

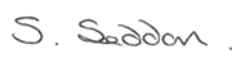
Phase 2 Geo-Environmental Investigation & Assessment

For

Glendene, Wythenshawe

Undertaken on behalf of

Garden City Design and Build Ltd

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Executive Summary

Site Location	The site comprises the land off Greenbrow Road, Wythenshawe, Manchester. It is centred on approximate Ordnance Survey National Grid Reference 381050E, 387672N with an indicative postcode of M23 2RE.
Development Proposals	The site of a former children's care home is being considered for the development of 56 no low rise residential houses. External areas will comprise access roads, hardstanding for parking and private gardens.
Ground Conditions	Ground conditions encountered during the intrusive investigation comprised topsoil or made ground to depths of between 0.25m and 1.50 meters below ground level (mbgl), these being underlain by glacial till and completely weathered Bollin Mudstone strata to depths of between 1.40m and 3.10mbgl, where more intact mudstone bedrock was encountered.
Site Preparation and Earthworks	No demolition of the existing building will proceed until an asbestos survey has been undertaken with any Asbestos Containing Material (ACM) so encountered being removed by an appropriately licensed specialist. Following demolition, all existing basement walls, foundations and other buried structures should be removed to facilitate construction of new foundations and drainage. All existing asphalt/concrete hardstanding and below ground foundations removed as part of the clearance work, subject to appropriate screening, crushing and confirmatory testing, will be suitable for re-use as bulk fill at the site. In consideration of the proposed development plan and current site topography, it is considered that there will be a requirement for localised site re-profiling to provide a level development platform. Earthworks should be carried out in accordance with recommendations and guidance provided in BS6031:2009, Code of Practice for Earthworks. Topsoil stripped from the area of redevelopment should be stockpiled and protected from inclement weather for future use in garden / landscaped areas subject to confirmatory chemical analysis.
Foundations and Floor Slabs	Over the majority of the site, new structures can be supported on shallow spread foundations within the firm/stiff glacial till or weathered Bollin Mudstone at anticipated depths of between 1.00m and 1.50mbgl and designed on a net allowable bearing pressure not exceeding 100kN/m² to reduce differential settlements to tolerable limits. This is provided that all formations are carefully inspected to confirm the anticipated soil strength with any soft/loose or otherwise incompetent soils so encountered being excavated and replaced with foundation concrete. Assessment as to the soil shrinkage/heave potential should then be undertaken for each structure at design stage in consideration of a medium volume change potential for the clay with foundations designed to appropriate depths and possibly incorporating compressible lining where such effects are envisaged. In areas of foundations would need to be designed on a net allowable bearing pressure of no more than 50kN/m² on well compacted fill to the basement or natural strata and would need to be adequately reinforced to take account of potential differential settlements. It is therefore recommended that further ground investigations are undertaken to determine the foundation requirements for specific plot. This is particularly relevant in the north-east of the site, where an in-filled pond is suspected. In consideration of the thickness of made ground and the potential for clay shrinkage/heave due to existing/removed trees, it is recommended that new floor slabs are suspended.
Excavations and Groundwater	Excavations at the site will be feasible using conventional hydraulic plant. All excavations at the site requiring man-entry will need adequate lateral support, or will need to be battering back to a safe angle to ensure their stability. Perched groundwater inflows should be anticipated within excavations although conventional 'sump and pump' dewatering measures will likely be adequate to keep excavations dry.
Pavements	New road pavement design should be based on a California Bearing Ratio (CBR) value of no more than 3% for glacial till sub-grade.

Concrete Classification	The typical design sulphate (DS) class and "Aggressive Chemical Environment for Concrete" (ACEC) class for the site are DS-1 and AC-1 respectively.
Soakaways	In consideration of the site being underlain by primarily cohesive soils, it is considered that soakaways would provide a suitable drainage option for the site.
Ground Gas	In consideration of the conceptual model and preliminary results it is anticipated that the localised peak concentrations of carbon dioxide at 5%, may not be representative of the gas regime and as such no specific ground gas protection measures would be required. However, due to the limited information at this time, the requirement for ground gas protection measures will need to be confirmed on completion of further ground gas monitoring and risk assessment. The final results will also need to be confirmed with the local authorities Environmental Health / Building Control Officer prior to any building design being finalised.
Contamination Assessment	Chemical analysis has confirmed that the site does not contain significant sources of ground contamination with the only exceedance relating to the PAH compound dibenz[a,h]anthracene being slightly elevated above its respective SL. However, 2no samples of made ground were found to contain fibres / clumps of chrysotile asbestos. As such, it cannot be wholly discounted that Asbestos Containing Material (ACM) and/or free fibres together with other unidentified contamination could occur on and beneath other areas of the site. Therefore without undertaking further plot specific ground investigation, a direct contact pollution linkage is plausible in proposed garden areas where made ground is exposed at the surface. The long-term risk from exposure to contaminants will be mitigated by removing the made ground from garden areas or alternatively covering it with a 600mm thickness of clean soil, comprising 450mm of sub-soil and 150mm of topsoil. Notwithstanding the above, all groundworks should therefore be undertaken under a watching brief by an asbestos specialist with any ACM so encountered being segregated for removal to landfill. Such operations may also need to incorporate specific control measures such as dust suppression, perimeter air monitoring and appropriate Personal Protective Equipment (PPE), as determined by the specialist. Based on the preliminary risk assessment and the results of the investigations and analyses risk to controlled waters from the site are considered low with no environmental remediation considered necessary.
Potable Water Supplies	The relevant water supply provider will need to be consulted with regards the selection of suitable water supply pipe materials for the development. In light of the ground conditions encountered, the requirement for specific materials and measures to protect the water supply from ground contamination is not envisaged. However, consideration may need to be given to the provision of lined service trenches and clean in-fill.
Waste Soils	On the basis of current information, it is likely that excavated made ground would be classified as Non-hazardous with natural strata classifies as 'Inert'. The disposal of topsoil would need to be considered separately due to its inherently high organic content. Final classification of soil for disposal would need to be confirmed by further analysis of bulk soils destined for landfill under consultation with the landfill operator.

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1.0 INTRODUCTION

Appointment

- 1.1 WML Consulting has been commissioned by Garden City Design and Build Ltd to undertake a Phase 2 Geo-environmental Investigation and Assessment of a site referred to as Glendene, located off Greenbrow Road, Manchester.

Proposed Development

- 1.2 The site of a former children's care home is being considered for the development of 56no low rise residential houses. External areas will comprise access roads, hardstanding for parking and private gardens.
- 1.3 The current propose layout by BTP Architects, referenced GD-BTP-00-SP-DR-A-3375-105.5, dated June 2018 is presented in Appendix 01.

Objective

- 1.4 The objective of the ground investigation and assessment was to provide geotechnical recommendations for construction design purposes together with a geo-environmental risk assessment in terms of possible ground contamination.
- 1.5 To achieve the objective, the following tasks were undertaken:
- Review the existing desk study report for the site and design a Phase 2 Ground Investigation in accordance with the Environment Agency (2004) Model Procedures for the Management of Land Contamination, CLR11.
 - Characterise the ground conditions in terms of geology, soil geotechnical parameters and ground contamination from information provided by the ground investigation.
 - Provide recommendations regarding suitable foundations, floor slabs and new pavement construction, together with any other geotechnical considerations that could affect possible future development.
 - Determine a ground conceptual model for the site so as to undertake an appropriate Phase 2 ground contamination Generic Quantitative Risk Assessment (GQRA).

Scope

- 1.6 A Phase 1 Desk Study for the site area has been undertaken by WML and is presented in the following report:
- Phase 1 Desk Study and Preliminary Geoenvironmental Assessment Report, Reference 9003G-WML-00-XX-RP-G-0001, dated November 2019.
- 1.7 This report includes the findings of a ground investigation designed on conclusions and recommendations provided in the Phase 1 Desk Study. For ease of reference, the findings of the desk study are summarised in the following sections. However, the two reports are not exclusive and should be read in conjunction.
- 1.8 The ground investigation has comprised the formation of window sample probeholes and machine excavated trial pits undertaken with reference to BS5930:2015 Code of Practice for Ground Investigation and BS10175:2011 together with A1:2013, "Investigation of Potentially Contaminated Sites - Code of Practice" except where superseded by EN ISO 22475-1 "Geotechnical Investigation and Assessment – Sampling by Drilling and Excavation and Groundwater Measurements".
- 1.9 Geotechnical soil testing has been undertaken in general accordance with guidelines provided in BS1377:1990 – Parts 1-9, "Method of Test for Soils for Civil Engineering Purposes". Samples for

chemical analysis were obtained and handled generally in accordance with the current guidelines (BS10175: 2011 and A1:2013).

- 1.10 The ground investigation has also been undertaken with reference to BS8576:2013, Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs).

2.0 SITE LOCATION AND DESCRIPTION

Site Location

- 2.1 The site comprises the land off Greenbrow Road, Wythenshawe, Manchester. It is centred on approximate Ordnance Survey National Grid Reference 381050E, 387672N with an indicative postcode of M23 2RE.
- 2.2 The proposed development site is bounded to the north by residential properties off Caithness Close, to the east by Greenbrow Road with residential properties beyond, to the south by a medical centre and nursery and to the west by residential properties off Ottawa Close.

Site Description

- 2.3 At the time of the inspection on 22nd October 2019, the site was noted to comprise a disused two-storey brick building (Glendene) located in the southern part with two smaller ancillary buildings in the central and south-western areas. The buildings were surrounded by areas of car parking and soft landscaping.
- 2.4 The north-western part of the site comprised an area of overgrown grass and exposed soil, formerly used as playing fields, while the north-eastern corner of the site comprised rough ground, with concrete floor slabs of former structures visible.
- 2.5 Soft landscaped areas comprised a mixture of unmaintained grass and shrubs. Numerous deciduous trees of varying species and maturity were located mainly in the northern and eastern parts and sporadically in other areas of the site.
- 2.6 Hardstanding to the south, east and west of Glendene comprised asphalt car parking while areas of former concrete floor slabs were located in the north-eastern part of the site.
- 2.7 A low, grassed mound was located in the south-eastern part of the site.
- 2.8 The site was accessed through gates from Greenbrow Road the south-east and Ottawa Close in the north-western part of the site.

Topography

- 2.9 The site reduces in elevation from around 52.38m Above Ordnance Datum (AOD) in the south-east to around 47.41m AOD in the northern corner over a distance of approximately 150m.
- 2.10 The low grassed mound in the south-eastern section of the site reduces in elevation from 52.17m AOD to the existing structures at around 50.15mAOD.
- 2.11 The topographic survey by Survey Systems Limited, referenced SSL:19766:250:1:1, is reproduced within Appendix 01.

3.0 SUMMARY OF ENVIRONMENTAL AND HISTORICAL SETTING

3.1 The following paragraphs summarise the most relevant findings of the Phase 1 desk study report.

Geology

- 3.2 The site is indicated by the BGS to be underlain by Devensian Glacial Till comprising mainly clay but possibly with interbedded sand and gravel horizons.
- 3.3 The superficial deposits are indicated to be underlain by the Triassic Bollin Mudstone Member which generally comprises mudstones and siltstones.
- 3.4 In consideration of the underlying geology, risks of subsidence from coal mining can be discounted.

Environmental Setting

- 3.5 The property is not in a radon affected area as defined by the BGS/Public Health England as less than 1% of properties are above the action level of exposure. Therefore, no radon protection measures are necessary for new structures as described in publication BR211 by the Building Research Establishment.
- 3.6 The superficial deposits underlying the site are classified as a 'Secondary (Undifferentiated) Aquifer'. The underlying bedrock is classified as a 'Secondary (B) Aquifer'.
- 3.7 The site is not within an Environment Agency Source Protection Zone (SPZ) and there are no groundwater abstraction licences within 500m of the site.
- 3.8 The nearest surface watercourse is Mill Brook, located 82m north-east of the site.
- 3.9 There are no active or historic landfill sites recorded within 500m of the site.
- 3.10 There are no records of sites which have been determined as Contaminated Land under Section 78R of the Environmental Protection Act 1990 within 250m of the site.

Site History

- 3.11 The earliest map dated 1876 indicates the site to have comprised undeveloped rural / agricultural land crossed by a number of field boundaries. A footpath crossed the western part of the site and a small pond was located on the western site boundary.
- 3.12 By 1960, the north-eastern part of the site had been developed with residential properties and the pond on the western site boundary had been infilled. Wastdale Road and Greenbrow Road had been constructed, forming the northern and south-east site boundary respectively.
- 3.13 By 1977 the remainder of the site had been developed with the structures in their current configuration.
- 3.14 The residential structures in the north-eastern part of the site were cleared sometime prior to 2010 and the area has remained undeveloped to the present day.
- 3.15 The surrounding area originally comprised undeveloped land in rural / agricultural use. Between the 1950's and 1970's the area surrounding the site underwent predominantly residential development and by the 1990's a medical centre had been constructed immediately to the south.

4.0 PRELIMINARY CONTAMINATION RISK ASSESSMENT

- 4.1 Based on the above findings, the Phase 1 desk study report concluded that potential pollution linkages are on the whole considered unlikely with associated preliminary risks being assessed generally as very low to low.
- 4.2 However, the approach at the Phase 1 Desk Study stage was precautionary until such time as uncertainties in the conceptual model could be verified by appropriate site investigation.
- 4.3 The investigation was to comprise sampling and chemical analysis of the near surface soil and the possible installation of ground gas monitoring standpipe with subsequent monitoring for hazardous ground gas concentrations and flow.
- 4.4 In addition, investigations were to be undertaken to establish geotechnical parameters for the design of foundations, floor slabs and pavement construction.

5.0 SITE INVESTIGATION

Rationale

- 5.1 Intrusive investigations were undertaken primarily to provide geotechnical parameters for structural design purposes but also to verify the preliminary site conceptual model and confirm the anticipated low environmental risk.
- 5.2 Window sample probeholes were undertaken to provide information on near surface deposits and to obtain samples for chemical analysis. This method of investigation was chosen in order to enable access to the majority of the site and to gain access to less accessible areas. Due to the small diameter of the probing equipment, the depth of penetration achieved is dependent on favourable ground conditions. As such, ground penetration may be restricted in circumstances where the ground is particularly strong or contains relatively large obstructions such as cobbles and/or boulders.
- 5.3 Machine excavated trial pits were undertaken in the accessible areas of soft landscaping to provide further information on the ground conditions and to take samples for chemical analysis and geotechnical testing.
- 5.4 Trial Pit TP04 was located within the area of a suspected pond infilled in the 1960's. However, due to the recent adjacent construction of residential properties and a fence at higher elevation to the site, the pit was located as close to the fence-line as possible without undermining its foundations.
- 5.5 Monitoring standpipes were installed in selected probeholes for the measurement of gas and groundwater levels.

Intrusive Works

- 5.6 Ground investigation work was undertaken by WML and DSUK Ltd on 5th and 6th December 2019. This comprised the formation of 13no window sample probeholes (DSUK) to a maximum depth of 4.00 metres below ground level (mbgl) and 12no machine excavated trial pits (WML) to a maximum depth of 1.80mbgl.
- 5.7 The exploratory hole records are presented in Appendix 02 of this report whilst the exploratory hole locations are shown on Drawing 9003G-SK01 in Appendix 01.

Monitoring Standpipes

- 5.8 Monitoring wells for the measurement of ground gas and groundwater levels were installed in 6no probeholes as indicated on the logs presented in Appendix 02.

Geotechnical and Chemical Testing

- 5.9 In-situ geotechnical testing was undertaken at regular intervals during the formation of the probeholes in the form of Standard Penetration Tests (SPTs) and during the formation of the trial pits in the form of Hand Shear Vane tests (HSVs). The results for this testing are presented on the descriptive logs in Appendix 02.
- 5.10 Laboratory soil classification testing was undertaken on selected samples for the following:
- Natural Moisture Content.
 - Liquid and Plastic Limit.
- 5.11 The results of the geotechnical testing are presented in Appendix 03.
- 5.12 Chemical analysis was undertaken on selected soil samples for the following contaminants of concern:

- Total Arsenic, Boron, Cadmium, Chromium VI, Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc.
- Total Cyanide, Phenols, Sulphur, Sulphate.
- Speciated USEPA Polyaromatic Hydrocarbons (PAH).
- Asbestos Screen and Identification.
- 2:1 water/soil sulphate extract, pH.

5.13 The results of the chemical analysis are presented in Appendix 04.

Gas and Groundwater Monitoring

5.14 Ground gas and groundwater monitoring has been carried out on two occasions to date on 6th and 20th January 2020. The monitoring results and relevant calibration certificates are presented in Appendix 05.

6.0 GROUND CONDITIONS

Stratigraphy

- 6.1 Ground conditions encountered during the intrusive investigation comprised topsoil or made ground to depths of between 0.25m and 1.50 meters below ground level (mbgl), these being underlain by glacial till and completely weathered Bollin Mudstone strata to depths of between 1.40m and 3.10mbgl, where more intact mudstone bedrock was encountered.

Topsoil

- 6.2 Within TP01, TP05, WS05, WS06 and WS13 topsoil was encountered to depths of between 0.40m and 0.50mbgl. This comprised slightly silty, sandy clay with roots and rootlets.
- 6.3 However, within TP04, TP09 and WS04, in the western part of the site, strata considered to represent relict natural topsoil was encountered at depths of between 0.15m and 0.40mbgl and extending to depths of between 0.25m and 0.80mbgl.

Made Ground

- 6.4 Made ground was encountered within the majority of exploratory holes from ground level to depths of between 0.25m and 1.50mbgl.
- 6.5 Within TP03, TP06, TP07, TP08, WS03, WS07, WS08 the made ground locally comprised a surface horizon of reworked topsoil underlain by variably sandy and gravelly clay to depths of between 0.55m and 1.10mbgl. Gravel sized fragments included brick, limestone, concrete, sandstone and locally ash and clinker. Within WS07 and WS08, the made ground included cobbles of brick.
- 6.6 Within TP04, TP09 and WS04, in the western part of the site, a surface horizon of made ground comprising locally slightly clayey, sandy gravel to depths of between 0.15m and 0.40mbgl overlay the relict topsoil described previously at this location.
- 6.7 Within TP11, TP12, WS10, WS11 and WS12 in the north-eastern section of the site the made ground comprises variably clayey, gravelly sand and sandy gravel to depths of between 0.45m and 1.00mbgl. Gravel sized fragments included limestone, mudstone, brick, sandstone, concrete, wood and plastic.
- 6.8 TP02 and WS02 in the eastern part of the site encountered made ground comprising locally gravelly, clayey sand to depths of between 1.40m and 1.50mbgl.
- 6.9 A surface horizon of asphalt encountered in TP10 and WS01 was underlain by variably sandy gravel including limestone and locally ash, clinker and brick to depths of 0.40m and 0.75mbgl respectively.
- 6.10 A single SPT 'N' value of 7 within the granular made ground 7 indicates a loose state of compaction.

Glacial Till

- 6.11 Within the majority of the exploratory holes, the topsoil or made ground was underlain by glacial till at depths of between 0.25 and 1.50mbgl, extending to depths of between 0.90m and 2.60mbgl.
- 6.12 This generally comprised soft to firm, orange brown and locally grey mottled, slightly gravelly, sandy clay.
- 6.13 Within WS09 in the north-eastern part of the site, a horizon of very soft, dark brown, peaty clay was recorded at a depth of 2.10m to 2.50mbgl. It is suspected that this could represent deposits associated with an unrecorded in-filled pond, with the overlying strata possibly being reworked.

- 6.14 SPT 'N' values within glacial deposits generally ranged between 5 and 19 with an average of 10 indicating a locally soft but generally becoming firm consistency.
- 6.15 However, a single SPT 'N' value of 0 was recorded within the peaty clay encountered in WS09, confirming the very soft visual assessment.
- 6.16 Insitu hand shear vane tests undertaken at varying depths within the till recorded values ranging between 76 and greater than 130kN/m², indicating the soils to be of predominantly stiff and of high strength.
- 6.17 Laboratory classification tests undertaken on the till recorded natural moisture contents of between 14 and 20%. Liquid Limits of between 29 and 40% together with corresponding Plasticity Indices of 14 to 21%, modified to 13 and 20% to take account of the fine constituent percentage, indicates clay of predominantly low plasticity and low volume change potential.

Bollin Mudstone

- 6.18 All of the window sample holes extended into strata considered to represent Bollin Mudstone at depths of between 0.30m and 2.50mbgl.
- 6.19 This was completely weathered at its surface, being described as firm, orange brown and locally grey mottled, slightly sandy, silty clay with occasional mudstone lithorelicts to depths of between 1.40m and 3.10mbgl.
- 6.20 Below these depths, the mudstone was less weathered and was described mainly as extremely weak, red brown, distinctly to partially weathered mudstone.
- 6.21 SPT 'N' values within the completely weathered mudstone ranged between 6 and 19 with an average of 11 indicating a locally soft but generally firm to stiff consistency. SPT 'N' values in the less weathered mudstone ranged between 14 and in excess of 50 with an average of 43 indicating the equivalent of a stiff to very stiff clay of high strength.
- 6.22 Laboratory classification tests undertaken on the mudstone recorded natural moisture contents of between 15 and 24%. Liquid Limits of between 35 and 51% together with corresponding Plasticity Indices of 17 to 28%, modified to 16 and 27% to take account of the fine constituent percentage, indicates clay of intermediate to high plasticity and medium volume change potential.

Visual/Olfactory Evidence of Contamination

- 6.23 No visual and/or olfactory evidence of significant ground contamination was identified within the exploratory holes during the investigation.

Groundwater

- 6.24 Perched groundwater was only encountered during the formation of WS08, WS09 and TP11 at depths of 2.00m, 1.00m and 0.70m respectively, recorded as seepages within the weathered mudstone, glacial deposits and made ground respectively.
- 6.25 During the initial monitoring visit, standing water was encountered at depths of between 0.79m and 2.60mbgl.
- 6.26 It should be appreciated that the groundwater monitoring described above was undertaken during a very short period of time. Significant variations in the long term groundwater regime may occur at other times, particularly with prolonged, extreme weather conditions, and that no account can be taken of such in this report.

- 6.27 Additionally, groundwater conditions may vary considerably within deeper strata beneath the depths of the current investigation.

General

- 6.28 It should also be appreciated that ground conditions may vary between and away from the exploratory hole positions, and that no account can be taken in this report of such variations.

7.0 GEOTECHNICAL APPRAISAL

Site Preparation and Earthworks

- 7.1 It is assumed that no demolition of the existing building will proceed until an asbestos survey has been undertaken with any Asbestos Containing Material (ACM) so encountered being removed by an appropriately licensed specialist.
- 7.2 Following demolition, all existing basement walls, foundations and other buried structures should be removed to facilitate construction of new foundations and drainage.
- 7.3 Also, due to the previously developed nature of the north-eastern part of the site, ground obstructions in the form of existing foundations, floor slabs and other buried obstructions may also be encountered beneath this part of the site and will need to be broken out to suitable depths below formation levels where they are to impinge on the proposed redevelopment.
- 7.4 All existing asphalt/concrete hardstanding and below ground foundations removed as part of the clearance work, subject to appropriate screening, crushing and confirmatory testing, will be suitable for re-use as bulk fill at the site.
- 7.5 It is assumed that demolition of the buildings and the removal of any trees and other vegetation will be undertaken in consultation with an ecological specialist.
- 7.6 Construction near retained trees and importantly within any Root Protection Areas (RPAs) should be undertaken with due regard to guidance provided in BS5837:2012 'Trees in relation to design, demolition and construction – recommendations'.
- 7.7 In consideration of the proposed development plan and current site topography, it is considered that there will be a requirement for localised site re-profiling to provide a level development platform.
- 7.8 Earthworks should be carried out in accordance with recommendations and guidance provided in BS6031:2009, Code of Practice for Earthworks.
- 7.9 Topsoil stripped from the area of redevelopment should be stockpiled and protected from inclement weather for future use in garden / landscaped areas subject to confirmatory chemical analysis.
- 7.10 Following the site strip, underlying cohesive soils are likely to prove sensitive to moisture change and will become softened if exposed, particularly during wet weather conditions. Where possible, the site strip should therefore be undertaken in stages and only as phased construction determines.
- 7.11 Where this is not possible and there is a requirement to expose the cohesive soils for any appreciable time, surfaces should be excavated to fall to facilitate surface water run-off and covered with a suitably granular protective layer which will also facilitate site plant movement.

Foundations

- 7.12 Made ground and soft/loose natural soils should be considered unsuitable for the direct support of structural loads as their generally incompetent nature could result in unacceptable total and differential settlements.
- 7.13 Over the majority of the site, new structures can be supported on shallow spread foundations within the firm/stiff glacial till or weathered Bollin Mudstone at anticipated depths of between 1.00m and 1.50mbgl and designed on a net allowable bearing pressure not exceeding 100kN/m² to reduce differential settlements to tolerable limits. This is provided that all formations are carefully inspected to confirm the anticipated soil strength with any soft/loose or otherwise incompetent soils so encountered being excavated and replaced with foundation concrete.

- 7.14 Where spread foundations are to be constructed in close proximity to existing or recently removed trees, consideration will need to be given to the potential for ground shrinkage and/or heave effects resulting from soil moisture changes. Identification of retained or removed tree species will be required to determine their water demand as provided in Appendix 4.2-A to 4.2-C of NHBC Standards 2011, Foundations, Chapter 4.2, Building Near Trees. Assessment as to the soil shrinkage/heave potential should then be undertaken for each structure at design stage in consideration of a medium volume change potential for the clay with foundations designed to appropriate depths and possibly incorporating compressible lining where such effects are envisaged.
- 7.15 The extent of the basement structure to Glendene should also be determined to establish whether this will impact on proposed plot foundations. It cannot be discounted at this stage that specific plots in this area may need to be relocated or re-configured to take account of deeper fill in this area.
- 7.16 Alternatively, foundations would need to be designed on a net allowable bearing pressure of no more than 50kN/m² on well compacted fill to the basement and areas of shallow less competent soils. Due to the variability in ground conditions foundations would need to be adequately reinforced to take account of potential differential settlements.
- 7.17 It is therefore recommended that further ground investigations are undertaken to determine the foundation requirements for specific plot. This is particularly relevant in the north-east of the site, where an in-filled pond is suspected.

Floor Slabs

- 7.18 In consideration of the thickness of made ground and the potential for clay shrinkage/heave due to existing/removed trees, it is recommended that new floor slabs are suspended. In this respect, a beam and block floor construction is generally considered appropriate for low rise housing.

Excavations and Groundwater

- 7.19 Excavations at the site will be feasible using conventional hydraulic plant. All excavations at the site requiring man-entry will need adequate lateral support, or will need to be battering back to a safe angle to ensure their stability.
- 7.20 Perched groundwater inflows should be anticipated within excavations although conventional 'sump and pump' dewatering measures will likely be adequate to keep excavations dry.

Pavement Design

- 7.21 It is recommended that new road pavement design should be based on a California Bearing Ratio (CBR) value of no more than 3% for glacial till sub-grade.
- 7.22 The CBR will need to be reviewed and confirmed by site inspection and possibly suitable in-situ testing at formation levels following any earthwork operations and prior to pavement construction.
- 7.23 In any event, all formations should be proof-rolled with any soft, loose or otherwise unsuitable material being removed and replaced with compacted granular fill.

Concrete Design

- 7.24 Design/mix of buried concrete should be undertaken in accordance with the "Aggressive Chemical Environment for Concrete" (ACEC) classification, of BRE Special Digest 1:2005 (Concrete in Aggressive Ground). With reference to the site history, it is deemed appropriate to classify the site as "Brownfield", with respect to BRE Special Digest.

- 7.25 Values of 2:1 water/soil extract for sulphate for soils at anticipated foundation depths do not exceed 10mg/kg. Values of pH range from 6.4 to 8.7, indicating slightly acidic through to slightly alkaline conditions.
- 7.26 On the basis of these results, the typical design sulphate (DS) class and "Aggressive Chemical Environment for Concrete" (ACEC) class for the site are DS-1 and AC-1 respectively.

Drainage and Soakaways

- 7.27 In consideration of the site being underlain by primarily cohesive soils, it is considered that soakaways would provide a suitable drainage option for the site.

8.0 GENERIC QUANTITATIVE RISK ASSESSMENT (GQRA)

General

- 8.1 A review of the desk study information has concluded that pollution linkages were generally considered unlikely and the overall preliminary risk was, on the whole, assessed as very low to low.
- 8.2 Further to this, no visual and/or olfactory evidence of significant ground contamination has been identified within the exploratory holes during the investigation.
- 8.3 However, due to the brownfield status of the site, it has been considered prudent to adopt a precautionary principal and undertake chemical analysis of the sub-surface soils to establish in more detail the human health risk status of the site.

Human Health

- 8.4 Selected samples have been analysed for a general suite of contaminants of concern and compared against Screening Levels (SL's) for human health to determine the significance of the measured concentrations in relation to the site conceptual model. Thus, a Generic Quantitative Risk Assessment has been undertaken in line with guidelines provided in CLR11, Model Procedures for the Management of Land Contamination, 2004.GQRA).
- 8.5 The criteria for a limited number of contaminants have been derived by DEFRA in their document entitled SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination, April 2014.
- 8.6 Within the document, Category 4 Screening Levels (C4SL's) are described as being more pragmatic than previous screening criteria and represent concentrations in soil that present an 'acceptable' level of risk within the context of Part 2A.
- 8.7 The National Planning Policy Framework states that 'after development, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990'. Therefore by inference, the C4SL's are appropriate for use in the planning context.
- 8.8 Although the SP1010 document states that C4SL only apply for a 'sandy loam soil with 6% soil organic matter', it is generally accepted that assessment criteria for metals are not sensitive to changes in soil organic content (SOM). The C4SL's have therefore been adopted as assessment criteria in this report for the listed metals within the SP1010.
- 8.9 Subsequent to SP1010, LQM/CIEH have published a document entitled 'The LQM/CIEH S4ULs for Human Health Risk Assessment' 2015. In brief, the document provides updated assessment criteria which have been derived in accordance with UK legislation, national as well as EA policy and using a modified version of the CLEA software and available guidance. The new screening criteria, or Suitable 4 Use Levels (S4ULs), are intended to provide a complete and updated replacement to the previous LQM/CIEH GAC of 2009. As such they are considered appropriate for use in this assessment for other contaminants not covered by C4SL's and/or for organic contaminants assuming a worst-case Soil Organic Matter (SOM) of 1% as an initial conservative assessment.
- 8.10 For each contaminant, S4UL's and C4SL's have been calculated for six land use scenarios, namely:
- Residential with homegrown produce.
 - Residential without homegrown produce.
 - Allotments.
 - Commercial.
 - Public Open Space near residential housing.
 - Public Parks (remote from residential housing).

- 8.11 In light of the proposed development, the SL's for a "Residential with homegrown produce" end-use are considered appropriate for a conservative assessment at this stage.
- 8.12 A table of relevant SL's protective of human health for 1% SOM are provided in Appendix 06.

Soil Test Results

- 8.13 19no soil samples were analysed for a suite of Contaminants of Concern (CoC). The Soil Organic Matter (SOM) content for the samples range from 0.52% to 16%. It has therefore been considered appropriate to adopt conservative SL's relating to a 1% SOM in the generic assessment.
- 8.14 The majority of the concentrations measured are below the SL's for "Residential with homegrown produce", with the following exception.

Contaminant	Number of Samples Exceeding SL	SL (mg/kg)	Recorded Concentrations (mg/kg)	Sample
Dibenz[a,h]anthracene	6	0.24	0.40	WS11 – 0.10m

- 8.15 Chrysotile asbestos in the form of fibres / clumps have been detected in 2no samples of made ground, namely TP06 at 0.50m and TP09 at 0.10m, both in the western area of the site.
- 8.16 Two samples of asphalt from TP10 and WS01 were analysed to determine the concentration of BaP, which, if the concentration exceeds 50mg/kg, may indicate that the asphalt is likely to contain coal tar at sufficient concentrations as to deem it hazardous waste. The analysis recorded concentrations of BaP within both samples of less than 0.1mg/kg, therefore suggesting that the asphalt does not contain coal tar at hazardous concentrations.

Discussion and Conclusions

Human Health

- 8.17 Chemical analysis has confirmed that the site does not contain significant sources of ground contamination with the only exceedance relating to the PAH compound dibenz[a,h]anthracene being slightly elevated above its respective SL.
- 8.18 However, 2no samples of made ground were found to contain fibres / clumps of chrysotile asbestos. As such, it cannot be wholly discounted that Asbestos Containing Material (ACM) and/or free fibres together with other unidentified contamination could occur on and beneath other areas of the site.
- 8.19 As the site is currently disused and unoccupied, the risk to human health from direct contact with these contaminants is considered low.
- 8.20 Following site development, where surfaced with buildings and hardstanding, there will be no mechanism for a direct contact pollution linkage with any unidentified contaminants or for any asbestos fibres to become airborne. Therefore the risk to end-users and to the general public will be negligible in such areas.
- 8.21 However, without undertaking further plot specific ground investigation, a direct contact pollution linkage is plausible in proposed garden areas where made ground is exposed at the surface. The long-term risk from exposure to contaminants will be mitigated by removing the made ground from garden areas or alternatively covering it with a 600mm thickness of clean soil, comprising 450mm of sub-soil and 150mm of topsoil.

- 8.22 Notwithstanding the above, there is a perceived risk of exposure to construction workers and the general public to airborne asbestos fibres during site enabling and ground works, particularly during dry weather conditions.
- 8.23 All groundworks should therefore be undertaken under a watching brief by an asbestos specialist with any ACM so encountered being segregated for removal to landfill. Such operations may also need to incorporate specific control measures such as dust suppression, perimeter air monitoring and appropriate Personal Protective Equipment (PPE), as determined by the specialist.
- 8.24 Should ACM be encountered in significant quantities, consideration should also be given to providing lined service trenches and clean in-fill to prevent possible exposure during any future maintenance work.
- 8.25 In consideration of the above, it is anticipated that a remediation strategy may be required to bring the site to a condition suitable for the intended use by removing unacceptable risks to human health. The strategy will need to be submitted to the Local Planning Authority for their approval prior to any development commencing.
- 8.26 The remediation strategy will need to consider the results of further ground investigation and chemical analysis which should be undertaken once existing buildings have been demolished.

Controlled Waters

- 8.27 In terms of sensitivity, the superficial 'Secondary (Undifferentiated) Aquifer' and underlying 'Secondary (B) Aquifer' are considered to be of limited resource value and utilisation.
- 8.28 Also, the site is not within an Environment Agency Source Protection Zone (SPZ) and there are no groundwater abstraction licences within 500m.
- 8.29 Mill Brook is located some 82m north-east but the underlying cohesive glacial till and its relatively low transmissivity rates will limit significant migration of any localised contamination from the site.
- 8.30 Further to this, no visual and/or olfactory evidence of significant ground contamination has been recorded with the results of chemical analyses confirming this to a large extent.
- 8.31 Therefore, the risk to controlled waters from the site is considered low with no environmental remediation considered necessary.

9.0 GROUND GAS RISK ASSESSMENT

Methodology

- 9.1 Current guidance for the assessment of risk associated with the presence of hazardous ground gases (principally methane and carbon dioxide) is provided in two key documents, namely:
- Code of practice for the Characterisation and remediation from Ground Gas in Affected Developments. British Standard Institution (BS 8485: 2015 & A1:2019); and
 - Assessing Risks posed by Hazardous Ground Gases to Buildings CIRIA (C665, 2007).
- 9.2 The assessment presented herein is primarily based on the BS8485 document.
- 9.3 Hazardous ground gas qualitative risk assessment is based on a conceptual model similar to that used for soil and groundwater contamination sources (i.e., source-pathway-receptor pollutant linkages). A semi-quantitative estimate of risk can be assessed based on knowledge of the conceptual model and a measure of hazardous gas concentration and gas flow at the site within monitoring standpipes.
- 9.4 Based on the measured flow rates and hazardous gas concentrations, individual "hazardous gas flow rates" (Qhg) can be derived for each monitoring point, from which the "site characteristic hazardous gas flow rate" (Qhgs), and then the "Characteristic Situation" (CS) can be determined.
- 9.5 BS8485 provides guidance on the level of gas protection requirements based upon the characteristic situation and the proposed development based on building type as outlined in Table 3.

Table 3 - Building Types

	Type A	Type B	Type C	Type D
Ownership	Private	Private or commercial/ Public, possible multiple	Commercial / Public	Commercial / Industrial
Control (Change of use)	None	Some but not all	Full	Full
Room Sizes	Small	Small/ medium	Small to Large	Large Industrial/ Retail Park

- 9.6 The proposed development therefore is indicated to comprise the construction of Type A buildings which include:-
- Private ownership with no building management controls on alterations to the internal structure, the use of rooms, the ventilation of rooms or the structural fabric of the building. Some small rooms present. Probably conventional building construction (rather than civil engineering). Examples include private housing and some retail premises.

Ground Gas Conceptual Model

- 9.7 The property is not in a radon affected area as defined by the BGS/Public Health England as less than 1% of properties are above the action level of exposure. Therefore, no radon protection measures are necessary for new structures as described in publication BR211 by the Building Research Establishment.
- 9.8 There are no active or historic landfill sites recorded within 500m of the site.
- 9.9 In consideration of the underlying geology, risks of shallow abandoned mine workings which could contain hazardous gases can be discounted.

- 9.10 No appreciable thickness of made ground from historical in-filling have been encountered beneath the site.
- 9.11 No evidence of significant thickness of organic soils were located in TP04 within the area of the anticipated infilled pond on the pr-1960 historical plans. However, the ground investigation has encountered localised, relative thin horizon peaty clay within WS09 in the north-eastern area of the site at a depth of 2.10 to 2.50mbgl. This could contain elevated concentrations of ground gas but has a low potential for continued generation of significant volumes.
- 9.12 With reference to Figure 6 of BS8576:2013, Guidance on investigations for ground gas – Permanent gases and Volatile Organic Compounds (VOCs) the made ground and any remaining relict topsoil beneath the site are therefore considered to present a 'very low to Low' ground gas generation potential.
- 9.13 In consideration of the above, the preliminary risk to the development from ground gas has been assessed as low. However, it has been considered prudent to confirm this by undertaking limited ground gas monitoring, primarily for methane and carbon dioxide, with associated flow rates, on two occasions to date, on 6th and 20th January 2020.

Results and Recommendations

- 9.14 The preliminary results indicate the concentrations of peak and steady state methane to be below instrument detection limits of 0.1% by volume in air (v/v). Peak carbon dioxide concentrations range from 0.7 to 5.0% with the steady state concentrations between 0.5 and 3.1%.
- 9.15 No detectable positive ground gas flows have been recorded during the initial monitoring visit.
- 9.16 Due to the variability in ground and groundwater conditions it is considered that determining a Characteristic Gas Situation from composite readings would not be appropriate. In addition, as only two visits have been undertaken to date, it is considered that insufficient data is currently available to characterise the site on individual readings.
- 9.17 The two peak carbon dioxide concentrations of 5% may be due to rising water levels. This traps the gas within the solid section of the standpipe, therefore in such cases the initial peak concentration may not be representative of the rate of gas generation.
- 9.18 Therefore, in consideration of the conceptual model and preliminary results it is anticipated that the localised peak concentrations of carbon dioxide may not be fully representative of the gas regime and as such no specific ground gas protection measures would be required.
- 9.19 However, due to the limited information at this time, the requirement for ground gas protection measures will need to be confirmed on completion of further ground gas monitoring and risk assessment. The final results will also need to be confirmed with the local authorities Environmental Health / Building Control Officer prior to any building design being finalised.

10.0 OTHER POTENTIAL DEVELOPMENT CONSIDERATIONS

Excavated Soils

- 10.1 Excavation works undertaken during the development will produce waste soils for which appropriate waste management will be required. In line with current sustainability principals, any waste soils should be considered for re-use where possible by incorporation into the development.
- 10.2 It should be noted that the re-use of excavated soils on site, or clean naturally derived soils off-site, should be undertaken in accordance with guidance provided in the CL:AIRE Definition of Waste, Development Industry Code of Practice, Version 2, 2011 (DoWCoP) so that the activity is removed from Environmental Permitting.
- 10.3 The document sets out good practice when assessing whether excavated materials are classified as waste or not. Provided materials are dealt with in accordance with the DoWCoP, the Environment Agency considers that those materials are unlikely to be waste when used for the purpose of land development.
- 10.4 This would require the production of a Materials Management Plan (MMP) which would sit alongside the site re-profiling proposals so that the principals of material re-use were fully demonstrated at the planning stage.
- 10.5 Under the DoWDICoP, clean, naturally derived soil can also be re-used at other 'receiver' sites provided that it can be demonstrated that it is suitable for the intended use and is in the correct volumes. This will include made ground derived from clean natural materials, provided that any anthropological materials such as asphalt, brick and concrete can be suitably segregated and adequate sampling and analysis is undertaken to confirm its suitability.
- 10.6 It should also be noted that Part III of the Finance Act 1996, which primarily encompasses landfill tax, has been amended from 1 April 2018 so that the scope of landfill tax has been extended to cover any site (not exclusively landfills) operating without the appropriate environmental permit, appropriate exemption or, correctly applied use of the DoWCoP.
- 10.7 Where soil is surplus to requirements and cannot be re-used, it will need to be removed from site under appropriate duty of care.
- 10.8 It should be noted that the chemical analysis results for disposal classification are assessed against different assessment criteria to those relating to ground contamination risk assessment. Soils that are deemed suitable for use in terms of risk to human health and the environment may not necessary be un-contaminated and could be classified as Non-Hazardous or even Hazardous for disposal purposes.
- 10.9 On the basis of current information, it is likely that excavated made ground would be classified as Non-hazardous with natural strata classifies as 'Inert'. The disposal of topsoil would need to be considered separately due to its inherently high organic content.
- 10.10 Final classification of soil for disposal would need to be confirmed by further analysis of bulk soils destined for landfill under consultation with the landfill operator.
- 10.11 In addition, for Inert Waste disposal (and in the unlikely event of Hazardous waste disposal), allowance will need to be made for adequate Waste Acceptance Criteria (WAC) testing with appropriate consideration of the additional time and cost associated with this.

Imported Fill

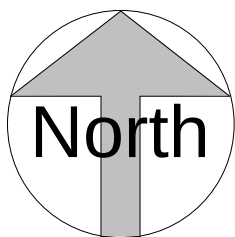
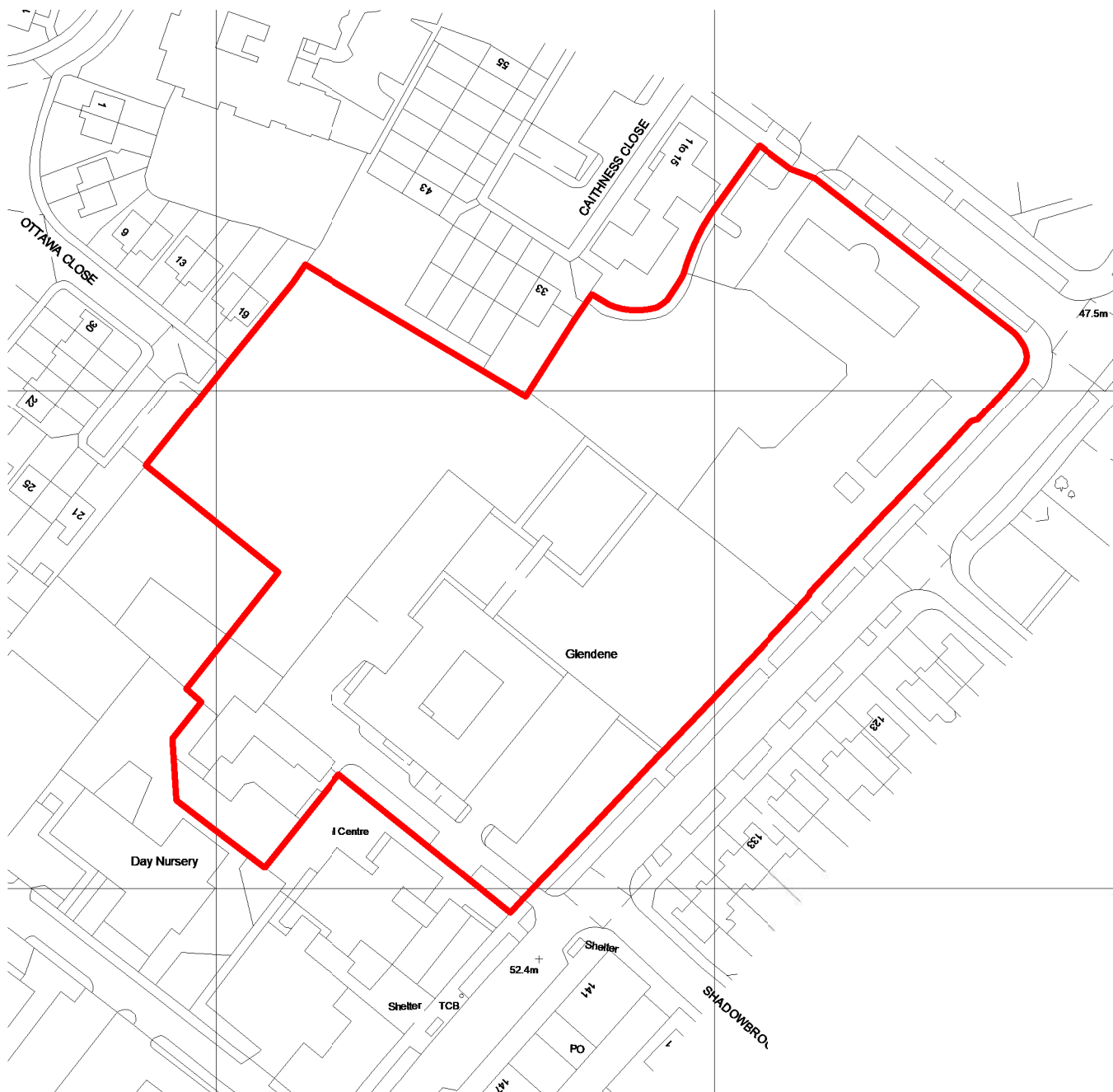
- 10.12 Imported fill will be subject to specific quality requirements and should be accompanied by appropriate certification to confirm its suitability. Allowance should also be made for testing imported fill materials prior to placement to ensure suitability.

Water Supply Pipes

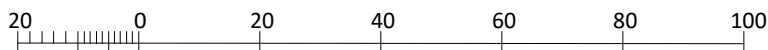
- 10.13 The relevant water supply provider will need to be consulted with regards the selection of suitable water supply pipe materials for the development. In light of the ground conditions encountered, the requirement for specific materials and measures to protect the water supply from ground contamination is not envisaged.
- 10.14 Consideration may need to be given to the provision of lined service trenches and clean in-fill to prevent possible exposure to ACM and asbestos fibres during any future maintenance work.

APPENDIX 01

Drawings



— Site Edged Red



2	03.05.18	LT	Red line boundary amended
1	02.05.18	LT	Red line boundary amended
Rev	Date	Int	Description



Client:
WCHG
Project:
Glendene

Job No:
3375

Scale @ A4:
1 : 1250

Description:
Location Plan

Drawn By: LT Checked By: VJS Date: 02/05/18 Status Code: S0 Drawing No: **100** Rev: **2**

Purpose of Issue:
Feasibility

File Identifier:
CF-BTP-00-LP-DR-A-3333_100



- SHARED OWNERSHIP**
- 8 2B3P Houses
 - 10 3B4P Houses
 - 4 4B5P Houses

- AFFORDABLE RENT**
- 6 2B3P Bungalows
 - 13 2B3P Houses
 - 12 3B4P Houses
 - 3 4B5P Houses

6	14.01.19	AP	Road amended in line with received comments in order to increase rear garden size for plots 46,47,48,49
5	03.08.18	MA	Plot 12 garden amended.
4	10.07.18	FA	Changes to house areas
3	26.06.18	LT	Layout amended in line with comments received from WCHG 25.06
2	13.10.16	MA	Layout amended in line with received comments.
1	21.09.16	MA	Mix amended. Layout amended to suit.
Rev	Date	Int	Description



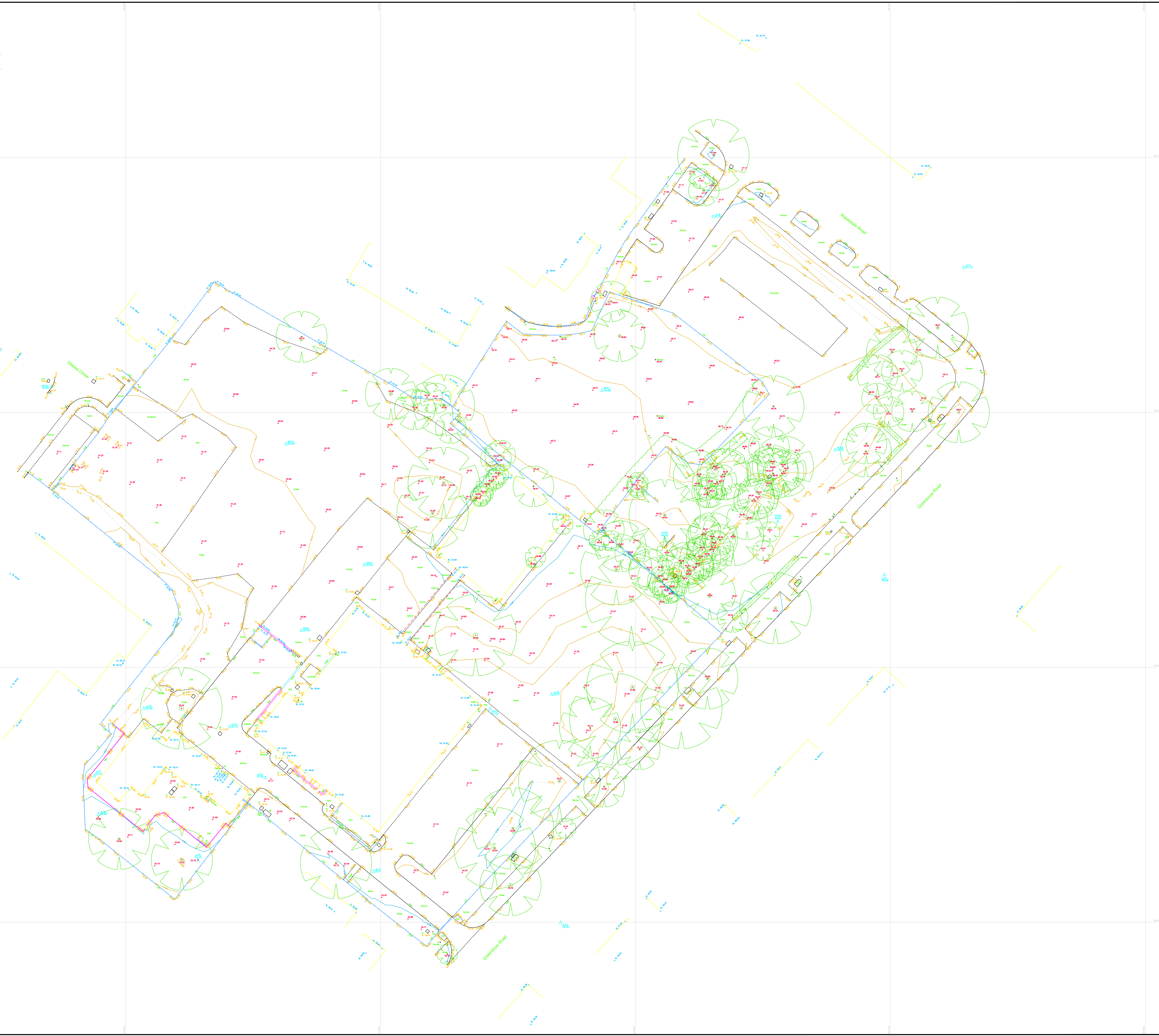
Client:
WCHG

Project:
Glendene

Description:
Site Plan option 1

Purpose of Issue:			
Feasibility			
Drawn By:	Checked By:	Date:	Scale @ A2:
FA	VS	05/06/18	
Job No:	Status Code:	Drawing No:	Rev:
3375	S0	105	6
File Identifier: GD-BTP-00-SP-DR-A-3375-105.6			
Elizabeth House, 486 Didsbury Road, Heaton Mersey, Stockport, SK4 3BS t 0161 443 1221 e info@bernardtaylor.co.uk w www.btparchitects.co.uk			

00 Site Plan Option 1
1 : 500



Stn	Easting	Northing	Height
D010	381020.36	367858.39	51.72
JL03	381048.56	367810.01	50.61
D001	381007.50	367807.00	50.75
D002	381046.76	367870.11	52.12
D003	381071.45	367855.10	49.66
D004	381105.70	367875.33	49.56
JL05	381127.88	367868.20	49.66
JL01	381148.80	367868.20	49.66
JL02	381165.29	367869.98	52.20
JL04	381227.34	367826.40	51.82
JL06	381149.19	367868.20	49.66
JL07	380994.61	367821.26	52.68
JL08	381015.81	367828.28	52.04
JL09	381033.56	367841.97	52.06
JL10	381164.36	367841.97	52.06
JL3A	381083.54	367844.74	52.01
JL1B	381152.22	367844.74	52.01
R00P	381005.41	367824.59	50.85
R00I	381001.41	367824.59	50.85
R003	380985.40	367830.15	50.88

Levels are related to **OSGB15**
 Value **176**

Coordinates are related to **National Grid** (GPs)

Scale **1:250**

0 2.5 5.0 7.5 10.0 12.5 15.0 17.5 20.0 22.5

metres

The accuracy of the survey is commensurate with the drawing scale specified within the title block.

Do not scale or resample remote with Survey Systems Ltd.

Do not scale from the drawing, work to figured dimensions.

Check all dimensions carefully.

In the event of any discrepancy, please refer enquiry to Survey Systems Ltd.

Title

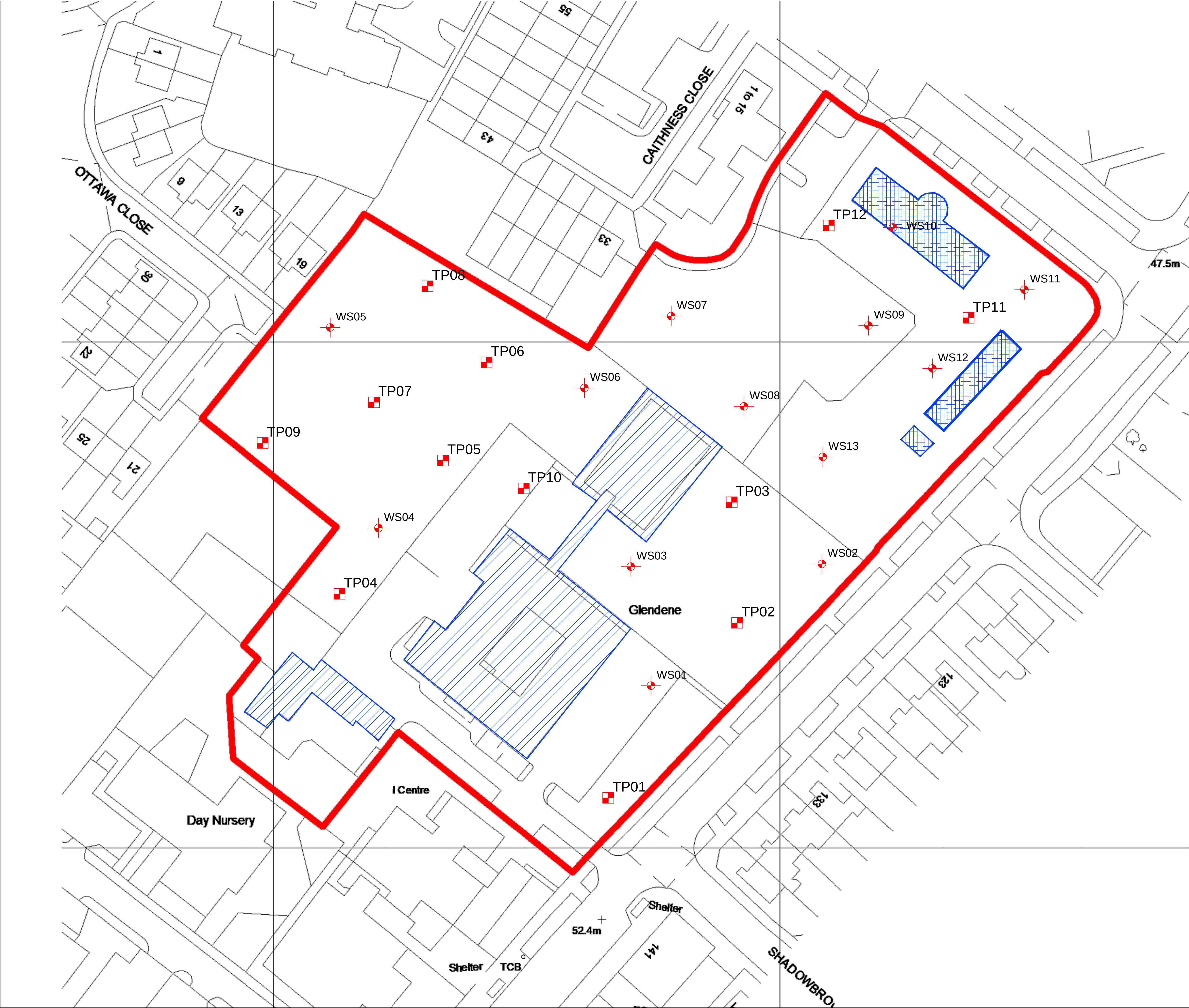
Topographical Survey
Glendene
150 Greenbrow Road
Wythenshawe M23 2RE

Surveyed **Cl DB JB** Drawn **GAT**

Date **November 2019** Checked

P/b no **17566** Revision **NA** Sheet size **A0**

Drawing no **SSL:19766-250-1:1**



GENERAL NOTES

- DO NOT SCALE FROM THIS DRAWING WORK TO FIGURED DIMENSIONS ONLY.
- NO DEVIATION FROM THE DETAILS SHOWN ON THIS DRAWING IS ALLOWED WITHOUT PRIOR PERMISSION IN WRITING.
- ALL DRAWINGS ARE TO BE READ IN CONJUNCTION WITH ALL ARCHITECTS, ENGINEERS AND SPECIALISTS DRAWINGS AND THE SPECIFICATION.
- THE CONTRACTOR SHALL INCORPORATE ALL THE REQUIREMENTS OF THE PRE-TENDER STAGE HEALTH & SAFETY PLAN.

KEY

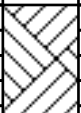
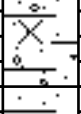
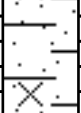
- SITE BOUNDARY
- WS01 WINDOW SAMPLE PROBEHOLES
- TP01 MACHINE EXCAVATED TRIAL PITS
- EXISTING STRUCTURES
- CONCRETE HARDSTANDING

P1	FIRST PRELIMINARY ISSUE.	AUG '19	SCS	PGD
Rev.	Amendment	Date	By	Chkd
Project GLENDENE				
Client WCHG				
Title EXPLORATORY HOLE LOCATION PLAN				
Drawn SCS	Checked PGD	Date 02-01-20	Scale 1:500@A2	
WML CONSULTING Chartered Civil and Structural Engineers No.8 Oak Green Earl Road Stanley Green Business Park Cheadle Hulme Cheshire SK8 6QL Tel 0161 482 0600 Fax 0161 486 5210 e-mail info@wmlconsulting.com www.wmlconsulting.com				
Job No. 9003G		Drawing No. SK-01-		

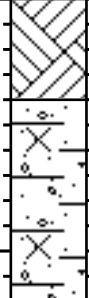
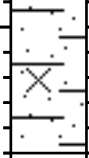
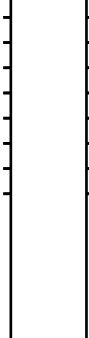
APPENDIX 02

Exploratory Hole Records

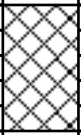
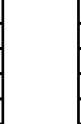
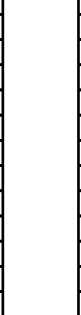
		Project Title: Glendene, Wythenshawe				WS05	
		Project Number: 9003G		Client: Garden City Design & Build Ltd			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 05/12/2019		Method: Window Sample		Driller: DSUK		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.90	D	N=7			0.50	Turf over dark brown, slightly silty, slightly gravelly, sandy CLAY. (TOPSOIL)		
					1.00	Firm, orange brown and grey mottled, slightly silty, slightly gravelly, sandy CLAY. Gravel is subangular, fine to coarse, including siltstone. (GLACIAL TILL)		
1.40	J	N=19			1.30			
					2.00	Firm to stiff, green grey SILT/CLAY with siltstone lithorelicts. (WEATHERED BOLLIN MUDSTONE MEMBER)		
					2.40			
					3.00	Extremely weak, red brown, distinctly weathered MUDSTONE. (BOLLIN MUDSTONE MEMBER)		
		pp 50/240mm				End Of Borehole At 3.00 m		
					4.00			

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level		REMARKS No Groundwater Encountered 	Water Strikes																										
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Date	Casing	Water	From	To	Hours																								

			Project Title: Glendene, Wythenshawe				WS06																																																	
			Project Number: 9003G		Client: Garden City Design & Build Ltd					Sheet 1 Of 1																																														
			GL (mAOD):		N Coord: 0		E Coord: 0																																																	
Date: 05/12/2019			Method: Window Sample		Driller: DSUK		Logged By: TPB																																																	
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe																																																
		N=6			0.40	Turf over dark brown, slightly silty, slightly gravelly, sandy CLAY with rootlets. Gravel is subangular, coarse, including brick. (TOPSOIL)																																																		
		N=19			1.00 1.20	Firm, orange brown, slightly silty, slightly sandy, slightly gravelly CLAY. Gravel is subangular to subrounded, fine to coarse, including siltstone. (GLACIAL TILL)																																																		
		pp 50/220mm			2.00 2.50	Soft, becoming firm to stiff, red brown and occasionally green mottled, slightly sandy, silty CLAY. (WEATHERED BOLLIN MUDSTONE MEMBER)																																																		
					3.00	Extremely weak, red brown, distinctly weathered MUDSTONE. (BOLLIN MUDSTONE MEMBER)																																																		
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Date	Casing	Water	From	To	Hours																																																			

		Project Title: Glendene, Wythenshawe				WS07	
		Project Number: 9003G		Client: Garden City Design & Build Ltd			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 06/12/2019		Method: Window Sample		Driller: DSUK		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.20	E	N=9			0.50	Brown, slightly sandy, gravelly CLAY. Gravel is subangular, fine to coarse, including sandstone, brick and concrete. Low cobble content. Cobbles are subangular, including brick. (MADE GROUND) Firm, red brown and occasionally grey mottled, slightly sandy, silty CLAY. (WEATHERED BOLLIN MUDSTONE MEMBER)		
1.00	D				1.00			
1.20	J				1.60			
		N=41			2.00	Extremely weak, red brown, initially distinctly, becoming partially weathered MUDSTONE. (BOLLIN MUDSTONE MEMBER)		
		pp 50/185mm			3.00	End Of Borehole At 3.00 m		
					4.00			

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level		REMARKS No Groundwater Encountered 	Water Strikes <table border="1"> <thead> <tr> <th>Date</th> <th>Strike</th> <th>Level</th> <th>Minutes</th> <th>Casing</th> <th>Sealed</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>	Date	Strike	Level	Minutes	Casing	Sealed																													
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Date	Casing	Water	From	To	Hours																																	

Scale: 1:30

			Project Title: Glendene, Wythenshawe			WS08																																																		
			Project Number: 9003G		Client: Garden City Design & Build Ltd																																																			
			GL (mAOD):		N Coord: 0		E Coord: 0																																																	
Date: 06/12/2019			Method: Window Sample		Driller: DSUK		Logged By: TPB																																																	
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe																																																
0.30	E				0.50	Brown, slightly silty, slightly gravelly, sandy CLAY. Gravel is subangular, fine to coarse, including sandstone, brick and concrete. Low cobble content. Cobbles are subangular, including brick. (MADE GROUND)																																																		
		N=6			1.00	Soft, orange brown and occasionally grey mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is subrounded, fine to coarse, including sandstone. (GLACIAL TILL)																																																		
		N=35			1.60																																																			
					2.00	Extremely weak, red brown, distinctly weathered MUDSTONE. (BOLLIN MUDSTONE MEMBER)	▼																																																	
																																																								
		pp 50/190mm			3.00	End Of Borehole At 3.00 m																																																		
																																																								
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Date	Casing	Water	From	To	Hours																																																			

Scale: 1:30

		Project Title: Glendene, Wythenshawe				WS09	
		Project Number: 9003G		Client: Garden City Design & Build Ltd			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 06/12/2019		Method: Window Sample		Driller: DSUK		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.10	E	N=5			0.45	Brown, slightly silty, slightly gravelly, sandy CLAY with roots. Gravel is subangular, fine to coarse, including ash, clinker and brick. (MADE GROUND)		
0.70	D				1.00	Soft, red brown and occasionally grey mottled, slightly sandy, slightly gravelly, silty CLAY. Gravel is subangular, fine to medium, including siltstone. (GLACIAL TILL)		
1.40	J				2.00			
					2.10			
2.30	D		N=0			2.50	Very soft, dark brown, peaty CLAY. (GLACIAL TILL)	
					2.75	Soft, red brown and occasionally grey mottled, slightly sandy, silty CLAY. (WEATHERED BOLLIN MUDSTONE MEMBER)		
					2.90	Extremely weak, red brown, initially distinctly, becoming partially weathered MUDSTONE. (BOLLIN MUDSTONE MEMBER)		
					3.00	End Of Borehole At 2.90 m		
					4.00			

KEY

D - Disturbed Sample
 B - Bulk Sample
 U - Undisturbed
 W - Water Sample
 S - Standard Penetration Test
 C - Cone Penetration Test
 N - Penetration Test 'N' Value
 V - Hand Shear Vane kPa
 - Groundwater Strike
 - Groundwater Level

REMARKS

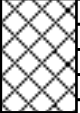
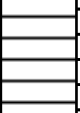
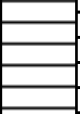
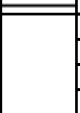
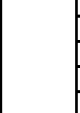
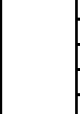
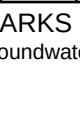
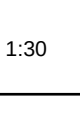
Scale: 1:30

Water Strikes

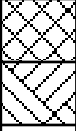
Date	Strike	Level	Minutes	Casing	Sealed
09/12/2019	1				

Daily Log Of Depths

Date	Casing	Water	From	To	Hours

			Project Title: Glendene, Wythenshawe				WS10																																																	
			Project Number: 9003G		Client: Garden City Design & Build Ltd					Sheet 1 Of 1																																														
			GL (mAOD):		N Coord: 0		E Coord: 0																																																	
Date: 06/12/2019			Method: Window Sample		Driller: DSUK		Logged By: TPB																																																	
Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe																																																
1.00	J	N=8			0.45	Dark greyish brown, clayey, gravelly SAND. Gravel is subangular, fine to coarse, including brick, limestone, concrete and wood. (MADE GROUND)																																																		
					1.00	Firm, orange brown and occasionally grey mottled, slightly sandy, silty CLAY with mudstone lithorelicts. (WEATHERED BOLLIN MUDSTONE MEMBER)																																																		
					1.80	Extremely weak, red brown, distinctly weathered MUDSTONE. (BOLLIN MUDSTONE MEMBER)																																																		
					2.00																																																			
		N=14			3.00	End Of Borehole At 3.00 m																																																		
		N=45																																																						
																																																								
																																																								
																																																								
																																																								
																																																								
																																																								
																																																								
																																																								
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Date	Casing	Water	From	To	Hours																																																			
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		Project Title: Glendene, Wythenshawe				WS11	
		Project Number: 9003G		Client: Garden City Design & Build Ltd			
		GL (mAOD):		N Coord: 0		E Coord: 0	
Date: 06/12/2019		Method: Window Sample		Driller: DSUK		Logged By: TPB	

Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water	Standpipe
0.10	E	N=10			0.25	Brownish grey, slightly clayey, gravelly SAND. Gravel is subangular, fine to coarse, including brick, limestone and plastic. Low cobble content. Cobbles are subangular, including brick. (MADE GROUND) Dark brown, slightly clayey, organic SAND. (TOPSOIL) Firm, red brown and occasionally grey mottled, slightly sandy, silty CLAY with mudstone lithorelicts. (WEATHERED BOLLIN MUDSTONE MEMBER) Extremely weak, red brown, initially distinctly, becoming partially weathered MUDSTONE. (BOLLIN MUDSTONE MEMBER)		
				0.50				
0.70	D			1.00				
				1.40				
				2.00				
		pp 50/180mm				End Of Borehole At 2.00 m		
					3.00			
					4.00			

KEY D - Disturbed Sample B - Bulk Sample U - Undisturbed W - Water Sample S - Standard Penetration Test C - Cone Penetration Test N - Penetration Test 'N' Value V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 		REMARKS No Groundwater Encountered Scale: 1:30		Water Strikes																									
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Date	Casing	Water	From	To	Hours																								

	Project Title: Glendene, Wythenshawe		TP01
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.20	E	V=>130,>130,>130					

WML CONSULTING	Project Title: Glendene, Wythenshawe		TP02
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.40	E					Turf over brown, slightly silty, clayey SAND with roots and rootlets. Rare subrounded gravel of sandstone. (MADE GROUND)	
					1.00		
					1.40		
					1.80	Stiff, brownish grey, slightly silty, slightly gravelly, very sandy CLAY. Gravel is subangular to subrounded, fine to coarse, including sandstone and quartz. (GLACIAL TILL)	
					2.00	End Of Trial Pit At 1.80 m	
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa ▽ - Groundwater Strike ▼ - Groundwater Level						REMARKS No Groundwater Encountered	



	Project Title: Glendene, Wythenshawe		TP03
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.30	E	V=105,108,110			0.15	Turf over dark brown, slightly silty, slightly sandy CLAY with roots and rootlets. (TOPSOIL)	
					0.55	Reddish brown, slightly gravelly, sandy CLAY. Gravel is subangular, coarse, including brick. (MADE GROUND)	
					1.00	Stiff, orange brown and occasionally grey mottled, slightly sandy, silty CLAY. (GLACIAL TILL)	
					1.40	End Of Trial Pit At 1.40 m	
					2.00		
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 						REMARKS No Groundwater Encountered	

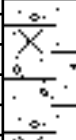
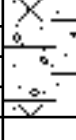
	Project Title: Glendene, Wythenshawe		TP04
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	E	V=120,122,102			0.15	Grey, subangular, fine to coarse GRAVEL including limestone, brick, sandstone and wood. (MADE GROUND)	
					0.25		
						Dark brown, slightly silty, slightly sandy, organic clay. (TOPSOIL)	
						Firm to stiff, orange brown and occasionally grey mottled, slightly silty, slightly sandy, slightly gravelly silty CLAY. Gravel is subangular to subrounded, fine to coarse, including sandstone and quartz. (GLACIAL TILL)	
					1.00		
					1.40	End Of Trial Pit At 1.40 m	
					2.00		
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 						REMARKS No Groundwater Encountered	

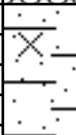
	Project Title: Glendene, Wythenshawe		TP05
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.20	E	V=128,122,112			0.45	Turf over dark brown, slightly silty, slightly sandy CLAY with rootlets. (TOPSOIL)	
					1.00	Firm to stiff, orange brown and grey mottled, slightly sandy, slightly gravelly, silty CLAY with pockets of sand. Gravel is subangular to subrounded, fine to coarse, including sandstone and quartz. (GLACIAL TILL)	
					1.30	End Of Trial Pit At 1.30 m	
					2.00		
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 						REMARKS No Groundwater Encountered	

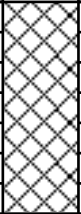
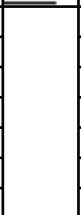
	Project Title: Glendene, Wythenshawe		TP06
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	E	V=84,78,76			0.30	Turf over dark brown, slightly silty, slightly sandy CLAY with rootlets. (TOPSOIL)	
0.50	E			0.90	Greyish brown, slightly gravelly, sandy CLAY. Gravel is subangular, fine to coarse, including brick and sandstone. (MADE GROUND)		
				1.00	Firm, becoming stiff, greyish brown, slightly sandy, silty CLAY. (GLACIAL TILL)		
				1.40	End Of Trial Pit At 1.40 m		
				2.00			
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 						REMARKS No Groundwater Encountered	

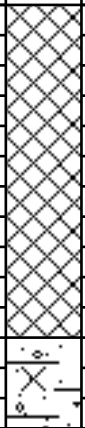
WML CONSULTING	Project Title: Glendene, Wythenshawe		TP07
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.40	E	V=90,100,90			0.70	Turf over dark brown, slightly silty, slightly gravelly, sandy CLAY with roots. Gravel is subangular, fine to coarse, including brick. (MADE GROUND)	
					1.00	Firm, becoming stiff, orange brown and grey mottled, silty, sandy CLAY. (GLACIAL TILL)	
					1.50	End Of Trial Pit At 1.50 m	
					2.00		
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 						REMARKS No Groundwater Encountered	

	Project Title: Glendene, Wythenshawe		TP08
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.50	E					Turf over dark brown, slightly silty, slightly sandy, slightly gravelly CLAY. Gravel is subangular fine to coarse, including brick and concrete. (MADE GROUND)	
					1.00		
					1.10		
					1.40	Stiff, orange brown and grey mottled, slightly sandy, silty CLAY. (GLACIAL TILL)	
						End Of Trial Pit At 1.40 m	
					2.00		
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 						REMARKS No Groundwater Encountered	

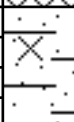
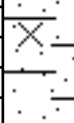
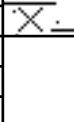
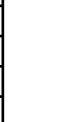
	Project Title: Glendene, Wythenshawe		TP09
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	E	V=108,122,100				Brownish grey, slightly clayey, sandy, subangular, fine to coarse GRAVEL including limestone, sandstone and brick. (MADE GROUND)	
					0.40	Dark, brown, slightly silty, organic clay. (TOPSOIL)	
					0.80		
					1.00	Firm to stiff, orange brown and occasionally grey mottled, silty, sandy CLAY. (GLACIAL TILL)	
					1.40	End Of Trial Pit At 1.40 m	
					2.00		
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 						REMARKS No Groundwater Encountered	

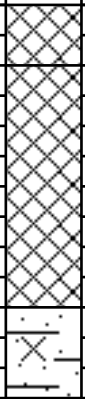
	Project Title: Glendene, Wythenshawe		TP10
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.02	J	V=120,122,124			0.10	Asphalt. (MADE GROUND)	
0.20	E				0.40	Light brown, slightly sandy, subangular, fine to coarse GRAVEL of limestone. (MADE GROUND)	
					1.00	Stiff, orange brown and grey mottled, slightly silty, sandy CLAY. (GLACIAL TILL)	
					1.30	End Of Trial Pit At 1.30 m	
					2.00		
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 					REMARKS No Groundwater Encountered		

	Project Title: Glendene, Wythenshawe		TP11
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	E				0.20	Turf over dark brown, slightly clayey, gravelly SAND with rootlets. Gravel is subangular, fine to coarse, including sandstone, brick and concrete. (MADE GROUND)	
						Brownish grey, slightly sandy, subangular, fine to coarse GRAVEL including limestone, concrete and plastic. (MADE GROUND)	
					1.00		
					1.30	Firm, orange brown and grey mottled, silty, sandy CLAY. (GLACIAL TILL)	
						End Of Trial Pit At 1.30 m	
					2.00		
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level						REMARKS 	

	Project Title: Glendene, Wythenshawe		TP12
	Project Number: 9003G	Client: Garden City Design & Build Ltd	
	GL (mAOD):	N Coord: 0	E Coord: 0
Date: 05/12/2019	Method: Tracked Excavator	Logged By: TPB	Scale: 1:25



Depth (m)	Type	Test Result	Level	Legend	Depth (m)	Description	Water
0.10	E	V=84,96,100			0.30	Greyish brown, slightly silty, sandy, subangular, fine to coarse GRAVEL including limestone, brick, sandstone, concrete and plastic. (MADE GROUND)	
					0.60	Dark brown, slightly gravelly, silty CLAY. Gravel is subangular, medium to coarse, including brick. (MADE GROUND)	
					1.00	Firm to stiff, orange brown and grey mottled, slightly gravelly, silty, sandy CLAY. Gravel is subangular, fine to medium, including siltstone. (GLACIAL TILL)	
					1.50		
					2.00		
						End Of Trial Pit At 1.50 m	
KEY D - Disturbed Sample B - Bulk Sample W - Water Sample V - Hand Shear Vane kPa  - Groundwater Strike  - Groundwater Level 						REMARKS No Groundwater Encountered	

APPENDIX 03

Geotechnical Testing Results



LABORATORY REPORT



4043

Contract Number: PSL19/7760

Report Date: 14 January 2020
Client's Reference: 9003G
Client Name: WML Consulting
No 8 Oak Green Earl Road
Stanley Green Business Park
Cheadle Hulme
Cheshire
SK8 6QL

For the attention of: Sam Seddon

Contract Title: Glendene

Date Received: 18/12/2019
Date Commenced: 18/12/2019
Date Completed: 14/1/2020

Notes: Opinions and Interpretations are outside the UKAS Accreditation

A copy of the Laboratory Schedule of accredited tests as issued by UKAS is attached to this report. 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 other than in full, without the prior written approval of the laboratory.

Checked and Approved Signatories:

R Gunson
(Director)

L Knight
(Senior Technician)

A Watkins
(Director)

S Eyre
(Senior Technician)

R Berriman
(Quality Manager)

S Royle
(Laboratory Manager)

5 – 7 Hexthorpe Road, Hexthorpe,
Doncaster DN4 0AR
tel: +44 (0)844 815 6641
fax: +44 (0)844 815 6642
e-mail: rgunson@prosoils.co.uk
awatkins@prosoils.co.uk

Page 1 of

SUMMARY OF LABORATORY SOIL DESCRIPTIONS

[illegible]

4043

PSL
Professional Soils Laboratory

Glendene

Contract No:

PSL19/7760

Client Ref:

9003G

SUMMARY OF SOIL CLASSIFICATION TESTS

(BS1377 : PART 2 : 1990)

[illegible]

SYMBOLS : NP : Non Plastic

*** : Liquid Limit and Plastic Limit Wet Sieved.**



4043

PSL
Professional Soils Laboratory

Glendene

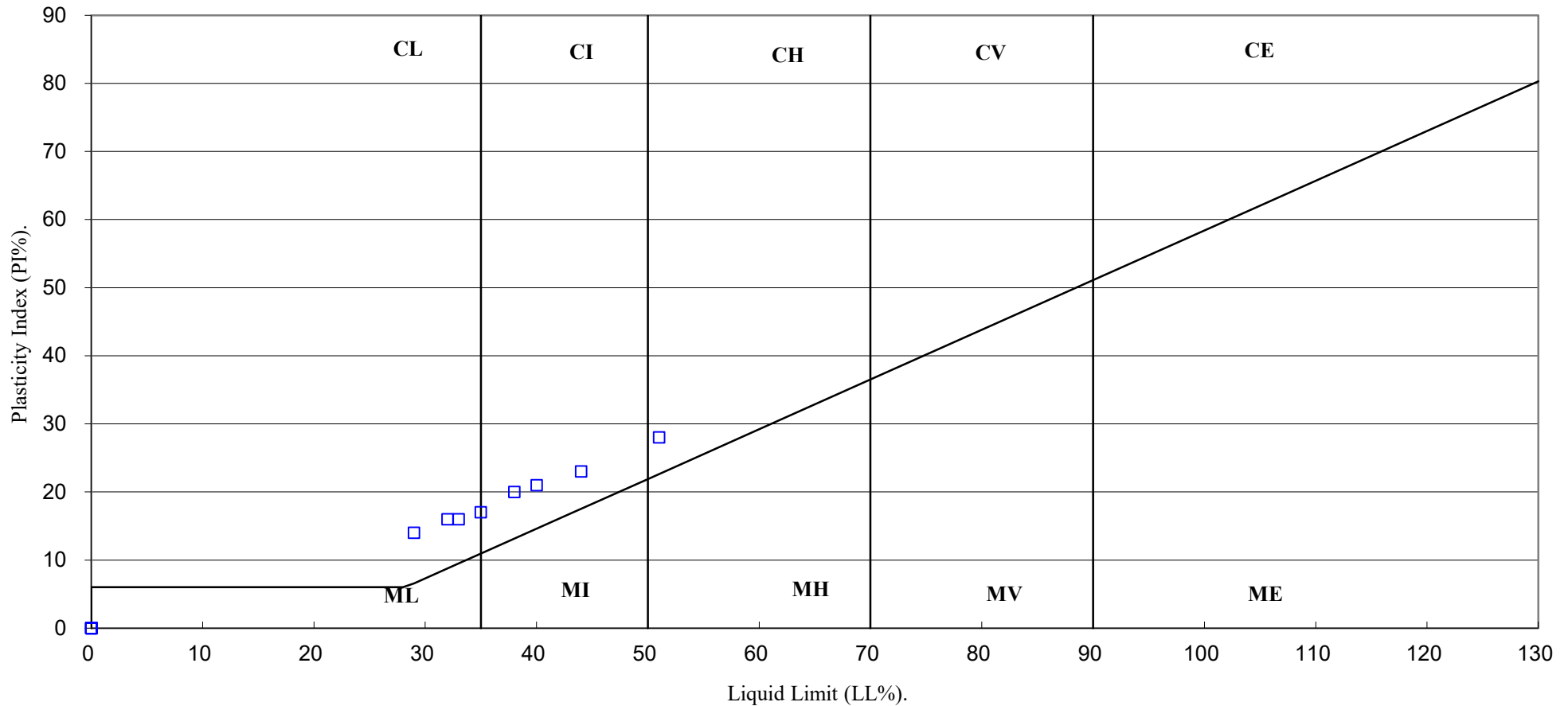
Contract No:

PSL19/7760

Client Ref:

9003G

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.



4043

PSL
Professional Soils Laboratory

Glendene

Contract No:

PSL19/7760

Client Ref:

9003G



Certificate of Analysis

Certificate Number 19-26246

02-Jan-20

Client Professional Soils Laboratory Ltd
5/7 Hexthorpe Road
Hexthorpe
DN4 0AR

Our Reference 19-26246

Client Reference PSL19/7760

Order No (not supplied)

Contract Title GLENDENE

Description One Soil sample.

Date Received 20-Dec-19

Date Started 20-Dec-19

Date Completed 02-Jan-20

Test Procedures Identified by prefix DETSn (details on request).

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

Approved By

Adam Fenwick
Contracts Manager



Summary of Chemical Analysis

Soil Samples

Our Ref 19-26246
Client Ref PSL19/7760
Contract Title GLENDENE

Lab No	1617291
Sample ID	WS09
Depth	2.30
Other ID	
Sample Type	D
Sampling Date	18/12/19
Sampling Time	n/s

Test	Method	LOD	Units	
Inorganics				
Organic matter	DETSC 2002#	0.1	%	6.3

Information in Support of the Analytical Results

Our Ref 19-26246
 Client Ref PSL19/7760
 Contract GLENDENE

Containers Received & Deviating Samples

Lab No	Sample ID	Date		Containers Received	Holding time exceeded for tests	Inappropriate container for tests
		Sampled				
1617291	WS09 2.30 SOIL	18/12/19		PT 500ml		

Key: P-Plastic T-Tub

DETS cannot be held responsible for the integrity of samples received whereby the laboratory did not undertake the sampling. In this instance samples received may be deviating. Deviating Sample criteria are based on British and International standards and laboratory trials in conjunction with the UKAS note 'Guidance on Deviating Samples'. All samples received are listed above. However, those samples that have additional comments in relation to hold time, inappropriate containers etc are deviating due to the reasons stated. This means that the analysis is accredited where applicable, but results may be compromised due to sample deviations. If no sampled date (soils) or date+time (waters) has been supplied then samples are deviating. However, if you are able to supply a sampled date (and time for waters) this will prevent samples being reported as deviating where specific hold times are not exceeded and where the container supplied is suitable.

Soil Analysis Notes

Inorganic soil analysis was carried out on a dried sample, crushed to pass a 425µm sieve, in accordance with BS1377. Organic soil analysis was carried out on an 'as received' sample. Organics results are corrected for moisture and expressed on a dry weight basis. The Loss on Drying, used to express organics analysis on an air dried basis, is carried out at a temperature of 28°C +/-2°C.

Disposal

From the issue date of this test certificate, samples will be held for the following times prior to disposal :- Soils - 1 month, Liquids - 2 weeks, Asbestos (test portion) - 6 months
--

APPENDIX 04

Chemical Analytical Results



2183

Final Report

Report No.: 19-41385-1 19-41385-1

Initial Date of Issue: 19/Dec/2019 19/Dec/2019

Client WML Consulting Ltd WML Consulting Ltd

Client Address: No. 8 Oak Green
Stanley Green Business Park
Earl Rd
Cheadle
SK8 6QL No. 8 Oak Green
Stanley Green Business Park
Earl Rd
Cheadle
SK8 6QL

Contact(s): Sam Seddon Sam Seddon

Project 9003G Glendene, Wythenshawe

Quotation No.: **Date Received:** 11/Dec/2019 1

Order No.: 9003G 9003G **Date Instructed:** 11/Dec/2019 1

No. of Samples: 30 30

Turnaround (Wkdays): 5 5 **Results Due:** 17/Dec/2019 1

Date Approved: 19/Dec/2019 19/Dec/2019

Approved By:



Details: Glynn Harvey, Laboratory Manager

Results - Soil

Project:

Client: WML Consulting Ltd	Chemtest Job No.:				19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385
Quotation No.:	Chemtest Sample ID.:				941303	941304	941305	941306	941307	941308	941309	941310	941311
Order No.: 9003G	Client Sample Ref.:				E	E	E	E	E	E	E	E	E
	Sample Location:				TP01	TP02	TP03	TP04	TP05	TP06	TP06	TP07	TP08
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m) (\$):				0.20	0.40	0.30	0.10	0.20	0.10	0.50	0.40	0.50
	Date Sampled (\$):				05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A	-	-	-	-	-	-	-	Fibres/Clumps	-
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	No Asbestos Detected	Chrysotile	No Asbestos Detected
ACM Detection Stage	U	2192		N/A	-	-	-	-	-	-	-	Stereo Microscopy	-
Moisture	N	2030	%	0.020	13	14	11	4.8	12	12	13	16	13
pH	U	2010		4.0	7.1	5.7	8.3	9.5	8.0	8.0	8.4	7.9	7.7
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	0.40	< 0.40
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.068	< 0.010	< 0.010	0.015	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
Total Sulphur	U	2175	%	0.010	0.059	0.032	< 0.010	0.032	0.036	0.031	< 0.010	0.026	0.049
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Sulphate (Total)	U	2430	mg/kg	100	900	650	240	470	540	470	340	770	910
Arsenic	U	2450	mg/kg	1.0	6.8	12	5.4	14	13	11	9.4	14	12
Cadmium	U	2450	mg/kg	0.10	0.21	0.17	< 0.10	0.36	0.23	0.24	0.12	0.21	0.25
Copper	U	2450	mg/kg	0.50	14	29	12	3.0	29	44	19	32	36
Mercury	U	2450	mg/kg	0.10	< 0.10	0.41	< 0.10	< 0.10	0.21	0.19	< 0.10	0.29	0.38
Nickel	U	2450	mg/kg	0.50	11	21	18	3.8	26	23	30	26	24
Lead	U	2450	mg/kg	0.50	27	57	15	7.1	46	39	18	70	70
Selenium	U	2450	mg/kg	0.20	0.34	0.32	< 0.20	< 0.20	0.26	0.22	< 0.20	0.37	0.37
Vanadium	U	2450	mg/kg	5.0	19	30	23	5.4	36	31	30	39	33
Zinc	U	2450	mg/kg	0.50	39	69	37	13	79	150	46	85	78
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Organic Matter	U	2625	%	0.40	12	3.6	1.1	0.60	2.2	1.3	0.52	2.9	7.2
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Phenanthrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.36	0.30	< 0.10	0.31	0.54
Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.14	0.10	< 0.10	0.11	0.20
Fluoranthene	U	2700	mg/kg	0.10	0.26	0.56	< 0.10	0.18	0.85	0.48	< 0.10	0.64	0.78
Pyrene	U	2700	mg/kg	0.10	0.33	0.50	< 0.10	0.17	1.0	0.63	< 0.10	0.72	0.83
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.38	< 0.10	< 0.10	< 0.10	< 0.10
Chrysene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	0.40	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10

Results - Soil

Project:

Client: WML Consulting Ltd	Chemtest Job No.:				19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385
Quotation No.:	Chemtest Sample ID.:				941303	941304	941305	941306	941307	941308	941309	941310	941311
Order No.: 9003G	Client Sample Ref.:				E	E	E	E	E	E	E	E	E
	Sample Location:				TP01	TP02	TP03	TP04	TP05	TP06	TP06	TP07	TP08
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m) (\$):				0.20	0.40	0.30	0.10	0.20	0.10	0.50	0.40	0.50
	Date Sampled (\$):				05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019
	Asbestos Lab:				COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY	COVENTRY
Determinand	Accred.	SOP	Units	LOD									
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0	< 2.0	< 2.0	< 2.0	3.1	< 2.0	< 2.0	< 2.0	2.4
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30

Results - Soil

Project:

Client: WML Consulting Ltd	Chemtest Job No.:				19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385
Quotation No.:	Chemtest Sample ID.:				941312	941313	941314	941323	941324	941325	941326	941327	941328
Order No.: 9003G	Client Sample Ref.:				E	J	E	E	E	J	E	J	J
	Sample Location:				TP09	TP10	TP10	TP11	TP12	WS01	WS01	WS01	WS02
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m) (\$):				0.10	0.02	0.20	0.10	0.10	0.05	0.40	2.00	2.00
	Date Sampled (\$):				05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019
	Asbestos Lab:				COVENTRY		COVENTRY	COVENTRY	COVENTRY		COVENTRY		
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A	Fibres/Clumps		-	-	-		-		
Asbestos Identification	U	2192	%	0.001	Chrysotile		No Asbestos Detected	No Asbestos Detected	No Asbestos Detected		No Asbestos Detected		
ACM Detection Stage	U	2192		N/A	Stereo Microscopy		-	-	-		-		
Moisture	N	2030	%	0.020	8.2	12	3.5	15	14	< 0.020	14	11	12
pH	U	2010		4.0	8.9		9.4	8.5	9.3		9.0	8.7	8.2
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	0.62		< 0.40	0.79	2.0		0.42		
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	0.80		0.053	0.095	0.042		0.013	< 0.010	< 0.010
Total Sulphur	U	2175	%	0.010	0.40		0.037	0.10	0.091		0.17	< 0.010	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50		< 0.50	< 0.50	< 0.50		< 0.50		
Sulphate (Total)	U	2430	mg/kg	100	4000		720	1700	1600		910		
Arsenic	U	2450	mg/kg	1.0	15		18	19	9.9		25		
Cadmium	U	2450	mg/kg	0.10	0.44		1.3	0.54	1.1		0.70		
Copper	U	2450	mg/kg	0.50	18		3.9	42	17		45		
Mercury	U	2450	mg/kg	0.10	< 0.10		< 0.10	< 0.10	< 0.10		< 0.10		
Nickel	U	2450	mg/kg	0.50	17		4.8	20	14		36		
Lead	U	2450	mg/kg	0.50	44		17	64	32		27		
Selenium	U	2450	mg/kg	0.20	< 0.20		< 0.20	< 0.20	< 0.20		< 0.20		
Vanadium	U	2450	mg/kg	5.0	23		5.6	23	18		51		
Zinc	U	2450	mg/kg	0.50	48		16	120	200		68		
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50		< 0.50	< 0.50	< 0.50		< 0.50		
Organic Matter	U	2625	%	0.40	2.9		3.5	4.8	2.6		16		
Naphthalene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.28	< 0.10		< 0.10		
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.11	< 0.10		< 0.10		
Acenaphthene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.14	< 0.10		< 0.10		
Fluorene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.26	< 0.10		< 0.10		
Phenanthrene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.99	< 0.10		< 0.10		
Anthracene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.37	< 0.10		< 0.10		
Fluoranthene	U	2700	mg/kg	0.10	0.55		< 0.10	2.1	0.32		< 0.10		
Pyrene	U	2700	mg/kg	0.10	0.69		< 0.10	2.2	0.53		< 0.10		
Benzo[a]anthracene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.96	< 0.10		< 0.10		
Chrysene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.90	< 0.10		< 0.10		
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	< 0.10		< 0.10	1.2	< 0.10		< 0.10		
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.51	< 0.10		< 0.10		
Benzo[a]pyrene	U	2700	mg/kg	0.10	< 0.10	< 0.10	< 0.10	1.4	< 0.10	< 0.10	< 0.10		
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	< 0.10		< 0.10	1.1	< 0.10		< 0.10		
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.40	< 0.10		< 0.10		

Results - Soil

Project:

Client: WML Consulting Ltd	Chemtest Job No.:					19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385
Quotation No.:	Chemtest Sample ID.:					941312	941313	941314	941323	941324	941325	941326	941327
Order No.: 9003G	Client Sample Ref.:					E	J	E	E	E	J	E	J
	Sample Location:					TP09	TP10	TP10	TP11	TP12	WS01	WS01	WS01
	Sample Type:					SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m) (\$):					0.10	0.02	0.20	0.10	0.10	0.05	0.40	2.00
	Date Sampled (\$):					05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019	05-Dec-2019
	Asbestos Lab:					COVENTRY		COVENTRY	COVENTRY	COVENTRY		COVENTRY	
Determinand	Accred.	SOP	Units	LOD									
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	< 0.10		< 0.10	0.97	< 0.10		< 0.10		
Total Of 16 PAH's	U	2700	mg/kg	2.0	< 2.0		< 2.0	14	< 2.0		< 2.0		
Total Phenols	U	2920	mg/kg	0.30	< 0.30		< 0.30	< 0.30	< 0.30		< 0.30		

Results - Soil

Project:

Client: WML Consulting Ltd	Chemtest Job No.:				19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385
Quotation No.:	Chemtest Sample ID.:				941329	941330	941331	941333	941334	941335	941336	941337	941338
Order No.: 9003G	Client Sample Ref.:				J	J	J	E	J	E	E	J	J
	Sample Location:				WS03	WS04	WS05	WS07	WS07	WS08	WS09	WS09	WS10
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m) (\$):				2.90	1.20	1.40	0.20	1.20	0.30	0.10	1.40	1.00
	Date Sampled (\$):				05-Dec-2019	05-Dec-2019	05-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019
	Asbestos Lab:							COVENTRY		COVENTRY	COVENTRY		
Determinand	Accred.	SOP	Units	LOD									
ACM Type	U	2192		N/A				-		-	-		
Asbestos Identification	U	2192	%	0.001				No Asbestos Detected		No Asbestos Detected	No Asbestos Detected		
ACM Detection Stage	U	2192		N/A				-		-	-		
Moisture	N	2030	%	0.020	7.4	12	17	15	19	18	19	20	18
pH	U	2010		4.0	9.0	7.9	7.7	7.6	6.6	7.4	5.6	7.0	6.4
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40				0.52		0.86	0.69		
Sulphate (2:1 Water Soluble) as SO4	U	2120	g/l	0.010	< 0.010	< 0.010	< 0.010	0.040	0.010	0.020	0.010	0.010	< 0.010
Total Sulphur	U	2175	%	0.010	< 0.010	< 0.010	0.011	0.052	0.016	0.044	0.051	0.019	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50				< 0.50		< 0.50	< 0.50		
Sulphate (Total)	U	2430	mg/kg	100				930		990	650		
Arsenic	U	2450	mg/kg	1.0				18		20	12		
Cadmium	U	2450	mg/kg	0.10				0.47		0.55	0.45		
Copper	U	2450	mg/kg	0.50				56		70	39		
Mercury	U	2450	mg/kg	0.10				0.14		0.35	< 0.10		
Nickel	U	2450	mg/kg	0.50				25		26	26		
Lead	U	2450	mg/kg	0.50				69		140	42		
Selenium	U	2450	mg/kg	0.20				< 0.20		0.36	0.47		
Vanadium	U	2450	mg/kg	5.0				33		33	30		
Zinc	U	2450	mg/kg	0.50				210		190	75		
Chromium (Hexavalent)	N	2490	mg/kg	0.50				< 0.50		< 0.50	< 0.50		
Organic Matter	U	2625	%	0.40				3.6		3.6	2.1		
Naphthalene	U	2700	mg/kg	0.10				< 0.10		0.84	< 0.10		
Acenaphthylene	U	2700	mg/kg	0.10				< 0.10		< 0.10	< 0.10		
Acenaphthene	U	2700	mg/kg	0.10				< 0.10		0.22	< 0.10		
Fluorene	U	2700	mg/kg	0.10				< 0.10		0.10	< 0.10		
Phenanthrene	U	2700	mg/kg	0.10				0.49		1.8	< 0.10		
Anthracene	U	2700	mg/kg	0.10				< 0.10		0.23	< 0.10		
Fluoranthene	U	2700	mg/kg	0.10				0.60		2.9	< 0.10		
Pyrene	U	2700	mg/kg	0.10				0.49		2.5	< 0.10		
Benzo[a]anthracene	U	2700	mg/kg	0.10				0.25		1.2	< 0.10		
Chrysene	U	2700	mg/kg	0.10				0.25		1.4	< 0.10		
Benzo[b]fluoranthene	U	2700	mg/kg	0.10				< 0.10		1.4	< 0.10		
Benzo[k]fluoranthene	U	2700	mg/kg	0.10				< 0.10		0.53	< 0.10		
Benzo[a]pyrene	U	2700	mg/kg	0.10				< 0.10		1.3	< 0.10		
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10				< 0.10		0.87	< 0.10		
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10				< 0.10		< 0.10	< 0.10		

Results - Soil

Project:

Client: WML Consulting Ltd	Chemtest Job No.:				19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385	19-41385
Quotation No.:	Chemtest Sample ID.:				941329	941330	941331	941333	941334	941335	941336	941337	941338
Order No.: 9003G	Client Sample Ref.:				J	J	J	E	J	E	E	J	J
	Sample Location:				WS03	WS04	WS05	WS07	WS07	WS08	WS09	WS09	WS10
	Sample Type:				SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
	Top Depth (m) (\$):				2.90	1.20	1.40	0.20	1.20	0.30	0.10	1.40	1.00
	Date Sampled (\$):				05-Dec-2019	05-Dec-2019	05-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019	06-Dec-2019
	Asbestos Lab:							COVENTRY		COVENTRY	COVENTRY		
Determinand	Accred.	SOP	Units	LOD									
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10				< 0.10		1.1	< 0.10		
Total Of 16 PAH's	U	2700	mg/kg	2.0				2.1		16	< 2.0		
Total Phenols	U	2920	mg/kg	0.30				< 0.30		< 0.30	< 0.30		

Project:

Client: WML Consulting Ltd	Chemtest Job No.:				19-41385	19-41385	19-41385
Quotation No.:	Chemtest Sample ID.:				941339	941340	941341
Order No.: 9003G	Client Sample Ref.:				E	E	J
	Sample Location:				WS11	WS12	WS13
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m) (\$):				0.10	0.10	1.50
	Date Sampled (\$):				06-Dec-2019	06-Dec-2019	06-Dec-2019
	Asbestos Lab:				COVENTRY	COVENTRY	
Determinand	Accred.	SOP	Units	LOD			
ACM Type	U	2192		N/A	-	-	
Asbestos Identification	U	2192	%	0.001	No Asbestos Detected	No Asbestos Detected	
ACM Detection Stage	U	2192		N/A	-	-	
Moisture	N	2030	%	0.020	16	17	18
pH	U	2010		4.0	8.5	7.6	7.5
Boron (Hot Water Soluble)	U	2120	mg/kg	0.40	0.96	0.75	
Sulphate (2:1 Water Soluble) as SO ₄	U	2120	g/l	0.010	0.22	0.010	< 0.010
Total Sulphur	U	2175	%	0.010	0.14	0.025	< 0.010
Cyanide (Total)	U	2300	mg/kg	0.50	< 0.50	< 0.50	
Sulphate (Total)	U	2430	mg/kg	100	2900	530	
Arsenic	U	2450	mg/kg	1.0	19	13	
Cadmium	U	2450	mg/kg	0.10	0.87	0.29	
Copper	U	2450	mg/kg	0.50	41	44	
Mercury	U	2450	mg/kg	0.10	< 0.10	< 0.10	
Nickel	U	2450	mg/kg	0.50	28	34	
Lead	U	2450	mg/kg	0.50	130	56	
Selenium	U	2450	mg/kg	0.20	< 0.20	< 0.20	
Vanadium	U	2450	mg/kg	5.0	24	43	
Zinc	U	2450	mg/kg	0.50	290	85	
Chromium (Hexavalent)	N	2490	mg/kg	0.50	< 0.50	< 0.50	
Organic Matter	U	2625	%	0.40	3.8	3.1	
Naphthalene	U	2700	mg/kg	0.10	< 0.10	< 0.10	
Acenaphthylene	U	2700	mg/kg	0.10	< 0.10	< 0.10	
Acenaphthene	U	2700	mg/kg	0.10	< 0.10	< 0.10	
Fluorene	U	2700	mg/kg	0.10	< 0.10	< 0.10	
Phenanthrene	U	2700	mg/kg	0.10	2.3	0.94	
Anthracene	U	2700	mg/kg	0.10	0.24	< 0.10	
Fluoranthene	U	2700	mg/kg	0.10	3.2	1.2	
Pyrene	U	2700	mg/kg	0.10	3.0	1.4	
Benzo[a]anthracene	U	2700	mg/kg	0.10	1.3	0.57	
Chrysene	U	2700	mg/kg	0.10	1.3	0.60	
Benzo[b]fluoranthene	U	2700	mg/kg	0.10	1.6	0.53	
Benzo[k]fluoranthene	U	2700	mg/kg	0.10	0.59	< 0.10	
Benzo[a]pyrene	U	2700	mg/kg	0.10	1.5	0.54	
Indeno(1,2,3-c,d)Pyrene	U	2700	mg/kg	0.10	1.0	0.30	
Dibenz(a,h)Anthracene	U	2700	mg/kg	0.10	0.24	< 0.10	

Project:

Client: WML Consulting Ltd	Chemtest Job No.:				19-41385	19-41385	19-41385
Quotation No.:	Chemtest Sample ID.:				941339	941340	941341
Order No.: 9003G	Client Sample Ref.:				E	E	J
	Sample Location:				WS11	WS12	WS13
	Sample Type:				SOIL	SOIL	SOIL
	Top Depth (m) (\$):				0.10	0.10	1.50
	Date Sampled (\$):				06-Dec-2019	06-Dec-2019	06-Dec-2019
	Asbestos Lab:				COVENTRY	COVENTRY	
Determinand	Accred.	SOP	Units	LOD			
Benzo[g,h,i]perylene	U	2700	mg/kg	0.10	1.2	0.23	
Total Of 16 PAH's	U	2700	mg/kg	2.0	18	6.3	
Total Phenols	U	2920	mg/kg	0.30	< 0.30	< 0.30	

SOP	Title	Parameters included	Method summary
2010	pH Value of Soils	pH	pH Meter
2030	Moisture and Stone Content of Soils(Requirement of MCERTS)	Moisture content	Determination of moisture content of soil as a percentage of its as received mass obtained at <37°C.
2120	Water Soluble Boron, Sulphate, Magnesium & Chromium	Boron; Sulphate; Magnesium; Chromium	Aqueous extraction / ICP-OES
2175	Total Sulphur in Soils	Total Sulphur	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2192	Asbestos	Asbestos	Polarised light microscopy / Gravimetry
2300	Cyanides & Thiocyanate in Soils	Free (or easy liberatable) Cyanide; total Cyanide; complex Cyanide; Thiocyanate	Alkaline extraction followed by colorimetric determination using Automated Flow Injection Analyser.
2430	Total Sulphate in soils	Total Sulphate	Acid digestion followed by determination of sulphate in extract by ICP-OES.
2450	Acid Soluble Metals in Soils	Metals, including: Arsenic; Barium; Beryllium; Cadmium; Chromium; Cobalt; Copper; Lead; Manganese; Mercury; Molybdenum; Nickel; Selenium; Vanadium; Zinc	Acid digestion followed by determination of metals in extract by ICP-MS.
2490	Hexavalent Chromium in Soils	Chromium [VI]	Soil extracts are prepared by extracting dried and ground soil samples into boiling water. Chromium [VI] is determined by 'Aquakem 600' Discrete Analyser using 1,5-diphenylcarbazide.
2625	Total Organic Carbon in Soils	Total organic Carbon (TOC)	Determined by high temperature combustion under oxygen, using an Eltra elemental analyser.
2700	Speciated Polynuclear Aromatic Hydrocarbons (PAH) in Soil by GC-FID	Acenaphthene; Acenaphthylene; Anthracene; Benzo[a]Anthracene; Benzo[a]Pyrene; Benzo[b]Fluoranthene; Benzo[ghi]Perylene; Benzo[k]Fluoranthene; Chrysene; Dibenzo[ah]Anthracene; Fluoranthene; Fluorene; Indeno[123cd]Pyrene; Naphthalene; Phenanthrene; Pyrene	Dichloromethane extraction / GC-FID (GC-FID detection is non-selective and can be subject to interference from co-eluting compounds)
2920	Phenols in Soils by HPLC	Phenolic compounds including Resorcinol, Phenol, Methylphenols, Dimethylphenols, 1-Naphthol and TrimethylphenolsNote: chlorophenols are excluded.	60:40 methanol/water mixture extraction, followed by HPLC determination using electrochemical detection.

Report Information

Key

- U UKAS accredited
- M MCERTS and UKAS accredited
- N Unaccredited
- S This analysis has been subcontracted to a UKAS accredited laboratory that is accredited for this analysis
- SN This analysis has been subcontracted to a UKAS accredited laboratory that is not accredited for this analysis
- T This analysis has been subcontracted to an unaccredited laboratory
- I/S Insufficient Sample
- U/S Unsuitable Sample
- N/E not evaluated
- < "less than"
- > "greater than"
- \$ This information has been supplied by the client and can affect the integrity of test data.

Comments or interpretations are beyond the scope of UKAS accreditation

The results relate only to the items tested

Uncertainty of measurement for the determinands tested are available upon request

None of the results in this report have been recovery corrected

All results are expressed on a dry weight basis

The following tests were analysed on samples as received and the results subsequently corrected to a dry weight basis TPH, BTEX, VOCs, SVOCs, PCBs, Phenols

For all other tests the samples were dried at < 37°C prior to analysis

All Asbestos testing is performed at the indicated laboratory

Issue numbers are sequential starting with 1 all subsequent reports are incremented by 1

Sample Deviation Codes

- A - Date of sampling not supplied
- B - Sample age exceeds stability time (sampling to extraction)
- C - Sample not received in appropriate containers
- D - Broken Container
- E - Insufficient Sample (Applies to LOI in Trommel Fines Only)

Sample Retention and Disposal

All soil samples will be retained for a period of 45 days from the date of receipt

All water samples will be retained for 14 days from the date of receipt

Charges may apply to extended sample storage

If you require extended retention of samples, please email your requirements to:
customerservices@chemtest.com

APPENDIX 05

Gas Monitoring Results

Gas & Groundwater Monitoring Record Sheet



Project Name:- Glendene
Project No:- 9003G
Client:- Garden City Design & Build Ltd

Date:- 06/01/2020
Start Time:- 10:10
End Time:- 11:10
Ground Conditions:- Dry
Weather Conditions:- Overcast

Atmospheric Pressure
Start:- 1008mb
End:- 1008mb
Trend:- Falling

Instrument:- Gas Data GFM436

Operator:- P Hobson

Hole ID	Peak Flow l/hr	Steady Flow l/hr	DP	CH4			CO2			Min O2 %	Peak H2S ppm	Peak CO ppm	Hexane %	Water Level mbgl	Base of Hole mbgl
				Peak %	Steady %	Qhg l/hr	Peak %	Steady %	Qhg l/hr						
WS1	<0.1	<0.1	0	0.0	-0.1	-0.0001	3.8	3.1	0.0031	16.7	0	0	0.000	2.60	3.00
WS4	<0.1	<0.1	0	0.0	-0.1	-0.0001	1.9	1.9	0.0019	16.8	0	0	0.000	1.10	3.00
WS5	<0.1	<0.1	0	0.0	-0.1	-0.0001	3.1	2.1	0.0021	13.6	0	0	0.000	1.65	3.00
WS7	<0.1	<0.1	0	0.0	-0.1	-0.0001	2.3	2.3	0.0023	16.5	0	0	0.000	1.20	2.80
WS9	<0.1	<0.1	0	0.0	-0.1	-0.0001	1.7	0.9	0.0009	18.1	0	0	0.000	1.00	2.84
WS11	<0.1	<0.1	0	0.0	0.0	0.0000	0.7	0.5	0.0005	19.7	0	0	0.000	0.87	1.85

Additional Comments

Gas & Groundwater Monitoring Record Sheet



Project Name:- Glendene
Project No:- 9003G
Client:- Garden City Design & Build Ltd

Date:- 20/01/2020
Start Time:- 13:15
End Time:- 14:12
Ground Conditions:- Wet
Weather Conditions:- Sunny

Atmospheric Pressure
Start:- 1040mb
End:- 1039mb
Trend:- Steady

Instrument:- Gas Data GFM436

Operator:- P Hobson

Hole ID	Peak Flow l/hr	Steady Flow l/hr	DP	CH4			CO2			Min O2 %	Peak H2S ppm	Peak CO ppm	Hexane %	Water Level mbgl	Base of Hole mbgl
				Peak %	Steady %	Qhg l/hr	Peak %	Steady %	Qhg l/hr						
WS1	<0.1	<0.1	0	-0.1	-0.1	-0.0001	4.0	1.3	0.0013	18.2	0	0	0.000	2.32	3.00
WS4	0.2	<0.1	0	-0.1	-0.1	-0.0001	2.1	2.1	0.0021	17.0	0	0	0.000	1.05	3.00
WS5	<0.1	<0.1	0	0.0	-0.1	-0.0001	3.1	3.1	0.0031	8.7	0	0	0.000	1.30	3.00
WS7	<0.1	<0.1	0	-0.1	-0.1	-0.0001	5.0	0.2	0.0002	20.5	0	0	0.000	1.10	2.73
WS9	<0.1	<0.1	0	-0.1	-0.1	-0.0001	5.0	0.2	0.0002	20.1	0	0	0.000	0.79	2.85
WS11	<0.1	<0.1	0	-0.1	-0.1	-0.0001	0.6	0.2	0.0002	20.4	0	0	0.000	0.80	1.90

Additional Comments

GAS MONITORING METHODOLOGY

1. The following are recorded upon arrival or at each location as the monitoring progresses:-
 - Operator name;
 - Instrumentation name i.e. Gas Data - GFM436;
 - Atmospheric pressure;
 - Time of commencement of the monitoring visit;
 - Ground conditions e.g. wet, dry waterlogged etc.;
 - General weather conditions, as the prevailing conditions may affect the results; and
 - Condition of the monitoring point e.g. damaged, covered etc.
2. The background oxygen concentration in the vicinity of the monitoring point is recorded to ensure that the instrument is zeroed.
3. Where appropriate, both the flow and pressure differential are recorded at each monitoring point prior to obtaining the gas concentrations.
4. Concentrations of light hydrocarbon gas, comprising methane (%v/v), carbon dioxide (%v/v), oxygen (%v/v), hydrogen sulphide (ppm), carbon monoxide (ppm) and hexane % are monitored continuously over a 90 seconds period. The highest concentrations of methane, carbon dioxide, carbon monoxide and hydrogen sulphide and the lowest concentration of oxygen are then recorded.
5. If/where concentrations stabilise after 90 seconds, the steady-state concentrations are recorded. If concentrations are still varying, monitoring is continued until steady-state conditions are attained and concentrations then recorded. The accuracy for light hydrocarbon gases is :-
 - Methane - +/-0.2% at 5%.
 - Carbon dioxide - +/-0.1% at 10%.
6. Depth to water level and base of installation are recorded as the movement of groundwater can affect gas migration and migration pathways to monitoring points.
7. The above steps are to be repeated at each monitoring point.
8. The following are then recorded upon completion of the monitoring process:-
 - Atmospheric pressure;
 - Time of completion of the monitoring visit.

Key For Gas Monitoring Records

BH/WS	- Readings taken from gas valve within borehole or window sample probehole.	PD	- Pressure differential measured in millibars
Flow	- Gas flow measured in litres per hour	%	- Percentage
<0.1	- Where flows are less than 0.1/hr are recorded	ppm	- Parts Per Million
CO ₂	- Carbon Dioxide	l/hr	- Litres per hour
O ₂	- Oxygen	CH ₄	- Methane
H ₂ S	- Hydrogen Sulphide	mbgl	- Metres below ground level
CO	- Carbon Monoxide	GSV	- Gas Screening Value

TEST DATE AND CONDITIONS			
Date	14/08/19		
Atmospheric Pressure	993	mB	
Ambient Temperature	21.9	°C	
EnviroNics Serial No.	5089		

**GFM436 Final Inspection & Calibration
Check Certificate**

GAS DATA LTD

Unit 4, Fairfield Court

Seven Stars Estate

Wheler Rd

Coventry

CV3 4LJ

Tel 02476303311

Fax 02476307711



Customer	WML Consulting Ltd
Certificate Number	121220
Order Number	323564

Serial Number	12969
Software Version	G436-00.0027/0010

Recalibration DUE Date
14/08/20

Instrument Checks			
Keyboard	✓		Display Contrast
Pump Flow In	500	Accept > 200 cc/min	Pump Flow @ -200mB
Clock Set / Running	✓		Labels Fitted
			✓

Gas Checks						
Sensor	CH ₄		CO ₂		O ₂	
	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %	Instrument Gas	True Gas Value %
	Readings %		Readings %		Readings %	
	60	60	40	40	20.9	20.9
	Accept ±3.0		Accept ±3.0		Accept ±0.5	
Zero Reading 100% N2	5	5	5	5	6	6
	Accept ±0.3		Accept ±0.3		Accept ±0.3	
Zero Reading 100% N2	0	0	0	0	0	0
	Accept ±0.0		Accept ±0.0		Accept ±0.1	

Optional Gas Checks						
Applied Gas & Range		Concentration Tested @ (ppm)	Instrument Readings (ppm)			
Gas Type	Range (ppm)		Zero Reading		Instrument Gas Reading	
H2S	5000	1500	0	Accept ±0.0	1500	Accept ±5.0
CO	2000	1000	0	Accept ±0.0	1000	Accept ±5.0
Hexane	2.0%	2.0%	0	Accept ±0.0	1.99	Accept ±10.0

Cross Gas Effects								
Applied Gas (ppm)		Instrument Readings (ppm)						
Gas Type	Concentration	Toxic 1:	H2S	Toxic 2:	CO	Toxic 3:	HEX	
H2S	1500	1500		0		0		
CO	1000	40		1000		0		
Hexane	2.0%	0		0		1.99		

Pressure Checks			
Atmospheric Pressure [AP] (mB)			
Current Atmospheric Pressure (mB)		Instrument Atmospheric Pressure Reading (mB)	
AP Open Ports		993	Accept ± 2.0
AP Port (Internal)	+800 mB	800	Accept ± 5.0
	+1200mh	1200	Accept ± 5.0

Flow Checks					
Borehole Flow			Differential Pressure		
Applied Reading (l/h)	Instrument Reading (l/h)		Applied Pressure (Pa)	Instrument Reading (Pa)	
-30	-30.3	Accept ± 3.0	-556	-570	Accept ± 50
-3	-3	Accept ± 1.0	-23	-22	Accept ± 6.0
0	0	Accept ± 0.0	0	0	Accept ± 0.5
3	3	Accept ± 0.5	17	17	Accept ± 3.0
30	30	Accept ± 3.0	385	384	Accept ± 50
60	60	Accept ± 6.0	1192	1193	Accept ± 130
90	90.4	Accept ± 9.0	2362	>>>>	Accept ± 250

Temperature Checks		
Calibration Temperature	Instrument Temperature Reading °C	
Applied Temperature °C		
-10	-10	Accept ± 2.0
0	0	Accept ± 1.0
30	30	Accept ± 1.0
60	60	Accept ± 1.0
100	100	Accept ± 1.0

Technician:
Jack Rutland

Date Tested:
15/08/19

The instrument identified by the serial number stated above has been tested by Gas Data personnel for calibration accuracy on the date and under the ambient conditions stated. Gas Data Ltd internal BS EN ISO9001:2015 compliant workshop procedures were followed to apply known calibration test gases, gas flow rates, pressures and temperatures of the values stated. The results displayed on the instrument at each stage are recorded above.

APPENDIX 06

Site Specific Acceptance Criteria