JOMAS ENGINEERING ENVIRONMENTAL

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BASIC GEOTECHNICAL GROUND INVESTIGATION REPORT

LONDON STADIUM, E20 2ST
WORKFORCE ENTRANCE (CAR PARK)

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Report Title: **Basic Geotechnical Ground Investigation Report for London Stadium, E20 2ST – Workforce Entrance (Car Park)**

Report Status: **Final v1.0**

Job No: **P2943J2025/SC**

Date: **14 May 2021**

QUALITY CONTROL - REVISIONS

Version	Date	Issued By

Prepared by: JOMAS ASSOCIATES LTD **For: LONDON STADIUM 185**

Prepared by	Reviewed by	Approved by
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1 INTRODUCTION

1.1 Terms of Reference

1.1.1 London Stadium 185 ("The Client") has commissioned Jomas Associates Ltd ('Jomas'), to undertake an investigation of the geotechnical factors pertaining to the proposed redevelopment at a site referred to as London Stadium, E20 2ST – Workforce Entrance (Car Park), to support the geotechnical assessment for foundations and buried concrete design prior to redevelopment of the site.

1.1.2 The intrusive investigation was undertaken in accordance with Jomas' proposal dated 19th March 2021.

1.2 Proposed Development

1.2.1 It is understood that the proposed development to comprise demolition works of the existing hardstanding (e.g. tarmac) car parking area, formerly used as a temporary staff entrance and the construction of a lightweight single-storey modular building.

1.2.2 For the purpose of geotechnical assessment, it is considered that the project could be classified as a Geotechnical Category (GC) 2 site in accordance with BS EN 1997.

1.3 Objectives

1.3.1 The objectives of Jomas' investigation were as follows:

- To assess ground conditions and determine soil parameters to inform foundation design, which is to be undertaken by the structural engineer;
- To obtain data from the geotechnical investigation was to form the basis of a preliminary interpretation with respect to foundation design, buried concrete specification and excavation stability.

1.4 Scope of Works

1.4.1 The following tasks were undertaken to achieve the objectives listed above:

- An intrusive ground investigation to determine ground and groundwater conditions;
- Laboratory geotechnical and chemical testing on soil samples collected from the site;
- Provision of a Basic Geotechnical Report detailing the findings of the ground and groundwater conditions encountered; the results of in-situ and laboratory testing; a geotechnical assessment for foundations, buried concrete, excavation stability and recommendations for further action (if required).

1.5 Limitations

1.5.1 Jomas Associates Ltd ('Jomas') has prepared this report for the sole use of London Stadium 185, in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas. No other third party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.

1.5.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless Jomas has actual knowledge to the contrary, information obtained from public sources or provided to Jomas by site personnel and other information sources, have been assumed to be correct. Jomas does not assume any liability for the misinterpretation of information or for items not visible, accessible or present on the subject property at the time of this study.

1.5.3 Whilst every effort has been made to ensure the accuracy of the data supplied, and any analysis derived from it, there may be conditions at the site that have not been disclosed by the investigation, and could not therefore be taken into account. As with any site, there may be differences in soil conditions between exploratory hole positions. Furthermore, it should be noted that groundwater conditions may vary due to seasonal and other effects and may at times be significantly different from those measured by the investigation. No liability can be accepted for any such variations in these conditions.

1.5.4 **This report is not an engineering design and the figures and calculations contained in the report should be used by the Structural Engineer, taking note that variations may apply, depending on variations in design loading, in techniques used, and in site conditions. Our recommendations should therefore not supersede the Engineer's design.**

2 SITE SETTING

2.1 Site Information

2.1.1 The site location plan is appended to this report in Appendix 1.

Table 2.1: Site Information

Name of Site	Workforce Entrance (Car Park)
Address of Site	London Stadium London E20 2ST
Approx. National Grid Ref.	537586, 183847
Site Area (Approx.)	0.09ha
Current Use	Car Park

2.2 Geology

2.2.1 With reference to British Geological Survey (BGS) mapping, the geology of the site is anticipated to comprise Alluvium overlying the Kempton Park Gravel Member over the Lambeth Group. In addition, given the close proximity of developed areas (e.g. tarmac car parking areas, a stadium and roads) within the boundaries of the site as well as within the surrounding area, a thickness of Made Ground could also be present overlying the natural soils.

2.2.2 BS5930:2015 defines **Made Ground** as anthropogenic ground in which the material has been placed without engineering control and/or manufactured by man in some way, such as through crushing or washing, or arising from an industrial process. Great variations in material type, thickness and degree of compaction invariably occur.

2.2.3 **Alluvium** is the most recent river or estuarine deposit and generally comprises silty clay usually with an appreciable organic content. The clay soils often exhibit low strength and high settlement characteristics. Lenses of sand and gravel are also commonly found, as are pockets of peat.

2.2.4 **The Kempton Park Gravel Member** comprises alternating layers of sands and gravel, locally with lenses of silt, clay or peat. The sands usually overlie the clays. The Kempton Park Gravel Member is transitional and overlays bedrock geology of the London Clay Formation, or Lambeth Group.

2.2.5 **The Lambeth Group** comprises a mixture of stiff to hard red, blue/grey and brown mottled clays with basal beds of sand and gravel which vary greatly both laterally and vertically. Locally, these sediments are cemented with calcium carbonate, iron oxides and silica to form materials with relatively high strength.

2.3 British Geological Survey (BGS) Borehole Data Review

2.3.1 Based on the BGS mapping, a significant number of boreholes were previously drilled within the surrounding area. The nearest borehole (referenced as TQ38SE6059) was

drilled in May 2006 which was located c.10m to the west of the site and centred at NGR 537575.71, 183845.02.

2.3.2 The table below summarises the ground conditions encountered together with in-situ testing (SPT 'N' values). A copy of this borehole log is presented in Appendix 2.

Table 2.2: Ground Conditions Encountered (Historic Data - May, 2006)

Stratum and Description	Depth Encountered (from-to) (mbgl)	Depth Encountered (from-to) (mOD)	Thickness (m)	SPT N Values
Loose dark grey slightly silty sandy angular to sub-angular fine to coarse gravel of ash, red and yellow brick, and concrete. Occasional cobbles of brick and concrete. (MADE GROUND)	0.0 to 3.2	0.9 to -2.3	3.2	9 6
Plastic pseudo fibrous slightly gravelly dark brown PEAT becoming very soft dark grey slightly gravelly CLAY with frequent roots/rootlets. Gravel is fine to medium angular to sub-rounded flint and claystone. (ALLUVIUM)	3.2 to 7.6	-2.3 to -6.7	4.4	4 4 4
Medium dense grey locally brown sandy angular to sub-angular predominantly fine to medium GRAVEL of flint. Sand is fine to coarse. 2No. coarse gravel size fragments of metal. (RIVER TERRACE DEPOSITS)	7.6 to >8.0 (Not proven)	-6.7 to <-7.1 (Not proven)	>0.4 (Not proven)	19

2.3.3 A 'slow' groundwater strike was reported at a depth of 5.6m bgl (-4.7m OD); the water level did not rise after a 20minutes period.

2.3.4 A second groundwater strike was recorded at a depth of 7.6m bgl (-6.7m OD); the water level did not rise after a 20minute period.

3 GROUND INVESTIGATION

3.1 Rationale for Ground Investigation

3.1.1 The ground investigation was designed in order to gather data representative of the ground conditions within the vicinity of the proposed building.

3.2 Scope of Ground Investigation

3.2.1 The ground investigation was undertaken between 8th and 9th April 2021, and comprised;

- Super heavy dynamic probing (DPSH) at 3No. positions to a maximum depth of 9.5m bgl (below ground level) to inform the geotechnical assessment;
- Construction of three dynamic sampler boreholes were drilled up to 6.0m bgl with associated sampling;
- 1No. hand excavated trial pit to a depth of 0.65m bgl.

3.2.2 Positions were marked on site during a site meeting with the client on the 25th March 2021.

3.2.3 The exploratory hole positions were marked and scanned by a specialist contractor (e.g. buried services survey's contractor) prior to breaking ground. The exploratory hole locations are shown in Figure 2, Appendix 1. The exploratory hole records are included in Appendix 2.

3.2.4 All exploratory holes were backfilled with the arisings (in the reverse order in which they were drilled) and the ground surface was reinstated with cold-lay tarmac.

3.3 In-situ Testing

3.3.1 Three Super Heavy Dynamic Probes (DPSH) were undertaken adjacent to the dynamic sampler boreholes, with the results included in Appendix 2. Dynamic probing was planned and undertaken to aid in the description of the soil 'strength' and to determine if any hard or soft spots of the ground exist.

3.4 Laboratory Analysis

3.4.1 Soil samples were submitted to the UKAS Accredited laboratory of i2 Analytical Ltd. for a series of analysis.

3.4.2 This testing was specifically designed to:

- classify the samples
- determine parameters (either directly or sufficient to allow relevant correlations to be used) relevant to the technical objectives of the investigation

3.4.3 The following laboratory geotechnical testing (as summarised in Table 3.1) was carried out:

Table 3.1 Laboratory Geotechnical Analysis

BS 1377 (1990) Test Number	Test Description	Number of tests
Part 2		
3.2	Moisture Content Determination	3
4.3 and 5.3	Liquid and Plastic Limit Determination (Atterberg Limits)	3
9.2 and 9.3	Particle Size Distribution - Sieving	1

3.4.1 In addition, 4No. samples were tested for water soluble sulphate and pH, the results of which were used in combination with BRE Special Digest 1 to allow buried concrete to be classified. The results of this chemical testing are provided in Appendix 4.

3.4.2 The results of the geotechnical laboratory testing are presented as Appendix 3 and discussed in Section 5 of this report.

4 ENCOUNTERED CONDITIONS

4.1 General

4.1.1 A factual record of the conditions encountered during the physical investigation of the site is presented in the following section.

4.1.2 For further details of the encountered ground conditions, reference should be made to the exploratory hole logs presented in Appendix 2, the geotechnical testing results in Appendix 3 and the geochemical testing results in Appendix 4.

4.1.3 The physical ground investigation works were undertaken between 8th and 9th April 2021.

4.1.4 Unless stated otherwise, all depths are reported as metres below ground level (m bgl).

4.2 Ground Conditions

4.2.1 The ground conditions encountered within the exploratory holes were slightly different from those anticipated, i.e. a thickness of Made Ground overlying cohesive and granular soils of the Alluvium. The Kempton Park Gravel Member and the Lambeth Group were not encountered during the investigation. A summary of the encountered soil conditions is presented in Table 4.1.

Table 4.1 : Ground Conditions Encountered

Stratum and Description	Encountered from (m bgl)	Base of strata (m bgl)	Thickness range (m)
Asphalt over brown clayey very sandy gravel. Gravel consist of fine to coarse angular to sub-rounded concrete, brick and flint with occasional asphalt and slate. (MADE GROUND)	0.0	1.0 - 1.6	1.0 - 1.6
Dark brown to black slightly organic sandy very gravelly clay / clayey sandy gravel. Gravel consists of fine to coarse angular to sub-rounded brick, flint and concrete with occasional glass, ceramics, slate and asphalt. (MADE GROUND)	1.0 - 1.6	1.8 - 2.7	0.8 - 1.3
Black organic clayey gravel with shells and plant debris. Gravel consists of fine to coarse angular to sub-angular flint with occasional ceramics and glass. (MADE GROUND)	1.8 - 2.7	3.0 - 4.0	1.2 - 1.5
Very soft to stiff consistency* brown to dark brown silty slightly gravelly CLAY with plant debris. Gravel consist of fine to medium sub-angular to rounded flint. Strong organic odour. (ALLUVIUM - Cohesive)	3.0	4.0	1.0

Table 4.1 : Ground Conditions Encountered

Stratum and Description	Encountered from (m bgl)	Base of strata (m bgl)	Thickness range (m)
Loose to medium dense black GRAVEL with occasional shells and wood fragments. Gravel consists of fine to coarse angular to sub-angular flint. Organic odour. (ALLUVIUM - Granular)	4.0	>6.0 (Base not proven)	>2.0 (Thickness not proven)

**Consistency estimated using semi-empirical correlations with SPT N-values, Plasticity Indices and published literature*

4.2.2 With the exception of an organic odour noted within the alluvial deposits at variable depths, no visual or olfactory evidence of potential contamination was identified within the investigation positions.

4.2.3 For more detailed descriptions of the ground conditions at specific locations, reference should be made to the exploratory hole logs presented in Appendix 2.

4.3 Groundwater

4.3.1 Groundwater strikes are summarised in Table 4.2.

Table 4.2: Groundwater Strikes During Drilling

Exploratory Hole ID	Depth Encountered (mbgl)	Depth After 20mins (mbgl)	Stratum
WS2	3.0	2.0	Made Ground
WS3	3.5	2.2	Made Ground
WS4	2.0	2.0	Made Ground

4.3.2 Groundwater was not encountered within WS1.

4.3.3 It should be noted that changes in groundwater levels occur for a number of reasons including seasonal effects and variations in drainage. Such fluctuations may only be recorded by the measurement of the groundwater level within a series of standpipes or piezometers installed within appropriate response zones.

4.4 Obstructions

4.4.1 During the investigation, WS1 refused at a depth of 0.65m bgl due to an impenetrable obstruction (possibly concrete). DPSHs were also prematurely terminated at depths of between 8.9m and 9.5m bgl due to the presence of impenetrable obstructions (e.g. coarse gravel). These exploratory holes did not reach their target depths (6.0m bgl and 10.0m bgl, respectively) during the course of the investigation. The presence of man-made/natural obstructions elsewhere on site cannot be discounted based on the findings of the intrusive investigation.

4.4.2 It should be noted that, due to granular nature of the materials encountered, it was not possible to recover samples within WS03 and WS04 at depths of between 4.00m bgl and 5.05m bgl and therefore no samples could be recovered at these depths.

4.5 Geotechnical Testing Results

4.5.1 As previously noted, three Super Heavy Dynamic Probe (DPSH) tests were undertaken adjacent to the dynamic sampler boreholes, with the results included in Appendix 2.

4.5.2 The equivalent SPT "N" blow counts were correlated from the dynamic tests. Generally, these test results ranged between equivalent SPT 'N' values of N=3 to N=>50 within the cohesive and granular soils of the Alluvium (excluding Made Ground) corresponding with a very low to high strength in the cohesive soils (based on correlations postulated by Stroud & Butler, 1975 and Stroud, 1989) of the Alluvium or loose to very dense relative density within the granular elements of the Alluvium.

4.5.3 The blow counts showed a general trend of increasing with depth, albeit with fluctuations noted. The test results indicated that the minimum equivalent SPT 'N' value of 1 was recorded within firm becoming very soft brown to dark brown silty slightly gravelly clay in WS04 at depths of between 3.6m and 4.4m bgl.

4.5.4 In contrast, the highest DPSH 'N' values were recorded where granular soils of the Alluvium were encountered and indicated these soils to be in a very dense state**.**

4.5.5 The results of geotechnical laboratory testing undertaken from the recovered samples of the Made Ground and Alluvium are summarised in Table 4.3.

Table 4.3: Summary of Geotechnical Test Results

Parameter		Made Ground	Granular Alluvium	Cohesive Alluvium
Moisture Content (%)		10 – 51	15	98
Liquid Limit (%)		-	N/A	94
Plastic Limit (%)		-		56
Plasticity Index (%)		-		38
Modified Plasticity Index (%)		-		22.8
Volume Change Potential [NHBC and BRE]		-		Medium
Particle Size Distribution	Gravel (%)	52 – 68	-	-
	Sand (%)	23 – 39	-	-
	Clay/Silt (%)	8 – 19	-	-
pH		7.70	7.90	7.50 – 7.70
Water soluble sulphate (g/l)		2.60	2.40	0.89 – 1.60
SPT (N)		1 – 13	4 – >50	3 – 18

4.5.6 It should be noted that, the engineering characteristics of Made Ground are variable and unpredictable, therefore Made Ground has not been assessed further as part of the geotechnical assessment.

4.6 Summary of General Properties Derived for Alluvium

4.6.1 Based on the analysis of the ground investigation data and past experience with similar deposits, the general parameters given in Table 4.4, have been derived for the Alluvium materials.

Table 4.4: Derived Parameters for Alluvium

Property*	Granular Alluvium	Cohesive Alluvium
Unit Weight	19	18
Drained Friction, φ' (◦)	30	22.00[1)]
Drained Cohesion, c' (kPa)	0	0
SPT 'N' Value	4 – >50	3 – 18
Drained Young's Modulus, E' (MPa)[2)]	4 – >50	N/D
Undrained Young's Modulus, E_u (MPa)[3)]	N/A	4 – 22
Undrained Shear Strength, c_u (kPa)[4)]		13 – 81
Plasticity Index (%)		38
Modified Plasticity Index (%)		22.8
Volume Change Potential [NHBC]		Medium
Modulus of Volume Compressibility, m_v (m^2/MN)[5)]		0.123 – 0.77

[1)] Calculated from: φ' = (42°- 12.5log10I_p) for 5% ≤ I_p ≤ 100% Where, I_p is the soil's plasticity index (BS8002:2015).
[2)] Calculated from: E' = 1 N MPa, based on the guidance given in CIRIA Report 143.
[3)] Calculated from: E_u = 1.2 N MPa, based on the guidance given in CIRIA Report 143.
[4)] The undrained shear strength (c_u) of the Alluvium was correlated to the SPT "N" values using Stroud (1974), where c_u=f_1N and f_1 is factor related to the Plasticity Index (PI) of the clay (a value of f_1 equal to 5.0 for PI ≤ 25% and a value of f_1 value equal to 4.5 for PI>25).
[5)] Calculated from: m_v = 1/f_2 N m^2/MN, f_2 is a coefficient proposed by Stroud and Butler (1975) and varies with Plasticity Index (PI) and presented in Figure 27 of CIRIA Report 27.
*These reported values are not considered as '*Characteristic Values*'.

5 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

5.1 General

Subsequent to intrusive investigation of the site and receipt of the laboratory test results, the following geotechnical assessments have been made.

5.2 Foundations

5.2.1 Based on the ground and groundwater conditions encountered, conventional shallow foundations may be suitable for the proposed redevelopment across the site, albeit taken through any Made Ground, soft clay, loose gravel, decayed roots or organic zones, or disturbed ground and bear wholly into, or onto the medium strength cohesive elements of the Alluvium.

5.2.2 The results of the laboratory analysis indicated the cohesive elements of the Alluvium may be treated as being of medium volume change potential as defined by NHBC Standards, Chapter 4.2. Therefore, a minimum founding depth, within natural soils of suitable bearing capacity, would be 0.9m bgl.

5.2.3 An allowable bearing capacity of 60kPa is recommended for the Alluvium. Under this loading, total settlements should remain within tolerable limits, i.e. <25mm. Where any unexpected or soft ground conditions are encountered during the groundworks, works in that area should cease and the advice of a suitably qualified geotechnical engineer sought.

5.2.4 In the event that conventional foundations are not suitable, e.g. due to due to the presence of deeper zones of Made Ground or very soft and loose soils encountered at depth and/or where the required depth of construction would dictate conventional foundations exceeding 2.5m bgl, an alternative such as a raft, hybrid raft with deeper sections edge and thickened under columns, pad and beam or reinforced ring beam, or piled foundations may be required. Very soft or loose alluvial deposits are considered likely to release high total and differential settlements even under a low bearing pressure.

5.2.5 An alternative foundation solution may also be preferable to avoid potentially excessive dewatering requirements during deep excavation.

5.2.6 Some form of alternative foundation solution such as piles to transfer the loads down into the high strength clay or very dense granular Alluvium is considered most appropriate. In order to obtain the necessary geotechnical parameters required for a pile design, further ground investigation will be required, e.g. with a cable percussion rig.

5.3 Concrete in the Ground

5.3.1 Based on the guidance given in BRE Special Digest 1, Part 1 (2005), the characteristic values of sulphate used to determine the concrete classification are determined using the methodology summarised in the table below.

Table 5.1: Concrete in the Ground Characteristic Value Determination

No. Samples in the dataset	Method for determining the sulphate characteristic value
1 - 4	Highest value
5-9	Mean of the top 2No. highest results
10 or greater	Mean of the top 20% highest results

5.3.2 Table 5.2 summarises the analysis of the aggressive nature of the ground for each of the strata encountered within the ground investigation.

Table 5.2: Concrete in the Ground Classes

Stratum	No. Samples	pH range	Characteristic WS Sulphate (mg/l)	Design Sulphate Class	ACEC Class
Made Ground	1	7.7	2600	DS-3	AC-3
Alluvium	3	7.5 - 7.9	2400	DS-3	AC-3

5.3.3 Based on the guidance given in BRE Special Digest 1, Part 1 (2005), a Design Sulphate Class of DS-2 with a concrete classification of AC-2 would be appropriate for shallow foundations (<2.5m bgl) and a Design Sulphate Class of DS-3 with a concrete classification of AC-3 would be appropriate for deep foundations (e.g. piles). It is recommended that the advice of this publication be taken for the design and specification of all sub-surface concrete.

5.4 Ground Floor Slabs

5.4.1 Given the presence of shrinkable soils, it is recommended that suspended floor slabs are used with an adequate void designed according to NHBC Standards. As a guide, initial modelling indicates a requirement for a sub-floor void of at least 250mm due to the presence of shrinkable soils of medium volume change potential. This would increase to a 300mm void where high volume change potential soils are present at shallow depth.

5.5 Excavations

5.5.1 Both shallow and deeper longer excavations within the Made Ground are unlikely to remain stable and some form of temporary support or battering back to a safe angle and dewatering are likely to be required.

5.5.2 Both shallow and deeper excavations above the groundwater level within the cohesive soils of the Alluvium are likely to remain relatively stable in the short to medium term though some spalling may be anticipated.

5.5.3 Ground works should always be designed in such a manner so as to avoid entry into excavations by construction or maintenance personnel. However, in the event that such works cannot be avoided or designed out, they should only be undertaken in accordance with a safe system of work, following an appropriate risk assessment and in accordance with any legislative requirements, e.g. Confined Spaces Regulations.

6 REFERENCES

BRE Special Digest 1: Concrete in Aggressive Ground, 2005

British Standards Institution (2015) BS 5930:2015 Code of practice for ground investigations. Milton Keynes: BSI

Ministry of Housing, Communities & Local Government: National Planning Policy Framework. February 2019.

NHBC Standards Chapter 4.2: 2021

APPENDICES

APPENDIX 1 – FIGURES

PROJECT NAME	London Stadium, E20 2ST - Workforce Entrance (Car Park)	**CLIENT**	London Stadium 185
TITLE	Site Location Plan	**PROJECT NO.**	P2943J2025
DATE	April 2021	**FIGURE NO.**	1

FIGURE 2

NOTE:
VERY POOR SIGNAL HERE
DUE TO MASS OF CABLES
ON TOP OF GROUND

UTS

BH

0.88d

MH
CABLE PIT
CABLE DEPTH = 0.80d
PIT DEPTH = 1.10d

x2 x2

x4

BH

BOX GULLY

MH
CABLE PIT
CABLE DEPTH = 0.85d
PIT DEPTH = 1.20d

x4 x2

x4

MH
CABLE PIT
CABLE DEPTH = 0.80d
PIT DEPTH = 1.15d

x4 x2

MH
CABLE PIT
CABLE DEPTH = 0.77d
PIT DEPTH = 1.15d

x4 x2

G

MH
UTS
UNDER HUT

HUT

0.88d

GATE

0.25d

BOX GULLY

0.60d

BH

LP

1.00d

NO DEPTH
STRONG SIGNAL PICKED
UP ON RADIO

NOTE:

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Sheet Diagram

UTILITIES KEY

	SURVEY BOUNDARY
150Ø	FOUL DRAINAGE
300Ø	SURFACE DRAINAGE
450Ø	COMBINED DRAINAGE
	ELECTRIC CABLE
	TELECOM CABLE
	WATER PIPE
	GAS PIPE
	CATV / CABLE TELEVISION
	COMMUNICATIONS CABLE
	TRAFFIC LIGHTS
	DUCTING
	UNIDENTIFIED
	EARTH CABLE
	PUMPING MAIN
	FUEL PIPE
	VENT PIPE
	OFFSET FILL PIPE
	VAPOUR RECOVERY
	GAUGE LINE
	RADAR TRACE
	RADAR AREA ANOMALY
	RADAR UTILITY TRACE
	RADAR UTILITY ANOMALY
UTS	UNABLE TO SURVEY

ABBREVIATIONS

AR	-	ASSUMED ROUTE
BD	-	BACKDROP
CL	-	COVER LEVEL
CR	-	CABLE RISER
EM	-	ELECTROMAGNETIC
EOT	-	END OF TRACE
GPR	-	GROUND PENETRATING RADAR
FH	-	FIRE HYDRANT
HV	-	HIGH VOLTAGE
IL	-	INVERT LEVEL
LV	-	LOW VOLTAGE
MH	-	MANHOLE
MW	-	MONITORING WELL
NL	-	NOT LOCATED
OSA	-	OUTSIDE SURVEY AREA
PR	-	PIPE RISER
RWP	-	RAIN WATER PIPE
TFR	-	TAKEN FROM RECORDS
TP	-	TELEGRAPH POLE
UTGA	-	UNABLE TO GAIN ACCESS
UTL	-	UNABLE TO LIFT
UTR	-	UNABLE TO ROD
UTS	-	UNABLE TO SURVEY
UTT	-	UNABLE TO TRACE
VP	-	VENT PIPE
WWP	-	WASTE WATER PIPE

Rev	Details	Date	Drawn

Terrascan

Client: Jomas Associates Ltd

Project: London Stadium

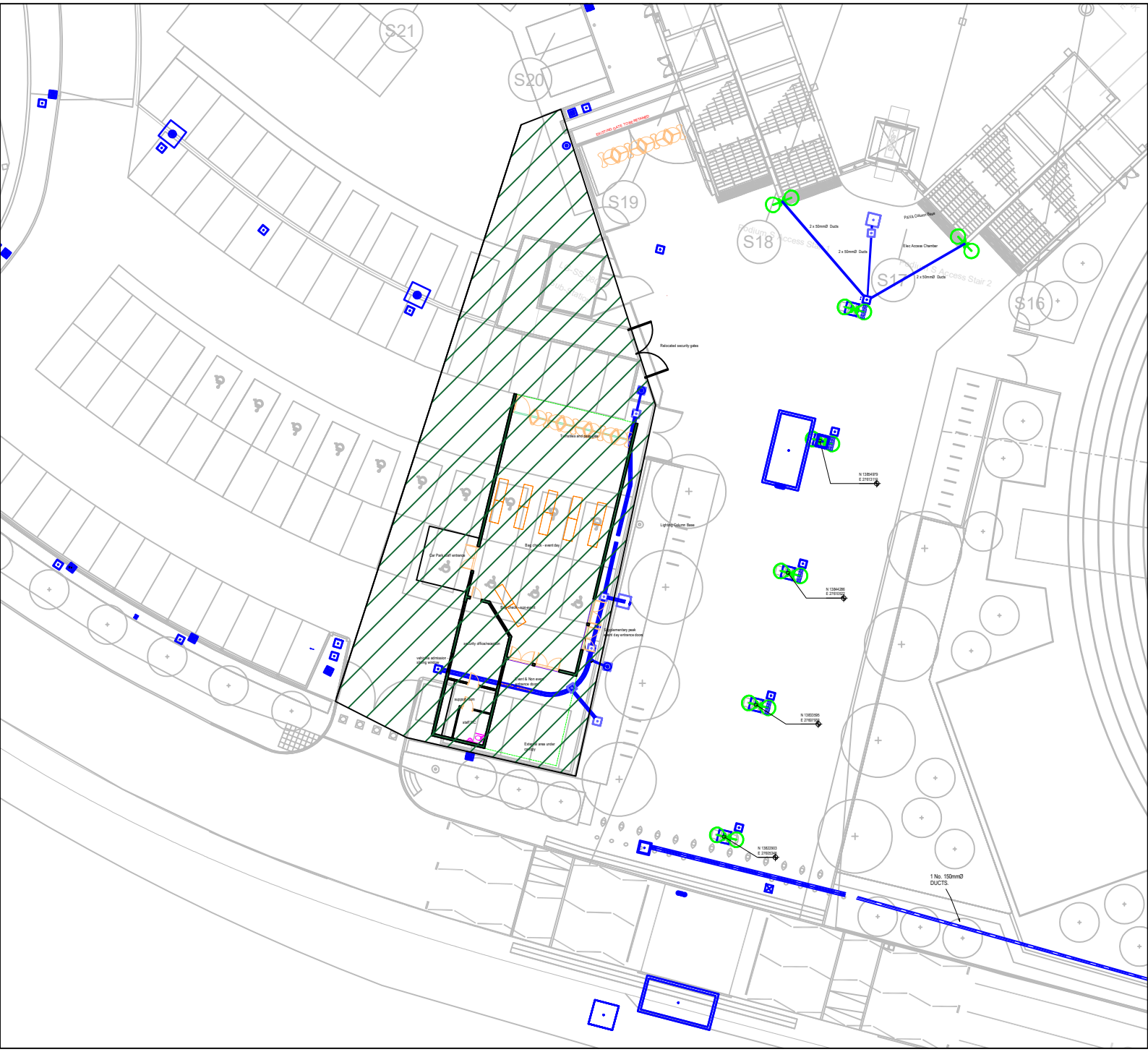
Title: Underground Utility Survey

Job No: 03745

Scale: 1:100@A1 | Date: 09.04.21 | Revision: 001

Units 1+2, Yarnbury Court
Wylye
Warminster
Wiltshire
BA12 0QE
www.terrascanuk.co.uk

FIGURE 3


S21
S20
S19
S18
S17
S16
Relocated security gates
Lighting Column Base
2 x 50mmØ Ducts
Elec Access Chamber
1 No. 150mmØ DUCTS.

APPENDIX 2 – EXPLORATORY HOLE RECORDS

WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

		Exploratory Hole No:	WS1
Site Address:	Staff Security Point, London Stadium, E20 2ST	Project No:	P2943J2025
Client:	London Stadium 185	Ground Level:	
Logged By:	JLW	Date Commenced:	08/04/2021
Checked By:	SC	Date Completed:	08/04/2021
Type and diameter of equipment:	Windowless Sampler Rig	Sheet No:	1 Of 1

Water levels recorded during boring, m						
Date:						
Hole depth:						
Casing depth:						
Level water on strike:						
Water Level after 20mins:						

Remarks

1: Borehole terminated at 0.65mbgl due to unknown concrete obstruction.

2: No water reported.

3:

4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									0.00					
											0.25		Asphalt. (MADE GROUND)	
D	0.50								0.50		0.65		Brown clayey very sandy gravel. Sand is medium to coarse. Gravel consists of fine to coarse, angular to sub-rounded concrete, brick, flint and slate, with occasional asphalt. (MADE GROUND)	
									1.00					
									1.50					
									2.00					
									2.50					
									3.00					
									3.50					
									4.00					
									4.50					
									5.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:	WS2		
Site Address:	Staff Security Point, London Stadium, E20 2ST	Project No:	P2943J2025
Client:	London Stadium 185	Ground Level:	
Logged By:	JLW	Date Commenced:	09/04/2021
Checked By:	SC	Date Completed:	09/04/2021
Type and diameter of equipment:	Windowless Sampler Rig	Sheet No:	1 Of 2

Water levels recorded during boring, m

Date:	08/04/2021					
Hole depth:	6.00					
Casing depth:						
Level water on strike:	3.00					
Water Level after 20mins:	2.00					

Remarks

1: Poor recovery noted from 4mbgl to 6mbgl.
2: Mesh/net membrane reported at 1.60m bgl
3: DPSH undertaken to 8.9m bgl prior to windowless sampling.
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									0.00					
											0.20		Asphalt. (MADE GROUND)	
D	0.50								0.50				Brown clayey very sandy gravel. Sand is medium to coarse. Gravel consists of fine to coarse, angular to sub-rounded concrete, brick, flint and slate, with occasional asphalt. (MADE GROUND)	
									1.00					
D	1.50								1.50					
											1.60			
													Brown sandy very gravelly clay / clayey sandy gravel with medium cobble content. Sand is fine to coarse. Gravel consists of fine to coarse, angular to sub-rounded brick, flint and concrete, with occasional glass and asphalt. Cobbles consist of sub-angular brick. (MADE GROUND)	
									2.00					
D	2.30													
									2.50		2.50			
													Black organic clayey gravel with frequent wood fragments. Gravel consists of fine to coarse, angular to sub-angular flint and ceramic, with occasional glass. Strong organic odour noted. (MADE GROUND)	
									3.00					
D	3.30													
									3.50					
											4.00			
									4.00				Loose to medium dense black GRAVEL with occasional wood fragments. Gravel consists of fine to coarse, angular to sub-angular flint. Organic odour noted. (ALLUVIUM)	
D	4.30													
									4.50					
									5.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:	WS2		
Site Address:	Staff Security Point, London Stadium, E20 2ST	Project No:	P2943J2025
Client:	London Stadium 185	Ground Level:	
Logged By:	JLW	Date Commenced:	09/04/2021
Checked By:	SC	Date Completed:	09/04/2021
Type and diameter of equipment:	Windowless Sampler Rig	Sheet No:	2 Of 2

Water levels recorded during boring, m

Date:	08/04/2021					
Hole depth:	6.00					
Casing depth:						
Level water on strike:	3.00					
Water Level after 20mins:	2.00					

Remarks

1: Poor recovery noted from 4mbgl to 6mbgl.

2: Mesh/net membrane reported at 1.60m bgl

3: DPSH undertaken to 8.9m bgl prior to windowless sampling.

4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									5.00				Loose to medium dense black GRAVEL with occasional wood fragments. Gravel consists of fine to coarse, angular to sub-angular flint. Organic odour noted. (ALLUVIUM)	
									5.50					
									6.00		6.00			
									6.50					
									7.00					
									7.50					
									8.00					
									8.50					
									9.00					
									9.50					
									10.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:	WS3		
Site Address:	Staff Security Point, London Stadium, E20 2ST	Project No:	P2943J2025
Client:	London Stadium 185	Ground Level:	
Logged By:	JLW	Date Commenced:	09/04/2021
Checked By:	SC	Date Completed:	09/04/2021
Type and diameter of equipment:	Windowless Sampler Rig	Sheet No:	1 Of 2

Water levels recorded during boring, m

Date:	09/04/2021					
Hole depth:	6.00					
Casing depth:						
Level water on strike:	3.50					
Water Level after 20mins:	2.20					

Remarks

1: Poor recovery noted from 5mbgl to 6mbgl.
2: Mesh/net membrane reported at 1.40m bgl
3: DPSH undertaken to 9.4m bgl prior to windowless sampling.
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									0.00					
											0.30		Asphalt. (MADE GROUND)	
D	0.50								0.50				Brown clayey very sandy gravel. Sand is medium to coarse. Gravel consists of fine to coarse, angular to sub-rounded concrete, brick, flint and slate, with occasional asphalt. (MADE GROUND)	
D	1.20								1.00					
											1.40			
									1.50				Dark brown to black slightly organic sandy very gravelly clay / clayey sandy gravel with low cobble content. Sand is fine to medium. Gravel consists of fine to coarse, angular to sub-rounded concrete, brick, ceramic, glass and flint. Cobbles consist of sub-angular ceramic. Organic odour noted. (MADE GROUND)	
D	2.20								2.00					
									2.50					
											2.70			
D	3.00								3.00				Black organic clayey gravel with frequent shell fragments and occasional wood fragments. Gravel consists of fine to coarse, angular to sub-angular flint, with occasional ceramic and glass. Strong organic odour noted.(MADE GROUND)	
											3.20			
									3.50				Black organic gravel with frequent shell fragments and occasional wood fragments. Gravel consists of fine to coarse, angular to sub-angular flint, with occasional ceramic and glass. Organic odour noted. (MADE GROUND)	
D	3.80													
									4.00		4.00		NO RECOVERY.	
									4.50					
D	5.00								5.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:	WS3		
Site Address:	Staff Security Point, London Stadium, E20 2ST	Project No:	P2943J2025
Client:	London Stadium 185	Ground Level:	
Logged By:	JLW	Date Commenced:	09/04/2021
Checked By:	SC	Date Completed:	09/04/2021
Type and diameter of equipment:	Windowless Sampler Rig	Sheet No:	2 Of 2

Water levels recorded during boring, m

Date:	09/04/2021					
Hole depth:	6.00					
Casing depth:						
Level water on strike:	3.50					
Water Level after 20mins:	2.20					

Remarks

1: Poor recovery noted from 5mbgl to 6mbgl.
2: Mesh/net membrane reported at 1.40m bgl
3: DPSH undertaken to 9.4m bgl prior to windowless sampling.
4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
D	5.00								5.00		5.05		NO RECOVERY.	
													Loose to medium desne black organic GRAVEL with frequent shell fragments and occasional wood fragments. Gravel consists of fine to coarse, angular to sub-angular flint. Organic odour noted. (ALLUVIUM)	
									5.50					
									6.00		6.00			
									6.50					
									7.00					
									7.50					
									8.00					
									8.50					
									9.00					
									9.50					
									10.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:	WS4		
Site Address:	Staff Security Point, London Stadium, E20 2ST	Project No:	P2943J2025
Client:	London Stadium 185	Ground Level:	
Logged By:	JLW	Date Commenced:	08/04/2021
Checked By:	SC	Date Completed:	08/04/2021
Type and diameter of equipment:	Windowless Sampler Rig	Sheet No:	1 Of 2

Water levels recorded during boring, m

Date:	08/04/2021					
Hole depth:	6.00					
Casing depth:						
Level water on strike:	2.00					
Water Level after 20mins:	2.00					

Remarks

1: Mesh/net membrane reported at 0.65m bgl

2: DPSH undertaken to 8.7m bgl prior to windowless sampling.

3: *Consistency estimated using semi-empirical correlations with SPT N-values, Plasticity Indices and published literature

4:

Sample or Tests										Strata				
Type	Depth (mbgl)	Result								Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N						
									0.00					
											0.25		Asphalt. (MADE GROUND)	
D	0.50								0.50				Brown slightly clayey sandy gravel. Sand is medium to coarse. Gravel consists of fine to coarse, angular to sub-rounded concrete, brick, asphalt and flint, with occasional slate. (MADE GROUND)	
											1.00			
									1.00				Firm consistency* brown to black sandy very gravelly clay / clayey sandy gravel. Sand is fine to coarse. Gravel consists of fine to coarse, angular to sub-rounded brick and flint, with occasional concrete and slate. Faint organic odour noted. (MADE GROUND)	
D	1.50								1.50					
											1.80			
									2.00				Black clayey gravel with frequent wood fragments. Gravel consists of fine to coarse, angular to sub-angular flint, with occasional ceramic and glass. Strong organic odour noted. (MADE GROUND)	
D	2.50								2.50					
											3.00			
									3.00				Firm becoming very soft consistency* brown to dark brown silty slightly gravelly CLAY with wood fragments. Gravel consists of fine to medium, sub-angular to rounded flint. Strong organic odour noted. (ALLUVIUM)	
D	3.50								3.50					
											4.00			
									4.00				NO RECOVERY.	
									4.50					
									5.00					

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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WINDOW/WINDOWLESS SAMPLING BOREHOLE RECORD

Exploratory Hole No:	WS4		
Site Address:	Staff Security Point, London Stadium, E20 2ST	Project No:	P2943J2025
Client:	London Stadium 185	Ground Level:	
Logged By:	JLW	Date Commenced:	08/04/2021
Checked By:	SC	Date Completed:	08/04/2021
Type and diameter of equipment:	Windowless Sampler Rig	Sheet No:	2 Of 2

Water levels recorded during boring, m

Date:	08/04/2021					
Hole depth:	6.00					
Casing depth:						
Level water on strike:	2.00					
Water Level after 20mins:	2.00					

Remarks

1: Mesh/net membrane reported at 0.65m bgl

2: DPSH undertaken to 8.7m bgl prior to windowless sampling.

3: *Consistency estimated using semi-empirical correlations with SPT N-values, Plasticity Indices and published literature

4:

Sample or Tests									Strata				
Type	Depth (mbgl)	Result							Legend	Depth (mbgl)	Water Strikes (mbgl)	Strata Description	Installation
		75	75	75	75	75	75	N					
										5.05		NO RECOVERY.	
D	5.20									5.40		Black clayey GRAVEL with frequent wood fragments. Gravel consists of fine to coarse, angular to sub-angular flint. Strong organic odour noted. (ALLUVIUM)	
D	5.80									6.00		Firm becoming stiff consistency* brown sandy gravelly CLAY. Sand is medium to coarse. Gravel consists of fine to coarse, sub-angular to rounded flint. Sand and gravel content is noted to increase at the base. Organic odour noted. (ALLUVIUM)	

5.00 5.50 6.00 6.50 7.00 7.50 8.00 8.50 9.00 9.50 10.00

Sampling Code: U- Undisturbed B - Large Disturbed D - Small Disturbed W - Water (U*) Non recovery of Sample

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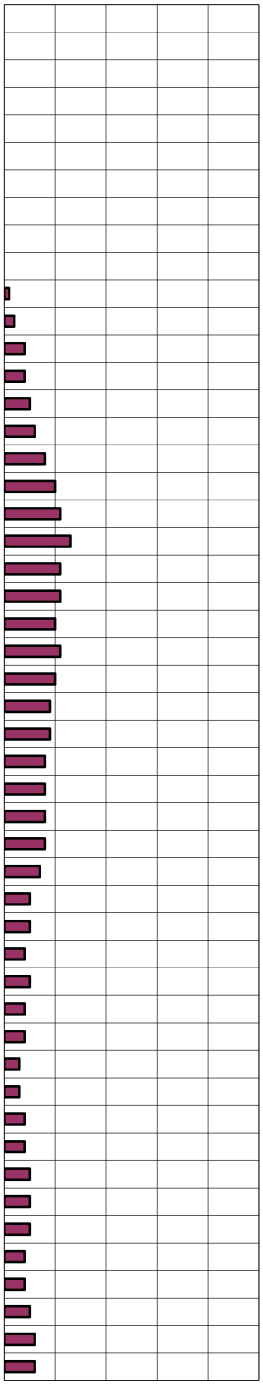
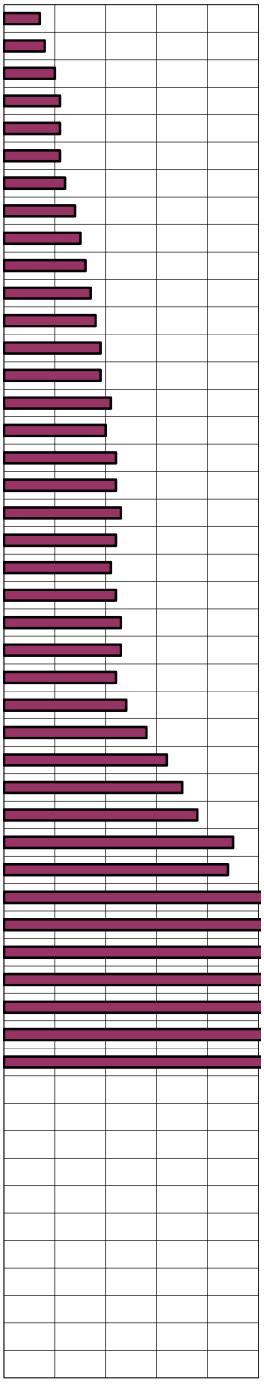
Depth mbgl	DPSH N(100)	SPT N(300)
0.0	0	
0.1	0	0
0.2	0	0
0.3	0	0
0.4	0	0
0.5	0	0
0.6	0	0
0.7	0	0
0.8	0	0
0.9	0	0
1.0	0	1
1.1	1	2
1.2	1	4
1.3	2	4
1.4	1	5
1.5	2	6
1.6	3	8
1.7	3	10
1.8	4	11
1.9	4	13
2.0	5	11
2.1	2	11
2.2	4	10
2.3	4	11
2.4	3	10
2.5	3	9
2.6	3	9
2.7	3	8
2.8	2	8
2.9	3	8
3.0	3	8
3.1	2	7
3.2	2	5
3.3	1	5
3.4	2	4
3.5	1	5
3.6	2	4
3.7	1	4
3.8	1	3
3.9	1	3
4.0	1	4
4.1	2	4
4.2	1	5
4.3	2	5
4.4	2	5
4.5	1	4
4.6	1	4
4.7	2	5
4.8	2	6
4.9	2	6
Continued		



Depth mbgl	DPSH N(100)	SPT N(300)
5.0	2	7
5.1	3	8
5.2	3	10
5.3	4	11
5.4	4	11
5.5	3	11
5.6	4	12
5.7	5	14
5.8	5	15
5.9	5	16
6.0	6	17
6.1	6	18
6.2	6	19
6.3	7	19
6.4	6	21
6.5	8	20
6.6	6	22
6.7	8	22
6.8	8	23
6.9	7	22
7.0	7	21
7.1	7	22
7.2	8	23
7.3	8	23
7.4	7	22
7.5	7	24
7.6	10	28
7.7	11	32
7.8	11	35
7.9	13	38
8.0	14	45
8.1	18	44
8.2	12	56
8.3	26	66
8.4	28	87
8.5	33	101
8.6	40	116
8.7	43	133
8.8	50	93
Refused		

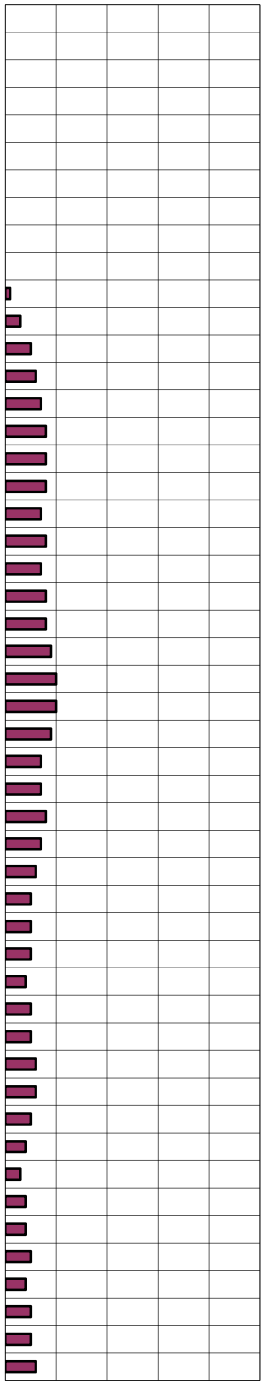


Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

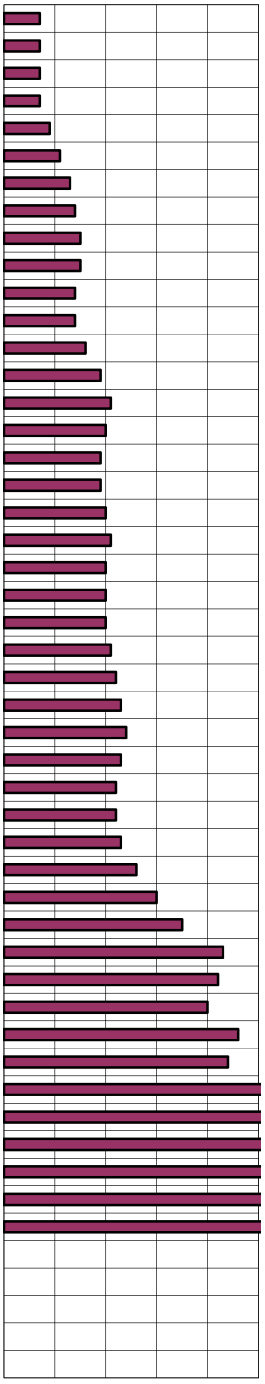
Project:	London Stadium			**Title:**	DYNAMIC PROBE LOG DP/WS02
Client:	London Stadium 185				
Ref No:	J2025	**Rev:**	v1		
Drawn:	LD	**Date:**	08.04.2021		
Figure:		**Scale:**	Not To Scale		

Depth mbgl	DPSH N(100)	SPT N(300)
0.0	0	
0.1	0	0
0.2	0	0
0.3	0	0
0.4	0	0
0.5	0	0
0.6	0	0
0.7	0	0
0.8	0	0
0.9	0	0
1.0	0	1
1.1	1	3
1.2	2	5
1.3	2	6
1.4	2	7
1.5	3	8
1.6	3	8
1.7	2	8
1.8	3	7
1.9	2	8
2.0	3	7
2.1	2	8
2.2	3	8
2.3	3	9
2.4	3	10
2.5	4	10
2.6	3	9
2.7	2	7
2.8	2	7
2.9	3	8
3.0	3	7
3.1	1	6
3.2	2	5
3.3	2	5
3.4	1	5
3.5	2	4
3.6	1	5
3.7	2	5
3.8	2	6
3.9	2	6
4.0	2	5
4.1	1	4
4.2	1	3
4.3	1	4
4.4	2	4
4.5	1	5
4.6	2	4
4.7	1	5
4.8	2	5
4.9	2	6

Continued



Depth mbgl	DPSH N(100)	SPT N(300)
5.0	2	7
5.1	3	7
5.2	2	7
5.3	2	7
5.4	3	9
5.5	4	11
5.6	4	13
5.7	5	14
5.8	5	15
5.9	5	15
6.0	5	14
6.1	4	14
6.2	5	16
6.3	7	19
6.4	7	21
6.5	7	20
6.6	6	19
6.7	6	19
6.8	7	20
6.9	7	21
7.0	7	20
7.1	6	20
7.2	7	20
7.3	7	21
7.4	7	22
7.5	8	23
7.6	8	24
7.7	8	23
7.8	7	22
7.9	7	22
8.0	8	23
8.1	8	26
8.2	10	30
8.3	12	35
8.4	13	43
8.5	18	42
8.6	11	40
8.7	11	46
8.8	24	44
8.9	9	63
9.0	30	77
9.1	38	109
9.2	41	127
9.3	48	139
9.4	50	98
	Refused	



Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	London Stadium			**Title:**	DYNAMIC PROBE LOG DP/WS03
Client:	London Stadium 185				
Ref No:	J2025	**Rev:**	v1		
Drawn:	LD	**Date:**	08.04.2021		
Figure:		**Scale:**	Not To Scale		

Depth mbgl	DPSH N(100)	SPT N(300)
0.0	0	
0.1	0	0
0.2	0	0
0.3	0	0
0.4	0	0
0.5	0	0
0.6	0	0
0.7	0	0
0.8	0	0
0.9	0	0
1.0	0	1
1.1	1	2
1.2	1	4
1.3	2	5
1.4	2	7
1.5	3	8
1.6	3	9
1.7	3	9
1.8	3	10
1.9	4	10
2.0	3	9
2.1	2	8
2.2	3	8
2.3	3	9
2.4	3	9
2.5	3	9
2.6	3	9
2.7	3	9
2.8	3	10
2.9	4	10
3.0	3	10
3.1	3	8
3.2	2	7
3.3	2	6
3.4	2	5
3.5	1	4
3.6	1	3
3.7	1	3
3.8	1	3
3.9	1	4
4.0	2	5
4.1	2	5
4.2	1	4
4.3	1	3
4.4	1	3
4.5	1	4
4.6	2	4
4.7	1	4
4.8	1	4
4.9	2	5
Continued		

Depth mbgl	DPSH N(100)	SPT N(300)
5.0	2	6
5.1	2	6
5.2	2	7
5.3	3	9
5.4	4	11
5.5	4	12
5.6	4	12
5.7	4	12
5.8	4	13
5.9	5	15
6.0	6	18
6.1	7	20
6.2	7	21
6.3	7	22
6.4	8	24
6.5	9	24
6.6	7	23
6.7	7	23
6.8	9	25
6.9	9	26
7.0	8	25
7.1	8	26
7.2	10	26
7.3	8	26
7.4	8	25
7.5	9	26
7.6	9	30
7.7	12	33
7.8	12	37
7.9	13	41
8.0	16	47
8.1	18	56
8.2	22	66
8.3	26	79
8.4	31	93
8.5	36	109
8.6	42	126
8.7	48	140
8.8	50	98
Refused		

Note: DPSH'N' and SPT'N' directly correlate. SPT'N'(300) calculated as sum of DPSH'N' over 300mm

Project:	London Stadium			**Title:**	DYNAMIC PROBE LOG DP/WS04
Client:	London Stadium 185				
Ref No:	J2025	**Rev:**	v1		
Drawn:	LD	**Date:**	08.04.2021		
Figure:		**Scale:**	Not To Scale		

APPENDIX 3 – GEOTECHNICAL LABORATORY TEST RESULTS

TEST CERTIFICATE

Liquid and Plastic Limits

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Tested in Accordance with: BS 1377-2: 1990: Clause 4.3 and 5

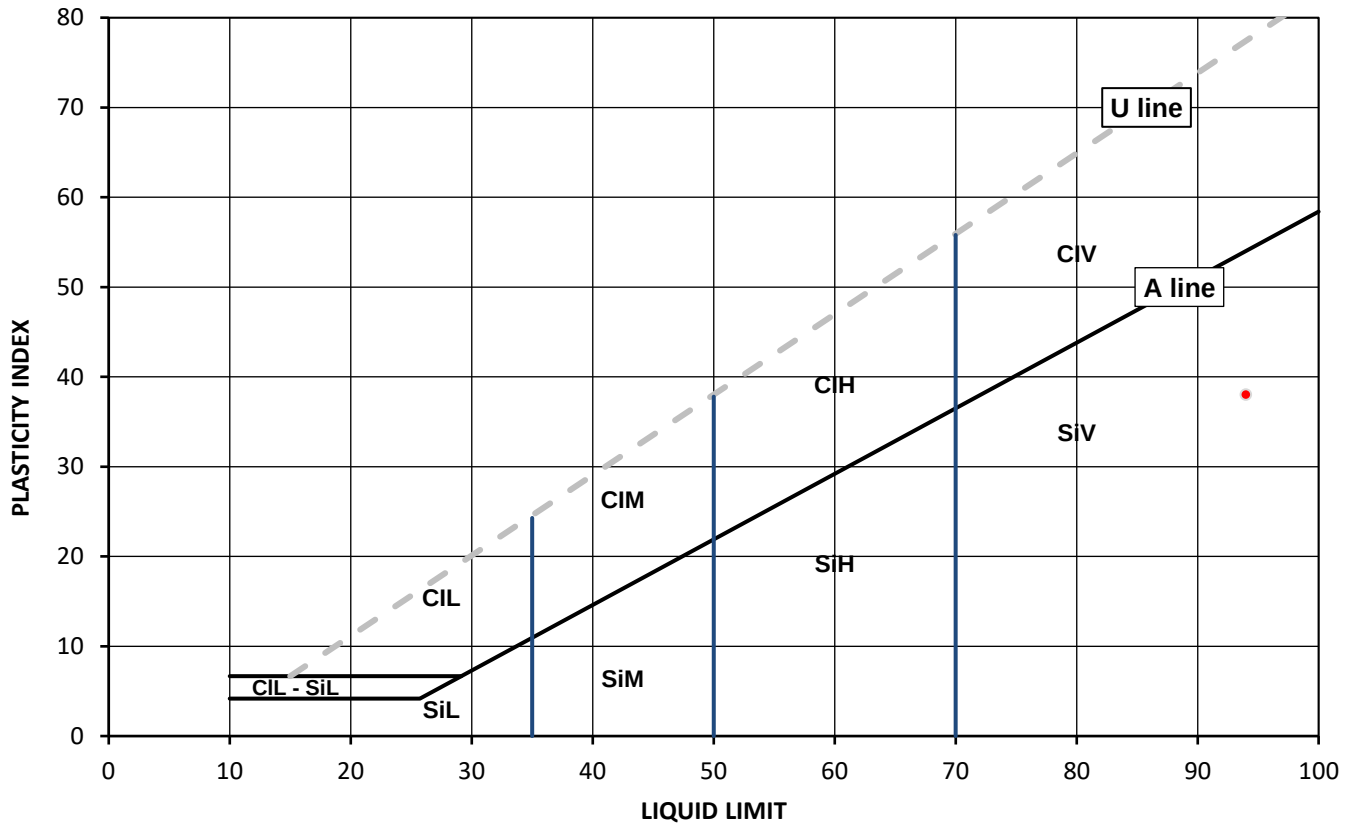
Client:	Jomas Associates Ltd	Client Reference:	JJ2025
Client Address:	Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD	Job Number:	21-68421
		Date Sampled:	13/04/2021
		Date Received:	12/04/2021
Contact:	Accounts	Date Tested:	28/04/2021
Site Address:	Staff Security Point, London Stadium, E20 2ST	Sampled By:	Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference:	1835397	Depth Top [m]:	3.50
Hole No.:	WS4	Depth Base [m]:	Not Given
Sample Reference:	Not Given	Sample Type:	D
Soil Description:	Black gravelly slightly organic CLAY		
Sample Preparation:	Tested after washing to remove >425um		

As Received Moisture Content [W] %	Liquid Limit [WL] %	Plastic Limit [Wp] %	Plasticity Index [Ip] %	% Passing 425µm BS Test Sieve
98	94	56	38	60



Legend, based on BS EN ISO 14688 2:2018 Geotechnical investigation and testing – Identification and classification of soil

		Plasticity		Liquid Limit
Cl	Clay	L	Low	below 35
Si	Silt	M	Medium	35 to 50
		H	High	50 to 70
		V	Very high	exceeding 70
		O	Organic	append to classification for organic material (eg ClHO)

Note: Moisture Content by BS 1377-2: 1990: Clause 3.2

Remarks:

Signed:

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 10/05/2021

GF 236.10

SUMMARY REPORT

Summary of Classification Test Results

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Tested in Accordance with:

Moisture Content by BS 1377-2: 1990: Clause 3.2; Water Content by BS EN 17892-1: 2014; Atterberg by BS 1377-2: 1990: Clause 4.3 (4 Point Test), Clause 4.4 (1 Point Test) and 5; PD by BS 1377-2: 1990: Clause 8.2

Client: Jomas Associates Ltd

Client Address: Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD

Contact: Accounts

Site Address: Staff Security Point, London Stadium, E20 2ST

Client Reference: JJ2025
Job Number: 21-68421
Date Sampled: 13/04/2021
Date Received: 12/04/2021
Date Tested: 27/04/2021
Sampled By: Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test results

Laboratory Reference	Hole No.	Sample				Description	Remarks	Moisture Content [W]	Water Content [W]	Atterberg				Density			Total Porosity#		
		Reference	Depth Top	Depth Base	Type			%	%	% Passing 425um	WL	Wp	Ip	bulk	dry	PD	%		
			m	m						%	%	%	%	Mg/m^3	Mg/m^3	Mg/m^3			
1835395	WS2	Not Given	0.50	Not Given	D	Dark brown slightly clayey slightly sandy GRAVEL		10											
1835396	WS3	Not Given	2.20	Not Given	D	Dark brown slightly clayey slightly sandy GRAVEL (MADE GROUND)		51											
1835397	WS4	Not Given	3.50	Not Given	D	Black gravelly slightly organic CLAY	Atterberg 4 Point	98		60	94	56	38						

Note: # Non accredited; NP - Non plastic

Comments:

Signed:

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 10/05/2021

GF 238.12

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Client: Jomas Associates Ltd

Client Address: Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD

Contact: Accounts

Site Address: Staff Security Point, London Stadium, E20 2ST

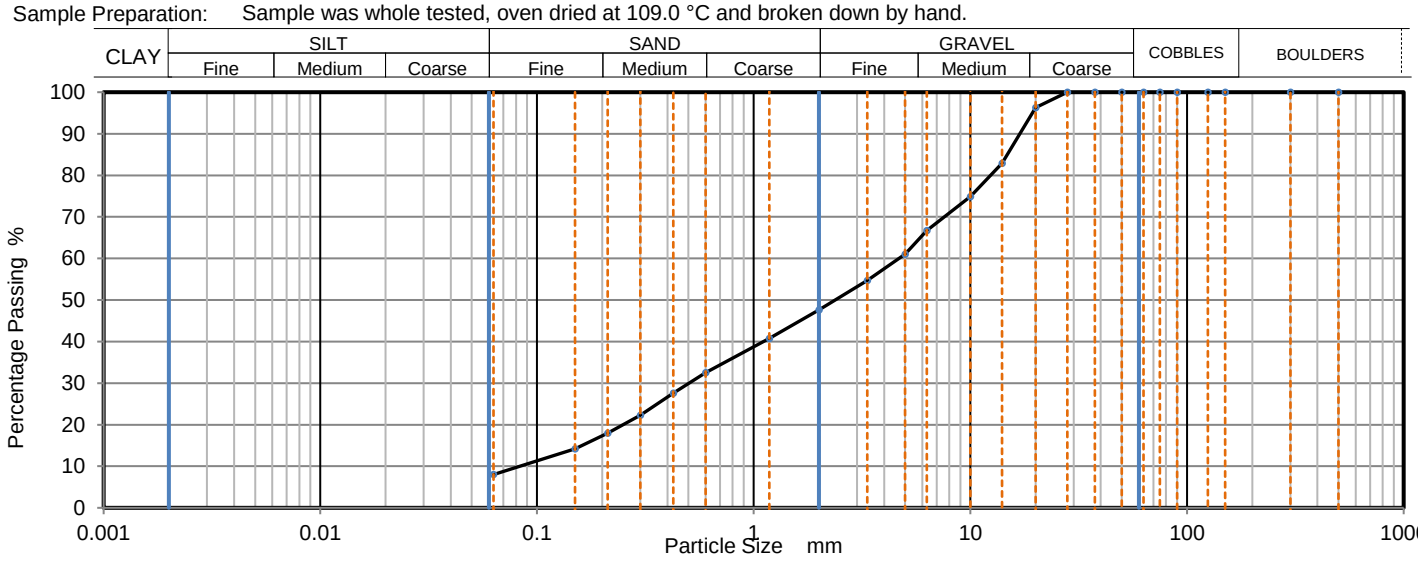
Client Reference: JJ2025
Job Number: 21-68421
Date Sampled: 13/04/2021
Date Received: 12/04/2021
Date Tested: 28/04/2021
Sampled By: Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 1835395
Hole No.: WS2
Sample Reference: Not Given
Sample Description: Dark brown slightly clayey very sandy GRAVEL
Sample Preparation: Sample was whole tested, oven dried at 109.0 °C and broken down by hand.

Depth Top [m]: 0.50
Depth Base [m]: Not Given
Sample Type: D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	96		
14	83		
10	75		
6.3	67		
5	61		
3.35	55		
2	48		
1.18	41		
0.6	33		
0.425	28		
0.3	22		
0.212	18		
0.15	14		
0.063	8		

Sample Proportions	% dry mass
Very coarse	0
Gravel	52
Sand	39
Fines <0.063mm	8

Grading Analysis		
D100	mm	28
D60	mm	4.69
D30	mm	0.502
D10	mm	0.0815
Uniformity Coefficient		57
Curvature Coefficient		0.66

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 10/05/2021

GF 100.20

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Client: Jomas Associates Ltd

Client Address: Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD

Contact: Accounts

Site Address: Staff Security Point, London Stadium, E20 2ST

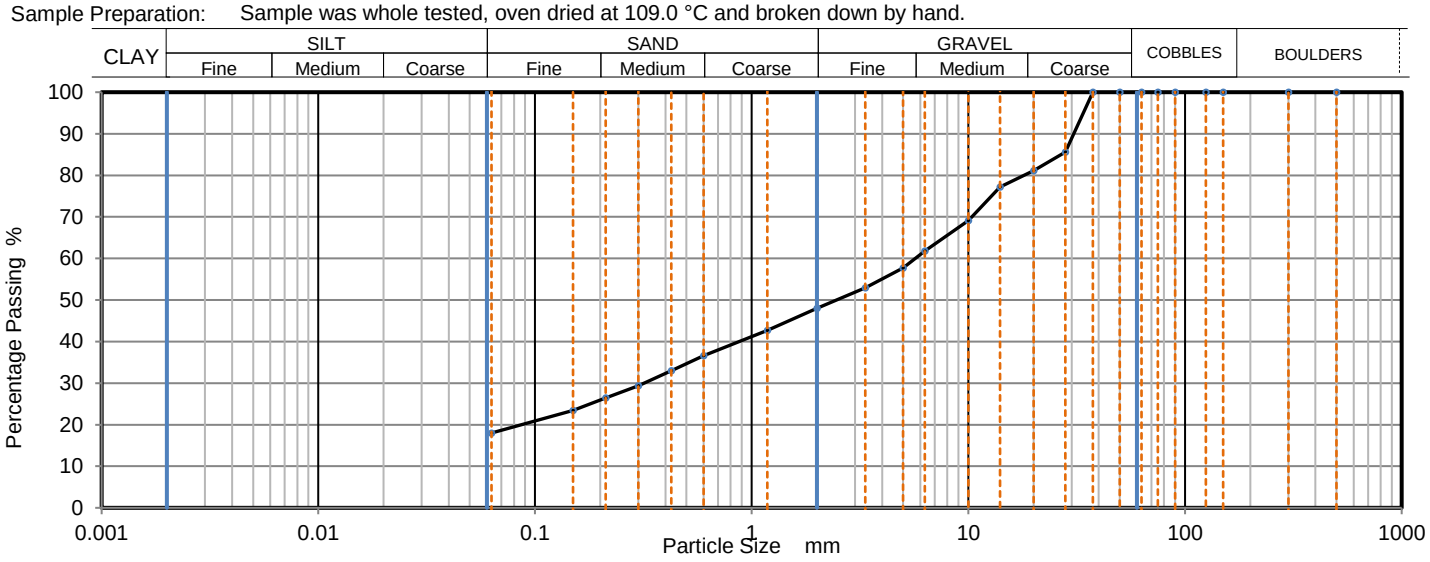
Client Reference: JJ2025
Job Number: 21-68421
Date Sampled: 13/04/2021
Date Received: 12/04/2021
Date Tested: 28/04/2021
Sampled By: Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 1835396
Hole No.: WS3
Sample Reference: Not Given
Sample Description: Dark brown clayey very sandy GRAVEL
Sample Preparation: Sample was whole tested, oven dried at 109.0 °C and broken down by hand.

Depth Top [m]: 2.20
Depth Base [m]: Not Given
Sample Type: D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	86		
20	81		
14	77		
10	69		
6.3	62		
5	58		
3.35	53		
2	48		
1.18	43		
0.6	37		
0.425	33		
0.3	29		
0.212	26		
0.15	23		
0.063	19		

Sample Proportions	% dry mass
Very coarse	0
Gravel	52
Sand	29
Fines <0.063mm	19

Grading Analysis		
D100	mm	37.5
D60	mm	5.69
D30	mm	0.317
D10	mm	
Uniformity Coefficient		> 90
Curvature Coefficient		

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 10/05/2021

GF 100.20

TEST CERTIFICATE

Particle Size Distribution

Tested in Accordance with: BS 1377-2: 1990

i2 Analytical Ltd
Unit 8 Harrowden Road
Brackmills Industrial Estate
Northampton NN4 7EB

4041

Client: Jomas Associates Ltd

Client Address: Lakeside House, 1 Furzeground Way, Stockley Park, UB11 1BD

Contact: Accounts

Site Address: Staff Security Point, London Stadium, E20 2ST

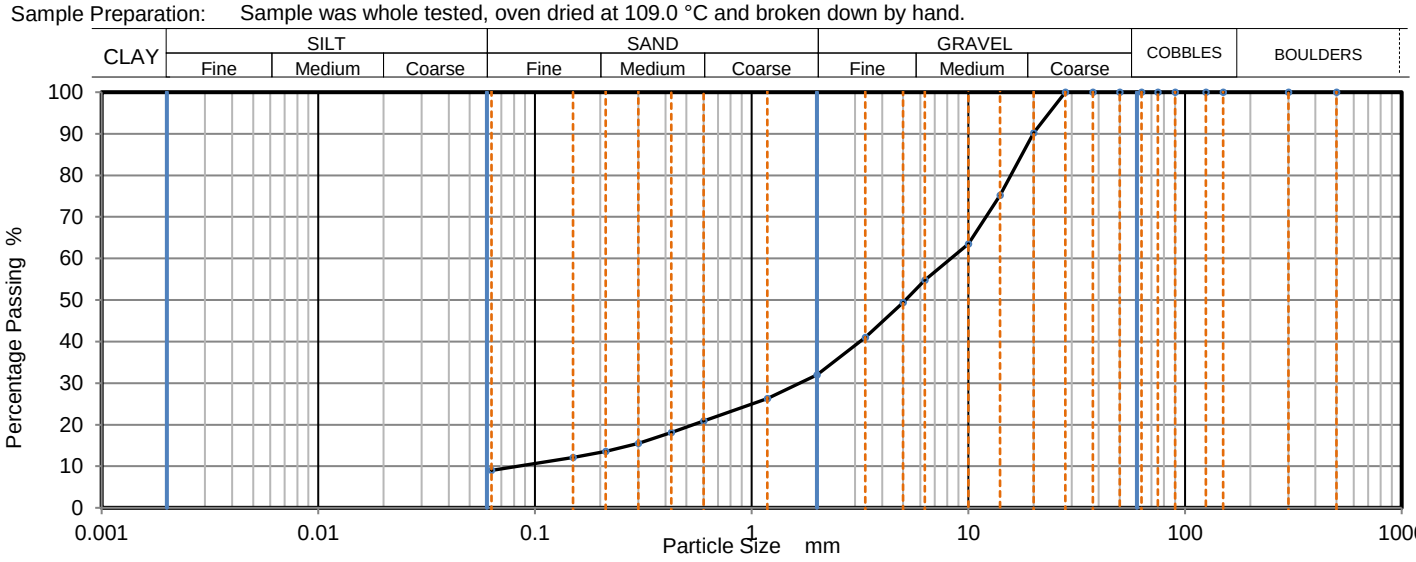
Client Reference: JJ2025
Job Number: 21-68421
Date Sampled: 13/04/2021
Date Received: 12/04/2021
Date Tested: 28/04/2021
Sampled By: Client

Testing carried out at i2 Analytical Limited, ul. Pionierow 39, 41-711 Ruda Slaska, Poland

Test Results:

Laboratory Reference: 1835398
Hole No.: WS4
Sample Reference: Not Given
Sample Description: Dark brown slightly clayey sandy GRAVEL
Sample Preparation: Sample was whole tested, oven dried at 109.0 °C and broken down by hand.

Depth Top [m]: 0.50
Depth Base [m]: Not Given
Sample Type: D



Sieving		Sedimentation	
Particle Size mm	% Passing	Particle Size mm	% Passing
500	100		
300	100		
150	100		
125	100		
90	100		
75	100		
63	100		
50	100		
37.5	100		
28	100		
20	90		
14	75		
10	64		
6.3	55		
5	49		
3.35	41		
2	32		
1.18	26		
0.6	21		
0.425	18		
0.3	16		
0.212	14		
0.15	12		
0.063	9		

Sample Proportions	% dry mass
Very coarse	0
Gravel	68
Sand	23
Fines <0.063mm	9

Grading Analysis		
D100	mm	28
D60	mm	8.29
D30	mm	1.67
D10	mm	0.0772
Uniformity Coefficient		110
Curvature Coefficient		4.3

Uniformity Coefficient and Coefficient of Curvature calculated in accordance with BS EN ISO 14688-2: 2004 + A1: 2013

Note: Tested in Accordance with BS1377:Part 2:1990, clause 9.2

Remarks: The material submitted - fails to meet the minimum mass requirements as stated in BS1377 Part 2 Table 3

Signed:

Szczepan Bielatowicz
PL Deputy Head of Geotechnical Section
for and on behalf of i2 Analytical Ltd

Date Reported: 10/05/2021

GF 100.20

APPENDIX 4 – CHEMICAL LABORATORY TEST RESULTS

Accounts
Jomas Associates Ltd
Lakeside House
1 Furzeground Way
Stockley Park
UB11 1BD

e: Jomas Associates -

i2 Analytical Ltd.
7 Woodshots Meadow,
Croxley Green
Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 21-68359

Project / Site name:	Staff Security Point London Stadium E20 2ST	**Samples received on:**	12/04/2021
Your job number:	JJ2025	**Samples instructed on/ Analysis started on:**	13/04/2021
Your order number:	P2943JJ2025 21	**Analysis completed by:**	20/04/2021
Report Issue Number:	1	**Report issued on:**	20/04/2021
Samples Analysed:	4 soil samples		

Signed: Karolina Marek

Karolina Marek
PL Head of Reporting Team
For & on behalf of i2 Analytical Ltd.

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

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

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

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

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

Analytical Report Number: 21-68359
Project / Site name: Staff Security Point London Stadium E20 2ST
Your Order No: P2943JJ2025 21

Lab Sample Number				1835099	1835100	1835101	1835102
Sample Reference				WS3	WS4	WS4	WS4
Sample Number				D	D	D	D
Depth (m)				5.00	1.50	3.50	5.80
Date Sampled				Deviating	Deviating	Deviating	Deviating
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**				
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	42	17	48	47
Total mass of sample received	kg	0.001	NONE	0.50	0.70	0.30	0.50
General Inorganics							
pH - Automated	pH Units	N/A	MCERTS	7.9	7.7	7.7	7.5
Water Soluble SO4 16hr extraction (2:1 Leachate Equivalent)	g/l	0.00125	MCERTS	2.4	2.6	1.6	0.89

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

Analytical Report Number : 21-68359
Project / Site name: Staff Security Point London Stadium E20 2ST

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
1835099	WS3	D	5	Black gravelly loam.
1835100	WS4	D	1.5	Brown loam with gravel.
1835101	WS4	D	3.5	Brown loam and clay with vegetation.
1835102	WS4	D	5.8	Brown clay and loam with vegetation.

Analytical Report Number : 21-68359
Project / Site name: Staff Security Point London Stadium E20 2ST

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Sulphate, water soluble, in soil (16hr extraction)	Determination of water soluble sulphate by ICP-OES. Results reported directly (leachate equivalent) and corrected for extraction ratio (soil equivalent).	In house method.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically. (30 oC)	In house method.	L019-UK/PL	W	NONE
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement.	In house method.	L099-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

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

Sample Deviation Report

Analytical Report Number : 21-68359
Project / Site name: Staff Security Point London Stadium E20 2ST

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
WS3	D	S	1835099	a	None Supplied	None Supplied	None Supplied
WS4	D	S	1835100	a	None Supplied	None Supplied	None Supplied
WS4	D	S	1835101	a	None Supplied	None Supplied	None Supplied
WS4	D	S	1835102	a	None Supplied	None Supplied	None Supplied

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The Chartered Institution of Wastes Management

silc – Specialist in Land Condition

The Geological Society

IEMA Transforming the world to sustainability

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JOMAS ASSOCIATES LTD

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Stockley Park

Uxbridge

UB11 1FW

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