage Tank
TCE	Trichloroethene
TPH	Total Petroleum Hydrocarbons
VC	Vinyl Chloride
WALL	CL:AIRE Water and Land Library

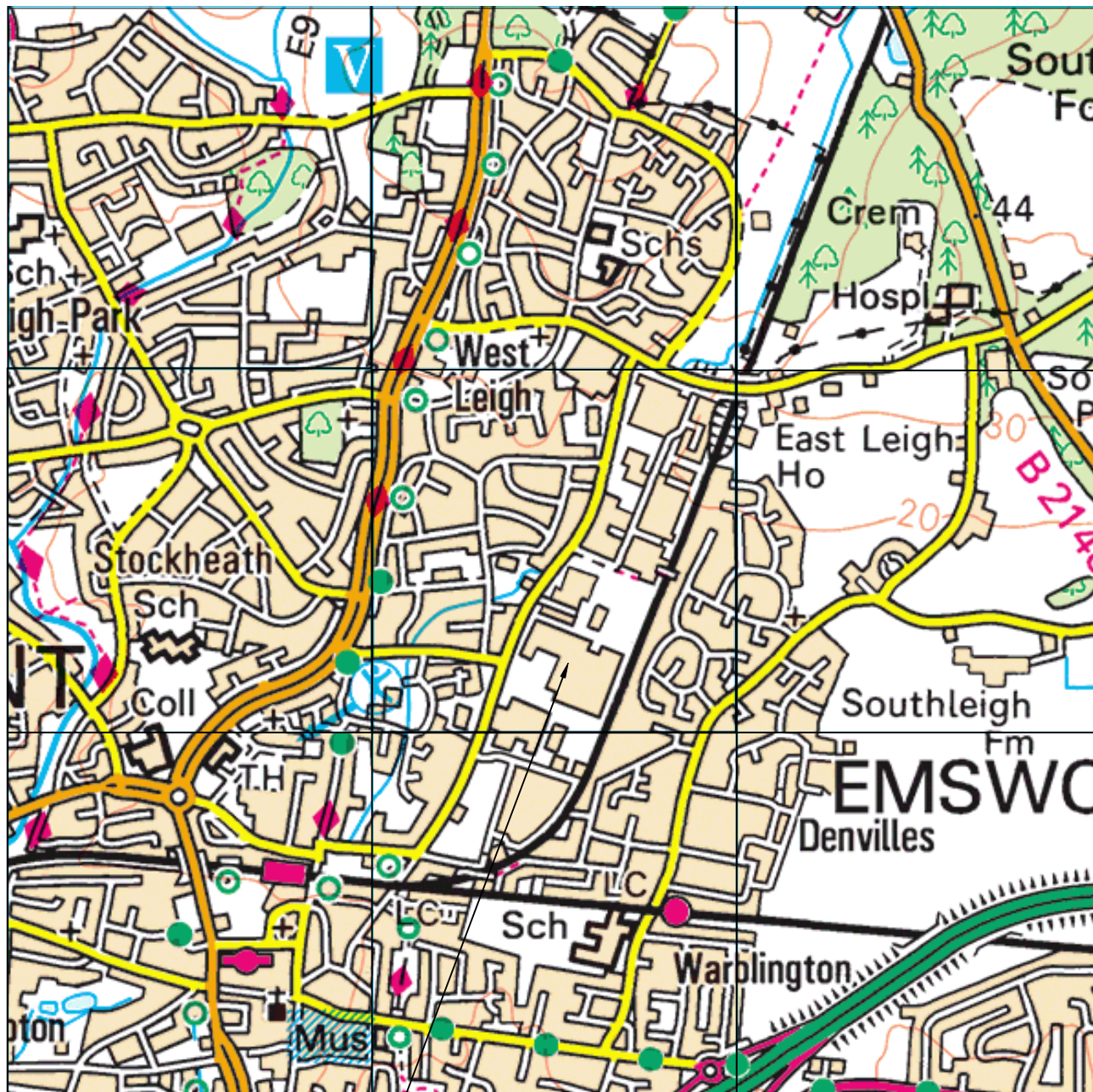
Building References

The following key current and former buildings have been identified and reference should be made to Appendix B for the current layout.

Building*	Location on Site	Description
A	NE corner	Small building built in 1974 of unknown use, possibly waste or former solvent store.
B	SE corner	Pharmaceutical building built in 1978, replaced by Building H.
C	SE corner	Bulk liquid store and laboratory built in 1978, including sugar solution storage for cough syrups.
D	Central Northern area	Possibly part of manufacturing support warehouse, built in 1964 replaced by Building N.
E	Central Northern area	Very small building built adjacent to boiler house ('R') in 1970. Unknown use.
F	Central Western Area	Built in 1956, central site building, replaced by Building S.
G (Present in 2021)	NE corner	Biotech Packaging Facility (BPF) which incorporates the site's waste storage area. Built c.2009.
H (Present in 2021)	Central Eastern area	Pharma Offices & Packaging Facility. c1992. Previously manufacturing of pharmaceuticals.
I	Central Western Area	Built in 1956, central site building, replaced by Building S.
J	Central Northern Area	BPF Switch room.
K (Present in 2021)	SE corner	Offices & packaging facility for quality control. c.1981-1990.
L (Present in 2021)	SE	Offices & Packaging Facility. c.1981-1990.
M	Central Eastern area	Transfer area associated with Building H.
N (Present in 2021)	Central Northern area	Low Bay Warehouse, just south of Building Q. c.1964/66
O	No records identified	-
P (Present in 2021)	Central	High Bay Warehouse just south of Building N containing the European Distribution Centre c.2009.
Q (Present in 2021)	Central Northern area	Site workshop and solvent (toluene) and oils store, just north of Building N. Partially redundant c.2002.
R	Central North/ NW area	Former boilerhouse. Now electricity substation.
S	Central northwest area.	'Injectables' and Nutritional SMA Large building demolished c.2002.
T	NW corner	Engineering workshop demolished c.2002.
U	NW corner	Former administrative building, demolished c. 2002.
V	Western area	Staff Restaurant. Demolished with northern site area in 2015-17.
W	Western area	Reception/Security
X	No records identified	-

Building*	Location on Site	Description
Y	No records identified	-
Z (Present in 2021)	Central Southern/ SW Area	Cold Stores 2 and 3, built in 2011. Diesel generator adjacent to these stores.
Fine Chemicals Manufacturing Unit (FCMU)	NE	Built in 1961. Adjacent to solvent storage. Demolished 1998.
Solvent Recovery	NE	Built in 1992.
SMA Building	SW area	Build in 1971, associated with smaller Buildings J and N. Demolished c.2001. SMA is infant milk formula.
Tablet/Dispensary	NE area	Built in 1956 (tablet) and 1975 (dispensary) and are replaced by BPF (Building G). Former tabletting and dispensary buildings were in central area, near BPF
North Site Distribution Warehouse	NE 'limb' (Outside of current redline).	Building in 1985 (but not currently within redline site boundary).

FIGURES



Approximate Site Location

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Title: Site Location Plan

Project: 32 New Lane, Havant

Fig No: 1

Scale: NTS

Drawn By: MJ

Approved By: SB

Job No: UK20.5052c

Dwg No: 32NewLane/0321/01

Date: March 2021



— Approximate Site Boundary

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Title: Current Site Layout

Project: 32 New Lane, Havant

Fig No: 2

Scale: NTS

Drawn By: MJ

Approved By: SB

Job No: UK20.5052c

Dwg No: 32NewLane/0321/02

Date: March 2021



— Approximate Site Boundary

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Title: Aerial Photograph

Project: 32 New Lane, Havant

Fig No: 3

Scale: NTS

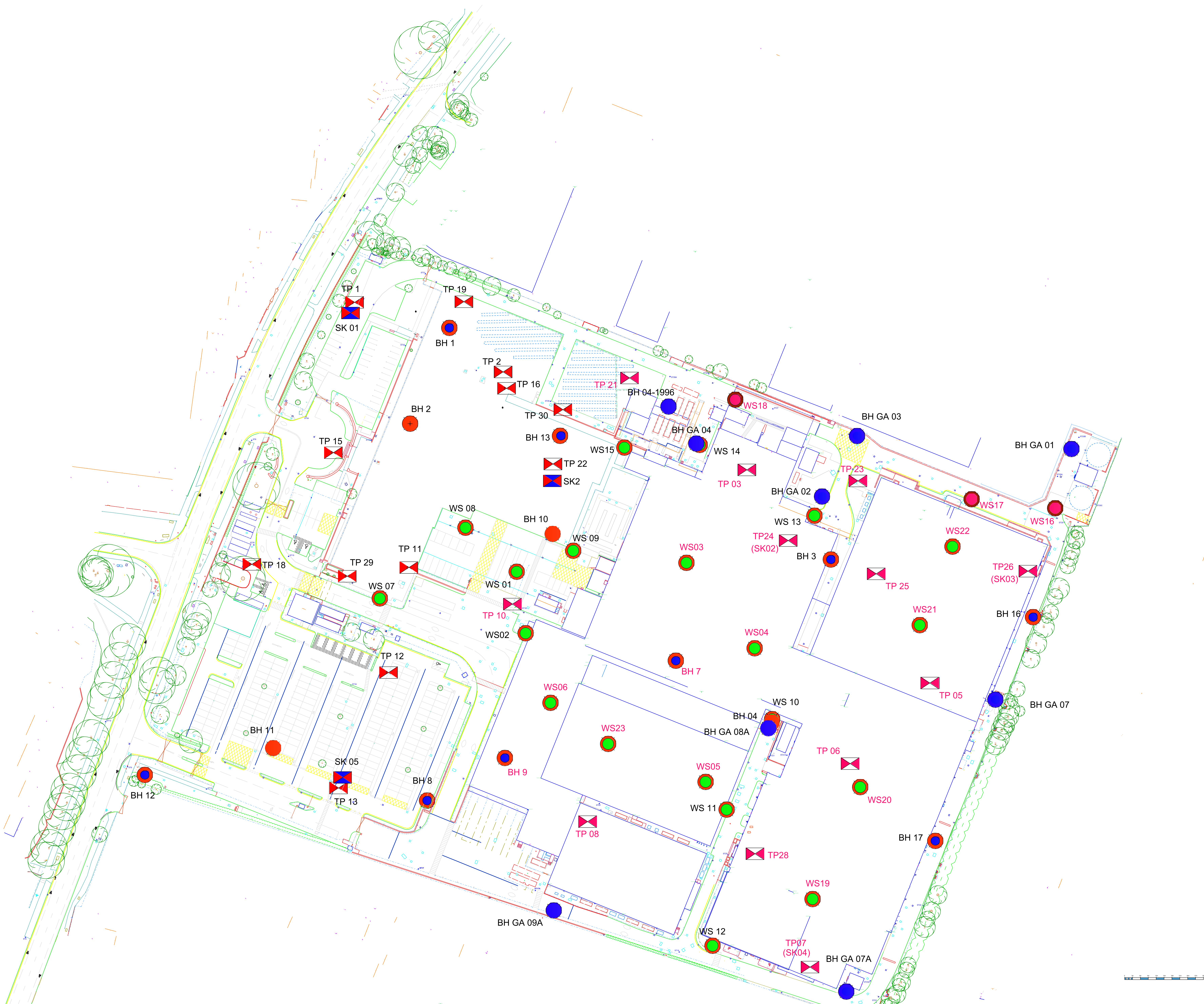
Drawn By: MJ

Approved By: SB

Job No: UK20.5052c

Dwg No: 32NewLane/0321/03

Date: March 2021



TABLES



Table 1a – Laboratory Testing Schedule (Environmental - Soil)

Sample ID	Sample Depth (m bgl)	EPS Mini Suite	EPS TPH Suite	EPS Waste Suite	VOC & SVOC	Ammonical Nitrogen	pH and Water Soluble Sulphate	Asbestos Screen
TP03	0.3	1	1	-	1	1	-	1
TP05	0.4-0.6	1	1	1	1	1	-	1
TP05	1.5	1	1	-	1	1	-	1
TP06	0.3-0.4	1	1	-	1	1	-	1
TP07	0.3-0.4	1	1	-	1	1	-	1
TP08	0.3-0.5	1	1	-	1	1	-	1
TP10	0.25-0.4	1	1	-	1	1	-	1
TP10	0.6-0.8	1	1	-	1	1	-	1
TP21	0.1-0.2	1	1	-	1	1	-	1
TP23	0.3-0.6	1	1	1	1	1	-	1
TP24	0.25-0.4	1	1	-	1	1	-	1
TP25	0.3-0.5	1	1	1	1	1	-	1
TP26	0.3-0.5	1	1	-	1	1	-	1
TP28	0.3-0.5	1	1	-	1	1	-	1
WS03	0.12-0.4	1	1	-	1	1	-	1
WS03	0.6-0.8	1	1	-	1	1	-	1
WS04	0.42-0.6	1	1	-	1	1	-	1
WS05	0.25-0.5	1	1	-	1	1	-	1
WS06a	0.4-0.6	1	1	-	1	1	-	1
WS16	0.2-0.4	1	1	-	1	1	-	1
WS17	0.3-0.6	1	1	-	1	1	-	1
WS18	0.3-0.5	1	1	-	1	1	-	1
WS19	0.4-0.8	1	1	-	1	1	-	1
WS20	0.7-0.8	1	1	-	1	1	-	1
WS21	0.4-0.6	1	1	-	1	1	-	1
WS22	0.2-0.4	1	1	-	1	1	-	1
WS23	0.3-0.7	1	1	-	1	1	-	1
BH7	0.3-0.4	1	1	-	1	1	-	1
BH7	9.0	-	-	-	-	-	1	-
BH7	11.0	-	-	-	-	-	1	-
BH9	0.4-0.5	1	1	-	1	1	-	1
BH9	3.0	-	-	-	-	-	1	-
BH9	6.5	-	-	-	-	-	1	-
BH9	9.0	-	-	-	-	-	1	-

Notes:
mbgl

meters below ground level



1	Sample Taken
-	Sample Not Analysed
EPS Mini Suite	Organic Matter, Cyanide, Metals, PAH's, Phenols, Asbestos, pH, sulphates
EPS TPH Suite	TPH CWG, BTEX, MTBE
EPS Waste Suite	Waste Characterisation Suite
VOC	Volatile Organic Compounds
SVOC	Semi-Volatile Organic Compound

Table 1b – Laboratory Testing Schedule (Environmental – Soil Gas)

Sample ID	TO15 List + TICs	Ground Gases	Hydrogen Sulphide	THP	Limonene
WS01	1	1	1	1	1
WS02	1	1	1	1	1
WS03	1	1	1	1	1
WS04	1	1	1	1	1
WS05	1	1	1	1	1
WS06	1	1	1	1	1
WS07	1	1	1	1	1
WS08	1	1	1	1	1
WS09	1	1	1	1	1
WS10	1	1	1	1	1
WS11	1	1	1	1	1
WS12	1	1	1	1	1
WS13	1	1	1	1	1
WS14	1	1	1	1	1
WS15	1	1	1	1	1
WS19	1	1	1	1	1
WS20	1	1	1	1	1
WS21	1	1	1	1	1
WS22	1	1	1	1	1
TP26a	1	1	1	1	1

Notes:

mbgl

1

-

Ground Gases

meters below ground level

Sample Taken

Sample Not Analysed

Carbon Dioxide, Methane, Oxygen, Nitrogen, Carbon Monoxide

Table 2 – Laboratory Testing Schedule (Geotechnical)

Sample ID	Sample Depth (m bgl)	Moisture Content	Liquid / Plastic Limits	Particle Size Distribution	CBR	Dry Density / Moisture Content
BH7	1.2-1.65	1	1	-	-	-
BH7	3.5-4.0	-	-	1	-	-
BH7	7.0-7.5	1	1	-	-	-
BH7	10.5-10.6	-	-	1	-	-
BH9	2.5-3.0	-	-	1	-	-
BH9	6.0-6.1	1	1	-	-	-
BH9	9.5-9.95	-	-	1	-	-
BH9	12.0-12.45	1	1	-	-	-
TP03	1.1-1.4	-	-	-	1	1
TP03	1.7	-	-	1	-	-
TP05	0.9-1.1	1	1	-	-	-
TP06	0.5-0.9	-	-	-	1	1
TP07	1.1-1.2	1	1	-	-	-
TP07	0.3-0.6	-	-	-	1	1
TP08	0.3-0.6	-	-	-	1	1
TP10	0.5-0.8	-	-	-	1	1
TP10	2.0	-	-	1	-	-
TP21	0.8-1.2	-	-	-	1	1
TP23	1.0-1.2	-	-	1	-	-
TP24	0.3-0.6	-	-	-	1	1
TP25	0.3-0.8	-	-	-	1	1
TP28	0.4	-	-	1	-	-

Notes:

mbgl

1

-

meters below ground level

Sample Taken

Sample Not Analysed

Table 3 - Ground Gas Monitoring Data

(11/08/2021)

Sample ID	WS03	WS04	WS05	BH7	BH9
CH ₄ (%)	<0.1	<0.1	<0.1	<0.1	<0.1
CO ₂ (%)	0.1	0.1	<0.1	<0.1	<0.1
O ₂ (%)	21.0	21.0	21.1	20.8	20.8
Flow Rate (l/hr)	<0.1	<0.1	<0.1	<0.1	<0.1

Readings collected on 11th August 2021 at an atmospheric pressure of 1017-1011 (falling).

(15/09/2021)

Sample ID	WS06a	WS19a	WS20a	WS21a	TP26a
CH ₄ (%)	<0.1	<0.1	<0.1	<0.1	<0.1
CO ₂ (%)	<0.1	<0.1	0.1	0.2	0.5
O ₂ (%)	20.2	20.6	19.9	20.0	19.9
Flow Rate (l/hr)	<0.1	<0.1	<0.1	<0.1	<0.1
VOC	<0.1	<0.1	<0.1	<0.1	<0.1

Readings collected on 15th September 2021 at an atmospheric pressure of 1013-1012 (falling).

APPENDICES

APPENDIX A

Selected Site Photographs



— Approximate Site Boundary

① Approximate Photo Location

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Title: Photograph Location Plan

Project: 32 New Lane, Havant

Appendix A

Scale: NTS

Drawn By: MJ

Approved By: SB

Job No: UK20.5052c

Dwg No: 32NewLane/0321/A

Date: March 2021

Photo 1: View looking south across the western face of the onsite buildings.



Photo 2: View looking north across the gravel area in the northwest corner of the site.



Photo 3: View looking north along the eastern edge of the site, with BH17 under the yellow cover.



Photo 4: View looking northeast, from the southwest corner of the site.



Photo 5: Drilling of BH9 towards the south-centre of the onsite buildings, slightly north of the loading bay entrances.



Photo 6: View within the large open area of warehouse in the northwest of the existing on site buildings.



Photo 7: View looking west along the road hugging the northern boundary of the site.

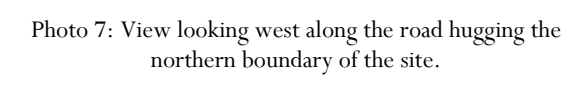


Photo 8: Trial pit being excavated within building towards the northeast of the site.

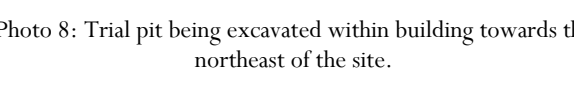




Photo 9: Trial pit excavation within building towards the northeast of the site.

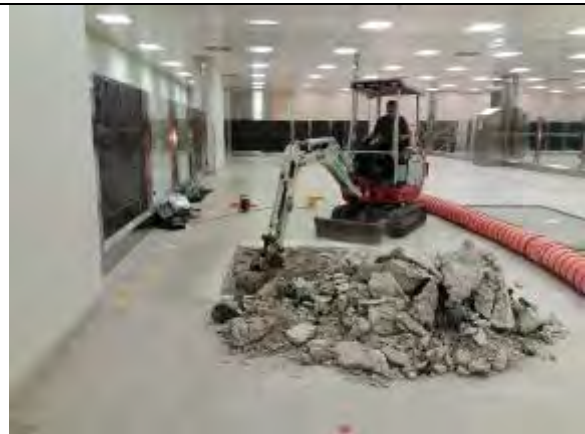


Photo 10: View of racking inside building.



APPENDIX B

Detailed Site Layout

