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Phase 2 – Intrusive Ground Investigation Report

Proposed Residential Development,

Butterfly Park,

Little London,

Long Sutton,

Lincolnshire.

24th July 2023

T. L. P. Ground Investigations.

Proposed Residential Development, Butterfly Park, Little London, Long Sutton, Lincolnshire.

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Phase 2 – Intrusive Ground Investigation Report

Site: Proposed Residential Development, Butterfly Park, Little London, Long Sutton, Lincolnshire.

Client: D. Brown Builders Ltd.

Architects: William Saunders Architecture.

Date: 24th July 2023.

Executive Summary

Introduction	TLP Ground Investigations Ltd. were instructed by Potton Construction Ltd. to undertake a Phase II Intrusive Survey in connection with a Proposed Residential Development, 45, Lea Way, Huntington, York.
Previous Desk Study - 30th May 2023	A Phase I Desk Study undertaken by TLP on 30th May 2023 entitled 'Phase 1 Desk Study - Proposed Residential Development, Butterfly Park, Little London, Long Sutton, Lincolnshire', identified pollution linkages at the site associated with its historical use and from potential contamination that may have migrated onto the site from off-site sources. Potential contamination perceived to be associated with these activities included metals, semi-metals, poly-aromatic hydrocarbons (PAH's), Total Petroleum Hydrocarbons (TPH), B-TEX, asbestos and harmful ground vapours. **Note – land gas monitoring was not considered necessary.*
Intrusive Survey	In accordance with the recommendations set out in the Desk Study (30th May 2023), TLP initiated a Phase II Intrusive Investigation on the 1st June 2023. The survey included the sinking of sampling boreholes / excavations followed up by chemical analysis of representative soil / groundwater samples. The survey also included for a Geotechnical assessment for engineering purposes.
Contamination Summary	**Soil Contamination** Using the results of the environmental screening from the recent Intrusive Phase II Investigation, **it has been established that the concentrations of contaminants recorded in the samples obtained from the site are within current guideline limits for a 'residential development with the consumption of home grown produce' scenario (res-with SOM 1%) and as such the site should not require any specific remediation.** **The near surface topsoil on site is considered to be potentially recyclable. BS3882 compliance testing and a visual inspection of the material indicates that the near surface topsoil is generally a good quality silty, slightly clayey loam and could be considered for use within residential garden environments, provided that the nutrient and organic status can be improved.** **Groundwater** Although the groundwater samples recorded concentrations of certain PAH's that exceed EQS fresh, estuary and coastal water guideline values, the concentration did not exceed the individual ATRISK WSV's. **As a consequence, the groundwater underlying the site is not considered to represent a significant risk to ground workers or future users of the site or the wider environment and no**

	remediation of groundwater is considered necessary. **Controlled Waters** Chemical analysis has demonstrated that the concentrations of potential contaminants in the near surface soils and groundwater are well within current guideline limits for a 'residential end use with the consumption of home grown produce' end use scenario. The housing development and associated road and drainage system when completed will reduce the amount of rainwater presently entering the near surface deposits and therefore reduce the potential for the generation of contaminated leachate. The near surface natural superficial soils are represented by Tidal Flat Deposits of clay and silt. Although it was considered that these deposits would be of moderate permeability, these soils are designated as an Unproductive Aquifer and as such would not be considered highly sensitive The underlying solid geology is represented by the Ampthill Clay Formation. Groundwater within the low permeability deposits of the Ampthill Clay Formation (i.e. Mudstone) is unlikely to be highly mobile. The site is not situated within 500m of a groundwater SPZ and the nearest current abstraction point is situated over 2000m from the site. No significant contamination was identified in the samples of the groundwater submitted for testing therefore the risk posed by groundwater contamination would appear to be very low. The Groundsure Report and walkover inspection has established that the nearest surface water feature to the site is an inland river not influenced by normal tidal action situated approximately 7m south of the site. At this distance, if any contamination is ultimately revealed at the study site, then this feature is likely to be considered at risk. No surface water abstractions have been identified within 1000m of the study site. **Land Gasses and Vapours** The Groundsure Report has not revealed any landfills, significant areas of in-filled ground or surface ground workings that could represent a credible source of harmful ground gas emissions. It is therefore considered that there is no requirement for a quantitative ground gas risk assessment at the study site. The absence of any significantly elevated TPH and B-TEX fractions within the soil samples submitted for testing suggests that the risk of hydrocarbon vapours entering the proposed new development is negligible. **A TPH vapour survey is not considered necessary and no additional protection from hydrocarbon vapours is deemed to be required within the proposed development.** **The site is not located within a radon affected area** as less than 1% of properties within the specified search area recorded above the action level. The Groundsure report indicates that no radon protection measures are required for new buildings or extensions to those already existing. **Soil Waste Disposal** The near surface topsoil can be recycled and the underlying sand could be considered a useful inert, free draining soil therefore both these soils could potentially be reused on site. WAC testing can be undertaken on an ad-hoc basis should any soils for export accumulate as a stock pile on site.
Geotechnical Summary	**Ground Conditions and Foundations** The recent borings have revealed that beneath a covering of topsoil and in the northwest corner of the site a shallow thickness of made / disturbed ground, the site is initially underlain by Tidal Flat Deposits comprising 'loose' to 'medium dense' silt. In places the more granular horizons are

interrupted by bands of 'firm to stiff' and occasionally 'soft', very silty clay / clayey silt.

The Tidal Flat Deposits should provide a satisfactory bearing stratum for shallow spread foundations provided the bearing pressures are limited to a magnitude which does not overstress the 'looser'/ 'softer' zones present within the sequence. As a preliminary guide to design and using conservative SPT values (corrected for the effects of overburden pressure) and shear strength data obtained from the recent borings, it has been estimated that for strip foundations, say 600mm to 800mm wide, resting on natural deposits of silt / clayey silt / very silty clay at around 0.90m depth, the safe foundation bearing pressure would be of the order 75kN/m^2. At this loading, long term settlement should be limited to 25mm.

Building Near Trees

The results of Atterberg limit tests performed on representative samples obtained from the near surface pockets of very silty **clay**, indicate that it is a material of 'low' to 'medium' volume change potential and as such, could experience some limited volume changes associated with seasonal fluctuations in soil moisture content, **which could be exacerbated by tree root action**. In this instance the NHBC Standard Chapter 4.2 'Building near Trees' provides useful guidance on building near trees particularly within the more clayey soils.

A number of semi-mature and mature tree specimens are currently growing within and adjacent to the site boundaries. Where these specimens coincide with areas of the site where pockets of very silty clay / clayey silt were identified, then the design of the foundations may need to take the presence and proximity of the trees into consideration. In certain instances it may be possible to excavate through any clayey shrinkable soils and construct the foundations on the underlying deposits of silt above the level of the groundwater table.

It may be prudent to undertake additional exploratory boreholes in order to establish the prevailing ground conditions for any potentially affected plots, which can then be cross referenced with an accurate topographical and tree survey (which includes identification and proximity of the tree species and their height)

Ground Floor Construction

Over the majority of the site, the covering of silty topsoil extended to depths of between 0.30m and 0.44m beneath the surface. Provided any topsoil is first removed and replaced with compacted stone of suitable grading, the use ground bearing floor slabs could be considered. Alternatively, a fully suspended ground floor construction could be adopted if this is the preferred option. However, where new properties are located in areas of the site where clayey deposits have been identified and are within the influencing distance of trees, the use of a fully suspended ground floor construction will be more appropriate than one which is ground bearing. A suspended ground floor construction may be the preference of the developer for all proposed units.

Stability of Excavations

Perched groundwater seepages were initially encountered in the sampling boreholes at depths of between 1.92m and 2.60m beneath the surface. On completion of the borings, the groundwater levels in the open holes was subsequently measured at depths of between 1.77m and 2.45m b.g.l. It is therefore considered unlikely that any significant groundwater seepages will be encountered in excavations for shallow foundations. However, the near surface soils are predominantly granular in composition and therefore may be only temporarily self supporting in open excavations.

Deeper excavations are likely to require the provision of trench supports and dewatering facilities to ensure that construction can proceed under optimum conditions. This is likely to be the case with the excavation for the proposed foul water pumping station, where the proximity of trees requires deeper house foundations, or where deeper infrastructure is anticipated.

Drainage

In order to establish the relative permeability of the near surface stratum *in situ*, 'falling head' (variable head) permeability tests were performed in seven of the completed borings in order to provide an overview of the permeability characteristics of the near surface soils across the site. The test holes were approximately 103mm in diameter and extended to depths of between 3.00m and 3.65m beneath the surface. To ensure that the sidewalls of the boreholes remained stable during the tests, a 50mm slotted standpipe was inserted into the test holes and surrounded by well screen gravel for the duration of the tests.

At the start of the tests, the test holes were quickly filled almost to the surface with water and then the time taken for the water to dissipate from the holes was subsequently monitored. **The results of the test indicate soil infiltration rates within the upper deposits of silt and very silty clay varied between 6.25 x 10^{-3}mm/s and 3.86 x 10^{-2}mm/s, which represents a range in permeability from a steady to moderate rate of soil infiltration.**

These results of the tests indicate that the deposits of silt and very clayey silt beneath the study site could potentially provide a suitable media in which to discharge surface water generated by the proposed residential development. The thickness of granular deposits and the level to standing groundwater does very across the site which will influence the storage capacity of any installed soakaway. The soakaway excavations should be extended to as deep as is practicable but should not extend into the water bearing deposits of silt. If groundwater is encountered during excavation for soakaways, the excavation could easily be partially backfilled with coarse free draining material (such as coarse washed gravel or washed rubble) to ensure the base of the soakaway is above the groundwater, before the placement of any soakaway crates/chambers *(design subject to approval by the local building control officer or warranty provider).*

The site investigation was undertaken in late spring / early summer therefore groundwater levels could possibly rise slightly during the wetter winter months.

Carriageway Design

California Bearing Ratio Tests (CBR) employing the TRL 587 CBR CP method, were performed at 14 No. locations along the routes of the proposed new estate roads. The tests were performed through the deposits of topsoil and any overlying deposits of made up / disturbed ground and extended into the underlying deposits of silt. The results of the tests have been provided on the enclosed spread sheets.

CBR values in the deposits of topsoil and made / disturbed ground were generally quite variable ranging (for soils below 250mm depth) between 4.0% and 55%.

Tests performed within the natural upper deposits of silty, medium sand *(to a maximum depth of say 800mm)* recorded CBR values ranging between 3.7% and 12.7%. Clearly the choice of the most appropriate design CBR value will largely depend on the type of highway construction and the nature of deposits which are exposed at road formation level.

The above results would suggest, a minimum design CBR of around **4.0%** would likely be acceptable for traditional paving construction, however, it should be noted that there may be some localised areas of the site where the deposits of topsoil and made / disturbed ground may be slightly thicker. It is likely if carriageways are to adopted by the local authority that all deposits of mid brown, silty topsoil and mixed deposits of silty, sandy soil will need to be removed from beneath proposed estate roads and paved areas prior to the placement of any sub-base. As the underlying natural deposits are initially generally loose in compaction, they would, (if dry), benefit from some mechanical compaction prior to the placement of any granular sub-base or up-fill that may be used to raise the site level.

	Foundation Concrete Chemical tests performed on representative samples of the near surface disturbed ground / topsoil as part of the environmental screening, recorded water-soluble sulphate concentrations between <10mg/l and 42mg/l (2:1water / soil extract) with pH between 6.5 and 8.6. Tests performed on groundwater samples, recorded total sulphate concentrations of between 77mg/l and 81mg/l with pH values of between 7.4 and 7.5. In accordance with the guidelines contained in Part 1 of the Digest and taking into account the geology and specific soil and groundwater conditions and the number of samples within the dataset (See section C5.1.1 of BRE Special Digest 1), the site can be assigned a Design Sulphate Class **DS-1** and an ACEC (Aggressive Chemical Environment for Concrete) Class **AC-1**.

1.0 Brief

Following the instructions of D. Brown Builders Ltd., a geo-environmental assessment was carried out on land at Butterfly Park, Little London, Long Sutton, Lincolnshire where a new residential development is proposed. For a number of years the site of the proposed new residential development was used as a wildlife and nature sanctuary known as the 'Long Sutton Butterfly & Wildlife Park'. In 2012, the park closed and since this time the site has remained disused. According to the current site layout drawings, the proposed development will involve the construction of a significant number of detached and semi-detached residential dwellings, each with individual private garden areas. The development will also include the construction of new access roads, private driveways, an area of public open space. The construction of a foul-water pumping station and other associated infrastructure are also envisaged.

The scope of this intrusive investigation was designed in accordance with the recommendations of a Phase 1 Desk Study report issued by TLP Ground Investigations Ltd., on 30th May 2023 entitled 'Phase 1 Desk Study - Proposed Residential Development, Butterfly Park, Little London, Long Sutton, Lincolnshire.' the findings of which are summarised in Section 3.0 of this report.

The intrusive borehole investigation (site work) was carried out between the 1st and 2nd June 2023 and included the collection of soil and groundwater from boreholes followed by chemical and geotechnical analysis of selected samples. This report presents the results and findings of both the chemical testing of soil and groundwater samples and an assessment of the contamination constraints associated with the proposed new development.

2.0 Site Description (*from Phase 1 Desk Study)*

'The area of land under consideration is situated in the northeast outskirts of village of Long Sutton in Lincolnshire. The roughly rectangular site has an approximate area of 5.45 Ha and is centred at National Grid Reference 543833, 323623. The site comprises a former wildlife park, which has remained disused for approximately ten years.

The site is currently accessible directly from a private road leading eastwards from Little London. The road extends onto a small tar macadam car park that was previously utilised by the former Wildlife Park. In the north western part of the site, adjacent to the tar macadam car park the ground surface has been disturbed in an area former buildings have been demolished. This part of the site is currently covered with bare earth with traces of brick and building rubble on the site surface. The area has recently been excavated to a slightly lower level than the surrounding car park and main road (Little London) and although the area is generally flat, the surface is uneven.

The road leading into the site also extends southwards onto a narrow track which extends around the south eastern boundary of the site. This track provides access to a number of agricultural fields situated to the south and east of the site, an orchard located to the east and two, large solar power generation farms, also located to the east and southeast of the site.

The remainder of the site comprises an undeveloped area of land, which has previously been used as a large wildlife park. The majority of the area is overgrown with weeds and meadow grasses with occasional wild flowers and herbs. Occasional self seeded saplings and semi-mature trees are scattered around the open areas of the site. In these areas of the site, the ground surface is also generally level but slightly uneven in places. The north western quarter of the site is more densely wooded and contains a variety of semi-mature and mature tree specimens including Silver Birch, Poplar, Eucalyptus, Willow, Sycamore, Oak and other species. In some areas, the site quite densely wooded and the ground covered with nettles or briars, which prevented access on foot.

Along the north western site boundary is a narrow water course, which at the time of the walkover survey contained running water. Beyond the north / northwest boundary is a medium sized Leisure Centre with playing fields, all weather pitches, a Day Nursery and other amenities. Open fields extend beyond the southern site boundary and to the west of the site are a number of residential properties and two agricultural structures used for storage purposes.

The site is situated within a rural residential setting with residential dwellings located in the areas to the west of the site along Little London. To the north is a Leisure Centre, Day Nursery and Secondary School and to the south and east is agricultural farmland and solar farms.

At the time of the walkover survey, no potential sources of contamination were identified and no areas of staining or standing groundwater were identified on the ground surface'.

3.0 Issues Arising from Phase 1 Assessment

- According to historical mapping, the site of the proposed development has only ever been used as an operational farm and later as Wildlife Sanctuary Visitors Attraction. Available historical data would indicate that it is highly unlikely that significant contamination will be present within the site boundaries from historical activities undertaken on site. During the historical use of the site as a working farm, activities could have taken place which may have given rise to the release of minor contamination. These include the use of farming plant and equipment and other activities undertaken both inside and outside the former farm structures. Owing to the construction and subsequent demolition of structures in the north western parts of the site, it is possible that deposits of made ground could be present which may contain contaminated residues. Historical aerial photography indicates that vehicles were routinely parked in certain parts of the site, which may have accidentally released contaminants onto the site.

- From the earliest extract of 1887 to the present day, the areas surrounding the site have mainly been used for agricultural and residential purposes. Sporadic commercial land use activities have been identified in the wider areas surrounding the site including a small Smithy and Sewage Works, however, these are considered to be at such a distance as to have had no significant impact on the contamination status of the soils beneath the study site. Other notable land use activities within influencing distance of the development include a number of agricultural storage buildings located just beyond the western site boundary, a solar photovoltaic farm to the northeast and southeast and a leisure centre and playing fields to the north, none of which are considered to represent a significant risk to the study site.

- Narrow drainage ditches have been identified flowing very close to the boundaries of the study site, which may represent a source of contamination, however bearing in mind the rural setting this is considered highly unlikely.

Table 1

Table 1 - Summarises the potential contaminative land uses on and in the vicinity of the site showing potential sources with associated contaminants.

Sources							
Sources Description	Contaminants Associated with Source						
	Metals	PAH	TPH/BTEX	Asbestos	Pesticides & Fertilizers	Harmful Ground Gasses CH4, CO2, CO, H2S	TPH Vapours
On Site							
Contamination resulting from the possible use of agricultural plant and machinery in the historical past. The possible presence of deposits of made up or disturbed ground across the site. The construction and subsequent demolition of the structures that have occupied various parts of the site. Potentially contaminative activities that may have taken place in the structures that have occupied the site.	✓	✓	✓	✓			✓
Burning processes that have taken place within the site boundaries, such as the burning of organic matter or the possible presence of PAH within any deposits of made ground that may be present over the site surface.	✓	✓					
Residual contamination from natural weathering of geological strata.	✓						
Off Site							
Contamination that may have migrated onto the site from commercial and industrial activities that have taken place in the surrounding areas.	✓	✓	✓	✓			✓
Contamination that may have migrated onto the site during the construction and development of the nearby commercial and residential structures.	✓	✓	✓	✓			✓

Table 1 - Summarises the potential contaminative land uses on and in the vicinity of the site showing potential sources with associated contaminants.

Key for Table 1

Metals

Includes - Metals and metalloids (Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc, Arsenic, Boron, Selenium and inorganic chemicals such as Cyanide

PAH

Includes – EA16 – Acenaphthene, Acenaphthylene, Anthracene, Benzo[a]anthracene, Benzo[a]pyrene, Benzo[b]fluoranthene, Benzo[g,h,i]perylene, Benzo[k]fluoranthene, Chrysene, Dibenzo[a,h]anthracene, Fluoranthene, Fluorene, Indeno[1,2,3-cd]pyrene, Naphthalene, Phenanthrene, Pyrene.

Table 2

Details the potential pathways with receptors identified for any contaminants that may be present in the ground at the site during and following the proposed development.

Pathways		**Receptors**	
Human Health		**Human Health**	
Dermal Contact with soil	✓	End users and construction workers	✓
Ingestion of soil	✓	End users and construction workers	✓
Inhalation of Contaminated Dust and Harmful Gasses	✓	End users and construction workers	✓
Ingestion of site grown vegetables	✓	End users	✓
Ingestion of water from affected service pipes	✓	End users	✓
Buildings		**Buildings**	
Mobile water soluble sulphates	✓	Concrete foundations	✓
Controlled Waters		**Controlled Waters**	
Lateral and vertical migration	✓	Surface water receptors & shallow / deeper groundwater regime	✓
Infiltration	✓	Surface water receptors & shallow / deeper groundwater regime	✓

Table 2 - details the potential pathways with receptors identified for any contaminants that may be present in the ground at the site during and following the proposed development.

4.0 Intrusive Investigation

4.1 Sampling Strategy

In order to quantify the potential contamination risk, an intrusive borehole investigation was undertaken in general accordance with the Model procedures for the Management of Land Contamination (CLR11), the relevant planning practice guidance (Land Affected by Contamination) and the Development of Land Affected by Contamination (Yorkshire and Lincolnshire Pollution Advisory Group) and the requirements of BS10175(2011) - Code of Practice for the Investigation of Potentially Contaminated Sites. The borehole investigation was undertaken between 1st and 2nd May 2023 and included a sampling strategy which was designed on the basis of the fundamental objectives of the Phase 1 Intrusive Investigation which were to:-

- Obtain representative samples of soil and where possible groundwater samples from strategic areas for subsequent analysis.
- Gather further information on contaminated land conditions to assist in the design and construction of the proposed new buildings and infrastructure.
- Re-evaluate the preliminary conceptual site model and undertake a qualitative contamination risk assessment.
- Determine whether mitigation measures or remediation is required in areas where soil / groundwater / vapours contamination may exist, in order to render the site suitable for the proposed end use.

The historical extracts have indicated that the site has primarily been used as a former agricultural farm and later as a Butterfly and Wildlife Park, which was marketed as a public attraction.

Consequently, for analytical purposes, the site has provisionally been considered as one 'averaging area' for the contamination assessment.

In the absence of any specific sources of contamination, the boreholes were located in order to provide an overview of the ground conditions prevailing beneath the site. The locations of the borings have been indicated on the enclosed site layout drawing / aerial photograph and details of the strata encountered have been provided on the enclosed borehole record sheets.

4.2 Fieldwork

The recent intrusive fieldwork included the following:-

- The sinking of 16 No. shallow sampling boreholes using windowless sampling equipment to depths of between 2.95m and 4.50m beneath the ground surface. At the borehole locations, soil samples were recovered as continuous cores reducing in size from 100mm to 63mm in diameter within rigid PVC core liner.

- Undertaking14 No. *in situ* CBR tests in accordance with the method TRL 587 CBR Test DCP in order to establish the relative compaction of the near surface subgrade *in situ*, to assist in the design of the proposed estate roads.

- Fragmental samples were obtained from the soil cores using appropriate tools (e.g. stainless steel trowel) and placed in appropriate containers, sealed, labelled and stored in cool boxes at low temperatures. The samples selected for analysis were subsequently transferred under chain of custody to an analytical laboratory.

4.3 Soil Sample Acquisition

A number of near surface samples were retained from each location and from these, a total of 25 No. soil samples were selected for chemical (contamination) analysis. The majority of the selected samples were obtained from the near surface soils as these were considered to represent the soils most likely to be contaminated and most likely to come into contact with construction workers and end users of the site. These near surface soils were also deemed to represent a potential source of contaminated leachate which could potentially enter any underlying sensitive groundwater regime.

Eight samples obtained from slightly greater depth were selected for a suite of tests often requested by water companies (UKWIR) in order to assess the most appropriate grade of protection for underground potable water supply pipes.

Perched groundwater seepages were encountered in each of the sampling boreholes at depths of between 1.92m and 2.60m beneath the surface. These seepages were encountered within the deposits of silty sand overlying the impermeable deposits of silty clay beneath. On completion of the borings groundwater levels were subsequently measured at depths of between 1.72m and 2.35m b.g.l. Samples of the groundwater were obtained from four locations and submitted for a similar suite of contamination tests as the soil samples.

5.0 Ground Conditions

5.1 Anticipated Geology

Maps published by British Geological Survey indicate that the natural superficial deposits overlying the site are represented by Tidal Flat Deposits of clay and silt. The underlying natural bedrock is represented by the Ampthill Clay Formation (Mudstone), which is of Oxfordian age and is anticipated to be present at least below 15m depth.

The Groundsure report for the site indicates that the maximum permeability of the superficial deposits is 'low' and that of the underlying bedrock, also as 'low'.

The Groundsure report for the site indicates that no geological faults or linear features are situated within 500m of the site.

Ground Conditions Encountered on Site

Made / Disturbed Ground

Deposits of made / disturbed ground were only encountered in two of the 16 No. borehole locations. These borings were located in the northwest corner of the site, which was formerly occupied by the former farm / wildlife park buildings and parking areas. In these locations, deposits of made ground extended to depths of between 0.42m and 0.55m beneath the surface.

At the location of BH1, this initially comprised a covering of topsoil over medium to coarse brick and stone rubble in a matrix of brown, silty sand. At 0.30m depth, this rested on slightly disturbed deposits of mixed brown and rust brown silt. At the location of BH2, the surface was initially covered with a layer of tar macadam 70mm in thickness resting on a sub-base of fine assorted gravel in a matrix of yellowish brown, silty sand. At 0.25m depth, this rested on mixed deposits of dark brown, clayey silt containing occasional fine fragments of brick.

Topsoil

In the remainder of the borings, deposits of topsoil were encountered at the surface extending to depths of between 0.32m and 0.44m beneath the surface. The deposits of topsoil generally comprised 'loose', mid brown silty soil, which in places contained occasional fine stone fragments.

Natural Deposits

At each of the borehole locations, the underlying natural superficial soils were represented by a sequence of Tidal Flat Deposits. These was predominantly represented by deposits of 'loose' to 'medium dense' silt with occasional layers of very silty clay or clayey silt. These slightly clayey horizons were encountered only in seven of the 16 No. borings suggesting that these layers are not laterally or vertically persistent. Where these slightly more clayey layers were encountered, they varied between 200mm and 1300mm in thickness.

At depths of between 2.15m and 3.40m, the borings penetrated deposits of 'loose' to 'medium dense', greyish brown or dark grey silt, which thereafter extended to the full depth of borehole penetration some 3.00m to 4.50m beneath the surface.

5.2 **Groundwater**

Perched groundwater seepages were encountered in each of the sampling boreholes within the deposits of silty sand at depths of between 1.92m and 2.60m beneath the surface. On completion of the borings the groundwater levels in the open holes were subsequently measured at depths of between 1.72m and 2.35m b.g.l. Samples of the groundwater were obtained from four locations and submitted for a similar suite of contamination tests as the soil samples.

6.0 Geotechnical Considerations

- In order to establish the relative compactness of the granular stratum *in situ*, Standard Penetration Tests (SPT's) were performed as the borings were advanced. The results of the tests have been interpreted as 'N' values (blows for 300mm penetration) and these have been indicated on the enclosed borehole record sheets. Tests performed within the

deposits of silt and very silty clay / clayey silt recorded SPT 'N' values of between 4 and 19 which (when corrected to allow for overburden pressure) are indicative of a 'loose' to 'medium dense' state of compaction for these deposits.

- In order to establish the consistency of the deposits of the more cohesive deposits of very silty clay, hand vane tests were performed on sections of the recovered, undisturbed soil cores. The results of the tests have been indicated on the enclosed borehole record sheets. Hand vane values ranged between 35kN/m^2 and 82kN/m^2, indicating consistencies ranging between 'soft' and 'firm to stiff' for the deposit.

- The stratum encountered comprised predominantly silt, which is considered to be non plastic and therefore would not be susceptible to volume change as a consequence of fluctuations in soil moisture content. Atterberg Limit tests were performed on representative samples of the very silty clay and the recorded Plastic Index values (PI's) have been noted on the enclosed summary laboratory data sheet. Plastic Index (PI's) values ranged between 18.7% and 22.7%, indicating a material of generally '**low / medium' volume change potential'** (NHBC Standards Chapter 4.2 'Building near Trees').

- California Bearing Ratio Tests (CBR) employing the TRL 587 CBR CP method, were performed at 14 No. locations along the routes of the proposed new estate roads. The tests were performed through the deposits of topsoil and any overlying deposits of made up / disturbed ground and extended into the underlying deposits of silt. The results of the tests have been provided on the enclosed spread sheets.

  CBR values in the deposits of topsoil and made / disturbed ground were generally quite variable ranging (for soils below 250mm depth) between 4.0% and 55%.

  Tests performed within the natural upper deposits of silty, medium sand *(to a maximum depth of say 800mm)* recorded CBR values ranging between 3.7% and 12.7%. Clearly the choice of the most appropriate design CBR value will largely depend on the type of highway construction and the nature of deposits which are exposed at road formation level.

  The above results would suggest, a minimum design CBR of around **4.0%** would likely be acceptable for traditional paving construction, however, it should be noted that there may be some localised areas of the site where the deposits of topsoil and made / disturbed ground may be slightly thicker. It is likely if carriageways are to adopted by the local authority that all deposits of mid brown, silty topsoil and mixed deposits of silty, sandy soil will need to be removed from beneath proposed estate roads and paved areas prior to the placement of any sub-base. As the underlying natural deposits are initially generally loose in compaction, they would, (if dry), benefit from some mechanical compaction prior to the placement of any granular sub-base or up-fill that may be used to raise the site level.

- Chemical tests performed on representative samples of the near surface disturbed ground / topsoil as part of the environmental screening, recorded water-soluble sulphate concentrations between <10mg/l and 42mg/l (2:1water / soil extract) with pH between 6.5 and 8.6. Tests performed on groundwater samples, recorded total sulphate concentrations of between 77mg/l and 81mg/l with pH values of between 7.4 and 7.5.

- In order to establish the suitability of the surface topsoil for re-use, 6 No. samples of soil obtained from the deposits of near surface topsoil were submitted for compliance testing in accordance with BS3882:2015. The results of the tests have been presented on the declarations of compliance numbered 123462 -11 and 123462-25 and indicate that although the majority of the determinands tested are generally compliant with multi-purpose topsoil, a number samples were slightly deficient in certain aspects and nutrients.

Virtually all of the samples submitted were deemed to fall outside the permitted soil texture parameters, being very slightly too silty for multipurpose topsoil, with silt contents ranging between 66% to 68%, i.e. only just outside the multipurpose range threshold of 65%.

One of the samples (BH11) were deemed to fall outside the permitted soil texture parameters, being too clayey for multipurpose topsoil, however the borehole log does indicate this and it is suspected this may be an anomalous result within the set.

Many of the samples submitted also contained a slightly deficient mass loss on ignition percentage. The deficient samples recorded MLI percentages between 3.1% and 4.5%, which are slightly lower than the required 5%. Four of the samples submitted for testing recorded deficient Nitrogen concentrations.

These deficiencies could be overcome through the use of soil improvers / fertilisers, which could increase the nutrient status of the materials and render them fully compliant with multipurpose topsoil should this be considered necessary. A visual examination of the near surface topsoil revealed that it was a good quality mixed silty slightly clayey loam which would appear to be ideal for use in garden areas (subject to contamination testing). Current weeds and grasses growing on site are thriving despite being cut down only several weeks before the fieldwork was undertaken

Owing to the limited availability of good quality topsoil locally for generally garden / building use and being mindful of environmental good practice and efficiency in design, if the samples are shown to be within residential thresholds for contamination, then the near surface soils on site should certainly be considered for recycling purposes for the proposed garden and landscaped areas of the development.

- In order to establish the relative permeability of the near surface stratum *in situ*, 'falling head' (variable head) permeability tests were performed in seven of the completed borings in order to provide an overview of the permeability characteristics of the near surface soils across the site. The test holes were approximately 103mm in diameter and extended to depths of between 3.00m and 3.65m beneath the surface. To ensure that the sidewalls of the boreholes remained stable during the tests, a 50mm slotted standpipe was inserted into the test holes and surrounded by well screen gravel for the duration of the tests.

  At the start of the tests, the test holes were quickly filled almost to the surface with water and then the time taken for the water to dissipate from the holes was subsequently monitored. **The results of the test indicate soil infiltration rates within the upper deposits of silt and very silty clay varied between 6.25 x 10^{-3}mm/s and 3.86 x 10^{-2}mm/s, which represents a range in permeability from a steady to moderate rate of soil infiltration.**

  These results of the tests indicate that the deposits of silt and very clayey silt beneath the study site could potentially provide a suitable media in which to discharge surface water generated by the proposed residential development. The thickness of granular deposits and the level to standing groundwater does very across the site which will influence the storage capacity of any installed soakaway. The soakaway excavations should be extended to as deep as is practicable but should not extend into the water bearing deposits of silt. If groundwater is encountered during excavation for soakaways, the excavation could easily be partially backfilled with coarse free draining material (such as coarse washed gravel or washed rubble) to ensure the base of the soakaway is above the groundwater, before the placement of any soakaway crates/chambers *(design subject to approval by the local building control officer or warranty provider).*

  The site investigation was undertaken in late spring / early summer therefore groundwater levels could possibly rise slightly during the wetter winter months.

7.0 Contamination

7.1 Preliminary Conceptual Site Model

The preliminary Conceptual Site Model (PCSM) detailed in the Phase 1 Assessment Report provides information regarding the potential 'source-pathway- receptor' linkages that may be present at the site.

- From an examination of the site's history, potential sources of 'on site' contamination could be associated with the activities that have taken place within the site boundaries during its history. From the earliest historical extracts, the site appears to have been used as an operational farm with a number of farm buildings located in the north western part of the site. Later the site was utilised as a Wildlife Sanctuary Public Attraction for a period of approximately 25 years. Potential contamination could be associated with historical agricultural activities include the use of farm vehicles and equipment, the possible storage of potentially contaminative materials and the construction and construction / demolition of farm buildings. Contamination may also have been released as a consequence of the parking of visitor's vehicles in certain parts of the study site. A number of narrow drainage ditches flow along or very close to the site boundaries. These conduits may represent a means by which contamination may have migrated onto the study site.

- Historically, since the 19th Century, the areas surrounding the site have been used predominantly for agricultural and residential purposes, however, a small number of industrial and commercial activities have also been identified. The most significant of these are a small Smithy once located to the south and a small Sewage Works once designated to the west of the site. Neither of these are considered to be located close enough to represent a significant risk to the site. Other notable land use activities include a number of agricultural storage buildings located just beyond the western site boundary, the nearby solar photovoltaic farm to the northeast and southeast and the former Sewage Works indicated to the west of the site. It is considered relatively unlikely that significant contamination could migrate onto the study site from these areas.

- Weathering of the natural geological stratum can occasionally cause enrichment of certain metals in the near surface strata, however, this is considered unlikely bearing in mind the information given in the 'Groundsure' report which in 'Section 20' (Estimated Background Soil Chemistry) shows very low anticipated levels of Arsenic, Cadmium, Chromium, Nickel and Lead.

The contaminants that might be associated with the past activities at the site and the surrounding area could include, but are not necessarily limited to the following:-

- **Metals, metalloids and asbestos** associated with any agricultural activities that have taken place on the site or within deposits of 'made or disturbed ground' that may have been placed on the site surface in the historical past. Contamination that may have been generated as a consequence of the activities associated with the construction and subsequent demolition of the structures that are / were once located on the site. Contamination derived from the various commercial / industrial activities that have taken place in the vicinity of the site. Contamination from natural weathering of the geological stratum. Possible contamination that may have migrated onto the study site during the development of the nearby residential properties and other structures located within the vicinity of the site.

- **Polycyclic Aromatic Hydrocarbons (PAH's)** derived from the incomplete combustion of organic materials, i.e. from the burning of organic materials that may have taken place in the historical past. PAH's contained within deposits of made ground or derived from the use of plant machinery or the parking of visitor's vehicles.

- **Total Petroleum Hydrocarbon (TPH)** contamination from the historical use, storage and possible maintenance of vehicles, or the possible use of agricultural plant and machinery. TPH from any imported made ground or accidental spillages within the structures once located on site. TPH contamination that may have migrated onto the site from other commercial / industrial sites in the near vicinity, although this is considered remote.

- The Groundsure Report has not revealed any areas of landfill, in-filled ground or surface ground workings that could represent a credible source of harmful ground gas emissions. It is therefore considered that there is no requirement for a quantitative ground gas risk assessment at the study site. The site is not located within a radon affected area as less than 1% of properties within the specified search area recorded above the action level. The Groundsure report indicates that within this Radon range, no radon protection measures are required for new buildings or extensions to those already existing.

7.2 Contamination Testing and Assessment Strategy

In accordance with the recommendations of Phase 1 Desk Study, a programme of chemical analysis was adopted that would target certain contaminants present in the soil that might be associated with the past and current activities at the site and in the immediate surrounding area.

From the 16 No. boreholes a total of 25 No. soil samples were selected for chemical (contamination) analysis. The majority of the selected samples were obtained from the near surface soils as these were considered to represent the most likely soils to be contaminated and most likely to come into contact with construction workers and end users of the site. These near surface soils were also deemed to represent a possible source of contaminated leachate which could potentially enter any underlying sensitive groundwater regime.

Eight of the samples obtained from slightly greater depth were selected for a suite of tests often requested by water companies (UKWIR) in order to assess the most appropriate grade of protection for underground potable water supply pipes.

In addition to the soil samples, four samples of the groundwater were obtained from the borings and submitted for a similar testing schedule as the soil samples.

All samples were placed in approved containers and cool boxes and despatched under a chain of custody to an accredited laboratory (Chemtech Environmental Ltd) for the range of tests outlined above. The results of the analyses have been provided on the enclosed laboratory certificates with contract numbers 123462, Butterfly Park, Long Sutton.

7.3 Assessment of Data

For the assessment of human health, the dataset has been compared to Soil Screening Values (SSV's) developed by **AT**RISK^{SOIL}. Atkins soil screening values (SSV's) have been derived in line with the EA 2009 guidance (SR2, SR3, SR4, and SR7) using the CLEA v1.071 software. The modelling inputs were made compliant with the SR3 residential, commercial and other conceptual site models and follow the guidance provided within SR3 where possible. The SSV's currently available include values for a range of metals and semi metals, speciated PAH's, characterized TPH, BETX and other organic contaminants.

The C4SL project methodology released by DEFRA in December 2014 was a step-change in the approach to the assessment of land contamination in the UK. The C4SLs introduced a change to toxicological appraisal that defined 'low risk', updated exposure parameters for the standard SR3 land uses and, following a review of relevant literature and Atkins own SSV approach, introduced the Public Open Space (Residential) and Public Open Space (Parks) land uses. These changes in exposure and land use were formalised in an update to the CLEA software with the release of CLEA v1.071 in September 2015.

Atkins updated the SSVs using CLEA v1.071 to incorporate the following changes:

- Updated exposure assumptions for the standard residential, commercial land uses as set out in the C4SL project methodology for 1% SOM sand and 6% SOM sandy loam soil types;
- Updated exposure assumptions for the standard allotments land use as set out in the C4SL project methodology for the 6% SOM sandy loam soil type;
- Derivation of the 'top two' produce for all contaminants for the residential and allotments land uses and inclusion of this method in the consumption of home grown produce pathway; and
- Inclusion of SSVs derived for the Public Open Space (residential) and Public Open Space (parks) land uses as set out in the C4SL project methodology at 1% SOM sand and 6% SOM sandy loam soil types.

As part of their routine updates they have updated the toxicological assessment of ten contaminants (based on minimal risks as set out in Environment Agency SR2 Guidance).

Further C4SLs based on 'Low Levels of Toxicological Concern' are to be derived by an industry led initiative in the future.

Certain organic contaminants can be compared to the EIC/AGS/CL:AIRE Soil Generic Assessment Criteria for Human Health Risk Assessment 2010 for a residential or commercial end use. They provide an indication of the chemical concentration in soil below which the long-term human health risks for site occupants (for various generic land-use scenarios) are considered to be tolerable or minimal.

Once the development is completed, large parts of the site surface will be covered with either foundation concrete or areas of permanent hard surfacing including estate roads, driveway / parking areas, patio and other areas of permanent paving. However, the development will also include private garden areas where future users could potentially grow produce for human consumption. With this in mind**, the proposed land use has been considered as a residential development with the potential that 'produce' could be grown within residential gardens for human consumption, i.e. 'residential with the consumption of home grown produce' (res-with) end use scenario**. The current contamination guideline values applicable to this end use have been adopted for the assessment of the contamination test data. The dataset has been compared to 1% soil organic matter (SOM) 'res-with' values as the mean of the recorded OMC concentrations were below 3% so this approach was considered appropriate.

BRE Digests Special Digest 1 can be reference to assess the risk from sulphate and acid attack on buried concrete.

Guidance issued by UKWIR Publication 2010 'Guidance for the selection of water supply pipes to be used in Brownfield sites can be used to assess the risk to underground water supply pipes.

7.3.1 **Analysis of Dataset**

If / when appropriate, statistical analysis of datasets can been carried out in accordance with the methodology outlined in 'Professional Guidance: Comparing Soil Contamination Data with Critical Concentration', CL: AIRE, Buckinghamshire, ISBN 978 -1-905046-35-5.

The above publication indicates that for a planning scenario, the developer should consider the following key question:

'Can we confidently say that the mean level of contamination on this land is low relative to some appropriate measure of risk?'

However, the statistical approach outlined in the above document is only applicable to situations where a relatively large number of soil samples are included within the dataset. A general rule of thumb outlined in the above document suggests a minimum sample size of between 20 and 50, and in certain circumstances, (such as when using log-symmetric data) this is still unlikely to be sufficient.

In the context of the current site, the area of proposed development is moderate in size and the risk posed to human health is generally considered to be low. There remains a 'moderate / low' and 'very low' risk to other environmental receptors, such as aquifers within the superficial deposits and bedrock, therefore in keeping with the constraints of the allocated budget and in the absence of any specific, identified source of contamination at the study site, a smaller sample size was considered appropriate.

For the assessment of human health, each determinand within the dataset has been compared directly to Soil Screening Values (SSV's) developed by ATRISK^{SOIL}. Atkins soil screening values (SSV's) have been derived in line with the EA 2009 guidance (SR2, SR3, SR4, and SR7) using the CLEA v1.071 software. The modelling inputs were made compliant with the SR3 residential, commercial and other conceptual site models and follow the guidance provided within SR3 where possible. The SSV's currently available include values for a range of metals and semi metals, speciated PAH's, characterized TPH, BETX and other organic contaminants.

7.4 Contamination Results

7.4.1 Soils

7.4.1.1 *Metals and Semi metals and General Contaminants*

20 of the 25 No. soil samples were submitted for testing and analysed for a general metals and semi-metals suite that might be associated with contamination resulting from the past uses of the site and activities in the surrounding area. On comparing the recorded values with current Atrisk SSV's, **all** of the samples recorded metals concentrations within current Atrisk SSV's for a 'res-with' end use scenario (SOM 1%).

In terms of Metals and semi metals contaminants it is considered that concentrations in the near surface soils across the site are generally low relative to their critical concentration, therefore in terms of these potential contaminants, the site would be considered suitable for its proposed residential end use without prior remediation.

7.4.1.2 *Polycyclic Aromatic Hydrocarbons*

20 of the 25 soil samples were submitted for testing and analysed for speciated PAH's (EPA16) and the results compared to current Atrisk SSV's. On comparing the recorded values with current Atrisk SSV's, **all** of the samples recorded PAH concentrations within current Atrisk SSV's for a 'res-with' end use scenario (SOM 1%).

In terms of PAH contaminants it is considered that concentrations in the near surface soils across the site are generally low relative to their critical concentration, therefore in terms of poly aromatic hydrocarbons, the site would be considered suitable for its proposed residential end use without prior remediation.

7.4.1.3 *Total Petroleum Hydrocarbons and BTEX*

20 of the 25 No. soil samples were submitted for testing and analysed for characterised TPH and B-TEX compounds and the results compared to current SSV's. On comparing the recorded values

with current guideline values, **none** of the determinands included in the suite of tests were found to be in concentrations which exceed the current Atrisk SSV's for a 'res-with' end use scenario (SOM 1%). Indeed, all of the determinands were found to be in concentrations which were below the limit of analytical detection and **with respect to TPH contaminants, the site can be considered suitable for its proposed end use without the need for any specific remediation**.

The absence of any significantly elevated TPH or B-TEX fractions within the soil samples submitted for testing suggests that the risk of hydrocarbon vapours entering the proposed new buildings is very low. A TPH vapour survey is not considered necessary at this stage and no specific protection from hydrocarbon vapours is considered to be warranted for the proposed new development.

7.4.1.4 ***Asbestos***

20 of the 25 No. soil samples were submitted for examination for the presence of asbestos in soil using polarised light microscopy. **No traces of asbestos were detected in any of the samples submitted for testing.**

7.4.1.5 ***Sulphate***

Chemical tests performed on representative samples of the near surface disturbed ground / topsoil as part of the environmental screening, recorded water-soluble sulphate concentrations between <10mg/l and 42mg/l (2:1water / soil extract) with pH between 6.5 and 8.6. Tests performed on samples of the shallow groundwater recorded sulphate concentrations ranging between 77mg/l and 81mg/l with pH values of between 7.4 and 7.5. In accordance with the guidelines contained in Part 1 of the Digest and taking into account the geology and specific soil and groundwater conditions and the number of samples within the dataset (See section C5.1.1 of BRE Special Digest 1), the site can be assigned a Design Sulphate Class **DS-1** and an ACEC (Aggressive Chemical Environment for Concrete) Class **AC-1**.

7.4.1.6 ***WIR Suite***

Eight of the soil samples were obtained from slightly greater depth and submitted for a UKWIR suite of tests that are commonly used to assist in the materials selection for potable water supply pipes. The results of the tests, together with the results of the TPH analyses would suggest that either PVC or PE could be suitable for underground potable water supply pipes, however, this should be confirmed at an early stage with the local water company who may wish to see all available contamination test data, particularly the results of any speciated hydrocarbon testing.

7.4.2 **Groundwater**

Four samples of the groundwater were obtained from the borings and analysed for a similar range of contaminants as the soil samples.

The results of the analysis have been compared to current ATRISK WSV's for a residential end use, EQS for fresh and salt water and also UK Drinking water standards.

The majority of the determinands were recorded either below their respective limit of analytical detection or well below current ATRISK WSV's, EQS freshwater / saltwater standards or UK DWS for consumers taps. Although all of the groundwater samples recorded concentrations of certain PAH compounds that exceed maximum allowable EQS fresh, estuary and coastal water guideline values, the concentrations did not exceed ATRISK WSV's for the individual determinands. No other significant exceedances were identified within the samples submitted for testing.

8.0 Contamination Summary, Revised Conceptual Site Model & Risk Assessment

Using the information gathered in this ground investigation and preliminary contamination risk assessment developed in the Phase 1 Desk Study, the principal potential contaminants of concern were considered to be metals, semi-metals, PAH's, TPH, BTEX, asbestos and potential toxic vapours.

The principal receptors of potential contamination from soil and groundwater were identified as current and future end users of the site, ground workers, controlled waters / aquifers, landscaping plants, structures and buried concrete. The risk classification afforded to these possible pollution linkages was perceived to range between 'Moderate / Low' and 'Very Low'.

Using the results of the environmental screening from the recent Intrusive Phase II Investigation, **it has been established that the concentrations of contaminants recorded in the samples obtained from the site are within current guideline limits for a 'residential development with the consumption of home grown produce' scenario (res-with SOM 1%) and as such the site should not require any specific remediation.**

The near surface topsoil on site is considered to be potentially recyclable. BS3882 compliance testing and a visual inspection of the material indicates that the near surface topsoil is generally a good quality silty, slightly clayey loam and could be considered for use within residential garden environments, provided that the nutrient and organic status can be improved.

Groundwater

Although the groundwater samples recorded concentrations of certain PAH's that exceed EQS fresh, estuary and coastal water guideline values, the concentration did not exceed the individual ATRISK WSV's. **As a consequence, the groundwater underlying the site is not considered to represent a significant risk to ground workers or future users of the site or the wider environment and no remediation of groundwater is considered necessary.**

On the basis of the information which has now become available in this Phase II Intrusive Investigation, a revised conceptual site model and risk assessment has been developed for the site which is outlined in the matrix below.

Revised Conceptual Site Model Based on available information gathered in Phase 2 Intrusive Investigation

Source	Pathway	Receptor	Any significant contamination present Y/N	Previous Risk Class Phase 1 Desk study	New Risk Class Based on Phase 2 Investigation
Contamination resulting from the possible use of agricultural plant and machinery in the historical past. The possible presence of deposits of made up or disturbed ground across the site. The construction and subsequent demolition of the structures that have once occupied various parts of the site. Potentially contaminative activities that may have taken place in the structures that have occupied the site or in the external areas of the site. The possible storage or use of fuels, lubricants and other hydrocarbons during the sites history. Burning processes that have taken place within the site boundaries, such as the burning of organic matter or the possible presence of PAH within any deposits of made ground that may be present over the site surface. PAH compounds that may have been released as a consequence of using plant and machinery or through the parking of vehicles on the study site. Residual contamination from natural weathering of geological strata. Contamination that may have migrated onto the site from agricultural or commercial activities that have taken place in the areas surrounding the site. Contamination that may have migrated onto the site through the narrow drainage ditches that pass along	Ingestion, Inhalation (dust) and / or Dermal Contact and Migration of Potentially Contaminated Leachate	Construction / Maintenance Workers / General Public during Excavations	No	Moderate / Low	**Low (standard PPE advised)** – The intrusive survey and associated chemical analysis has demonstrated that across the site, the concentrations of potential contaminants are within current guideline limits for a residential end use. Whilst the risk is minimal, site / ground workers should, nevertheless, be equipped with appropriate PPE (overalls, gloves, dust masks, eye protection) during the earth works. Sufficient welfare facilities such as hand washing facilities should also be provided. Exposure to any contamination not identified within this survey would likely to be only temporary and if the above precautions are adopted then the risk could be reduced to negligible. If earthworks are carried out during very dry and dusty conditions, as a precaution dust suppression measures should preferably be put in place and all haulage vehicles removing soils from site should be covered to limit the release of airborne particulates.
		Future Site Users	No	Moderate / Low	**Low -** The intrusive survey and associated chemical analysis has demonstrated that across the site, the concentrations of potential contaminants are within current guideline limits for a residential end use. Any small identified pockets of stony and rubbly made ground (encountered in areas of previous construction) should, however, be removed from proposed landscaped and garden areas of the site. Landscaped garden areas are likely to require a surface dressing of certified 'clean' loamy topsoil of at least 100mm to150mm in thickness. It should be noted that it is a requirement of the NHBC that any coarse stone or other obstructions will need to be removed from the upper 300mm of soil in any garden or landscaped areas. As per requirements of NHBC Ch. 9.2. Contamination testing and BS3882:2015 testing of topsoil obtained from the site (i.e. site won) has demonstrated that it is within contamination thresholds for a 'Res-with' end use. The samples were also found be generally acceptable as multi-purpose topsoil within the BS3882 specification, provided the organic composition is monitored and nutrient status slightly improved. It should be noted that the "loss on ignition" result for all near surface samples tested, averaged approximately 4.75% which does not seem to be unduly low for organic content in a soil with silty clay loam composition. Assuming this '**site won'** topsoil is used as the surface dressing in gardens and landscaped areas, then no further certification should be required. **If imported soils are to be considered** then these will require additional appropriate certification demonstrating that the imported material is free from

or very close to the site boundaries. Potential Contaminants Include – PAH, TPH, B-TEX, metals, semi-metals and asbestos. Vapours include hydrocarbon vapours.					contamination and is within BS3882 specification (YALPAG Guidance – verification requirements for cover systems).
		Landscaping Plants	No	Very Low	**Very Low -** The intrusive survey and associated chemical analysis has demonstrated that across the site, the concentrations of potential contaminants are well within current guideline limits for a residential end use. Any small identified pockets of stony and rubbly made ground (encountered in areas of previous construction) should, however, be removed from proposed landscaped and garden areas of the site. Landscaped /garden areas are likely to require a surface dressing of certified 'clean' loamy topsoil of at least 100mm to150mm in thickness. It should be noted that it is a requirement of the NHBC that any coarse stone or other obstructions will need to be removed from the upper 300mm of soil in any garden or landscaped areas. As per requirements of NHBC Ch. 9.2. In order to establish the suitability of the surface topsoil for re-use, 6 No. samples of soil obtained from the deposits of near surface topsoil were submitted for compliance testing in accordance with BS3882:2015. The results of the tests have been presented on the declarations of compliance numbered 123462 -11 and 123462-25 and indicate that virtually all of the samples submitted were deemed to fall outside the permitted soil texture parameters, being very slightly too silty for multipurpose topsoil, with silt contents ranging between 66% to 68%, i.e. only just outside the multipurpose range threshold of 65%. One of the samples (BH11) were deemed to fall outside the permitted soil texture parameters, being too clayey for multipurpose topsoil, however the borehole log does indicate this and it is suspected this may be an anomalous result within the set. Many of the samples submitted also contained a slightly deficient mass loss on ignition percentage. The deficient samples recorded MLI percentages between 3.1% and 4.5%, which are slightly lower than the required 5%. Four of the samples submitted for testing recorded deficient Nitrogen concentrations. These deficiencies could be overcome through the use of soil improvers / fertilisers, which could increase the nutrient status of the materials and render them fully compliant with multipurpose topsoil should this be considered necessary. A visual examination of the near surface topsoil revealed that it was a good quality mixed silty slightly clayey loam which would appear to be ideal for use in garden areas (subject to contamination testing). Current weeds and grasses growing on site are thriving despite being cut down only several weeks before the fieldwork was undertaken Owing to the limited availability of good quality topsoil locally for generally garden / building use and being mindful of environmental good practice and efficiency in design, if the samples are shown to be within residential thresholds for

					contamination, then the near surface soils on site should certainly be considered for recycling purposes for the proposed garden and landscaped areas of the development.
		Water supply Pipes	No	Low	**Very Low** – Environmental screening of the soil samples submitted for testing revealed that concentrations of contaminants were within acceptable guideline limits for a 'residential with the consumption of home grown produce' end use scenario. Nevertheless, the local water company will need to be contacted at an early stage to ascertain the most appropriate materials for use in potable water supply pipes. Reference should be made to UKWIR Publication 2010. Eight of the soil samples were obtained from slightly greater depth and submitted for a UKWIR suite of tests that are commonly used to assist in the materials selection for potable water supply pipes. The results of the tests, together with the results of the TPH analyses would suggest that either PVC or PE could be suitable for underground potable water supply pipes, however, this should be confirmed at an early stage with the local water company who may wish to see all available contamination test data, particularly the results of any speciated hydrocarbon testing.
		Underground Structures	No – sulphate does not exceed DS-1	Low	**Very Low** – Chemical tests performed on representative samples of the near surface disturbed ground / topsoil as part of the environmental screening, recorded water-soluble sulphate concentrations between <10mg/l and 42mg/l (2:1water / soil extract) with pH between 6.5 and 8.6. Tests performed on groundwater samples, recorded total sulphate concentrations of between 77mg/l and 81mg/l with pH values of between 7.4 and 7.5. In accordance with the guidelines contained in Part 1 of the Digest and taking into account the geology and specific soil and groundwater conditions and the number of samples within the dataset (See section C5.1.1 of BRE Special Digest 1), the site can be assigned a Design Sulphate Class **DS-1** and an ACEC (Aggressive Chemical Environment for Concrete) Class **AC-1**.
		Controlled waters (Surface / Groundwater / Off Site Drains)	No	Moderate / Low	**Low** – Chemical analysis has demonstrated that the concentrations of potential contaminants in the near surface soils and groundwater are well within current guideline limits for a 'residential end use with the consumption of home grown produce' end use scenario. The housing development and associated road and drainage system when completed will reduce the amount of rainwater presently entering the near surface deposits and therefore reduce the potential for the generation of contaminated leachate. The near surface natural superficial soils are represented by Tidal Flat Deposits of clay and silt. Although it was considered that these deposits would be of moderate permeability, these soils are designated as an Unproductive Aquifer and as such would not be considered highly sensitive

					The underlying solid geology is represented by the Ampthill Clay Formation. Groundwater within the low permeability deposits of the Ampthill Clay Formation (i.e. Mudstone) is unlikely to be highly mobile. The site is not situated within 500m of a groundwater SPZ and the nearest current abstraction point is situated over 2000m from the site. No significant contamination was identified in the samples of the groundwater submitted for testing therefore the risk posed by groundwater contamination would appear to be very low. The Groundsure Report and walkover inspection has established that the nearest surface water feature to the site is an inland river not influenced by normal tidal action situated approximately 7m south of the site. At this distance, if any contamination is ultimately revealed at the study site, then this feature is likely to be considered at risk. No surface water abstractions have been identified within 1000m of the study site.
	Migration of harmful ground gasses / vapours through permeable made ground and natural strata and accumulation in confined spaces.	Current and Future Site Users Construction / Maintenance Workers	No	Moderate / Low	**Low** – The Groundsure Report has not revealed any landfills, significant areas of in-filled ground or surface ground workings that could represent a credible source of harmful ground gas emissions. It is therefore considered that <u>there is no requirement for a quantitative ground gas risk assessment at the study site</u>. The absence of any significantly elevated TPH and B-TEX fractions within the soil samples submitted for testing suggests that the risk of hydrocarbon vapours entering the proposed new development is negligible. **A TPH vapour survey is not considered necessary and no additional protection from hydrocarbon vapours is deemed to be required within the proposed development.** **The site is not located within a radon affected area** as less than 1% of properties within the specified search area recorded above the action level. The Groundsure report indicates that <u>no radon protection measures are required f</u>or new buildings or extensions to those already existing.

9.0 <u>Precautionary Measures</u>

Some precautionary measures are recommended and these are listed:-

- Ground workers involved in the development should be provided with appropriate personal protective equipment in order to mitigate the risk of temporary exposure to any <u>slight</u> soil contamination that has not been identified during this survey.

- If materials suspected of being significantly contaminated are revealed during site preparation, then it will be necessary to take representative samples and carry out additional analysis. All such occurrences should be photographed, carefully logged and the extent shown on a copy of the site plan. Remediation work should not take place until this potential 'new' contamination has been fully identified and a remediation strategy approved by the local authority. Any soils suspected of being contaminated, which are stockpiled, should be placed on sheeted areas and representative samples submitted for analysis. Upon receipt of the results, these materials will be either available for re-use or exported to an authorized landfill.

- **If** it is necessary to export excavated soil from the site, this should be to an appropriate receiving facility. Any documentation relating to the export of soils from site should be retained for possible future inspection by the local authority Environmental Protection Unit. Changes in legislation concerning hazardous waste may have an effect on the disposal costs of any materials from the site. Compliance testing may be required in order to classify materials within the Waste Acceptance Criteria (WAC).

- The risk to site users, neighbouring occupants, and 'general' public and to construction workers from airborne pollution is considered to be generally 'very low' , however, as a precaution, basic dust suppression measures should be adopted for the duration of any earth works particularly during dry and dusty conditions. Haulage vehicles removing any excavated soils from site should preferably be provided with a cover sheet to reduce the possibility of release of potentially contaminated airborne particulates during transportation.

- If potable water supply pipes are to be placed within the surface soils then these may require appropriate protection. Eight of the soil samples were obtained from slightly greater depth and submitted for a UKWIR suite of tests that are commonly used to assist in the materials selection for potable water supply pipes. The results of the tests, together with the results of the TPH analyses would suggest that either PVC or PE could be suitable for underground potable water supply pipes, however, this should be confirmed at an early stage with the local water company who may wish to see all available contamination test data particularly any speciated hydrocarbon testing.

Provided the measures detailed above are implemented, then the long term risk to human health and other environmental receptors is considered to be generally Low.

10.0 Engineering Comments – Geotechnical

Ground Conditions and Foundations

The recent borings have revealed that beneath a covering of topsoil and in the northwest corner of the site a shallow thickness of made / disturbed ground, the site is initially underlain by Tidal Flat Deposits comprising 'loose' to 'medium dense' silt. In places the more granular horizons are interrupted by bands of 'firm to stiff' and occasionally 'soft', very silty clay / clayey silt.

The Tidal Flat Deposits should provide a satisfactory bearing stratum for shallow spread foundations provided the bearing pressures are limited to a magnitude which does not overstress the 'looser'/ 'softer' zones present within the sequence. As a preliminary guide to design and using conservative SPT values (corrected for the effects of overburden pressure) and shear strength data obtained from the recent borings, it has been estimated that for strip foundations, say 600mm to 800mm wide, resting on natural deposits of silt / clayey silt / very silty clay at around 0.90m depth, the safe foundation bearing pressure would be of the order 75kN/m^2. At this loading, long term settlement should be limited to 25mm.

Building Near Trees

The results of Atterberg limit tests performed on representative samples obtained from the near surface pockets of very silty **clay**, indicate that it is a material of 'low' to 'medium' volume change potential and as such, could experience some limited volume changes associated with seasonal fluctuations in soil moisture content, **which could be exacerbated by tree root action**. In this instance the NHBC Standard Chapter 4.2 'Building near Trees' provides useful guidance on building near trees particularly within the more clayey soils.

A number of semi-mature and mature tree specimens are currently growing within and adjacent to the site boundaries. Where these specimens coincide with areas of the site where pockets of very silty clay / clayey silt were identified, then the design of the foundations may need to take the presence and proximity of the trees into consideration. In certain instances it may be possible to excavate through any clayey shrinkable

soils and construct the foundations on the underlying deposits of silt above the level of the groundwater table.

It may be prudent to undertake additional exploratory boreholes in order to establish the prevailing ground conditions for any potentially affected plots, which can then be cross referenced with an accurate topographical and tree survey (which includes identification and proximity of the tree species and their height)

Ground Floor Construction

Over the majority of the site, the covering of silty topsoil extended to depths of between 0.30m and 0.44m beneath the surface. Provided any topsoil is first removed and replaced with compacted stone of suitable grading, the use ground bearing floor slabs could be considered. Alternatively, a fully suspended ground floor construction could be adopted if this is the preferred option.
However, where new properties are located in areas of the site where clayey deposits have been identified and are within the influencing distance of trees, the use of a fully suspended ground floor construction will be more appropriate than one which is ground bearing. A suspended ground floor construction may be the preference of the developer for all proposed units.

Stability of Excavations

Perched groundwater seepages were initially encountered in the sampling boreholes at depths of between 1.92m and 2.60m beneath the surface. On completion of the borings, the groundwater levels in the open holes was subsequently measured at depths of between 1.77m and 2.45m b.g.l. It is therefore considered unlikely that any significant groundwater seepages will be encountered in excavations for shallow foundations. However, the near surface soils are predominantly granular in composition and therefore may be only temporarily self supporting in open excavations.

Deeper excavations are likely to require the provision of trench supports and dewatering facilities to ensure that construction can proceed under optimum conditions. This is likely to be the case with the excavation for the proposed foul water pumping station, where the proximity of trees requires deeper house foundations, or where deeper infrastructure is anticipated.

Drainage

In order to establish the relative permeability of the near surface stratum *in situ*, 'falling head' (variable head) permeability tests were performed in seven of the completed borings in order to provide an overview of the permeability characteristics of the near surface soils across the site. The test holes were approximately 103mm in diameter and extended to depths of between 3.00m and 3.65m beneath the surface. To ensure that the sidewalls of the boreholes remained stable during the tests, a 50mm slotted standpipe was inserted into the test holes and surrounded by well screen gravel for the duration of the tests.

At the start of the tests, the test holes were quickly filled almost to the surface with water and then the time taken for the water to dissipate from the holes was subsequently monitored. **The results of the test indicate soil infiltration rates within the upper deposits of silt and very silty clay varied between 6.25 x 10^{-3}mm/s and 3.86 x 10^{-2}mm/s, which represents a range in permeability from a steady to moderate rate of soil infiltration.**

These results of the tests indicate that the deposits of silt and very clayey silt beneath the study site could potentially provide a suitable media in which to discharge surface water generated by the proposed residential development. The thickness of granular deposits and the level to standing groundwater does very across the site which will influence the storage capacity of any installed soakaway. The soakaway excavations should be extended to as deep as is practicable but should not extend into the water bearing deposits of silt. If groundwater is encountered during excavation for soakaways, the excavation could easily be partially backfilled with coarse free draining material (such as coarse washed gravel or washed rubble) to ensure the base of the soakaway is above the groundwater, before the placement of any soakaway crates/chambers *(design subject to approval by the local building control officer or warranty provider).*

The site investigation was undertaken in late spring / early summer therefore groundwater levels could possibly rise slightly during the wetter winter months.

Carriageway Design

California Bearing Ratio Tests (CBR) employing the TRL 587 CBR CP method, were performed at 14 No. locations along the routes of the proposed new estate roads. The tests were performed through the deposits of topsoil and any overlying deposits of made up / disturbed ground and extended into the underlying deposits of silt. The results of the tests have been provided on the enclosed spread sheets.

CBR values in the deposits of topsoil and made / disturbed ground were generally quite variable ranging (for soils below 250mm depth) between 4.0% and 55%.

Tests performed within the natural upper deposits of silty, medium sand *(to a maximum depth of say 800mm)* recorded CBR values ranging between 3.7% and 12.7%. Clearly the choice of the most appropriate design CBR value will largely depend on the type of highway construction and the nature of deposits which are exposed at road formation level.

The above results would suggest, a minimum design CBR of around **4.0%** would likely be acceptable for traditional paving construction, however, it should be noted that there may be some localised areas of the site where the deposits of topsoil and made / disturbed ground may be slightly thicker. It is likely if carriageways are to adopted by the local authority that all deposits of mid brown, silty topsoil and mixed deposits of silty, sandy soil will need to be removed from beneath proposed estate roads and paved areas prior to the placement of any sub-base. As the underlying natural deposits are initially generally loose in compaction, they would, (if dry), benefit from some mechanical compaction prior to the placement of any granular sub-base or up-fill that may be used to raise the site level.

Foundation Concrete

Chemical tests performed on representative samples of the near surface disturbed ground / topsoil as part of the environmental screening, recorded water-soluble sulphate concentrations between <10mg/l and 42mg/l (2:1water / soil extract) with pH between 6.5 and 8.6. Tests performed on groundwater samples, recorded total sulphate concentrations of between 77mg/l and 81mg/l with pH values of between 7.4 and 7.5.

In accordance with the guidelines contained in Part 1 of the Digest and taking into account the geology and specific soil and groundwater conditions and the number of samples within the dataset (See section C5.1.1 of BRE Special Digest 1), the site can be assigned a Design Sulphate Class **DS-1** and an ACEC (Aggressive Chemical Environment for Concrete) Class **AC-1**.

The opinions expressed in this Report are consistent with guideline standards available at the time of its preparation and assume that the ground conditions do not vary significantly beyond the range revealed within the agreed scope and budget for the investigation. There may, however, be conditions at the site, which have not been identified by the investigation and therefore will not have been considered in the report. Accordingly a careful watch should be maintained during any future ground works at the site and the report and its conclusions reviewed and / or modified accordingly within the context of the nature any development intended at the site.

Prepared by: …… **……R. L. Trattles** (Director)

Reviewed by: …… **……S. P. Trattles** (Director)

TLP Ground Investigation Ltd. RT/DBBL/WSA/BPLSPH2/07/23

Site Location Plan

Proposed Residential Development, Butterfly Park, Little London, Long Sutton, Lincolnshire



Site Location Plan

Proposed Residential Development, Butterfly Park, Little London, Long Sutton, Lincolnshire



Borehole Location Plan

Proposed Residential Development, Butterfly Park, Little London, Long Sutton, Lincolnshire



Borehole Location Plan

Proposed Residential Development, Butterfly Park, Little London, Long Sutton, Lincolnshire



T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH1.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 01.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Dark brown, silty, sandy **Topsoil** containing occasional fine fragments of stone.			(0.13)	0.00 - 0.60	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
			0.13					
Medium to coarse brick and concrete rubble in a matrix of brown, silty sand.			(0.17)					
Made Up / Disturbed Ground			0.30	(0.12)				
Mixed brown and rust brown silt.			0.42					
Loose, brown and occasionally rust brown **Silt.**			(0.58)	0.60 - 1.60	U	2	S N6	
							0.73	
Tidal Flat Deposits							**End of Test**	
Soft to firm, mid brown and rust brown, very silty **Clay /** clayey **Silt.**			1.00	1.10			Vane	42kN/m²
			(0.40)					
			1.40	1.40			Vane	56kN/m²
				1.60 - 2.75	U	3	S N9	
Loose, mid brown **Silt.**			(2.00)					
				2.75	D	1	S N7	
				3.20	D	7	S N8	
Loose, mid brown and grey **Silt.**			3.40					
			3.65				**End of Borehole**	

Observations

The stratum became wet at around 2.05m depth. On completion groundwater level in the open borehole was subsequently measured at 2.23m beneath the surface.

On completion a 'falling head' (variable head) permeability test was performed within the completed borehole. The results of the test are presented on the enclosed data sheets.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH1
Date of Test	01/06/2023

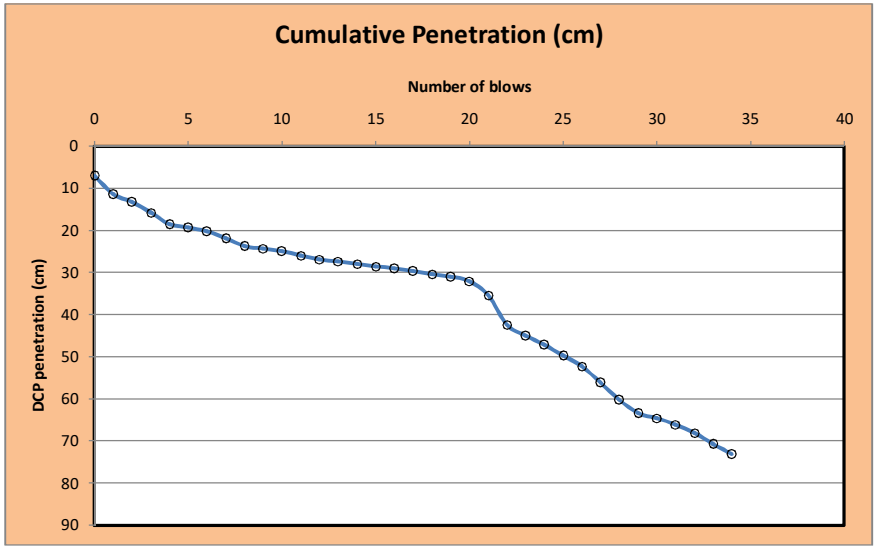
Notes - test from site surface level

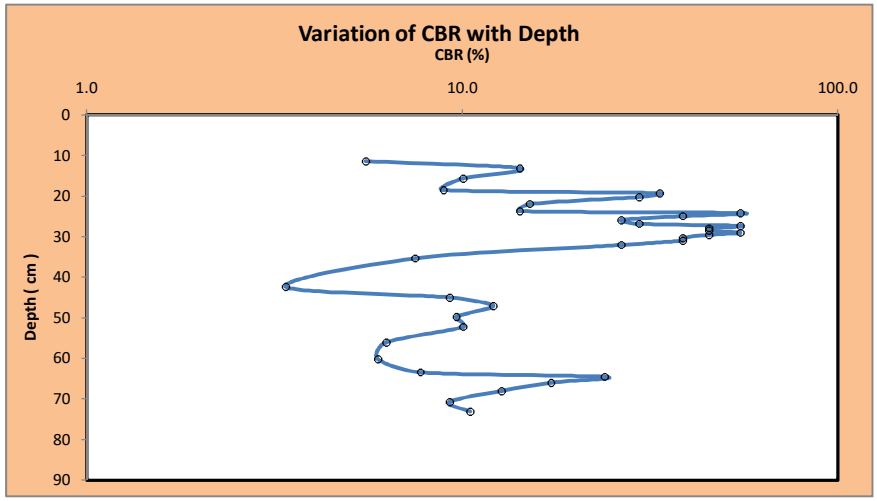
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	7	0	70		7
1	11.4	44	114	5.5	11.4
2	13.2	18	132	14.2	13.2
3	15.7	25	157	10.1	15.7
4	18.5	28	185	8.9	18.5
5	19.3	8	193	33.5	19.3
6	20.2	9	202	29.6	20.2
7	21.9	17	219	15.1	21.9
8	23.7	18	237	14.2	23.7
9	24.2	5	242	55.1	24.2
10	24.9	7	249	38.6	24.9
11	25.9	10	259	26.5	25.9
12	26.8	9	268	29.6	26.8
13	27.3	5	273	55.1	27.3
14	27.9	6	279	45.4	27.9
15	28.5	6	285	45.4	28.5
16	29	5	290	55.1	29
17	29.6	6	296	45.4	29.6
18	30.3	7	303	38.6	30.3
19	31	7	310	38.6	31
20	32	10	320	26.5	32
21	35.3	33	353	7.5	35.3
22	42.3	70	423	3.4	42.3
23	45	27	450	9.3	45
24	47.1	21	471	12.1	47.1
25	49.7	26	497	9.6	49.7
26	52.2	25	522	10.1	52.2
27	56.1	39	561	6.3	56.1
28	60.2	41	602	6.0	60.2
29	63.4	32	634	7.7	63.4
30	64.5	11	645	23.9	64.5
31	66	15	660	17.3	66
32	68	20	680	12.7	68
33	70.7	27	707	9.3	70.7
34	73.1	24	731	10.5	73.1

topsoil / dist ground

Tidal Flat



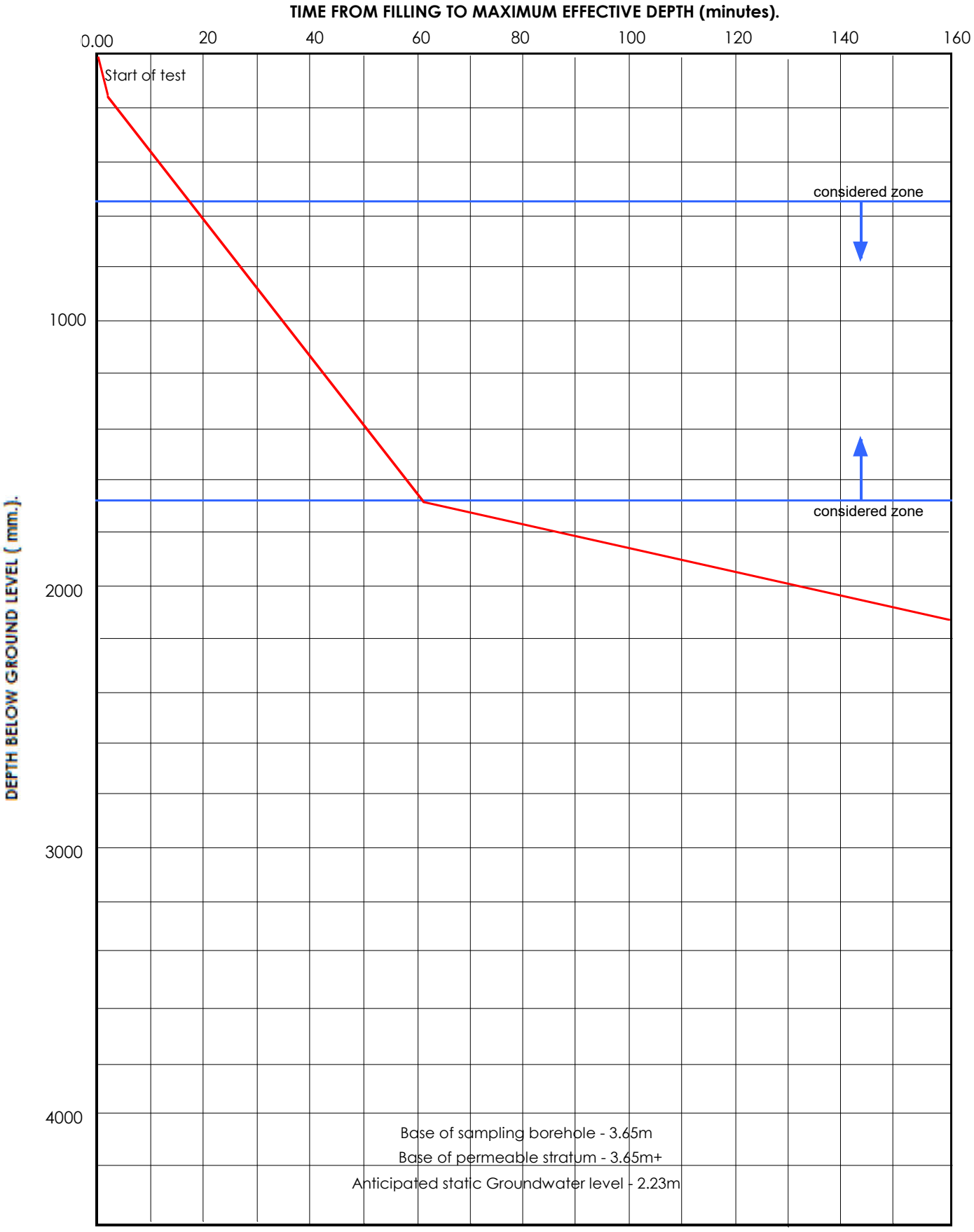


Percolation Graph

Falling Head Test

Soak BH1

Project Location : **Butterfly Park, Long Sutton.**
Client : **D Brown Builders Ltd.**
Date of SI : **01/06/23**



T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH2.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 01.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples Type	samples No.	Test	Field Records
			(0.07)					
Tar macadam..			0.07	0.00 - 0.70	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Fine assorted gravel in a matrix of yellowish brown, silty sand.			(0.18)					
Made Up / Disturbed Ground			0.25					
Dark brown, silty, slightly clayey silt containing very occasional fine fragments of brick.			(0.30)					
			0.55				S	
Firm becoming soft to firm, mid brown, very silty **Clay** / clayey **Silt.**				0.70 - 1.65	U	2	N6	52kN/m²
							0.80 **End of Test**	
				1.00			Vane	42kN/m²
			(1.15)					
Tidal Flat Deposits				1.30			Vane	44kN/m²
				1.30			Vane	35kN/m²
			1.70	1.65 - 3.00	U	3	S N6	
Loose, mid brown **Silt.**							S N7	
			(1.10)	2.25				
				2.70			S N6	
			2.80					
Loose, greyish brown **Silt.**				3.15			S N6	
				3.60			S N7	
			4.10					
			End of Borehole					

Observations

The stratum became wet at around 2.60m depth. On completion groundwater level in the open borehole was subsequently measured at 2.13m beneath the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH2
Date of Test	01/06/2023

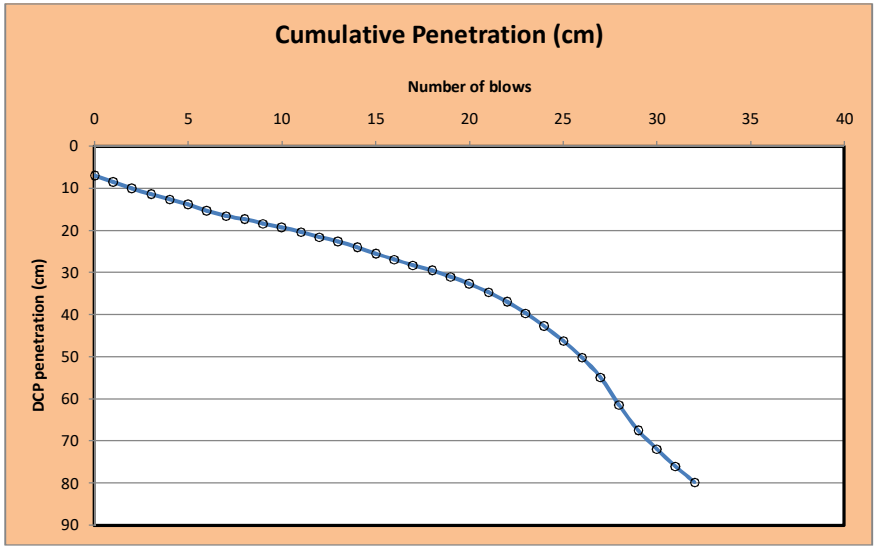
Notes - test from site surface level

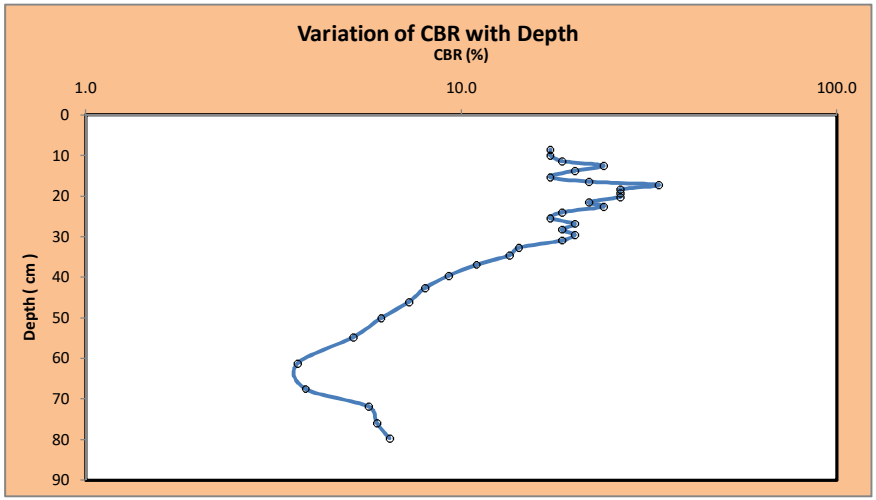
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	7	0	70		7
1	8.5	15	85	17.3	8.5
2	10	15	100	17.3	10
3	11.4	14	114	18.6	11.4
4	12.5	11	125	23.9	12.5
5	13.8	13	138	20.1	13.8
6	15.3	15	153	17.3	15.3
7	16.5	12	165	21.8	16.5
8	17.3	8	173	33.5	17.3
9	18.3	10	183	26.5	18.3
10	19.3	10	193	26.5	19.3
11	20.3	10	203	26.5	20.3
12	21.5	12	215	21.8	21.5
13	22.6	11	226	23.9	22.6
14	24	14	240	18.6	24
15	25.5	15	255	17.3	25.5
16	26.8	13	268	20.1	26.8
17	28.2	14	282	18.6	28.2
18	29.5	13	295	20.1	29.5
19	30.9	14	309	18.6	30.9
20	32.7	18	327	14.2	32.7
21	34.6	19	346	13.4	34.6
22	36.9	23	369	11.0	36.9
23	39.6	27	396	9.3	39.6
24	42.7	31	427	8.0	42.7
25	46.1	34	461	7.3	46.1
26	50.1	40	501	6.1	50.1
27	54.8	47	548	5.2	54.8
28	61.3	65	613	3.7	61.3
29	67.5	62	675	3.8	67.5
30	71.8	43	718	5.7	71.8
31	75.9	41	759	6.0	75.9
32	79.7	38	797	6.5	79.7

topsoil / dist ground

Tidal Flat





T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH3.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 01.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Mid brown, silty **Topsoil** containing occasional fine fragments of brick and stone..			(0.32)	0.00 - 0.60	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Topsoil			0.32					
Loose becoming very loose, buff brown and rust brown **Silt.**				0.60 - 1.60	U	2	S N10	
								0.79
							End of Test	
Tidal Flat Deposits			(2.28)	1.60 - 3.00	U	3	S N6	
				2.05			S N6	
				2.50			S N7	
Loose, greyish brown **Silt.**			2.60					
			3.00					
			End of Borehole					

Observations

The stratum became wet at around 2.60m depth. On completion, the groundwater level in the open borehole was subsequently measured at 1.79m beneath the surface.

A 'falling head' (permeability test was performed within the completed borehole. The results of the test are presented on the enclosed data sheets.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH3
Date of Test	01/06/2023

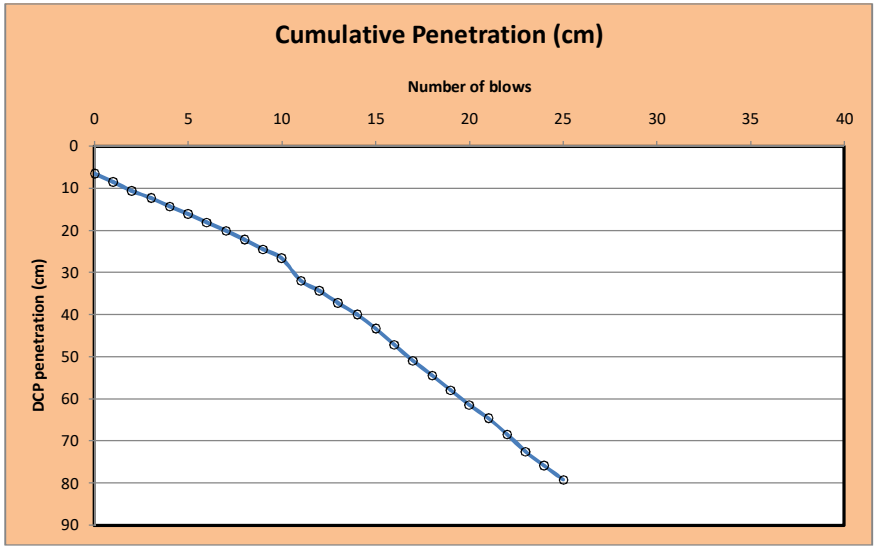
Notes - test from site surface level

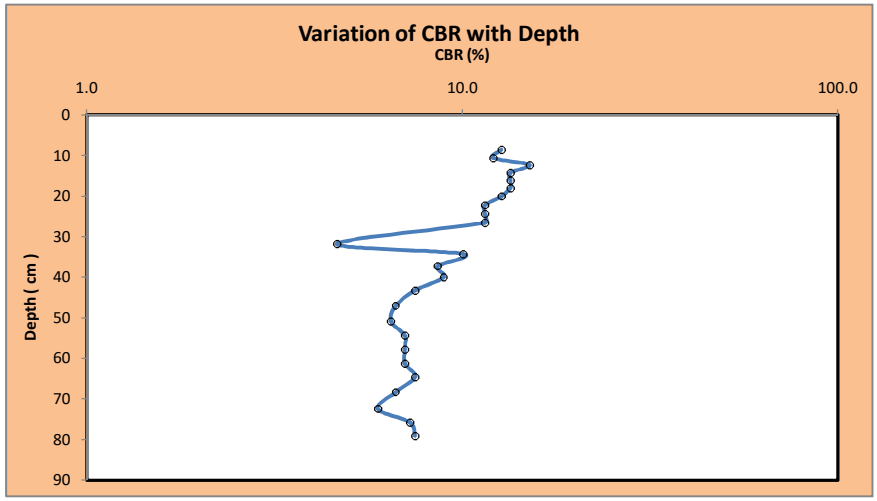
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	6.5	0	65		6.5
1	8.5	20	85	12.7	8.5
2	10.6	21	106	12.1	10.6
3	12.3	17	123	15.1	12.3
4	14.2	19	142	13.4	14.2
5	16.1	19	161	13.4	16.1
6	18	19	180	13.4	18
7	20	20	200	12.7	20
8	22.2	22	222	11.5	22.2
9	24.4	22	244	11.5	24.4
10	26.6	22	266	11.5	26.6
11	31.8	52	318	4.6	31.8
12	34.3	25	343	10.1	34.3
13	37.2	29	372	8.6	37.2
14	40	28	400	8.9	40
15	43.3	33	433	7.5	43.3
16	47	37	470	6.6	47
17	50.8	38	508	6.5	50.8
18	54.3	35	543	7.0	54.3
19	57.8	35	578	7.0	57.8
20	61.3	35	613	7.0	61.3
21	64.6	33	646	7.5	64.6
22	68.3	37	683	6.6	68.3
23	72.4	41	724	6.0	72.4
24	75.8	34	758	7.3	75.8
25	79.1	33	791	7.5	79.1

topsoil / dist ground

Tidal Flat



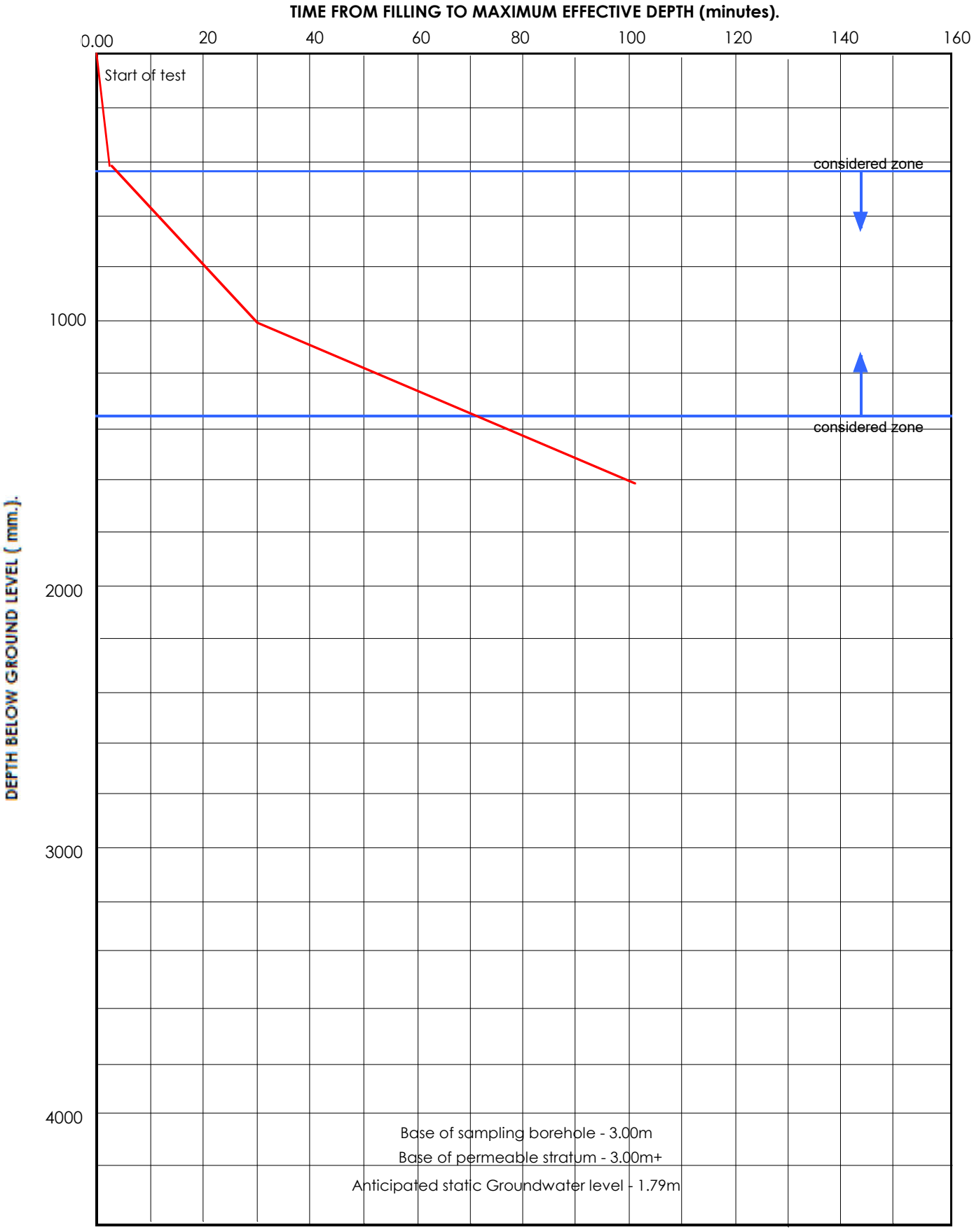


Percolation Graph

Falling Head Test

Soak BH3

Project Location : **Butterfly Park, Long Sutton.**
Client : **D Brown Builders Ltd.**
Date of SI : **01/06/23**



T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH4.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 01.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Mid brown, silty **Topsoil** containing occasional fine fragments of brick and stone..				0.00 - 0.60	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Topsoil			(0.41)					
			0.41					
Medium dense, buff brown and rust brown **Silt.**				0.60 - 1.65	U	2	S N11	
								0.79
							End of Test	
Tidal Flat Deposits			(2.19)	1.65 - 3.00	U	3	S N10	
				2.10	D	1	S N13	
			2.60					
Loose, greyish brown **Silt.**								
			3.00					
			End of Borehole					

Observations

The stratum became wet at around 2.60m depth. On completion groundwater level in the open borehole was measured at 2.35m beneath the surface.

A 'falling head' (permeability test was performed within the completed borehole. The results of the test are presented on the enclosed data sheets.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH4
Date of Test	01/06/2023

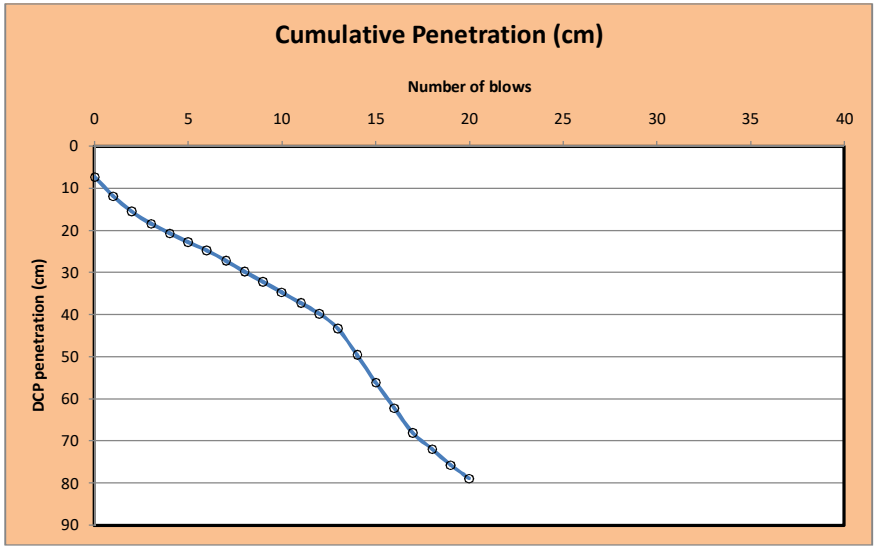
Notes - test from site surface level

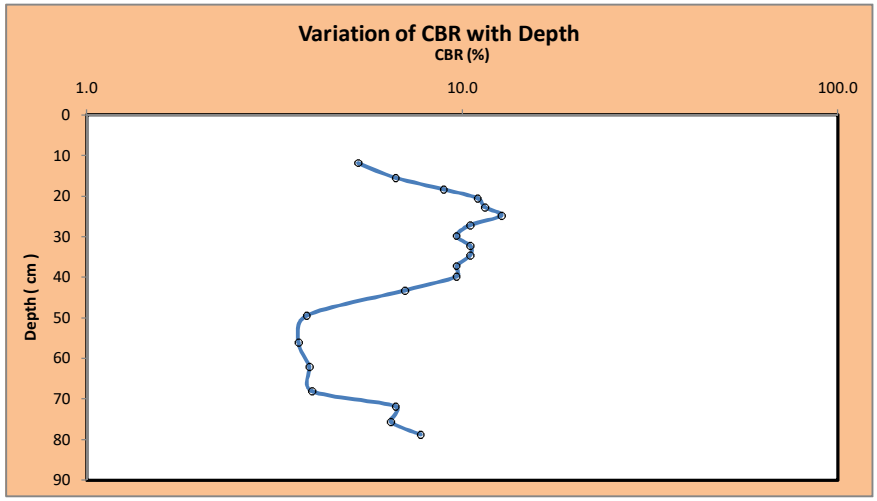
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	7.2	0	72		7.2
1	11.8	46	118	5.3	11.8
2	15.5	37	155	6.6	15.5
3	18.3	28	183	8.9	18.3
4	20.6	23	206	11.0	20.6
5	22.8	22	228	11.5	22.8
6	24.8	20	248	12.7	24.8
7	27.2	24	272	10.5	27.2
8	29.8	26	298	9.6	29.8
9	32.2	24	322	10.5	32.2
10	34.6	24	346	10.5	34.6
11	37.2	26	372	9.6	37.2
12	39.8	26	398	9.6	39.8
13	43.3	35	433	7.0	43.3
14	49.5	62	495	3.8	49.5
15	56	65	560	3.7	56
16	62.1	61	621	3.9	62.1
17	68.1	60	681	4.0	68.1
18	71.8	37	718	6.6	71.8
19	75.6	38	756	6.5	75.6
20	78.8	32	788	7.7	78.8

topsoil / dist ground

Tidal Flat



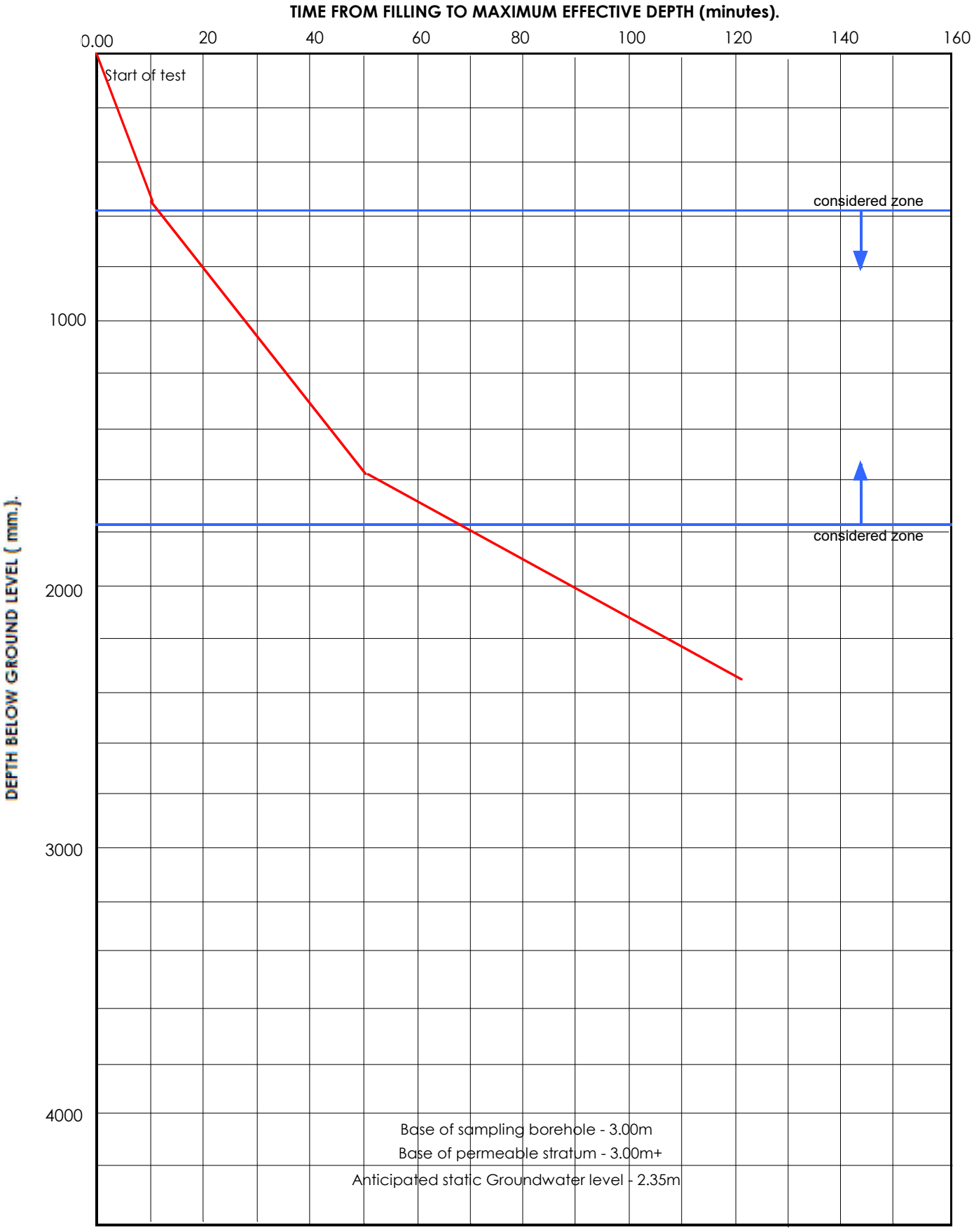


Percolation Graph

Falling Head Test

Soak BH4

Project Location : **Butterfly Park, Long Sutton.**
Client : **D Brown Builders Ltd.**
Date of SI : **01/06/23**



T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH5.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 01.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Mid brown, silty **Topsoil** containing occasional fine fragments of brick and stone..				0.00 - 0.65	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Topsoil			(0.38)					
			0.38					
Loose to medium dense, buff brown and rust brown **Silt.**				0.65 - 1.70	U	2	S N9	
							0.81	
							End of Test	
Tidal Flat Deposits			(1.12)					
			1.50					
Loose, buff brown and rust brown, slightly clayey **Silt.**			(0.25)	1.70 - 3.00	U	3	S N7	
			1.75					
Medium dense, mid brown **Silt.**				2.15			S N11	
				2.60			S N13	
			3.00					
			End of Borehole					

Observations

The stratum became wet at around 2.55m depth. On completion groundwater level in the open borehole was subsequently measured at 2.15m beneath the surface.

A 'falling head' (permeability test was performed within the completed borehole. The results of the test are presented on the enclosed data sheets.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH5
Date of Test	01/06/2023

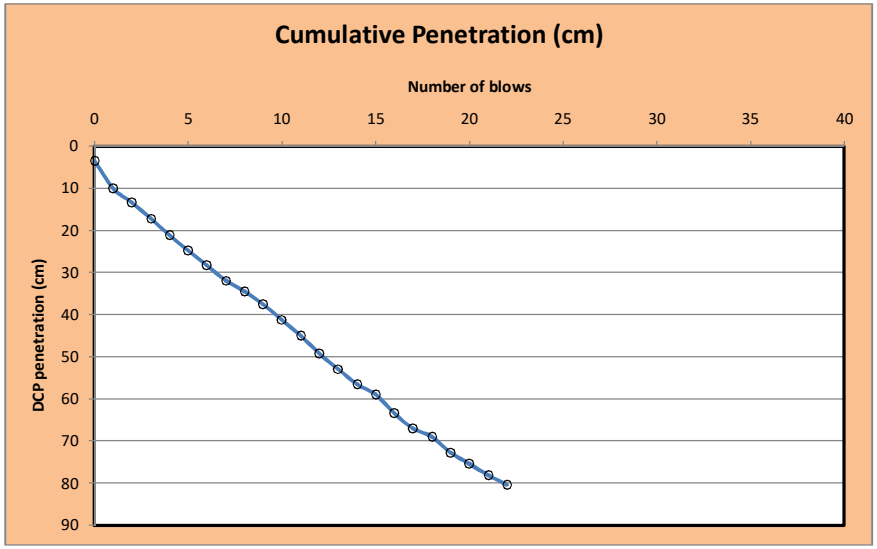
Notes - test from site surface level

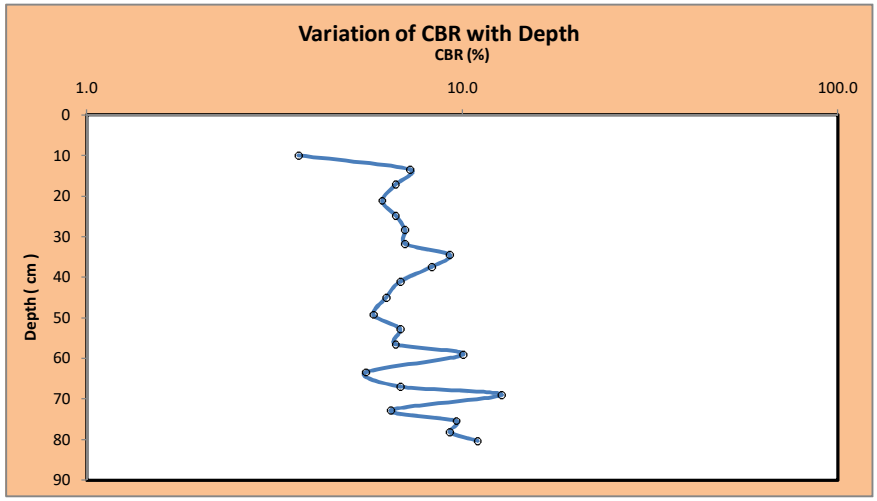
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	3.5	0	35		3.5
1	10	65	100	3.7	10
2	13.4	34	134	7.3	13.4
3	17.1	37	171	6.6	17.1
4	21.1	40	211	6.1	21.1
5	24.8	37	248	6.6	24.8
6	28.3	35	283	7.0	28.3
7	31.8	35	318	7.0	31.8
8	34.5	27	345	9.3	34.5
9	37.5	30	375	8.3	37.5
10	41.1	36	411	6.8	41.1
11	45	39	450	6.3	45
12	49.2	42	492	5.8	49.2
13	52.8	36	528	6.8	52.8
14	56.5	37	565	6.6	56.5
15	59	25	590	10.1	59
16	63.4	44	634	5.5	63.4
17	67	36	670	6.8	67
18	69	20	690	12.7	69
19	72.8	38	728	6.5	72.8
20	75.4	26	754	9.6	75.4
21	78.1	27	781	9.3	78.1
22	80.4	23	804	11.0	80.4

topsoil / dist ground

Tidal Flat



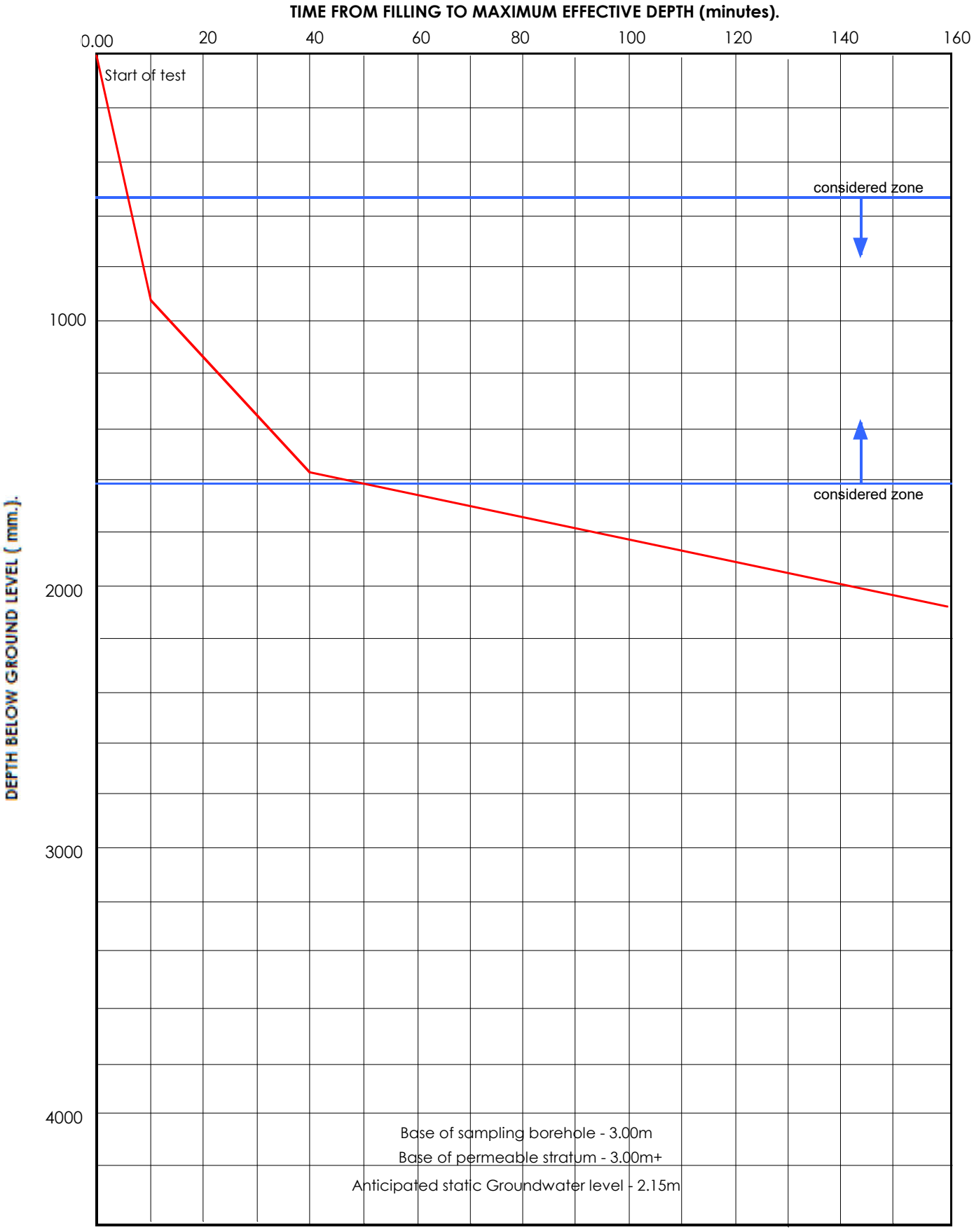


Percolation Graph

Falling Head Test

Soak BH5

Project Location : **Butterfly Park, Long Sutton.**
Client : **D Brown Builders Ltd.**
Date of SI : **01/06/23**



T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH6.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 01.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Mid brown, silty **Topsoil** containing occasional fine fragments of brick and stone..				0.00 - 0.60	U	1		
Topsoil			(0.43)					
			0.43					
Medium dense, becoming loose to medium dense buff brown and rust brown **Silt.**				0.60 - 1.60	U	2	S N10	
Tidal Flat Deposits			(2.37)	1.60 - 3.00	U	3	S N9	
				2.05	D	1	S N8	
				2.50	D	2	S N8	
			2.80					
Loose, greyish brown **Silt.**			(0.30)	3.00 - 4.50	U	4	S N5	
			3.10					
Loose, to medium dense, dark grey **Silt.**				3.45			S N6	
				3.90			S N9	
			4.50					
			End of Borehole					

Observations

The stratum became wet at around 2.30m depth. On completion the groundwater level in the open borehole was subsequently measured at 2.09m beneath the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH7.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 01.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Mid brown, silty **Topsoil**.				0.00 - 0.60	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Topsoil			(0.43)					
			0.43					
Loose, buff brown and rust brown **Silt.**				0.60 - 1.60	U	2	S N8	
								0.78
							End of Test	
Tidal Flat Deposits			(2.37)	1.60 - 3.00	U	3	S N6	
				2.05	D	1	S N7	
Loose, greyish brown **Silt.**			2.80					
			3.00					
			End of Borehole					

Observations

The stratum became wet at around 2.00m depth. On completion groundwater level in the open borehole was subsequently measured at 1.85m beneath the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH7
Date of Test	01/06/2023

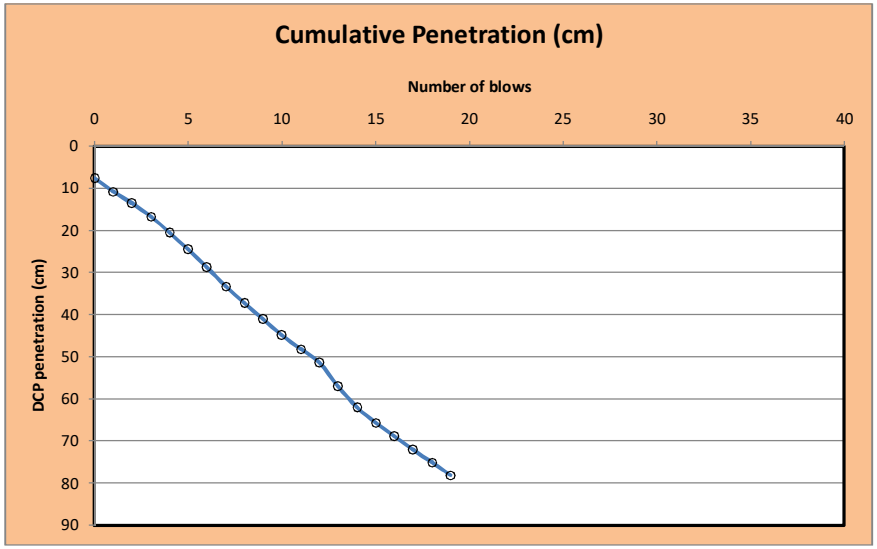
Notes - test from site surface level

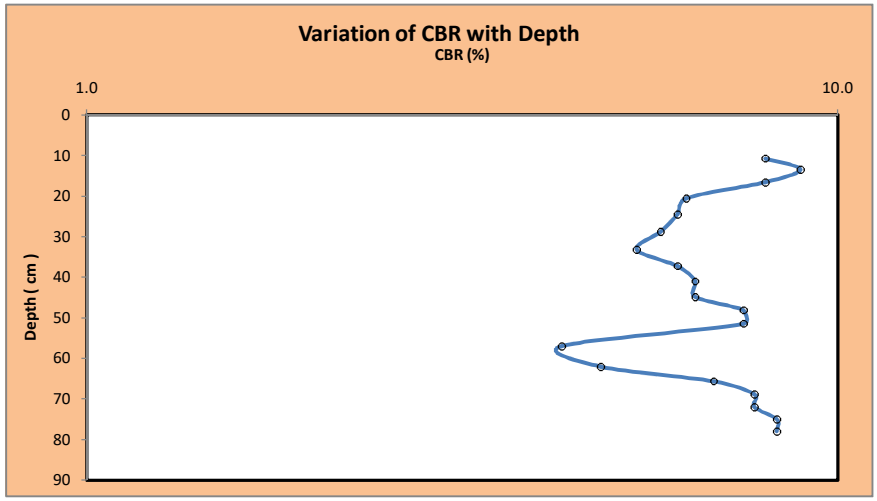
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	7.6	0	76		7.6
1	10.7	31	107	8.0	10.7
2	13.5	28	135	8.9	13.5
3	16.6	31	166	8.0	16.6
4	20.5	39	205	6.3	20.5
5	24.5	40	245	6.1	24.5
6	28.7	42	287	5.8	28.7
7	33.2	45	332	5.4	33.2
8	37.2	40	372	6.1	37.2
9	41	38	410	6.5	41
10	44.8	38	448	6.5	44.8
11	48.1	33	481	7.5	48.1
12	51.4	33	514	7.5	51.4
13	57	56	570	4.3	57
14	62	50	620	4.8	62
15	65.6	36	656	6.8	65.6
16	68.8	32	688	7.7	68.8
17	72	32	720	7.7	72
18	75	30	750	8.3	75
19	78	30	780	8.3	78

topsoil / dist ground

Tidal Flat





T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH8.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 01.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Mid brown, silty **Topsoil**..				0.00 - 0.60	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Topsoil			(0.42)					
			0.42					
Loose, buff brown and rust brown **Silt.**				0.60 - 1.60	U	2	S N8	
							0.80 **End of Test**	
			(1.88)					
Tidal Flat Deposits				1.60 - 3.00	U	3	S N6	
				2.05	D	1	S N7	
Loose, brown and dark grey stained, silty **Clay.**			2.30 (0.20)					
			2.50					
Loose, dark grey **Silt.**								
			3.00 **End of Borehole**					

Observations

The stratum became wet at around 2.10m depth. On completion groundwater level in the open borehole was measured at 2.04m beneath the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH8
Date of Test	01/06/2023

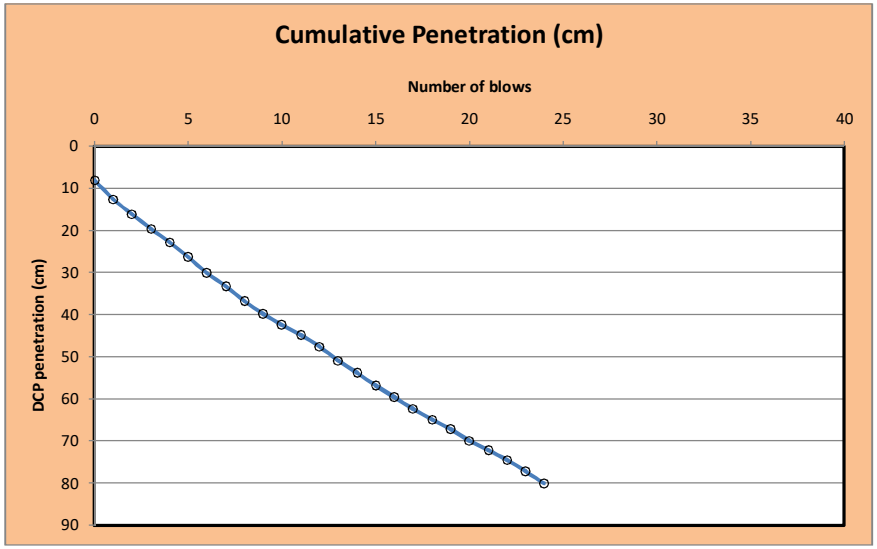
Notes - test from site surface level

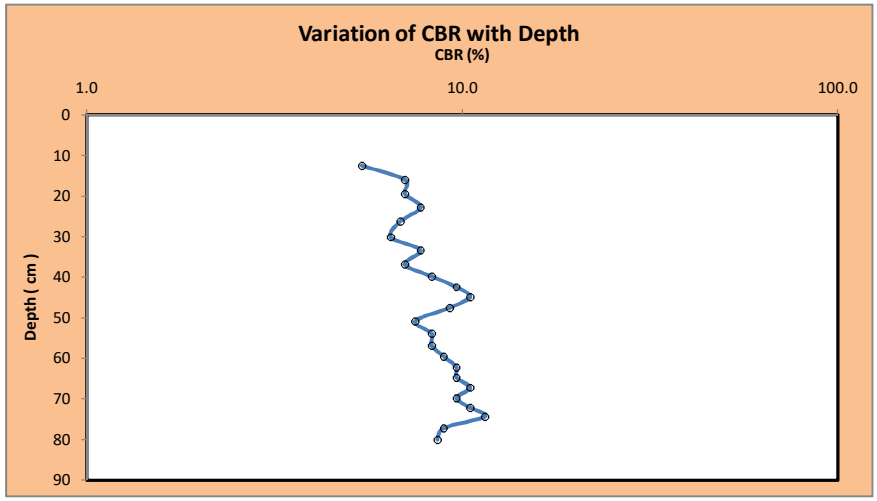
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	8	0	80		8
1	12.5	45	125	5.4	12.5
2	16	35	160	7.0	16
3	19.5	35	195	7.0	19.5
4	22.7	32	227	7.7	22.7
5	26.3	36	263	6.8	26.3
6	30.1	38	301	6.5	30.1
7	33.3	32	333	7.7	33.3
8	36.8	35	368	7.0	36.8
9	39.8	30	398	8.3	39.8
10	42.4	26	424	9.6	42.4
11	44.8	24	448	10.5	44.8
12	47.5	27	475	9.3	47.5
13	50.8	33	508	7.5	50.8
14	53.8	30	538	8.3	53.8
15	56.8	30	568	8.3	56.8
16	59.6	28	596	8.9	59.6
17	62.2	26	622	9.6	62.2
18	64.8	26	648	9.6	64.8
19	67.2	24	672	10.5	67.2
20	69.8	26	698	9.6	69.8
21	72.2	24	722	10.5	72.2
22	74.4	22	744	11.5	74.4
23	77.2	28	772	8.9	77.2
24	80.1	29	801	8.6	80.1

topsoil / dist ground

Tidal Flat





T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH9.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 01.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Dark brown, silty, clayey soil containing very occasional fine stones. **Topsoil / Disturbed Ground** Mid brown and dark brown silt containing occasional fine fragments of brick and stone.			(0.12) 0.12	0.00 - 0.65	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
			(0.18) 0.30					
Loose to medium dense, buff brown and rust brown **Silt.**			(0.55) 0.85	0.65 - 1.70	U	2	S N9	
							End of Test 0.80	64kN/m²
Firm, mid brown, very silty **Clay.**				0.90				
				1.20			Vane	72kN/m²
Tidal Flat Deposits			(0.95)					
				1.50			Vane	72kN/m²
				1.70 - 3.05	U	3	S N9	
Firm, grey, mottled rust brown, very silty **Clay** containing occasional lenses of rust brown silt**.**			1.80 (0.35)	1.80				65kN/m²
			2.15	2.10 2.15	D	1	S N14	68kN/m²
Medium dense, dark grey **Silt.**				2.60	D	1	S N19	
			3.05					
			End of Borehole					

Observations

The stratum became wet at around 2.27m depth. On completion groundwater level in the open borehole was subsequently measured at 1.83m beneath the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH9
Date of Test	01/06/2023

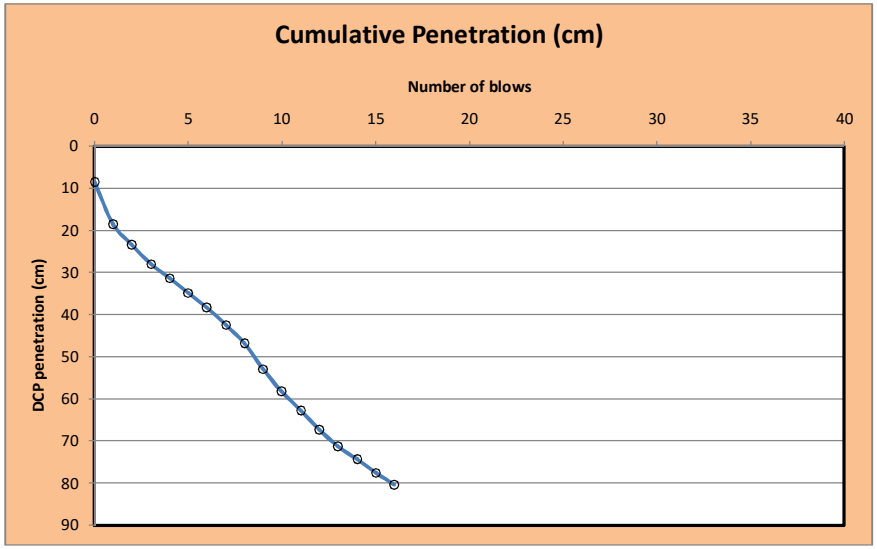
Notes - test from site surface level

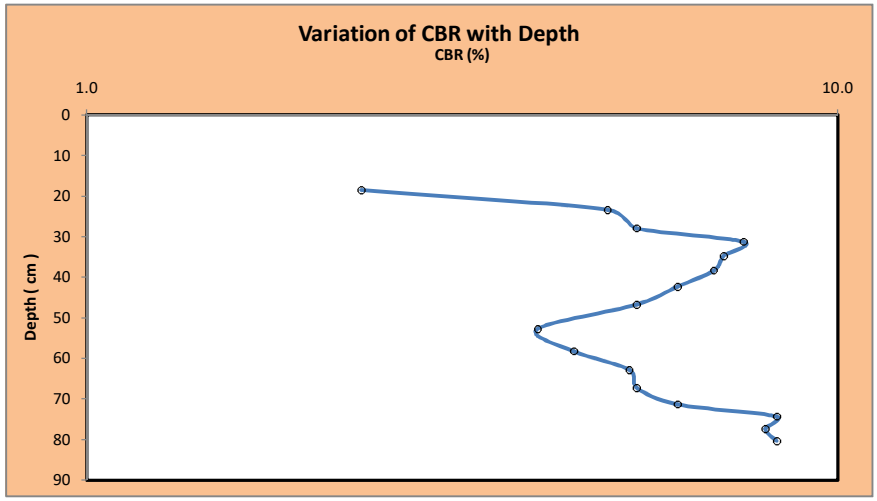
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	8.5	0	85		8.5
1	18.5	100	185	2.3	18.5
2	23.4	49	234	4.9	23.4
3	27.9	45	279	5.4	27.9
4	31.2	33	312	7.5	31.2
5	34.7	35	347	7.0	34.7
6	38.3	36	383	6.8	38.3
7	42.3	40	423	6.1	42.3
8	46.8	45	468	5.4	46.8
9	52.8	60	528	4.0	52.8
10	58.2	54	582	4.5	58.2
11	62.8	46	628	5.3	62.8
12	67.3	45	673	5.4	67.3
13	71.3	40	713	6.1	71.3
14	74.3	30	743	8.3	74.3
15	77.4	31	774	8.0	77.4
16	80.4	30	804	8.3	80.4

topsoil / dist ground

Tidal Flat





T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH10.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 02.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Mid brown, silty **Topsoil** containing occasional fine fragments of brick and stone..				0.00 - 0.60	U	1		
Topsoil			(0.38)					
			0.38					
Loose, buff brown and rust brown **Silt.**			(0.42)	0.60 - 1.60	U	2	S N8	
Tidal Flat Deposits			0.80					
Firm to stiff, buff brown and rust brown, very silty **Clay** / slightly clayey **Silt.**			(0.25)	1.00			Vane	82kN/m²
			1.05					
Loose becoming medium dense, buff brown and rust brown **Silt.**				1.60 - 3.00	U	3	S N7	
			(1.75)	2.05	D	1	S N12	
				2.50	D	2	S N11	
			2.80					
Loose, greyish brown **Silt.**			3.00					
			End of Borehole					

Observations

The stratum became wet at around 2.10m depth. On completion groundwater level in the open borehole was subsequently measured at 1.87m beneath the surface.

A 'falling head' permeability test was performed within the completed borehole. The results of the test are presented on the enclosed data sheets.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

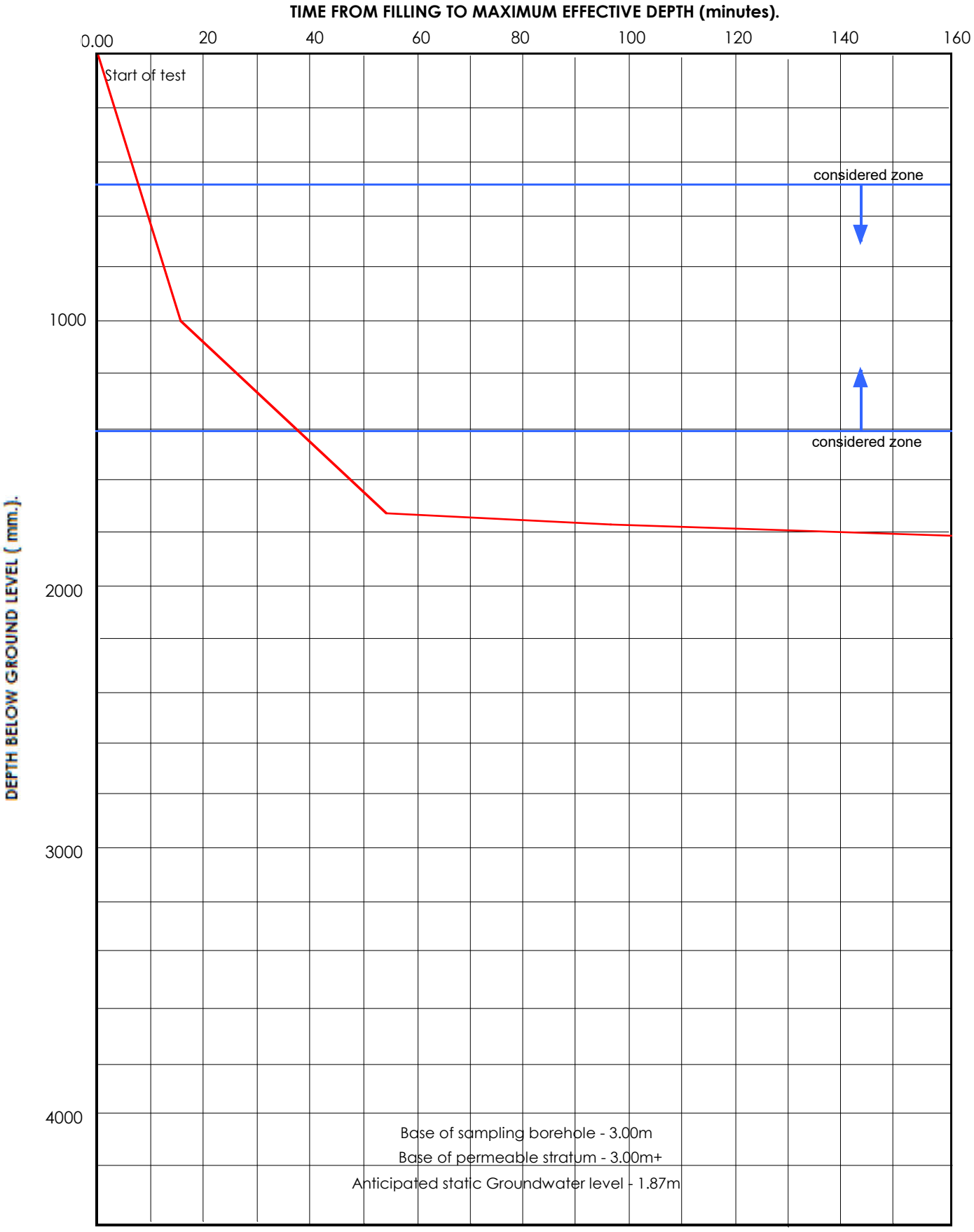
Fig.

Percolation Graph

Falling Head Test

Soak BH10

Project Location : **Butterfly Park, Long Sutton.**
Client : **D Brown Builders Ltd.**
Date of SI : **02/06/23**



T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH11.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 02.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Mid brown, silty **Topsoil.**				0.00 - 0.60	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Topsoil			(0.41)					
			0.41					
Loose to medium dense, buff brown and rust brown **Silt.**				0.60 - 1.60	U	2	S N7	
							0.82 **End of Test**	
Tidal Flat Deposits			(1.89)	1.60 - 3.05	U	3	S N9	
				2.05	D	1	S N8	
			2.30					
Loose becoming medium dense, dark grey **Silt.**				2.50	D	1	S N9	
			3.05 **End of Borehole**					

Observations

The stratum became wet at around 2.10m depth. On completion groundwater level in the open borehole was subsequently measured at 1.95m beneath the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH11
Date of Test	02/06/2023

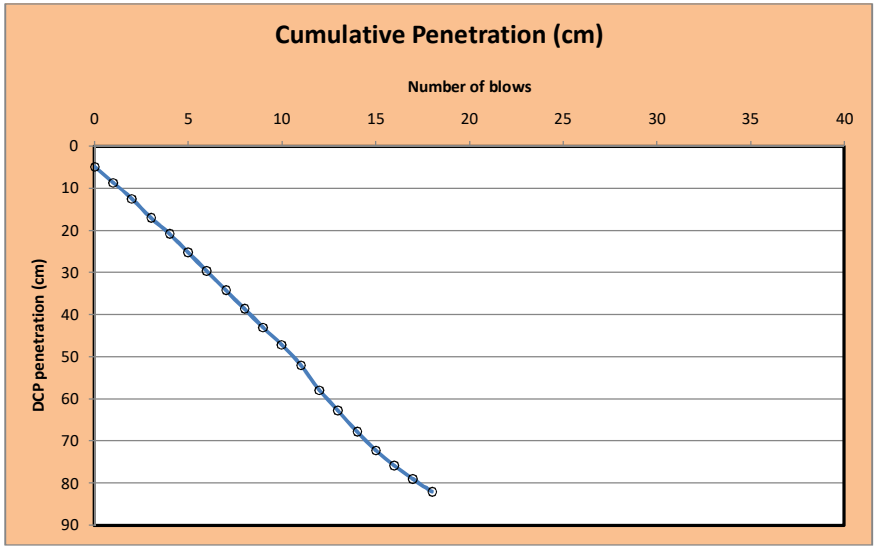
Notes - test from site surface level

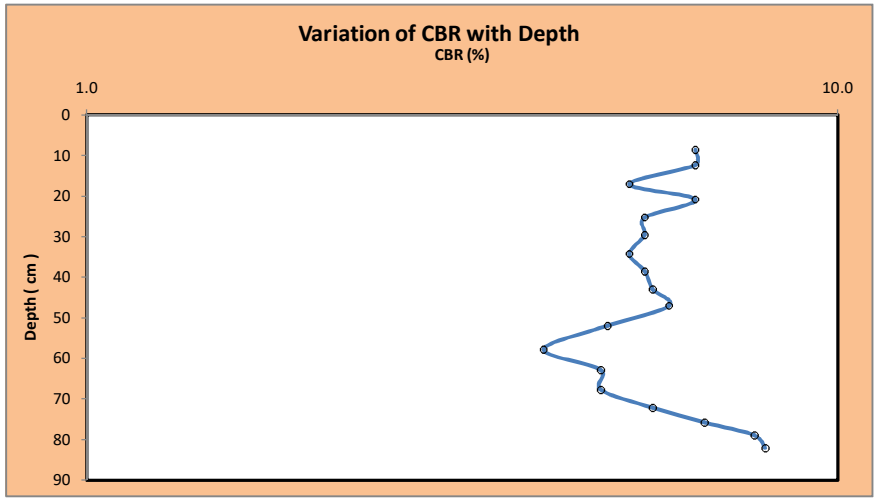
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	4.8	0	48		4.8
1	8.6	38	86	6.5	8.6
2	12.4	38	124	6.5	12.4
3	17	46	170	5.3	17
4	20.8	38	208	6.5	20.8
5	25.2	44	252	5.5	25.2
6	29.6	44	296	5.5	29.6
7	34.2	46	342	5.3	34.2
8	38.6	44	386	5.5	38.6
9	42.9	43	429	5.7	42.9
10	47	41	470	6.0	47
11	51.9	49	519	4.9	51.9
12	57.8	59	578	4.1	57.8
13	62.8	50	628	4.8	62.8
14	67.8	50	678	4.8	67.8
15	72.1	43	721	5.7	72.1
16	75.8	37	758	6.6	75.8
17	79	32	790	7.7	79
18	82.1	31	821	8.0	82.1

topsoil / dist ground

Tidal Flat





T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH12.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 02.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Dark brown, silty soil containing very occasional fine stones. **Topsoil**			(0.38) 0.38	0.00 - 0.60	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Loose becoming medium dense, buff brown and rust brown **Silt.**				0.60 - 1.60	U	2	S N8	
							0.82 **End of Test**	
Tidal Flat Deposits			(2.32)	1.60 - 3.05	U	3	S N4	
				2.05	D	1	S N5	
				2.50	D	1	S N10	
Medium dense, greyish brown **Silt.**			2.70					
			3.05 **End of Borehole**					

Observations

The stratum became wet at around 2.35m depth. On completion groundwater level in the open borehole was subsequently measured at 1.72m beneath the surface.

A 'falling head' (permeability test was performed within the completed borehole. The results of the test are presented on the enclosed data sheets.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH12
Date of Test	02/06/2023

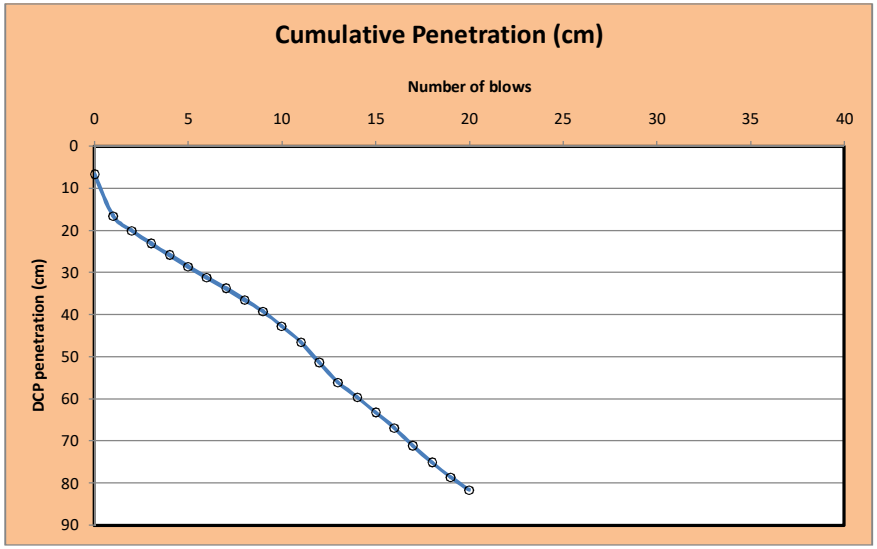
Notes - test from site surface level

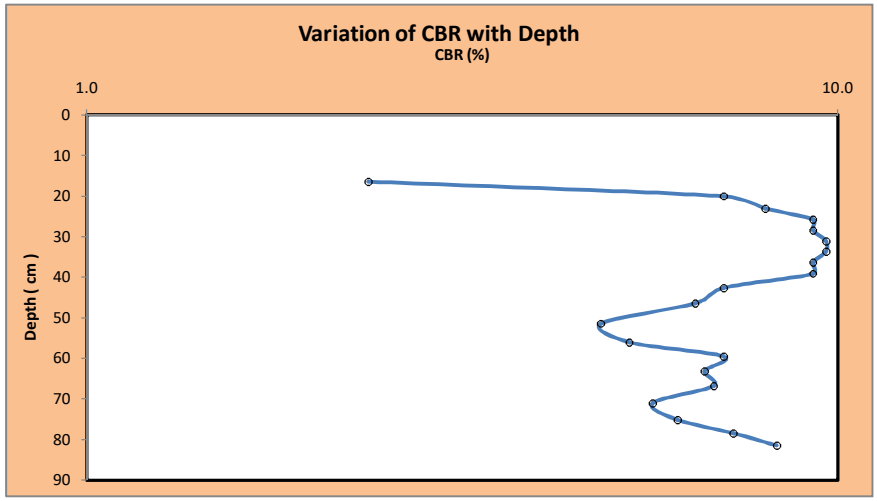
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	6.7	0	67		6.7
1	16.5	98	165	2.4	16.5
2	20	35	200	7.0	20
3	23.1	31	231	8.0	23.1
4	25.8	27	258	9.3	25.8
5	28.5	27	285	9.3	28.5
6	31.1	26	311	9.6	31.1
7	33.7	26	337	9.6	33.7
8	36.4	27	364	9.3	36.4
9	39.1	27	391	9.3	39.1
10	42.6	35	426	7.0	42.6
11	46.4	38	464	6.5	46.4
12	51.4	50	514	4.8	51.4
13	56	46	560	5.3	56
14	59.5	35	595	7.0	59.5
15	63.2	37	632	6.6	63.2
16	66.8	36	668	6.8	66.8
17	71.1	43	711	5.7	71.1
18	75.1	40	751	6.1	75.1
19	78.5	34	785	7.3	78.5
20	81.5	30	815	8.3	81.5

topsoil / dist ground

Tidal Flat



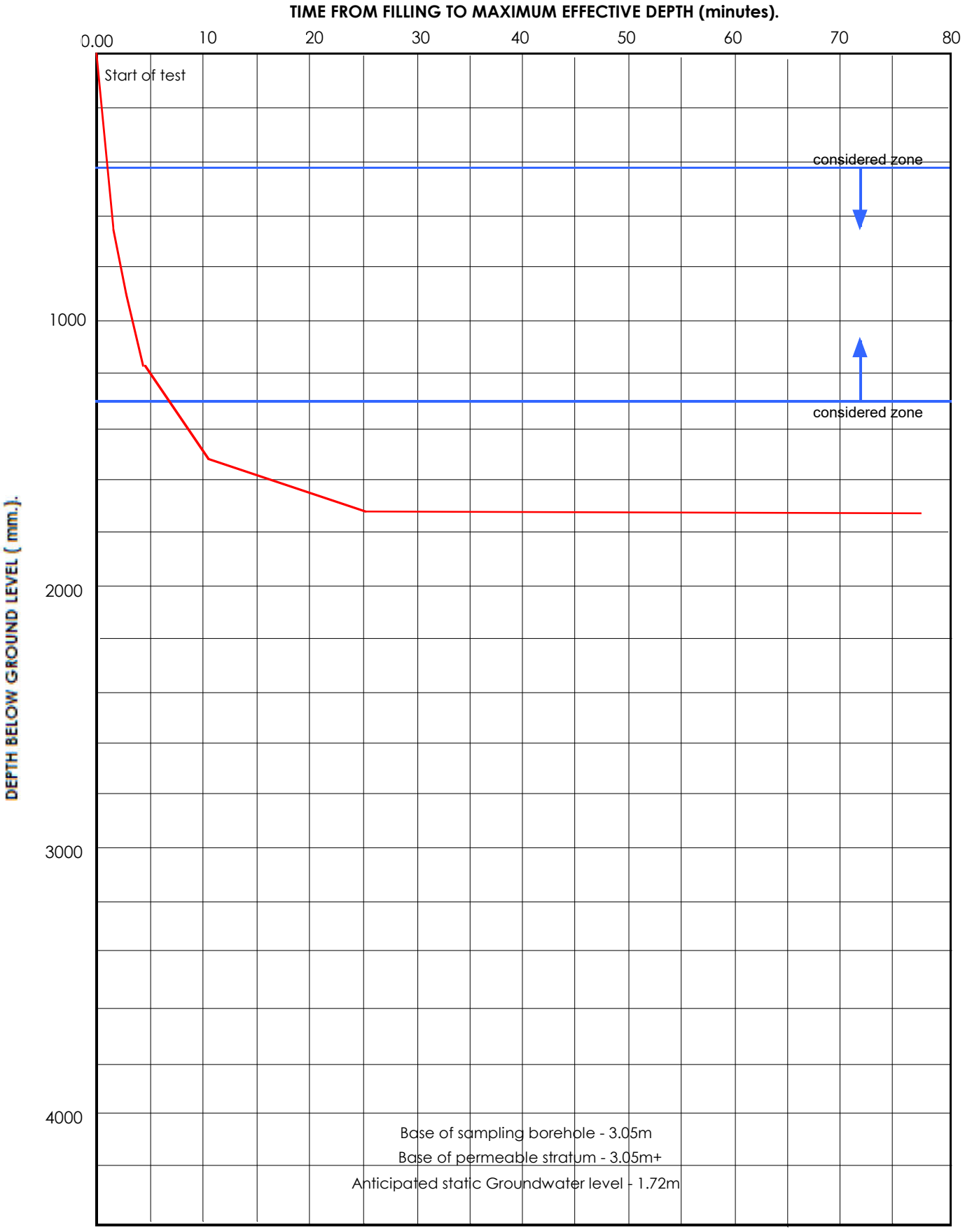


Percolation Graph

Falling Head Test

Soak BH12

Project Location : **Butterfly Park, Long Sutton.**
Client : **D Brown Builders Ltd.**
Date of SI : **02/06/23**



T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH13.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 02.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Dark brown, silty soil containing very occasional fine stones. **Topsoil**			(0.44) 0.44	0.00 - 0.60	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Loose, buff brown and rust brown **Silt.**				0.60 - 1.60	U	2	S N8	
							0.80 **End of Test**	
Tidal Flat Deposits			(2.26)	1.60 - 3.05	U	3	S N5	
				2.05	D	1	S N5	
				2.50	D	2	S N7	
Medium dense, greyish brown **Silt.**			2.70					
			3.05 **End of Borehole**					

Observations

The stratum became wet at around 2.05m depth. On completion groundwater level in the open borehole was subsequently measured at 1.95m beneath the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH13
Date of Test	02/06/2023

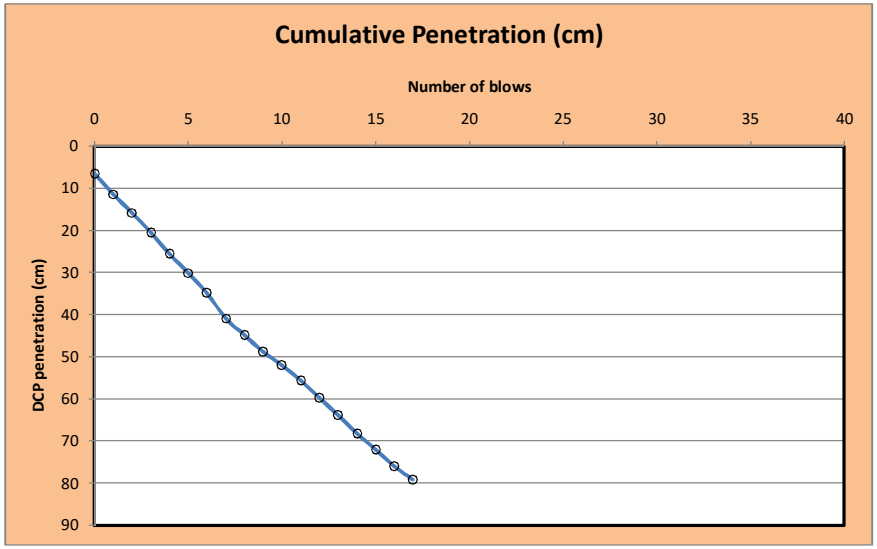
Notes - test from site surface level

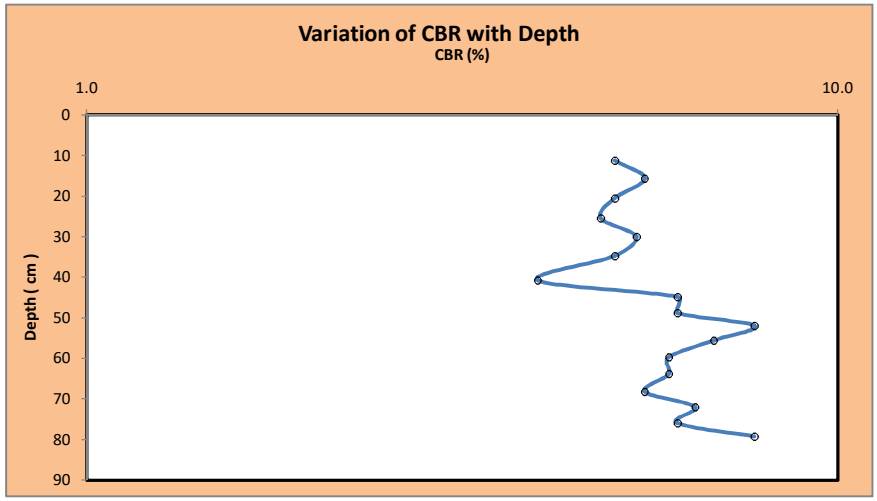
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	6.5	0	65		6.5
1	11.3	48	113	5.0	11.3
2	15.7	44	157	5.5	15.7
3	20.5	48	205	5.0	20.5
4	25.5	50	255	4.8	25.5
5	30	45	300	5.4	30
6	34.8	48	348	5.0	34.8
7	40.8	60	408	4.0	40.8
8	44.8	40	448	6.1	44.8
9	48.8	40	488	6.1	48.8
10	52	32	520	7.7	52
11	55.6	36	556	6.8	55.6
12	59.7	41	597	6.0	59.7
13	63.8	41	638	6.0	63.8
14	68.2	44	682	5.5	68.2
15	72	38	720	6.5	72
16	76	40	760	6.1	76
17	79.2	32	792	7.7	79.2

topsoil / dist ground

Tidal Flat



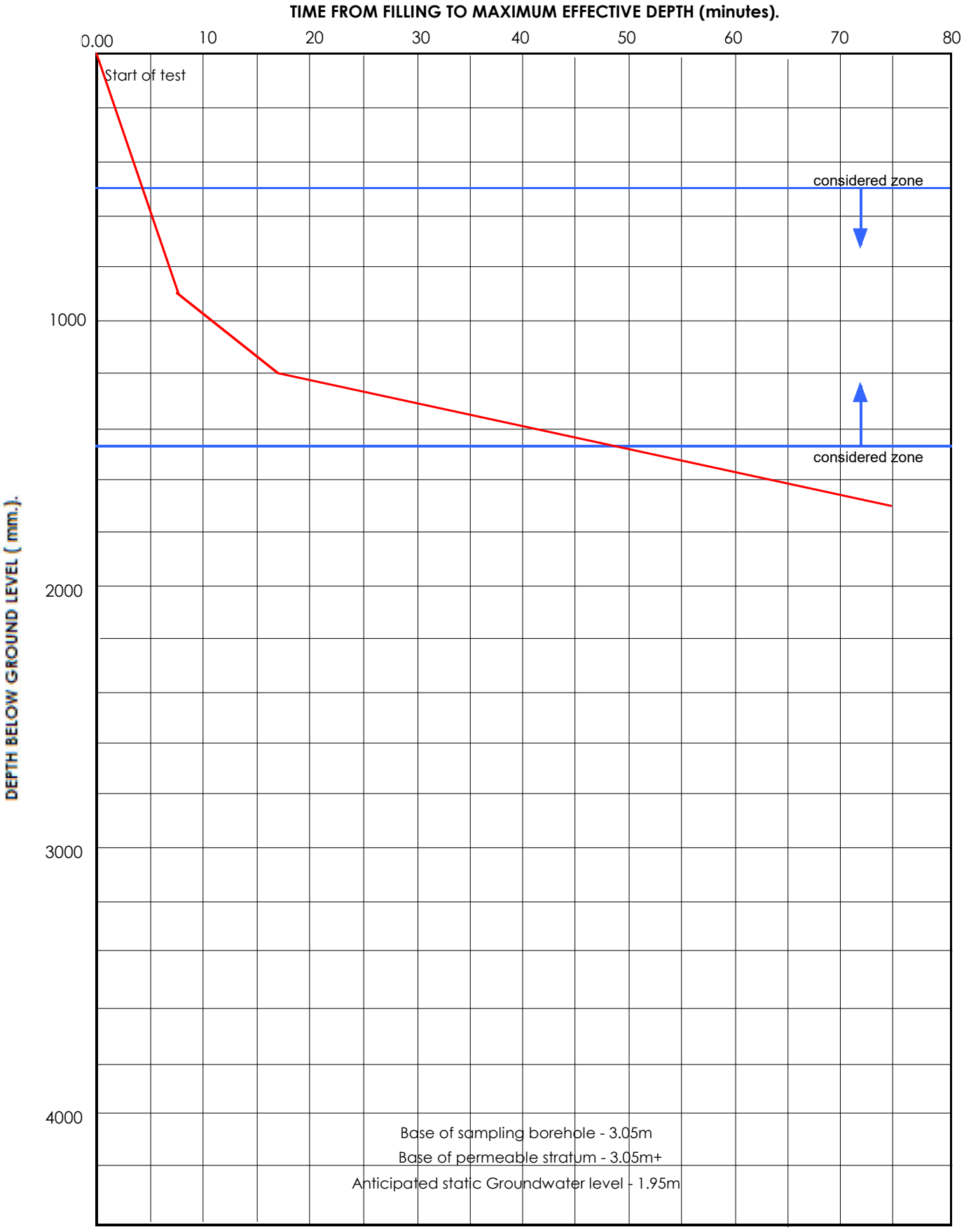


Percolation Graph

Falling Head Test

Soak BH13

Project Location : **Butterfly Park, Long Sutton.**
Client : **D Brown Builders Ltd.**
Date of SI : **02/06/23**



T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH14.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 02.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Dark brown, silty soil containing very occasional fine stones.			(0.34)	0.00 - 0.65	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Topsoil			0.34					
Loose, buff brown and rust brown **Silt.**				0.65 - 1.70	U	2	S N6	
							0.80 **End of Test**	
Tidal Flat Deposits			(2.46)	1.70 - 3.05	U	3	S N8	
				2.15	D	1	S N6	
				2.60	D	2	S N5	
Medium dense, greyish brown **Silt.**			2.80					
			3.05 **End of Borehole**					

Observations

The stratum became wet at around 2.34m depth. On completion groundwater level in the open borehole was subsequently measured at 2.06m beneath the surface.

A 'falling head' permeability test was performed within the completed borehole. The results of the test are presented on the enclosed data sheets.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH14
Date of Test	02/06/2023

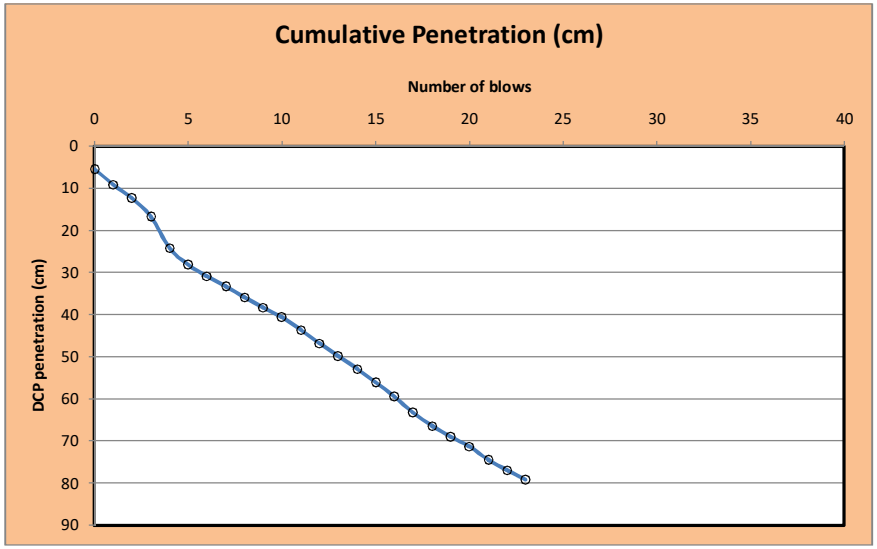
Notes - test from site surface level

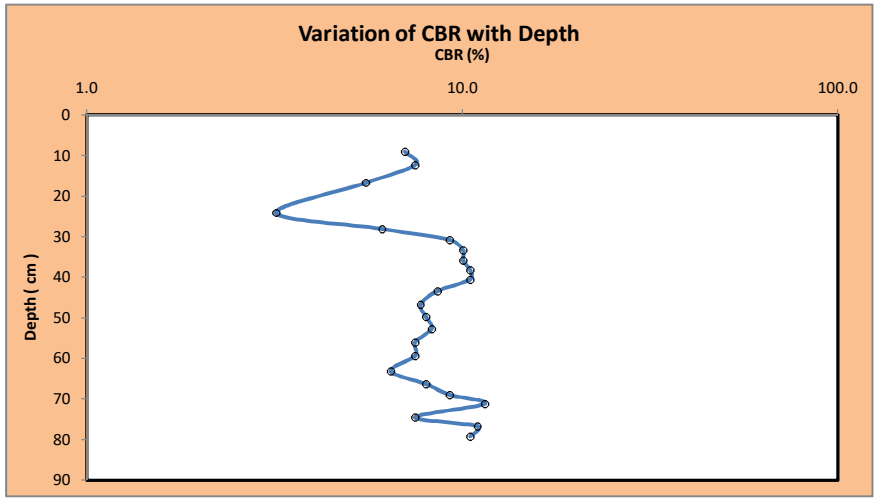
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	5.5	0	55		5.5
1	9	35	90	7.0	9
2	12.3	33	123	7.5	12.3
3	16.7	44	167	5.5	16.7
4	24.1	74	241	3.2	24.1
5	28.1	40	281	6.1	28.1
6	30.8	27	308	9.3	30.8
7	33.3	25	333	10.1	33.3
8	35.8	25	358	10.1	35.8
9	38.2	24	382	10.5	38.2
10	40.6	24	406	10.5	40.6
11	43.5	29	435	8.6	43.5
12	46.7	32	467	7.7	46.7
13	49.8	31	498	8.0	49.8
14	52.8	30	528	8.3	52.8
15	56.1	33	561	7.5	56.1
16	59.4	33	594	7.5	59.4
17	63.2	38	632	6.5	63.2
18	66.3	31	663	8.0	66.3
19	69	27	690	9.3	69
20	71.2	22	712	11.5	71.2
21	74.5	33	745	7.5	74.5
22	76.8	23	768	11.0	76.8
23	79.2	24	792	10.5	79.2

topsoil / dist ground

Tidal Flat



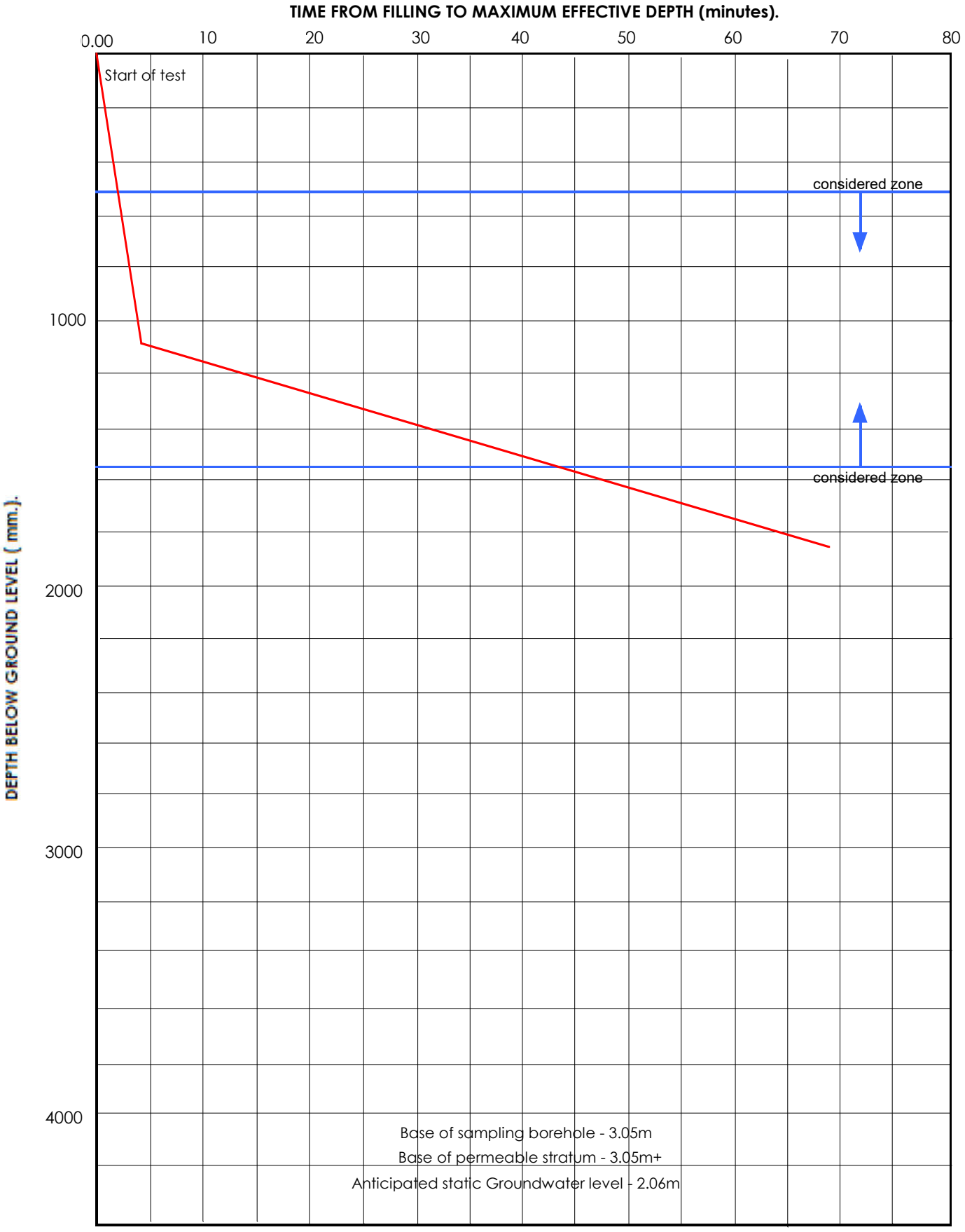


Percolation Graph

Falling Head Test

Soak BH14

Project Location : **Butterfly Park, Long Sutton.**
Client : **D Brown Builders Ltd.**
Date of SI : **02/06/23**



T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH15.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 02.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Dark brown, silty soil containing very occasional fine stones.			(0.35)	0.00 - 0.60	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Topsoil			0.35					
Loose becoming medium dense, buff brown and rust brown **Silt.**				0.60 - 1.65	U	2	S N8	
							0.81 **End of Test**	
Tidal Flat Deposits			(2.26)	1.65 - 3.05	U	3		
				2.05	D	1	S N7	
				2.50	D	2	S N10	
Medium dense, grey **Silt.**			2.65					
			2.95 **End of Borehole**					

Observations

The stratum became wet at around 2.00m depth. On completion groundwater level in the open borehole was subsequently measured at 1.80m beneath the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH15
Date of Test	02/06/2023

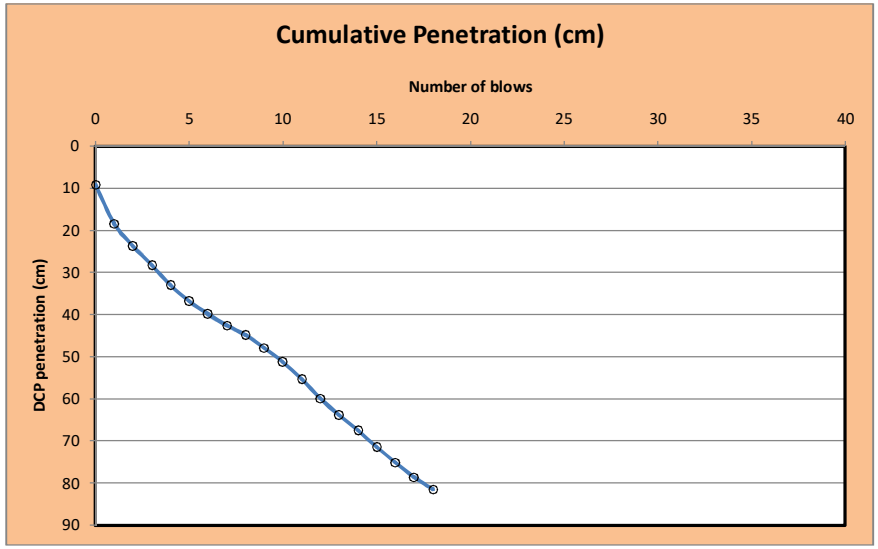
Notes - test from site surface level

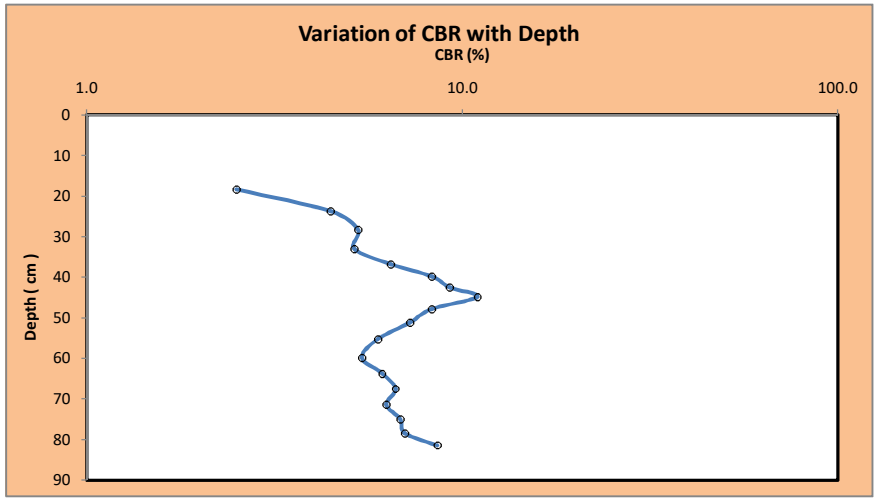
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	9	0	90		9
1	18.3	93	183	2.5	18.3
2	23.7	54	237	4.5	23.7
3	28.3	46	283	5.3	28.3
4	33	47	330	5.2	33
5	36.8	38	368	6.5	36.8
6	39.8	30	398	8.3	39.8
7	42.5	27	425	9.3	42.5
8	44.8	23	448	11.0	44.8
9	47.8	30	478	8.3	47.8
10	51.2	34	512	7.3	51.2
11	55.3	41	553	6.0	55.3
12	59.8	45	598	5.4	59.8
13	63.8	40	638	6.1	63.8
14	67.5	37	675	6.6	67.5
15	71.4	39	714	6.3	71.4
16	75	36	750	6.8	75
17	78.5	35	785	7.0	78.5
18	81.4	29	814	8.6	81.4

topsoil / dist ground

Tidal Flat





T.L.P. Ground Investigations Ltd.	**Borehole Record** Dynamic Sampling Rig	**Location :** Proposed Residential Development, Butterfly Park, Little London, Long Sutton.	**Borehole No.** BH16.
Carried out For D. Brown Builders Ltd.		Ground Level	Co-ordinates	Date : 02.06.23.

Description	Reduced Level	Legend	Depth & Thickness	Samples/Tests: Depth	samples: Type	samples: No.	Test	Field Records
Dark brown, silty soil containing very occasional fine stones. **Topsoil**			(0.41) 0.41	0.00 - 0.60	U	1		CBR test performed adjacent to the borehole using TRL 587 Method.
Loose, buff brown and rust brown **Silt.**			(0.54) 0.95	0.60 - 1.60	U	2	S N7	
							0.81 **End of Test**	
Firm and firm to stiff, very silty **Clay** containing occasional lenses of silt.				1.00			Vane	50kN/m²
				1.30			Vane	77kN/m²
Tidal Flat Deposits			(1.05)	1.60 - 3.00	U	3	S N3	80kN/m²
				1.90			Vane	35kN/m²
Loose becoming medium dense, buff brown and rust brown **Silt.**			2.00 (0.80)	2.05	D	1	S N6	
				2.50	D	2	S N10	
Medium dense, grey **Silt.**			2.80 2.95					
			End of Borehole					

Observations

The stratum became wet at around 1.92m depth. On completion groundwater level in the open borehole was subsequently measured at 1.84m beneath the surface.

S.P.T. : Where full penetration has not been achieved the number of blows for the quoted penetration is given (Not 'N' value)

Depths: All depths and reduce levels in metres. Thickness given in brackets in depth column.

Samples/Test Key.

D Disturbed Sample
B Bulk Sample
W Water Sample
U Undisturbed Core sample
S Standard Penetration Test
V Vane Test

Remarks

Logged by S. P. T. / J. T.

Scale 1 : 25

Fig.

TRL 587 CBR Analysis

Site	Butterfly Park, Long Sutton
Sample Location	BH16
Date of Test	02/06/2023

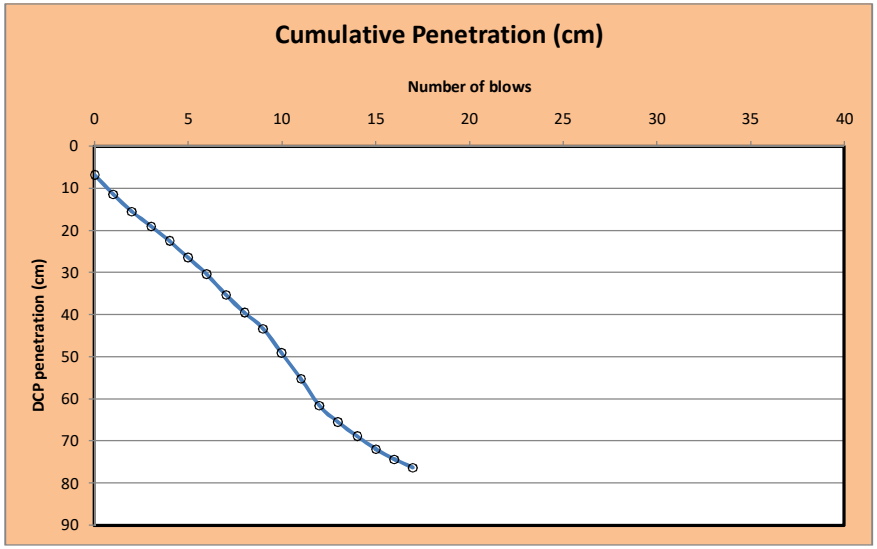
Notes - test from site surface level

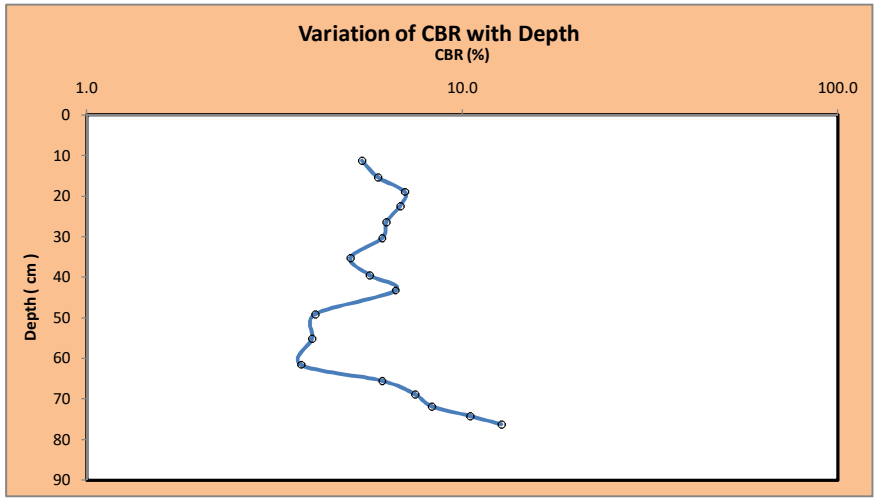
ANALYSIS OF DYNAMIC CONE PENETRATION TEST RESULT

No. of Blows	DCP Scale Reading (cm)	Penetration /Blow (mm)	Cumulative Penetration (mm)	CBR Value (%)	Cumulative Penetration (cm)
0	6.8	0	68		6.8
1	11.3	45	113	5.4	11.3
2	15.4	41	154	6.0	15.4
3	18.9	35	189	7.0	18.9
4	22.5	36	225	6.8	22.5
5	26.4	39	264	6.3	26.4
6	30.4	40	304	6.1	30.4
7	35.2	48	352	5.0	35.2
8	39.5	43	395	5.7	39.5
9	43.2	37	432	6.6	43.2
10	49.1	59	491	4.1	49.1
11	55.1	60	551	4.0	55.1
12	61.5	64	615	3.7	61.5
13	65.5	40	655	6.1	65.5
14	68.8	33	688	7.5	68.8
15	71.8	30	718	8.3	71.8
16	74.2	24	742	10.5	74.2
17	76.2	20	762	12.7	76.2

topsoil / dist ground

Tidal Flat





Calculation of Soil Infiltration Rate
Butterfly Park Long Sutton

Parameter	BH1	BH3	BH4	BH5	BH10	BH12	BH13	BH14
diameter of borehole	0.105	0.105	0.105	0.105	0.105	0.105	0.105	0.105
Height of water at start of considered zone (m) H1	1.6725	1.3425	1.7625	1.6125	1.4025	1.29	1.4625	1.545
Height of water at end of considered zone (m) H2	0.5575	0.4475	0.5875	0.5375	0.4675	0.43	0.4875	0.515
Considered depth change (m) = H1 - H2	1.115	0.895	1.175	1.075	0.935	0.86	0.975	1.03
Volume out flowing within considered depth	0.009654802	0.007749818	0.010174342	0.009308441	0.008096179	0.007446753	0.00844254	0.008918785
Mean effective depth during outflow	1.115	0.895	1.175	1.075	0.935	0.86	0.975	1.03
Mean surface area during outflow	0.37646098	0.303890189	0.396253014	0.363266291	0.317084878	0.292344836	0.330279568	0.348422265
Time of considered outflow (mins)	44	68	50	44	30	11	40	41
Soil infiltration rate m/s	9.71E-06	6.25E-06	8.56E-06	9.71E-06	1.42E-05	3.86E-05	1.07E-05	1.04E-05
Soil infiltration rate mm/s	9.71E-03	6.25E-03	8.56E-03	9.71E-03	1.42E-02	3.86E-02	1.07E-02	1.04E-02
Soil infiltration rate m/hour	0.0350	0.0225	0.0308	0.0349	0.0511	0.1389	0.0383	0.0375

Calculations from BRE 365 1991

Typical Percolation Values	Value mm/s
Gravels	>10
Sands	1 to 1 x 10E-2
Fine Sands / Coarse Silts	1x10E-2 to 1 x 10E-4
Silts	1x10E-4 to 1 x 10E-6
Clays	< 1 x 10E-6

Table from - Elements of Soil Mechanics for Civil & Mining Engineers (G .N. Smith 1974)

Summary of Lab Test Data

Moisture Content and Plasticity

Client	D Brown Builders
Location	Butterfly Park, Long Sutton
Job No.	Your Ref. - above
Date of SI	02/06/2023

Sample Details			Classification						
No. Type	Depth (m)	Description	w%	%<425µ	wa%	LL%	PL%	PI%	I'p%
BH1	1.10	Very Silty Clay / Clayey Silt	20.1	100	20.1	32.4	11.2	21.2	21.2
BH2	1.30	Very Silty Clay / Clayey Silt	19.9	100	19.9	30.1	11.4	18.7	18.7
BH5	1.60	Slightly Clayey Silt	21.4	100	21.4	31.4	12.5	18.9	18.9
BH9	1.20	Very Silty Clay	22.0	100	22.0	35.3	12.6	22.7	22.7
BH10	1.00	Very Silty Clay / Clayey Silt	21.6	100	21.6	31.5	11.8	19.7	19.7
BH16	1.00	Very Silty Clay	19.7	100	19.7	34.5	12.0	22.5	22.5

Key

BS1377	%<425µ	Percent Passing 425 Micron Sieve
BS1377	w%	Natural Moisture Content
BS1377	wa%	Corrected w% for <425 Micron
BS1377	LL%	Liquid Limit of Sample >425 Micron removed
BS1377	PL%	Plastic Limit of Sample >425 Micron removed
BS1377	PI%	Plastic Index LL% - PL%
NHBC 4.2	I'p%	Modified Plasticity Index for <425 micron - NHBC 4.2

Liquid limit determinations performed on soil samples in natural state <425 micron particle size, using one point method in accordance with BS 1377 Part 2

Plastic limit determinations performed on soil samples in natural state <425 micron particle size in accordance with BS 1377 Part 2

Notes - Classification

NP	Non Plastic
CL	Clay of Low Plasticity
CI	Clay of Intermediate Plasticity
CH	Clay of High Plasticity
CV	Clay of Very High Plasticity
CE	Clay of Extremely High Plasticity
ML	Silt of Low Plasticity
MI	Silt of Intermediate Plasticity
MH	Silt of High Plasticity
MV	Silt of Very High Plasticity
ME	Silt of Extremely High Plasticity

Based on Plasticity Chart Fig 31. (B.S. 5930 - 1981)

ANALYTICAL TEST REPORT

Contract no: 123462

Contract name: Butterfly Park, Long Sutton

Client reference: 05062023

Clients name: TLP Ground Investigations

Clients address: 64 Wentworth Road
South Park Industrial Estate
Scunthorpe
DN17 2AZ

Samples received: 06 June 2023

Analysis started: 06 June 2023

Analysis completed: 23 June 2023

Report issued: 23 June 2023

Key

U	UKAS accredited test
M	MCERTS & UKAS accredited test
$	Test carried out by an approved subcontractor
I/S	Insufficient sample to carry out test
N/S	Sample not suitable for testing
NAD	No Asbestos Detected

Approved by: E. McCulloch

Ellis McCulloch
Senior Reporting Administrator

Chemtech Environmental Limited

SAMPLE INFORMATION

MCERTS (Soils):

Soil descriptions are only intended to provide a log of sample matrices with respect to MCERTS validation. They are not intended as full geological descriptions. MCERTS accreditation applies for sand, clay and loam/topsoil, or combinations of these whether these are derived from naturally occurring soils or from made ground, as long as these materials constitute the major part of the sample. Other materials such as concrete, gravel and brick are not accredited if they comprise the major part of the sample.

Lab ref	Sample id	Depth (m)	Sample description	Material removed	% Removed	% Moisture
123462-1	BH1	0.30-0.45	Sand with Roots	-	-	18.5
123462-2	BH1	0.90-1.00	Sand with Roots	-	-	19.2
123462-3	BH2	0.30-0.50	Sand with Roots	-	-	15.0
123462-4	BH3	0.20-0.40	Sand with Roots	-	-	15.8
123462-5	BH3	0.90-1.00	Sand with Roots	-	-	18.9
123462-6	BH4	0.20-0.40	Sand with Roots	-	-	12.2
123462-7	BH5	0.20-0.40	Sand with Roots	-	-	14.9
123462-8	BH5	0.90-1.00	Sand with Roots	-	-	17.2
123462-9	BH6	0.20-0.40	Sand with Roots	-	-	12.4
123462-10	BH6	0.90-1.00	Sand with Roots	-	-	17.4
123462-11	BH7	0.20-0.40	Sand with Roots	-	-	12.6
123462-12	BH7	0.90-1.00	Sand with Roots	-	-	17.2
123462-13	BH8	0.20-0.40	Sand with Roots	-	-	12.3
123462-14	BH9	0.20-0.30	Sand with Roots	-	-	15.7
123462-15	BH10	0.20-0.40	Sand with Roots	-	-	14.0
123462-16	BH10	0.90-1.00	Sandy Clay	-	-	13.1
123462-17	BH11	0.20-0.40	Sand with Roots	-	-	14.5
123462-18	BH11	0.90-1.00	Sand with Roots	-	-	17.3
123462-19	BH12	0.20-0.38	Sandy Clay with Roots	-	-	13.3
123462-20	BH12	0.90-1.00	Sand	-	-	17.1
123462-21	BH13	0.20-0.40	Sand with Roots	-	-	16.8
123462-22	BH13	0.90-1.00	Sand	-	-	20.4
123462-23	BH14	0.20-0.40	Sand with Roots	-	-	13.4
123462-24	BH15	0.20-0.40	Sand	-	-	16.0
123462-25	BH16	0.20-0.40	Sand	-	-	15.9

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SOILS

Lab number			123462-1	123462-3	123462-4	123462-5	123462-6	123462-7
Sample id			BH1	BH2	BH3	BH3	BH4	BH5
Depth (m)			0.30-0.45	0.30-0.50	0.20-0.40	0.90-1.00	0.20-0.40	0.20-0.40
Date sampled			05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023
Test	**Method**	**Units**						
Boron (water soluble)	CE063 U	mg/kg B	2.2	2.3	1.1	0.7	1.1	1.1
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Arsenic	$ M	mg/kg	11.0	13.0	12.0	9.0	14.0	15.0
Cadmium	$ M	mg/kg	0.2	< 0.10	< 0.10	< 0.10	0.2	0.2
Chromium	$ M	mg/kg	26.0	27.0	24.0	19.0	29.0	29.0
Copper	$ M	mg/kg	71.0	20.0	17.0	6.6	26.0	26.0
Lead	$ M	mg/kg	27.0	31.0	26.0	9.1	29.0	38.0
Mercury	$ M	mg/kg	0.2	0.2	0.1	< 0.05	0.2	0.2
Nickel	$ M	mg/kg	16.0	21.0	18.0	16.0	17.0	21.0
Selenium	$ M	mg/kg	0.4	< 0.25	0.4	0.3	0.5	0.5
Zinc	$ M	mg/kg	240.0	64.0	51.0	37.0	53.0	120.0
pH	CE004 M	units	7.9	7.4	6.6	8.4	7.9	8.1
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	17	42	<10	10	<10	11
Sulphate (acid extractable)	CE062 M	mg/kg SO_4	539	408	404	1156	617	449
Sulphide	CE016	mg/kg S^{2-}	35	12	<10	<10	<10	<10
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Thiocyanate	CE145 M	mg/kg SCN	<1	1.6	<1	<1	<1	<1
Phenols (total)	CE078	mg/kg PhOH	0.6	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	1.8	1.7	1.5	0.6	1.6	1.9
Estimate of OMC (calculated from TOC)	CE197	% w/w	3.0	2.9	2.6	1.1	2.7	3.3
Loss On Ignition at 440°C	CE006 U	% w/w	5.2	5.3	3.3	2.4	4.5	5.9
PAH								
Naphthalene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	0.03
Acenaphthylene	CE087 M	mg/kg	0.03	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene	CE087 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	CE087 M	mg/kg	0.51	0.09	0.07	<0.02	0.08	0.12
Anthracene	CE087 U	mg/kg	0.05	0.02	<0.02	<0.02	0.03	<0.02
Fluoranthene	CE087 M	mg/kg	0.71	0.20	0.16	<0.02	0.16	0.26
Pyrene	CE087 M	mg/kg	0.54	0.16	0.13	<0.02	0.13	0.23
Benzo(a)anthracene	CE087 U	mg/kg	0.17	0.09	0.08	<0.02	0.09	0.11
Chrysene	CE087 M	mg/kg	0.32	0.11	0.09	<0.03	0.09	0.19
Benzo(b)fluoranthene	CE087 M	mg/kg	0.30	0.11	0.09	<0.02	0.09	0.21
Benzo(k)fluoranthene	CE087 M	mg/kg	0.12	0.05	0.04	<0.03	0.04	0.09
Benzo(a)pyrene	CE087 U	mg/kg	0.27	0.11	0.09	<0.02	0.08	0.16
Indeno(123cd)pyrene	CE087 M	mg/kg	0.18	0.07	0.05	<0.02	0.05	0.12
Dibenz(ah)anthracene	CE087 M	mg/kg	0.04	<0.02	<0.02	<0.02	<0.02	0.03
Benzo(ghi)perylene	CE087 M	mg/kg	0.18	0.08	0.06	<0.02	0.06	0.13
PAH (total of USEPA 16)	CE087	mg/kg	3.43	1.09	0.85	<0.34	0.91	1.68

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SOILS

Lab number			123462-1	123462-3	123462-4	123462-5	123462-6	123462-7
Sample id			BH1	BH2	BH3	BH3	BH4	BH5
Depth (m)			0.30-0.45	0.30-0.50	0.20-0.40	0.90-1.00	0.20-0.40	0.20-0.40
Date sampled			05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023
Test	**Method**	**Units**						
BTEX & TPH								
Benzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Toluene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
m & p-Xylene	CE192 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-Xylene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	<10	<10	<10	<10	<10	<10
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	<10	<10	<10	<10	<10	<10
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	<1	<1	<1	<1	<1	<1
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	<1	<1	<1	<1	<1	<1
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	<1	<1	<1	<1	<1	<1
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EPH Aliphatic (>C10-C12)	CE250	mg/kg	<6	<6	<6	<6	<6	<6
EPH Aliphatic (>C12-C16)	CE250	mg/kg	<6	<6	<6	<6	<6	<6
EPH Aliphatic (>C16-C35)	CE250	mg/kg	<15	<15	<15	<15	<15	<15
EPH Aliphatic (>C35-C44)	CE250	mg/kg	<10	<10	<10	<10	<10	<10
Subcontracted Analysis								
Asbestos (qualitative)	$	-	NAD	NAD	NAD	NAD	NAD	NAD

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SOILS

Lab number			123462-8	123462-9	123462-11	123462-13	123462-14	123462-15
Sample id			BH5	BH6	BH7	BH8	BH9	BH10
Depth (m)			0.90-1.00	0.20-0.40	0.20-0.40	0.20-0.40	0.20-0.30	0.20-0.40
Date sampled			05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023
Test	**Method**	**Units**						
Boron (water soluble)	CE063 U	mg/kg B	0.7	1.3	0.9	0.8	1.0	0.9
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Arsenic	$ M	mg/kg	9.3	13.0	15.0	12.0	14.0	13.0
Cadmium	$ M	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chromium	$ M	mg/kg	19.0	22.0	26.0	28.0	27.0	26.0
Copper	$ M	mg/kg	6.1	14.0	17.0	21.0	17.0	15.0
Lead	$ M	mg/kg	8.3	28.0	31.0	24.0	39.0	40.0
Mercury	$ M	mg/kg	< 0.05	0.1	0.3	0.1	0.1	0.1
Nickel	$ M	mg/kg	16.0	16.0	19.0	17.0	21.0	21.0
Selenium	$ M	mg/kg	< 0.25	0.3	0.5	0.4	< 0.25	0.4
Zinc	$ M	mg/kg	36.0	48.0	51.0	46.0	61.0	150.0
pH	CE004 M	units	7.9	8.1	8.0	8.2	6.5	7.1
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	<10	11	13	<10	14	12
Sulphate (acid extractable)	CE062 M	mg/kg SO_4	198	367	379	341	358	361
Sulphide	CE016	mg/kg S^{2-}	<10	<10	<10	<10	<10	<10
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Thiocyanate	CE145 M	mg/kg SCN	<1	<1	<1	<1	1.4	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	0.7	1.5	1.6	1.6	1.5	1.6
Estimate of OMC (calculated from TOC)	CE197	% w/w	1.1	2.5	2.7	2.7	2.5	2.8
Loss On Ignition at 440°C	CE006 U	% w/w	7.7	4.1	4.7	4.0	6.1	5.5
PAH								
Naphthalene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene	CE087 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	CE087 M	mg/kg	<0.02	0.04	0.03	0.04	0.03	0.09
Anthracene	CE087 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluoranthene	CE087 M	mg/kg	<0.02	0.09	0.06	0.07	0.09	0.24
Pyrene	CE087 M	mg/kg	<0.02	0.08	0.05	0.06	0.07	0.20
Benzo(a)anthracene	CE087 U	mg/kg	<0.02	0.05	0.03	0.04	0.05	0.12
Chrysene	CE087 M	mg/kg	<0.03	0.06	0.04	0.04	0.05	0.13
Benzo(b)fluoranthene	CE087 M	mg/kg	<0.02	0.06	0.03	0.04	0.05	0.13
Benzo(k)fluoranthene	CE087 M	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	0.06
Benzo(a)pyrene	CE087 U	mg/kg	<0.02	0.05	0.03	0.04	0.04	0.13
Indeno(123cd)pyrene	CE087 M	mg/kg	<0.02	0.03	0.02	0.03	0.03	0.08
Dibenz(ah)anthracene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(ghi)perylene	CE087 M	mg/kg	<0.02	0.03	0.03	0.04	0.03	0.09
PAH (total of USEPA 16)	CE087	mg/kg	<0.34	0.48	<0.34	0.40	0.43	1.27

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SOILS

Lab number			123462-8	123462-9	123462-11	123462-13	123462-14	123462-15
Sample id			BH5	BH6	BH7	BH8	BH9	BH10
Depth (m)			0.90-1.00	0.20-0.40	0.20-0.40	0.20-0.40	0.20-0.30	0.20-0.40
Date sampled			05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023
Test	**Method**	**Units**						
BTEX & TPH								
Benzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Toluene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
m & p-Xylene	CE192 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-Xylene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	<10	<10	<10	<10	<10	<10
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	<10	<10	<10	<10	<10	<10
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	<1	<1	<1	<1	<1	<1
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	<1	<1	<1	<1	<1	<1
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	<1	<1	<1	<1	<1	<1
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EPH Aliphatic (>C10-C12)	CE250	mg/kg	<6	<6	<6	<6	<6	<6
EPH Aliphatic (>C12-C16)	CE250	mg/kg	<6	<6	<6	<6	<6	<6
EPH Aliphatic (>C16-C35)	CE250	mg/kg	<15	<15	<15	<15	<15	<15
EPH Aliphatic (>C35-C44)	CE250	mg/kg	<10	<10	<10	<10	<10	<10
Subcontracted Analysis								
Asbestos (qualitative)	$	-	NAD	NAD	NAD	NAD	NAD	NAD

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SOILS

Lab number			123462-17	123462-18	123462-19	123462-21	123462-22	123462-23
Sample id			BH11	BH11	BH12	BH13	BH13	BH14
Depth (m)			0.20-0.40	0.90-1.00	0.20-0.38	0.20-0.40	0.90-1.00	0.20-0.40
Date sampled			05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023
Test	**Method**	**Units**						
Boron (water soluble)	CE063 U	mg/kg B	1.3	0.6	1.1	1.0	0.7	1.0
Chromium (VI)	CE146	mg/kg CrVI	<1	<1	<1	<1	<1	<1
Arsenic	$ M	mg/kg	12.0	6.6	8.5	15.0	8.3	14.0
Cadmium	$ M	mg/kg	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Chromium	$ M	mg/kg	26.0	19.0	15.0	29.0	21.0	28.0
Copper	$ M	mg/kg	18.0	5.7	9.3	18.0	7.0	18.0
Lead	$ M	mg/kg	24.0	7.8	17.0	26.0	9.8	30.0
Mercury	$ M	mg/kg	0.1	< 0.05	0.2	0.1	< 0.05	0.2
Nickel	$ M	mg/kg	20.0	13.0	11.0	18.0	16.0	18.0
Selenium	$ M	mg/kg	0.4	< 0.25	< 0.25	0.4	< 0.25	0.4
Zinc	$ M	mg/kg	54.0	32.0	31.0	82.0	36.0	52.0
pH	CE004 M	units	8.0	8.6	7.2	7.9	8.3	8.2
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	<10	15	<10	11	11	11
Sulphate (acid extractable)	CE062 M	mg/kg SO_4	473	277	351	409	258	318
Sulphide	CE016	mg/kg S^{2-}	12	<10	<10	<10	<10	<10
Cyanide (free)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1	<1	<1	<1	<1
Thiocyanate	CE145 M	mg/kg SCN	<1	<1	<1	<1	<1	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	2.1	0.7	1.5	2.1	0.8	1.7
Estimate of OMC (calculated from TOC)	CE197	% w/w	3.6	1.3	2.5	3.6	1.4	3.0
Loss On Ignition at 440°C	CE006 U	% w/w	6.2	3.3	5.5	5.4	2.0	4.5
PAH								
Naphthalene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthylene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Acenaphthene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene	CE087 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Phenanthrene	CE087 M	mg/kg	0.05	<0.02	0.02	0.04	<0.02	0.07
Anthracene	CE087 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	0.02
Fluoranthene	CE087 M	mg/kg	0.11	<0.02	0.05	0.08	<0.02	0.11
Pyrene	CE087 M	mg/kg	0.09	<0.02	0.04	0.07	<0.02	0.10
Benzo(a)anthracene	CE087 U	mg/kg	0.05	<0.02	0.03	0.04	<0.02	0.06
Chrysene	CE087 M	mg/kg	0.07	<0.03	0.04	0.05	<0.03	0.07
Benzo(b)fluoranthene	CE087 M	mg/kg	0.06	<0.02	0.04	0.05	<0.02	0.08
Benzo(k)fluoranthene	CE087 M	mg/kg	<0.03	<0.03	<0.03	<0.03	<0.03	0.04
Benzo(a)pyrene	CE087 U	mg/kg	0.06	<0.02	0.03	0.05	<0.02	0.07
Indeno(123cd)pyrene	CE087 M	mg/kg	0.04	<0.02	<0.02	<0.02	<0.02	0.04
Dibenz(ah)anthracene	CE087 M	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo(ghi)perylene	CE087 M	mg/kg	0.04	<0.02	<0.02	0.03	<0.02	0.05
PAH (total of USEPA 16)	CE087	mg/kg	0.56	<0.34	<0.34	0.40	<0.34	0.71

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SOILS

Lab number			123462-17	123462-18	123462-19	123462-21	123462-22	123462-23
Sample id			BH11	BH11	BH12	BH13	BH13	BH14
Depth (m)			0.20-0.40	0.90-1.00	0.20-0.38	0.20-0.40	0.90-1.00	0.20-0.40
Date sampled			05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023
Test	**Method**	**Units**						
BTEX & TPH								
Benzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Toluene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethylbenzene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
m & p-Xylene	CE192 U	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
o-Xylene	CE192 U	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	<10	<10	<10	<10	<10	<10
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	<10	<10	<10	<10	<10	<10
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	<1	<1	<1	<1	<1	<1
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	<1	<1	<1	<1	<1	<1
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	<1	<1	<1	<1	<1	<1
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EPH Aliphatic (>C10-C12)	CE250	mg/kg	<6	<6	<6	<6	<6	<6
EPH Aliphatic (>C12-C16)	CE250	mg/kg	<6	<6	<6	<6	<6	<6
EPH Aliphatic (>C16-C35)	CE250	mg/kg	<15	<15	<15	<15	<15	<15
EPH Aliphatic (>C35-C44)	CE250	mg/kg	<10	<10	<10	<10	<10	<10
Subcontracted Analysis								
Asbestos (qualitative)	$	-	NAD	NAD	NAD	NAD	NAD	NAD

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SOILS

Lab number			123462-24	123462-25
Sample id			BH15	BH16
Depth (m)			0.20-0.40	0.20-0.40
Date sampled			05/06/2023	05/06/2023
Test	**Method**	**Units**		
Boron (water soluble)	CE063 U	mg/kg B	1.0	1.0
Chromium (VI)	CE146	mg/kg CrVI	<1	<1
Arsenic	$ M	mg/kg	14.0	9.8
Cadmium	$ M	mg/kg	< 0.10	< 0.10
Chromium	$ M	mg/kg	26.0	19.0
Copper	$ M	mg/kg	32.0	16.0
Lead	$ M	mg/kg	27.0	20.0
Mercury	$ M	mg/kg	0.2	0.1
Nickel	$ M	mg/kg	20.0	15.0
Selenium	$ M	mg/kg	0.4	< 0.25
Zinc	$ M	mg/kg	55.0	42.0
pH	CE004 M	units	7.6	7.8
Sulphate (2:1 water soluble)	CE061 U	mg/l SO_4	<10	<10
Sulphate (acid extractable)	CE062 M	mg/kg SO_4	614	435
Sulphide	CE016	mg/kg S^{2-}	16	<10
Cyanide (free)	CE077	mg/kg CN	<1	<1
Cyanide (total)	CE077	mg/kg CN	<1	<1
Thiocyanate	CE145 M	mg/kg SCN	<1	<1
Phenols (total)	CE078	mg/kg PhOH	<0.5	<0.5
Total Organic Carbon (TOC)	CE197	% w/w C	1.3	1.7
Estimate of OMC (calculated from TOC)	CE197	% w/w	2.3	2.9
Loss On Ignition at 440°C	CE006 U	% w/w	4.2	5.3
PAH				
Naphthalene	CE087 M	mg/kg	<0.02	<0.02
Acenaphthylene	CE087 M	mg/kg	<0.02	<0.02
Acenaphthene	CE087 M	mg/kg	<0.02	<0.02
Fluorene	CE087 U	mg/kg	<0.02	<0.02
Phenanthrene	CE087 M	mg/kg	0.03	0.05
Anthracene	CE087 U	mg/kg	<0.02	<0.02
Fluoranthene	CE087 M	mg/kg	0.05	0.13
Pyrene	CE087 M	mg/kg	0.04	0.10
Benzo(a)anthracene	CE087 U	mg/kg	0.03	0.07
Chrysene	CE087 M	mg/kg	0.03	0.08
Benzo(b)fluoranthene	CE087 M	mg/kg	0.03	0.09
Benzo(k)fluoranthene	CE087 M	mg/kg	<0.03	0.04
Benzo(a)pyrene	CE087 U	mg/kg	0.03	0.07
Indeno(123cd)pyrene	CE087 M	mg/kg	<0.02	0.03
Dibenz(ah)anthracene	CE087 M	mg/kg	<0.02	<0.02
Benzo(ghi)perylene	CE087 M	mg/kg	<0.02	0.03
PAH (total of USEPA 16)	CE087	mg/kg	<0.34	0.69

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SOILS

Lab number			123462-24	123462-25
Sample id			BH15	BH16
Depth (m)			0.20-0.40	0.20-0.40
Date sampled			05/06/2023	05/06/2023
Test	**Method**	**Units**		
BTEX & TPH				
Benzene	CE192 U	mg/kg	<0.01	<0.01
Toluene	CE192 U	mg/kg	<0.01	<0.01
Ethylbenzene	CE192 U	mg/kg	<0.01	<0.01
m & p-Xylene	CE192 U	mg/kg	<0.02	<0.02
o-Xylene	CE192 U	mg/kg	<0.01	<0.01
VPH Aromatic (>EC5-EC7)	CE067	mg/kg	<0.01	<0.01
VPH Aromatic (>EC7-EC8)	CE067	mg/kg	<0.01	<0.01
VPH Aromatic (>EC8-EC10)	CE067	mg/kg	<0.01	<0.01
EPH Aromatic (>EC10-EC12)	CE250	mg/kg	<10	<10
EPH Aromatic (>EC12-EC16)	CE250	mg/kg	<10	<10
EPH Aromatic (>EC16-EC21)	CE250	mg/kg	<1	<1
EPH Aromatic (>EC21-EC35)	CE250	mg/kg	<1	<1
EPH Aromatic (>EC35-EC44)	CE250	mg/kg	<1	<1
VPH Aliphatic (>C5-C6)	CE067	mg/kg	<0.1	<0.1
VPH Aliphatic (>C6-C8)	CE067	mg/kg	<0.1	<0.1
VPH Aliphatic (>C8-C10)	CE067	mg/kg	<0.1	<0.1
EPH Aliphatic (>C10-C12)	CE250	mg/kg	<6	<6
EPH Aliphatic (>C12-C16)	CE250	mg/kg	<6	<6
EPH Aliphatic (>C16-C35)	CE250	mg/kg	<15	<15
EPH Aliphatic (>C35-C44)	CE250	mg/kg	<10	<10
Subcontracted Analysis				
Asbestos (qualitative)	$	-	NAD	NAD

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SOILS

Lab number			123462-2	123462-5	123462-8	123462-10	123462-12	123462-16
Sample id			BH1	BH3	BH5	BH6	BH7	BH10
Depth (m)			0.90-1.00	0.90-1.00	0.90-1.00	0.90-1.00	0.90-1.00	0.90-1.00
Date sampled			05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023	05/06/2023
Test	**Method**	**Units**						
VPH (>C5-C10)	CE067	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
EPH (>C10-C16)	CE033	mg/kg	<10	<10	<10	<10	<10	<10
EPH (>C16-C40)	CE033	mg/kg	21	28	79	23	18	<10
VOC (total) inc TICs	CE174 [1,2]	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
BTEX & MTBE (total)	CE057 [2]	mg/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
SVOC (total) inc TICs	CE189 [2,3]	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Phenols (total)	CE189 [2]	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cresols & chlorinated phenols (total)	CE189 [2]	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ethers*	CE189 [2]	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrobenzene*	CE189 [2]	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ketones*	CE189 [2]	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aldehydes*	CE189 [2]	mg/kg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Amines*	CE189 [2]	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
pH	CE004 [M]	units	8.3	8.4	7.9	7.7	8.5	8.0
Electrical conductivity	CE007 [U]	µS/cm	153	79	122	516	70	134
Redox potential	CE082	mV	274	123	289	256	251	202

Notes
1: Total VOCs (excluding BTEX & MTBE)
2: LOD applies to each compound
3: Total SVOCs (excluding PAHs and those substances marked with an *)

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SOILS

Lab number			123462-20	123462-22
Sample id			BH12	BH13
Depth (m)			0.90-1.00	0.90-1.00
Date sampled			05/06/2023	05/06/2023
Test	**Method**	**Units**		
VPH (>C5-C10)	CE067	mg/kg	<0.1	<0.1
EPH (>C10-C16)	CE033	mg/kg	<10	<10
EPH (>C16-C40)	CE033	mg/kg	20	11
VOC (total) inc TICs	CE174 [1,2]	mg/kg	<0.01	<0.01
BTEX & MTBE (total)	CE057 [2]	mg/kg	<0.02	<0.02
SVOC (total) inc TICs	CE189 [2,3]	mg/kg	<0.1	<0.1
Phenols (total)	CE189 [2]	mg/kg	<0.01	<0.01
Cresols & chlorinated phenols (total)	CE189 [2]	mg/kg	<0.01	<0.01
Ethers*	CE189 [2]	mg/kg	<0.1	<0.1
Nitrobenzene*	CE189 [2]	mg/kg	<0.1	<0.1
Ketones*	CE189 [2]	mg/kg	<0.01	<0.01
Aldehydes*	CE189 [2]	mg/kg	<0.01	<0.01
Amines*	CE189 [2]	mg/kg	<0.1	<0.1
pH	CE004 [M]	units	8.7	8.3
Electrical conductivity	CE007 [U]	µS/cm	117	88
Redox potential	CE082	mV	288	264

Notes
1: Total VOCs (excluding BTEX & MTBE)
2: LOD applies to each compound
3: Total SVOCs (excluding PAHs and those substances marked with

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GROUNDWATERS

Lab number			123462-26	123462-27	123462-28	123462-29
Sample id			BH1	BH5	BH10	BH12
Depth (m)			2.23	2.06	1.77	1.72
Date sampled			05/06/2023	05/06/2023	05/06/2023	05/06/2023
Time sampled			-	-	-	-
Test	**Method**	**Units**				
Arsenic (dissolved)	$	µg/l As	1.9	1.4	0.52	0.64
Boron (dissolved)	$	µg/l B	81	79	82	81
Cadmium (dissolved)	$	µg/l Cd	< 0.11	< 0.11	< 0.11	< 0.11
Chromium (dissolved)	$	µg/l Cr	1.2	0.75	1.0	1.1
Chromium VI (dissolved)	CE050 U	µg/l CrVI	<10	<10	<10	<10
Copper (dissolved)	$	µg/l Cu	12	6.4	2.7	3.1
Lead (dissolved)	$	µg/l Pb	< 0.50	< 0.50	< 0.50	< 0.50
Mercury (dissolved)	$	µg/l Hg	< 0.05	< 0.05	< 0.05	< 0.05
Nickel (dissolved)	$	µg/l Ni	1.8	1.1	1.0	0.87
Selenium (dissolved)	$	µg/l Se	1.3	1.0	1.3	0.57
Zinc (dissolved)	$	µg/l Zn	11	< 2.5	< 2.5	< 2.5
pH	CE213 U	units	7.4	7.4	7.4	7.5
Sulphate	CE049 U	mg/l SO_4	81	79	77	77
Sulphide	CE249	µg/l S^{2-}	<100	<100	<100	<100
Cyanide (free)	CE147	µg/l CN	6	6	6	8
Cyanide (total)	CE147	µg/l CN	<5	<5	<5	<5
Thiocyanate	CE014 U	µg/l SCN	<200	<200	<200	<200
Phenols (total)	CE148	µg/l PhOH	<10	<10	<10	<10
Total Organic Carbon	CE247	mg/l C	6	5	<5	<5
PAH						
Naphthalene	CE051	µg/l	<0.1	<0.1	<0.1	0.1
Acenaphthylene	CE051	µg/l	<0.1	<0.1	<0.1	<0.1
Acenaphthene	CE051	µg/l	<0.1	<0.1	<0.1	<0.1
Fluorene	CE051	µg/l	<0.1	<0.1	<0.1	<0.1
Phenanthrene	CE051	µg/l	<0.1	1.4	0.9	<0.1
Anthracene	CE051	µg/l	<0.1	0.4	0.4	<0.1
Fluoranthene	CE051	µg/l	0.2	5.1	2.4	0.2
Pyrene	CE051	µg/l	0.2	4.6	2.1	<0.1
Benzo(a)anthracene	CE051	µg/l	<0.1	3.2	1.7	<0.1
Chrysene	CE051	µg/l	<0.1	3.4	1.4	<0.1
Benzo(b)fluoranthene	CE051	µg/l	<0.1	3.1	1.4	<0.1
Benzo(k)fluoranthene	CE051	µg/l	<0.1	1.5	0.6	<0.1
Benzo(a)pyrene	CE051	µg/l	<0.1	3.0	1.2	<0.1
Indeno(123cd)pyrene	CE051	µg/l	<0.1	1.4	0.6	<0.1
Dibenz(ah)anthracene	CE051	µg/l	<0.1	0.4	<0.1	<0.1
Benzo(ghi)perylene	CE051	µg/l	<0.1	2.0	0.8	<0.1
PAH (total of USEPA 16)	CE051	µg/l	<1.6	29.6	13.4	<1.6

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GROUNDWATERS

Lab number			123462-26	123462-27	123462-28	123462-29
Sample id			BH1	BH5	BH10	BH12
Depth (m)			2.23	2.06	1.77	1.72
Date sampled			05/06/2023	05/06/2023	05/06/2023	05/06/2023
Time sampled			-	-	-	-
Test	**Method**	**Units**				
BTEX & TPH						
Benzene	CE057 U	µg/l	<1	<1	<1	<1
Toluene	CE057 U	µg/l	<1	<1	<1	<1
Ethylbenzene	CE057 U	µg/l	<1	1	<1	<1
m & p-Xylene	CE057 U	µg/l	<2	3	<2	<2
o-Xylene	CE057 U	µg/l	<1	2	<1	<1
VPH Aromatic (>EC5-EC7)	CE175	µg/l	<1	<1	<1	<1
VPH Aromatic (>EC7-EC8)	CE175	µg/l	<1	<1	<1	<1
VPH Aromatic (>EC8-EC10)	CE175	µg/l	<1	5	<1	<1
EPH Aromatic (>EC10-EC12)	CE251	µg/l	<1	<1	<1	<1
EPH Aromatic (>EC12-EC16)	CE251	µg/l	<1	<1	<1	<1
EPH Aromatic (>EC16-EC21)	CE251	µg/l	<1	<1	<1	<1
EPH Aromatic (>EC21-EC35)	CE251	µg/l	<1	<1	<1	<1
EPH Aromatic (>EC35-EC44)	CE251	µg/l	<1	<1	<1	<1
VPH Aliphatic (>C5-C6)	CE175	µg/l	<1	<1	<1	<1
VPH Aliphatic (>C6-C8)	CE175	µg/l	<1	<1	<1	<1
VPH Aliphatic (>C8-C10)	CE175	µg/l	<1	11	<1	<1
EPH Aliphatic (>C10-C12)	CE251	µg/l	<1	<1	<1	<1
EPH Aliphatic (>C12-C16)	CE251	µg/l	<1	<1	<1	<1
EPH Aliphatic (>C16-C35)	CE251	µg/l	<1	<1	<1	<1
EPH Aliphatic (>C35-C44)	CE251	µg/l	<1	<1	<1	<1

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE063	Boron (water soluble)	Hot water extract, ICP-OES	Dry	U	0.5	mg/kg B
CE146	Chromium (VI)	Acid extraction, Colorimetry	Dry		1	mg/kg CrVI
$^M	Arsenic	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg
$^M	Cadmium	Aqua regia digest, ICP-MS	Dry	M	0.10	mg/kg
$^M	Chromium	Aqua regia digest, ICP-MS	Dry	M	0.5	mg/kg
$^M	Copper	Aqua regia digest, ICP-MS	Dry	M	0.50	mg/kg
$^M	Lead	Aqua regia digest, ICP-MS	Dry	M	0.50	mg/kg
$^M	Mercury	Aqua regia digest, ICP-MS	Dry	M	0.05	mg/kg
$^M	Nickel	Aqua regia digest, ICP-MS	Dry	M	0.50	mg/kg
$^M	Selenium	Aqua regia digest, ICP-MS	Dry	M	0.25	mg/kg
$^M	Zinc	Aqua regia digest, ICP-MS	Dry	M	0.50	mg/kg
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE061	Sulphate (2:1 water soluble)	Aqueous extraction, ICP-OES	Dry	U	10	mg/l SO_4
CE062	Sulphate (acid extractable)	HCl extract, analysed by ICP-OES	Dry	M	100	mg/kg SO_4
CE016	Sulphide	Distillation, Titration	Dry		10	mg/kg S^{2-}
CE077	Cyanide (free)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE077	Cyanide (total)	Extraction, Continuous Flow Colorimetry	As received		1	mg/kg CN
CE145	Thiocyanate	Weak acid extraction, Colorimetry	Dry	M	1	mg/kg SCN
CE078	Phenols (total)	Extraction, Continuous Flow Colorimetry	As received		0.5	mg/kg PhOH
CE197	Total Organic Carbon (TOC)	Carbon Analyser	Dry		0.1	% w/w C
CE197	Estimate of OMC (calculated from TOC)	Calculation from Total Organic Carbon	Dry		0.1	% w/w
CE006	Loss On Ignition at 440°C	Based on BS 1377, Gravimetry	Dry	U	0.1	% w/w
CE087	Naphthalene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Acenaphthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Fluorene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Phenanthrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(a)anthracene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Chrysene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(b)fluoranthene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(k)fluoranthene	Solvent extraction, GC-MS	As received	M	0.03	mg/kg
CE087	Benzo(a)pyrene	Solvent extraction, GC-MS	As received	U	0.02	mg/kg
CE087	Indeno(123cd)pyrene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Dibenz(ah)anthracene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	Benzo(ghi)perylene	Solvent extraction, GC-MS	As received	M	0.02	mg/kg
CE087	PAH (total of USEPA 16)	Solvent extraction, GC-MS	As received		0.34	mg/kg
CE192	Benzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Toluene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	Ethylbenzene	Headspace GC-FID	As received	U	0.01	mg/kg
CE192	m & p-Xylene	Headspace GC-FID	As received	U	0.02	mg/kg
CE192	o-Xylene	Headspace GC-FID	As received	U	0.01	mg/kg

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METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE067	VPH Aromatic (>EC5-EC7)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC7-EC8)	Headspace GC-FID	As received		0.01	mg/kg
CE067	VPH Aromatic (>EC8-EC10)	Headspace GC-FID	As received		0.01	mg/kg
CE250	EPH Aromatic (>EC10-EC12)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC12-EC16)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC16-EC21)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC21-EC35)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE250	EPH Aromatic (>EC35-EC44)	Solvent extraction, GCxGC-FID	As received		1	mg/kg
CE067	VPH Aliphatic (>C5-C6)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C6-C8)	Headspace GC-FID	As received		0.1	mg/kg
CE067	VPH Aliphatic (>C8-C10)	Headspace GC-FID	As received		0.1	mg/kg
CE250	EPH Aliphatic (>C10-C12)	Solvent extraction, GCxGC-FID	As received		6	mg/kg
CE250	EPH Aliphatic (>C12-C16)	Solvent extraction, GCxGC-FID	As received		6	mg/kg
CE250	EPH Aliphatic (>C16-C35)	Solvent extraction, GCxGC-FID	As received		15	mg/kg
CE250	EPH Aliphatic (>C35-C44)	Solvent extraction, GCxGC-FID	As received		10	mg/kg
$	Asbestos (qualitative)	HSG 248, Microscopy	Dry	U	-	-

Chemtech Environmental Limited

METHOD DETAILS

METHOD	SOILS	METHOD SUMMARY	SAMPLE	STATUS	LOD	UNITS
CE067	VPH (>C5-C10)	Headspace GC-FID	As received		0.1	mg/kg
CE033	EPH (>C10-C16)	Solvent extraction, GC-FID	As received		10	mg/kg
CE033	EPH (>C16-C40)	Solvent extraction, GC-FID	As received		10	mg/kg
CE174	Volatile Organic Compounds	Headspace GC-MS	As received		0.01	mg/kg
CE174	VOC Tentatively Identified Compounds	Headspace GC-MS	As received		-	-
CE057	BTEX & MTBE (total)	Headspace GC-FID	As received		0.02	mg/kg
CE189	Semi-volatile Organic Compounds	Solvent extraction, GC-MS	As received		0.01-0.1	mg/kg
CE189	SVOC Tentatively Identified Compounds	Solvent extraction, GC-MS	As received		-	-
CE004	pH	Based on BS 1377, pH Meter	As received	M	-	units
CE007	Electrical conductivity	Conductivity Meter	As received	U	10	µS/cm
CE082	Redox potential	ORP meter	As received		±1	mV

Chemtech Environmental Limited

METHOD DETAILS

METHOD	GROUNDWATERS	METHOD SUMMARY	STATUS	LOD	UNITS
$	Arsenic (dissolved)	ICP-MS	U	0.2	µg/l As
$	Boron (dissolved)	ICP-MS	U	10	µg/l B
$	Cadmium (dissolved)	ICP-MS	U	0.11	µg/l Cd
$	Chromium (dissolved)	ICP-MS	U	0.5	µg/l Cr
CE050	Chromium VI (dissolved)	Colorimetry	U	10	µg/l CrVI
$	Copper (dissolved)	ICP-MS	U	0.5	µg/l Cu
$	Lead (dissolved)	ICP-MS	U	0.5	µg/l Pb
$	Mercury (dissolved)	ICP-MS	U	0.05	µg/l Hg
$	Nickel (dissolved)	ICP-MS	U	0.5	µg/l Ni
$	Selenium (dissolved)	ICP-MS	U	0.5	µg/l Se
$	Zinc (dissolved)	ICP-MS	U	3	µg/l Zn
CE213	pH	Based on BS 1377, pH Meter	U	-	units
CE049	Sulphate	Ion Chromatography	U	1.7	mg/l SO_4
CE249	Sulphide	Distillation, Titration		100	µg/l S^{2-}
CE147	Cyanide (free)	Continuous Flow Colorimetry		5	µg/l CN
CE147	Cyanide (total)	Continuous Flow Colorimetry		5	µg/l CN
CE014	Thiocyanate	Colorimetry	U	200	µg/l SCN
CE148	Phenols (total)	Continuous Flow Colorimetry		10	µg/l PhOH
CE247	Total Organic Carbon	Combustion TOC analyser		5	mg/l C
CE051	Naphthalene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Acenaphthylene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Acenaphthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Fluorene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Phenanthrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Anthracene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Fluoranthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Pyrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(a)anthracene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Chrysene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(b)fluoranthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(k)fluoranthene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(a)pyrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Indeno(123cd)pyrene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Dibenz(ah)anthracene	Solvent extraction, GC-MS		0.1	µg/l
CE051	Benzo(ghi)perylene	Solvent extraction, GC-MS		0.1	µg/l
CE051	PAH (total of USEPA 16)	Solvent extraction, GC-MS		1.6	µg/l
CE057	Benzene	Headspace GC-FID	U	1	µg/l
CE057	Toluene	Headspace GC-FID	U	1	µg/l
CE057	Ethylbenzene	Headspace GC-FID	U	1	µg/l
CE057	m & p-Xylene	Headspace GC-FID	U	2	µg/l
CE057	o-Xylene	Headspace GC-FID	U	1	µg/l
CE175	VPH Aromatic (>EC5-EC7)	Headspace GC-FID		1	µg/l
CE175	VPH Aromatic (>EC7-EC8)	Headspace GC-FID		1	µg/l
CE175	VPH Aromatic (>EC8-EC10)	Headspace GC-FID		1	µg/l

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METHOD DETAILS

METHOD	GROUNDWATERS	METHOD SUMMARY	STATUS	LOD	UNITS
CE251	EPH Aromatic (>EC10-EC12)	Solvent extraction, GCxGC-FID		1	µg/l
CE251	EPH Aromatic (>EC12-EC16)	Solvent extraction, GCxGC-FID		1	µg/l
CE251	EPH Aromatic (>EC16-EC21)	Solvent extraction, GCxGC-FID		1	µg/l
CE251	EPH Aromatic (>EC21-EC35)	Solvent extraction, GCxGC-FID		1	µg/l
CE251	EPH Aromatic (>EC35-EC44)	Solvent extraction, GCxGC-FID		1	µg/l
CE175	VPH Aliphatic (>C5-C6)	Headspace GC-FID		1	µg/l
CE175	VPH Aliphatic (>C6-C8)	Headspace GC-FID		1	µg/l
CE175	VPH Aliphatic (>C8-C10)	Headspace GC-FID		1	µg/l
CE251	EPH Aliphatic (>C10-C12)	Solvent extraction, GCxGC-FID		1	µg/l
CE251	EPH Aliphatic (>C12-C16)	Solvent extraction, GCxGC-FID		1	µg/l
CE251	EPH Aliphatic (>C16-C35)	Solvent extraction, GCxGC-FID		1	µg/l
CE251	EPH Aliphatic (>C35-C44)	Solvent extraction, GCxGC-FID		1	µg/l

Chemtech Environmental Limited

DEVIATING SAMPLE INFORMATION

Comments
Sample deviation is determined in accordance with the UKAS note "Guidance on Deviating Samples" and based on reference standards and laboratory trials.
For samples identified as deviating, test result(s) may be compromised and may not be representative of the sample at the time of sampling.
Chemtech Environmental Ltd cannot be held responsible for the integrity of sample(s) received if Chemtech Environmental Ltd did not undertake the sampling. Such samples may be deviating.

Key

N	No (not deviating sample)
Y	Yes (deviating sample)
NSD	Sampling date not provided
NST	Sampling time not provided (waters only)
EHT	Sample exceeded holding time(s)
IC	Sample not received in appropriate containers
HP	Headspace present in sample container
NCF	Sample not chemically fixed (where appropriate)
OR	Other (specify)

Lab ref	Sample id	Depth (m)	Deviating	Tests (Reason for deviation)
123462-1	BH1	0.30-0.45	N	
123462-2	BH1	0.90-1.00	N	
123462-3	BH2	0.30-0.50	N	
123462-4	BH3	0.20-0.40	N	
123462-5	BH3	0.90-1.00	N	
123462-6	BH4	0.20-0.40	N	
123462-7	BH5	0.20-0.40	N	
123462-8	BH5	0.90-1.00	N	
123462-9	BH6	0.20-0.40	N	
123462-10	BH6	0.90-1.00	N	
123462-11	BH7	0.20-0.40	N	
123462-12	BH7	0.90-1.00	N	
123462-13	BH8	0.20-0.40	N	
123462-14	BH9	0.20-0.30	N	
123462-15	BH10	0.20-0.40	N	
123462-16	BH10	0.90-1.00	N	
123462-17	BH11	0.20-0.40	N	
123462-18	BH11	0.90-1.00	N	
123462-19	BH12	0.20-0.38	N	
123462-20	BH12	0.90-1.00	N	
123462-21	BH13	0.20-0.40	N	
123462-22	BH13	0.90-1.00	N	
123462-23	BH14	0.20-0.40	N	
123462-24	BH15	0.20-0.40	N	
123462-25	BH16	0.20-0.40	N	
123462-26	BH1	2.23	Y	Cyanide (NCF), Thiocyanate (NCF), Sulphide (NCF)
123462-27	BH5	2.06	Y	Cyanide (NCF), Thiocyanate (NCF), Sulphide (NCF)
123462-28	BH10	1.77	Y	Cyanide (NCF), Thiocyanate (NCF), Sulphide (NCF)
123462-29	BH12	1.72	Y	Cyanide (NCF), Thiocyanate (NCF), Sulphide (NCF)

Chemtech Environmental Limited

ADDITIONAL INFORMATION

Notes

Opinions and interpretations expressed herein are outside the UKAS accreditation scope.

Unless otherwise stated, Chemtech Environmental Ltd was not responsible for sampling.

All testing carried out at Unit 6 Parkhead, Stanley, DH9 7YB, except for subcontracted testing.

Methods, procedures and performance data are available on request.

Results reported herein relate only to the material supplied to the laboratory.

This report shall not be reproduced except in full, without prior written approval.

Samples will be disposed of 4 weeks from initial receipt unless otherwise instructed.

BTEX compounds are identified by retention time only and may include interference from co-eluting compounds.

For soils and solids, all results are reported on a dry basis. Samples dried at no more than 30°C in a drying cabinet.

For soils and solids, analytical results are inclusive of stones, where applicable.

Moisture Content Calculated on a Wet Weight basis

DECLARATION OF COMPLIANCE (BS3882:2015)

CHEMTECH environmental part of Cawood

Lab ref	123462-11	**Date received**	06 June 2023
Contract name	Butterfly Park, Long Sutton	**Analysis started**	06 June 2023
Sample ID	BH 7 0.20-0.40m	**Analysis completed**	23 June 2023
OS Grid reference	Not supplied	**Report issued**	23 June 2023
Date sampled	05 June 2023		

Test	**Units**	**Result**	**Compliant with Multipurpose? (Y/N)**	**Compliant with specific purpose? (Y/N)**				
				Acidic	**Calcareous**	**Low Fertility**	**Low F Acidic**	**Low F Calcareous**
Texture								
Clay content	% w/w	31						
Silt content	% w/w	68						
Sand content	% w/w	2						
Soil texture	**class**	**SILTY CLAY LOAM**	N	N	N	N	N	N
Stone content								
>2mm	% w/w	0	Y	Y	Y	Y	Y	Y
>20mm	% w/w	0	Y	Y	Y	Y	Y	Y
>50mm	% w/w	0	Y	Y	Y	Y	Y	Y
Mass loss on ignition								
Clay 5-20%	% w/w	-	-	-	-	-	-	-
Clay 20-35%	% w/w	4.5	N	N	N	Y	Y	Y
pH	pH units	8.0	Y	N	Y	Y	N	Y
Carbonate (calcareous only)	% w/w $CaCO_3$	-1.0			N			N
Nitrogen (total)	% w/w N	0.14	N	N	N			
Carbon:Nitrogen ratio	-	11.2	Y	Y	Y	Y	Y	Y
Phosphorus (extractable)	mg/l P	30	Y	Y	Y	N	N	N
Potassium (extractable)	mg/l K	296	Y	Y	Y			
Magnesium (extractable)	mg/l Mg	280.94	Y	Y	Y			
Electrical conductivity	µS/cm	72	Y					
Phytotoxic contaminants (by soil pH)								
Copper (Nitric acid extract)	mg/kg Cu	20	Y	Y	Y	Y	Y	Y
Nickel (Nitric acid extract)	mg/kg Ni	25	Y	Y	Y	Y	Y	Y
Zinc (Nitric acid extract)	mg/kg Zn	67	Y	Y	Y	Y	Y	Y
VISIBLE CONTAMINANTS								
(air-dried soil)	% w/w	<0.1	Y	Y	Y	Y	Y	Y
...of which plastics	% w/w	<0.1	Y	Y	Y	Y	Y	Y
Sharps	% w/w	None	Y	Y	Y	Y	Y	Y

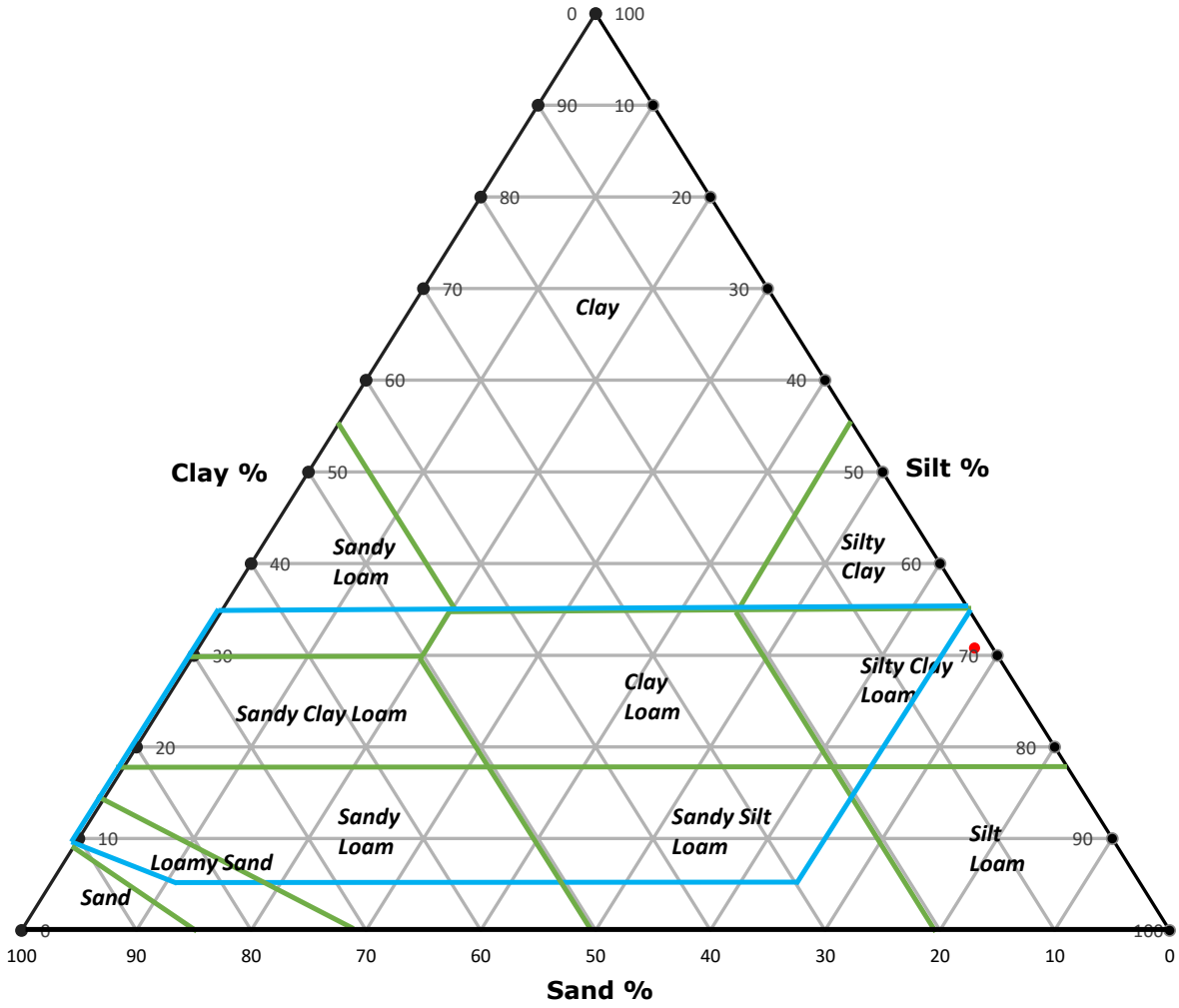
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Assessment is outside the scope of the laboratory's UKAS accreditation.

Signature E. McCulloch

Name Ellis McCulloch

Position Senior Reporting Administrator

DECLARATION OF COMPLIANCE
(BS3882:2015)



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DECLARATION OF COMPLIANCE (BS3882:2015)

CHEMTECH environmental part of Cawood

Lab ref	123462-13	**Date received**	06 June 2023
Contract name	Butterfly Park, Long Sutton	**Analysis started**	06 June 2023
Sample ID	BH 8 0.20-0.40m	**Analysis completed**	23 June 2023
OS Grid reference	Not supplied	**Report issued**	23 June 2023
Date sampled	05 June 2023		

Test	**Units**	**Result**	**Compliant with Multipurpose? (Y/N)**	**Compliant with specific purpose? (Y/N)**				
				Acidic	**Calcareous**	**Low Fertility**	**Low F Acidic**	**Low F Calcareous**
Texture								
Clay content	% w/w	30						
Silt content	% w/w	68						
Sand content	% w/w	2						
Soil texture	**class**	**SILTY CLAY LOAM**	N	N	N	N	N	N
Stone content								
>2mm	% w/w	0	Y	Y	Y	Y	Y	Y
>20mm	% w/w	0	Y	Y	Y	Y	Y	Y
>50mm	% w/w	0	Y	Y	Y	Y	Y	Y
Mass loss on ignition								
Clay 5-20%	% w/w	-	-	-	-	-	-	-
Clay 20-35%	% w/w	3.5	N	N	N	Y	Y	Y
pH	pH units	8.2	Y	N	Y	Y	N	Y
Carbonate (calcareous only)	% w/w $CaCO_3$	0.1			N			N
Nitrogen (total)	% w/w N	0.11	N	N	N			
Carbon:Nitrogen ratio	-	14.5	Y	Y	Y	Y	Y	Y
Phosphorus (extractable)	mg/l P	21	Y	Y	Y	N	N	N
Potassium (extractable)	mg/l K	213	Y	Y	Y			
Magnesium (extractable)	mg/l Mg	138.59	Y	Y	Y			
Electrical conductivity	µS/cm	62	Y					
Phytotoxic contaminants (by soil pH)								
Copper (Nitric acid extract)	mg/kg Cu	14	Y	Y	Y	Y	Y	Y
Nickel (Nitric acid extract)	mg/kg Ni	16	Y	Y	Y	Y	Y	Y
Zinc (Nitric acid extract)	mg/kg Zn	46	Y	Y	Y	Y	Y	Y
VISIBLE CONTAMINANTS								
(air-dried soil)	% w/w	<0.1	Y	Y	Y	Y	Y	Y
...of which plastics	% w/w	<0.1	Y	Y	Y	Y	Y	Y
Sharps	% w/w	None	Y	Y	Y	Y	Y	Y

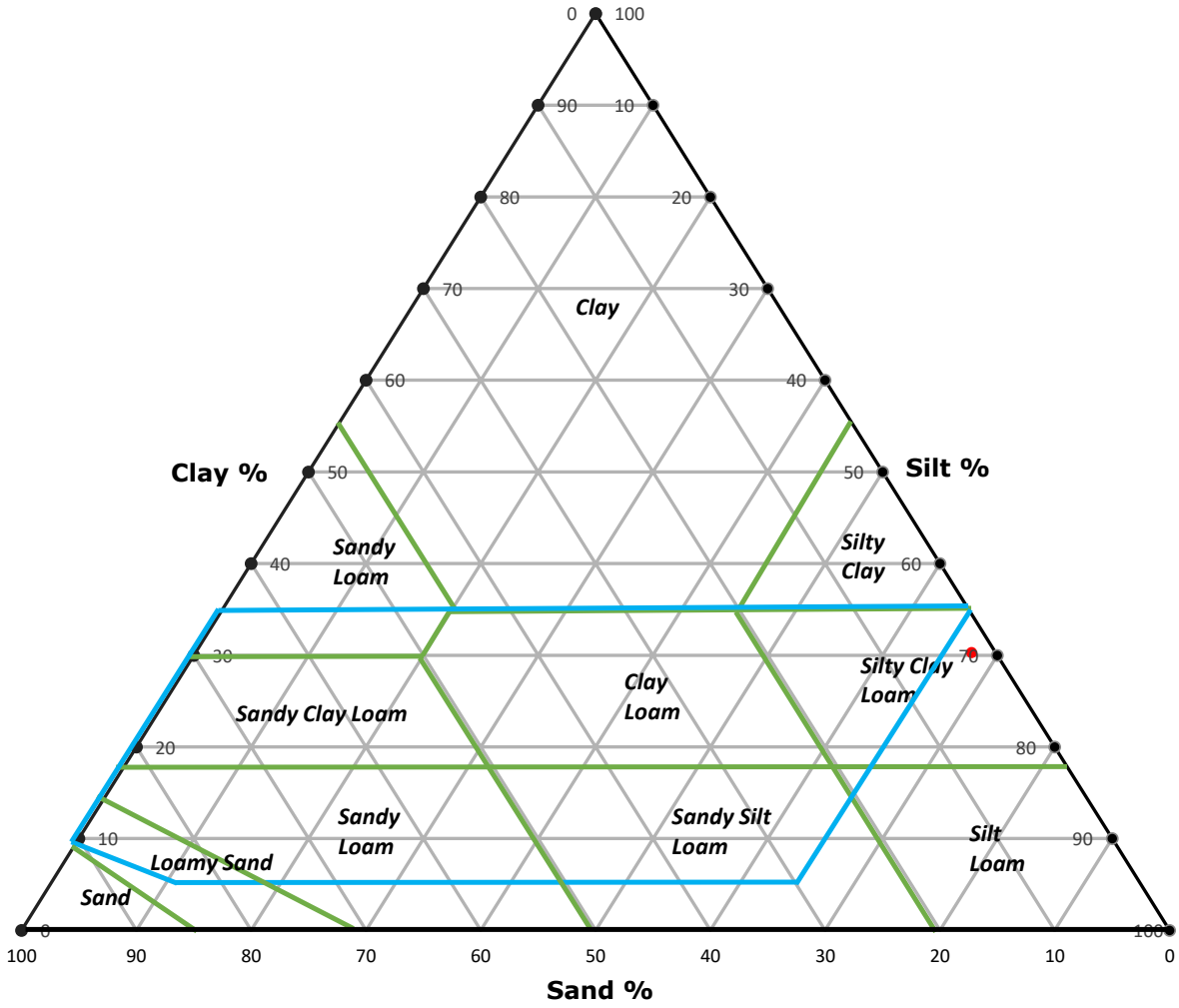
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Assessment is outside the scope of the laboratory's UKAS accreditation.

Signature E. McCulloch

Name Ellis McCulloch

Position Senior Reporting Administrator

DECLARATION OF COMPLIANCE
(BS3882:2015)



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DECLARATION OF COMPLIANCE (BS3882:2015)

CHEMTECH environmental part of Cawood

Lab ref	123462-15	**Date received**	06 June 2023
Contract name	Butterfly Park, Long Sutton	**Analysis started**	06 June 2023
Sample ID	BH 10 0.20-0.40m	**Analysis completed**	23 June 2023
OS Grid reference	Not supplied	**Report issued**	23 June 2023
Date sampled	05 June 2023		

Test	**Units**	**Result**	**Compliant with Multipurpose? (Y/N)**	**Compliant with specific purpose? (Y/N)**				
				Acidic	**Calcareous**	**Low Fertility**	**Low F Acidic**	**Low F Calcareous**
Texture								
Clay content	% w/w	31						
Silt content	% w/w	67						
Sand content	% w/w	2						
Soil texture	**class**	**SILTY CLAY LOAM**	N	N	N	N	N	N
Stone content								
>2mm	% w/w	1	Y	Y	Y	Y	Y	Y
>20mm	% w/w	0	Y	Y	Y	Y	Y	Y
>50mm	% w/w	0	Y	Y	Y	Y	Y	Y
Mass loss on ignition								
Clay 5-20%	% w/w	-	-	-	-	-	-	-
Clay 20-35%	% w/w	3.1	N	N	N	Y	Y	Y
pH	pH units	7.1	Y	N	N	Y	N	N
Carbonate (calcareous only)	% w/w $CaCO_3$	-1.2			N			N
Nitrogen (total)	% w/w N	0.13	N	N	N			
Carbon:Nitrogen ratio	-	12.5	Y	Y	Y	Y	Y	Y
Phosphorus (extractable)	mg/l P	41	Y	Y	Y	N	N	N
Potassium (extractable)	mg/l K	390	Y	Y	Y			
Magnesium (extractable)	mg/l Mg	205.11	Y	Y	Y			
Electrical conductivity	µS/cm	33	Y					
Phytotoxic contaminants (by soil pH)								
Copper (Nitric acid extract)	mg/kg Cu	17	Y	Y	Y	Y	Y	Y
Nickel (Nitric acid extract)	mg/kg Ni	25	Y	Y	Y	Y	Y	Y
Zinc (Nitric acid extract)	mg/kg Zn	176	Y	Y	Y	Y	Y	Y
VISIBLE CONTAMINANTS								
(air-dried soil)	% w/w	<0.1	Y	Y	Y	Y	Y	Y
...of which plastics	% w/w	<0.1	Y	Y	Y	Y	Y	Y
Sharps	% w/w	None	Y	Y	Y	Y	Y	Y

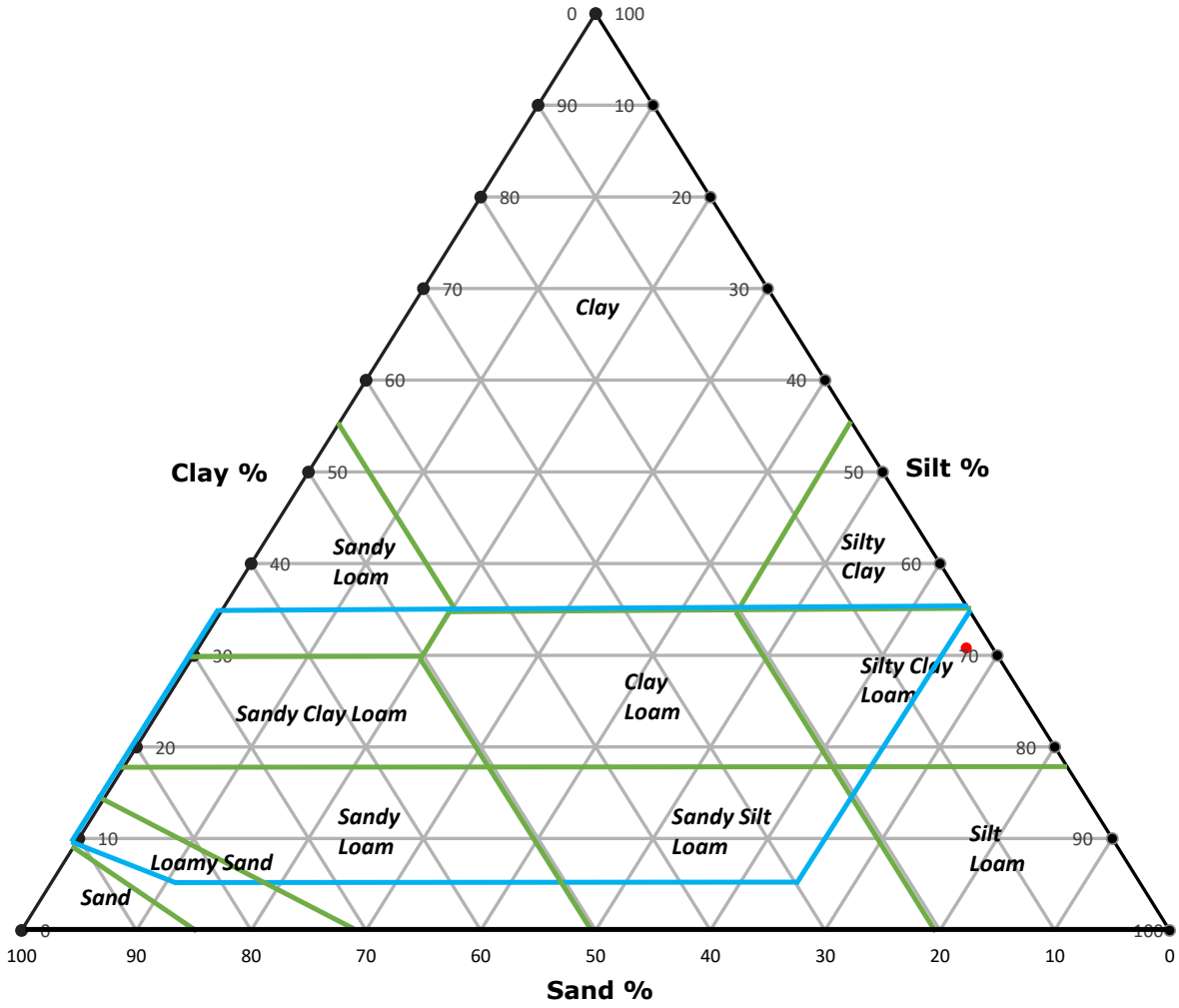
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Signature E. McCulloch

Name Ellis McCulloch

Position Senior Reporting Administrator

DECLARATION OF COMPLIANCE
(BS3882:2015)



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DECLARATION OF COMPLIANCE (BS3882:2015)

CHEMTECH environmental part of Cawood

Lab ref	123462-17	**Date received**	06 June 2023
Contract name	Butterfly Park, Long Sutton	**Analysis started**	06 June 2023
Sample ID	BH 11 0.20-0.40m	**Analysis completed**	23 June 2023
OS Grid reference	Not supplied	**Report issued**	23 June 2023
Date sampled	05 June 2023		

Test	**Units**	**Result**	**Compliant with Multipurpose? (Y/N)**	**Compliant with specific purpose? (Y/N)**				
				Acidic	**Calcareous**	**Low Fertility**	**Low F Acidic**	**Low F Calcareous**
Texture								
Clay content	% w/w	83						
Silt content	% w/w	14						
Sand content	% w/w	4						
Soil texture	**class**	**CLAY**	N	N	N	N	N	N
Stone content								
>2mm	% w/w	13	Y	Y	Y	Y	Y	Y
>20mm	% w/w	0	Y	Y	Y	Y	Y	Y
>50mm	% w/w	0	Y	Y	Y	Y	Y	Y
Mass loss on ignition								
Clay 5-20%	% w/w	-	-	-	-	-	-	-
Clay 20-35%	% w/w	6.2	Y	Y	Y	Y	Y	Y
pH	pH units	8.0	Y	N	Y	Y	N	Y
Carbonate (calcareous only)	% w/w $CaCO_3$	-1.4			N			N
Nitrogen (total)	% w/w N	0.23	Y	Y	Y			
Carbon:Nitrogen ratio	-	9.0	Y	Y	Y	Y	Y	Y
Phosphorus (extractable)	mg/l P	78	Y	Y	Y	N	N	N
Potassium (extractable)	mg/l K	456	Y	Y	Y			
Magnesium (extractable)	mg/l Mg	201.96	Y	Y	Y			
Electrical conductivity	µS/cm	53	Y					
Phytotoxic contaminants (by soil pH)								
Copper (Nitric acid extract)	mg/kg Cu	18	Y	Y	Y	Y	Y	Y
Nickel (Nitric acid extract)	mg/kg Ni	21	Y	Y	Y	Y	Y	Y
Zinc (Nitric acid extract)	mg/kg Zn	61	Y	Y	Y	Y	Y	Y
VISIBLE CONTAMINANTS								
(air-dried soil)	% w/w	<0.1	Y	Y	Y	Y	Y	Y
...of which plastics	% w/w	<0.1	Y	Y	Y	Y	Y	Y
Sharps	% w/w	None	Y	Y	Y	Y	Y	Y

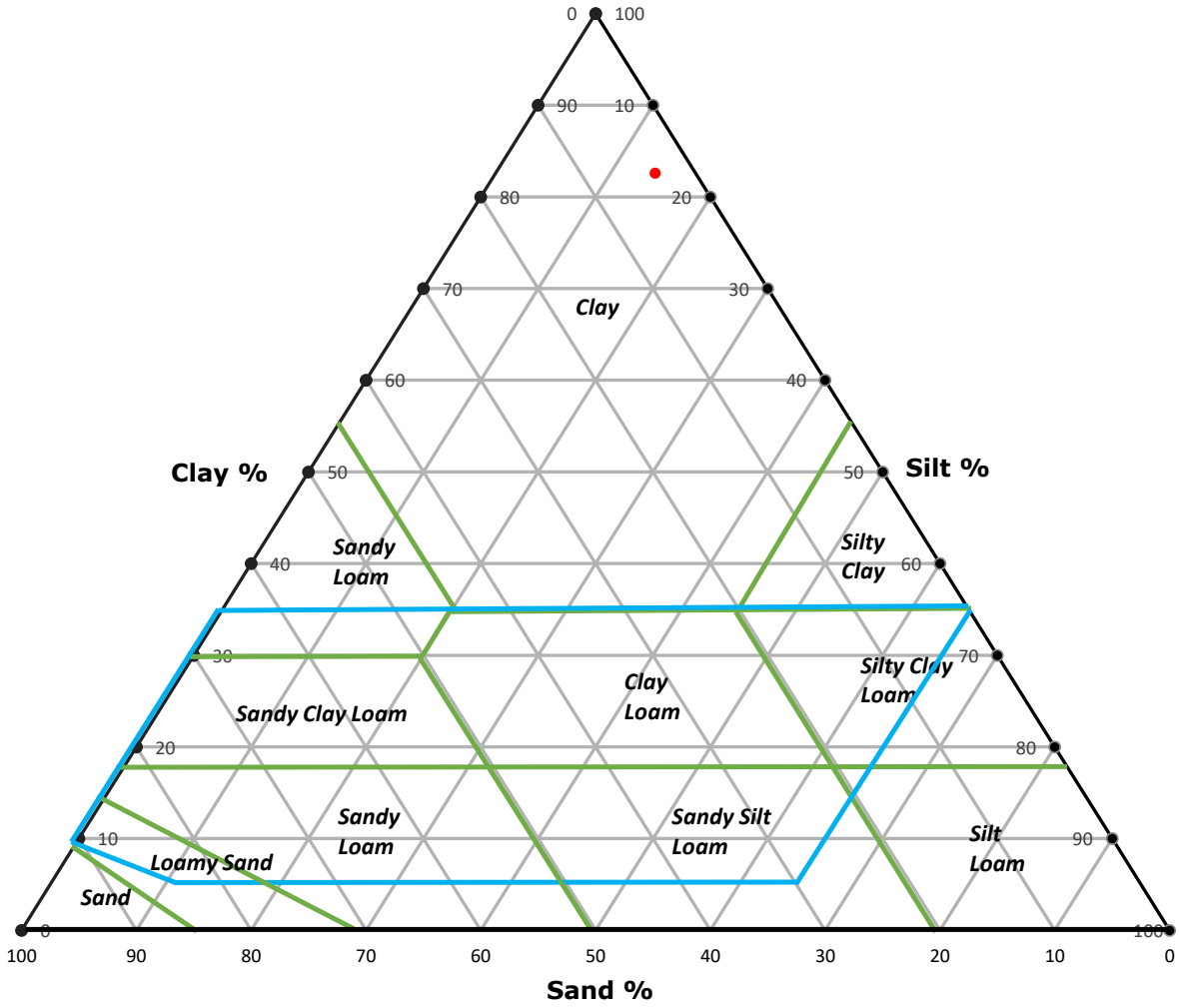
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CHEMTECH environmental part of Cawood

Lab ref	123462-23	**Date received**	06 June 2023
Contract name	Butterfly Park, Long Sutton	**Analysis started**	06 June 2023
Sample ID	BH 14 0.20-0.40m	**Analysis completed**	23 June 2023
OS Grid reference	Not supplied	**Report issued**	23 June 2023
Date sampled	05 June 2023		

Test	Units	Result	Compliant with Multipurpose? (Y/N)	Compliant with specific purpose? (Y/N)				
				Acidic	Calcareous	Low Fertility	Low F Acidic	Low F Calcareous
Texture								
Clay content	% w/w	31						
Silt content	% w/w	68						
Sand content	% w/w	2						
Soil texture	**class**	**SILTY CLAY LOAM**	N	N	N	N	N	N
Stone content								
>2mm	% w/w	0	Y	Y	Y	Y	Y	Y
>20mm	% w/w	0	Y	Y	Y	Y	Y	Y
>50mm	% w/w	0	Y	Y	Y	Y	Y	Y
Mass loss on ignition								
Clay 5-20%	% w/w	-	-	-	-	-	-	-
Clay 20-35%	% w/w	4.5	N	N	N	Y	Y	Y
pH	pH units	8.2	Y	N	Y	Y	N	Y
Carbonate (calcareous only)	% w/w $CaCO_3$	0.1			N			N
Nitrogen (total)	% w/w N	0.77	Y	Y	Y			
Carbon:Nitrogen ratio	-	2.2	Y	Y	Y	Y	Y	Y
Phosphorus (extractable)	mg/l P	24	Y	Y	Y	N	N	N
Potassium (extractable)	mg/l K	315	Y	Y	Y			
Magnesium (extractable)	mg/l Mg	171.61	Y	Y	Y			
Electrical conductivity	µS/cm	56	Y					
Phytotoxic contaminants (by soil pH)								
Copper (Nitric acid extract)	mg/kg Cu	20	Y	Y	Y	Y	Y	Y
Nickel (Nitric acid extract)	mg/kg Ni	22	Y	Y	Y	Y	Y	Y
Zinc (Nitric acid extract)	mg/kg Zn	62	Y	Y	Y	Y	Y	Y
VISIBLE CONTAMINANTS								
(air-dried soil)	% w/w	<0.1	Y	Y	Y	Y	Y	Y
...of which plastics	% w/w	<0.1	Y	Y	Y	Y	Y	Y
Sharps	% w/w	None	Y	Y	Y	Y	Y	Y

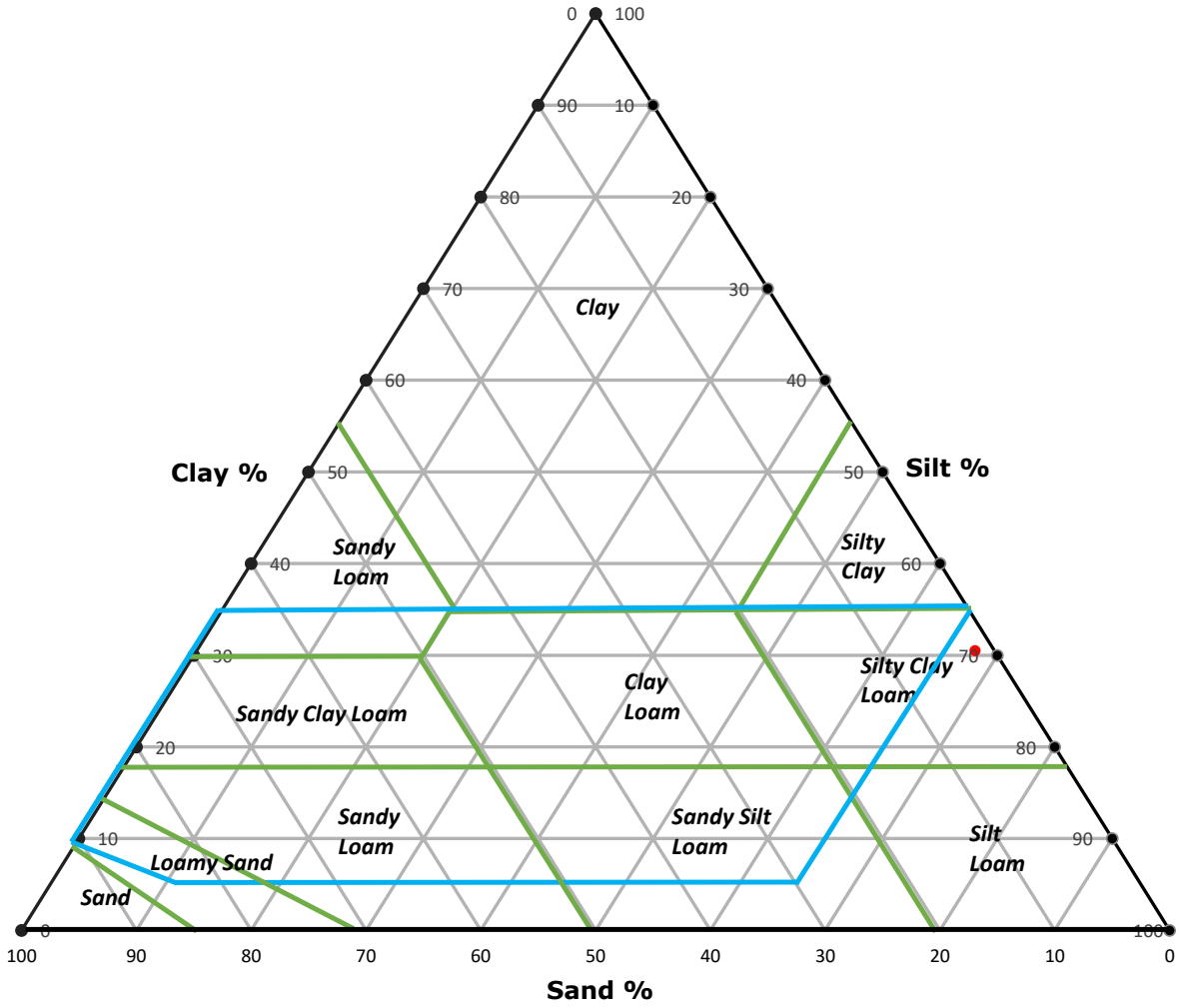
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CHEMTECH environmental part of Cawood

Lab ref	123462-25	**Date received**	06 June 2023
Contract name	Butterfly Park, Long Sutton	**Analysis started**	06 June 2023
Sample ID	BH 16 0.20-0.40m	**Analysis completed**	23 June 2023
OS Grid reference	Not supplied	**Report issued**	23 June 2023
Date sampled	05 June 2023		

Test	Units	Result	Compliant with Multipurpose? (Y/N)	Compliant with specific purpose? (Y/N)				
				Acidic	Calcareous	Low Fertility	Low F Acidic	Low F Calcareous
Texture								
Clay content	% w/w	31						
Silt content	% w/w	66						
Sand content	% w/w	2						
Soil texture	**class**	**SILTY CLAY LOAM**	N	N	N	N	N	N
Stone content								
>2mm	% w/w	1	Y	Y	Y	Y	Y	Y
>20mm	% w/w	0	Y	Y	Y	Y	Y	Y
>50mm	% w/w	0	Y	Y	Y	Y	Y	Y
Mass loss on ignition								
Clay 5-20%	% w/w	-	-	-	-	-	-	-
Clay 20-35%	% w/w	5.3	Y	Y	Y	Y	Y	Y
pH	pH units	7.8	Y	N	Y	Y	N	Y
Carbonate (calcareous only)	% w/w $CaCO_3$	-1.2			N			N
Nitrogen (total)	% w/w N	0.15	N	N	N			
Carbon:Nitrogen ratio	-	11.4	Y	Y	Y	Y	Y	Y
Phosphorus (extractable)	mg/l P	41	Y	Y	Y	N	N	N
Potassium (extractable)	mg/l K	418	Y	Y	Y			
Magnesium (extractable)	mg/l Mg	109.56	Y	Y	Y			
Electrical conductivity	µS/cm	60	Y					
Phytotoxic contaminants (by soil pH)								
Copper (Nitric acid extract)	mg/kg Cu	20	Y	Y	Y	Y	Y	Y
Nickel (Nitric acid extract)	mg/kg Ni	21	Y	Y	Y	Y	Y	Y
Zinc (Nitric acid extract)	mg/kg Zn	59	Y	Y	Y	Y	Y	Y
VISIBLE CONTAMINANTS								
(air-dried soil)	% w/w	<0.1	Y	Y	Y	Y	Y	Y
...of which plastics	% w/w	<0.1	Y	Y	Y	Y	Y	Y
Sharps	% w/w	None	Y	Y	Y	Y	Y	Y

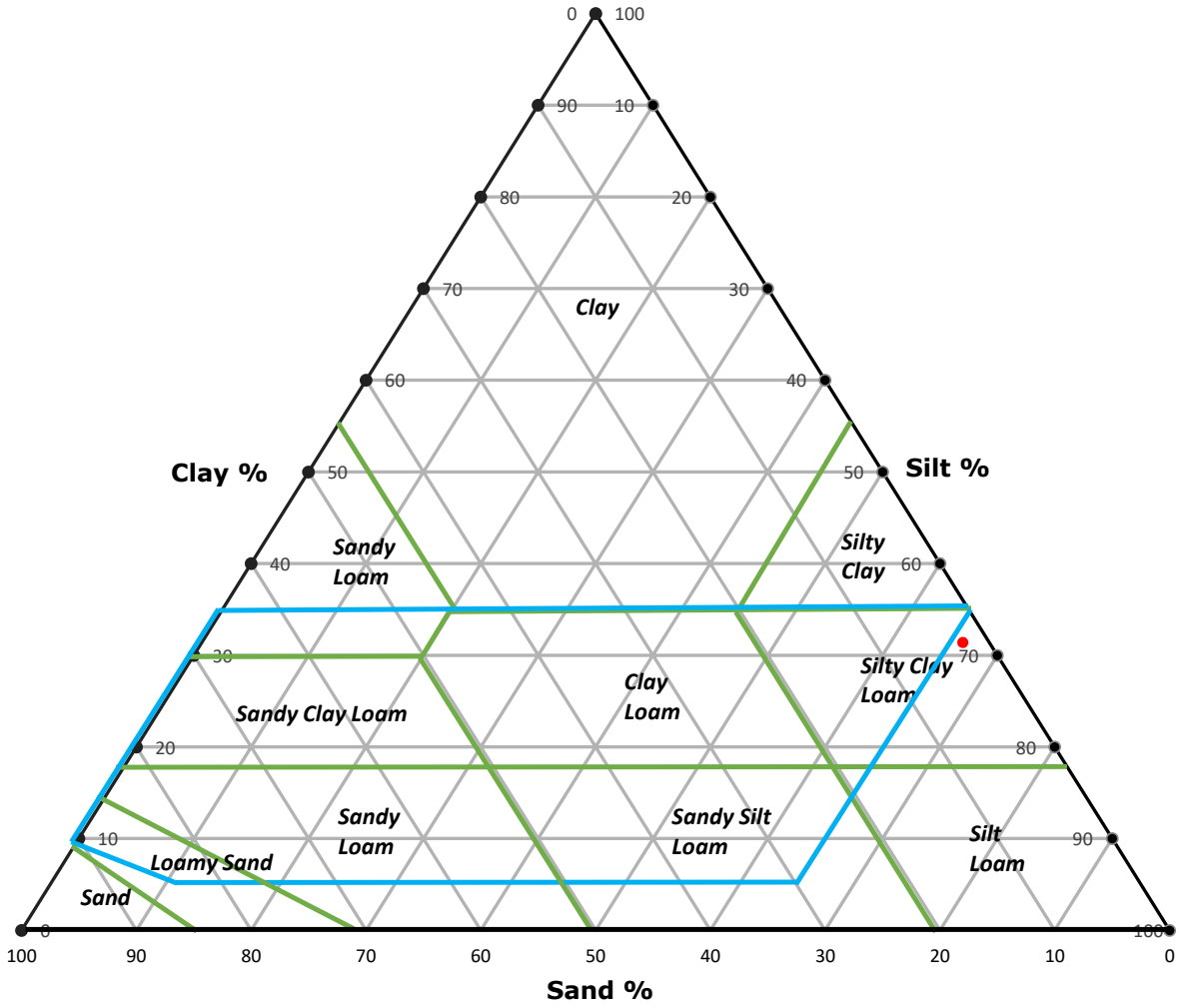
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Statement of Conformity

Statement of Conformity
Where Chemtech reports a statement of conformity to a specification, the decision rules applied are derived from the Ilac document ILAC G8:09/2019.
Acceptance limits (AL), applied are derived from the tolerance limits (TL) by you the client or applicable standard (e.g. 2003.33.EC Council Decision, BS3882, BS8601)

Agreed and reported Decision Rule:
"PASS" if the result < TL, and the bias / precision values for the process meet the targets defined within the methodology and/or applied accreditation.

Reported Decisions:
Result < TL for determinands: PASS
Result > TL for determinands: FAIL

Definitions Used:
Acceptance limit (AL) Specified upper or lower bounds of permissible measured quantity values.
Tolerance limit (TL) Specified upper or lower bound of permissible values of a property.