



# RIDGE

SITE INVESTIGATION REPORT  
DUNSBURY WAY, HAVANT

DUNSBURY WAY LIMITED

July 2021

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July 2021

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## 1. INTRODUCTION

### 1.1. Brief

Ridge and Partners LLP (Ridge) was commissioned by Dunsbury Way Limited (the client) to undertake an intrusive Site Investigation in relation to the proposed development of residential apartments at land off Dunsbury Way, Havant, PO9 5BQ (hereafter referred to as 'the site'). A site location plan is included as Figure 1.

The brief was to undertake an intrusive contamination investigation in relation to contamination conditions associated with an application (APP/19/01109) for the redevelopment of the Former Dairy Crest site for up to 74no. dwellings and access off Fulflood Road. The outline application was granted permission on 31 March 2021.

### 1.2. Planning and Consultations

The outline application was granted permission on 31 March 2021. Condition 5 of the Grant of Outline Planning Permission states:

- ♣ Prior to development an assessment of the nature and extent of contamination at the site shall be submitted. The assessment may comprise separate reports, such as
- ♣ An intrusive site investigation based on the proposals outlined within the Ridge Desk Top Study (Ref: 5003415 v2) issued October 2018; to provide sufficient data and information to adequately identify & characterise any physical contamination on or affecting the site, and to inform an appropriate assessment of the risks to all identified receptors
- ♣ A Remediation Strategy
- ♣ A Verification Plan and Validation Report

A Havant Borough Council Environmental Health Memorandum dated 8 January 2019 stated that Environmental Health are in general agreement with recommendations for an intrusive site investigation within the previously issued Ridge Desk Top Study. A review of further comments is provided below:

- ♣ The Councils conceptual understanding of the local hydrogeology and hydrology has developed, most notably in connection with the recent assessment of a nearby site on Fulflood Road. The Council will draw upon its knowledge of the site when considering the results of future site investigations. This will in particular be relevant to the consideration of the local surface water Riders Stream, which has status as a statutory main river and which ultimately discharges to an Ecological asset which benefits from multiple European designations;
- ♣ The Ridge Desk Study assigned a risk level of 'very low' to this feature. Environmental Health disagree with this on the basis of the above, and the recent water quality sampling which identified elevated concentrations of pollutants within this feature upstream of the subject site; and,
- ♣ It has been shown that the local superficial Secondary aquifer is in hydraulic continuity with the stream.

The Environment Agency provided comment on 7 May 2019, and applied the following conditions:

- ♣ Piling or other deep foundations using penetrative methods shall not be carried out other than with the written consent of the Local Planning Authority (LPA). Groundwater is particularly sensitive in this location because the proposed development site is within Source Protection Zone 1c for a public drinking water supply.
- ♣ If, during development, contamination (i.e. free phase hydrocarbons) is identified or found to be present at the site, then no further development (unless otherwise agreed in writing with the LPA) shall be carried out until a remediation strategy detailing how this contamination will be dealt with has been submitted to, and approved in writing by, the LPA.

### 1.3. Summary of Works

The Ridge Site Investigation comprised the following:

- ♣ 9no. windowless sample boreholes drilled to a maximum depth of 5.45mbgl;
- ♣ In-situ geotechnical testing namely Standard Penetration Tests;
- ♣ Installation of monitoring wells in 3no. boreholes;
- ♣ Contamination laboratory analysis; and
- ♣ Monitoring of ground gas, soil vapour and groundwater in monitoring wells, over five monitoring rounds.

As of Tuesday 24 March 2020, movement in the UK was restricted due to the coronavirus outbreak, and at this time Ridge decided to suspend all site works including monitoring visits. As a result, monitoring visits span March 2020 to June 2021.

### 1.4. Proposals

Proposals are for the re-development of the Former Dairy Crest site and adjacent Southern Co-Op owned land to the south. The development will comprise 74no. apartments spread across the northern and western parts of the site with car parking occupying much of the remainder. A communal amenity space is proposed in the south, while covered bicycle storage located in the centre. Ground floor flats will have private gardens.

Development plans are included as Figure 2.

### 1.5. Report Scope and Limitation

This report is based upon a review of readily available information and the recent Site Investigation data detailed herein. The report presents an interpretation of the borehole and laboratory data provided by the Ridge Site Investigation undertaken on 28 February 2020 and 8 March 2020. In addition, this report outlines the basic ground conditions encountered in the exploratory holes and the results of limited monitoring of installed wells.

This information has been collated, processed and used to provide an interpretation of the ground conditions, with recommendations on any contamination issues.

The recommendations and opinions expressed in this report are based on the strata observed in the exploratory holes, the results of the site and laboratory tests, and information obtained as part of the desk study or provided by others. Ridge takes no responsibility for conditions that have not been revealed by the

exploratory holes, or which occur between them or for features which may be more widespread to those found.

Whilst efforts have been made to interpret the conditions between investigation locations, such information is only indicative and liability cannot be accepted for its accuracy. Information provided from other sources is taken in good faith and Ridge cannot guarantee its accuracy.

The information contained in this report is intended for the use of Dunsbury Way Limited and Ridge can take no responsibility for the use of this information by any other party or for uses other than that described in this report.

## 2. SITE SETTING

### 2.1. Site Location and Description

The site is approximately square in plan with an area of approximately 0.50 ha. The northern part of the site comprises a single storey masonry former milk packaging and distribution depot building along the north-west boundary with covered bays and a yard in the north-east and east, a toilet block in the north-east corner and parking bays in the west of the site. The building contains predominantly office accommodation at the western end with warehouse, storage, refrigeration and loading areas in the centre and west. The covered bays in the north-east and east of the site, where milk distribution vehicles are believed to have been parked, were noted to be of steel frame construction with brick rear walls and suspected asbestos cement sheeting forming the roofs. The yard was predominantly covered by asphalt surfacing with a concrete slab along the western edge of the yard. No evidence of fuel or chemical storage was observed during the walkover survey and it is understood from planning records that repair, servicing or refuelling of vehicles was not permitted on site under the planning permission for the development of the depot.

The southern part of the site comprises a single storey brick funeral care facility with soft landscaping and parking fronting Dunsbury Way to the west of the building with a yard and garage to the rear (east) of the building. Adjacent to the south of the funeral care building is a residential bungalow, understood to have originally been constructed as the dwelling for the manager of the funeral care facility, with soft landscaping fronting Dunsbury Way and a rear garden to the east. No evidence of fuel or chemical storage was noted in relation to the funeral care facility or the bungalow. The southern boundary of the site is formed by a steep embankment down to the adjacent Riders Stream, approximately 2-3m below the general site level.

The site is situated within a residential and commercial part of Havant. Residential properties are located to the south and west, with a number of associated public green spaces noted. Light commercial properties are located to the east.

Riders Infant School is situated 125m west, and The Catholic Church of Saint Michael and All Angels is located 50m north-west.

### 2.2. Site History

The Ordnance Survey maps provided and reviewed from 1866 to 2014 (scales 1:2,500, 1:10,000, 1:1,250, 1:10,560) indicate that the site formed part of an open field from the earliest available map until the site was initially developed as part of a sewage disposal works sometime shortly after 1932, which included the construction of Dunsbury Way along the western boundary of the site. The site comprised Congestion Tanks in the south-east and Sludge Beds in the south-west with Settling Tanks and Filter beds shown adjacent to the east of the site and Humus Beds shown beyond Dunsbury Way to the west of the site. A Site Plan detailing these features is included as Figure 3.

The sewage works appear to have been removed in the mid to late 1950s and a housing estate was developed to the south of the site. The site is shown to be vacant until the 1962 map, which shows the northern part of the site to have been developed as a Depot, believed to be the existing former Dairy Crest Depot. The Depot on site appears to have formed part of an industrial estate with another Depot adjacent to the east, the Leigh Park Estate Office and Fulflood Road adjacent to the north with large Works buildings beyond these. A garage is also shown beyond Dunsbury Way to the west.

The ground level of the site and the associated new industrial estate appears to have been raised as part of the development with an embankment shown along the stream to the south of the site.

During the late 1960s/early 1970s the south of the site was developed with two linked buildings identified as 222 and 224, believed to be the existing Co-operative Funeral care premises and adjacent residential bungalow. The 1971 map also shows the Depot to the east to be an Omnibus Depot, the Works beyond that to the east to have been extended and referred to as a Factory and the Works building to the north to have also been extended. It is understood that these units formed the former Procter and Gamble factory. The western section of the Factory building was subsequently demolished during the early 1990s and the works buildings and former Estate Office to the north of the site were demolished between 2002 and 2010 and the majority of the area replaced with housing.

### 3. PHYSICAL SETTING

#### 3.1. Geology and Hydrogeology

The following observations are taken from the British Geological Survey (BGS) Geology of Britain Viewer (2021) and the previously issued Desk Top Study.

The Geology of Britain Viewer (2021) indicates that the majority of the site is underlain by Superficial Deposits of Head, with no deposits recorded in the north-east corner of the site. Bedrock geology is recorded as the London Clay Formation in the west, and the Bognor Sand Member in the east.

The table below identifies the expected composition of the published strata and associated aquifer classification.

| SUPERFICIAL DEPOSITS                   |                                                                                                                                                                                                                                                                                                     |
|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Unit Name                              | Head – Clay, Silt, Sand and Gravel                                                                                                                                                                                                                                                                  |
| Geology Description                    | Comprises Gravel, Sand and Clay depending on upslope source and distance from source. Poorly sorted and poorly stratified deposits. Essentially comprises Sand and Gravel, locally with lenses of Silt, Clay or peat and organic material.                                                          |
| Aquifer Classification                 | Secondary Undifferentiated                                                                                                                                                                                                                                                                          |
| Aquifer Description                    | Assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type. |
| BEDROCK GEOLOGY – WESTERN PART OF SITE |                                                                                                                                                                                                                                                                                                     |
| Unit Name                              | London Clay Formation                                                                                                                                                                                                                                                                               |
| Geology Description                    | Bioturbated or poorly laminated, blueish grey or greyish brown, slightly calcareous, silty to very silty Clay, clayey Silt and sometimes Silt, with some layers of sandy Clay.                                                                                                                      |
| Aquifer Classification                 | Unproductive                                                                                                                                                                                                                                                                                        |
| Aquifer Description                    | Rock layers of drift deposits with low permeability that have negligible significance for water supply or river base flow.                                                                                                                                                                          |
| BEDROCK GEOLOGY – EASTERN PART OF SITE |                                                                                                                                                                                                                                                                                                     |
| Unit Name                              | Bognor Sand Member                                                                                                                                                                                                                                                                                  |
| Geology Description                    | Glauconitic bioturbated or cross-bedded fine and medium grained sands, partially cemented.                                                                                                                                                                                                          |
| Aquifer Classification                 | Secondary (A) Aquifer                                                                                                                                                                                                                                                                               |
| Aquifer Description                    | Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers                                                                                                                                  |

Table 3.1: Geology and Hydrogeology

### 3.1.1. Artificial Ground and Landslips

There are no records within the 500m search buffer.

### 3.1.2. Ground Workings

There are no records of historical or current ground workings within 250m of the site.

### 3.1.3. Radon

The property is not in a Radon Affected Area, as less than 1% of properties are above the Action Level. No Radon Protective Measures are necessary for new properties or extensions to existing ones.

### 3.1.4. Natural Ground Subsidence

The BGS has provided the following information as summarised in the table below.

| PROCESS                             | RISK LEVEL |
|-------------------------------------|------------|
| Running Sands                       | Low        |
| Shrink Swell Clay                   | Low        |
| Landslides                          | Very Low   |
| Collapsible Deposits                | Very Low   |
| Ground Dissolution of Soluble Rocks | Negligible |
| Compressible Deposits               | Negligible |

Table 3.2: Ground Subsidence

## 3.2. Hydrology

### 3.2.1. Surface Water Features

The nearest surface water feature is Riders Stream, which has status as a statutory main river and which ultimately discharges to an ecological asset named Langstone Harbour, which benefits from multiple European designations.

### 3.2.2. Flooding

The site is classified as an Environment Agency Zone 3 Flood Area –annual probability of flooding between 1% or greater from rivers, and 0.5% or greater from the sea.

The Risk of Flooding from Rivers and Sea (RoFRaS) Flood Rating is classified as High (1 in 30 or greater).

There are no flood defences or areas benefiting from flood defences within 250m of the site.

## 3.3. Controlled Waters

### 3.3.1. Abstraction Licenses

There are no groundwater abstraction licenses within 1km of the site. There are no records of surface water abstraction licenses within 2km of the site boundary.

### 3.3.2. Source Protection Zones

The site is situated within a Zone 1c SPZ. This is defined as an inner zone SPZ for subsurface activity only. This is where the aquifer is confined and may be impacted by deep drilling activities.

## 4. PREVIOUS REPORTS

### 4.1. Ridge Desk Top Study (2018)

Ridge issued a Desk Top Study (Ref: 5003415, Dated October 2018) in relation to the specific study site. A summary is provided below.

#### 4.1.1. Sources

Following site reconnaissance, and review of historical and environmental records, the Ridge DTS identified the following potential sources of contamination:

1. Potential ground gas associated with organic materials (congestion tank) and Made Ground (cut and fill).
2. Possible asbestos containing materials (ACMs) in soils and Made Ground associated with historical development of site. Contaminants of Concern (CoC) include asbestos, heavy metals, petroleum hydrocarbons and PAHs.
3. Potential fuel oil and other contaminants associated with the refuelling depot on the adjacent (east) former bus depot. CoC primarily include petroleum hydrocarbons and PAHs.
4. Surrounding land uses within 100m inclusive of depots, vehicle repair, service centre, factory and works. CoC include commonly identified contaminants such as asbestos, heavy metals, petroleum hydrocarbons and PAHs.

#### 4.1.2. Receptors

Receptors that may be affected by the potential contamination sources as listed above are considered to be:

- ♣ End Users (residents and maintenance workers)
- ♣ Construction workers during development
- ♣ Secondary (undifferentiated) aquifer within superficial deposits (Head)
- ♣ Secondary (A) aquifer within bedrock (Bognor Sand)
- ♣ Adjacent south Riders Stream

#### 4.1.3. Pathways

The key environmental pathways and exposure routes by which potentially toxic substances may possibly reach the identified potential receptors are considered to be:

- ♣ Vertical and lateral migration of organic and inorganic compounds through underlying geology and/ or via overland flow;
- ♣ Vertical and lateral migration of ground gas and soil vapours leading to accumulation in enclosed spaces;
- ♣ Inhalation of ground gas and soil vapour;
- ♣ Inhalation of contaminated dust;
- ♣ Ingestion of contaminated soils; and,
- ♣ Dermal contact with contaminated soils.

#### 4.1.4. Preliminary Risk Rating

The risk of impact to identified receptors from the identified potential sources is considered to be very low to moderate.

#### 4.1.5. Recommendations

An intrusive investigation was recommended to further investigate the potential contamination risks to human health and controlled waters.

## 5. FIELDWORK SUMMARY OF SCOPE AND RATIONALE

### 5.1. Site Management and Preparation

Suitably experienced Ridge staff supervised the intrusive investigation, which was undertaken on 28 February and 8 March 2020. Methods employed during the investigation were carried out in general accordance with statutory guidance including BS5930:1999 Code of Practice for Site Investigations (Amendment 3: 2015) and BS10175:2011+A1:2013 Investigation of Potentially Contaminated Sites: Code of Practice.

#### 5.1.1. Utility Clearance

Publicly available utility plans were consulted prior to setting out borehole positions. During the Site Investigation, each test location was scanned with a Cable Avoidance Tool (CAT) prior to breaking ground, and furthermore each position was subject to a hand advanced inspection pit to 1.00mbgl where practical.

### 5.2. Rationale and Summary of Scope

The Site Investigation scope was devised by Ridge, based on information collated to date, and comprised the following:

- ♣ 9no. windowless sample boreholes (WS1-9) drilled to a maximum depth of 5.45mbgl;
- ♣ Standard Penetration Testing (SPT) completed at 1.00m centres in each borehole in order to provide SPT-n values;
- ♣ Installation of monitoring wells in 3no. boreholes (WS1, WS7 and WS8);
- ♣ Contamination laboratory analysis; and
- ♣ Subsequent monitoring of ground gas, soil vapour and groundwater in monitoring wells, over five monitoring rounds.

#### 5.2.1. Windowless Sample Boreholes

Nine windowless sample boreholes (WS1-WS9) were drilled on site as per Figure 3. The primary objective was to assess contaminant source areas relating to the site including: congestion tanks and sludge beds, potential fuel oil and other contaminants associated with refuelling depot on the adjacent east former bus depot, asbestos containing soils across the site, and surrounding land uses.

The boreholes allowed the production of detailed engineers logs, recovery of samples for laboratory testing, and additionally allowed in situ Standard Penetration Testing to provide an indication of geotechnical parameters. All boreholes either reached natural soils of the Bognor Sand and were therefore terminated or refused on deep anthropogenic features (WS6 and WS7 at 4.40mbgl). WS9 was halted at 1.00mbgl as it was completed with hand digging tools as access did not allow the use of a drilling rig.

WS1, WS7 and WS8 were installed with a 50mm diameter standpipe with response zone in shallow soils to enable gas and groundwater monitoring.

#### 5.2.2. Test Location Rationale

Rationale for each test location completed is detailed in the table below.

| ID  | Rationale                                                                                                                                            | Max Depth (mbgl) |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| WS1 | Located in the north-western portion of the site for coverage and to assess impacts on present and former off-site uses to the north and west.       | 3.45             |
| WS2 | WS2 located in the central northern part of the site for coverage.                                                                                   | 3.00             |
| WS3 | Located close to the eastern site boundary and therefore the former fuel depot.                                                                      | 4.00             |
| WS4 | Located within or close proximity to the former sludge beds on site.                                                                                 | 4.45             |
| WS5 |                                                                                                                                                      | 4.45             |
| WS6 | Located within or close proximity to the former congestion tanks.                                                                                    | 5.45             |
| WS7 | Provides coverage of south-eastern portion of site and former off site fuel depot. Located within or close proximity to the former congestion tanks. | 4.50             |
| WS8 | Located within or close proximity to the former sludge beds on site. Also, provide coverage of the south-western part of the site.                   | 3.45             |
| WS9 | Located within or close proximity to the former sludge beds on site.                                                                                 | 1.00             |

Table 5.1: Test Location Rationale

The layout of the exploratory positions is presented in Figure 3.

### 5.3. Soil Sampling

All intrusive locations were logged and visual or olfactory evidence of contamination noted in accordance with best practice.

Soil sampling of the near surface materials was undertaken to assess the contamination risks to human health and controlled waters.

Samples were handled using a fresh pair of nitrile gloves. Equipment was cleaned between use at different test locations and different sampling depths to prevent cross-contamination.

Selected samples were placed in sealed glass jars and plastic tubs (dependent on the exact laboratory requirement and analysis to be undertaken) and stored in a temperature controlled environment before transit.

Soil logs are presented in Appendix 2.

### 5.4. Ground Gas Monitoring

Ground gas monitoring was conducted on the following dates: 8 March 2020, 9 June 2021, 15 June 2021, 21 June 2021 and 24 June 2021.

Gas monitoring was conducted in accordance with BS8576:2013 Guidance on investigations for ground gas –permanent gases and volatile organic compounds. Atmospheric pressure was noted to be decreasing during monitoring round 2 and 5 –further details are provided in Section 7.6.

Boreholes (WS1, WS7 and WS8) were monitored for the presence of soil gases including methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulphide. In addition, gas flow rates and downhole pressure were also measured using a GA5000 Geotech Gas Analyser. Gas monitoring was conducted for at least three minutes, with readings taken at 30 second intervals.

Note, it was not possible to access all monitoring wells on all occasions. Monitoring sheets are presented in Appendix 3.

### 5.5. Groundwater Gauging and Sampling

All serviceable monitoring wells were gauged during the same mobilisation as gas monitoring to enable assessment of groundwater levels and the presence of any visual/ olfactory evidence of contamination on groundwater.

Groundwater sampling was conducted on 16 and 24 June 2021 to enable collection of groundwater samples for laboratory analysis. Samples were collected by way of the low-flow (peristaltic pump) technique whereby environmental parameters are monitored before sample collection.

## 6. GROUND CONDITIONS ENCOUNTERED

### 6.1. Soil Conditions

#### 6.1.1. Surface Covering

All positions with the exception of WS4, WS8 and WS9 were surfaced with hardstanding comprising either reinforced concrete, macadam / concrete mix or macadam. Thickness of hardstanding varied between 0.10m and 0.20m.

WS4, WS8 and WS9 were all surfaced with grass.

#### 6.1.2. Topsoil

WS4, WS8 and WS9 all contained topsoil comprising brown Silt to 0.10mbgl.

#### 6.1.3. Made Ground

Made Ground was identified in all test locations and varied in depth from 0.60mbgl (WS1) to 4.50mbgl (WS6 and WS7).

Many of the test locations (WS1-WS7) contained a layer of fill material usually comprising brick and gravel, occasionally Chalk. This layer was approximately 0.50m in thickness.

An ash and macadam fill layer was identified from 0.60-1.10mbgl in WS3. Both WS3 and WS5 contained Made Ground with some organic content in the form of wood fragments or possible peat from 1.10-1.90mbgl and 0.90-1.90mbgl, respectively.

WS6 and WS7, situated over/ in the area of former congestion tanks identified the following: granular fill to 0.40m depth under surfacing of concrete/ macadam. Below this, another layer of fill inclusive of abundant brick and flint. From 1.10m depth, very loose to loose clayey Sand was observed, perhaps indicative of settlement of fines associated with the former use as congestion tanks. Drilling tools appeared to bounce or show signs of resistance at 4.50mbgl in both boreholes, perhaps a sign of the base of a former congestion tank. Drilling tools appeared to pierce through said tank in WS6, but not WS7, below which natural soils were identified.

Made Ground within WS8 (0.10-2.80mbgl) and WS9 (0.30-1.00mbgl [max. drill depth]) comprised what appeared to be re-worked natural soils with limited anthropogenic materials such as brick.

#### 6.1.4. Head Deposits

Possible head deposits comprising medium dense grey Gravel of angular to sub-rounded fine and medium flint were observed in WS8 (only) from 2.80-3.30mbgl. These deposits may well have been identified across more of the site if it wasn't for the significant thickness of Made Ground.

#### 6.1.5. Bognor Sand Member

Medium dense, becoming dense light brown/ orange gravelly fine and medium Sand, with gravel of sub-angular to rounded fine and medium flint, was identified in all boreholes drilled deeper than 1.00m (WS9) and those that did not refuse on the base of a tank (WS7).

The upper boundary was observed as shallow as 0.60mbgl in WS1 but more regularly was observed below 2.00mbgl. The depth to the top of the Bognor Sand is linked with the significant thickness of Made Ground seen across the site. Where penetrated into, all boreholes terminated in the Bognor Sand.

### 6.1.6. Summary

The above soil conditions are fairly consistent with the published geology, albeit with varying thickness of Made Ground observed across the site. BGS maps show London Clay present beneath the western part of the site, however this was not confirmed by the investigation undertaken.

## 6.2. Obstructions and Refusals

During the drilling of WS6 and WS7, situated over/ in the area of former congestion tanks, drilling tools appeared to bounce or show signs of resistance at 4.50mbgl in both boreholes, perhaps a sign of the base of a formerly operational congestion tank. Drilling tools appeared to pierce through said tank in WS6, but not WS7, below which natural soils were identified.

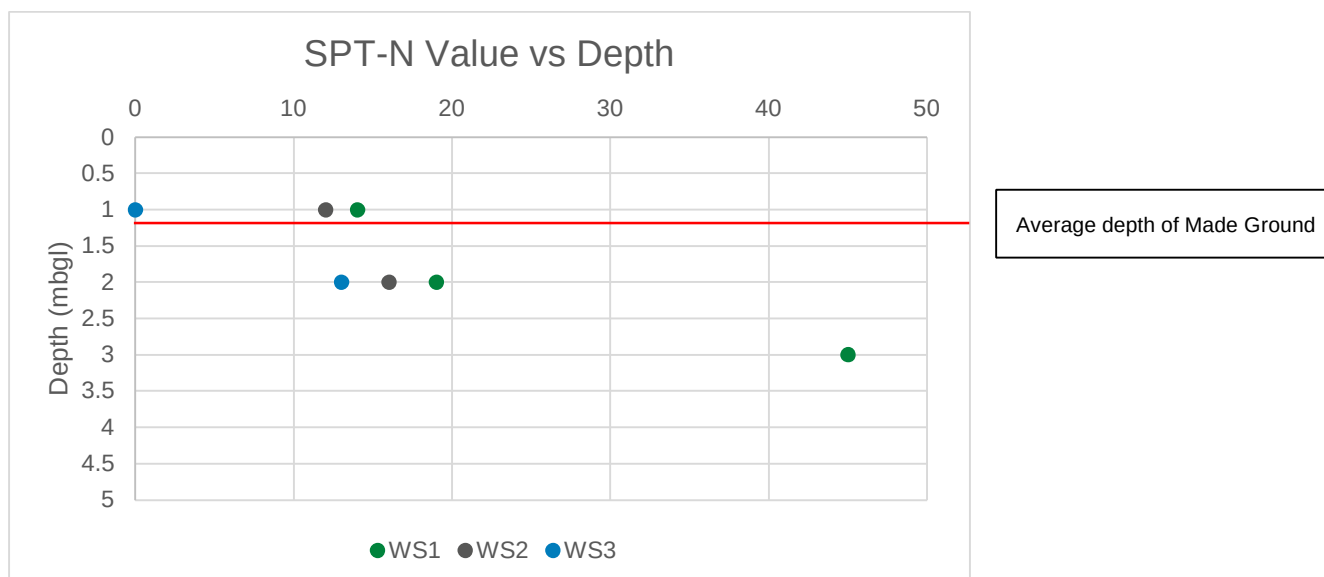
## 6.3. In Situ Testing

### 6.3.1. Standard Penetration Testing (SPT)

SPTs were completed throughout the drilling of all boreholes generally at 1.00m centres. SPT is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test is completed using a 63.5kg drop hammer weight, over a 750mm drop, measuring the blow counts for six, 75mm increments. The first two values are recorded as seating blows, with the remaining four values, added together to provide an 'N-value'.

The graphs below show SPT results by site area and based on historical uses.

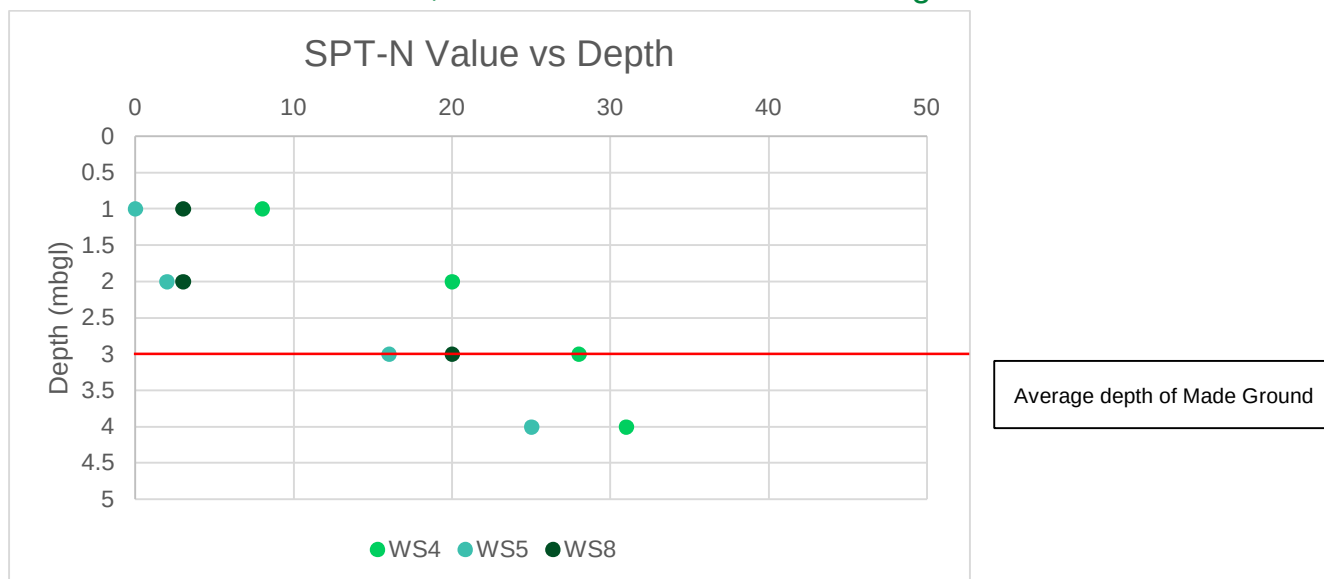
#### 6.3.1.1. SPT Results WS1-WS3



Graph 6.1: SPT Results –WS1-WS3

The N-Value results for WS1-WS3 appear to increase with depth, which perhaps reflects the fact that Made Ground was identified to a maximum depth of 1.90mbgl in this area of the site. Natural soils of the Bognor Member, which comprised light brown/ orange gravelly fine and medium sand, were found to be medium dense within the top two metres and dense below this.

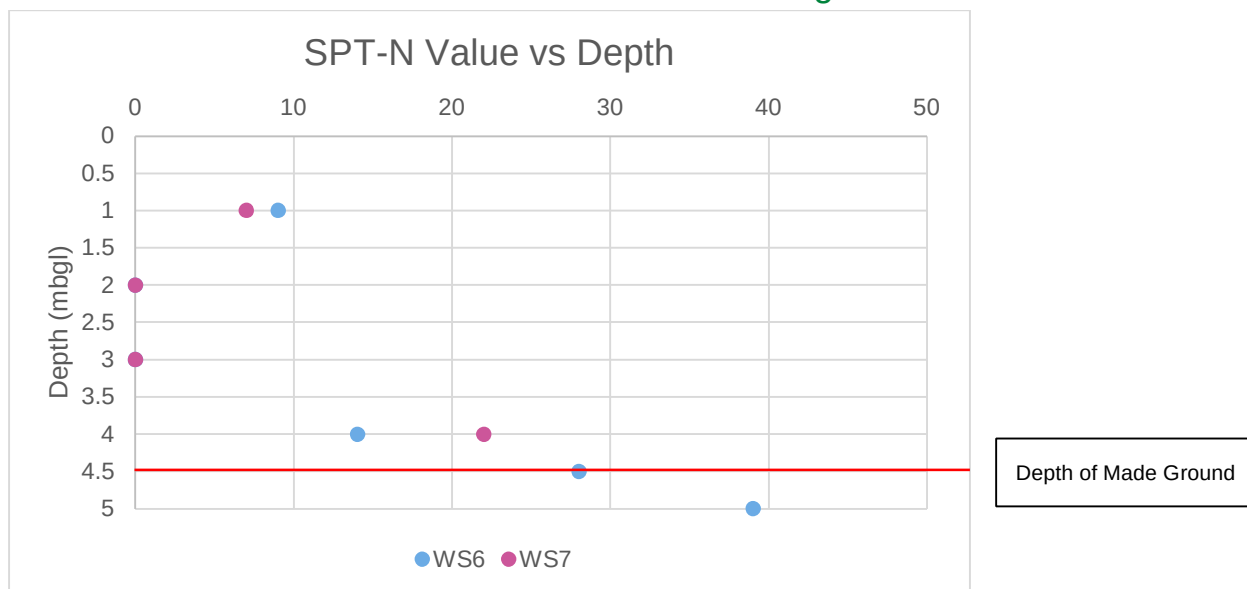
### 6.3.1.2. SPT Results WS4, WS5 and WS8 –Former sludge beds



Graph 6.2: SPT Results –WS4, WS5 and WS8 –former Sludge Beds

The N-Value results for WS4, WS5 and WS8 are fairly varied in the top 3m (Made Ground) although results do appear to increase with depth. All borehole locations record an N-Value of 10+ at 3m depth. SPTs carried out in natural soils return results over 20.

### 6.3.1.3. SPT Results WS6 and WS7 –Former congestion tanks



Graph 6.3: SPT Results –WS6 and WS7 –former Congestion Tanks

There is a great deal of inconsistency of results within the top 4.50m of WS6 and WS7, which is indicative of the former congestion tanks in this area of the site. The base of the tanks were identified at 4.50m, at which point tests carried out below in natural soils of the Bognor Member returned results over 30.

Results for both WS6 and WS7 at 2.00m and 3.00m returned results of 0 (zero), indicative of very loose soils.

## 6.4. Groundwater Conditions

Groundwater was not identified during drilling works, although the subsequent rounds of monitoring recorded the following:

| UPPERCASE    | WS1       | WS7       | WS8       | AVERAGE  |
|--------------|-----------|-----------|-----------|----------|
| 8 March 2020 | 1.46mbgl  | No access | 1.89mbgl  | 1.68mbgl |
| 9 June 2021  | No access | 0.51mbgl  | 2.06mbgl  | 1.27mbgl |
| 15 June 2021 | 1.72mbgl  | No access | 2.57mbgl  | 2.15mbgl |
| 21 June 2021 | 1.62mbgl  | No access | No access | 1.62mbgl |
| 24 June 2021 | 1.76mbgl  | 0.86mbgl  | 2.04mbgl  | 1.55mbgl |

Table 6.1: Groundwater Levels - Monitoring

Groundwater levels ranged from 0.51mbgl to 2.57mbgl across the monitoring programme, with average depths circa 1.70mbgl.

## 6.5. Visual/ Olfactory Evidence of Contamination

### 6.5.1. Soils

Other than anthropogenic materials noted in Made Ground, there was no visual/ olfactory evidence of contamination.

### 6.5.2. Groundwater

There was no evidence of contamination noted during the groundwater gauging.

## 7. CONTAMINATION ASSESSMENT

### 7.1. Selection of Contaminants of Concern for Analysis

A screen of common contaminants was carried out. Determinand groups were chosen based on outcomes of desk-based research and site history as well as those contaminants more commonly present. Testing included asbestos, heavy metals, PAHs, TPH CWG, BTEX and MTBE.

Primary contaminant source areas relating to the site include: congestion tanks and sludge beds, potential fuel oil and other contaminants associated with the refuelling depot on the adjacent east former bus depot, asbestos containing soils across the site, and surrounding land uses.

Determinand groups as detailed above were considered sufficient to provide an indication of impact to soils.

### 7.2. Soil Assessment Methodology

Specific soil sample locations and depths were chosen based on site coverage, where anthropogenic materials were identified and where desk based research had shown contaminants were more likely to be present i.e. former congestion tanks/ sludge beds (WS4-9) and areas adjacent to the eastern site boundary (WS3 and WS7). Other test positions provided appropriate coverage of the site.

#### 7.2.1. Generic Assessment Criteria

In the first instance, Ridge have undertaken a screen of the soil laboratory results using generic assessment criteria. Generic assessment criteria (GAC) are conservative contaminant concentration values used for comparison purposes to assess the risk associated with contaminant concentrations found on site and are derived using non-site-specific information.

In order to assess the soil analyses results with regard to potential human health risks, Ridge has adopted published guidance criteria widely referred to by professionals within the industry, which include the following:

- ♣ Suitable 4 Use Levels (S4ULs) Generic Assessment Criteria (GAC) developed by the Chartered Institute of Environmental Health (CIEH) in partnership with Land Quality Management Ltd. (LQM);
- ♣ Category 4 Screening Levels (C4SL) for lead, produced by CL:AIRE (2014); and
- ♣ The UK Soil Guideline Values (SGVs) for selected metals, BTEX and phenols, produced by the EA and Department of Environment, Food and Rural Affairs (2009).

Based on the proposed future use of the site, comparisons have been made against the 'residential end use' land use setting. More specifically, comparisons have been made with the 'residential with possible consumption of homegrown produce' land use setting based on the proposal for private gardens. Results were compared to the conservative 1.00% soil organic matter value unless otherwise stated.

With regard to human health, the CLEA model states that, 'the contamination is assumed to be at or within 1.00m of the surface' (CLR10 pg10). It is considered that at depths greater than 1m, the probability of human exposure via the direct contact pathways are significantly reduced, leaving inhalation of volatile compounds as the dominant pathway with regard to human health risks. Typically, volatile compounds only significantly affect the indoor inhalation pathway. Therefore, for the purposes of statistical analysis, data from the top 1.00m to 1.50m is used for assessment of risks to human health via direct contact pathways in accordance with the CLEA model, dependant on proposed future site levels.

## 7.3. Soil Assessment

### 7.3.1. General

Nine soil samples collected during the Ridge site investigation from Made Ground and shallow natural soils at various depths and locations were submitted to a UKAS accredited laboratory for analysis for a suite of asbestos, heavy metals, PAHs, TPH CWG, BTEX and MTBE. Laboratory analysis certificates are included as Appendix 4.

The range of potentially hazardous contaminants present on the site can be wide and varied and the suite has been chosen to reflect commonly found contaminants and others indicated by review of available data to have a chance of being present. Sample rationale is provided in the table below.

| Sample    | Rationale                                                                                                                                                                                                          |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| WS1-0.30m | Sample obtained from Made Ground comprising brick from WS1 located in the north-western part of the site.                                                                                                          |
| WS1-0.80m | Obtained from shallow natural soil beneath Made Ground and to delineate any contamination identified in the sample above.                                                                                          |
| WS2-0.50m | Sample obtained from Made Ground comprising brick and gravel from WS2 located in the central northern part of the site.                                                                                            |
| WS2-1.30m | Obtained from shallow natural soil beneath Made Ground and to delineate any contamination identified in the sample above.                                                                                          |
| WS3-0.70m | WS3 located close to the eastern site boundary and therefore the former fuel depot. Sample obtained from fill material inclusive of brick, macadam and concrete.                                                   |
| WS3-1.20m | Sample obtained from deeper Made Ground comprising sandy Clay with rare gravel of flint. Rootlets and wood fragments were also observed.                                                                           |
| WS7-0.50m | WS7 located in area of former congestion tanks. Sample obtained from Made Ground comprising abundant brick and flint.                                                                                              |
| WS8-0.50m | Sample obtained from fill inclusive flint, brick and occasional macadam within brown clay matrix. WS8 positioned in location of former sludge beds and close to the south-western corner of the site for coverage. |
| WS8-1.00m | Sample obtained from re-worked Sand containing rare brick in vicinity of former sludge beds.                                                                                                                       |

Table 7.1: Sample Rationale

### 7.3.2. Organic Matter

Organic matter ranged from 0.70 –4.40% in Made Ground, and 0.50 –0.90% in natural soils. Low organic matter content in shallow natural soils is associated with the granular nature of soils (Sands and Gravels).

### 7.3.3. Asbestos

Asbestos was detected in two of the nine samples tested.

WS1-0.30m identified small bundles of chrysotile. Quantification analysis found fibres to represent <0.001% of the total sample by volume.

WS2-0.50m identified chrysotile and crocidolite present in microscopic loose fibrous debris. Quantification analysis found fibres to represent <0.003% of the total sample by volume.

Soil samples obtained from arisings below those detailed above (WS1-0.80m and WS2-1.30m) did not identify any trace of asbestos. Asbestos was identified in samples obtained from Made Ground soils only, asbestos was not detected in natural soils.

Currently there is no Soil Guideline Value (SGV) for asbestos, so most human health risk assessments use the 0.001% laboratory limit of detection (LOD) limit as their guide.

### 7.3.4. Heavy Metals

A summary of results is presented in the table below.

| Determinand   | Max. Concentration (mg/ kg) | GAC Screening Value (mg/ kg) | Exceedances of Screening Value (location and depth) |
|---------------|-----------------------------|------------------------------|-----------------------------------------------------|
| Arsenic       | 23.00                       | 32.00                        | None                                                |
| Cadmium       | 0.30                        | 10.00                        | None                                                |
| Chromium      | 22.00                       | 910.00                       | None                                                |
| Chromium VI   | 2.00                        | 6.00                         | None                                                |
| Copper        | 118.00                      | 2400.00                      | None                                                |
| Lead          | 400.00                      | 200.00                       | 3<br>WS1-0.30m, WS3-0.70m, WS2-0.50m                |
| Mercury       | 1.00                        | 40.00                        | None                                                |
| Nickel        | 53.00                       | 130.00                       | None                                                |
| Selenium      | 3.00                        | 250.00                       | None                                                |
| Zinc          | 245.00                      | 3700.00                      | None                                                |
| Total Phenols | 2.00                        | 280.00                       | None                                                |

Table 7.2: Heavy Metal Results

There were exceedances of the GAC for lead only, no other metal determinands returned exceedances of the GAC. Samples obtained from WS1-0.30m, WS3-0.70m and WS2-0.50m returned concentrations for lead of 384, 362 and 400mg/kg respectively, which exceeded the GAC of 200mg/kg.

All samples exceeding the lead GAC were within Made Ground soils, there were no exceedances from natural ground samples. Samples tested directly below those exceeding the GAC did not return any exceedances of lead.

Concentrations of chromium VI, mercury, selenium and total phenols were all below laboratory limit of detection (LOD) for all samples.

### 7.3.4.1. Statistical Analysis of Lead Results

Due to three exceedances of the lead GAC, statistical analysis can be used to further assess whether results represent the site as a whole or whether the three results represent isolated lead contamination 'hotspots'.

According to Guidance on Comparing Soil Contamination Data with a Critical Concentration - CLAIRE (2008), consideration should be given to treating Made Ground sample results as a separate dataset. This avoids the skewing of results by the use of a large number of non-detects (or in this case lower concentrations) associated with natural soils.

Following statistical analysis, those samples exceeding the lead GAC (WS1-0.30m, WS3-0.70m and WS2-0.50m), can indeed be classified as significant outliers ( $P < 0.05$ ) when compared to the remainder of the Made Ground dataset.

Therefore, lead results at WS1-0.30m, WS3-0.70m and WS2-0.50m are considered to represent isolated lead contamination 'hotspots'.

### 7.3.5. Polycyclic Aromatic Hydrocarbons (PAHs)

A summary of results is presented in the table below.

| Determinand            | Max. Concentration (mg/ kg) | GAC Screening Value (mg/ kg) | Exceedances of Screening Value |
|------------------------|-----------------------------|------------------------------|--------------------------------|
| Naphthalene            | 0.58                        | 2.30                         | None                           |
| Acenaphthylene         | 0.10                        | 170.00                       | None                           |
| Acenaphthene           | 1.11                        | 210.00                       | None                           |
| Fluorene               | 1.35                        | 170.00                       | None                           |
| Phenanthrene           | 19.50                       | 95.00                        | None                           |
| Anthracene             | 5.86                        | 2400.00                      | None                           |
| Fluoranthene           | 45.60                       | 280.00                       | None                           |
| Pyrene                 | 38.80                       | 620.00                       | None                           |
| Benzo(a)anthracene     | 21.50                       | 7.20                         | 1<br>WS1-0.30m                 |
| Chrysene               | 15.10                       | 15.00                        | 1<br>WS1-0.30m                 |
| Benzo(b)fluoranthene   | 17.10                       | 2.60                         | 1<br>WS1-0.30m                 |
| Benzo(k)fluoranthene   | 5.53                        | 77.00                        | None                           |
| Benzo(a)pyrene         | 12.10                       | 2.20                         | 1<br>WS1-0.30m                 |
| Indeno(1,2,3-cd)pyrene | 7.02                        | 27.00                        | None                           |
| Dibenz(a,h)anthracene  | 1.19                        | 0.24                         | 1<br>WS1-0.30m                 |
| Benzo(ghi)perylene     | 4.99                        | 320.00                       | None                           |

Table 7.3: PAH Results

There were five exceedances of the GAC, all returned from one sample WS1-0.30m. The sample was obtained from Made Ground comprising brick and gravel within a sand / silt matrix. There were no exceedances within natural soils. Samples tested directly below those exceeding the GAC did not return any exceedances of PAHs. The majority of the remaining tests across all samples were below LOD.

### 7.3.5.1. Statistical Analysis of PAH Results

Statistical analysis can be used to further assess whether PAH GAC exceedances are represent of the site as a whole or whether results represent an isolated PAH contamination 'hotspot'.

According to Guidance on Comparing Soil Contamination Data with a Critical Concentration - CLAIRE (2008), consideration should be given to treating Made Ground sample results as a separate dataset. This would avoid the skewing of results by the use of a large number of non-detects (or in this case lower concentrations) associated with natural soils.

Following statistical analysis, all determinands exceeding PAH GAC in the sample obtained from WS1 at 0.30m can be classified as significant outliers ( $P < 0.05$ ) when compared to the remainder of the Made Ground dataset.

Therefore, PAH results at WS1-0.30m are considered to represent an isolated PAH contamination 'hotspot'.

### 7.3.6. Total Petroleum Hydrocarbons (TPH)

A summary of results is presented in the table below.

| Determinand  | Max. Concentration (mg/ kg) | GAC Screening Value (mg/ kg) | Exceedances of Screening Value |
|--------------|-----------------------------|------------------------------|--------------------------------|
| Ali >C5-C6   | 0.01                        | 42.00                        | None                           |
| Ali >C6-C8   | 0.05                        | 100.00                       | None                           |
| Ali >C8-C10  | 2.00                        | 27.00                        | None                           |
| Ali >C10-C12 | 2.00                        | 130.00                       | None                           |
| Ali >C12-C16 | 3.00                        | 1100.00                      | None                           |
| Ali >C16-C21 | 3.00                        | -                            | n/a                            |
| Ali >C21-C34 | 10.00                       | -                            | n/a                            |
| Aro >C5-C7   | 0.01                        | 70.00                        | None                           |
| Aro >C7-C8   | 0.05                        | 130.00                       | None                           |
| Aro >C8-C10  | 2.00                        | 34.00                        | None                           |
| Aro >C10-C12 | 2.00                        | 74.00                        | None                           |
| Aro >C12-C16 | 13.00                       | 140.00                       | None                           |
| Aro >C16-C21 | 141.00                      | 260.00                       | None                           |
| Aro >C21-C35 | 189.00                      | 1100.00                      | None                           |

Table 7.4: TPH Results

There were no exceedances of the GAC recorded in any samples for any determinands. Aromatic C12-35 were slightly elevated above LOD for the sample obtained from WS1 at 0.30m, although all other results for all samples were below LOD.

Results reflect observations made in the field during soil logging –there was no visual/ olfactory evidence of contamination noted.

### 7.3.7. BTEX and MTBE

A summary of results is presented in the table below.

| Determinand  | Max. Concentration (mg/ kg) | GAC Screening Value (mg/kg) | Exceedances of Screening Value (location and depth) |
|--------------|-----------------------------|-----------------------------|-----------------------------------------------------|
| Benzene      | 0.002                       | 0.087                       | None                                                |
| Toluene      | 0.005                       | 130.00                      | None                                                |
| Ethylbenzene | 0.002                       | 47.00                       | None                                                |
| Xylenes      | 0.002                       | 116.00                      | None                                                |
| MTBE         | 0.005                       | 73.00                       | None                                                |

Table 7.5: BTEX/ MTBE Results

There were no exceedances of GAC, and furthermore all results were below LOD for all samples.

### 7.3.8. Summary of Results

Asbestos was detected in two of the nine samples tested. WS1-0.30m identified small bundles of chrysotile at <0.001% of the total sample volume. WS2-0.50m identified chrysotile and crocidolite present in microscopic loose fibrous debris <0.003% of the total sample by volume. Asbestos was identified in samples obtained from Made Ground soils only, asbestos was not detected in natural soils.

There were exceedances of the GAC for lead. Samples obtained from WS1-0.30m, WS3-0.70m and WS2-0.50m returned concentrations for lead of 384, 362 and 400mg/kg respectively, which exceeded the GAC of 200mg/kg. All samples exceeding the lead GAC were removed from Made Ground soils, there were no exceedances of natural soils. Following statistical analysis, those samples exceeding the lead GAC can be classified as significant outliers ( $P < 0.05$ ) when compared to the remainder of the Made Ground dataset. Therefore, lead results at WS1-0.30m, WS3-0.70m and WS2-0.50m are considered to represent isolated lead contamination 'hotspots'.

There were five exceedances of the PAH GAC, all returned from one sample WS1-0.30m. The sample was obtained from Made Ground comprising brick. There were no exceedances of natural soils. Following statistical analysis, all determinands exceeding PAH GAC in the sample obtained from WS1 at 0.30m can be classified as significant outliers ( $P < 0.05$ ) when compared to the remainder of the Made Ground dataset. Therefore, PAH results at WS1-0.30m are considered to represent an isolated PAH contamination 'hotspot'.

### 7.3.9. Discussion

Across the sample population, just three samples either identified asbestos or exceeded the GAC. These samples (WS1-0.30m, WS2-0.50m and WS3-0.70m) were all collected from Made Ground within the top 1m comprising fill material such as brick, gravel, ash or macadam. There was no asbestos detected or exceedances identified below 1m depth or in natural soils. Nevertheless, asbestos, lead and PAHs represent a risk to human receptors.

WS1, WS2 and WS3 are all positioned outside of the footprint of the former congestions tanks and sludge beds and are located across the northern parts of the site. In terms of contamination sources, these areas of the site are not considered to contain specific on site contamination sources other than Made Ground associated with historical development.

In terms of the proposed development; WS1, WS2 and WS3 are situated over the north-western part of the development, external hardstanding, and within the proposed bicycle storage. These areas represent a limited chance of exposure to site end users as in effect the contaminant pathway is interrupted by either hardstanding or build footprint. There is considered to be only a short-term risk to development/ construction workers and more specifically groundworkers from the identified contaminants.

#### 7.4. Waste Material

Results from all nine analysed samples were input into a Soils Characterisation Assessment Tool (CAT-Waste Soil) to identify whether soils on site had hazardous properties. Refer to Table 7.1 for details of sample collection and soil characteristics.

All nine samples returned Non-Hazardous properties. The CAT-Waste Soil output sheet is included as Appendix 5.

The second part of the assessment process is a review of Waste Acceptance Classification (WAC) testing, which was carried out on the sample collected from WS8-0.50m, as this was considered to be representative of typical Made Ground across the site. The sample was classified as Inert.

#### 7.5. Controlled Waters Assessment

This section of the report presents the generic risk assessment for the controlled waters receptors.

##### 7.5.1. Screening Criteria

EA guidance for the assessment of groundwater provides information on the appropriate compliance criteria to adopt 'a general approach is to use an environmental standard. This standard should be relevant to the current or intended use of the aquifer'.

The standards adopted for Generic Assessment Criteria (GAC) are as follows:

- ♣ Water Supply (Water Quality Regulations –UK DWS);
- ♣ Surface Waters (Dangerous Substances) (Classification) Regulations –UK EQS;
- ♣ Directive establishing a framework for Community action in the field of water policy (Water Framework Directive) –EU EQS;
- ♣ Surrogate indicator compounds (used as a proxy standard for compounds of similar chemical attributes and toxicity); and
- ♣ International Standards (European Council Directive, WHO, USEPA, Surface Water Abstraction Directive) –appropriate for the receptor and in line with UK approach.

Where a number of standards are available for a particular compound, that standard selected for screening purposes is based on the most relevant standard for the receptor, in the first instance. Therefore, statutory standards are prioritised over non statutory standards.

### 7.5.2. Identification of Primary Receptor

Riders Stream is situated adjacent south-east of the site. Riders Stream has status as a statutory main river which ultimately discharges to an ecological asset which benefits from multiple European designations. Investigations in the vicinity have shown the local superficial Secondary Aquifer to be in hydraulic continuity with the stream.

### 7.5.3. Design of Groundwater Monitoring Programme

The following points are considered pertinent in the design of the monitoring programme.

| Factor                                     | More Monitoring Required                                                                                                                                                                                           | Less Monitoring Required                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Sensitivity of controlled waters receptors | The superficial Secondary undifferentiated aquifer is considered to be in continuity with the adjacent Riders Stream, which has status as a statutory main river and ultimately discharges to an ecological asset. | Superficial Secondary undifferentiated aquifer and bedrock Secondary (A) aquifer are considered to be Low in terms of sensitivity.                                                                                                                                                                                                                                                                                                                                                                  |
| Soil analysis                              | Exceedances of the lead GAC in three samples obtained from Made Ground at depths between 0.30m and 0.70m.<br><br>Exceedances of PAH GAC for the sample obtained from Made Ground in WS1 at 0.30m.                  | No exceedances across the remaining six samples for any determinands.<br><br>Most PAH results were below laboratory limit of detection (LOD).<br><br>The majority of TPH CWG results were below LOD.<br><br>All BTEX/ MTBE results were below LOD for all samples.                                                                                                                                                                                                                                  |
| Soil contaminant mobility                  | -                                                                                                                                                                                                                  | Lead tends to be retained in soil, although it is acknowledged certain lead compounds become sparingly mobile and bio-available in acidic soil conditions. All soil samples ranged from pH 7.4 –8.5, therefore shallow soils are not considered acidic.<br><br>Benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(a)pyrene and dibenz(a,h)anthracene are expected to have no/ only slight mobility in soil. If released into water it's expected to adsorb to suspended solids and sediment. |
| Depth to groundwater                       | -                                                                                                                                                                                                                  | Groundwater was shown to rest at an average of 1.70mbgl. Soil exceedances were identified in soils at 0.30-0.70mbgl and therefore it is unlikely soil contamination has migrated to groundwater.                                                                                                                                                                                                                                                                                                    |

Table 7.6: Factors influencing Design of Groundwater Monitoring Programme

#### 7.5.4. Monitoring Programme

It was considered that at least one round of groundwater monitoring and analysis should be carried out to confirm the assessment detailed in the table above.

#### 7.5.5. Groundwater Samples

Three groundwater samples were collected from two wells on two different sampling occasions on 16 June and 24 June 2021.

Monitoring wells WS7 and WS8 are located on the downgradient boundary of the site, adjacent to Riders Stream. Due to an insufficient water column within the well, it was not possible to obtain samples from WS1.

Samples were submitted to a UKAS accredited laboratory for analysis for a suite of heavy metals, PAHs, TPH CWG, BTEX and MTBE; mirroring the soil analytical suite. Laboratory analysis certificates are included as Appendix 4.

The range of potentially hazardous contaminants present on the site can be wide and varied and the suite has been chosen to reflect commonly found contaminants and others indicated by review of the previous report to have a chance of being present.

#### 7.5.6. Heavy Metals

Results are summarised in the table below.

| DETERMINANT | MAXIMUM CONCENTRATION (UG/L) | EXCEEDANCES OF GAC |
|-------------|------------------------------|--------------------|
| Arsenic     | 13                           | None               |
| Cadmium     | 0.4                          | None               |
| Chromium    | 5                            | None               |
| Copper      | 5                            | None               |
| Lead        | 5                            | None               |
| Mercury     | 0.05                         | None               |
| Nickel      | 10                           | None               |
| Selenium    | 5                            | None               |
| Zinc        | 22                           | None               |

Table 7.7: Summary of heavy metal GW results

Results for all but two determinands were below the laboratory limit of detection (LOD). Results were below LOD for cadmium, chromium, copper, lead, mercury and selenium. There were no exceedances of the GAC.

### 7.5.7. Polycyclic Aromatic Hydrocarbons (PAHs)

Results are summarised in the table below.

| DETERMINANT            | MAXIMUM CONCENTRATION (UG/L) | EXCEEDANCES OF GAC |
|------------------------|------------------------------|--------------------|
| Naphthalene            | 0.07                         | None               |
| Acenaphthylene         | 0.01                         | None               |
| Acenaphthene           | 0.02                         | None               |
| Fluorene               | 0.02                         | None               |
| Phenanthrene           | 0.02                         | None               |
| Anthracene             | 0.01                         | None               |
| Fluoranthene           | 0.02                         | None               |
| Pyrene                 | 0.02                         | None               |
| Benzo(a)anthracene     | 0.01                         | None               |
| Chrysene               | 0.01                         | None               |
| Benzo(b)fluoranthene   | 0.01                         | None               |
| Benzo(k)fluoranthene   | 0.01                         | None               |
| Benzo(a)pyrene         | 0.01                         | None               |
| Indeno(1,2,3-cd)pyrene | 0.01                         | None               |
| Dibenz(a,h)anthracene  | 0.01                         | None               |
| Benzo(ghi)perylene     | 0.01                         | None               |

Table 7.8: Summary of PAH GW results

There were no exceedances of the GAC and the majority of results were below the LOD. All results for the following determinands were below the LOD: benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene and benzo(ghi)perylene.

### 7.5.8. Total Petroleum Hydrocarbons (TPH)

All results for all determinands were below the LOD. There were no exceedances of the GAC.

### 7.5.9. BTEX and MTBE

All results were below the LOD, there were no exceedances of the GAC.

### 7.5.10. Discussion of Results

There were no exceedances of the GAC, and the majority of results were below LOD.

Analytical results mirror observations made in the field, in that there was no visual/ olfactory evidence of contamination noted during groundwater sampling.

Groundwater was shown to rest at an average of 1.70mbgl. Soil exceedances were identified in soils at 0.30-0.70mbgl and therefore it is unlikely soil contamination has migrated to groundwater.

## 7.6. Ground Gas Assessment

### 7.6.1. Design of Monitoring Programme

In accordance with BS8576:2013 Guidance on investigations for ground gas –permanent gases and volatile organic compounds, the extent of monitoring deemed necessary to assess the ground gas and vapour regime is determined by the generation potential of the source, i.e. what is the risk that large volumes of gas can be generated and can plausibly migrate to pose a credible hazard to the identified receptors. This is known as a multiple-lines-of-evidence approach.

Factors detailed in the table below were pertinent in the design of the gas monitoring programme. Information detailed in the table has either been taken from the Desk Top Study or interpreted from the intrusive investigation conducted.

| Factor                                  | More Monitoring Required                                                                                                                                                                                                                                                                                        | Less Monitoring Required                                                                                                                                                                         |
|-----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Landfills and waste sites               | -                                                                                                                                                                                                                                                                                                               | There are no records of current or historical waste facilities or landfill within 1km of the site.                                                                                               |
| Ground/ mine workings                   | -                                                                                                                                                                                                                                                                                                               | There are no records within 250m of the site.                                                                                                                                                    |
| Artificial Ground                       | -                                                                                                                                                                                                                                                                                                               | No historical or current records within 250m of the site.                                                                                                                                        |
| On site Made Ground and organic content | <p>The site investigation identified up to 4.50m of Made Ground/ reworked material.</p> <p>Rare rootlets and wood fragments were identified in soils from WS3 at 1.10-1.90m.</p> <p>Possible peat was observed in WS5 from 1.60-1.90m, although this may be associated with sludge from former sludge beds.</p> | <p>Organic content of Made Ground was typically low, with a maximum TOC of 4.40% identified (WS3).</p> <p>Made Ground generally comprised granular/ inert materials such as sand and gravel.</p> |
| Former sludge pits and congestion tanks | <p>Potential for gas producing soils.</p> <p>Made Ground/ reworked soils were observed to a depth of between 2.80mbgl and 3.30mbgl in WS4, WS5 and WS8 (sludge pits).</p> <p>Made Ground/ reworked soils were observed to a depth of 4.50mbgl in WS6 and WS7 (congestion tanks).</p>                            | <p>Although significant thicknesses of Made Ground were identified in boreholes WS4-WS8, soils were predominantly granular and inert, and the time since infill is thought to be lengthy.</p>    |
| Volatiles                               | -                                                                                                                                                                                                                                                                                                               | Laboratory results did not return elevated concentration of hydrocarbons.                                                                                                                        |

Table 7.9: Factors influencing Design of Gas Monitoring Programme

## 7.6.2. Generation Potential of Source

Based on the information within Table 7.7, the generation potential is considered to be Very Low to Low and according to guidance this would equate to 'gas monitoring might not be necessary' or 'gas monitoring over a period of two months with up to weekly measurements'.

## 7.6.3. Monitoring Programme

Based on the above Ridge considered that five rounds of monitoring should be completed with a subsequent review of consistency of data.

Gas monitoring has been conducted by Ridge on the following occasions: 8 March 2020, 9 June 2021, 15 June 2021, 21 June 2021 and 24 June 2021, in accordance with BS8576:2013 Guidance on investigations for ground gas –permanent gases and volatile organic compounds. Boreholes were monitored for the presence of soil gases including methane, carbon dioxide, oxygen, carbon monoxide and hydrogen sulphide. In addition, gas flow rates and downhole pressure were also measured using a GA5000 Geotech Gas Analyser. Gas monitoring was conducted for at least three minutes, with readings taken at 30 second intervals.

Note, it was not possible to access all monitoring wells during all monitoring rounds.

### 7.6.4. Monitoring Results

Results from the monitoring programme are summarised in the table below. Atmospheric pressure was noted to be decreasing during monitoring rounds 2 and 5. Monitoring sheets can be viewed in Appendix 3.

|                             | WS1  | WS7   | WS8  | Worst Case |
|-----------------------------|------|-------|------|------------|
| Max. Flow Rate (L/hr)       | 0    | 0.30  | 0.10 | 0.30       |
| Peak CH <sub>4</sub> (%)    | 0.20 | 59.70 | 0.20 | 59.70      |
| Peak CO <sub>2</sub> (%)    | 9.60 | 1.10  | 6.80 | 9.60       |
| Min. O <sub>2</sub> (%)     | 0.90 | 0.60  | 7    | 0.60       |
| Max. H <sub>2</sub> S (ppm) | 0    | 0     | 0    | 0          |
| Max. CO (ppm)               | 84   | 0     | 2    | 84         |
| VOCs (ppm)                  | 0.40 | 0.26  | 0.39 | 0.40       |

Table 7.10: Summary of monitoring programme

#### 7.6.4.1. Flow Rate

Flow rate was recorded consistently low across the monitoring programme with a maximum flow of 0.30L/hr recorded in WS7.

#### 7.6.4.2. Methane

Methane was consistently high in WS7, with a maximum of 59.70% recorded, although it is likely equilibrium levels are closer to 10.70% which was recorded during the last monitoring round.

Methane was less than 1% across the remainder of the monitoring wells.

#### 7.6.4.3. Carbon Dioxide

Carbon dioxide was recorded above 5% within two of the three monitoring wells with a maximum of 9.60% recorded at WS1 during monitoring round 4.

#### 7.6.4.4. Carbon Monoxide

Carbon monoxide was generally below 10ppm, other than that recorded at WS1 during monitoring round 3, where 84ppm was recorded. This reduced to 6ppm after 30 seconds, and to ≤1ppm thereafter.

#### 7.6.4.5. Volatile Organic Compounds

All results were below 1ppm across the monitoring programme.

### 7.6.5. Gas Screening Value

Worst case gas levels and flow rates identified across the programme can be used to calculate a conservative Gas Screening Value (GSV) as defined in CIRIA C665 Assessing Risks Posed by Hazardous Ground Gases to Buildings (2002).

$GSV = (\text{worst case CO}_2 \text{ or CH}_4 \text{ concentration} / 100) \times \text{worst case flow rate}$

$GSV = (59.70\% / 100) \times 0.30\text{L/hr}$

$GSV = 0.18$

According to the guidance, the GSV equates to Characteristic Situation (CS) 2 as it is below the upper threshold of 0.7.

#### 7.6.6. Characteristic Situation Check

A check can be performed to allow assessment of the likelihood that the upper CS threshold could be met during different monitoring conditions:

- ♣ Either the flow or the ground gas % would need to increase by circa 4 times to reach the next threshold. This seems unlikely given the consistency of results to date, the conservative CS calculation method and the downward trend of gas results over the monitoring programme.

#### 7.6.7. Gas Protection

The outcomes of the gas monitoring programme mean that gas protection is required to CIRIA Characteristic Situation 2. Further details are provided in Section 10.

## 8. CONCEPTUAL SITE MODEL/ RISK ASSESSMENT

### 8.1. Sources

Following investigations conducted to date and screening of chemical analysis results, the following contaminant sources have been identified:

- ♣ Soil contaminants in Made Ground across the site inclusive of asbestos. Note, natural soils do not appear to be impacted; and,
- ♣ Ground gas associated with Made Ground and historical development of the site, and former use as sewage works.

### 8.2. Receptors

Receptors that may possibly be affected by the identified contaminant sources are considered to be:

- ♣ End Users (residents, visitors and maintenance workers);
- ♣ Construction workers during development;
- ♣ Secondary (undifferentiated) aquifer within superficial deposits (Head);
- ♣ Secondary (A) aquifer within bedrock (Bognor Sand); and
- ♣ Adjacent south Riders Stream.

### 8.3. Pathways

The key environmental pathways and exposure routes by which potentially toxic substance can reach the identified potential receptors are considered to be:

- ♣ Vertical and lateral migration of organic and inorganic compounds through underlying geology and/ or via overland flow;
- ♣ Vertical and lateral migration of ground gas leading to accumulation in enclosed spaces;
- ♣ Inhalation of ground gas;
- ♣ Inhalation of contaminated dust;
- ♣ Ingestion of contaminated soils; and,
- ♣ Dermal contact with contaminated soils.

## 9. CONTAMINATION RISK ASSESSMENT

### 9.1. Risk Assessment Procedure

By considering the sources, pathways and receptors (pollutant linkages), an assessment of the human health/ environmental risks is made with reference to the significance and degree of the risk. This assessment is based on consideration of whether the source contamination can reach a receptor and hence whether it is of major or minor significance.

The risk assessment has been undertaken with reference to BS 10175:2011+A1:2013 and CIRIA Document C552: Contaminated Land Risk assessment 'A Guide to Good Practice'. The risk assessment has been carried out by assessing the severity of the potential consequence, taking into account both the potential magnitude of the hazard and the sensitivity of the target, based on the categories provided below.

| Category | Examples                                                                    |
|----------|-----------------------------------------------------------------------------|
| High     | Residential with gardens/Groundwater Source Protection Zone                 |
| Medium   | Residential without gardens/Principal (Major) Aquifer/sensitive watercourse |
| Low      | Commercial and industrial use/Secondary (Minor) Aquifer                     |
| Very Low | Construction and maintenance workers/non-sensitive watercourse              |

Table 9.1: Sensitivity of receptor

| Category        | Examples                                                                                         |
|-----------------|--------------------------------------------------------------------------------------------------|
| Gross Impact    | Heavily contaminated gasworks or industrial Site, hazardous waste landfill                       |
| Moderate Impact | Major leaks and spills from fuel infrastructure (e.g. petrol stations), domestic waste landfills |
| Slight Impact   | Minor leaks and spills from fuel infrastructure, 'inert' waste landfills                         |

Table 9.2: Magnitude of impact

| Magnitude of impact | Sensitivity of receptor |        |       |          |
|---------------------|-------------------------|--------|-------|----------|
|                     | High                    | Medium | Low   | Very Low |
| Gross Impact        | Severe                  | Medium | Mild  | Minor    |
| Moderate Impact     | Medium                  | Mild   | Minor | Minor    |
| Slight Impact       | Mild                    | Minor  | Minor | Minor    |

Table 9.3: Level of severity of potential hazard

The likelihood of an event (probability) takes into account both the presence of the hazard and target and the integrity of the pathway and has been assessed based on the categories given below.

| Category        | Examples                                                                                                                              |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------|
| High likelihood | Pollutant linkage may be present, and risk is almost certain to occur in long term, or there is evidence of harm to the receptor      |
| Likely          | Pollutant linkage may be present, and it is probable that the risk will occur over the long term                                      |
| Low likelihood  | Pollutant linkage may be present, and there is a possibility of the risk occurring, although there is no certainty that it will do so |
| Unlikely        | Pollutant linkage may be present, but the circumstances under which harm would occur are improbable                                   |

Table 9.4: Probability of risk definition

The potential severity of the risk and the probability of the risk occurring have been combined in accordance with the following matrix in order to give a level of risk for each potential hazard.

| Probability of risk | Sensitivity of receptor |              |              |               |
|---------------------|-------------------------|--------------|--------------|---------------|
|                     | Severe/ High            | Medium       | Mild/ Low    | Minor/ V. Low |
| High likelihood     | Very High               | High         | Moderate     | Low/Moderate  |
| Likely              | High                    | Moderate     | Low/Moderate | Low           |
| Low likelihood      | Moderate                | Low/Moderate | Low          | Very Low      |
| Unlikely            | Low/Moderate            | Low          | Very Low     | Very Low      |

Table 9.5: Level of risk for potential hazard definition

The assessment is discussed below in terms of plausible pollutant linkages. A complete assessment of the pollutant linkages is presented in Table 9.6.

A description of these risk classifications and likely action required are given in CIRIA 552 as:

Very high risk –High probability that severe harm could arise to a designated receptor from an identified hazard OR there is evidence that severe harm to a designated receptor is currently happening. This risk, if realised, is likely to result in substantial liability. Urgent investigation and remediation are likely to be required.

High risk –Harm is likely to arise to a designated receptor from an identified hazard. This risk, if realised, is likely to result in substantial liability. Urgent investigation is required and remedial works may be necessary in the short term and are likely over the long term.

Moderate risk –It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.

Low risk –It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.

Very low risk –It is a low possibility that harm could arise to a designated receptor. In the event of such harm being realised it is not likely to be severe.

## 9.2. Pollutant Linkage Discussion

### 9.2.1. Controlled Waters

Riders Stream, which has status as a statutory main river and which ultimately discharges to an Ecological asset which benefits from multiple European designations, is considered to be in connectivity with the underlying superficial Secondary undifferentiated aquifer. The superficial Secondary undifferentiated aquifer and bedrock Secondary (A) aquifers are considered to be Low in terms of sensitivity.

Although resources are considered to be in continuity, soil analysis to date has identified limited contaminant elevations in lead and PAHs across three samples (only), and at relatively shallow depths of a maximum of 0.70mbgl. No GAC exceedances were identified across the remaining six samples, and the majority of TPH CWG, BTEX and MTBE results were below laboratory detection limits.

In terms of contaminant mobility, both lead and PAHs tend to be retained in soil. It is acknowledged that certain lead compounds become sparingly mobile and bio-available in acidic soil conditions. All soil samples ranged from pH 7.4 to 8.5, therefore shallow soils are not considered acidic. PAHs are considered to adsorb to suspended solids and sediment.

Groundwater levels ranged from 0.51mbgl to 2.57mbgl across the monitoring programme, with average depths circa 1.70mbgl. It is unlikely that fairly immobile contaminants observed within the top 1m of soils will migrate to groundwater, and subsequently surface water. Groundwater monitoring and analysis was carried out to verify this.

Following groundwater analysis, there were no exceedances of the GAC, and the majority of results were below LOD. Analytical results mirror observations made in the field, in that there was no visual/ olfactory evidence of contamination noted during groundwater sampling.

If a piled foundation solution is to be utilised, the risk assessment in Section 9.3 below will require amending.

### 9.2.2. Contaminants in Soil

Risks related with contaminants in soils are associated with asbestos, lead and PAHs.

Across the sample population, just three samples either identified asbestos or exceeded the GAC for lead and/ or PAHs. These samples were all collected from Made Ground within the top 0.70m comprising fill material such as brick, gravel, ash or macadam. There was no asbestos detected or exceedances identified below 0.70m depth or in natural soils.

In terms of the proposed development, test locations where contaminants were identified are located over hardstanding or build footprint. Nevertheless, the heterogenous nature of Made Ground means that there is a chance there is unidentified contamination across the site (in Made Ground). Therefore, contaminants in Made Ground are considered to represent a risk to human receptors –both residential end users, and construction/ development workers.

It is possible to mitigate risks to construction/ ground workers during site works, but long-term remedial measures will be required for site residents/ end users.

It is acknowledged that much of the site will comprise hardstanding in the form of roadways or pavements, or build footprint (~75% of total area). Risks to end users in these areas will be much lower due to a reduced chance of exposure. It is understood that the proposed development will include private gardens, communal amenity space and aesthetical landscaping i.e. in the car park. Risks to end users are considered to be higher in areas of private gardens due to the significantly longer length of exposure and chance of interaction with soils. Private gardens represent just circa 325m<sup>2</sup>, with the total development size circa 4500m<sup>2</sup>.

### 9.2.3. Ground Gas

The outcomes of the gas monitoring programme mean that gas protection is required to CIRIA Characteristic Situation 2, for the residential development. Further details are provided in Section 10.

It is unlikely that construction/ groundworkers will be exposed to ground gas in an external work setting.

### 9.2.4. Soil Vapour

There is not considered to be a risk from (hydrocarbon related) soil vapour. Negligible soil and vapour monitoring results were observed.

## 9.3. Pollutant Linkage Assessment

The Pollutant Linkage Assessment below relates to perceived current worst case conditions on site, prior to the application of mitigation or remedial measures.

| Source                                                                                                         | Pathway                                                                                                                               | Receptor                                                     | Severity | Likelihood     | Risk Level |
|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------|----------------|------------|
| Made Ground across the site inclusive of asbestos, lead and PAHs.                                              | Dermal contact                                                                                                                        | Future Site Users (residents, visitors, maintenance workers) | Medium   | Likely         | Moderate   |
|                                                                                                                | Ingestion                                                                                                                             | Construction/ groundworkers                                  | Minor    | Likely         | Low        |
|                                                                                                                | Inhalation                                                                                                                            | Construction/ groundworkers                                  | Minor    | Likely         | Low        |
|                                                                                                                | Vertical and lateral migration of organic and inorganic compounds (not asbestos) through underlying geology and/ or via overland flow | Superficial secondary (undifferentiated) aquifer             | Minor    | Likely         | Low        |
|                                                                                                                |                                                                                                                                       | Bedrock secondary (A) aquifer                                | Minor    | Low Likelihood | Very Low   |
| Ground gas associated with Made Ground and historical development of the site, and former use as sewage works. | Vertical and lateral migration of ground gas leading to accumulation in enclosed spaces and inhalation                                | Adjacent south Riders Stream                                 | Minor    | Low Likelihood | Very Low   |
|                                                                                                                |                                                                                                                                       | Future Site Users (residents, visitors, maintenance workers) | Medium   | Likely         | Moderate   |
|                                                                                                                |                                                                                                                                       | Construction/ groundworkers                                  | Minor    | Unlikely       | Very Low   |

Table 9.6: Pollutant Linkage Assessment

## 10. CONCLUSIONS AND RECOMMENDATIONS

### 10.1. Contamination

The design of the Site Investigation incorporated information from the Desk Top Study, with potential contamination source areas investigated as far as practicable.

#### 10.1.1. Contaminated Soils

Currently, as a worst case, a Moderate risk has been assessed to Site End Users, relating to possible exposure to asbestos, lead and PAHs in soils. The risk level is defined as - 'It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, or if any harm were to occur it is more likely that the harm would be relatively mild. Investigation is normally required to clarify risks and to determine potential liability. Some remedial works may be required in the long term.'

A Low risk has been applied to construction/ groundworkers in terms of contaminated soils. This is defined as -'It is possible that harm could arise to a designated receptor from an identified hazard but it is likely that this harm, if realised, would at worst normally be mild.'

Further to the above, remedial mitigation measures are required, in relation to contaminated soils.

##### 10.1.1.1. Cover System –Private Gardens

Due to the presence of Made Ground at depth, the cover system is to include a geotextile warning membrane (if Made Ground is deeper than 600mm) to prevent the migration of contaminated to the ground surface and to act as a marker layer for people excavating in the cover material.

It is proposed that the cover system can incorporate natural soils already in situ. All Made Ground should be removed from areas proposed as gardens, unless Made Ground is thicker than 600mm, and in this case a hi-vis geotextile membrane should be installed. If natural soils are encountered within 600mm the excavation may be halted, with clean certified soil imported to bring up to finished levels.

##### 10.1.1.2. Cover System –Amenity/ Landscaped Areas

As with private gardens, due to the presence of Made Ground at depth, the cover system is to include a geotextile membrane, but in this case only if Made Ground is deeper than 400mm.

All Made Ground should be removed from areas proposed as amenity, landscaped areas, unless Made Ground is thicker than 400mm, and in this case a hi-vis geotextile membrane should be installed. If natural soils are encountered within 400mm the excavation may be halted, with clean certified soil imported to bring up to finish levels.

##### 10.1.1.3. Cover Material

The composition of the cover material is to be suitable for the proposed landscaping requirements and as a minimum the soil should be free from asbestos, metals, plastic, wood, glass, tarmac, paper and odours associated with contaminated soils and otherwise comply with the requirements of BS 3882:2015 – Specification for topsoil and requirements for use. Requirements regarding rooting depths should broadly follow BS3882:2015, although final details will be provided by the landscape team.

#### 10.1.1.4. Re-Use of Material

Theoretically, soil below depth to base of Made Ground is natural and therefore re-usable. Re-use of site-won soil is significantly more sustainable than the import of all soil, although a mixture of the two techniques may need to be employed. Suitable segregation of made ground / natural materials would need to be carried out if this option is to be progressed.

Similarly, a membrane would not be required if all Made Ground is removed from a particular area. Re-use of soil would be subject to verification of suitability for reuse by a consultant from Ridge.

#### 10.1.1.5. Discovery Strategy

A discovery strategy should be implemented in case there are any unidentified areas of contamination observed during ground work. This discovery strategy should be implemented by the Site Manager during construction works in tandem with support from a Geo-Environmental Consultant such as Ridge.

### 10.1.2. Controlled Waters

Risks to Controlled Waters have been assessed as Low in terms of the development, utilising traditional foundations.

If a piled foundation solution is to be utilised, the risk assessment will require amending. A Piling Risk Assessment will be required.

### 10.1.3. Ground Gas

It is unlikely that construction/ groundworkers will be exposed to ground gas in an external work setting.

The outcomes of the gas monitoring programme mean that gas protection is required to CIRIA Characteristic Situation 2.

#### 10.1.3.1. Gas Protection

Referring to Tables 3 and 4 within BS 8485:2015+A1:2019 Code of Practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings, the proposed development would be classified as a Type A Building.

A Type A Building is classified as: private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Examples include private housing and some retail premises. The corresponding gas protection score is 3.5 for a Type A building with CS 2.

Having determined the gas protection score (3.5) an element or combination of elements should be utilised with a combined score achieving the recommend gas protection score. The gas protection system should consist of at least two different elements; for example, a barrier element with either a membrane or a ventilation or dilution element (or both). The elements work independently and collaboratively, and a single element should not be used because there would be no redundancy to allow for defects in the component.

We have assumed the preferred floor and substructure design for this development is precast suspended segmental subfloor (beam and block). Based on the above, the following mitigation measures are considered appropriate for the development:

- ♣ Precast suspended segmental subfloor (beam and block). [0.0 points] *and*
- ♣ Passive sub floor dispersal layer [1.5 points] - media used to provide dispersal layer are
  - o Clear void
  - o Polystyrene void former blanket
  - o Geo-composite void former blanket
  - o No fines gravel layer *and*
- ♣ Gas resistant membrane [2.0 points].

The gas resistant membrane should meet the following criteria –

| Protection element/system                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Score | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gas resistant membrane meeting all of the following criteria: <ul style="list-style-type: none"> <li>• sufficiently impervious to the gases with a methane gas transmission rate &lt;40.0 ml/day/m<sup>2</sup>/atm (average) for sheet and joints (tested in accordance with BS ISO 15105-1 manometric method);</li> <li>• sufficiently durable to remain serviceable for the anticipated life of the building and duration of gas emissions;</li> <li>• sufficiently strong to withstand in-service stresses (e.g. settlement if placed below a floor slab);</li> <li>• sufficiently strong to withstand the installation process and following trades until covered (e.g. penetration from steel fibres in fibre reinforced concrete, penetration of reinforcement ties, tearing due to working above it, dropping tools, etc);</li> <li>• capable, after installation, of providing a complete barrier to the entry of the relevant gas; and</li> <li>• verified in accordance with CIRIA C735 [N1]</li> </ul> | 2     | The performance of membranes is heavily dependent on the quality and design of the installation, resistance to damage after installation and integrity of joints.<br><br>For example, a minimum 0.4 mm thickness (equivalent to 370 g/m <sup>2</sup> for polyethylene) reinforced membrane (virgin polymer) meets the performance criteria in Table 7 (see C.3).<br><br>If a membrane is installed that does not meet all the criteria in column 1 then the score is zero. |

Image 7.1: Extract from BS 8485:2015

### 10.1.4. Remediation Method Statement

It is likely a Remediation Method Statement will be required to detail remedial measures, mitigation measures and follow-up validation. This report cannot be completed until risks associated with ground gas and controlled waters are further refined.

### 10.1.5. Piling Risk Assessment

A Piling Risk Assessment should be compiled should a piled foundation solution be required at the development.

## 10.2. Waste Removal

Results from all nine analysed samples were input into a Soils Characterisation Assessment Tool (CAT-Waste Soil) to identify whether soils on site had hazardous properties. All nine samples returned Non-Hazardous properties.

The second part of the assessment process is a review of Waste Acceptance Classification (WAC) testing, which was carried out on the sample collected from WS8-0.50m, as this was considered to be representative of typical Made Ground across the site. The sample was classified as Inert.

All waste materials will need to be properly handled and disposed of in accordance with the Landfill Directive and other relevant legislation.

Testing has shown soils to be inert, however asbestos has been identified in a number of samples and is expected to be present in Made Ground soils across the site. Further testing and segregation of soils will be required as part of the redevelopment process.

### 10.3. Geotechnical

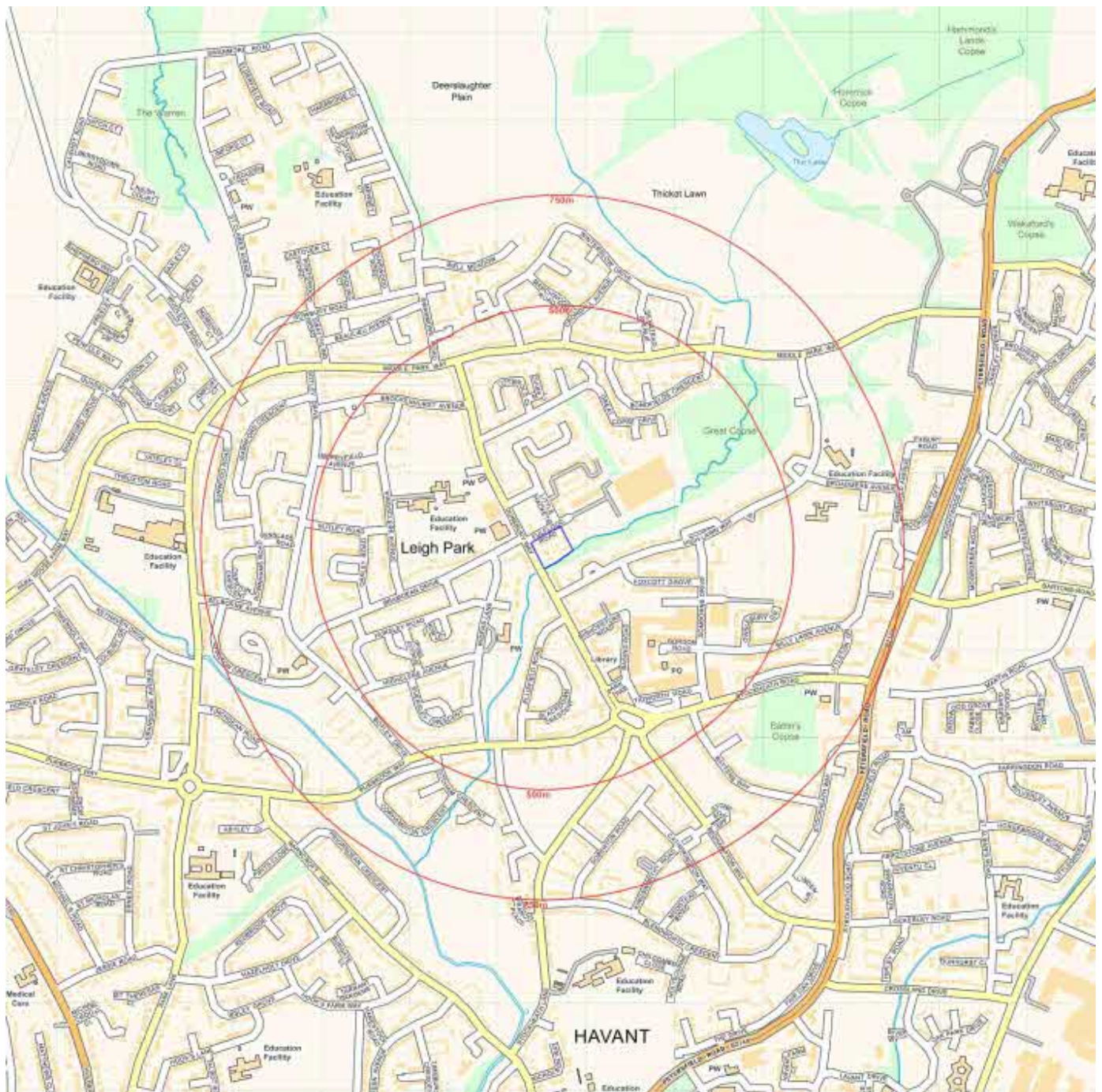
In situ testing was carried out across the site in the form of Standard Penetration Tests (SPTs). Testing highlighted the variability in density and stiffness of Made Ground materials. This was particularly prevalent in areas formerly used as sludge beds (WS4, WS5 and WS8) and congestion tanks (WS6 and WS7) where Made Ground was identified to approximate depths of 3.00mbgl and 4.50mbgl respectively. SPT-N values varied significantly in Made Ground with consecutive zeros recorded in WS6 and WS7 at 2m and 3m depth.

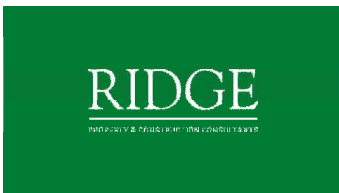
Natural soils of the Bognor Sand Member were observed as shallow as 0.60mbgl in WS1 but more regularly was observed below 2.00mbgl. Depth to the top of the Bognor Sand is linked with the significant thickness of Made Ground seen across the site. Generally these soils were described as medium dense, becoming dense light brown/ orange gravelly fine and medium Sand, with gravel of sub-angular to rounded fine and medium flint.

It would be prudent to improve the geotechnical understanding of the site by advancing additional boreholes in areas proposed as buildings, and subsequently commission geotechnical laboratory testing. It would be sensible to conduct this following demolition of existing structures to obtain full site coverage.

Boreholes advanced below/ close to proposed buildings identified natural soils at the following depths: WS1-0.60m, WS2-1.20m, WS3-1.90m, WS4-3.30m, WS8-2.80m. Additional investigation in specific build footprint areas would allow assessment of whether traditional foundations can be utilised.

FIGURE 1 –SITE LOCATION PLAN



|             |                     |           |                      |        |                                                                                      |                                                                           |
|-------------|---------------------|-----------|----------------------|--------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| Project:    | DunsburyWay, Havant |           |                      | Title: | Site Location Plan                                                                   |                                                                           |
| Job Number: | 5012199             | Client:   | Dunsbury Way Limited |        |  | Partnership House<br>Moorside Road<br>Winchester<br>Hampshire<br>SO23 7RX |
| Drawing:    | 5012199-01          | Revision: | -                    |        |                                                                                      |                                                                           |
| Drawn:      | MS                  | Date:     | April 2020           |        |                                                                                      |                                                                           |
| Checked by: | RJH                 | Scale:    | NTS                  |        |                                                                                      |                                                                           |
|             |                     |           |                      |        | Ridge and Partners LLP<br>www.ridge.co.uk                                            | TEL: 01962 834300                                                         |

## FIGURE 2 –DEVELOPMENT PLANS



#### Schedule of Accommodation

**Car Parking Spaces**  
76 Car Parking Spaces

**Cycle Parking Spaces**  
132 Cycle Parking Spaces  
24 Visitor Cycle Parking Spaces

**Communal Amenity Space**  
Amenity Space 176.591m<sup>2</sup>

#### Apartments

**Ground Floor Plan**  
6 X 1 Bedroom Apartments  
4 X 2 Bedroom Apartments

**First Floor Plan**  
10 X 1 Bedroom Apartments  
9 X 2 Bedroom Apartments

**Second Floor Plan**  
10 X 1 Bedroom Apartments  
9 X 2 Bedroom Apartments

**Third Floor Plan**  
10 X 1 Bedroom Apartments  
9 X 2 Bedroom Apartments

**Fourth Floor Plan**  
4 X 1 Bedroom Apartments  
3 X 2 Bedroom Apartments

**Total Apartments**  
40 x 1 Bedroom Apartments  
34 x 2 Bedroom Apartments

= 74 Apartments

#### Apartment Schedule

| 1 BED |                | 2 BED |                |
|-------|----------------|-------|----------------|
| No.   | m <sup>2</sup> | No.   | m <sup>2</sup> |
| 1     | 54             | 1     | 73.5           |
| 10    | 50.8           | 1     | 61.1           |
| 4     | 51.2           | 2     | 69.9           |
| 4     | 51.6           | 3     | 64.9           |
| 5     | 52.9           | 4     | 61.5           |
| 3     | 56             | 6     | 65             |
| 3     | 52.2           | 3     | 64.6           |
| 4     | 50.4           | 3     | 62.4           |
| 3     | 58.2           | 4     | 61.2           |
| 1     | 53.9           | 3     | 65.5           |
| 1     | 51.1           | 1     | 66.8           |
|       |                | 2     | 64.7           |
|       |                | 1     | 70.4           |
|       |                | 1     | 66             |

0.

Proposed Ground Floor Plan

1:200

revisions & notes:

|   |            |     |                                                |
|---|------------|-----|------------------------------------------------|
| A | 19.02.2018 | LMW | Issued to JLL                                  |
| B | 21.02.2018 | LMW | Revision to Parking Layout                     |
| C | 19.10.2018 | LMW | Issued to JLL                                  |
| D | 12.03.2019 | LMW | Proposed re-design following planning comments |
| E | 18.04.2019 | JS  | Proposed re-design following planning comments |

project: **The Southern Cooperative**  
**222-224 Dunsbury Way**  
Havant  
PO9 5BQ

drawing name: **Ground Floor Layout**

status: **PLANNING**

date: **February 2018**

scale: **1:200**

drawn: **LMW**

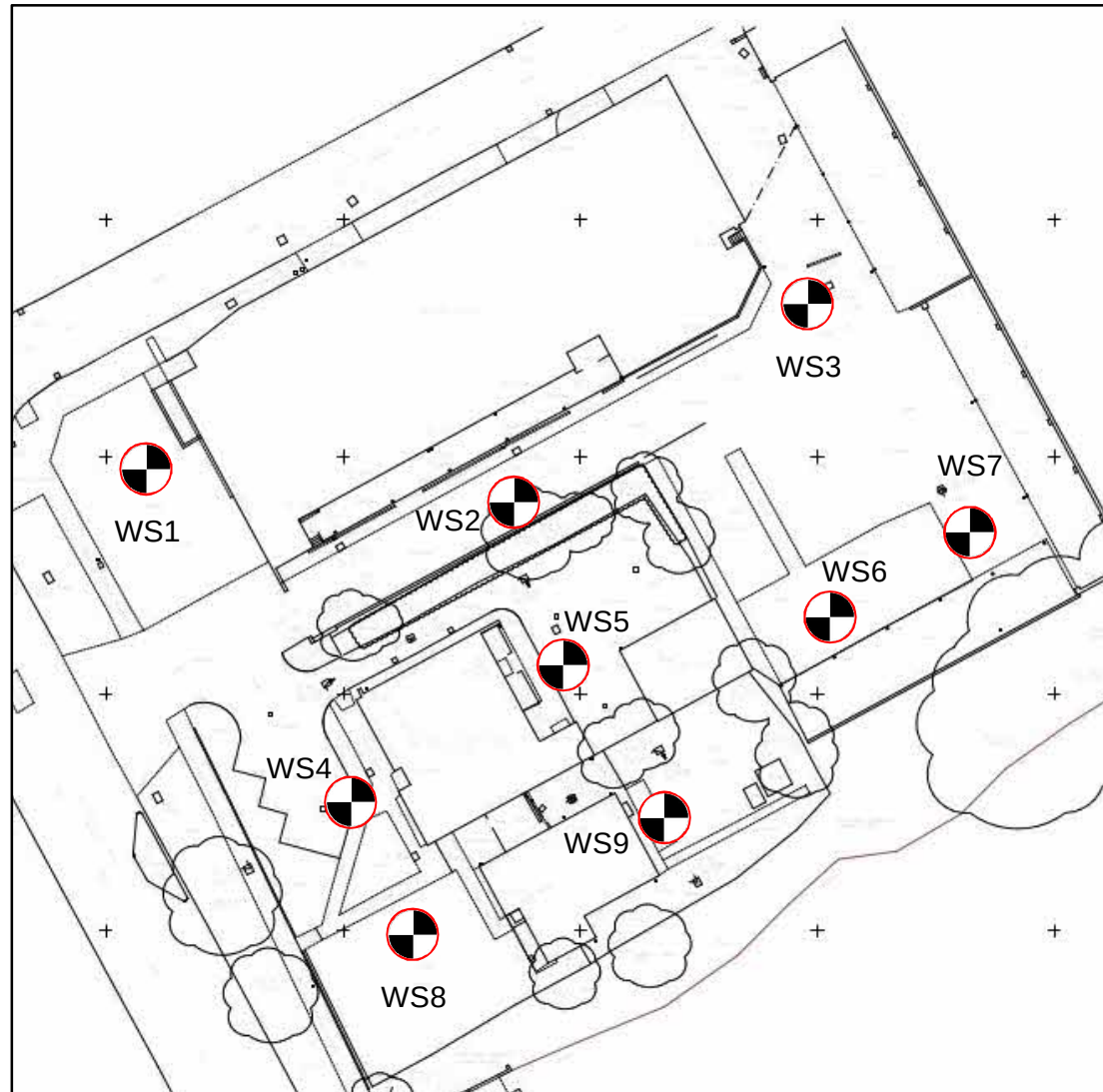
61 South Street, Havant, Hampshire PO9 1BZ  
t: 023 9248 2494  
e: design@pwp-architects.com  
w: www.pwp-architects.com

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Project No. **5264** drawing No. **1201** rev **E**

Note: All dimensions to be checked on site by the contractor before fabrication and erection. Figured dimensions to be taken in preference to scaled dimensions. This drawing is the copyright of the architects and must not be reproduced or used without their express consent, except for the purposes of a planning application. Electronic issue of this drawing to be confirmed by paper hard copy only.

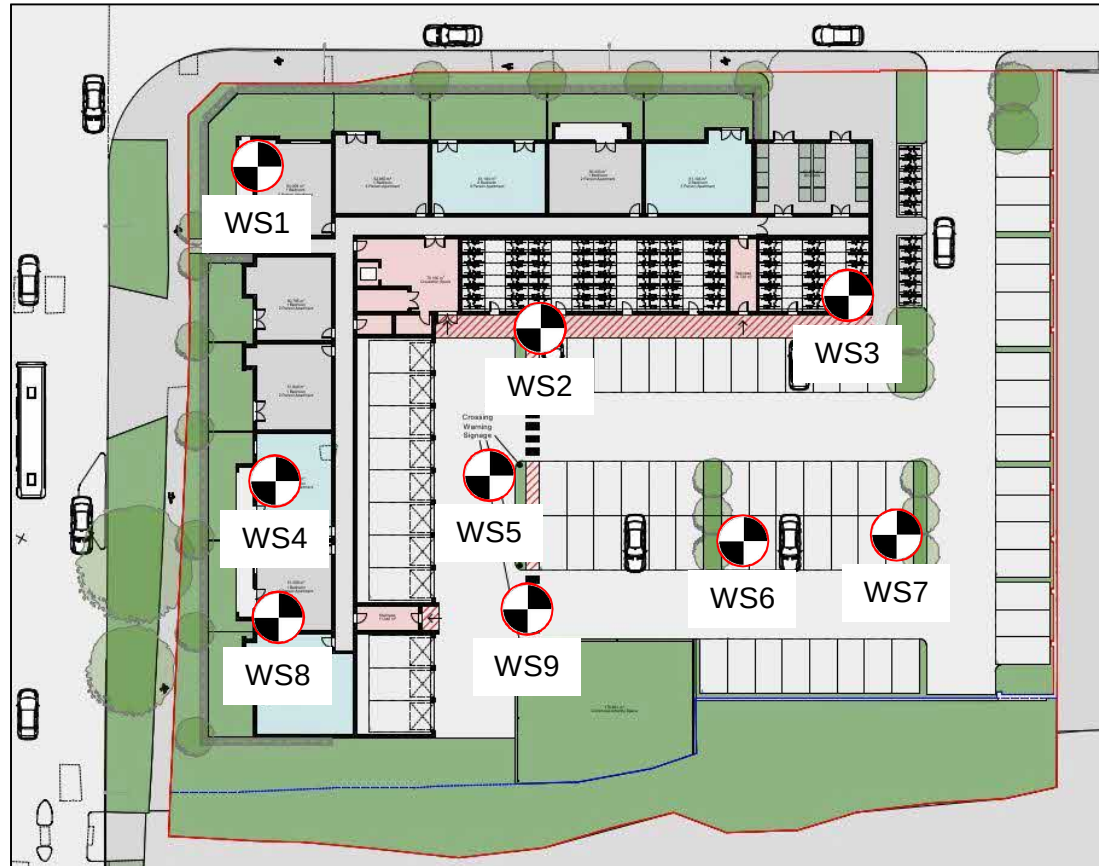
FIGURE 3 –TEST LOCATION PLAN



 Borehole  
 North

Existing layout

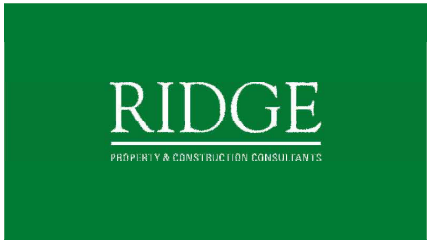
|                    |                     |                  |                      |                                                                |                                                                           |                                                                                       |
|--------------------|---------------------|------------------|----------------------|----------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Project:</b>    | DunsburyWay, Havant |                  |                      | <b>Title:</b>                                                  | Site Investigation Plan -Existing Layout                                  |                                                                                       |
| <b>Job Number:</b> | 5012199             | <b>Client:</b>   | Dunsbury Way Limited | Ridge and Partners LLP<br>TEL: 01962 834300<br>www.ridge.co.uk | Partnership House<br>Moorside Road<br>Winchester<br>Hampshire<br>SO23 7RX |  |
| <b>Draw ing:</b>   | 5012199-Fig3        | <b>Revision:</b> | -                    |                                                                |                                                                           |                                                                                       |
| <b>Drawn:</b>      | RG                  | <b>Date:</b>     | March 2020           |                                                                |                                                                           |                                                                                       |
| <b>Checked by:</b> | RJH                 | <b>Scale:</b>    | NTS                  |                                                                |                                                                           |                                                                                       |

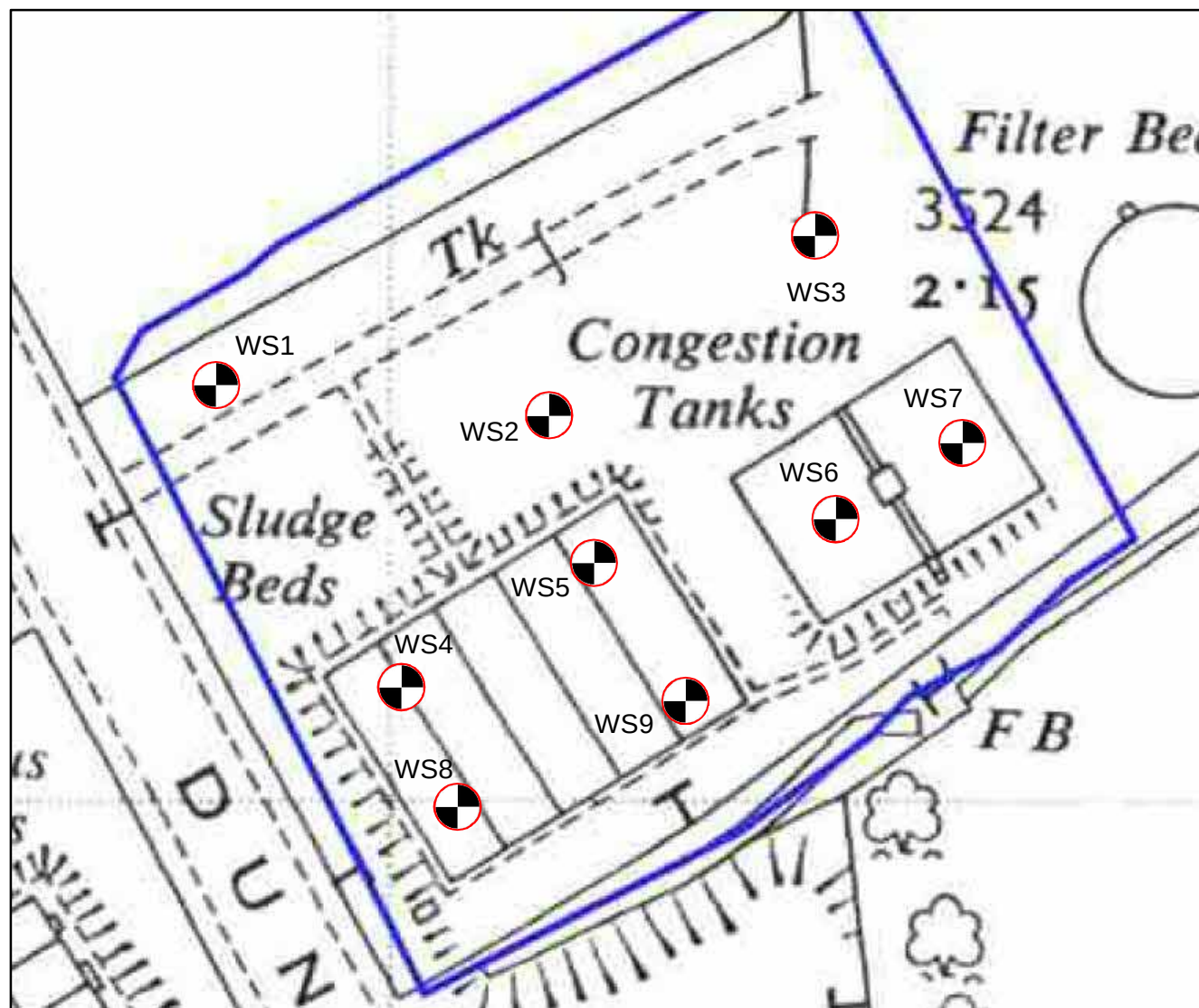


 Borehole

 North

Proposed layout

|                    |                     |                  |                      |                                                                |                                                                           |                                                                                       |
|--------------------|---------------------|------------------|----------------------|----------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Project:</b>    | DunsburyWay, Havant |                  |                      | <b>Title:</b>                                                  | Site Investigation Plan -Proposed Layout                                  |                                                                                       |
| <b>Job Number:</b> | 5012199             | <b>Client:</b>   | Dunsbury Way Limited | Ridge and Partners LLP<br>TEL: 01962 834300<br>www.ridge.co.uk | Partnership House<br>Moorside Road<br>Winchester<br>Hampshire<br>SO23 7RX |  |
| <b>Draw ing:</b>   | 5012199-Fig3        | <b>Revision:</b> | -                    |                                                                |                                                                           |                                                                                       |
| <b>Drawn:</b>      | RG                  | <b>Date:</b>     | March 2020           |                                                                |                                                                           |                                                                                       |
| <b>Checked by:</b> | RJH                 | <b>Scale:</b>    | NTS                  |                                                                |                                                                           |                                                                                       |



Historical layout  
circa 1950s

|                    |                     |                  |                      |                                                                |                                                                           |                                                                                       |
|--------------------|---------------------|------------------|----------------------|----------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| <b>Project:</b>    | DunsburyWay, Havant |                  |                      | <b>Title:</b>                                                  | Site Investigation Plan -Historical Layout                                |                                                                                       |
| <b>Job Number:</b> | 5012199             | <b>Client:</b>   | Dunsbury Way Limited | Ridge and Partners LLP<br>TEL: 01962 834300<br>www.ridge.co.uk | Partnership House<br>Moorside Road<br>Winchester<br>Hampshire<br>SO23 7RX |  |
| <b>Draw ing:</b>   | 5012199-Fig3        | <b>Revision:</b> | -                    |                                                                |                                                                           |                                                                                       |
| <b>Drawn:</b>      | RG                  | <b>Date:</b>     | March 2020           |                                                                |                                                                           |                                                                                       |
| <b>Checked by:</b> | RJH                 | <b>Scale:</b>    | NTS                  |                                                                |                                                                           |                                                                                       |

## APPENDIX 1 –REPORT CONDITIONS

This report is produced solely for the benefit of Dunsbury Way Limited and no liability is accepted for any reliance placed on it by any other party unless specifically agreed in writing otherwise.

This report refers, within the limitations stated, to the condition of the site at the time of the inspections. No warranty is given as to the possibility of future changes in the condition of the Site.

This report is based on a visual Site inspection, study of readily accessible referenced historical records, information supplied by those parties noted in the text and preliminary discussions with local and Statutory Authorities. Some of the opinions are based on unconfirmed data and information and are presented in good faith without exhaustive clarification. Where ground contamination is suspected but no physical Site test results are available to confirm this, the report must be regarded as initial advice only, and further assessment should be undertaken prior to detailed activities related to the Site. Where test results undertaken by others have been made available these can only be regarded as a limited sample. The possibility of the presence of contaminants, not revealed by this research cannot be discounted.

Whilst confident in the findings detailed within this report because there are no exact UK definitions of these matters, being subject to risk analysis, we are unable to give categoric assurances that they will be accepted by Authorities or Funds etc. without question, as such bodies may have unpublished, often more stringent objectives. This report is prepared for the proposed uses stated in the report and should not be used in a different context without reference to Ridge and Partners LLP. In time improved practices or amended legislation may necessitate a re-assessment.

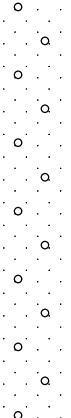
The report is necessarily limited to those aspects of land contamination specifically reported on and no liability is accepted for any other aspect especially concerning gradual or sudden pollution incidents that may occur. The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous use and abuse of the Site and adjacent Sites. The report concentrates on the Site as defined in the report and provides an opinion on surrounding Sites. If migrating pollution or contamination (past or present) exists this can only practically be better assessed following extensive on and off Site intrusive investigations and monitoring.

## APPENDIX 2 –SOIL LOGS



## BOREHOLE LOG

|                                           |                              |                  |                 |                           |  |
|-------------------------------------------|------------------------------|------------------|-----------------|---------------------------|--|
| Project<br><b>Dunsbury</b>                |                              |                  |                 | BOREHOLE No<br><b>WS1</b> |  |
| Job No<br><b>5012199</b>                  | Date<br>28-02-20<br>28-02-20 | Ground Level (m) | Co-Ordinates () |                           |  |
| Contractor<br><b>South Coast Drilling</b> |                              |                  |                 | Sheet<br><b>1 of 1</b>    |  |

| SAMPLES & TESTS |         |             | STRATA        |                                                                                    |                        |                                                                                                                                                                                               |
|-----------------|---------|-------------|---------------|------------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Depth           | Type No | Test Result | Reduced Level | Legend                                                                             | Depth (Thickness)      | DESCRIPTION                                                                                                                                                                                   |
| 0.30            | ES      | N14         |               |   | 0.10<br>(0.50)<br>0.60 | MADE GROUND: Macadam<br>MADE GROUND: Fill inclusive of brick and gravel within Silt/ Sand matrix.                                                                                             |
| 0.80<br>1.00    | ES      |             |               |  | (2.85)                 | Medium dense, becoming dense light brown/ orange gravelly fine and medium SAND. Gravel is sub-angular to rounded fine and medium flint. [Bognor Sand]<br><br>Gravel less abundant with depth. |
| 2.00<br>3.00    |         |             |               |                                                                                    | 3.45                   |                                                                                                                                                                                               |
|                 |         | N19         |               |                                                                                    |                        |                                                                                                                                                                                               |
|                 |         | N45         |               |                                                                                    |                        |                                                                                                                                                                                               |

| Boring Progress and Water Observations |      |      |                                    |                |             | Chiselling                                   |    |       | Water Added            |    | GENERAL REMARKS                                                                                                                                                                                  |
|----------------------------------------|------|------|------------------------------------|----------------|-------------|----------------------------------------------|----|-------|------------------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Depth                                  | Date | Time | Casing Depth                       | Casing Dia. mm | Water Depth | From                                         | To | Hours | From                   | To |                                                                                                                                                                                                  |
|                                        |      |      |                                    |                |             |                                              |    |       |                        |    | Borehole advanced with tracked dynamic sampling rig to terminal depth of 3.45m bgl. Groundwater not identified. Installed with 50mm diameter standpipe with response zone from 0.20 - 2.00m bgl. |
| All dimensions in metres<br>Scale 1:50 |      |      | Client <b>Dunsbury Way Limited</b> |                |             | Method/<br>Plant Used <b>Dynamic Sampler</b> |    |       | Logged By<br><b>MS</b> |    |                                                                                                                                                                                                  |



# BOREHOLE LOG

|                                    |                              |                  |                 |                               |
|------------------------------------|------------------------------|------------------|-----------------|-------------------------------|
| Project<br>Dunsbury                |                              |                  |                 | BOREHOLE No<br><br><b>WS2</b> |
| Job No<br>5012199                  | Date<br>28-02-20<br>28-02-20 | Ground Level (m) | Co-Ordinates () |                               |
| Contractor<br>South Coast Drilling |                              |                  |                 | Sheet<br>1 of 1               |

[illegible]

| Boring Progress and Water Observations |      |                                |              |                |             | Chiselling            |    |                 | Water Added |    | GENERAL REMARKS                                                                                                                                         |
|----------------------------------------|------|--------------------------------|--------------|----------------|-------------|-----------------------|----|-----------------|-------------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Depth                                  | Date | Time                           | Casing Depth | Casing Dia. mm | Water Depth | From                  | To | Hours           | From        | To |                                                                                                                                                         |
|                                        |      |                                |              |                |             |                       |    |                 |             |    | Borehole advanced with tracked dynamic sampling rig to terminal depth of 3.00m bgl. Groundwater not identified. Backfilled with arisings on completion. |
| All dimensions in metres<br>Scale 1:50 |      | Client    Dunsbury Way Limited |              |                |             | Method/<br>Plant Used |    | Dynamic Sampler |             |    | Logged By<br>MS                                                                                                                                         |

# BOREHOLE LOG

|                                    |                              |                  |                 |                               |
|------------------------------------|------------------------------|------------------|-----------------|-------------------------------|
| Project<br>Dunsbury                |                              |                  |                 | BOREHOLE No<br><br><b>WS3</b> |
| Job No<br>5012199                  | Date<br>28-02-20<br>28-02-20 | Ground Level (m) | Co-Ordinates () |                               |
| Contractor<br>South Coast Drilling |                              |                  |                 | Sheet<br>1 of 1               |

| SAMPLES & TESTS      |         |             | No                                                                                | STRATA                                                                            |                                                                                                                                       |                                                                                                                                | No | Remarks                                                                             |
|----------------------|---------|-------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|----|-------------------------------------------------------------------------------------|
| Depth                | Type No | Test Result |                                                                                   | Reduced Level                                                                     | Legend                                                                                                                                | Depth (Thick-ness)                                                                                                             |    |                                                                                     |
| 0.70<br>1.00<br>1.20 | ES      | N0          |                                                                                   |  | 0.20                                                                                                                                  | Reinforced CONCRETE.                                                                                                           |    |  |
|                      |         |             |                                                                                   |  | (0.40)<br>0.60                                                                                                                        | MADE GROUND: Fill inclusive of brick, macadam and concrete in clayey Sand matrix.                                              |    |                                                                                     |
|                      |         |             |  | (0.50)<br>1.10                                                                    | MADE GROUND: Ash and macadam fill within Sand and Gravel of flint.                                                                    |                                                                                                                                |    |                                                                                     |
| 2.00                 | ES      | N13         |                                                                                   |  | (0.80)<br>1.90                                                                                                                        | MADE GROUND: Grey sandy Clay/ clayey Sand with rare gravel of rounded fine and medium flint. Rare rootlets and wood fragments. |    |  |
|                      |         |             |                                                                                   |  | (0.60)<br>2.50                                                                                                                        | Medium dense grey slightly clayey fine and medium SAND. Occasional sub-angular and fine and medium flint. [Bognor Sand]        |    |                                                                                     |
|                      |         |             |  | (1.50)<br>4.00                                                                    | Medium dense brown/ light brown slightly clayey fine and medium SAND with occasional sub-angular fine and medium flint. [Bognor Sand] |                                                                                                                                |    |                                                                                     |
|                      |         |             |                                                                                   |                                                                                   |                                                                                                                                       |                                                                                                                                |    |                                                                                     |

| Boring Progress and Water Observations |      |      |                                |                |             | Chiselling                               |    |       | Water Added |    | GENERAL REMARKS                                                                                                                                                             |
|----------------------------------------|------|------|--------------------------------|----------------|-------------|------------------------------------------|----|-------|-------------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Depth                                  | Date | Time | Casing Depth                   | Casing Dia. mm | Water Depth | From                                     | To | Hours | From        | To |                                                                                                                                                                             |
|                                        |      |      |                                |                |             |                                          |    |       |             |    | Borehole advanced with tracked dynamic sampling rig to terminal depth of 4.00m bgl. Groundwater not identified. Hole collapsed to 3.40m, therefore only two SPTs completed. |
| All dimensions in metres<br>Scale 1:50 |      |      | Client    Dunsbury Way Limited |                |             | Method/<br>Plant Used    Dynamic Sampler |    |       |             |    | Logged By<br>MS                                                                                                                                                             |



# BOREHOLE LOG

|                                    |                              |                  |                 |                               |
|------------------------------------|------------------------------|------------------|-----------------|-------------------------------|
| Project<br>Dunsbury                |                              |                  |                 | BOREHOLE No<br><br><b>WS4</b> |
| Job No<br>5012199                  | Date<br>08-03-20<br>08-03-20 | Ground Level (m) | Co-Ordinates () |                               |
| Contractor<br>South Coast Drilling |                              |                  |                 | Sheet<br>1 of 1               |

[illegible]

| Boring Progress and Water Observations |      |      |       |                   |                | Chiselling |    |       | Water Added |    | GENERAL<br>REMARKS                                                                                                                                      |
|----------------------------------------|------|------|-------|-------------------|----------------|------------|----|-------|-------------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Depth                                  | Date | Time | Depth | Casing<br>Dia. mm | Water<br>Depth | From       | To | Hours | From        | To |                                                                                                                                                         |
|                                        |      |      |       |                   |                |            |    |       |             |    | Borehole advanced with tracked dynamic sampling rig to terminal depth of 4.45m bgl. Groundwater not identified. Backfilled with arisings on completion. |



Ridge & Partners LLP  
Moorside Road  
SO23 7RX

## BOREHOLE LOG

|                                           |                                            |                  |                 |                           |  |
|-------------------------------------------|--------------------------------------------|------------------|-----------------|---------------------------|--|
| Project<br><b>Dunsbury</b>                |                                            |                  |                 | BOREHOLE No<br><b>WS5</b> |  |
| Job No<br><b>5012199</b>                  | Date<br><b>08-03-20</b><br><b>08-03-20</b> | Ground Level (m) | Co-Ordinates () |                           |  |
| Contractor<br><b>South Coast Drilling</b> |                                            |                  |                 | Sheet<br><b>1 of 1</b>    |  |

| SAMPLES & TESTS |         |             | STRATA        |        |                   |                                                                                                                                                                                                                                                                                                                       |  |
|-----------------|---------|-------------|---------------|--------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Depth           | Type No | Test Result | Reduced Level | Legend | Depth (Thickness) | DESCRIPTION                                                                                                                                                                                                                                                                                                           |  |
| 1.00            | N0      |             |               |        | 0.10              | CONCRETE with 4mm diameter steel reinforcement.                                                                                                                                                                                                                                                                       |  |
|                 |         |             |               |        | (0.50)            | MADE GROUND: Granular fill of orange Sand and Gravel with occasional brick fragments.                                                                                                                                                                                                                                 |  |
|                 |         |             |               |        | 0.60              |                                                                                                                                                                                                                                                                                                                       |  |
|                 |         |             |               |        | 0.90              | MADE GROUND: Grey slightly clayey Sand and Gravel fill with occasional brick fragments.                                                                                                                                                                                                                               |  |
| 2.00            | N2      |             |               |        | (2.00)            | MADE GROUND: Fine grey slightly gravelly Sand. Gravel is sub-angular and sub-rounded fine and medium flint.<br><br>Possible peat observed from 1.60-1.90mbgl, but likely to be associated with sludge from former sludge beds.<br><br>Grey sand with occasional gravel of flint and slight organic odour at 2.10mbgl. |  |
|                 |         |             |               |        | 2.90              |                                                                                                                                                                                                                                                                                                                       |  |
| 3.00            | N16     |             |               |        |                   | Medium dense, becoming dense light brown/ orange gravelly fine and medium SAND. Gravel is sub-angular to rounded fine and medium flint. [Bognor Sand]                                                                                                                                                                 |  |
| 4.00            | N25     |             |               |        | (1.55)            |                                                                                                                                                                                                                                                                                                                       |  |
|                 |         |             |               |        | 4.45              |                                                                                                                                                                                                                                                                                                                       |  |

| Boring Progress and Water Observations |      |      |                                    |                |             | Chiselling                                   |    |       | Water Added            |    | GENERAL REMARKS                                                                                                                                        |
|----------------------------------------|------|------|------------------------------------|----------------|-------------|----------------------------------------------|----|-------|------------------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| Depth                                  | Date | Time | Depth                              | Casing Dia. mm | Water Depth | From                                         | To | Hours | From                   | To |                                                                                                                                                        |
|                                        |      |      |                                    |                |             |                                              |    |       |                        |    | Borehole advanced with tracked dynamic sampling rig to terminal depth of 4.45mbgl. Groundwater not identified. Backfilled with arisings on completion. |
| All dimensions in metres<br>Scale 1:50 |      |      | Client <b>Dunsbury Way Limited</b> |                |             | Method/<br>Plant Used <b>Dynamic Sampler</b> |    |       | Logged By<br><b>MS</b> |    |                                                                                                                                                        |

# BOREHOLE LOG

|                                    |                              |                  |                  |                               |
|------------------------------------|------------------------------|------------------|------------------|-------------------------------|
| Project<br>Dunsbury                |                              |                  |                  | BOREHOLE No<br><br><b>WS6</b> |
| Job No<br>5012199                  | Date<br>28-02-20<br>28-02-20 | Ground Level (m) | Co-Ordinates ( ) |                               |
| Contractor<br>South Coast Drilling |                              |                  |                  | Sheet<br>1 of 1               |

| SAMPLES & TESTS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |             | X | STRATA        |        |                    |             | Y | Z |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------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| Depth                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Type No | Test Result |   | Reduced Level | Legend | Depth (Thick-ness) | DESCRIPTION |   |   |
| 1.00<br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br><br>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|         |             |   |               |        |                    |             |   |   |

| Boring Progress and Water Observations |      |      |                                |         |             | Chiselling                               |    |                 | Water Added |    | GENERAL REMARKS                                                                                                                                                                                       |
|----------------------------------------|------|------|--------------------------------|---------|-------------|------------------------------------------|----|-----------------|-------------|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Depth                                  | Date | Time | Casing Depth                   | Dia. mm | Water Depth | From                                     | To | Hours           | From        | To |                                                                                                                                                                                                       |
|                                        |      |      |                                |         |             |                                          |    |                 |             |    | Borehole advanced with tracked dynamic sampling rig to terminal depth of 5.45m. Groundwater not identified. Appeared to pierce through base of tank at 4.50m. Backfilled with arisings on completion. |
| All dimensions in metres<br>Scale 1:50 |      |      | Client    Dunsbury Way Limited |         |             | Method/<br>Plant Used    Dynamic Sampler |    | Logged By<br>MS |             |    |                                                                                                                                                                                                       |

# BOREHOLE LOG

|                                    |                              |                  |                  |                               |
|------------------------------------|------------------------------|------------------|------------------|-------------------------------|
| Project<br>Dunsbury                |                              |                  |                  | BOREHOLE No<br><br><b>WS7</b> |
| Job No<br>5012199                  | Date<br>28-02-20<br>28-02-20 | Ground Level (m) | Co-Ordinates ( ) |                               |
| Contractor<br>South Coast Drilling |                              |                  |                  | Sheet<br>1 of 1               |

| SAMPLES & TESTS                                      |         |                                               |  |               |        | Depth          | STRATA                                                                                                                                                                                                    |  |  |  |
|------------------------------------------------------|---------|-----------------------------------------------|--|---------------|--------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|
| Depth                                                | Type No | Test Result                                   |  | Reduced Level | Legend | (Thick-ness)   | DESCRIPTION                                                                                                                                                                                               |  |  |  |
| 0.50<br><br>1.20<br><br>2.00<br><br>3.00<br><br>4.00 | ES      | N7<br><br><br>N0<br><br><br>N0<br><br><br>N22 |  |               |        | 0.15           | CONCRETE/ MACADAM                                                                                                                                                                                         |  |  |  |
|                                                      |         |                                               |  |               |        | 0.40           | MADE GROUND: Light brown granular fill.                                                                                                                                                                   |  |  |  |
|                                                      |         |                                               |  |               |        | (0.70)<br>1.10 | MADE GROUND: Grey/ brown Clay fill inclusive of abundant brick and flint.                                                                                                                                 |  |  |  |
|                                                      |         |                                               |  |               |        | 3.50           | MADE GROUND: (very loose to loose) Grey/ brown slightly clayey fine and medium Sand.                                                                                                                      |  |  |  |
|                                                      |         |                                               |  |               |        | (1.00)<br>4.50 | MADE GROUND: (loose) Grey/ light brown fine and medium Sand.<br><br>Similar characteristics to BOGNOR SAND. The spoon appeared to bounce at 4.50m, perhaps the base of a tank. Not possible to penetrate. |  |  |  |
|                                                      |         |                                               |  |               |        |                |                                                                                                                                                                                                           |  |  |  |

| Boring Progress and Water Observations |      |      |                                |                   |                | Chiselling                               |    |                 | Water Added |    | GENERAL<br>REMARKS                                                                                                                                                                                                            |
|----------------------------------------|------|------|--------------------------------|-------------------|----------------|------------------------------------------|----|-----------------|-------------|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Depth                                  | Date | Time | Casing<br>Depth                | Casing<br>Dia. mm | Water<br>Depth | From                                     | To | Hours           | From        | To |                                                                                                                                                                                                                               |
|                                        |      |      |                                |                   |                |                                          |    |                 |             |    | Borehole advanced with tracked dynamic sampling rig to 4.50m bgl, where spoon appeared to bounce on base of a tank. No groundwater. No recovery from 2.00-3.20m. Installed with 50mm diameter pipe, response zone 0.20-2.20m. |
| All dimensions in metres<br>Scale 1:50 |      |      | Client    Dunsbury Way Limited |                   |                | Method/<br>Plant Used    Dynamic Sampler |    | Logged By<br>MS |             |    |                                                                                                                                                                                                                               |



Ridge & Partners LLP  
Moorside Road  
SO23 7RX

## BOREHOLE LOG

|                                           |                                            |                  |                 |                           |  |
|-------------------------------------------|--------------------------------------------|------------------|-----------------|---------------------------|--|
| Project<br><b>Dunsbury</b>                |                                            |                  |                 | BOREHOLE No<br><b>WS8</b> |  |
| Job No<br><b>5012199</b>                  | Date<br><b>28-02-20</b><br><b>28-02-20</b> | Ground Level (m) | Co-Ordinates () |                           |  |
| Contractor<br><b>South Coast Drilling</b> |                                            |                  |                 | Sheet<br><b>1 of 1</b>    |  |

| SAMPLES & TESTS |         |             | STRATA        |        |                   |                                                                                                                                                                                                      |
|-----------------|---------|-------------|---------------|--------|-------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Depth           | Type No | Test Result | Reduced Level | Legend | Depth (Thickness) | DESCRIPTION                                                                                                                                                                                          |
| 0.50            | ES      | N3          |               |        | 0.10              | Grass over brown silt TOPSOIL.                                                                                                                                                                       |
|                 |         |             |               |        | (0.70)            | MADE GROUND: Fill inclusive of flint, brick and occasional macadam within a brown clay matrix.                                                                                                       |
| 1.00            | ES      |             |               |        | 0.80              |                                                                                                                                                                                                      |
| 1.00            | ES      | N3          |               |        | (2.00)            | MADE GROUND: Very loose light brown/ orange gravelly fine and medium Sand. Gravel is sub-angular to rounded fine and medium flint and rare brick. [reworked]<br><br>Gravel less abundant with depth. |
| 2.00            | ES      |             |               |        | 2.80              |                                                                                                                                                                                                      |
| 2.00            | ES      |             |               |        |                   |                                                                                                                                                                                                      |
| 3.00            |         | N20         |               |        | (0.50)            | Medium dense grey GRAVEL of angular and sub-rounded fine and medium flint. Possible Head Deposits.                                                                                                   |
|                 |         |             |               |        | 3.30              |                                                                                                                                                                                                      |
|                 |         |             |               |        | 3.45              | Medium dense, becoming dense light brown/ orange gravelly fine and medium SAND. Gravel is sub-angular to rounded fine and medium flint. [Bognor Sand]                                                |

| Boring Progress and Water Observations |      |      |                                    |                |             | Chiselling                                   |    |       | Water Added            |    | GENERAL REMARKS                                                                                                                                                                                  |
|----------------------------------------|------|------|------------------------------------|----------------|-------------|----------------------------------------------|----|-------|------------------------|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Depth                                  | Date | Time | Casing Depth                       | Casing Dia. mm | Water Depth | From                                         | To | Hours | From                   | To |                                                                                                                                                                                                  |
|                                        |      |      |                                    |                |             |                                              |    |       |                        |    | Borehole advanced with tracked dynamic sampling rig to terminal depth of 3.45m bgl. Groundwater not identified. Installed with 50mm diameter standpipe with response zone from 0.30 - 3.00m bgl. |
| All dimensions in metres<br>Scale 1:50 |      |      | Client <b>Dunsbury Way Limited</b> |                |             | Method/<br>Plant Used <b>Dynamic Sampler</b> |    |       | Logged By<br><b>MS</b> |    |                                                                                                                                                                                                  |



# BOREHOLE LOG

|                                    |                              |                  |                 |                               |
|------------------------------------|------------------------------|------------------|-----------------|-------------------------------|
| Project<br>Dunsbury                |                              |                  |                 | BOREHOLE No<br><br><b>WS9</b> |
| Job No<br>5012199                  | Date<br>08-03-20<br>08-03-20 | Ground Level (m) | Co-Ordinates () |                               |
| Contractor<br>South Coast Drilling |                              |                  |                 | Sheet<br>1 of 1               |

| SAMPLES & TESTS |         |             | STRATA        |        |                   |                                                                                                      |
|-----------------|---------|-------------|---------------|--------|-------------------|------------------------------------------------------------------------------------------------------|
| Depth           | Type No | Test Result | Reduced Level | Legend | Depth (Thickness) | DESCRIPTION                                                                                          |
|                 |         |             |               |        | 0.10              | Grass over brown silt TOPSOIL.                                                                       |
|                 |         |             |               |        | 0.30              | MADE GROUND: Brown Silt with occasional gravel of flint.                                             |
|                 |         |             |               |        | (0.70)            | MADE GROUND: Light brown Sand and Gravel with occasional brick fragments. Occasional roots observed. |
|                 |         |             |               |        | 1.00              | No evidence of historical settling beds.                                                             |

| Boring Progress and Water Observations |      |                                |              |         |             | Chiselling                                  |    |       | Water Added |    | GENERAL REMARKS                                                                       |
|----------------------------------------|------|--------------------------------|--------------|---------|-------------|---------------------------------------------|----|-------|-------------|----|---------------------------------------------------------------------------------------|
| Depth                                  | Date | Time                           | Casing Depth | Dia. mm | Water Depth | From                                        | To | Hours | From        | To |                                                                                       |
|                                        |      |                                |              |         |             |                                             |    |       |             |    | Advanced with hand digging tools to 1m depth. Backfilled with arisings on completion. |
| All dimensions in metres<br>Scale 1:50 |      | Client    Dunsbury Way Limited |              |         |             | Method/<br>Plant Used    Hand Digging Tools |    |       |             |    | Logged By<br>MS                                                                       |

## APPENDIX 3 –MONITORING SHEETS

|                    |                      |
|--------------------|----------------------|
| Project Name:      | Dunsbury Way, Havant |
| Project Reference: | 5012199              |

**RIDGE**  
PROPERTY & CONSTRUCTION CONSULTANTS

Partnership House, Moorside Road, Winchester,  
SO23 7RX

|                    |                      |
|--------------------|----------------------|
| Project Name:      | Dunsbury Way, Havant |
| Project Reference: | 5012199              |



Partnership House, Moorside Road, Winchester,  
SO23 7RX

Ground Gas and Soil Vapour Monitoring

|                    |                      |
|--------------------|----------------------|
| Project Name:      | Dunsbury Way, Havant |
| Project Reference: | 5012199              |

|         | Date       | Personnel | Pressure Trend | Start Pressure (mb) | End Pressure (mb) | Equipment Used  | Weather  | Max. Flow | Max. CO2 | Max. Methane |
|---------|------------|-----------|----------------|---------------------|-------------------|-----------------|----------|-----------|----------|--------------|
| Round 1 | 08/03/2020 | MS        | Increasing     | 1015                | 1015              | GA 5000-G505446 | Overcast | 0         | 1.3      | 0.2          |
| Round 2 | 09/06/2021 | RM        | Decreasing     | 1023                | 1023              | GA 5000-G505446 | Sunny    | 0         | 6        | 59.7         |
| Round 3 | 15/06/2021 | RM        | Stable         | 1023                | 1023              | GA 5000-G505446 | Overcast | 0.1       | 8.7      | 0            |
| Round 4 | 21/06/2021 | RM        | Increasing     | 1010                | 1010              | GA 5000-G505446 | Raining  | 0         | 9.6      | 0            |
| Round 5 | 24/06/2021 | RM        | Decreasing     | 1023                | 1023              | GA 5000-G505447 | Sunny    | 0.3       | 9.4      | 10.7         |



| ID  | Pipe Diameter (mm) | Monitoring Round | Time (elapsed time) | Atmospheric Pressure (mb) | Relative Pressure (mb) | Gas Flow (L/hr) [Max. and Steady] | Methane (%v) | Carbon Dioxide (%v) | Oxygen (%v) | Carbon Monoxide (ppm) | Hydrogen Sulphide (ppm) | LEL (%) | PID (ppm) | DTW (mbgl) | DTB (mbgl) | Response Zone (mbgl) | Comments                        |
|-----|--------------------|------------------|---------------------|---------------------------|------------------------|-----------------------------------|--------------|---------------------|-------------|-----------------------|-------------------------|---------|-----------|------------|------------|----------------------|---------------------------------|
| WS8 | 25                 | 2                | 0                   | 1023                      | 0.09                   | 0.1                               | 0            | 1.6                 | 16.7        | 1                     | 0                       | -       | 0.39      | 2.57       | 2.93       | -                    | No sheen, slight organic odour. |
|     |                    |                  | 30                  |                           |                        |                                   | 0            | 5.4                 | 15.5        | 1                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 60                  |                           |                        |                                   | 0            | 5.8                 | 15.1        | 1                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 90                  |                           |                        |                                   | 0            | 5.7                 | 15.3        | 1                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 120                 |                           |                        |                                   | 0            | 5.5                 | 15.6        | 1                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 150                 |                           |                        |                                   | 0            | 5.3                 | 15.9        | 0                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 180                 |                           |                        |                                   | 0            | 5.2                 | 16.1        | 1                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  |                     |                           |                        |                                   |              |                     |             |                       |                         |         |           |            |            |                      |                                 |
| WS1 | 25                 | 1                | 0                   | 1023                      | 0.07                   | 0                                 | 0            | 2.7                 | 19.4        | 84                    | 0                       | -       | 0.4       | 1.72       | 1.78       | -                    | No sheen, slight organic odour. |
|     |                    |                  | 30                  |                           |                        |                                   | 0            | 6.7                 | 4.6         | 6                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 60                  |                           |                        |                                   | 0            | 8.7                 | 3.5         | 0                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 90                  |                           |                        |                                   | 0            | 8.7                 | 3.5         | 0                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 120                 |                           |                        |                                   | 0            | 8.7                 | 3.4         | 1                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 150                 |                           |                        |                                   | 0            | 8.7                 | 3.4         | 1                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 180                 |                           |                        |                                   | 0            | 8.7                 | 3.4         | 1                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  |                     |                           |                        |                                   |              |                     |             |                       |                         |         |           |            |            |                      |                                 |

Ground Gas and Soil Vapour Monitoring

|                    |                      |
|--------------------|----------------------|
| Project Name:      | Dunsbury Way, Havant |
| Project Reference: | 5012199              |

|         | Date       | Personnel | Pressure Trend | Start Pressure (mb) | End Pressure (mb) | Equipment Used  | Weather  | Max. Flow | Max. CO2 | Max. Methane |
|---------|------------|-----------|----------------|---------------------|-------------------|-----------------|----------|-----------|----------|--------------|
| Round 1 | 08/03/2020 | MS        | Increasing     | 1015                | 1015              | GA 5000-G505446 | Overcast | 0         | 1.3      | 0.2          |
| Round 2 | 09/06/2021 | RM        | Decreasing     | 1023                | 1023              | GA 5000-G505446 | Sunny    | 0         | 6        | 59.7         |
| Round 3 | 15/06/2021 | RM        | Stable         | 1023                | 1023              | GA 5000-G505446 | Overcast | 0.1       | 8.7      | 0            |
| Round 4 | 21/06/2021 | RM        | Increasing     | 1010                | 1010              | GA 5000-G505446 | Raining  | 0         | 9.6      | 0            |
| Round 5 | 24/06/2021 | RM        | Decreasing     | 1023                | 1023              | GA 5000-G505447 | Sunny    | 0.3       | 9.4      | 10.7         |



Partnership House, Moorside Road,  
Winchester, SO23 7RX

| ID  | Pipe Diameter (mm) | Monitoring Round | Time (elapsed time) | Atmospheric Pressure (mb) | Relative Pressure (mb) | Gas Flow (L/hr) (Max. and Steady) | Methane (%v) | Carbon Dioxide (%v) | Oxygen (%v) | Carbon Monoxide (ppm) | Hydrogen Sulphide (ppm) | LEL (%) | PID (ppm) | DTW (mbgl) | DTB (mbgl) | Response Zone (mbgl) | Comments                        |
|-----|--------------------|------------------|---------------------|---------------------------|------------------------|-----------------------------------|--------------|---------------------|-------------|-----------------------|-------------------------|---------|-----------|------------|------------|----------------------|---------------------------------|
| WS1 | 25                 | 2                | 0                   | 1010                      | 0.09                   | 0                                 | 0            | 5.8                 | 19.2        | 8                     | 0                       | -       | 0.13      | 1.62       | 1.76       | -                    | No sheen, slight organic odour. |
|     |                    |                  | 30                  |                           |                        |                                   | 0            | 8.6                 | 2.2         | 0                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 60                  |                           |                        |                                   | 0            | 9.5                 | 1           | 0                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 90                  |                           |                        |                                   | 0            | 9.6                 | 0.9         | 0                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 120                 |                           |                        |                                   | 0            | 9.6                 | 0.9         | 0                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 150                 |                           |                        |                                   | 0            | 9.6                 | 0.9         | 0                     | 0                       |         |           |            |            |                      |                                 |
|     |                    |                  | 180                 |                           |                        |                                   | 0            | 9.6                 | 0.9         | 0                     | 0                       |         |           |            |            |                      |                                 |

Ground Gas and Soil Vapour Monitoring

|                    |                      |
|--------------------|----------------------|
| Project Name:      | Dunsbury Way, Havant |
| Project Reference: | 5012199              |

|         | Date       | Personnel | Pressure Trend | Start Pressure (mb) | End Pressure (mb) | Equipment Used  | Weather  | Max. Flow | Max. CO2 | Max. Methane |
|---------|------------|-----------|----------------|---------------------|-------------------|-----------------|----------|-----------|----------|--------------|
| Round 1 | 08/03/2020 | MS        | Increasing     | 1015                | 1015              | GA 5000-G505446 | Overcast | 0         | 1.3      | 0.2          |
| Round 2 | 09/06/2021 | RM        | Decreasing     | 1023                | 1023              | GA 5000-G505446 | Sunny    | 0         | 6        | 59.7         |
| Round 3 | 15/06/2021 | RM        | Stable         | 1023                | 1023              | GA 5000-G505446 | Overcast | 0.1       | 8.7      | 0            |
| Round 4 | 21/06/2021 | RM        | Increasing     | 1010                | 1010              | GA 5000-G505446 | Raining  | 0         | 9.6      | 0            |
| Round 5 | 24/06/2021 | RM        | Decreasing     | 1023                | 1023              | GA 5000-G505447 | Sunny    | 0.3       | 9.4      | 10.7         |



Partnership House, Moorside Road, Winchester,  
SO23 7RX

| ID  | Pipe Diameter (mm) | Monitoring Round | Time (elapsed time) | Atmospheric Pressure (mb) | Relative Pressure (mb) | Gas Flow (L/hr) [Max. and Steady] | Methane (%v) | Carbon Dioxide (%v) | Oxygen (%v) | Carbon Monoxide (ppm) | Hydrogen Sulphide (ppm) | LEL (%) | PID (ppm) | DTW (mbgl)  | DTB (mbgl) | Response Zone (mbgl) | Comments                        |
|-----|--------------------|------------------|---------------------|---------------------------|------------------------|-----------------------------------|--------------|---------------------|-------------|-----------------------|-------------------------|---------|-----------|-------------|------------|----------------------|---------------------------------|
| WS7 | 25                 | 3                | 0                   | 1023                      | 0.45                   | 0.3                               | 0            | 0.1                 | 20.1        | 0                     | 0                       | -       | 0.26      | 0.86        | 1.45       | -                    | No sheen, strong organic odour. |
|     |                    |                  | 30                  |                           |                        |                                   | 0            | 0.9                 | 11.5        | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 60                  |                           |                        |                                   | 0            | 1                   | 7           | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 90                  |                           |                        |                                   | 1.5          | 1                   | 5.8         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 120                 |                           |                        |                                   | 3.1          | 1.1                 | 5.8         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 150                 |                           |                        |                                   | 6.3          | 1.1                 | 5.5         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 180                 |                           |                        |                                   | 10.7         | 1                   | 5.3         | 1                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 210                 |                           |                        |                                   | 8            | 1                   | 5.6         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 240                 |                           |                        |                                   | 7.7          | 1                   | 5.8         | 0                     | 0                       |         |           |             |            |                      |                                 |
| WS8 | 25                 | 3                | 0                   | 1023                      | 0.03                   | 0.1                               | 0            | 0.4                 | 19.5        | 0                     | 0                       | -       | 0.02      | 2.04        | 2.91       | -                    | No sheen, slight organic odour. |
|     |                    |                  | 30                  |                           |                        |                                   | 0            | 6.6                 | 7.3         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 60                  |                           |                        |                                   | 0            | 6.8                 | 7           | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 90                  |                           |                        |                                   | 0            | 6.4                 | 7.8         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 120                 |                           |                        |                                   | 0            | 6.2                 | 8.7         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 150                 |                           |                        |                                   | 0            | 5.9                 | 9.5         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 180                 |                           |                        |                                   | 0            | 5.6                 | 10.4        | 0                     | 0                       |         |           |             |            |                      |                                 |
| WS1 | 25                 | 3                | 0                   | 1023                      | 0.05                   | 0                                 | 0            | 0.1                 | 20.8        | 3                     | 0                       | -       | 0.31      | Wet at base | 1.76       | -                    | No sheen, slight organic odour. |
|     |                    |                  | 30                  |                           |                        |                                   | 0            | 9.1                 | 2           | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 60                  |                           |                        |                                   | 0            | 9.4                 | 1.2         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 90                  |                           |                        |                                   | 0            | 9.4                 | 1.2         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 120                 |                           |                        |                                   | 0            | 9.4                 | 1.2         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 150                 |                           |                        |                                   | 0            | 9.4                 | 1.2         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  | 180                 |                           |                        |                                   | 0            | 9.4                 | 1.2         | 0                     | 0                       |         |           |             |            |                      |                                 |
|     |                    |                  |                     |                           |                        |                                   |              |                     |             |                       |                         |         |           |             |            |                      |                                 |
|     |                    |                  |                     |                           |                        |                                   |              |                     |             |                       |                         |         |           |             |            |                      |                                 |
|     |                    |                  |                     |                           |                        |                                   |              |                     |             |                       |                         |         |           |             |            |                      |                                 |

## APPENDIX 4 –LABORATORY CERTIFICATES



Max Smeeth  
Ridge  
Partnership House  
Moorside Road  
Winchester  
SO23 7RX

**DETS Ltd**  
Unit 1  
Rose Lane Industrial Estate  
Rose Lane  
Lenham Heath  
Kent  
ME17 2JN  
**t:** 01622 850410

## **DETS Report No: 20-02929**

**Site Reference:** Dunsbury Way, Havant

**Project / Job Ref:** 5012199

**Order No:** 5012199-11728

**Sample Receipt Date:** 04/03/2020

**Sample Scheduled Date:** 05/03/2020

**Report Issue Number:** 1

**Reporting Date:** 11/03/2020

**Authorised by:**



Ela Mysiara  
Quality Manager

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.



DETS Ltd  
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Lenham Heath  
Maidstone  
Kent ME17 2JN  
Tel : 01622 850410



| Soil Analysis Certificate            |                 |               |               |               |               |
|--------------------------------------|-----------------|---------------|---------------|---------------|---------------|
| DETS Report No: 20-02929             | Date Sampled    | 28/02/20      | 28/02/20      | 28/02/20      | 28/02/20      |
| Ridge                                | Time Sampled    | None Supplied | None Supplied | None Supplied | None Supplied |
| Site Reference: Dunsbury Way, Havant | TP / BH No      | WS1           | WS8           | WS8           | WS3           |
| Project / Job Ref: 5012199           | Additional Refs | None Supplied | None Supplied | None Supplied | None Supplied |
| Order No: 5012199-11728              | Depth (m)       | 0.30          | 0.50          | 1.00          | 0.70          |
| Reporting Date: 11/03/2020           | DETS Sample No  | 466967        | 466968        | 466969        | 466970        |

| Determinand                            | Unit          | RL      | Accreditation |                             |              |              |              |              |
|----------------------------------------|---------------|---------|---------------|-----------------------------|--------------|--------------|--------------|--------------|
| Asbestos Screen <sup>(S)</sup>         | N/a           | N/a     | ISO17025      | Detected                    | Not Detected | Not Detected | Not Detected | Not Detected |
| Sample Matrix <sup>(S)</sup>           | Material Type | N/a     | NONE          | Small bundles of Chrysotile |              |              |              |              |
| Asbestos Type <sup>(S)</sup>           | PLM Result    | N/a     | ISO17025      | Chrysotile                  |              |              |              |              |
| Asbestos Quantification <sup>(S)</sup> | %             | < 0.001 | ISO17025      | < 0.001                     |              |              |              |              |
| pH                                     | pH Units      | N/a     | MCERTS        | 8.2                         | 8.3          | 8.5          | 7.8          | 8.2          |
| Total Cyanide                          | mg/kg         | < 2     | NONE          | < 2                         | < 2          | < 2          | < 2          | < 2          |
| Organic Matter                         | %             | < 0.1   | MCERTS        | 1.6                         | 2.6          | 0.7          | 4.4          | 1.6          |
| Arsenic (As)                           | mg/kg         | < 2     | MCERTS        | 11                          | 8            | 5            | 23           | 9            |
| Cadmium (Cd)                           | mg/kg         | < 0.2   | MCERTS        | 0.3                         | 0.2          | < 0.2        | 0.2          | < 0.2        |
| Chromium (Cr)                          | mg/kg         | < 2     | MCERTS        | 19                          | 16           | 12           | 16           | 19           |
| Chromium (hexavalent)                  | mg/kg         | < 2     | NONE          | < 2                         | < 2          | < 2          | < 2          | < 2          |
| Copper (Cu)                            | mg/kg         | < 4     | MCERTS        | 42                          | 13           | 6            | 118          | 11           |
| Lead (Pb)                              | mg/kg         | < 3     | MCERTS        | 384                         | 46           | 18           | 362          | 22           |
| Mercury (Hg)                           | mg/kg         | < 1     | NONE          | < 1                         | < 1          | < 1          | < 1          | < 1          |
| Nickel (Ni)                            | mg/kg         | < 3     | MCERTS        | 15                          | 9            | 6            | 53           | 10           |
| Selenium (Se)                          | mg/kg         | < 3     | NONE          | < 3                         | < 3          | < 3          | < 3          | < 3          |
| Zinc (Zn)                              | mg/kg         | < 3     | MCERTS        | 245                         | 51           | 25           | 187          | 37           |
| Total Phenols (monohydric)             | mg/kg         | < 2     | NONE          | < 2                         | < 2          | < 2          | < 2          | < 2          |

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C  
Subcontracted analysis (S)



DETS Ltd  
Unit 1, Rose Lane Industrial Estate  
Rose Lane  
Lenham Heath  
Maidstone  
Kent ME17 2JN  
Tel : 01622 850410



| Soil Analysis Certificate            |                 |               |  |  |  |  |
|--------------------------------------|-----------------|---------------|--|--|--|--|
| DETS Report No: 20-02929             | Date Sampled    | 28/02/20      |  |  |  |  |
| Ridge                                | Time Sampled    | None Supplied |  |  |  |  |
| Site Reference: Dunsbury Way, Havant | TP / BH No      | WS2           |  |  |  |  |
| Project / Job Ref: 5012199           | Additional Refs | None Supplied |  |  |  |  |
| Order No: 5012199-11728              | Depth (m)       | 0.50          |  |  |  |  |
| Reporting Date: 11/03/2020           | DETS Sample No  | 466972        |  |  |  |  |

| Determinand                            | Unit          | RL      | Accreditation | Detected                                                                        |  |  |  |  |
|----------------------------------------|---------------|---------|---------------|---------------------------------------------------------------------------------|--|--|--|--|
| Asbestos Screen <sup>(S)</sup>         | N/a           | N/a     | ISO17025      | Chrysotile and Crocidolite present in microscopic loose fibrous asbestos debris |  |  |  |  |
| Sample Matrix <sup>(S)</sup>           | Material Type | N/a     | NONE          |                                                                                 |  |  |  |  |
| Asbestos Type <sup>(S)</sup>           | PLM Result    | N/a     | ISO17025      | Chrysotile Crocidolite                                                          |  |  |  |  |
| Asbestos Quantification <sup>(S)</sup> | %             | < 0.001 | ISO17025      | 0.003                                                                           |  |  |  |  |
| pH                                     | pH Units      | N/a     | MCERTS        | 10.0                                                                            |  |  |  |  |
| Total Cyanide                          | mg/kg         | < 2     | NONE          | < 2                                                                             |  |  |  |  |
| Organic Matter                         | %             | < 0.1   | MCERTS        | 1                                                                               |  |  |  |  |
| Arsenic (As)                           | mg/kg         | < 2     | MCERTS        | 8                                                                               |  |  |  |  |
| Cadmium (Cd)                           | mg/kg         | < 0.2   | MCERTS        | 0.2                                                                             |  |  |  |  |
| Chromium (Cr)                          | mg/kg         | < 2     | MCERTS        | 13                                                                              |  |  |  |  |
| Chromium (hexavalent)                  | mg/kg         | < 2     | NONE          | < 2                                                                             |  |  |  |  |
| Copper (Cu)                            | mg/kg         | < 4     | MCERTS        | 29                                                                              |  |  |  |  |
| Lead (Pb)                              | mg/kg         | < 3     | MCERTS        | 400                                                                             |  |  |  |  |
| Mercury (Hg)                           | mg/kg         | < 1     | NONE          | < 1                                                                             |  |  |  |  |
| Nickel (Ni)                            | mg/kg         | < 3     | MCERTS        | 7                                                                               |  |  |  |  |
| Selenium (Se)                          | mg/kg         | < 3     | NONE          | < 3                                                                             |  |  |  |  |
| Zinc (Zn)                              | mg/kg         | < 3     | MCERTS        | 132                                                                             |  |  |  |  |
| Total Phenols (monohydric)             | mg/kg         | < 2     | NONE          | < 2                                                                             |  |  |  |  |

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C  
Subcontracted analysis (S)



DETS Ltd  
Unit 1, Rose Lane Industrial Estate  
Rose Lane  
Lenham Heath  
Maidstone  
Kent ME17 2JN  
Tel : 01622 850410



| Soil Analysis Certificate - Speciated PAHs |                 |               |               |               |               |
|--------------------------------------------|-----------------|---------------|---------------|---------------|---------------|
| DETS Report No: 20-02929                   | Date Sampled    | 28/02/20      | 28/02/20      | 28/02/20      | 28/02/20      |
| Ridge                                      | Time Sampled    | None Supplied | None Supplied | None Supplied | None Supplied |
| Site Reference: Dunsbury Way, Havant       | TP / BH No      | WS1           | WS8           | WS8           | WS3           |
| Project / Job Ref: 5012199                 | Additional Refs | None Supplied | None Supplied | None Supplied | None Supplied |
| Order No: 5012199-11728                    | Depth (m)       | 0.30          | 0.50          | 1.00          | 0.70          |
| Reporting Date: 11/03/2020                 | DETS Sample No  | 466967        | 466968        | 466969        | 466970        |

| Determinand            | Unit  | RL    | Accreditation |       |       |       |       |       |
|------------------------|-------|-------|---------------|-------|-------|-------|-------|-------|
| Naphthalene            | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 | 0.58  | < 0.1 |
| Acenaphthylene         | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Acenaphthene           | mg/kg | < 0.1 | MCERTS        | 1.11  | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Fluorene               | mg/kg | < 0.1 | MCERTS        | 1.35  | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Phenanthrene           | mg/kg | < 0.1 | MCERTS        | 19.50 | < 0.1 | < 0.1 | 0.23  | < 0.1 |
| Anthracene             | mg/kg | < 0.1 | MCERTS        | 5.86  | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Fluoranthene           | mg/kg | < 0.1 | MCERTS        | 45.60 | 0.15  | 0.15  | < 0.1 | < 0.1 |
| Pyrene                 | mg/kg | < 0.1 | MCERTS        | 38.80 | 0.14  | 0.14  | < 0.1 | < 0.1 |
| Benzo(a)anthracene     | mg/kg | < 0.1 | MCERTS        | 21.50 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Chrysene               | mg/kg | < 0.1 | MCERTS        | 15.10 | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Benzo(b)fluoranthene   | mg/kg | < 0.1 | MCERTS        | 17.10 | 0.19  | 0.12  | < 0.1 | < 0.1 |
| Benzo(k)fluoranthene   | mg/kg | < 0.1 | MCERTS        | 5.53  | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Benzo(a)pyrene         | mg/kg | < 0.1 | MCERTS        | 12.10 | 0.16  | < 0.1 | < 0.1 | < 0.1 |
| Indeno(1,2,3-cd)pyrene | mg/kg | < 0.1 | MCERTS        | 7.02  | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Dibenz(a,h)anthracene  | mg/kg | < 0.1 | MCERTS        | 1.19  | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Benzo(ghi)perylene     | mg/kg | < 0.1 | MCERTS        | 4.99  | < 0.1 | < 0.1 | < 0.1 | < 0.1 |
| Total EPA-16 PAHs      | mg/kg | < 1.6 | MCERTS        | 197   | < 1.6 | < 1.6 | < 1.6 | < 1.6 |

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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#### Soil Analysis Certificate - Speciated PAHs

|                                      |                 |               |  |  |  |  |
|--------------------------------------|-----------------|---------------|--|--|--|--|
| DETS Report No: 20-02929             | Date Sampled    | 28/02/20      |  |  |  |  |
| Ridge                                | Time Sampled    | None Supplied |  |  |  |  |
| Site Reference: Dunsbury Way, Havant | TP / BH No      | WS2           |  |  |  |  |
| Project / Job Ref: 5012199           | Additional Refs | None Supplied |  |  |  |  |
| Order No: 5012199-11728              | Depth (m)       | 0.50          |  |  |  |  |
| Reporting Date: 11/03/2020           | DETS Sample No  | 466972        |  |  |  |  |

| Determinand            | Unit  | RL    | Accreditation |       |  |  |  |
|------------------------|-------|-------|---------------|-------|--|--|--|
| Naphthalene            | mg/kg | < 0.1 | MCERTS        | < 0.1 |  |  |  |
| Acenaphthylene         | mg/kg | < 0.1 | MCERTS        | < 0.1 |  |  |  |
| Acenaphthene           | mg/kg | < 0.1 | MCERTS        | < 0.1 |  |  |  |
| Fluorene               | mg/kg | < 0.1 | MCERTS        | < 0.1 |  |  |  |
| Phenanthrene           | mg/kg | < 0.1 | MCERTS        | 0.19  |  |  |  |
| Anthracene             | mg/kg | < 0.1 | MCERTS        | < 0.1 |  |  |  |
| Fluoranthene           | mg/kg | < 0.1 | MCERTS        | 0.45  |  |  |  |
| Pyrene                 | mg/kg | < 0.1 | MCERTS        | 0.40  |  |  |  |
| Benzo(a)anthracene     | mg/kg | < 0.1 | MCERTS        | 0.26  |  |  |  |
| Chrysene               | mg/kg | < 0.1 | MCERTS        | 0.26  |  |  |  |
| Benzo(b)fluoranthene   | mg/kg | < 0.1 | MCERTS        | 0.43  |  |  |  |
| Benzo(k)fluoranthene   | mg/kg | < 0.1 | MCERTS        | 0.19  |  |  |  |
| Benzo(a)pyrene         | mg/kg | < 0.1 | MCERTS        | 0.28  |  |  |  |
| Indeno(1,2,3-cd)pyrene | mg/kg | < 0.1 | MCERTS        | 0.17  |  |  |  |
| Dibenz(a,h)anthracene  | mg/kg | < 0.1 | MCERTS        | < 0.1 |  |  |  |
| Benzo(ghi)perylene     | mg/kg | < 0.1 | MCERTS        | 0.17  |  |  |  |
| Total EPA-16 PAHs      | mg/kg | < 1.6 | MCERTS        | 2.8   |  |  |  |

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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| Soil Analysis Certificate - TPH CWG Banded |                 |               |               |               |               |               |
|--------------------------------------------|-----------------|---------------|---------------|---------------|---------------|---------------|
| DETS Report No: 20-02929                   | Date Sampled    | 28/02/20      | 28/02/20      | 28/02/20      | 28/02/20      | 28/02/20      |
| Ridge                                      | Time Sampled    | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Site Reference: Dunsbury Way, Havant       | TP / BH No      | WS1           | WS8           | WS8           | WS3           | WS7           |
| Project / Job Ref: 5012199                 | Additional Refs | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Order No: 5012199-11728                    | Depth (m)       | 0.30          | 0.50          | 1.00          | 0.70          | 0.50          |
| Reporting Date: 11/03/2020                 | DETS Sample No  | 466967        | 466968        | 466969        | 466970        | 466971        |

| Determinand          | Unit  | RL     | Accreditation |        |        |        |        |        |
|----------------------|-------|--------|---------------|--------|--------|--------|--------|--------|
| Aliphatic >C5 - C6   | mg/kg | < 0.01 | NONE          | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Aliphatic >C6 - C8   | mg/kg | < 0.05 | NONE          | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Aliphatic >C8 - C10  | mg/kg | < 2    | MCERTS        | < 2    | < 2    | < 2    | < 2    | < 2    |
| Aliphatic >C10 - C12 | mg/kg | < 2    | MCERTS        | < 2    | < 2    | < 2    | < 2    | < 2    |
| Aliphatic >C12 - C16 | mg/kg | < 3    | MCERTS        | < 3    | < 3    | < 3    | < 3    | < 3    |
| Aliphatic >C16 - C21 | mg/kg | < 3    | MCERTS        | < 3    | < 3    | < 3    | < 3    | < 3    |
| Aliphatic >C21 - C34 | mg/kg | < 10   | MCERTS        | < 10   | < 10   | < 10   | < 10   | < 10   |
| Aliphatic (C5 - C34) | mg/kg | < 21   | NONE          | < 21   | < 21   | < 21   | < 21   | < 21   |
| Aromatic >C5 - C7    | mg/kg | < 0.01 | NONE          | < 0.01 | < 0.01 | < 0.01 | < 0.01 | < 0.01 |
| Aromatic >C7 - C8    | mg/kg | < 0.05 | NONE          | < 0.05 | < 0.05 | < 0.05 | < 0.05 | < 0.05 |
| Aromatic >C8 - C10   | mg/kg | < 2    | MCERTS        | < 2    | < 2    | < 2    | < 2    | < 2    |
| Aromatic >C10 - C12  | mg/kg | < 2    | MCERTS        | < 2    | < 2    | < 2    | < 2    | < 2    |
| Aromatic >C12 - C16  | mg/kg | < 2    | MCERTS        | 13     | < 2    | < 2    | < 2    | < 2    |
| Aromatic >C16 - C21  | mg/kg | < 3    | MCERTS        | 141    | < 3    | < 3    | < 3    | < 3    |
| Aromatic >C21 - C35  | mg/kg | < 10   | MCERTS        | 189    | < 10   | < 10   | < 10   | < 10   |
| Aromatic (C5 - C35)  | mg/kg | < 21   | NONE          | 343    | < 21   | < 21   | < 21   | < 21   |
| Total >C5 - C35      | mg/kg | < 42   | NONE          | 343    | < 42   | < 42   | < 42   | < 42   |

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| Soil Analysis Certificate - TPH CWG Banded |                 |               |  |  |  |  |
|--------------------------------------------|-----------------|---------------|--|--|--|--|
| DETS Report No: 20-02929                   | Date Sampled    | 28/02/20      |  |  |  |  |
| Ridge                                      | Time Sampled    | None Supplied |  |  |  |  |
| Site Reference: Dunsbury Way, Havant       | TP / BH No      | WS2           |  |  |  |  |
| Project / Job Ref: 5012199                 | Additional Refs | None Supplied |  |  |  |  |
| Order No: 5012199-11728                    | Depth (m)       | 0.50          |  |  |  |  |
| Reporting Date: 11/03/2020                 | DETS Sample No  | 466972        |  |  |  |  |

| Determinand          | Unit  | RL     | Accreditation |        |  |  |  |
|----------------------|-------|--------|---------------|--------|--|--|--|
| Aliphatic >C5 - C6   | mg/kg | < 0.01 | NONE          | < 0.01 |  |  |  |
| Aliphatic >C6 - C8   | mg/kg | < 0.05 | NONE          | < 0.05 |  |  |  |
| Aliphatic >C8 - C10  | mg/kg | < 2    | MCERTS        | < 2    |  |  |  |
| Aliphatic >C10 - C12 | mg/kg | < 2    | MCERTS        | < 2    |  |  |  |
| Aliphatic >C12 - C16 | mg/kg | < 3    | MCERTS        | < 3    |  |  |  |
| Aliphatic >C16 - C21 | mg/kg | < 3    | MCERTS        | < 3    |  |  |  |
| Aliphatic >C21 - C34 | mg/kg | < 10   | MCERTS        | < 10   |  |  |  |
| Aliphatic (C5 - C34) | mg/kg | < 21   | NONE          | < 21   |  |  |  |
| Aromatic >C5 - C7    | mg/kg | < 0.01 | NONE          | < 0.01 |  |  |  |
| Aromatic >C7 - C8    | mg/kg | < 0.05 | NONE          | < 0.05 |  |  |  |
| Aromatic >C8 - C10   | mg/kg | < 2    | MCERTS        | < 2    |  |  |  |
| Aromatic >C10 - C12  | mg/kg | < 2    | MCERTS        | < 2    |  |  |  |
| Aromatic >C12 - C16  | mg/kg | < 2    | MCERTS        | < 2    |  |  |  |
| Aromatic >C16 - C21  | mg/kg | < 3    | MCERTS        | < 3    |  |  |  |
| Aromatic >C21 - C35  | mg/kg | < 10   | MCERTS        | < 10   |  |  |  |
| Aromatic (C5 - C35)  | mg/kg | < 21   | NONE          | < 21   |  |  |  |
| Total >C5 - C35      | mg/kg | < 42   | NONE          | < 42   |  |  |  |

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| Soil Analysis Certificate - BTEX / MTBE |                 |               |               |               |               |               |
|-----------------------------------------|-----------------|---------------|---------------|---------------|---------------|---------------|
| DETS Report No: 20-02929                | Date Sampled    | 28/02/20      | 28/02/20      | 28/02/20      | 28/02/20      | 28/02/20      |
| Ridge                                   | Time Sampled    | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Site Reference: Dunsbury Way, Havant    | TP / BH No      | WS1           | WS8           | WS8           | WS3           | WS7           |
| Project / Job Ref: 5012199              | Additional Refs | None Supplied | None Supplied | None Supplied | None Supplied | None Supplied |
| Order No: 5012199-11728                 | Depth (m)       | 0.30          | 0.50          | 1.00          | 0.70          | 0.50          |
| Reporting Date: 11/03/2020              | DETS Sample No  | 466967        | 466968        | 466969        | 466970        | 466971        |

| Determinand  | Unit  | RL  | Accreditation |     |     |     |     |     |
|--------------|-------|-----|---------------|-----|-----|-----|-----|-----|
| Benzene      | ug/kg | < 2 | MCERTS        | < 2 | < 2 | < 2 | < 2 | < 2 |
| Toluene      | ug/kg | < 5 | MCERTS        | < 5 | < 5 | < 5 | < 5 | < 5 |
| Ethylbenzene | ug/kg | < 2 | MCERTS        | < 2 | < 2 | < 2 | < 2 | < 2 |
| p & m-xylene | ug/kg | < 2 | MCERTS        | < 2 | < 2 | < 2 | < 2 | < 2 |
| o-xylene     | ug/kg | < 2 | MCERTS        | < 2 | < 2 | < 2 | < 2 | < 2 |
| MTBE         | ug/kg | < 5 | MCERTS        | < 5 | < 5 | < 5 | < 5 | < 5 |

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| Soil Analysis Certificate - BTEX / MTBE |                 |               |  |  |  |  |
|-----------------------------------------|-----------------|---------------|--|--|--|--|
| DETS Report No: 20-02929                | Date Sampled    | 28/02/20      |  |  |  |  |
| Ridge                                   | Time Sampled    | None Supplied |  |  |  |  |
| Site Reference: Dunsbury Way, Havant    | TP / BH No      | WS2           |  |  |  |  |
| Project / Job Ref: 5012199              | Additional Refs | None Supplied |  |  |  |  |
| Order No: 5012199-11728                 | Depth (m)       | 0.50          |  |  |  |  |
| Reporting Date: 11/03/2020              | DETS Sample No  | 466972        |  |  |  |  |

| Determinand  | Unit  | RL  | Accreditation |     |  |  |  |
|--------------|-------|-----|---------------|-----|--|--|--|
| Benzene      | ug/kg | < 2 | MCERTS        | < 2 |  |  |  |
| Toluene      | ug/kg | < 5 | MCERTS        | < 5 |  |  |  |
| Ethylbenzene | ug/kg | < 2 | MCERTS        | < 2 |  |  |  |
| p & m-xylene | ug/kg | < 2 | MCERTS        | < 2 |  |  |  |
| o-xylene     | ug/kg | < 2 | MCERTS        | < 2 |  |  |  |
| MTBE         | ug/kg | < 5 | MCERTS        | < 5 |  |  |  |

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C





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| Soil Analysis Certificate - Sample Descriptions |  |
|-------------------------------------------------|--|
| DETS Report No: 20-02929                        |  |
| Ridge                                           |  |
| Site Reference: Dunsbury Way, Havant            |  |
| Project / Job Ref: 5012199                      |  |
| Order No: 5012199-11728                         |  |
| Reporting Date: 11/03/2020                      |  |

| DETS Sample No | TP / BH No | Additional Refs | Depth (m) | Moisture Content (%) | Sample Matrix Description                 |
|----------------|------------|-----------------|-----------|----------------------|-------------------------------------------|
| 466967         | WS1        | None Supplied   | 0.30      | 12.7                 | Brown loamy sand with brick and concrete  |
| 466968         | WS8        | None Supplied   | 0.50      | 12.5                 | Brown loamy sand with brick and concrete  |
| 466969         | WS8        | None Supplied   | 1.00      | 15.2                 | Brown sandy clay with stones              |
| 466970         | WS3        | None Supplied   | 0.70      | 23                   | Black loamy sand with stones              |
| 466971         | WS7        | None Supplied   | 0.50      | 17.8                 | Black loamy clay                          |
| 466972         | WS2        | None Supplied   | 0.50      | 14.1                 | Brown loamy sand with stones and concrete |

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample <sup>I/S</sup>

Unsuitable Sample <sup>U/S</sup>



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| Soil Analysis Certificate - Methodology & Miscellaneous Information |  |
|---------------------------------------------------------------------|--|
| DETS Report No: 20-02929                                            |  |
| Ridge                                                               |  |
| Site Reference: Dunsbury Way, Havant                                |  |
| Project / Job Ref: 5012199                                          |  |
| Order No: 5012199-11728                                             |  |
| Reporting Date: 11/03/2020                                          |  |

| Matrix | Analysed On | Determinand                                                                                                                                     | Brief Method Description                                                                                                                             | Method No |
|--------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Soil   | D           | Boron - Water Soluble                                                                                                                           | Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES                                                            | E012      |
| Soil   | AR          | BTEX                                                                                                                                            | Determination of BTEX by headspace GC-MS                                                                                                             | E001      |
| Soil   | D           | Cations                                                                                                                                         | Determination of cations in soil by aqua-regia digestion followed by ICP-OES                                                                         | E002      |
| Soil   | D           | Chloride - Water Soluble (2:1)                                                                                                                  | Determination of chloride by extraction with water & analysed by ion chromatography                                                                  | E009      |
| Soil   | AR          | Chromium - Hexavalent                                                                                                                           | Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry | E016      |
| Soil   | AR          | Cyanide - Complex                                                                                                                               | Determination of complex cyanide by distillation followed by colorimetry                                                                             | E015      |
| Soil   | AR          | Cyanide - Free                                                                                                                                  | Determination of free cyanide by distillation followed by colorimetry                                                                                | E015      |
| Soil   | AR          | Cyanide - Total                                                                                                                                 | Determination of total cyanide by distillation followed by colorimetry                                                                               | E015      |
| Soil   | D           | Cyclohexane Extractable Matter (CEM)                                                                                                            | Gravimetrically determined through extraction with cyclohexane                                                                                       | E011      |
| Soil   | AR          | Diesel Range Organics (C10 - C24)                                                                                                               | Determination of hexane/acetone extractable hydrocarbons by GC-FID                                                                                   | E004      |
| Soil   | AR          | Electrical Conductivity                                                                                                                         | Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement                             | E022      |
| Soil   | AR          | Electrical Conductivity                                                                                                                         | Determination of electrical conductivity by addition of water followed by electrometric measurement                                                  | E023      |
| Soil   | D           | Elemental Sulphur                                                                                                                               | Determination of elemental sulphur by solvent extraction followed by GC-MS                                                                           | E020      |
| Soil   | AR          | EPH (C10 - C40)                                                                                                                                 | Determination of acetone/hexane extractable hydrocarbons by GC-FID                                                                                   | E004      |
| Soil   | AR          | EPH Product ID                                                                                                                                  | Determination of acetone/hexane extractable hydrocarbons by GC-FID                                                                                   | E004      |
| Soil   | AR          | EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)                                                                                   | Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS                                        | E004      |
| Soil   | D           | Fluoride - Water Soluble                                                                                                                        | Determination of Fluoride by extraction with water & analysed by ion chromatography                                                                  | E009      |
| Soil   | D           | FOC (Fraction Organic Carbon)                                                                                                                   | Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate                     | E010      |
| Soil   | D           | Loss on Ignition @ 450oC                                                                                                                        | Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace                                       | E019      |
| Soil   | D           | Magnesium - Water Soluble                                                                                                                       | Determination of water soluble magnesium by extraction with water followed by ICP-OES                                                                | E025      |
| Soil   | D           | Metals                                                                                                                                          | Determination of metals by aqua-regia digestion followed by ICP-OES                                                                                  | E002      |
| Soil   | AR          | Mineral Oil (C10 - C40)                                                                                                                         | Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge                                                  | E004      |
| Soil   | AR          | Moisture Content                                                                                                                                | Moisture content; determined gravimetrically                                                                                                         | E003      |
| Soil   | D           | Nitrate - Water Soluble (2:1)                                                                                                                   | Determination of nitrate by extraction with water & analysed by ion chromatography                                                                   | E009      |
| Soil   | D           | Organic Matter                                                                                                                                  | Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate                                 | E010      |
| Soil   | AR          | PAH - Speciated (EPA 16)                                                                                                                        | Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards                | E005      |
| Soil   | AR          | PCB - 7 Congeners                                                                                                                               | Determination of PCB by extraction with acetone and hexane followed by GC-MS                                                                         | E008      |
| Soil   | D           | Petroleum Ether Extract (PEE)                                                                                                                   | Gravimetrically determined through extraction with petroleum ether                                                                                   | E011      |
| Soil   | AR          | pH                                                                                                                                              | Determination of pH by addition of water followed by electrometric measurement                                                                       | E007      |
| Soil   | AR          | Phenols - Total (monohydric)                                                                                                                    | Determination of phenols by distillation followed by colorimetry                                                                                     | E021      |
| Soil   | D           | Phosphate - Water Soluble (2:1)                                                                                                                 | Determination of phosphate by extraction with water & analysed by ion chromatography                                                                 | E009      |
| Soil   | D           | Sulphate (as SO4) - Total                                                                                                                       | Determination of total sulphate by extraction with 10% HCl followed by ICP-OES                                                                       | E013      |
| Soil   | D           | Sulphate (as SO4) - Water Soluble (2:1)                                                                                                         | Determination of sulphate by extraction with water & analysed by ion chromatography                                                                  | E009      |
| Soil   | D           | Sulphate (as SO4) - Water Soluble (2:1)                                                                                                         | Determination of water soluble sulphate by extraction with water followed by ICP-OES                                                                 | E014      |
| Soil   | AR          | Sulphide                                                                                                                                        | Determination of sulphide by distillation followed by colorimetry                                                                                    | E018      |
| Soil   | D           | Sulphur - Total                                                                                                                                 | Determination of total sulphur by extraction with aqua-regia followed by ICP-OES                                                                     | E024      |
| Soil   | AR          | SVOC                                                                                                                                            | Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS                                               | E006      |
| Soil   | AR          | Thiocyanate (as SCN)                                                                                                                            | Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry  | E017      |
| Soil   | D           | Toluene Extractable Matter (TEM)                                                                                                                | Gravimetrically determined through extraction with toluene                                                                                           | E011      |
| Soil   | D           | Total Organic Carbon (TOC)                                                                                                                      | Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate                                 | E010      |
| Soil   | AR          | TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)         | Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS       | E004      |
| Soil   | AR          | TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44) | Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS       | E004      |
| Soil   | AR          | VOCs                                                                                                                                            | Determination of volatile organic compounds by headspace GC-MS                                                                                       | E001      |
| Soil   | AR          | VPH (C6-C8 & C8-C10)                                                                                                                            | Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID                                                                            | E001      |

D Dried  
AR As Received



Max Smeeth  
Ridge  
Partnership House  
Moorside Road  
Winchester  
SO23 7RX

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## **DETS Report No: 20-03228**

**Site Reference:** Dunsbury Way, Havant

**Project / Job Ref:** None Supplied

**Order No:** None Supplied

**Sample Receipt Date:** 12/03/2020

**Sample Scheduled Date:** 12/03/2020

**Report Issue Number:** 1

**Reporting Date:** 18/03/2020

**Authorised by:**



Dave Ashworth  
Technical Manager

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| Soil Analysis Certificate            |                 |               |               |               |  |  |
|--------------------------------------|-----------------|---------------|---------------|---------------|--|--|
| DETS Report No: 20-03228             | Date Sampled    | None Supplied | None Supplied | None Supplied |  |  |
| Ridge                                | Time Sampled    | None Supplied | None Supplied | None Supplied |  |  |
| Site Reference: Dunsbury Way, Havant | TP / BH No      | WS1           | WS2           | WS3           |  |  |
| Project / Job Ref: None Supplied     | Additional Refs | None Supplied | None Supplied | None Supplied |  |  |
| Order No: None Supplied              | Depth (m)       | 0.80          | 1.30          | 1.20          |  |  |
| Reporting Date: 18/03/2020           | DETS Sample No  | 468142        | 468143        | 468144        |  |  |

| Determinand                    | Unit     | RL    | Accreditation |              |              |              |  |  |
|--------------------------------|----------|-------|---------------|--------------|--------------|--------------|--|--|
| Asbestos Screen <sup>(S)</sup> | N/a      | N/a   | ISO17025      | Not Detected | Not Detected | Not Detected |  |  |
| pH                             | pH Units | N/a   | MCERTS        | 8.5          | 8.3          | 7.4          |  |  |
| Total Cyanide                  | mg/kg    | < 2   | NONE          | < 2          | < 2          | < 2          |  |  |
| Organic Matter                 | %        | < 0.1 | MCERTS        | 0.5          | 0.9          | 0.7          |  |  |
| Arsenic (As)                   | mg/kg    | < 2   | MCERTS        | 5            | 10           | 8            |  |  |
| Cadmium (Cd)                   | mg/kg    | < 0.2 | MCERTS        | < 0.2        | < 0.2        | < 0.2        |  |  |
| Chromium (Cr)                  | mg/kg    | < 2   | MCERTS        | 14           | 22           | 22           |  |  |
| Chromium (hexavalent)          | mg/kg    | < 2   | NONE          | < 2          | < 2          | < 2          |  |  |
| Copper (Cu)                    | mg/kg    | < 4   | MCERTS        | 5            | 9            | 7            |  |  |
| Lead (Pb)                      | mg/kg    | < 3   | MCERTS        | 10           | 21           | 10           |  |  |
| Mercury (Hg)                   | mg/kg    | < 1   | NONE          | < 1          | < 1          | < 1          |  |  |
| Nickel (Ni)                    | mg/kg    | < 3   | MCERTS        | 6            | 8            | 10           |  |  |
| Selenium (Se)                  | mg/kg    | < 3   | NONE          | < 3          | < 3          | < 3          |  |  |
| Zinc (Zn)                      | mg/kg    | < 3   | MCERTS        | 26           | 36           | 31           |  |  |
| Total Phenols (monohydric)     | mg/kg    | < 2   | NONE          | < 2          | < 2          | < 2          |  |  |

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C

Subcontracted analysis (S)



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Kent ME17 2JN  
Tel : 01622 850410



| Soil Analysis Certificate - Speciated PAHs |                 |               |               |               |  |  |
|--------------------------------------------|-----------------|---------------|---------------|---------------|--|--|
| DETS Report No: 20-03228                   | Date Sampled    | None Supplied | None Supplied | None Supplied |  |  |
| Ridge                                      | Time Sampled    | None Supplied | None Supplied | None Supplied |  |  |
| Site Reference: Dunsbury Way, Havant       | TP / BH No      | WS1           | WS2           | WS3           |  |  |
| Project / Job Ref: None Supplied           | Additional Refs | None Supplied | None Supplied | None Supplied |  |  |
| Order No: None Supplied                    | Depth (m)       | 0.80          | 1.30          | 1.20          |  |  |
| Reporting Date: 18/03/2020                 | DETS Sample No  | 468142        | 468143        | 468144        |  |  |

| Determinand            | Unit  | RL    | Accreditation |       |       |       |  |  |
|------------------------|-------|-------|---------------|-------|-------|-------|--|--|
| Naphthalene            | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Acenaphthylene         | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Acenaphthene           | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Fluorene               | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Phenanthrene           | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Anthracene             | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Fluoranthene           | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Pyrene                 | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Benzo(a)anthracene     | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Chrysene               | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Benzo(b)fluoranthene   | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Benzo(k)fluoranthene   | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Benzo(a)pyrene         | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Indeno(1,2,3-cd)pyrene | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Dibenz(a,h)anthracene  | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Benzo(ghi)perylene     | mg/kg | < 0.1 | MCERTS        | < 0.1 | < 0.1 | < 0.1 |  |  |
| Total EPA-16 PAHs      | mg/kg | < 1.6 | MCERTS        | < 1.6 | < 1.6 | < 1.6 |  |  |

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# Soil Analysis Certificate - TPH CWG Banded

|                                      |                 |               |               |               |  |  |
|--------------------------------------|-----------------|---------------|---------------|---------------|--|--|
| DETS Report No: 20-03228             | Date Sampled    | None Supplied | None Supplied | None Supplied |  |  |
| Ridge                                | Time Sampled    | None Supplied | None Supplied | None Supplied |  |  |
| Site Reference: Dunsbury Way, Havant | TP / BH No      | WS1           | WS2           | WS3           |  |  |
| Project / Job Ref: None Supplied     | Additional Refs | None Supplied | None Supplied | None Supplied |  |  |
| Order No: None Supplied              | Depth (m)       | 0.80          | 1.30          | 1.20          |  |  |
| Reporting Date: 18/03/2020           | DETS Sample No  | 468142        | 468143        | 468144        |  |  |

| Determinand          | Unit  | RL     | Accreditation |        |        |        |  |  |
|----------------------|-------|--------|---------------|--------|--------|--------|--|--|
| Aliphatic >C5 - C6   | mg/kg | < 0.01 | NONE          | < 0.01 | < 0.01 | < 0.01 |  |  |
| Aliphatic >C6 - C8   | mg/kg | < 0.05 | NONE          | < 0.05 | < 0.05 | < 0.05 |  |  |
| Aliphatic >C8 - C10  | mg/kg | < 2    | MCERTS        | < 2    | < 2    | < 2    |  |  |
| Aliphatic >C10 - C12 | mg/kg | < 2    | MCERTS        | < 2    | < 2    | < 2    |  |  |
| Aliphatic >C12 - C16 | mg/kg | < 3    | MCERTS        | < 3    | < 3    | < 3    |  |  |
| Aliphatic >C16 - C21 | mg/kg | < 3    | MCERTS        | < 3    | < 3    | < 3    |  |  |
| Aliphatic >C21 - C34 | mg/kg | < 10   | MCERTS        | < 10   | < 10   | < 10   |  |  |
| Aliphatic (C5 - C34) | mg/kg | < 21   | NONE          | < 21   | < 21   | < 21   |  |  |
| Aromatic >C5 - C7    | mg/kg | < 0.01 | NONE          | < 0.01 | < 0.01 | < 0.01 |  |  |
| Aromatic >C7 - C8    | mg/kg | < 0.05 | NONE          | < 0.05 | < 0.05 | < 0.05 |  |  |
| Aromatic >C8 - C10   | mg/kg | < 2    | MCERTS        | < 2    | < 2    | < 2    |  |  |
| Aromatic >C10 - C12  | mg/kg | < 2    | MCERTS        | < 2    | < 2    | < 2    |  |  |
| Aromatic >C12 - C16  | mg/kg | < 2    | MCERTS        | < 2    | < 2    | < 2    |  |  |
| Aromatic >C16 - C21  | mg/kg | < 3    | MCERTS        | < 3    | < 3    | < 3    |  |  |
| Aromatic >C21 - C35  | mg/kg | < 10   | MCERTS        | < 10   | < 10   | < 10   |  |  |
| Aromatic (C5 - C35)  | mg/kg | < 21   | NONE          | < 21   | < 21   | < 21   |  |  |
| Total >C5 - C35      | mg/kg | < 42   | NONE          | < 42   | < 42   | < 42   |  |  |

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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| Soil Analysis Certificate - BTEX / MTBE |                 |               |               |               |  |  |
|-----------------------------------------|-----------------|---------------|---------------|---------------|--|--|
| DETS Report No: 20-03228                | Date Sampled    | None Supplied | None Supplied | None Supplied |  |  |
| Ridge                                   | Time Sampled    | None Supplied | None Supplied | None Supplied |  |  |
| Site Reference: Dunsbury Way, Havant    | TP / BH No      | WS1           | WS2           | WS3           |  |  |
| Project / Job Ref: None Supplied        | Additional Refs | None Supplied | None Supplied | None Supplied |  |  |
| Order No: None Supplied                 | Depth (m)       | 0.80          | 1.30          | 1.20          |  |  |
| Reporting Date: 18/03/2020              | DETS Sample No  | 468142        | 468143        | 468144        |  |  |

| Determinand  | Unit  | RL  | Accreditation |     |     |     |  |  |
|--------------|-------|-----|---------------|-----|-----|-----|--|--|
| Benzene      | ug/kg | < 2 | MCERTS        | < 2 | < 2 | < 2 |  |  |
| Toluene      | ug/kg | < 5 | MCERTS        | < 5 | < 5 | < 5 |  |  |
| Ethylbenzene | ug/kg | < 2 | MCERTS        | < 2 | < 2 | < 2 |  |  |
| p & m-xylene | ug/kg | < 2 | MCERTS        | < 2 | < 2 | < 2 |  |  |
| o-xylene     | ug/kg | < 2 | MCERTS        | < 2 | < 2 | < 2 |  |  |
| MTBE         | ug/kg | < 5 | MCERTS        | < 5 | < 5 | < 5 |  |  |

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C



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#### Soil Analysis Certificate - Sample Descriptions

DETS Report No: 20-03228

Ridge

Site Reference: Dunsbury Way, Havant

Project / Job Ref: None Supplied

Order No: None Supplied

Reporting Date: 18/03/2020

| DETS Sample No | TP / BH No | Additional Refs | Depth (m) | Moisture Content (%) | Sample Matrix Description |
|----------------|------------|-----------------|-----------|----------------------|---------------------------|
| ^ 468142       | WS1        | None Supplied   | 0.80      | 13.1                 | Brown sandy clay          |
| ^ 468143       | WS2        | None Supplied   | 1.30      | 15                   | Brown sandy clay          |
| ^ 468144       | WS3        | None Supplied   | 1.20      | 18.5                 | Brown loamy sand          |

Moisture content is part of procedure E003 & is not an accredited test

Insufficient Sample <sup>IS</sup>

Unsuitable Sample <sup>US</sup>

^ no sampling date provided; unable to confirm if samples are within acceptable holding times



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# Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 20-03228

Ridge

Site Reference: Dunsbury Way, Havant

Project / Job Ref: None Supplied

Order No: None Supplied

Reporting Date: 18/03/2020

| Matrix | Analysed On | Determinand                                                                                                                                     | Brief Method Description                                                                                                                            | Method No |
|--------|-------------|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Soil   | D           | Boron - Water Soluble                                                                                                                           | Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES                                                           | E012      |
| Soil   | AR          | BTEX                                                                                                                                            | Determination of BTEX by headspace GC-MS                                                                                                            | E001      |
| Soil   | D           | Cations                                                                                                                                         | Determination of cations in soil by aqua-regia digestion followed by ICP-OES                                                                        | E002      |
| Soil   | D           | Chloride - Water Soluble (2:1)                                                                                                                  | Determination of chloride by extraction with water & analysed by ion chromatography                                                                 | E009      |
| Soil   | AR          | Chromium - Hexavalent                                                                                                                           | Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 dphenylcarbazine followed by colorimetry | E016      |
| Soil   | AR          | Cyanide - Complex                                                                                                                               | Determination of complex cyanide by distillation followed by colorimetry                                                                            | E015      |
| Soil   | AR          | Cyanide - Free                                                                                                                                  | Determination of free cyanide by distillation followed by colorimetry                                                                               | E015      |
| Soil   | AR          | Cyanide - Total                                                                                                                                 | Determination of total cyanide by distillation followed by colorimetry                                                                              | E015      |
| Soil   | D           | Cyclohexane Extractable Matter (CEM)                                                                                                            | Gravimetrically determined through extraction with cyclohexane                                                                                      | E011      |
| Soil   | AR          | Diesel Range Organics (C10 - C24)                                                                                                               | Determination of hexane/acetone extractable hydrocarbons by GC-FID                                                                                  | E004      |
| Soil   | AR          | Electrical Conductivity                                                                                                                         | Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement                            | E022      |
| Soil   | AR          | Electrical Conductivity                                                                                                                         | Determination of electrical conductivity by addition of water followed by electrometric measurement                                                 | E023      |
| Soil   | D           | Elemental Sulphur                                                                                                                               | Determination of elemental sulphur by solvent extraction followed by GC-MS                                                                          | E020      |
| Soil   | AR          | EPH (C10 - C40)                                                                                                                                 | Determination of acetone/hexane extractable hydrocarbons by GC-FID                                                                                  | E004      |
| Soil   | AR          | EPH Product ID                                                                                                                                  | Determination of acetone/hexane extractable hydrocarbons by GC-FID                                                                                  | E004      |
| Soil   | AR          | EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)                                                                                   | Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS                                       | E004      |
| Soil   | D           | Fluoride - Water Soluble                                                                                                                        | Determination of Fluoride by extraction with water & analysed by ion chromatography                                                                 | E009      |
| Soil   | D           | FOC (Fraction Organic Carbon)                                                                                                                   | Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate                    | E010      |
| Soil   | D           | Loss on Ignition @ 450oC                                                                                                                        | Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace                                      | E019      |
| Soil   | D           | Magnesium - Water Soluble                                                                                                                       | Determination of water soluble magnesium by extraction with water followed by ICP-OES                                                               | E025      |
| Soil   | D           | Metals                                                                                                                                          | Determination of metals by aqua-regia digestion followed by ICP-OES                                                                                 | E002      |
| Soil   | AR          | Mineral Oil (C10 - C40)                                                                                                                         | Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge                                                 | E004      |
| Soil   | AR          | Moisture Content                                                                                                                                | Moisture content; determined gravimetrically                                                                                                        | E003      |
| Soil   | D           | Nitrate - Water Soluble (2:1)                                                                                                                   | Determination of nitrate by extraction with water & analysed by ion chromatography                                                                  | E009      |
| Soil   | D           | Organic Matter                                                                                                                                  | Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate                                | E010      |
| Soil   | AR          | PAH - Speciated (EPA 16)                                                                                                                        | Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards               | E005      |
| Soil   | AR          | PCB - 7 Congeners                                                                                                                               | Determination of PCB by extraction with acetone and hexane followed by GC-MS                                                                        | E008      |
| Soil   | D           | Petroleum Ether Extract (PEE)                                                                                                                   | Gravimetrically determined through extraction with petroleum ether                                                                                  | E011      |
| Soil   | AR          | pH                                                                                                                                              | Determination of pH by addition of water followed by electrometric measurement                                                                      | E007      |
| Soil   | AR          | Phenols - Total (monohydric)                                                                                                                    | Determination of phenols by distillation followed by colorimetry                                                                                    | E021      |
| Soil   | D           | Phosphate - Water Soluble (2:1)                                                                                                                 | Determination of phosphate by extraction with water & analysed by ion chromatography                                                                | E009      |
| Soil   | D           | Sulphate (as SO4) - Total                                                                                                                       | Determination of total sulphate by extraction with 10% HCl followed by ICP-OES                                                                      | E013      |
| Soil   | D           | Sulphate (as SO4) - Water Soluble (2:1)                                                                                                         | Determination of sulphate by extraction with water & analysed by ion chromatography                                                                 | E009      |
| Soil   | D           | Sulphate (as SO4) - Water Soluble (2:1)                                                                                                         | Determination of water soluble sulphate by extraction with water followed by ICP-OES                                                                | E014      |
| Soil   | AR          | Sulphide                                                                                                                                        | Determination of sulphide by distillation followed by colorimetry                                                                                   | E018      |
| Soil   | D           | Sulphur - Total                                                                                                                                 | Determination of total sulphur by extraction with aqua-regia followed by ICP-OES                                                                    | E024      |
| Soil   | AR          | SVOC                                                                                                                                            | Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS                                              | E006      |
| Soil   | AR          | Thiocyanate (as SCN)                                                                                                                            | Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry | E017      |
| Soil   | D           | Toluene Extractable Matter (TEM)                                                                                                                | Gravimetrically determined through extraction with toluene                                                                                          | E011      |
| Soil   | D           | Total Organic Carbon (TOC)                                                                                                                      | Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate                                | E010      |
| Soil   | AR          | TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)         | Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS      | E004      |
| Soil   | AR          | TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44) | Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS      | E004      |
| Soil   | AR          | VOCS                                                                                                                                            | Determination of volatile organic compounds by headspace GC-MS                                                                                      | E001      |
| Soil   | AR          | VPH (C6-C8 & C8-C10)                                                                                                                            | Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID                                                                           | E001      |

D Dried  
AR As Received

## APPENDIX 5 –CAT WASTE OUTPUT

|              |                      |
|--------------|----------------------|
| Site Name    | Dunsbury Way         |
| Location     | Havant               |
| Site ID      | 5012199              |
| Job Number   | 5012199              |
| Date         | 3/24/2020            |
| User Name    | msmeeth@ridge.co.uk  |
| Company Name | Ridge & Partners LLP |

[illegible]



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