Scoping Investigation Report

at
Thames Young Mariners, Riverside Drive, Richmond TW10 7RX

for
Surrey County Council

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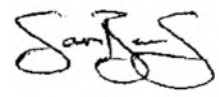

This is not a valid document for use in the design of the project unless it is titled Final in the document status box.

Current regulations and good practice were used in the preparation of this report. The recommendations given in this report must be reviewed by an appropriately qualified person at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Commission

Surrey County Council commissioned Soils Limited to undertake an intrusive ground investigation and prepare a Scoping Investigation Report on land at Thames Young Mariners, Riverside Drive, Richmond TW10 7RX. The scope of the investigation was outlined in the Soils Limited quotation reference Q25989 rev 101, dated 30th March 2022.

This document comprises the Scoping Investigation Report (SIR) and incorporates the results, discussion, and conclusions to this intrusive works.

This SIR must be read in conjunction with the Preliminary Investigation Report (PIR) undertaken on the above site by Soils Limited, Report ref: 20295/PIR, dated September 2022.

Limitations and Disclaimers

This Scoping Investigation Report relates to the site located at Thames Young Mariners, Riverside Drive, Richmond TW10 7RX and was prepared for the sole benefit of Surrey County Council (The "Client"). The report was prepared solely for the brief described in Section 1.1 of this report.

The contents, recommendations and advice given in the report are subject to the Terms and Conditions given in Quotation Q25989 rev 101, dated 30th March 2022 accepted by the by Pick Everard on behalf of the Client on 1st June 2022.

Soils Limited disclaims any responsibility to the Client and others in respect of any matters outside the scope of the above.

This report has been prepared by Soils Limited, with all reasonable skill, care and diligence within the terms of the Contract with the Client, incorporation of our General Conditions of Contract of Business and taking into account the resources devoted to us by agreement with the Client.

The report is personal and confidential to the Client and Soils Limited accept no responsibility of whatever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report wholly at its own risk.

The Client may not assign the benefit of the report or any part to any third party without the written consent of Soils Limited.

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the Client in accordance with their brief. As such these do not necessarily address all aspects of ground behaviour at the site.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

If the term “competent person” is used in this report or any Soils Limited document, it means an engineering geologist or civil engineer with a minimum of three years post graduate experience in the understanding and application of the appropriate codes of practice.

Unless the site investigation works have been designed and specified in accordance with EC7, this report is a Geotechnical Investigation Report and is not necessarily a Ground Investigation Report as defined by EC7 (Eurocode 7 Part 1, §3.4, Part 2, §6.1) or a Geotechnical Design Report (Eurocode 7 Part 1, §2.8) as defined by Eurocode 7 and as such may not characterise the ground conditions and additional works may be required to comply with the requirements of EC7.

Within the report reference to ground level relates to the site level at the time of the investigation, unless otherwise stated.

Exploratory hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sample borehole implies the specific technique used to produce an exploratory hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The Client is responsible for establishing the depth to roots and/or of desiccation on a plot by plot basis prior to the construction of foundations. Supplied site surveys may not include substantial shrubs or bushes and is also unlikely to have data or any trees, bushes or shrubs removed prior to or following the site survey.

Where trees are mentioned in the text this means existing trees, substantial bushes or shrubs, recently removed trees (approximately 20 years to full recovery on cohesive soils) and those planned as part of the site landscaping).

The geotechnical laboratory testing was performed by GEO Site & Testing Services Ltd (GSTL) in accordance with the methods given in BS 1377:1990 Parts 1 to 8 and their UKAS accredited test methods.

For the preparation of this report, the relevant BS code of practice were adopted for the geotechnical laboratory testing technical specifications, in the absence of the relevant Eurocode specifications (ref: ISO TS 17892).

The chemical analyses were undertaken by Derwentside Environmental Testing Services (DETS) in accordance with their UKAS and MCERTS accredited test methods or their documented in-house testing procedures. This investigation did not comprise an environmental audit of the site or its environs.

Ownership of land brings with it onerous legal liabilities in respect of harm to the environment. “Contaminated Land” is defined in Section 57 of the Environment Act 1995 (as updated 2021) as:

“Land which is in such a condition by reason of substances in, on or under the land that significant harm is being caused or that there is a significant possibility of such harm being caused or that pollution of controlled waters is being, or is likely to be caused”.

It must be noted that a detailed survey of the possible presence or absence of invasive species, such as Japanese Knotweed, is outside of the scope of investigation.

Deleterious materials may be present in any Made Ground that pose a potential risk to site workers, end users and adjacent vulnerable receptors. These could include a range of contaminants, including asbestos, especially if the material includes large fractions of demolition derived materials.

The investigation, analysis or recommendations in respect of contamination are made solely in respect of the prevention of harm to vulnerable receptors, using where possible best practice at the date of preparation of the report. The investigation and report do not address, define or make recommendations in respect of environmental liabilities. A separate environmental audit and liaison with statutory authorities is required to address these issues.

All environmental works are undertaken in the context of, and in compliance with, BS10175+A2 2017 and LCRM (EA 2021) and all other pertinent planning, standards, documentation and guidance appropriate to the site at the time of production which may include, but are not necessarily limited to, documents provided by BS/CEN/ISO, NHBC, AGS, CIEH, CIRIA, SoBRA and CLAIRE.

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Section 1 Introduction

1.1 Objective of Investigation

Surrey County Council commissioned Soils Limited to undertake an intrusive ground investigation and to prepare a Scoping Investigation Report to supply the Client and their designers with information regarding ground conditions, to assist in preparing a foundation scheme for development that was appropriate to the settings present on the site.

The investigation was to be undertaken to provide comment on appropriate foundation options for the proposed development. The investigation was to be made by means of in-situ testing and geotechnical laboratory testing undertaken on soil samples taken from the exploratory holes.

Soil samples were taken for chemical laboratory testing to enable recommendations for the safe redevelopment of the site and the protection of site workers, end-users and the public from any contamination identified as dictated by the Conceptual Site Model (CSM) in the Preliminary Investigation Report undertaken for the site by Soils Limited (Report ref: 20295/PIR, September 2022).

1.2 Location

The Site was located west of Riverside Drive, approximately 1.2km northeast of Teddington and 1.1km southeast of Twickenham, within the boundary of the London Borough of Richmond upon Thames (LBRuT), at a postcode of TW10 7RX. The centre of the site had an approximate O.S Land Ranger Grid Reference of TQ 16397 72304.

The site location plan is given in Figure 1.

1.3 Site Description

The wider site area was approximately 8.9ha and located off the eastern bank of the River Thames. Approximately 3.7ha of the current site was cover by an artificial lake, formed circa 1934 and later remodelled, circa 1980 into its current shape. Surrounding the northern and eastern sides of the lake was woodland, becoming grassland with pockets of trees along the south-eastern side. Within the south-western corner was the main Thames Young Mainers (TYM) complex which comprised a cluster of single storey, brick, timber, and metal buildings, with exception of the main building, which had a lower ground floor looking out on to the lake. The remaining area southwest of the main complex was outdoor amenity space and a few storage buildings.

The proposed development area was centred around the main complex and extended along the southern side of the lake.

An aerial photograph of the site and its close environs has been included in Figure 2.

1.4 Proposed Development

The proposal comprised demolition of the existing TYM complex and associated building and construction of new main building, guest residential accommodation, changing block, staff residential accommodation, repair workshop and camping changing block. The layout comprised the main building located in the northwest corner followed by three guest accommodation buildings arranging approximately in a circle southeast of the main building. To the east of the main building was the changing block, and along the southern boundary was the staff accommodation building. Within the southwestern corner of the site was the camping changing block and repair workshop. Surrounding the building would be communal grassland. The use of the site would remain the same. The life span of the development was anticipated to be 100 years.

In compiling this report reliance was placed on document, Pre-Application Report 03, Issue number P01 dated July 2022 and was prepared by Pick Everard. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Development plans provided by the Client are presented in Appendix G.

1.5 Anticipated Geology

The 1:50,000 BGS map showed the site to be located upon Artificial Deposits, with superficial deposits of Kempton Park Gravel Member and bedrock of the London Clay Formation.

1.5.1 Artificial Deposits – Infilled Ground

Artificial Deposits (Made Ground) labelled as infilled ground exists where the natural ground surface has been excavated and subsequently partially or wholly backfilled with worked ground.

1.5.2 Kempton Park Gravel Member

The Kempton Park Gravel Member is part of the river terrace deposits, which form the base of the Maidenhead Formation. The river terrace deposits were formed by ancient floodplains associated with the rivers of south-east England. The rivers have been subject to at least three changes of level since Pleistocene times, forming a complex series of river terrace deposits. The Kempton Park Gravel is found at an elevation below the current river. The composition varies greatly, depending on the source material that was available in the river's catchment. Deposits generally consist of sands and gravels of roughly bedded flint or chert gravels commonly in a matrix of silts and clays.

1.5.3 London Clay Formation

The London Clay Formation comprises stiff grey fissured clay, weathering to brown near surface. Concretions of argillaceous limestone in nodular form (Claystones) occur throughout the formation. Crystals of gypsum (Selenite) are often found

within the weathered part of the London Clay, and precautions against sulphate attack to concrete are sometimes required.

The upper boundary member of the London Clay Formation is known as the Claygate Member and marks the transition between the deep water, predominantly clay environment and succeeding shallow-water, sand environment of the Bagshot Formation.

The lower boundary is generally marked by a thin bed of well-rounded flint gravel and/or a glauconitic horizon. The formation overlies the Harwich Formation or where the Harwich Formation is absent the Lambeth Group.

Section 2 Site Works

2.1 Proposed Project Works

The proposed intrusive investigation was designed to provide information on the ground conditions and to aid the design of foundations for the proposed development. The intended investigation, as outlined within the Soils Limited quotation (Q25989 rev 101, dated 30th March 2022), was to comprise the following items:

- Scanning of exploratory hole locations with a Cable Avoidance Tool (C.A.T.) and GENNY prior to excavation to ensure the health and safety of the operatives,
- 1No. 20m deep cable percussive borehole,
- 4No. up to 4m deep Windowless sampling boreholes,
- 4No. up to 6m deep dynamic probes (DPSH),
- Californian Bearing Ratio (CBR) via Dynamic Cone Penetrometer (DCP) -TRL probe,
- 1No. machine excavated trial pit for infiltration testing to the principles of BRE 365,
- Installation of combined groundwater and gas monitoring well,
- 3No rounds of gas and groundwater monitoring.

2.1.1 Actual Project Works

The actual project works were undertaken between 10th and 12th August 2022, with subsequent sample logging, laboratory testing, monitoring, and reporting. The actual works comprised:

- Scanning of exploratory hole locations with a C.A.T. and GENNY prior to excavation to ensure the health and safety of the operatives,
- 1No. 20m deep cable percussive borehole – BH1,
- 4No. up to 4m deep Windowless sampling boreholes – WS1 to WS4,
- 4No. up to 6m deep DPSH – DP1 to DP4,
- Californian Bearing Ratio (CBR) via Dynamic Cone Penetrometer (DCP) -TRL probe – DCP1 to DCP6,
- 2No. Machine excavated trial pits for infiltration testing to the principles of BRE 365 – TPSK1 and TPSK2,
- Installation of combined groundwater and gas monitoring well,
- 3No rounds of gas and groundwater monitoring (ongoing),
- 1No. Foundation Exposure (FE1).

The four windowless sampler boreholes and two trial pits were backfilled with arisings.

The cable percussive borehole was backfilled with arisings to 6.00m below ground level (bgl), followed by the installation of the 6m standpipe monitoring well.

All exploratory hole locations have been presented in Figure 3.

Following completion of site works, soil cores were logged, and sub-sampled so that samples could be sent to the laboratory for both contamination and geotechnical testing.

2.2 Ground Conditions

The intrusive investigation was carried out between the 10th and 12th August 2022 and included:

- One 20m deep cable percussive borehole (BH1) drilled using a Dando 2000, at a location selected by Soils Limited based on proposed information provided by the Client. A 6m deep standpipe monitoring well was installed to allow a period of ground gas and groundwater monitoring by Soils Limited.
- Four windowless sampler boreholes (WS1 to WS4) were drilled to depths between 4.00m and 5.00m bgl, using a Premier 110 drilling rig at locations selected by Soils Limited, located around existing infrastructure and based on the proposed development plan. WS1 was extended to 5.00m bgl due to encountering Made Ground to a depth of 4.50m bgl.
- Four DPSH were undertaken prior and adjacent to their respective windowless sampler borehole to depths between 5.00m and 7.00m bgl. DP1 was extended to 7.00m bgl due to extremely low blow counts between 4.50m and 5.50m bgl and DP2 was terminated at 5.00m bgl due to consecutive high blow counts and reaching the equipment's safe working limit.
- Six DCP-TRL probes (DCP1 to DCP6) were undertaken to a depth of 0.95m bgl, located around existing infrastructure and based on the proposed development plan.
- Two trial pits (TPSK1 and TPSK2) machine excavated to depths between 2.40m and 3.20m bgl, for conducting infiltration testing to the principles of BRE 365. The second trial pit location was undertaken on request from the Client's engineers.
- One 6m standpipe monitoring well installed into BH1 comprising, slotted pipe with a gravel surround from 6.00m to 1.00m bgl, followed by plain pipe with a bentonite seal, and cast-iron cover. A total of three monitoring visits were commissioned, which were ongoing at the time of reporting.
- One foundation exposure was undertaken at the request of the Clients engineers to determine the foundation depth of the existing main building. The foundation exposure was undertaken at a location where access could be gain along the northern side of the existing main building.

The maximum depths of exploratory holes have been included in Table 2.1.

Table 2.1 Final Depth of Exploratory Holes

Exploratory Hole	Depth (m bgl)	Exploratory Hole	Depth (m bgl)
BH1[W]	20.00	WS4 [DP4]	4.00 [6.00]
WS1 [DP1]	5.00 [7.00]	DCP1 to DCP6	0.95
WS2 [DP2]	4.00 [5.00]	TPSK1	3.20
WS3 [DP3]	4.00 [6.00]	TPSK2	2.40

Note(s): [W] - well installation. The depths given in this table are taken from the ground level on-site at the time of investigation.

The approximate exploratory hole locations are shown on Figure 3.

The soil conditions encountered were recorded and soil sampling commensurate with the purposes of the investigation was carried out. The depths given on the exploratory hole logs and quoted in this report were measured from ground level.

The soils encountered from immediately below ground surface have been described in the following manner. Where the soil incorporated an organic content such as either decomposing leaf litter or roots or has been identified as part of the in-situ weathering profile, it has been described as Topsoil both on the logs and within this report. Where man has clearly either placed the soil, or the composition altered, with say greater than an estimated 5% of a non-natural constituent, it has been referred to as Made Ground both on the log and within this report.

For more complete information about the soils encountered within the general area of the site reference must be made to the detailed records given within Appendix B, but for the purposes of discussion, the succession of conditions encountered in the exploratory holes in descending order can be summarised as:

Artificial Deposits – Made Ground/ Worked Ground (MG/ WG)
Kempton Park Gravel Member (KPGR)
London Clay Formation (LC)

The ground conditions encountered in the exploratory holes are summarised in Table 2.2.

Table 2.2 Ground Conditions

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
MG	Anthropocene	G.L.	2.10 to 4.50	3.40	Orangish brown/ dark brown slightly clayey/ clayey gravelly SAND Soft to stiff orangish brown/ brown mottled dark brown slightly gravelly/ gravelly CLAY Dark greyish brown mottled orangish brown, light brown clayey very sandy

Strata	Epoch	Depth Encountered (m bgl)		Typical Thickness (m)	Typical Description
		Top	Bottom		
					GRAVEL
WG	Anthropocene	1.10 to 4.50	1.10 to >7.50	Not proven[2]	Soft to firm yellowish brown slightly gravelly sandy CLAY. The gravel was sub-angular, fine to medium flint.
KPGR	Pleistocene	2.10 to 4.50	9.70	6.20	Yellowish brown slightly clayey gravelly fine to coarse SAND / sandy GRAVEL
LC	Eocene	9.70	20.00[1]	Not proven[2] (>11.30)	Firm to stiff grey silty CLAY.

Note(s): [1] Final depth of exploratory hole. [2] Base of strata not established. The depths given in this table are taken from the ground level on-site at the time of investigation.

2.3 Ground Conditions Encountered in Exploratory Holes

The ground conditions encountered in exploratory holes have been described below in descending order. The engineering logs are presented in Appendix B.1.

2.3.1 Artificial Deposits

The terms Made Ground and Worked Ground, for the purposes of this report are used to describe deposits based on the following definitions:

Made Ground: Deposits that have been disturbed and placed by human activity and include anthropogenic material (brick, concrete fragments etc.).

Worked Ground: Deposits that contain no anthropogenic material but exhibit signs of disturbance or appear to be fill material.

Soils described as Made Ground were encountered from ground level in all exploratory holes to a minimum depth of 0.50m and maximum depth of 4.50m bgl.

The Made Ground was variable and typically comprised combination of the following soil types:

Orangish brown/ dark brown slightly clayey/ clayey gravelly SAND. The gravel was fine to coarse, with a combination of brick, glass, sandstone, ceramic, metal, clinker, and flint.

Soft to stiff orangish brown/ brown mottled dark brown slightly gravelly/ gravelly CLAY. The gravel was fine to medium, angular to sub-angular, with a combination of flint, clinker, and brick.

Dark greyish brown mottled orangish brown, light brown clayey very sandy GRAVEL. The gravel was sub-angular fine to coarse, with a combination of flint, concrete, brick, tarmacadam, and clinker.

Soils described as Worked Ground were encountered underlying the Made Ground in three locations (WS1, TPSK1 and TPSK2), to a minimum depth of 1.10m and maximum depth of >7.00m bgl.

The Worked Ground comprised soft to firm yellowish brown slightly gravelly sandy CLAY. The gravel was sub-angular, fine to medium flint.

The established depth of Made Ground and Worked Ground found at each exploratory hole location have been included in Table 2.3.

Table 2.3 Established Depth of Artificial Deposits

Exploratory Hole	Made Ground Depth (m bgl)	Worked Ground Depth (m bgl)
BH1	3.50	Not encountered
WS1 [DP1]	4.50 [4.50]	>5.00[1] [>7.00[1]][2]
WS2 [DP2]	3.00 [3.00]	Not encountered
WS3 [DP3]	2.10 [2.10]	Not encountered
WS4 [DP4]	>4.00 [5.70][2]	Not encountered
TPSK1	2.00	>3.20[1]
TPSK2	0.50	1.10

Note(s): [1] Final depth of exploratory hole. [2] Base of strata not established.

2.3.2 Kempton Park Gravel Member

Soils described as Kempton Park Gravel Member were encountered underlying the Made Ground or Worked Ground at five out of seven exploratory locations. WS1 and TPSK1 were terminated in the overlying Worked Ground.

The Kempton Park Gravel Member typically comprised yellowish brown slightly clayey gravelly fine to coarse SAND / sandy GRAVEL. The gravel was rounded to angular, fine to coarse, flint.

The established depth of Kempton Park Gravel Member found at each exploratory hole location have been included in Table 2.4.

Table 2.4 Established Depth of Kempton Park Gravel Member

Exploratory Hole	Depth (m bgl)
BH1	9.70
WS1 [DP1]	Not encountered
WS2 [DP2]	>4.00[1] [>5.00[1]][2]
WS3 [DP3]	>4.00[1] [>6.00[1]][2]
WS4 [DP4]	[>6.00[1]][2]
TPSK1	Not encountered
TPSK2	>2.40[1]

Note(s): [1] Final depth of exploratory hole. [2] Base of strata not established.

2.3.3 London Clay Formation

Soils described as London Clay Formation were established in BH1 underlying the Kempton Park Gravel Member and persisted to the full investigatory depth of 20.00m bgl. The six other exploratory locations terminated in overlying soils of either, Made Ground, Worked Ground or Kempton Park Gravel Member.

The London Clay Formation typically comprised firm to stiff grey slightly silty/silty slightly sandy CLAY.

The established depth of London Clay Formation is included in Table 2.5.

Table 2.5 Established Depth of London Clay Formation

Exploratory Hole	Depth (m bgl)
BH1	>20.00[1]

Note(s): [1] Final depth of exploratory hole.

2.4 Roots

Roots were encountered in six out of seven exploratory holes at depths ranging between 1.75m and 5.00m bgl.

The established depth of root penetration found at the exploratory hole locations has been included in Table 2.6.

Table 2.6 Established Depth of Root Penetration

Exploratory Hole	Depth (m bgl)	Exploratory Hole	Depth (m bgl)
WS1	5.00	WS4	1.75
WS2	3.00	TPSK1	3.20
WS3	1.85	TPSK2	2.40

Roots may be found to greater depth at other locations on the site particularly close to trees and/or trees that have been removed both within the site and its close environs.

It must be emphasised that the probability of determining the maximum depth of roots from a narrow diameter borehole is low. A direct observation such as from within a trial pit is necessary to gain a better indication of the maximum root depth.

Based on Google Earth™ imagery back to 2002, the development area of the site has largely, baring a couple of isolated semi to mature trees, had no vegetation apart from grass. The 1945 aerial map potentially showed the site development area to be covered in trees, but it was not possible to confirm due to the image's low resolution.

2.5 Groundwater

Groundwater was not encountered during the drilling or excavation of the trial pit. Due to

the speed of drilling and casing used within the cable percussive borehole, groundwater strikes can be masked.

Changes in groundwater level occur for a number of reasons including seasonal effects and variations in drainage or tidal effects. The investigation was conducted in August (2022), when groundwater levels are typically reaching their annual minimum (lowest) elevation, which typically occurs around September, then rising to their annual maximum (highest) elevation, which typically occurs March.

A 6m deep groundwater monitoring well was installed into BH1, with 3No. return monitoring visits commissioned. The River Thames in this reach is tidal and groundwater is likely to be influenced by the river level, with a lag and attenuation. The recorded groundwater depths are presented in Table 2.7.

Table 2.7 Groundwater Monitoring

Exploratory Hole	Well Depth (m bgl)	Depth to Water (m bgl)		
		07/09/22	20/09/22	06/10/22
BH1	6.00	4.00	5.55	5.59

Groundwater equilibrium conditions may only be conclusively established, if a series of observations are made via groundwater monitoring wells.

2.6 Foundation Exposures

A single foundation exposure (FE1) was undertaken at the request from the Client's engineers to investigate the existing foundation of the main building. The exposure was undertaken where access could be gained.

2.6.1 Foundation Exposure FE1

FE1 was excavated to a depth of 0.70m bgl, with Made Ground encountered from surface to 0.70m bgl. The base of the building's foundation was established at 0.55m bgl and comprised a 200mm thick concrete footing, which extended out from the brickwork by 180mm. The concrete footing was founded on the Made Ground.

The full foundations sketched is presented in Appendix B.2.

Section 3 Discussion of Geotechnical In-Situ and Laboratory Testing

3.1 Standard Penetration Tests

Standard Penetration Tests (SPTs) were undertaken in BH1. The results were interpreted based on the classifications outlined in Appendix C.1, Table C.1.1 to Table C.1.2.

The SPT "N60" values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig's trip hammer efficiency, borehole depth, overburden factors etc. Further correction of the 'N' values should therefore not be necessary. The energy ratio of the drilling rig was 85%. The energy ratio for each location is presented on the individual logs within Appendix B.1.

The Made Ground recorded an SPT "N60" value of 10.

The Kempton Park Gravel Member recorded SPT "N60" values between 16 and >50. Classifying the granular soils with a relative density of medium dense to very dense, generally increasing in density with depth. The SPT undertaken at 9.50m bgl was excluded due to being undertaken across the boundary between the Kempton Park Gravel Member and underlying London Clay Formation.

The London Clay Formation recorded SPT "N60" values between 43 and 48. Classifying the cohesive soils as very high strength within inferred undrained cohesive strength of 215 to 240kPa. The strength was generally increasing with depth.

A full interpretation of the SPT results, are outlined in Appendix C.2, Table C.2.1.

3.2 Dynamic Probe Tests

Dynamic probing (DPSH) was undertaken at four locations (DP1 to DP4) adjacent and prior their respective windowless sampler boreholes, to depths between 5.00m and 7.00m bgl. The results were converted to equivalent SPT "N60" values based on dynamic energy using commercial computer software (Geostru). The results were then interpreted based on the classifications outlined in Appendix C.1,Table C.1.1 to **Error! Reference source not found.**.

The SPT "N60" values presented have been corrected in accordance with BS EN 22476 Part 3, to account for the rig's trip hammer efficiency, borehole depth, overburden factors etc. Further correction of the 'N' values should therefore not be necessary. The energy ratio of the drilling rig was 92.96%. The energy ratio for each location is presented on the individual logs within Appendix B.1.

The Made Ground/ Worked Ground recorded equivalent SPT "N60" values of between <2 and 37. The highest blow count were observed in the upper 1m metre. The lowest blow counts/ equivalent SPT "N60" values were recorded in DP1 and DP4. Equivalent SPT "N60" values of <2 to 5 were recorded in DP1 between 3.30m and 6.80m bgl, and in

DP4 values of <2 to 4 were recorded between 0.90m and 5.80m bgl. The dynamic probes indicated that the Made Ground/ Work Ground has been placed as uncontrolled fill and will therefore exhibit extremely variable strength and density characteristics.

The Kempton Park Gravel Member recorded equivalent SPT “N60” values between 14 and >50. Classifying the granular soils with a relative density of medium dense to very dense. The density was generally increasing with depth.

The London Clay Formation was not encountered within the dynamic probes, which were driven to a maximum depth of 7.00m bgl.

A full interpretation of the DPSH tests, are outlined in Appendix C.2, Table C.2.2.

3.3 Dynamic Cone Penetrometer Tests

The DCP-TRLs were undertaken at six locations (DCP1 – DCP6), located around existing infrastructure and based on the proposed development plan. The results were interpreted based on the classification outlined in Appendix C.1.

The results from DCP testing indicated CBR values of between 7% and 141% for the soils encountered in the top 1.00m bgl. The calculated values were not consistent along the test length, which was characteristic of the variable Made Ground encountered.

The DCP results are presented in Appendix C.3.

3.4 Infiltration Tests

Infiltration testing was undertaken in TPSK1 and TPSK2 within the Worked Ground and Kempton Park Gravel Member respectively. The testing following the principles of BRE Digest 365 Soakaway design: 2016. BRE 365, which states to obtain an accurate infiltration rate a soakage pit needs to be filled three times in quick succession. Each test can only be ended once 75% of the water present has drained away.

A single test was carried in TPSK1, which observed insufficient soakage to allow the calculation of an infiltration rate. The trial pit was excavated to a depth of 3.20m bgl. Made Ground was encountered to 2.00m bgl followed by Worked Ground to the base of the trial pit. The Worked Ground was described as slightly gravelly sandy CLAY. Water was added to the pit up to a depth of 2.38m bgl and over a period of 4.5hrs dropped 140mm.

Three complete tests were carried out in TPSK2 within the Kempton Park Gravel Member, with a base depth of 2.40m bgl. 1000 litres of water were pumped into the trial pit for each test. The water draining away within 2 minutes for each test. An infiltration rate was calculated as 1.99E-03 m/sec.

The test data is presented in Appendix B.3.

3.5 Quick Unconsolidated Undrained Triaxial Compression Tests

Quick Unconsolidated Undrained Triaxial Compression Tests (QUU) were performed on four samples obtained from the London Clay Formation. The strength interpretation was based on the classification outlined in Table C.2.3.

The QUU testing indicated soils of the London Clay Formation were of a high to very high strength with an undrained cohesion of 87 to 231kPa. The strength was increasing with depth.

A full interpretation of the QUU tests are outlined Table C.2.3, Appendix C.2 and the laboratory report in Appendix C.3.

3.6 Atterberg Limit Tests

Atterberg Limit tests were performed on four samples, one obtained from the Made Ground, one obtained from the Worked Ground, and the remaining two from the London Clay Formation. The results were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2.

The sample of Made Ground was recorded as non-plastic and had no volume change potential.

The Worked Ground was classified as low volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2. Due to the inherent variability of Worked Ground soils with a higher volume change potential could be found at other locations on the site.

The London Clay Formation was classified as medium volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

A full interpretation of the Atterberg Limit tests, are outlined in Table C.2.4, Appendix C.2 and the laboratory report in Appendix C.3.

3.7 Particle Size Distribution Tests

Particle Size Distribution (PSD) tests were performed on five samples from the Kempton Park Gravel Member.

The PSD tests classified the granular beds of the Kempton Park Gravel Member as having a no volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

A full interpretation of the PSD tests, are outlined in Table C.2.5, Appendix C.2 and the laboratory report in Appendix C.3.

3.8 Sulphate and pH Tests

Seven samples, three obtained from the Made Ground, two from the Kempton Park Gravel Member and two from the London Clay Formation, were submitted for water soluble sulphate (2:1) and pH testing in accordance with Building Research Establishment Special Digest 1, 2005, 'Concrete in Aggressive Ground'.

The tests recorded water soluble sulphate between <10mg/l and 205mg/l with pH values of 7.4 to 8.6.

The significance of the sulphate and pH Test results are discussed in Section 5.2 and the laboratory report in Appendix C.3.

Section 4 Engineering Appraisal

4.1 Established Ground Conditions

An engineering appraisal of the soil types encountered during the site investigation and likely to be encountered during the redevelopment of this site is presented. Soil descriptions are based on analysis of disturbed samples taken from the exploratory holes.

4.1.1 Artificial Deposits

Foundations must not be placed on non-engineered fill unless such use can be justified on the basis of a thorough ground investigation and detailed design. Foundations must be taken through any Topsoil, Made Ground or Worked Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

Soils described as Made Ground and Worked Ground were encountered at all seven exploratory hole locations, to depth ranging between 1.10m and >7.00m bgl.

Atterberg Limits testing undertaken on granular Made Ground showed the sample to have no volume change potential at the sampling locations.

Atterberg Limits testing undertaken on cohesive Worked Ground showed the sample to have a low volume change potential in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Due to the inherent variability of Artificial Deposits soils with varying volume change potential could be present across the site.

4.1.2 Kempton Park Gravel Member

Soils described as Kempton Park Gravel Member were encountered underlying the Made Ground or Worked Ground at five out of seven exploratory locations. WS1 and TPSK1 were terminated in the overlying Worked Ground.

The SPT results classified the relative density of the Kempton Park Gravel Member as medium dense to very dense.

The results from DPSH testing inferred the relative density of the Kempton Park Gravel Member as medium to very dense.

The results from PSD tests confirmed that the soils of the Kempton Park Gravel Member had **no volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Soils of the Kempton Park Gravel Member are granular superficial deposits and as such expected to display moderate to high bearing capacities with low settlement

characteristics. However, due to the thickness of overlying Artificial Deposits the Kempton Park Gravel Member would only be suitable for a deep foundation scheme, based on the proposed development.

4.1.3 London Clay Formation

Soils described as London Clay Formation were established in BH1 underlying the Kempton Park Gravel Member and persisted to the full investigatory depth of 20.00m bgl. The six other exploratory locations terminated in overlying soils of either, Made Ground, Worked Ground or Kempton Park Gravel Member.

The SPT results classified the strength of the London Clay Formation as very high, with inferred undrained cohesive strength of 215 to 240kPa.

The QUU tests indicated soils of the London Clay Formation were of a high to very high strength with an undrained cohesion of 87 to 231kPa.

The results from Atterberg Limits tests showed that the soils of the London Clay Formation had **medium volume change potential** in accordance with both BRE Digest 240 and NHBC Standards Chapter 4.2.

Soils of the London Clay Formation are overconsolidated cohesive soils that typically comprise moderate bearing and moderate to high settlement characteristics. At the depth encountered of 9.70m bgl the London Clay Formation was suitable for deep foundations.

4.1.4 Guidance on Shrinkable Soils

The ground conditions were established as Artificial Deposits of the Made Ground and Worked Ground. Typically, the Made Ground encountered was granular and the Worked Ground encountered cohesive. The Artificial Deposits overlay the granular Kempton Park Gravel Member followed by the cohesive London Clay Formation.

Atterberg Limit and PSD testing were classified in accordance with BRE Digest 240 and NHBC Standards Chapter 4.2 to determine the volume change potential.

The volume change potential for each stratum was established and presented in Table 4.1.

Table 4.1 Established Volume Change Potential by Strata

Strata	Volume Change Potential		Lower Boundary (m bgl)
	BRE	NHBC	
MG - Granular	None	None	2.10 to 4.50
WG - Cohesive	Low	Low	1.10 to >7.50
KPGR	None	None	9.70

Strata	Volume Change Potential		Lower Boundary (m bgl)
	BRE	NHBC	
LC	Medium	Medium	>20.00

4.1.5 Groundwater

Groundwater was not encountered during the intrusive investigation. Due to water being adding to aid drilling of the BH1 groundwater strikes were likely masked. A 6.00m bgl monitoring well was installed into BH1 and monitored on two occasions at the time of reporting. The monitoring was carried out in September, with groundwater recorded at 4.00m and 5.55m bgl.

The groundwater level around the site was likely to be affected by the tidal river water level within the River Thames, with a lag and attenuation. The water level within the on-site lake was also controlled by a lock connecting to the River Thames. Groundwater levels were therefore likely to vary daily due to tidal changes and yearly basis due to seasonal changes.

Section 5 Foundation Scheme

5.1 Foundation Recommendations

Foundations **must not** be constructed within any Made Ground/ Worked Ground due to the likely variability and potential for large load induced settlements both total and differential.

Due to the thickness of Made Ground/ Worked Ground encountered across the site a deep foundation scheme will be required.

5.1.1 Piled Foundations

Deep foundations such as bored piles could be adopted within piles taken to depth into suitable soils of the Kempton Park Gravel Member and/ or London Clay Formation.

The construction of a piled foundation is a specialist job with the actual pile working load depending on the pile type and installation method. Prior to finalising the foundation design the advice from a reputable contractor who is familiar with the ground and groundwater conditions present at the site must be sought.

Vertical load capacities are provided in Appendix D.1., for varying diameters and lengths of bored piles taken into the Kempton Park Gravel Member and London Clay Formation, based on geotechnical laboratory and in-situ testing, and must only be used for preliminary design purposes.

A factor of safety of 3 was applied to the characteristic line derived from testing undertaken, for both the shaft and base load capacities. Values of 9 and 0.45 were adopted for the bearing capacity factor Nc and Alpha Value, respectively.

The bearing values given in Appendix D.1., are applicable to single vertically loaded piles. Where piles are to be constructed in groups the bearing value of each individual pile should be reduced by a factor of about 0.8 and a calculation made to check the factor of safety against block failure.

From ground level the upper 4m of the pile shaft has been ignored in the preliminary pile design given.

To prevent necking of the green concrete, temporary casing may be required where the pile passes through the Made Ground, Worked Ground or Kempton Park Gravel Member, and below the groundwater table (where encountered). To achieve the full bearing value a pile should penetrate the bearing stratum by at least five times the pile diameter.

No allowance has been made for negative skin friction that could be generated where piles pass through cohesive soils of the Made Ground/ Worked Ground

underlying the site. The negative skin friction must be applied to the pile working load and must not be factored.

5.2 Subsurface Concrete

The sulphate and pH tests carried out in accordance with BRE Special Digest 1, 2005, 'Concrete in Aggressive Ground', established the site concrete classifications for each stratum as presented in Table 5.1.

Table 5.1 Concrete Classification

Stratum	Design Sulphate Class	ACEC Class
MG	DC-1	AC-1
KPGR	DC-1	AC-1
LC	DC-1	AC-1s

Concrete to be placed in contact with soil or groundwater must be designed in accordance with the recommendations of Building Research Establishment Special Digest 1 2005, *'Concrete in Aggressive Ground'* taking into account any possible exposure of potentially pyrite bearing natural ground and the pH of the soils.

5.3 Excavations

Shallow excavations in the Made Ground and Kempton Park Gravel Member are likely to be marginally stable in the short term at best.

Deeper excavations (>1.20m) are likely to be unstable and require support. Unsupported earth faces formed during excavation may be liable to collapse without warning and suitable safety precautions must therefore be taken to ensure that such earth faces are adequately supported or battered back to a safe angle of repose.

Excavations beneath the groundwater table are likely to be unstable and dewatering recommended.

Section 6 Pavements

6.1 Pavements

The Transport Research Laboratory (TRL) Dynamic Cone Penetrometer (DCP) was undertaken at six locations (DCP1 to DCP6). The results from dynamic cone penetrometer tests indicated **CBR values of between 7% and 141%** for the soils encountered in the top 1.00m bgl. The calculated values were not consistent along the test length, which was characteristic of the variable Made Ground encountered.

As CBR values were highly variable due to changes due to the ground conditions, **in-situ testing must be undertaken** immediately prior to the installation of pavements/roads.

The Made Ground was variable in composition and the frost susceptibility of these soils would vary across the site. It is therefore recommended that soils are considered frost susceptible unless otherwise proven non frost susceptible.

The overall thickness of the pavement will be dictated by the frost susceptibly of the sub-grade.

Section 7 Site Drainage

7.1 Soakaways

The results of in-situ infiltration tests calculated an infiltration rate of 1.99E-03 m/sec, within the Kempton Park Gravel Member. This indicated that the Kempton Park Gravel Member would have good drainage characteristics.

Negligible infiltration was recorded within the cohesive Worked Ground, which indicated these ground conditions to be unsuitable for soakaways.

It is recommended that the results of the in-situ permeability testing are passed to a drainage engineer for commentary and design.

Consultation with the Environment Agency must be sought regarding any use which may have an impact on groundwater resources.

7.2 Sustainable Drainage Systems (SuDS)

The intrusive investigation established the ground conditions to be Made Ground/ Worked Ground (typical thickness 3.4m) overlying the Kempton Park Gravel Member (typical thickness 6.2m). The Made Ground/ Worked Ground had varying composition of clay, sand and gravel, and therefore had variable permeability. Pockets of cohesive clay soil would have low permeability and be unsuitable for SuDS but the granular deposits are likely to be suitable. The underlying Kempton Park Gravel Member was granular and expected to have a high permeability and suitability for drainage.

The infiltration tests undertaken found the cohesive Worked Ground to have insufficient soakage and would be unsuitable for infiltration SuDS. The Kempton Park Gravel Member was found to have good soakage potential and suitable for the use of infiltration SuDS.

Due to the variability in ground conditions the development will likely have to adopt a combined system of attenuation and infiltration SuDS.

Reference must be made to The SuDS Manual C753 CIRIA November 2015 and local planning constraints as outlined in the local plans and statements for LBRuT. The SuDS design for the proposed development will implement a SuDS “management train” to use a variety of drainage techniques in series to incrementally reduce pollution, flow rates, volumes, and frequency of runoff. Run-off prevention and source control ensures that flows are managed, and silt is removed towards the beginning of the drainage system. The SuDS “management train” comprises:

- Prevention - good housekeeping measures within development
- Source control - managing runoff at or near its source where it falls as rain
- Site control - dealing with runoff within or local to the development site

The final aspect of the SuDS management train is the concept of off-site regional control, which is the control of runoff in amenity space SuDS features before final outfall.

The hierarchy above seeks to ensure that surface water run-off is controlled as near to its source as possible to mimic natural drainage systems and retain water on or near to the site, in contrast to traditional drainage approaches, which tend to pipe water off-site as quickly as possible.

Before disposal of surface water to the public sewer is considered all other options set out in the drainage hierarchy should be exhausted. When no other practicable alternative exists to dispose of surface water other than the public sewer, the Water Company or its agents should confirm that there is adequate spare capacity in the existing system taking future development requirements into account.

Section 8 Determination of Chemical Analysis

8.1 Site Characterisation and Revised Conceptual Site Model

The Preliminary Investigation Report undertaken by Soils Limited (ref: 20295/PIR dated September 2022) identified a very low to moderate/low risk of ground contamination from previous usage of the site and infilled ground on and off-site.

The scoping intrusive investigation identified Made Ground to depths between 2.10m and 4.50m bgl.

The Made Ground was variable and typically comprised combination of the following soil types:

Orangish brown/ dark brown slightly clayey/ clayey gravelly SAND. The gravel was fine to coarse, with a combination of brick, glass, sandstone, ceramic, metal, clinker, and flint.

Soft to stiff orangish brown/ brown mottled dark brown slightly gravelly/ gravelly CLAY. The gravel was fine to medium, angular to sub-angular, with a combination of flint, clinker, and brick.

Dark greyish brown mottled orangish brown, light brown clayey very sandy GRAVEL. The gravel was sub-angular fine to coarse, with a combination of flint, concrete, brick, tarmac, and clinker.

There were no significant visual or olfactory indicators of contamination noted.

The revised CSM is presented in Appendix E.1.

8.2 Soil Sampling

Exploratory hole locations were established to provide an overview of ground conditions across the site in relation to the proposed construction, together with enabling the collection of samples to enable chemical characterisation of the underlying strata.

Representative samples for potential environmental testing were obtained from the exploratory holes at depths of between 0.10m and 0.90m to allow appropriate representation of the materials encountered, with additional samples to be obtained, if necessary, where there was visual or olfactory evidence of contamination.

Unless otherwise stated, analytical testing was based initially on a screening suite of commonly identified inorganic and organic contaminants, taking into account the prevailing site conditions and the findings of the initial conceptual site model.

8.3 Determination of Chemical Analysis

The driver for determination of the analysis suite was the information obtained from the preliminary and intrusive investigations.

The chemical analyses were carried out on six samples of Made Ground. The nature of the analyses is detailed in Table 8.1.

Table 8.1 Chemical Analyses Suites

No. of Tests	Determinants
6	Metal suites: Arsenic, Boron (Water Soluble), Cadmium, Chromium (total & hexavalent), Copper, Lead, Mercury, Nickel, Selenium, Vanadium, Zinc
6	Organic Matter
6	Total Organic Carbon
6	pH
6	Polycyclic aromatic hydrocarbons (PAH) – (EPA 16)
6	Phenols – total monohydric
6	Extractable petroleum hydrocarbons (EPH) – Texas banding
6	Asbestos screening

The soil testing was carried out in compliance with the MCERTS performance standard, and the results are shown in Appendix E.2, Test Report 22-07961.

Section 9 Qualitative Risk Assessment

9.1 Assessment Criteria

The assessment criteria used to determine risks to human health are derived and explained within Appendix E.3.

9.2 Representative Contamination Criteria - Soil

The proposal comprised demolition of the existing TYM complex and associated building and construction of new main building, guest residential accommodation, changing block, staff residential accommodation, repair workshop and camping changing block. The layout comprised the main building located in the northwest corner followed by three guest accommodation buildings arranging approximately in a circle southeast of the main building. To the east of the main building was the changing block, and along the southern boundary was the staff accommodation building. Within the southwestern corner of the site was the camping changing block and repair workshop. Surrounding the building would be communal grassland. The use of the site would remain the same. The life span of the development was anticipated to be 100 years.

In compiling this report reliance was placed on document, Pre-Application Report 03, Issue number P01 dated July 2022 and was prepared by Pick Everard. The recommendations provided within this report are made exclusively in relation to the scheme outlined above and must not be applied to any other scheme without further consultation with Soils Limited. Soils Limited must be notified about any change or deviation from the scheme outlined.

Based on the proposed development, the results of the chemical analysis have been compared against generic assessment criteria (GAC) for a ‘Public Open Space - Residential’ end use, as presented in SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014 (C4SL), derived for the protection of human health. Where this document has not published screening values for determinants, GACs derived for the same end use have been adopted from the following published guidance; DEFRA Soil Guideline Values (SGV) and LQM/CIEH/Suitable 4 Use Level (S4UL).

To assess the potential toxicity of organic determinants (Petroleum Hydrocarbons and Polyaromatic Hydrocarbons) to the human health, soils samples were analysed for Soil Organic Matter (SOM). The selected samples analysed recorded, SOM values of between 1.1% and 3.9%. For each soil sample tested, the resultant SOM allowed for the correct comparison to be made with the appropriate guideline value for each organic determinants analysed.

9.3 Risk Assessment – Made Ground

Table 9.1 outlines the sample that have exceeded their relevant assessment criteria. The full laboratory report is presented in Appendix E.2.

Table 9.1 Summary of GAC Exceedances – Made Ground

Location	Depth (m bgl)	Contaminant	Concentration	Guidance Level
WS4	0.90	Lead	853	630

Note(s): Units mg/kg

The risk assessment has established, based on this scoping analysis, a potential pollutant linkage in relation to human health from an elevated lead concentration within the Made Ground across the site. Additional sampling and analysis are recommended to allow statistical analysis, prior to carrying out a generic quantitative risk assessment.

9.4 Asbestos

The test certificate for each sample submitted for contamination analysis during this investigation includes the results of an Asbestos Screen. In each case 'Not detected' was reported.

This finding does not obviate the risk of asbestos being present on the site and the Client must seek advice from qualified and competent asbestos specialist during and prior to undertaking works to ensure compliance with appropriate legislation and guidance.

9.5 Risk to Groundwater

No groundwater samples were collected as part of this scoping investigation. No additional sources of contamination were identified during the intrusive works, and the potential risk to the groundwater receptors remained low.

Groundwater sampling would be recommended if further investigation uncovered contamination, that presented a greater risk to the groundwater receptors.

9.6 Risk from Ground Gas Ingression

Three monitoring visits were commissioned as part of this investigation, and all three had been completed at the time of reporting.

The preliminary investigation report (ref: 20295/PIR, Rev 1.0) identified a potential risk from ground gases, due to on-site and off-site infilled ground. The intrusive investigation established a significant thickness of Artificial Deposits across the site, confirming the potential risk from infilled ground.

No significant concentrations of gases recorded in the three monitoring visits undertaken to date.

The TOC value was determined on six samples of Made Ground and recorded between 0.6 and 2.3%. Based on the limited dataset the Made Ground a relative low percentage of organic carbon content and likely to have a low gas generation potential. Due to the thickness of the Made Ground and potential for off-site infilled ground the gas monitoring is recommended to characterise the gas risk.

The installation of two additional monitoring wells, followed by an additional three monitoring visits are recommend. Providing a total of six reading with a combined minimum period of three months.

The monitoring data completed to date is presented in Appendix F.

9.7 Recommended Investigation

This scoping investigation has established significant thickness of Made Ground, although no signs of gross contamination. One out of six soil sample analysis recorded an elevated concentration of lead, against a Public Open Space - Residential land use. A single groundwater and gas monitoring well was installed into BH1. No groundwater samples were collected as part of this investigation, a total of three monitoring visits for gas recording were commissioned (ongoing). To date no significant gas concentrations have been recorded, however the data set is considered insufficient to undertake a ground gas risk assessment, in accordance with relevant guidance.

Further exploratory holes and soil chemical analysis is recommended. The additional soil analysis is recommended to allow statistical analysis and evaluation of the Made Ground at depth. Installation of two additional monitoring wells, and a further three gas monitoring visits over a period of 1.5-months, providing a total period of 3-months of monitoring data.

9.8 Duty of Care

Groundworkers must maintain a good standard of personal hygiene including the wearing of overalls, boots, gloves and eye protectors and the use of dust masks during periods of dry weather.

To prevent exposure to airborne dust by both the general public and construction personnel the site must be kept damp during dry weather and at other times when dust is generated as a result of construction activities. The site must be securely fenced at all times to prevent unauthorised access.

Washing facilities should be provided and eating restricted to mess huts.

9.9 Excavated Material

Excavated material as waste must be defined or classified prior to any disposal, transport, recycling or re-use at or by an appropriately licensed or exempt carrier and/or

off-site disposal facility. The requirements inherent in both Duty of Care and Health and Safety must also be complied with. In order to determine what is to happen, what is suitable, appropriate and most effective in the disposal of wastes, especially those subject to CDM waste management plan requirements, several factors must be considered, and competent advice must always be sought.

The amount, type and nature of the material to be removed will in part determine the amount and type of analysis that may be required to comply with current waste guidance, and thereby allow a qualified person to suitably classify the material. Often this data is uncertain or unavailable, especially in the early stages of a project, and therefore further investigation, testing and analysis may be required as additional information regarding the development becomes available.

Wastes must be classified and defined by their solid characteristics to comply with current waste guidance. Existing information and analysis derived for environmental purposes may therefore be suitable for use in this context. Waste Acceptance Criteria (WAC) report the leachability of materials and therefore cannot be used to classify, characterise or define wastes. The only purpose of a WAC analysis is to determine the suitability of a given material for acceptance at one of the three different types of available licenced landfills (inert, stable non-reactive hazardous or hazardous).

Other options are available that may lead to significant savings against disposal to landfill and expert advice must always be sought from a qualified person to advise on their relative costs or benefits and advise on any additional analysis, sampling or investigation that may be required to reduce remaining uncertainties and comply with current guidance. Further consideration of results using HazWasteOnlineTM can be undertaken on request to give an indication of potentially hazardous properties in the materials analysed.

9.10 Re-use of Excavated Material On-site

The re-use of on-site soils may be undertaken either under the Environmental Permitting Regulations 2007 (EPR), in which case soils other than uncontaminated soils are classed as waste, or under the CL:AIRE Voluntary Code of Practice (CoP) which was published in September 2008 and is accepted as an alternative regime to the EPR.

Under the EPR, material that is contaminated but otherwise suitable for re-use is also classified as waste and its re-use must be in accordance with the Environmental Permitting Regulations 2007 (EPR). Environmental Permit Exemptions (EPE) are for the re-use of non-hazardous or inert waste only; hazardous waste cannot be re-used under a permit exemption. EPE apply only to imported inert waste materials; inert material arising on site and recovered on site is not classified as waste and does not require an exemption. It is possible that materials arising on-site will be classified as inert and would not need an exemption.

Environmental Permit Exemptions are only allowed for certain activities, placing controls

on the quantities that can be stored and re-used. The re-use of waste shall be within areas and levels defined in planning applications and permissions for the development. An EPE requires a site-specific risk assessment for the receptor site to demonstrate that the materials are suitable for use, i.e. that they will not give rise to harm to human health or pollution of the environment.

Under the CL:AIRE voluntary code of practice (CoP) materials excavated on-site are not deemed contaminated if suitable for re-use at specified locations or generally within the site.

Material that may have been classified as hazardous waste under the EPR may be re-used. The CoP regime requires that a 'Qualified Person' as defined under the CoP reviews the development of the Materials Management Plan, including review of Risk Assessments and Remediation Strategy/Design Statement together with documentation relating to Planning and Regulatory issues, and signs a Declaration which is forwarded to the Environment Agency, and which confirms compliance with the CoP.

Should it be necessary to import materials from another site where materials are excavated and which is not material from a quarry or produced under a WRAP protocol, then an EPE would be necessary for the imported material whether the work was managed under the CoP or the EPR.

9.11 Imported Material

Any soil, which is to be imported onto the site, must undergo chemical analysis to permit classification prior to its importation and placement in order to ascertain its status with specific regard to contamination, i.e. to prove that it is suitable for the purpose for which it is intended.

9.12 Discovery Strategy

There may be areas of contamination not identified during the course of the investigation. Such occurrences may also be discovered during the demolition and construction phases for the redevelopment of the site.

Care must be taken during excavation works especially to investigate any soils, which appear by eye (e.g. such as fibrous materials, large amounts of ash and unusual discolouration), odour (e.g. fuel, oil and chemical type odours or unusual odours such as sweet odours or fishy odours) or wellbeing (e.g. light headedness and/or nausea, burning of nasal passages and blistering or reddening of skin due to contact with soil) to be contaminated or of unusual and/or different character to standard soils or those analysed.

In the event of any discovery of potentially contaminated soils or materials, this discovery must be quarantined and reported to the most senior member of site staff or the designated responsible person at the site for action. The location, type and quantity must

be recorded and the Local Authority, and a competent and appropriate third party Engineer/Environmental consultant notified immediately. An approval from the Local authority must be sought prior to implementing any proposed mitigation action.

The discovery strategy must remain on site at all times and must demonstrate a clear allocation of responsibility for reporting and dealing with contamination. A copy of the strategy must be placed on the health and safety notice board and /or displayed in a prominent area where all site staff are able to take note of and consult the document at any time. Any member of the workforce entering the site to undertake any excavation must be made aware of the potential to discover contamination and the discovery strategy.

List of Figures

List of Appendices

Figure 1 – Site Location Map

Job Number 20295	**Project** Thames Young Mariners, Riverside Drive, Richmond TW10 7RX
Client Surrey County Council	**Date** October 2022

Figure 2 – Aerial Photograph

Project
Thames Young Mariners, Riverside Drive, Richmond TW10 7RX

Client
Surrey County Council

Date
October 2022

Job Number
20295

N

Figure 3 – Exploratory Hole Plan

Project
Thames Young Mariners, Riverside Drive, Richmond TW10 7RX

Client
Surrey County Council

Date
October 2022

Job Number
20295

Appendix A Standards and Resources

The site works, soil descriptions and geotechnical testing was undertaken in accordance with the following standards were applicable:

- BS 5930:2015 and BS EN ISO 22476-2 2005+A1:2011
- BS 5930:2015 and BS EN ISO 22476-2&3:2005+A1:2011
- BS 5930:2015 and BS EN ISO 22476-3:2005+A1:2011
- BS EN 1997-1:2004+A1:2013 Eurocode 7. Geotechnical design
- BS EN ISO 14688-1:2018 - Geotechnical investigation and testing - Identification and description
- BS EN ISO 14688-2:2018 - Geotechnical investigation and testing - Principles for a classification
- BS 10175:2011+A2:2017 - Investigation of potentially contaminated sites
- LCRM 2021 Environment Agency
- BS 8004:2015 – Code of practice for foundations
- BS 1377:1990 Parts 1 to 8
- BRE Digest 241 “Low-rise buildings on shrinkable clay soils: Part 2
- BRE Special Digest 1, 2005, ‘Concrete in Aggressive Ground’
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- Robertson, P.K., 2010, “Soil Behaviour type from the CPT: an update”, 2nd International Symposium on Cone Penetration Testing, Huntington Beach, CA, Vol.2. pp575-583.
- N.E. Simons, B.K. Menzies, “A Short Course in Foundation Engineering”
- NHBC Standards Chapter 4.2, January 2022.
- SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination December 2014
- CIRIA C733, Asbestos in soil and made ground: a guide to understanding and managing risks and CAR2012 regulations.
- CIRIA C574, Engineering in Chalk; 2002
- Google Earth
- British Geological Survey Website & iGeology App

Appendix B Field Work

Appendix B.1 Engineers Logs

soils LIMITED

Contract Name:		Client:			Hole ID:
Thames Young Mariners Project		SCC			**BH1**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
20295	12/08/22	DJ	LW	FINAL	**CP**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
			Dando 2000	11/10/2022	1:50

Weather: Sunny | Termination: Reached required depth. | SPT Hammer: AR3552 Energy Ratio: 85% | Sheet 1 of 2

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
				(3.50)		Brown slightly clayey gravelly SAND. Sand is fine to medium. Gravel is angular to subangular fine to medium flint. Rare fine clinker and glass fragments. MADE GROUND.		
1.20 1.20 - 1.65	SPT B	N=7 (1,1/2,1,2,2)						
2.00 2.00 - 2.45	SPT D	N=7 (2,2/2,1,2,2)						
2.60 - 3.00	B							
3.00 3.00 - 3.45	SPT D	N=7 (1,2/2,1,2,2)						
				3.50				
3.60 - 4.00	B					Light brown multicoloured mottled SAND and GRAVEL. Sand is coarse. Gravel is angular fine to medium flint. KEMPTON PARK GRAVEL MEMBER		
4.00	SPT	N=21 (2,2/3,4,7,7)						
4.40 - 4.50	B							
5.00 5.00 - 5.50	SPT B	N=27 (2,2/4,6,8,9)						
6.00	D							
6.50 6.50 - 6.95	SPT B	N=11 (2,2/2,3,3,3)		(6.20)				
7.50	D							
8.00 8.00 - 8.50	SPT B	50 (25 for 105mm/50 for 165mm)						
9.00	D							
9.50 9.50 - 9.95	SPT B	N=17 (16,6/3,3,5,6)						
				9.70		Stiff grey mottled dark and light grey CLAY with silt. Rare 1mm laminations. LONDON CLAY FORMATION		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)
							5.00	150
							10.00	150

Remarks:

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)
				0.00	1.00	PLAIN	50
				1.00	8.00	SLOTTED	50

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:			Hole ID:
Thames Young Mariners Project		SCC			**BH1**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
20295	12/08/22	DJ	LW	FINAL	**CP**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
			Dando 2000	11/10/2022	1:50

Weather: Sunny | Termination: Reached required depth. | SPT Hammer: AR3552 Energy Ratio: 85% | Sheet 2 of 2

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
						Stiff grey mottled dark and light grey CLAY with silt. Rare 1mm laminations. LONDON CLAY FORMATION		
10.50	D							
11.00 - 11.40	U							
11.40	D							
12.00	D							
12.50	SPT	N=30 (2,4/6,8,8,8)						
12.50 - 12.95	D							
13.50	D							
				(7.80)				
14.00 - 14.35	U							
14.35	D							
15.00	D							
15.50	SPT	N=33 (4,6/7,8,8,10)						
15.50 - 15.95	D							
16.50	D							
17.00 - 17.40	U							
17.40	D							
17.50 - 17.80	B			17.50				
				(0.30)		Recovered as soft grey slightly sandy slightly gravelly CLAY. Sand is fine to medium. Gravel is angular to subangular fine to coarse CEMENTSTONE. LONDON CLAY FORMATION		
				17.80		Stiff grey slightly silty slightly sandy CLAY. Frequent 1mm laminations. LONDON CLAY FORMATION		
18.50	SPT	N=34 (3,5/8,8,9,9)						
18.50 - 18.95	D							
				(2.20)				
19.50 - 19.90	U							
19.90	D							
				20.00		End of Borehole at 20.00m		

Start & End of Shift Observations				
Date	Time	Depth (m)	Casing (m)	Water (m)

Borehole Diameter	
Depth (m)	Dia (mm)

Casing Diameter	
Depth (m)	Dia (mm)
5.00	150
10.00	150

Remarks:

Chiselling			
From (m)	To (m)	Duration	Remarks

Installation			
Top (m)	Base (m)	Type	Dia (mm)
0.00	1.00	PLAIN	50
1.00	8.00	SLOTTED	50

Water Strikes

Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

soils LIMITED

Contract Name:		Client:			Hole ID:
Thames Young Mariners Project		SCC			**WS1**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
20295	10/08/22	KW	LW	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
			Premier 1	11/10/2022	1:50

Weather: Sunny | Termination: Reached required depth. | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.10	ES			0.20		Soft dark greyish brown sandy gravelly CLAY. Gravel is subangular to angular fine to medium flint, concrete, glass, clinker and charcoal. Frequent rootlets and large roots ~12mm, desiccated. MADE GROUND		
0.30	D					Dark orangish brown banded dark brown slightly silty gravelly SAND. Gravel is fine to coarse subangular flint and fine subrounded clinker and brick. Occasional fine sand sized clinker and brick. Frequent roots and rootlets. Frequent weakly cemented sandstone blocks. MADE GROUND		
0.50	ES							
0.70	D							
0.80	ES							
1.30	D			(2.40)				
1.70	D							
2.30	D							
				2.60		Greenish grey sandy gravelly CLAY. Gravel is subrounded to rounded fine to medium flint and mudstone. Common desiccated roots. MADE GROUND		
2.90	D			2.80		Orangish brown mottled brown sandy very gravelly CLAY. Gravel is fine to medium flint. Occasional coarse sand to fine gravel sized brick and clinker. MADE GROUND		
3.30	D			3.00		Orangish brown gravelly very clayey SAND. Gravel is subangular fine to medium flint and brick. Occasional clayey lenses. MADE GROUND		
3.70	D			(1.50)		*Frequent light grey silty lenses*		
4.30	D							
				4.50		Light yellowish brown gravelly very sandy CLAY. Gravel is fine to medium flint. Rare desiccated roots. WORKED GROUND		
4.70	D			(0.50)				
				5.00		End of Borehole at 5.00m		

1 2 3 4 5 6 7 8 9 10

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)

Remarks:
Rootlets observed to 5.00m bgl.

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater encountered.

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

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Contract Name:		Client:			Hole ID:
Thames Young Mariners Project		SCC			**WS2**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
20295	10/08/22	KW	LW	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
			Premier 1	11/10/2022	1:50

Weather: Sunny | Termination: Reached required depth. | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.10	ES					Soft dark greyish brown very sandy very gravelly CLAY. Gravel is subangular fine to coarse flint brick, concrete, glass, clinker, and ceramics. Occasional roots. MADE GROUND		
0.30	D			(0.65)				
0.50	ES							
0.70	D			0.65		Orangish brown banded greyish brown silty gravelly SAND. Gravel is subrounded flint, brick, clinker, glass, concrete. Rare rootlets. MADE GROUND		
0.90	ES			(0.35)		*Stiff clayey lense*		
				1.00		Concrete debris with metal fragments. MADE GROUND		
1.30	D			(0.50)				
				1.50		Stiff dark greyish brown mottled orangish brown and light brown sandy very gravelly GRAVEL. Gravel is subangular fine to coarse flint, concrete, brick, clinker. Occasional rootlets. MADE GROUND		
1.70	D			(0.70)				
				2.20		Dark greyish brown silty gravelly SAND. Gravel is subrounded flint, brick, clinker, glass, concrete. occasional rootlets. MADE GROUND		
2.30	D					*Concrete debris with metal fragments.*		
2.70	D			(0.80)				
				3.00		Yellowish brown slightly clayey gravelly SAND. Sand is predominantly medium to coarse. Gravel is subrounded fine to coarse flint, sandstone. KEMPTON PARK GRAVEL MEMBER		
3.30	D			(0.50)				
				3.50		Yellowish brown sandy very clayey GRAVEL. Sand is predominantly medium to coarse. Gravel is subrounded fine to coarse flint. KEMPTON PARK GRAVEL MEMBER		
3.70	D			(0.50)				
				4.00		End of Borehole at 4.00m		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)

Remarks:
Rootlets observed to 3.00m bgl.

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater encountered.

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

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Contract Name:		Client:			Hole ID:
Thames Young Mariners Project		SCC			**WS3**
Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
20295	10/08/22	EF	LW	FINAL	**WS**
Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
			Premier 1	11/10/2022	1:50

Weather: Sunny | Termination: Reached required depth. | Sheet 1 of 1

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.10	ES			0.25		Soft dark greyish brown sandy gravelly CLAY. Gravel is angular to subangular fine to medium flint, brick, concrete, glass, ceramics and clinker. Sand is medium. Frequent rootlets. MADE GROUND. *Concrete band.*		
0.30	D					Greyish brown slightly silty gravelly SAND. Gravel is angular to subangular fine to coarse flint, brick, concrete, clinker and glass. Sand is medium. Rare rootlets. Occasional bioturbation and red ants observed between 0.7 and 0.95m bgl. MADE GROUND.		
0.50	ES			(0.75)				
0.70	D							
0.90	ES			1.00				
				(0.35)		Brownish grey slightly silty slightly gravelly SAND. Gravel is angular to subrounded flint, concrete, brick and clinker. Sand is fine to medium. Occasional rootlets. MADE GROUND		
				1.35				
1.50	D			(0.50)		Stiff dark orangish brown mottled light orangish brown and dark grey slightly gravelly CLAY. Gravel is angular fine to medium flint, sandstone and brick. Occasional rootlets. Potentially reworked ground. MADE GROUND		
1.90	D			1.85				
				2.00		Dark grey slightly clayey slightly gravelly SAND. Gravel is angular fine to medium sandstone, flint clinker and ceramics. MADE GROUND.		
				2.10		Stiff dark orangish brown mottled dark grey slightly silty gravelly CLAY. Gravel is angular fine to coarse concrete. MADE GROUND.		
2.50	D			(0.90)		Dark brownish grey becoming light orangish brown with depth very gravelly SAND. Gravel is angular to subrounded fine to coarse flint. Sand is fine to medium. KEMPTON PARK GRAVEL MEMBER		
2.90	D			3.00				
						Light brown multicoloured mottled gravelly SAND. Gravel is well rounded to angular flint. Sand is fine to medium. KEMPTON PARK GRAVEL MEMBER		
3.50	D			(1.00)				
3.90	D			4.00		End of Borehole at 4.00m		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Remarks:
Rootlets observed to 1.85m bgl.

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater encountered.

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

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Contract Name:	Client:	Hole ID:
Thames Young Mariners Project	SCC	**WS4**

Contract Number:	Start and End Date:	Logged By:	Checked By:	Status:	Hole Type:
20295	10/08/22	EF	LW	FINAL	**WS**

Easting:	Northing:	Ground Level:	Plant Used:	Print Date:	Scale:
			Premier 1	11/10/2022	1:50

Weather: Sunny | Termination: Reached required depth. |

Samples & In Situ Testing			Strata Details				Groundwater	
Depth	Type	Results	Level (mAOD)	Depth (m) (Thickness)	Legend	Strata Description	Water Strike	Backfill/ Installation
0.10	ES					Dark brownish grey slightly gravelly SAND. Gravel is angular fine to medium flint, concrete, brick, clinker, glass and slate. Sand is fine to medium. Occasional rootlets and rare metallic material. MADE GROUND		
0.20	D			(0.40)				
				0.40		Light orangish brown slightly clayey gravelly SAND. Gravel is subangular fine to medium flint, brick and sandstone. Sand is fine to medium. Occasional rootlets. MADE GROUND.		
0.50	ES			0.60		Dark brown mottled multicoloured gravelly SAND. Gravel is angular fine to coarse brick, glass, sandstone, ceramic and clinker. Sand is fine to medium. Occasional rootlets and rare metallic material. MADE GROUND.		
0.70	D			0.85		Stiff orangish brown mottled dark grey slightly gravelly CLAY. Gravel is fine to medium angular to subangular flint, clinker and brick. Rare rootlets. MADE GROUND		
0.90	ES			(0.90)				
1.50	D			1.75		Light orangish brown multicoloured mottled clayey SAND. Sand is fine to medium. MADE GROUND		
1.90	D			2.00		Dark brown mottled orangish brown gravelly SAND. Gravel is fine to medium brick, flint and clinker. Sand is fine to medium. MADE GROUND		
2.30	D			(0.50)				
2.60	D			2.50		Dark orangish brown mottled dark grey gravelly SAND. Gravel is angular to subrounded flint. Sand is fine to medium. MADE GROUND		
				(0.40)				
				2.90		Soft brown mottled dark brown slightly gravelly CLAY. Gravel is fine to medium angular flint and brick. MADE GROUND		
3.50	D			(1.10)				
3.90	D			4.00		End of Borehole at 4.00m		

Start & End of Shift Observations					Borehole Diameter		Casing Diameter	
Date	Time	Depth (m)	Casing (m)	Water (m)	Depth (m)	Dia (mm)	Depth (m)	Dia (mm)

Remarks:
Rootlets observed to 1.75m bgl.

Chiselling				Installation			
From (m)	To (m)	Duration	Remarks	Top (m)	Base (m)	Type	Dia (mm)

Water Strikes					
Strike (m)	Casing (m)	Sealed (m)	Time (mins)	Rose to (m)	Remarks
			0	0.00	No groundwater encountered.

Hand vane (HV), Hand penetrometer (HP) reported in kPa. PID reported in ppm.

Soils Limited
Newton House, Cross Road, Tadworth KT20 5SR
Tel: 01737 814221 Email: admin@soilslimited.co.uk

Trial Pit Log

Trial Pit No.
TPSK1
Sheet 1 of 1

Project Name: Thames Young Mariners Project	Project No.: 20295	Method:	Hole Type: TP
Location: Thames Young Mariners Project, TW10 7RX		Plant: JCB	Scale: 1:25
Client: SCC	Trial Pit Length: m	Support: Trial Pit Width: m	Logged By: JC
Dates: 10/08/2022	Level:	Co-ords:	

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
	0.20	D		0.10			Grass over grey, gravelly SILT. Gravel is angular to well rounded, fine to coarse flint. Occasional fine angular brick. roots and rootlets. MADE GROUND
	0.50	D					Brown silty gravelly CLAY. Gravel is angular, fine to boulder brick, flint, tarmac, concrete and metal. roots and rootlets. MADE GROUND
	1.00	D		0.80			Brown and orange gravelly sandy CLAY. Gravel is sub angular to well rounded, fine to coarse flint, metal sheeting and glass. Slight hydrocarbon type smell. Roots and rootlets. MADE GROUND
	1.50	D					
	2.00	D		2.00			Brown, slightly gravelly sandy CLAY. Gravel is sub-angular flint. Roots and rootlets. WORKED GROUND
	2.50	D					
				3.20			End of Pit at 3.200m

1
2
3
4
5

General Remarks:

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

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Trial Pit Log

Trial Pit No.
TPSK2
Sheet 1 of 1

Project Name: Thames Young Mariners Project	Project No.: 20295	Method:	Hole Type: TP
Location: Thames Young Mariners Project, TW10 7RX		Plant: JCB	Scale: 1:25
Client: SCC	Trial Pit Length: m	Support: Trial Pit Width: m	Logged By: JC
Dates: 10/08/2022	Level:	Co-ords:	

Water Strike	Samples & In Situ Testing: Depth	Type	Results	Depth (m)	Level (mAOD)	Legend	Stratum Description
	0.20	D		0.10			Grass over grey, gravelly SILT. Gravel is angular to well rounded, fine to coarse flint. Occasional fine angular brick. roots and rootlets. MADE GROUND
							Brown silty GRAVEL. Gravel is angular, fine to cobble brick, flint, tarmac, concrete. roots and rootlets. MADE GROUND
	0.50	D		0.50			Brown and grey, gravelly very silty SAND. Gravel is sub angular to well rounded, fine to coarse flint. Roots and rootlets. WORKDED GROUND
	1.00	D		1.10			Brown SAND AND GRAVEL. Gravel is sub-angular flint. roots and rootlets. KEMPTON PARK GRAVEL MEMBER
	1.50	D					
	2.00	D		2.40			End of Pit at 2.400m

1 2 3 4 5

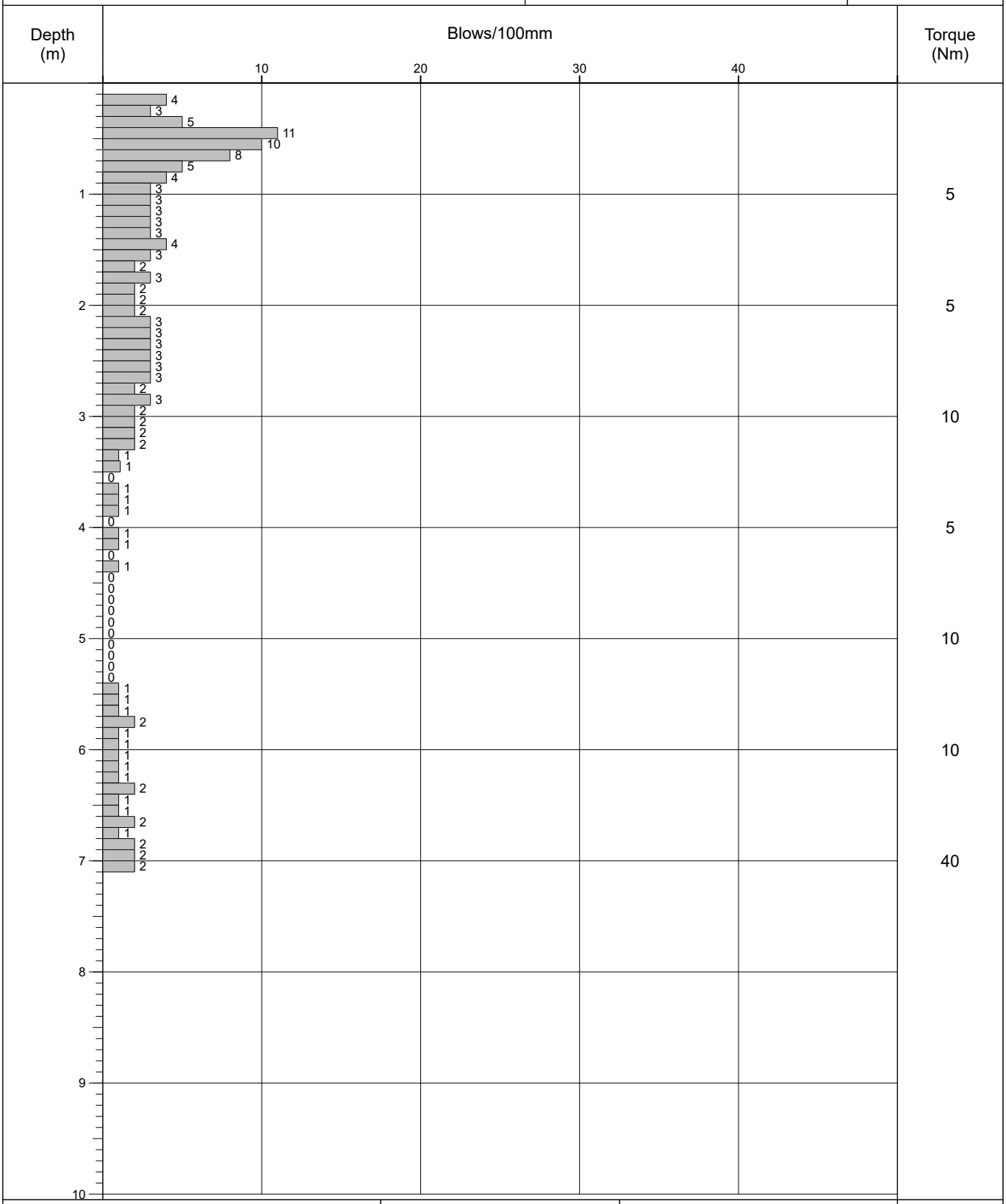
General Remarks:

Groundwater Remarks:

Sample Type
D: Disturbed
B: Bulk
J: Jar
W: Water

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP1** Sheet 1 of 1

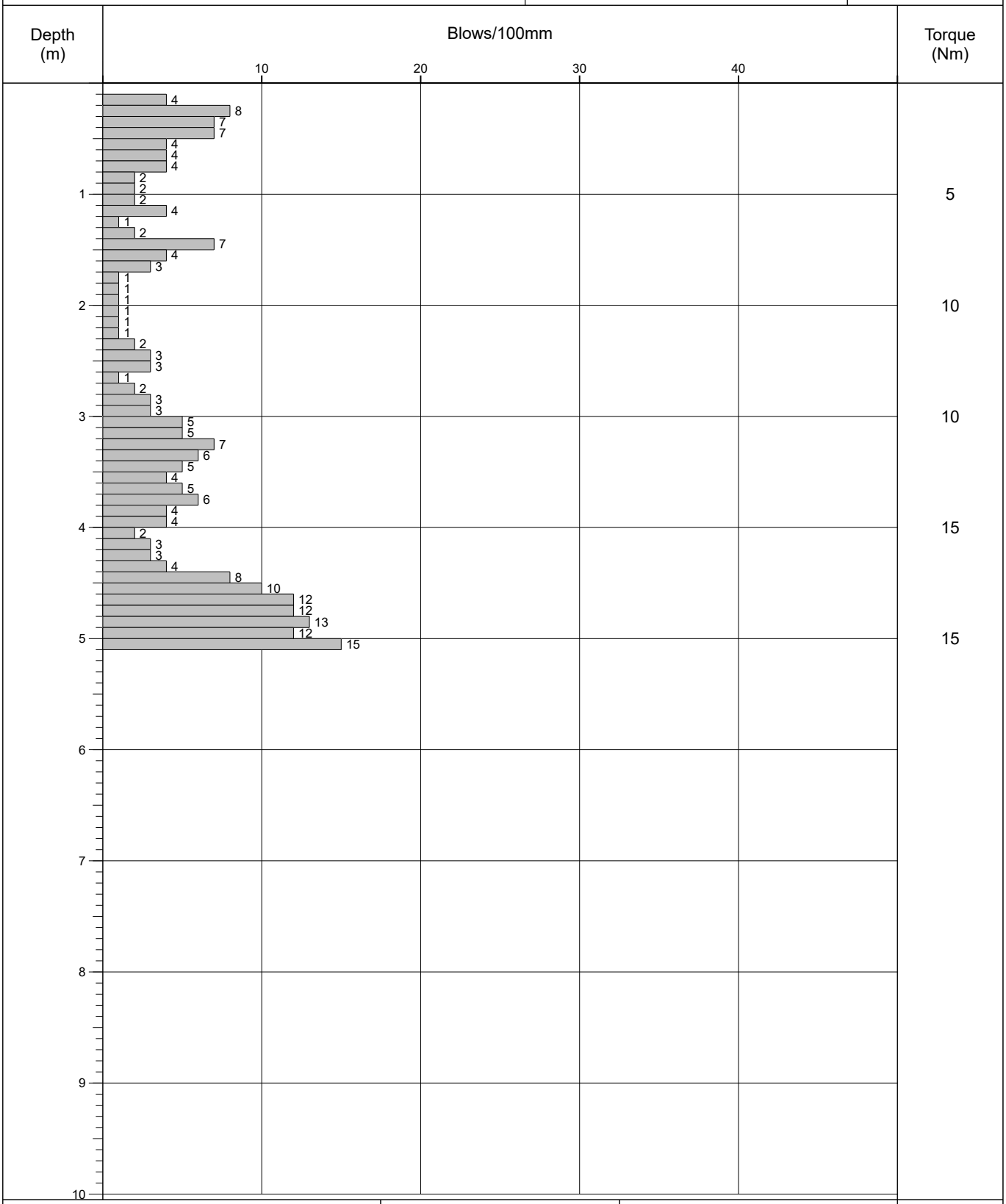
Project Name:	Thames Young Mariners Project	Project No. 20295	Co-ords:	Hole Type DP
Location:	Thames Young Mariners Project, TW10 7RX		Level: m AOD	Scale 1:50
Client:	SCC		Dates: 10/08/2022	Logged By SW



Remarks	Fall Height	760mm	Cone Base Diameter	52mm	AGS REGISTERED USER 2020
	Hammer Weight	63.5kg	Final Depth	7m	
	Probe Type	DPSH	Energy Ratio (Er)	92.96%	

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP2** Sheet 1 of 1

Project Name:	Thames Young Mariners Project	Project No. 20295	Co-ords:	Hole Type DP
Location:	Thames Young Mariners Project, TW10 7RX		Level: m AOD	Scale 1:50
Client:	SCC		Dates: 10/08/2022	Logged By SW

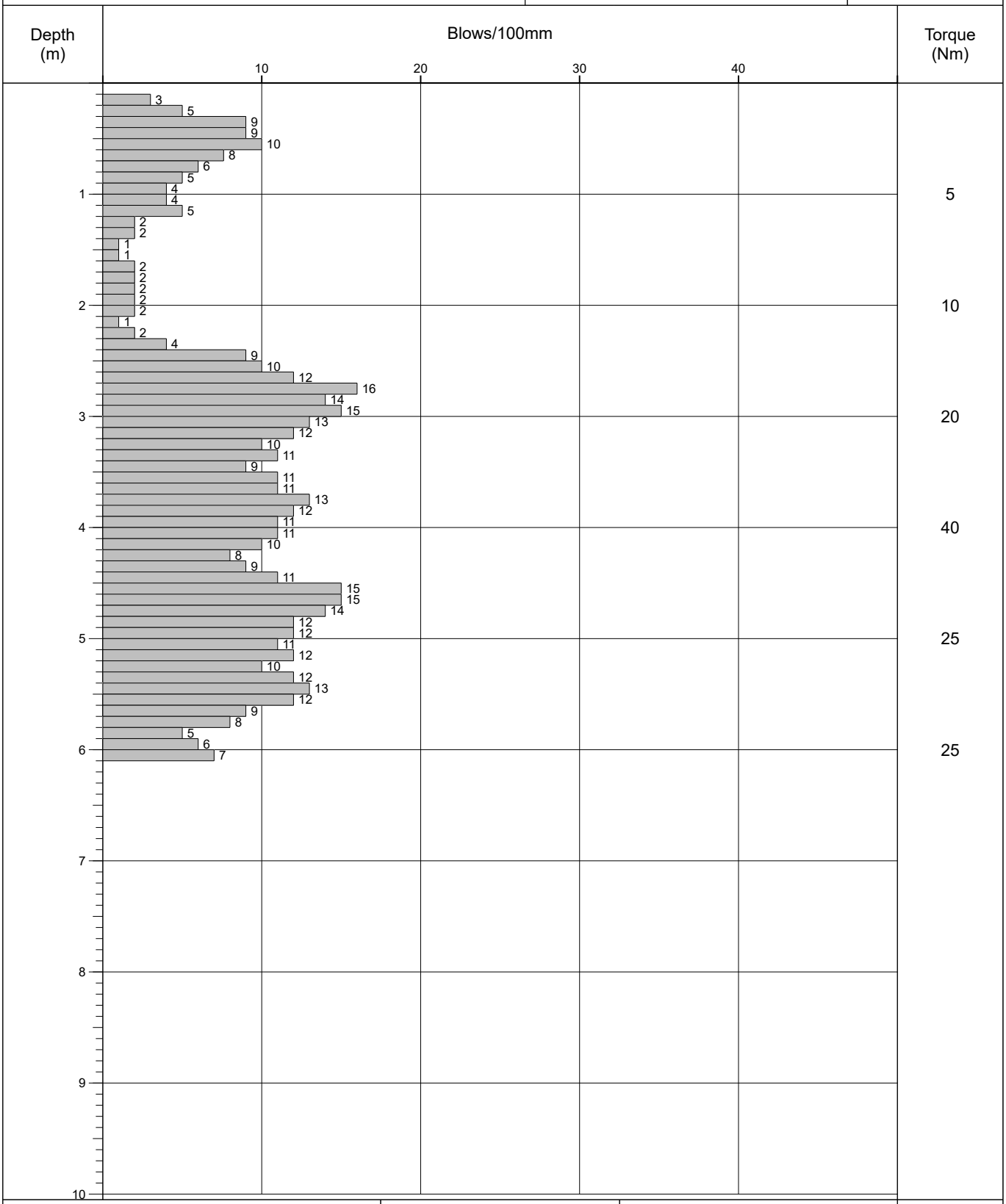


Remarks				
	Fall Height	760mm	Cone Base Diameter	52mm
	Hammer Weight	63.5kg	Final Depth	5m
	Probe Type	DPSH	Energy Ratio (Er)	92.96%

AGS REGISTERED USER 2020

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP3** Sheet 1 of 1

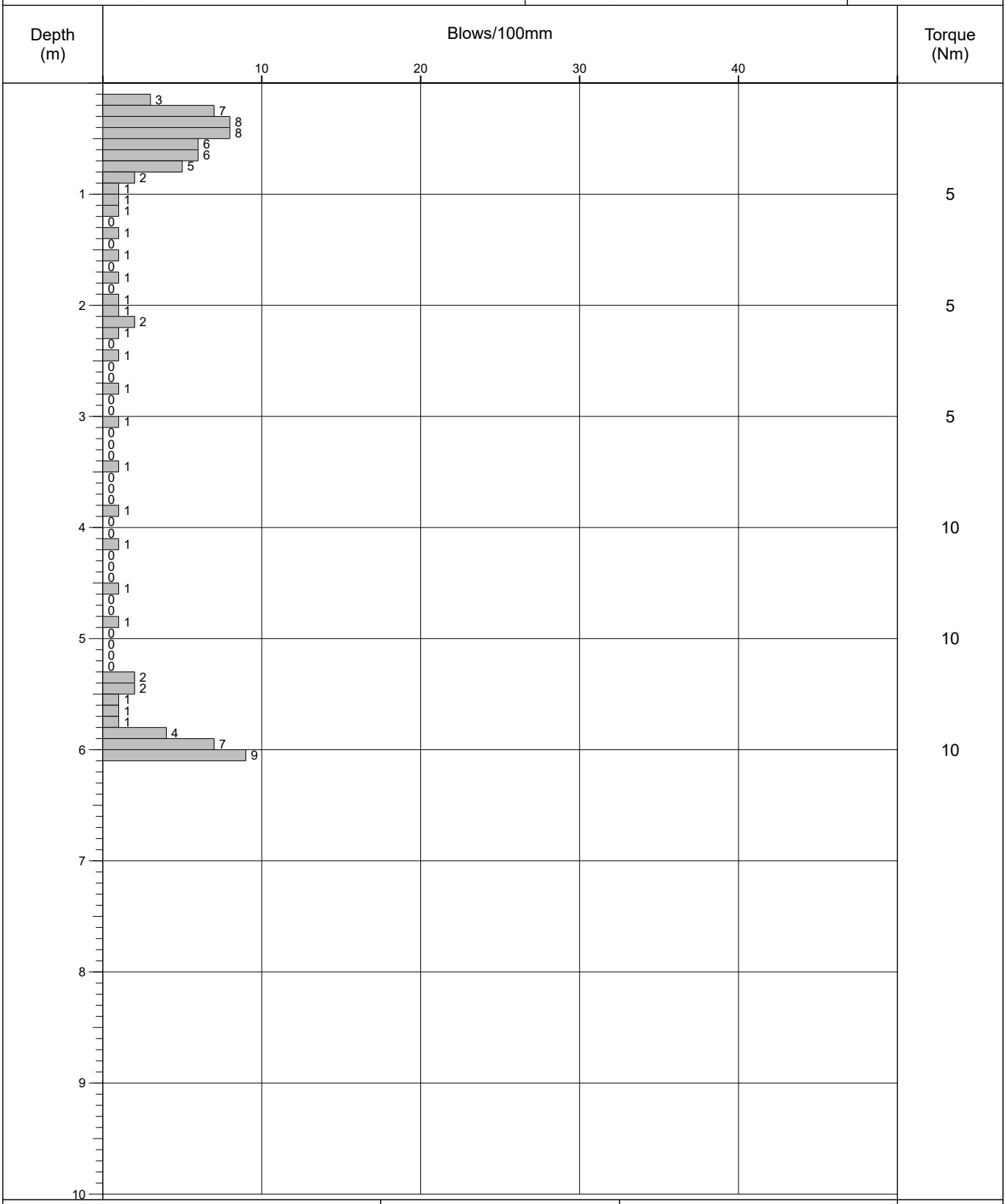
Project Name:	Thames Young Mariners Project	Project No. 20295	Co-ords:	Hole Type DP
Location:	Thames Young Mariners Project, TW10 7RX		Level: m AOD	Scale 1:50
Client:	SCC		Dates: 10/08/2022	Logged By SW



Remarks	Fall Height	760mm	Cone Base Diameter	52mm	AGS REGISTERED USER 2020
	Hammer Weight	63.5kg	Final Depth	6m	
	Probe Type	DPSH	Energy Ratio (Er)	92.96%	

Soils Limited Newton House, Cross Road, Tadworth KT20 5SR Tel: 01737 814221 Email: admin@soilslimited.co.uk	**Probe Log**	Probe No. **DP4** Sheet 1 of 1

Project Name:	Thames Young Mariners Project	Project No. 20295	Co-ords:	Hole Type DP
Location:	Thames Young Mariners Project, TW10 7RX		Level: m AOD	Scale 1:50
Client:	SCC		Dates: 10/08/2022	Logged By SW



Remarks				
	Fall Height	760mm	Cone Base Diameter	52mm
	Hammer Weight	63.5kg	Final Depth	6m
	Probe Type	DPSH	Energy Ratio (Er)	92.96%

AGS REGISTERED USER 2020

Appendix B.2 Foundation Exposures

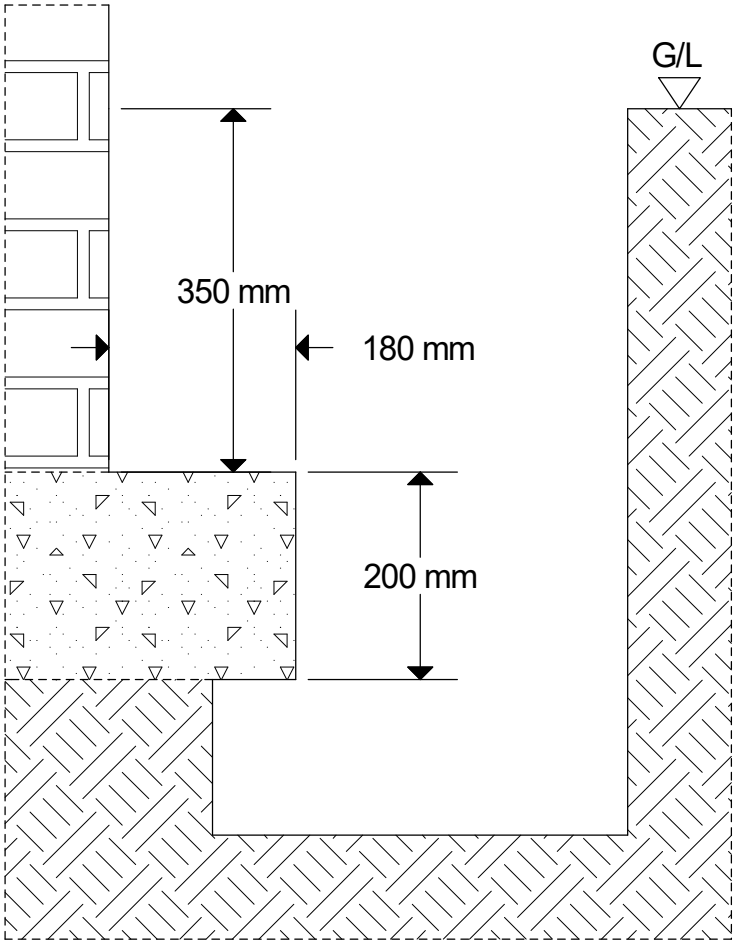
Project Name: Thames Young Mariners
Project No.: 20295
Client: SCC

Foundation Sketches

Brickwork

Concrete

See TP Logs



NTS

Appendix B.3 Infiltration Test Data

Job No.:	20295	**Location ID:**	TP1
Job Name:	TYM	**Test Number:**	1

Trial Pit Dimensions (m)		Final Depth:	3.20
Width Top:	1.00	Width Base:	0.60
Length Top:	2.20	Length Base:	1.80

Elapsed Time	**Water Depth**
(minutes)	(m bgl)
0.00	2.38
2.00	2.38
6.00	2.39
14.00	2.39
24.00	2.39
37.00	2.40
57.00	2.41
84.00	2.43
119.00	2.44
170.00	2.47
210.00	2.49
240.00	2.50
270.00	2.52

Job No.:	20295	**Location ID:**	TP2
Job Name:	TYM	**Test Number:**	1

Trial Pit Dimensions (m)		Final Depth:	2.50
Width Top:	1.20	Width Base:	0.60
Length Top:	2.20	Length Base:	2.00

Elapsed Time	**Water Depth**
(minutes)	(m bgl)
0.00	2.20
1.00	2.30
2.00	2.40*

*Dry - TP base at 2.40m bgl

Job No.:	20295	**Location ID:**	TP2
Job Name:	TYM	**Test Number:**	2

Trial Pit Dimensions (m)		Final Depth:	2.40
Width Top:	1.20	Width Base:	0.60
Length Top:	2.20	Length Base:	2.00

Elapsed Time	**Water Depth**
(minutes)	(m bgl)
0.00	2.25
1.00	2.30
2.00	2.40

Job No.:	20295	**Location ID:**	TP2
Job Name:	TYM	**Test Number:**	3

Trial Pit Dimensions (m)		Final Depth:	2.40
Width Top:	1.20	Width Base:	0.60
Length Top:	2.20	Length Base:	2.00

Elapsed Time	**Water Depth**
(minutes)	(m bgl)
0.00	2.20
1.00	2.30
2.00	2.40

Appendix C Geotechnical In-Situ and Laboratory Testing

Appendix C.1 Classification

Classification based on SPT "N" values:

The inferred undrained strength of the cohesive soils was based on the SPT "N" blow counts, derived from the relationship suggested by Stroud (1974) and classified using Table C.1.1. (Ref: Stroud, M. A. 1974, "The Standard Penetration Test – its application and interpretation", Proc. ICE Conf. on Penetration Testing in the UK, Birmingham. Thomas Telford, London.).

Table C.1.1 SPT "N" Blow Count Cohesive Classification

Classification	Undrained Cohesive Strength C_u (kPa)
Extremely low	<10
Very low	10 – 20
Low	20 – 40
Medium	40 – 75
High	75 – 150
Very high	150 – 300
Extremely high	> 300

Note(s): (Ref: BS EN ISO 14688-2:2004+A1:2013 Clause 5.3.)

The relative density of granular soils was classified based of the relationship given in Table C.1.2.

The *UK National Annex to Eurocode 7: Geotechnical design – Part 2: Ground investigation and testing, NA 3.7 SPT test, BS EN 1997-2:2007, Annex F* states "Relative density descriptions on borehole records should also be based on uncorrected SPT N values, unless significantly disturbed, using the density classification in BS 5930:2015, Table 7.

Table C.1.2 SPT "N" Blow Count Granular Classification

Classification	SPT "N" blow count (blows/300mm)
Very loose	0 to 4
Loose	4 to 10
Medium dense	10 to 30
Dense	30 to 50
Very dense	Greater than 50

Note(s): (Ref: The Standard Penetration Test (SPT): Methods and Use, CIRIA Report 143, 1995)

Classification of DCP results to CBR:

The DCP consists of a cone fixed to the bottom of a 575mm vertical rod. An 8kg weight is repeatedly lifted and dropped onto an anvil at the mid-height of the rod to deliver a 'blow'. A vertical scale alongside the rod is used to measure the depth of penetration of the cone. These measurements are then converted to CBR values using the following equation derived from the DTP Interim Advice Note 73/06 – Design Guidance for Road Pavement Foundations:

$$Log_{10}(CBR) = 2.48 - 1.057 \times Log_{10}(mm/blow)$$

Appendix C.2 Interpretation

Table C.2.1 Interpretation of SPT Tests

BH	Strata	SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
BH1	MG 0.00 – 3.50	10	N/A
	KPGR 3.50 – 9.70 Sand and Gravel	16 - >50	Medium dense to very dense
	LC 9.70 – 20.00 Clay	43 – 48	Very high strength (Cu = 215 to 240kPa)

Table C.2.2 Interpretation of DPSH Blow Counts

DP	Strata	Equivalent SPT N60 Blow Counts	Inferred Cohesive Strength/Granular Density
DP1	MG/WG 0.00 - >7.00	<2 – 34	N/A
DP2	MG 0.00 – 3.00	4 – 27	N/A
	KPGR 3.00 – 5.00[1] Sand and Gravel	14 - >50	Medium dense to very dense
DP3	MG 0.00 – 2.10	7 – 37	N/A
	KPGR 2.10 – 6.00[1] Sand and Gravel	31 - >50	Dense to very dense
DP4	MG 0.00 – 5.70[2]	<2 – 31	N/A
	KPGR 5.70 – 6.00[1]	N/A	N/A

Note(s): [1] Ground conditions inferred past the base of windowless sampler boreholes.

Table C.2.3 Interpretation of QUU Tests

Location	Stratum	Sample Depth (m bgl)	Moisture Content (%)	Soil Strength	Shear Strength (kPa)
BH1	LC	11.00	28	High	87
BH1	LC	14.00	27	High	117
BH1	LC	17.00	25	High	126
BH1	LC	19.50	25	Very high	231

Table C.2.4 Interpretation of Atterberg Limit Tests

Stratum	Moisture Content (%)	Plasticity Index (%)	Passing 425µm Sieve (%)	Modified Plasticity Index (%)	Soil Classification	Volume Change Potential	
						BRE	NHBC
MG	4.6	N/A	95	N/A	N/A	NP	
WG	18	16	95	15	CL	Low	Low
LC	25 – 28	22 – 24	100	22 – 24	CI	Medium	Medium

Note(s): NP: Non Plastic
BRE Volume Change Potential refers to BRE Digest 240 (based on Atterberg results)
NHBC Volume Change Potential refers to NHBC Standards Chapter 4.2
Soils Classification based on British Soil Classification System
The most common use of the term clay is to describe a soil that contains enough clay-sized material or clay minerals to exhibit cohesive properties. The fraction of clay-sized material required varies, but can be as low as 15%. Unless stated otherwise, this is the sense used in Digest 240. The term can be used to denote the clay minerals. These are specific, naturally occurring chemical compounds, predominately silicates. The term is often used as a particle size descriptor. Soil particles that have a nominal diameter of less than 2 µm are normally considered to be of clay size, but they are not necessarily clay minerals. Some clay minerals are larger than 2 µm and some particles, 'rock flour' for example, can be finer than 2 µm but are not clay minerals.
(The Atterberg Limit Tests were undertaken in accordance with BS 1377:Part 2:1990 Clauses 3.2, 4.3 and 5)

Table C.2.5 Interpretation of PSD Tests

Location	Depth (m bgl)	Soil Description	Volume Change Potential		Passing 63µm Sieve (%)
			BRE	NHBC	
BH1	3.60	Brown slightly silty/clay fine to coarse sandy fine to coarse GRAVEL	No	No	1
BH1	6.50		No	No	1
BH1	8.00		No	No	1
WS2	3.50		No	No	4
WS3	3.50		No	No	1

Note(s): BRE 240 states that a soil has a volume change potential when the clay fraction **exceeds 15%**. Only the silt and clay combined fraction are determined by sieving therefore the volume change potential is estimated from the percentage passing the 63µm sieve. NHBC Standards Chapter 4.2 states that a soil is shrinkable if the percentage of silt and clay passing the 63µm sieve is greater than 35% and the Plasticity Index is greater than 10%.
(The Particle Size Distribution Tests were undertaken in accordance with BS 1377: Part 2: 1990 Clause 9)

Appendix C.3 Geotechnical In-Situ and Laboratory Results

Laboratory Report

GSTL
GEOTECHNICAL SITE & TESTING LABORATORIES
A PHENNA GROUP COMPANY

UKAS TESTING 2788

Contract Number: 61023

Client Ref: **20295**
Client PO: **20295**

Date Received: **24-08-2022**
Date Completed: **20-09-2022**
Report Date: **20-09-2022**

Client: **Soils Limited**
Newton House
Cross Road
Tadworth
Surrey
KT20 5SR

This report has been checked and approved by:

Paul Evans
Director

Contract Title: **Thames Young Mariners**
For the attention of: **Luke Wilkinson**

Test Description	Qty
Moisture Content of Soil BS1377 : Part 2 : Clause 3.2 : 1990 - * UKAS	4
4 Point Liquid & Plastic Limit BS 1377:1990 - Part 2 : 4.3 & 5.3 - * UKAS	4
PSD Wet & Dry Sieve method BS 1377:1990 - Part 2 : 9.2 - * UKAS	5
Quick Undrained Triaxial Compression test - single specimen at one confining pressure (100mm or 38mm diameter) BS 1377:1990 - Part 7 : 8 - * UKAS	4
Disposal of samples for job	1

Notes: **Observations and Interpretations are outside the UKAS Accreditation**
*** - denotes test included in laboratory scope of accreditation**
 # - denotes test carried out by approved contractor
@ - denotes non accredited tests

Approved Signatories:
Brendan Evans (Office Administrator) - Paul Evans (Director) - Richard John (Quality/Technical Manager)
Shaun Jones (Laboratory manager) - Shaun Thomas (Site Manager) - Wayne Honey (Human Resources/ Health and Safety Coordinator)

GEO Site & Testing Services Ltd
Units 3-4, Heol Aur, Dafen, Llanelli, Carmarthenshire, Wales SA14 8QN
Tel: 01554 784040 Fax: 01554 784041 info@gstl.co.uk gstl.co.uk

GSTL
GEOTECHNICAL SITE & TESTING LABORATORIES

Summary of Soil Descriptions

Contract Number	61023
Site Name	Thames Young Mariners
Client Reference	20295

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Descriptions
BH1		B	3.60	-	4.00	Brown slightly silty/clay fine to coarse sandy fine to coarse GRAVEL
BH1		B	6.50	-	6.95	Brown slightly silty/clay fine to coarse sandy fine to coarse GRAVEL
BH1		B	8.00	-	8.50	Brown slightly silty/clay fine to coarse sandy fine to coarse GRAVEL
BH1		U	11.00	-	11.40	Brown silty CLAY
BH1		U	14.00	-	14.35	Brown silty CLAY
BH1		U	17.00	-	17.40	Brown silty CLAY
BH1		U	19.50	-	19.90	Brown silty CLAY
WS1		D	2.30	-		Brown slightly clayey SAND
WS1		D	4.70	-		Brown fine to medium gravelly sandy CLAY
WS2		D	3.30	-		Brown slightly silty/clay fine to coarse sandy fine to coarse GRAVEL
WS3		D	3.50	-		Brown slightly silty/clay fine to coarse sandy fine to coarse GRAVEL
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GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	NATURAL MOISTURE, LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX (BS 1377:1990 - Part 2 : 4.3 & 5.3)	
Contract Number	61023	
Project Location	Thames Young Mariners	
Date Tested	07/09/2022	

Sample/Hole Reference	Sample Number	Sample Type	Depth (m)			Moisture Content %	Liquid Limit %	Plastic Limit %	Plasticity index %	Passing 0.425mm %	Remarks
BH1		U	11.00	-	11.40	28	48	24	24	100	CI Intermediate Plasticity
BH1		U	17.00	-	17.40	25	44	22	22	100	CI Intermediate Plasticity
WS1		D	2.30	-		4.6		NP		95	
WS1		D	4.70	-		18	28	12	16	95	CL Low Plasticity
				-							
				-							
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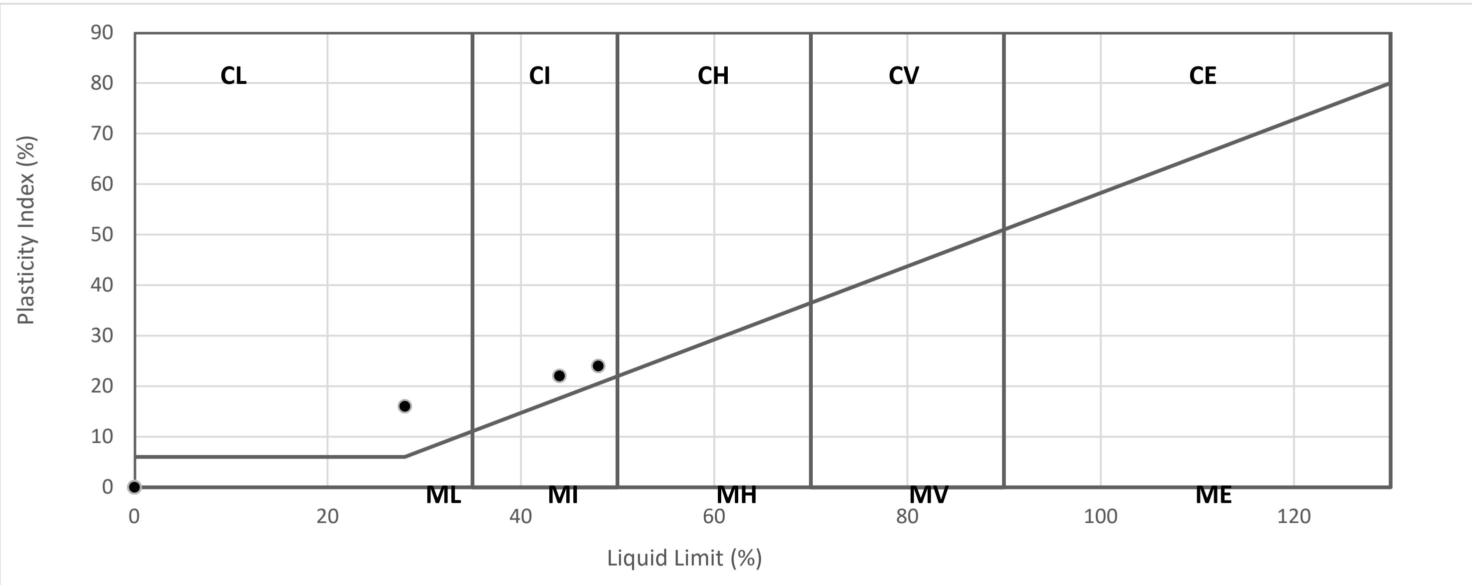
Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

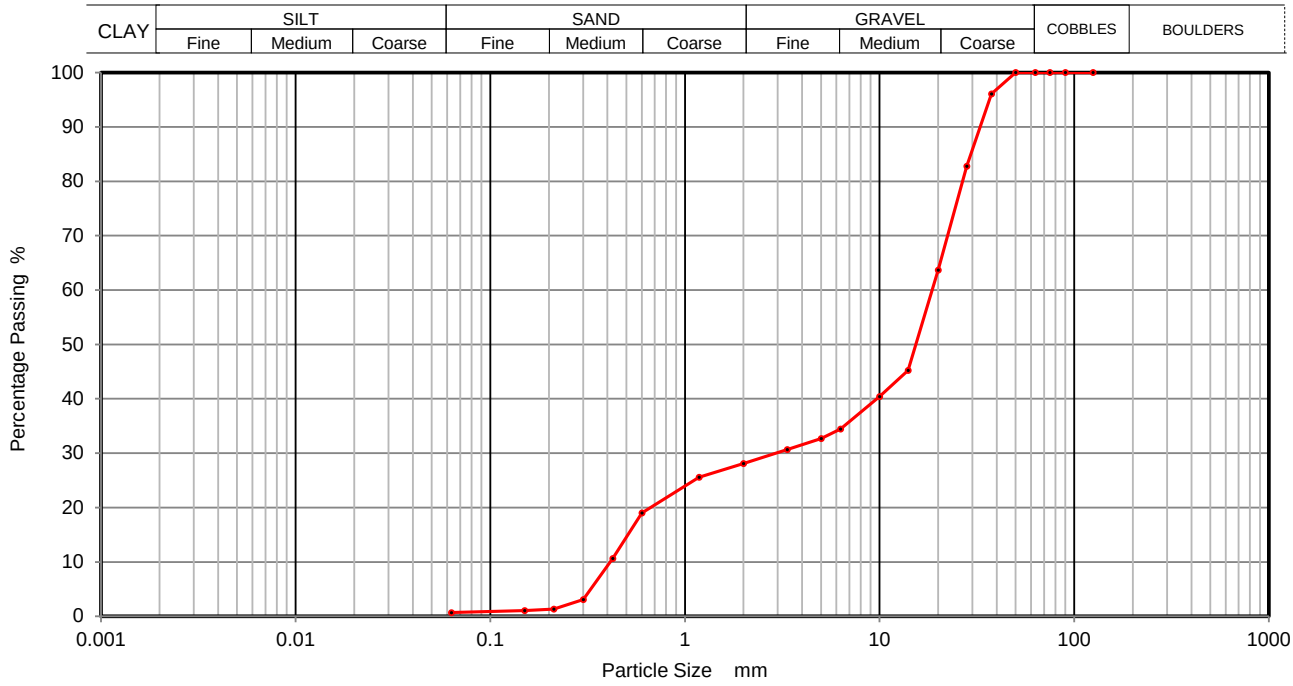
PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION
BS 5930:1999+A2:2010



Operators
Darcy Etheridge

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	61023
		Borehole/Pit No.	BH1
Site Name	Thames Young Mariners	Sample No.	
Soil Description	*See sample description sheet	Depth Top	3.60
		Depth Base	4.00
Date Tested	09/09/2022	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	96		
28	83		
20	64		
14	45		
10	40		
6.3	34		
5	33		
3.35	31		
2	28		
1.18	26		
0.6	19		
0.425	11		
0.3	3		
0.212	1		
0.15	1		
0.063	1		

Sample Proportions	% dry mass
Cobbles	0
Gravel	72
Sand	27
Silt and Clay	1

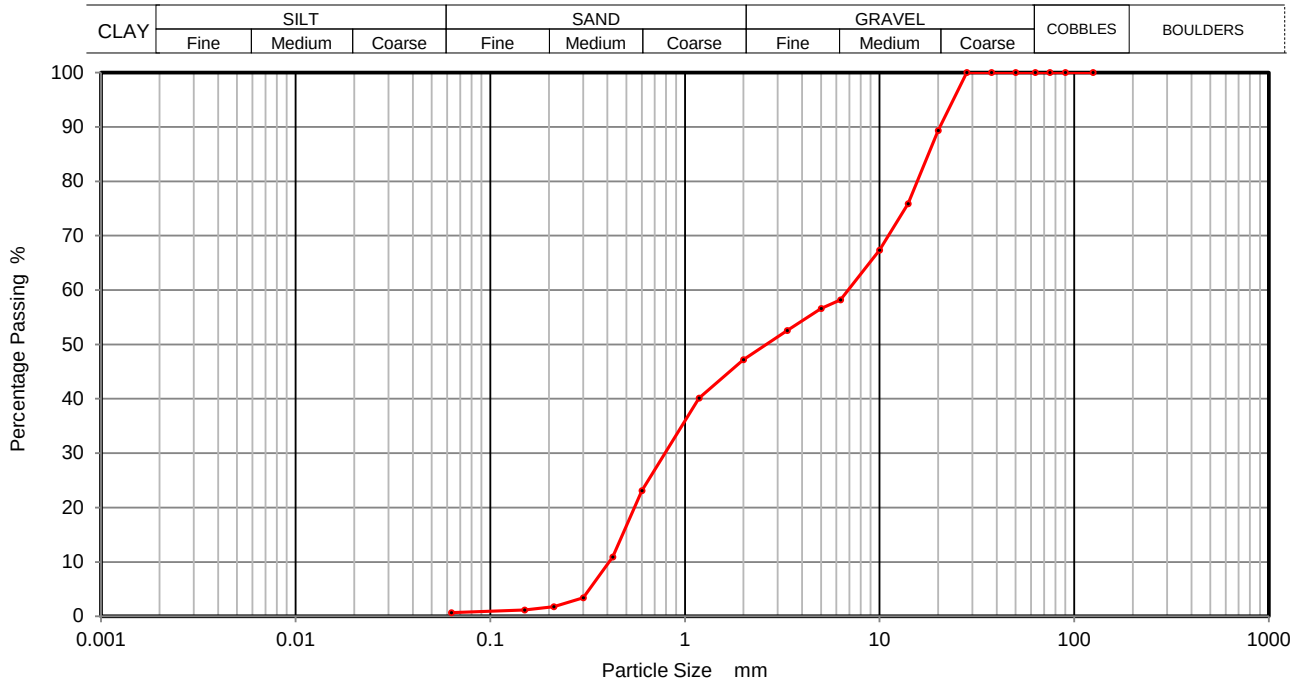
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	61023
		Borehole/Pit No.	BH1
Site Name	Thames Young Mariners	Sample No.	
Soil Description	*See sample description sheet	Depth Top	6.50
		Depth Base	6.95
Date Tested	09/09/2022	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	89		
14	76		
10	67		
6.3	58		
5	57		
3.35	53		
2	47		
1.18	40		
0.6	23		
0.425	11		
0.3	3		
0.212	2		
0.15	1		
0.063	1		

Sample Proportions	% dry mass
Cobbles	0
Gravel	53
Sand	46
Silt and Clay	1

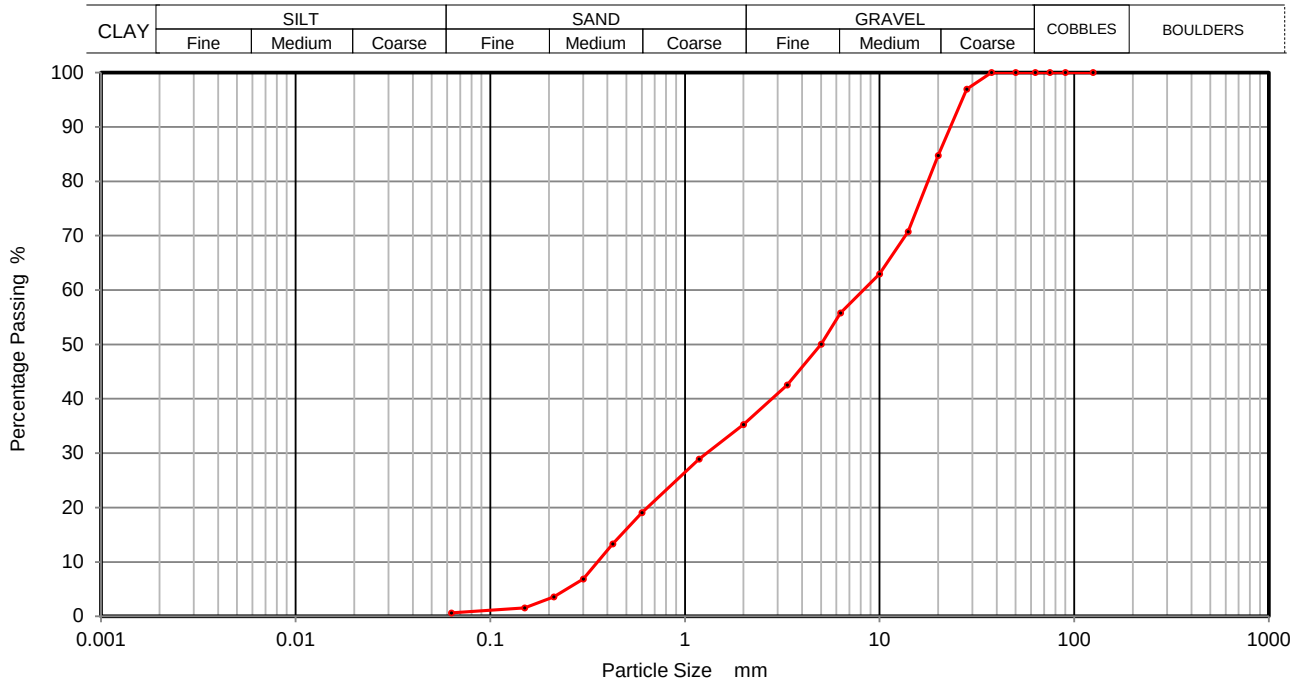
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	61023
		Borehole/Pit No.	BH1
Site Name	Thames Young Mariners	Sample No.	
Soil Description	*See sample description sheet	Depth Top	8.00
		Depth Base	8.50
Date Tested	09/09/2022	Sample Type	B



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	97		
20	85		
14	71		
10	63		
6.3	56		
5	50		
3.35	43		
2	35		
1.18	29		
0.6	19		
0.425	13		
0.3	7		
0.212	4		
0.15	2		
0.063	1		

Sample Proportions	% dry mass
Cobbles	0
Gravel	65
Sand	34
Silt and Clay	1

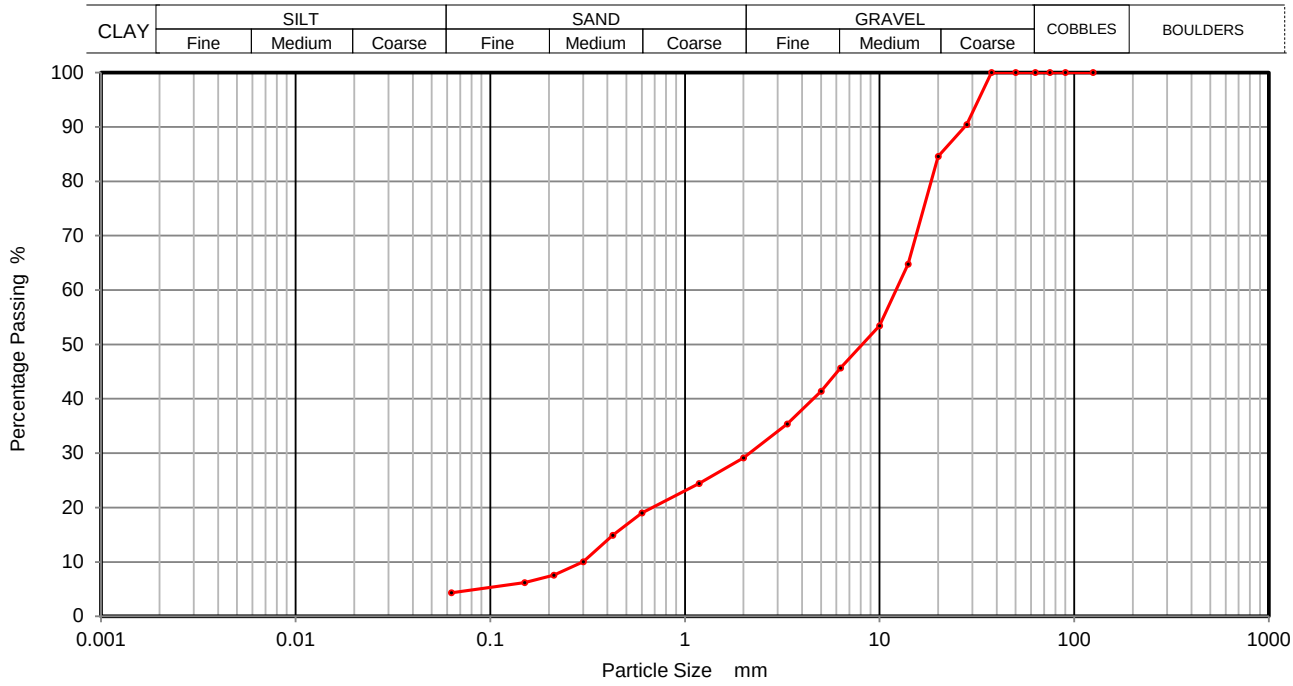
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	61023
		Borehole/Pit No.	WS2
Site Name	Thames Young Mariners	Sample No.	
Soil Description	*See sample description sheet	Depth Top	3.30
		Depth Base	
Date Tested	09/09/2022	Sample Type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	90		
20	85		
14	65		
10	53		
6.3	46		
5	41		
3.35	35		
2	29		
1.18	24		
0.6	19		
0.425	15		
0.3	10		
0.212	8		
0.15	6		
0.063	4		

Sample Proportions	% dry mass
Cobbles	0
Gravel	71
Sand	25
Silt and Clay	4

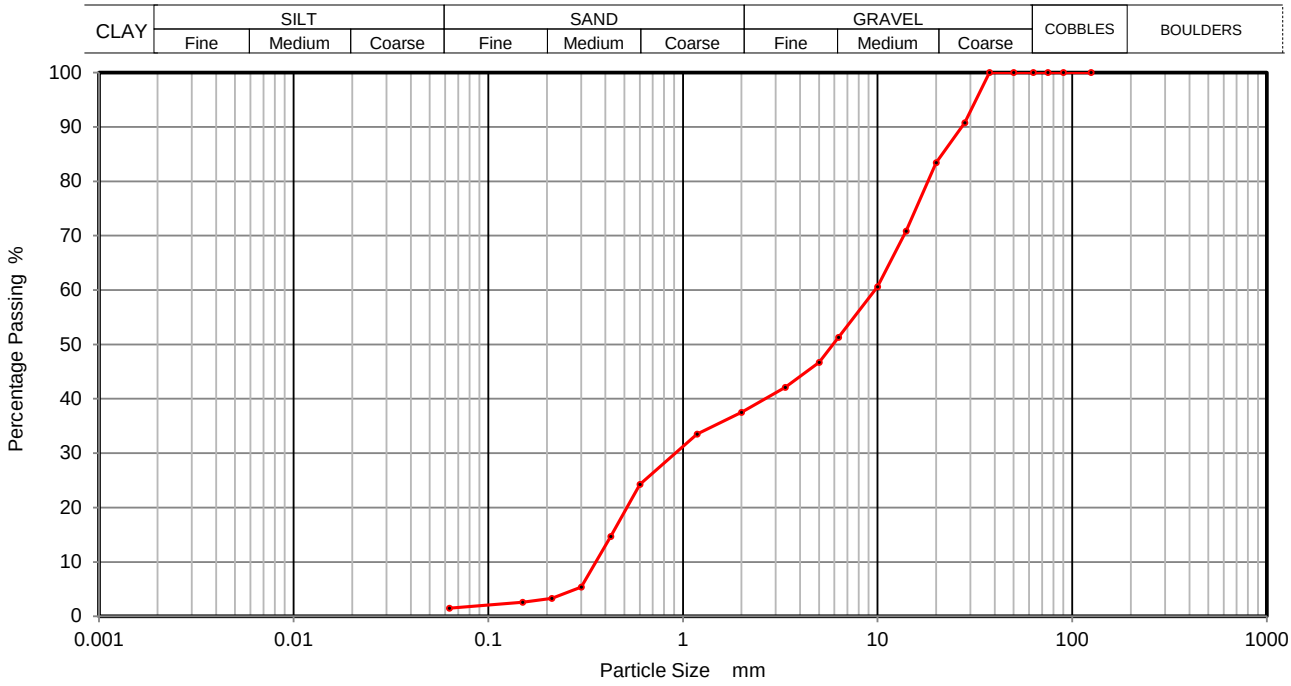
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**PARTICLE SIZE DISTRIBUTION** **BS 1377 Part 2:1990** **Wet Sieve, Clause 9.2**	Contract Number	61023
		Borehole/Pit No.	WS3
Site Name	Thames Young Mariners	Sample No.	
Soil Description	*See sample description sheet	Depth Top	3.50
		Depth Base	
Date Tested	09/09/2022	Sample Type	D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	91		
20	83		
14	71		
10	61		
6.3	51		
5	47		
3.35	42		
2	38		
1.18	34		
0.6	24		
0.425	15		
0.3	5		
0.212	3		
0.15	3		
0.063	1		

Sample Proportions	% dry mass
Cobbles	0
Gravel	62
Sand	37
Silt and Clay	1

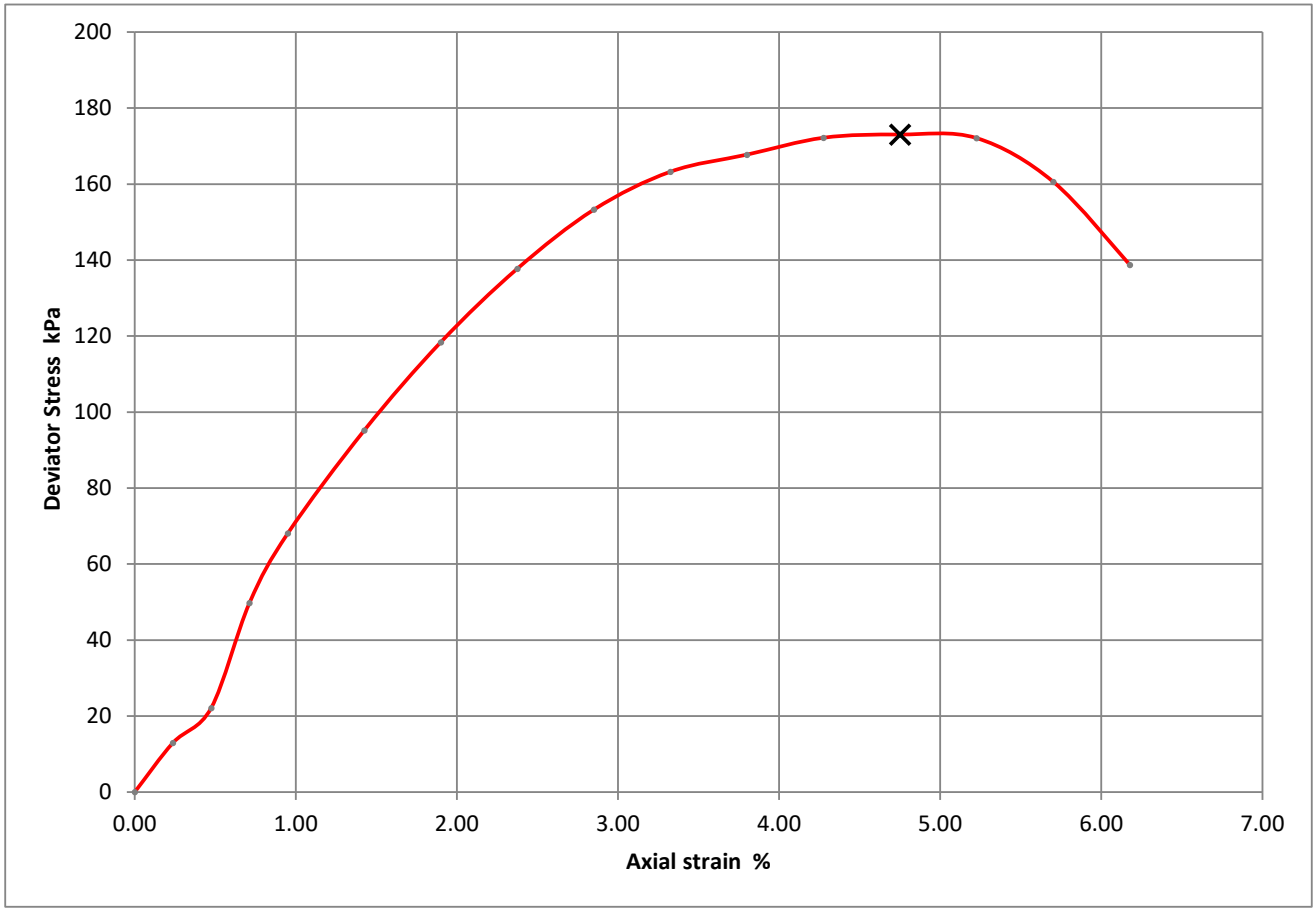
Remarks

Preparation and testing in accordance with BS1377 unless noted below

Operator
David Edwards

UKAS TESTING 2788

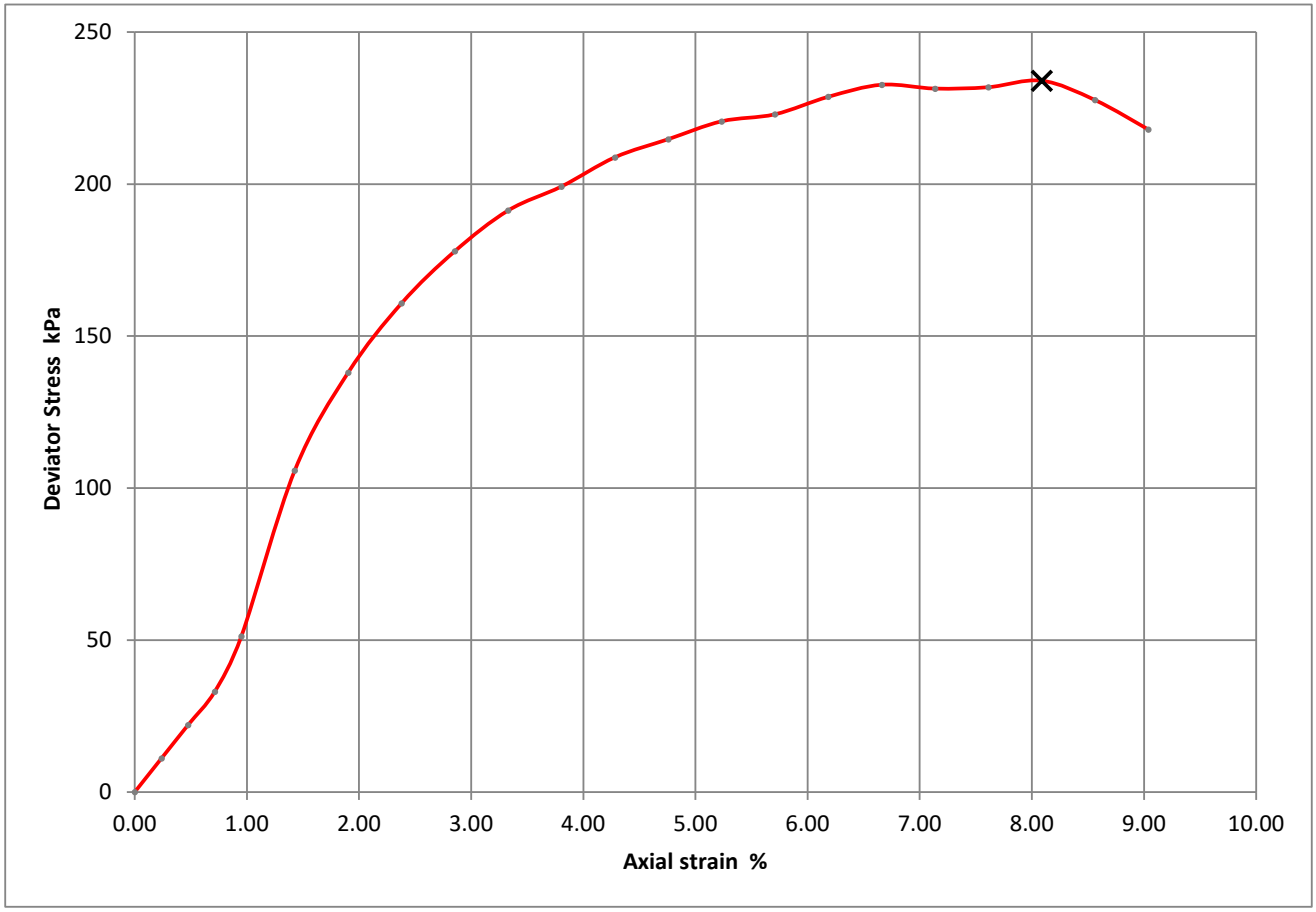
GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**Single Stage Unconsolidated-Undrained Triaxial Test BS 1377 : 1990 Part 7 : 8**	Contract Number	61023
		Borehole/Pit No.	BH1
Site Name	Thames Young Mariners	Sample No.	
Soil Description	*See Sample Description Sheet	Depth Top (m)	11.00
		Depth Base (m)	11.40
Date Tested	12/09/2022	Sample Type	U
		Technician	Jordan



Moisture Content (%)	28
Bulk Density (Mg/m^3)	1.84
Dry Density (Mg/m^3)	1.44
Specimen Length (mm)	210.5
Specimen Diamteter (mm)	105.2
Cell Pressure (kPa)	220
Deviator Stress (kPa)	173
Undrained Shear Strength (kPa)	87
Failure Strain (%)	5
Mode Of Failure	Brittle
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.43

UKAS TESTING
2788

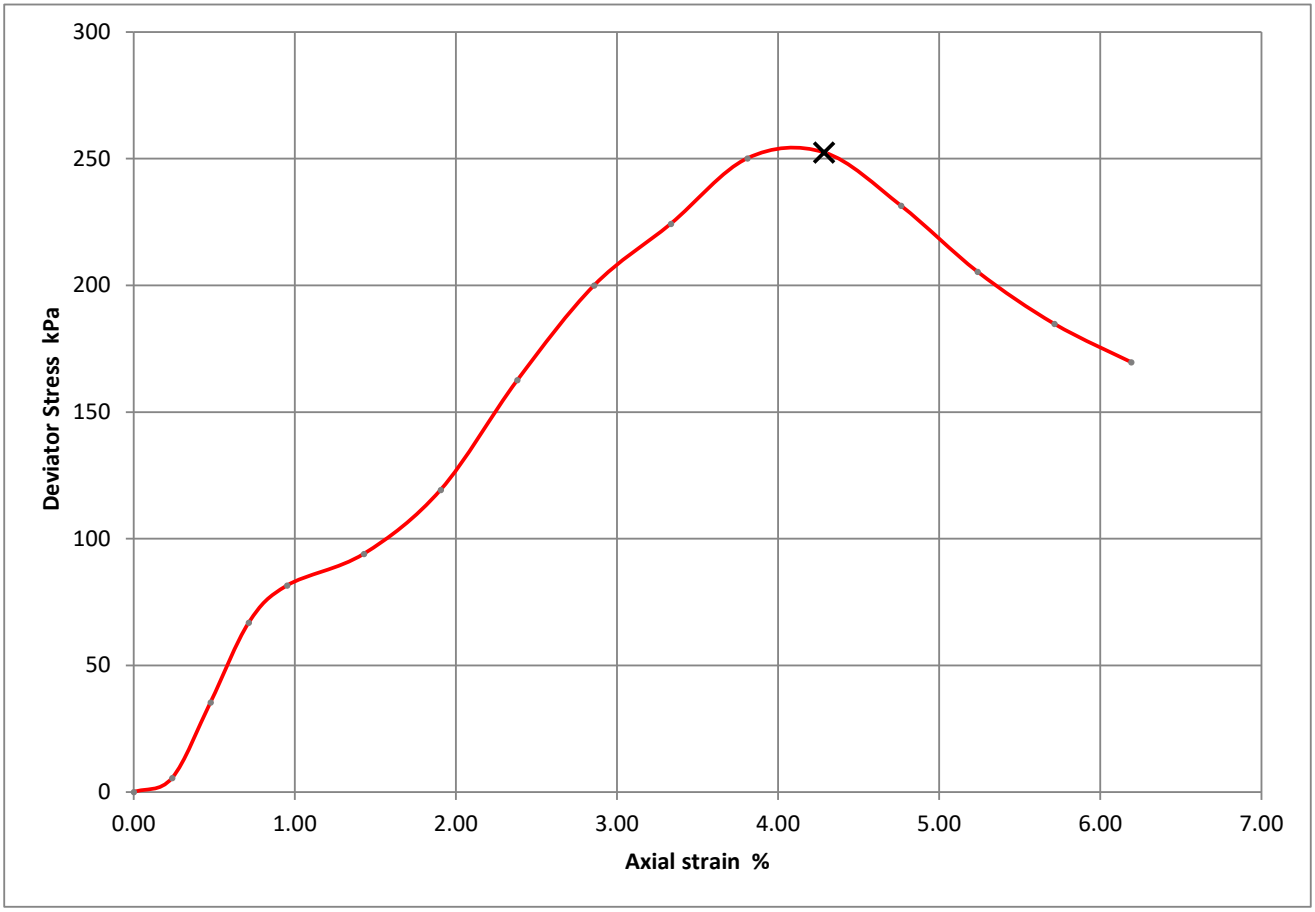
GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**Single Stage Unconsolidated-Undrained Triaxial Test BS 1377 : 1990 Part 7 : 8**	Contract Number	61023
		Borehole/Pit No.	BH1
Site Name	Thames Young Mariners	Sample No.	
Soil Description	*See Sample Description Sheet	Depth Top (m)	14.00
		Depth Base (m)	14.35
Date Tested	12/09/2022	Sample Type	U
		Technician	Jordan



Moisture Content (%)	27
Bulk Density (Mg/m^3)	1.87
Dry Density (Mg/m^3)	1.47
Specimen Length (mm)	210.2
Specimen Diamteter (mm)	105.4
Cell Pressure (kPa)	280
Deviator Stress (kPa)	234
Undrained Shear Strength (kPa)	117
Failure Strain (%)	8
Mode Of Failure	Brittle
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.43

UKAS TESTING
2788

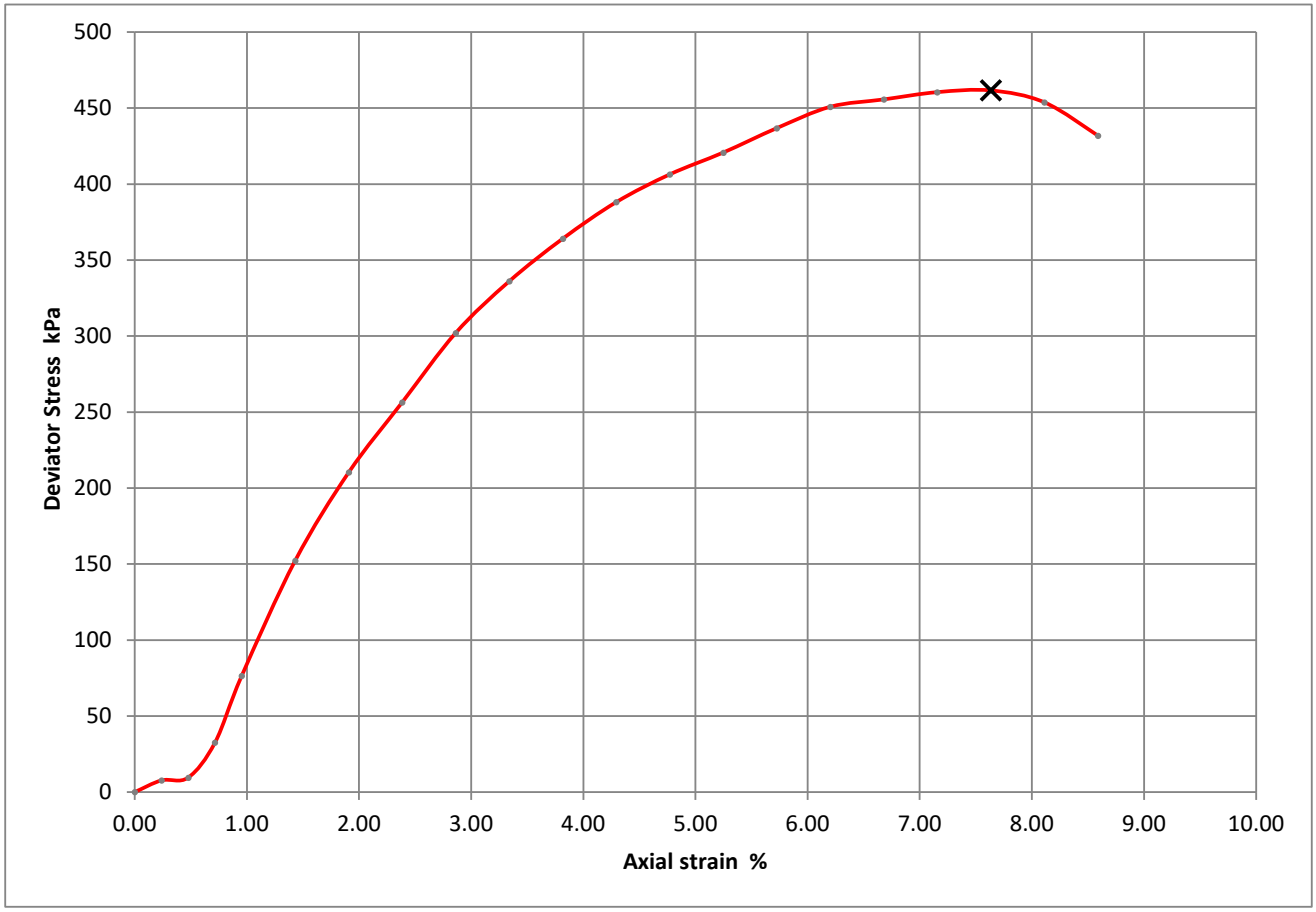
GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**Single Stage Unconsolidated-Undrained Triaxial Test BS 1377 : 1990 Part 7 : 8**	Contract Number	61023
		Borehole/Pit No.	BH1
Site Name	Thames Young Mariners	Sample No.	
Soil Description	*See Sample Description Sheet	Depth Top (m)	17.00
		Depth Base (m)	17.40
Date Tested	12/09/2022	Sample Type	U
		Technician	Jordan



Moisture Content (%)	25
Bulk Density (Mg/m^3)	1.91
Dry Density (Mg/m^3)	1.53
Specimen Length (mm)	210
Specimen Diamteter (mm)	104.8
Cell Pressure (kPa)	340
Deviator Stress (kPa)	252
Undrained Shear Strength (kPa)	126
Failure Strain (%)	4
Mode Of Failure	Brittle
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.43

UKAS TESTING 2788

GSTL GEOTECHNICAL SITE & TESTING LABORATORIES	**Single Stage Unconsolidated-Undrained Triaxial Test BS 1377 : 1990 Part 7 : 8**	Contract Number	61023
		Borehole/Pit No.	BH1
Site Name	Thames Young Mariners	Sample No.	
Soil Description	*See Sample Description Sheet	Depth Top (m)	19.50
		Depth Base (m)	19.90
Date Tested	12/09/2022	Sample Type	U
		Technician	Jordan



Moisture Content (%)	25
Bulk Density (Mg/m^3)	1.99
Dry Density (Mg/m^3)	1.59
Specimen Length (mm)	209.6
Specimen Diamteter (mm)	103.2
Cell Pressure (kPa)	390
Deviator Stress (kPa)	462
Undrained Shear Strength (kPa)	231
Failure Strain (%)	8
Mode Of Failure	Brittle
Membrane Used/Thickness	Rubber/0.3mm
Rate of Strain (%/min)	1.43

UKAS TESTING
2788

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Surrey
KT20 5SR

Derwentside Environmental Testing Services Ltd
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 22-07184

Site Reference:	Thames Young Mariners
Project / Job Ref:	20295
Order No:	None Supplied
Sample Receipt Date:	24/08/2022
Sample Scheduled Date:	24/08/2022
Report Issue Number:	1
Reporting Date:	31/08/2022

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

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Soil Analysis Certificate						
DETS Report No: 22-07184	**Date Sampled**	10/08/22	10/08/22	12/08/22	12/08/22	12/08/22
Soils Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Thames Young Mariners	**TP / BH No**	WS2	WS3	BH1	BH1	BH1
Project / Job Ref: 20295	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: None Supplied	**Depth (m)**	1.30	1.50	2.00 - 2.45	6.00	9.00
Reporting Date: 31/08/2022	**DETS Sample No**	610300	610301	610302	610303	610304

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	8.6	7.9	8.1	7.4	8.2
Total Sulphate as SO_4	mg/kg	< 200	MCERTS	2237	< 200	201	< 200	284
Total Sulphate as SO_4	%	< 0.02	MCERTS	0.22	< 0.02	0.02	< 0.02	0.03
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	200	201	18	< 10	35
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.20	0.20	0.02	< 0.01	0.03
Total Sulphur	%	< 0.02	NONE	0.09	< 0.02	< 0.02	< 0.02	0.07
Ammonium as NH_4	mg/kg	< 0.5	ISO17025	0.9	1.1	0.8	0.6	1
Ammonium as NH_4	mg/l	< 0.05	ISO17025	0.09	0.11	0.08	0.06	0.10
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	60	59	5	3	8
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	29.8	29.4	2.3	1.5	4
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS	91	91	< 3	< 3	< 3
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	MCERTS	45.4	45.5	< 1.5	< 1.5	< 1.5
W/S Magnesium	mg/l	< 0.1	NONE	0.9	2.3	1.3	0.3	1.3

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)

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Soil Analysis Certificate						
DETS Report No: 22-07184	**Date Sampled**	12/08/22	12/08/22			
Soils Ltd	**Time Sampled**	None Supplied	None Supplied			
Site Reference: Thames Young Mariners	**TP / BH No**	BH1	BH1			
Project / Job Ref: 20295	**Additional Refs**	None Supplied	None Supplied			
Order No: None Supplied	**Depth (m)**	12.00	19.90			
Reporting Date: 31/08/2022	**DETS Sample No**	610305	610306			

Determinand	Unit	RL	Accreditation					
pH	pH Units	N/a	MCERTS	8.4	8.5			
Total Sulphate as SO_4	mg/kg	< 200	MCERTS	542	728			
Total Sulphate as SO_4	%	< 0.02	MCERTS	0.05	0.07			
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	MCERTS	138	205			
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	MCERTS	0.14	0.20			
Total Sulphur	%	< 0.02	NONE	0.50	0.34			
Ammonium as NH_4	mg/kg	< 0.5	ISO17025	19.2	32.2			
Ammonium as NH_4	mg/l	< 0.05	ISO17025	1.92	3.22			
W/S Chloride (2:1)	mg/kg	< 1	MCERTS	10	9			
W/S Chloride (2:1)	mg/l	< 0.5	MCERTS	4.9	4.3			
Water Soluble Nitrate (2:1) as NO_3	mg/kg	< 3	MCERTS	< 3	< 3			
Water Soluble Nitrate (2:1) as NO_3	mg/l	< 1.5	MCERTS	< 1.5	< 1.5			
W/S Magnesium	mg/l	< 0.1	NONE	5	5.5			

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)

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Soil Analysis Certificate - Sample Descriptions
DETS Report No: 22-07184
Soils Ltd
Site Reference: Thames Young Mariners
Project / Job Ref: 20295
Order No: None Supplied
Reporting Date: 31/08/2022

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
$ 610300	WS2	None Supplied	1.30	13.1	Brown sandy clay with stones
$ 610301	WS3	None Supplied	1.50	18.2	Brown clay
$ 610302	BH1	None Supplied	2.00 - 2.45	12.1	Light brown sandy clay with stones
$ 610303	BH1	None Supplied	6.00	4.2	Light brown gravelly sand with stones
$ 610304	BH1	None Supplied	9.00	12.1	Brown clayey sand with stones
$ 610305	BH1	None Supplied	12.00	17.5	Brown clay
$ 610306	BH1	None Supplied	19.90	18.1	Brown clay

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
Unsuitable Sample U/S

$ samples exceeded recommended holding times

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Soil Analysis Certificate - Methodology & Miscellaneous Information
DETS Report No: 22-07184
Soils Ltd
Site Reference: Thames Young Mariners
Project / Job Ref: 20295
Order No: None Supplied
Reporting Date: 31/08/2022

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

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List of HWOL Acronyms and Operators
DETS Report No: 22-07184
Soils Ltd
Site Reference: Thames Young Mariners
Project / Job Ref: 20295
Order No: None Supplied
Reporting Date: 31/08/2022

Acronym	**Description**
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det - Acronym

Appendix D Foundation Design

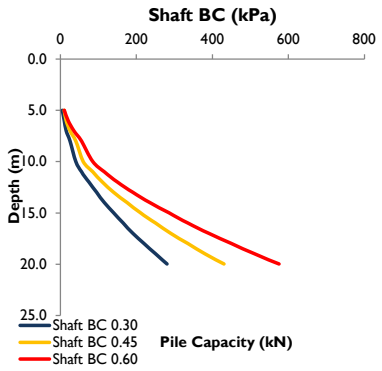
Appendix D.1 Preliminary Pile Design

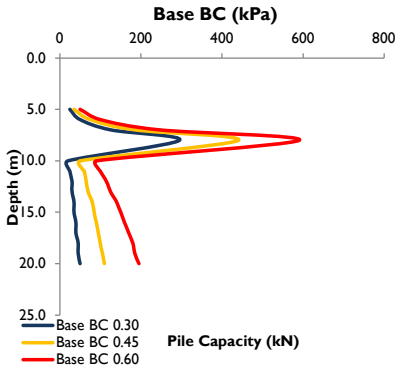
Preliminary Pile Working Loads

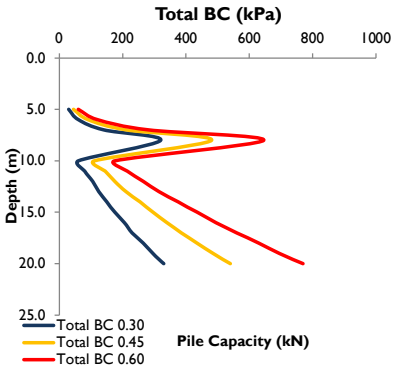
Single Vertically Loaded Pile (kN)

Parameters:		FOS:	Shaft	Base			Alpha Value (α):	0.45	Maximum no. of layers	2
Name:	TYM	Clay:	3	3	GW Level:	4m BGL	NC Value:	9		
Job No:	20295									
Date:	28.9.22	Gravel:	3	3						

Notes: Piles founded in the KPGR but in close proximity to the LC boundary must consider the reduced allowable load within the underlying LC, within the final design, to prevent overstressing.







		Pile Diameter (m):									
Pile Depths		0.3			0.45			0.6			
Material	(m bgl)	Shaft	Base	Total	Shaft	Base	Total	Shaft	Base	Total	Layer
Gravel	5.0	5	25	30	10	35	45	10	50	60	1
Gravel	6.0	10	50	60	15	75	90	20	100	120	1
Gravel	7.0	15	125	140	25	185	210	35	245	280	1
Gravel	8.0	25	295	320	40	440	480	55	590	645	1
Clay	10.0	40	20	60	60	50	110	85	90	175	2
Clay	11.0	55	25	80	85	60	145	115	100	215	2
Clay	12.0	75	30	105	110	65	175	150	115	265	2
Clay	13.0	95	30	125	140	70	210	190	125	315	2
Clay	14.0	115	35	150	175	80	255	235	140	375	2
Clay	15.0	140	35	175	210	85	295	285	150	435	2
Clay	16.0	165	40	205	250	90	340	335	160	495	2
Clay	17.0	190	40	230	290	95	385	390	170	560	2
Clay	18.0	220	45	265	335	100	435	450	180	630	2
Clay	19.0	250	45	295	380	105	485	510	185	695	2
Clay	20.0	280	50	330	430	110	540	575	195	770	2
Clay	20.0	280	50	330	430	110	540	575	195	770	2

Appendix E Chemical Laboratory Analyses

Appendix E.1 Conceptual Site Model

Table E.1.1 CSM Revised Pre-Chemical Analyses

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from PIR & Intrusive Investigation			Comments	Proposed Investigation
				Severity	Probability	Risk		
Sand and Gravel Works (Buildings), Tank, Infilled Ground (Made Ground) On-site historic and current site usage.	Metals, Semi-metals and non-metals, PAHs	Inhalation of dust	Site Workers/Site Maintenance	Medium	Unlikely	Low	Site located on bedrock of the London Clay Formation, which was classified as unproductive strata and would act as an aquiclude to the deep groundwater receptors. Overlying superficial deposits of Kempton Park Gravel Member anticipated to be granular and could support local groundwater.	Chemical testing prior to undertaking a generic quantitative risk assessment.
			End Users	Medium	Low	Moderate/Low		
			Off-site Users	Medium	Unlikely	Low		
	TPHs	Inhalation of vapour/gases	Site Workers/Site Maintenance	Mild	Unlikely	Very low		
			End Users					
			Off-site Users	Minor	Unlikely	Very low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH, Asbestos	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Medium	Unlikely	Low		
			End Users	Medium	Low	Moderate/Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Migration via surface runoff	Surface Water	Mild	Low	Low		
		Migration in solution via groundwater	Surface Water	Mild	Low	Low		
			Shallow Aquifer	Mild	Low	Low		
			~~Deep Aquifer~~	-	-	-		
		Direct contact with construction material	Buried Structures	Medium	Low	Moderate/Low		
			Buried Services					
	PAHs, TPHs	Migration of gases via permeable soils	Building and Confined Spaces	Mild	Unlikely	Very Low		
			End Users	Mild	Unlikely			
			Off-site Users	Minor	Unlikely	Very Low		
Infilled Ground (Made Ground) On-site and Off-site contaminative processes.	Ground Gases	Inhalation of Vapour/gases	Site Workers/Site Maintenance	Medium	Low	Moderate/low	Significant areas of historically infilled land on and off the site.	Gas monitoring to confirm risk from ground gases.
			End Users	Medium	Low			
			Off-site Users	Mild	Low	Low		
	Ground Gases	Migration of gases via permeable soils	Site Workers/Site Maintenance	Medium	Low	Very Low		
			End Users	Medium	Low			
			Off-site Users (On-site source)	Mild	Low	Low		
			Building and confined spaces	Mild	Low			

Table E.1.2 CSM Revised Post-Chemical Analyses

Source	Potential Contaminant	Exposure Pathway	Receptor	Initial Assessment from PIR & Intrusive Investigation			Comments	Recommended Investigation
				Severity	Probability	Risk		
Sand and Gravel Works (Buildings), Tank, Infilled Ground (Made Ground) On-site historic and current site usage.	**Metals**, Semi-metals and non-metals, PAHs	Inhalation of dust	Site Workers/Site Maintenance	Medium	Unlikely	Low	Site located on bedrock of the London Clay Formation, which was classified as unproductive strata and would act as an aquiclude to the groundwater receptors. Overlying superficial deposits of Kempton Park Gravel Member anticipated to be granular and could support local groundwater. The risk assessment has established, based on this scoping analysis, a potential pollutant linkage in relation to human health from an elevated lead concentration within the Made Ground across the site. Additional sampling and analysis are recommended to allow statistical analysis, prior to carrying out a generic quantitative risk assessment.	This scoping investigation has established significant thickness of Made Ground, although no signs of gross contamination. One out of six soil sample analysis recorded an elevated concentration of lead, against a Public Open Space - Residential land use. A single groundwater and gas monitoring well was installed into BH1. No groundwater samples were collected as part of this investigation, a total of three monitoring visits for gas recording were commissioned (ongoing). To date no significant gas concentration have been recorded, however the data set is considered insufficient to undertake a ground gas risk assessment. Further exploratory holes and soil chemical analysis is recommended. The additional soil analysis is recommended to allow statistical analysis and evaluation of the Made Ground at depth. Installation of two additional monitoring wells, and a further three gas monitoring visits over a period of 1.5-months, providing a total period of 3-months of monitoring data.
			End Users	Medium	Low	Moderate/Low		
			Off-site Users	Medium	Unlikely	Low		
	TPHs	Inhalation of vapour/gases	Site Workers/Site Maintenance	Mild	Unlikely	Very low		
			End Users					
			Off-site Users	Minor	Unlikely	Very low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH, Asbestos	Ingestion and absorption via direct contact	Site Workers/Site Maintenance	Medium	Unlikely	Low		
			End Users	Medium	Low	Moderate/Low		
	Metals, Semi-metals and non-metals, PAHs, TPHs, pH	Migration via surface runoff	Surface Water	Mild	Low	Low		
		Migration in solution via groundwater	Surface Water	Mild	Low	Low		
			Shallow Aquifer	Mild	Low	Low		
			~~Deep Aquifer~~	-	-	-		
		Direct contact with construction material	Buried Structures	Medium	Low	Moderate/Low		
			Buried Services					
	PAHs, TPHs	Migration of gases via permeable soils	Building and Confined Spaces	Mild	Unlikely	Very Low		
			End Users	Mild	Unlikely			
			Off-site Users	Minor	Unlikely	Very Low		
Infilled Ground (Made Ground) On-site and Off-site contaminative processes.	Ground Gases	Inhalation of Vapour/gases	Site Workers/Site Maintenance	Medium	Low	Moderate/low	No significant concentrations of gases recorded in the three monitoring visits undertaken to date. The TOC value was determined on six samples of Made Ground and recorded between 0.6 and 2.3%. Based on the limited dataset the Made Ground a relative low percentage of organic carbon contact and likely to have a low gas generation potential. Due to the thickness of the Made Ground and potential for off-site infilled ground the gas monitoring is recommended to characterise the gas risk.	
			End Users	Medium	Low			
			Off-site Users	Mild	Low	Low		
	Ground Gases	Migration of gases via permeable soils	Site Workers/Site Maintenance	Medium	Low	Very Low		
			End Users	Medium	Low			
			Off-site Users (On-site source)	Mild	Low	Low		
			Building and confined spaces	Mild	Low			

Appendix E.2 Chemical Laboratory Results

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KT20 5SR

Derwentside Environmental Testing Services Ltd
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DETS Report No: 22-07961

Site Reference:	Thames Young Mariners
Project / Job Ref:	20295
Order No:	20295
Sample Receipt Date:	23/09/2022
Sample Scheduled Date:	23/09/2022
Report Issue Number:	1
Reporting Date:	29/09/2022

Authorised by:

Dave Ashworth
Technical Manager

Dates of laboratory activities for each tested analyte are available upon request.

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Soil Analysis Certificate						
DETS Report No: 22-07961	**Date Sampled**	10/08/22	10/08/22	10/08/22	10/08/22	10/08/22
Soils Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Thames Young Mariners	**TP / BH No**	WS1	WS2	WS3	WS3	WS4
Project / Job Ref: 20295	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 20295	**Depth (m)**	0.50	0.50	0.10	0.90	0.10
Reporting Date: 29/09/2022	**DETS Sample No**	613939	613940	613941	613942	613943

Determinand	Unit	RL	Accreditation					
Asbestos Screen (S)	N/a	N/a	ISO17025	Not Detected	Not Detected	Not Detected	Not Detected	Not Detected
pH	pH Units	N/a	MCERTS	7.6	7.8	7.4	7.9	7.3
Organic Matter (SOM)	%	< 0.1	MCERTS	1.1	1.8	3.5	2.3	3.9
TOC (Total Organic Carbon)	%	< 0.1	MCERTS	0.6	1	2	1.3	2.3
Arsenic (As)	mg/kg	< 2	MCERTS	15	18	9	15	19
W/S Boron	mg/kg	< 1	NONE	< 1	< 1	< 1	< 1	< 1
Cadmium (Cd)	mg/kg	< 0.2	MCERTS	< 0.2	0.2	< 0.2	< 0.2	1.7
Chromium (Cr)	mg/kg	< 2	MCERTS	18	34	18	23	25
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2
Copper (Cu)	mg/kg	< 4	MCERTS	10	31	24	23	47
Lead (Pb)	mg/kg	< 3	MCERTS	25	136	96	87	162
Mercury (Hg)	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
Nickel (Ni)	mg/kg	< 3	MCERTS	13	30	11	19	28
Selenium (Se)	mg/kg	< 2	MCERTS	< 3	< 3	< 3	< 3	< 3
Vanadium (V)	mg/kg	< 1	MCERTS	40	51	33	40	39
Zinc (Zn)	mg/kg	< 3	MCERTS	38	110	77	112	212
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2	< 2	< 2	< 2	< 2

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)

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Soil Analysis Certificate						
DETS Report No: 22-07961	**Date Sampled**	10/08/22				
Soils Ltd	**Time Sampled**	None Supplied				
Site Reference: Thames Young Mariners	**TP / BH No**	WS4				
Project / Job Ref: 20295	**Additional Refs**	None Supplied				
Order No: 20295	**Depth (m)**	0.90				
Reporting Date: 29/09/2022	**DETS Sample No**	613944				

Determinand	**Unit**	**RL**	**Accreditation**					
Asbestos Screen (S)	N/a	N/a	**ISO17025**	Not Detected				
pH	pH Units	N/a	**MCERTS**	7.8				
Organic Matter (SOM)	%	< 0.1	**MCERTS**	2.2				
TOC (Total Organic Carbon)	%	< 0.1	**MCERTS**	1.3				
Arsenic (As)	mg/kg	< 2	**MCERTS**	13				
W/S Boron	mg/kg	< 1	NONE	< 1				
Cadmium (Cd)	mg/kg	< 0.2	**MCERTS**	0.3				
Chromium (Cr)	mg/kg	< 2	**MCERTS**	32				
Chromium (hexavalent)	mg/kg	< 2	NONE	< 2				
Copper (Cu)	mg/kg	< 4	**MCERTS**	53				
Lead (Pb)	mg/kg	< 3	**MCERTS**	853				
Mercury (Hg)	mg/kg	< 1	**MCERTS**	< 1				
Nickel (Ni)	mg/kg	< 3	**MCERTS**	27				
Selenium (Se)	mg/kg	< 2	**MCERTS**	< 3				
Vanadium (V)	mg/kg	< 1	**MCERTS**	46				
Zinc (Zn)	mg/kg	< 3	**MCERTS**	330				
Total Phenols (monohydric)	mg/kg	< 2	NONE	< 2				

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)

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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 22-07961	**Date Sampled**	10/08/22	10/08/22	10/08/22	10/08/22	10/08/22
Soils Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Thames Young Mariners	**TP / BH No**	WS1	WS2	WS3	WS3	WS4
Project / Job Ref: 20295	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 20295	**Depth (m)**	0.50	0.50	0.10	0.90	0.10
Reporting Date: 29/09/2022	**DETS Sample No**	613939	613940	613941	613942	613943

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.30	0.16	< 0.1
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1	< 0.1	0.24	0.13	< 0.1
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1	1.21	2.60	1.40	0.27
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.26	0.72	0.33	< 0.1
Fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	3.78	3.84	2.04	0.72
Pyrene	mg/kg	< 0.1	MCERTS	< 0.1	3.46	3.32	1.70	0.68
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	2.52	1.95	0.98	0.43
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1	2.17	1.59	0.83	0.42
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	2.32	1.71	0.85	0.54
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1	0.90	0.68	0.32	0.16
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	2.07	1.56	0.77	0.45
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1	1.11	0.86	0.42	0.28
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1	0.33	0.23	< 0.1	< 0.1
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1	0.92	0.70	0.32	0.23
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6	21	20.3	10.2	4.2

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Soil Analysis Certificate - Speciated PAHs						
DETS Report No: 22-07961	**Date Sampled**	10/08/22				
Soils Ltd	**Time Sampled**	None Supplied				
Site Reference: Thames Young Mariners	**TP / BH No**	WS4				
Project / Job Ref: 20295	**Additional Refs**	None Supplied				
Order No: 20295	**Depth (m)**	0.90				
Reporting Date: 29/09/2022	**DETS Sample No**	613944				

Determinand	Unit	RL	Accreditation					
Naphthalene	mg/kg	< 0.1	MCERTS	< 0.1				
Acenaphthylene	mg/kg	< 0.1	MCERTS	< 0.1				
Acenaphthene	mg/kg	< 0.1	MCERTS	< 0.1				
Fluorene	mg/kg	< 0.1	MCERTS	< 0.1				
Phenanthrene	mg/kg	< 0.1	MCERTS	< 0.1				
Anthracene	mg/kg	< 0.1	MCERTS	< 0.1				
Fluoranthene	mg/kg	< 0.1	MCERTS	0.14				
Pyrene	mg/kg	< 0.1	MCERTS	0.13				
Benzo(a)anthracene	mg/kg	< 0.1	MCERTS	< 0.1				
Chrysene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(b)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(k)fluoranthene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(a)pyrene	mg/kg	< 0.1	MCERTS	< 0.1				
Indeno(1,2,3-cd)pyrene	mg/kg	< 0.1	MCERTS	< 0.1				
Dibenz(a,h)anthracene	mg/kg	< 0.1	MCERTS	< 0.1				
Benzo(ghi)perylene	mg/kg	< 0.1	MCERTS	< 0.1				
Total EPA-16 PAHs	mg/kg	< 1.6	MCERTS	< 1.6				

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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 22-07961	**Date Sampled**	10/08/22	10/08/22	10/08/22	10/08/22	10/08/22
Soils Ltd	**Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Site Reference: Thames Young Mariners	**TP / BH No**	WS1	WS2	WS3	WS3	WS4
Project / Job Ref: 20295	**Additional Refs**	None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Order No: 20295	**Depth (m)**	0.50	0.50	0.10	0.90	0.10
Reporting Date: 29/09/2022	**DETS Sample No**	613939	613940	613941	613942	613943

Determinand	Unit	RL	Accreditation					
EPH Texas (C6 - C8) : HS_1D_MS_Total	mg/kg	< 0.05	NONE	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
EPH Texas (>C8 - C10) : EH_1D_Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C10 - C12) : EH_1D_Total	mg/kg	< 1	MCERTS	< 1	< 1	< 1	< 1	< 1
EPH Texas (>C12 - C16) : EH_1D_Total	mg/kg	< 1	MCERTS	< 1	2	4	1	< 1
EPH Texas (>C16 - C21) : EH_1D_Total	mg/kg	< 1	MCERTS	< 1	18	24	11	4
EPH Texas (>C21 - C40) : EH_1D_Total	mg/kg	< 6	MCERTS	< 6	61	61	52	40
EPH Texas (C6 - C40) : HS_1D_MS+EH_1D_Total	mg/kg	< 6	NONE	< 6	81	88	64	44

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Soil Analysis Certificate - EPH Texas Banded						
DETS Report No: 22-07961	**Date Sampled**	10/08/22				
Soils Ltd	**Time Sampled**	None Supplied				
Site Reference: Thames Young Mariners	**TP / BH No**	WS4				
Project / Job Ref: 20295	**Additional Refs**	None Supplied				
Order No: 20295	**Depth (m)**	0.90				
Reporting Date: 29/09/2022	**DETS Sample No**	613944				

Determinand	Unit	RL	Accreditation					
EPH Texas (C6 - C8) : HS_1D_MS _Total	mg/kg	< 0.05	NONE	< 0.05				
EPH Texas (>C8 - C10) : EH_1D_Total	mg/kg	< 1	MCERTS	< 1				
EPH Texas (>C10 - C12) : EH_1D_Total	mg/kg	< 1	MCERTS	< 1				
EPH Texas (>C12 - C16) : EH_1D_Total	mg/kg	< 1	MCERTS	< 1				
EPH Texas (>C16 - C21) : EH_1D_Total	mg/kg	< 1	MCERTS	< 1				
EPH Texas (>C21 - C40) : EH_1D_Total	mg/kg	< 6	MCERTS	< 6				
EPH Texas (C6 - C40) : HS_1D_MS+EH_1D_Total	mg/kg	< 6	NONE	< 6				

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Soil Analysis Certificate - Sample Descriptions
DETS Report No: 22-07961
Soils Ltd
Site Reference: Thames Young Mariners
Project / Job Ref: 20295
Order No: 20295
Reporting Date: 29/09/2022

DETS Sample No	TP / BH No	Additional Refs	Depth (m)	Moisture Content (%)	Sample Matrix Description
$ 613939	WS1	None Supplied	0.50	3.1	Light brown sandy clay
$ 613940	WS2	None Supplied	0.50	11	Brown sandy clay with stones
$ 613941	WS3	None Supplied	0.10	2.8	Brown gravelly sand with stones and concrete
$ 613942	WS3	None Supplied	0.90	6.7	Brown sandy clay with stones and concrete
$ 613943	WS4	None Supplied	0.10	6.2	Brown sandy clay with stones and vegetation
$ 613944	WS4	None Supplied	0.90	13.3	Brown sandy clay with stones

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample I/S
& samples received in inappropriate containers for hydrocarbon analysis

$ samples exceeded recommended holding times

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Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 22-07961

Soils Ltd

Site Reference: Thames Young Mariners

Project / Job Ref: 20295

Order No: 20295

Reporting Date: 29/09/2022

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received

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List of HWOL Acronyms and Operators
DETS Report No: 22-07961
Soils Ltd
Site Reference: Thames Young Mariners
Project / Job Ref: 20295
Order No: 20295
Reporting Date: 29/09/2022

Acronym	**Description**
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total

Det - Acronym
EPH Texas (C10 - C12) - EH_1D_Total
EPH Texas (C12 - C16) - EH_1D_Total
EPH Texas (C16 - C21) - EH_1D_Total
EPH Texas (C21 - C40) - EH_1D_Total
EPH Texas (C6 - C40) - HS_1D_MS+EH_1D_Total
EPH Texas (C6 - C8) - HS_1D_MS _Total
EPH Texas (C8 - C10) - EH_1D_Total

Appendix E.3 General Assessment Criteria

HUMAN HEALTH RISK ASSESSMENT

Introduction

The statutory definition of contaminated land is defined in the Environmental Protection Act 1990, ref. 1.1, which was introduced by the Environment Act 1995, ref. 1.2;

'Land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that –

(a) significant harm is being caused or there is a significant possibility of such harm being caused; or

(b) pollution of controlled waters is being, or is likely to be, caused.'

The UK guidance on the assessment of contaminated has developed as a direct result of the introduction of these two Acts. The technical guidance supporting the new legislation has been summarised in a number of key documents collectively known as the Contaminated Land Reports (CLRs), a proposed series of twelve documents. Seven were originally published in March 1994, four more were published in April 2002, while the last remaining guidance document, CLR 11, ref 1.3 was published in 2004. In 2008 CLR reports 7 to 10 were withdrawn by DEFRA and the Environment Agency and updated version of CLR 9 and 10 were produced in the form of Science Reports SR2, ref. 1.4 and SR3, ref. 1.5.

In establishing whether a site fulfils the statutory definition of 'contaminated land' it is necessary to identify, whether a pollutant linkage exists in respect of the land in question and whether the pollutant linkage:

- is resulting in significant harm being caused to the receptor in the pollutant linkage,
- presents a significant possibility of significant harm being caused to that receptor,
- is resulting in the pollution of the controlled waters which constitute the receptor, or
- is likely to result in such pollution.

A 'pollutant linkage' may be defined as the link between a contaminant 'source' and a 'receptor' by means of a 'pathway'.

Assessment Methodology

The guidance proposes a four-stage assessment process for identifying potential pollutant linkages on a site. These stages are set out in the table below:

No.	Process	Description
1	Hazard Identification	Establishing contaminant sources, pathways and receptors (the conceptual model).
2	Hazard Assessment	Analysing the potential for unacceptable risks (what linkages could be present, what could be the effects).
3	Risk Estimation	Trying to establish the magnitude and probability of the possible consequences (what degree of harm might result and to what receptors, and how likely is it).
4	Risk Evaluation	Deciding whether the risk is unacceptable.

Stages 1 and 2 develop a *'conceptual model'* based upon information collated from desk based studies, and frequently a walkover of the site. The walkover survey should be conducted in general accordance with CLR 2, ref. 1.6. The formation of a conceptual model is an iterative process and as such, it should be updated and refined throughout each stage of the project to reflect any additional information obtained.

The extent of the desk studies and enquiries to be conducted should be in general accordance with CLR 3, ref. 1.7. The information from these enquiries is presented in a desk study report with recommendations, if necessary, for further work based upon the conceptual model. Specific DoE 'Industry Profiles' provide guidance on the nature of contaminants relating to specific industrial processes.

If potential pollutant linkages are identified within the conceptual model, a Phase 2 site investigation and report will be recommended. The investigation should be planned in general accordance with CLR 4, ref 1.8. The number of exploratory holes and samples collected for analysis should be consistent with the size of the site and the level of risk envisaged. This will enable a contamination risk assessment to be conducted, at which point the conceptual model can be updated and relevant pollutant linkages can be identified.

A two-stage investigation may be more appropriate where time constraints are less of an issue. The first stage investigation being conducted as an initial assessment for the presence of potential sources, a second being a more refined investigation to delineate wherever possible the extent of the identified contamination.

All site works should be in general accordance with the British Standards BS 10175:2011, ref. 1.9. and BS 5930:2015, ref. 1.10.

The generic contamination risk assessment screens the results of the chemical analysis against generic guidance values which are dependent on the proposed end-use of the development.

The end-use may be defined as one of the following ref. 1.15;

- Residential with homegrown produce – domestic low rise and low density housing with gardens where vegetables may be grown for home consumption
- Residential without homegrown produce – domestic low density and low density housing where no gardens are present.
- Allotments – specific areas where vegetables are grown for home consumption.
- Public open space in close proximity to residential housing – includes the predominantly grassed area adjacent to high density housing and the central green area around which houses are developed. This land-use includes the smaller areas commonly incorporated in newer developments as informal grassed areas or more formal landscaped areas with a mixture of open space and covered soil with planting.
- Public open space in use as general parkland – provided for recreational use and may be used for family visits and picnics, children's play area, sports grounds and dig walking.
- Commercial – industrial premises where there is limited exposure to soil.

Standard Land-use Scenarios

The standard land-use scenarios used to develop conceptual exposure models are presented in the following sections:

Residential with homegrown produce

Generic scenario assumes a typical two-storey house built on a ground bearing slab with a private garden having a lawn, flowerbeds and a small fruit and vegetable patch.

• Critical receptor is a young female child (zero to six years old)
• Exposure duration is six years.
• Exposure pathways include direct soil and indoor dust ingestion, consumption of home-grown produce and any adhering soil, skin contact with soils and indoor dust and inhalation of indoor and outdoor dust and vapours.
• Building type is a two-storey small terraced house.

A sub-set of the Residential land-use is **Residential without Homegrown produce**. The generic scenario assumes low density housing with communal landscaped gardens where the consumption of home grown vegetables will not occur.

Allotments

Provision of open space (about 250sq.m) commonly made available to tenants by the local authority to grow fruit and vegetable for their own consumption. Typically, there are a number of plots to a site which may have a total area of up to 1 hectare. The tenants are assumed to be adults and that young children make occasional accompanied visits.

Although some allotment holders may choose to keep animals including rabbits, hens, and ducks, potential exposure to contaminated meat and eggs is not considered.

- Critical receptor is a young female child (zero to six years old)
- Exposure duration is six years.
- Exposure pathways include direct soil ingestion, consumption of homegrown produce and any adhering soil, skin contact with soils and inhalation of outdoor dust and vapours.
- There is no building.

Commercial

The generic scenario assumes a typical commercial or light industrial property comprising a three-storey building at which employees spend most time indoors and are involved in office-based or relatively light physical work.

- Critical receptor is a working female adult (aged 16 to 65 years old).
- Exposure duration is a working lifetime of 49 years.
- Exposure pathways include direct soil and indoor dust ingestion, skin contact with soils and dusts and inhalation of dust and vapours.
- Building type is a three-storey office (pre 1970).

Public Open Space within Residential Area

The generic scenario refers to any grassed area 0.05 ha and that is close to Housing.

- Grassed area of up to 0.05 ha and a considerable proportion of this (up to 50%) may be bare soil
- Predominantly used by children for playing and may be used for activities such as a football kick about
- Sufficiently close proximity to home for tracking back of soil to occur, thus indoor exposure pathways apply
- older children as the critical receptor on basis that they will use site most frequently (Age class 4-9)
- ingestion rate 75 $mg.day^{-1}$

Public Open Space Park

This generic scenario refers to any public park that is more than 0.5ha in area:

- Public park (>0.5 ha), predominantly grassed and may also contain children's play equipment and border areas of soil containing flowers or shrubs (75% cover)
- Female child age classes 1-6
- Soil ingestion rate of 50 $mg.day^{-1}$
- Occupancy period outdoors = 2 $hours.day^{-1}$
- Exposure frequency of 170 days.year-1 for age classes 2-18 and 85
- $days.year^{-1}$ for age class 1
- Outdoor exposure pathways only (no tracking back).

Human Health Generic Quantitative Risk Assessment (GQRA) involves the comparison of contaminant concentrations measured in soil at the site with Generic Assessment Criteria (GAC).

GAC are conservative values adopted to ensure that they are applicable to the majority of possible contaminated site. These values may be published Contaminated Land Exposure Assessment Model (CLEA) derived GAC derived by a third party or the Environment Agency/ DEFRA. It is imperative to the risk assessor to understand the uncertainties and limitations associated with these GAC to ensure that they are used appropriately. Where the adoption of a GAC is not appropriate, for instance when the intended land-use is at variance the CLEA standard land-uses, then a Detailed Quantitative Risk Assessment (DQRA) may be undertaken to develop site specific values for relevant soil contaminants based on the site specific conditions.

In 2014, the publication of Category 4 Screening Levels (C4SL) ref 1.15, 1.16, as part of the Defra-funded research project SP1010, included modifications to certain exposure assumptions documented within EA Science Report SC050221/SR3 (herein after referred to as SR3) ref 1.5 used in the generation of SGVs. C4SL were published for six substances (cadmium, arsenic, benzene, benzo(a)pyrene, chromium VI and lead) for a sandy loam soil type with 6% soil organic matter, based on a low level of toxicological concern (LLTC; see Section 2.3 of research project report SP1010 ref 1.16. Where a C4SL has been published, Soils Limited has adopted them as GAC for these six substances.

For all other substances the soils will be compared to Suitable 4 Use Levels (S4ULs) published by LQM ref. 1.12, which were developed for around 85 substances and are intended to enable a screening assessment of the risks posed by soil quality on development sites. The updated LQM/CIEH GAC publication was developed to accommodate recent developments in the understanding of chemical, toxicological and routine exposure to soil-based contaminants.

Where no S4UL or C4SL is available, the assessment criteria (AC) may be generated using the Contaminated Land Exposure Assessment (CLEA) Software Version 1.07, ref. 1.13. Toxicological and physico-chemical/fate and transport data used to generate the AC has been derived from a hierarchy of data sources as follows:

1. Environment Agency or Department of Environment Food and Rural Affairs (DEFRA) documents;
2. Other documents produced by UK Government or state organisations;
3. European institution documents;
4. International organisation documents;
5. Foreign government institutions.

In the case of the majority of contaminants considered, the toxicological data has been drawn from the relevant CLR 9 TOX report, or updated toxicological data published by the Environment Agency (2009), ref. 1.6, where available. Where no TOX report is available reference has been made to the health criteria values, derived for use in Land Quality Press (2006), ref. 1.17, as this is considered to represent a peer reviewed data source. Similarly, fate and transport data has been derived in the first instance from Environment Agency (2003), ref. 1.18 and for contaminants not considered in this
document the fate and transport data used in previous versions of the CLEA model has been used.

Chemical laboratory test results are processed as follows. A statistical analysis of the results is conducted, as detailed in CIEH and CL:AIRE 'Guidance on Comparing Soil Contamination Data with a Critical Concentration', ref. 1.14. Individual concentrations are compared to the selected guideline values to identify concentrations of contaminants that are above the selected screening criteria.

Where the risk estimation identifies significant concentrations of one or more contaminants, a further risk evaluation needs to be undertaken.

References

1.1 The Environmental Protection Act, Part IIA, Section 78, DoE 1990.

1.2 Environment Act 1995, Section 57, DoE 1995.

1.3 CLR 11, '*Model Procedures for the Management of Contaminated Land*', DEFRA and Environment Agency, 2004.

1.4 Environment Agency Science Report SC050021/SR2 'Human health toxicological assessment of contaminants in soil'.

1.5 Science Report SC050021/SR3 '*Updated technical background to the CLEA model*', Environment Agency, 2008

1.6 CLR 2, '*Guidance on preliminary site inspection of contaminated land*', Report by Applied Environmental, DoE 1994.

1.7 CLR 3 '*Documentary Research on Industrial Sites*', Report by RPS Consultants Ltd., DOE, 1994

1.8 CLR 4, '*Sampling strategies for contaminated land*', Report by The Centre for Research into the Built Environment, the Nottingham Trent University, DoE, 1994

1.9 BS 10175: 2011 '*Investigation of potentially contaminated sites. Code of practice*', British Standards Institute, 2011

1.10 BS 5930: 2015 '*Code of practice for ground investigations*', British Standards Institute, 2015

1.11 Science Report SC050021 '*Contaminants in Soil: Updated Collation of Toxicological Data and Intake Values for Humans*', Environment Agency, 2009

1.12 The LQM/S4ULs for Human Health Risk Assessment, Nathanail P, McCaffery C, Gillett A, Ogden R, and Nathanail J, Land Quality Press, Nottingham, published 2015.

1.13 CLEA '*Software Version 1.071*' (downloaded from the Environment Agency website, http://www.environment-agency.gov.uk)

1.14 CIEH '*Guidance on Comparing Soil Contamination Data with a Critical Concentration*', Chartered Institute of Environmental Health (CIEH) and Contaminated Land: Applications in Real Environments (CL:AIRE), May 2008.

1.15 DEFRA SP1010: Development of Category 4 Screening Levels for the Assessment of Land Affected by Contamination, published March 2014.

1.16 Contaminated Land: Applications in Real Environment (CL:AIRE) (2014). 'Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination', Revision 2, DEFRA research project SP1010.

1.17 Generic Assessment Criteria for Human Health Risk Assessment, Nathanial CP, McCaffery C, Ashmore M, Cheng Y, Gillett A, Hooker P and Ogden RC

1.18 CLR 2, '*Guidance on preliminary site inspection of contaminated land*', Report by Applied Environmental, DoE 1994.

				Residential with home-grown produce			Residential without home-grown produce			Allotments			Commercial			Public Open Space - Resi			Public Open Space -Park					
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6			
Type	Contaminants	Species	Year																					
Metals	Antimony		2010					550						7500								EIC/AGS/	CL:AIRE	2010
	Arsenic		2014		37			40			49			640			79			168		C4SL	DEFRA	2014
			2015		~~37~~			40			40			640			79			170		S4UL	LQM/CIEH	2015
	Beryllium		2015		1.7			1.7			35			12			2.2			63		S4UL	LQM/CIEH	2015
	Boron		2015		290			11000			45			240000			21000			46000		S4UL	LQM/CIEH	2015
	Cadmium		2015		~~11~~			85			1.9			190			120			532		S4UL	LQM/CIEH	2015
			2014		26			149			4.9			410			220			880		C4SL	DEFRA	2014
	Chromium	III	2015		910			910			18000			8600			1500			33000		S4UL	LQM/CIEH	2015
		VI	2014		21			21			170			49			23			250		C4SL	DEFRA	2014
		VI	2015		6			6			1.8			33			7.7			220		S4UL	LQM/CIEH	2015
	Copper		2015		2400			7100			520			68000			12000			44000		S4UL	LQM/CIEH	2015
	Lead		2014		200			310			80			2330			630			1300		C4SL	DEFRA	2014
	Mercury	Elemental	2015		1.2			1.2			21			*58*			16			*30*		S4UL	LQM/CIEH	2015
		Inorganic	2015		40			56			19			1100			120			240		S4UL	LQM/CIEH	2015
		Methyl	2015		11			15			6			320			40			68		S4UL	LQM/CIEH	2015
	Nickel		2015		130			180			53			980			230			800		S4UL	LQM/CIEH	2015
	Selenium		2015		250			430			88			12000			1100			1800		S4UL	LQM/CIEH	2015
	Vanadium		2015		410			1200			91			9000			2000			5000		S4UL	LQM/CIEH	2015
	Zinc		2015		3700			40000			620			730000			81000			170000		S4UL	LQM/CIEH	2015
	Benzene		2014		0.87			3.3			0.18			98			140			230		C4SL	DEFRA	2014
			2015	0.087	0.17	0.37	0.38	0.7	1.4	0.017	0.034	0.075	27	47	90	72	72	73	90	100	110	S4UL	LQM/CIEH	2015
	Toluene		2015	130	290	660	*880*	1900	3900	22	51	120	*65000*	*110000*	*180000*	56000	56000	56000	*87000*	*95000*	*100000*	S4UL	LQM/CIEH	2015
	Ethylbenzene		2015	47	110	260	83	190	440	16	39	91	*4700*	*13000*	*27000*	24000	24000	25000	*17000*	*22000*	*27000*	S4UL	LQM/CIEH	2015
	Xylenes	o-xylene	2015	60	140	330	88	210	480	28	67	160	*6600*	*15000*	*33000*	41000	42000	43000	*17000*	*24000*	*33000*	S4UL	LQM/CIEH	2015
		m-xylene	2015	59	140	320	82	190	450	31	74	170	*6200*	*14000*	*31000*	41000	42000	43000	*17000*	*24000*	*32000*	S4UL	LQM/CIEH	2015
		p-xylene	2015	56	130	310	79	180	310	29	69	160	*5900*	*14000*	*30000*	41000	42000	43000	*17000*	*23000*	*31000*	S4UL	LQM/CIEH	2015
Petroleum Hydrocarbons Fractions	Aliphatic >C5 - C6		2015	42	78	160	42	78	160	730	1700	3900	*3200*	*5900*	*12000*	*570000*	590000	600000	*95000*	*130000*	*180000*	S4UL	LQM/CIEH	2015
	Aliphatic >C6 - C8		2015	100	230	530	100	230	530	2300	5600	13000	*7800*	*17000*	*40000*	600000	610000	620000	*150000*	*220000*	*320000*	S4UL	LQM/CIEH	2015
	Aliphatic >C8 - C10		2015	27	65	150	27	65	150	320	770	1700	*2000*	*4800*	*11000*	13000	13000	13000	*14000*	*18000*	*21000*	S4UL	LQM/CIEH	2015
	Aliphatic >C10 - C12		2015	*130*	*330*	*760*	*130*	*330*	*770*	2200	4400	7300	*9700*	*23000*	*47000*	13000	13000	13000	*21000*	*23000*	*24000*	S4UL	LQM/CIEH	2015
	Aliphatic >C12 - C16		2015	*1100*	*2400*	*4300*	*1100*	*2400*	*4400*	11000	13000	13000	*59000*	*82000*	*90000*	13000	13000	13000	*25000*	*25000*	*26000*	S4UL	LQM/CIEH	2015
	Aliphatic >C16 - C35		2015	*65000*	*92000*	*110000*	*65000*	*92000*	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aliphatic >C35 - C44		2015	*65000*	*92000*	*140000*	*65000*	*92000*	110000	260000	270000	270000	1600000	1700000	1800000	250000	250000	250000	450000	480000	490000	S4UL	LQM/CIEH	2015
	Aromatic >C5 - C7		2015	70	140	300	370	690	1400	13	27	57	*26000*	*46000*	*86000*	56000	56000	56000	*76000*	*84000*	*92000*	S4UL	LQM/CIEH	2015
	Aromatic >C7 - C8		2015	130	290	660	860	1800	3900	22	51	120	*56000*	*110000*	*180000*	56000	56000	56000	*87000*	*95000*	*100000*	S4UL	LQM/CIEH	2015
	Aromatic >C8 - C10		2015	34	83	190	47	110	270	8.6	21	51	*3500*	*8100*	*17000*	5000	5000	5000	*7200*	*8500*	*9300*	S4UL	LQM/CIEH	2015
	Aromatic >C10 - C12		2015	74	180	380	250	590	1200	13	31	74	*16000*	*28000*	*34000*	5000	5000	5000	*9200*	*9700*	*10000*	S4UL	LQM/CIEH	2015
	Aromatic >C12 - C16		2015	140	330	660	1800	2300	2500	23	57	130	*36000*	*37000*	*38000*	5100	5100	5000	10000	10000	10000	S4UL	LQM/CIEH	2015
	Aromatic >C16 - C21		2015	260	540	930	1900	1900	1900	46	110	260	28000	28000	28000	3800	3800	3800	7600	7700	7800	S4UL	LQM/CIEH	2015
	Aromatic >C21 - C35		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aromatic >C34 - C44		2015	1100	1500	1700	1900	1900	1900	370	820	1600	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
	Aliphatic + Aromatic >C44 - C70		2015	1600	1800	1900	1900	1900	1900	1200	2100	3000	28000	28000	28000	3800	3800	3800	7800	7800	7900	S4UL	LQM/CIEH	2015
Polycyclic Aromatic Hydrocarbons (PAH' s) (mg/kg)	Acenaphthene		2015	210	510	1100	*3000*	*4700*	*6000*	34	85	200	*84000*	*97000*	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Acenaphthylene		2015	170	420	920	*2900*	*4600*	*6000*	28	69	160	*83000*	*97000*	100000	15000	15000	15000	29000	30000	30000	S4UL	LQM/CIEH	2015
	Anthracene		2015	2400	5400	11000	*31000*	*35000*	*37000*	380	950	2200	520000	54000	540000	74000	74000	74000	150000	150000	150000	S4UL	LQM/CIEH	2015
	Benzo(a)anthracene		2015	7.2	11	13	11	14	15	2.9	6.5	13	170	170	180	29	29	29	49	56	62	S4UL	LQM/CIEH	2015
	Benzo(a)pyrene		2014			5			5.3			5.7			76			10			21	C4SL	DEFRA	2014
			2015	2.2	2.7	3	3.2	3.2	3.2	0.97	2	3.5	35	35	36	5.7	5.7	5.7	11	12	13	S4UL	LQM/CIEH	2015
	Benzo(b)fluoranthene		2015	2.6	3.3	3.7	3.9	4.0	4.0	0.99	2.1	3.9	44	44	45	7.1	7.2	7.2	13	15	16	S4UL	LQM/CIEH	2015
	Benzo(ghi)perylene		2015	320	340	350	360	360	360	290	470	640	3900	4000	4000	640	640	640	1400	1500	1600	S4UL	LQM/CIEH	2015
	Benzo(k)fluoranthene		2015	77	93	100	110	110	110	37	75	130	1200	1200	1200	190	190	190	370	410	440	S4UL	LQM/CIEH	2015
	Chrysene		2015	15	22	27	30	31	32	4.1	9.4	19	350	350	350	57	57	57	93	110	120	S4UL	LQM/CIEH	2015
	Dibenz(a,h)anthracene		2015	0.24	0.28	0.3	0.31	0.32	0.32	0.14	0.27	0.43	3.5	3.6	3.6	0.57	0.57	0.58	1.1	1.3	1.4	S4UL	LQM/CIEH	2015

			Residential with home-grown produce			Residential without home-grown produce			Allotments			Commercial			Public Open Space - Resi			Public Open Space -Park					
		SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6			
Type	Contaminants Species	Year																					
	Fluoranthene	2015	280	560	890	1500	1600	1600	52	130	290	23000	23000	23000	3100	3100	3100	6300	6300	6400	S4UL	LQM/CIEH	2015
	Fluorene	2015	170	400	860	*2800*	*3800*	*4500*	27	67	160	63000	68000	71000	9900	9900	9900	20000	20000	20000	S4UL	LQM/CIEH	2015
	Indeno(1,2,3-cd)pyrene	2015	27	36	41	45	46	46	9.5	21	39	500	510	510	82	82	82	150	170	180	S4UL	LQM/CIEH	2015
	Naphthalene	2015	2.3	5.6	13	2.3	5.6	13	4.1	10	24	*190*	*460*	*1100*	4900	4900	4900	*1200*	*1900*	*3000*	S4UL	LQM/CIEH	2015
	Phenanthrene	2015	95	220	440	*1300*	*1500*	*1500*	15	38	90	22000	22000	23000	3100	3100	3100	6200	6200	6300	S4UL	LQM/CIEH	2015
	Pyrene	2015	620	1200	2000	3700	3800	3800	110	270	620	54000	54000	54000	7400	7400	7400	15000	15000	15000	S4UL	LQM/CIEH	2015
	Coal Tar(Bap as surrogate matter)	2015	0.79	0.98	1.1	1.2	1.2	1.2	0.32	0.67	1.2	15	15	15	2.2	2.2	2.2	4.4	4.7	4.8	S4UL	LQM/CIEH	2015
Chloroalkanes & alkenes	1,2 Dichloroethane	2015	0.0071	0.011	0.019	0.0092	0.013	0.023	0.0046	0.0083	0.016	0.67	0.97	1.7	29	29	29	21	24	28	S4UL	LQM/CIEH	2015
	1,1,1 Trichloroethane	2015	8.8	18	39	9	18	40	48	110	240	660	1300	3000	140000	140000	*140000*	*57000*	*76000*	*100000*	S4UL	LQM/CIEH	2015
	1,1,2,2 Tetrachloroethane	2015	1.6	3.4	7.5	3.9	8	17	0.41	0.89	2	270	550	1100	1400	1400	1400	1800	2100	2300	S4UL	LQM/CIEH	2015
	1,1,1,2 Tetrachloroethane	2015	1.2	2.8	6.4	1.5	3.5	8.2	0.79	1.9	4.4	110	250	560	1400	1400	1400	1500	1800	2100	S4UL	LQM/CIEH	2015
	Tetrachloroethene	2015	0.18	0.39	0.9	0.18	0.4	0.92	0.65	1.5	3.6	19	42	95	1400	1400	1400	*810*	*1100*	1500	S4UL	LQM/CIEH	2015
	Tetrachloromethane (Carbon Tetrachloride)	2015	0.026	0.056	0.13	0.026	0.056	0.13	0.45	1	2.4	2.9	6.3	14	890	920	950	190	270	400	S4UL	LQM/CIEH	2015
	Trichloroethene	2015	0.016	0.034	0.075	0.017	0.036	0.08	0.041	0.091	0.21	1.2	2.6	5.7	120	120	120	70	91	120	S4UL	LQM/CIEH	2015
	Trichloromethane	2015	0.91	1.7	3.4	1.2	2.1	4.2	0.42	0.83	1.7	99	170	350	2500	2500	2500	2600	2800	3100	S4UL	LQM/CIEH	2015
	Vinyl Chloride (cloroethene)	2015	0.00064	0.00087	0.0014	0.00077	0.001	0.0015	0.00055	0.001	0.0018	0.059	0.077	0.12	3.5	3.5	3.5	4.8	5	5.4	S4UL	LQM/CIEH	2015
Explosives	2,4,6 Trinitrotoluene	2015	1.6	3.7	8.1	65	66	66	0.24	0.58	1.4	1000	1000	1000	130	130	130	260	270	270	S4UL	LQM/CIEH	2015
	RDX (Hexogen/Cyclonite/1,3,5-trinitro-1,3,5-triazacyclohexane)	2015	120	250	540	13000	13000	13000	17	38	85	210000	210000	210000	26000	26000	27000	49000	51000	53000	S4UL	LQM/CIEH	2015
	HMX (Octogen/1,3,5,7-tetrenitro-1,3,5,7-tetrazacyclo-octane)	2015	5.7	13	26	6700	6700	6700	0.86	1.9	3.9	110000	110000	110000	13000	13000	13000	*23000*	*23000*	*24000*	S4UL	LQM/CIEH	2015
Pesticides	Aldrin	2015	5.7	6.6	7.1	7.3	7.4	7.5	3.2	6.1	9.6	170	170	170	18	18	18	30	31	31	S4UL	LQM/CIEH	2015
	Dieldrin	2015	0.97	2	3.5	7	7.3	7.4	0.17	0.41	0.96	170	170	170	18	18	18	30	30	31	S4UL	LQM/CIEH	2015
	Atrazine	2015	3.3	7.6	17.4	610	620	620	0.5	1.2	2.7	9300	9400	9400	1200	1200	1200	2300	2400	2400	S4UL	LQM/CIEH	2015
	Dichlorvos	2015	0.032	0.066	0.14	6.4	6.5	6.6	0.0049	0.01	0.022	140	140	140	16	16	16	26	26	27	S4UL	LQM/CIEH	2015
	Alpha - Endosulfan	2015	7.4	18	41	*160*	*280*	*410*	1.2	2.9	6.8	*5600*	*7400*	*8400*	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Beta - Endosulfan	2015	7	17	39	*190*	*320*	*440*	1.1	2.7	6.4	*6300*	*7800*	*8700*	1200	1200	1200	2400	2400	2500	S4UL	LQM/CIEH	2015
	Alpha -Hexachlorocyclohexanes	2015	0.23	0.55	1.2	6.9	9.2	11	0.035	0.087	0.21	170	180	180	24	24	24	47	48	48	S4UL	LQM/CIEH	2015
	Beta -Hexachlorocyclohexanes	2015	0.085	0.2	0.46	3.7	3.8	3.8	0.013	0.032	0.077	65	65	65	8.1	8.1	8.1	15	15	16	S4UL	LQM/CIEH	2015
	Gamma -Hexachlorocyclohexanes	2015	0.06	0.14	0.33	2.9	3.3	3.5	0.0092	0.023	0.054	67	69	70	8.2	8.2	8.2	14	15	15	S4UL	LQM/CIEH	2015
Chlorobenzenes	Chlorobenzene	2015	0.46	1	2.4	0.46	1	2.4	5.9	14	32	56	130	290	11000	13000	14000	*1300*	*2000*	*2900*	S4UL	LQM/CIEH	2015
	1,2-Dichlorobenzene	2015	23	55	130	24	57	130	94	230	540	*2000*	*4800*	*11000*	90000	95000	98000	*24000*	*36000*	*51000*	S4UL	LQM/CIEH	2015
	1,3-Dichlorobenzene	2015	0.4	1	2.3	0.44	1.1	2.5	0.25	0.6	1.5	30	73	170	300	300	300	390	440	470	S4UL	LQM/CIEH	2015
	1,4-Dichlorobenzene	2015	61	150	350	61	150	350	15	37	88	*4400*	*10000*	*25000*	17000	17000	1700	*36000*	*36000*	*36000*	S4UL	LQM/CIEH	2015
	1,2,3,-Trichlorobenzene	2015	1.5	3.6	8.6	1.5	3.7	8.8	4.7	12	28	102	250	590	1800	1800	1800	*770*	*1100*	*1600*	S4UL	LQM/CIEH	2015
	1,2,4,-Trichlorobenzene	2015	2.6	6.4	15	2.6	6.4	15	55	140	320	220	530	1300	15000	17000	19000	*1700*	*2600*	*4000*	S4UL	LQM/CIEH	2015
	1,3,5,-Trichlorobenzene	2015	**0.33**	**0.81**	**1.9**	**0.33**	**0.81**	**1.9**	**4.7**	**12**	**28**	**23**	**55**	**130**	**1700**	**1700**	**1800**	***380***	***580***	***860***	S4UL	LQM/CIEH	2015
	1,2,3,4,-Tetrachlorobenzene	2015	**15**	**36**	**78**	**24**	**56**	**120**	**4.4**	**11**	**26**	**1700**	**3080**	**4400**	**830**	**830**	**830**	***1500***	***1600***	***1600***	S4UL	LQM/CIEH	2015
	1,2,3,5,- Tetrachlobenzene	2015	**0.66**	**1.6**	**3.7**	**0.75**	**1.9**	**4.3**	**0.38**	**0.9**	**2.2**	***49***	***120***	***240***	**78**	**79**	**79**	***110***	***120***	***130***	S4UL	LQM/CIEH	2015
	1,2,4, 5,- Tetrachlobenzene	2015	**0.33**	**0.77**	**1.6**	**0.73**	**1.7**	**3.5**	**0.06**	**0.16**	**0.37**	***42***	***72***	***96***	**13**	**13**	**13**	**25**	**26**	**26**	S4UL	LQM/CIEH	2015
	Pentachlrobenzene	2015	**5.8**	**12**	**22**	**19**	**30**	**38**	**1.2**	**3.1**	**7**	***640***	***770***	***830***	**100**	**100**	**100**	**190**	**190**	**190**	S4UL	LQM/CIEH	2015
	Hexachlorobenzene	2015	***1.8***	***3.3***	**4.9**	***4.1***	***5.7***	***6.7***	**0.47**	**1.1**	**2.5**	***110***	**120**	**120**	**16**	**16**	**16**	**30**	**30**	**30**	S4UL	LQM/CIEH	2015
Phenols & Chlorophenols																							
	Phenols	2015	120	200	380	440	690	1200	23	42	83	*440*	*690*	*1300*	*440*	*690*	*1300*	*440*	*690*	*1300*	S4UL	LQM/CIEH	2015
	Chlorophenols (4 Congeners)	2015	**0.87**	**2**	**4.5**	**94**	**150**	**210**	**0.13**	**0.3**	**0.7**	**3500**	**4000**	**4300**	**620**	**620**	**620**	**1100**	**1100**	**1100**	S4UL	LQM/CIEH	2015
	Pentachlorophenols	2015	**0.22**	**0.52**	**1.2**	***27***	**29**	**31**	**0.03**	**0.08**	**0.19**	**400**	**400**	**400**	**60**	**60**	**60**	**110**	**120**	**120**	S4UL	LQM/CIEH	2015
Others																							
	Carbon Disulphide	2015	**0.14**	**0.29**	**0.62**	**0.14**	**0.29**	**0.62**	**4.8**	**10**	**23**	**11**	**22**	**47**	**11000**	**11000**	**12000**	**1300**	**1900**	**2700**	S4UL	LQM/CIEH	2015
	Hexachloro-1,3-Butadiene	2015	**0.29**	**0.7**	**1.6**	**0.32**	**0.78**	**1.8**	**0.25**	**0.61**	**1.4**	**31**	**66**	**120**	**25**	**25**	**25**	**48**	**50**	**51**	S4UL	LQM/CIEH	2015
	Sum of PCDDs, PCDFs and dioxin-like PCB's.	2012			8			8			8			240							SGV	DEFRA	2012

NOTE

Priority	Guideline (mg kg^{-1})

				Residential with home-grown produce			Residential without home-grown produce			Allotments			Commercial			Public Open Space - Resi			Public Open Space -Park		
			SOM	1.0	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6	1	2.5	6
Type	Contaminants	Species	Year																		
	1	Site Specific Assessment Criteria (SSAC) (Soils Limited)																			
	2	2014: Category 4 Screening Level (C4SL) (Contaminated Land: Application in Real Environment (CL:ARE), 2014)																			
	3	2012: Soil Guideline Value (SGV) (Environment Agency, 2009)																			
	4	2015: Suitable 4 Use Level (S4UL) (Nathanail *et al*, 2015)																			
		For Generic Risk Assessment, the values in Bold have priority																			
		Table reviewed February 2020																			

Appendix F Gas Monitoring Data

Job Number:	20295
Site Name:	Thames Young Mariners
BH/WS ID:	BH1
Date:	07/09/2022
Start Time:	14:52:34

Weather	* Delete as appropriate			
Wind		*Light*		
Cloud Cover			*Cloudy*	
Precipitation			*Moderate*	
Ground Conditions			*Wet*	

Gas Monitor:*	*Gas Data GFM 435 11555*	*or*	
PID:*	*Watchgas*	*or*	
Dip meter:*		*or*	*Single Phase*

Step 3	
Depth to Water (m bgl)	Base of Hole (m bgl)
4.00	5.90

Step 1			
	Monitoring interval	Flow L/hr	DP Pa
	Atmosphere	0.0	0
Borehole measurement	00:00:05	0.0	0
	00:00:30	0.0	0
	00:01:00	0.0	0
	00:02:00	0.0	0
	00:03:00	0.0	0
	00:04:00		
	00:05:00		
	00:06:00		
	00:07:00		
	00:08:00		
	00:09:00		
	00:10:00		

Step 2										
	Monitoring interval	CH_4 % v/v	LEL CH_4 %	CO_2 % v/v	O_2 % v/v	H2S ppm	Co ppm	aP mb	VOC (PPM)	Temp (^oC)
	Atmosphere	0.0	<<<<.<	0.0	20.9	0	1	1009	0	19
Borehole measurement	00:00:05	0.0	<<<<.<	3.7	18.5	0	0		0	
	00:00:30	0.0	<<<<.<	3.9	16.6	0	0		0	
	00:01:00	0.0	<<<<.<	3.9	16.6	0	0		0	
	00:02:00	0.0	<<<<.<	3.9	16.6	0	0		0	
	00:03:00									
	00:04:00									
	00:05:00									
	00:06:00									
	00:07:00									
	00:08:00									
	00:09:00									
	00:10:00									

Samples		Notes;

Job Number:	20295
Site Name:	Thames Young Mariners
BH/WS ID:	BH1
Date:	20.9.22
Start Time:	16:03:00

Weather	* Delete as appropriate			
Wind		*Light*		
Cloud Cover				*Overcast*
Precipitation	*Dry*			
Ground Conditions	*Dry*			

Gas Monitor:*	*Gas Data GFM 435 11555*	*or*	
PID:*	*Poli mp400 p*	*or*	
Dip meter:*		*or*	*Single Phase*

Step 3	
Depth to Water (m bgl)	Base of Hole (m bgl)
5.55	8m

Step 1			
	Monitoring interval	Flow L/hr	DP Pa
	Atmosphere		
Borehole measurement	00:00:05	-0.1	0
	00:00:30	-0.1	0
	00:01:00	-0.1	0
	00:02:00	-0.1	0
	00:03:00	-0.1	0
	00:04:00	-0.1	0
	00:05:00		
	00:06:00		
	00:07:00		
	00:08:00		
	00:09:00		
	00:10:00		

Step 2										
	Monitoring interval	CH_4 % v/v	LEL CH_4 %	CO_2 % v/v	O_2 % v/v	H2S ppm	Co ppm	aP mb	VOC (PPM)	Temp (^oC)
	Atmosphere	0.0	<<<.<	0.0	21.3	0	0		2	20
Borehole measurement	00:00:05	0.0	0	2.8	16.0	0	2	1025	3	
	00:00:30	0.0	<<<.<	4.2	15.7	0	1	1025	3	
	00:01:00	0.0	<<<.<	4.2	15.7	0	0	1025	3	
	00:02:00	0.0	<<<.<	4.2	15.7	0	0	1025	3	
	00:03:00	0.0	<<<.<	4.2	15.6	0	0	1025	3	
	00:04:00	0.0	<<<.<	4.2	15.6	0	1	1025	3	
	00:05:00	0.0	<<<.<	4.2	15.6	0	1	1025	3	
	00:06:00	0.0	<<<.<	4.2	15.6	0	1	1025	3	
	00:07:00									
	00:08:00									
	00:09:00									
	00:10:00									

Samples	
1 Litre Plastic	
1 Litre Glass	
40ml Vial	
Gas sample (Tedlar bag etc	

Notes;

Job Number:	20295
Site Name:	Thames young mariners
BH/WS ID:	BH1
Date:	06/10/2022
Start Time:	2:58:46 PM

Weather	* Delete as appropriate			
Wind		*Light*		
Cloud Cover			*Cloudy*	
Precipitation	*Dry*			
Ground Conditions		*Moist*		

Gas Monitor:*	*Gas Data GFM 435 11555*	*or*	
PID:*	*Watchgas*	*or*	
Dip meter:*	*Dual Phase*	*or*	

Step 3	
Depth to Water (m bgl)	Base of Hole (m bgl)
5.59	8.00

Step 1

Monitoring interval		Flow L/hr	DP Pa
Atmosphere		0.0	0
mea	00:00:05	0.2	0
	00:00:30	0.1	0
	00:01:00	0.2	0
	00:02:00	0.1	0
	00:03:00	0.1	0
	00:04:00	0.0	0
	00:05:00	0.0	0
	00:06:00		
	00:07:00		
	00:08:00		
	00:09:00		
	00:10:00		

Step 2

Monitoring interval		CH_4 % v/v	LEL CH_4 %	CO_2 % v/v	O_2 % v/v	H2S ppm	Co ppm	aP mb	VOC (PPM)	Temp (^oC)
Atmosphere		0.0	<<<.<	0.0	20.6	0	0	1029	0	16
mea	00:00:05	0.0	<<<.<	0.0	20.4	0	0		0	
	00:00:30	0.0	0	1.9	19.0	0	0		0	
	00:01:00	0.0	<<<.<	2.2	18.4	0	0		0	
	00:02:00	0.0	<<<.<	2.2	18.4	0	0		0	
	00:03:00									
	00:04:00									
	00:05:00									
	00:06:00									
	00:07:00									
	00:08:00									
	00:09:00									
	00:10:00									

Samples		Notes;

Appendix G Information Provided by the Client

Confidential

SURREY COUNTY COUNCIL

SURREY OUTDOOR LEARNING & DEVELOPMENT CENTRE
THAMES YOUNG MARINERS

PRE-APPLICATION REPORT 03

ISSUE NUMBER P01

July 2022

PICK
EVERARD

imagine.explore.create

Document History

Issue	Date	Comments	Author	Checked
P01	15/07/2022	Issue for review & comment	LH	CG

SURREY COUNTY COUNCIL

SOLD | Surrey Outdoor Learning & Development

PICK EVERARD

Turner & Townsend

Vail Williams

ATKINS

Contents

Introduction

1

1.1 Introduction

Project Overview

Thames Young Mariners (TYM), requires redeveloping in order to bring the site up to current health and safety standards with modern, fit for purpose facilities which will allow SOLD to increase its service capacity and strengthen its commercial operation for Surrey County Council.

Please refer to Pre-App document 1 for further background information.

1.2 LBR Consultation Summary

An initial engagement meeting with the London Borough of Richmond Planning Department took place on 28th February 2022 at the TYM (Thames Young Mariners) site. The following points summarise the key points of discussion:

- Concerns impact on Metropolitan Open Land due to extent of additional floor area compared to existing. Further details required regarding existing building floor areas and extent of existing hardstanding.
- Proposals should highlight where there is replacement of existing facilities and where new/intensified activities are being introduced.
- Concerns raised regarding the two staff accommodation buildings/ dwellings located towards the entrance to the site, suggested these should be revisited in the proposals.
- Suggestion that site arrangement should be revisited to focus within the area of previously developed land/existing 'cluster' developed areas of the site.
- Concern raised with the two storey elements of the site layout with suggestion that buildings should predominantly be two storeys.
- Comments that proposals should respond to the natural environment and ensure ecological surveys are up to date and proposals should achieve a biodiversity net gain.

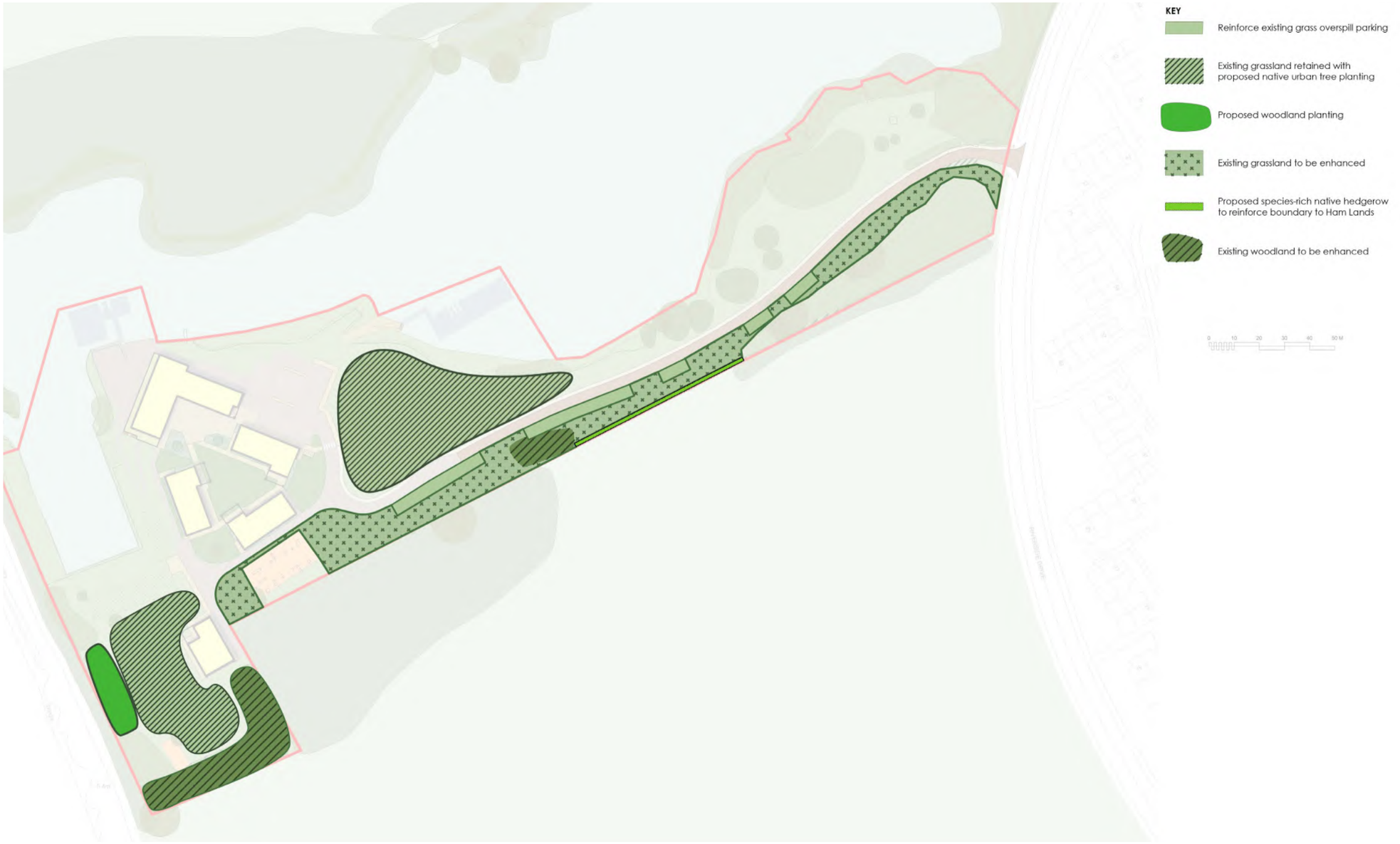
The content of this report captures the progress made since the initial engagement.

Landscape Design Development

2

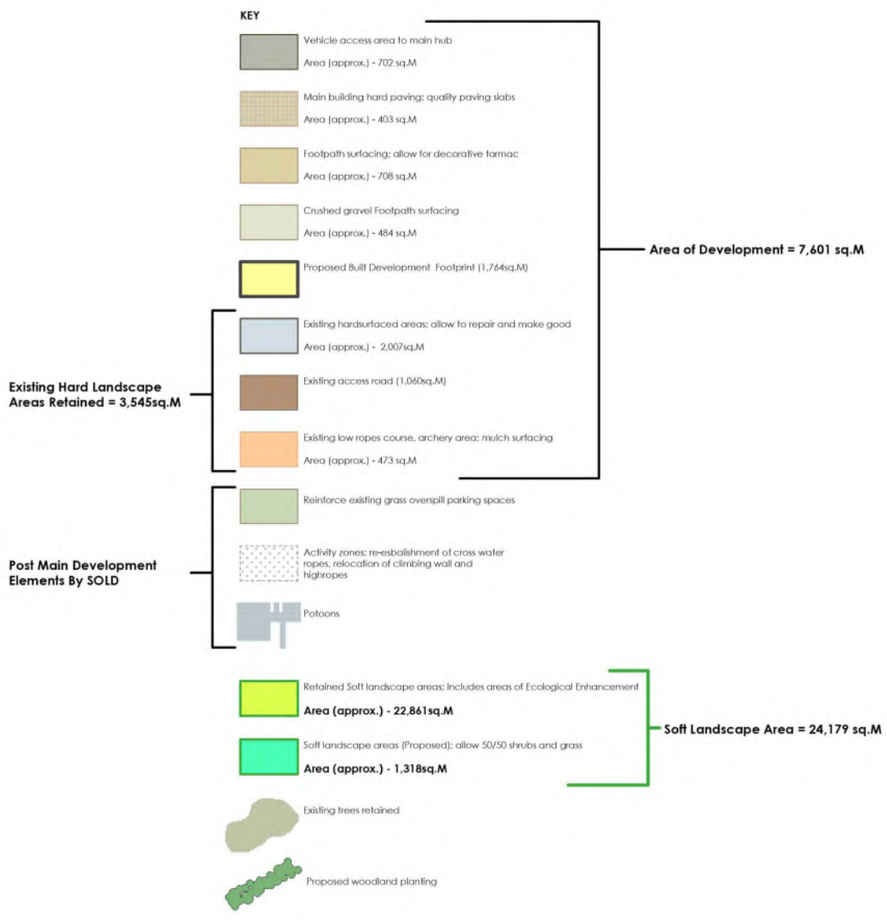
2.1 Proposed Block Plan

2.2 Landscape Strategy

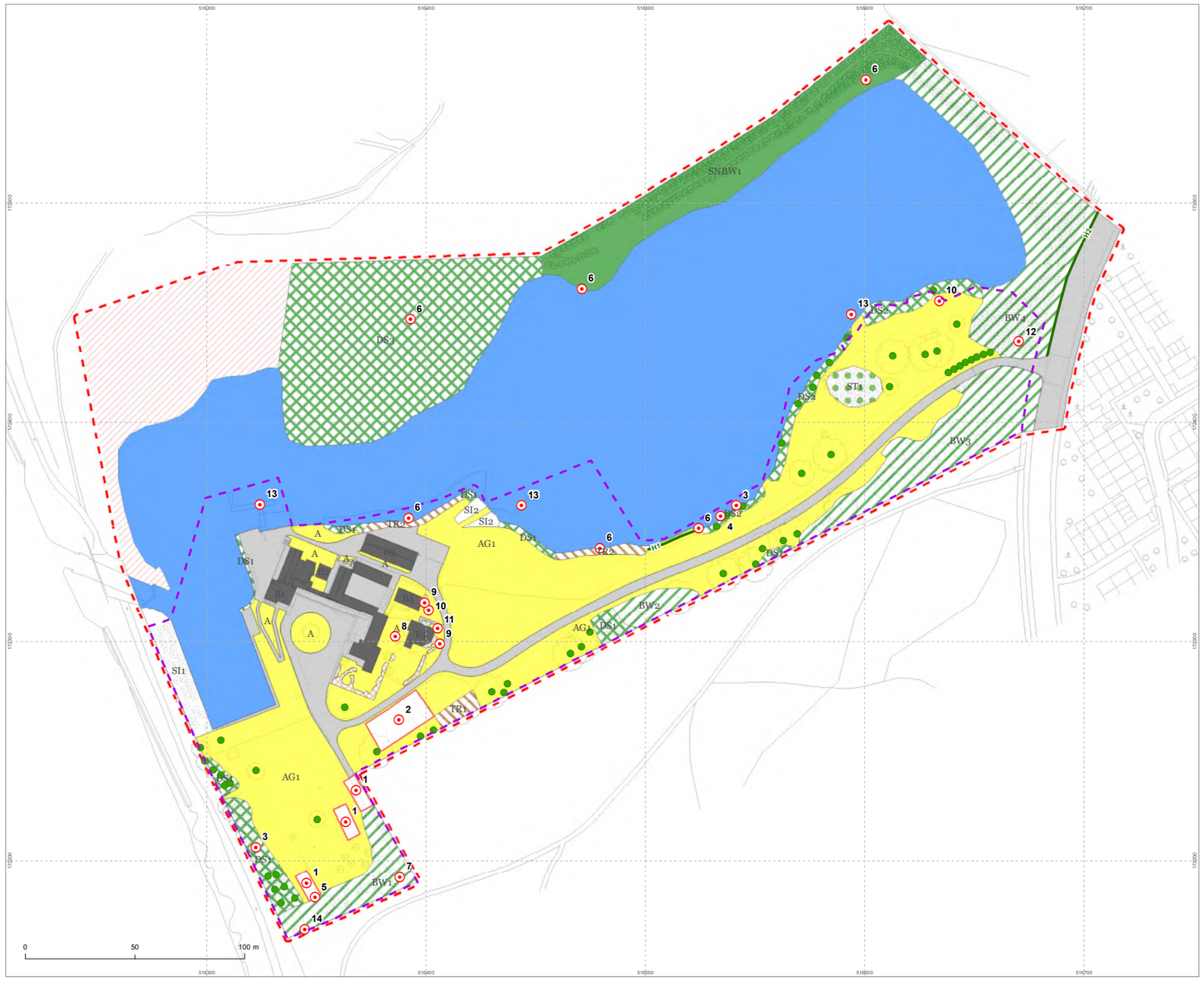


2.3 Site Assessment - Existing Areas

2.3 Site Assessment - Proposed Areas of Site Development for Biodiversity Net Gain



2.4 Summary of Ecology and Biodiversity Net Gain Strategy



C157100-03-01-RevB

Legend

- Development Area
- Phase 1 Survey Area
- Scattered tree
- Species-poor intact hedgerow
- Amenity grassland
- Building
- Dense scrub
- Hardstanding
- Introduced shrub
- No access
- Other habitat
- Plantation broad-leaved woodland
- Poor semi-improved grassland
- Scattered trees
- Semi-natural broad-leaved woodland
- Standing water
- Tall ruderal
- Target note

N

Project	Thames Young Mariners, Richmond, London
Drawing	Phase 1 Habitat Map
Client	Pick Everard
Drawing Number: C157100-03-01-RevB	Revision: Rev B
Scale @ A3: 1:1,600	Date: July 2022
Approved By: WR	Drawn By: VO/CD

MIDDLEMARCH
Triumph House, Birmingham Road, Allesley, Coventry CV5 9AZ
T:01676 525880
E:admin@middlemarch-environmental.com

On 2nd March 2022 Middlemarch Environmental Ltd undertook an Ecological Walkover Assessment to assess baseline habitat conditions within the Thames Young Mariners site to inform a Biodiversity Net Gain Assessment associated with the proposed redevelopment of the site.

The existing value of the habitats within the Redline Application Boundary is 32.70 Biodiversity Units (BU) and 0.23 Hedgerow Units. Proposals have been designed to retain and protect notable habitats on site, in accordance with the Ecological Mitigation Hierarchy. Small scale losses of "Low Distinctiveness "and "Poor" condition habitats, amenity grassland and introduced shrub, are required to facilitate the development. The addition of pontoons within the lake is not projected to significantly alter the condition of the habitat with respect to the Defra 3.1 condition assessment criteria.

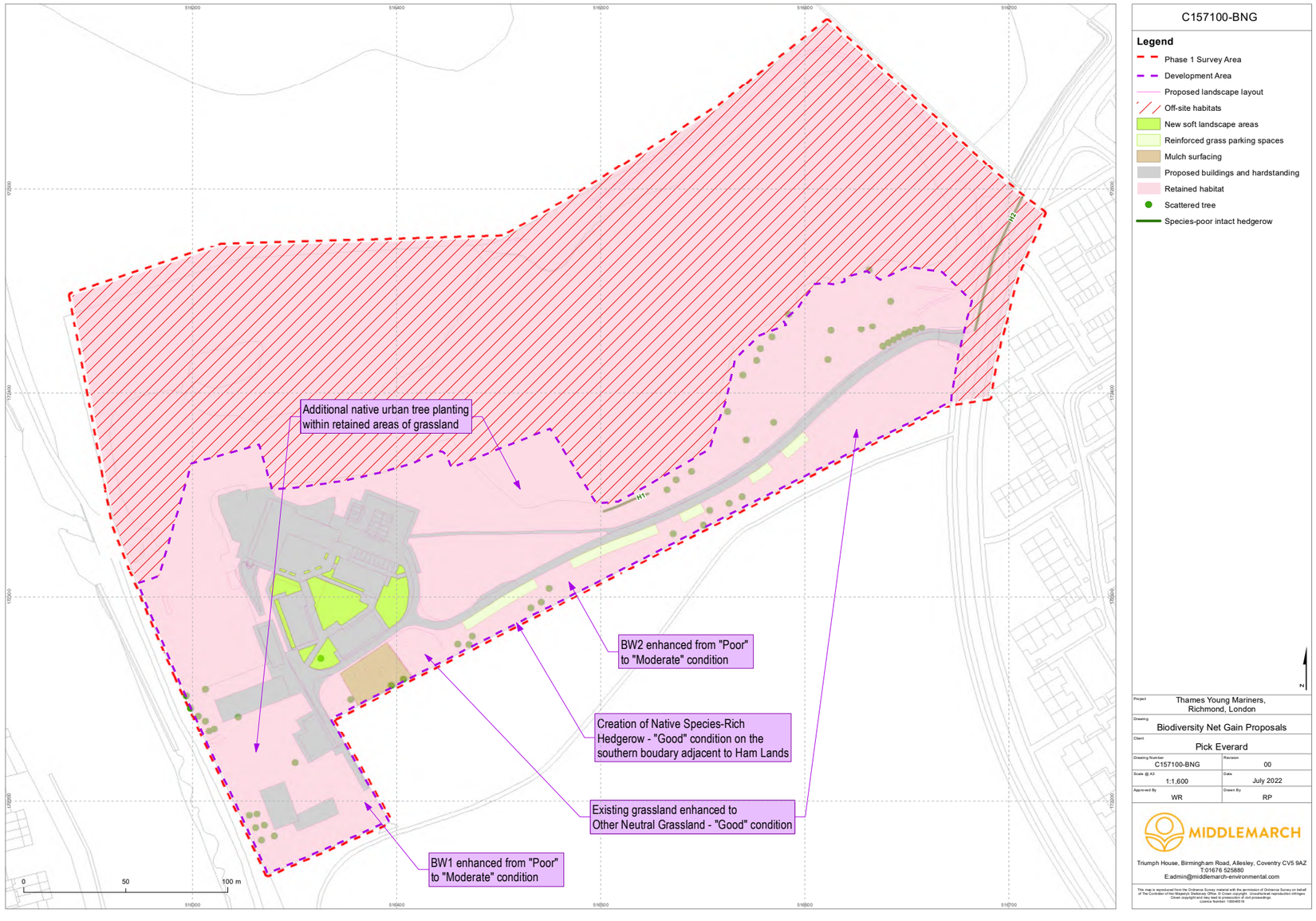
As compensation for the habitat loss, the following outline enhancements have been proposed:

- Enhancement of 0.30 ha of amenity grassland adjacent to the southern site boundary as species rich other neutral grassland, targeting "Good" condition;
- Enhancement of woodland parcels BW1 and BW2 from "Poor" to "Moderate" condition;
- Planting of 10 no. native scattered trees in the "Medium" size category targeting "Moderate" condition; and,
- Planting of a native species rich hedgerow along the southern site boundary adjacent to Ham Lands, targeting "Good" condition.

The above outline enhancements have been targeted to improve habitat continuity between the Thames Young Mariners site and adjacent Ham Lands SINC.

In combination with the above enhancements, proposals are projected to deliver >10% increase relative to baseline habitat units and hedgerow units.

The projected onsite habitat values given above are based on the assumption that an appropriate establishment management plan will be implemented to ensure that the habitats/hedgerows will be established and maintained to fulfil their intended biodiversity value. Biodiversity Net Gain Principles necessitates that any biodiversity units claimed must be deliverable over a minimum period of 30 years. As such, the Management Plan must provide long-term management proposals and provide scope for monitoring and reporting to demonstrate that the intended values are achieved over the 30-year period.



2.5 Proposed Landscape Plan

2.6 Materials Palette

The soft landscape planting strategy for Thames Young Mariners has been developed in collaboration with the project ecologist with the objective of developing a landscape scheme that respects existing habitats, the biodiversity of the site and the wider context.

Ham Lands Local Nature Reserve has been identified as a key natural asset that forms the immediate curtilage to the north and south of the site. Together with appraising the collective objectives of Ham Lands LNR and the Richmond upon Thames Biodiversity Action Plan, the landscape design for Thames Young Mariners will aim to become a key contributor to the environmental and ecological improvements of this region of the borough.

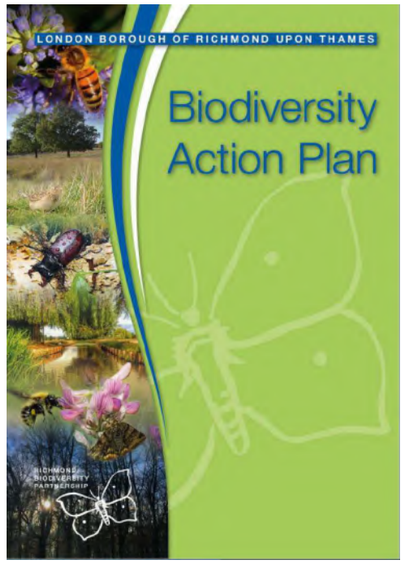
A primary aim of the Richmond upon Thames Biodiversity Action Plan is:

'To conserve and enhance the variety of habitats and species in the London Borough of Richmond upon Thames, in particular those which are of international or national importance, are in decline locally, are characteristic to the borough and/or have particular public appeal, which can raise the profile of biodiversity.'

From this understanding our landscape design has been formulated to protect, conserve, and enhance the natural assets of the site to achieve a Biodiversity Net Gain, as summarised in section 2.4: Summary of Ecology and Biodiversity Net Gain Strategy.

A recommended species list has been developed with the project ecologist that considers the sensitivity of the site, and a broader ecology strategy plan has been developed identifying areas of structural planting to support the Biodiversity Net Gain. Native and wildlife attracting species are proposed in key locations on site, such as the southern boundary grassland to the south of the access road, to serve as an extension of the Ham Lands meadow, boundary conditions enhanced with additional native, species-rich hedgerow planting and scattered tree planting within areas of existing grassland. The focus will be on habitat creation and improving connections to the wider Ham Lands and regional green infrastructure.

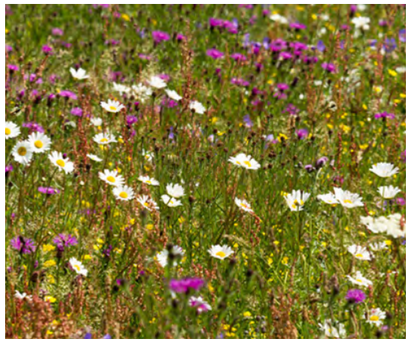
Richmond Upon Thames Biodiversity Action Plan



Mixed Meadows

Native Hedgerows

Native Trees



2.7 Access Strategy

KEY

- Vehicular Movement
- Service Movement
- Pedestrian Movement
- Cycle Movement
- Main Pedestrian Crossing Points
- Coach Drop Off
- Access Points to Main Building
- Refuse Location
- Cycle Storage Location

Architectural Design Development

3

3.1 Proposed Schedule of Accommodation

Revised Brief

Following the feedback received from earlier pre-application consultations we have reviewed the proposals to reduce the impact on Metropolitan Open Land. To achieve this we have modified the design for the Main Building to incorporate the Staff Accommodation at first floor level and merged the northern Changing Block to provide those facilities at upper ground level.

The result of this exercise has omitted two buildings from the redeveloped site and constricted the amount of developed area. The height of the Main Building has increased as an outcome, although this positively reinforces the hierarchy of buildings on the site and relationship to the water. Lower building heights are maintained working towards the site boundary, where ecological interventions are planned as part of the Bio-diversity Net Gain measures.

Proposed Gross Internal Area

The tables to the right provide details of the gross internal area (GIA) for each proposed building compared to the existing development.

Schedule	Building Provision	Approx GIA	Quantity	Total Area (sqm)
1.0	Main Building	910	1	910
2.0	Guest Residential Accommodation	255	3	765
3.0	Changing Block (Ground Floor)	210	1	210
4.0	Staff Residential Accommodation	120	1	120
5.0	Repair Workshop	50	1	50
6.0	Camping Changing Block	180	1	180
			Total GIA (sqm)	2235.00

Schedule 1 - Pre-App 2 Schedule

Schedule	Building Provision	Approx GIA	Quantity	Total Area (sqm)	
1.0	Main Building + Staff Accommodation	1009	1	1009	← Area increase due to incorporation of changing & staff provision = 99sqm
2.0	Guest Residential Accommodation	255	3	765	← No change
3.0	Changing Block (Ground Floor)				← Reduced from 6no units to 1no unit, area reduction = 520sqm
4.0	Staff Residential Accommodation				← Building omitted
5.0	Repair Workshop				← Building omitted
6.0	Camping Changing Block	200	1	200	← Area increase due to personal care provision requirement = 20sqm
			Total GIA (sqm)	1974.00	← Overall GIA Redution = **261sqm**

Schedule 2 - Pre-App 3 Schedule

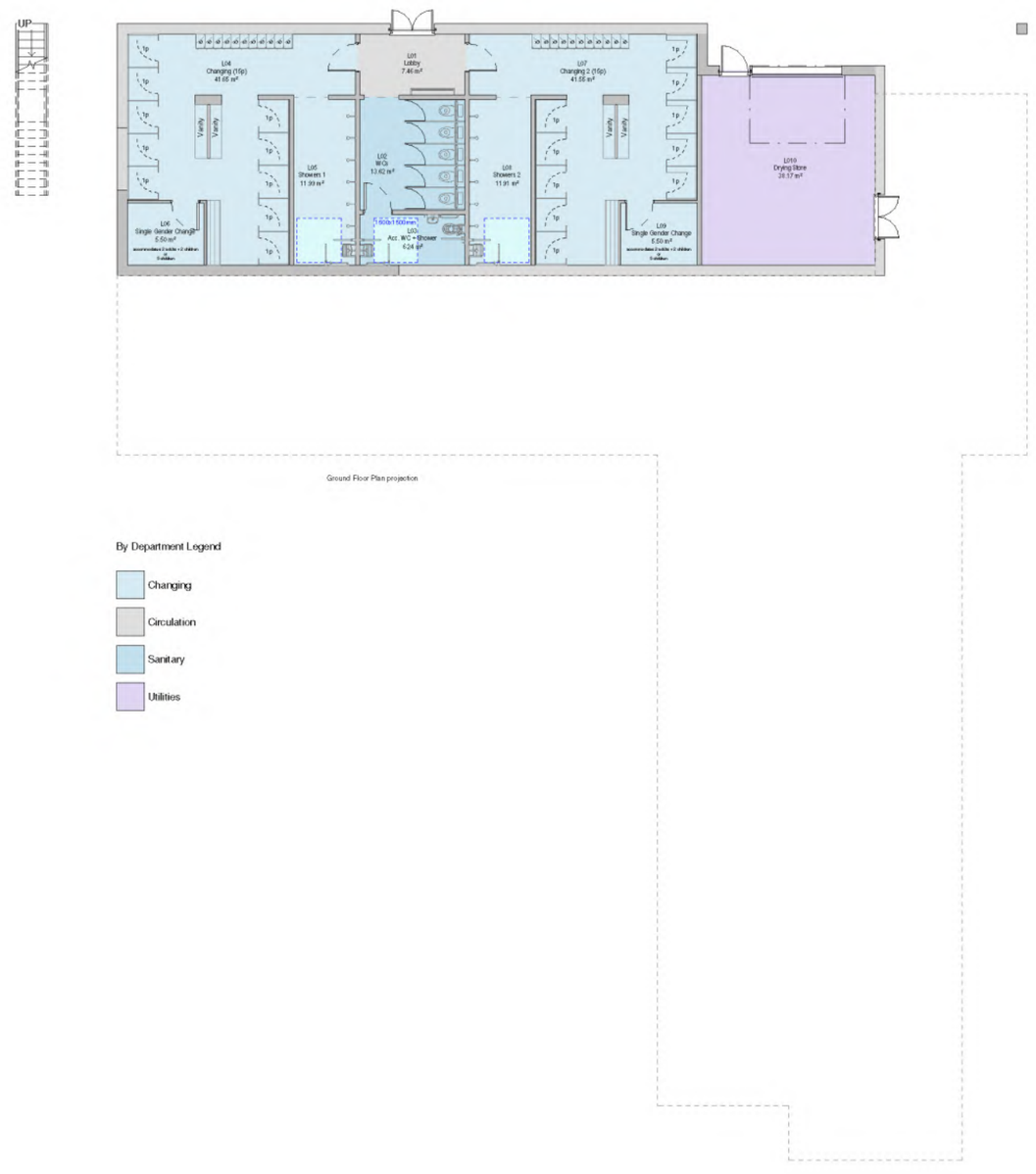
3.2 Proposed General Arrangement Plans

Key Plan

3.2.1 Main Building - Lower Ground Plan

The lower ground floor maintains the relationship to the waters edge via the slipway of the existing development, comprising changing and drying facilities for water-based activities. Changing facilities are designed to provide flexibility and diversity in use by a variety of user groups, integrating accessible facilities for independent or inclusive use.

Existing storage located adjacent to the building is to be transferred to the proposed floating pontoons indicated on the plan. These combine access to the water with storage with boats and equipment to support the multiple water-based activities.



3.2 Proposed General Arrangement Plans

Key Plan

3.2.2 Main Building - Ground Floor Plan

The upper ground floor is positioned relative to ground level on approach to the building.This includes the main reception point for visitors with office and staff welfare accommodation. The hall with kitchen is a principal part of the scheme to provide a base for groups during lunch breaks and for hosting events. External paving to the southern side and a terrace overlooking the water on the western side provide opportunities for outside dining, congregating, or observing activities.

Additional changing facilities are included at this level to support land-based activities and additional water-based activities that may use the eastern slipway.Toilets are provided for flexibility for each user group and considers concurrent activities throughout the day.

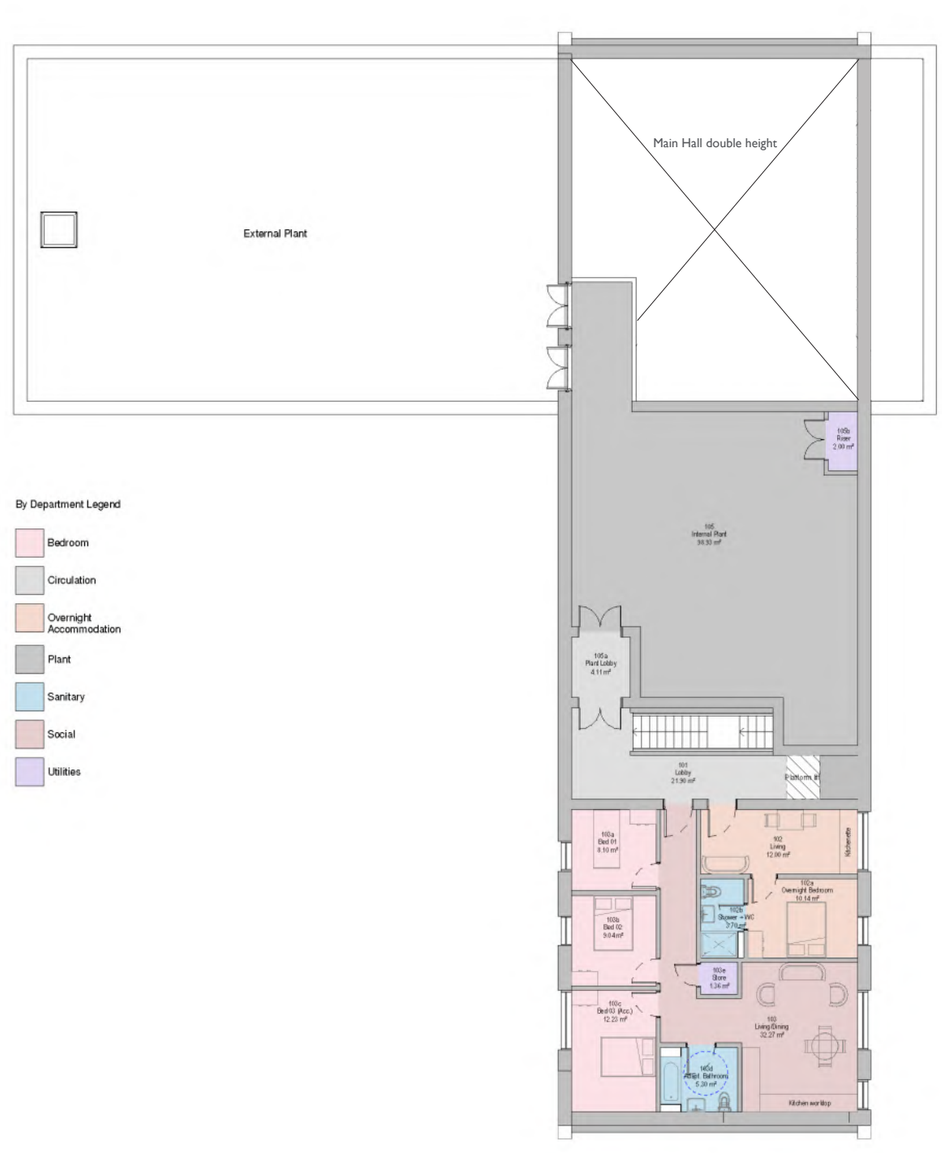
3.2 Proposed General Arrangement Plans

Key Plan

3.2.3 Main Building - First Floor Plan

These proposals show the relocated staff residential accommodation at first floor level. The scale of provision has been reviewed with SOLD to optimise the amount of accommodation and include overnight surveillance of the site, which is an important security measure necessary due to the equipment stored within the site. Access to this accommodation is distinct from the general use at upper ground floor level.

To achieve the energy efficiency targets for this scheme, a plantroom is included at this level for the primary energy generation plant that serves this building and the adjacent Guest Residential Blocks. Air source heat pumps (ASHPs) will be located here, with heat rejection equipment positioned externally on the flat roof above the kitchen and changing areas.



3.2 Proposed General Arrangement Plans

Key Plan

3.2.4 Guest Residential Blocks

The three Guest Residential Blocks are additional to the existing development and represent an important part of the long-term viability. These will enable school groups to extend their stay on the site to multiple days and fully experience what is on offer. A standard design for each block is proposed to enable application of offsite modular construction.

The layout is organised around a central corridor with four bed dormitories sharing ensuite shower facilities. Additional guardian bedrooms are necessary for appropriate safeguarding of each group of children. The number of bedrooms is based on school group size.

As for the changing facilities, our approach has been to integrate accessible sleeping provision alongside standard bedrooms so that groups can be fully inclusive. A small flexible room is included in each building for the school group to socialize and gather before and after activities.

3.2 Proposed General Arrangement Plans

Key Plan

3.2.5 Camping Changing Block

Camping Changing

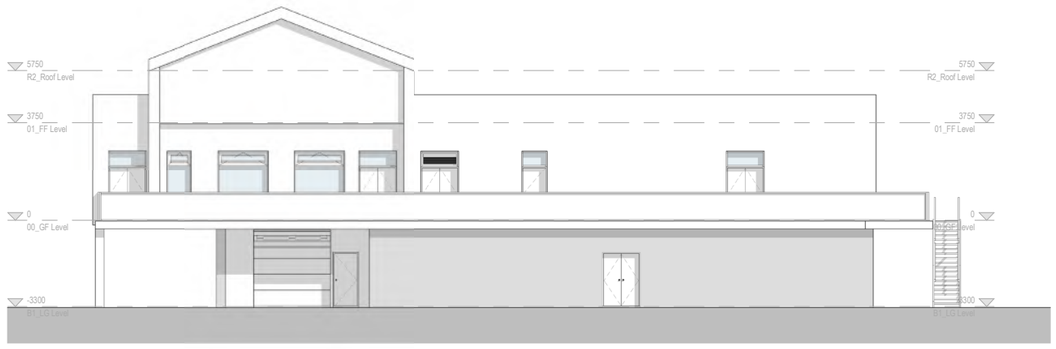
The proposed camping changing block is a new provision on site and will serve as a dedicated facility to camping guests throughout their stay at TYM. This accommodation is located adjacent to the camping area, providing improved access and provision and improving the overall operation of the site by providing discrete accommodation for different user groups.

Repair Workshop

To reduce the scale of the Camping Changing Block the workshop facility has been detached and will occupy an existing container unit on the site.

3.3 Proposed General Arrangement Elevations

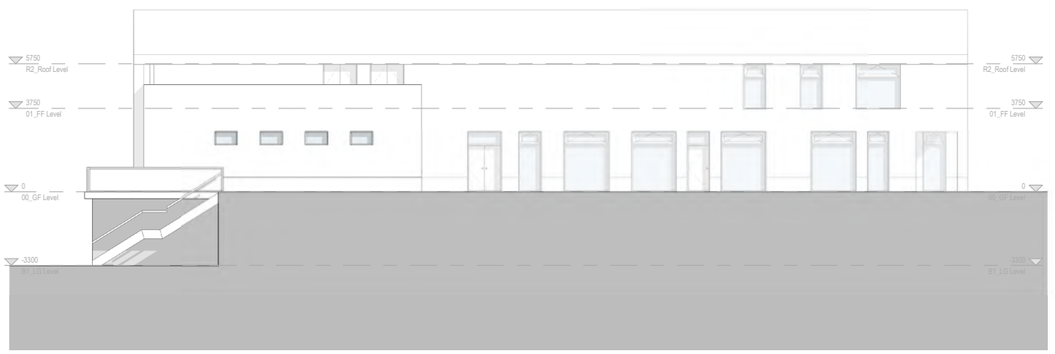
3.3.1 Main Building



North Elevation

East Elevation

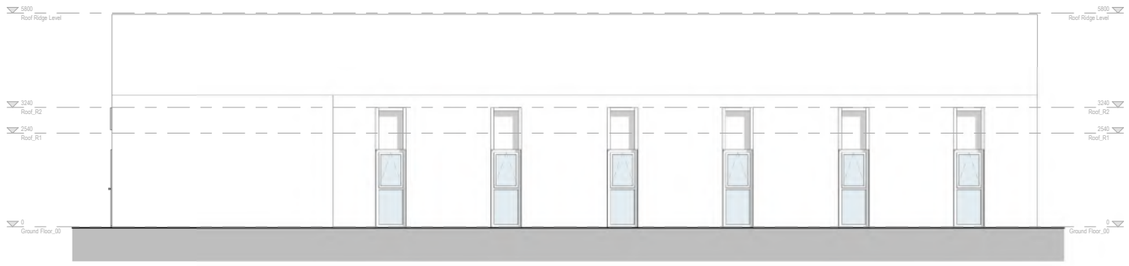
South Elevation



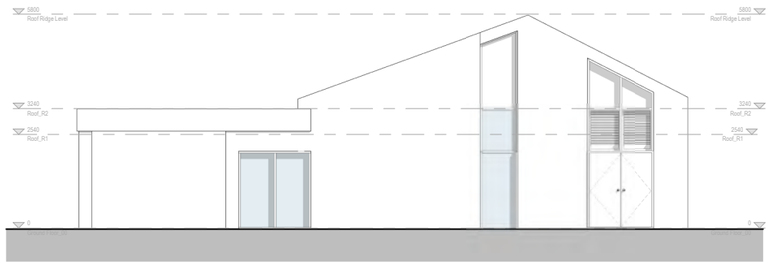
West Elevation

3.3 Proposed General Arrangement Elevations

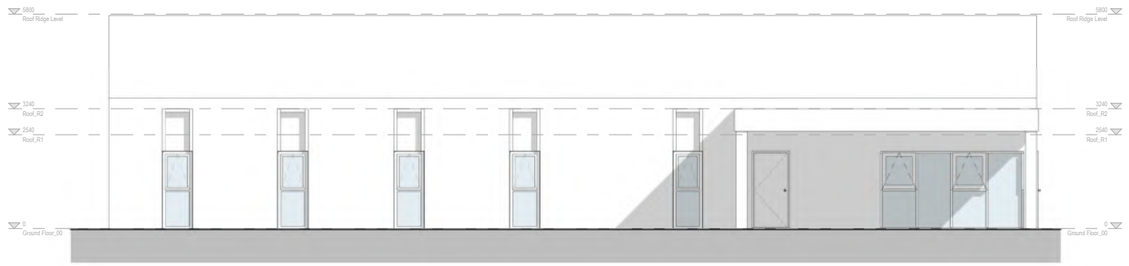
3.3.2 Guest Residential Blocks



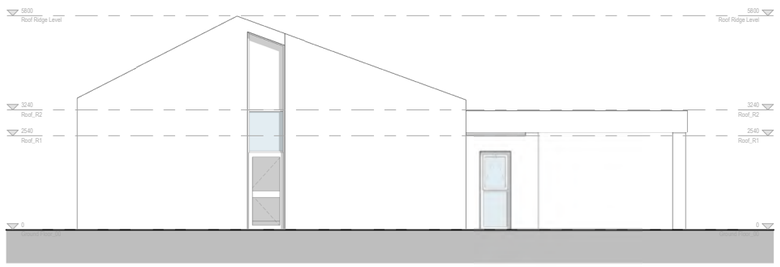
North Elevation



East Elevation



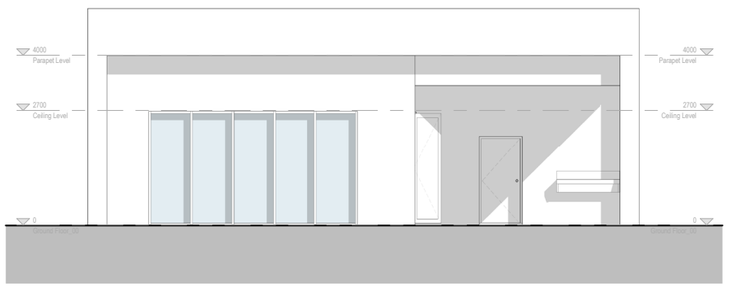
South Elevation



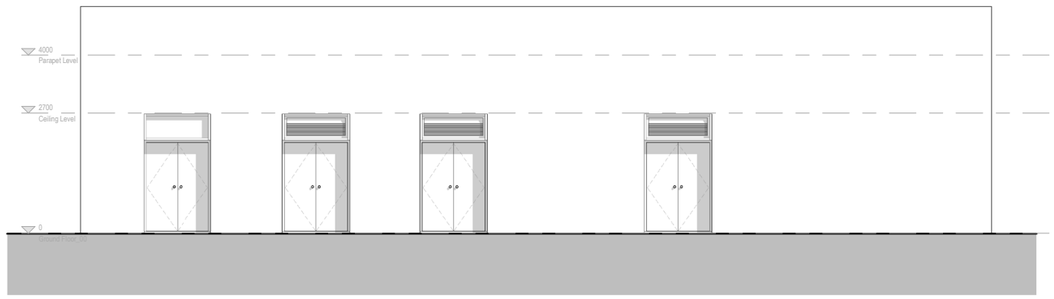
West Elevation

3.3 Proposed General Arrangement Elevations

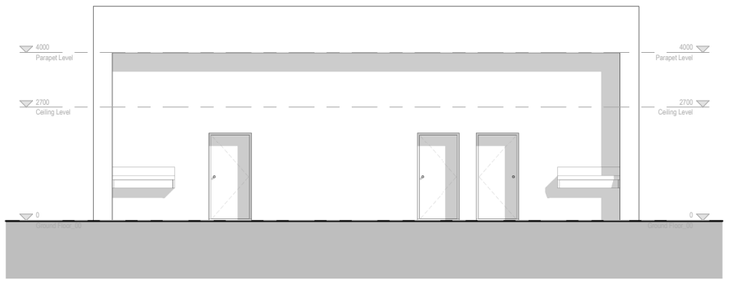
3.3.3 Camping Changing Block



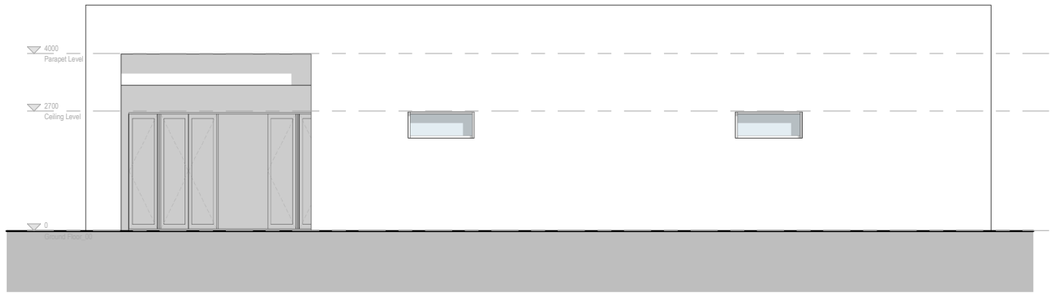
North Elevation



East Elevation



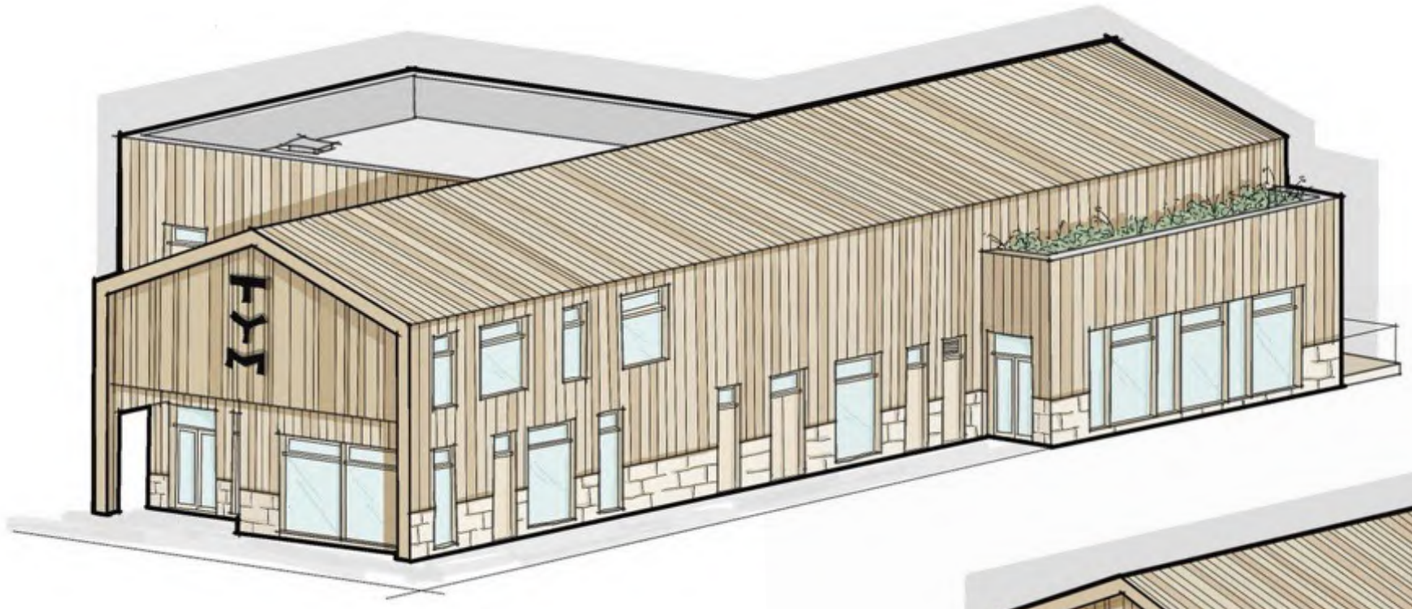
South Elevation



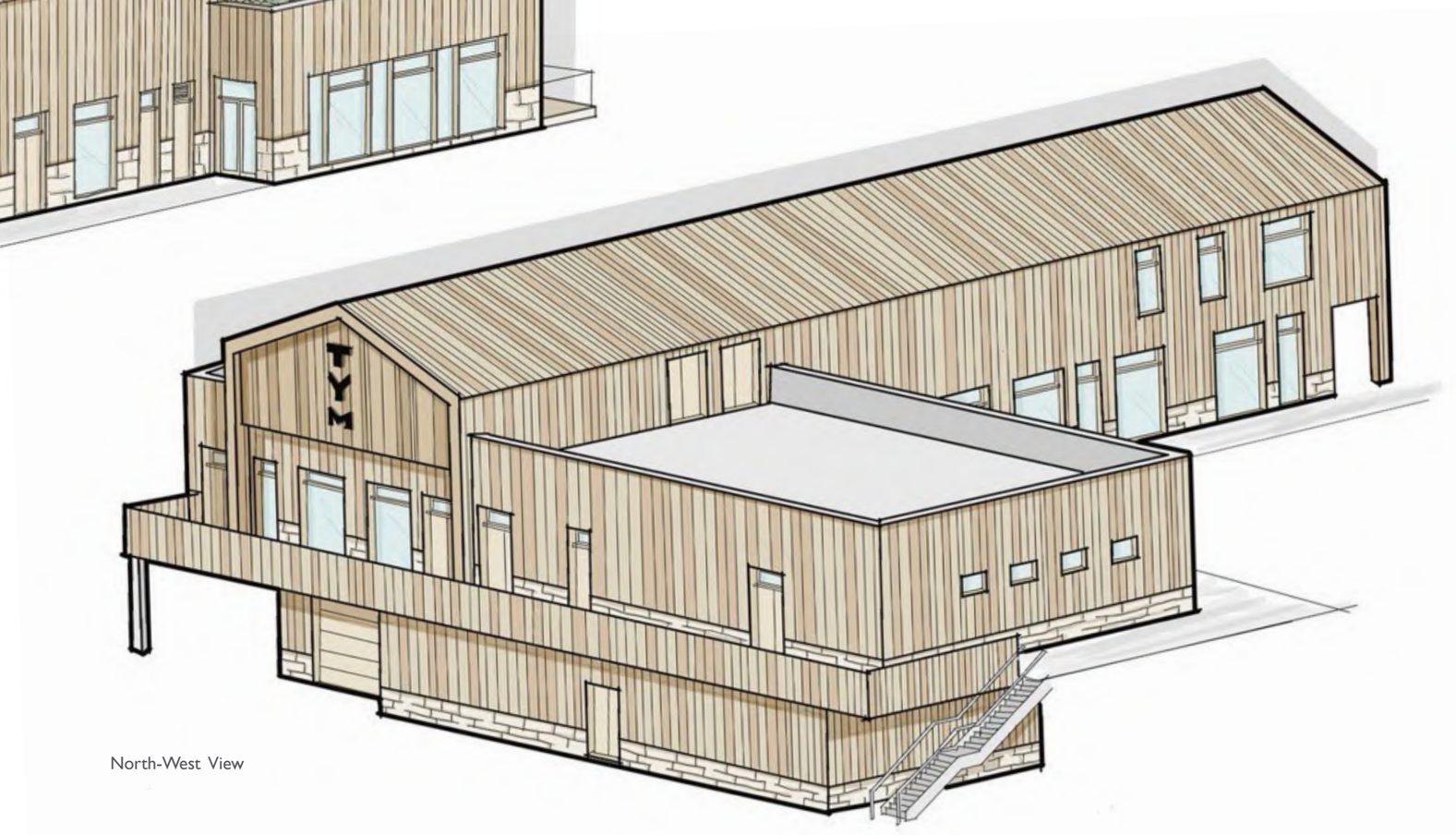
West Elevation

3.4 Proposed General Arrangement Isometrics

3.4.1 Main Building



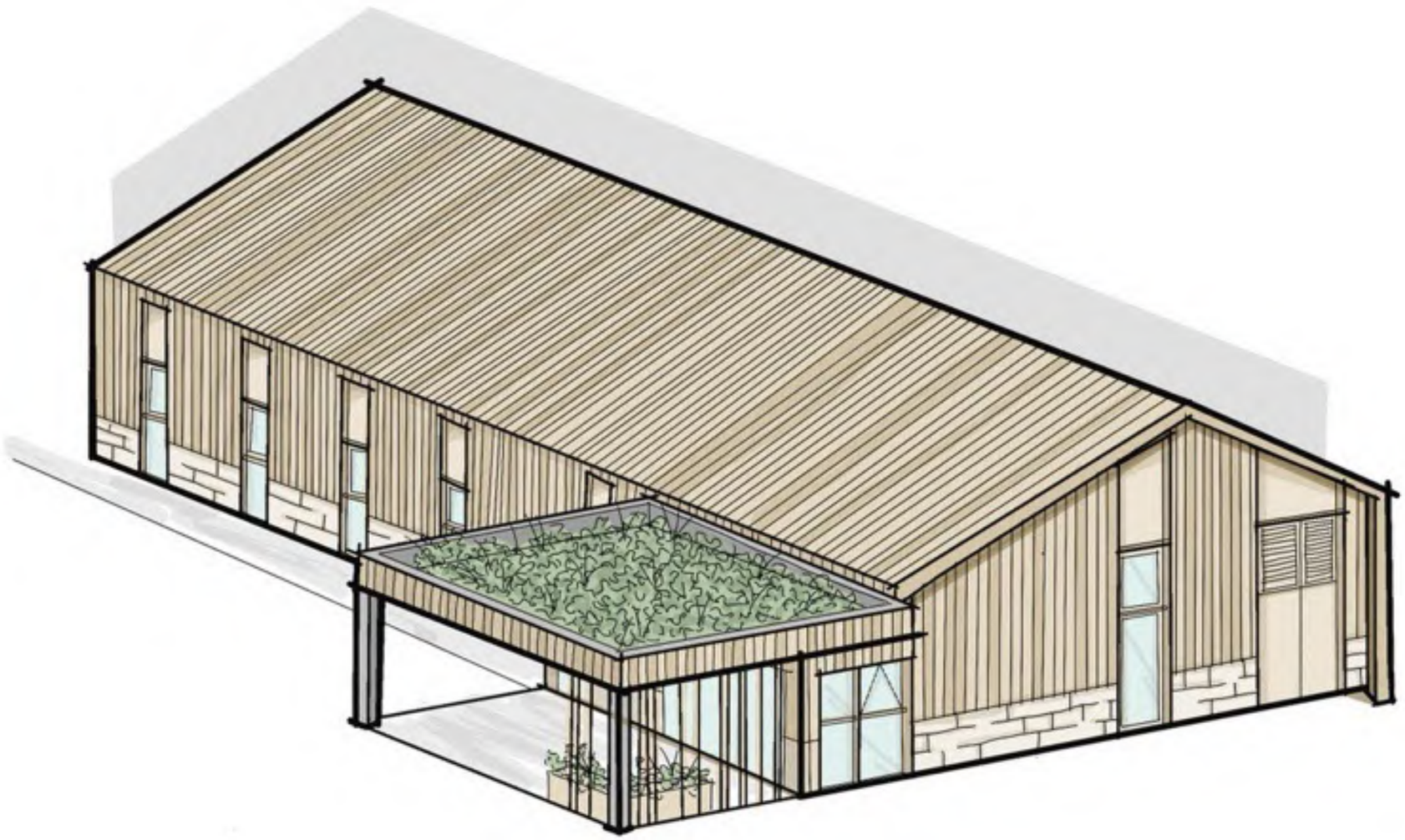
South-East View



North-West View

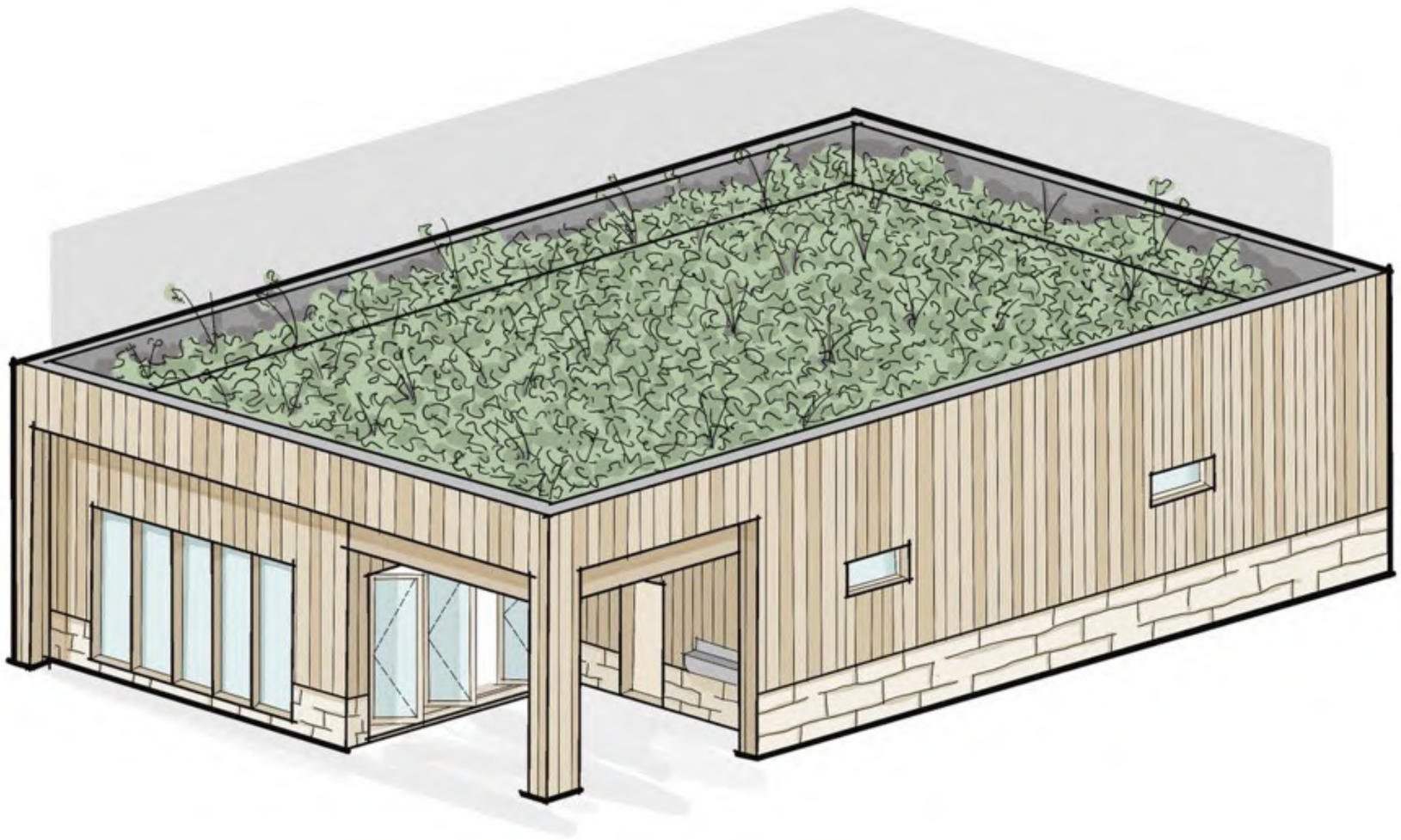
3.4 Proposed General Arrangement Isometrics

3.4.2 Guest Residential Blocks



3.4 Proposed General Arrangement Isometrics

3.4.3 Camping Changing Block



3.5 Material Palette

Material Palette

Timber rainscreen cladding

Timber window reveals

Stone 'effect' block plinths & upstands

Stone gabions

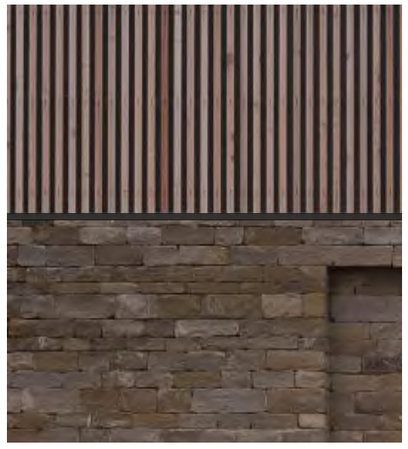
A simple, natural & minimal material palette is proposed in order to blend in to the natural environment of the site.

Articulation in the elevations will be achieved through variation in the detailing as can be seen on the following pages.

Material Application Precedent Studies

Timber rainscreen cladding with stone effect block upstand

Timber rainscreen cladding with stone effect four course block plinth



Timber rainscreen cladding & stone wall junction

3.6 Precedents

Unknown

Archio

Bureau de Change

Innauer Matt

Bureau de Change

Alventosa Morrell Arquitectes

3.7 Timber Details Precedents

Gable end & screening detail - 31/44 Architects

Variation to plain facades - Line Architecture

Varying widths of timber cladding - Fergus Perdie Architects

Timber Soffit - ReFormat Architects

Flush & projecting timber fins - Mary Arnold & Fosters Architects

Entrance wayfinding detail - 3D Reid

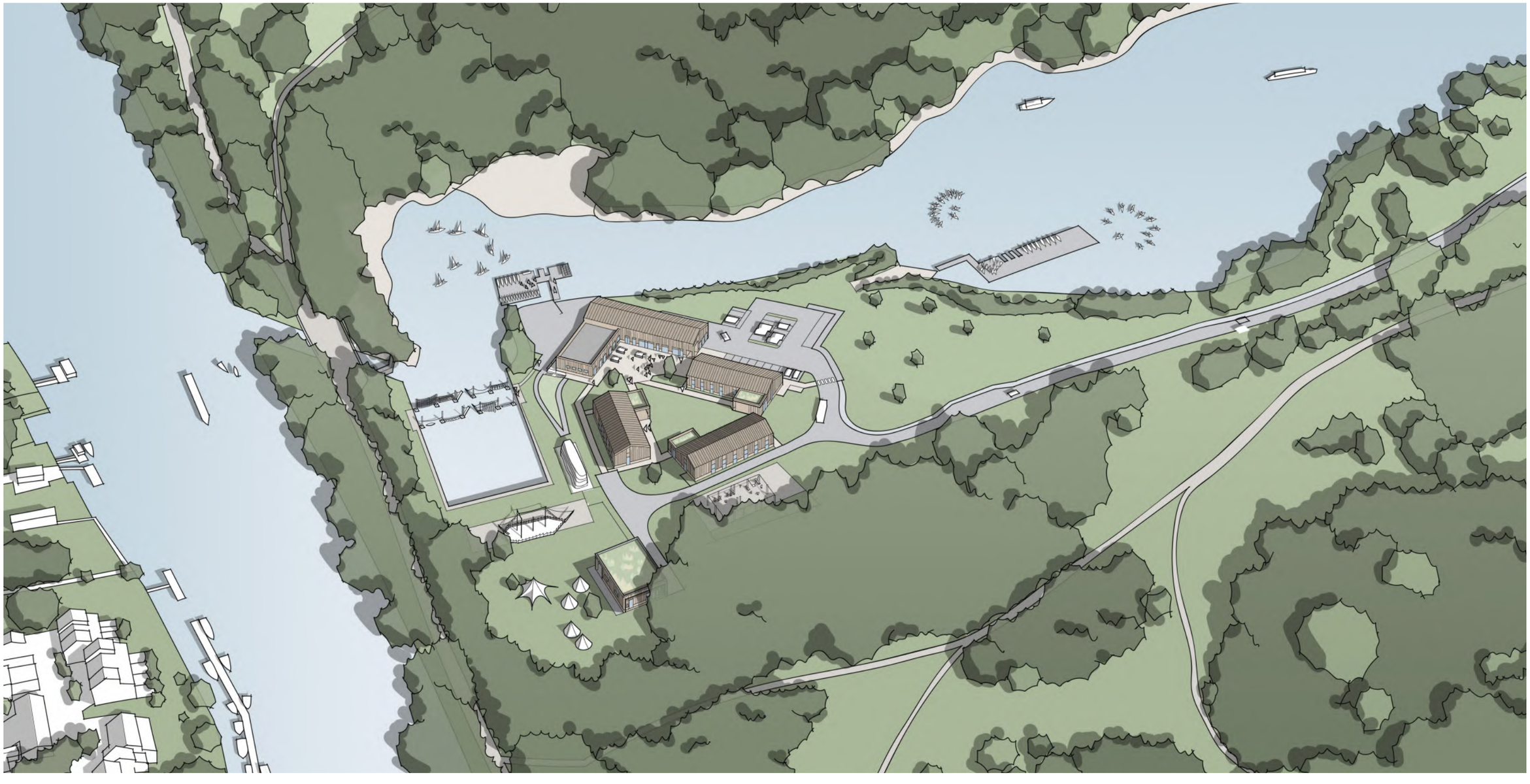
Variation to plain facades - Dualchas Architects

Timber wall to eaves detail - Mary Arnold & Fosters Architects

Visuals

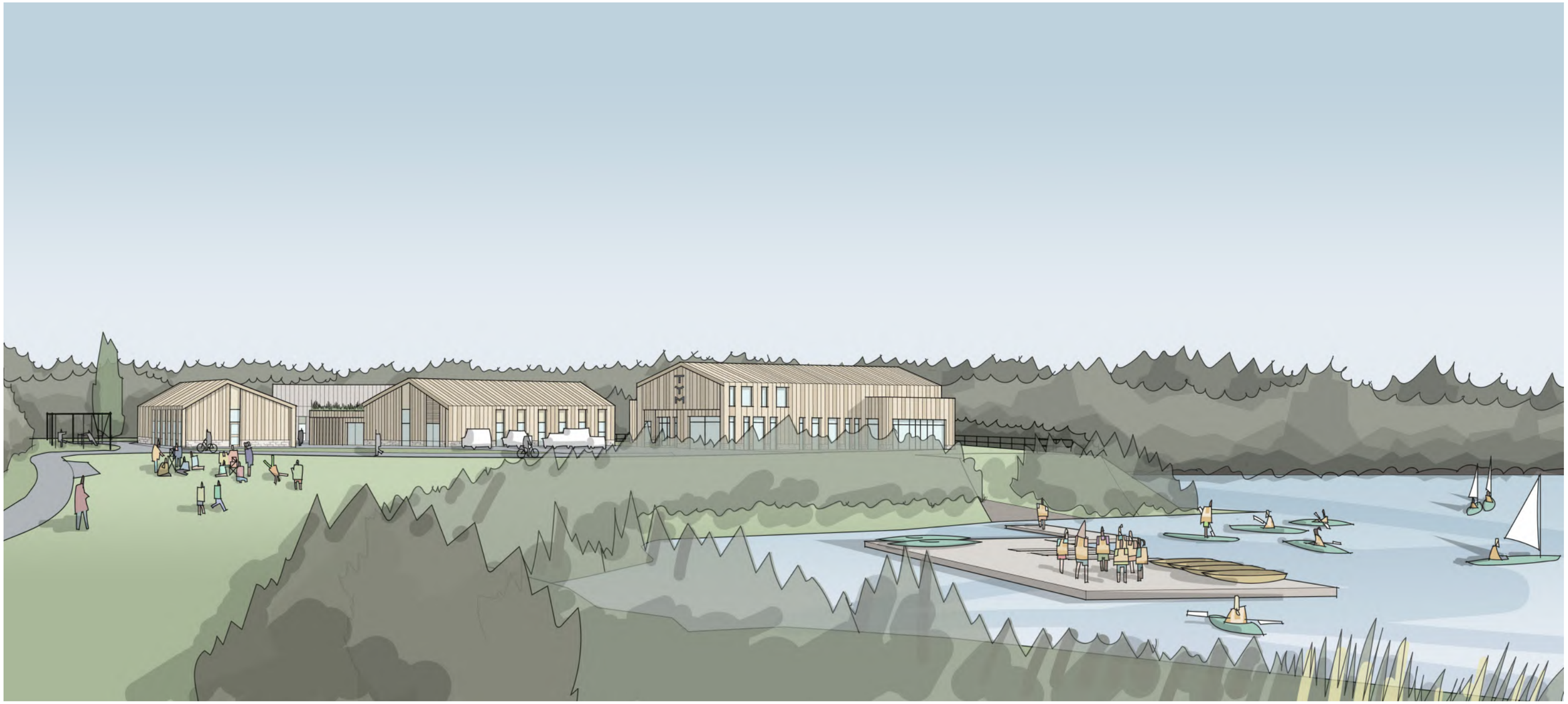
4

4.1 Bird's Eye Visual



4.2 Thames Path Lock Visual

4.3 Arrival Visual



Next Steps

5

5.1 Next Steps

Next Steps

This information is intended to conclude the pre-application consultation with the London Borough of Richmond and the Greater London Authority. Comments received from this engagement will be integrated into these design proposals prior to submission of a full plans application.

Design information will be developed to provide the level of technical clarity commensurate with the planning criteria, supported by relevant surveys and strategy documents. Vail Williams will coordinate the planning documents and submit these for validation in the normal way, along with the application fee provided by Surrey County Council.

A calculation to verify the Biodiversity Net Gain on the site is to be carried out based on the finalised landscaping proposals. Initial feedback of the scheme so far is positive that the targets can be achieved, utilising native species to supplement existing habitats.

Should further site visits be required by the planning team and consultees, these can be organised through Vail Williams and will be hosted by SOLD, subject to coordination with ongoing activities on the site.

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