

SUMMARY DRAINAGE REPORT



APPENDIX B – GROUND INVESTIGATION REPORT



GROUND INVESTIGATION LAND AT CENTRAL AVENUE GRAVESEND

**Prepared for: Avery Healthcare Limited, Octopus Healthcare
and Willowbank Healthcare Developments Ltd**

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GROUND INVESTIGATION LAND AT CENTRAL AVENUE GRAVESEND

1 INTRODUCTION

In January 2022, ASL were instructed by Avery Healthcare Limited to undertake the necessary ground investigation and consultancy services associated with the proposed development of the site known as Land at Central Avenue, Gravesend.

A ground investigation is required in order to determine the geotechnical properties of the ground conditions at the site ahead of its proposed development. It is understood that the proposed development comprises the demolition of the existing structures and redevelopment to provide a sixty-two bedroom care home (Use Class C2) together with associated access, car and cycle parking, structural landscaping, and amenity space provision. A proposed development layout is presented as Appendix I.

ASL has previously completed a Desk Study Report (report reference 002-21-719-11, dated February 2021). This report assessed the potential for environmental and geotechnical risk issues and liabilities pertaining to the future development of the site. Based on the findings of the desk study it was recommended that an intrusive ground investigation was completed ahead of any development works to determine the founding properties of the underlying ground conditions and to determine the actual contaminative status of the site. It was also recommended that the intrusive investigation should include an assessment of hazardous ground gas.

The scope of works for this project was set out in ASL's proposal reference 002-21-719.elo.3529Rev1, dated 26th January 2022 which was formally accepted by Avery Healthcare Limited in their email dated 27th January 2022 together with associated purchase order number HL-Gravesend-019.

This report presents the factual results from an intrusive investigation and subsequent laboratory analyses and monitoring together with interpretative comment in terms of the contaminative status of the site and the geotechnical properties of the ground conditions encountered at the site in relation to the proposed development. This report should be read in conjunction with ASL's Desk Study Report for the site.

This report has been prepared for the sole benefit of the joint Clients, Avery Healthcare Limited, Octopus Healthcare and Willowbank Healthcare Developments Ltd and their associated representatives and agents. The report has been written based on the results of data searches and ground conditions encountered at the time of the investigation and the results of subsequent analyses. Future changes in legislation and advances in current best practises or provision of more detailed design proposals will result in this report requiring review and possible further assessment after the date of issue. The general notes section within this report should be noted in relation to the limitations of this investigation and assessment.



2 THE SITE

The site is located to the south-west of the junction between Central Avenue to the east and Ascot Road to the north approximately 1.8km to the south of Gravesend town centre at approximate National Grid Reference TQ649724 as presented as Figure 1.

The site comprises a rectangular shaped piece of land with maximum dimensions of approximately 65m by 60m with the long axis aligned east to west. The site is generally flat lying with only minor elevation changes present.

The site is separated into two main areas.

The first area comprises the majority of the site in the north and east. This portion of the site is occupied by the Ascot Arms public house. During the site walkover the public house was not in use and the windows and doors had been secured against unauthorised access with steel sheet panels.

The public house is constructed with brick walls and a sloping tiled roof and extends to two storeys in height. A cellar hatch is located centrally to the northern elevation indicating that a basement structure is present. The nature and extent of the basement structure is not known.

The public house is generally surrounded by areas of tarmacadam hardstanding to the north-east, north and north-west used for access and vehicle parking. An electrical substation is located in the north-west of this area.

The public house is generally surrounded by soft landscaped areas to the south-east, south and west. Locally picnic benches are present in the south providing outside seating areas. A covered decking area is located on the south-eastern elevation of the public house. A palisade fence runs from the south-east of the site to the north-west of the site. This palisade fence separates the site from the remainder of the site in the south and south-west and is surrounded by mature trees.

The second area in the south and south-west comprises a portion of a larger grassed playing field.

The northern and eastern boundaries of the public house portion of the site are generally formed by heras fencing and locally concrete Jersey Blocks at vehicle access points to prevent unauthorised access. The western boundary is formed by wooden fencing in the north and metal palisade fencing centrally and in the south. The southern boundary is not physically marked with this area open to further areas of grassed playing field.

The site is bound to the east by Central Avenue with residential dwellings beyond, to the north by Ascot Road with residential dwellings beyond, to the west by Aintree Close with residential dwellings beyond and to the south by a playing field with residential dwellings beyond.

The general site layout is presented as Figure 2.

It is understood that the proposed development comprises the demolition of the existing structures and redevelopment to provide a sixty-two bedroom care home (Use Class C2) together with associated access, car and cycle parking, structural landscaping, and amenity space provision. A proposed development layout is presented as Appendix I.



3 ENVIRONMENTAL SETTING

The British Geological Survey (BGS) Sheets No. 271 – Dartford (Solid and Drift) and the Geology of Britain Viewer indicates the site to be devoid of drift deposits and to be directly underlain by solid geology comprising the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated). The chalk stratum is generally described as 'white, soft with courses of flint'. The chalk stratum is indicated to be 70m thick in the vicinity of the site.

In addition to the published geology, it is expected that Made Ground and/or Topsoil will be present at the surface of beneath hardstandings given the current use of the site.

The site is located in an area that may not be affected by coal mining and at unlikely risk from non-coal mining activities.

The site is located in an area at 'inconclusive' risk from rock mining. There is one man made mining cavity located within 0.5km of the site. The listing relates to a vertical shaft with chambers at the base for the extraction of chalk located approximately 270m to the south.

There are no BGS recorded mineral sites located within 0.5km of the site.

The site is located in an area indicated to have a very significant soluble rock risk with a 'high possibility' of occurrence, however there are no recorded natural cavities in the vicinity of the site.

The environmental database search indicates the site is in a lower probability radon area and that new developments or extensions do not require radon protection measures.

The Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) is classified by the EA as a 'Principal Aquifer'.

The site is located in a Source Protection Zone (SPZ) II (Outer Protection Zone) and an SPZ III (Total Catchment). A boundary with a SPZ I (inner protection zone) is located approximately 265m to the north.

There are four abstractions from groundwater located within 1.0km of the site. The first listing relates to the abstraction of groundwater for industrial processing located approximately 445m to the east. The second listing relates to the abstraction of groundwater for spray irrigation located approximately 755m to the south-west. The remaining listings relate to the abstraction of groundwater for potable supply located approximately 765m and 840m to the north.

The nearest surface water feature is an unnamed stream located approximately 815m to the west. The unnamed stream is not classified chemically or biologically by the EA in the vicinity of the site.

There is one abstraction from surface water within 1.0km of the site. This listing relates to the abstraction of surface water for sand and gravel washing located approximately 760m to the north.



4 GROUND INVESTIGATION, TESTING AND MONITORING

4.1 Ground Investigation

The scope of works was defined for the project by ASL and comprised six windowless sample boreholes and one hand dug trial pit. The intrusive investigation was designed to target the location of the proposed development, to target potential sources of contamination and to provide general site coverage within accessible areas. The investigation was completed to obtain information relating to the contaminative status of the site and the geotechnical properties of the underlying ground conditions. It should be noted that the locations of exploratory locations have been limited by the presence of existing structures. The positions of the exploratory holes have been surveyed and plotted approximately on Figure 2. The investigation works were completed under the supervision of a UXO specialist who cleared all exploratory locations.

The ground investigation was carried out in general accordance with BS5930+A1 (2020) 'Code of Practice for Site Investigations' and BS10175+A2:2017 'Investigation of Potentially Contaminated Sites - Code of Practice' and in accordance with current best practice.

The scope of works for the ground investigation was as follows:

- 6 No. Windowless Sample (WS) boreholes to a maximum depth of approximately 5.45m bgl;
- 1 No. hand dug trial pit (HP) to a depth of approximately 0.56m bgl;
- Insitu standard penetration tests (SPT) at regular intervals within all WS;
- Installation of gas and groundwater monitoring wells at selected WS (3 No.);
- Chemical and geotechnical laboratory testing of selected soil samples;
- Gas and groundwater monitoring programme.

The ground investigation was undertaken on 17th February 2022. The intrusive investigation was supervised by a suitably experienced geotechnical engineer from ASL. The exploratory holes were logged by the supervising engineer and the logs are presented in Appendix II.

4.2 Gas and Groundwater Monitoring

Monitoring wells were installed at WS1, WS3 and WS6. Details of the response zones are presented on the exploratory hole logs in Appendix II.

Two gas and groundwater monitoring events were completed on 3rd and 10th March 2022. The monitoring events comprise level measurements of methane, oxygen, carbon dioxide, carbon monoxide, hydrogen sulphide, relative and atmospheric pressure, gas flow rate and groundwater level.

The results of the gas and groundwater level monitoring are presented in Appendix II.

4.3 Permeability Testing

Falling head permeability testing was completed at all of the monitoring installations on 10th March 2022. The falling head permeability tests were completed by filling the installations with clean water and monitoring the rate at which the water fell.

The results of the permeability testing are presented in Appendix II.



4.4 Chemical Laboratory Testing

Selected soil samples were scheduled for chemical testing for a range of contaminants in order to determine the general contaminative status of conditions on the site.

The samples were scheduled for chemical laboratory testing for the following determinants:

Arsenic, Boron (water soluble), Beryllium, Cadmium, Chromium (total and VI), Copper, Cyanide (free and total) Lead, Mercury, Nickel, Selenium, Vanadium, Zinc, Poly-cyclic Aromatic Hydrocarbons (PAH), Total Petroleum Hydrocarbons (TPH), pH, Phenols, Sulphate (soluble), Total Sulphur, Total Sulphate, fraction of organic carbon, Asbestos Presence and ID (Made Ground and Topsoil only).

Further to this, selected samples were scheduled for a full Waste Acceptance Criteria (WAC) suite.

Selected soil samples were scheduled for the following determinants in leachate:

Arsenic, Boron, Beryllium, Cadmium, Calcium, Chromium (total and hexavalent), Copper, Cyanide (free and total), Dissolved Organic Carbon, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc and pH.

The chemical testing is being undertaken by a UKAS accredited laboratory in accordance with the MCERTS accreditation where available.

The results of the chemical laboratory testing are presented in full in Appendix III

4.5 Geotechnical Laboratory Testing

Geotechnical laboratory testing was completed on selected soil samples. The samples have been scheduled for moisture content analysis and Atterberg Limit testing to assess volume change potential and materials properties and sulphate testing to assess the concrete classification for the proposed development.

The results of the laboratory testing are presented in Appendix III and IV.



5 GROUND AND GROUNDWATER CONDITIONS

5.1 Materials Encountered

The BGS indicates the site to be devoid of drift deposits and to be directly underlain by solid geology comprising the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated).

The intrusive investigation generally confirmed the published geology of chalk. In addition to the published geology, minor thicknesses of Made Ground and/or Made Ground Topsoil were encountered at the surface or beneath hardstandings across the site. Further to this, cohesive materials were encountered at all exploratory locations above the chalk materials that have been interpreted as drift geology of Clay with Flints.

Table 1 presents a summary of the ground conditions encountered during the intrusive investigation. Full details of the conditions encountered are presented on the exploratory hole logs in Appendix II.

Table 1 Summary of Strata Encountered

Description	Top of Unit (m bgl)		Thickness of Unit (m)		SPT 'N' Value
	Min	Max	Min	Max	
Made Ground (Topsoil) Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets and occasional roots. Gravel is angular to subrounded fine to coarse flint, chalk, brick, plastic, charcoal and wood.	0.00	0.00	0.20	0.30	None Taken
Made Ground Black, grey and brown sandy locally slightly clayey angular to subangular fine to coarse GRAVEL of roadstone and tarmacadam.	0.00	0.00	0.30	0.30	None Taken
Clay with Flints Soft to stiff locally dry brown and light brown slightly gravelly slightly sandy to sandy silty CLAY with rare to occasional rootlets and locally rare roots and locally rare subangular cobbles of flint. Gravel is angular to subrounded fine to coarse flint and chalk.	0.20	0.30	0.36*	1.90	7-16
Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) Recovered as structureless CHALK composed of locally friable white, cream, yellow and yellow brown slightly sandy locally slightly gravelly to gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. Locally rare to occasional angular to subangular fine to coarse gravel of rinded flint. Locally rare subangular cobbles of rinded flint.	0.70	2.20	0.81*	4.75*	11->50

Notes: * = Base not proven

In addition to the strata summarised in Table 1, concrete paving slabs and associated mortar and concrete was encountered at the surface at WS3 to a depth of 0.28m bgl.

Three SPTs were completed within typically cohesive materials interpreted as Clay with Flints that recorded SPT 'N' values between 7 and 16 indicating low to high strength cohesive materials.

Twenty-three SPTs were completed within typically cohesive materials interpreted as Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) that recorded SPT 'N' values between 11 and >50 indicating the presence of competent chalk materials. Based on the findings of the intrusive



investigation, the higher SPT 'N' values are coincident with flint bands within the chalk materials and are therefore not considered to be representative of the bulk chalk material properties.

A plot of SPT 'N' value versus depth below ground level is presented as Figure 3.

Three samples of cohesive materials interpreted as Clay with Flints recovered from depths of 0.7m and 1.6m bgl were scheduled for Atterberg Limit testing to determine the geotechnical properties of the materials encountered.

The results of the Atterberg Limit testing indicate the Clay with Flints materials tested to comprise clays of low to intermediate plasticity with liquid limits of between 29% and 40%, plastic limits of between 11% and 19% and modified plasticity indices of between approximately 14.3% and 18.9% indicating the materials tested to be of low volume change potential.

Natural moisture contents of between 10% and 21% were recorded for the materials tested indicating the materials to generally be in a state of potential of desiccation.

Two samples of cohesive materials interpreted as the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) recovered from depths of 0.8m and 2.6m bgl were scheduled for Atterberg Limit testing to determine the geotechnical properties of the materials encountered.

The results of the Atterberg Limit testing indicate the chalk materials tested to comprise clays of low to intermediate plasticity with liquid limits of 35% and 49%, plastic limits of between 15% and 27% and modified plasticity indices of approximately 14% and 19.8% indicating the materials tested to be of low volume change potential.

Natural moisture contents of 9% and 29% were recorded for the materials tested indicating the shallower materials tested to be in a state of potential of desiccation.

The geotechnical laboratory analysis test results are presented in full in Appendix IV.

5.2 Permeability Testing

Falling head permeability testing was completed at all monitoring installations on 10th March 2022. The falling head permeability tests were completed within chalk materials and locally cohesive materials interpreted as Clay with Flints.

The falling head permeability tests recorded infiltration rates between 4.22×10^{-6} m/s and 1.58×10^{-4} m/s at WS1 and WS6 respectively.

Full details are presented in Appendix II.

5.3 UXO

The UXO supervision and magnetometer surveying completed during the fieldwork did not identify any evidence of potential UXO at the exploratory locations.

5.4 Visual and Olfactory Evidence of Contamination

No significant visual or olfactory evidence of contamination was noted during the intrusive investigation. However, the near surface soils were noted to contain construction



materials. Materials of this type are considered to be a potential source of contamination in the form of asbestos.

Based on the visual and olfactory evidence of contamination and based on the findings of the desk study, a general suite of analysis including asbestos was generally considered appropriate to confirm the contaminative ground conditions at the site.

It is noted that the desk study identified the electrical substation in the north-west to be a potential source of contamination in the form of oil based hydrocarbons and polychlorinated biphenyl (PCB). A selected soil sample has been scheduled for hydrocarbon testing in this area as a risk driver species and to characterise the contaminative status of the site. If significant hydrocarbons are not identified, it is considered that PCB will also not be present.

5.5 Groundwater

Groundwater was not encountered during the intrusive investigation however damp strata was identified at WS1, WS3, WS5 and WS6 at depths from approximately 3.0m and 3.3m bgl.

Groundwater was not recorded within any of the monitoring installations during the monitoring programme.

Full details are presented in Appendix II.

5.6 Gas

As part of the monitoring programme below ground gas levels within monitoring standpipes were measured during two events completed on 3rd and 10th March 2022. The results are presented in full in Appendix II.

Methane, hydrogen sulphide and carbon monoxide were not recorded in excess of the relevant analytical detection limits of the apparatus used during the monitoring programme.

Carbon dioxide was recorded in excess of the analytical detection limits of the apparatus used at all of the monitoring installations during the monitoring programme except WS1 during the first monitoring event at concentrations between 0.6% and 0.9% v/v.

Oxygen was recorded above the analytical detection limits of the apparatus used at all monitoring installations during the monitoring programme at concentrations between 19.2% and 20.7% v/v.

Average downhole pressures and average flow rates were recorded as zero during the monitoring programme.

The first monitoring event was completed during a period of lower atmospheric pressure whilst the second monitoring event was completed during a period of higher atmospheric pressure.



6 GEOTECHNICAL ASSESSMENT

6.1 General

It is understood that the proposed development comprises the demolition of the existing structures and redevelopment to provide a sixty-two bedroom care home (Use Class C2) together with associated access, car and cycle parking, structural landscaping, and amenity space provision. A proposed development layout is presented as Appendix I.

The ground conditions at the site generally comprise a limited thickness of Made Ground Topsoil or Made Ground at the surface or beneath hardstandings. The superficial deposits were underlain by cohesive materials interpreted as Clay with Flints and in turn chalk materials of the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated).

6.2 Buried Structures

A cellar hatch is located centrally to the northern elevation indicating that a basement structure is present beneath the existing public house. The nature and extent of the basement structure is not known. This structure has the potential to impact on the foundation solution for the proposed development.

During the demolition and site clearance works, it is recommended that the extent and depth of any significant excavations carried out to remove buried structures are surveyed. This foundation assessment should be reviewed following the completion of these works to confirm that the recommendation remains appropriate.

It is recommended that any large or deep excavations are backfilled with geotechnically suitable materials in accordance with an engineering specification for the site.

6.3 Foundation Assessment

Due to their inconsistency and variability the Made Ground Topsoil and Made Ground materials are not considered a suitable founding stratum in their current condition.

It is considered that conventional strip or pad foundations could be adopted for the proposed development with foundations placed within the Clay with Flints or chalk materials at a minimum depth of 1.0m bgl (assuming restricted new planting) and designed to a net allowable bearing pressure of 100kN/m² to limit total settlements to 25mm and differential settlements to acceptable levels. Foundations should be deepened through any soft, loose or otherwise unsuitable materials particularly in the vicinity of WS2 where foundations up to approximately 1.5m bgl and placed at least 150mm into the founding stratum.

Subject to the nature and extent of any excavations created by the removal of the existing basement, conventional foundations may not provide a practical or economic foundation solution in this area. However, conventional foundations may be adopted in this area and placed within the natural Clay with Flints or chalk materials. Foundations should be stepped down within the natural strata from areas outside the extent of the basement and extending through all fill materials and placed at least 150mm into natural strata. The excavation developed to remove the basement should be filled with suitably compacted fill.



Should higher loads be required for the proposed development, it is considered that the use of conventional foundations may not be feasible and that an alternative foundation solution such as piles should be considered for the site. If a piled foundation solution is required, it is recommended that deeper boreholes are undertaken at the site to obtain further geotechnical information on the deeper ground conditions.

Where foundations span across varying strata, i.e. Clay with Flints and chalk materials, such footings could be subject to differential settlement potentially leading to structural distress. Consideration should be given to inclusion of appropriate mesh reinforcement to span across the interface between different stratum types extending at least 1m either side of the interface. This should reduce the potential for differential settlement to occur.

Plasticity index results indicate the cohesive Clay with Flints and chalk materials to be of low volume change potential. Therefore, where foundations are within the influencing distance of existing, proposed or recently removed trees, foundations may need to be locally deepened in accordance with NHBC guidelines for low volume change potential soils.

The cohesive materials have been identified to be in a potential state of desiccation, therefore consideration should be given to the inclusion of appropriate heave precautions into the foundation design.

All foundations should be appropriately designed in accordance with CIRIA C574 'Engineering in Chalk'.

6.4 Floor Slabs

Due to the presence of shallow cohesive nature strata, it is recommended that suspended floor slabs with a suitable floor void are adopted for the proposed development.

6.5 Road Pavements

It is considered that for the basis of design of any areas of hardstandings or road pavements a design CBR value of 3% could be adopted within the natural strata following the removal of any Made Ground Topsoil and Topsoil materials and suitable preparation of the formation layer. A design CBR value of 1% could be adopted within the Made Ground following the removal of the overlying Topsoil.

It should be noted that the formation should be proof rolled and any 'soft' spots removed and replaced with suitable fill. The formation is likely to deteriorate if left uncovered and therefore the road should be constructed within a short time frame after stripping of superficial materials or a protective layer should be left in place. The natural strata at formation level may be frost susceptible and suitable precautions should be adopted.

6.6 Excavations

Excavation of the materials encountered on site is likely to be achieved using conventional plant, however, should any obstructions remain in the ground at shallow depths, such as former foundations the use of pneumatic/hydraulic breakout equipment may be required, particularly within confined excavations.

Shallow excavations should remain stable in the short term however, deeper excavations may be susceptible to collapse. Consequently, temporary support should be considered for all excavations where collapse is to be avoided. Heavier duty closed shoring should be



provided for any excavation where man entry is necessary in compliance with statutory requirements to ensure safe working conditions.

6.7 Dewatering

Groundwater was not encountered during the intrusive investigation or subsequent monitoring programme. Damp strata was locally encountered from depths between approximately 3.0m and 3.3m bgl.

It is therefore considered unlikely that groundwater issues will occur within shallow excavations associated with the proposed development. Where localised inflows occur within shallow excavations, it is considered these may be sufficiently controlled by conventional sump pumping techniques. However, instability and spalling of excavations is anticipated in conjunction with groundwater inflows.

6.8 Buried Concrete Classification

Based on the results of chemical laboratory testing undertaken on samples recovered from the site, it is considered that a Design Sulphate Class “DS-1” (based on total potential sulphate) and an ACEC site classification “AC-1” should be adopted for all concrete placed in contact with the ground within open excavations, such as foundations and services.

6.9 Drainage Design and Surface Water Management

Falling head permeability tests were completed at all monitoring installations on 10th March 2022. The falling head permeability tests recorded infiltration rates between 4.22×10^{-6} m/s and 1.58×10^{-4} m/s at WS1 and WS6 respectively.

Based on the results of the permeability testing completed, the use of shallow soakaways or other infiltration drainage systems may be feasible within the chalk strata present at the site. It is recommended that soakaways should be appropriately designed and located away from proposed or existing structures in accordance with CIRIA C574 ‘Engineering in Chalk’.

If soakaways or other infiltration drainage systems are adopted at the proposed development, it is recommended that trial pit soakaway testing is completed at the locations of proposed drainage structures to confirm the ground conditions and drainage characteristic in these areas.

It is recommended that the advice of a specialist drainage engineer is sought with regards to the design and installation of any drainage systems which may form part of the proposed development.

6.10 Gas Protection Measures

The environmental database search indicates the site to be in a lower probability radon area and that no radon protective measures are necessary in the construction of new dwellings or extensions.

The gas monitoring results indicate gas conditions corresponding to a worst case Hazardous Gas Flow (HGF) of <0.07/hr indicating Characteristic Situation 1 (CS1) characterised as very low potential hazard.



Based on the results of the ground gas monitoring, the findings of the desk study that did not identify significant potential sources of hazardous ground gas and guidance provided in BS8485, it is considered that gas protection measures are not required as part of the proposed development.

This conclusion should be agreed with the relevant regulatory authorities prior to the commencement of development works to confirm that the assessment completed meets with their requirements and further monitoring to verify these results is not required.

6.11 Ground Dissolution Risk

The site is located in an area indicated to have a very significant soluble rock risk with a 'high possibility' of occurrence, however there are no recorded natural cavities in the vicinity of the site. Further to this, the environmental database search indicates the site to be at 'very low' risk from ground dissolution stability hazards.

Based on the findings of the Desk Study Report, the potential risk from ground dissolution at the site is considered to be very low.

It is considered that the findings of the current intrusive investigation have confirmed the findings of the Desk Study Report with competent chalk materials encountered at shallow depth across the site. However, it is recommended that where less competent chalk or any other anomalous ground is encountered during the development works the materials are inspected by a suitably qualified geotechnical engineer to assess whether the materials pose a constraint to the development works.



7 CONTAMINATION ASSESSMENT – HUMAN HEALTH

7.1 Introduction

The results of the chemical laboratory testing undertaken on selected soil samples (see Section 4.4), have been compared where possible to the relevant industry guidance as detailed in the following section.

Defra have published Development of Category 4 Screening Levels (C4SL) for Assessment of Land Affected by Contamination (document reference SP1010, dated 20th December 2013). This document includes proposed C4SL for six contaminants of concern. In March 2014, it was agreed that the C4SL could be used as part of the planning process. The chemical laboratory test results have therefore been compared where relevant to the C4SL. The C4SL have been derived based on the proposed end use of the site. In this instance an end use of 'residential without gardens' has been considered the most appropriate. Should the proposed development at the site change the potential risk posed by the identified contamination should be reviewed.

It is noted that the C4SL for benzo(a)pyrene has been derived as a surrogate marker for all genotoxic PAH species including this determinant assuming the assessed site investigation data conforms with the Culp et al 2010 assessment. The remaining genotoxic PAH species included in the priority 16 PAH suite of analysis are benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(ghi)perylene, chrysene, dibenzo(ah)anthracene and indeno(123cd)pyrene. An assessment of the site investigation data has been completed and shown the site investigation data to conform with the upper and lower limits from Culp 2010 assessment and therefore assessment criteria are not considered necessary for these determinants and benzo(a)pyrene may be used as a surrogate marker.

C4SLs have not been provided for the full range of determinants assessed as part of this contamination assessment. Further Generic Assessment Criteria (GAC) in accordance with this guidance are currently in production. Contaminated Land Exposure Assessment (CLEA) guidance to assess the risk to human health (Document References SC050021/SR2, SC050021/SR3, SC050021/SR4 and SC050021/SR7) is available. GAC for the relevant contaminants of concern included in this report have been derived in accordance with this CLEA guidance and spreadsheet Version 1.06. These criteria are considered to remain appropriate as C4SL are proposed to be more pragmatic whilst still highly precautionary when compared to the previously published guidance and associated SGVs. The GAC in this report are therefore considered to be conservative and define a lower level of risk in consideration of the potential risk to human health when compared to the current guidance and C4SL. The derived GAC are presented in Appendix V.

Laboratory data at the site recorded an average result of approximately 3.88% for soil organic matter calculated using fraction of organic carbon results. The GAC for the site are therefore calculated assuming 3.88% SOM.

7.2 Chemical Test Results - Soils

The results of the chemical laboratory testing undertaken on the selected soil samples are summarised in Table 2. Only those determinants recorded in excess of their relevant laboratory detection limits are assessed here.



At tier 1, TPH (C10-C40) is assessed using the GAC for the aliphatic TPH fraction >C12-C16. This GAC is selected as it is the most stringent TPH fraction GAC representative of the recorded TPH.

It is noted that significant hydrocarbon contamination was not recorded in the vicinity of the electrical substation. As a result, chemical laboratory analysis for PCB's was not considered necessary.

The chemical test results on soil are presented in full in Appendix III.

Table 2 Summary of Soils Data with Respect to Human Health (Tier 1)

Contaminants	Max Conc. (mg/kg)	Defra C4SL mg/kg (Residential without gardens)	CLEA Derived GAC mg/kg (Residential without gardens)	No. of Tests
Arsenic	14	40 (0)	-	5
Beryllium	1.1	-	99.3 (0)	5
Boron	1.3	-	10800 (0)	5
Cadmium	1.4	150 (0)	-	5
Chromium	32	-	1110 (0)	5
Copper	64	-	6590 (0)	5
Lead	110	310 (0)	-	5
Mercury	0.6	-	238 (0)	5
Nickel	27	-	189 (0)	5
Vanadium	42	-	581 (0)	5
Zinc	160	-	40400 (0)	5
TPH (C10-C40)	28	-	201^ (0)	5
Benzo(a)pyrene	1.5	5.3 (0)	-	5
Naphthalene	0.33	-	10.2 (0)	5
Acenaphthene	0.44	-	607^ (0)	5
Fluorene	0.29	-	4940 (0)	5
Phenanthrene	2.9	-	5200 (0)	5
Anthracene	0.37	-	39300 (0)	5
Fluoranthene	3.4	-	1650 (0)	5
Pyrene	2.7	-	3960 (0)	5

Note: 1. Number in brackets represents the number of results above guideline values.
2. ^ Denotes theoretical saturation limit taken as representative.

None of the contaminants of concern summarised in Table 2 are recorded in excess of their relevant screening criterion.

In addition to the determinants summarised in Table 2, asbestos was analysed for in four samples of near surface soils. Asbestos was not identified at any of the samples analysed.

No further assessment of the potential risk from contaminants of concern including asbestos in soil is considered necessary. No remediation of soils in order to be protective of human health is considered necessary.

However, it is also recommended that the chemical laboratory test results within this report should be forwarded to the mains water service provider to ensure that their requirements for service line construction are satisfied.



8 CONTAMINATION ASSESSMENT – CONTROLLED WATERS

8.1 Introduction

To assess the potential risk to controlled waters from the recorded concentrations in soils, the use of leachability is generally used to determine contaminant mobility within the ground with the results of these tests compared to the determinants respective environmental quality standards (EQS) or other applicable standards such as UK drinking water standards (DWS). As groundwater has been identified as potentially at risk, the DWS is used in this assessment where available. For organic determinants, the use of leachability is not considered reliable. These determinants are assessed using half the inert WAC criteria. Exceedances of these criterion are considered to require further assessment.

8.2 Summary of Results - Soils

Table 3 presents a summary of the screening criteria compared with the recorded concentrations of determinants at the site. Only those determinants recorded in excess of their relevant laboratory detection limits are assessed here.

The chemical test results are presented in full in Appendix III.

Table 3 Summary of Soils Data with Respect to Controlled Waters (Tier 1)

Determinant	Max Conc. (mg/l)	Tier 1 Value (mg/l)	No. of Exceedances
Arsenic	0.0043	0.01	0 (3)
Beryllium	0.0002	0.004	0 (3)
Boron	0.038	1	0 (3)
Chromium	0.0016	0.05	0 (3)
Copper	0.047	2	0 (3)
Lead	0.0046	0.01	0 (3)
Nickel	0.0083	0.02	0 (3)
Vanadium	0.0071	0.06	0 (3)
Zinc	0.016	5	0 (3)
TPH (C10-C40)	28	250	0 (5)
PAH total	18.4	50	0 (5)

Notes 1. Numbers in brackets denote the number of tests undertaken.
2. Organic determinant concentrations in mg/kg.

None of the contaminants of concern summarised in Table 3 are recorded in excess of their relevant screening criteria.

Based on the findings of this contamination assessment, no further assessment of the potential risk to controlled waters from contamination present in soil is considered necessary. No remediation of soil to be protective of controlled waters is considered necessary.



9 WASTE DISPOSAL

Based on the results of the chemical laboratory analysis, the Made Ground Topsoil and Clay with Flints at the site may be classified as inert in terms of waste disposal and should be considered as such until further testing is completed to confirm otherwise.

Chemical laboratory analysis has not been completed on the chalk materials. However, it is anticipated that the chalk materials may be classified as inert following suitable classification testing.

Prior to disposal, the characteristics of any excavated soils will need final classification in consultation with the relevant waste disposal facility and further testing and analysis may be required on the actual materials requiring off-site disposal.



10 DISCOVERY STRATEGY

There is the potential for more significantly contaminated materials, differing ground conditions and buried structures to be present at the site between exploratory hole locations. Should any of these conditions be identified during the development works, ASL should be contacted immediately to allow further assessment to be completed to ensure the identified critical receptors are not at risk.

This assessment may take the form of additional intrusive investigation, sampling and laboratory analyses subject to the nature of the conditions encountered.



11 CONCLUSIONS AND RECOMMENDATIONS

A ground investigation has been completed at the site, to characterise the ground and groundwater conditions. A geotechnical and contamination assessment has been completed based on the results of these investigations. The conclusions of this assessment are summarised as follows:

It is recommended that an appropriate asbestos survey is completed ahead of demolition the demolition works. If asbestos is identified, these materials should be removed by a suitably licensed contractor.

A basement structure is indicated to be present beneath the existing public house. It is recommended that the extent and depth of any significant excavations to remove buried structures are surveyed. This foundation assessment should be reviewed following the completion of these works to confirm that the recommendation remains appropriate.

It is recommended that any large or deep excavations are backfilled with geotechnically suitable materials in accordance with an engineering specification for the site.

Conventional strip or pad foundations could be adopted for the proposed development within the Clay with Flints or chalk materials at a minimum depth of 1.0m bgl (assuming restricted new planting) and designed to a net allowable bearing pressure of 100kN/m².

Subject to the nature and extent of any excavations created by the removal of buried structures, traditional foundations may not provide a practical or economic foundation solution in this area. However, conventional foundations may be adopted in this area and placed within the natural Clay with Flints or chalk materials. Foundations should be stepped down within the natural strata from areas outside the extent of the basement and extending through all fill materials and placed at least 150mm into natural strata. The excavation developed to remove the basement should be filled with suitably compacted fill.

Should higher loads be required for the proposed development, an alternative foundation solution such as piles should be considered for the site. If a piled foundation solution is required, it is recommended that deeper boreholes are undertaken at the site to obtain further geotechnical information on the deeper ground conditions.

All foundations should be deepened through any areas of deeper Made Ground, soft, loose or otherwise unsuitable materials.

Consideration should be given to inclusion of appropriate mesh reinforcement to span across the interface between different stratum types to reduce the potential for differential settlement to occur.

Where foundations are within the influencing distance of trees, foundations may need to be locally deepened in accordance with NHBC guidelines for low volume change potential soils.

Consideration should be given to the inclusion of appropriate heave precautions into the foundation design.

All foundations should be appropriately designed in accordance with CIRIA C574 'Engineering in Chalk'.



It is recommended that suspended floor slabs with a suitable floor void are adopted for the proposed development.

A design CBR value of 3% could be adopted within the natural strata and 1% could be adopted within the Made Ground following the removal of any Topsoil materials and suitable preparation of the formation layer. The natural strata at formation level may be frost susceptible and suitable precautions should be adopted.

A Design Sulphate Class “DS-1” and an ACEC site classification “AC-1” should be adopted for all concrete placed in contact with the ground within open excavations, such as foundations and services.

The use of shallow soakaways or other infiltration drainage systems may be feasible within the chalk strata present at the site. It is recommended that soakaways should be appropriately designed and located away from proposed or existing structures in accordance with CIRIA C574 ‘Engineering in Chalk’.

If soakaways or other infiltration drainage systems are adopted at the proposed development, it is recommended that trial pit soakaway testing is completed at the locations of proposed drainage structures to confirm the ground conditions and drainage characteristic in these areas.

Gas protection measures are not required as part of the proposed development.

Ground dissolution risks at the site are considered to be very low. However, it is recommended that where less competent chalk or any other anomalous ground is encountered during the development works the materials are inspected by a suitably qualified geotechnical engineer to assess whether the materials pose a constraint to the development works.

The contamination assessment has not identified a potential risk to human health or controlled waters. No further assessment of the potential risk from contaminants of concern including asbestos in soil is considered necessary. No remediation of soils is considered necessary.

It is also recommended that the chemical laboratory test results within this report should be forwarded to the mains water service provider to ensure that their requirements for service line construction are satisfied.

The Made Ground Topsoil and Clay with Flints at the site may be classified as inert. It is anticipated that the chalk materials may be classified as inert following suitable classification testing.



REFERENCES

ASL 'Desk Study Report, Land at Central Avenue, Gravesend', report reference 002-21-719-11, dated February 2021

BGS Sheet No. 271 – Dartford (Solid and Drift)

British Geological Survey GeoIndex

DEFRA R&D Publication CLR 11 “Model Procedures for the Management of Land Contamination” dated September 2004.

DEFRA R&D Publication CLR 12 “A Quality Approach for Contaminated Land Consultancy” dated 1997.

www.environment-agency.gov.uk

www.ukradon.org

BS5930+A1:2020 “Code of Practice for Site Investigation”

BS10175+A2:2017 “Code of Practice for the Investigation of Potentially Contaminated Sites”

BS1377-1:2016 “Method of Tests for Soils for Civil Engineering Purposes”

Environmental Quality Standards (EQS) for List 1 dangerous substances, EC Dangerous Substances Directive (76/464/EEC)

Guidance on the Water Supply (Water Quality) Regulations 2000 (England) and the Water Supply (Water Quality) Regulations 2001 (Wales), Drinking Water Inspectorate, May 2005.

Concrete – Complementary British Standards to BS EN 206-1 Part 1: Method of specifying and guidance for the specifier (BS 8500-1:2019)

Concrete – Complementary British Standard to BS EN 206-1 – Part 2: Specification for constituent materials and concrete (BS 8500-2:2019)

Environment Agency's Publication 'Methodology for the Derivation of Remedial Targets for Soil and Groundwater to Protect Water Resources' R&D Publication 20

Environment Agency's 'Remedial Targets Worksheet, Release 3.1' (2006)

Total Petroleum Hydrocarbon Criteria Working Group Series Volume 3 and 4, 1997

Human health toxicological assessment of contaminants in soil (Report Reference SC050021/SR2, dated January 2009);

Updated technical background to the CLEA model (Report Reference SC050021/SR3, dated January 2009);

CLEA Software (Version 1.06) Handbook (Report Reference SC050021/SR4, dated September 2009);

Compilation of Data for Priority Organic Pollutants for Derivation of Soil Guideline Values (Report Reference SC050021/SR7, dated November 2008).

NHBC Standards 2022

BS8485 'Code of practice for the characterisation and remediation from ground gas in affected developments', 2019



GENERAL NOTES

The interpretation made in this report is based on the information obtained during the course of the desk study and ground investigation. It should be appreciated that any desk study information is not necessarily exhaustive and that further information relevant to the site and its proposed usage may be available. There may be conditions present on the site that have not been revealed by the ground investigation which as a result have not been addressed within this report.

The accuracy of any map extracts cannot be guaranteed, and it should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.

The qualitative assessment of risk presented in this report presents an assessment of potential pollutant linkages between sources, pathways and receptors. A level of risk is attributed to these linkages. However, a low or insignificant risk does not imply that elevated concentrations of various determinants are not present on the site when compared to background or 'greenfield' conditions.

The level of risk attributed is based on a number of factors and the interpretation of this risk may be applied in a different manner for a different end use or environmental setting. The presence of contaminants may be assessed in alternative ways by institutional bodies regardless of whether an apparent risk is present based on the identified pollutant linkages in this assessment.

This report may express an opinion on possible configurations of strata underlying the site between or beyond the exploratory holes or on the possible presence of features based on either visual, verbal or published evidence, this is for guidance only and no liability can be accepted for its accuracy.

Comments made on ground conditions are based on the observations made at the time of the investigation works. It should be noted that groundwater levels may vary due to seasonal fluctuation or other factors. Observations made with respect to below ground gas concentrations may also vary due to seasonal factors and atmospheric conditions.

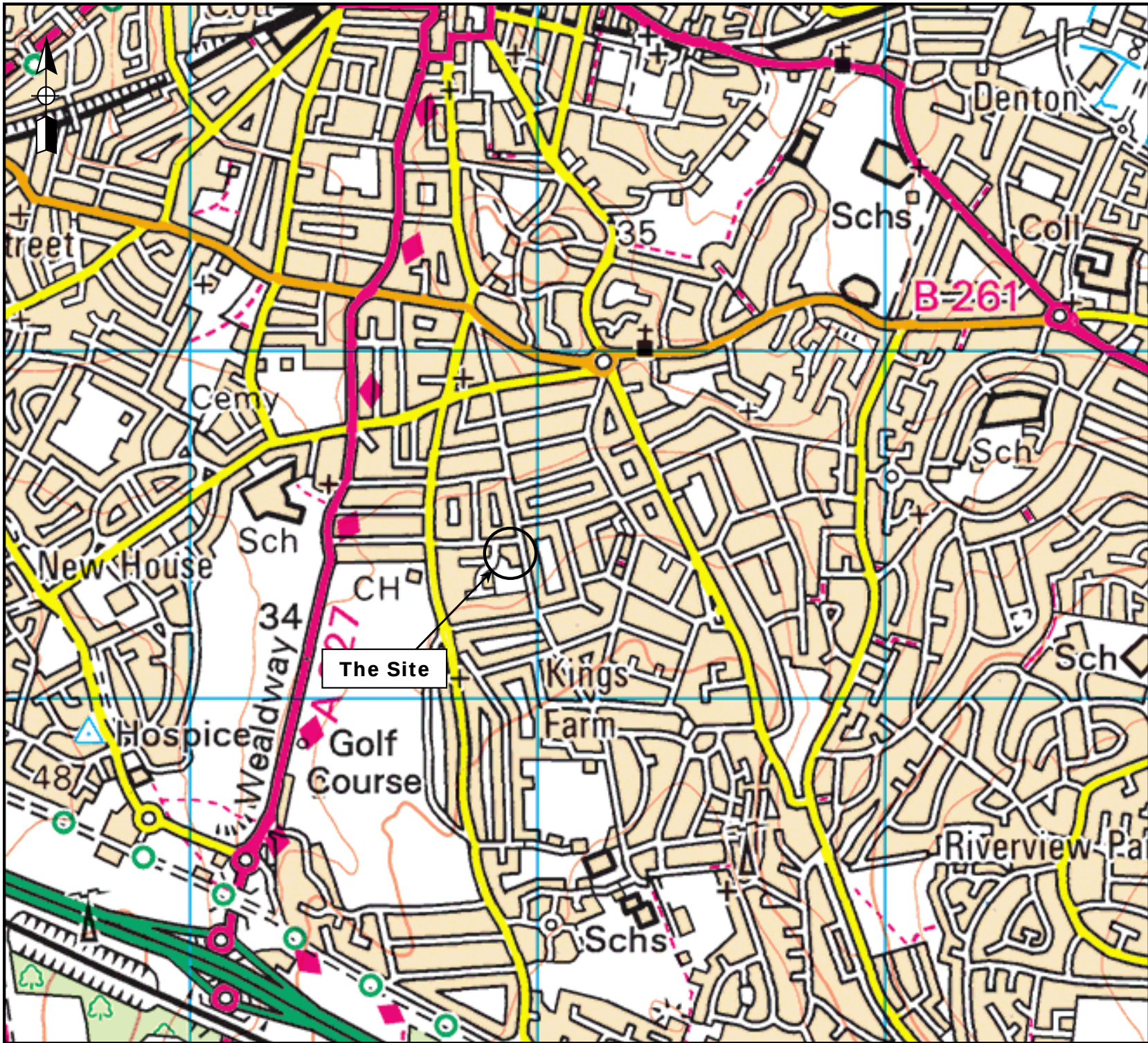
This report has been prepared in relation to the proposed development as detailed herein. Should the nature of the development change following the submission of this report a re-assessment of the conditions recorded on the site may be necessary.

This report may not be used in the assessment of the conditions at any site other than the site described herein.

This report has been prepared for the sole use of the client and the client's agents and advisors in relation to the proposed development as detailed herein. The issue of this report to third parties not involved in the proposed development as described herein is not permitted without the prior permission being received in writing by ASL. Reproduction of this report to include all figures, drawings and appendices is prohibited without the prior written consent of ASL.



FIGURES



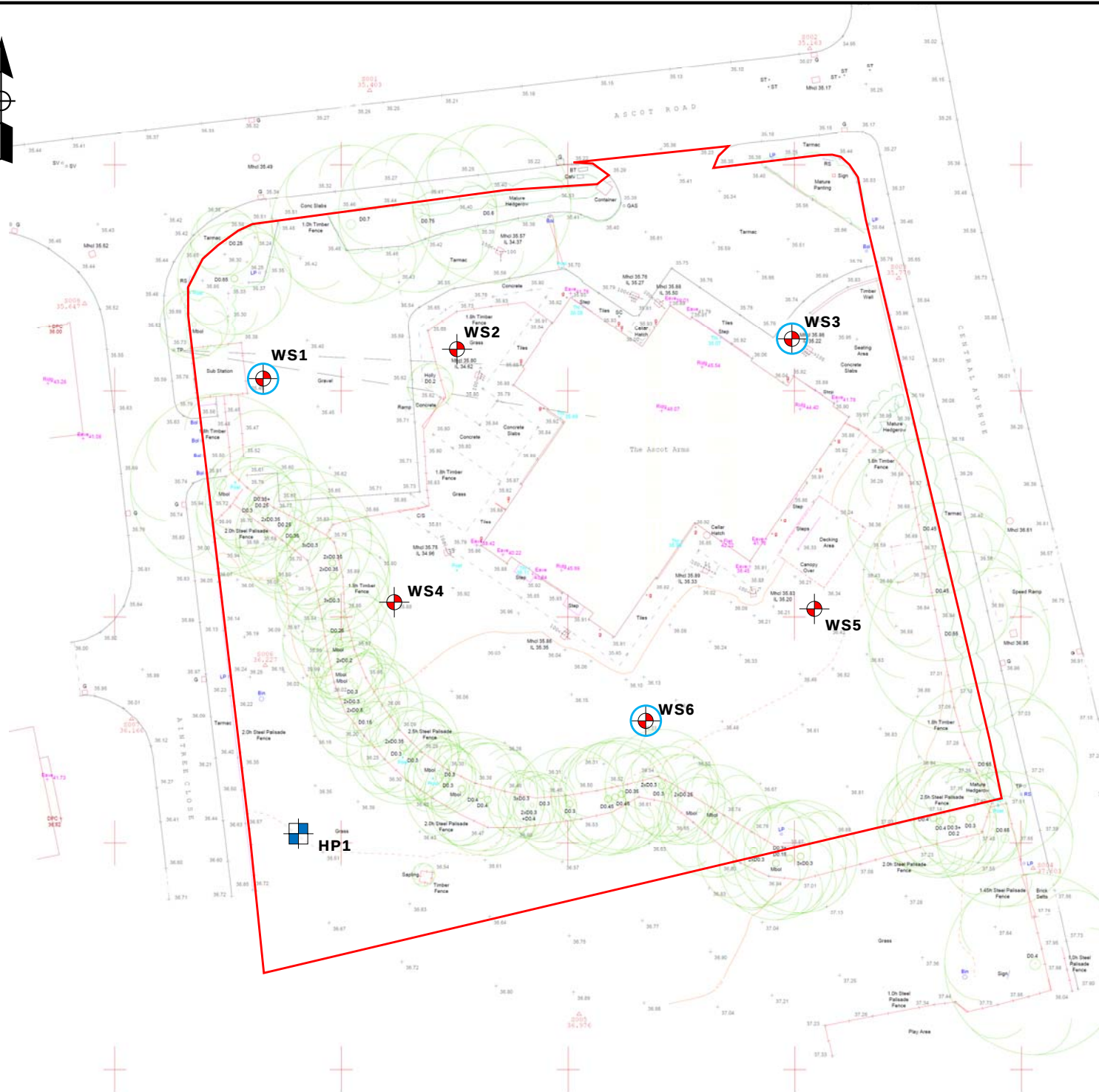
Reproduced under licence to ASL. Licence No. 100044800
OS Map Sheet No. 178 Map of Thames Estuary, Rochester & Southend-on-Sea, 1:50,000 Scale, dated 2016

Drawing No.	Figure 1
Drawing Name	Site Layout Plan
Project	Land at Central Avenue, Gravesend
Client Name	Avery Healthcare Group
Project No.	002-21-719

ASL
Holly Farm Business Park
Honiley
Warwickshire
CV8 1NP

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W: www.aslenvironmental.co.uk





Key

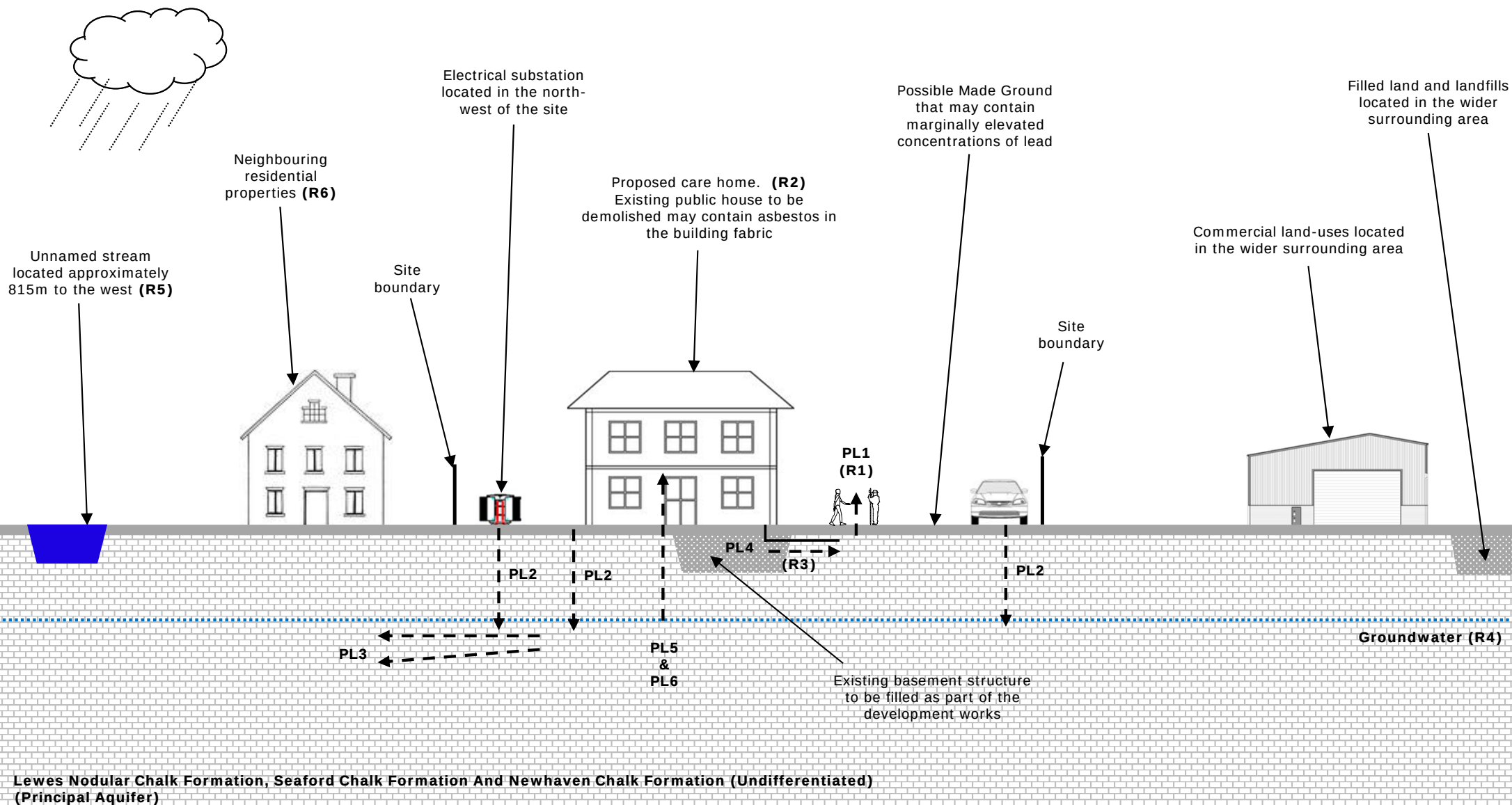
-  Windowless Sample Borehole Location
-  Hand excavated Trial Pit
-  Monitoring Installation
-  Approximate Site Boundary

Drawing No.	Figure 2
Drawing Name	Site Location Plan
Project	Land at Central Avenue, Gravesend
Client Name	Avery Healthcare Group
Project No.	002-21-719

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Drawing No.	Figure 3
Drawing Name	Conceptual Site Model
Project Name	Land at Central Avenue, Gravesend
Client Name	Avery Healthcare Group
Project No.	002-21-719

Summary of Pollutant Linkages (for full details see contamination associated report)

Receptors:

R1 - Construction and maintenance workers;
R2 - Current and future site users;
R3 - Service Lines;
R4 - Groundwater;
R5 - Surface watercourses;
R6 - Neighbouring properties and residents.

Pathways:

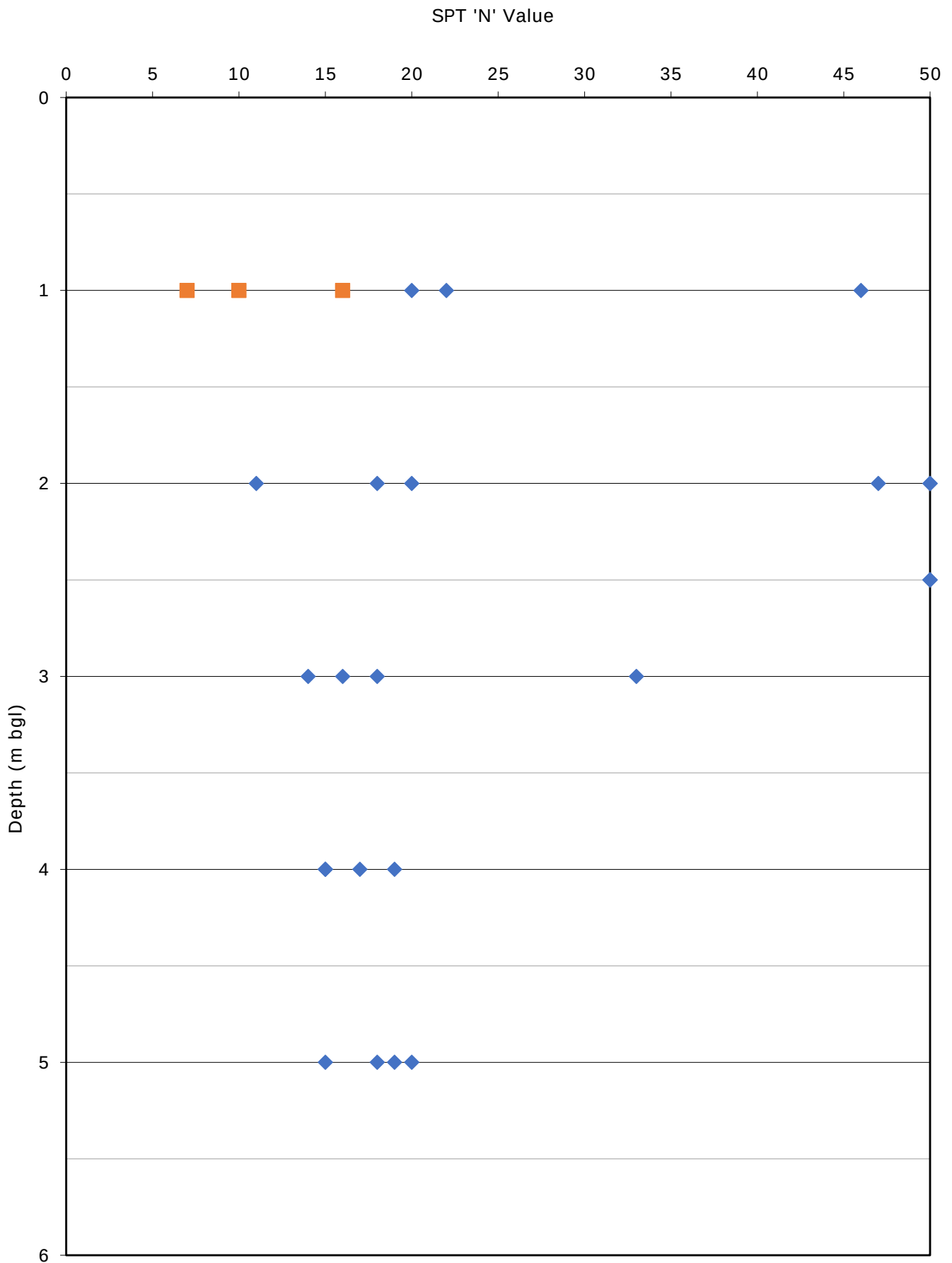
PL1 - Direct Physical Contact;
PL2 - Migration from soils to groundwater via leaching;
PL3 - Migration within groundwater;
PL4 - Migration via service lines;
PL5 - Volatilisation of contaminants from soils and groundwater;
PL6 - Migration of hazardous ground gas.

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Drawing No.	Figure 4	Legend ■ Clay with Flints ◆ Chalk	ASL Holly Farm Business Park Honiley Warwickshire CV8 1NP T: +44 (0)1926 485 508 E: info@aslenvironmental.co.uk W: www.aslenvironmental.co.uk	
Drawing Name	SPT 'N' Value Versus Depth Below Ground Level			
Project Name	Land at Central Avenue, Gravesend			
Client Name	Avery Healthcare Group			
Project No.	002-21-719			



APPENDIX I

PROPOSED DEVELOPMENT LAYOUT



Rev.



APPENDIX II

FIELD RECORDS

Land at Central Avenue, Gravesend

Project No.:

002-21-719

Hole Type

TP

Location:

Central Avenue, Gravesend, Kent

Co-ords:
564897.69 E
172380.33 N

Level:
36.46m AOD

Scale

1:25

Client:

Avery Healthcare Ltd, Octopus Healthcare and Willowbank Healthcare Developments Ltd

Start	Dates:	Finish
17/02/2022		17/02/2022

Logged By

SP

Sample and In Situ Testing				Depth (m)	Level (m)	Stratum Description	Legend	S/W
Depth (m)	Type	HVP (KPa)	PID (ppm)					
0.10	ES1			0.20	36.26	MADE GROUND: Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets and occasional roots. Gravel is angular to subrounded fine to coarse flint, brick, plastic, charcoal and wood. (Topsoil)		1 2 3 4 5
0.40	ES2					Firm brown slightly sandy slightly gravelly silty CLAY with occasional rootlets and rare roots. Gravel is angular to subrounded fine to coarse flint and chalk. (Clay with Flints)		
				0.56	35.90	End of Trial Pit at 0.560m		

Remarks

Hand dug pit to completed depth. Groundwater not encountered. Backfilled with arisings on completion.

Key

D - Disturbed Sample
ES- Environmental Sample
B - Bulk Sample
U - Undisturbed Sample
SS - Surface Sample
VS - Validation Sample

N/R - No Recovery
HVP - Hand Vane Shear Test
W/S - Water Strike
W - Water Sample



 www.aslenvironmental.co.uk										Window Sample No. WS1 Sheet 1 of 2	
Project Name: Land at Central Avenue, Gravesend							Project No.: 002-21-719		Hole Type WLS		
Location: Central Avenue, Gravesend, Kent							Co-ords: 564894.09 E 172419.99 N		Level: 35.41m AOD		
Client: Avery Healthcare Ltd, Octopus Healthcare and Willowbank Healthcare Developments Ltd							Start Dates: Finish 17/02/2022 17/02/2022		Logged By SP		
Sample and In Situ Testing					Depth (m)	Level (m)	Stratum Description	Legend	W/S	Well	
Depth (m)	Type	SPT	HPV (KPa)	PID (ppm)							
0.01	D1				0.03	35.38	MADE GROUND: Black and grey sandy angular to subangular fine to coarse GRAVEL of roadstone and tarmacadam.				
0.20	ES2				0.30	35.11	MADE GROUND: Brown grey sandy slightly clayey angular to subangular fine to coarse GRAVEL of roadstone.				
0.50	D3				0.70	34.71	Firm brown slightly sandy slightly gravelly silty CLAY with rare rootlets. Gravel is angular to subrounded fine to coarse flint and chalk. (Clay with Flints)				
0.80	D4						Firm becoming stiff below 1.0m bgl dry light brown sandy silty CLAY with rare angular to rounded fine to coarse gravel of flint. (Clay with Flints)				
1.00 - 1.45 1.00	D5 SPT (S)	N=10 (2,2/2,2,3,3)									
1.60	D6										
2.00 - 2.45 2.00	D7 SPT (S)	N=47 (5,7/11,12,12,12)			2.20	33.21	Recovered as structureless CHALK composed of white, cream locally yellow slightly sandy SILT. Occasional angular to subangular fine to coarse gravel of rinded flint. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
2.60	D8										
3.00 - 3.45 3.00	D9 SPT (S)	N=14 (3,2/4,3,3,4)			3.00	32.41	Recovered as structureless CHALK composed of white, cream locally yellow slightly sandy SILT. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
3.60	D10										
4.00 - 4.45 4.00	D11 SPT (S)	N=15 (6,4/3,3,4,5)									
4.60	D12										
5.00 - 5.45	D13						Continued on Next Sheet				
Remarks Windowless sampling from ground level to completed depth. Damp strata noted at 3.30m bgl. Installed with combined gas and groundwater monitoring standpipe on completion.							Key D - Disturbed Sample ES - Environmental Sample B - Bulk Sample U - Undisturbed Sample SS - Surface Sample VS - Validation Sample W - Water Sample N/R - No Recovery HVP - Hand Vane Shear Test W/S - Water Strike				



Sheet 2 of 2

Project No.:

Hole Type

002-21-719

WLS

Co-ords:
564894.09 E
172419.99 N

Level:

Scale

564894.09 E
172419.99 N

35.41m AOD

1:25

Start	Dates:	Finish
17/02/2022		17/02/2022

Logged By

Avery Healthcare Ltd, Octopus Healthcare and Willowbank Healthcare Developments Ltd

17/02/2022	17/02/2022
------------	------------

SP

10

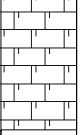
	Key
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Key
D - Disturbed Sample
ES - Environmental Sample
B - Bulk Sample
U - Undisturbed Sample
SS - Surface Sample
VS - Validation Sample
W - Water Sample

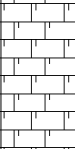


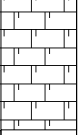
 www.aslenvironmental.co.uk										Window Sample No.	
										WS2	
										Sheet 1 of 1	
Project Name: Land at Central Avenue, Gravesend							Project No.: 002-21-719			Hole Type WLS	
Location: Central Avenue, Gravesend, Kent							Co-ords: 564910.14 E 172421.48 N		Level: 35.77m AOD		Scale 1:25
Client: Avery Healthcare Ltd, Octopus Healthcare and Willowbank Healthcare Developments Ltd							Start 17/02/2022		Dates: Finish 17/02/2022		Logged By SP
Sample and In Situ Testing					Depth (m)	Level (m)	Stratum Description	Legend	WS	Well	
Depth (m)	Type	SPT	HPV (KPa)	PID (ppm)							
0.10	ES1				0.25	35.52	MADE GROUND: Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets and occasional roots. Gravel is angular to subrounded fine to coarse flint, brick, charcoal, chalk and wood. (Topsoil)				
0.70	ES2						Firm brown slightly sandy slightly gravelly silty CLAY with occasional rootlets and rare roots. Gravel is angular to subrounded fine to coarse flint and chalk. (Clay with Flints)				
0.95 1.00 - 1.45 1.00	D3 D4 SPT (S)	N=7 (1,2/1,1,2,3)			0.90	34.87	Stiff dry light brown sandy silty CLAY with rare angular to rounded fine to coarse flint. (Clay with Flints)				
1.50	D5										
1.80	D6				1.67	34.10	Recovered as structureless CHALK composed of friable white, cream and yellow brown slightly sandy gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. Rare angular to subangular fine to coarse rinded flint gravel. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
2.00 - 2.45 2.00	D7 SPT (S)	N=50 (10,11/50 for 280mm)									
2.50 - 2.95 2.50	D8 SPT (S)	N=50 (11,14/50 for 280mm)									
					2.93	32.84	End of Borehole at 2.930m				
Remarks							Key				
Windowless sample from ground level to completed depth. Borehole terminated at 2.93m bgl due to competent strata. Groundwater not encountered. Backfilled with arisings on completion.							D - Disturbed Sample ES - Environmental Sample B - Bulk Sample U - Undisturbed Sample SS - Surface Sample VS - Validation Sample W - Water Sample		N/R - No Recovery HVP - Hand Vane Shear Test W/S - Water Strike		
											

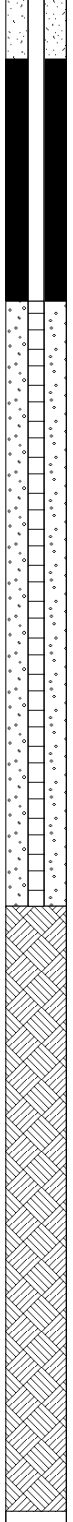
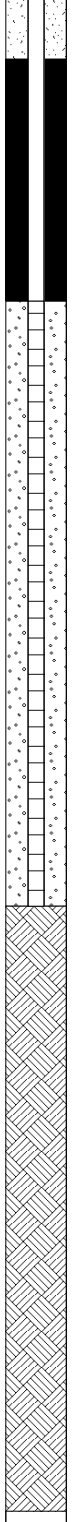
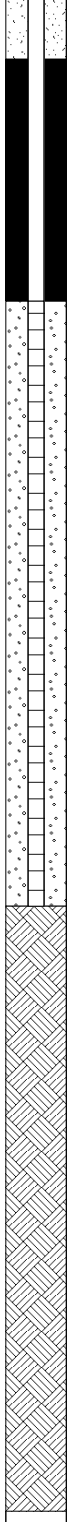
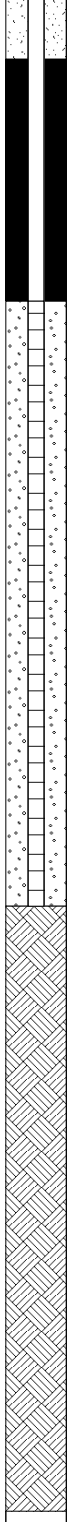
 www.aslenvironmental.co.uk										Window Sample No. WS3 Sheet 1 of 2	
Project Name: Land at Central Avenue, Gravesend						Project No.: 002-21-719		Hole Type WLS			
Location: Central Avenue, Gravesend, Kent						Co-ords: 564941.94 E 172424.62 N		Level: 35.87m AOD			
Client: Avery Healthcare Ltd, Octopus Healthcare and Willowbank Healthcare Developments Ltd						Start Dates: Finish 17/02/2022 17/02/2022		Logged By SP			
Sample and In Situ Testing					Depth (m)	Level (m)	Stratum Description	Legend	WS	Well	
Depth (m)	Type	SPT	HPV (KPa)	PID (ppm)							
0.04 0.08					0.04	35.83	MADE GROUND: Concrete paving slab.				
					0.08	35.79	MADE GROUND: Mortar.				
							MADE GROUND: Concrete.				
0.28					0.28	35.59	Firm brown slightly sandy slightly gravelly silty CLAY with occasional rootlets and rare roots. Gravel is angular to subrounded fine to coarse flint and chalk. (Clay with Flints)				
0.50	ES1	N=20 (3,5/4,5,5,6)					Recovered as structureless CHALK composed of friable white, cream and yellow brown slightly sandy gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. Rare angular to subangular fine to coarse rinded flint gravel. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
0.70	ES2										
0.90	D3										
1.00 - 1.45	D4 SPT (S)										
1.00											
1.50	D5	N=11 (1,2/2,3,3,3)					Recovered as structureless CHALK composed of white, cream and locally yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
1.65	34.22										Very gravelly.
1.80	D6										
1.85	34.02										Recovered as structureless CHALK composed of white, cream and locally yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))
2.00 - 2.45	D7 SPT (S)										
2.00		N=16 (6,3/3,4,4,5)					Recovered as structureless CHALK composed of cream and yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density cream with black specks angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
2.25	33.62										Recovered as structureless CHALK composed of white, cream and locally yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))
2.60	D8										
3.00 - 3.45	D9 SPT (S)										
3.00											
3.60	D10	N=15 (3,3/3,4,4,4)					Recovered as structureless CHALK composed of white, cream and locally yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
4.00 - 4.45	D11 SPT (S)										
4.00											
4.60	D12										
5.00 - 5.45	D13										
Continued on Next Sheet											
Remarks Windowless sampling from ground level to completed depth. Damp strata noted at 3.0m bgl. Installed with combined gas and groundwater monitoring standpipe on completion.						Key D - Disturbed Sample ES - Environmental Sample B - Bulk Sample U - Undisturbed Sample SS - Surface Sample VS - Validation Sample W - Water Sample N/R - No Recovery HVP - Hand Vane Shear Test W/S - Water Strike					

		www.aslenvironmental.co.uk					Window Sample No. WS3 Sheet 2 of 2			
Project Name: Land at Central Avenue, Gravesend						Project No.: 002-21-719		Hole Type WLS		
Location: Central Avenue, Gravesend, Kent						Co-ords: 564941.94 E 172424.62 N		Level: 35.87m AOD		Scale 1:25
Client: Avery Healthcare Ltd, Octopus Healthcare and Willowbank Healthcare Developments Ltd						Start 17/02/2022		Dates: Finish 17/02/2022		Logged By SP
Sample and In Situ Testing					Depth (m)	Level (m)	Stratum Description	Legend	WS	Well
Depth (m)	Type	SPT	HPV (KPa)	PID (ppm)						
5.00	SPT (S)	N=15 (3,2/3,4,4,4)			5.45	30.42	Recovered as structureless CHALK composed of white, cream and locally yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))			
End of Borehole at 5.450m										
6 7 8 9 10										
Remarks Windowless sampling from ground level to completed depth. Damp strata noted at 3.0m bgl. Installed with combined gas and groundwater monitoring standpipe on completion.						Key D - Disturbed Sample ES - Environmental Sample B - Bulk Sample U - Undisturbed Sample SS - Surface Sample VS - Validation Sample W - Water Sample N/R - No Recovery HVP - Hand Vane Shear Test W/S - Water Strike				

 www.aslenvironmental.co.uk										Window Sample No.		
										WS4		
										Sheet 1 of 1		
Project Name:							Project No.:			Hole Type		
Land at Central Avenue, Gravesend							002-21-719			WLS		
Location:							Co-ords:		Level:		Scale	
Central Avenue, Gravesend, Kent							564905.55 E 172400.34 N		35.93m AOD		1:25	
Client:							Start		Dates:		Finish	
Avery Healthcare Ltd, Octopus Healthcare and Willowbank Healthcare Developments Ltd							17/02/2022		17/02/2022		Logged By SP	
Sample and In Situ Testing					Depth (m)	Level (m)	Stratum Description	Legend	WS	Well		
Depth (m)	Type	SPT	HPV (KPa)	PID (ppm)								
0.10	ES1						MADE GROUND: Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets and occasional roots. Gravel is angular to subrounded fine to coarse flint, brick, charcoal and wood. (Topsoil)					
0.40	ES2				0.28 0.45	35.65 35.48	Firm brown slightly sandy slightly gravelly silty CLAY with occasional rootlets and rare roots. Gravel is angular to subrounded fine to coarse flint and chalk. (Clay with Flints)					
0.70	D3						Stiff dry light brown sandy slightly gravelly locally gravelly silty CLAY. Gravel is angular to rounded fine to coarse chalk. (Clay with Flints)					
1.00 - 1.45 1.00	D4 SPT (S)	N=16 (3,3/3,4,5,4)									1	
1.60	D5											
2.00 - 2.45 2.00	D7 SPT (S)	N=50 (10,11/50 for 255mm)				2.00	33.93	subangular cobble of flint.				
2.50 - 2.95 2.50	D8 SPT (S)	N=50 (25 for 125mm/50 for 275mm)				2.00	33.93	Recovered as structureless CHALK composed of friable white, cream and yellow brown slightly sandy gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. Rare angular to subangular fine to coarse rinded flint gravel. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))			2	
					2.81	33.12	End of Borehole at 2.810m				3	
											4	
											5	
Remarks							Key					
Windowless sample from ground level to completed depth. Borehole terminated at 2.81m bgl due to competent strata. Groundwater not encountered. Backfilled with arisings on completion.							D - Disturbed Sample ES - Environmental Sample B - Bulk Sample U - Undisturbed Sample SS - Surface Sample VS - Validation Sample W - Water Sample			N/R - No Recovery HVP - Hand Vane Shear Test W/S - Water Strike		
												

 www.aslenvironmental.co.uk										Window Sample No. WS5 Sheet 1 of 2	
Project Name: Land at Central Avenue, Gravesend						Project No.: 002-21-719		Hole Type WLS			
Location: Central Avenue, Gravesend, Kent						Co-ords: 564945.27 E 172402.14 N		Level: 36.44m AOD			
Client: Avery Healthcare Ltd, Octopus Healthcare and Willowbank Healthcare Developments Ltd						Start Dates: Finish 17/02/2022 17/02/2022		Logged By SP			
Sample and In Situ Testing					Depth (m)	Level (m)	Stratum Description	Legend	WS	Well	
Depth (m)	Type	SPT	HPV (KPa)	PID (ppm)							
0.10	ES1				0.30	36.14	MADE GROUND: Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets and occasional roots. Gravel is angular to subrounded fine to coarse flint, brick and wood. (Topsoil)				
0.50	ES2					35.74	Soft to firm brown slightly sandy slightly gravelly silty CLAY with occasional rootlets and rare roots. Gravel is angular to subrounded fine to coarse flint and chalk. (Clay with Flints)				
0.80	D3				2.30	34.14	Recovered as structureless CHALK composed of friable white, cream and yellow brown slightly sandy gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. Rare angular to subangular fine to coarse rinded flint gravel. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
1.00 - 1.45	D4	N=22 (6,6/6,6,5,5)									
1.00	SPT (S)										
1.50	D5										
1.80	D6				2.30	34.14	Recovered as structureless CHALK composed of white, cream and locally yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density white with black species angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
2.00 - 2.45	D7	N=20 (5,4/5,4,5,6)									
2.00	SPT (S)										
2.60	D8										
3.00 - 3.45	D9	N=18 (3,3/4,4,5,5)			2.30	34.14	Recovered as structureless CHALK composed of white, cream and locally yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density white with black species angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
3.00	SPT (S)										
3.60	D10										
4.00 - 4.45	D11	N=17 (3,3/3,4,4,6)									
4.00	SPT (S)				2.30	34.14	Recovered as structureless CHALK composed of white, cream and locally yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density white with black species angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
4.60	D12										
5.00 - 5.45	D13										
Continued on Next Sheet											
Remarks Windowless sampling from ground level to completed depth. Damp strata noted at 3.0m bgl. Backfilled with arisings on completion.							Key D - Disturbed Sample ES - Environmental Sample B - Bulk Sample U - Undisturbed Sample SS - Surface Sample VS - Validation Sample W - Water Sample N/R - No Recovery HVP - Hand Vane Shear Test W/S - Water Strike				

		www.aslenvironmental.co.uk					Window Sample No. WS5 Sheet 2 of 2				
Project Name: Land at Central Avenue, Gravesend						Project No.: 002-21-719		Hole Type WLS			
Location: Central Avenue, Gravesend, Kent						Co-ords: 564945.27 E 172402.14 N		Level: 36.44m AOD		Scale 1:25	
Client: Avery Healthcare Ltd, Octopus Healthcare and Willowbank Healthcare Developments Ltd						Start 17/02/2022		Dates: Finish 17/02/2022		Logged By SP	
Sample and In Situ Testing					Depth (m)	Level (m)	Stratum Description	Legend	WS	Well	
Depth (m)	Type	SPT	HPV (KPa)	PID (ppm)							
5.00	SPT (S)	N=18 (3,3/3,4,6,5)			5.45	30.99	Recovered as structureless CHALK composed of white, cream and locally yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated)) End of Borehole at 5.450m				
6 7 8 9 10											
Remarks Windowless sampling from ground level to completed depth. Damp strata noted at 3.0m bgl. Backfilled with arisings on completion.							Key D - Disturbed Sample ES - Environmental Sample B - Bulk Sample U - Undisturbed Sample SS - Surface Sample VS - Validation Sample W - Water Sample N/R - No Recovery HVP - Hand Vane Shear Test W/S - Water Strike				

 www.aslenvironmental.co.uk										Window Sample No. WS6 Sheet 1 of 2	
Project Name: Land at Central Avenue, Gravesend							Project No.: 002-21-719		Hole Type WLS		
Location: Central Avenue, Gravesend, Kent							Co-ords: 564929.17 E 172390.03 N		Level: 36.39m AOD		
Client: Avery Healthcare Ltd, Octopus Healthcare and Willowbank Healthcare Developments Ltd							Start Dates: Finish 17/02/2022 17/02/2022		Logged By SP		
Sample and In Situ Testing					Depth (m)	Level (m)	Stratum Description	Legend	WS	Well	
Depth (m)	Type	SPT	HPV (KPa)	PID (ppm)							
0.10	ES1	N=46 (3,3/5,11,14,16)			0.30	36.09	MADE GROUND: Soft dark brown slightly sandy slightly gravelly CLAY with frequent rootlets and occasional roots. Gravel is angular to subrounded fine to coarse flint, brick, wood and rare chalk and charcoal. (Topsoil)				
0.50	ES2						Soft to firm brown slightly sandy slightly gravelly locally gravelly silty CLAY with occasional rootlets and rare roots. Gravel is angular to subrounded fine to coarse flint and chalk. (Clay with Flints)				
0.70	D3										
1.00 - 1.45 1.00	D4 SPT (S)	N=18 (7,6/5,4,4,5)			1.25	35.14	Recovered as structureless CHALK composed of friable white, cream and yellow brown slightly sandy gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. Rare angular to subangular fine to coarse rinded flint gravel. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
1.60	D5										
2.00 - 2.45 2.00	D6 SPT (S)						Recovered as structureless CHALK composed of white, cream and yellow slightly sandy slightly gravelly SILT. Gravel is very weak low density white with black specks angular to subangular fine to coarse. (Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated))				
2.60	D7	N=33 (4,5/6,7,10,10)			2.00	34.39					
3.00 - 3.45 3.00	D8 SPT (S)										
3.60	D9										
4.00 - 4.45 4.00	D10 SPT (S)	N=19 (5,3/4,4,5,6)									
4.60	D11										
5.00 - 5.45	D12										
							Continued on Next Sheet				
Remarks Windowless sampling from ground level to completed depth. Damp strata noted at 3.0m bgl. Installed with combined gas and groundwater monitoring standpipe on completion.							Key D - Disturbed Sample ES - Environmental Sample B - Bulk Sample U - Undisturbed Sample SS - Surface Sample VS - Validation Sample W - Water Sample N/R - No Recovery HVP - Hand Vane Shear Test W/S - Water Strike				



Hole ID	Event	GW Level (m bgl)	Borehole Depth (m bgl)	CH ₄ (% v/v)	CO ₂ (% v/v)	O ₂ (% v/v)	CO (ppm)	H ₂ S (ppm)	Downhole Pressure (Pa)		Average Flow Rate (l/hr)	
									Average	Peak	Average	Peak
Start	1	-	-	<0.1	<0.1	20.8	<1	<1	0	-	0	-
Finish	1	-	-	<0.1	<0.1	20.7	<1	<1	0	-	0	-
WS1	1	DRY	3.11	<0.1	<0.1	20.7	<1	<1	0	-	0	-
WS3	1	DRY	3.02	<0.1	0.6	20.7	<1	<1	0	-	0	-
WS6	1	DRY	3.04	<0.1	0.8	19.2	<1	<1	0	-	0	-

Notes: Date: 03/03/22

Atmospheric Pressure: 1011, Weather Conditions: 12°C overcast, dry

Hole ID	Event	GW Level (m bgl)	Borehole Depth (m bgl)	CH ₄ (% v/v)	CO ₂ (% v/v)	O ₂ (% v/v)	CO (ppm)	H ₂ S (ppm)	Downhole Pressure (Pa)		Average Flow Rate (l/hr)	
									Average	Peak	Average	Peak
Start	2	-	-	<0.1	<0.1	20.5	<1	<1	0	-	0	-
Finish	2	-	-	<0.1	<0.1	20.5	<1	<1	0	-	0	-
WS1	2	DRY	3.11	<0.1	0.6	20.0	<1	<1	0	-	0	-
WS3	2	DRY	3.02	<0.1	0.9	19.5	<1	<1	0	-	0	-
WS6	2	DRY	3.05	<0.1	0.8	19.5	<1	<1	0	-	0	-

Notes: Date: 10/03/22

Atmospheric Pressure: 1015, Weather Conditions: 13.5°C Overcast, dry

Table IIa

Gas and Groundwater Monitoring Results

Site Name: Land at Central Avenue, Gravesend

Project No. 002-21-719

Prepared for: Avery Healthcare Limited, Octopus Healthcare and Willowbank Healthcare Developments Ltd

Project No:	002-21-719
Project:	Land at Central Avenue, Gravesend
Date:	10/03/2022
Borehole No.:	WS1

Diameter of piezometer (or where surrounded by granular filter, the diameter of the filter)	96.5	mm
Diameter of standpipe	50	mm
Top of response zone	1.00	m bgl
Base of response zone	3.14	m bgl
Length of response zone (saturated)	2.14	m
L/D	22.18	
Area	0.0019625	m ²
Starting Water Level	3.14	m

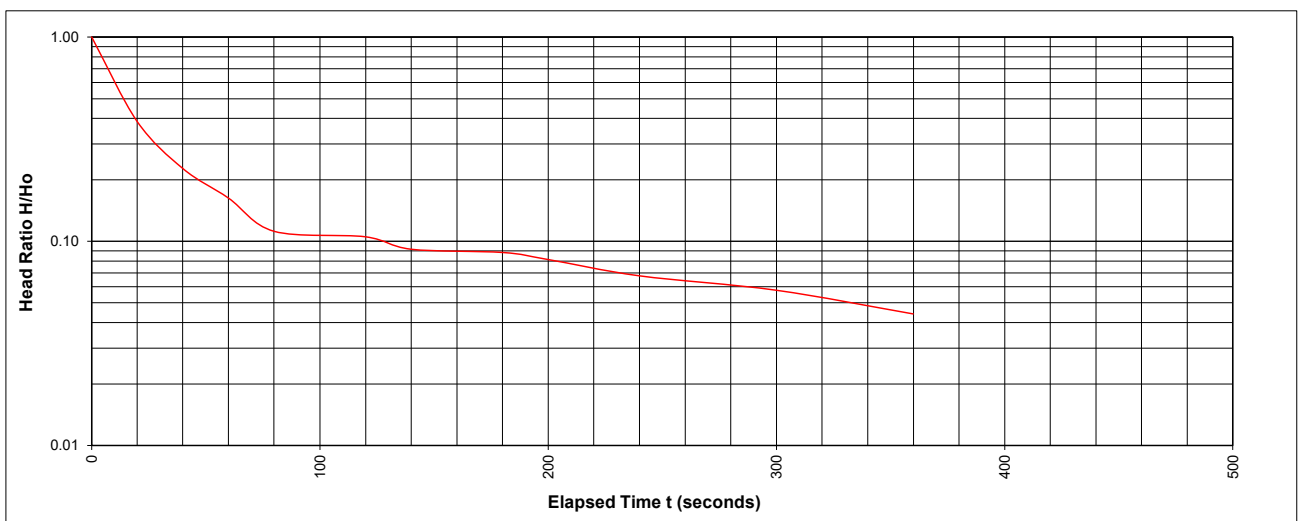
Comments:
Test carried out in general accordance with the methodology set out in BS 5930:1999

Time Interval (t_1)	0	seconds
Time Interval (t_2)	360	seconds

Method	Intake Factor (F)	
a = Soil flush with bottom at impervious boundary	0.193	○
b = Soil flush with bottom in uniform soil	0.265	○
c = Well or hole extended at impervious boundary	3.413	○
d = Well or hole extended in uniform soil	3.543	○
e = Soil in casing with bottom at impervious boundary	0.003	○
f = Soil in casing with bottom in uniform soil	0.003	○
Test carried out in piezometer tube	4.0362	●

Intake Factor (F)	4.0362	
Permeability (k) - General Method	4.22E-06	m / s

Installation surcharged with approximately 30 litres of water in approximately 160 seconds.



Project No:	002-21-719
Project:	Land at Central Avenue, Gravesend
Date:	10/03/2022
Borehole No.:	WS3

[illegible]

Diameter of piezometer (or where surrounded by granular filter, the diameter of the filter)	96.5	mm
Diameter of standpipe	50	mm
Top of response zone	1.00	m bgl
Base of response zone	3.06	m bgl
Length of response zone (saturated)	2.06	m
L/D	21.35	
Area	0.0019625	m ²
Starting Water Level	3.06	m

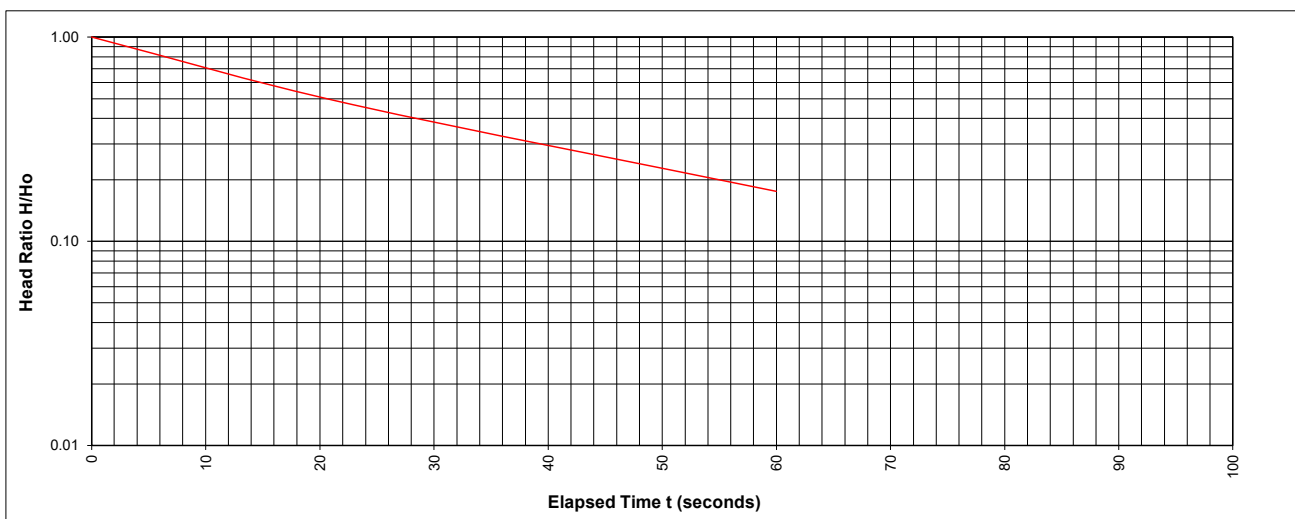
Comments:
Test carried out in general accordance with the methodology set out in BS 5930:1999

Time Interval (t_1)	0	seconds
Time Interval (t_2)	60	seconds

Method	Intake Factor (F)	
a = Soil flush with bottom at impervious boundary	0.193	○
b = Soil flush with bottom in uniform soil	0.265	○
c = Well or hole extended at impervious boundary	3.317	○
d = Well or hole extended in uniform soil	3.446	○
e = Soil in casing with bottom at impervious boundary	0.003	○
f = Soil in casing with bottom in uniform soil	0.004	○
Test carried out in piezometer tube	3.9240	●

Intake Factor (F)	3.9240	
Permeability (k) - General Method	1.45E-05	m / s

Installation surcharged with approximately 30 litres of water in approximately 160 seconds.



The Geo-Environmental Service Provider

[illegible]

Diameter of piezometer (or where surrounded by granular filter, the diameter of the filter)	96.5	mm
Diameter of standpipe	50	mm
Top of response zone	1.00	m bgl
Base of response zone	3.05	m bgl
Length of response zone (saturated)	2.05	m
L/D	21.24	
Area	0.0019625	m ²
Starting Water Level	3.05	m

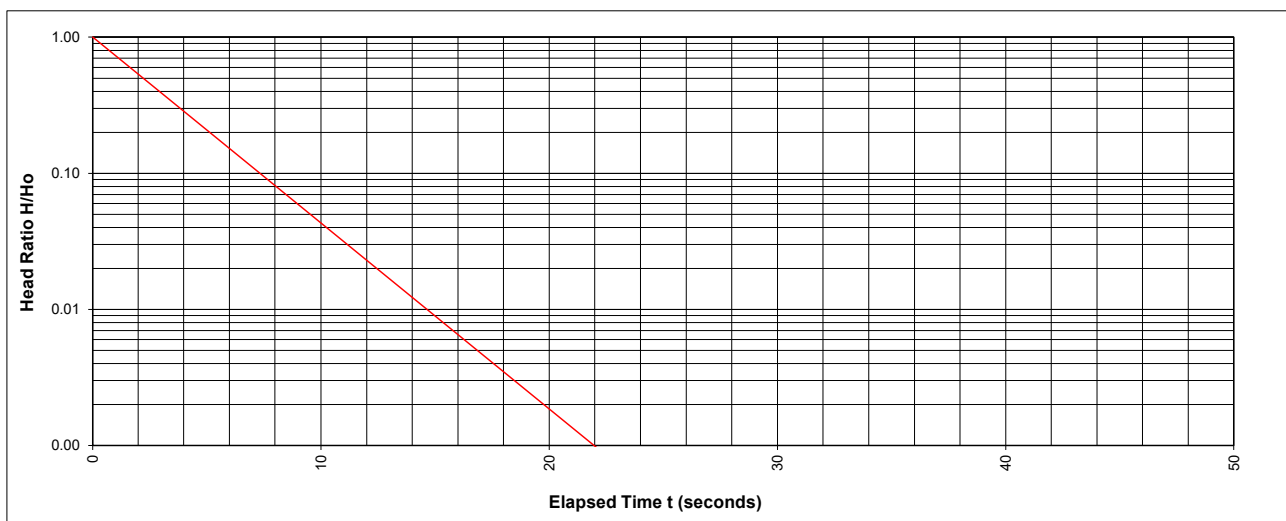
Comments:	
Test carried out in general accordance with the methodology set out in BS 5930:1999	

Time Interval (t_1)	0	seconds
Time Interval (t_2)	25	seconds

Method	Intake Factor (F)	
a = Soil flush with bottom at impervious boundary	0.193	○
b = Soil flush with bottom in uniform soil	0.265	○
c = Well or hole extended at impervious boundary	3.305	○
d = Well or hole extended in uniform soil	3.433	○
e = Soil in casing with bottom at impervious boundary	0.004	○
f = Soil in casing with bottom in uniform soil	0.004	○
Test carried out in piezometer tube	3.9099	⊗

Intake Factor (F)	3.9099	
Permeability (k) - General Method	1.58E-04	m/s

Installation surcharged with approximately 30 litres of water in approximately 160 seconds.





APPENDIX III

CHEMICAL LABORATORY TEST RESULTS

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Analytical Report Number : 22-41640

Project / Site name:	Central Avenue, Gravesend	Samples received on:	23/02/2022
Your job number:	002-21-719	Samples instructed on/ Analysis started on:	23/02/2022
Your order number:	002-21-719	Analysis completed by:	04/03/2022
Report Issue Number:	1	Report issued on:	04/03/2022
Samples Analysed:	3 leachate samples - 8 soil samples		

Signed:



Anna Goc
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement. Application of uncertainty of measurement would provide a range within which the true result lies. An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 22-41640
Project / Site name: Central Avenue, Gravesend
Your Order No: 002-21-719

Lab Sample Number				2184155	2184156	2184157	2184158	2184159
Sample Reference				HP1	WS1	WS2	WS3	WS4
Sample Number				ES1	D3	ES1	D5	D3
Depth (m)				0.10	0.50	0.10	1.50	0.70
Date Sampled				17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	29	39	< 0.1
Moisture Content	%	0.01	NONE	19	13	16	8.0	4.9
Total mass of sample received	kg	0.001	NONE	1.0	1.0	1.0	1.0	1.0

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected	-	-
Asbestos Analyst ID	N/A	N/A	N/A	GFI		GFI		

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	7.2	8.4	7.8	9.3	8.1
Total Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Free Cyanide	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Total Sulphate as SO ₄	mg/kg	50	MCERTS	620	370	590	-	-
Total Sulphate as SO ₄	%	0.005	MCERTS	-	-	-	0.055	0.027
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.0081	0.0050	0.014	0.060	0.0042
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	-	-	60.0	4.2
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	-	-	18	1.3
Total Sulphur	mg/kg	50	MCERTS	530	210	440	-	-
Total Sulphur	%	0.005	MCERTS	-	-	-	0.023	0.013
Ammoniacal Nitrogen as NH ₄	mg/kg	0.5	MCERTS	-	-	-	< 0.5	< 0.5
Ammonium as NH ₄ (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	-	-	< 0.05	< 0.05
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.033	0.0064	0.023	-	-
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	-	-	< 2.0	< 2.0

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Fluorene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Phenanthrene	mg/kg	0.05	MCERTS	0.23	< 0.05	1.0	-	-
Anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	0.20	-	-
Fluoranthene	mg/kg	0.05	MCERTS	0.65	< 0.05	2.0	-	-
Pyrene	mg/kg	0.05	MCERTS	0.63	< 0.05	1.7	-	-
Benzo(a)anthracene	mg/kg	0.05	MCERTS	0.37	< 0.05	0.95	-	-
Chrysene	mg/kg	0.05	MCERTS	0.36	< 0.05	0.84	-	-
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	0.45	< 0.05	0.98	-	-
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.20	< 0.05	0.57	-	-
Benzo(a)pyrene	mg/kg	0.05	MCERTS	0.39	< 0.05	0.92	-	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.22	< 0.05	0.51	-	-
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	< 0.05	< 0.05	< 0.05	-	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.24	< 0.05	0.56	-	-

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	3.74	< 0.80	10.3	-	-
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Analytical Report Number: 22-41640
 Project / Site name: Central Avenue, Gravesend
 Your Order No: 002-21-719

Lab Sample Number				2184155	2184156	2184157	2184158	2184159
Sample Reference				HP1	WS1	WS2	WS3	WS4
Sample Number				ES1	D3	ES1	D5	D3
Depth (m)				0.10	0.50	0.10	1.50	0.70
Date Sampled				17/02/2022	17/02/2022	17/02/2022	17/02/2022	17/02/2022
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)				Units	Limit of detection	Accreditation Status		
Heavy Metals / Metalloids								
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	7.5	14	-	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.1	0.94	0.87	-	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.5	0.5	1.3	-	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.7	0.5	1.4	-	-
Chromium (hexavalent)	mg/kg	4	NONE	< 4.0	< 4.0	< 4.0	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	32	30	32	-	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	44	16	64	-	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	84	15	110	-	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	< 0.3	< 0.3	< 0.3	-	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	27	26	27	-	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	< 1.0	-	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	42	36	42	-	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	120	56	160	-	-
Magnesium (water soluble)	mg/kg	5	NONE	-	-	-	< 5.0	< 5.0
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	-	-	< 2.5	< 2.5
Petroleum Hydrocarbons								
TPH C10 - C40 _{EH, CU, ID, TOTAL}	mg/kg	10	MCERTS	24	< 10	22	-	-
TPH2 (C6 - C10) _{HS, ID, TOTAL}	mg/kg	0.1	MCERTS	< 0.1	< 0.1	< 0.1	-	-

U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number: 22-41640
Project / Site name: Central Avenue, Gravesend
Your Order No: 002-21-719

Lab Sample Number				2184160	2184161	2184162
Sample Reference				WS5	WS5	WS6
Sample Number				ES1	D6	ES1
Depth (m)				0.10	1.80	0.10
Date Sampled				17/02/2022	17/02/2022	17/02/2022
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Stone Content	%	0.1	NONE	23	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	16	18	16
Total mass of sample received	kg	0.001	NONE	1.0	1.0	1.0

Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Not-detected
Asbestos Analyst ID	N/A	N/A	N/A	GF1		GF1

General Inorganics

pH - Automated	pH Units	N/A	MCERTS	8.0	8.5	7.2
Total Cyanide	mg/kg	1	MCERTS	< 1.0	-	< 1.0
Free Cyanide	mg/kg	1	MCERTS	< 1.0	-	< 1.0
Total Sulphate as SO ₄	mg/kg	50	MCERTS	670	-	600
Total Sulphate as SO ₄	%	0.005	MCERTS	-	0.048	-
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	0.011	0.0079	0.018
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	-	7.9	-
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	-	6.1	-
Total Sulphur	mg/kg	50	MCERTS	360	-	370
Total Sulphur	%	0.005	MCERTS	-	0.017	-
Ammoniacal Nitrogen as NH ₄	mg/kg	0.5	MCERTS	-	< 0.5	-
Ammonium as NH ₄ (10:1 leachate equivalent)	mg/l	0.05	MCERTS	-	< 0.05	-
Fraction Organic Carbon (FOC) Automated	N/A	0.001	MCERTS	0.022	-	0.028
Water Soluble Nitrate (2:1) as N (leachate equivalent)	mg/l	2	NONE	-	< 2.0	-

Total Phenols

Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	< 1.0
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Speciated PAHs

Naphthalene	mg/kg	0.05	MCERTS	< 0.05	-	0.33
Acenaphthylene	mg/kg	0.05	MCERTS	< 0.05	-	< 0.05
Acenaphthene	mg/kg	0.05	MCERTS	< 0.05	-	0.44
Fluorene	mg/kg	0.05	MCERTS	< 0.05	-	0.29
Phenanthrene	mg/kg	0.05	MCERTS	2.3	-	2.9
Anthracene	mg/kg	0.05	MCERTS	< 0.05	-	0.37
Fluoranthene	mg/kg	0.05	MCERTS	3.4	-	3.3
Pyrene	mg/kg	0.05	MCERTS	2.7	-	2.6
Benzo(a)anthracene	mg/kg	0.05	MCERTS	1.2	-	1.6
Chrysene	mg/kg	0.05	MCERTS	1.5	-	1.3
Benzo(b)fluoranthene	mg/kg	0.05	MCERTS	1.7	-	1.6
Benzo(k)fluoranthene	mg/kg	0.05	MCERTS	0.89	-	0.72
Benzo(a)pyrene	mg/kg	0.05	MCERTS	1.5	-	1.4
Indeno(1,2,3-cd)pyrene	mg/kg	0.05	MCERTS	0.77	-	0.72
Dibenz(a,h)anthracene	mg/kg	0.05	MCERTS	0.21	-	< 0.05
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.75	-	0.72

Total PAH

Speciated Total EPA-16 PAHs	mg/kg	0.8	MCERTS	16.9	-	18.4
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Analytical Report Number: 22-41640
Project / Site name: Central Avenue, Gravesend
Your Order No: 002-21-719

Lab Sample Number				2184160	2184161	2184162
Sample Reference				WS5	WS5	WS6
Sample Number				ES1	D6	ES1
Depth (m)				0.10	1.80	0.10
Date Sampled				17/02/2022	17/02/2022	17/02/2022
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Limit of detection	Accreditation Status			
Heavy Metals / Metalloids						
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	11	-	11
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	0.97	-	0.96
Boron (water soluble)	mg/kg	0.2	MCERTS	0.7	-	0.7
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	0.6	-	0.6
Chromium (hexavalent)	mg/kg	4	NONE	< 4.0	-	< 4.0
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	30	-	27
Copper (aqua regia extractable)	mg/kg	1	MCERTS	47	-	41
Lead (aqua regia extractable)	mg/kg	1	MCERTS	67	-	88
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	0.6	-	0.6
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	25	-	24
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	40	-	39
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	75	-	77
Magnesium (water soluble)	mg/kg	5	NONE	-	< 5.0	-
Magnesium (leachate equivalent)	mg/l	2.5	NONE	-	< 2.5	-
Petroleum Hydrocarbons						
TPH C10 - C40 _{EH, CU, ID, TOTAL}	mg/kg	10	MCERTS	22	-	28
TPH2 (C6 - C10) _{HS, ID, TOTAL}	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1

U/S = Unsuitable Sample I/S = Insufficient Sample



Analytical Report Number: 22-41640

Project / Site name: Central Avenue, Gravesend

Your Order No: 002-21-719

Lab Sample Number				2184163	2184164	2184165
Sample Reference				HP1	WS2	WS6
Sample Number				ES1	ES1	ES1
Depth (m)				0.10	0.10	0.10
Date Sampled				17/02/2022	17/02/2022	17/02/2022
Time Taken				None Supplied	None Supplied	None Supplied
Analytical Parameter (Leachate Analysis)				Units	Limit of detection	Accreditation Status

General Inorganics

pH (automated)	pH Units	N/A	ISO 17025	7.3	7.8	7.5
Total Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1.0	< 1.0	< 1.0
Free Cyanide (Low Level 1 µg/l)	µg/l	1	ISO 17025	< 1	< 1	< 1
Dissolved Organic Carbon (DOC)	mg/l	0.1	NONE	9.40	7.41	12.2

Heavy Metals / Metalloids

Arsenic (dissolved)	µg/l	1	ISO 17025	< 1.0	4.3	< 1.0
Beryllium (dissolved)	µg/l	0.2	ISO 17025	0.2	0.2	0.2
Boron (dissolved)	µg/l	10	ISO 17025	38	36	21
Cadmium (dissolved)	µg/l	0.08	ISO 17025	< 0.08	< 0.08	< 0.08
Chromium (hexavalent)	µg/l	5	ISO 17025	< 5.0	< 5.0	< 5.0
Chromium (dissolved)	µg/l	0.4	ISO 17025	1.6	1.2	1.1
Copper (dissolved)	µg/l	0.7	ISO 17025	47	23	27
Lead (dissolved)	µg/l	1	ISO 17025	4.5	4.6	4.0
Mercury (dissolved)	µg/l	0.5	ISO 17025	< 0.5	< 0.5	< 0.5
Nickel (dissolved)	µg/l	0.3	ISO 17025	8.3	3.9	3.4
Selenium (dissolved)	µg/l	4	ISO 17025	< 4.0	< 4.0	< 4.0
Vanadium (dissolved)	µg/l	1.7	ISO 17025	5.0	7.1	3.0
Zinc (dissolved)	µg/l	0.4	ISO 17025	16	13	12

Calcium (dissolved)	mg/l	0.012	ISO 17025	5.4	19	9.7
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U/S = Unsuitable Sample I/S = Insufficient Sample

Analytical Report Number : 22-41640

Project / Site name: Central Avenue, Gravesend

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2184155	HP1	ES1	0.1	Brown loam and gravel with vegetation and glass
2184156	WS1	D3	0.5	Brown clay and loam with gravel and vegetation.
2184157	WS2	ES1	0.1	Brown loam and clay with vegetation and stones.
2184158	WS3	D5	1.5	Light brown clay and sand with chalk and stones.
2184159	WS4	D3	0.7	Light brown sandy clay with gravel.
2184160	WS5	ES1	0.1	Brown loam and clay with vegetation and stones.
2184161	WS5	D6	1.8	Beige clay and sand with chalk and gravel
2184162	WS6	ES1	0.1	Brown clay and loam with gravel and vegetation.

Analytical Report Number : 22-41640

Project / Site name: Central Avenue, Gravesend

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
NRA Leachate Prep	10:1 extract with de-ionised water shaken for 24 hours then filtered.	In-house method based on National Rivers Authority	L020-PL	W	NONE
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Metals by ICP-OES in leachate	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L039-PL	W	ISO 17025
Boron in leachate	Determination of boron in leachate. Sample acidified and followed by ICP-OES.	In-house method based on MEWAM	L039-PL	W	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
Hexavalent chromium in leachate	Determination of hexavalent chromium in leachate by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	ISO 17025
Hexavalent chromium in soil	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	NONE
Free cyanide in soil	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES.	In-house method based on TRL 447	L038-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Speciated EPA-16 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
pH at 20oC in leachate (automated)	Determination of pH in leachate by electrometric measurement.	In house method.	L099B	W	ISO 17025
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS

Analytical Report Number : 22-41640

Project / Site name: Central Avenue, Gravesend

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
TPH2 (Soil)	Determination of hydrocarbons C6-C10 by headspace GC-MS.	In-house method based on USEPA8260	L088-PL	W	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Dissolved Organic Carbon in leachate	Determination of dissolved organic carbon in leachate by the measurement on a non-dispersive infrared analyser of carbon dioxide released by acidification.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE
Ammonium as NH4 in soil	Determination of Ammonium/Ammonia/ Ammoniacal Nitrogen by the colorimetric salicylate/nitroprusside method, 10:1 water extraction.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L082-PL	W	MCERTS
TPH Banding in Soil by FID	Determination of hexane extractable hydrocarbons in soil by GC-FID.	In-house method, TPH with carbon banding and silica gel split/cleanup.	L076-PL	D	MCERTS
Free cyanide in leachate	Determination of free cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	ISO 17025
Total cyanide in leachate - 1µg/l	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Fraction Organic Carbon FOC Automated	Determination of fraction of organic carbon in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method	L009	D	MCERTS
Total Sulphate in soil as %	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Total Sulphur in soil as %	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In house method.	L038-PL	D	MCERTS
Water Soluble Nitrate (2:1) as N in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry.	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction.	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser.	In house method.	L082-PL	D	MCERTS
Sulphate, water soluble, in soil	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS

Analytical Report Number : 22-41640
Project / Site name: Central Avenue, Gravesend

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
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For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total

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Analytical Report Number : 22-41643

Project / Site name:	Central Avenue, Gravesend	Samples received on:	23/02/2022
Your job number:	002-21-719	Samples instructed on/ Analysis started on:	23/02/2022
Your order number:	002-21-719	Analysis completed by:	04/03/2022
Report Issue Number:	1	Report issued on:	07/03/2022
Samples Analysed:	3 10:1 WAC samples		


Signed:

Anna Goc
Technical Reviewer (Reporting Team)
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

i2 Analytical

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Waste Acceptance Criteria Analytical Results						
Report No:	22-41643					
				Client: ASL		
Location	Central Avenue, Gravesend					
Lab Reference (Sample Number)	2184172 / 2184173			Landfill Waste Acceptance Criteria		
Sampling Date	17/02/2022			Limits		
Sample ID	WS1 D3			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Depth (m)	0.50					
Solid Waste Analysis						
TOC (%)**	0.6			3%	5%	6%
Loss on Ignition (%) **	2.6			--	--	10%
BTEX (µg/kg) **	< 10			6000	--	--
Sum of PCBs (mg/kg) **	< 0.007			1	--	--
Mineral Oil (mg/kg) EH, 10, CU, AL	< 10			500	--	--
Total PAH (WAC-17) (mg/kg)	< 0.85			100	--	--
pH (units)**	8.4			--	>6	--
Acid Neutralisation Capacity (mmol / kg)	16			--	To be evaluated	To be evaluated
Eluate Analysis						
	10:1		10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l		mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0015		0.0125	0.5	2	25
Barium *	0.0116		0.0989	20	100	300
Cadmium *	< 0.0001		< 0.0008	0.04	1	5
Chromium *	0.0036		0.031	0.5	10	70
Copper *	0.0071		0.061	2	50	100
Mercury *	< 0.0005		< 0.0050	0.01	0.2	2
Molybdenum *	0.0010		0.0089	0.5	10	30
Nickel *	0.0049		0.042	0.4	10	40
Lead *	0.0033		0.029	0.5	10	50
Antimony *	< 0.0017		< 0.017	0.06	0.7	5
Selenium *	< 0.0040		< 0.040	0.1	0.5	7
Zinc *	0.011		0.093	4	50	200
Chloride *	0.45		3.9	800	15000	25000
Fluoride	0.53		4.6	10	150	500
Sulphate *	0.99		8.5	1000	20000	50000
TDS*	58		500	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010		< 0.10	1	-	-
DOC	9.49		81.1	500	800	1000
Leach Test Information						
Stone Content (%)	< 0.1					
Sample Mass (kg)	1.0					
Dry Matter (%)	87					
Moisture (%)	13					
Results are expressed on a dry weight basis, after correction for moisture content where applicable. * = UKAS accredited (liquid eluate analysis only)						
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation ** = MCERTS accredited						
Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3. This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.						

i2 Analytical

7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results						
Report No:	22-41643					
				Client: ASL		
Location	Central Avenue, Gravesend					
Lab Reference (Sample Number)	2184174 / 2184175			Landfill Waste Acceptance Criteria		
Sampling Date	17/02/2022			Limits		
Sample ID	WS2 ES1			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Depth (m)	0.10					
Solid Waste Analysis						
TOC (%)**	2.3			3%	5%	6%
Loss on Ignition (%) **	5.5			--	--	10%
BTEX (µg/kg) **	< 10			6000	--	--
Sum of PCBs (mg/kg) **	< 0.007			1	--	--
Mineral Oil (mg/kg) EH, 10, CU, AL	< 10			500	--	--
Total PAH (WAC-17) (mg/kg)	7.67			100	--	--
pH (units)**	8.1			--	>6	--
Acid Neutralisation Capacity (mmol / kg)	6.0			--	To be evaluated	To be evaluated
Eluate Analysis						
	10:1		10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l		mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0062		0.0520	0.5	2	25
Barium *	0.0295		0.248	20	100	300
Cadmium *	< 0.0001		< 0.0008	0.04	1	5
Chromium *	0.0023		0.019	0.5	10	70
Copper *	0.028		0.23	2	50	100
Mercury *	< 0.0005		< 0.0050	0.01	0.2	2
Molybdenum *	0.0025		0.0210	0.5	10	30
Nickel *	0.0046		0.038	0.4	10	40
Lead *	0.0060		0.051	0.5	10	50
Antimony *	< 0.0017		< 0.017	0.06	0.7	5
Selenium *	< 0.0040		< 0.040	0.1	0.5	7
Zinc *	0.014		0.12	4	50	200
Chloride *	0.78		6.6	800	15000	25000
Fluoride	< 0.050		< 0.50	10	150	500
Sulphate *	1.5		12	1000	20000	50000
TDS*	88		740	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010		< 0.10	1	-	-
DOC	11.3		94.7	500	800	1000
Leach Test Information						
Stone Content (%)	29					
Sample Mass (kg)	1.0					
Dry Matter (%)	84					
Moisture (%)	16					
Results are expressed on a dry weight basis, after correction for moisture content where applicable. * = UKAS accredited (liquid eluate analysis only)						
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation ** = MCERTS accredited						
Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3. This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.						

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Watford, WD18 8YS

Telephone: 01923 225404
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email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results						
Report No:	22-41643					
				Client: ASL		
Location	Central Avenue, Gravesend					
Lab Reference (Sample Number)	2184176 / 2184177			Landfill Waste Acceptance Criteria		
Sampling Date	17/02/2022			Limits		
Sample ID	WSS ES1			Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Depth (m)	0.10					
Solid Waste Analysis						
TOC (%)**	2.2			3%	5%	6%
Loss on Ignition (%) **	5.1			--	--	10%
BTEX (µg/kg) **	< 10			6000	--	--
Sum of PCBs (mg/kg) **	< 0.007			1	--	--
Mineral Oil (mg/kg) EH, 10, CU, AL	< 10			500	--	--
Total PAH (WAC-17) (mg/kg)	10.1			100	--	--
pH (units)**	7.5			--	>6	--
Acid Neutralisation Capacity (mmol / kg)	1.4			--	To be evaluated	To be evaluated
Eluate Analysis						
	10:1		10:1	Limit values for compliance leaching test		
(BS EN 12457 - 2 preparation utilising end over end leaching procedure)	mg/l		mg/kg	using BS EN 12457-2 at L/S 10 l/kg (mg/kg)		
Arsenic *	0.0018		0.0148	0.5	2	25
Barium *	0.0076		0.0631	20	100	300
Cadmium *	< 0.0001		< 0.0008	0.04	1	5
Chromium *	0.0012		0.0097	0.5	10	70
Copper *	0.012		0.097	2	50	100
Mercury *	< 0.0005		< 0.0050	0.01	0.2	2
Molybdenum *	0.0010		0.0082	0.5	10	30
Nickel *	0.0032		0.026	0.4	10	40
Lead *	0.0033		0.027	0.5	10	50
Antimony *	< 0.0017		< 0.017	0.06	0.7	5
Selenium *	< 0.0040		< 0.040	0.1	0.5	7
Zinc *	0.0036		0.030	4	50	200
Chloride *	1.6		13	800	15000	25000
Fluoride	0.32		2.7	10	150	500
Sulphate *	1.2		10	1000	20000	50000
TDS*	65		540	4000	60000	100000
Phenol Index (Monohydric Phenols) *	< 0.010		< 0.10	1	-	-
DOC	12.2		101	500	800	1000
Leach Test Information						
Stone Content (%)	23					
Sample Mass (kg)	1.0					
Dry Matter (%)	84					
Moisture (%)	16					
Results are expressed on a dry weight basis, after correction for moisture content where applicable. * = UKAS accredited (liquid eluate analysis only)						
Stated limits are for guidance only and i2 cannot be held responsible for any discrepancies with current legislation ** = MCERTS accredited						
Landfill WAC analysis (specifically leaching test results) must not be used for hazardous waste classification purposes as defined by the Waste (England and Wales) Regulations 2011 (as amended) and EA Guidance WM3. This analysis is only applicable for landfill acceptance criteria (The Environmental Permitting (England and Wales) Regulations) and does not give any indication as to whether a waste may be hazardous or non-hazardous.						

Analytical Report Number : 22-41643

Project / Site name: Central Avenue, Gravesend

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
2184172	WS1	D3	0.5	Brown clay and loam with gravel and vegetation.
2184174	WS2	ES1	0.1	Brown loam and clay with vegetation and stones.
2184176	WS5	ES1	0.1	Brown loam and clay with vegetation and stones.

Analytical Report Number : 22-41643

Project / Site name: Central Avenue, Gravesend

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
BS EN 12457-2 (10:1) Leachate Prep	10:1 (as recieved, moisture adjusted) end over end extraction with water for 24 hours. Eluate filtered prior to analysis.	In-house method based on BSEN12457-2.	L043-PL	W	NONE
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance"	L046-PL	W	NONE
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In house method.	L047-PL	D	MCERTS
Mineral Oil (Soil) C10 - C40	Determination of mineral oil fraction extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method with silica gel split/clean up.	L076-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270. MCERTS accredited except Coronene.	L064-PL	D	NONE
PCB's By GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	MCERTS
pH at 20oC in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In house method.	L005-PL	W	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Total organic carbon (Automated) in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In house method.	L009-PL	D	MCERTS
BTEX in soil (Monoaromatics)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073B-PL	W	MCERTS
Total BTEX in soil (Poland)	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073-PL	W	MCERTS
Metals in leachate by ICP-OES	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil"	L039-PL	W	ISO 17025
Chloride 10:1 WAC	Determination of Chloride colorimetrically by discrete analyser.	In house based on MEWAM Method ISBN 0117516260.	L082-PL	W	ISO 17025
Fluoride 10:1 WAC	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Use of Total Ionic Strength Adjustment Buffer for Electrode Determination"	L033B-PL	W	ISO 17025
Sulphate 10:1 WAC	Determination of sulphate in leachate by ICP-OES	In-house method based on MEWAM 1986 Methods for the Determination of Metals in Soil"	L039-PL	W	ISO 17025
Total dissolved solids 10:1 WAC	Determination of total dissolved solids in water by EC probe using a factor of 0.6.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L004-PL	W	ISO 17025

Analytical Report Number : 22-41643
Project / Site name: Central Avenue, Gravesend

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters (PrW) Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Monohydric phenols 10:1 WAC	Determination of phenols in leachate by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L080-PL	W	ISO 17025
Dissolved organic carbon 10:1 WAC	Determination of dissolved inorganic carbon in leachate by TOC/DOC NDIR Analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton	L037-PL	W	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.

For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Information in Support of Analytical Results

List of HWOL Acronyms and Operators

Acronym	Descriptions
HS	Headspace Analysis
MS	Mass spectrometry
FID	Flame Ionisation Detector
GC	Gas Chromatography
EH	Extractable Hydrocarbons (i.e. everything extracted by the solvent(s))
CU	Clean-up - e.g. by Florisil®, silica gel
1D	GC - Single coil/column gas chromatography
2D	GC-GC - Double coil/column gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics
AR	Aromatics
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
-	Operator - understore to separate acronyms (exception for +)
+	Operator to indicate cumulative e.g. EH+HS_Total or EH_CU+HS_Total



APPENDIX IV

GEOTECHNICAL LABORATORY TEST DATA



Laboratory Report



Contract Number: 58316

Client Ref: **002-21-719**

Report Date: **08-03-2022**

Client PO: **002-21-719**

Client **ASL**
Holly Farm Business Park
Honiley
Warwickshire
CV8 1NP

Contract Title: **Central Avenue, Gravesend**
For the attention of: **Scott Pritchard**

Date Received: **25-02-2022**

Date Completed: **08-03-2022**

Test Description	Qty
Moisture Content BS 1377:1990 - Part 2 : 3.2 - * UKAS	5
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	5
Samples Received - @ Non Accredited Test	5
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**

* - denotes test included in laboratory scope of accreditation

- denotes test carried out by approved contractor

@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

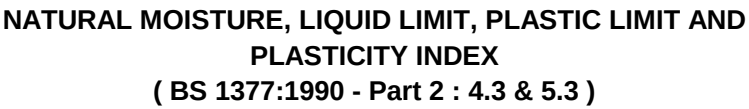
Emma Sharp (Business Support Manager) - Paul Evans (Director) - Richard John (Quality/Technical Manager)

Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Quality Assistant / Administrator / Health and Safety Coordinator)

GEO Site & Testing Services Ltd

Unit 3-4, Heol Aur, Dafen Ind Estate, Dafen, Llanelli, Carmarthenshire SA14 8QN

Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk



Contract Number	58316	
Site Name	Central Avenue, Gravesend	
Date Tested	03/03/2022	
	DESCRIPTIONS	

[illegible]

Operators	Checked	07/03/2022	Richard John (Advanced Testing Manager)
Conor Davison	Approved	07/03/2022	Paul Evans (Quality/Technical Manager)





APPENDIX V

QUALITATIVE RISK ASSESSMENT

STEP 2: BASIC SETTINGS

Apply Settings to Model

Back to Guide

SELECT LAND USE

Residential without produce

RATIO MODE

☐

LAND USE OPTIONS

RECEPTOR

Female (com)

BUILDING

Small terraced house

SOIL TYPE

Sandy clay loam

START AC

1

END AC

6

pH

7

SOM (%)

3.88

EXPOSURE PATHWAYS

ORAL ROUTES

direct soil and dust ingestion

☒

consumption of homegrown produce

☐

soil attached to homegrown produce

☐

DERMAL ROUTES

indoor

☒

outdoor

☒

INHALATION ROUTES

indoor dust

☒

outdoor dust

☒

indoor vapour

☒

outdoor vapour

☒

STEP 5: RESULTS

Find AC

Print Reports

[Back to Guide](#)

[illegible]

STEP 5: RESULTS

Find AC

[Print Reports](#)

[Back to Guide](#)

[illegible]

STEP 5: RESULTS

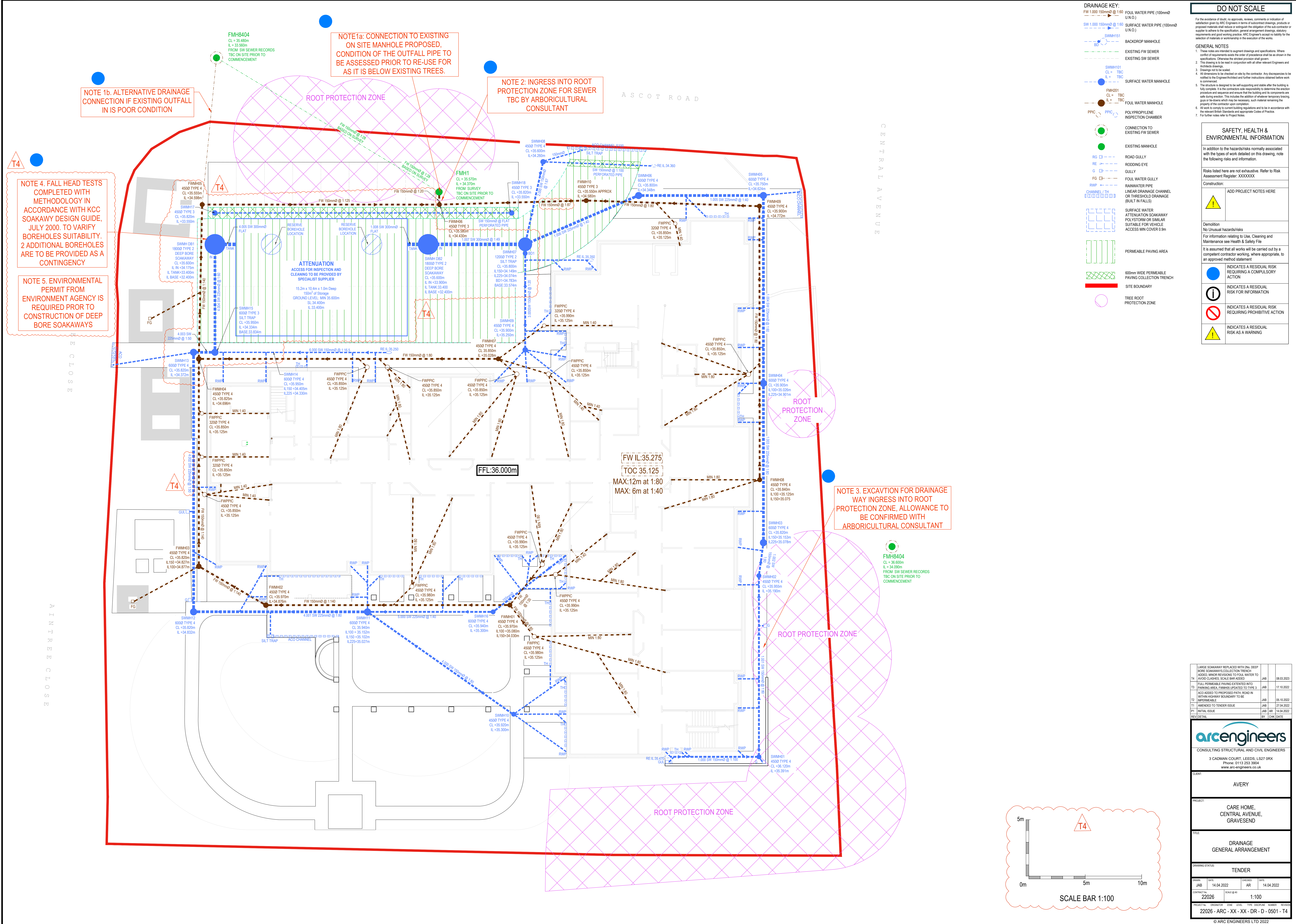
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Print Reports

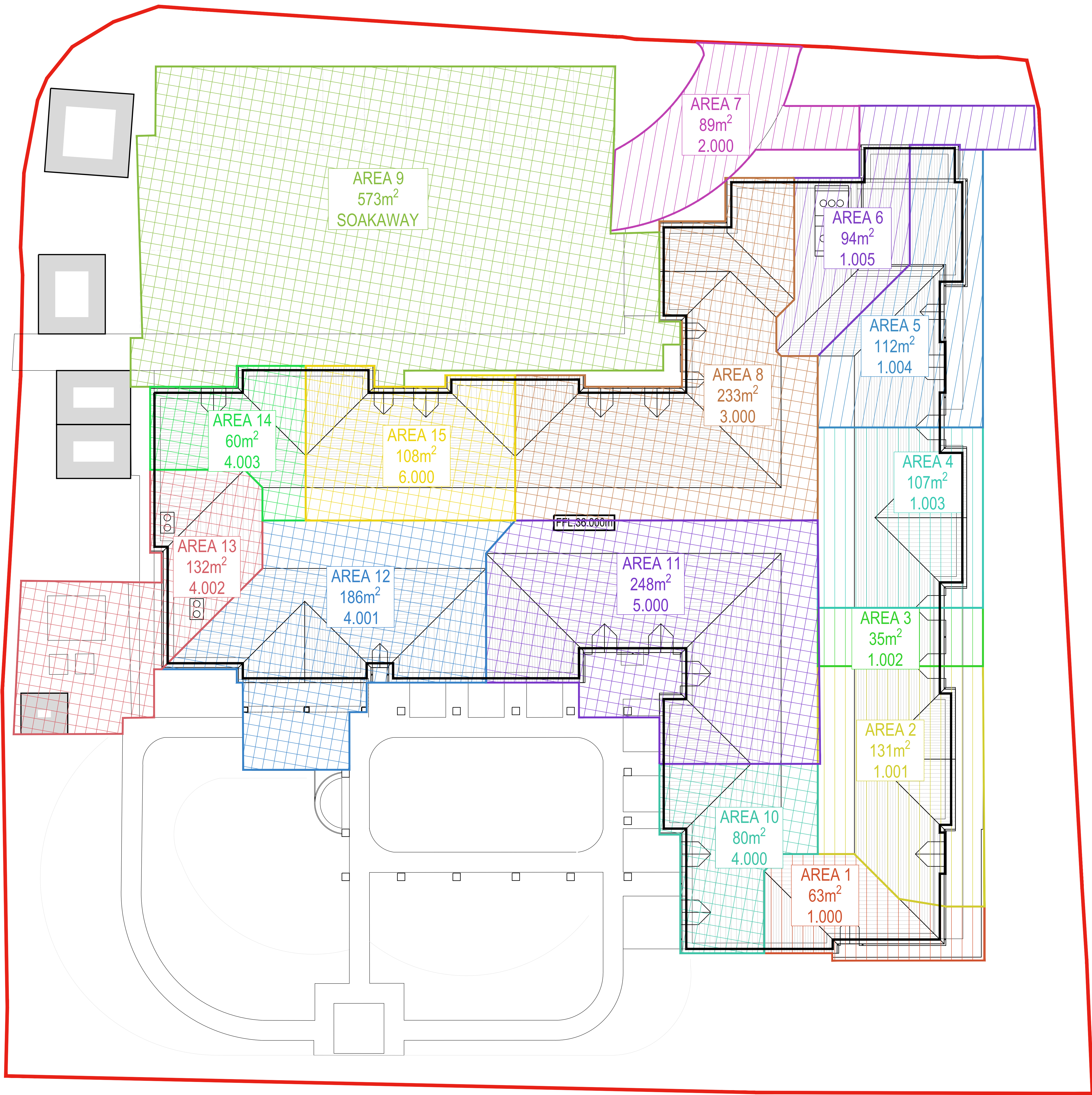
[Back to Guide](#)

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APPENDIX C – DRAINAGE DRAWINGS

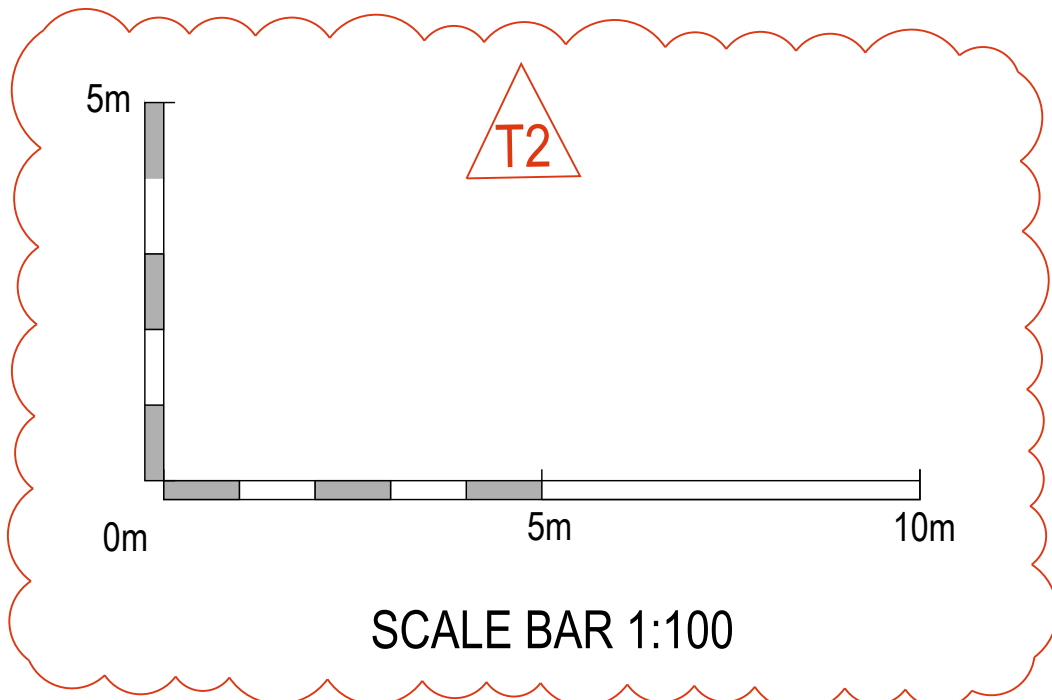


**APPENDIX D –DRAINAGE DESIGN CALCULATIONS AND DRAINAGE
AREA PLAN**



- DRAINAGE AREA 1 - 1.000 - 63m²
- DRAINAGE AREA 2 - 1.001 - 131m²
- DRAINAGE AREA 3 - 1.002 - 35m²
- DRAINAGE AREA 4 - 1.003 - 107m²
- DRAINAGE AREA 5 - 1.004 - 112m²
- DRAINAGE AREA 6 - 1.005 - 94m²
- DRAINAGE AREA 7 - 2.000 - 89m²
- DRAINAGE AREA 8 - 3.000 - 233m²
- DRAINAGE AREA 9 - SOAKAWAY - 573m²
- DRAINAGE AREA 10 - 4.000 - 80m²
- DRAINAGE AREA 11 - 5.000 - 248m²
- DRAINAGE AREA 12 - 4.001 - 186m²
- DRAINAGE AREA 13 - 4.002 - 132m²
- DRAINAGE AREA 14 - 4.003 - 60m²
- DRAINAGE AREA 15 - 6.000 - 108m²

TOTAL - 2251m²



DO NOT SCALE

For the avoidance of doubt, no approvals, reviews, comments or indication of satisfaction given by ARC Engineers in terms of associated drawings, products or proposed materials shall reduce or extinguish the obligation of the sub-contractor or supplier to adhere to the specification, general arrangement drawings, statutory requirements and good working practice. ARC Engineers accept no liability for the selection of materials or workmanship in the execution of the works.

GENERAL NOTES

- These notes are intended to augment drawings and specifications. Where conflict of requirements exists the order of precedence shall be as shown in the specifications. Otherwise the exact position shall govern.
- This drawing is to be read in conjunction with all other relevant Engineers and Architects drawings.
- Drawings not to be scaled.
- All dimensions to be checked on site by the contractor. Any discrepancies to be notified to the Engineer/Architect and further instructions obtained before work is commenced.
- The structure is designed to be self-supporting and stable after the building is fully complete. It is the contractors sole responsibility to determine the erection procedure and sequence and ensure that the building and its components are safe during erection. This includes the addition of whatever temporary bracing, girders or beams, which may be necessary, such material ensuring the property of the contractor upon completion.
- All work to comply to current building regulations and to be in accordance with the relevant British Standards and appropriate Codes of Practice.
- For further notes refer to Project Notes.

SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following risks and information.

Risks listed here are not exhaustive. Refer to Risk Assessment Register: XXXXXXX

Construction:

ADD PROJECT NOTES HERE

Demolition:
No Unusual hazards/risks
For information relating to Use, Cleaning and Maintenance see Health & Safety File

It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement.

INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION

INDICATES A RESIDUAL RISK FOR INFORMATION

INDICATES A RESIDUAL RISK REQUIRING PROHIBITIVE ACTION

INDICATES A RESIDUAL RISK AS A WARNING

T2 SCALE BAR ADDED

T1 INITIAL ISSUE

REVI DETAIL

JAB

JAB

BY

08.03.2023

04.10.2022

CHK (DATE)

arcengineers

CONSULTING STRUCTURAL AND CIVIL ENGINEERS

3 CADMAN COURT, LEEDS, LS27 0RX

Phone: 0113 263 3804

www.arc-engineers.co.uk

CLIENT:

AVERY

PROJECT:

CARE HOME,
CENTRAL AVENUE,
GRAVESEND

TITLE:

DRAINAGE
CATCHMENT AREAS

DRAWING STATUS:

TENDER

ISSUED

DATE

DESIGNED

DATE

JAB

04.10.2022

AA

04.10.2022

CONTRACT NO.

SCALE @ AS

22026

1:100

PROJECT NO.

ORIGINATOR

ZONE

LEVEL

TYPE

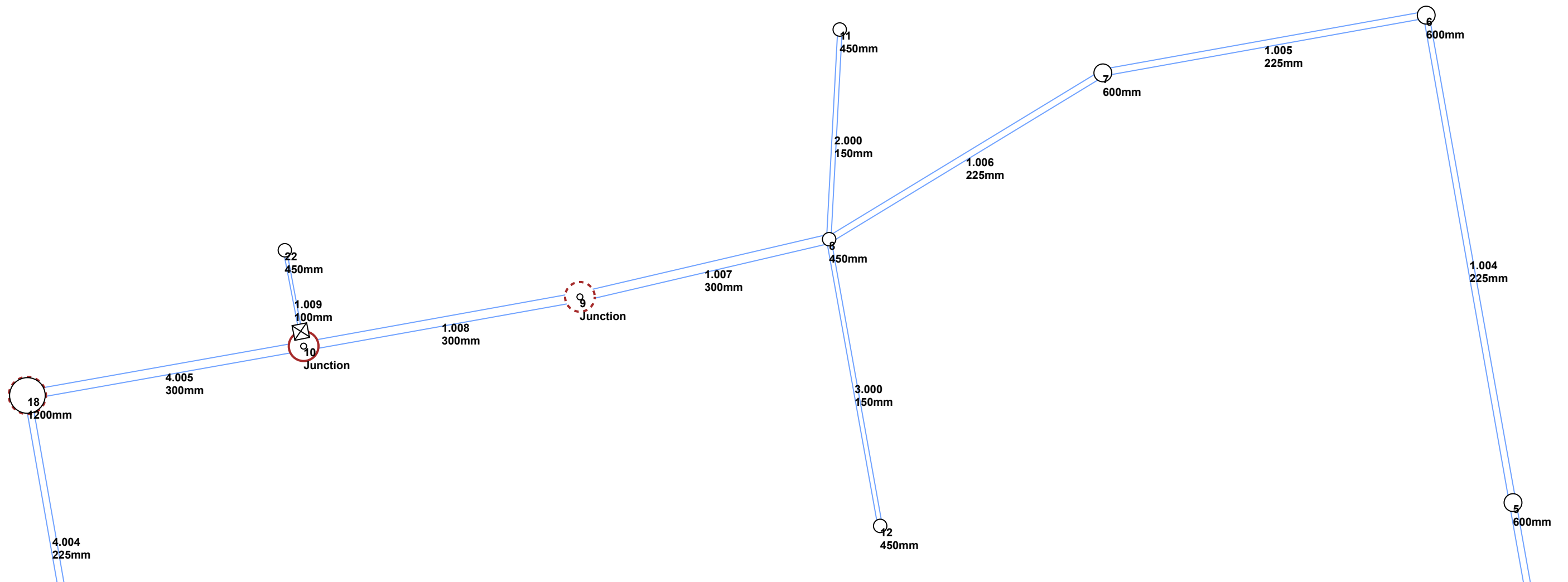
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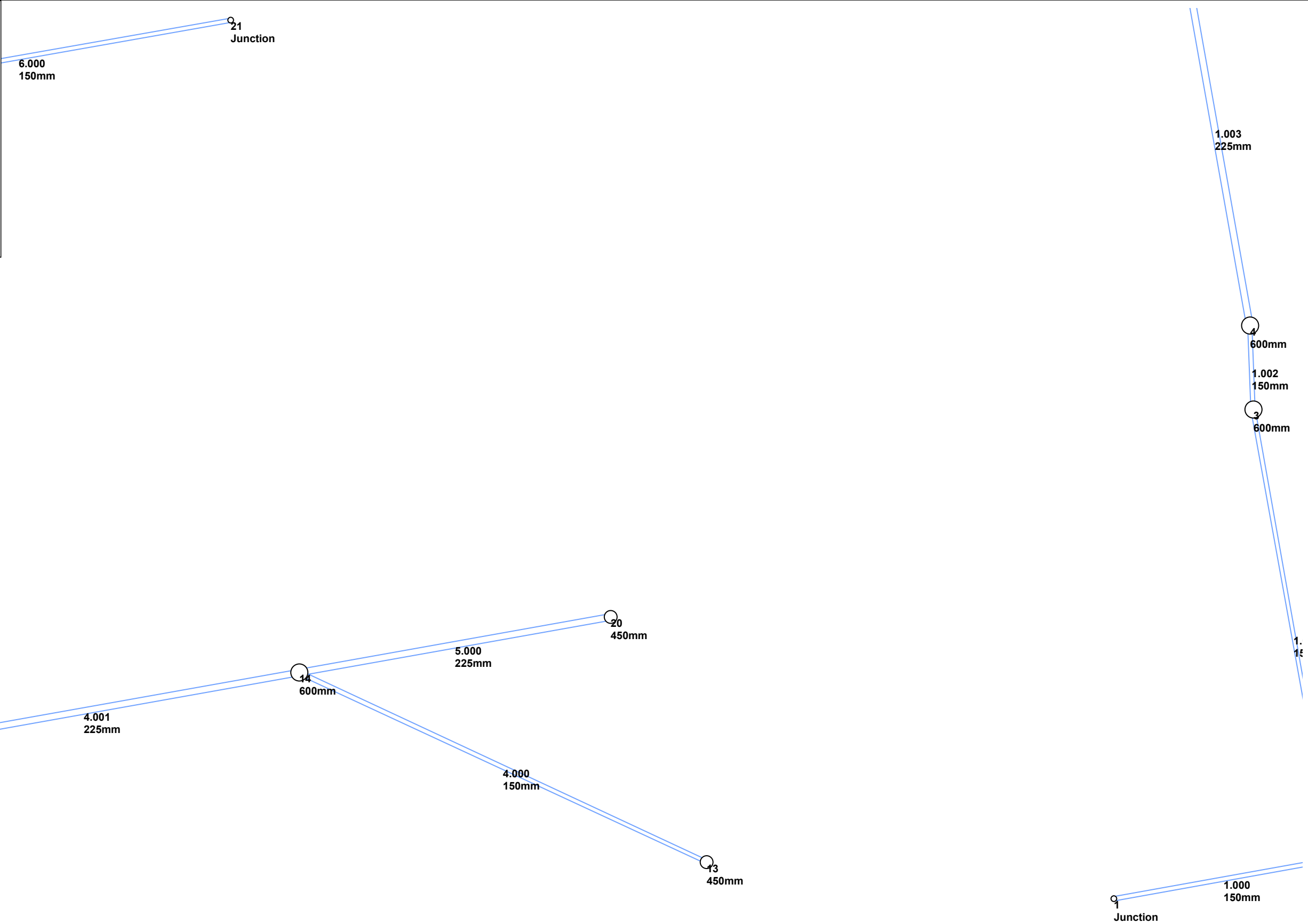
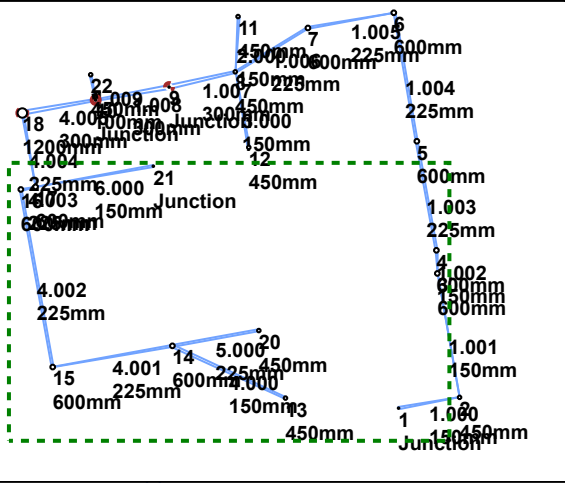
NUMBER

REVISION

22 026 - ARC - XX - XX - DR - D - 0503 - T2

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Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.006	5.00	36.000		564942.959	172386.676	0.530
2	0.013	5.00	36.120	450	564950.692	172388.054	0.729
3	0.004	5.00	35.820	600	564947.874	172403.862	0.630
4	0.011	5.00	35.820	600	564947.756	172406.812	0.742
5	0.011	5.00	35.905	600	564945.276	172420.725	1.004
6	0.009	5.00	35.750	600	564942.354	172437.115	1.126
7			35.800	600	564931.469	172435.174	1.452
11	0.009	5.00	35.600	450	564922.611	172436.632	1.340
12	0.023	5.00	35.900	450	564923.973	172419.942	0.650
8			35.800	450	564922.255	172429.582	1.796
9	0.029	5.00	35.550		564913.865	172427.643	2.150
13	0.008	5.00	35.920	450	564928.625	172387.959	0.620
20	0.025	5.00	35.940	450	564925.248	172396.574	0.640
14	0.019	5.00	35.940	600	564914.288	172394.623	0.913
15	0.013	5.00	35.820	600	564899.117	172391.919	0.988
16	0.006	5.00	35.820	600	564895.078	172414.574	1.448
21	0.011	5.00	36.000		564911.872	172417.543	0.750
17			35.825	600	564896.945	172414.907	1.491
18			35.825	1200	564895.266	172424.328	2.425
10			35.550	450	564904.565	172425.986	2.159
22			35.550	450	564903.932	172429.210	0.150

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	7.857	0.600	35.470	35.391	0.079	99.5	150	5.13	50.0
1.001	2	3	16.057	0.600	35.391	35.190	0.201	79.9	150	5.37	50.0
1.002	3	4	2.953	0.600	35.190	35.153	0.037	79.8	150	5.41	50.0
1.003	4	5	14.132	0.600	35.078	34.901	0.177	79.8	225	5.57	50.0
1.004	5	6	16.648	0.600	34.901	34.624	0.277	60.1	225	5.74	50.0
1.005	6	7	11.056	0.600	34.624	34.348	0.276	40.1	225	5.83	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.000	1.007	17.8	1.5	0.380	0.579	0.006	0.0
1.001	1.125	19.9	4.8	0.579	0.480	0.019	0.0
1.002	1.126	19.9	5.8	0.480	0.517	0.023	0.0
1.003	1.464	58.2	8.6	0.517	0.779	0.034	0.0
1.004	1.690	67.2	11.4	0.779	0.901	0.045	0.0
1.005	2.073	82.4	13.7	0.901	1.227	0.054	0.0

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.006	7	8	10.780	0.600	34.348	34.079	0.269	40.1	225	5.91	50.0
2.000	11	8	7.062	0.600	34.260	34.154	0.106	66.6	150	5.10	50.0
3.000	12	8	9.789	0.600	35.250	34.750	0.500	19.6	150	5.07	50.0
1.007	8	9	8.599	0.600	34.004	33.904	0.100	86.0	300	6.00	50.0
1.008	9	10	9.446	0.600	33.400	33.391	0.009	1000.0	300	6.32	50.0
4.000	13	14	15.810	0.600	35.300	35.102	0.198	79.8	150	5.23	50.0
5.000	20	14	11.133	0.600	35.300	35.027	0.273	40.8	225	5.09	50.0
4.001	14	15	15.411	0.600	35.027	34.832	0.195	79.0	225	5.41	50.0
4.002	15	16	23.013	0.600	34.832	34.372	0.460	50.0	225	5.62	50.0
4.003	16	17	1.896	0.600	34.372	34.334	0.038	50.0	225	5.63	50.0
6.000	21	17	15.158	0.600	35.250	34.409	0.841	18.0	150	5.11	50.0
4.004	17	18	9.570	0.600	34.334	34.174	0.160	60.0	225	5.73	50.0
4.005	18	10	9.446	0.600	33.400	33.391	0.009	1000.0	300	6.05	50.0
1.009	10	22	4.279	0.600	35.450	35.400	0.050	85.6	100	6.40	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)
1.006	2.072	82.4	13.7	1.227	1.496	0.054	0.0
2.000	1.234	21.8	2.3	1.190	1.496	0.009	0.0
3.000	2.286	40.4	5.8	0.500	0.900	0.023	0.0
1.007	1.696	119.9	21.8	1.496	1.346	0.086	0.0
1.008	0.489	34.6	29.1	1.850	1.859	0.115	0.0
4.000	1.126	19.9	2.0	0.470	0.688	0.008	0.0
5.000	2.054	81.7	6.3	0.415	0.688	0.025	0.0
4.001	1.472	58.5	13.2	0.688	0.763	0.052	0.0
4.002	1.853	73.7	16.4	0.763	1.223	0.065	0.0
4.003	1.854	73.7	18.0	1.223	1.266	0.071	0.0
6.000	2.383	42.1	2.8	0.600	1.266	0.011	0.0
4.004	1.691	67.2	20.7	1.266	1.426	0.082	0.0
4.005	0.489	34.6	20.7	2.125	1.859	0.082	0.0
1.009	0.832	6.5	49.8	0.000	0.050	0.197	0.0

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	7.857	99.5	150	1 GRAVESEND SW	36.000	35.470	0.380	36.120	35.391	0.579
1.001	16.057	79.9	150	1 GRAVESEND SW	36.120	35.391	0.579	35.820	35.190	0.480
1.002	2.953	79.8	150	1 GRAVESEND SW	35.820	35.190	0.480	35.820	35.153	0.517
1.003	14.132	79.8	225	1 GRAVESEND SW	35.820	35.078	0.517	35.905	34.901	0.779
1.004	16.648	60.1	225	1 GRAVESEND SW	35.905	34.901	0.779	35.750	34.624	0.901
1.005	11.056	40.1	225	1 GRAVESEND SW	35.750	34.624	0.901	35.800	34.348	1.227

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1		Junction		2	450	Manhole	1 GRAVESEND SW
1.001	2	450	Manhole	1 GRAVESEND SW	3	600	Manhole	1 GRAVESEND SW
1.002	3	600	Manhole	1 GRAVESEND SW	4	600	Manhole	1 GRAVESEND SW
1.003	4	600	Manhole	1 GRAVESEND SW	5	600	Manhole	1 GRAVESEND SW
1.004	5	600	Manhole	1 GRAVESEND SW	6	600	Manhole	1 GRAVESEND SW
1.005	6	600	Manhole	1 GRAVESEND SW	7	600	Manhole	1 GRAVESEND SW

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.006	10.780	40.1	225	1 GRAVESEND SW	35.800	34.348	1.227	35.800	34.079	1.496
2.000	7.062	66.6	150	1 GRAVESEND SW	35.600	34.260	1.190	35.800	34.154	1.496
3.000	9.789	19.6	150	1 GRAVESEND SW	35.900	35.250	0.500	35.800	34.750	0.900
1.007	8.599	86.0	300	1 GRAVESEND SW	35.800	34.004	1.496	35.550	33.904	1.346
1.008	9.446	1000.0	300	1 GRAVESEND SW	35.550	33.400	1.850	35.550	33.391	1.859
4.000	15.810	79.8	150	1 GRAVESEND SW	35.920	35.300	0.470	35.940	35.102	0.688
5.000	11.133	40.8	225	1 GRAVESEND SW	35.940	35.300	0.415	35.940	35.027	0.688
4.001	15.411	79.0	225	1 GRAVESEND SW	35.940	35.027	0.688	35.820	34.832	0.763
4.002	23.013	50.0	225	1 GRAVESEND SW	35.820	34.832	0.763	35.820	34.372	1.223
4.003	1.896	50.0	225	1 GRAVESEND SW	35.820	34.372	1.223	35.825	34.334	1.266
6.000	15.158	18.0	150	1 GRAVESEND SW	36.000	35.250	0.600	35.825	34.409	1.266
4.004	9.570	60.0	225	1 GRAVESEND SW	35.825	34.334	1.266	35.825	34.174	1.426
4.005	9.446	1000.0	300	1 GRAVESEND SW	35.825	33.400	2.125	35.550	33.391	1.859
1.009	4.279	85.6	100	1 GRAVESEND SW	35.550	35.450	0.000	35.550	35.400	0.050

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.006	7	600	Manhole	1 GRAVESEND SW	8	450	Manhole	1 GRAVESEND SW
2.000	11	450	Manhole	1 GRAVESEND SW	8	450	Manhole	1 GRAVESEND SW
3.000	12	450	Manhole	1 GRAVESEND SW	8	450	Manhole	1 GRAVESEND SW
1.007	8	450	Manhole	1 GRAVESEND SW	9		Junction	
1.008	9		Junction		10	450	Junction	
4.000	13	450	Manhole	1 GRAVESEND SW	14	600	Manhole	1 GRAVESEND SW
5.000	20	450	Manhole	1 GRAVESEND SW	14	600	Manhole	1 GRAVESEND SW
4.001	14	600	Manhole	1 GRAVESEND SW	15	600	Manhole	1 GRAVESEND SW
4.002	15	600	Manhole	1 GRAVESEND SW	16	600	Manhole	1 GRAVESEND SW
4.003	16	600	Manhole	1 GRAVESEND SW	17	600	Manhole	1 GRAVESEND SW
6.000	21		Junction		17	600	Manhole	1 GRAVESEND SW
4.004	17	600	Manhole	1 GRAVESEND SW	18	1200	Manhole	1 GRAVESEND SW
4.005	18	1200	Manhole	1 GRAVESEND SW	10	450	Junction	
1.009	10	450	Junction		22	450	Manhole	1 GRAVESEND SW

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Detailed
FSR Region	England and Wales	Skip Steady State	x
M5-60 (mm)	20.000	Drain Down Time (mins)	240
Ratio-R	0.400	Additional Storage (m³/ha)	20.0
Summer CV	1.000	Check Discharge Rate(s)	x
Winter CV	1.000	Check Discharge Volume	x

Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Node 10 Online Depth/Flow Control

Flap Valve x | Replaces Downstream Link ✓ | Invert Level (m) 35.450

Depth (m) Flow (l/s)
6.000 0.000

Node 18 Deep Bore Soakaway Storage Structure

BRE-365: Volume (m³)	0.100	Safety Factor	2.0	Borehole Diameter	0.300
BRE-365: Area (m²)	1.954	Porosity	1.00	Borehole Depth (m)	11.500
BRE-365: Time (hrs)	0.108	Invert Level (m)	32.400	Inf Depth (m)	9.500
BRE-365: Inf Coef (m/hr)	0.47386	Time to half empty (mins)		Number Required	1
Base Inf Coefficient (m/hr)	0.47386	Diameter (m)	1.800		
Side Inf Coefficient (m/hr)	0.47386	Depth (m)			

Node 9 Deep Bore Soakaway Storage Structure

Base Inf Coefficient (m/hr)	0.47386	Invert Level (m)	32.400	Borehole Diameter	0.300
Side Inf Coefficient (m/hr)	0.47386	Time to half empty (mins)		Borehole Depth (m)	11.500
Safety Factor	2.0	Diameter (m)	1.800	Inf Depth (m)	9.500
Porosity	1.00	Depth (m)		Number Required	1

Node 10 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	33.391
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	150.0	0.0	1.000	150.0	0.0	1.001	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	35.495	0.025	1.1	0.0056	0.0000	OK
15 minute summer	2	10	35.432	0.041	3.4	0.0213	0.0000	OK
15 minute summer	3	11	35.241	0.051	4.0	0.0208	0.0000	OK
15 minute summer	4	11	35.127	0.049	5.9	0.0286	0.0000	OK
15 minute summer	5	11	34.954	0.053	7.9	0.0268	0.0000	OK
15 minute summer	6	11	34.677	0.053	9.4	0.0236	0.0000	OK
15 minute summer	7	11	34.402	0.054	9.4	0.0153	0.0000	OK
15 minute summer	11	10	34.288	0.028	1.6	0.0083	0.0000	OK
15 minute summer	12	10	35.283	0.033	4.1	0.0289	0.0000	OK
15 minute summer	8	11	34.078	0.074	14.9	0.0118	0.0000	OK
15 minute summer	9	12	33.518	0.118	19.8	3.6981	0.0000	OK
15 minute summer	13	11	35.327	0.027	1.4	0.0114	0.0000	OK
15 minute summer	20	10	35.336	0.036	4.5	0.0335	0.0000	OK
15 minute summer	14	10	35.090	0.063	9.3	0.0438	0.0000	OK
15 minute summer	15	10	34.891	0.059	11.5	0.0324	0.0000	OK
15 minute summer	16	11	34.451	0.079	12.4	0.0290	0.0000	OK
15 minute summer	21	10	35.272	0.022	2.0	0.0065	0.0000	OK
15 minute summer	17	11	34.410	0.076	14.3	0.0215	0.0000	OK
180 minute winter	18	176	33.503	0.103	3.3	3.7462	0.0000	OK
180 minute winter	10	176	33.503	0.112	6.9	16.8368	0.0000	OK
15 minute summer	22	1	35.400	0.000	0.0	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	1.1	0.371	0.060	0.0230	
15 minute summer	2	1.001	3	3.3	0.727	0.167	0.0735	
15 minute summer	3	1.002	4	4.0	0.821	0.201	0.0144	
15 minute summer	4	1.003	5	5.9	0.873	0.102	0.0961	
15 minute summer	5	1.004	6	7.9	1.099	0.117	0.1195	
15 minute summer	6	1.005	7	9.4	1.303	0.114	0.0800	
15 minute summer	7	1.006	8	9.4	1.343	0.115	0.0759	
15 minute summer	11	2.000	8	1.6	0.702	0.072	0.0158	
15 minute summer	12	3.000	8	4.1	1.436	0.101	0.0277	
15 minute summer	8	1.007	9	14.9	1.143	0.125	0.1125	
15 minute summer	9	1.008	10	21.6	2.170	0.625	0.1253	
15 minute summer	9	Infiltration		0.6				
15 minute summer	13	4.000	14	1.4	0.646	0.070	0.0343	
15 minute summer	20	5.000	14	4.5	0.700	0.055	0.0726	
15 minute summer	14	4.001	15	9.2	1.057	0.157	0.1337	
15 minute summer	15	4.002	16	11.3	1.101	0.154	0.2393	
15 minute summer	16	4.003	17	12.4	1.026	0.168	0.0229	
15 minute summer	21	6.000	17	2.0	1.216	0.047	0.0246	
15 minute summer	17	4.004	18	14.4	1.291	0.214	0.1068	
180 minute winter	18	4.005	10	2.6	0.632	0.076	0.2149	
180 minute winter	18	Infiltration		0.6				
180 minute winter	10	Depth/Flow	22	0.0				0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	35.509	0.039	2.6	0.0087	0.0000	OK
15 minute summer	2	10	35.460	0.069	8.3	0.0354	0.0000	OK
15 minute summer	3	10	35.277	0.087	10.0	0.0356	0.0000	OK
15 minute summer	4	10	35.158	0.080	14.7	0.0465	0.0000	OK
15 minute summer	5	10	34.987	0.086	19.4	0.0432	0.0000	OK
15 minute summer	6	11	34.711	0.087	23.1	0.0387	0.0000	OK
15 minute summer	7	11	34.437	0.089	23.2	0.0251	0.0000	OK
15 minute summer	11	10	34.305	0.045	3.9	0.0133	0.0000	OK
15 minute summer	12	10	35.304	0.054	10.1	0.0468	0.0000	OK
15 minute summer	8	11	34.124	0.120	36.7	0.0191	0.0000	OK
360 minute winter	9	352	33.795	0.395	6.3	4.4778	0.0000	SURCHARGED
15 minute summer	13	10	35.343	0.043	3.5	0.0181	0.0000	OK
15 minute summer	20	10	35.355	0.055	11.0	0.0521	0.0000	OK
15 minute summer	14	10	35.130	0.103	22.7	0.0722	0.0000	OK
15 minute summer	15	10	34.928	0.096	28.2	0.0522	0.0000	OK
15 minute summer	16	11	34.513	0.141	30.6	0.0515	0.0000	OK
15 minute summer	21	10	35.284	0.034	4.8	0.0100	0.0000	OK
15 minute summer	17	11	34.464	0.130	35.1	0.0367	0.0000	OK
360 minute winter	18	352	33.795	0.395	4.6	4.8188	0.0000	SURCHARGED
360 minute winter	10	352	33.795	0.404	9.1	60.6096	0.0000	OK
15 minute summer	22	1	35.400	0.000	0.0	0.0000	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	2.6	0.458	0.145	0.0448	
15 minute summer	2	1.001	3	8.2	0.890	0.412	0.1476	
15 minute summer	3	1.002	4	9.9	1.024	0.495	0.0284	
15 minute summer	4	1.003	5	14.6	1.094	0.250	0.1885	
15 minute summer	5	1.004	6	19.3	1.368	0.287	0.2343	
15 minute summer	6	1.005	7	23.2	1.614	0.281	0.1587	
15 minute summer	7	1.006	8	23.2	1.697	0.282	0.1478	
15 minute summer	11	2.000	8	3.9	0.900	0.178	0.0304	
15 minute summer	12	3.000	8	10.0	1.829	0.248	0.0537	
15 minute summer	8	1.007	9	36.8	1.456	0.307	0.2176	
360 minute winter	9	1.008	10	5.5	0.788	0.158	0.6652	
360 minute winter	9	Infiltration		0.6				
15 minute summer	13	4.000	14	3.4	0.831	0.172	0.0652	
15 minute summer	20	5.000	14	11.0	0.876	0.134	0.1412	
15 minute summer	14	4.001	15	22.5	1.330	0.384	0.2607	
15 minute summer	15	4.002	16	28.0	1.328	0.380	0.4846	
15 minute summer	16	4.003	17	30.4	1.220	0.413	0.0473	
15 minute summer	21	6.000	17	4.8	1.432	0.113	0.0664	
15 minute summer	17	4.004	18	35.2	1.600	0.524	0.2108	
360 minute winter	18	4.005	10	3.7	0.458	0.106	0.6652	
360 minute winter	18	Infiltration		0.6				
360 minute winter	10	Depth/Flow	22	0.0				0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 99.91%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute summer	1	10	35.523	0.053	4.8	0.0120	0.0000	OK
15 minute summer	2	10	35.494	0.103	15.2	0.0530	0.0000	OK
15 minute summer	3	10	35.325	0.135	18.3	0.0555	0.0000	OK
15 minute summer	4	10	35.194	0.116	26.8	0.0669	0.0000	OK
15 minute summer	5	10	35.025	0.124	35.4	0.0623	0.0000	OK
15 minute summer	6	10	34.751	0.127	42.3	0.0561	0.0000	OK
15 minute summer	7	11	34.476	0.128	42.2	0.0363	0.0000	OK
15 minute summer	11	10	34.324	0.064	7.2	0.0187	0.0000	OK
15 minute summer	12	10	35.327	0.077	18.3	0.0666	0.0000	OK
480 minute winter	8	472	34.299	0.295	7.0	0.0469	0.0000	OK
480 minute winter	9	472	34.299	0.899	10.0	5.8967	0.0000	SURCHARGED
15 minute summer	13	10	35.359	0.059	6.4	0.0245	0.0000	OK
15 minute summer	20	10	35.377	0.077	19.9	0.0723	0.0000	OK
15 minute summer	14	10	35.180	0.153	41.4	0.1067	0.0000	OK
15 minute summer	15	10	34.972	0.140	51.4	0.0766	0.0000	OK
15 minute summer	16	11	34.631	0.259	56.2	0.0948	0.0000	SURCHARGED
15 minute summer	21	10	35.297	0.047	8.8	0.0136	0.0000	OK
15 minute summer	17	11	34.561	0.227	64.6	0.0642	0.0000	SURCHARGED
480 minute winter	18	472	34.299	0.899	6.6	6.6722	0.0000	SURCHARGED
480 minute winter	10	472	34.299	0.908	14.2	136.2412	0.0000	OK
15 minute summer	22	1	35.400	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute summer	1	1.000	2	4.8	0.517	0.268	0.0723	
15 minute summer	2	1.001	3	15.1	1.005	0.757	0.2375	
15 minute summer	3	1.002	4	18.0	1.163	0.904	0.0454	
15 minute summer	4	1.003	5	26.6	1.244	0.457	0.3037	
15 minute summer	5	1.004	6	35.1	1.552	0.523	0.3783	
15 minute summer	6	1.005	7	42.2	1.820	0.512	0.2562	
15 minute summer	7	1.006	8	42.4	1.949	0.514	0.2343	
15 minute summer	11	2.000	8	7.1	1.052	0.327	0.0479	
15 minute summer	12	3.000	8	18.2	2.115	0.451	0.0843	
480 minute winter	8	1.007	9	8.6	0.922	0.072	0.6045	
480 minute winter	9	1.008	10	8.5	0.689	0.247	0.6652	
480 minute winter	9	Infiltration		0.6				
15 minute summer	13	4.000	14	6.3	0.880	0.319	0.1232	
15 minute summer	20	5.000	14	19.8	0.974	0.243	0.2263	
15 minute summer	14	4.001	15	41.0	1.498	0.700	0.4212	
15 minute summer	15	4.002	16	51.4	1.430	0.697	0.7568	
15 minute summer	16	4.003	17	55.8	1.403	0.757	0.0754	
15 minute summer	21	6.000	17	8.8	1.476	0.208	0.1677	
15 minute summer	17	4.004	18	63.3	1.771	0.941	0.3453	
480 minute winter	18	4.005	10	5.7	0.253	0.164	0.6652	
480 minute winter	18	Infiltration		0.6				
480 minute winter	10	Depth/Flow	22	0.0				0.0

APPENDIX E – DRAINAGE EXCEEDANCE PLAN DRAWING

AIN TREE CLOSE

AIN TREE CLOSE

ASCOT ROAD

CENTRAL AVENUE

- DRAINAGE KEY:**
- FW 1.000 150mm @ 1.60 FOUL WATER PIPE (100mm U.N.O.)
 - SW 1.000 150mm @ 1.60 SURFACE WATER PIPE (100mm U.N.O.)
 - BACKDROP MANHOLE
 - EXISTING FW SEWER
 - EXISTING SW SEWER
 - SWMH01 CL = TBC IL = TBC SURFACE WATER MANHOLE
 - FM201 CL = TBC IL = TBC FOUL WATER MANHOLE
 - PPIC POLYPROPYLENE INSPECTION CHAMBER
 - CONNECTION TO EXISTING FW SEWER
 - EXISTING MANHOLE
 - ROAD GULLY
 - RODDING EYE
 - GULLY
 - FOUL WATER GULLY
 - RWP RAINWATER PIPE
 - LINEAR DRAINAGE CHANNEL OR THRESHOLD DRAINAGE (BUILT IN FALLS)
 - SURFACE WATER ATTENUATION SOAKAWAY POLYSTORM OR SIMILAR SUITABLE FOR VEHICLE ACCESS MIN COVER 0.8m
 - PERMEABLE PAVING AREA
 - 600mm WIDE PERMEABLE PAVING COLLECTION TRENCH
 - SITE BOUNDARY
 - TREE ROOT PROTECTION ZONE
 - EXCEEDANCE FLOWS

EXTERNAL WORKS LEGEND

- DENOTES KERB TYPE K1 (125 x 225mm) HALF BALT
- ALL KERBS TO BE K1 UNLESS NOTED OTHERWISE
- DENOTES KERB TYPE D1 (125 x 150mm) DROPPED I
- PROPOSED SITE LEVEL
- EXISTING SITE LEVEL
- 300 THICK CAVITY FILL MASONRY WALL
- FOE (FLAG ON EDGE) WITH HEIGHT

DO NOT SCALE

For the avoidance of doubt, no approvals, reviews, comments or indication of satisfaction given by ARC Engineers in terms of submittal drawings, production or proposed materials shall reduce or extinguish the obligation of the sub-contractor or supplier to adhere to the specification, general arrangement drawings, statutory requirements and good working practice. ARC Engineers accept no liability for the selection of materials or workmanship in the execution of the works.

GENERAL NOTES

- These notes are intended to augment drawings and specifications. Where conflict of requirements exists the order of precedence shall be as shown in the specifications. Otherwise the original provision shall govern.
- This drawing is to be used in conjunction with all other relevant Engineers and Architects drawings.
- Drawings not to be scaled.
- All dimensions to be checked on site by the contractor. Any discrepancies to be notified to the Engineer/Architect and further instructions obtained before work is commenced.
- The structure is designed to be self supporting and stable after the building is fully complete. It is the contractor's sole responsibility to determine the erection procedure and sequence and ensure that the building and its components are safe during erection. This includes the addition of whatever temporary bracing, girders or beams which may be necessary, such material remaining the property of the contractor upon completion.
- All work to comply to current building regulations and to be in accordance with the relevant British Standards and appropriate Codes of Practice.
- For further notes refer to Project Notes.

SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following risks and information.

Risks listed here are not exhaustive. Refer to Risk Assessment Register: XXXXXXX

Construction:

ADD PROJECT NOTES HERE

Demolition

No Unusual hazards/risks

For information relating to Use, Cleaning and Maintenance see Health & Safety File

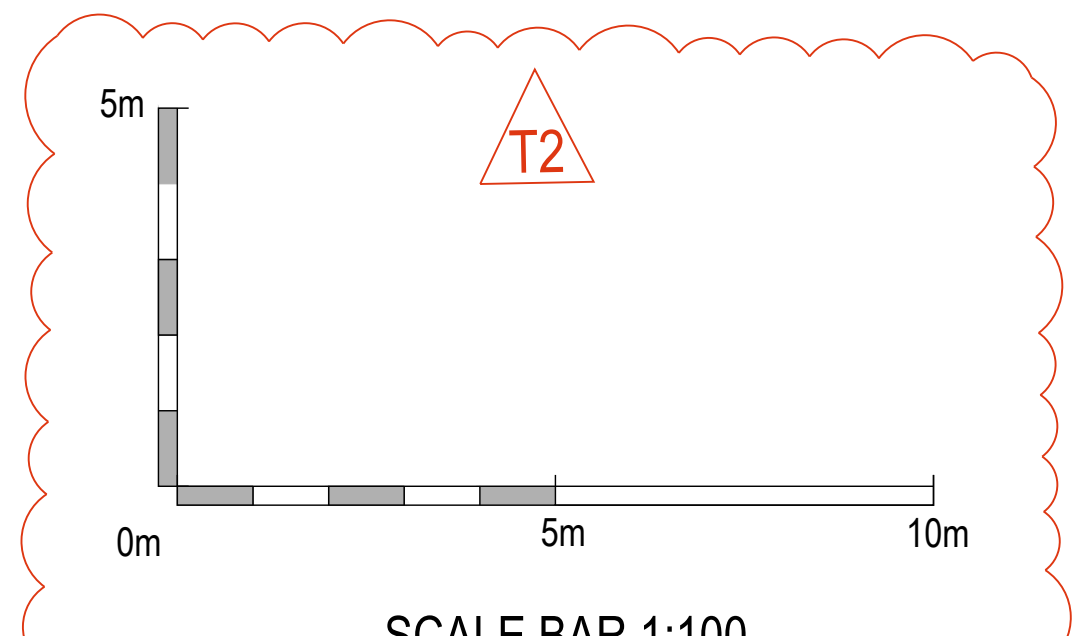
It is assumed that all works will be carried out by a competent contractor working, where appropriate, to an approved method statement.

INDICATES A RESIDUAL RISK REQUIRING A COMPULSORY ACTION

INDICATES A RESIDUAL RISK FOR INFORMATION

INDICATES A RESIDUAL RISK REQUIRING PROHIBITIVE ACTION

INDICATES A RESIDUAL RISK AS A WARNING



T2	SCALE BAR ADDED	JAB	08.03.2023
T1	INITIAL ISSUE	JAB	05.10.2022
REV	DETAIL	BY	CHK DATE

arcengineers
CONSULTING STRUCTURAL AND CIVIL ENGINEERS
3 CADAMAN COURT, LEEDS, LS2 9PX
Phone: 0113 253 3904
www.arc-engineers.co.uk

CLIENT: AVERY

PROJECT: CARE HOME, CENTRAL AVENUE, GRAVESEND

TITLE: DRAINAGE EXCEEDANCE ROUTE PLAN

DRAWING STATUS: TENDER

ISSUE: JAB DATE: 05.10.2022 CHECKED: DATE:

CONTRACT NO: 22026 SCALE: 1:100

PROJECT NO: ORIGINATOR: ZONE: LEVEL: TYPE: DESCRIPTION: NUMBER: REGION:

22026 - ARC - XX - XX - DR - D - 0504 - T2

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APPENDIX F – SOAKAWAY, FALLING HEAD AND BOREHOLE LOGS

KEY:

WS - WINDOW SAMPLE

BH - BOREHOLE

I - INSTALLATION

TP - TRIAL PIT

HDP - HAND DUG TRIAL PIT

SP - SOAKAGE PIT

DCP - DYNAMIC CONE PENETRATION

DP - DYNAMIC PROBE

HA - HAND AUGER

PT - PERCOLATION TEST

GM - GAS MONITORING STANDPIPE

S - SAMPLE LOCATION

CLIENT:

JENNER CONTRACTORS

SITE ADDRESS:

NEW CARE HOME

CENTRAL AVENUE

GRAVESEND

DA12 5AW

DRAWING NO.:

FIGURE 1

DRAWING TITLE:

EXPLORATORY HOLE LOCATION PLAN

PROJECT NO.:

12992

DATE:

01/2023

DRAWN:

PJ

REVISION:

GROUND AND ENVIRONMENTAL SERVICES (GES) LIMITED

UNIT 2

MONTPELIER BUSINESS PARK

DENCORA WAY

ASHFORD

KENT TN23 4FG

TEL: 01233 646 237





Ground and Environmental Services Limited

Unit 2 Montpelier Business Park
Dencora Way, Ashford
Kent TN23 4FG

Tel: 01233 646237

Trial Pit No. SP1

Sheet: 1 of 1

Equipment & Methods.
JCB 3CX Pit Dimensions 1.80m by 0.50m.
Support Used: None

Project Name: New Care Home
Project Location: Gravesend
Client: Jenner Contractors

Job No:
12992

Co-ordinates:
E:
N:

Ground Level (m):

Date Started: 27/01/2023
Date Completed: 27/01/2023

Samples and In situ Testing

Depth
(m)

No.

Type

Result

Field Records

DESCRIPTION

Reduced
Level
(m)

Legend

Depth
(Thick)
(m)

2.95

D

MADE GROUND - Tarmac and Type 1.
MADE GROUND - Type 1 fill.

Brown, slightly silty CLAY.

-0.05

-0.20

(0.05)

(0.15)

0.20

-2.40

-2.90

-2.95

2.40

(0.50)

2.90

(0.95)

End of Trial Pit 2.95 m
(Thickness of basal layer
not proven)

Remarks:

Logged By:

Checked By:

PJ

Scale:
1:19.75

Approved By:

FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.



SOAKAWAY TESTING

Test in accordance with BRE 365 Guidelines

Project Reference Number: 12992 Client: Jenner Contractors

Site: New Care Home

Location: Central Avenue, Gravesend, DA12 5AW

SP 1 Test
1 / 1

Weather: Clear skies, sunny

Date of Test: 27-Jan-23

TRIAL PIT DIMENSIONS

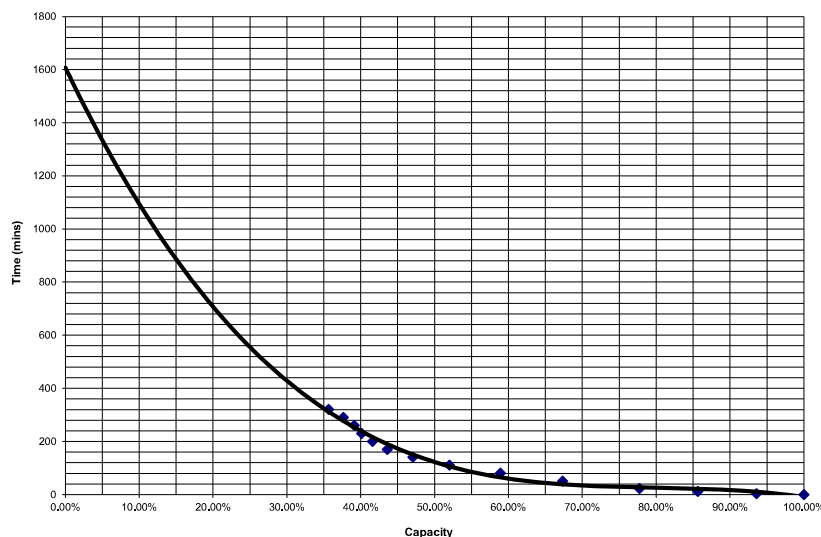
Width (m): 0.5 Length (m): 1.8

Depth (m): 2.95 Invert Depth (m): 0.93

Drainage time of test (mins): 321 (64% Drained)

SOAKAGE RESULTS

Depth	(%)	Time
0.93	100.00%	0
1.06	93.56%	4
1.22	85.64%	12
1.38	77.72%	23
1.59	67.33%	51
1.76	58.91%	81
1.9	51.98%	111
2	47.03%	141
2.07	43.56%	171
2.11	41.58%	201
2.14	40.10%	231
2.16	39.11%	261
2.19	37.62%	291
2.23	35.64%	321
2.95	0.00%	



INFILTRATION RATE

Depth (B.G.L) (m)	Infiltration Rate (m/s)
0.93 - 2.95	5.15E-06

Departures from the specified test method: None

Remarks: low infiltration-rate based on extrapolation of test data

Authorised Signatory: C SPANTON Date: 1 / 02 / 2023



SOAKAWAY TESTING

Test in accordance with BRE 365 Guidelines

Project Reference Number: 12992 Client: Jenner Contractors
Site: New Care Home
Location: Central Avenue, Gravesend, DA12 5AW

SP 2 Test
1 / 1

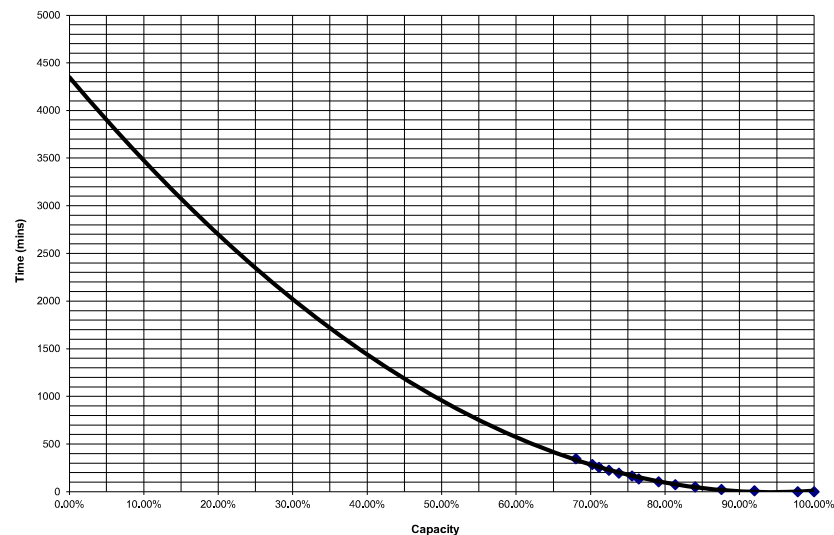
Weather: Clear skies, sunny
Date of Test: 27-Jan-23

TRIAL PIT DIMENSIONS

Width (m): 0.5 Length (m): 2
Depth (m): 3.25 Invert Depth (m): 1
Drainage time of test (mins): 346 (32% Drained)

SOAKAGE RESULTS

Depth	(%)	Time
1	100.00%	0
1.05	97.78%	1
1.18	92.00%	11
1.28	87.56%	26
1.36	84.00%	50
1.42	81.33%	76
1.47	79.11%	106
1.53	76.44%	136
1.55	75.56%	166
1.59	73.78%	196
1.62	72.44%	226
1.65	71.11%	256
1.67	70.22%	286
1.72	68.00%	346
3.25	0.00%	



INFILTRATION RATE

Depth (B.G.L.) (m)	Infiltration Rate (m/s)
1.00-3.25	1.30E-06

Departures from the specified test method: None

Low infiltration - rate based on extrapolation of test data

Remarks: _____

Authorised Signatory: C SPANTON Date: 1 / 02 / 2023



Ground and Environmental Services Limited

Unit 2 Montpelier Business Park
Dencora Way, Ashford
Kent TN23 4FG

Tel: 01233 646237

Trial Pit No. SP2

Sheet: 1 of 1

Equipment & Methods.
JCB 3CX Pit Dimensions 2.00m by 0.50m.
Support Used: None

Project Name: New Care Home
Project Location: Gravesend
Client: Jenner Contractors

Job No:
12992

Co-ordinates:
E:
N:

Ground Level (m):

Date Started: 27/01/2023
Date Completed: 27/01/2023

Samples and In situ Testing

Depth
(m)

No.

Type

Result

Field Records

DESCRIPTION

Reduced
Level
(m)

Legend

Depth
(Thick)
(m)

3.25

D

MADE GROUND - turf over topsoil.

Brown slightly silty CLAY with occasional gravel. Gravel is medium to cobble-sized sub-angular to sub-rounded flint.

-0.02

(0.02)

(1.93)

-1.95

1.95

-2.10

(0.15)
2.10

(1.15)

-3.25

3.25

End of Trial Pit 3.25 m
(Thickness of basal layer
not proven)

Remarks:

Logged By:

Checked By:

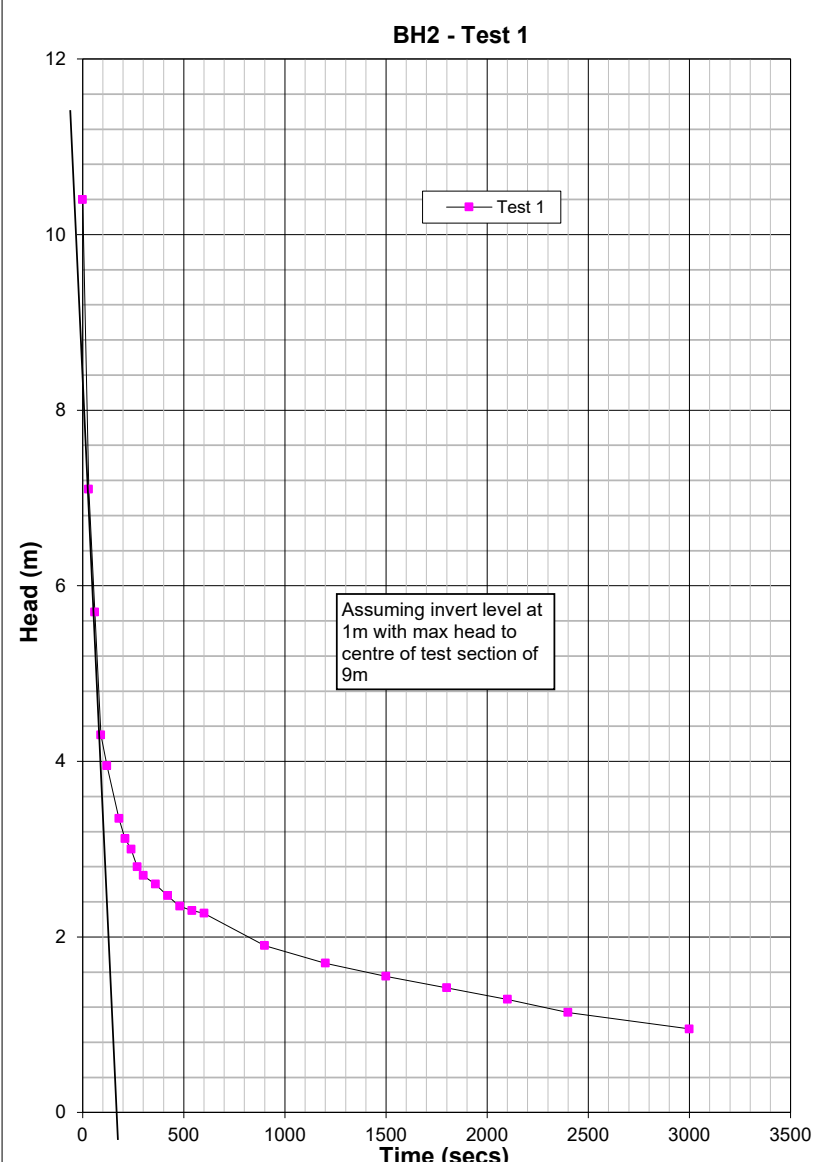
PJ

Scale:
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Approved By:

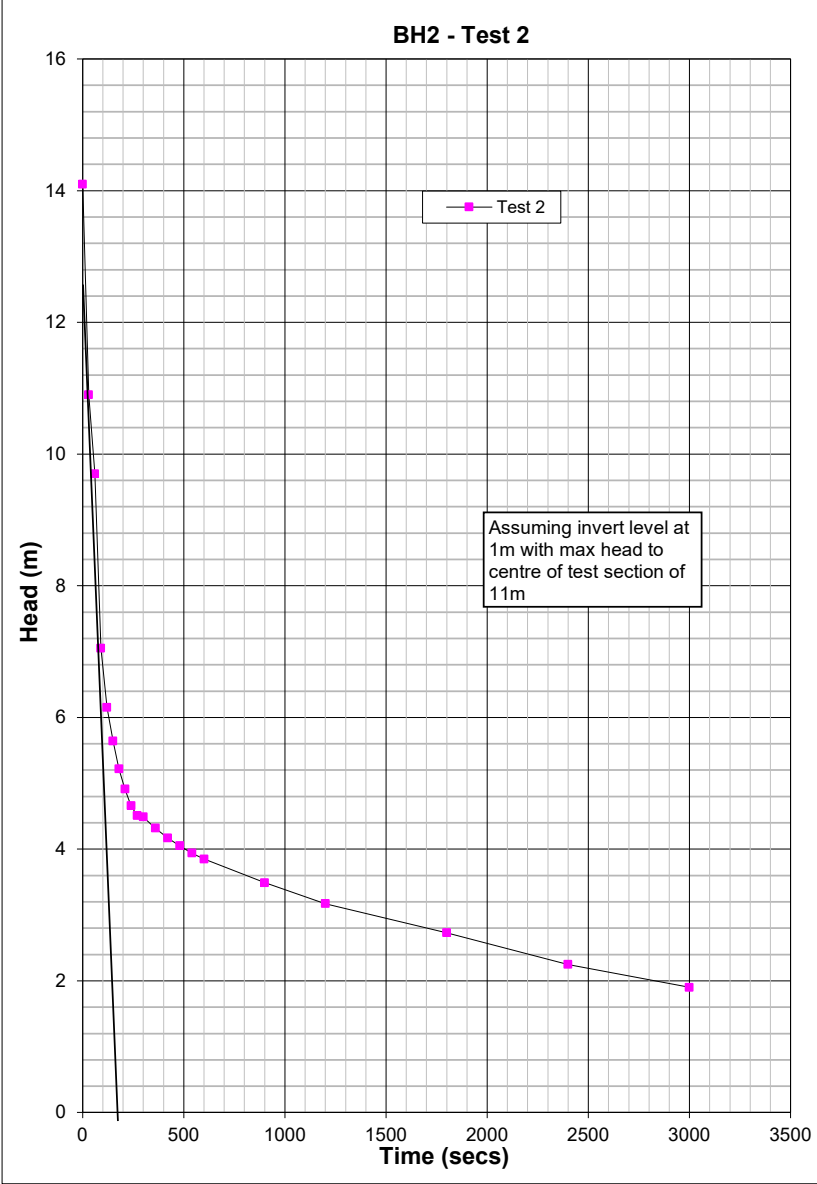
FIG No.

Notes: For explanation of symbols and abbreviations, see Key Sheet.

		New Care Home, Central Avenue, Gravesend				BH2		
Top section Bottom section	9 11	m m	Centre section Diameter of test section	10 0.15	m m	Diameter of Hole Length of test section	0.15 2	m m
Water Level		dry m						
Time (Seconds)	Depth	Head						
0	0.6	10.4						
30	3.9	7.1						
60	5.3	5.7						
90	6.7	4.3						
120	7.05	3.95						
180	7.65	3.35						
210	7.88	3.12						
240	8	3						
270	8.2	2.8						
300	8.3	2.7						
360	8.4	2.6						
420	8.53	2.47						
480	8.65	2.35						
540	8.7	2.3						
600	8.73	2.27						
900	9.1	1.9						
1200	9.3	1.7						
1500	9.45	1.55						
1800	9.58	1.42						
2100	9.71	1.29						
2400	9.86	1.14						
3000	10.05	0.95						
			BH2 - Test 1					
								
			METHODOLOGY IN ACCORDANCE WITH KCC SOAKAWAY DESIGN GUIDE, JULY 2000.					
Soakage Rate:	$250 \cdot H_p \cdot d^2$		Hp	9.2	m	th	3	mins
	$D \cdot L \cdot th$		Very good Infiltration - 1000L added to borehole in 240 seconds. Constant head at 0.6m for 1 minute 10 seconds. Borehole collapsed to 10.2m during the test					
=	57.50	L/m ² /min	After BS5930:1999 k(approx) = 1.7 x 10 ⁻³ m/s ESTIMATED					

	New Care Home, Central Avenue, Gravesend				BH2
Top section	9	m	Centre section	12	m
Bottom section	15	m	Diameter of test section	0.15	m
			Diameter of Hole	0.15	m
			Length of test section	6	m
Water Level dry m					

Time (Seconds)	Depth	Head
0	0.9	14.1
30	4.1	10.9
60	5.3	9.7
90	7.95	7.05
120	8.85	6.15
150	9.36	5.64
180	9.78	5.22
210	10.09	4.91
240	10.34	4.66
270	10.49	4.51
300	10.51	4.49
360	10.68	4.32
420	10.83	4.17
480	10.95	4.05
540	11.06	3.94
600	11.15	3.85
900	11.51	3.49
1200	11.83	3.17
1800	12.27	2.73
2400	12.75	2.25
3000	13.1	1.9

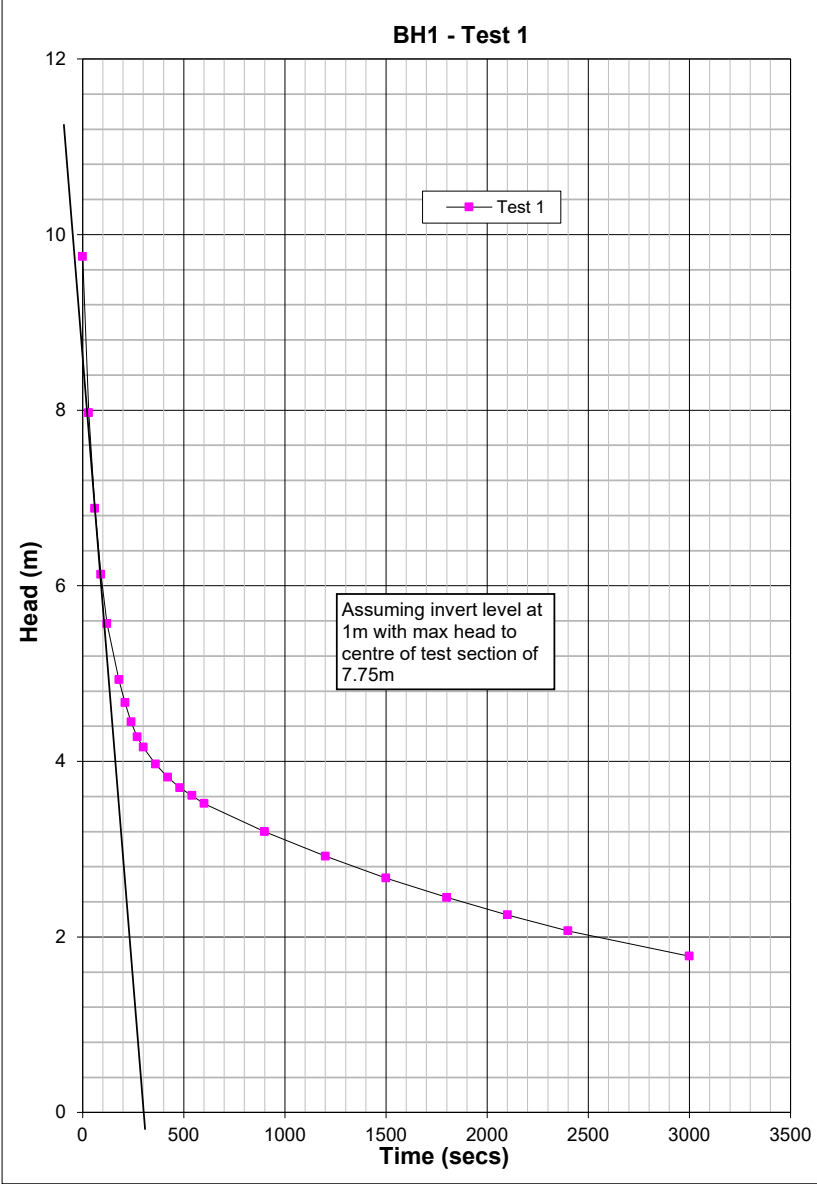


BH2 - Test 2

METHODOLOGY IN ACCORDANCE WITH KCC SOAKAWAY DESIGN GUIDE, JULY 2000.							
Soakage Rate:	$250 \cdot H_p \cdot d^2$	H_p	12	m	t_h	3.5	mins
	$D \cdot L \cdot t_h$	Very good Infiltration - 1000L added to borehole in 250 seconds. Borehole collapsed to 13.9m during the test					
=	21.43						
		After BS5930:1999		$k(\text{approx}) = 1.6 \times 10^{-3} \text{ m/s}$		ESTIMATED	

		New Care Home, Central Avenue, Gravesend				BH1					
Top section		7.5	m	Centre section		8.75	m	Diameter of Hole		0.15	m
Bottom section		10	m	Diameter of test section		0.15	m	Length of test section		2.5	m
Water Level		dry									

Time (Seconds)	Depth	Head
0	0.25	9.75
30	2.03	7.97
60	3.12	6.88
90	3.87	6.13
120	4.43	5.57
180	5.07	4.93
210	5.33	4.67
240	5.55	4.45
270	5.72	4.28
300	5.84	4.16
360	6.03	3.97
420	6.18	3.82
480	6.3	3.7
540	6.39	3.61
600	6.48	3.52
900	6.8	3.2
1200	7.08	2.92
1500	7.33	2.67
1800	7.55	2.45
2100	7.75	2.25
2400	7.93	2.07
3000	8.22	1.78



METHODOLOGY IN ACCORDANCE WITH KCC SOAKAWAY DESIGN GUIDE, JULY 2000.									
Soakage Rate:	$250 \cdot H_p \cdot d^2$	Hp	8.25	m	th	5	mins		
	$D \cdot L \cdot th$	Very good Infiltration - 1000L added to borehole in 280 seconds. Constant head at 0.25m for 40 seconds. Borehole collapsed to 9.35m during the test							
=	24.75	L/m²/min		After BS5930:1999		k(approx) = 4.3 x10⁻⁴m/s		ESTIMATED	



Ground and Environmental Services Limited

Unit 2 Montpelier Business Park,
Dencora Way, Ashford,
Kent TN23 4FG

Tel: 01233 646237

Borehole No. BH1

Sheet: 1 of 3

Equipment & Methods. Dando 150 Backfill: Arisings					Project Name: New Care Home Project Location: Central Avenue, Gravesend, Kent Client: Jenner (Contractors) Ltd			Job No: 12992		
Co-ordinates: E: N:					Ground Level (m):			Date Started:01/02/2023 Date Completed:07/02/2023		
Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)		
Depth (m)	No.	Type	Result							
0.70		D		3,4/4,5,6,5	MADE GROUND: Grass over silty sandy clayey topsoil with frequent roots	-0.70		(0.70)		
1.00- 1.45		SS	SN=20		Stiff orange brown silty gravelly CLAY. Gravel is fine to coarse flint					
1.60		D		3,5/5,4,5,5				(1.50)		
2.00- 2.45		SS	SN=19							
2.60		D		4,5/4,5,5,5	Off white and light brown highly weathered CHALK. recovered as fine to coarse chalk gravel in a silt matrix	-2.20		2.20		
3.00- 3.45		SS	SN=19		White partially weathered CHALK. Recovered as fine to coarse chalk gravel in a comminuted silt matrix. Scattered flint throughout	-2.60		(0.40)		
3.70		D		2,4/5,4,4,3				2.60		
4.00- 4.45		SS	SN=15							
4.60		D		3,3/4,3,3,4						
5.00- 5.45		SS	SN=14							
6.00		D		2,4/5,4,4,3						
6.50- 6.95		SS	SN=16							
7.00		D		2,3/3,4,3,5						
8.00		SS	SN=15							
8.00- 8.45		D		2,2/3,4,4,4						
9.00		SS	SN=15							
9.50- 9.95		D		2,3/3,4,5,4						
10.00		SS	SN=16							
11.00		D		3,3/4,5,4,4						
11.00- 11.45		SS	SN=17							
12.00		D						(17.40)		
Remarks:						Logged By:		Checked By:		
						DPR		CSS		
						Scale: 1:60		Approved By:		
Notes: For explanation of symbols and abbreviations, see Key Sheet.						FIG No.		.1		



Ground and Environmental Services Limited

Unit 2 Montpelier Business Park,
Dencora Way, Ashford,
Kent TN23 4FG

Tel: 01233 646237

Borehole No. BH1

Sheet: 2 of 3

Equipment & Methods. Dando 150 _Backfill: Arisings					Project Name: New Care Home Project Location: Central Avenue, Gravesend, Kent Client: Jenner (Contractors) Ltd			Job No: 12992		
Co-ordinates: E: N:					Ground Level (m):			Date Started:01/02/2023 Date Completed:07/02/2023		
Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)		
Depth (m)	No.	Type	Result							
12.00- 12.45		SS								
13.00		D								
14.00		D	SN=32	3,3/5,7,8,12						
14.00- 14.45		SS								
15.00		D								
15.50- 15.95		SS	SN=34	4,4/7,8,9,10						
16.00		D								
17.00		D	SN=35	4,6/6,8,9,12						
17.00- 17.45		SS								
18.00		D								
18.50- 18.95		SS	SN=35	4,7/7,9,9,10						
19.00		D								
20.00		D	SN=36	4,5/8,8,9,11						
20.00- 20.45		SS								
						-20.00	20.00			
						End of Borehole 20.00 m (Thickness of basal layer not proven)				
Remarks:						Logged By:		Checked By:		
						DPR		CSS		
						Scale: 1:60		Approved By:		
Notes: For explanation of symbols and abbreviations, see Key Sheet.						FIG No.		.2		



Ground and Environmental Services Limited

Unit 2 Montpelier Business Park,
Dencora Way, Ashford,
Kent TN23 4FG

Tel: 01233 646237

Borehole No. BH1

Sheet: 3 of 3

Equipment & Methods.

Dando 150
_Backfill: Arisings

Project Name: New Care Home

Project Location: Central Avenue, Gravesend, Kent

Client: Jenner (Contractors) Ltd

Job No:

12992

Co-ordinates:

E:

N:

Ground Level (m):

Date Started:01/02/2023

Date Completed:07/02/2023

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
1-2-23	00:00	2.00		dry	end of shift
6-2-23	08:00	2.00		dry	start of shift
6-2-23	15:00	12.00	6.00	dry	end of shift
7-2-23	08:00	12.00	6.00	dry	start of shift
7-2-23	14:00	20.00	6.00	dry	end of borehole

Hole Diameter by Depth Table

Depth of Hole (m)	Diameter of Hole (mm)	Diameter of Casing (mm)	Depth of Casing (m)
20.00	150	150	9.00

Remarks:

Logged By:

DPR

Checked By:

CSS

Scale:
1:60

Approved By:

FIG No.

.3

Notes: For explanation of symbols and abbreviations, see Key Sheet.



Ground and Environmental Services Limited

Unit 2 Montpelier Business Park,
Dencora Way, Ashford,
Kent TN23 4FG

Tel: 01233 646237

Borehole No. BH2

Sheet: 1 of 3

Equipment & Methods. Dando 150 Backfill: Arisings					Project Name: New Care Home Project Location: Central Avenue, Gravesend, Kent Client: Jenner (Contractors) Ltd			Job No: 12992		
Co-ordinates: E: N:					Ground Level (m):			Date Started:30/01/2023 Date Completed:01/02/2023		
Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)		
Depth (m)	No.	Type	Result							
0.50		D			MADE GROUND: Grass over silty sandy clayey topsoil with frequent roots			(0.80)		
1.00- 1.45		SS	SN=29	4,6/7,7,7,8	Off white and light brown highly weathered CHALK. recovered as fine to coarse chalk gravel in a silt matrix	-0.80		0.80		
1.70		D								
2.00- 2.45		SS	SN=24	3,5/5,6,7,6				(2.10)		
2.60		D								
3.00- 3.45		SS	SN=19	4,6/5,4,5,5	...from 2.60 to 2.90 flints	-2.90		2.90		
3.50		D			White partially weathered CHALK. Recovered as fine to coarse chalk gravel in a comminuted silt matrix. Scattered flint throughout					
4.00- 4.45		SS	SN=17	3,4/5,4,4,4						
4.60		D								
5.00- 5.45		SS	SN=19	3,4/4,5,4,6						
6.00		D								
6.50- 6.95		SS	SN=16	3,3/4,3,4,5						
7.00		D								
8.00		D	SN=23	4,5/6,5,6,6						
8.00- 8.45		SS								
9.00		D								
9.50- 9.95		SS	SN=25	4,5/5,6,6,8	...from 9.10 to 9.50 flints					
10.00		D			...from 9.70 to 10.00 flints					
11.00		D	SN=22	3,5/5,6,6,5						
11.00- 11.45		SS						(17.10)		
Remarks:						Logged By:		Checked By:		
						DPR		CSS		
						Scale: 1:60		Approved By:		
Notes: For explanation of symbols and abbreviations, see Key Sheet.						FIG No.		.1		



Ground and Environmental Services Limited

Unit 2 Montpelier Business Park,
Dencora Way, Ashford,
Kent TN23 4FG

Tel: 01233 646237

Borehole No. BH2

Sheet: 2 of 3

Equipment & Methods. Dando 150 _Backfill: Arisings					Project Name: New Care Home Project Location: Central Avenue, Gravesend, Kent Client: Jenner (Contractors) Ltd			Job No: 12992		
Co-ordinates: E: N:					Ground Level (m):			Date Started:30/01/2023 Date Completed:01/02/2023		
Samples and In situ Testing				Field Records	DESCRIPTION	Reduced Level (m)	Legend	Depth (Thick) (m)		
Depth (m)	No.	Type	Result							
13.00 13.00- 13.45		D SS	SN=29	3,5/6,7,7,9						
14.00		D								
15.00 15.00- 15.45		D SS	SN=27	4,5/5,6,7,9						
16.00 16.00- 16.45		D SS	SN=46	4,7/7,10,12,17						
17.00		D								
17.50- 17.95		SS	SN=40	5,6/8,9,10,13						
18.00		D								
19.00		D								
19.50- 19.95		SS	SN=37	3,7/8,8,9,12						
						-20.00		20.00		
						End of Borehole 20.00 m (Thickness of basal layer not proven)				
Remarks:						Logged By:		Checked By:		
						DPR		CSS		
						Scale: 1:60		Approved By:		
Notes: For explanation of symbols and abbreviations, see Key Sheet.						FIG No.		.2		



Ground and Environmental Services Limited

Unit 2 Montpelier Business Park,
Dencora Way, Ashford,
Kent TN23 4FG

Tel: 01233 646237

Borehole No. BH2

Sheet: 3 of 3

Equipment & Methods.

Dando 150
_Backfill: Arisings

Project Name: New Care Home

Project Location: Central Avenue, Gravesend, Kent

Client: Jenner (Contractors) Ltd

Job No:

12992

Co-ordinates:

E:

N:

Ground Level (m):

Date Started:30/01/2023

Date Completed:01/02/2023

Water Level Observations During Boring

Date	Time	Depth of Hole (m)	Depth of Casing (m)	Depth to Water (m)	Remarks
30-1-23	00:00	6.50	1.50	dry	end of shift
31-1-23	08:00	6.50	1.50	dry	start of shift
31-1-23	16:00	15.00	9.00	dry	end of shift
1-2-23	09:00	15.00	9.00	dry	start of shift
1-2-23	13:00	20.00	9.00	dry	end of borehole

Hole Diameter by Depth Table

Depth of Hole (m)	Diameter of Hole (mm)	Diameter of Casing (mm)	Depth of Casing (m)
20.00	150	150	9.00

Chiselling Details

From (m)	To (m)	Time Taken (hhmm)	Chiselling Tool Used	Notes
2.60	2.90	00:15		flints
9.10	9.50	00:30		flints
9.70	10.00	00:15		flints

Remarks:

Logged By:

DPR

Checked By:

CSS

Scale:
1:60

Approved By:

FIG No.

.3

Notes: For explanation of symbols and abbreviations, see Key Sheet.

**APPENDIX G – Environnent Agency Pre-Application Response and
The Environment Agency's Approach to ground water protection –
Section G.**

Avery Healthcare Limited
3 Cygnet Drive
Swan Valley
Northampton
NN4 9BS

Our Ref: EPR/GP3120ST/A001

Date: 13/04/2023

Dear Sir/Madam,

**Pre-application checks – Basic service
Ascot Arms**

Following your pre-application request dated 08/03/2023 we have the following advice:

Application reference number	EPR/GP3120ST/A001
Summary and advice	Please find below a summary of our discussions and advice based on information provided within the online pre-application form and correspondence with your contact James Bowkett: You have requested advice about whether you need to apply for a discharge permit for your site 'Ascot Arms'. • You propose to discharge surface water runoff from roofs and hardstanding to ground via a borehole. • The surface water runoff will be treated by SuDS methods including a permeable paving system and infiltration/collection trench. • The maximum daily discharge volume will be around 160 m³/day (160 m³ for 1 in 100 + 40%). • Based on your site plan, the discharge point will be located near to national grid reference TQ 64912 72426. Based on the information that you have provided us within your pre-application form and correspondence, we can provide the following advice: Advice from our local Groundwater Team As part of this pre-application request, I have consulted with our local Area Groundwater Team who have advised that the proposed discharge does not require an environmental permit, so long as the following advice is implemented: The consultant/developer must <u>not</u> allow direct discharges to groundwater and there <u>must</u> be an unsaturated zone beneath the base of the proposed borehole and the highest seasonal groundwater table at all times. Provided that the operator can ensure the above advice is followed,

	which might mean making the borehole shallower, the Groundwater Team would not object here. Please note – the operator should also have regard to the Environment Agency’s Groundwater Protection Position Statements: https://www.gov.uk/government/publications/groundwater-protection-position-statements, Section G. They should also look more generally at the pages on groundwater protection: https://www.gov.uk/government/collections/groundwater-protection. Discharges to boreholes are not our preferred method of surface water disposal, as they bypass the shallow soil layers where natural attenuation of pollutants occurs. If a borehole is proposed for the discharge of <u>clean</u> surface water, it must not discharge directly to groundwater. Direct discharges are <u>not</u> allowed. The borehole should be constructed as shallow as possible when required infiltration rates are reached. The surface water system should include pollution prevention measures, especially if draining roads. Such measures can include treatment methods such as oil interceptors, downstream defenders, etc., which must be maintained as per the manufacturer’s guidance. Please be aware that the proposed site is located within groundwater Safeguard Zone and a Source Protection Zone 2. As such the groundwater is of high vulnerability. If you cannot meet our Groundwater Team’s advice If you are unable to meet the above advice, provided by our Groundwater Team, then you will need to apply for an environmental permit, as outlined in the below sections.
Forms required to be submitted	If you cannot meet our Groundwater Team’s advice and you need to apply for an environmental permit Applying for a permit If you submit an environmental permit application, then please quote this pre-application reference number EPR/GP3120ST/A001. Please ensure that you read the application form guidance and the information in the table below. <u>Important notice</u> The information that you need to submit with your application is explained in the application form and its guidance. The Environment Agency will check that you have submitted this information and the correct application charges. If you haven’t, we will contact you and you will need to send it within 5 working days. If we cannot progress your application any further, we will return your application to you. We’ll retain 20% of the correct application charge to cover our costs in reviewing your application and requesting information. This maximum amount we’ll retain is capped at £1,500. This is explained

	in the environmental permitting charges guidance. Please provide a fully completed version of the appropriate forms for your activity, in this case Forms Part A, Part B2, Part B6 and Part F1. If sections are not applicable to your permit, please indicate this rather than leaving a section blank. Please find links to these forms below: • Part A – https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-a-about-you • Part B2 – https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-b2-new-bespoke • Part B6 – https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-b6-new-bespoke-water-discharge-activity-and-groundwater-point-source-activity • Part F1 – https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-f1-opra-charges-declarations https://www.gov.uk/government/collections/environmental-permit-application-forms-for-a-new-bespoke-permit Please download the application forms and open with <i>Adobe Acrobat Reader</i>. You may not be able to complete the form using other pdf readers, such as the one built into your internet browser. You can also find out further information by following this link: https://www.gov.uk/guidance/discharges-to-surface-water-and-groundwater-environmental-permits Please ensure all relevant sections of the application forms are completed accurately and all required documents are submitted and fully completed – failure to do so could cause delays in processing and the potential for us to retain a portion of the application fee (should we need to return the application because it is incomplete and you fail to provide us the outstanding information in due time). In addition, the declaration must be signed by a relevant person as described in the form guidance: https://www.gov.uk/government/publications/application-for-an-environmental-permit-part-f1-opra-charges-declarations
Baseline fee required	If you cannot meet our Groundwater Team’s advice and you need to apply for an environmental permit Please refer to the ‘Additional documents required’ section below regarding ‘risk assessment’ screening for specific (e.g. hazardous) pollutants. Your environmental permit application will attract one of the following application fees: Scenario 1 – if all substances are screened out by the pollution risk assessment, and the volume is greater than 5 m³/day, then the cost of the application fee will be £4,652 as detailed in the Environment Agency’s Charging Scheme, activity 1.3.13:

	<i>Trade effluent and/or non-sewage effluent and/or rainfall related discharges to surface water or groundwater with a volume greater than 5m³ a day (not requiring specific substances assessment).</i> https://www.gov.uk/government/publications/environmental-permits-and-abstraction-licences-tables-of-charges If your permit is issued, an annual subsistence fee will be payable. This will be dependent on the type and volume of effluent. Scenario 2 – if any of the substances are not screened out in the pollution risk assessment, then the application fee will be £7,953 as detailed in the Environment Agency’s Charging Scheme, activity 1.3.14: <i>Trade effluent and/or non-sewage effluent and/or rainfall related discharges to surface water or groundwater requiring specific substances assessment (any volume).</i> https://www.gov.uk/government/publications/environmental-permits-and-abstraction-licences-tables-of-charges If your permit is issued, an annual subsistence fee will be payable. This will be dependent on the type and volume of effluent. Please note – the application charges outlined in this section are an estimate based on information provided at the pre-application stage. The application charges cover the work the Environment Agency carries out to determine the permit application. It is possible that, based on the information you submit for the full permit application, the determining permitting officer may decide that different or additional fees are required to cover the determination work. If it is decided that different or additional fees are applicable, then the determining permitting officer will discuss this with you when they are allocated your application.
Habitats screening	If you cannot meet our Groundwater Team’s advice and you need to apply for an environmental permit If we need to complete a habitats assessment during the determination of your application, you will need to pay an extra charge of £779 to cover the costs of this assessment. Further details of what “habitats assessment” refers to can be found in the charging guide at the following link: https://www.gov.uk/government/publications/environmental-permits-and-abstraction-licences-tables-of-charges
Additional documents required	If you cannot meet our Groundwater Team’s advice and you need to apply for an environmental permit Please provide these additional documents / supporting information: • When you submit your application, you will also need to include a site plan. The site plan must be clearly marked and labelled with the locations of the treatment and discharge systems, discharge point(s) and sample point(s). • A non-technical summary (section 5c of form/guidance form B2).

	• A summary of your management system (see section 3d of both Form B2 and Guidance form for B2 – you can find the link in the previous section). • Any other supporting documents that you mention in your form. • A risk assessment (section 8 of form B6). Please see the following links: https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit https://www.gov.uk/government/collections/risk-assessments-for-specific-activities-environmental-permits Risk assessment for groundwater: https://www.gov.uk/guidance/groundwater-risk-assessment-for-your-environmental-permit A screening for hazardous substances in groundwater: https://www.gov.uk/government/publications/protect-groundwater-and-prevent-groundwater-pollution/protect-groundwater-and-prevent-groundwater-pollution#hazardous-substances
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If you cannot meet our Groundwater Team's advice and you need to apply for an environmental permit

Please ensure your completed application includes the following information;

Declaration	Please ensure the declaration is signed by a 'relevant person'. For an application from an individual, a relevant person is the person to be named on the permit. For an application from more than one individual, each person who is applying for their name to be on the permit must complete the declaration – you will have to print a separate copy of the declaration page for each additional individual to complete. In the case of a company, a relevant person must be an active director/company secretary as listed on Companies House – https://find-and-update.company-information.service.gov.uk/ Please ensure the declaration tick box is completed.
Site Plan	The site plan must be clearly marked and labelled with the locations of the treatment and discharge systems, discharge point(s) and sample point(s).
Foul sewer	Please check whether you can connect to a foul sewer. To find out if there is a public sewer near your property, contact your local water company https://www.ofwat.gov.uk/contact-companies/
Payment	Please note an application will not be processed until we receive the full payment.

Dealing with the impact of COVID-19

We are following Government advice to manage the risks of Coronavirus to our organisation, to protect the health, safety and wellbeing of our staff and sustain our critical operations.

It is important that you inform us of any applications that are critical to maintain national resilience, national infrastructure and critical environmental protection.

If your application falls under these categories, please highlight this clearly in your cover email.

How to submit your application

Please send your completed application documents via email to:

psc-waterquality@environment-agency.gov.uk

Postal applications

We would advise you to submit applications via email wherever possible, however, if you would like to submit a postal application, please send it to the following address:

Water Quality Team
Permitting Support Centre
Quadrant 2
99 Parkway Avenue
Sheffield
S9 4WF

Disclaimer

The advice given is based on the information you have provided and does not constitute a formal response or decision of the Environment Agency with regards to future permit applications. Any views or opinions expressed are without prejudice to the Environment Agency's formal consideration of any application. Please note that any application is subject to a full technical check during duly making and determination, and additional information may be required based on your detailed submission and site-specific requirements.

This advice covers Groundwater Activities only. Other permissions from the Environment Agency and/or other bodies may be required for associated or other activities.

Please note that a permit does not give any right or permission to discharge where land is not owned by the applicant.

In addition, for discharges to a watercourse it does not imply the suitability, with regards to volumetric capacity of the receiving watercourse. It is the responsibility of any permit holder to negotiate any wayleaves, easements etc. in order to use or cross another person's land; and to identify and negotiate any requirement for downstream improvement works with the riparian owners concerned.

This pre-application request is now closed. Further enquiries resulting from this response must be logged as a new request using the online form:

<https://www.gov.uk/government/publications/environmental-permit-pre-application-advice-form>

If you need more extensive or technical pre-application advice, you can ask for our Enhanced service. The enhanced pre-application advice is charged at £100 per hour plus



VAT. You will need to complete and submit a new online pre-application request to request enhanced pre-application advice.

If you have any questions, please find my contact details below.

Yours faithfully,

Mike Coleman

Permitting Officer
National Permitting Service
preapplicationservice@environment-agency.gov.uk

G. Discharge of liquid effluents into the ground

This section applies to the millions of litres of sewage effluent, surface water run-off, industrial effluent and waste waters that are released into the ground every year. These discharges, if not properly managed could result in pollution of groundwater.

It explains how the Environment Agency will respond to different types and methods of disposal of liquid effluents to the ground. The position statements apply principally to:

- direct discharges to groundwater
- discharges of effluents to ground
- surface water run-off

Regulation and permitting of discharges

You must not cause or knowingly permit the discharge of hazardous substances or non-hazardous pollutants that might lead to an input of that substance into groundwater without an environmental permit unless the discharge qualifies for an exemption (in which case the discharge must meet the conditions relating to that exemption) or exclusion. If necessary, the Environment Agency may serve a notice to prohibit or bring into control, activities that may result in pollution.

The Environment Agency adopts a risk based approach to all discharges (see also [position statement A1](#)) and will not allow those which cannot be mitigated. If discharging to ground, you must be able to comply with the conditions for an exemption or permit. Where planning applications and permits are required, it is recommended that parallel tracking is used.

For certain specified groundwater discharge activities where sufficient information is supplied with the application, the Environment Agency may be able to undertake an initial risk assessment, but generally operators must also assess the environmental impact of their proposal to demonstrate an acceptable environmental outcome at the proposed discharge site.

Exempt small sewage discharges

Discharge of treated sewage of 2 metres cubed per day or less to ground/groundwater are called small sewage discharges (SSDs). The majority of SSDs do not require an environmental permit if they comply with certain qualifying conditions called [general binding rules](#) (GBRs). A permit is required however for all SSDs in source protection zone 1 (SPZ1). See the [small sewage discharge guidance](#).

Direct inputs

G1 - Direct inputs into groundwater

The Environment Agency must take all necessary measures to:

- prevent the input of any hazardous substance to groundwater
- limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater

The Environment Agency will not agree to the [direct input](#) of non-hazardous pollutants into groundwater unless the activity can be included within groundwater activities as stated in paragraph 8 of Schedule 22 to EPR 2016, AND if all of the following apply:

- it will not result in pollution of groundwater
- there are clear and overriding reasons why the discharge cannot reasonably be made indirectly, and
- there is adequate evidence to show that the increased pollution risk from direct inputs will be mitigated

Direct input into groundwater presents a significantly increased risk of pollution. Discharges that concentrate the flow of effluent at one location and bypass some of the soil layers will limit the ability of the ground to attenuate pollutants and protect groundwater.

The Environment Agency is seeking to stop direct discharges to groundwater through wells, boreholes and shafts ([position statement G9](#)). The Environment Agency will only allow them if they meet the criteria in position statement G1.

Sewage and trade effluent

For treated sewage effluent discharges, the Environment Agency encourages the use of shallow infiltration systems, which maximise attenuation within the drainage blanket and the underlying unsaturated zone. [British Standard 6297:2007+A1:2008](#) (or latest version) provides guidance on the design and installation of drainage fields for use in wastewater treatment and should be used to determine if a shallow infiltration system is a feasible option.

G2 - Sewage effluent discharges inside SPZ1

Inside SPZ1 all sewage effluent discharges to ground must have an environmental permit.

All permit applications will be considered on the basis of risk assessment and the appropriateness of the discharge with respect to the local environmental setting. For new discharges you should contact the Environment Agency to discuss whether or not it is likely to grant a permit.

Existing small sewage discharges in SPZ1*

If there is no evidence of pollution or significant risk of pollution associated with the discharge from an existing single sewage treatment system then the Environment Agency will normally grant a permit.

If an unpermitted discharge is discovered in a SPZ1 and there is evidence of pollution or a significant risk of pollution, the Environment Agency will work with the operator to address the issue on a site specific basis. Where necessary, the Environment Agency may use a notice to deal with any unacceptable discharge.

*An existing small sewage discharge is one that was in place before 1 January 2015.

G3 - Cumulative impact from sewage effluent discharges

The Environment Agency will only agree to developments where the addition of new sewage effluent discharges to ground in an area of existing discharges is unlikely to lead to an unacceptable cumulative impact. This will apply especially to sewage effluent in areas where concentrations of non-mains drainage to ground have given rise to known surface water or groundwater pollution.

Whilst some sewage effluent discharges may not pose a risk to groundwater quality individually, the cumulative risk of pollution from aggregations of discharges can be significant. Improvement or pre-operational conditions may be imposed before granting an environmental permit.

G4 - Trade effluent and other discharges inside SPZ1

Inside SPZ1 the Environment Agency will object to any new trade effluent, storm overflow from sewerage system or other significantly contaminated discharges to ground where the risk of groundwater pollution is high and cannot be adequately mitigated. If necessary, the Environment Agency will use a prohibition notice to stop any such existing discharge.

G5 - Connection to public foul sewer

Generally, the Environment Agency will only agree to developments involving release of sewage effluent, trade effluent or other contaminated discharges to ground if it is satisfied that it is not reasonable to make a connection to the public foul sewer. You will have to provide evidence of why your proposed development cannot connect to the foul sewer via your planning application. This position will not

normally apply to surface water run-off via sustainable drainage systems and discharges from sewage treatment works operated by sewerage undertakers with appropriate treatment and discharge controls

G6 - Cesspools and cesspits

The Environment Agency does not encourage the use of cesspools or cesspits, other than in exceptional circumstances. A cesspool or cesspit is a sealed unit that is used for the storage of untreated sewage. There must be no discharge to the environment. Poorly managed cesspools and cesspits present a considerable risk of causing pollution, which can be difficult to monitor and correct.

G7 - Evidence of pollution from liquid effluent

The Environment Agency will work with dischargers to seek solutions to pollution arising from liquid effluent. Where necessary it may use its notice powers to require or vary permits or to prohibit further discharge.

G8 - Sewerage pipework

The Environment Agency will require the use of the highest specification pipework and designs for schemes involving new sewerage systems in SPZ1 to minimise leakage.

Sewage effluent discharges to deep infiltration systems

Deep infiltration systems include deep pit based systems such as boreholes, shafts, concrete rings or other structures that bypass the soil layers. The Environment Agency does not regard the use of boreholes or other deep structures for the discharge of sewage effluent as routinely appropriate disposal options because they concentrate the flow of effluent at one location and bypass the soil layers. This limits the ability of the ground to attenuate pollutants and presents a greater risk of groundwater pollution. For this reason all such discharges require an environmental permit and are not eligible for an exemption from permitting requirements. A detailed risk assessment is a prerequisite for any permit application.

G9 - Use of deep infiltration systems for surface water or sewage effluent disposal

The Environment Agency will only agree to the use of deep infiltration systems for surface water or sewage effluent disposal if the developer can show that all of the following apply:

- the discharge to groundwater is indirect (with the exception of clean uncontaminated roof water to ground - see Position Statement G12)
- there are no other feasible disposal options such as shallow infiltration systems or drainage fields/mounds that can be operated in accordance with the appropriate current [British Standard 6297:2007+A1:2008](#)
- the system is no deeper than is required to obtain sufficient soakage
- acceptable pollution control measures are in place
- risk assessment demonstrates that no unacceptable discharge to groundwater will take place – in particular inputs of hazardous substances to groundwater will be prevented
- there are sufficient mitigating factors or measures to compensate for the increased risk arising from the use of deep structures

For new effluent discharges that meet the above criteria, secondary treatment is required.

The Environment Agency will apply [position statement G1](#) to any deep infiltration systems potentially involving the discharge of non-hazardous pollutants. The Environment Agency will encourage operators of existing deep infiltration systems to alter their facilities so that direct inputs of pollutants are avoided, particularly where there is potential for hazardous substances to enter groundwater.

Mitigating factors for deep infiltration systems may include additional levels of effluent treatment, but for all proposed new systems the depth of the structure must be no deeper than required to obtain sufficient soakage. This will maximise attenuation in the unsaturated zone. Position statement G1 will also apply if the input to groundwater is direct.

While the Environment Agency cannot prevent the use of boreholes or other deep structures for sewage effluent disposal, their use must not be regarded as a routinely appropriate disposal option. BS: 6297 makes it clear that drainage fields are considered to be an important component of a non-mains wastewater treatment system. The British Standard states that deep pit based systems should not be used for sewage effluent disposal, as they do not provide sufficient treatment. This is because the effluent would not be distributed so as to minimise the hydraulic loading and maximise the beneficial effects of biological action around infiltration systems. The deep infiltration system will also not maximise attenuation in the soils and unsaturated zone.

BS: 6297 does not specifically refer to the use of boreholes for disposal but the principles are the same; a borehole may bypass even more of the available attenuation capacity of the soils and unsaturated zone and allow direct input of pollutants to groundwater. It is also possible that bio-fouling within the borehole will diminish the efficiency of the system with time.

The level of prior examination required to support a proposal to use a borehole may be significantly greater than required for near surface infiltration systems, since the Environment Agency cannot make the basic assumptions about the effectiveness of drainage fields that normally form part of our risk-based approach.

The extent of examination is site-specific and a matter for local judgement by Environment Agency staff based on local groundwater sensitivity. In general, the larger the proposed discharge and the more vulnerable the location, the more likely it is that a detailed quantitative risk assessment is required. This may need to be supported by site-specific data on the aquifer properties, seasonal variation in depth to water table and baseline groundwater quality.

Potentially polluting discharges

G10 - Developments posing an unacceptable risk of pollution

The Environment Agency will normally object to new developments that pose an unacceptable risk of pollution to groundwater from sewage effluent, trade effluent or contaminated surface water.

This applies if the source of pollution is an individual discharge or the combined effects of several discharges, or where the discharge will cause pollution by mobilising contaminants already in the ground. In all cases the Environment Agency will normally object to any proposal to discharge untreated sewage* to ground and will use its notice powers to ensure treatment of any existing discharges.

* A sewage treatment system means a septic tank, infiltration system, drainage field and/or a package treatment plant or any other additional treatment in place. It does not include cesspools or cesspits.

G11 - Discharges from areas subject to contamination

Discharges of surface water run-off to ground at sites affected by land contamination, or from sites used for the storage of potential pollutants are likely to require an environmental permit.

This applies especially to sites where storage, handling or use of hazardous substances occurs (for example, garage forecourts, coach and lorry parks/turning areas and metal recycling/vehicle dismantling facilities). These sites will need to be subject to risk assessment with acceptable effluent treatment provided.

See also [position statement C4](#).

Discharge of clean water

Some discharges to ground (such as clean roof drainage or highway drainage) may not require permits. However, they can still have the potential to cause pollution if the discharge is not carefully designed or managed.

G12 - Discharge of clean roof water to ground

The discharge of clean roof water to ground is acceptable both within and outside SPZ1, provided that all roof water down-pipes are sealed against pollutants entering the system from surface run-off, effluent disposal or other forms of discharge. The method of discharge must not create new pathways for pollutants to groundwater or mobilise contaminants already in the ground. No permit is required, if the above criteria can be met.

See also [position statement C4](#).

Sustainable drainage systems

G13 - Sustainable drainage systems

The [Government's expectation](#) is that sustainable drainage systems (SuDS) will be provided in new developments wherever this is appropriate. The Environment Agency supports this expectation.

Where infiltration SuDS are to be used for surface run-off from roads, car parking and public or amenity areas, they should:

- be suitably [designed](#)
- meet [Governments non-statutory technical standards](#) for sustainable drainage systems – these standards should be used in conjunction with the [National Planning Policy Framework and Planning Practice Guidance](#)
- use a SuDS management treatment train – that is, use drainage components in series to achieve a robust surface water management system that does not pose an unacceptable risk of pollution to groundwater

Where infiltration SuDS are proposed for anything other than clean roof drainage (see G12) in a SPZ1, a hydrogeological risk assessment should be undertaken, to ensure that the system does not pose an unacceptable risk to the source of supply.

This position statement G13 needs to be read in conjunction with [position statement G10](#).

The design of infiltration SuDS schemes and of their treatment stages needs to be appropriate to the sensitivity of the location and subject to a relevant risk assessment, considering the types of pollutants likely to be discharged, design volumes and the dilution and attenuation properties of the aquifer.

Unless the supporting risk assessments show that SuDS schemes in SPZ1 will not pose an unacceptable risk to the drinking water abstraction, the Environment Agency will object to the use of infiltration SuDS under [position statement G10](#).