

**KINGSWAY BUSINESS PARK - PLOT W,  
ROCHDALE**

**REMEDIATION STRATEGY**

**For: David Wilson Homes & Rexel Group**

**December 2022**

**R3119-R01-v2**

## DOCUMENT CONTROL SHEET

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Remediation Strategy

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### Signed for Smith Grant LLP

|          | Name                                           | Position             | Signature                                                                            | Date     |
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## **KINGSWAY BUSINESS PARK - PLOT W, ROCHDALE**

### **REMEDIATION STRATEGY**

#### **CONTENTS**

1. Introduction
2. Information Sources
3. Site Characterisation
4. Scope of Remediation
5. Health, Safety and Environmental Management
6. Inspection and Verification
7. Conclusions and Recommendations

#### **DRAWINGS**

|      |                                      |
|------|--------------------------------------|
| D01  | Site Boundary & Phasing              |
| D02  | Previous S.I. Entries                |
| D03  | Anticipated MG and Buried OM Extents |
| PL01 | Phasing Plan                         |

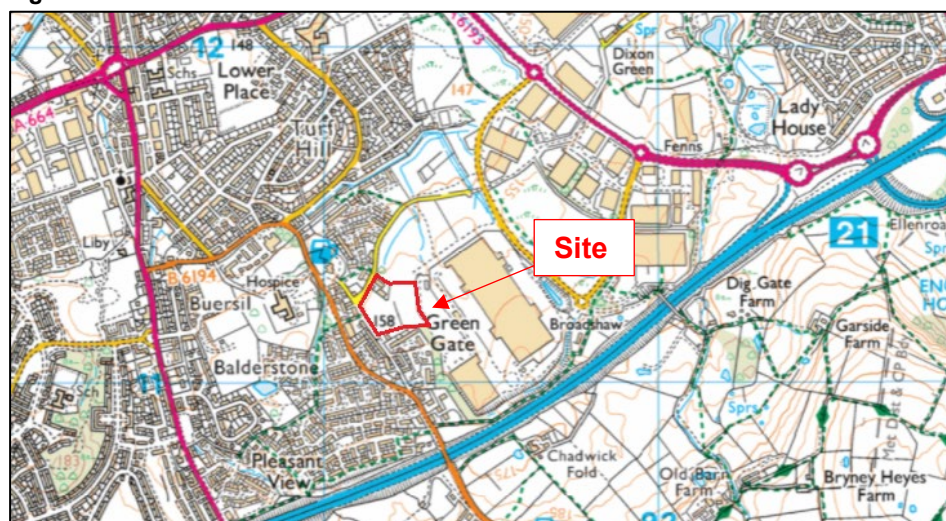
# 1. Introduction

- 1.1. A planning application has been submitted (ref: 22/00998/FUL) for the residential redevelopment of the former Silver Hill Farm site located in southeast Rochdale including partial demolition and refurbishment of the Grade II Listed Silver Hill Farmhouse Building. David Wilson Homes (DWH) and Rexel Property Group (RPG) intend to develop the site and have instructed Smith Grant LLP (SGP) to produce a Remediation Strategy for submission to Rochdale Borough Council (RBC).
- 1.2. The site has predominantly consisted of agricultural land with the only notable development being the construction of several agricultural buildings (Silverhill Farm) in the north which initially occurred before the earliest available historical mapping (1851) with gradual expansion of the farm buildings noted throughout the site's history until circa 1992. It is understood that several of the farm buildings remain derelict on-site and under current plans these will be partially retained and refurbished into residential dwellings which is to be undertaken by RPG (Phase 2) with the remainder of the site to be developed by DWH (Phase 1). A proposed phasing plan and development layout is appended to this report (drawing ref: PL01).

**Table 1.1: Site details**

|                                |                                                                                                                                                                                                                                |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Address</b>                 | Silver Hill Farm, Lower Lane, Rochdale, OL16 4PT                                                                                                                                                                               |
| <b>National Grid Reference</b> | 391203, 411237                                                                                                                                                                                                                 |
| <b>Local Authority</b>         | Rochdale Borough Council (RBC)                                                                                                                                                                                                 |
| <b>Site Area</b>               | ~ 24,000m <sup>2</sup>                                                                                                                                                                                                         |
| <b>Current Site Use</b>        | Vacant site overgrown with vegetation following abandonment of farm – some derelict agricultural buildings remain in the north of the site.                                                                                    |
| <b>Proposed Use</b>            | Residential development comprising the construction of 64 no. low rise dwellings including partial conversion of the Silver Hill Farm buildings with associated infrastructure, private gardens and areas of soft landscaping. |

**Figure 1.1: Site Location**



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- 1.3. It is understood that DWH and RPG have received comments from the RBC Environmental Protection team with regards to the proposed contaminated land Condition which is to be applied to the site as follows:

*“Prior to commencement of the development an investigation and risk assessment, in addition to any assessment provided with the planning application, must be completed to assess the nature and extent of any contamination on the site, whether or not it originates on the site. The investigation and risk assessment must be undertaken by competent persons and a written report of the findings must be produced and shall have been first submitted to and approved in writing by the Local Planning Authority before development commences. The report of the findings must include:*

- i) a survey of the extent, scale and nature of contamination*
- ii) an assessment of the potential risks to:*
  - human health,*
  - property (existing or proposed) including buildings, crops, livestock, pets, woodland, and service lines and pipes,*
  - adjoining land,*
  - groundwaters and surface waters,*
  - ecological systems,*
  - archaeological sites and ancient monuments;*
- iii) where unacceptable risks are identified, an appraisal of remedial options and proposal of the preferred option(s).*

*The development shall thereafter be completed in full accordance with the approved recommendations.”*

- 1.4. It is anticipated that elements (i) and (ii) of the proposed Condition will be satisfied by the prior reporting carried out for the site by BWB Consulting (see Section 2). This report details the Remedial Strategy to be implemented by David Wilson Homes (Phase 1) and RPG (Phase 2) as per the proposed phasing plan (drawing ref: PL01) in order to satisfy element (iii) of the proposed Condition.
- 1.5. The assessment methodology follows the framework described in EA / DEFRA Contaminated Land Report 11: ‘Model Procedures for the Management of Land Contamination’ 2004 as amended by ‘Land Contamination: Risk Management’ (LCRM), comprising an options appraisal to evaluate and identify feasible remediation options, specification of appropriate techniques, and an implementation programme and verification plan.

- 1.6. It is intended that this Remediation Strategy is submitted to RBC to allow confidence that preparatory earthworks may commence on the site in preparation for its development as residential housing.
- 1.7. A programme of works to physically prepare the site for development will also be required. Assessment of the geotechnical properties of the ground, its stability, and related impacts on foundation and infrastructure design lie outside the scope of this report which relates to risks from contamination only.

## 2. Information Sources

### 2.1. Previous reports

2.1.1. A previous contamination investigation for the site is available, the details of which are presented in Table 2.1 below:

**Table 2.1: Information Sources**

| Report                                                                                                                                                                   | Factual Information                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| BWB Consulting (BWB)<br><br>Phase 1 and 2 Geo-Environmental Assessment: Plot W Kingsway Business Park, Rochdale, December 2019 (Doc ref: KPW-BWB-ZZ-XX-RP-GE-0001_Ph1&2) | Phase 1 Desk Study comprising site description, review of site history, setting, geology, hydrogeology, hydrology and risk assessment. The Phase 2 Ground Investigation comprised a total of 20 trial-pits, 3 cable percussion boreholes and 6 dynamic sampler boreholes. 8 soil samples (Made Ground and natural) were analysed for BWB Standard Suite (metals/metalloids, pH, soluble sulphate, phenols, cyanide, PAHs (spec. 16) and TPH), 6 of these were also submitted for asbestos analysis and 3 were submitted for speciated TPHCWG hydrocarbons and BTEX. 8 separate soil samples were submitted for organic matter analysis. Six rounds of ground gas monitoring were completed. |

### 2.2. Investigation Coverage

2.2.1. The total of 29 investigation entries across the site is roughly equivalent to an average of 1 entry per 830m<sup>2</sup> or an approximate 29m grid spacing across all areas. A good spacing was achieved throughout the site, however, as many of the farm buildings remained at the time of the investigation (some of which will remain as part of the site's proposed redevelopment), entries were constrained to areas outside the building footprints. A good density of entries was, however, achieved in the vicinity of the farm buildings.

2.2.2. Only a limited number of soil samples were collected from across the site for contamination analysis (8 no.) but given that Made Ground was generally absent from the site with localised deposits only recorded in the north in the vicinity of the farm buildings (the area from which the majority of the soil samples were collected from), this isn't considered a significant limitation of the previous investigation / assessment.

2.2.3. The site investigation completed is considered to have provided a reasonable assessment of the ground conditions at the site appropriate to its development history and anticipated ground conditions. On this basis, it is concluded that although localised sources could have been missed, the investigation has been sufficient to develop an appropriate Remediation Strategy.

2.2.4. The investigation carried out has been completed in general in accordance with the guidance principals of BS10175:2011 + A2:2017 and BS5930:2015.

### 2.3. Use of Information in Strategy Development

- 2.3.1. This report contains a brief summary of the findings of the previous investigation and other available information, including assessment of any limitations and levels of confidence that can be placed on the findings. The risk assessment is summarised and then the risk pathways identified are used to define clear remediation objectives which must be met to allow the site to be developed without significant risk to human health or the wider environment. The various options for achieving these objectives are explored and a preferred strategy is arrived at and presented.

### 3. Site Characterisation

#### 3.1. Historical Development and Potentially Contaminative Land Use

- 3.1.1. A review of the historical development of the site and the immediate surrounding area is contained within the BWB reporting and is summarised below.
- 3.1.2. Silver Hill Farm is present in the north of the site in the earliest available historical OS mapping (1851) appearing to comprise two separate buildings with an associated field to the south; the remainder of the site consists of parts of two separate fields which appear to be in agricultural use. In the following years, the gradual construction of numerous buildings and structures occurred in the vicinity of the original farm buildings until circa 1992. Electricity pylons and overhead powerlines are shown crossing the southeast corner of the site on the mapping from 1955 to 1974-76 but are not indicated from 1992 onwards. Between 2010 and 2012, the largest, easternmost farm building (presumed barn) appears to have been demolished with only 3 buildings indicated on site.
- 3.1.3. In the 1851 mapping, the surrounding land use predominantly comprised agricultural land / open fields with occasional scattered buildings (presumed residential / agricultural). Very little development of the surrounding area is shown in the subsequent decades, apparently limited to the construction of the Springfield Works (Wheelwright) to the west of the site by 1891 and a limited number of residential / agricultural buildings. In the mapping from 1987-1995, the Springfield Works is described as 'Works' and by 2003 appears to have been demolished. A circular 'Tank' associated with the farm is indicated to the direct north of the site in the 1994-2010 mapping which BWB assumed was for water storage, however, it is considered more likely that this will have been a slurry tank.
- 3.1.4. Significant residential development occurred to the south, west and northwest of the site between 1993 and 2010. Between 2010 and 2019, two large industrial style buildings were constructed 200m to the east and southeast. Several small drains and watercourses have been indicated along the surrounding field boundaries throughout the site's history.
- 3.1.5. No indication of landfilling on or near the site was indicated in the Groundsure report or the historical mapping reviewed by BWB, however significantly elevated ground gas (especially methane) has been detected in the southeast of the site during the BWB ground gas monitoring programme. It was hypothesised that this was due to the presence of highly organic deposits buried at shallow depth in the area, the extent of which is possibly indicated by an area of brown surface vegetation demonstrated in the aerial imagery contained in the BWB report.
- 3.1.6. The potential onsite sources of contamination were determined to be fairly limited, restricted to Made Ground and machinery associated with the former Silver Hill Farm (including the potential burial of organic material in the southeast of the site). The potential contaminants of concern associated with the site's former use were determined to be heavy metals, cyanides, sulphates, nitrates, asbestos containing materials, VOCs, hydrocarbons, methane and carbon dioxide.

3.1.7. The only potentially contaminative external source identified was the unspecified 'Works' previously located to the west of the site, although the significant migration of contaminants from this potential source area is considered very unlikely. The potential contaminants associated with the 'Works' were determined to be heavy metals, cyanides, sulphates, nitrates, hydrocarbons, methane and carbon dioxide.

3.1.8. The various buildings constructed on site may have contained asbestos containing materials (ACM). It understood that all existing structures will undergo a comprehensive asbestos survey and strip (where required) prior to their demolition / refurbishment.

## 3.2. Present Land Condition

3.2.1. Descriptions are based on observations made within the reviewed reports and examination of more recent mapping and aerial photographs.

**Table 3.1: Land Condition Summary**

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site Description</b>                   | The site is currently vacant and predominantly comprises former agricultural fields which are now heavily overgrown; the unoccupied farm buildings, as described in the historical review, remain derelict in the north of the site. According to OS mapping, the topography of the site is relatively flat lying at between 155m to 160m AOD with a slight slope to the south.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Access</b>                             | Access is from the northwest via Lower Lane, although significant site clearance will be required to access the majority of the site due to the overgrown vegetation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Boundaries/Adjoining Land Uses</b>     | Residential dwellings border the south, west and northwest of the site, an open field is present to the direct north and a car park borders the site to the east, beyond which are large industrial / commercial units.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Services / Wayleaves</b>               | SGP has not undertaken a utility search as part of this assessment and no details regarding the presence of utilities is included in the BWB reporting; however, SGP understand following discussions with DWH that there is a live sewer present on site which runs along the eastern boundary.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Surfaces / Vegetation / Structures</b> | <p>With exception of the northern area in the vicinity of the farm buildings, the majority of the site is heavily overgrown with vegetation (grasses / shrubs / weeds etc) with trees / hedgerow bordering the majority of the site and the onsite buildings. A small, wooded area is also present in the northeast.</p> <p>The only visible hardstanding is located between, and to the northwest of, the former farm buildings. The BWB investigation also determined the presence of cohesive and granular Made Ground deposits in the vicinity of the farm buildings which mainly consisted of inert materials, although ash was described in some of the cohesive Made Ground soils.</p> <p>Several large and small structures are present in the north of the site associated with Silver Hill Farm which are described in the BWB report as being of stone construction. Given the addition of buildings during a time when asbestos was commonly used (especially within agricultural buildings), the potential presence of ACM cannot be discounted.</p> |

### 3.3. Geology

3.3.1. The ground conditions reported during the BWB intrusive site investigation were consistent with the mapped geology and developed history of the site as summarised below.

#### *Topsoil / Reworked Topsoil*

3.3.2. Natural topsoil was encountered within 14 of the 24 exploratory holes and was present on the whole site with exception of the Silver Hill Farm area in the north. Both granular and cohesive compositions of topsoil were identified with the former being described as “*a dark brown slightly clayey slightly gravelly fine to coarse sand with abundant rootlets*” (3 locations) and the latter “*a soft dark brown slightly gravelly or silty sandy clay with abundant roots and rootlets*” (11 locations). The thickness of the topsoil ranged from between 0.1m to 0.9m.

3.3.3. Reworked topsoil was identified within 6 of the 24 exploratory hole locations, generally in the south / southeast of the site as well as one location in the north, and thicknesses ranged from between 0.2m to 0.4m. The reworked topsoil was generally described as a “*soft dark brown slightly gravelly sandy clay with abundant roots and rootlets*” with anthropogenic inclusions of brick and pottery.

#### *Made Ground*

3.3.4. Made Ground was encountered within 6 of the 24 investigation entries in the north of the site where Silver Hill Farm is located (predominantly within the proposed Phase 2 development area but also in the north of Phase 1) with thicknesses ranging from between 0.5m to an unproven depth of >1.30m (terminated due to trial pit collapse). Within four of these locations, the Made Ground was described as “*a very soft to firm dark brown or light brown mottled orange and grey or multicoloured sandy gravelly clay*” with variable inclusions of brick, ash, concrete, sandstone, pottery and coal.

3.3.5. Within four of the investigation locations, granular Made Ground was encountered described as “*a brown slightly clayey gravelly fine to coarse sand*” (2 locations), “*dark brown slightly gravelly cobbles*” (1 location) and “*a dark brown slightly clayey sandy gravel*” (1 location). Anthropogenic inclusions described in the granular Made Ground soils were inert in nature and consisted of brick, concrete, wood and plastic.

3.3.6. Hardstanding (concrete) is present in the vicinity of the former Silver Hill Farm buildings and BWB postulated that relict subfloor structures may also be present within this area.

3.3.7. No significant organic deposits have been encountered; however, it is suspected that buried turf / topsoil may be present in the east associated with elevated methane concentrations

3.3.8. The anticipated extent of the Made Ground and the buried organic material, as indicated by historic plans and aerial imagery, is shown on drawing D03.

### *Natural Strata*

- 3.3.9. Glacial Superficial Deposits were identified underlying the topsoil / Made Ground to unconfirmed depths in all locations where the extent of the Made Ground was proven. The Glacial deposits were identified as predominantly cohesive, with granular strata also recorded in eleven of the investigation locations.
- 3.3.10. Four locations identified cohesive superficial deposits comprising a “*very soft pinkish / greyish / orangish brown sandy gravelly silt*” and twenty two locations described a “*very soft to stiff light / dark / orangish / greying / reddish brown sandy gravelly, sometimes silty, clay*”.
- 3.3.11. Nine locations identified granular Glacial Superficial Deposits consisting of a “*very loose to very dense orangish brown clayey or silty gravelly fine to coarse sand*” and two locations identified a “*very loose to dense orangish brown sand and gravel with occasional silt and clay bands*”. Two further locations described a “*greyish and orangish brown slightly clayey sandy gravel of angular to sub rounded fine to coarse mudstone and sandstone with a low cobble content*”.
- 3.3.12. Bedrock wasn't encountered during the BWB investigation and entries were drilled to a maximum depth of 15.45m bgl.

### 3.4. Hydrogeology and Hydrology

- 3.4.1. The superficial deposits and the underlying bedrock are classified by the Environment Agency (EA) as Secondary A aquifers. The site is not located within a Groundwater Source Protection Zone.
- 3.4.2. Groundwater was encountered during the intrusive investigation works in the majority of the entries within the topsoil, Made Ground and Glacial Deposits at depths ranging from between 0.2m to 3.2m bgl. During subsequent monitoring of the installed boreholes, groundwater was recorded between 0.59m - 4.22m bgl.
- 3.4.3. It was concluded that based on the observed geology, variable groundwater strike depths, and the variable resting groundwater levels observed during the monitoring that there is not a significant and consistent groundwater flow regime at the site and that groundwater is likely to accumulate and flow within granular pockets in a variety of directions.
- 3.4.4. Unnamed tributaries are present approximately 40m to the north of the site flowing in a northerly direction.

### 3.5. Soil Contamination

- 3.5.1. The only indicators of soil contamination described within the ground investigation logs was black staining of Made Ground soils with PID readings of 1.2-1.3ppm within two entries (TP01 & TP03) and the presence of ash in the Made Ground within another (BH01), all located within Phase 2 in the area of the farm buildings.

- 3.5.2. Waste materials were encountered within the Made Ground soils across the area of the farm buildings in the north, but these were generally limited to inert materials (brick, concrete, plastic, wood, tile and metal). Based on the soil descriptions, degradable organic matter is unlikely to constitute a significant proportion of the Made Ground on site and the materials described are generally not considered likely to generate hazardous amounts of ground gas. The only potential exception to this is the suspected buried organic soils in the east (located in Phase 1) where elevated ground gas has been recorded (BH03 & DS202), however this has not yet been proven and requires further investigation.
- 3.5.3. A comprehensive testing suite has been completed on the 8 soil samples collected during the investigation appropriate to the site characterisation, three of which did not contain elevated concentrations of contaminants that would be unacceptable under a residential land use scenario. Where exceedances of the BWB derived Generic Site Assessment Criteria (GSAC) for a residential land use were recorded (developed using CLEA Model 1.07), these were generally limited to minor elevated concentrations of PAHs and heavy-end hydrocarbons within the Made Ground in the area of the Silver Hill Farm buildings (TP01, TP02 & TP05). Low levels of asbestos (0.003% v/v) were also detected in the Made Ground soil sample collected from TP04, again located in the vicinity of the former farm buildings.
- 3.5.4. More significantly elevated PAH and hydrocarbon concentrations above residential screening criteria have been reported within one entry in the southwest of the Silver Hall Farm area (TP03) including for the semi-volatile contaminant's naphthalene and aromatic C12-16 hydrocarbons. The likely source of this is the black stained Made Ground soil described within this entry.
- 3.5.5. All of the exceedances were limited to samples of Made Ground typically collected from the proposed Phase 2 development area with the exception of one sample collected in the north of Phase 1 (TP05). The locations of all of the site investigation entries are shown on drawing D02.
- 3.5.6. The BWB risk assessment concluded that mitigation measures to manage risks to human health from soil contamination could be limited to the areas where Made Ground is present (the anticipated extent of which is indicated on Drawing D03). BWB proposed that the risks from the identified contaminants could be mitigated by the placement of a clean capping layer and a marker membrane in garden areas to break the pollutant pathway to future site users or, alternatively, removal of the localised Made Ground could be considered as this would remove the contamination source and the requirement for a capping layer / marker membrane in future gardens.

### 3.6. Groundwater Contamination

- 3.6.1. No groundwater or surface water samples were collected during the BWB site investigation.
- 3.6.2. BWB considered that given the lack of contaminants recorded within the superficial deposits and the predominantly cohesive nature of the superficial deposits, it is highly unlikely that a pathway exists from the localised Made Ground to the wider Secondary A Aquifer. Similarly, given the

variable presence of granular strata in the Glacial Deposits and the lack of significant groundwater flow across the site, they concluded it was unlikely that there is a clear pathway towards the local unnamed tributary.

- 3.6.3. BWB therefore concluded that the site poses a low risk to controlled waters and that development of the site would reduce rainfall infiltration and inhibit leachate migration, thereby further reducing the risk to controlled waters. SGP considers this to be a reasonable assessment.

### 3.7. Ground Gas Contamination

- 3.7.1. BWB didn't identify any areas of landfilling on, or in close proximity to, the site but given the anticipated presence of Made Ground it was determined that the site presented a low to medium risk of ground gas ingress into future dwellings with the potential to accumulate to levels harmful to human health. Consequently, the cable percussion boreholes drilled as part of the original BWB site investigation (BH01-BH03) were installed with monitoring standpipes and a ground gas monitoring programme was initiated. BH01 was targeted to the Made Ground in the vicinity of the Silver Hill Farm buildings whilst the other two entries were targeted to shallow natural organic deposits recorded during the drilling.

- 3.7.2. During the first three monitoring rounds, significantly elevated methane and, to a lesser extent, carbon dioxide was detected in BH03 and it was hypothesised that this was due to the presence of highly organic deposits buried at shallow depth in the area. An additional six dynamic sampler boreholes were therefore drilled to depths of between 1-3m bgl with monitoring standpipes installed, three of which were located in the vicinity of BH03 to assess the local extent of the ground gassing issue in this area (DS201-203) with the remaining three positioned across the site to assess the hypothesis that the ground gas issue is localised (DS204-206). Three further monitoring rounds were then completed on both the installed cable percussion and dynamic sampler boreholes.

- 3.7.3. Significantly elevated methane was detected in BH03 (max. 66.5%) and DS202 (max. 73.5%) with less significant, but still elevated, maximum carbon dioxide concentrations of 9.8% and 13.2%, respectively. Both of these entries were located in the east of the site where organic material is suspected to be buried. A maximum carbon dioxide concentration of 5% was detected in the other seven boreholes and methane was below detection limits (<0.1%) indicating that the ground gas issue is localised to the eastern part of the site within the proposed Phase 1 development area. Neither hydrogen sulphide nor carbon monoxide was detected at significantly elevated concentrations in any of the boreholes.

- 3.7.4. Eight soil samples from entries DS201-206 were tested for organic matter with concentrations recorded between 0.9-5.4%. The highest concentrations were recorded at locations DS201 and DS202 at between 3.9-5.4%; elsewhere, the maximum concentration was 1.9% (DS204). The higher organic matter concentrations correlate with the higher levels of carbon dioxide / methane recorded providing further evidence that the high levels of ground gas being generated are localised to the eastern area of the site.

- 3.7.5. BWB concluded that If development is to occur in the vicinity of BH03 and DS202 then the anticipated organic deposits should be delineated and excavated with either disposal at a landfill or reused on site within an area of Public Open Space (POS). SGP are in general agreement with this conclusion, however, if any excavated organic material is used within a POS area it must be placed at shallow depth (<1m bgl) and testing would be required to confirm its suitability. The resulting void would then have to be replaced with suitable, inert material.
- 3.7.6. If organic deposits are not encountered in the eastern part of the site it is considered that the live sewer that runs along the eastern boundary could be an alternative source of the elevated ground gas. If there is damage to the sewer, this could result in the escape of sewer gases potentially resulting in the elevated methane and carbon dioxide concentrations recorded in the eastern part of the site.
- 3.7.7. BWB also concluded that given the potential for organic material to be present at the site and the potential for lateral gas migration that CS2 / Amber 1 gas protection measures should be installed within future dwellings across the site. This is considered to be a sensible approach outside of the eastern part of the site; however, considering the elevated methane concentrations recorded, post-remediation ground gas monitoring should be carried out in the eastern area to ensure that significantly elevated ground gas concentrations no longer remain.
- 3.7.8. Consideration could also be given to carrying out a ground gas monitoring programme in the vicinity of the farm buildings in Phase 2 as negligible methane and carbon dioxide concentrations were recorded within the two nearest boreholes to this area (BH01 & DS205) resulting in borehole specific NHBC ground gas classifications of 'Green' (no gas protection measures required). If similar conditions are confirmed across Phase 2, this could negate the requirement for CS2 / Amber 1 gas protection measures in this area.

### 3.8. Risk Assessment

- 3.8.1. The potential contamination sources identified during the BWB investigation which could impose constraints on the proposed redevelopment of the site for residential use are:
- localised Made Ground in the vicinity of the farm buildings with slightly elevated PAH / hydrocarbon concentrations as reflected in the soils analysis (see Section 3.5.3);
  - localised area of black-stained Made Ground associated with more significantly elevated PAH / hydrocarbon concentrations as reported in the soil sample collected from TP03 (includes the semi-volatiles naphthalene and C12-16 aromatic hydrocarbons);
  - asbestos release during demolition or refurbishment of previous structures and in the Made Ground soils (1 incidence of trace asbestos (0.003% chrysotile) detected within the shallow Made Ground sample collected from entry TP04);
  - organic soils with potential to generated hazardous ground gas (significantly elevated methane detected in BWB boreholes BH03 & DS202).

- 3.8.2. Concentrations of contaminants were compared to site-specific assessment criteria derived by BWB for the protection of human health under a residential land use scenario. The exceedances reported were localised to the north of the site associated with the Made Ground in the vicinity of the farm buildings suggesting that most of the site soils are suitable for retention within a residential land use scenario. However, the Made Ground in the previously developed part of the site within the proposed Phase 2 development area and in the north of Phase 1 should be excluded from future gardens / landscaping.
- 3.8.3. A total of 6 rounds of ground gas monitoring have been completed across the site which satisfies the suggested monitoring frequency for a highly sensitive land use (residential) with a low generation potential<sup>1</sup>. Due to the significantly elevated methane detected in the east of the site (located within the proposed Phase 1 development area) which results in a CIRIA CS4 / NHBC Red classification, source removal and a post-remediation ground gas monitoring programme is recommended for this part of the site. Given the low ground gas concentrations recorded across the rest of the site whilst recognising the potential for other organic deposit to be present, it is considered that the classification of the rest of the site as CIRIA CS2 / NHBC Amber-1 (thereby requiring basic protection measures to be installed within dwellings) is sensible as a precautionary approach.
- 3.8.4. There is no evidence to date that elevated ground gas concentrations are present within Phase 2, however it is also recognised that there is limited monitoring data for this area. As discussed in Section 3.7.8, a ground gas monitoring programme could be considered for Phase 2 and if negligible ground gas concentrations are recorded this could negate the requirement for ground gas protection measures in this part of the site. Alternatively, ground gas protection measures compliant to CIRIA CS2 / NHBC Amber-1 would be required as described above.
- 3.8.5. An assessment of the ground conditions to determine their potential to impact concrete has been carried out by BGCE who recommended a classification of Design Sulphate DS-3 and Aggressive Chemical Environments for Concrete of AC-3. It is unlikely that special materials for water supply pipes will be required based on the soil contamination identified to date, although this assumes no unexpected contamination sources are identified during the preparatory / construction works.

### 3.9. Conceptual Site Model

- 3.9.1. The conceptual site model is summarised below:

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<sup>1</sup> Ground Gas Handbook (2009)

**Table 3.2: Summary of Key Pollutant Linkages under development and residential use**

| receptors                                                                                                   | pathways                                                                                                                    | contaminant sources                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Human health (future residents) (transient risks to construction workers addressed under HSWA 1974 / COSHH) | Consumption of contaminated vegetables                                                                                      | Elevated PAHs / hydrocarbons and trace asbestos fibre in the shallow Made Ground soils; restricted to the northern area of the site in the vicinity of the Silver Hill Farm Buildings (Phase 2 and north of Phase 1).                                                                                                                                                                                                                                                           |
|                                                                                                             | Soil and dust ingestion                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                                                                             | Inhalation of dust                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                                                                                                             | Dermal uptake                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Built development (and by extension future residents)                                                       | Contact with aggressive soil or groundwater                                                                                 | BWB recommends a concrete classification of Design Sulphate DS-3 and Aggressive Chemical Environments for Concrete of AC-3.                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                                             | Ingress of hazardous ground gas / vapours into poorly ventilated spaces and build up to harmful or flammable concentrations | Significantly elevated concentrations of methane were consistently recorded in 2 locations (BH03 & DS202) resulting in a CIRIA CS4 / NHBC Red classification (remediation and/or further assessment required) in the east of the site (Phase 1); the remainder of the site is classified as CIRIA CS2 / NHBC-Amber 1 (basic gas protection measures required). Localised black-stained Made Ground containing elevated naphthalene and aromatic C12-C16 hydrocarbons (Phase 2). |

## 4. Scope of Remediation

### 4.1. Remediation Objectives

4.1.1. The remediation objectives, strategy and implementation plan described below address the contamination identified to date and the likely requirements should further contamination be identified during the remediation works.

4.1.2. The key remediation objectives are to:

- break significant or potentially significant future pollutant linkages resulting from the change of land use;
- remove / remediate significant pollution sources if identified during the works that pose a risk to man and/or the environment;
- respond appropriately to contingencies, in particular the discovery of currently uncharacterised contamination;
- recover materials with the potential for re-use within the development (specifically soils which may be used in gardens, although recovery of aggregates may be considered);
- manage all emissions to air and water to protect local-residents, surface waters and groundwater, and the atmosphere during the remediation works;
- allow appropriate additional protection measures to be implemented during construction.

4.1.3. The potential risks identified will be managed to break any potential pollution linkages and allow development of the site for its intended residential use without harm to human health, property and the environment. Each of the potential contaminant linkages identified in the site conceptual model and risk assessment will be addressed for the Remediation Strategy to be considered appropriate for the site and to allow construction to commence.

4.1.4. During the remediation works there is a small but not negligible chance that contaminated materials may be exposed and precautionary mitigation to prevent exposure of site workers, local-residents and site visitors to harmful or nuisance substances including dust is a requirement of the Remediation Strategy. Similarly, the works must not cause pollution of water by discharge of silt or other materials to surface waters.

4.1.5. The risk assessment carried out does not indicate any requirement for remediation of contamination to protect controlled waters; risks to surface and groundwater appear to be minimal based on the available evidence.

4.1.6. The potential for exposure of concrete to aggressive ground conditions and water supply pipes to damaging substances is considered to be low but may be subject to further assessment during or following the remediation works.

4.1.7. Enabling works will also be required to physically prepare the site for the proposed development. This will entail the stripping of topsoil and vegetation, removing wastes, obstructions and otherwise deleterious materials (possibly including organic soils if encountered), modifying ground levels and provision of supporting structures and suitable founding surfaces for infrastructure.

4.1.8. A watching brief should be maintained during all the required preparatory earthworks and excavations for uncharacterised sources of contamination.

## 4.2. Options Appraisal

**Table 4.1: Remedial Options Outline**

| Method                                                            | Advantages                                                                                                                                                                                                                | Disadvantages.                                                                                                                                                                                                                                                                                         | Feasibility                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Do nothing                                                        | No cost                                                                                                                                                                                                                   | Potential long-term human health risk remains from exposure to impacted soils in garden areas if present                                                                                                                                                                                               | Acceptable for most of Phase 1 (excluding eastern area of high methane) if inspections confirm absence of made ground soil strip and site regrade.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Physical Barriers                                                 | Well understood technology.                                                                                                                                                                                               | Requirement to source, place and maintain cover layers; possible waste generation to accommodate system within design levels. Cost of installing and verifying.<br><br>Expense of designing, materials, installation and verification of gas / vapour protection measures (limited to specific areas). | Practical option for gardens and landscaped areas where direct exposure is a possibility due to the presence of Made Ground impacted by low levels of typical urban contaminants and asbestos. Validation of cover system required<br><br>Gas protection measures required site-wide on current information due to elevated methane concentrations recorded and the potential for localised organic deposits; however, ground gas monitoring programme could be considered for Phase 2 to negate the requirement for gas protection measures in this part of site (dependant on findings).<br><br>In the absence of source removal, vapour protection measures could be considered due to the identified presence of elevated concentrations of hydrocarbons and naphthalene associated with black-stained Made Ground in TP03 (Phase 2). |
| In-situ treatment                                                 | Treat contamination at source, reducing disposal cost and waste generation.                                                                                                                                               | Most sources anticipated to be either minor in volume resulting in disproportionate assessment and mobilisation costs or of low concentration and widespread affecting large volumes of materials therefore not amenable to such methods                                                               | Unlikely to be practicable over development programme timescales.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Excavation followed by ex situ treatment, replacement or disposal | Well understood technology. Method can reduce source volume and contaminant level and can be validated on short timescale. Any contamination requiring mitigation is likely to be at shallow depth so readily accessible. | Ex situ treatment on site has an uncertain timescale and additional regulatory burden. Disposal options are less sustainable and if a hazardous waste classification is arrived at may be costly.                                                                                                      | Practical option for defined hotspot in shallow soils (i.e. black-stained Made Ground in TP03) and buried organic soils anticipated in east of site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

- 4.2.1. One of the main potential risks to human health is associated with exposure to shallow soils in gardens if the contaminants identified (PAHs, mid to heavy-end aromatic hydrocarbons and asbestos) are present at shallow depths following site preparation and construction. This is only considered likely where Made Ground will remain at shallow depth (<600mm) in gardens following development (currently anticipated to be limited to Phase 2 and the northern part of Phase 1) and these materials should be isolated from sensitive areas such as gardens. Additionally, care should be taken during any regrading works so that Made Ground is not spread over other areas.
- 4.2.2. Inspection of the formation level following preparatory earthworks is required to confirm whether the shallow soils are suitable for retention within garden areas. Where Made Ground is present at the formation surface, a precautionary approach should be adopted where the site is trimmed to allow placement of a clean soil cover system in garden areas.
- 4.2.3. All site won soils or imported materials used for gardens or landscaping should be demonstrably suitable for use, whether placed as clean cover over Made Ground or used as a growing medium in the remaining uncontaminated areas.
- 4.2.4. More localised risks are present in the areas of the PAH / hydrocarbon hotspot (TP03 in Phase 2) and in the east of the site where significantly elevated methane was detected on several occasions (Phase 1). In the absence of remediation, this could potentially lead to human health impacts via the ingress of vapours / methane into future built development and subsequent inhalation by site users; mitigation is therefore required in both areas. The preferred option is source removal with verification testing to confirm the adequacy of the works followed by offsite disposal or relocation to a less sensitive POS area.
- 4.2.5. If residual sources remain following the PAH / hydrocarbon hotspot excavation works, the installation of precautionary vapour protection measures may be necessary in the affected area. Given the very high methane levels recorded in the east of the site, a post-remediation ground gas monitoring programme is recommended following source removal to determine the efficacy of the works. Further investigation should also be undertaken to confirm the integrity of the sewer in the east to assess whether this could be the source of the elevated methane. As a precautionary approach, and in the absence of a Phase 2 ground gas monitoring programme, site-wide basic gas protection measures compliant to a CIRIA CS2 / NHBC Amber-1 classification are recommended for all dwellings.
- 4.2.6. If it is proposed to reprocess materials such as hard-standing and relict foundations to generate aggregate on the site then these should be inspected for ACM before crushing and screened for asbestos at an appropriate frequency before use.
- 4.2.7. The preferred option for managing soil contamination within the site therefore involves elements of all the previously described techniques. This will entail:

- Removal of any surface wastes and fly tipped materials (if present);
- Soil / vegetation strip and recovery with testing to determine the likely potential for re-use within the development;
- regrading of the site to appropriate formation levels with inspection of ground conditions to confirm suitability of formation soils for retention in garden areas;
- in areas of the site where low-level residual contamination can be anticipated (i.e. where Made Ground soils are anticipated), or where in-situ formation inspection indicates possible exceedances, provision of 600mm clean cover soils in gardens (reduced to 300mm cover in POS / landscaped areas) in combination with a basal geotextile;
- excavation of PAH / hydrocarbon hotspot (TP03) with verification testing of formation soils to demonstrate adequacy of removal (Phase 2);
- excavation of suspected ground gas source in east of site (buried organic soils) followed by post-remediation ground gas monitoring to confirm gas risks have been effectively removed (Phase 1);
- site-wide basic gas protection measures compliant to a CIRIA CS2 / NHBC Amber-1 classification to be installed within all dwellings (a higher specification may be required in the eastern Phase 1 area of the site dependent on the findings of the post-remediation ground gas monitoring programme / assessment);
- offsite disposal of excavated contaminated soils (i.e. black-stained Made Ground) OR relocation and reburial at depth within a suitable low-sensitive POS area;
- offsite disposal of excavated organic soils from east of site OR relocation and replacement at shallow depth within a suitable low-sensitivity POS area – if these soils are to be reused on site for this purpose then these would require testing to confirm their suitability for reuse;
- turnover of Made Ground soils down to natural strata and regrading of the site to appropriate formation with inspection of ground conditions to identify currently uncharacterised areas of soil contamination.

#### 4.3. General Approach: Preparatory Remediation Earthworks

4.3.1. The general approach to site preparatory / remediation works is described below:

**Table 4.2: Remedial General Approach**

|                                      |                                                                                                                                                                                                                             |
|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Site security and supervision</b> | The site will be securely fenced throughout the works and appropriate security provided; a full-time site manager will attend site during the works and welfare facilities for staff/visitors will be provided.             |
| <b>Access</b>                        | Access will be formed through the site fencing off Lower Lane.                                                                                                                                                              |
| <b>Ecological clearance</b>          | SGP understand that a detailed ecological survey has been completed. Any related constraints to the implementation of this Remediation Strategy must be identified and detailed in the verification reporting for the site. |

|                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Vegetation / Topsoil strip</b>                                                              | The vegetation strip will entail removal of tall plants and grass and turf stripping to a nominal 50mm depth; stripped vegetation will be stockpiled for reuse or disposal. Topsoil to be stripped and stockpiled for assessment to determine suitability for reuse.                                                                                                                                                                                                                                         |
| <b>Site turnover</b>                                                                           | All areas of Made Ground / fill are to be excavated (where feasible given that some of the farm buildings are to be retained on site) to allow inspection by site operatives for currently uncharacterised contamination and the presence of deleterious materials and to facilitate the removal of obstructions, relict structures and voids. Suitable inert materials are to be replaced in-situ and subject to an appropriate degree of compaction suitable for the foundation and infrastructure design. |
| <b>Further investigations</b>                                                                  | Targeted investigation to determine the extents of the buried organic material in the east (Phase 1). Targeted investigation of the black-stained Made Ground in the vicinity of TP03 (PAH / hydrocarbon hotspot in Phase 2) with removal of impacted soils and verification testing to demonstrate adequacy of works. Investigation of the integrity of the sewer. General inspections of ground conditions during site turnover.                                                                           |
| <b>Post-Remediation Monitoring</b>                                                             | Following removal of any organic rich sounds in the east, a post-remediation monitoring programme will be required to establish the effectiveness of the remedial works and allow reclassification of the gas regime in the east of the site (Phase 1). A ground gas monitoring programme may also be considered in Phase 2 to determine the phase-specific ground gas regime which could negate the requirement for ground gas protection measures in this area.                                            |
| <b>Demolition/Obstructions<br/>Breaking out paved surfaces, foundations and sub-structures</b> | Partial demolition of above ground structures to be completed following comprehensive asbestos surveys and strip / disposal off site. Concrete slabs, tarmac roads, relict foundations and other sub-structures which could provide obstructions to development or result in ground stability risks should be removed.                                                                                                                                                                                       |
| <b>Earthworks / regrading</b>                                                                  | It is envisaged that a programme of earthworks to provide sensibly level development areas and acceptable gradients for access and drainage will be required. The earthworks will be undertaken in accordance with The Definition of Waste: Development Industry Code of Practice where applicable and in such a way that contaminated materials are managed in accordance with the overall requirements of the Remediation Strategy.                                                                        |
| <b>Handling / treatment of hazardous materials / liquid wastes</b>                             | Provided no uncharacterised sources of contamination such as surface deposits or caches of ACM or currently unidentified soil contaminants are encountered, wastes generated from the site are unlikely to be classed as hazardous. The holder of all waste materials, whether the developer or their contractors, has a duty of care to ensure the correct classification and appropriate disposal of all wastes generated.                                                                                 |

|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Completion / Verification</b> | <p>On completion of the remediation works the site will be re-graded to design formation levels. In any areas where Made Ground was previously present but removed during the remediation works, sampling of the natural formation soils will allow determination on whether the soils are suitable for retention within garden areas or whether gardens should be left low (-600mm) to allow placement of a clean cover system to isolate impacted materials from residents.</p> <p>Post-remediation monitoring will be undertaken to establish whether the remedial works will allow reclassification of the ground gas regime in the east of the site.</p> |
|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

#### 4.4. Contamination Hotspots

##### *Phase 2*

4.4.1. The only hotspot requiring specific, targeted remediation is the black-stained Made Ground recorded in BWB entry TP03 in Phase 2 containing elevated PAHs (including naphthalene) and mid-heavy end aromatic hydrocarbons. This will entail excavation of the impacted soils and delineation via visual inspection and screening with a PID followed by placement of the excavated material in a secure stockpile on an impermeable membrane liner; the stockpile will be sheeted to minimise leachate generation. The volume of material to be relocated to a less sensitive POS area or disposed of offsite will be minimised by segregation of contaminated and non-contaminated materials where possible. The side walls and base of the excavation should then be sampled to verify that contamination has been reduced to acceptable levels (see section 6.3).

##### *Phase 1*

4.4.2. Similarly, the suspected buried organic soils in the east of the site in the Phase 1 development area can also be treated like a hotspot requiring removal which. This will entail excavation of the organic soils and delineation via visual inspection followed by placement of the excavated material in a secure stockpile before being relocated to a less sensitive POS area at shallow depth (provided its suitability is confirmed with testing) or disposal offsite. A post-remediation ground gas monitoring programme should then be undertaken in this area to verify that the ground gas source has been adequately removed.

4.4.3. No other potential contamination hotspots have been identified within the completed assessments; however, a weekly site inspection should be completed by the appointed consultant to maintain a watching brief and photographic record.

4.4.4. A watching brief should also be maintained by site supervisors and operatives and if suspect materials are encountered then the consultant should be notified immediately. Soil sampling must then be carried out to determine the significance of the soil contamination and whether or not the material should be treated as a hotspot.

#### 4.5. Materials Management

- 4.5.1. Assuming an earthworks balance can be achieved but that development levels necessitate significant regrading and materials such as topsoil will be recovered for reuse within the development, the proposed works require the treatment or recovery of wastes. A Materials Management Plan (MMP), as set out under the Definition of Waste: The Development Industry Code of Practice (CoP), is therefore required. This can be completed once final development levels are fixed, the earthworks modelled, and volume calculations for recovered materials are available.
- 4.5.2. Earthworks will be carried out using methods / controls to ensure that contaminated materials, runoff, discharge or dust does not affect clean areas of the site or surroundings.
- 4.5.3. If natural, undisturbed soils are produced as part of the site regrade, these could be re-used in gardens where a cover system is required (anticipated to be limited to Phase 2 and the north of Phase 1) subject to careful segregation, handling and quarantine. The topsoil or re-worked topsoil cover may also be suitable for re-use if stripped and stored under the same controls; however, additional validation testing of stockpiled materials will be required to confirm this. Stockpiles of materials intended for re-use should be battered to prevent saturation over a winter programme.
- 4.5.4. If recovery of recycled aggregate is proposed, this should be carried out under the Quality Protocol for the Production of Aggregates from inert Waste (WRAP) and the relevant Mobile Plant permit for deployment.
- 4.5.5. In the event that surplus arisings requiring removal from the site comprising Made Ground are generated, or materials other than natural soils or recovered aggregate need to be removed, then these will be waste materials requiring disposal at a suitably permitted facility and retention of transfer documentation. Similarly, waste transfer notes for other materials removed from the site should be retained. Clean, uncontaminated soils could be transferred within an MMP for an external receiving site.

#### 4.6. Unexpected Contamination

- 4.6.1. It is not considered likely that previously uncharacterised materials or contamination sources (i.e., buried wastes / tanks etc.) will be identified during the works; however, in this eventuality, a decision must be made as to whether these can be dealt with using the techniques selected to manage the contamination characterised to date. Materials must be inspected by an appropriately qualified and experienced person and, if appropriate, samples collected and analysed. The Local Authority will be immediately informed in writing following any such discovery.
- 4.6.2. It is anticipated that the materials associated with immobile (low volatility/solubility) contaminants (i.e., Made Ground) would be retained but excluded from garden areas. It is also envisaged that the black-stained Made Ground associated with volatile contaminants (TP03) and the organic soils anticipated in the east of the site will be removed offsite for disposal, although placement within a less sensitive POS area onsite could be considered if a suitable location is identified. If other

contaminants including ACM, volatile / liquid hydrocarbons, drums, tanks or pipes, or discrete deposits of organic wastes are identified these will be excavated and removed from site for treatment or disposal.

#### 4.7. Construction materials

4.7.1. It is considered unlikely that protected water mains will be necessary although United Utilities (UU) guidelines will require production of a pipeline risk assessment based on the site investigation and/or remediation verification data.

4.7.2. Requirements for concrete specification are as specified within the BGCE report (DS3-AC3), subject to any further testing which may be completed.

#### 4.8. Programme and Phasing

4.8.1. Given the that the site is to be split into two phases which have specific remedial requirements and are to be developed by separate developers, DWH (Phase 1) and RPG (Phase 2), it is considered that two verification reports for each Phase will be required. The earthworks may, however, be undertaken separately or concurrently subject to development proposals.

#### 4.9. Construction Stage Mitigation Measures

4.9.1. The area requiring a clean soil cover system for gardens / POS areas is anticipated to be limited to the entirety of Phase 2 and the north of Phase 1 where Made Ground is present at formation which has been shown to contain marginally elevated levels of PAH, hydrocarbon and asbestos contamination (as indicated by drawing D03). For clarity, this includes the POS / landscaped areas to the north and southeast of Phase 2, but not the POS area to the southwest.

4.9.2. Provided that removal of the potential volatile contaminants in the area of entry TP03 in Phase 2 (black stained Made Ground) is successfully undertaken and confirmed with verification testing, it is not anticipated that vapour protection measures will be required within future dwellings in this area. However, if residual concentrations exist which still represent a risk after the excavation works have been completed, then such measures will be necessary.

4.9.3. Gas protection measures in accordance with a CIRIA CS2 / NHBC Amber-1 classification are recommended site-wide; however, an increased specification may be required in the east of the site in Phase 1 dependent on the findings of the post-remediation ground gas monitoring programme / assessment. A ground gas monitoring programme could also be considered for Phase 2 which may negate the requirement for ground gas protection measures in this area.

## **5. Health, Safety and Environmental Management**

### **5.1. Health and Safety Roles / Responsibilities**

- 5.1.1. The Principal Contractor under the Construction Design and Management Regulations 2015 (CDM2015) will be responsible for managing health and safety during the remediation / preparation works and for producing any risk assessments and method statements required.
- 5.1.2. SGP's responsibilities as 'Designer' under CDM 2015 is to eliminate, reduce or control foreseeable risks that may arise during construction, maintenance or use, and to provide information to other members of the project team to assist them in fulfilling their duties. The recommendations in this report should be considered by the 'Client' and/or 'Principal Designer' and Principal Contractor and included in the Health and Safety File for the site.
- 5.1.3. Protection of site workers, local residents and visitors during the remediation works can be achieved by the adoption of appropriate health and safety practices, environmental management and site security. All site workers will be given a comprehensive health and safety induction and required to use appropriate personal protective equipment.

### **5.2. Environmental Management Issues**

- 5.2.1. The scope of remediation works is unlikely to have a significant impact upon the nearby housing and environment provided that due care is taken to control dust, odour, noise and vibration, and to prevent surface runoff onto roads and into drains. Noise emissions will be managed through the observation of approved working hours and the use of appropriate plant.
- 5.2.2. Appropriate dust suppression measures will be deployed for crushing plant and earthworks during dry periods. Dust will be routinely monitored visually and if unacceptable emissions beyond the site boundaries are noted then the element of the works contributing to this will be halted until appropriate mitigation (damping down, road sweeper, etc) can be deployed.
- 5.2.3. No discharges of dewatering or surface runoff to surface waters is permitted, however uncontaminated or marginally contaminated water may be discharged to foul sewer in agreement with the utility provider.
- 5.2.4. Plant fuel and lubricant storage will take place using suitable containers, bunds and secured filling points. An oil spill kit and adsorbent materials to manage any accidental release of liquid pollutants will be provided. Suitable sealed skips and containers will be used for the temporary storage of small quantities of asbestos or other hazardous wastes, if encountered.

## 6. Inspection and Verification

### 6.1. General Site Inspections

- 6.1.1. The remediation earthworks should be carried out under the supervision of an appropriately qualified and experienced site manager. If unexpected ground conditions and potential indicators of significant ground contamination are encountered, then works in that area should cease until specialist advice can be sought as described in Section 4.6.
- 6.1.2. Weekly inspections of the site and exposed soils (i.e. Made Ground) are to be undertaken by an independent consultant to assess whether currently uncharacterised contamination or pollution sources exist on the site.
- 6.1.3. During construction, a full-time site manager will be required to supervise the implementation of the remaining mitigation measures and arrange verification testing and inspections by the independent consultant as required.

### 6.2. Material Verification Testing

- 6.2.1. If it is intended that crushed hard-standing and foundation arisings are to be used for low sensitivity purposes (including protection of the site surface on haul routes, or as a sub-base for hard standing, and in the construction of roads), no chemical testing is required unless this material is used in garden areas. However, the feedstock should be inspected by an appropriately trained operative and an asbestos screen on the final product at an appropriate frequency will be required. Depending on the volume generated, a sampling rate of 1 sample per 250m<sup>3</sup> or 1kg bulk sample per 250m<sup>3</sup> should be implemented. Widely accepted threshold values are currently unavailable for asbestos in soils or reclaimed materials, but incidences over the common quantification threshold of 0.001% will require further assessment to determine the suitability of processed materials for retention within the development.
- 6.2.2. Soils recovered during the works or imported onto the site intended for use within gardens will also be sampled to verify their suitability for use. Given the site history and contamination status is well characterised, a screening frequency of 1 sample per 250m<sup>3</sup> is proposed for site recovered soils to be used in gardens. Soil concentrations will be compared to assessment criteria based on a residential land use as detailed in Table 6.1 below.
- 6.2.3. Where criteria are not published and cannot be readily derived (for asbestos for example) an arbitrary level which is representative of what would be considered a clean soil is used. Typically, this is the limit of detection that can be achieved through quantification of the amount of asbestos in the soil by commercially available laboratory techniques, typically 0.001% by mass. If higher concentrations are encountered then further assessment would be required to determine likely risks, however concentrations above what are widely recognised as “trace” are not normally tolerated in residential soils and so this will be adopted for the residential areas of the development.

Higher concentrations in other areas / or at greater depths may be acceptable (i.e., below the soil cover system or within low sensitivity areas such as POS), depending on whether future exposure during construction or maintenance can be reasonably anticipated. The criteria of 0.001% will be adopted for any validation of residual Made Ground following the removal of ACM, exceedances of this will prompt further risk assessment utilising the CL:AIRE JIWG Decision Support and Receptor Ranking Assessment, however concentrations of 0.01% would prompt further removal.

**Table 6.1 Garden Cover System Compliance Criteria**

| <b>Contaminant</b>    | <b>Residential Use Screening criteria<br/>(mg/kg unless stated)</b> |
|-----------------------|---------------------------------------------------------------------|
| Asbestos              | <0.001% by mass (LOD)                                               |
| Arsenic               | 37 LQM/CIEH S4UL                                                    |
| Cadmium               | 11 LQM/CIEH S4UL                                                    |
| Chromium (total)      | 910 LQM/CIEH S4UL                                                   |
| Hexavalent Chromium   | 6 LQM/CIEH S4UL                                                     |
| Copper                | 2,400 LQM/CIEH S4UL                                                 |
| Lead                  | 200 (C4SL)                                                          |
| Mercury               | 40 LQM/CIEH S4UL                                                    |
| Nickel                | 180 LQM/CIEH S4UL                                                   |
| Zinc                  | 3,700 LQM/CIEH S4UL                                                 |
| Naphthalene           | 2.3 LQM/CIEH S4UL                                                   |
| Acenaphthylene        | 170 LQM/CIEH S4UL                                                   |
| Acenaphthene          | 210 LQM/CIEH S4UL                                                   |
| Fluorene              | 170 LQM/CIEH S4UL                                                   |
| Phenanthrene          | 95 LQM/CIEH S4UL                                                    |
| Fluoranthene          | 2400 LQM/CIEH S4UL                                                  |
| Anthracene            | 280 LQM/CIEH S4UL                                                   |
| Pyrene                | 620 LQM/CIEH S4UL                                                   |
| Benzo(a)anthracene    | 7.2 LQM/CIEH S4UL                                                   |
| Chrysene              | 15 LQM/CIEH S4UL                                                    |
| Benzo(b)fluoranthene  | 2.6 LQM/CIEH S4UL                                                   |
| Benzo(k)fluoranthene  | 77 LQM/CIEH S4UL                                                    |
| Benzo(a)pyrene        | 2.2 LQM/CIEH S4UL                                                   |
| Indeno(123cd)pyrene   | 27 LQM/CIEH S4UL                                                    |
| Dibenzo(ah)anthracene | 0.24 LQM/CIEH S4UL                                                  |
| Benzo(ghi)perylene    | 320 LQM/CIEH S4UL                                                   |
| Aliphatic C5-C6       | 42 LQM / CIEH S4UL                                                  |
| Aliphatic C6-C8       | 100 LQM / CIEH S4UL                                                 |
| Aliphatic C8-C10      | 27LQM / CIEH S4UL                                                   |
| Aliphatic C10-C12     | 130LQM / CIEH S4UL                                                  |
| Aliphatic C12-C16     | 1100 LQM / CIEH S4UL                                                |
| Aliphatic C16-C21     | 65,000 LQM / CIEH S4UL                                              |
| Aliphatic C21-C35     | 65,000 LQM / CIEH S4UL                                              |
| Aromatic C5-C6        | 70 LQM / CIEH S4UL                                                  |
| Aromatic C6-C8        | 130 LQM / CIEH S4UL                                                 |
| Aromatic C8-C10       | 34 LQM / CIEH S4UL                                                  |
| Aromatic C10-C12      | 74 LQM / CIEH S4UL                                                  |

| Contaminant      | Residential Use Screening criteria<br>(mg/kg unless stated) |
|------------------|-------------------------------------------------------------|
| Aromatic C12-C16 | 140 LQM / CIEH S4UL                                         |
| Aromatic C16-C21 | 260 LQM / CIEH S4UL                                         |
| Aromatic C21-C35 | 1100 LQM / CIEH S4UL                                        |
| Benzene          | 0.08 LQM / CIEH S4UL                                        |
| Toluene          | 130 LQM / CIEH S4UL                                         |
| Ethyl-benzene    | 47 LQM / CIEH S4UL                                          |
| m/p-xylene       | 56 LQM / CIEH S4UL                                          |
| o-xylene         | 60 LQM / CIEH S4UL                                          |

S4UL: Generic assessment criteria published by Chartered Institute of Environmental Health and Land Quality Management Ltd S4UL, residential land use scenario; COPYRIGHT Land Quality Management Limited reproduced with permission; publication number UL3102. All Rights Reserved

C4SL: Category 4 Screening Levels published by CL: AIRE 'residential land use with plant uptake'

6.2.4. Similarly, imported soils intended for use at shallow depths in gardens (whether or not these form part of a specified 600mm cover system) should be tested. For imported materials from an uncharacterised source, or one where there is considered to be a higher likelihood of soil contamination are used, the sampling frequency will be increased to 1 sample per 50m<sup>3</sup>. A lower frequency (1 per 250m<sup>3</sup>) may be acceptable from materials of known provenance from lower risk Greenfield sources.

6.2.5. For plots where a soil cover system is required (anticipated across Phase 2 and the north of Phase 1 as indicated by Drawing D03), depth verification testing should be carried out at a frequency of 1 entry per 3 plots to confirm the correct depth of soils have been placed. In POS areas, a frequency of 1 entry per 25m grid would be sufficient (minimum 3 entries per POS area).

### 6.3. Hydrocarbon / PAH Hotspot Removal Verification

6.3.1. Following excavation and removal of the PAH / hydrocarbon hotspot in Phase 2 (as described in Section 4.4.1), testing of the base / sidewalls for TPHCWG hydrocarbons and PAHs will be carried out with comparison to the criteria as set out in Table 6.1 in the first instance to determine if any residual risks remain, particularly with regards to the volatile contaminants naphthalene and aromatic C12-16 aromatic hydrocarbons which could affect requirements for vapour protection measures. The sampling frequency should be equivalent to a minimum 5m grid over the impacted area with a minimum of 4 sample locations collected from the sidewalls and 1 sample collected from the base of the excavation.

### 6.4. Post-Remediation Gas Monitoring (Ph1 East)

6.4.1. Following removal of the anticipated organic deposits in the east of Phase 1 (if present), a post-remediation ground gas monitoring programme will be required to confirm that the source of the significantly elevated methane and carbon dioxide recorded has been effectively removed. Given that the source is anticipated to be organic clays of limited thickness, monitoring boreholes should

be installed at 25-50m intervals over the affected area<sup>2</sup>. The anticipated extent of the buried organic materials (as indicated on drawing D03) is approximately 25m x 55m therefore 2 monitoring wells should be sufficient; a weekly 6-week ground gas monitoring programme is then recommended.

#### 6.5. Gas / Vapour protection Measures

6.5.1. Gas protection measures in accordance with a CIRIA CS2 / NHBC-Amber 1 classification are recommended for all plots within the development with the potential for a higher specification to be required within the east of the site in Phase 1 dependent on the findings of the post-remediation gas monitoring programme. A final recommendation on protection measures will be made in the earthwork's completion reports following final remediation and assessment. Hydrocarbon resistant vapour protection measures should not be required in the vicinity of BWB TP03 in Phase 2 unless residual risks are determined to remain following the hydrocarbon / PAH hotspot removal works. Verification of the vapour / gas protection measures should be completed in accordance with CIRIA C735<sup>3</sup>.

#### 6.6. Remediation / Preparatory Earthworks Completion Reporting

6.6.1. Two separate phased reports detailing the works carried out and the results of the validation / verification testing will be prepared by an Independent Consultant and submitted to the Local Authority for approval upon completion of the works. The reports will include a full description of the works carried out, the findings of all validation and verification testing and the post-remediation gas monitoring, any photographic records, details of wastes removed, and any fills imported. The report will also confirm the construction-stage recommendations with respect to gas protection and soil cover systems.

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<sup>2</sup> Ground Gas Handbook (2009)

<sup>3</sup> CIRIA C735. Good Practice on the Testing and Verification of Protection Systems for Buildings against Hazardous Ground Gases. 2014

## 7. Conclusions and Recommendations

### 7.1. Conclusions

#### *Phase 1 Development Area*

7.1.1. The majority of the Phase 1 area is at low risk from significant land contamination having apparently remained as agricultural fields associated with Silver Hill Farm throughout its mapped history. Made Ground associated with the former farm was, however, confirmed in one entry within the Phase (TP05) which was associated with minor elevated concentrations of PAHs and heavy-end hydrocarbons. The area where Made Ground is anticipated to be present within Phase 1 is indicated on drawing D03.

7.1.2. It is also anticipated that highly organic deposits have been buried at shallow depth in the east of Phase 1 due to the elevated methane in entries BH03 and DS202 but further investigation / remediation is required to confirm this. A second potential source is the sewer which crosses this part of the site and further investigation to assess the integrity of the sewer is required to rule this out as a possible source of the elevated methane / identify whether repair works are required.

#### *Phase 2 Development Area*

7.1.3. The Phase 2 area of the site was developed as a series of farm buildings (Silver Hill Farm) prior to the earliest available mapping with the addition of several buildings / structures over the following circa 140 years, many of which have since been demolished. Made ground has been observed on site localised to the area around the Silver Hill Farm buildings within which occasional contamination indicators have been described including black staining and an inclusion of ash. Concentrations of contaminants above residential assessment criteria have been reported by BWB which were limited to the Made Ground in the vicinity of the farm buildings.

7.1.4. Amongst the reported exceedances within the Made Ground, a localised PAH / hydrocarbon hotspot (black-stained Made Ground) has been identified in Phase 2 (TP03) that poses a potential vapour inhalation risk to future site users. Trace asbestos has also been detected in the Made Ground soil in one location in the vicinity of the farm buildings and it is considered possible that asbestos is / was contained within the fabric of the existing / former buildings on site.

#### *General*

7.1.5. SGP considers that most parts of the site have been adequately investigated for the purpose of devising a Remediation Strategy suitable to prepare the site for residential development and the likely key development constraints and requirements for remediation are understood. However, some inspections / investigations are proposed during the preparatory earthworks programme to give additional confidence to this.

7.1.6. The remedial measures proposed are generally limited to demonstrating exclusion of contaminated Made Ground materials from planned gardens / landscaped areas (with provision of contingency

in the form of clean cover soils where this cannot be accomplished) and site-wide basic ground gas protection measures. The two areas which require more specific remediation measures are the PAH / hydrocarbon hotspot (Phase 2) and the suspected organic soils in the east (Phase 1).

## 7.2. Recommendations

### *Phase 1 Development Area*

- 7.2.1. Further investigation should be carried out to delineate the suspected buried organic soils in the east of Phase 1. If confirmed, the organic soils should be excavated as far as reasonably practicable and removed offsite as described in Section 4.4.2 unless a suitable POS area is identified onsite for its replacement at shallow depth (provided testing confirms its suitability). Investigation of the live sewer that runs along the eastern part of the site should also be carried out to determine whether this could be a potential source of the elevated methane.
- 7.2.2. A post-remediation ground gas monitoring programme should then be carried out in the eastern part of the site comprising the drilling / installation of 2 monitoring wells followed by weekly monitoring over a 6-week period (see Section 6.4.1) to determine if any residual gas risks remain and to determine the requisite gas protection / verification measures for future dwellings in this part of the site (Plots 28-33 & 40-51). As a minimum, gas protection measures in accordance with CIRIA CS2 / NHBC Amber-1 are required within all dwellings in Phase 1.
- 7.2.3. In accordance with BS8485:2015+A1:2019<sup>4</sup>, gas protection measures for a Type A building (private ownership with no building management controls) on a site classified as CS2 are required to achieve a score of **3.5**. This could be achieved by a venting sub-floor void with very good performance (**2.5**) or good performance (**1.5**), and installation of a gas membrane that is sufficiently impervious to the gases (methane and carbon dioxide), is sufficiently durable and strong, and has been verified in accordance with CIRIA<sup>5</sup> (2).
- 7.2.4. To achieve a point score for the gas membrane, verification of its installation in accordance with CIRIA C735 is required. The suggested level of verification for a Situation B (residential low-rise housing) with ventilated sub-floor void on a low-risk Amber-1 site is dependent on the experience of the installer. It is assumed that a general builder / groundworker will install the membrane and so the suggested level of verification is as follows:

*Verifier (consultant or qualified and experienced installer) to conduct thorough verification (visual) inspection of first plot and after placement of reinforcement if no protection provided. Subsequent inspections carried out at approx. frequency of 1 in 10 plots (minimum 5). Contractor to supply signoff sheets (verification evidence) including photographs for all other plots. Consideration is given to need for/scope of integrity testing if concerns identified by visual inspections.*

<sup>4</sup> Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings (2015)

<sup>5</sup> Good practice on the testing and verification of protection systems for buildings against hazardous ground gases (2014)

- 7.2.5. It is proposed that the first 5 plots will be verified by a suitably trained consultant to provide confidence in the quality of workmanship. Providing a good level of work is demonstrated then the frequency of inspections will reduce to the suggested level of 1 in every 10 plots. It is not proposed to undertake integrity testing.
- 7.2.6. Due to the identified presence of elevated contaminants within the Made Ground in the north of Phase 1, garden levels are to be trimmed in this area to -600mm to accommodate the placement of a clean, validated, soil cover system with a basal geotextile (Plots 15-19). For these plots where a cover system is specified, depth validation testing will be undertaken in the rear gardens at a frequency of 1 entry per 3 plots with a photographic record maintained to confirm the depth of soil cover, the strata placed and the location of the depth entry in relation to the plot.
- 7.2.7. Verification testing of all soils (subsoil and topsoil) for use within the cover system or as a growing medium will be subject to chemical testing to ensure suitability for use. Sampling should be undertaken by an independent consultant. The frequency of testing will be dependent on the provenance of the soil and will be completed as follows:
- Natural site won topsoil / subsoil: 1 sample per 250m<sup>3</sup>
  - Imported topsoil / subsoil (Well-Characterised Greenfield source): 1 sample per 250m<sup>3</sup>
  - Imported topsoil / subsoil (Well Characterised Brownfield source with evidence that extraction of suitable soils for transfer is feasible): 1 sample per 100m<sup>3</sup>
  - Imported topsoil / subsoil (unknown source): 1 sample per 50m<sup>3</sup>
  - Minimum of 3 samples to be collected from each source.

#### *Phase 2 Development Area*

- 7.2.8. The PAH / hydrocarbon hotspot (black-stained Made Ground) identified in BWB entry TP03 should be excavated with verification testing carried out as described in Sections 4.4.1 & 6.3. The contaminated material should then either be removed offsite for disposal or, if a less-sensitive POS area is identified onsite where the material can be buried at depth (>1m) and encapsulated in clay, and it can be demonstrated that this will not pose a risk to future site users, then this could be considered. If the verification testing indicates that potential vapour risks remain following the excavation works then vapour protection measures may be required within dwellings in the vicinity of the hotspot area, however this should be confirmed in the remediation verification reporting.
- 7.2.9. Consideration could be given to the implementation of a ground gas monitoring program in Phase 2 to negate the site-wide recommendation for the installation of basic CIRIA CS2 / NHBC Amber-1 gas protection measures which may be preferable given the proposed refurbishment of existing buildings in this area. As the potential source considered is Made Ground with a low degradable content, ground gas monitoring installations would be required on a 25m-50m grid<sup>6</sup> (circa 3 installations) followed by a 6-week, weekly monitoring programme. In the absence of this, gas

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<sup>6</sup> Ground Gas Handbook (2009)

protection measures in accordance with CIRIA CS2 / NHBC Amber 1 are required within all dwellings in Phase 2 with construction / verification in accordance with the guidance specified in Sections 7.2.2-7.2.5.

7.2.10. Due to the identified presence of elevated contaminants within the Made Ground in Phase 2, garden levels are to be trimmed in this area to -600mm to accommodate the placement of a clean, validated, soil cover system with a basal geotextile, reduced to -300mm within the POS / landscaped areas to the north / southeast of Phase 2. Verification testing of the soils used for this purpose will be carried out as per Section 7.2.7.

7.2.11. Depth validation testing will be undertaken in the rear gardens at a frequency of 1 entry per 3 plots with a photographic record maintained to confirm the depth of soil cover, the strata placed and the location of the depth entry in relation to the plot. Depth testing will also be required within POS / landscaped areas to the southeast / north of Phase 2 at a frequency of 1 entry per 25m grid spacing with a minimum of 3 entries per landscaped area.

#### *General*

7.2.12. Weekly site inspections by an independent consult during the preparatory earthworks including the breaking out of hardstanding, turnover of the Made Ground and trimming of site levels is required to maintain a detailed watching brief and photographic record. If any unexpected contamination is identified during the inspections these will be subject to dedicated, targeted investigations, including soil sampling and analysis appropriate to the type of material encountered.

7.2.13. If any currently uncharacterised areas of Made Ground are identified during the remediation works which do not exhibit indicators of contamination, then these soils could be tested to see if they are suitable for retention within gardens / POS areas. In the absence of testing, or if concentrations above residential screening criteria are confirmed, a soil cover system as described above should be placed within the affected areas.

7.2.14. Site recovered and imported soils intended for reuse within gardens / landscaped areas of the development should be tested as per Section 7.2.7 to determine their suitability for use. Recycled aggregate should also be tested for an asbestos screen and quantification (if detected) to determine its suitability if considered for reuse on site.

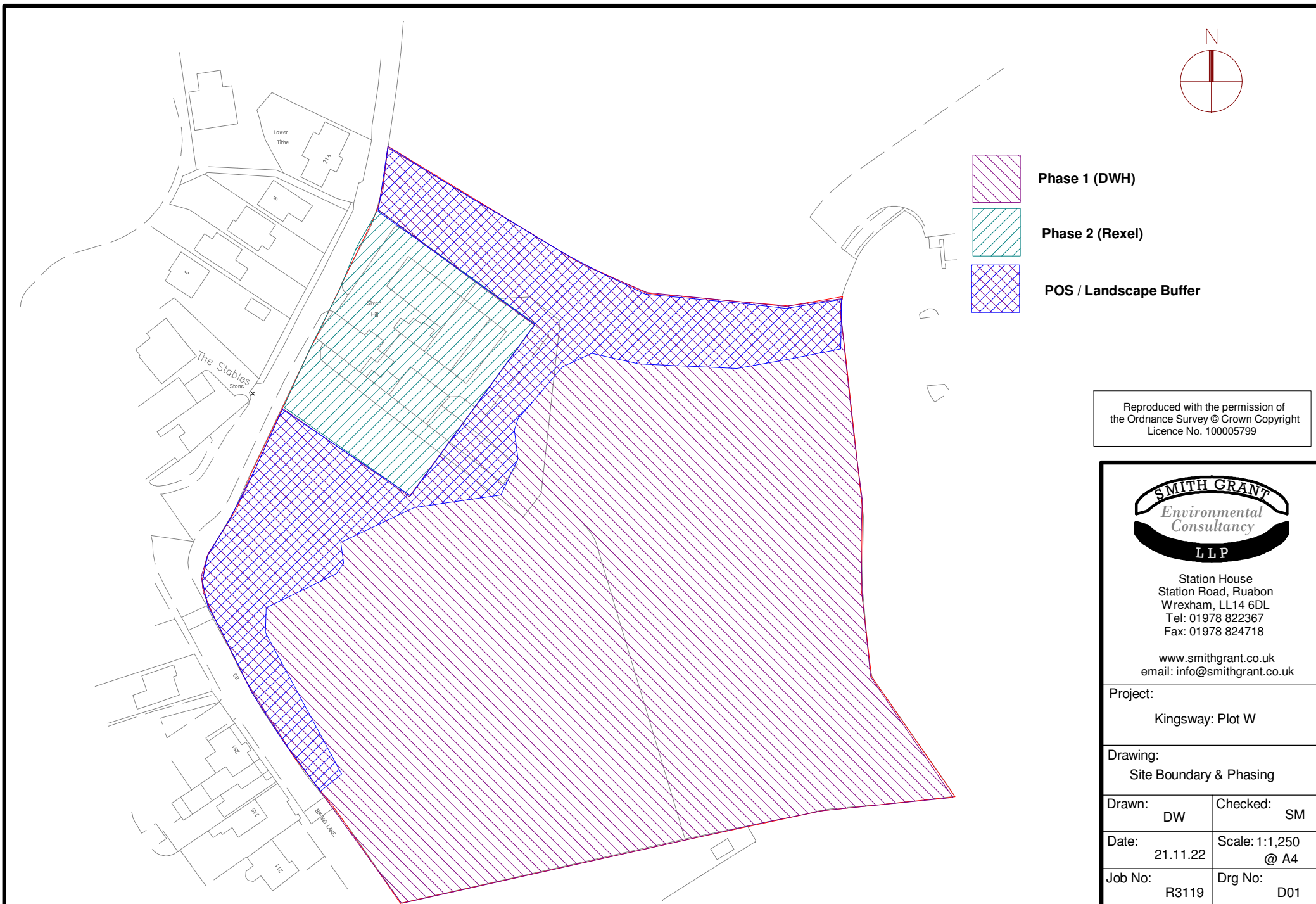
7.2.15. The proposed management and remediation, and implementation and reporting of the verification / validation testing regime, will demonstrate that the proposed remedial works have been carried out and the site made suitable for the proposed development, subject to the execution of any additional requirements by the developers during the construction stage of the development.

7.2.16. With the adoption of the above normal practices for Brownfield development, and on the information available to it, SGP considers that the site can be safely and economically redeveloped, and the existing environmental liabilities managed.

### 7.3. Limitations

- 7.3.1. This report has been prepared by SGP for the sole and exclusive use of David Wilson Homes and Rexel Property Group. All reasonable skill, care and diligence has been exercised within the budget available, and in accordance with the technical requirements of the brief. Notwithstanding the efforts made by the professional team in undertaking the assessment and preparing this report, it is possible that other ground conditions and contamination as yet undetected may exist. Reliance on the findings of this report must therefore be limited accordingly. Such reliance must be based on the whole report and not on extracts which may lead to incomplete or incorrect conclusions when taken out of context.
- 7.3.2. The factual information and recommendations for foundations measures has been largely informed by information prepared by third parties and provided to SGP. The recommendations contained within this report have been made in good faith, based on the totality of the information provided to SGP, however SGP accepts no responsibility or liability for errors or omissions caused by information which has been withheld, or where errors or omissions within previous reporting have led to false or unreliable conclusions by others relating to the contamination status of the site
- 7.3.3. SGP reserves the right to alter any of the foregoing information in the event of new information being disclosed or provided and in the light of changes to legislation, guidelines and responses by the statutory and regulatory authorities.

## **DRAWINGS**



**Phase 1 (DWH)**



**Phase 2 (Rexel)**



**POS / Landscape Buffer**

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email: [info@smithgrant.co.uk](mailto:info@smithgrant.co.uk)

**Project:**

Kingsway: Plot W

**Drawing:**

Site Boundary & Phasing

**Drawn:**

DW

**Checked:**

SM

**Date:**

21.11.22

**Scale:** 1:1,250

@ A4

**Job No:**

R3119

**Drg No:**

D01



Phase 1 (DWH)



Phase 2 (Rexel)



POS / Landscape Buffer



Trial-Pit



Borehole (DP)



Borehole (CP)

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Project:

Kingsway: Plot W

Drawing:

Previous S.I. Entries

Drawn:

DW

Checked:

SM

Date:

21.11.22

Scale: 1:1,250

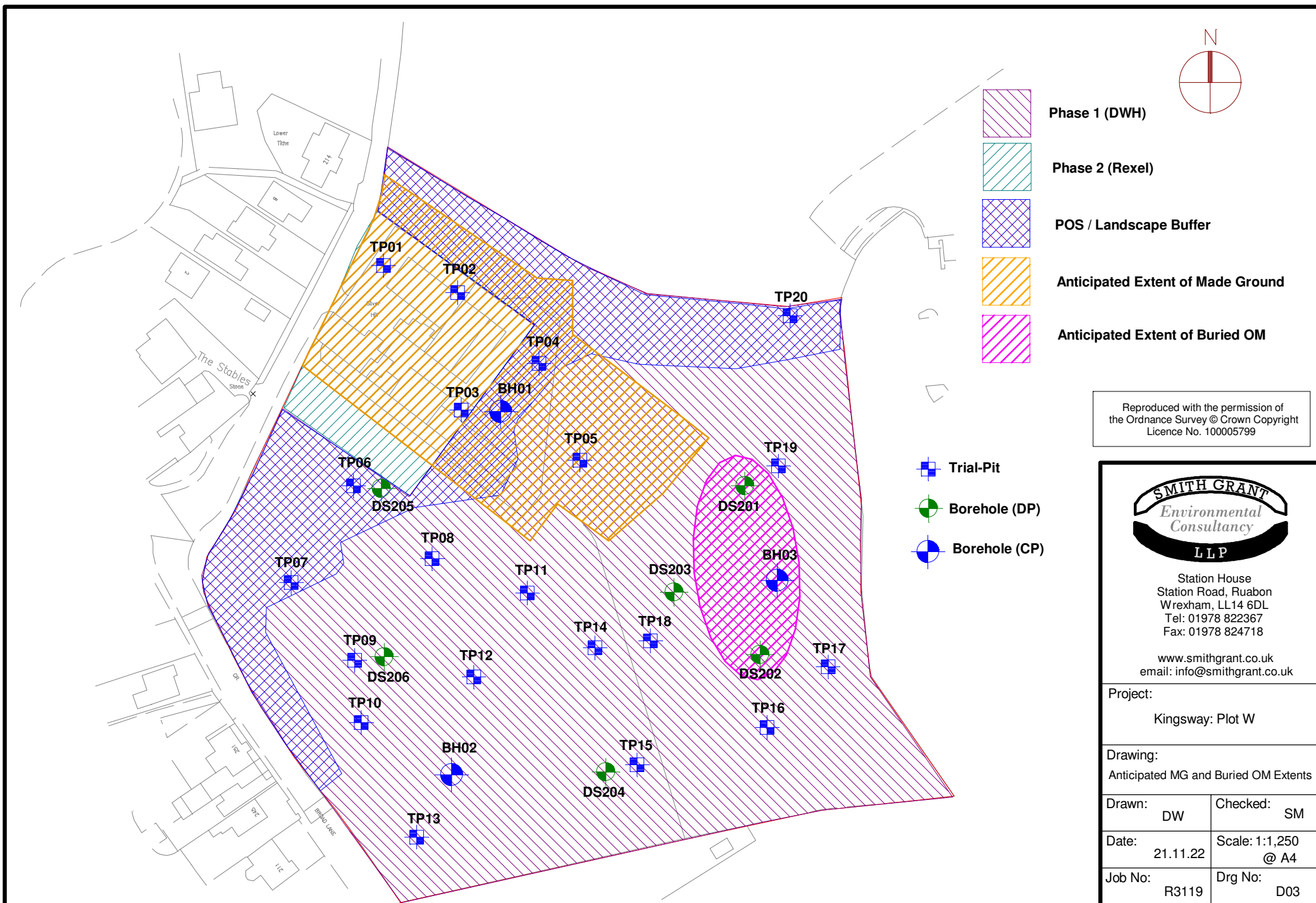
@ A4

Job No:

R3119

Drg No:

D02



# KINGSWAY PLOT W PHASING PLAN



Key:

- Development Boundary
- Sales Arena
- Sewer Easement
- FS Feature Stone Plot
- Site Entrance Feature

Phase 1

Phase 2

| No. | Screening | Drawn/Date |
|-----|-----------|------------|
|     |           |            |

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**DAVID WILSON HOMES**

WHERE QUALITY LIVES

Project

**PLOT - W**

**KINGSWAY**

**ROCHDALE**

Drawing Title

**PHASING PLAN**

Status

**For Comment**

Scale

**N150 @ A1**

Date

**17.01.22**

Drawn By

**ML**

Drawing Ref

**PL01**

Revision