

Item	Description
Previous Land Use	Anecdotal information provided by a local resident at the time of the intrusive investigation suggests that the site was formerly used as a municipal tip where there were no restrictions on the type of waste that could be deposited. The recorded of the landfill/tip is shown in Figure 2-3 below. Further site history information is presented in Sections 3.1 and 3.2 below.
Surface cover and vegetation	The site is predominantly grassed, with patches of overgrown vegetation throughout. Numerous large, mature deciduous trees encompass the site and define its boundaries.
<i>Figure 2-3: Recorded extent of the landfill</i> (reproduced from Groundsure IO, not to scale)	

2.3 Published Geology

The general geology of the site is shown on the BGS GeoIndex and 1:50,000 geological map of Horsham (Sheet 302), with further information provided in the BGS Memoir for Sheet 302.

Table 2-3: Published Geological Sequence

Reference	Location	Stratigraphic Name	Description
Artificial Ground/Topsoil			
Artificial Ground is not indicated to be present on site, although based on the site history and previous investigations, Made Ground associated with historical infilling is expected to be present in the centre of site.			
Solid Geology			
1	On site – Northern half	Upper Tunbridge Wells Sand	Typically comprising thinly bedded silty mudstones, siltstones, silty sandstones and fine-grained sandstones. These weather to a pale yellowish grey or brown colour. The lower boundary typically comprises grey and greenish grey silty mudstones and siltstones, red-mottled in part.



hydrocarbons EPH >C16-C35. These are located throughout the Made Ground, however concentrations within the Made Ground leachate and natural geology groundwater samples were generally below detection with no exceedances of the WQT, although elevated concentrations of benzo(b)fluoranthene and fluoranthene were recorded in the groundwater samples taken from the natural strata in the Stantec investigation. The CoPC recorded within the soil leachate and groundwater samples are similar to those identified within the Made Ground, indicating that the overlying Made Ground is the likely source of contamination. Earthworks are proposed as part of the development enabling works and where not suitable, Made Ground will be removed from site. In some areas, up to 3m of fill is proposed which will limit the infiltration of surface water and further mobilisation of contaminants. This is further support by the presence of proposed building footprints and hardstanding. Although elevated concentrations of contaminants have been recorded in the soil leachate and groundwater samples, it would be disproportionately costly to excavate and remove all of the Made Ground from the groundwater.

To date, surface water samples from the adjacent ponds to the west have not been taken. It is recommended that this is undertaken. The results of which should be used to inform the requirement for further detailed risk assessment.

11.7 Ground gas risk assessment

The potential risk from ground gas has been assessed in accordance with BS 8485:2015+A1:2019 and has been based on the relevant data identified and summarised in Section 8.

11.7.1 Assessment Criteria

Gas monitoring has been undertaken at the site on the basis of the historical ground investigation data and preliminary risk assessment. The assessment guidelines set out in Table 2 of BS 8485 are based on interpretation of the gas concentrations and the gas flow rates. The quantitative assessment has been carried out by comparing the individual gas concentrations and gas screening values (GSV) within Appendix C with the published characteristic situation (CS) thresholds, in addition to worst-case GSV assessment in accordance with Section 6.3.7 of BS8485.

The range of ground gas concentrations and their computed gas screen values are assessed as per BS8485:2015+A1:2019 to determine the appropriate Characteristic Situation for the site. Characteristic Situation GSV criteria is summarised below.

Table 11-1: Characteristic Situation as per BS8485:2015+A1:2019

Characteristic Situation (CS)	Hazard Potential	GSV value
CS1	Very low	<0.07
CS2	Low	0.07 - 0.7
CS3	Moderate	0.7 - <3.5
CS4	Moderate to high	3.5 - <15
CS5	High	15 - <70
CS6	Very high	>70



11.7.2 Data adequacy

As per BS8576:2013 Decision Matrix for Initial Monitoring, it is judged from the available evidence that the gas generation potential at the site is high to very high as the site is a Made Ground, and as per Tables 5.5a and 5.5b CIRIA C665, the sensitivity of the development is high as it is a proposed care development. Consequently, and in accordance with CIRIA C665 (Table 5.5a and 5.5b) and Figure 6 BS8576:2013, an appropriate minimum monitoring regime is 6 visits on a fortnightly basis provided other monitoring requirements are also met, such as prevailing atmospheric pressure conditions (for example, BS 8485:2015 +A1:2019 suggests monitoring should include a period of falling atmospheric pressure).

Stantec has undertaken four visits to date, alongside a previous monitoring regime of three visits.

11.7.3 Assessment results

The risks associated with the ground gases methane (CH₄) and carbon dioxide (CO₂) have been assessed using BS 8485:2015 +A1:2019.

The assessment guidelines set out in Table 2 of BS 8485 are based on interpretation of the gas concentrations and the gas flow rates. The quantitative assessment has been carried out by comparing the individual gas concentrations and borehole hazardous gas flow rate values (Q_{hg}) in Appendix C with the published CS thresholds (BS 8485 Table 2), in addition to a worst-case GSV assessment in accordance with section 6.3.7 of BS 8485. The assessment is summarised and presented in full in Appendix C.

11.7.4 Risk evaluation

Ground gas risk assessment did not form part of the scope of works of the Omnia 2023 historical ground investigation report used throughout this report. Ground gas monitoring was undertaken as part of the Harrison Environmental Group ground investigation, which it is understood that the client does not have reliance upon. Conclusions of this ground gas risk assessment were Characteristic Situation 2 conditions at the site. However, it should be noted that there was no flow within any of the boreholes during monitoring, and based on the groundwater level monitoring completed after installation it is likely that the response zones were flooded and as such are not considered to be representative of the true ground gas conditions at the site.

To date, four rounds of gas monitoring have been undertaken with a further two rounds to be undertaken within the Stantec 2026 boreholes. The calculated borehole hazardous gas flow rates for carbon dioxide and methane indicates CS1 conditions and methane and carbon dioxide at concentrations are 'typically' below 1% and 5% respectively. As such, the site is provisionally classified as Characteristic Situation 1. This report will be updated upon completion of the monitoring.

Based on the data to date, subject to confirmation with the LPA and the warranty provider, no mitigation measures are required.

11.8 Phytotoxicity risk assessment

Soil contaminants, if present at sufficient concentrations, can have an adverse effect on plant health. Phytotoxic effects can be manifested by a variety of responses, such as growth inhibition, interference



Plan'), which will need to be submitted to the warranty provider and the regulatory authorities for approval.

The writing and approval of a Materials Management Plan will be required to allow reuse of the minimal volumes of suitable uncontaminated, naturally occurring soils present at the site. In addition, as excavation of existing waste soils is required, an appropriate Environmental Permit will also be required to manage and control the works. This will require discussion and agreement with the Environment Agency, and at this stage, it is anticipated the permit will comprise a Standard Rule No. 27, although this is subject to Environment Agency agreement.

Verification reports by a suitably qualified independent geo-environmental specialist will be required following completion of any remedial works (including ground gas membrane installation).

11.12.2 Enablement phase

It is anticipated that the Enablement Phase of works would be undertaken by a specialist remediation Contractor, and the following works are considered necessary during Enablement:

- Excavation and disposal of the existing topsoil (due to the requirement to raise site levels and the inability to re-use the Made Ground soils (due to waste regulations).
- Excavation of the Made Ground and natural soils as required to leave the site at the formation level required for construction or to allow filling.
- Ground improvement as necessary.
- Installation of deep drainage, services and service ducts, to include:
 - » Over-excavation of and backfill with suitable soil (clean imported granular material).
 - » Installation of plastic pipes above the groundwater table; or
 - » Installation of clay ware or concrete pipes / manholes where installed below the groundwater table.
- Removal of any free phase hydrocarbons encountered and disposal (none encountered to date).
- Import of subsoil in accordance with a MMP to allow filling to formation level.
- Placement of fill as per the Earthworks Specification to leave the site at the Formation Level to allow construction.
- Disposal of all excavated historical Made Ground soils (due to waste regulations) and management (in accordance with an Enablement Phase Material Management Plan (MMP) of any excavated natural uncontaminated soils.
- verification during enablement works.

Due to the potential for low concentrations of dissolved phase petroleum hydrocarbons in the groundwater, treatment of any water pumped from excavations (via a granulated activated carbon plant) may be required prior to discharge from the site. This would apply to both the enablement and construction phase of works.



11.12.3 Construction phase

Prior to commencement of the Construction Phase, it is anticipated that Enablement Phase works will have been completed to leave the site at a formation level to allow construction works, and the Construction Phase of works will comprise:

- Appropriate materials handling in accordance with a Construction Phase MMP (re-use of the imported uncontaminated natural soils used as fill during the Enablement Phase).
- Installation of barrier pipework (subject to agreement with the water authority).
- Over-excavation of shallow service trenches and backfill of plastic drainage pipes (above the groundwater table) with suitable soil (clean imported granular material).
- Potential installation of ground gas mitigation measures, subject to completion of the required monitoring.
- Import of aggregate (either recycled under the Quality Protocol, or quarried products), and use as part of road and pavement construction and temporary works (working platforms).
- Import of subsoil and topsoil in accordance with the Construction Phase MMP.
- The installation of an engineered cover system in gardens and public open space, likely to comprise:
 - » a high visibility bonded geogrid (factory bonded geogrid and nonwoven geotextile) to act as a marker / separator / hard to dig layer; and
 - » 450mm of Subsoil and/or Topsoil (minimum 150mm Topsoil) in public open space; or
 - » 600mm of Subsoil and/or Topsoil (minimum 150mm Topsoil) in gardens.
 - » Deepening will be required for tree pits.
- Installation of barrier pipework for water supplies.
- Disposal of all excavated historical Made Ground soils that had to be excavated during construction (due to waste regulations).

The methodology for the remediation should be set out in a Remediation Strategy (which will include the 'Implementation Plan', the 'Verification Plan' and the 'Long Term Monitoring and Maintenance Plan'), which will need to be submitted to the warranty provider and the regulatory authorities for approval.

In addition, the production of a Materials Management Plan and its approval by a Qualified Person may be required to allow reuse of suitable material at the site in accordance with waste regulations.

Verification reports by a competent independent geo-environmental specialist will be required following completion of any remedial works (including ground gas membrane installation).

